

Final Report

WORKING GROUP ON
RURAL ROADS

IN THE 11TH FIVE YEAR PLAN



**Government of India
Planning Commission**

Ministry of Rural Development

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Executive Summary

Rural roads are the tertiary road system in total road network which provides accessibility for the rural habitations to market and other facility centres. In India, during the last five decades, rural roads are being planned and programmed 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 programme known as 'Pradhan Mantra Gram Sadak Yojana (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 taken as one of the components and blended with PMGSY programme. It targeted to provide connectivity to all habitations having population of 1000 and above (500 and above in hilly, desert and tribal areas) by 2009 and also aimed 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 the existing rural roads which are identified as the through routes of the core network. 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 upgradation 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 upgradation. For new connectivity alone, total amount required is estimated as 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 upgradation 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.

In addition, the report analyses the various initiatives and development under taken for development of rural roads under PMGSY/Bharat Nirman programmes of Government of India. It focused on future planning and engineering issues for providing, multiple connectivity, intra village road development, performance based design, utilisation of locally available and waste materials in rural road works, maintenance management aspects, institutional and capacity building issues, research and development needs and resources mobilization. In each of these areas, a set of recommendations is provided in the following section.

Recommendations:

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.

PMGSY/Bharat Nirman

- For integrated development of rural connectivity, upgradation is required to be included in addition to new connectivity links, as envisaged in Bharat Nirman.
- Rural roads development targets (based on 2001 population census and to be modified after next census) will require continuance of the programme even beyond 11th Plan period.
- The structure and systems of delivery developed so far should be strengthened and continued. The performance of achievements under the programme shows that there is need to fasten the implementation process to achieve the targets.

Physical Targets

- 11th Five Year Plan should continue to support the rural connectivity and upgradation targets as a major policy in view of huge untapped potential in rural India.
- Special provisions for funding through budgetary and other sources shall be required to continue with the objective of road connectivity for habitations.
- Maintenance may be taken to the top of the priority list to sustain the assets created and to reap the benefits perennially.

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 a 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 3-5 years and maintained as geo-referenced data.
- Engineering design and Detailed Project Report (DPR) must be the basis for implementation of rural roads in 11th Plan.
- Economy in design and specification to be pursued through performance based designs and use of locally available and marginal materials.

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 labour 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 programmes.
- 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.

Maintenance Management

- No asset lasts long without due maintenance and rural roads are no exemption. Routine and periodic maintenance should be planned and executed with due budgeting for the funds during 11th Plan.

- Projectisation of maintenance option can be examined with appropriate cost sharing basis by the State and Central Governments for PMGSY/Bharat Nirman roads.
- Uniform level of service criteria for maintenance of rural roads be developed and adopted across the country (in all States). Suitable computerized maintenance management system (MMS) utilizing simple measurements (inventory and PCI data) be developed and adopted for rural roads based on the principles of asset management.
- Since the roads are to be owned by the Panchayat Raj Institutions (PRIs), a community based maintenance programme may be adopted with hierarchical arrangement with District Programme Implementation Units (PIUs) for higher level maintenance while routine maintenance being the responsibility of PRIs.

Looking Beyond PMGSY

- All programmes supporting construction of rural roads for all-weather connectivity must fall under one umbrella organization like State Rural Road Development Agency (SRRDA) in the State, irrespective of funding source including the external source or borrowing or even Public Private Partnership. This will ensure uniform standard and quality.
- The existing cluster approach, should be reviewed on the basis of ground level survey of the settlement patterns in States like Arunachal Pradesh and consequential amendments should be made in the programme guidelines, so that larger number of habitations become eligible for coverage in hill States.
- The States may use the resources from Wage Employment Programme and other available sources from the State for providing connectivity to the lower order settlements.
- The planning and design standards shall remain uniform across the board (in all States) with an overriding objective of developing only sustainable assets subject to variations in terrain, soil, traffic and environmental conditions.
- While PMGSY contemplates connectivity to habitations with 500 and above normally and 250 and above in special areas, in future (11th Five Year Plan and beyond), connectivity should be aimed at all habitations irrespective of population sizes (including lower order settlements).
- PMGSY has been able to change the scenario of the country in terms of capacity of the contracting industry, trained manpower and also the availability of modern equipments. The 11th Plan must utilize this capacity and enhance it for fulfilling the higher targets set for the 11th and subsequent Plans.

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 programme, 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.

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.
- Afforestation along the rural roads by plantations of fruit trees etc be systematically adopted as part of the design (i.e. DPR) itself.
- 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.

Institutional Development and Capacity Building

- PMGSY has achieved a laudable level of institutional developments during the last six years. State and district level institutions developed are to be made more professional by way of qualified manpower and training. This is a primary requirement for higher targets in 11th Plan.
- The ownership of the rural roads will rest with the PRIs eventually, and therefore, capacity is to be built at the grass root level by qualified manpower and appropriate training.
- Construction industry is still having only a limited capacity at this time, and the PMGSY targets are finding difficult to be achieved. The 11th Plan targets will require a significant boost to the capacity of road construction industry.
- The duly exemptions on the purchase of machinery that is now available for the projects funded by World Bank and ADB may be extended across the board for PMGSY Projects in all States, in order to facilitate capacity building of contractors.

- The sustainability of the huge asset being built under rural connectivity programmes will be dependent on the capacity of the PRIs to look after these assets which they will own. With ownership, the responsibility of their maintenance also can be given to PRI. For this, of course, a systematic training will have to be organized for the teams to be entrusted with this responsibility.

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 PRI level Safety Committee/Council be established for collecting the accident data in a standard format and reporting to the District Police. The District level committee will have input from all such PRI committees.
- 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.

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.
- Generally R&D is starved of funds in most cases; and it will be disastrous if R&D is not given prominence in the context of rural roads, as we have just began to accept rural roads construction as a scientific work.
- Most significant areas to be researched are the means of cost cutting by choice of materials and design, and also evolving the innovative financing mechanisms for such roads.
- It is proposed that the State Executing Agencies of rural roads shall make it possible to take atleast 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.

Mobilisation of Resources

- Dedicated fund for rural roads, as was in 10th Plan, should continue in 11th Five Year Plan.
- Innovative funding options other than borrowing – by charging the beneficiaries, may have to be adopted.

- Deferred payment schemes to be adopted for PPP model to fulfill the targets, so as to make the benefits to flow early. Starting with about 5000 to 10,000 km of rural roads may be experimented during the 11th plan period.

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Chapter 1

Working Group on Rural Roads in the 11th Five Plan (2007-12).

1.1 Constitution of Working Group

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.

1.2 Meeting of Working Group

The first meeting of the working group was held on the 9th August, 2006 at 2:30 pm 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 which is placed as Appendix 1.

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 the 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 section.

1.3 Structure of the Report

It is proposed to present the report in 14 chapters including this introductory chapter. The gist of each chapter is presented below:

Chapters

2. Overview of developments of Rural Roads up to the Tenth FYP – achievements in different Plans; Accessibility criteria by Planning Commission for different facilities in villages
3. PMGSY and Bharat Nirman for Rural Accessibility Provision; Strategy and objective; Connectivity status; Achievements (documentation, OMMS, etc); Institutional framework, etc.
4. Physical targets – 10th FYP, 11th FYP and spillover to 12th FYP; Financial requirements; for new connectivity and upgradation Dedicated road fund – pool of funds from other programmes, etc. and maintenance strategies.
5. Planning and design of rural roads in 11th FYP – Network planning (including prioritisation of villages, accessibility criteria), Intra-village road development, multiple connectivity, Geo-information technology for database, etc; Design of rural road – complete with all features of road (including all stage of engineering and design), pavement design with all options available; Common standard and specifications for rural roads constructed under all programmes and funding sources – paved and unpaved criteria
6. Materials and construction technology for rural roads in 11th Plan; Intermediate technologies for construction; Alternate (non-conventional) materials for rural road construction – resource mapping; Labour based vs. mechanised construction
7. Maintenance management for rural roads – technical criteria for interventions; privatized contract management – performance based; hierarchical responsibility of management; community participation in maintenance
8. Looking beyond PMGSY – existing other programmes, issues; utilization of capacity built under PMGSY and Bharat Nirman
9. Quality assurance – Quality control in planning, design, construction and in sustaining the asset (rural roads); Quality control system (including institutional set up, field laboratory, and trained man-power)

10. Environment and social safeguard issues – plantation of trees, land acquisition impacts (marginal farmers), etc.
11. Issues relating to capacity development – Institutional (PRI, PIU, SRRDA, etc), contracting industry, planning and design, construction man-power (skilled, unskilled and semi-skilled), maintenance
12. Road safety issues in relation to rural roads – Monitoring of road safety for rural roads, RSA for the rural road design and RSAR, campaign for public awareness
13. Research and Development on Rural Roads – Use of low quality materials, high performance materials, cost-effective life-cycle cost based designs, performance based design and specifications; Efficient cost-effective drainage systems, use of cold-mix technologies for construction and maintenance
14. Mobilization of Resources – Assessment of overall fund requirement for 11th Five Year Plan, existing sources of funding, new options for resource mobilization

At the end of each chapter, summary of the recommendations are presented.

Chapter – 2

Overview of Development of Rural Roads

2.1 Historical Development

Since 1940's the Government of India and the State Government had drawn several policies, programmes 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 programmes/schemes under the Five Year Plans.

2.1.1 Long Term Policy Issues

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 presented in Table 2.1.

Table 2.1: Criteria, Targets and Achievements in the Road Development Plans

Name of the Plan	Basis of fixation of targets	Targets km	Achievement Km	Target density (All roads) sq. km
Nagpur Plan (1943-61)	Length of ODRs + VRs assessed on the basis of number of villages with population 500 and less, 501-1000, 1001-2000 and 2001-5000.	332,335	500,802	0.32 km per sq. km
Bombay Plan (1961-81)	Length based on the number of villages with population less than 500, 500-1000, 1000-2000 and 2000-5000	651,780	912,684	0.46 km per sq. km
Lucknow Plan (1981-01)	Length assessed on the basis of number of villages and towns.	2,189,000	2,994,000	0.82 km per sq km

Source: Rural Road Development Vision 2025 (Draft)

Currently, the Road Development Plan Vision-2021 has been brought out to guide the Central and State Governments in developing the road infrastructure of adequate standards in the country. The strategy proposed in the vision document for planning rural roads emphasized the need for preparation of master plans for rural road network in each district. The planning of network for the district may cover all habitations with minimum population of 100 and above to be served by all-weather roads. Table 2.2 presents the prioritized targets for the provision of all-weather roads. It also suggested for providing connectivity to all the habitations by the end of this decade (2010).

Table 2.2: Vision 2021- Target for Connectivity of Villages

Villages (population category) to be connected by all-weather roads	Target Year
Villages with population above 1000	2003
Villages with population 500-1000	2007
Villages with population below 500	2010

Source: IRC (2001): Road Development Plan-Vision 2021

The Vision also gives priority by way of special attention to the coastal regions, tribal areas, deserts and hill areas for road development in general. It has also recommended for consideration to improve the existing fair-weather roads to all-weather standards, by providing adequate cross drainage structures wherever they are missing and also for completion of works in progress.

2.1.2 Rural Roads in Five Year Plans

Constitutionally, the development of rural roads is the responsibility of the State Government in India. Because of this, the rural roads received very little attention from the Central Government until 1967, when a special committee, under the chairmanship of Shri H.P. Sinha was appointed. The committee studied the rural roads and the connectivity pattern and recommended certain criteria for developing and for allocation of budget for rural roads. Since Fifth Five Year Plan, funds are allocated under various rural development programme such as Minimum Needs Programme (MNP), National Rural Employment Programme (NREP), Rural Landless Employment Guarantee Programme (RLEGP), Jawahar Rozgar Yojana (JRY), etc for the development of rural roads.

During the Fifth Five Year Plan period (1974-1979) rural roads were included as a part of Minimum Needs Programme (MNP) of the Central Government and received importance for development. The programme envisaged connectivity of all villages with population of 1500 and above, as per 1971 census, with an all-weather road by the end of the Fifth Five Year Plan. It also proposed a cluster approach for connectivity in respect of hilly, coastal, tribal and desert areas, where the villages are smaller in population size.

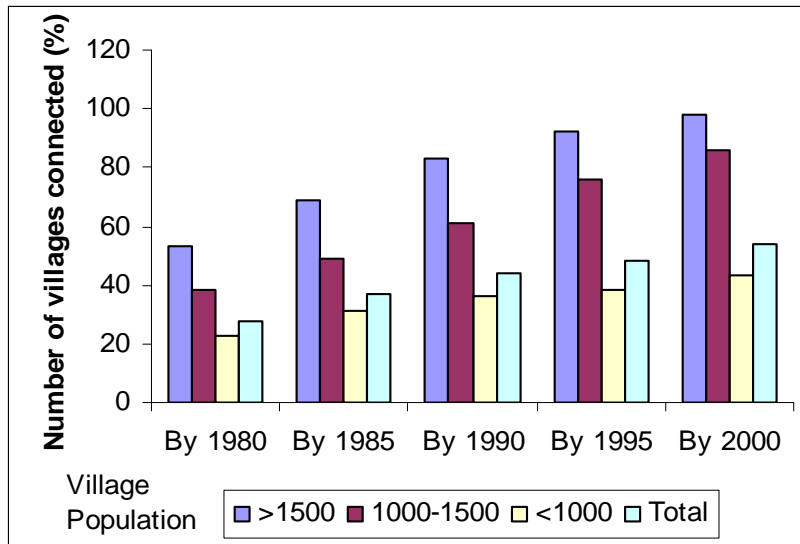
In the year 1978 a Working Group on Rural Roads was set up by the Planning Commission of India to formulate connectivity criteria and make projections of road length and estimate requirement of funds for development of rural roads. The Committee made an assessment of existing rural road connectivity and estimated that an amount around Rs.11,000 crores (at 1978 prices) would be required to connect all villages with all-weather road. Some of the recommendations of the Working Group were taken into consideration while formulating budget for road development in the Sixth Five Year Plan (1980-85) and about 30% of the total road outlay was allocated for rural road sector. Similarly, the plan outlay under the Seventh Five Year Plan (1985-90) was Rs.1729.40 crore for providing rural connectivity.

The criteria for connectivity under MNP were periodically revised. During the Eighth Five Year Plan (1992-1997) the criteria for linkage of villages to a road were modified. Priorities were accorded to link all villages with a population of 1000 and above on the basis of 1981 census and special efforts to accelerate village connectivity in respect of backward regions and tribal areas.

The connectivity criteria under MNP were once again revised for the Ninth Five Year Plan (1997-2002). The revised norms for connectivity of villages adopted the 1991 population census as the base and the criteria were as follows:

- **Plain areas:** (i) 100 % of all villages with population above 1000 and (ii) 75 % of all villages with population between 500-1000
- **Hilly areas:** (i) 100 % of all villages with population above 500 and (ii) 75 % of villages with population between 200-500
- **Tribal, coastal, riverine and desert areas:** (i) 100 % of villages with population above 500 and (ii) 75 % of villages with population between 200-500.

It is further stipulated that in case the above criteria does not ensure connectivity to 85 % of the village population in a district, then villages with lesser population than mentioned above should also be considered for connectivity. Population category wise connectivity of the villages from 1980 to 2000 is presented in Figure 2.1.



Source : Planning Commission & MoRTH

Figure 2.1: Population Category wise Connectivity Status

According to the above statistics, by 2000 almost all villages with population over 1500, about 86 % with 1000 to 1500 villages, and 43 % of villages with less than 1000 population were connected with all-weather road facility.

2.2 Socio-Economic Development by Rural Roads

Rural roads are the basic infrastructure requirement and play a vital role in socio-economic upliftment 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 centres. 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. CRR (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 fertiliser consumption, (c) increase in non-agricultural activities, and (d) better utilisation of existing facilities like, school, health, banks and post offices. Similarly, a socio-economic

survey conducted in a remote area in India by CRR I 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 6 times of truck transport cost. The net agricultural benefits, educational benefits and health benefits were calculated and added in the benefit stream. Recently, a similar study by CRR I (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 Programme (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.

2.2.1 Impact on Rural Economy

Ministry of Rural Development had commissioned a series of quick assessments of socio-economic impact of PMGSY in Assam, Himachal Pradesh, Madhya Pradesh, Mizoram, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. These studies were conducted by independent agencies during January to February, 2004. Important findings are given in **Annexure-4**.

The impacts of rural roads are summarized as given below:

- **Improvement in transportation services:-** which leads to improved access to market centres for the rural producers, better availability of farm inputs at reduced prices;
- **Diversification of agricultural:-** improved market access promotes shift in favour of cash crops and commercialization of agricultural activities.

- **Diversification of livelihood opportunities:**– better connectivity enhances employment opportunities in the non-agricultural sectors.
- **Improved services:**– improved road connectivity, interalia, enhances access to education, health and financial services.
- **Increase in the outreach of the State:**– Improved rural roads facilitates better availability of public services and functionaries in rural areas.

2.2.2 Poverty Alleviation

Asian Development Bank (2002) also conducted a study on ‘Impact of Rural Roads on Poverty Reduction – A Case Study’. The study concluded that rural roads are the important enabling conditions for livelihood development for people in rural areas. The poor and very poor primarily benefit through the indirect impact of road improvements, of better access to state services and improved provision of services to the villages, and opportunities in alternative livelihood income stream.

Better rural infrastructure has primarily two effects – promotion of economic growth and decline in the incidence of poverty. Jocelyn A Songco (Columbia University and the World Bank, 2002) in a study pointed out that rural infrastructure investments benefit the rural poor through increased incomes and improved consumption patterns. Some empirical studies illustrate a strong relationship between infrastructure and economic growth. According to World Bank sources, 1% increase in infrastructure stock is associated with a proportionate increase in GDP across all countries. A specific sectoral study by Deichman et al for Mexico shows that a 10% increase in market access leads to increase in labour productivity by 6%.

Linkages between public investment on rural connectivity, agricultural growth and poverty alleviation in the Indian context were investigated in a research report authored by Shengenn Fan, Peter Hazell and Sukhadeo Thorat (Research Paper No.110, IFPRI, 1999). Using State-level data on Government spending from 1970 to 1993, this study attempted to quantitatively measure how different types public investment affect agricultural growth and rural poverty. The model estimated the number of poor people who would be raised above the poverty line for each Rs.1 million (1993 constant prices) of additional investment in eight different components of public spending — roads, research and extension, education, rural development, health, irrigation, soil and water conservation and power. Accordingly, Government expenditures were ranked in terms of their effectiveness in poverty alleviation. The findings of this study are striking. Government spending on roads was found to have the largest impact on rural poverty. For each Rs.1 million increase in investment in roads, 165 poor people would be enabled to cross the poverty line. Its impact on poverty was nearly twice as large as that the next best poverty reducer - Government

investment in agricultural R&D. Investment in roads was also found to be contributing significantly to productivity growth. An additional Rs.100 billion (in 1993 prices) invested in roads would increase productivity growth by more than 3 percent.

2.3 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 as on 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.1,11,000 crore. A sum of Rs.1,79,200 crore was estimated for providing black topped road to the existing unconnected villages, black topping of present metalled 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 centralised 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 programme are based on diesel cess, 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 programme. In order to ensure speedy and systematic execution of the programme, 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 programme for development of rural roads. A special rural road development programme known as 'Pradhan Mantri Gram Sadak Yojana' 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.

2.4 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.

Chapter 3

Pradhan Mantri Gram Sadak Yojana and Bharat Nirman

3.1 Pradhan Mantri Gram Sadak Yojana (PMGSY)

On the recommendations of the National Rural Road Development Committee, Government of India has launched a nation wide programme called 'Pradhan Mantri Gram Sadak Yojana' (PMGSY) on the 25th December 2000. For the first time the focus is directly on the rural connectivity under dedicated road fund. The objective of the program is to provide road connectivity, through good all-weather roads to all rural habitations of targeted population.

3.1.1 Strategy and Objectives

The focus of the programme is to construct good quality all-weather roads for new connectivity and upgradation of existing roads. For the first time the focus is directly on the rural connectivity under dedicated road fund, and the 50% of the cess amount collected on high speed diesel has been allocated for this programme. In earlier programmes, the village with a defined population was the target for providing connectivity, while the PMGSY envisage 'habitation' as the unit, to reach out to more settlements and more people with accessibility.

The programme aimed to provide connectivity to all habitations up to 500 and above population in plain and in respect of hilly, desert and tribal areas the habitations with 250 and above population is targeted. It was planned to provide connectivity in a phased manner. In the general order of priority for connectivity, first priority is accorded for new connectivity. The order of priority for new connectivity and upgradation is given in Table 3.1.

Table 3.1: Priority for new connectivity and upgradation

Priority	Population size of Habitations being connected
I	1000 and above
II	500 – 999
III	250 – 499 * (hilly, backward and special areas)
IV	Upgradation of through routes
V	Upgradation of selected link roads

3.1.2 Initiatives for Structured Development

The programme is being coordinated at Central level by the National Rural Development Agency (NRRDA) through Ministry of Rural Development, Government of India. At State level the programme is executed through agency known as State Rural Road Development Agency (SRRDA). At the District level,

the programme is planned, co-ordinated, and implemented through the executing agencies known as Programme Implementation Unit (PIU).

The programme is being implemented by preparing the detailed district level rural road plan and the core network by the PIUs, which provide prioritized links for connectivity of rural habitations satisfying the qualifying population criteria. These plans are approved at various level d Panchayat Raj System and at state level and national level organization. Detailed project reports (DPR) are prepared for the prioritized links by the PIUs for execution. The DPRs are scrutinized by the selected State Level Technical Agencies before their approval by the State and Central level agencies. The projects are implemented by the PIUs and are monitored by a three tier quality control system.

3.1.3 Assessment of Connectivity Requirements

When the PMGSY was launched in 2000, it was estimated that about 3,30,000 habitations out of a total of 8,25,000 habitations were without any all-weather access. As per the initial estimates at the time of launching PMGSY, about 1,60,000 habitations were expected to be covered under the programme with an anticipated investment of Rs.60,000 crore.

New Connectivity: According to latest figures made available by the State Governments, after a detailed survey undertaken to identify core networks (based on DRRP) there are about 1.73 lakh unconnected habitations and about 3.65 lakh km new road connectivity are required to be taken up under the PMGSY programme as per the norms. The total estimated habitations according to population size, and the road length and cost of construction are given in Table 3.2. The state wise estimated road length and cost required for new connectivity is given in the Discussion Paper (**Appendix 1 - Table 3**).

Table 3.2: Estimated Road Length and Fund Required for New Connectivity as Per PMGSY Norms

Habitation Population Group	Number of Rural Unconnected Habitations	Length Required (km)	Estimated cost (Rs billion)
1000+	59,855	133,949	784.18
500-999	81,466	161,955	
250-499 *	31,451*	69,901*	
Total	172,772	365,805	784.18

* Only in hill states, desert and tribal areas as per PMGSY eligibility criteria.

Upgradation: The requirement of fund and length in km were estimated for the upgradation of the existing roads as per the guidelines. The total upgradation requirement is about 3.73 lakh km of rural roads with an estimated cost about Rs.590330 million as per PMGSY norms. The state level estimates of the length

for upgradation and the estimated cost is given in the Discussion Paper **(Appendix 1 - Table 4)**.

3.1.4 Achievement Till 10th Plan

The proposals prepared by states based on inputs provided by PRIs were submitted to NRRDA for year-wise implementing of the programme. NRRDA approved the proposals under PMGSY prepared by States after scrutiny of NRRDA and cleared in different phases since 2001. The total road length constructed up to end of phase IV is about 93,000 km. Against the target originally set for the new connectivity, the proposals cleared so far (May 2006) are expected to provide connectivity to only 56638 habitations. The works completed so far have provided connectivity to only 27,303 habitations. The status of habitations coverage achieved so far under this scheme has been indicated in Table 3.3. The state-wise statement showing physical and financial progress and achievement so far under this programme is summarized and given in the Discussion Paper **(Appendix 1- Table 5)**.

Table 3.3: Connectivity Status under PMGSY (as October 2006)

Population category	No. of eligible habitations	No. of habitations covered by projects approved	No. of habitations connected
1000 and above	59855	28361	16081
500 and above	81466	21942	8602
250 and above	31451	6335	2620
Total	172772	56638	27303

The figures show that only 15.80 % of habitations have been actually connected so far, it is envisaged that the scheme would miss the 10th Plan target (original target of PMGSY) by a huge margin. Recognizing this slippage the time frame for providing full connectivity to habitations with population above 1000 (above 500 in hill, desert, and tribal areas) has been reset under Bharat Nirman.

3.1.5 Analysis of Performance of states

A glance at the Physical and Financial performance of the States under PMGSY/ Bharat Nirman clearly brings out the fact that those States who took initiatives in streamlining the institutional arrangements have performed well compared to the others.

The state-wise statement showing physical and financial progress under PMGSY (Phases I-IV and ADB/WB) is presented in Table 8 of Discussion Paper provided in Appendix - I. The physical target represents the length of road works and number of road works sanctioned and completed. The financial targets are represented by the total amount released and expenditure made.

The total value of the proposals cleared so far is Rs.31750 crores out of which Rs.17483 crores has been released. More than 80 % of amount released has been spend by constructing total road length of 94,000 km comprising of 32,000 road works. The target upto Phase-IV under PMGSY revealed that on an average, about 60% of total sanctioned road works and 52.6 % of sanctioned road length are completed in time. Nearly 83 % of total amount released has been spent by the States agencies to complete the physical targets. Out of all, 15 States have achieved the physical targets of number of road works and construction of road length more than the national level average. Remaining states are still lagging behind. The data shows that some states have steadily increased their absorbing capacity, but still they have to enhance their capacity to absorb the yearly allocation in coming years, and to achieve the proposed targets of 11th FYP in time.

While comparing the financial performance the states viz., Andhra Pradesh, Gujarat, Madhya Pradesh, Punjab and Rajasthan have spend more than 90 % of the amount released and could achieve well above the national average figure of the road works and length of roads. In the states like Jammu and Kashmir, Assam, Bihar, Chattisgarh, Himachal Pradesh, Kerala, Uttranchal and West Bengal performance is less than the national average of the sanctioned road works, length and amount released.

While some of the above States may have adverse climatic conditions that cannot be the sole reason for poor performance. Some of the constraints could be: limited working season, delay in statutory clearance from forest department, non-availability of required land, limitations of qualified manpower and contractors, over and above non-availability of dedicated personnel for the programme with streamlined institutional arrangements. States may have to look into the issues, examine critically and come out with mitigation measures to achieve the targets, as planned.

3.2 Bharat Nirman

3.2.1 Objectives

It is a flagship programme of the Government of India conceived as time bound business plan to provide rural infrastructure during 2005-06 to 2008-09. Six major rural infrastructure namely, rural roads, telephone connection, irrigation, water supply, housing and electrification are identified and over Rs.1,74,000 crore has year marked for development. The programme was initiated during the year 2005-06, under rural road component, it targeted to provide all weather connectivity to all habitations having population of 1000 or more (500 or more in hill, tribal and desert areas) by 2009. While the primary objective of PMGSY has been to provide 'last mile connectivity' to all eligible unconnected habitations, it

also includes an upgradation component in order to ensure farm to market connectivity.

It is pertinent to mention that the rural road component of the Bharat Nirman programme is actually embedded in the PMGSY with the target for the connectivity to habitations with 1000 or more population. Thus, the rural road component is concomitant to PMGSY with wider funding base and extended scope. Bharat Nirman envisages a massive scaling up of the programme in terms of habitation connectivity coverage, construction targets and financial investment.

3.2.2 Target and Achievement till 10th Five Year Plan

To achieve the targets of Bharat Nirman, 1,46,185 km of rural road 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 of the existing rural roads which are identified through routes of the core network. The total investment on rural connectivity under Bharat Nirman has been estimated at Rs. 48,000 crore during 2005-2009. Table 3.4 provides the national level habitation connectivity targets set and achievements under PMGSY/Bharat Nirman, and Table 3.5 provides the national level road length in km for connecting the above-targeted habitations under PMGSY/Bharat Nirman. The year wise targets for new connectivity (**Appendix 1 – Table 7**) and upgradation (**Appendix 1 – Table 8**) have been given in the Discussion Paper

Table 3.4: Connectivity of habitations - Target and Achievements under PMGSY/Bharat Nirman Programme (habitations in numbers)

Habitation	Total Target completion upto 10th FYP	Expected completion during 07-09	Expected completion during 10-12	Overall Targets for 11th FYP	Balance work for 12th FYP	Core Network Estimate
1000+	25371	34484		34484	0	59855
500+	14854	9154	19778	28932	37680	81466
250+	2511		14888	14888	14052	31451
Total	42736	43638	34666	78304	51732	172772

Table 3.5: Length of Rural Roads- Target and Achievements under PMGSY/Bharat Nirman Programme (length in km)

Length	Total Target completion upto 10th FYP	Expected completion during 07-09	Expected completion during 10-12	Overall Targets for 11th FYP	Balance work for 12th FYP	Core Network Estimate
New Connectivity	95960	95510	69734	165244	104601	365805
Upgradation	83757	128067	64397	192464	96595	372816
Total	179717	223577	134131	357708	201196	738621

3.3 Recommendations

- For integrated development of rural connectivity, upgradation is required to be included in addition to new connectivity links, as envisaged in Bharat Nirman.
- Rural roads development targets (based on 2001 census and to modify after next census) will require continuance of the programme even beyond 11th Plan period.
- The structure and systems of delivery developed so far should be strengthened and continued.

Chapter 4

Physical Targets – 10th FYP, 11th FYP and Spillover 12th FYP

4.1 Physical Targets of 10th Five Year Plan

The PMGSY envisages providing connectivity to all habitation of 500 and above in all States and 250 and above in hill states, tribal and desert areas. Based on the projects already approved under PMGSY, a further 2,39,000 km of new roads will have to be built to provide connectivity to the remaining eligible habitations under PMGSY. It is expected that 56,600 habitations will get connected, with new link roads of 1,26,670 km by end of 10th Five Year Plan.

The data available from the National Rural Roads Development Agency (NRRDA), value of works sanctioned is Rs. 154,550 million covering both new construction and upgrading upto the end of year 2004-05. A total of 38,129 habitations have been covered already.

4.2 Physical Targets for 11th Five Year Plan

4.2.1 Targets of 11th Five Year Plan

The physical target set under the Bharat Nirman till end of 2008-09 is found to be beyond the capacity of the States, due to unpreparedness from the beginning of the Bharat Nirman programme. Therefore, it is assumed the left over targets of Bharat Nirman for 2007-09 will be completed only by the end of financial year 2009-10. For the remaining period of 2 years in the 11th Five Year Plan i.e. 2010-12 the targets are set in such a way that 40 % of the balance left over in the PMGSY programme, both the new connectivity and upgradation will be completed during this period leaving 60 % of the balance PMGSY targets to be completed in the 12th Five Year Plan. Accordingly the targets for the 11th Five Year Plan are finalized and presented In Table 4.1.

Table 4.1: Estimated Targets for 11th Five Year Plan

Period	No. of Habitations to be covered	Length for new connectivity	Length for upgradation	Length (km) for renewal (to be borne by the State Governments)
Target up to the year 2009 as per Bharat Nirman	43,638	95,510 km	1,28,067 km	76,986 km
Target for 2010-12	34,666	69,734 km	64,397 km (38,638 upgradation + 25,759 km of renewal to be borne by the States)	
Overall for the 11th F Y Plan	78,304	1,65,244 km	1,92,464 km (1,15,478 km funded under PMGSY)	76,986 km

It is proposed to connect about qualifying 78,000 habitations with 1.65 lakh km of new roads. Nearly, 1.15-lakh km length of rural roads needs upgradation during the 11th Plan under PMGSY. It is also expected that the a portion of upgradation in terms of periodical renewal works as estimated will be borne by the State Governments in order to provide better rural roads network. The estimated portion of the funds for upgradation/renewal activities is expected to come from the state resources. According to PMGSY guidelines, the construction contractors are obligated to provide routine maintenance for five year. After completion of 5 years the State Government will carry out maintenance/renewal works through Panchayat Raj Institutions (PRI) by providing necessary funds and capacity building.

4.2.2 Physical Targets - Spillover to 12th Five Year Plan

The balance work, which will not be possible to be completed during the 11th Plan, may be carried during the 12th Five Year Plan in order to achieve the PMGSY targets of providing 100 percent connectivity to all eligible habitations. It is estimated that the habitations to be covered would be around 60,000 requiring about 1.05 lakh km road length. In addition, about 58,000 km of the existing rural roads would need upgradation and about 40,000 km requires periodical renewal so as to keep the entire network at a desirable level of service (LOS).

4.3 Financial Requirements during 11th Five Year Plan

Estimation has been made based on the current average cost of construction in the country as seen in case 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 upgradation.

4.3.1 New Connectivity

The average cost per km for provision of new connectivity is estimated as Rs.30.00 lakh/km for rural roads. The total amount required for construction of 1.65 lakh km length of new connectivity is estimated as about **Rs. 50,000 crore**.

4.3.2 Upgradation

The average cost per km for upgradation of the existing rural roads under core network is about Rs.25.00 lakh/km. 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.

4.3.3 Cost Trends

The cost of construction of rural road is found to be more compared to pre-PMGSY scheme. However this cost increase is due to the need based provision based on actual site condition. It is in deviation with the regular system of

making line estimates which proved to be inadequate many times. Cost trends in targets may vary depending up on the site conditions and requirements. The State-wise average per km cost of construction for the new connectivity as well as upgradation under PMGSY is annexed in the Discussion Paper.

4.3.4 Maintenance

Fund requirement for maintenance of rural roads of the core network identified from the district rural road plan is estimated as Rs.140,000 million per year. It is estimated that about 1.4 million km length under core network would require routine and periodical maintenance during the 11th Five Year Plan. The average maintenance cost/km/year is Rs.1,00,000/km which consist of routine maintenance about Rs.20,000/km and the periodic maintenance with 6 year renewal cycle is about Rs. 80,000/km. A total Rs.1,40,000 million is required every year for maintaining the estimated length of 1.4 million km during the period.

4.3.5 Maintenance Strategies in State Government Programmes

Recently, the NRRDA has conducted a feed back study on regarding the norms for maintenance of rural roads in various states. The data shows that annual maintenance norms per km followed by Andhra Pradesh, Gujarat, Karnataka, Tamil Nadu and Uttar Pradesh range from Rs. 10,000 to Rs. 23,000 per km. In respect of Orissa, the norm is Rs. 25,000 to Rs. 30,000 per km for unpaved roads and Rs. 120,000 per km for black topped roads. Corresponding figures for Rajasthan are Rs. 23,400 and Rs. 47,120 respectively. The States of Arunachal Pradesh, Bihar, Madhya Pradesh and Meghalaya do not have norms of their own but they follow those which are laid down by the Indian Roads Congress (IRC) or Ministry of Road Transport and Highways (MoRTH). Maharashtra Government reviews the norms periodically by setting up a special committee for this purpose. In Maharashtra, a norm of Rs. 54,000 to Rs. 59,200 per km is adopted. The states of Assam, Haryana, Jammu & Kashmir, Punjab and Uttar Pradesh are firming up their policy on maintenance.

4.4 Recommendations

- 11th Five Year Plan should continue to support the rural connectivity and upgradation targets as a major policy in view of huge untapped potential in rural India.
- Special provisions for funding shall be required to continue with the policy of opening up rural India.
- Maintenance may be taken to the top of the priority list to sustain the assets created and reap the benefits.

Chapter 5

Planning and Design of Rural Roads

5.1 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 centres. Planning of road system should always focus on spatial aspect of planning and should be integrated with other non-spatial socio-economic activities. Roads have to be planned and programmed in such away 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.

5.1.1 District Rural Road Plan (DRRP) and Core Network (CN) in PMGSY

Under PMGSY programme, the investment for new construction and upgradation are being assessed by preparing a district level rural road plan and core network of rural roads. The District Rural Road Plan (DRRP) is a compendium of the existing and proposed road network system in the district which clearly identifies the proposed roads for connecting the yet unconnected habitations to already connected habitations/all-weather roads in an economic and efficient way interms of cost and utility. It is also known as Master Plan for Rural Roads for the district. Preparing maps and database on habitations and road details for each Block, such maps are integrated at District level to form the District Rural Road Plan. Detailed guidelines were prepared by the Ministry of Rural Development and circulated to the State agencies.

The Core Network (CN) is a subset of DRRP which provides the 'basic access' to all villages/habitations with one all-weather road to the near by market centre or rural business hub and essential social and economic services. It comprises of Through Routes and Link Routes. Through routes are the ones which collect traffic from several link roads or a long chain of habitations and lead it to a market centre or a higher category of roads. Link routes are the roads connecting a single habitation or a group of habitations to Through Roads or

Major Road leading to market centre. Links routes generally will have dead ends terminating on habitations, while through routes arise from the confluence of two or more link routes and emerge on to a major road or to a market centre. All State agencies have already prepared the DRRP and Core Network and currently, funds are being allocated based on these plans.

After the Block-wise Master Plan has been approved by the Block level Panchayat, it would be forwarded to the District Planning Committee, where the Block Plan would be integrated into the District Master Plan, called District Rural Roads Plan. This would be placed before the District Panchayat for consideration and approval. After approval this would become the final District Rural Roads Plan, and would form the basis for selection of road works under PMGSY, through core network work. This plan may be considered for all rural road development programmes.

The DRRP and Core Networks serve as master plans and provide basic information on connectivity to the habitations up to 100 person. It may expect to serve the rural road development beyond PMGSY/Bharat Nirman targets. However this needs periodic updation every 3 to 5 years based on the nature and extent of development taken place.

5.1.2 Optimal Network Planning with Multiple Connectivity

The Core Network based on the DRRP database prepared at the beginning of the PMGSY programme to provide single connectivity to the habitations needs to be reviewed. Core Network maps basically result in spanning tree structure for the network, particularly when basic access is the target. This type of network, though provides connectivity, may result in constrained access which leads to detouring and making circuitous travel. There for the procedure for preparing the core network requires a review, particularly in those districts which have achieved the basic connectivity. It is a case for providing multi-connectivity for selected habitations having higher levels of economic activity that may require access from more than one direction, in order to cut down the total transportation cost. Though providing basic access is a social obligation, the multiple accesses are to be fully justified and substantiated by suitable economic appraisal and should be taken only when proved to be beneficial. In this connection, the decision criteria can be based on economic analysis and tools like Road Economic decision (RED) model and Highway Development and Management (HDM) model can be effectively used. Care should be taken for non-quantifiable social impacts while taking final decisions based on economic analysis.

Core network provides basic access to all habitations, however, the multiple links proposed may serve additional facilities or service centres. Integrated functional accessibility criteria may be used to select the best link options for provision of multiple connectivity strictly based on social and economic criteria.

The accessibility may be classified as (i) access to fulfill social needs and (ii) to provide access to market centres to increase economic activities of the area. Appropriate method of estimating accessibility indicator may serve this purpose. If the proposed links generates economic activities then it can be justified and prioritised using the economic criteria such as cost benefit analysis and/or cost-effectiveness approach.

Accessibility based network planning shall be required to address the sparsely populated areas (like hill, desert and coastal areas) with dispersed settlements. The criteria may be selected appropriately for such areas to meet the accessibility to lower order population levels (habitations with population 250 or less). The states like Arunachal Pradesh and Jammu and Kashmir and other hill states where the settlements are dispersed in a wider area needs a special accessibility approach to find out optimal network to provide connectivity to these settlements. Therefore, it is necessary to take appropriate steps through pilot projects on development of optimal rural road network in such regions to select appropriate links which provides maximum benefit in terms of access to various socio-economic functions.

It is also proposed to review the current core network and strategic development of optimal functional accessibility based network in selected districts, and thereby incorporating basic access to lower order settlements also, not limiting to the targeted eligible habitations under PMGSY, which will ultimately provide guidelines for multiple connectivity.

5.2 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 programme with out 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.

5.3 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 other wise the continuity of transport flows may get affected. Currently lot of emphasis is given for the roads providing mobility through programmes like NHDP for selected national highways, some state road programme 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 centres 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.

5.4 Geo-Information Technology for Database

Currently, the PMGSY is being implemented and monitored through a web based On-line Management, Monitoring and Accounting System (OMMAS), which provide the basic master data and the detailed projects wise information along with the accounting system. To bring more transparency and management of the rural road programme implementation in totality, would be to develop these databases using Geo-Information Technology during the 11th Five Year Plan. At present, the databases of the DRRP and core network are already available as geo-referred attribute data along with maps prepared in the scale 1:50,000 for each Block. A little more effort of creating digital spatial data is needed to complete the database on Geographic Information System (GIS) platform. The National Map Policy (2005) with availability of satellite imageries can facilitate the development of spatial data at different levels. By integrating the spatial data and the attribute data on roads as well as the habitations, a GIS database can be generated for better planning and management of rural road programme at district/block level. In addition, special plans can be prepared by adopting contours in GIS maps for hilly regions to identify optimal route locations to provide connectivity to the targeted habitations without affecting the

environment. The network planning tools available in various GIS software will be useful for finding out optimal road network based on accessibility criterion and socio-economic benefit criteria.

Ministry of Rural Development (MORD)/National Rural Road Development Agency (NRRDA) had taken up a pilot project of 'Web based GIS Application for Rural Roads' in the states of Rajasthan and Himachal Pradesh, in collaboration with C-DAC, Pune under PMGSY/Bharat Nirman programme. This effort should be expanded to all States for creation of spatial data on GIS platform (especially the DRRP, core network, and work programme, etc.) and upload the same at the national database. This may be taken as a primary objective under rural road network planning and evaluation within the plan period of 11th Plan.

5.5 Design of Rural Roads

In the past, rural roads have been constructed under various rural road development programmes, which are mainly conceived for employment generation and poverty alleviation. In such programmes serious efforts were not made to build sustainable all-weather roads. Roads were never considered to be engineering structures and these not designed to the required specifications. The roads built under these programmes, without back-up system or facility to sustain them with engineering inputs for repair and maintenance, have disappeared in no time. Many of the technical aspects of road making (for example, adequate compaction of subgrade, roadside drainage, required cross drainage etc.) were seldom given due importance in rural road construction.

In order to fulfil the objectives of PMGSY for provision of all-weather rural roads, the Indian Road Congress brought out the 'Rural Roads Manual' IRC:SP-20:2002. The manual covers all aspects related to rural roads including planning and alignment; geometric design standards; climate and environment; road materials and pavement design; road drainage, culverts and small bridges on rural roads; construction specifications and quality control aspects; guidelines for using waste materials such as fly ash, etc., maintenance of rural roads and sources of finance for rural road development.

Currently the manual is being followed for design of rural roads under PMGSY/Bharat Niman projects. To achieve more economy in designing the rural roads the Indian Roads congress is revising the manual based on the following criteria;

- Rural Roads are low volume facilities basically serving the access needs. The design speed and level of service expected are low. The design standards should be in harmony with such expectations.
- Geometric standards, particularly gradients, are difficult to change later, and hence should be selected carefully with the future requirements in view.

- The initial cost is an important consideration. Many roads particularly through routes will, in due course, carry fairly substantial traffic but it is preferable to optimize costs by stage construction in tune with traffic growth.
- A design period of 10 years is considered adequate, with rehabilitation being planned based on road condition.
- Durable and permanent assets need to be aimed at through adequate provision for drainage and protection works.
- The maintenance of assets must receive careful attention as a policy and should not be capitalized into richer than required standards at the design stage. .

5.5.1 Feasibility and Detailed Project Report

Each rural road project, whether new construction or upgradation of an existing road should have a separate feasibility and Detailed Project Report (DPR). The DPR should be based on the detailed survey and investigations and designed with choice of technology. The guidance for preparation of the DPR may be taken from IRC:SP:19, and other relevant IRC Codes of Practices along with all data supported by necessary investigations and the maps/drawings. The cost and quantity estimates should be based on the Schedule of Rates, which will be prepared using the MORD specifications and Standard Data Book (SDB) for Analysis of Rates for Rural Roads.

Under PMGSY, the DPR prepared by the executing agencies are being scrutinized by the State technical agencies before it is being approved. The system should also continue during the 11th Five year Plan Period not only for proposals under PMGSY but also for other major programmes and schemes under taken by the States.

5.5.2 Pavement Design

The IRC Rural Roads Manual gives pavement thickness based on, (i) 4-day soaked CBR value of soil and (ii) traffic in terms of commercial vehicles per day (CVPD). As regards the type of surfacing, all rural roads except those (i) in an arid region with annual rainfall less than 500 mm and traffic upto 150 motorised vehicles per day and (ii) in a region with an annual rainfall less than 1000 mm and traffic upto 50 motorised vehicles per day (except two-wheelers) were required to be provided with a bituminous treatment. Unsealed gravel roads did not receive adequate treatment, and thus, practically all rural roads being constructed in the country now are black-topped.

The definition of commercial vehicles is not given, and practicing engineers often include agricultural tractors in this category. Though the curves are the standard UK Road Research Laboratory curves, these curves are applicable for commercial vehicles of laden weight more than 3 tonnes.

Considerable amount of work has been done on pavement design of low volume roads internationally. Of these, the following may be mentioned:

- (i) AASHTO design curves for low volume roads
- (ii) Australian pavement design curves for low volume roads
- (iii) Chinese pavement design curves for unsurfaced low volume roads.

AASHTO design curves have been evolved after extensive observation of performance of roads under various climatic conditions and traffic load repetitions.

Since rural road cater for low volume of traffic, and serving in various climatic regions in India (spread out to every district of the country), it is felt that such performance based design method will prove to be more economical rather than the conventional method of designing rural roads. Therefore, NRRDA has initiated a research and development programme on 'Rural Roads Pavement Performance Study (RRPPS)' in selected States with an aim to develop performance data and to develop performance based design and specifications of rural roads for Indian condition. The results of such studies (which are in progress) will provide ways and means to devise design methods based on the performance observation during the last few years by researchers. The 11th Plan should aim to develop design methods based on these results, which may economise in design of rural roads, thereby saving in construction cost.

Indian Roads Congress has already revised the manual and is being published as special publication. It recommends the design of flexible pavements for rural roads using the concept of performance based designs (AASHTO) with Equivalent standard Axle Loads (ESAL) which will optimise the pavement structure and the cost of construction. The design of rigid pavement of rural roads including that of block pavements and roller compacted cement concrete have been brought by the Indian Roads Congress is being recommended for implementation of rural road programme.

The roads constructed under PMGSY/Bharat Nirman follows the set standards for designing of rural roads; it is also recommended that adoption of uniform design standards for all rural roads irrespective of the source of funding.

5.5.3 Options for Paved and Unpaved All-weather Roads

Bituminous surfacing is currently being provided on almost all rural roads, without any consideration of traffic and rainfall. This is a costly item, its cost being in the range of Rs 4-6 lakh per km at current prices. Blacktopping, therefore, has a bearing on investments needed for rural roads. Availability of bitumen at reasonable cost and in desired quantities may also pose a problem in foreseeable future. Moreover, this surfacing will involve extra cost in periodic maintenance subsequently. Subject to consideration of rainfall and traffic, blacktopping may be restricted to Through Routes and Major Rural Links (MRL). The Major Rural Links function is similar to through routes but designated as link

route For roads connecting villages with population less than 1000, gravel roads can adequately serve as all-weather roads unless heavy rainfall conditions justify blacktopping.

Several countries in the world, including USA, have a large percentage of unpaved roads. The USA experience shows that upto 100,000 repetitions of standard axles, gravel roads can be considered, and for traffic less than 10,000 repetitions earth roads are suitable. Roughly, under present loading conditions observed in India, this implies that many of the link roads in low rainfall areas can be constructed as gravel or thin surfaced roads. It is thus apparent that unpaved gravel roads have an important role to play in India's future road programme. The unpaved roads can be sealed with appropriate dust palliatives in order to reduce the dust pollution in rural areas.

Furthermore, several low cost bituminous sealing techniques are available. These include surface dressing, which can be practiced with low cost equipment and labour-intensive techniques. Gravel roads and soil-cement roads can also be sealed by a thin bituminous treatment.

5.5.4 Cross Drainage Structures

Cross-drainage (CD) structure which are intended for crossing of water barriers along the road alignment constitute the most important component affecting the all-weather character of the road. These cross-drainage structures are one of the costly items (forming roughly 25-30 percent of the total construction cost) in road projects. On rural roads these structures should be as economical as possible to be consonance with the low-cost concept of the road and at the same time consistent with the technical and functional requirements. Currently cross-drainage structure up to a span of 25 meter is being permitted under the PMGSY/Bharat Nirman programme. For CD structure beyond 25 m the cost of bridge beyond 25 m is to be borne by the concerned states. IRC is revising the recommendations for small and medium size CD structures for rural roads and it is expected to be released soon. The construction of CD works and control of quality are most difficult task in remote places where most rural roads are located. Therefore, it may be necessary to adopt steel construction for small and medium size bridges if technically suitable. Further, most of the culverts can be systematically provided with uniform standard and quality by adopting appropriate pre-casts modular designs.

5.6 Recommendations

- The DRRP and Core Network preparation in a master plan framework to be continued in the 11th Plan.
- Based on the
- The network planning may be revisited and optimal network may be attempted in 11th Plan including multiple connectivity to avail circuitry of the network.

- Pilot projects may be taken up in special regions like Arunachal Pradesh, Jammu and Kashmir, etc. where the settlements are located in geographically wide spread areas using functional accessibility based on network planning for selection of optimal links during the 11th Plan period.
- Intra-village/habitation roads should be given priority in 11th Five Year Plan, starting with the priority to the villages having more than 1000 population.
- The planning data should be updated every 3-5 years and maintained as geo-referenced data.
- During 11th Plan period, GIS Application for Rural Roads database management for planning and maintenance may be undertaken in a phased manner in all States based on the experience of the pilot projects.
- Engineering design and DPR must be the basis for implementation of rural roads in 11th Plan.
- Economy in design and specification to be pursued through performance based designs and use of locally available and marginal materials.

Chapter 6

Materials and Construction Technology

6.1 Pavement Materials

Recognizing that the rural roads are essentially low cost roads, the specifications for pavement materials in various layers should be as economical 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.

6.1.1 Conventional Materials

For road construction, the conventional materials required are soil, stone aggregates, bitumen, cement and steel. Considering the targets of new construction and upgradation of about 4 lakh km of rural roads during the 11th FYP period and periodic maintenance of about 2 lakh km per year, broadly the materials required would be: aggregate about 24.3 million cum, bitumen 0.9 million tonne per year and cement 0.5 - .035 million tonne per year. The requirement of these materials on other construction sectors would be far grater. Nevertheless requirement for rural roads is also considerable. Accordingly, there is a need to reduce the consumption of construction materials of high quality and initiative be taken to use of locally available materials which can satisfy the design requirement of rural roads.

6.1.2 Locally Available Low Grade/Marginal Materials

Surveys carried out in the country for different types of low grade materials revealed that there is a wide variety of these local materials that can be used in rural road construction. These materials are broadly categorized as (i) Moorum/Gravel, (ii) Kankar, (iii) Dhanla (iv) Laterite and (v) Soft stone/sand stones. Usually these materials can be adopted for construction of sub-base/base courses, and shoulders. However, these materials may need suitable treatment for using in different layers of road works.

A major constraint in the use of local material lies in the procedures adopted by the field agencies and lack of awareness and exposure. It is possible to popularize the use of stabilization techniques thorough appropriate training and capacity building of the field engineers. The reluctance of the field agencies to

deviate from the conventional methods in design as well as use of local materials and to try out innovative technologies also call for attitudinal changes through HRD interventions.

6.1.3 Non-Conventional Materials

The non-conventional road construction materials are the industrial waste and by-products such as fly ash from thermal power plants, iron and steel slag, marble dust from quarry, Phosphogypsum – a by-product of phosphoric acid based fertilizer plants, processed municipal wastes, jute and plastic wastes. Many organisations carried out research work to develop specification for these materials. These materials can be used as replacement for the conventional materials wherever they are available in abundance, this will not only reduce the cost but also preserve the precious environment around the industries.

The detailed notes on various non-conventional materials are as follows:

Fly ash: It is produced as waste by-product of coal combustion in thermal power stations. The present annual generation of fly ash is estimated to be about 140 million tonnes. Fly ash can be used as filler material in embankment, base/sub-base courses. Sub-base course can be constructed using pond ash or bottom ash replacing conventionally used moorum. The pozzolanic property of fly ash enables it to be used as an alternate binder in place of cement. While coarser fly ash can be used as fill material, the finer ash can be used for replacement of sand and cement in road construction works. Use of fly ash for rural road work has been covered in IRC:SP:20 2002 and Rural Road Manual. Several demonstrated rural road project are implemented around major thermal power plants in India.

Steel Slag: It is a waste product of steel industries and it can be used as pavement material in a variety of forms. Normally production of one tonne of steel results in generation of one tonne of solid waste. The big steel plants in India generate about 29 million tonnes of waste material annually. In addition, there are several medium and small plants all over the country also produces steel slags. It can be used as a base or sub-base material either in bound or unbound condition. It meets all the requirements set forth by the MORTH. As per IRC:37-2001, Rs 5 lakh per km can be saved by using slag as road material.

Marble dust: It is a waste material of marble industry and widely found in Rajasthan,. It has been shown that the California Bearing Ratio (CBR) of the sub-soil may be increased by upto 40% to 50% by mixing 15% to 25% of marble dust depending upon the nature of soil. Thus the cost of construction may be reduced considerably.

Processed Municipal Wastes: Inorganic materials in the processed municipal wastes such as pebbles, glass pieces and other non-degradable materials can be used along with the local soils in construction of low volume and rural roads. Under the aegis of Ministry of Environment and Forest, the CRRI has conducted

laboratory and field studies. Based on laboratory studies pavement design thickness was arrived and constructed a test track using the tractor bound technology for various operations while construction. The performance of this road has been studied for about three years and found that it has performed well. Depending upon the local conditions and the nature of the material, it is proposed to make detailed study and develop specifications for its use in road works.

Phosphogypsum - It is a by-product of phosphoric acid based fertilizer plants. It can be used to stabilise black cotton soils as it reduces the shrinkage and swelling of black cotton soil. The fertilizer plant located at Dalhej, Gujarat has demonstrated usage of this technology. The cost of road after phosphogypsum stabilisation is about 25% less than the normal construction cost.

Jute Geo-Textile (JGT) is a natural technical textile laid in or on soil to improve its engineering properties in road construction. The NRRDA has taken up a pilot project in collaboration with the Jute Manufacturers Development Council (JMDC) to demonstrate the potential benefits of use of JGT in construction of rural roads. This pilot project aims at standardization of different types of Jutes. Under the pilot project 10 roads have been selected in Assam, Chattisgarh, Madhya Pradesh and Orissa covering a length of 47.84 km. Central Road Research Institute has been engaged as a technical consultant for this project for project preparation, quality control, and monitoring and performance evaluation.

Waste Plastics: Polymer modified bitumen is emerging as one of the important construction materials for flexible pavement. The choice of the polymers varies from virgin polymer to waste polymers and latex to waste rubber. The plastic wastes are polymers, they are either blended or dispersed with bitumen and the mix is used as modified binder. Use of plastic waste in the construction of flexible pavement is gaining importance due to better properties and reduction of plastic waste pollution. Several researches are carried out and specifications are developed and tested by construction of test tracks and the results are encouraging. Codes and procedures are being prepared for use of plastic wastes in rural roads. NRRDA has initiated the process of getting design specifications and also getting the approval of Indian Roads Congress to promote this type of specifications in rural roads.

6.2 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.

6.2.1 Traditional Methods and Technology

The current practice of construction and maintenance of rural roads continue to be traditional. Though there is an increasing awareness regarding the need of maximising use of locally available materials, adoption of soil stabilisation techniques and relevance of sealed gravel roads for low volume traffic conditions, cost effectiveness practices have not yet found favour in most of the rural road construction. Deployment of equipment/plant by and enlarge is the same as is being used for higher category of roads. State may have a mechanism of interacting with financial institutions, contractors and equipment manufacturers to facilitate the availability of required machinery for construction and maintenance of rural roads.

Even though intermediate technology is advocated for rural roads for speedy construction, achieving the required quality of construction, use of machineries will become necessary in selected operations. The present assessment is that available machinery for rural road sector is nearly 1/3 of what it should be. It has been estimated for PMGSY works that for Rs.5 crore package, initial cost of machine is Rs.1 to 1,5 crore. Though, the cost to the work is much less as the same machine is used in other works as well. In order to increase the use of machines, awareness among the Contractors is to be created sensitizing them on quality assurance system.

6.2.2 Labour-based Technology

As the rural population grows in the coming years, off-farm employment opportunities need to be created to contain migration of rural population to towns and cities. Road construction and maintenance using labour-based technology promises to be a good avenue for creating employment potential while building productive assets. Many of the operations involved in rural road construction on such as excavation, embankment construction, soil-stabilisation, surface dressing, maintenance operations like trimming of berms and cutting grass and weeds, are easily amenable to be undertaken by manual means with support of light equipment. Provision of better tools to enhance the productivity of labour and training of the work-force will help in the process. International experience from China and several African countries suggests that most of the operations involved in the construction and maintenance of Rural Roads can be efficiently performed by labour, aided by simple implements to increase their productivity.

6.2.3 Intermediate Construction Technology and Equipment

The construction of rural roads in our country is largely with conventional techniques and is labour intensive. However, these techniques are slow and often result in sub-standard quality of finished product. On the other hand, machine based technologies are capital intensive and hence cannot be pressed for low volume rural road construction. Keeping in view the importance of employment opportunities and at the same time ensuring a minimum standard quality necessitates adoption of intermediate technology. A study on use of tractor-powered technology using locally available agricultural machinery, tractors-tiller was developed. The important operations such as loosening the soil for excavation, site clearance, loading and unloading, pulverization, mixing of additives, watering, spreading of soil, additives, leveling of soil at desired camber and compaction can be done with such a machinery. Normally, these equipments remain idle in the agricultural fields for a considerable time in rural areas during sowing-harvesting cycles and therefore facilitate their use with no further investment and simultaneously getting better productivity of existing machinery.

The equipment manufacturing industries needs to focus on intermediate and low-end technology machines which can be used cost effectively by the local contractors in construction and maintenance of rural roads. Simple equipments such as Pedestrian road rollers, chip sealing machines, simple equipment for spraying emulsion, cold mix plants of small capacity, pot hole kit are some of the promising items of the equipment. There is a scope for developing a healthy equipment leasing industry in the private sector to reduce financial burden on contractors in the use of machinery.

6.3 Design Modifications

Indian Roads Congress has revised its design guidelines of flexible and rigid pavements for rural roads. However, performance based design to be developed during 11th Plan, is likely to further modify the design to provide improved performance. Such design shall be suiting to the need of terrain, climate, material availability, drainage condition, etc. and even at lower cost. This is to be an important target in 11th Plan, and also to use the non-conventional materials as primary material for rural roads with modified design.

6.4 Effect of Cost due to material haulage.

In any road construction, substantial portion of the cost of construction is the materials cost. In many places in the country (like parts of UP and north Bihar, Mizoram, Tripura, etc) the materials like hard stone has to be hauled from a lead distance more than 100 to 200 km and sometimes upto 500 km. Use of locally available materials (with design modifications) and adopting appropriate construction technology may reduce the cost of construction drastically bringing

down the cost of haulage from far away distances. However, this requires considerable efforts right at the development of specifications for the marginal materials in the road construction, inclusion of the same in the standard specifications and insist that these be followed meticulously while preparing the project proposals. Appropriate R&D initiatives at the State will facilitate and accelerate the use of marginal materials for cutting down the cost of construction due to longer haulage of standard materials.

6.5 Employment Potentials in Rural Road Sector

Road construction activities generate direct employment opportunities for the skilled, unskilled labourers and also provide an opportunity for local entrepreneurship to supply the procurement of rural road project activities. The labour employment opportunity is mainly depends upon the construction technology. The technology is also decides proportion of labour, material and equipment usage in road works. Depending upon the sites and availability of labourers the labour-based methods are well suited for site clearance, earthwork, short hauling, and aggregate preparation. Even bituminous work also generates labour employment. Table 6.1 provides an estimation of portion of labour, material and equipment which gives an idea of direct employment generation in road construction.

Table 6.1 Proportions of Labour, Materials and Equipment in Rural Road Construction

SI No.	Technology chosen	Proportion of			
		Materials	Labour	Equipment	Total
1	Purely labour-oriented*	60	40	--	100
2	Labour oriented, but with selective use of light equipment (Intermediate technology)	60	25	15	100
3	Highly equipment oriented	60	5	35	100

*Applicable to tracks and uncompacted roads

(Source: Rural Road development Vision t – 2025 Draft)

Rural roads should be constructed by adopting the Intermediate Technology. An expenditure of Rs. 1 crore in rural roads is likely to create 40,000 man-days of employment (taking an average wage rate of Rs. 75 per day). Taking into account the assessment of investments required in construction and maintenance of rural roads during the plan periods, the employment in terms of man-days likely to be generated is in tune of 440 million mandays.

There are many spin-offs that can be expected from the rural road programmes that can lead to the creation of additional jobs. These will be:

- creation of better avenues for self-employment;

- on-farm employment opportunities due to shift in cropping pattern
- non-farm opportunities like grocery shops, tea stalls, small businesses and cottage industries;
- expansion of health, education and agro-based industries.

There is a need for undertaking studies to quantify such spin off employment potential by construction of rural roads. The general impression is that it is several times that of direct employment and is of continuing nature.

6.6 Recommendations

- Low cost marginal and industrial waste 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 labour based construction methods also may be adopted. But, it must be emphasized that employment generation is not the focus of rural roads programmes.
- 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.

Chapter 7

Maintenance Management for Rural Roads

7.1 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.

- (i) The roads in each District will be ranked according to the Pavement Condition Index (PCI). Subject to the overall availability of funds, roads of progressively lower PCI will be uniformly taken up in all Districts for inclusion in the list.
- (ii) In case it is necessary, a further sub-prioritisation will be done on the basis of Annual Average Daily Traffic (AADT), which will need to be applied only in case of all roads of a particular class, cannot be taken up for maintenance due to scarcity of resources.
- (iii) Subject to earmarking of maintenance funds on project basis e.g., World Bank aided projects, PMGSY maintenance contracts; etc., the divisible pool of maintenance fund will be distributed among the Districts in ratio of the total length of roads of the priority classes being taken up for maintenance.

Priority should be given to preventive maintenance techniques, such as crack sealing, surface dressing, dressing and maintenance of shoulders, drainage works to extend the life of the pavement significantly.

As per PMGSY Guidelines, the State Government is required to undertake the maintenance of the entire Core Network in addition to the road works constructed / upgraded under the Programme. The State Governments will need to develop sustainable sources of funding for undertaking the maintenance functions.

Providing dedicated fund is pre-requisite for sustainable maintenance. Normal sources of funding for maintenance is comes from regular budgetary sources and creation of fund with special purpose levy such as mandi cess, fuel etc. and

maintenance awards by finance commission. The other option is projectisation of maintenance option can be examined with appropriate cost sharing basis by the State and Central Governments for PMGSY/Bharat Nirman roads. The same can also be practiced for other rural road programme by the state governments.

7.2 Asset Management Strategy

The components of road asset include pavement, bridges and other cross drainage structures, tress and other amenities within road land. The management of road asset comprises of maintenance of all these components to the required level of serviceability, and traffic management. Thus, road asset management is systematic process for maintaining, upgrading and operating physical assets cost effectively. In other words, it is combination of engineering principles with sound business practices and economic theory. It should provide short term and long range planning for the asset. In the 11th Plan the asset management principles may be adopted by creating asset information system, and a pilot scale development should be attempted for selected districts through the rural roads programme under PMGSY/Bharat Nirman.

7.3 Maintenance Interventions and Technology

The core problem in maintenance is in attitudes which need a change. There is no clear ownership of rural roads for almost all the rural roads, as they have been constructed on and off under different schemes.

As per PMGSY guidelines, the rural roads construction under the programme will be maintained by the same contractor of a period of five years. Clear guidelines are developed and presented in the rural road manual (IRC:SP:20:2002). The specifications of items of routine maintenance shall be as per the Specification of Rural Roads and the analysis of rates shall be based on the Standard data book.

7.4 Maintenance Management System

The existing database for roads is generally weak. For rural roads, the position is worse. There is an urgent need to establish a Road Management Unit at the Head Quarters of the State PWD / Rural Engineering Organisations (in fact preferably the SRRDA). This unit should have the responsibility of a creation of a Maintenance Management System. The output expected from the MMS would be:

- Network condition
- Road Inventory
- Need based priorities based on deterioration prediction models
- Annual Maintenance Plan for a given budget

7.5 Privatized Contract Management

With the expansion of the road network to provide connectivity to habitations associated with increasing traffic due to economic growth that leads to faster deterioration and frequent interventions, the States face difficulty in undertaking routine maintenance. A few States have already started performance based system of contract maintenance in respect of rural roads. The Standard Bidding Document (SBD) developed for PMGSY and prescribed to all the States clearly brings out one aspect of the policy on Contract Maintenance. In the World Bank funded Andhra Pradesh Economic Restructuring project, maintenance works are also being executed, on pilot basis, through annual maintenance contracts in geographically compact packages. The experiences thus far are encouraging and need to be standardized for wider application.

7.6 Community Participation in Maintenance

The basic objective of the community participation in maintenance of rural road is to improve the quality and serviceability of the road. In this process it is expected that community may voluntarily participate by way of donating labour, informing the damages, or repairing of small pot holes, cracks etc. However, not much headway is made in this direction in India. Therefore, it calls for a dialogue with various stake holders such as NGOs operating in rural areas, cooperative societies, Panchayat Institutions, etc. Since the PRIs provide the organised form of community participation their involvement and details are discussed Chapter 11 and in Section 11.5. A few international experiences are discussed in the subsequent paragraphs to throw light on these types of systems.

The Government of Finland has promoted rural road maintenance using road cooperatives. A road cooperative is a rural road maintenance organisation whereby the people living along it maintain the road. The Finnish Government has provided a legal framework which stipulates the right-of-way, cooperative ownership, and the formula for distribution of maintenance costs amongst the road users and property holders along the road. Participation in the road cooperative is compulsory for property owners who use the road. The cost of road maintenance is shared amongst the members of the cooperative depending on the benefits to each member in the form of the size of the holding and the created traffic.

In Peru, the Rural Roads Project (RRP) has set up a cost-effective routine maintenance system based on contracting out labour-intensive maintenance works to micro-enterprises, local cooperatives and other community based organisations. The composition of the micro-enterprises varies according to the length of the road. Their average size is about 13 people and the average length of the roads covered under a contract is about 34.6 km. Typically, micro-enterprises are made up of 11 to 20 people living close to the road. Priority is

given to unemployed people who have previous experience in construction works.

Simple routine maintenance can be assigned to various community groups such as NGO, cooperatives, etc. on cost sharing basis with necessary orientation, training and motivation.

7.7 Recommendations

- No asset lasts long without due maintenance and rural roads are no exemption. Routine and periodic maintenance should be planned and executed with due budgeting for the funds during 11th Plan.
- Projectisation of maintenance option can be examined with appropriate cost sharing basis by the State and Central Governments for PMGSY/Bharat Nirman roads.
- Uniform level of service criteria for maintenance be developed and adopted across the country. Suitable computerized maintenance management system (MMS) utilizing simple measurements (inventory and PCI data) be adopted for rural roads.
- Since the roads are to be owned by the PRIs, a community based maintenance programme may be adopted with hierarchical arrangement with District PIUs for higher level maintenance while routine maintenance being the responsibility of PRIs.
- Scientifically based 'PMMS' (pavement maintenance management system) suitable for sustainability of rural roads should be evolved based on the principles of road asset management.

Chapter 8

Looking Beyond PMGSY

8.1 New Initiatives in PMGSY

Under PMGSY several guidelines, manuals and documents on planning, project preparation, design, construction and maintenance of rural roads, culverts and small bridges; operational manual for execution; quality control handbooks and registers; standard bid documents (SBD); etc were prepared for assisting the executive agencies. Apart from these developments, the PMGSY programme also initiated several associated project implementation aspects. It has prescribed a separate institutional pattern for planning and implementation of the programme. At District level the programme is executed by Programme Implementing Unit (PIU), and they are coordinated at State level by the State Rural Road Development Agency (SRRDA) and at national level the NRRDA provides operational and management support to the programme.

To ensure streamlined functioning and adequate coordination (especially where there is more than one executing agency), officers of the PIU are made fully accountable to the SRRDA and be brought under its administrative control. The SRRDA would function as dedicated agency of the state nodal department for rural roads, to ensure integrated development of rural roads through the various schemes including PMGSY. In order to facilitate speedy implementation and provide better roads by attracting good contractors, the project proposals are packaged between Rs.1 to 5 crore. This attracted big contractors in this sector and also enabled and strengthens the capacity of the local contractors.

Various research and academic institutions are networked as State Technical Agencies (STA) for assisting in the preparation and scrutiny of the project proposals prepared by the executing agency (PIU). In addition, the programme also assisted in developing the capacity of these network institutions by organizing several workshops and trainer training programmes. As a part of the programme, several conferences, seminars and workshops are being organized to disseminate the knowledge and the implementing system. It sponsored several training programme to the field engineers and technicians.

Taking advantage of the information and communication technology, the programme is being monitored and managed through a web enabled 'On-line Management & Monitoring and Accounting System (OMMAS)'. The executing agencies will have to input all the data pertaining to the programme. It is not only speeding up the execution, but also provides transparency in implementation of the programme.

The efforts made under this programme should be perused with further refinements for achieving the targets proposed in the 11th Five Year Plan.

8.2 Uniform Standards and Specifications

Rural roads are being constructed by several agencies under State Governments in different programmes. They adopt their own standards, specifications and design procedures, which are often lower than what the IRC manual advocates. Over a period of time, when the traffic increases, it is difficult to widen or strengthen these roads. It may become more cost than constructing a new road. Therefore, it is suggested that all rural road constructed by different agencies or funded by different institutions such as NABARD should follow the same standards prescribed for the rural road projects under taken in the PMGSY/Bharat Niman as per IRC/MORD book of specifications.

8.3 Utilisation of Capacity Built under PMGSY

As mentioned earlier, the existing institutional setup for implementation of PMGSY/Bharat Nirman can be utilized for development of intra-village/habitation roads, state rural road programme and multilateral funded projects. Application of uniform standard and specifications developed by Indian Roads Congress for Ministry of Rural Development, Government of India should be made compulsory for all roads irrespective of the source of funding.

8.4 Accessibility to Lower Order Settlements

8.4.1 Magnitude of the Problem.

PMGSY envisages providing New Connectivity to all the habitations with 500 and above population in Plains and to the habitations of 250 and above in Hill States, Tribal and Desert Areas.

Table 8.1 gives the category wise eligibility of Unconnected Habitations to be covered under PMGSY for all the States. With this eligibility criteria, out of 3,46,607 unconnected habitations only 1,78,768 habitations become eligible for new connectivity under PMGSY, covering only 51.58% of the unconnected habitations. The eligibility varies from 17% to almost 100% in different States. Even with the assumption that some of the unconnected habitations of lower order population may get connected incidentally, the percentage connectivity of the habitation may touch about 60% leaving 40% of the habitations with lower order population unconnected.

As per the programme guidelines currently applicable in the plain areas, the eligibility of the habitations getting connected varies from 19% to almost 100% in different States. However, in maximum number of States, the eligibility levels are at the higher end. In the States of Karnataka and Maharashtra, the eligibility

stands at 19% and 22% respectively and Uttar Pradesh has only 32% eligible habitations covering under PMGSY.

Similarly, in the hill states the prospects are more discouraging. For example in the State of Arunachal Pradesh only 17% of the habitations (466 out of 2741) are becoming eligible for new connectivity under PMGSY. These figures are 27.5% for Meghalaya, 29.4% for Uttranchal, 30.81% for Himachal Pradesh and 43% for Tripura. Only for States like Mizoram, Nagaland, Sikkim the eligibility has crossed 70%.

The reason for low eligibility in the States like Arunachal Pradesh, Meghalaya, Uttranchal etc. is the wide spread of smaller habitations and even with the existing Guidelines on the Cluster Approach, many settlements are not getting the eligibility for new roads.

As indicated in Table 3.5, the task of providing new connectivity, even to those habitations eligible under PMGSY according to the existing norms, is expected to spill over to the 12th Five year Plan. However, it would not be desirable to postpone the provision of connectivity to the lower order settlements till that time, since even these habitations need to have primary access to health, education and market facilities. The issue of connecting habitations which are not eligible according to the current norms of PMGSY, therefore, needs to be tackled during the 11th Five year Plan itself.

Table 8.1: Eligibility of Habitations to be connected under PMGSY

#	Name the State	Total No of Habitations	No. of Unconnected Habitations	Eligible Unconnected Habitations			Total to be covered under PMGSY	% eligible Unconnected habitations
				1000+	500-999	250-499		
1	Andhra Pradesh	67401	2679	167	417	396	980	36.58
2	Arunachal Pradesh	3880	2741	49	127	290	466	17.00
3	Assam	23152	17975	7323	4862	3161	15346	85.37
4	Bihar	39824	11497	8187	1847	0	10034	87.27
5	Chattisgarh	29544	24202	2604	6313	3644	12561	51.90
6	Goa	369	55	0	20	35	55	100.00
7	Gujarat	35282	8127	472	2288	1493	4253	52.33
8	Haryana	6745	23	0	2	0	2	8.70
9	Himachal Pradesh	16997	11340	262	853	2379	3494	30.81
10	Jammu & Kashmir	9270	3946	785	942	1065	2792	70.76
11	Jarkhand	35769	21036	2622	4178	3896	10696	50.85
12	Karnataka	56682	4608	156	118	602	876	19.01
13	Kerala	14899	475	121	333	19	473	99.58
14	Madhya Pradesh	55719	34771	5804	10645	2043	18492	53.18
15	Maharashtra	56663	6892	187	810	516	1513	21.95
16	Manipur	2905	1142	71	187	340	598	52.36
17	Meghalaya	5362	2752	9	150	597	756	27.47
18	Mizoram	790	392	47	114	124	285	72.70
19	Nagaland	1049	127	21	32	41	94	74.02
20	Orissa	50101	29023	3703	6715	7921	18339	63.19
21	Punjab	13579	920	103	433	0	536	58.26
22	Rajasthan	39954	19945	2725	6428	1842	10995	55.13
23	Sikkim	901	410	16	138	164	318	77.56
24	Tamil Nadu	62919	5318	577	1825	238	2640	49.64
25	Tripura	8132	4448	179	655	1083	1917	43.10
26	Uttar Pradesh	170004	89246	10898	17944	0	28842	32.32
27	Uttaranchal	16800	8613	152	690	1689	2531	29.39
28	West Bengal	58263	33904	12790	10142	5952	28884	85.19
	Total	882955	346607	60030	79208	39530	178768	51.58

8.4.2 The Way Out

In order to overcome the deprivation of the people living in lower order settlements from basic access to socio-economic needs, there are two possible approaches that can be pursued.

- I. The cluster approach, currently envisaged in the guidelines of PMGSY do not seem to be adequate for the hill states, where smaller habitations with population less than 250 are dispersed over a wide geographical area. The existing cluster approach, should be reviewed on the basis of ground level survey of the settlement patterns in States like Arunachal Pradesh and consequential amendments should be made in the programme guidelines, so that larger number of habitations become eligible for coverage in hill States.
- II. In other States, it may be necessary to use the resources from Wage Employment Programme and other available sources from the State for providing connectivity to the lower order settlements.

In both the cases, it is necessary to review and revamp the Core Network methodology that formed the basis for selection and prioritization of roads under PMGSY, for developing a master plan providing accessibility to the lower order settlements. While the Core Network Plans are being reviewed, optimal rural roads network is to be developed for providing access to various socio-economic needs of the society, with uniform treatment to all the habitations, without discriminating with the size of the settlement. As recommended earlier, the concept of accessibility should be brought in while preparing the master plan. Once such a plan is ready, guidelines for prioritization of the links in the master plan are to be prepared strictly on scientific basis. With the master plan as the basis, there is an urgent need to develop a business plan for connecting the habitations of lower order population looking beyond PMGSY.

8.4.3 Need for Standard Guidelines.

Providing connectivity to smaller settlements should not be left entirely to the state wise practices of the implementing agencies. There should be common guidelines on Standards for the roads leading to smaller size settlement both with respect to Geometrics as well as need based structure for the Pavement. Though, it is possible to upgrade the pavement structure at a later stage, as a routine, when higher level of traffic is generated, it would be difficult and become too costly to improve the Geometrics once the alignment is fixed and development sets in along the road. Therefore, while developing the guidelines, the minimum Geometrical Standards are to be insisted upon, so that such roads built for connecting smaller habitations will become amenable for upgradation through Stage Construction process. The idea here is to provide fair weather

connectivity to start with for maximum number of people, which may be improved to all weather connectivity over a period of time.

It should be emphasized here that there should be no compromise in Planning, Design and Construction of Drainage System, in order to ensure sustainability of the roads, as the past experience showed that poor drainage is the critical factor for the premature deterioration and failures of roads as well as for their poor performance. Therefore, guidelines for integrated drainage are to be accordingly developed.

8.5 Recommendations

- All programmes supporting construction of rural roads for all-weather connectivity must fall under one umbrella organization like SRRDA, irrespective of funding source including the external source or borrowing or even Public Private Partnership.
- The existing cluster approach, should be reviewed on the basis of ground level survey of the settlement patterns in States like Arunachal Pradesh and consequential amendments should be made in the programme guidelines, so that larger number of habitations become eligible for coverage in hill States.
- It is recommended that the States may use the resources from Wage Employment Programme and other available sources from the State for providing connectivity to the lower order settlements.
- The planning and design standards shall remain uniform across the board and across the nation for developing only sustainable assets subject to variations in terrain, soil, traffic and environmental conditions.
- While PMGSY contemplates connectivity to habitations with 500 and above normally and 250 and above in special areas, in future connectivity should be aimed at all habitations irrespective of population sizes (including lower order settlements).
- PMGSY has been able to change the scenario in the country in terms of capacity of contracting industry, trained manpower and also the availability of modern equipments. The future Plans must utilize this capacity and enhance it for achieving higher targets of the 11th and subsequent Plans

Chapter 9

Quality Assurance

9.1 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.

9.2 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 DPRs 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.

There has been, by and large, a good feedback on the experience of quality in construction of PMGSY roads. The contractors are also taking pride in delivery of quality work. The states will do well by adopting such features uniformly on all rural road works irrespective of the source of funding and the agency responsible for rural roads. However it must be emphasized that while the responsibility of ensuring the stated quality fully rests on the contractor, the supervisory staff responsible for final acceptance has the duty of ensuring that the contractor discharges his responsibility faithfully. Quality comes at a price, but is a price worth paying only if the system ensures that the quality product is delivered.

9.3 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.

Quality control, quality assurance and third party quality audit are to be systematically adopted with streamlined institutional arrangements with an objective of achieving Total Quality Management (TQM) in rural roads. It may be mentioned that quality product (i.e. rural road) is dependent firstly on planning itself, i.e. a quality Detailed Project Report (DPR). Thus, State level quality assurance system will have to facilitate higher level of technical inputs including project planning technique, material characterization and design for rural roads.

In order to strengthen the implementation of quality systems requires earmarked funds. Some percentage of the cost of the project should be set apart for this purpose as is done under PMGSY. This should also include funds required for training of the personnel.

Total Quality Management can succeed only if the engineers (at various levels), contractor's staff, consultant's experts and laboratory technicians are trained at appropriate level to systematically strive for quality. The training should be a continuous process, with skills getting updated as new processes and materials are involved in Rural Roads.

9.4 Modern Techniques for Quality Assurance

Using modern techniques and construction methodology can provide the quality assurance in rural road construction. One such example is that in PMGSY, it recommended to use modern equipment such as using vibratory rollers to provide good compaction of base courses and sub-bases to achieve desired quality. The other modern methods, using latest technology equipments, such as non-destructive testing using, falling weight deflector, nuclear density gage, infra-red based equipment to know the grade and bituminous thickness can be effectively be used to assure the quality of rural roads.

9.5 Recommendations

- Durable assets can be created by ensuring quality; this has been the prime objective of PMGSY. Very high standard of quality has been set up by this programme, 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.
- To achieve total quality management in rural road works the thrust of the States should start from the preparation of DPR itself.
- A method of citizens' audit should be adopted to provide more transparency in the design and construction stages; while the planning already takes care of this aspect through their participation in various ways.

Chapter 10

Environmental and Social Safeguard Issues

10.1 Environmental Issues

Environmental considerations forms an integral part of road planning and project appraisal process. It captures the likely negative effects of a new project on the quality of life. Construction of new roads or improvement of existing roads tends to have adverse impact on physical environment such as land, soils, water, air, noise and on flora and fauna. Due to increase in traffic such projects also have effect on community cohesiveness of indigenous population. The rural road may have less impact on the environment due to its scale of implementation. The social impacts may also arise due to land acquisition for improvement of the existing tracts. These problems need to be addressed, studies and suitably amendable in the project appraisal stage. In order to study and reduce the adverse impacts on environment, several methodologies and techniques, are proposed in various guidelines (ADB, 1988; IRC, 1988; MOEF, 1993; OECD, 1994; DMRB, 1996; and World Bank, 1991) for road projects, which can be useful while planning and development of road network system.

10.2 Social Impacts

Social impact assessment of road projects is a systematic investigation of the social processes and factors that affect the society. The major purpose is to minimize the negative impact of the projects and maximise the benefits. It is being established through collection of base line socio-economic data and stakeholder analysis. To avoid the negative impacts, normally project affected persons (PAP) or the families are identified and assessed the impacts in terms of loss of land, property and livelihood. In this process appropriate action plan is prepared to rehabilitate and resettle the affected persons or families.

Currently under PMGSY programme the environmental and social issues are given importance through a 'Transect Walk'. While preparing the DPR, PIU will hold consultation with the local community through the mechanism of the Gram Panchayat in order to determine the most suitable alignment, sort out issues of land availability (including forest land), moderate any adverse social and environmental impact (including barrow fits and channeling drains) and elicit necessary community participation in the programme. It is being organized by conducting a mandatory 'Transect Walk' along the project road by the representatives of PIUs, Gram Panchayat, revenue officials and forest officials for identifying various issues related to land requirements for the road and its impact on landowners, environmental impacts and other social issues. During the walk, due opportunity shall be given to interested persons to put forward their point of view. At the end of the walk, alignment shall be finalized after

recording the issues that arose during the walk and the action taken / proposed to resolve the issues.

10.3 Afforestation

Rural road projects (new construction as well as upgrading) may require removal of trees falling along the alignment. In addition to felling of trees, borrow areas and mining areas have to be cleared of all vegetation before the soil can be used for roadwork. In view of the large programme of construction of rural roads envisaged now, a proper afforestation strategy and mechanism for sustainability of plantation needs to be put in place.

10.3.1 Plantation Strategy

A plan for tree plantation should be formulated at the time of finalizing the detailed project report for construction/upgrading of rural roads. Some of the objectives of tree plantation along rural roads are:

- To create a green belt and avenues for meeting aesthetic recreational needs and their by providing shade to pedestrians and reduce ambient temperature
- To reduce the surface run-off discharge and checking erosion in the downhill side especially in hilly regions.
- To create a storehouse of genetic diversity by planting all the indigenous trees, shrubs, herbs, climbers, creepers, conifers and green foliages including fruits and medicinal plants.
- To reduce the encroachment of road reserve areas.
- Drought proofing (including afforestation and tree plantation) e.g. pasture development, block plantation, horticulture plantation, barren hill plantation, avenue plantation.
- The raising of nurseries, plantation of saplings and maintenance of trees would generate employment opportunities for the local people and also provides a sustainable source of fuel wood for the rural communities.

The current guidelines of the NRRDA specify that the State Governments would take up the plantation of fruit or other suitable trees on both sides of the rural roads from their own funds. However, certain precautions must be taken in design of avenue or cluster plantation so that the trees do not have an adverse impact on road maintenance and/or safety of the road user. Emphasis must be placed on a greater involvement of communities and Gram Panchayats in planning, maintenance and upkeep of roadside trees.

As suggested by the Rural Roads Vision-2025 document, a comprehensive Manual for planning and plantation of trees along rural roads may be prepared in consultation the National Afforestation and Eco-Development Board (NAEB) for serving as guidance to the project implementation units at the time of execution

of rural road projects and the Gram Panchayats in proper maintenance and upkeep of the trees.

10.3.2 Tree Plantation and Mechanism for Sustainability

During the 11th Plan period it is proposed to take up 1.65 lakh km length of new construction and around 1.92 lakh km length for upgradation and renewal of rural roads. A total about 3.57 lakh km of rural roads may be used for road side plantation. Even if, we estimate about 200 trees per km length, with an average of 100 trees in each side, a total of about 700 lakh trees may be grown. Depending upon the species to be adopted, the quantum of benefits may be derived in terms of green cover fruits yield (especially *neem*, *jamun*, *tamarind*, etc.), woods (fire woods, and for wood based product, etc) and others.

A mechanism can be proposed to grow and sustain these trees in a systematic way either as a part of the road project itself or under NREGP or any other State and Central Government programmes. The saplings of the identified species be planted along these roads and the ownership may be given to the owner of the roadside land along with necessary funds for sustenance (as part of routine maintenance adopted in case of PMGSY roads). Alternatively, the beneficiaries could be those from NREGP or similar programmes or the Village Panchayat through the PIUs to take care of them till it grows up to it's self-sustainability level (say 5 year period). In forest areas the forest department should be involved in afforestation activities along with PIUs. Incentives of funds to maintain/grow the trees and ownership to take advantage of the yields as suggested above will ensure sustainability of the plantations.

10.4 Impact of Land Acquisition

Rural roads are often constructed by upgrading the existing earthen tracks. Sometimes these tracks are narrow and need improvement to meet the minimum engineering standards. This involves acquisition of adjoining lands. Many a time the owners of these lands are small and marginal farmers who need to be compensated adequately. The land acquisition process starts by identifying the required land by the engineering department based on alignment requirements. The revenue department, which is responsible for acquiring the land for public purposes, identifies the owners of the land and evaluates their land according to the records and current usage of the land and fixes the value of the land. Many a time the valuations are less than market values and are not adequately compensated to the owners. This situation leads to litigation in acquisition of the land. It directly affects the total cost of construction and creates constraints during construction activities. In case of land acquisition occurs, Resettlement and Rehabilitation (R&R) Action Plan may be prepared and implemented according to the R&R guidelines.

10.5 Environmental Code of Practice

The MORD has recently finalized “Environmental Codes of Practice” for adoption on the rural road works financed by World Bank assistance taken up, under PMGSY, in the four states. Similar action has also been taken up under schemes financed by Asian Development Bank. There is need to evolve an all India Code of Practice accounting for state level variations based on local conditions.

10.6 Recommendations

- In all developments of rural roads the environmental issues must be safeguarded. Further, speedy construction to be ensured by participation of authority responsible for environmental clearances.
- Afforestation along the rural roads by plantations of fruit trees etc be systematically adopted as part of the design (i.e. DPR) itself. Also for sustainability, the ownership of such plantations be transferred to the roadside land owner or the Village Panchayat.
- 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.

Chapter 11

Issues related to Capacity Development

11. 1 Institutional Development

In India, rural roads are planned and executed by several state government agencies, such as Public Works Department (PWD), Rural Engineering Organisation (REO), District Rural Development Agency (DRDA), Irrigation Department, and Forest Department. These organisations often lack co-ordination among themselves in planning and implementation of rural road programmes. Most organisations lack capacity (manpower, machinery, etc.) to carry out all weather road construction activities. There are no sustained efforts for capacity building of the organisations involved in development of rural roads in the area of planning, programming, budgeting and financial management. Under PMGSY, Programme Implementation Unit (PIU) is established in each district to plan and execute the rural road projects. The PIU are formed by drawing manpower mostly from the existing Public Works Department, Rural Engineering Organisation or Panchayati Raj Engineering Department. They are fully trained and empowered to handle the projects.

One most important aspect of the central intervention for development of rural roads in the form of PMGSY has been a generic shift from programme based resource allocation for implementation to projectised project implementation. This change has facilitated enforcement of all engineering principles in planning, design and construction of the rural roads. Further, this has allowed ensuring quality at every stage of development, which has been possible only because an agency like district PIU is managing the implementation. However, for state level coordination a higher level coordinating body will be required to manage the pooled fund from all programmes for uniform development of rural roads.

There is need for a single specialized nodal agency in each State, which should be responsible for overall policy, planning and management of rural roads in the State. The states should also have uniform Works Accounting System. The one evolved for the PMGSY can serve as a guide. The States need to move in the direction of a single sectoral agency for effective implementation of all developmental projects for rural areas. Until then, a nodal agency be identified and be made responsible for coordination with other agencies and ensuring integration of various programmes and schemes. Such an agency should also be able to dovetail with other development programmes relating to rural infrastructure and public transport.

To effectively manage such a large workload, the ideal set up should be a lean and thin government organisation, with all major activities like survey, investigations, designs and construction, being partly outsourced to consultants. The other alternative is to network with various existing institutions having

specific capacities for taking advantage of the available expertise. Such a system has been developed under PMGSY by networking with 40 academic engineering institutions in the form of State Technical Agency to scrutinize the projectised proposals and to help in other technical matters.

11.2. Panchayati Raj Institutions

Due to introduction of Panchayati Raj system, the State Governments have brought the rural road sector under the umbrella of Rural Development Departments. This may help in implementing the projects with effective local participation in planning, implementation and maintenance of rural roads. In some states this process is however yet to take place. These departments are lacking in appropriate technical manpower to carry out the tasks of planning and building all-weather rural roads for large number of projects. Local community involvement at each stage of planning process is needed for selection of optimal and desired links for connectivity.

For effective delivery of rural infrastructure by the PRI, they need to be provided with adequate technical support. A separate Rural Roads Wing should be set up in each state. This Wing may be brought under the Panchayat Raj Department of the state. The Executive Engineers in the field should be working directly under the District Panchayats, and they should be responsible to the Panchayats for all administrative matters. However, for all technical matters, the field Executive Engineers should report to the Superintending Engineers/Chief Engineer of the Rural Roads Wing. Like in PMGSY, there should be one Project Implementation Unit (PIU) in each district, capable of handling capital works to the tune of Rs.100-200 million per year and maintenance works to the tune of Rs.50 million per year. If the existing system of SRRDA/PIUs can act as a single agency for rural road development in any State, then their existing linkages with the PRIs at different levels should be further strengthened.

The rural road works are by nature small and dispersed over a wide geographic area in blocks. Such works are difficult to supervise due to the demanding travel and logistics requirements. This has led to the need of decentralization of responsibility for provision and maintenance for rural roads to Panchayati Raj Institutions (PRIs). For discharge of functions, expected of these PRIs, some states have set up full-fledged Rural Engineering Service/Department to undertake all engineering works entrusted to the Panchayats. Some others entrust the works for execution to the Public Works Departments since they have a battery of experienced technical personnel and well laid down procedures for engagement of contractors and their in-house capability in monitoring of quality during execution.

11.3 Construction Industry

In several states, the contractors engaged in the construction of rural roads are by and large medium size highway contractors having heavy duty equipment/plants like Hot Mix Plants, Vibratory Rollers, Excavators, etc. Due to several road development programmes, which lead a heavy demand for construction industries in highway sector created shortage of contractors for rural roadwork. The small-sized and scattered rural road works are in some cases being subcontracted by these contractors to petty inexperienced contractors. Currently, the technology under the PMGSY contracts is seen to be equipment intensive. In order to encourage the healthy growth of small local contractors for rural works and to increase their capacity, a number of steps need to be taken. Some suggestions in this regard are:

- Contractors specializing in different activities of road works, e.g, earthwork, supply of materials, bituminous works, culverts and bridges, shall be registered under different categories based on size and nature of work.
- The small contractors and specialized contractors shall be encouraged to serve as subcontractors to large contractors under a formal subcontract, so that they gain expertise and slowly graduate to take up large size contracts
- There is need to formulate different size contract packages for rural roads so as to enable small contractors to gain independent entry for small size contracts to start with
- The concept of equipment banks in the private sector is coming up. This needs to be encouraged. There are several activities where equipment is required for short duration at a time although needed on several occasions. This would help small contractors as they cannot invest in procurement of equipment but all the same will need them for execution of works
- There is also need for capacity building of small contractors through training in works and simple business accounting practices The ITIs and Polytechnics could be used to impart training. The equipment manufacturers should also come forward in training of foremen and operators. Stress is to be on both the know-how and the show-how of workmanship.
- It is suggested that it may be necessary that the duty exemptions on the purchase of machinery that is now available for the projects funded by World Bank and ADB may be extended across the board for PMGSY Projects in all States, in order to facilitate capacity building of contractors.

11.4 Training and Development

In the present set-up, the aspect of imparting adequate training to the staff engaged in rural road development works, right from senior-level rural road engineers, down to the unskilled workers at the ground level, leaves a lot to be desired. Concerted efforts are needed to identify the capacity building and

training needs at various levels and to chalk out a time-bound programme for this purpose. Continuous skill enhancement on the part of government engineers is necessary to keep abreast of the latest trends and developments in road technology. This must be supplemented with knowledge and skill on project management, financial and legal matters. Sufficient funds should be budgeted to the departments for conducting the training and creating infrastructure for training facilities. Training programme is required for departmental engineers, contractors, project engineers and supervisors.

The national level training institutions such as National Institute for Training Highway Engineers (NITHE), Central Road Research Institute (CRRI), National Institute for Construction Management and Research (NICMAR), National Academy for Construction (NAC) and CIDC as well as State Road Research Institutes along with the selected academic institutes such as IITs and NITs and prominent engineering colleges have to be further involved in strengthening of training needs, development of curricula and imparting training to the rural road engineers, consultants, contractors and other associated staff.

11.4.1 Training of Skilled and Semi-skilled Workers

Training is also required for skilled, semi-skilled workers, operators of equipment, and laboratory assistants. The Industrial training Institutions (ITI) have to be encouraged to reorient their course syllabus to meet the present day requirement of road construction aspects. New trade in operation and management of road construction may be introduced in it is. This will not only enrich the profession but also result in good quality of road works.

11.4.2 Training of Ground Level Workers

The important aspect of training ground-level workers in construction and maintenance of roads and cross drainage works is often ignored. However, the quality of road works and cross-drainage works will depend, to a large extent, on the manner in which workers in the field have accomplished the various tasks. In view of their very limited educational background, the ground level workers can best be trained by showing specially prepared video training films on various construction techniques and maintenance tasks. Such an approach has been successfully adopted in several countries in Asia and Africa. The video training films focus on such aspects of construction and maintenance that need special emphasis. Also, the various 'dos' and 'don'ts' can be effectively brought out in these films. Such training films need to be dubbed in the local language of the region, also bringing out extra care to be taken on special problems associated with the region.

11.4.3 Training Modules

The training modules for different category of manpower have to be prepared considering the various aspects of rural roads such as, network planning and

database management, preparation of DPRs, contract management, construction technologies and quality assurance, and asset management for sustenance. The modules should focus on short training and workshops for planners and policy makers (government officials), short duration training for the engineering staff with the PIUs, and contractors. Region specific training programmes can be organized through well established R&D and educational institutions like CRRI, NITHE, IITs, IIMs, NITs and University Engineering Departments.

11.5 Decentralized Maintenance

The three-tier Panchayati Raj System (PRIs), offer an excellent opportunity to institutionalize a hierarchical, decentralized system of maintenance with more technical and complex operations assigned to the district level and the most routine and low technology operations to be tackled by the Village Panchayats through the Maintenance Gangs (MGs). The model envisages formation of MGs with 4–5 able-bodied villagers to be selected from the village itself and imparted training on simple maintenance activities. The suggested model for allocation of maintenance responsibility at different local level is given in Table 11.1.

Table 11.1: A Typical model for allocation of maintenance responsibilities

Admn./Orgn Unit	Extent of Road Length, Km.	Responsibility
District	500 – 1000	Planning and assessment of maintenance needs regularly; rehabilitation and renewal works periodically every 5 – 7 years.
Block (Intermediate Panchayat)	50 – 100	Procurement of materials and equipment/implements & distribution to Central Village Gang (CVG).
Central Village Gang (for a Group of Villages)	8 – 10	Collection of materials and equipment/implements from Block HQ and storing for distribution to MG.
Maintenance Gang of Village	1 – 2	Execution of routine maintenance by the MG of the village.

Each MG would be made responsible for maintaining 1–2 kms of road located very close to the village. The intermediate panchayat level set up will have the responsibility to procure and store materials (aggregates and cold bituminous emulsion) and implements required for maintenance which will be distributed to the Central Village Gangs (CVGs) for further distribution to the MGs of the villages.

Normal agricultural/household implements used by villagers would actually be utilized for carrying out maintenance works. A specially made push-cart will be used by the MG for transporting materials and implements to the sites for maintenance works. A manually operated pug-mill fitted to the push-cart will be

used for mixing the aggregates and bitumen for producing the cold mix to be used in maintenance of bituminous layer. A calibrated small metal container of known volume can be used for batching of the mix and a normal rammer will be used for manual compaction of the repaired shoulder, side slope, side drain or location of the crack repaired. The proposed framework envisages availability of engineers at the district level to assess the maintenance needs and current pavement conditions every 6 months in rotation and to pass on the status report to the intermediate Panchayat for onward transmission to the village Panchayats. The district level maintenance unit will have facilities for periodic maintenance and renewal interventions based on pavement condition evaluation. Fair and equitable distribution of funds and material resources for operationalising this arrangement will be ensured by the functionaries at the district and the intermediate level.

The proposed model allocates responsibility to the three-tiers of the Panchayats commensurate with the capacity available at each level. The model also envisages competition among the Panchayats and MGs to increase effective community participation in maintenance of rural roads through the PRIs.

11.6 Sustainability of Rural Roads

Sustainable rural road development denotes economic use of the resource base which maintains its capacity and renewable productivity on a perpetual basis. It is a way of ensuring continued productivity of the asset, while maintaining those characters of environment necessary to human welfare in long run. Therefore, the rural roads asset created using the valuable environment resources such as precious soil, stone and other products, it has to be maintained to deliver the desired level of service. The institutional set up and the maintenance management aspects are to be synchronized with the environment aspects to sustain the assets created in various programmes.

11.7 Recommendations

- PMGSY has achieved a laudable level of institutional developments during the last six years. State and district level institutions developed are to be made more professional by way of qualified manpower and training. HRD should be a primary requirement for higher targets in 11th Plan.
- The ownership of the rural roads will rest with the PRIs eventually, and therefore, capacity is to be built at the grass root level by qualified manpower and other training.
- Construction industry is having only a limited capacity at this time, and the PMGSY targets are finding difficult to be achieved. The 11th Plan targets will require a significant boost to the capacity of road construction industry
- The sustainability of the huge asset being built under rural connectivity programmes will be dependent on the capacity of the PRIs to look after

these assets which they will own. With ownership, the responsibility of their maintenance also can be given to PRI. For this, of course, a systematic training will have to be organized for the teams to be entrusted with the responsibility.

Chapter 12

Road Safety Issues in Relation to Rural Roads

12. 1 Road Safety Issues – Introduction

Road safety is a multi- disciplinary activity. This involves joint and complementary inputs by the road agencies, transport, police, health, insurance, educational institutes, mass media, NGOs, etc. Road safety offers an opportunity to a wide range of stakeholders to actively engage in addressing the problem. The ABC of road safety is Attitude, Behaviour and Culture of our drivers and other users on the road. This demands all-round improvement. The government has taken a number of steps in this direction but it will need support from users. Safety consciousness has to be cherished as a social value and be viewed as a yardstick to measure the quality of life.

12.2 Engineering Measures

Rural roads are generally single lane roads with low design speeds and with low volumes of traffic both motorised and non-motorised. Road safety should receive increasing attention in planning, design and implementation process. The engineering measures for road safety may be identified with the help of traffic and safety specialists and interaction with users.

Intersections and junctions of rural roads with the main highways are more susceptible to accidents. The design of these intersections calls for ensuring adequate sight distance and removal of encroachments at junctions to improve safety. Provision of rumble strips on rural roads, close to intersections with main roads would also help. Especially, the junctions of rural roads with other main roads should be flared and with provisions of speed change lanes to achieve higher level of safety.

Accidents sometimes occur, as the shoulders (road berms) remain cluttered with construction waste and/or other maintenance material. It is important that the berms are kept clear and formation of the road widened to provide platform for repair and maintenance materials.

Road signs and pavement markings should be integral part of road construction and upgradation works. These signs and markings will also require regular maintenance to serve the intended purpose.

Wherever existing geometrics are poor, efforts should be made to undertake spot improvements through identifying such spots by traffic specialists. In the meantime, appropriate cautionary and speed limits signs may be posted in such locations. Speed management measures on roads passing through built up area of habitations should be identified and steps taken to provide such measures.

12.3 Safety Councils, Committees

The state governments have set up safety councils at state level under the Motor Vehicles Act. District level Rural Road Safety Committees are being set up in several states. The head of the Project Implementation Units (PIU) created for Rural Roads may be included in the district level committees. Similarly, State Level Quality Coordinator of the SRRDA may be nominated to the State Level Safety Council. Similarly, there can be safety committee at the PRI level to monitor and evaluate the day-to-day safety issues of the area they represent.

12.4 Safety Audit and Accident Reporting system.

There would be need to carry out safety audit of the road network in the district, with the help of local Panchayati Raj Institution officials, to identify the expected points of conflict and take effective corrective measures. All accidents involving serious injuries and loss of life need to be recorded, cause of accident analysed and the safety audit report updated on the basis of such analysis. Information signs should indicate about the location of nearest trauma centres or hospitals so that help can become available at time of emergencies. PRI level safety committee can be trained and entrusted to keep the vigil (audit) though out as well as to collect and maintain the accident data of the area. However, the audit of the design initially be done by a professional safety audit personnel.

12.5 Policing and Enforcement

Policing of rural roads is virtually non-existent now. With the rapid expansion of rural road network and general prosperity that will take place in the rural areas in the coming years, enforcement of motor vehicle rules should receive attention. Panchayati Raj Institutions can play effective role in supplementing the police efforts in increasing the awareness for observance of traffic rules. PRI level safety committee would be most suited to carry out this function very well.

12.6 Campaigns for Public Awareness

It is also necessary to sensitize the communities and users of rural roads to road safety concerns and the role they can play in reducing the accident burden. Help of Gram Sabha/NGOs may be sought for awareness campaigns for road safety. Suitable educational materials should be developed and aimed at risk groups identified by specialists. School teachers, children, school bus drivers, two wheel riders, agricultural tractor drivers are some of the groups needing special

attention. School children may be made aware of simple precautions to be taken while moving along or crossing the roads.

12.7 Recommendations

- All safety engineering measures be built into the design (i.e. DPR) of the project roads. All designs must be safety audited.
- A PRI level Safety Committee/Council be established for collecting the accident data in a standard format and reporting to the District Police. The District level committee will have input from all such committees.
- A team of Road safety Awareness Raisers (RSAR) be created by training and retraining so as to change the present situation to a culture of safe use of the roads in rural areas.

Chapter 13

Research and Development on Rural Roads

13.1 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 over emphasized 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 CRRRI to identify and prioritise 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 CRRRI 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.

The key areas for research are:

- Road construction materials for reduction of costs
- Performance based design and specifications
- Network planning with focus on accessibility, and not connectivity
- Maintenance mechanism for rural roads including maintenance management system
- Innovative funding for construction and maintenance of rural roads

13.2 Emerging R&D Areas

Some of the more important thrust areas identified, in the draft vision plan, for Medium Term R&D work and Long-Term R&D work requiring immediate attention are:

- Critical appraisal of design and construction practices being adopted for low volume roads around the world.
- Review of the existing geometric design standards pertaining to low volume rural roads.
- Evolving low cost drainage and erosion control measures for low volume roads and preparing an a comprehensive manual
- Identification of sources of locally available materials for road construction at district level and determining the strength and other characteristics of such materials.

- Developing stabilisation techniques for improving performance of locally available softer materials.
- Evolving appropriate technologies for the construction and maintenance of low volume rural roads, both sealed and unsealed pavements.
- Evolving suitable and economical 'Performance-Based' pavement designs for low volume rural roads, for both sealed and unsealed pavements.
- Evolving suitable and economical designs for low cost Cross-Drainage structures.
- Encouraging the use of cold mix technology and emulsions.
- Socio-economic impact assessment of investments in rural roads
- Evolving designs for fabrication and manufacture of low-end technology and inexpensive machinery suitable for construction and maintenance of rural roads.

Out of these emerging R&D areas, priority may be accorded during the 11th Plan period in the following areas.

- Strategic development of optimal accessibility based rural road network planning
- Development of performance based design and specifications for rural roads
- Use of industrial wastes and marginal materials in rural road works
- Design, fabrication and manufacturing of inexpensive machineries with low-end technology for construction and maintenance
- Rural road pavement maintenance management system with associated simplified techniques

The State Executing Agencies have to come forward to make R&D a part of their routine. They have to initiate R&D projects with one or more of the following:

- Use of new material.
- Use of new technology
- Use of new process

NRRDA and the Executing Agencies shall make it possible to take atleast 5% of the road works under R&D as stated above which is likely to ensure R&D culture in the field engineers.

13.3 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.

As has been the experience 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.

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.

The implementing agencies in the States may be encouraged to utilize the R&D results for rural roads. Often, adoption of research results may be required to be studied in field before wider application; and at that stage funding is required for this field investigation.

13.4 Special Budget for R&D on Field Applications

It is proposed that during the 11th Plan period about 10,000 km length of rural roads, under new road construction as well as upgradation, may be earmarked for experimenting new R&D findings and application of innovative non-conventional method (where economy could be achieved) in the field. These experiments may be in application of non-conventional materials, improved or modified construction technologies, and new methods/techniques of design and construction. Since it involves risk and uncertainties, appropriate guidelines and budgetary provisions may be provided to encourage the field engineers to take up such projects on pilot scale to prove their efficacy and economy in construction of rural roads.

13.5 Recommendations

- 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.
- Generally R&D is starved of funds in most cases; and it will be disastrous if R&D is not given prominence in the context of rural roads, as we have just began to accept rural roads construction as a scientific work.
- Most significant areas to be researched are the means of cost cutting by choice of materials and design, and also evolving the innovative financing mechanisms for such roads.

- Special budget be provided in 11th Plan for field trials of R&D results.
- The State Executing Agencies may be asked to bring R&D proposals on regular basis with the use of new materials or new technology or new process to the extent to atleast 5% of the proposals in each phase during the 11th Five Year Plan.

Chapter 14

Mobilisation of Resources

14.1 Overall Fund Requirements in 11th Five Year Plan

It is estimated that the total fund required for new construction and upgradation to achieve the PMGSY/Bharat Nirman targets alone during the 11th Five Year Plan is about Rs.1,20,000 crore. Cost of maintenance of the roads being built will be around Rs.5,400 crore. In addition, funds for maintenance of the entire length of rural roads under core network would require another Rs. 700,000 (140,000m X 5 years) million during the plan period.

14.2 Existing Resources of Funding

The existing sources of financing are budgetary sources, Central Road Fund (CRF), market committee fees, loan assistance from NABARD, the World Bank and the Asian Development Bank. Government of India provides 100 percent grant to the States for rural roads under the PMGSY programme. It was decided by the Central Government to levy an additional excise duty of Re. 1.00 per litre on petrol since 2nd September 1998 and Re. 1.00 per litre on high speed diesel since 1st March 1999 and earmarked the proceeds for development of the road sector. The major source of fund for development of rural roads is now the Central Road Fund. As per the CRF Act 2000, 50 percent of the cess on diesel is earmarked for development of rural roads. An amount of about Rs. 2500 crore per annum has been available from CRF for rural roads. The current additional excise duty is Rs. 2.00 per litre for petrol and diesel. The funds for rural roads are set to increase. It is estimated that a total of Rs. 20,575 crore will be available from the cess during the plan period i.e. 2007-08 to 2011-12.

The total investment required to achieve the Bharat Nirman targets alone is estimated to be an amount of Rs.48,000 crore. Out of which about Rs.9,000 crore is expected from Cess on HSD and Rs.16000 crore is likely to be available from the World Bank and ADB. It is proposed to barrow additional amount of Rs.16,500 crore from funding agencies such as NABARD. In such case, the repayment may start immediately from the year 2010; this may take away a significant amount from the collection of the Cess on HSD. Therefore, there is need to enhance the Central as well as State budgetary support for development of rural roads to scale up to achieve the PMGSY targets of providing 100 percent connectivity.

Most State Governments face the resource crunch, barring a few States which are able to take recourse to RIDF loans, and therefore, not much allocations other than under PMGSY are going into the rural road network. The World Bank and the ADB have also agreed to extend loan assistance for rural roads under the PMGSY. This is in addition to some funds coming as part of agriculture development projects. A loan amount of Rs. 4000 crore has been approved from these sources.

Some states levy cess on food grains through their market committees and proceeds utilised, among other items, for construction and maintenance of roads in rural areas, for example, Punjab, Haryana, Rajasthan, Madhya Pradesh and Uttar Pradesh. In addition, some kind of a rural development cess is also levied and road improvement and maintenance are being funded out of such resources as well. In sugar cane belts, some cess is levied on sugar, and roads constructed and repaired out of such proceeds.

Funds for roads are also available from other employment oriented schemes such as Sampoorna Grameen Rozgar Yojana, Command Area Development Agencies, Local Area Development funds of Members of Parliament and Members of State Legislative Assembly. Some funds might also become available out of the National Rural Employment Guarantee Programme – a recent initiative of the Government of India. However, given the orientation towards local employment at unskilled level, these funds can at most be useful for construction of tracks or maintenance of rural roads of non-core network. In addition, funds can also be pooled from other central programmes introduced such as PURA focused and directed for development of rural roads and intra-village roads.

14.3 New Options for Resources Mobilisation

The following additional strategies for mobilization of funds are discussed below:

- **Independent Road Fund**

It needs to be appreciated that there is practically no scope for private sector financing of rural roads since they carry very low volumes of traffic. The central Government already created a dedicated road fund imposing cess on petrol and diesel. Similarly a few states like Uttar Pradesh and Karnataka have also set up dedicated funds for augmenting the resources for maintenance. Such funds are to be created in each State and proportionately be allocated for development and management of rural roads.

- **Market Committee Funds**

Another strategy could be to extend the scheme of levying marketing fee and rural development cess on agriculture produce to all states. The state governments may seek the support of the farmers' community in this endeavour. The funding needs of rural roads can be supplemented by this approach so as to accelerate the process of developing rural roads. Part of these funds should be used for maintenance of rural roads.

- **Stamp Duty on Land Transactions**

There have been suggestions that since values of lands close to road tend to increase sharply, beneficiaries may be expected to share this gain by way of paying stamp duty on sale of land. The state governments may examine the practicality of this proposition as a possible supplementary resource.

- **Vehicle Fees**

In addition to taxes on fuels, additional funds should be generated through special purchase tax on two wheelers, cars and agricultural tractors. Part or whole of such funds so collected may be allocated for rural roads and provision of road transport services in rural areas.

- **Domestic Borrowings**

Recently, NABARD in India has come up in a significant way to provide loan assistance for construction of rural roads in several states. This is proving useful in accelerating the programme of improving accessibility to our villages, and thus contributing to the alleviation of poverty and socio-economic development of our rural areas.

For a financial institution like NABARD, it is difficult to have technical expertise to ensure that the projects they fund are well conceived and executed. It may be worthwhile to consider providing the NABARD loans with technical and management inputs of NRRDA to enhance the financial and technical discipline, as well as adoption of uniform standards to be applied in respect of these roads as on the lines of the PMGSY. This can be channelised by transferring the total loan amount to a pool to be availed by the States under the same or similar guidelines as that of PMGSY.

- **Borrowings from Multi-lateral Agencies**

The multi-lateral financing agencies like the World Bank, ADB and JBIC have been providing loan assistance for highway projects for the central and the state governments. Normally, the projects executed through external borrowings are well planned, designed and executed under a set of guidelines. The external funding agency also insists on the state governments to ensure that the assets created are well maintained.

- **User Charges**

The scope for user charges in rural roads, which unlike the highways are meant to provide basic access, is rather limited. At best, this may be a potential source only in selected roads with high commercial traffic volume (e.g. in mining areas). However, even in those cases also user charges may cover the maintenance requirements only and not rehabilitation/upgradation requirements.

- **Private Financing**

While there is little experience of private financing in the context of development of rural infrastructure in India, it would be a possible worthy experience to explore such financing that might work. Taking in to consideration the complexity of any rural development context, creating a space for private financing shall not be easy, but appears feasible. The rural cooperative societies, like sugar cane producers and sugar mill association/societies in association with the financial institutions and NRRDA can form a PPP model based on BOT/annuity concepts

to accelerate the rural road development programmes in the specific regions where benefits are distinctly visible.

- **Public Private Partnership**

In order to faster the current rural connectivity programme, and to achieve its goal to total connectivity, it can be proposed to try out through PPP model and can be implemented in selected regions (say 3 to 4 district) having homogeneous socio-economic characters with an established local level development organization. It can cover about 1000 to 1500 km length of rural roads in the region. With the established institutional set-up the private partners can associate with the PIUs and identify such rural roads which can be implemented under PPP model. It has to mobilize funding from its own resources or through financial institutions for the requirement of the entire rural roads in the region for new construction as well as upgradation. The project implementation however shall be as per PMGSY guidelines. The fund utilized can be paid over a period of time on annuity basis the MoRD. The implementing agency can also levy some fee/charges from the users if feasible and accordingly the annuity needs to be arrived. The Concept Note of the proposal is given in **Appendix 2**.

14.4 Maintenance Funding Strategy

The total maintenance funding for the entire core network road is estimated as Rs.1,40,000 million per year. Allocation of grossly inadequate funds is the major constraint in preserving the existing rural roads assets. The huge network built over the years is becoming a victim of neglect because of the financing gap between what is needed and what is allocated for maintenance. Providing dedicated funding is pre-requisite for sustainable maintenance of the existing rural roads.

The normal sources of funding for maintenance are the regular budgetary provisions under non-plan grants, which need to be increased as well as redefined for its importance. Creation of fund with special purpose levy such as mandi cess, fuel cess etc. for maintenance at state level can be explored. Projectised maintenance options can be examined with appropriate cost sharing by State and Central Government for rural roads. Creation of funds through the model adopted in Rajasthan may be adopted in other states.

Each State needs to undertake a detailed study for estimating the fund requirement for maintenance of rural roads on a realistic basis with clear break up for routine maintenance, periodic maintenance and rehabilitation/upgradation in case of different pavement, traffic, terrain and climatic conditions prevailing in the states. This should be based on the scientific approach and norms, which should consider the frequency of various maintenance tasks required. They should spell out minimum essential requirements and those considered desirable for better or higher level of service.

14.5 Financing Skill Development

The need for Human Resource Development for rural roads development has been elaborated in Chapter 11. However, there is a need for mobilization of required funds for these purposes. In the allocation for 11th Plan, there should be augmented additional resource for the HRD activities commensurate to the enhanced targets of 11th Plan. A portion of the 'welfare cess for workers on contracts' or a nominal amount from contractors' fee (in every contract) may be charged to create a poll of funds for imparting specialized training to the skilled and unskilled workers of the contractors.

14.6 Recommendations

- Dedicated fund for rural roads as was in 10th Plan should continue in 11th Five Year Plan.
- Innovative funding options other than borrowing – by charging the beneficiaries, may have to be adopted.
- Deferred payment schemes to be adopted for PPP model to fulfill the targets, so as to make the benefits to flow early.
- As a beginning, a minimum of 5000 – 10,000 km length of rural roads to be taken up for upgradation may be experimented under PPP model during the 11th Plan period.

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Annexure 1.

Members of the Working Group

- | | |
|---|------------|
| 1. Secretary, Ministry of Rural Development | - Chairman |
| 2. AS, Ministry of Rural Development | - Member |
| 3. Adviser (Tpt.), Planning Commission | - Member |
| 4. Director, CRRRI New Delhi | - Member |
| 5. Representative from NRRDA | - Member |
| 6. Representative from Department of Expenditure, Ministry of Finance | - Member |
| 7. Representative from DONER | - Member |
| 8. Principal Secretary, PWD, Govt. of Gujarat | - Member |
| 9. Chief Engineer, PWD, Govt. of Haryana | - Member |
| 10. Chief Engineer, PWD, Govt. of West Bengal | - Member |
| 11. Chief Engineer, PWD, Govt. of Mizoram | - Member |
| 12. Chief Engineer, PWD, Govt. of Karnataka | - Member |
| 13. Chief Engineer, PWD, Govt. of Rajasthan | - Member |
| 14. Joint Secretary, Ministry of Rural Development | - Convener |

In accordance with the memo constituting the Working Group, the Chairperson of the Working Group has co-opted the following experts as members vide MoRD order No. P.17024/50/2005-RC dated 29th May, 2006.

1. Managing Director, IDFC.
2. Dr. P.K. Sikdar, Former Director, CRRRI.

Terms of Reference

1. To critically review the financial and the physical progress of the development of the rural road network during 10th Five Year Plan, highlighting the constraints faced and the remedial actions required to be taken in the context of the preparation of the 11th Five Year Plan.
2. Keeping in view the experience acquired from PMGSY and launch of Bharat Nirman, recommend a policy framework for the development of rural roads in the 11th Five Year Plan and a perspective for the next decade beyond 11th Plan-Vision-2021-taking cognizance of the various issues, including inter-alia the following:
 - i) need for providing connectivity with a view to improving accessibility;
 - ii) need for enhancing the capacities of various implementing agencies in order to achieve time targets;
 - iii) prioritization of development work in view of a large number of deficiencies in the existing rural roads network with a view to consolidating the network;
 - iv) need for maintenance and preservation of existing assets;
 - v) need for creating an environment conducive to public private partnerships, in view of the increasing role of private sector;
 - vi) need for upgradation of technology in order to improve quality of construction of rural roads and reduce construction time;
 - vii) energy conservation and environment protection.
3. To formulate a programme for development of rural roads for the Eleventh Five Year Plan indicating monitorable physical targets, financial outlays and their year wise phasing during this Plan period. While formulating the Plan, various aspects should be examined including inter-alia the requirement to provide essential road links to rural areas in the country in a cost effective manner, existing deficiencies of road system and remedial measures and the need for integrating backward and remote areas particularly the north-east and tribal areas with the rest of the country.
4. To review the existing arrangements, including the availability of resources from Central Road Fund, for funding the development of rural roads and suggest innovative measures for augmentation of resources both for construction and maintenance of rural roads.

5. To review the existing norms and criteria for maintenance and repairs for rural roads, assess actual requirements of funds for each year of the Eleventh Plan and recommend measures to meet such requirements.
6. To review the type of machinery and material presently being used in rural road construction and maintenance and suggest improvements, including steps needed for growth of road equipment industry in the country in order to deliver quality output in a time bound manner.
7. To review the existing manpower training arrangements at the Central and State level and suggest improvements, keeping in view the need for construction of quality rural roads in a time bound manner.
8. To review the status of various implementing agencies involved in the development and maintenance of rural roads in terms of their capability to deliver timely outputs and to recommend measures, including outsourcing and institutional for enhancing capacities of the States.
9. To suggest measures for effectively monitoring the progress of construction and maintenance of rural roads. Also to evolve a mechanism to ensure that funds allocated for maintenance of roads in the 12th Finance Commission are optimally utilized.
10. To review the status of domestic construction industry in terms of its capability to absorb, utilize and augment the technology being presently used timely for rural road construction.
11. To examine any other matter considered important by the Working Group.

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9. Shri. H.K. Srivastava, Director (Projects-I), NRRDA - Convener.

Annexure 4

Impact Assessment of PMGSY on Rural Economy

Ministry of Rural Development had commissioned a series of quick assessments of socio-economic impact of PMGSY in Assam, Himachal Pradesh, Madhya Pradesh, Mizoram, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. These studies were conducted by independent agencies during January to February, 2004 (MORD 2004). The major findings are as follows:

Impact on agriculture

Construction of the PMGSY roads has substantially *benefited the farmers*. Prior to the construction of the PMGSY roads, farmers found it difficult to sell agricultural goods in the bigger markets located far away from their villages.

PMGSY road connectivity has led to a *better transport system* during all seasons. Farmers mentioned that the problem of not being able to access the markets during monsoon has been solved by the construction of the roads. This impact has been greatly felt in the states of West Bengal, Himachal Pradesh, Mizoram, Assam etc.

The PMGSY roads have made it easier to transport agricultural inputs to villages which led some farmers to switch from food crops to cash crops (such as ginger, jute, sugarcane, sunflower).

An increase in the number of families rearing goats/sheep for commercial purposes was mentioned by beneficiaries in states of Rajasthan, Himachal Pradesh and Uttar Pradesh reported. Many families had bought cycles after the construction of the road to be able to carry *dairy products* for sale to nearby towns.

Employment Generation

After the construction of PMGSY roads, an improvement in the employment situation in terms of *more job opportunities*, avenues for self-employment, etc. were observed. *On-farm employment* opportunities also increased due to shift from grains to cash crops and also multiple cropping particularly in the state of Tamil Nadu, Madhya Pradesh and Mizoram.

More people are going to nearby towns and villages for *odd jobs* like selling woods, vegetables, dairy products and locally made items like pickles, papad etc. due to expansion of local industries, which in turn has generated employment opportunities.

Cottage Industry

Beneficiaries reported that the pottery and brick making industry of Orissa has benefited from the PMGSY roads. *Cottage industries* of Tamil Nadu, Handloom industry of West Bengal and Agro industry in Assam also benefited from road connectivity.

Health

There has been an overall improvement in access to the health facilities like PHCs, sub-centres and district hospitals in the States of West Bengal, Uttar Pradesh, Orissa, Tamil Nadu, Himachal Pradesh and Madhya Pradesh. Positive impact was observed on accessibility to preventive and curative health care facilities; better management of infectious diseases and attending to emergencies and increase in frequency of visits by health workers.

Improvement in antenatal and post-natal care thereby decreasing obstetrics emergencies was observed by beneficiaries in the States of Mizoram, Madhya Pradesh, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. Road connectivity and an improved transport system enabled families to opt for institutional deliveries in hospitals outside the village. Decrease in infant and child mortality especially in the States of Orissa, Madhya Pradesh, Himachal Pradesh, Tamil Nadu, Uttar Pradesh and West Bengal was reported.

Education

With the construction of PMGSY roads, there has been an improvement in the accessibility to education facilities. This has resulted in increased school enrolment and school attendance in all the states, especially, an increase in the number of girls going to schools in the States of Assam, Madhya Pradesh, Orissa, Tamil Nadu and West Bengal has been observed. Most parents mentioned that they were now more confident about sending their daughters to schools unescorted. Moreover, regular attendance of the teachers throughout the year is observed and greater willingness is evidenced among parents to send boys and girls for higher studies and college education outside their villages.

Governance and public services

The road connectivity has increased the frequency of visits by government officials and grass root level functionaries like health workers/Auxilliary Nurse and Midwives (ANMs), Village Level Workers (VLWs) and Village Anganwadi Worker (VAWs) in the states of Orissa, Himachal Pradesh, Madhya Pradesh and West Bengal. There has been an improvement in accessibility to banks, the Post and Telegraph offices and quicker access to police.

Transport services

The benefits of rural connectivity has been felt most in Mizoram and Rajasthan where PMGSY roads have made it easier for the beneficiaries to cope with the

difficult terrain. There has been an increase in ownership of *bicycles and two wheelers* especially in the States of Assam, Rajasthan, West Bengal and Tamil Nadu. Also, there has been an improvement in the public as well as the private *transport systems* in all the states.

Quality of Life

An immediate and direct impact of providing rural road connectivity was observed in the quality of life as cooking gas became available in villages. The states of Mizoram, Tamil Nadu, West Bengal reported conversion of *kuchcha houses* to *pucca houses*. The connectivity led to sudden escalation of *prices of land* adjacent to the PMGSY roads. This also led to an increase in the sale of land for commercial purposes.

Poverty Alleviation

The roads, directly or indirectly have provided opportunities for on-farm and off-farm employments as well as *self-employment*. With the improvement in on-farm and non-farm employment opportunities, beneficiaries in all the states reported *increase in their average household income*, thus, reduction in poverty.

Distributional and Equity Issues

Though, it has been revealed through several impact studies that rural roads have multi dimensional beneficial impact on the rural community, these benefits may not be equitably distributed. The well-off households with better resource endowments, capabilities and skill sets generally derive more benefits from the improved access as compared to poor households. This calls for prior indepth analysis of the potential input on the major stakeholders with a view to devise appropriate mitigation measures to make this scheme 'inclusive' in terms of its benefits.

Though, rural roads provide accessibility, the assurance on transport availability and affordability must be looked into. For instance, a rural road serving as a means of transportation may permit people to use their own mode of transport, but unless public or intermediate public transportation is available the benefit of the rural road will not reach all. Further, even when Public Transport Service is available the affordability to use the services may once again put the very poor at a disadvantage.

In short, roads are clearly a critically enabling condition for improvement of living conditions and quality of life in rural areas. Distribution of economic benefits can now be ensured to all sections through the creation of complementary activities for broadening livelihood opportunities to economically weak sections of the rural society.

Discussion Paper for the Working Group on Rural Road in the 11th Five Year Plan Constituted by the Planning Commission.

1.0 INTRODUCTION

India has a road network of about 3.2 million kms of which rural roads account for around 2.7 million kms (85%). According to the Road Development Plan Vision – 2001 of the Ministry of Road Transport and Highways, overall village accessibility stood at 54% by 2000.

Better rural infrastructure has primarily two effects – promotion of economic growth and decline in the incidence of poverty. Jocelyn A Songco (Columbia University and the World Bank, 2002) in a study has pointed out that rural infrastructure investments benefit the rural poor through increased incomes and improved consumption patterns. Some empirical studies illustrate a strong relationship between infrastructure and economic growth. According to World Bank sources, 1% increase in infrastructure stock is associated with a proportionate increase in GDP across all countries. A specific sectoral study by Deichman et al for Mexico shows that a 10% increase in market access leads to increase in labour productivity by 6%.

Linkages between public investment on rural connectivity, agricultural growth and poverty alleviation in the Indian context were investigated in a research report authored by Shengenn Fan, Peter Hazell and Sukhadeo Thorat (Research Paper NO.110, IFPRI, 1999). Using State-level data on Government spending from 1970 to 1993, this study attempted to quantitatively measure how different types public investment affect agricultural growth and rural poverty. The model estimated the number of poor people who would be raised above the poverty line for each Rs.1 million (1993 constant prices) of additional investment in eight different components of public spending — roads, research and extension, education, rural development, health, irrigation, soil and water conservation and power. Accordingly, Government expenditures were ranked in terms of their effectiveness in poverty alleviation. The findings of this study are striking. Government spending on roads was found to have the largest impact on rural poverty. For each Rs.1 million increase in investment in roads, 165 poor people would be enabled to cross the poverty line. Its impact on poverty was nearly twice as large as that the next best poverty reducer - Government investment in agricultural R&D. Investment in roads was also found to be contributing significantly to productivity growth. An additional Rs.100 billion (in 1993 prices) invested in roads would increase productivity growth by more than 3 percent.

Better rural connectivity is broadly recognized as a fundamental pre-condition for the all round development of rural areas, isolation, remoteness and lack of mobility are widely perceived as factors heightening vulnerability of the rural poor and perpetuating their poverty. Investment in rural roads can create economic opportunities for the poor directly through employment in infrastructure construction and maintenance, and the provision of rural transport services. It has also indirect impact on rural poverty through improvement in the conditions and

opportunities for marketing of goods and services, reduction in the input prices, opening opportunities in new markets and offering seasonal migration opportunities for work. Broadly the impact of rural roads can be summarized as follows:-

- **Improvement in transportation** services leading to **improved market access** for the rural producers, better availability of farm inputs at reduced prices;
- **Diversification of agriculture** – Improved market access promotes shift in favour of cash crops and commercialization of agriculture.
- **Diversification of livelihood opportunities** – Better connectivity enhances employment opportunities in the non-farm sectors.
- Improved services – Improved road connectivity, inter alia, enhances access to education, health and financial services.
- **Increase in the outreach of the State** – Improved rural roads facilitates better availability of public services and public functionaries in the rural areas.

2.0 CONNECTIVITY STATUS OF RURAL INDIA.

Before and since independence, through long term road plans such as Nagpur Plan (1943-61), the Bombay Plan (1961-81) and Lucknow Plan (1981-2001) specific targets had been set for providing connectivity to the villages with different population levels. Along with such plans, the programmes like Minimum Needs Programme, Basic Minimum Services Programme etc. have also focused on the development of Rural Road. As per Road Development Plan Vision -2021, status of connectivity of villages upto 2000 is given in **Table 1**.

Apart from the above programmes, RIDF of NABARD also helped the rural roads development. The targets and achievements under 20 Year road plans are given in **Table 2**.

Table 1: Connectivity Status

Population category	Total No. of villages	No. of villages connected				
		By 1980	By 1985	By 1990	By 1995	By 2000
1500 & above	71623	37950 (53%)	49495 (69%)	59722 (83%)	65704 (92%)	70000 (98%)
1000-1500	58229	21970 (38%)	28732 (49%)	35362 (61%)	44120 (76%)	50000 (86%)
Less Than 1000	459465	107324 (23%)	142020 (31%)	166311 (36%)	173837 (38%)	200000 (43%)
Total	589317	167244 (28%)	220247 (37%)	261395 (44%)	283661 (48%)	320000 (54%)

Note: Figures within brackets give the percentage of villages in each population category (1981 census) to the total number of villages in that category.
Source: Planning Commission and MORTH Road Development Plan Vision 2021 (published by IRC in 2001)

Table 2: Targets and Achievements of Plans for Road Development
(in kms.)

Road category	Nagpur Plan (1943-61)		Bombay Plan (1961-81)		Lucknow Plan (1981-2001)	
	Target	Achievement	Target	Achievement	Target	Achievement
1. National Highways	33,395	22,636	51,500	31,737	66,000	57,700
2. State Highways	86,825	62,052	112,650	95,491	145,000	124,300
3. Major District Roads	80,145	113,483	241,400	153,000	300,000	2,994,000*
4. Rural Roads (Other District Roads and Village Roads)	332,335	500,802	651,780	912,684	2,189,000	
Total	532,700	698,973	1,057,330	1,192,912	2,700,000	3,176,000

* Includes 1000000 km of earth tracks, mostly under employment generation programmes.

Note: Figures for targets and achievement relate to the end of the Plan period.

(Source: Road Development Plan-Vision:2021 (IRC-2001))

It may be seen from Table 2 that under the aforesaid long term plans emphasis was particularly on achieving the length targets and no specific targets for providing connectivity to villages/habitations were actually set. Secondly, in all these plans a network approach to rural road planning was noticeably missing. While achieving the length targets, in many States, more than one connection was provided for a village, resulting in redundancy and development of a large network which was difficult to maintain. Furthermore, the issues of regional imbalances were not specifically addressed in these plans.

At this point, some comments on the prevailing system of maintenance of road statistics particularly with reference to rural roads would be in order. The existing system of planning and management of various categories of roads involves a lot of judgement and empiricism due to lack of systematic and adequate database on the status of roads, traffic volumes etc. Even in respect of national highways, the database is reported to be inadequate with regard to road and bridge inventories. The position with regard to accuracy and reliability of statistics with regard to rural roads is far more unsatisfactory. There are multiplicity of agencies involved in construction and maintenance of rural roads and a nodal agency coordinating projects being undertaken by these agencies is absent. The need, therefore, is for creation of a dynamic database for all categories of roads, including rural roads, for which a coordinating agency needs to be identified with defined responsibilities and precise methodology for data collection and validation. It is hoped that this issue would be given due consideration during the 11th Five Year Plan.

3.0 PRADHAN MANTRI GRAM SADAK YOJANA (PMGSY)

In pursuance of the nationally significant cause of providing complete rural road connectivity through all weather roads, to set villages free from the handicap of isolation and deprivation of accessibility, Government of India set up the **National Rural Roads Development Committee (NRRDC)** in January, 2000 chaired by Shri Nitin Gadkari. This committee after dwelling on the effects of deprivation of rural accessibility and keeping in view expected benefits from rural connectivity recommended a special intervention, the **Pradhan Mantri Gram Sadak Yojana (PMGSY)** which was launched on 25th December, 2000 as a 100% Centrally assisted scheme to provide all weather connectivity to over 1.6 lakh eligible unconnected habitations at an estimated expenditure of Rs. 60,000 crores, as per

estimates provided by NRRDC. The set primary objective of PMGSY was to provide all weather road connectivity to:

- All habitations with over 1000 population by 2003.
- All habitations of 500 to 1000 population by 2007 (end of the 10th FYP)
- All habitations with population above 250 (in the case of hill states, deserts and tribal areas) by 2007.

Upgradation of selected rural roads to provide **farm to market connectivity** is the **secondary objective** of PMGSY Programme. In earlier programmes, the **village** with a defined population was the target for providing connectivity, while PMGSY envisage the **habitation** as the unit, to reach out to more settlements and more people with rural accessibility.

After launching PMGSY, States were asked to prepare **District Rural Roads Plan (DRRPs)**, with a complete inventory of existing roads and list out proposed roads for providing connectivity to unconnected habitations of the defined population level. As per data provided by States, after preparing the DRRP and identifying the **Core Network** to ensure **single all weather connectivity** to targeted habitations and continuity up to market centers, State wise requirements for rural roads for new connectivity can be arrived at. They are presented in **Table No.3** along with the budget required for providing new connectivity earmarked at Rs. 784180 million.

Table 3: Length and Cost of Rural Roads for New Connectivity under PMGSY

Sl. No.	State	No. of Unconnected Habitations	Eligible Unconnected Habitations						Total length to be covered (kms)	Cost for Connectivity under PMGSY in Rs. million
			1000+		500-999		250-499			
				Length (kms)		Length (kms)		Length (kms)		
1	A P	2679	167	668	417	1668	396	990	3326	4520
2	Arunachal	2654	43	303	105	854	267	1954	3111	8390
3	Assam	15786	6149	7900	4196	6671	2799	4416	18987	51950
4	Bihar	24321	11717	26687	6203	6664	0	0	33351	66470
5	Chhattisgarh	24202	2604	12213	6313	14709	3644	10634	37556	76700
6	Goa	55	0	0	20	40	35	50	90	100
7	Gujarat	8127	472	1038	2288	4027	1493	2387	7452	10210
8	Haryana	23	0	0	2	26	0	0	26	60
9	H P	11340	262	1734	853	3389	2379	7709	12832	34900
10	J & K	3946	785	3454	942	2722	1065	2236	8412	27720
11	Jharkhand	21036	2622	5298	4178	8943	3896	7204	21445	36420
12	Karnataka	4608	156	103	118	397	602	1367	1867	2250
13	Kerala	440	117	116	303	323	18	21	460	950
14	M P	34771	5804	25131	10645	31403	2043	3730	60264	121990
15	Maharashtra	6892	203	633	794	1961	754	1774	4368	7680
16	Manipur	1142	71	355	187	633	340	1143	2131	5170
17	Meghalaya	2752	9	31	150	553	597	2078	2662	6930
18	Mizoram	392	47	236	114	948	124	837	2021	5910
19	Nagaland	127	21	280	32	478	41	231	989	2490
20	Orissa	28299	3850	7946	6738	13652	3805	7776	29374	69620
21	Punjab	920	103	205	433	774	0	0	979	1610
22	Rajasthan	20729	2906	7063	6073	19468	2036	5417	31948	40630
23	Sikkim	410	16	78	138	541	164	488	1107	3280
24	Tamil Nadu	5318	577	1426	1825	3552	238	281	5259	7870
25	Tripura	3803	203	260	706	1205	1182	1516	2981	9610

26	Uttaranchal	8654	171	1299	667	4251	1767	4880	10430	22990
27	Uttar Pradesh	61554	8839	16300	15358	22300	87	125	38725	87560
28	West Bengal	35667	11941	13192	11668	9803	1679	657	23652	70200
	Total:	330647	59855	133949	81466	161955	3145 1	69901	365805	784180

There are about 60,000 habitations of 1000+ population, 81,500 habitations with population between 500 and 999 and about 31,500 habitations of 250-499 population eligible for connectivity under PMGSY with an estimated length requirement of about 3.65 lakh kms of new roads at an estimated cost of Rs. 784180 million.

The fund and kilometer requirement for upgradation along with the estimated cost is given in **Table 4**. There is a total upgradation requirement of about 3.73 lakh km of rural roads at an estimated cost of about Rs. 590330 million.

Figures in the Table indicate the position at the beginning of the PMGSY programme.

Table 4 : Length and Cost of Rural Roads for Upgradation under PMGSY

S.No.	State	Length of Core Network (Rural Roads)			Length of Upgradation to be covered(km)	Estimated cost (Rs. Million)
		Through roads (km)	Link roads (km)	Total (km)		
1	Andhra Pradesh	8576	57495	66071	17201	25820
2	Arunachal Pradesh	2750	9154	11904	4123	7260
3	Assam	10551	16632	27183	13046	33400
4	Bihar	12746	38898	51644	18581	27770
5	Chhattisgarh	12536	29040	41576	16892	27850
6	Goa	71	788	859	190	190
7	Gujarat	2982	40668	43650	9082	9720
8	Haryana	6567	6387	12954	7525	13150
9	Himachal Pradesh	5894	23577	29471	9431	16600
10	Jammu & Kashmir	3585	15238	18822	5870	11400
11	Jharkhand	7978	29677	37654	12429	17280
12	Karnataka	8141	58539	66679	16921	18720
13	Kerala	305	15734	16039	2665	4190
14	Madhya Pradesh	25330	79380	104710	37237	57420
15	Maharashtra	8905	72130	81035	19724	27650
16	Manipur	1343	7284	8627	2435	3750
17	Meghalaya	2312	7120	9432	3380	6020
18	Mizoram	1117	2396	3513	1476	2650
19	Nagaland	805	6003	6807	1705	2510
20	Orissa	19138	61257	80395	28327	43480
21	Punjab	7484	17751	25235	10147	12500
22	Rajasthan	14821	75304	90125	26117	27750
23	Sikkim	485	2408	2893	846	1150
24	Tamil Nadu	14317	52561	66878	22201	30190
25	Tripura	1637	4704	6341	2343	4760
26	Uttaranchal	4321	17124	21446	6890	12100
27	Uttar Pradesh	40363	111404	151767	57074	99720
28	West Bengal	13410	36991	50400	18958	45330
	Total	238470	895642	1134112	372816	590330

4.0 ACHIEVEMENTS UNDER PMGSY

Proposals under PMGSY prepared by States are being cleared in different phases since 2001. The physical and financial status and achievements so far under PMGSY are summarized in **Table 5**.

While completion of over 90,000km of roads under the scheme may appear impressive as compared to past record in the rural roads sector, the actual achievements have fallen far short of the targets originally envisaged. The original goal set under the scheme was to provide connectivity to all unconnected habitations with a population of 1000 or more by 2003 and all unconnected habitations with a population of 500 and above by the end of the 10th Plan period (2007). All habitations with a population of 250 or more in the hill states, desert areas, and tribal areas were also targeted to be covered by the terminal year of the 10th Five Year Plan (2007). As against these programme targets originally set, the proposals cleared so far are expected to provide connectivity to only 56638 habitations. The works completed so far have provided connectivity to only 27,303 habitations. The status of habitation coverage achieved so far under this scheme has been indicated in **Table 6**.

Table 5: Physical and Financial Status and achievements under PMGSY
Statement showing Physical & Financial progress under PMGSY (Phases - I to VI + ADB/WB)

(Rs. in crores, length in kms)

Sl. No	State	Value of proposals cleared	Amount released (upto 25.05.06)	No. of road works	Length of road works	No. of road works completed	Length of road works completed	% of completed road works	% Length completed	Expenditure	% Exp. to amount released
1	2	3	4	5	6	7	8	9	10	11	12
1	AP	1632.95	1011.47	4580.00	13284.10	3564.00	8535.35	77.82%	64.25%	914.62	90.42%
2	Arunachal	437.74	179.46	446.00	1786.65	337.00	1096.08	75.56%	61.35%	127.36	70.97%
3	Assam	1601.11	721.29	1294.00	4385.87	640.00	1558.26	49.46%	35.53%	609.50	84.50%
4	Bihar	1384.03	592.80	1297.00	5239.60	613.00	1609.76	47.26%	30.72%	504.84	85.16%
5	Chattisgarh	2220.21	1078.26	2094.00	10993.84	914.00	4998.56	43.65%	45.47%	1088.23	100.92%
6	Goa	9.72	10.00	90.00	178.16	72.00	158.70	80.00%	0.00%	5.32	53.20%
7	Gujarat	438.34	284.87	1553.00	3250.02	1139.00	2373.75	73.34%	73.04%	274.54	96.37%
8	Haryana	258.08	201.18	111.00	1575.51	77.00	1107.85	69.37%	70.32%	163.38	81.21%
9	HP	1353.08	482.80	1506.00	7590.09	510.00	2742.21	33.86%	36.13%	359.57	74.48%
10	J & K	312.40	145.35	277.00	1025.81	41.00	91.30	14.80%	8.90%	59.71	41.08%
11	Jharkhand	633.03	504.41	629.00	3362.37	439.00	2317.95	69.79%	68.94%	411.28	81.54%
12	Karnataka	759.36	506.24	1921.00	7240.01	1518.00	5015.49	79.02%	69.27%	403.63	79.73%
13	Kerala	196.73	121.97	443.00	837.04	192.00	345.80	43.34%	41.31%	75.33	61.76%
14	MP	5103.92	2102.50	5562.00	26456.59	2271.00	10529.22	40.83%	39.80%	2066.99	98.31%
15	Maharashtra	684.75	596.21	2148.00	5146.84	1508.00	3245.59	70.20%	63.06%	485.94	81.50%
16	Manipur	273.04	104.33	849.00	1266.84	525.00	688.84	61.84%	54.37%	98.01	93.94%
17	Meghalaya	145.72	123.17	347.00	811.43	286.00	661.91	82.42%	81.57%	93.40	75.83%
18	Mizoram	333.23	225.50	114.00	1526.83	67.00	978.60	58.77%	64.09%	163.75	72.62%
19	Nagaland	194.43	161.56	208.00	1996.67	173.00	1582.37	83.17%	79.25%	107.74	66.69%
20	Orissa	2240.95	1445.56	2880.00	9514.74	1663.00	5137.43	57.74%	53.99%	1147.02	79.35%
21	Punjab	217.90	176.30	508.00	1282.78	412.00	815.11	81.10%	63.54%	166.77	94.59%
22	Rajasthan	4490.81	2395.60	8865.00	30877.01	4374.00	15427.75	49.34%	49.97%	1926.34	80.41%
23	Sikkim	298.37	111.26	182.00	1912.48	59.00	1503.68	32.42%	78.62%	85.13	76.51%
24	Tamil Nadu	724.18	491.87	2604.00	5040.68	1738.00	3121.72	66.74%	61.93%	366.78	74.57%
25	Tripura	200.99	96.39	311.00	841.38	205.00	437.07	65.92%	51.95%	77.60	80.51%
26	UP	2916.29	2193.87	11186.00	21227.95	7957.00	13657.31	71.13%	64.34%	1624.25	74.04%
27	Uttaranchal	360.83	215.33	292.00	1822.86	131.00	508.36	44.86%	27.89%	150.53	69.91%
28	West Bengal	2328.20	1203.45	1274.00	7650.14	683.00	3471.40	53.61%	45.38%	929.36	77.22%
	Grand Total	31750.39	17483.00	53571.00	178124.29	32108.00	93717.42	59.94%	52.61%	14486.92	82.86%

Table 6: Connectivity Status under PMGSY

Population Category	No. of eligible habitations	No. of habitations covered by projects approved	No of habitations connected
1000 and above	59855	28361	16081
500 and above	81466	21942	8602
250 and above	31451	6335	2620
Total	172772	56638	27303

With only 15.80% of habitations having been actually connected so far, it is evident that the scheme would miss the 10th Plan target by a huge margin. Recognising this slippage the time frame for providing full connectivity to habitations with population above 1000 (above 500 in hill, desert, and tribal areas) has been reset under Bharat Nirman.

5.0 BHARAT NIRMAN

Announced as a time bound business plan for augmenting rural infrastructure, Bharat Nirman has rural roads as one of the six components. The targets announced by the Finance Minister in his budget speech on February 28, 2005 seek to provide all-weather connectivity to all habitations having population of 1000 or more (500 or more in hill, tribal and desert areas) by 2009. While the primary objective of PMGSY has been to provide 'last mile connectivity' to all eligible unconnected habitations, in order to ensure full farm to market connectivity Bharat Nirman also includes an upgradation component. It is estimated that under Bharat Nirman 66802 habitations would be provided new connectivity with a road length of 1,46,185km. Besides, 1.94lakh km of existing through routes of the Core Network would be upgraded/renewed. The total investment on rural connectivity under Bharat Nirman has been estimated at Rs.48000 crore over 2005-2009. The year-wise targets for new connectivity and upgradation have been detailed at **Table 7** and **Table 8**.

Bharat Nirman envisages a massive scaling up of the programme in terms of habitations coverage, construction targets and financial investment. While around 19000 habitations were provided connectivity during 2000-2005, coverage is targeted to register more than three-fold increase over 2005-09. While average annual spending during 2000-2005 was around Rs.2500 crore, it is targeted to increase by four to five times under Bharat Nirman. While this is a bold initiative to address the infrastructure deficit in the rural areas, the quantum increase envisaged in the programme size call for commensurate efforts in augmenting the programme implementation capacity, contracting capacity, materials planning, construction management systems and work processes.

Table 7: Bharat Nirman- Targets for New Connectivity

(Length in kms, Habitations in Numbers)

S.No	Name of the State	2005-06		2006-07		2007-08		2008-09		Total	
		Length	Habs	Length	Habs	Length	Habs	Length	Habs	Length	Habs
1	Andhra Pradesh	0	0	0	0	0	0	0	0	0	0
2	Arunachal Pradesh	162.5	22	637.5	85	646.875	86	671.875	105	2118.75	298
3	Assam	605.852	421	2864.063	1988	3889.845	2701	5793.46	4022	13153.22	9132
4	Bihar	1665.831	896	3928.75	2062	6121.425	3214	7230.306	3784	18946.312	9956
5	Chhattisgarh	1501.365	478	4367.606	1310	6450.644	2007	8255.181	2514	20574.796	6309
6	Goa	0	0	0	0	0	0	0	0	0	0
7	Gujarat	402.955	230	429.723	246	438.675	251	438.675	251	1710.028	978
8	Haryana	0	0	0	0	0	0	0	0	0	0
9	Himachal Pradesh	464.583	127	795.833	209	638.542	166	479.167	123	2378.125	625
10	J&K	169.972	57	1059.49	352	1781.869	593	1405.099	466	4416.43	1468
11	Jharkhand	1051.779	526	2594.39	1295	1812.298	901	2319.31	1155	7777.777	3877
12	Karnataka	0	0	0	0	0	0	0	0	0	0
13	Kerala	0	0	0	0	0	0	0	0	0	0
14	Madhya Pradesh	2602.139	768	6162.451	1760	8326.848	2399	10470.17	2905	27561.608	7832
15	Maharashtra	0	0	0	0	0	0	0	0	0	0
16	Manipur	100	11	460.714	48	464.286	48	719.048	74	1744.048	181
17	Meghalaya	123.609	35	135.971	39	140.091	40	144.211	41	543.882	155
18	Mizoram	82.746	12	274.819	39	277.884	39	306.498	43	941.947	133
19	Nagaland	93.318	9	104.529	10	109.507	10	114.485	11	421.839	40
20	Orissa	1055.95	493	1985.609	874	2524.021	1087	4427.774	1993	9993.354	4447
21	Punjab	0	0	0	0	0	0	0	0	0	0
22	Rajasthan	2153.615	743	3629.519	1252	3554.217	1225	2123.494	732	11460.845	3952
23	Sikkim	75.031	22	104.042	30	108.043	31	132.053	37	419.169	120
24	Tamil Nadu	0	0	0	0	0	0	0	0	0	0
25	Tripura	94.774	66	261.74	183	354.701	248	447.661	313	1158.876	810
26	Uttar Pradesh	1966.416	1236	2390.632	1504	2059.213	1295	1378.701	867	7794.962	4902
27	Uttaranchal	380.609	95	422.008	106	1025.641	257	1020.299	255	2848.557	713
28	West Bengal	739.378	787	2572.767	2738	3265.307	3473	3643.359	3876	10220.811	10874
	Total	15492.42	7034	35182.16	16130	43989.93	20071	51520.83	23567	146185.34	66802

6.0 INSTITUTIONAL DEVELOPMENTS UNDER PMGSY.

6.1 To ensure efficient, streamlined execution of works under PMGSY, a series of interventions have been made to enhance the programme implementation capacity of the States and to ensure 'on time' completion, cost management, and rigorous quality control. These interventions are summarized below:

- **DRRP & Core Network:** The concept of Core Network has been operationalised for the first time, under PMGSY, in order to focus on the set of roads which are considered essential to provide connectivity to all habitations of the desired size. The District Rural Road Plan (DRRP) with inventory of the entire Road Network is the starting point for the exercise. The Core Network will be the basic instrumentality for prioritization of construction, upgradation and allocation of funds for maintenance.

Table 8: Bharat Nirman Targets for Upgradation**(Length in Kms)**

Sl.No	Name of the State	2005-06	2006-07	2007-08	2008-09	Total
		Length	length	Length	Length	Length
1	2	3	4	5	6	7
1	Andhra Pradesh	1821.494	2258.652	2258.652	2258.652	8597.45
2	Arunachal Pradesh	0	0	0	0	0
3	Assam	0	2005.71	2269.808	2219.843	6495.361
4	Bihar	0	2393.617	3510.638	3390.958	9295.213
5	Chhattisgarh	0	1986.063	3240.418	3222.996	8449.477
6	Goa	190.114	190.114	190.114	190.114	760.456
7	Gujarat	0	1557.971	1557.971	1413.043	4528.985
8	Haryana	229.358	1146.789	1146.789	1238.532	3761.468
9	Himachal Pradesh	0	1515.923	1694.268	1503.185	4713.376
10	Jammu & Kashmir	0	1007.584	920.91	1007.584	2936.078
11	Jharkhand	0	2108.433	2123.494	1987.952	6219.879
12	Karnataka	2573.529	2573.529	2573.529	2573.529	10294.116
13	Kerala	524.109	628.931	524.109	524.109	2201.258
14	Madhya Pradesh	0	5189.543	6614.379	6823.53	18627.452
15	Maharashtra	4334.365	4334.365	4334.365	4334.365	17337.46
16	Manipur	0	0	0	0	0
17	Meghalaya	0	587.583	587.583	665.189	1840.355
18	Mizoram	0	257.998	257.998	216.718	732.714
19	Nagaland	0	246.914	246.914	370.371	864.199
20	Orissa	0	4438.574	4663.144	5059.445	14161.163
21	Punjab	423.729	1483.051	1483.051	1680.791	5070.622
22	Rajasthan	0	4764.543	4653.74	3656.51	13074.793
23	Sikkim	0	196.85	137.795	98.425	433.07
24	Tamil Nadu	1297.71	2824.427	2824.427	4167.939	11114.503
25	Tripura	0	373.737	383.838	414.141	1171.716
26	Uttar Pradesh	0	7158.962	6956.031	14408.12	28523.113
27	Uttaranchal	0	889.454	1283.354	1270.648	3443.456
28	West Bengal	0	2549.942	2878.965	4054.053	9482.96
	Total	11394.408	54669.259	59316.284	68750.742	194130.693

- **Quality Control System:** The road works under the PMGSY are being executed by the State Governments. The primary responsibility of maintaining the quality of works is of the State Authorities. Under the PMGSY, quality is sought to be ensured through a three-tier Quality Control System, in which the Executing Agency is primarily responsible for maintaining the quality through its Executive Engineers, at the District Level, as well as through an independent Quality Control Agency, whether departmental or otherwise, which is responsible to the officers of the Executing Agency or the Nodal Department independent of the Field Engineers at the State Level.
- In addition, the National Rural Roads Development Agency (NRRDA), as a third-tier, engages National Quality Monitors (NQMs) to verify at random the quality of road works. The reports of the NQMs are sent to the State Government for necessary action. About 21000 inspections have been carried out so far, out of which about 18,000 works have been found satisfactory. Any infringement/deficiency, detected by the Monitors, are rectified before the State Authorities can make further payments.
- **On-line Management & Monitoring System:** A web-based On-line Management & Monitoring System (OMMS) is being used for the PMGSY.

The website can be accessed at www.omms.nic.in . A new website has also been developed by the Rural Connectivity Division containing details of the PMGSY Schemes, Guidelines, Agencies involved, role and responsibilities, progress, etc. and can be accessed at www.pmgsy.nic.in.

- **Streamlined Administration and Accounting:** State Rural Roads Development Agency (SRRDA) have been set up in all States with the task of functioning as the dedicated agency of the State nodal Department for rural roads to ensure the integrated development of all rural roads schemes, including PMGSY. Funds for the PMGSY programme are routed to these SRRDAs and operated by the designated officers in each of the district PIUs, under a works accounting system specifically designed for PMGSY by the Institute of Public Auditors of India (IPAI).
- **Technical Agencies:** The Ministry have identified 43 State Technical Agencies, mainly National Institutes of Technology and Government Engineering Colleges of repute, in consultation with the State Governments to advise and assist the Executing Agencies, on behalf of the Ministry, on technical matters relating to PMGSY. The STAs are expected to scrutinize the project proposals prepared by the State Governments, provide requisite technical support to the State Governments, and to undertake Training Programme.
- The NRRDA has also identified 7 **Principal Technical Agencies** (PTAs) to act as the Regional Coordinators of the STAs as well as the extended arms of NRRDA in the pursuit of its objectives. The PTAs oversee the activities of the STAs in the region, carry out random checks of the DPRs scrutinized by STAs, evaluate specifications and practices, develop course material for Training Programmes, and act as Resource Institutions. The PTAs are also to assist the NRRDA in quality audit of roads.
- The identified PTAs are the Central Road Research Institute (CRRI), IIT, Mumbai, Department of Civil Engineering, University of Bangalore, IIT, Kharagpur, IIT Roorkee, Birla Institute of Technology, Pilani and National Institute of Technology, Warangal.
- **Rural Roads Manual:** The original Manual, called Manual on Route Location, Design, Construction and Maintenance of Rural Roads was brought out by the Indian Roads Congress as a publication in 1979 (IRC: SP:20-1979).
- Following the launch of the PMGSY, the Ministry of Rural Development constituted 3 Committees in January 2001 to go into various aspects of rural road construction and the manuals on these different aspects brought out by the committees were combined into a separate 'Rural Roads Manual' and published as an IRC publication (IRC:SP: 20-2002) in supercession of earlier manual.
- This Manual is now the basis of all works under the PMGSY.

- **Standard Bidding Documents:** To standardise the PMGSY works tendering process in the States, a Standard Bidding Document has been prepared and is used by all States for tendering of works under PMGSY.
- **Book of Specifications and Standard Data Book:** In order to streamline the process of estimating and standardise contracts, a separate Book of Specification and Standard Data Book has been prepared for rural roads. State Governments have been advised to publish Annual Schedule of Rates for rural roads based on these documents.
- **Operations Manual:** The NRRDA has prepared an Operations Manual which would be utilized by all the Executing Agencies in the field in the implementation of projects cleared under the PMGSY. This is expected to provide clear and uniform Guidelines to the Executing Agencies in the States in regard to standards, specifications, Guidelines and prioritization criteria.
- **Maintenance Management :** PMGSY is a massive Central investment in the State sector as a part of a poverty reduction strategy. Huge assets are being created as a result of construction of new roads and upgradation of existing roads in order to provide full farm to market connectivity. To provide regular and systematic maintenance of the assets created under PMGSY, the Guidelines provide for the ways and means to ensure maintenance of these assets. The State Governments are expected to take steps to build up capacity in the District Panchayats and endeavour to devolve funds and functionaries onto these Panchayats to enable them to manage maintenance contracts for rural roads.

All PMGSY roads (including associated Main Rural Links/Through Routes of PMGSY link routes) are covered by 5-years maintenance contracts entered into along with the construction contract, with the same contractor, as per the Standard Bidding Document. Maintenance funds to service the contract are to be budgeted by the State Government and placed at the disposal of SRRDA in a separate Maintenance Account. The States have also been advised to prepare comprehensive Maintenance Management Plans.

- 6.2 While these interventions have brought about some degree of professionalism in the programme management and fostered culture of quality in the rural roads sector, the absorption capacity of the states as well as those of contractors are still well below the levels required to achieve the targets set under Bharat Nirman.
- 6.3 A comprehensive and in depth evaluation of PMGSY has not yet been made either by the Ministry of Rural Development or by any independent agency. However, Planning Commission did carry out a quick concurrent evaluation through its Programme Evaluation Organisation (PEO) in 2005. The findings of this evaluation have been summarized in **Box 1**.

Box-1: Overall Assessment of PMGSY

PMGSY has succeeded in providing connectivity to some of the most deserving habitations although the pace of implementation in most of the selected States is rather slow. Selection of these road works seem to be justified, unless one gives a high weightage to the opportunity cost in terms of road works forgone in other Districts/other States. All the implementing States have designated an implementing agency as the nodal agency. All the selected implementing States have more or less adhered to the PMGSY guidelines as far as selection of habitations, project proposals and clearance are concerned. Quality of PMGSY roads has been found to be generally good. PMGSY roads provide connectivity to important places such as School/College, Market Centre, and Block Office etc. It has improved the accessibility of beneficiary villagers and resulted in higher income in the form of better price for agricultural produce, new employment avenues etc. The cost of providing connectivity for some of the habitations in States like Himachal Pradesh is very high due to difficult terrain. But for PMGSY, no road would have been taken up in these sparsely populated habitations

However, what is important is that not only both the phases of PMGSY are efficiently completed within prescribed time targets by overcoming the problems/constraints faced from time to time but the learning experiences of the past are also always kept in view. Further, it is hoped that by the end of Tenth Five Year Plan, all unconnected villages/habitations will be actually connected through the construction of all-weather surfaced roads so that vast chunk of India's population living in rural areas also enjoys the fruits of development.

In the mid-term evaluation of the 10th Plan, Planning Commission has also taken note of the implementation capacity constraints which has been referred to above. For successful implementation of PMGSY the Planning Commission recommended that it is necessary to address the issue relating to capacity development at the State level. The Commission also recommended that the issues relating to maintenance funding, management and integration of rural roads with higher categories, particularly major district roads, and the need to develop an appropriate role for the district panchayats in the management of rural roads need to be addressed.

- 6.7 While creating an institutional architecture for coordinated development of rural roads, codification of technical standards and specifications, assured funding support to the implementing agencies, comprehensive planning for development of the rural road network and institutionalization of a quality assurance system can be identified as the major strengths of PMGSY, experience gained/lessons learnt over the past six years have also brought out some structural weaknesses in the scheme. First of all, being essentially a scheme to provide the 'last mile' connectivity, the guidelines of the scheme perhaps weigh excessively in favour of new connectivity, providing only limited allocation for modernization/upgradation of the through routes. The existing guidelines limit allocation for upgradation to only 20%. With this limited allocation it has not been possible so far to upgrade a significant proportion of the through routes. As a matter of fact, a major criticism of the scheme from the perspective of the road users has been that to access small stretches of new connectivity link roads built under PMGSY, one has to traverse long distances on the through routes with highly deteriorated pavement conditions. Besides, major district roads which carry large volumes of traffic in the rural areas are outside the purview of the scheme even though these roads are

part of the Core Network. This neglect of the MDRs under PMGSY as also in other ongoing schemes has impeded the comprehensive development of the rural road network. Secondly, even though Core Networks have been developed under PMGSY, to serve as the basis of network planning and development, this is still not being used by agencies other than the Ministry of Rural Development for funding rural roads construction/upgradation. This fragmented approach by the funding agencies needs to be rationalized. Third, with all the interventions made for capacity development, time overrun in project completion is widespread. Although the Standard Bidding Document requires works taken up under PMGSY to be completed within 12 months, even now 26% of the works approved under Phase III (2003-04) are still incomplete. This indicates prevalence of weak contract management and the need for revisiting the procurement processes including appropriate provisions for incentives/disincentives for timely completion of projects. Besides, lack of exposure of the field engineers to new techniques, technologies and construction management practices need to be addressed. Fourth, while engineering designs and specifications for rural roads have been codified under the scheme, which is, no doubt, a major initiative, this massive programme for rural connectivity should also be used as a window of opportunity to experiment with alternative cost effective designs and materials. However, there is still a marked reluctance on the part of the implementation agencies and the field engineers to deviate from the conventional methods and to try out innovative methods and designs. In many parts of rural India standard materials for road construction are not available in adequate quantity. However, there are alternative materials and weak aggregates which can be used in the construction if appropriate technological processes are used. Except for a few R&D projects, PMGSY has still not been able to incentivise R&D projects on a significant scale. Finally, the problem of maintenance management has not yet been adequately addressed in almost all the States though a few states moved some distance in this regard (e.g. Rajasthan). Adequate and assured funding for maintenance is not available. Too many agencies are still involved in the maintenance of rural roads leading to diffusion of responsibility and accountability. Appropriate systems for prioritization of maintenance have still not been institutionalized. In this context it also needs to be mentioned that though the guidelines of PMGSY envisage that the maintenance functions should be transferred to the district panchayats (with funds and functionaries), an effective decentralised system of maintenance of rural roads has not been operationalised in any State so far under the scheme.

7.0 ISSUES FOR CONSIDERATION

In order to develop a strategy for rural road development for the 11th Five Year Plan, the key issues are to be taken note for deliberation and focus on the possible measures. The spectrum of the issues covers different facets of Rural Roads Development including achievable targets, implementation strategy, Institutional development for enhancing absorption capacities, technologies for cost effectiveness, management of assets created, quality assurance and possible synergies with other programmes meant for rural development. Some of the major issues are being presented in the following articles:

7.1 Targets for the coverage by the end of 11th Five Year Plan.

PMGSY envisages providing connectivity to all habitations of 500 and above in all States and 250 and above in hill States, tribal and desert areas. To achieve the above objective State-wise demand for rural connectivity is estimated at **Table 3**. Based on the projects already approved under PMGSY, a further 2,39,000km of new link roads will have to be built to provide connectivity to the remaining eligible habitations under PMGSY. It is expected that about **56,600** habitations will get connected, with new link roads of **1,26,670 kms** by the end of 10th Five Year Plan. It may not be possible to complete the new connectivity target during the 11th Five Year Plan at the current pace. Even on the premise that absorption capacities of States will increase with time and make it possible to set higher targets, it appears that the total target is beyond the reach of getting completed during the 11th Five Year Plan. Therefore it may be necessary to set a workable target for achievement during 11th Five Year Plan. The expert group preparing the Rural Roads Development Plan – Vision 2025 have recommended completion of 1,20,000km of roads for new connectivity and 50000km of upgradation during the 11th Five Year Plan. This would require investment of Rs.34000 crore at current prices.

The issues for consideration are setting feasible physical targets, both in terms of road length and habitation coverage, for the 11th Five Year Plan. While setting physical targets the working group may also consider the absorption capacity of the States and constraints on the contracting capacity and the measures that may be required to address these constraints.

7.2 Modification in the Programme Design.

PMGSY has been conceptualized primarily as a programme to achieve the last mile connectivity to habitations of specified population categories. It does not envisage coverage of habitations below population of 500 in plain areas and below 250 in hill, desert and tribal areas. It is observed that even though in some States where habitations coverage, as per the existing criteria has not been fully achieved there are districts where the prescribed level of situation has been reached. It is for consideration whether the connectivity programme in these districts should be extended to habitations with lower population densities. Secondly, in the hill States, and North Eastern States a more liberalized approach to connect a cluster of habitations has been often demanded. In respect of States where full connectivity (of the defined categories of habitations) has already been achieved, the existing schemes provides only limited allocation for upgradation. These States have built a large stock of rural roads with their own investment over the years. Their rural road networks is in need of major rehabilitation and upgradation keeping in view the pavement condition and increased traffic volumes. The working group may deliberate on these issues and consider whether there is a need to modify the design of PMGSY to address these issues.

7.3 Support Needed for Capacity Development.

Though the absorption capacity is increasing with the institutional interventions made, States are not fully geared up to meet targets under Bharat Nirman. While all efforts are being made by States for capacity development, constraints on the availability of trained manpower, qualified and capable contractors and the large scale requirement of material availability and associated logistics have surfaced.

At the beginning of the programme, based on the expected budget allocation, States have established the required number of Programme Implementation Units (PIUs) in the executing agencies. However, with the increase in the fund availability and higher targets set under PMGSY and Bharat Nirman, the executing agencies have experienced shortage of the PIUs both at field execution level as well as supervisory level. While, States are making the best efforts by increasing the number of PIUs to cope up with the work the shortage of manpower still persists. In order to overcome this situation, States are advised to adopt outsourcing of some of the functions of the PIUs such as the preparation of the DPRs, construction supervision and quality control, fully monitoring and management activities. States are further advised for the deployment of engineers from other departments, if spare capacity is available, with proper orientation and training, as required.

As a step towards capacity building of contractors, repackaging of the roads is permitted in some States at their request. Efforts are also being made to facilitate development of the capacity of the small and medium contractors by enabling them to acquire machineries through appropriate financing options.

In spite of these measures, implementation capability of the executing agencies is still inadequate. Hence, further measures in this regard need to be considered.

The Committee may deliberate on:

- **Support from Government of India to States for increasing the institutional capacity for effective implementation.**
- **Development of the contracting industry by bringing more players into the arena through appropriate procurement processes.**
- **Identification of specific training needs for the personnel of all stake holders.**
- **Establishing equipment banks to facilitate smaller contractors to participate.**

7.4 Application of Cost Effective Technologies.

Cost trends in different States, over the phases are presented in **Annexure**. It indicates a large increase in the cost of construction for the rural roads per unit length.

In this context, it is essential to understand that cost of construction per unit length of road is a function of several factors such as type of terrain, the nature of soil condition (strength in terms of CBR), expected traffic, availability of construction materials within normal leads, rainfall and other environmental factors. The terrain where the rural road is being constructed may further influence the cost with the requirements of appropriate geometrics, cross drainage works and protection works. Under these varied conditions, it may not be possible to standardize the cost of construction of rural roads across the States or some times across the districts in a State or within a district itself, owing to the fact that the cost of construction is based on location specific conditions.

Cost analysis of rural roads in different states and different technologies carried out by IIT, Roorkee brought out the fact that haulage distance for bringing the construction materials, the terrain that influences the requirement for CD Works and protection works, the earthwork requirements and type of soil are the main reasons for cost variation in different States. Further, research also revealed that by adopting innovative technologies with local materials through appropriate stabilization with lime, cement, fly ash or a combination substantially reduces the cost of construction.

A further point to note here is that before the launching of PMGSY, rural roads were not constructed with appropriate design and specifications and adequate provisions for their sustainability. Such a trend was noticed even during I and II Phases of PMGSY where the states seldom provided what was required for a good all weather road.

In the light of the above, the following issues are suggested for deliberation :

- Promote use of locally available and waste material from industrial plants in lower layers, by treating them with lime, cement or mechanical stabilization.
- Review current pavement design charts for flexible pavements in the light of performance studies and international practices on a continual basis.
- Evolve low cost bituminous surfacing to provide a water proofing layer on top.
- For access to small size habitations in areas with low to moderate rainfall, provide gravel roads with a 3 m carriageway to start with. Stabilize the top layer with cement or other additives to reduce dust.
- Lay stress on the provision of low cost water crossings.
- Encourage intermediate technology for construction (labour based methods with light equipment) and enhance use of local skills and practices.
- Consider reducing the currently stipulated formation width of 7.5 m to 6 m on roads with traffic less than 100 motorized vehicles per day.
- Review core network alignments shown in district level Master Plans for possible reduction of the overall length.
- Continue R&D efforts in evolving cost-effective and innovative material for road construction.
- Use of environmental friendly compounds and enzymes for soils stabilization that may, partially or fully replaces the use of aggregates.

7.5 Maintenance of Road Assets.

Rural roads created as assets deteriorate over a period of time. Hence, it must be maintained to a minimum level of acceptable serviceability. If proper attention is lacking, for whatever reason, it is bound to accelerate the process of deterioration, which in turn results in :

- Loss of time.
- Loss of agriculture output
- Heavy rehabilitation cost
- Increase in the vehicle operating costs
- Loss of Access

- Acceleration of Isolation and
- Loss of asset itself.

Differed Maintenance entails rehabilitation of the road many more times of resources required to be spent in the maintenance. Because of the neglect in the maintenance in the past, the same roads are in effect being constructed over and over at a high social and economic cost. Such a situation is to be avoided, therefore, even on the principals of economics the key to prevent this and other ill effects are to adopt an assured and sustainable maintenance strategy for the rural roads. Regular maintenance of rural roads is a critical pre condition for sustaining the positive impacts that roads bring to rural communities. Minor maintenance is often neglected not only because of lack of funds, but also because there is a little political capital, or mileage in maintaining roads regularly as the outcome is not highly visible.

An important point to note here is that maintenance of any asset depends upon the care with which it is planned, designed, constructed. A meticulously planned, scientifically designed, and properly constructed with merciless quality control results in minimum maintenance interventions.

Institutional Initiatives: The UN Economic Commission for Africa and the World Bank launched a Road Maintenance Issue (RMI) in late 80's, with a hope of reversing the massive deterioration of the road network. It was based on two essential postulates:

- The core problem of road maintenance is not rooted in technical matters, but is political and institutional.
- Any change in policies, to be affective, must be rooted in a firm awareness at the highest level of government, of the importance of road maintenance.

Among several issues to be addressed, with regard to maintenance, the most critical are:

- **Government Policy**
- **Dedicated funds.**
- **Maintenance backlog**
- **Maintenance management system**
- **Institutional reforms**
- **Contract maintenance**
- **Involvement of Panchayati Raj Institutions.**
- **Modernization and R&D**

The expert group of Rural Roads Development Plan – Vision: 2025 recommended the following strategies for putting maintenance of rural roads on sound footing.

- Introduction of Rural Road Maintenance Act with clearly defined functions and powers.
- Estimation of realistic norms.
- Providing dedicated funds with streamlined management.
- Making the roads maintainable by removing backlogs.

- Bringing in Panchayati Raj Institutions with necessary capacity building.
- Planning of maintenance works on the principles of asset management.
- Review of gang labour system.
- Documentation and introduction of incentives.

While the PMGSY guidelines envisage that State Governments transfer the responsibility of maintenance of rural roads to the Panchayati Raj Institutions (PRIs), hardly any worthwhile effort has been made during the 10th Five Year Plan to enable the State Governments to move forward in this direction. This issue should, therefore, merit consideration on priority in the 11th Five Year Plan. Specifically, the working group may deliberate on a model of decentralization laying down which tier of the PRI should take up which segment of the maintenance responsibility, mobilisation of finances for enabling the PRIs to meet the maintenance needs, provision of technical and administrative support at each level of the PRIs to discharge the maintenance responsibilities entrusted to them.

7.6 Alternative Modes of Financing Rural Roads.

There is a wide gap between the funds currently made available for rural roads and those required to meet the demand. It will therefore be necessary to tap additional sources of financing to meet the requirement. It may be pointed out that not all the funds obtained from taxation of road transport are ploughed back on roads. **Table 8** gives the relevant information.

Table 8: Revenue and Expenditure of Road Transport Sector.

Year	Transport Revenue (Rs. million)	Road Expenditure (Rs. million)	Expenditure as percentage of revenue
1950-51	470	260	55%
1990-91	76,310	33,000	43%
2002-03	500,000	211,000	42%

Source: *Road Development Plan- Vision 2021 (IRC), 2001 and Financing Indian Highways (World Bank), 2005.*

It can be seen from the above that the share of expenditure in the road based revenue is on the decline.

Currently the following sources of financing are available for rural roads construction:

- Government Budget
- Central Road Fund
- Market Committee Fee.
- Mandi Fees
- Loan Assistance from NABARD.
- Loan Assistance from World Bank and ADB.

Current projections under Bharat Nirman :

The total investment requirements under Bharat Nirman (upto 2008-09) has been estimated at Rs.48000 crore. While Rs.16000 crore is expected to be available

from Cess on HSD, Rs.9000 crore is likely to be available from the World Bank and ADB. To meet the financing gap under Bharat Nirman, it is proposed to borrow Rs.16500 crore from NABARD by leveraging the Cess accrual. The residual gap is expected to be made by way of budgetary support. In this context, it needs to be pointed out that leveraging of the Cess accrual to bridge the financing gap under Bharat Nirman would entail substantial amounts that would accrue from Cess from 2009-10 onwards would have to be set aside for repayment of the NABARD loan. The schedule of repayment of loan and the amount of Cess likely to be used for repayment, year-wise, is indicated in **Table 9**.

Table 9: Borrowing and Repayment Schedule

(Rs in crore)

S.No	Year	Amount Borrowed	Repayments		Total	Likely Cess Inflow	Balance Cess after servicing
			Interest	Principal			
1	2	3	4	5	6	7	8
1	2006-07	4500	0	0	0	3876	3876
2	2007-08	4000	292.5	0	292.5	3954	3661.5
3	2008-09	4000	552.5	0	552.5	4033	3484.5
4	2009-10	4000	812.5	900	1712.5	4113	2400.5
5	2010-11	0	1014	1700	2714	4196	1482
6	2011-12	0	903.5	2500	3403.5	4279	875.5
7	2012-13	0	741	3300	4041	4365	324
8	2013-14	0	526.5	3300	3826.5	4452	625.5
9	2014-15	0	312	2400	2712	4541	1829
10	2015-16	0	156	1600	1756	4632	2876
11	2016-17	0	52	800	852	4725	3873
12	Total	16500	5362.5	16500	21862.5	47166	25307.5

The Table 9 clearly shows that in the last two years of the 11th Five Year Plan, the amount of Cess that would be available net of repayment to finance the rural roads programme would be very limited. The working group may, therefore, consider how the financing needs of the rural roads programme in the 11th Five Year Plan would be taken care of, particularly in the last two years of the Plan. The options are to continue leveraging Cess or to increase the extent of budgetary support. While the former option may tie up the Cess accruals for repayment for a longer period in future (which should consequently affect the future Plans), the latter option may have to contain with the overall constraints of Plan resources.

The following additional strategies are recommended in the Draft Vision- 2025 Document which the committee may deliberate:

➤ **Independent Road Fund**

It needs to be appreciated that there is practically no scope for financing of rural roads by the private sector as is done for national highways and state highways. This is mainly because they carry very low volumes of traffic, mostly non commercial in nature and hence charges in the form of toll are difficult to levy for the recovery of investments. The central government has already created a dedicated road fund. A few states like Uttar Pradesh and Karnataka have also set up their own dedicated funds for augmenting the resources for maintenance.

➤ **Market Committee Fund**

This strategy should be extending levying of market fee and rural development cess on agricultural produce which has been successfully tried in States like Punjab, Haryana etc. Part of these funds should be earmarked for rural road maintenance.

➤ **Stamp Duty on Land Transactions.**

There have been suggestions that since land value close to roads tend to increase the beneficiaries may pay additional stamp duty on sale of such lands.

➤ **Vehicle Fee**

In addition to taxes on fuel additional funds may be generated to special purchase tax on passenger vehicles and agricultural tractors using a part of this for the maintenance of rural roads.

➤ **Domestic Borrowings**

NABARD is already extending loan assistance for construction of rural roads in several states through their RIDG programmes. Further, resources can be tapped from such institutions for rural roads maintenance.

➤ **User charges**

The scope for user charges in rural roads, which unlike the highways are meant to provide basic access, is rather limited. At best, this may be a potential source only in selected roads with very high commercial traffic volumes (e.g. in mining areas). However, even in those cases user charges may cover the maintenance requirements and not the rehabilitation/upgradation requirements.

➤ **Public Private Partnership (PPP)**

While there is little experience of PPP in the context of rural infrastructure in India, it would be a worthy exercise to explore partnership that might work taking in to the complexity of the rural context, creating space for private financing, the economic, social and political nature of the service sought to be provided and the end users. In this context it may be mentioned that there has been some success in Latin America for rehabilitation and maintenance of roads through service contracts by forming community based micro enterprises. The possibility of replication of this model may be considered.

7.7 Quality Assurance

Quality of any product including rural roads can be defined as “**Conformance to Requirements**”. The Conformance to requirements should be both with respect to the materials used for road construction as well as the workmanship. Since quality begins right from planning and design of the road, all efforts are needed for quality assurance from that stage till the road is opened for traffic. A well trained quality appreciation unit should therefore be set up within the departments to undertake Quality checks at specified intervals.

Currently, under PMGSY, a Three Tier Quality Management System is in position which is yielding the desired results. However, further efforts are required for a better Quality Assurance System.

The following issues are flagged for discussion:

- Financial Provision for Quality Measures.
- Training as a means for Quality Assurance through skill development.
- Third Party Quality Assurance mechanism on similar lines to the present NQM system.
- Technical Audit of the assets.
- Public Participation and Transparency Measures.

7.8 Synergy with other Programmes.

Several developmental programmes are being taken up in rural areas by both Central and State governments. The National Employment Guarantee Scheme is one among them. The Government's initiative on Social Forestry is another. If rural roads development is appropriately linked to such programmes the synergy may lead to better efficiencies in all the associated programmes. However, while linking the programmes, the requirements and standards of any one of them should not be compromised.

The Committee may discuss possible linkages with the other on – going programmes of rural development with rural roads development.

Annexure - Cost Trends under PMGSY

#	State	2000-01		2001-03		2003-04		2004-05		2005-06		2006-07	
		NC	UP	NC	UP	NC	UP	NC	UP	NC	UP	NC	UP
1	Andhra Pradesh	6.72	7.25	14.69	11.49	10.23	15.02		15.47	0.00	18.99		
2	Arunachal Pradesh	0.00	12.88	12.29	0.00	No proposal		31.24	0.00	51.03	0.00		
3	Assam	41.74	0.00	26.06	25.55	24.96	0.00	32.57	0.00	40.36	19.08		
4	Bihar	17.82	19.49	21.52	0.00								
5	Chattisgarh	0.00	9.61	16.03	0.00	19.59	0.00	22.03	0.00	23.00	22.79		
6	Goa	0.00	3.19	16.81	0.00	No proposal		25.07	0.00				
7	Gujarat	11.46	8.48	11.68	8.85	13.29	0.00	17.25	0.00	17.53	10.82		
8	Haryana	0.00	5.50	0.00	17.04	0.00	17.48	0.00	21.97	0.00	23.28		
9	Himachal Pradesh	11.22	0.00	14.19	0.00	14.30	0.00	21.39	0.00	23.03	0.00		
10	Jammu & Kashmir	18.78	23.45	24.99	0.00	30.95	24.36	34.90	0.00				
11	Jarkhand	26.18	3.67	19.18	0.00	20.85	0.00	23.73	0.00				
12	Karnataka	8.09	6.17	10.55	8.49	0.00	10.80	0.00	16.53	0.00	17.48		
13	Kerala	17.58	15.41	20.55	12.53	20.97	0.00	29.40	0.00	30.41	25.26		
14	Madhya Pradesh	12.07	10.51	14.85	9.63	20.67	0.00	21.00	0.00	20.31	17.45	22.45	19.88
15	Maharashtra	0.00	8.76	16.05	11.55	18.01	11.03	19.56	11.30				
16	Manipur	NA		11.36	0.00	No proposal		No proposal		26.08	33.25		
17	Meghalaya	0.00	7.69	30.60	0.00	32.28	0.00	37.52	0.00				
18	Mizoram	12.81	0.00	17.53	0.00	16.74	0.00	32.63	0.00	24.69	0.00		
19	Nagaland	0.00	2.27	16.74	12.77	11.13	10.90	16.71	0.00	18.27	17.42		
20	Orissa	17.17	12.69	20.70	12.98	18.39	0.00	26.40	21.29	28.42	33.11		
21	Punjab	16.33	0.00	16.54	12.65	16.11	0.00	17.63	19.07				
22	Rajasthan	11.62	7.68	9.06	0.00	12.37	0.00	13.28	0.00	17.01	0.00	18.81	0.00
23	Sikkim	0.00	1.21	33.03	11.31	33.32	0.00	43.67	0.00	46.09	0.00		
24	Tamil Nadu	11.96	8.86	15.42	12.32	14.61	0.00	15.17	11.22	25.15	17.25		
25	Tripura	0.00	5.98	25.16	0.00	48.91	0.00	55.17	0.00				
26	Uttar Pradesh	0.00	3.93	20.80	0.00	22.32	16.81	24.45	17.73				
27	Uttaranchal	25.17	18.70	28.55	20.26	13.83	0.00	18.02	23.52				
28	West Bengal	17.45	16.73	27.12	0.00	29.12	0.00	31.92	35.03	38.86	0.00		

The Concept Note on PPP

1. Background

Rural road connectivity is an extremely desirable objective not only from an economic perspective but also from a social standpoint. However, development of rural roads has suffered on account of lack of vision, shortage of funds, weak implementation mechanisms and absence of initiative. In spite of the efforts made at the state and central levels only about 40% of the rural habitations in the country are connected by roads, most of which may not be categorised as all-weather roads on account of poor serviceability conditions.

In August 2000, the Prime Minister announced a Centrally Sponsored Scheme called the Pradhan Mantri Gram Sadak Yojana (PMGSY). The primary objective of PMGSY is to provide connectivity by way of all-weather roads to unconnected habitations with a population of 1000 persons and above by 2003 and all unconnected habitations with a population of 500 persons and above by 2007. PMGSY is being financed through 50% of the cess on High Speed Diesel (HSD) which is being earmarked for the programme.

Apart from its own initiative, the government has been keen to leverage the technical, financial and managerial resources of the private sector to facilitate development of rural roads by utilising funds earmarked for PMGSY under Public-Private-Partnership (PPP) frameworks.

Against this background, XYZ Group has conceptualised a rural road development project covering approximately 1000 Km spanning the districts of Kolhapur, Sindhudurg and Sangli in Maharashtra and submitted its proposal to MoRD and GOM.

XYZ Group of Co-operatives is one of the successful rural enterprises in India. It was set up four decades ago with the objective of providing basic irrigation facilities. This was followed by setting up of the sugar factory, distillery, paper mill, power plant, organic fertilisers unit, jute mill etc. XYZ Group also runs a highly successful dairy business and has established a strong brand in western India. The Group has subsequently set up a co-operative bank, chain of rural super markets, educational institutes and a hospital.

The Ministry of Rural Development (MoRD) is in-principle agreeable to designate the project proposed by XYZ Group as a pilot project, replicable as a model.

Although the Project is being conceived under the umbrella of PMGSY, MoRD has agreed to allocate funds for the Project over and above the normal allocation for the State of Maharashtra under PMGSY (please refer to discussion under 'Flow of Funds' provided below).

This note outlines the project concept, the commercial framework and touches upon some of the key issues that need to be addressed to take the process forward.

2. Project Objectives

Apart from the broad objective of establishing an alternate track for rural road development, the other objectives of this Project are:

- Leveraging private sector efficiencies in the whole aspect of rural road service delivery;
- Ensuring implementation of a large project within a compressed time-frame;
- Incentives for better design without consequent increase costs to government;
- Utilize, where permitted, income from other activities including dairy development, sugar business, super markets, educational institutions and horticulture, for rural road developments ("Other Activities");
- Involvement of local communities in the Project;
- Ensuring long term maintenance of the Project;
- Encouraging commercial Lenders to provide financial assistance to the private sector entity ~i.e. XYZ in the instant case) against commitments from PMGSY; and
- Utilising the expertise of Lenders/independent experts project development, implementation and monitoring.

Project

The project involves construction and maintenance of rural roads of about 1000 km on BOT (Build-Operate-Transfer) basis in the districts of Kolhapur, Sindhudurg and Sangli in Maharashtra.

Project Scope:

The broad scope of the Project is as under:

- Development/upgradation of rural roads comprising other district roads and village roads covering an approximate length of 1000 Km including cross-drainage works as set out in the DPR; (the "Rural Roads").
- Maintenance of the Rural Roads (the "Maintenance Component")

Eligible Stretches

Only stretches that qualify under the PMGSY Guidelines and form part of the Core Network (as specified under the Guidelines) would be undertaken as part of the Project. Government of Maharashtra ("GoM") would certify that the selected rural roads are eligible stretches as defined by the PMGSY guidelines.

Detailed Project Report (DPR)

XYZ shall prepare the DPR, at its own cost and get it approved as per the requirements outlined under the PMGSY Guidelines. Amongst other aspects as required under the PMGSY Guidelines, the DPR shall inter-alia provide the following information

- Review of proposed road network envisaged under the Project and confirmation as to its eligibility under PMGSY;
- Detailed engineering including design as per PMGSY Guidelines;
- Bill of Quantities (BOQ);
- Estimates for capital cost of construction of the Rural Roads;
- Estimated annual cost of the Maintenance Component;
- Implementation schedule with broad milestones;
- List of clearances / approvals required for the Project.

For better operating performance and reduced costs of maintenance, XYZ may implement certain sections with alternate designs (having higher standard than those prescribed under the PMGSY Guidelines for eg. Certain road sections may be developed with rigid pavements). XYZ would identify stretches where it intends to adopt alternate designs at the DPR preparation stage and provide requisite details of the same (including the cost differential) to MoRD. Any additional costs (as compared to the applicable PMGSY costs) on account of the alternate designs shall be borne by XYZ. MoRD may require XYZ to demonstrate availability of equity funds for meeting such additional expenditure.

3. Implementing Agency

The Project would be implemented by a Spv set up by XYZ Group.

4. Commercial Framework

Once the DPR is approved by the MoRD, the Project would be awarded under a concession framework, broadly similar to the one followed for PPP based BOT road projects. Under the framework, MoRD and GoM would jointly grant a concession to XYZ for development of the project. The arrangement would be formalised by way of a tripartite concession agreement (known as Concession Agreement or CA) between MoRD, XYZ and GoM (collectively known as "parties").

Upon execution of the Concession Agreement between the parties, the terms and conditions for the implementation of the Project and the duties and obligations of the parties would be strictly governed by the Concession Agreement.

5. Project Funding

The Project would be developed on project finance basis, under which the capital cost of the Project would be funded through equity / promoter's debt from XYZ Group (equity) funds from MoRD (MoRD Contribution) and project debt (Debt) from commercial lenders (Lenders). The amount of MoRD Contribution for the project would be fixed based on the cost of construction of Rural Roads (This would comprise of the capital cost of construction of rural roads and the associated financing cost – inclusive of upfront financing charges, interest during construction etc.- taking into account the nature of the transaction). Upon finalisation of DPR, XYZ would work out the amount of quarterly MoRD Contribution and get the same approved from MoRD.

The construction of Rural Roads would be financed by Equity, Debt and MoRD Contribution.

During construction, the MoRD contribution shall be applied in the following order of priority:

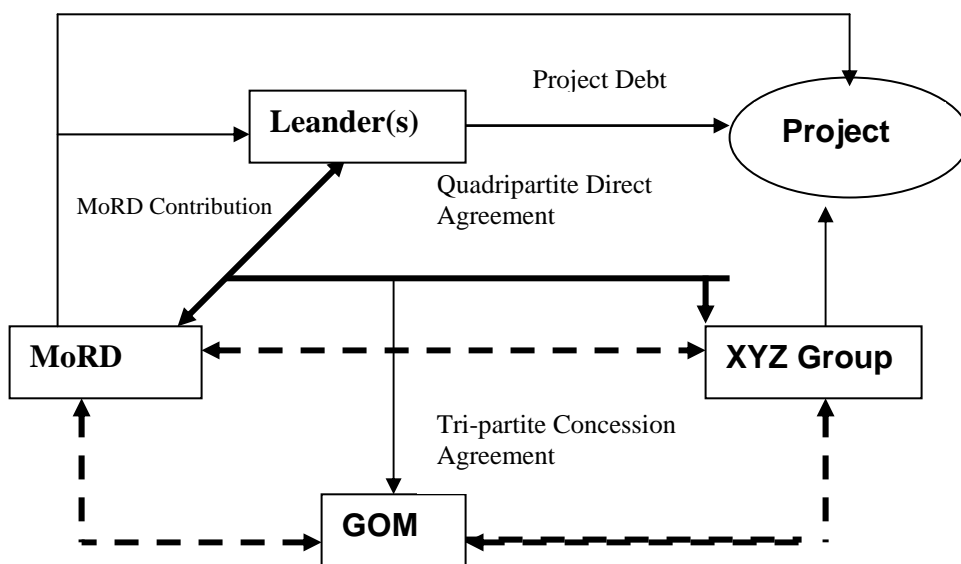
- Towards interest on Debt drawn from Lenders;
- Towards cost of construction of Rural Roads.

During operations (maintenance period), MoRD Contribution shall be applied solely towards repayment of principal amount of Debt, interest and other monies payable to the persons providing Debt to the project under the relative financing documents. Upon repayment of entire Debt (including any other amounts due to the Lenders pertaining to the Project), MoRD Contribution would cease. Prior to implementation of the Project, MoRD shall obtain letter/ s of comfort from Government of India, agreeing to specifically earmark and provide additional funds for the Project, in addition to the normal allocation of funds for the State of Maharashtra under the PMGSY.

MoRD, GOM, XYZ and the Lenders would enter into a quadripartite Direct Agreement in order to give effect to this arrangement and matters incidental and ancillary thereto.

MoRD's obligation would be limited to bearing the capital cost (inclusive of associated financing cost) of construction of Rural Roads on a deferred basis as described above. All other costs relating to the Project, including costs of the Maintenance Component shall be borne by XYZ out of income from Other Activities/ Equity. XYZ would be solely responsible for the maintenance of the Rural Roads and MoRD / GoM / Lenders would have no liability on this count. XYZ shall provide to MoRD, suitable performance bank guarantee equivalent to the estimated maintenance expenses for the entire operations period.

The arrangement has been diagrammatically represented below:



Accordingly, the proposed means of finance for different components is as under:

Project Component	Means of Finance
Road	Equity, Debt & MoRD Contribution
Maintenance	<ul style="list-style-type: none"> • Income from Other Activities/Equity • Backed by a performance bank guarantee

6. Contractual Arrangement

The following agreements would be the key contracts to be executed prior to commencement of the Project:

- *Concession Agreement (CA)*: The CA would form the basic contract between MoRD, GoM and XYZ in context of the Project which shall set out the roles and responsibilities of the parties.
A discussion on the key provisions of the CA has been provided below under the head "Concession Outline".
- *Direct Agreement*: The Direct Agreement would form the basis for raising Debt from Lenders through the project finance route. This quadripartite agreement would be entered between MoRD, GoM, Lenders and XYZ. It would, inter alia, include the following aspects pertaining to the Project:
 - Amount of MoRD Contribution
 - Periodicity of payment
 - Mode of payment
 - Direct payment to Lenders in an Escrow Account/ Trust and Retention Account (IRA)
 - Payment of compensation in the event of Termination

7. Steering Committee

MoRD would constitute a Steering Committee to take the project from a conceptual stage through to signing of the CA. The Steering Committee would comprise representatives of MoRD, GoM, XYZ and (potential) Lenders and would be required to play an important role in resolving project related issues during the project development phase - till signing of the CA.

On and after signing of the CA, the Steering Committee would be responsible for the overall monitoring and supervision of the Project during the concession period (construction and operations period). The Engineering Consultant would periodically report progress of the Project to the Steering Committee.

8. Engineering Consultant

A reputed engineering consultancy firm (Engineering Consultant or EC) shall be jointly

appointed by MoRD and XYZ to carry out the following broad activities:

- Monitor construction. of the Project with regard to the approved DPR and the project requirements enshrined in the Concession Agreement and report periodically to the Steering Committee.
- Monitor the condition of the Project roads on a periodic basis during the operations period and report to the Steering Committee.

9. Concession Outline

9.1 Grant of Concession

MoRD and GoM would award the concession to investigate study, design, engineer, procure, finance, construct, operate and maintain the Project to XYZ. A tri-partite Concession Agreement would be signed by MoRD, XYZ and GoM in this regard.

9.2 Concession Period

The concession period for the Project would be limited to 15 years. The concession period would include 2 years of construction period and 13 years of maintenance period (operations period).

9.3 Project Completion

XYZ would have to commence implementation of the Project, by the Commencement Date⁴. A period of 2 years from the Commencement Date (Six months from the date of signing the CA, by which time the requisite land should have been provided and the funding should have been tied up and requisite clearances and approvals including environmental obtained. Suitable remedies would have to be built into the CA to take care of events which might affect the stated time-schedules.) A period of 2 year from the Commencement date would be provided for completion of the construction of the Rural Roads.

9.4 Project Site

GoM shall hand over the entire Project site / necessary right-of-way to XYZ as per the pre-agreed schedule (not exceeding 6 months from the date of execution of the Concession Agreement) free of encumbrances for the purpose of developing the Project. XYZ shall be permitted to use the. land / site only for the purpose of the Project and would have an obligation to keep the Project site free of any encroachments.

9.5 Payment of MoRD Contribution

Construction Period:

MoRD shall during the construction period disburse the MoRD Contribution in quarterly instalments into a designated project escrow (charge to the lenders) account (Escrow Account) immediately upon certification by the Engineering Consultant of XYZ meeting the various project construction milestones. However, MoRD would ensure that sufficient contribution is made to service interest dues of Lenders providing the Debt,

during the construction period, even in circumstances where XYZ has not been able to meet project milestones and obtain the consequent certification therefor. Disbursement of MoRD Contribution would begin after conditions precedent stipulated in the CA have been complied with by XYZ.

Operations Period:

During operations period, MoRD Contribution shall continue to be disbursed into the Escrow Account on a quarterly basis in accordance with the schedule of servicing the Debt provided by Lenders. The said Debt servicing schedule shall be set out in the Direct Agreement.

9.6 XYZ's Obligations

9.6.1 Supervision Consultant

XYZ would need to appoint a reputed engineering consultancy firm as a Supervision Consultant for the Project with the prior approval of the Steering Committee. The Supervision Consultant shall assist XYZ in:

- Preparation of the DPR
- Managing the bidding process for selection of the contractor(s) for construction of the Rural Roads
- Any other technical matter pertaining to the Rural Roads and Maintenance Component of the project

All the expenses pertaining to the Supervision Consultant (including fee) shall be borne by XYZ group.

9.6.2 Performance Guarantee

XYZ would need to provide performance bank guarantee to MoRD / GoM as per the following requirements:

- Of a suitable amount specified by MoRD for the construction period.
- For an amount equivalent to the estimated (as estimated by MoRD/GoM) maintenance expenses for the entire operations period (13 years). So long as XYZ undertakes the Maintenance Component as per the maintenance requirements laid down in the Concession Agreement, the performance bank guarantee may be suitably released annually (on a pro-rata basis) by MoRD / GoM.

9.6.3 Approvals

XYZ would be responsible for procuring the requisite clearances / approvals for the Project. However, GoM shall procure the environmental clearances for the Project.

9.6.4 Design

The Project would be implemented by XYZ as per the design laid out in the approved DPR.

9.6.5 Construction

XYZ would be responsible for constructing the Project facilities as set out in the DPR within the specified time. XYZ shall appoint contractor/ s to undertake implementation of the Rural Roads. The selection of the contractor(s) would be based on the pre-qualification and bidding criteria (Generally in accordance with MORD's Standard bidding documents/Gol's bidding procedures for BOT projects) approved by the Steering Committee. XYZ would evaluate the bids submitted by various bidders and submit the evaluation report to the Steering Committee and award the contract to a contractor only after obtaining approval of the Steering committee.

XYZ would have the freedom to make construction arrangements on such commercial terms, as it may consider necessary, subject to following the above-mentioned bidding process for appointment of the contractor. In any case, XYZ would be responsible at all times for such contractors' performance. All payments to contractors by XYZ shall be in arrears and shall be certified by EC and statutory auditors of XYZ.

In select circumstances, XYZ may be permitted to undertake construction of the Project departmentally with prior written approval of by MoRD/Steering Committee and the Lenders. Such approval shall be subject MoRD / Steering Committee / Lenders being satisfied of the technical capabilities XYZ.

Any cost escalation with regard to the Project would have to be borne by XYZ.

9.6.6 Maintenance

XYZ would be required to maintain the Project as per the Maintenance Requirements stipulated in the Concession Agreement. These requirements would be based on the Government of Maharashtra practices and Rural Roads Manual Provisions.

The EC would be responsible for monitoring the condition of the Rural Roads throughout the concession period and reporting to the Steering Committee on a periodic basis. The process of evaluating and certifying compliance with the Maintenance Requirements would be further laid out in the Concession Agreement.

XYZ is expected to bear the cost of maintenance of the Project from the revenue generated from Other Activities. In case of a shortfall in its revenue, XYZ would arrange funds for meeting the maintenance costs from its own sources. In order to demonstrate assured availability of funds for undertaking maintenance of the Project, XYZ shall be required to provide a performance bank guarantee as outlined in the Clause 10.6.2 above.

In case of material breach of Maintenance Requirements by XYZ, MoRD and/ GoM would have the option of undertaking the maintenance themselves and recovering their expenses by encashing the Performance Guarantee upto the requisite amount. In case of persistent and material breach of Maintenance Requirements by XYZ, MoRD and/ GoM would be entitled to terminate the CA and acquire all rights and title to the Project. In case the CA is so terminated, the obligation to maintain the project roads would revert back to GoM. The (balance) Performance Guarantee would be encashable in the event of termination of the

CA for the above-mentioned reasons. In such a scenario MoRD shall payoff the outstanding Debt (including other overdue) to the Lenders.

9.6.7 Financing

XYZ would be responsible for making the financing arrangements - equity and debt, within a period of 6 months from the date of signing the CA.

9.6.8 Insurance

XYZ would be required to take stipulated insurance cover for the Project during the construction and operations period.

9.6.9 Reporting

XYZ would provide periodic progress reports to the EC which in turn will forward such reports, with its observations, to the Steering Committee on the progress of the Project. XYZ would have to install necessary computer hardware to enable online monitoring of the Project as required under the PMGSY Guidelines. The cost for the same would be included in the Project cost.

9.6.10 Audit

XYZ would have to appoint a reputed chartered accountants firm as a statutory auditor to audit its accounts.

9.6.11 Handbook

Upon the expiry of the concession period, XYZ would handback the project to GoM, free of cost. It would also ensure that the physical condition of the Project roads is such, so as to enable them to be certified as good all-weather roads under the PMGSY, by the EC. GoM / MoRD may set out some of the physical attributes pertaining to the condition of the roads at the time of handback in the CA.

9.7 MoRD's Obligation

MoRD would be responsible for:

- Appointing the EC jointly with XYZ
- Awarding the Project to XYZ
- Signing the Concession Agreement
- Signing the Direct Agreement
- Procuring Letter/ s of Comfort from Government of India for servicing the Debt.
- Providing requisite approvals in a timely manner
- Disbursing MoRD Contribution as agreed in the CA
- Making termination payments to the Lenders

9.8 GOM's Obligation

GoM would be responsible for:

- Providing delivery of Project site / right of way. GoM would have to provide a

- certificate to MoRD regarding availability of the necessary right of way.
- Providing requisite clearances / approvals in a timely manner Joindy (alongwith XYZ) procuring the environmental clearance for the Project
- Signing the Concession Agreement and the Direct Agreement
- Supporting the Project at the local level

9.9 Change of Scope

If MoRD desires a change of scope in the Project, the same upto a level of 5% of the Project cost may be approved by the Steering Committee on the recommendations of the EC. The payment for the increased scope would be directly disbursed by MoRD as one lumpsum amount. This payment would be over and above the MoRD Contribution.

For change of scope exceeding 5% of the Project cost, the proposal would have to be separately reviewed by MoRD, XYZ and the Lenders. The implementation and financing mechanism to give effect to proposed changes would be separately worked out.

9.10 Force Majeure

Force Majeure (PM) Events would include events that prevent a party from performing its obligations under the CA (“affected party”) and are beyond the reasonable control of and not arising out of the fault of the affected party. FM Events would include fire, cyclone, flood and other acts of God, expropriation, war, ionising radiation etc.

The CA would provide for remedies to parties in the event of force Majeure and consequences if a prolonged FM event leads to termination.

Depending on the nature of the PM Events the CA shall provide for suitable termination payment by MoRD. Under all circumstances, the termination payment shall at least cover the entire outstanding Debt (along with overdues, if any) to the Lenders.

9.11 Events of Default and Termination

Appropriate provisions would be included in the CA listing out the possible events which could lead to premature termination of the CA and the financial consequences thereof. Any party (MoRD or GoM or XYZ) may terminate the CA on account of a persistent default of obligations by the other party. MoRD shall pay the entire outstanding Debt (along with overdues, if any) to the Lenders in the event of termination of the CA.

9.12 Dispute Resolution

The CA would set out the mechanism to be followed by the parties in case of a dispute. The parties shall endeavour to resolve all the disputes in an amicable manner. Disputes which are not resolved amicably would be referred to Secretary, Ministry of Rural Development, Government of India. If the dispute remains unresolved, it would be settled as per the provisions of Arbitration & Conciliation Act, 1996.

10. Pilot Project

MoRD shall take appropriate steps to designate the Project as a Pilot Project for Private Sector Participation in the manner provided in this Concept Note, under the PMGSY, as

modified herein, and to sanction funds to the Project over and above the allocation for the State of Maharashtra under PMGSY. Similarly, GoM shall take all steps to recognise the Project as an innovative means for rural road development in the State.

11. Flow of Funds

MoRD shall provide a letter, to the Lenders (potential), conforming the total amount of its contribution for the Project which shall be payable in a phased manner in accordance with the agreement with XYZ and its Lenders. GoM shall provide a letter accepting and conforming that MoRD contribution specifically earmarked for this Project shall not be mixed with the State's PMGSY account and shall be deposited directly to the project escrow account.

12. Frame work of PPP

MoRD shall enable development of the Project as stated in this Concept Note through a suitable government order. Such government order would provide for participation by XYZ in the financing, construction, and maintenance of the Rural Roads with assistance from MoRD and the concerned State Government, inter alia, by way of, capital contribution, subsidy, conferment of development rights in respect of the land granted for the project or any other approved means.
