

Socio-Economic impact of rural roads on rural population: Analysis of PMGSY scheme

JULY 2012

Submitted by:

Aseem Khattri

Indian Institute of Technology,
Kanpur

Mentored by:

Smt. Alka Upadhyay

CEO Rural Development
Authority, MP

PREFACE

I am Aseem Khattri, fourth year undergraduate, studying in Material Science and Engineering Discipline at IIT Kanpur. I am doing my summer '12 internship project in Rakshak Foundation under the guidance of Smt. Alka Upadhyay, CEO Rural Development Authority, and MP. Rakshak Foundation is a 501© (3) Non-profit Organisation. It's headquarter is in Santa Clara, California. Its main work is to research about different public policy issues and create awareness about them. Rakshak Foundation along with volunteers around the world is dedicated to the propagation of social harmony, creating awareness on issues affecting Indians and NRI's around the world.

The reason I chose to work on my project topic is because it is the prime issue now-days to look upon the welfare of rural population in India. As about 70% of the Indian population resides in rural areas so it becomes essential to develop the rural areas for healthy and steady growth of India.

Acknowledgements

First and foremost I would like to acknowledge the great opportunity, Rakshak Foundation gave me to do this internship programme which helped me in better understanding of the social issues and ways to counteract them efficiently.

I would like to acknowledge the advice and guidance of my mentor Smt. Alka Upadhyay for guiding me throughout the course of my project. She provided me the right direction to do my research work on. Many a times I was drifted from the path of my project and do an extensive study which was not required, she specifically pointed out the things which I had to do and the things that were not required.

I would also like to acknowledge the help provide by Mr. Rohit Aggarwal and Mr. Kunal Sharma. They both provided help in early stages of my project as there was some discrepancy in my project topic which was assigned to me. They helped me in resolving the problem quickly and efficiently.

Table of Contents

List of figures	4
List of Tables	4
Executive Summary	5
1. Introduction of project	7
1.1. Background Information	7
1.2. Main Problems, their scope and impact on the society	17
1.3. Goal and Objectives of the project	18
2. Methodology	19
2.1. Literature Search	19
2.2. Field Visits	20
2.3. Meetings and Interviews	20
3. Current NGO, and Govt. Efforts	21
3.1. Social work done by NGOs	21
3.2. Government Efforts so far	21
3.3. Analysis of work done so far	21
4. Results and Discussions	22
4.1. Findings from Literature	22
4.2. Finding from the fields and impact on the theoretical focus of the project	39
4.3. Gap Analysis	40
5. Recommendations, Scope and Strategy for Implementation	42
6. Suggestions for future work	43
7. Conclusion	44
8. References	45
Appendix A: Meetings and Interviews	46
Appendix B: Fig. and Tables	50

List of Figures

Figure 1.1	The relationship between connectivity and poverty.....	8
Figure 1.2	Share of Different Categories of roads.....	9
Figure 4.1	Cumulative Connectivity achieved by PMGSY.....	24
Figure 4.2	Percentage increase in four districts.....	32
Figure 4.3	Infrastructure investments and economic growth: (a) developed countries, (b) developing countries.....	36
Figure 4.4	Reliance of human development on individual networks of infrastructure.....	36

List of Tables

Table 1.1	Progress of Rural road accessibility till launching of PMGSY.....	8
Table 1.2	Achievement of PMGSY across the country.....	13
Table 4.1	Impact on Agriculture and allied activities.....	28
Table 4.2	Impact at Village level.....	29
Table 4.3	Impact on Health.....	30
Table 4.4	Impact on Education.....	31
Table 4.5	Impact on Income of people in four districts of MP.....	32
Table 4.6	Effects of Additional Government expenditures on poverty and productivity in India.....	33
Table 4.7	Funds required for Bharat Nirman.....	40
Table 4.8	Funding for the programme by different means.....	41
Table A.1	Number of habitations connected and the length of the roads completed under PMGSY.....	50
Table A.2	Proposals cleared under PMGSY during 2008-09, 2009-10, 2010-11.....	51
Table A.3	Connectivity of habitations - Target and Achievements under PMGSY/Bharat Nirman Programme (habitations in numbers).....	52

Executive Summary

This project is related to social and economic impact of development of rural roads on rural population. Connectivity of rural areas with roads is a key factor for rural development, since it promotes access to economic and social services thereby generating increased agricultural income and productive employment opportunities in rural India. With this aim in mind, on 25th December 2000, government launched Pradhan Mantri Gram Sadak Yojna (PMGSY) which was a fully funded Centrally Sponsored Scheme. Its main objective was to provide connectivity in rural areas of the country through all-weather roads. The programme envisions of connecting all habitations with a population of 500 or above in the plains and with population of 250 or above in hilly areas.

Around 70% of the Indian population resides in rural India. The number of unconnected habitations in rural India are around 0.6 million. They lack infrastructure mainly road connectivity which is essential for providing basic necessities like health care, education, market connectivity etc... If India has to have a steady and healthy growth rate then it should be in all-round development of nation. Hence, development of rural India becomes very important.

The rural road connectivity has the largest impact on alleviating rural poverty. The HDI (Human Development Index) for 'paved roads per capita' is around 0.70 which is fairly high. Also, by increasing the investment in rural road development by Rs. 100 billion the rural poverty decrease by 0.9%, also, for each Rs. 1 million increase in investment in roads, 165 people would be lifted above poverty line.

Construction of PMGSY roads has many positive impacts on the Agriculture, Employment, Industrial development, Education and social condition of the rural population. The scheme has also done an efficient job in alleviating country's poverty, one of the main reasons the scheme was launched, as due to increased connectivity the non-farm employment opportunity increases.

Key Findings:

- On 25th December, 2000 Government launched PMGSY scheme as a poverty alleviating strategy
- It is purely a centrally sponsored scheme
- 50% of the cess on high speed diesel (HSD) is charged for this programme
- Originally 1,60,000 habitations were estimated to be covered under the programme with capital investment of about Rs. 60,000 crore
- Main objectives of PMGSY:
 - To provide connectivity to all unconnected habitation with all-weather roads across the country

- In Plains habitations with population above 1000 were to be addressed first by 2003 then the habitations with 500+ population till the end of 10th five year plan i.e. till 2007
 - In hilly/desert areas habitations with 500+ are addressed first by 2003 then the habitations with 250+ population till 2007
- Construction of PMGSY roads has resulted in increased and easier movements of the farmers and their produce and has thus increased agricultural profit.
 - More opportunities of self-employment are available now due to construction of roads. Many housewives have started small scale industries like making pickles, *papads*, *boris*(lentil cakes), *murir moa*(puffed rice balls) etc...
 - People go to nearby towns and villages for odd jobs like selling woods, dairy products and locally made items like pickles, *papads* etc...
 - Road connectivity has also led to expansion of local industry, which in turn has generated employment opportunities.
 - An impact on existing small industries was observed in terms of easier access to raw materials, availability of commercial vehicles to transport bulk product to the markets etc... This has led to economies of scale, particularly in the state of Assam and Mizoram.
 - Access to health facilities like PHC's (Public Health Centre) was significantly increased. Accessibility to preventive and curative health care facilities was also increased.
 - Increase in School enrolment and school attendance was also observed. Number of girls going to school has also been increased.
 - Construction of roads has also led to increase in frequency of the visits of government officials which is likely to result in better implementation of various government schemes and programs.
 - The construction of PMGSY roads have also impacted the transport facilities especially in states like Mizoram and Rajasthan by making it easily to cope with the terrain.
 - The lifestyle of the rural people has also been significantly altered for the better. Ownership of television and other electronic gadgets have increased.
 - The income of the habitants benefiting from these roads has been significantly increased.

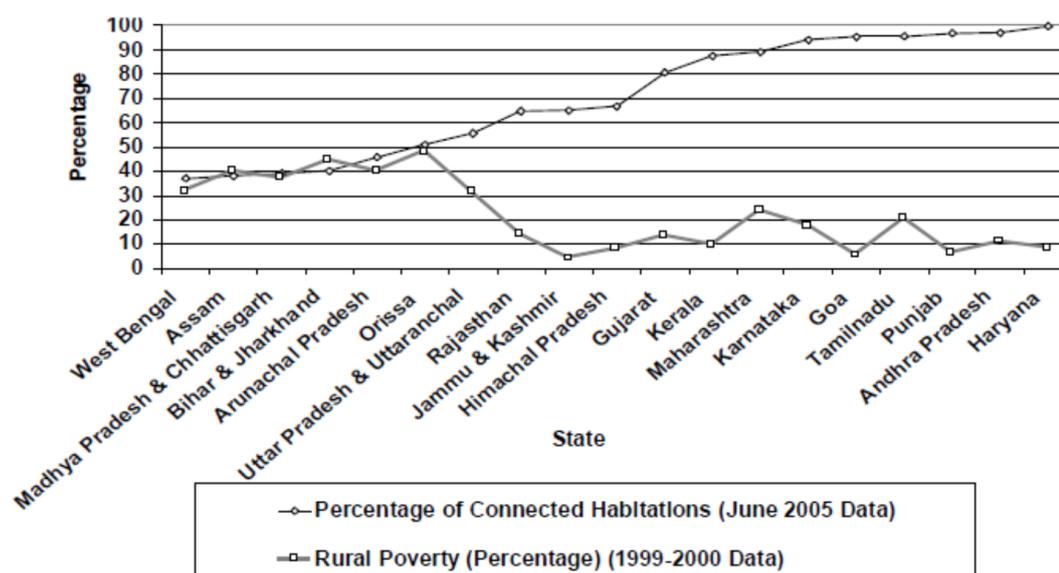
Main Body

1. Introduction

1.1 Background Information

Rural development has become a matter of great urgency considering social justice, national integration, economic up-liftment and inclusive growth. For rural development, the provision of rural road network is a key component to enable the rural people to have access to schools, health centres and markets. In 1951, planned development scheme was launched, since then we have a reasonably good railway system, a few ports and around 40,000 kms. of serviceable road network but accessibility to villages was poor as only 20% of them had all-weather road links. Rural roads facilitates the promotion of sustainable agricultural growth, improvement of basic health, provides access to schools and economic opportunities and thus holds the key to accelerated poverty reduction, achievements of Millennium Development Goals (MDG), socio-economic transformation, national integration and breaking the remoteness of village communities and all round and inclusive rural development. A study (Fan, Hazel and Throat, 1999) carried out by the International Food Policy Research Institute on linkages between government expenditure and poverty in rural India has revealed that an investment of Rs. 10 crore (at 2009-10 prices) in roads lifts 16,500 persons above the poverty line. Following figure depicts graphically the relationship between connectivity and poverty. States having low connectivity had higher poverty levels. Provision of good roads in rural areas also changes the characteristics of rural transport. With people tend to travel more, the ownership of vehicles increases. There is a shift from non-motorized vehicles to motorized ones and the cost and time of travel get reduced.

Figure 1.1



Source: Rural Road Development Plan: Vision 2025

Progress of rural roads accessibility achieved as a result of investments in the road sector has been established till the commencement of PMGSY and is depicted in following **Table**. While the targets envisioned in terms of length were achieved, the imbalance in development of rural road network grew. Some States provided 100% connectivity while some others did not have enough financial resources at their disposal and consequently connectivity remained at low levels. Also, inadequate funds for maintenance, up-gradation and rehabilitation of existing rural roads were also a problem. A network approach and provision of sustainable accessibility with assured maintenance was virtually absent.

Table 1.1: Progress of Rural Road accessibility till launching of PMGSY.

Year	Accessibility with all-weather roads		Average distance of a village from a road
	Percentage of villages with population above 1000	Overall village accessibility	
1950-51	32%	20%	10 km
1960-61	36%	22%	8 km
1970-71	40%	25%	5 km
1980-81	46%	28%	4 km
1990-91	73%	44%	3 km
2000-01	90%	54%	2 km

Update on Rural Roads Scenario:

Long term 20 year plans were formulated by Chief Engineers in-charge of roads under the aegis of the Indian Roads Congress for development of roads. These were viz. Nagpur Plan (1943-61), Bombay Plan (1961-81), Lucknow Plan (1981-2001), Road Development Plan Vision: 2021. These plans have served as sound reference framework for the Centre and State Governments to formulate their Five Year Plans successfully. The consequence of these coherent planning was that the road network was about 3.3 million kms. by 2000. Among these 2.7 million kms i.e. 85% were rural roads with overall village accessibility of about 54%. The share of different types of roads in India are given in **Figure 1.2**

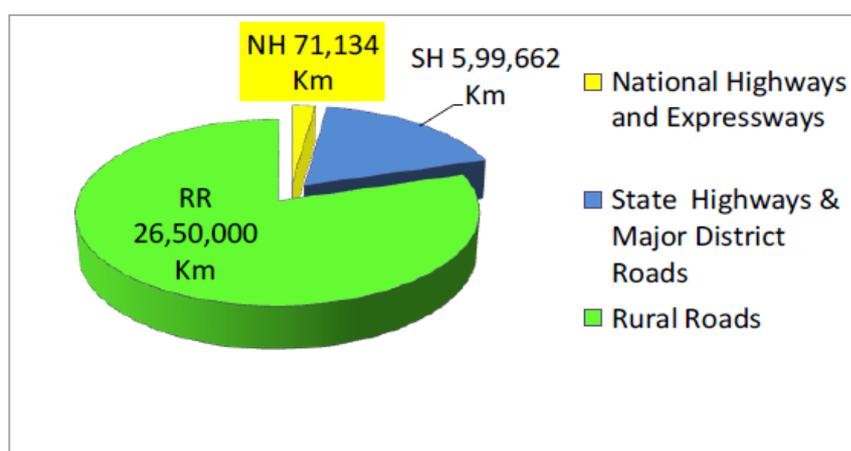


Figure 1.2: Share of different categories of roads

Pradhan Mantri Gram Sadak Yojna:

As an effective poverty alleviation strategy, PMGSY was launched in the year 2000, as a centrally sponsored programme. **The main objective of the program was to provide connectivity to unconnected habitations with all-weather roads. Habitations with the population of 1000 and above were to be provided with road connectivity by 2003 and those with population of 500 and above by 2007. In respect to hilly/desert areas the objective was to link habitations with population 250 and above. Up-gradation of selected rural roads to provide full farm to market connectivity is also an objective of the scheme, though not central.** The programme was meant to achieve its goals till 2007; however, because of certain constraints in implementing it and due to lack of funds, the targets of the programme have not been achieved so far.

The salient features of the programme as mentioned by Ministry of rural development are:

- i. **Decentralised Planning:** The model of decentralized network planning has been adopted by the government. The District Rural Roads Plans (DRRP's) have been

developed for all the districts of the country and Core Network has been drawn out of the DRRP to provide for at least a single connectivity to every target habitation. Comprehensive New Connectivity Priority List (CNCPL) and Comprehensive Up-gradation Priority List (CUPL) are used for prioritization of the yearly project proposals. The CNCPL and CUPL have been developed from the core network data. This planning exercise has been carried out with full involvement of the three tier Panchayati Raj Institutions.

- ii. **Standards and Specifications:** Before the PMGSY, rural roads in India were being constructed on the basis of the specifications prescribed for the roads catering to the requirements of heavy traffic such as SH and MDR's etc. Earlier it was the case that wherever the traffic was the heaviest or for the villages in where major amount of crop were produced. Separate specifications for the low volumes/rural roads were not available, therefore, large scale revision of Rural Roads Manual, IRC SP: 20 were carried out by IRC at the special intervention of Ministry of Rural Development. This Manual has established the standards for construction of Rural Roads under this programme. As envisaged in the programme guidelines, later a dedicated Book of Specifications for Rural Roads was developed by IRC. A Standard Data Book is being used for preparation of bill of quantities in a uniform manner. These publications enabled the executing agencies to implement the programme with confidence based on technical parameters.
- iii. **Detailed Project Reports (DPRs) and Scrutiny:** As an important step to the quality output, for every road under the programme proper survey and adequate investigations are insisted. Detailed Project Report (DPR) is a pre-requisite for project clearance. Independent scrutiny of the project proposals to ensure the adequacy of designing and project preparation is carried out by over 50 prominent institutions of Engineering and Technology in the country, identified as State Technical Agencies.
- iv. **Institutional Arrangements and HRD:** Ministry of Rural Development is the nodal Ministry for implementation of the programme at Central level and National Rural Roads Development Agency has been constituted to provide technical and managerial support. At the State level, nodal departments have been identified for management and State Rural Roads Development Agencies have been constituted to implement the programme. District level Programme Implementation Units (PIUs) have been set up for implementing the programme. Reputed Technical Institutions have been identified as Principal Technical Agencies and State Technical Agencies to provide support to the programme in matters of project scrutiny, training and R&D. Central Roads Research Institute, Indian Roads Congress and other premier institutions have

also joined hands with NRRDA and the Ministry to provide support on matters relating to standards, technology and other relevant aspects.

The programme has adequate provisions for providing large scale training not only to managers and engineers involved in programme implementation but also to the field level functionaries like skilled workmen, roller drivers and machine operators.

Dedicated and specialized institutions with clear responsibility at every level have provided focused attention to the programme implementation. The HRD interventions have given opportunity to the personnel at the field as well as management level to develop better understanding about various aspects associated with the programme which has ultimately helped the programme implementation.

- v. **Procurement Process:** The States are responsible for execution of works under the programme but it was found that the procurement process prevalent in some of the States were not in tune with the requirements in particular reference to quality and timely completion of work. When the programme is centred on quality, it is very essential that a transparent procurement process should be in place which could ensure timely completion of work with defined quality standards. Therefore, Standard Bidding Document based on best national and international practices has been developed for procurement of works under the PMGSY. All the works under the programme are tendered on the basis of the Standard Bidding Document. In addition to distinct advantages, this process has enabled the executing agencies in taking up works from qualified Contractors with adequate capacity and has helped in ensuring quality by deployment of appropriate machinery, technical manpower and testing laboratories.
- vi. **Quality Assurance:** A three tier quality mechanism has been operationalised to ensure quality of road works during construction. The first tier quality standards are enforced through in-house mechanism by establishing field laboratories and carrying out mandatory tests. NRRDA has developed Quality Control Handbook to help the field staff in ensuring proper field and laboratory testing. It was felt that mere carrying out prescribed tests is not enough but the recording of results and making them available to the supervisory officers is also important. For this purpose, Quality Control Registers have been prescribed to ensure systematic recording of test results under this tier.

The independent monitoring of quality at the State level has been prescribed under the second tier, where-in the States are required to monitor the quality of

works by deployment of quality monitors, independent of the executing machinery. The works are required to be inspected at three stages of construction, i.e., formation, pavement construction and finishing or completion stage.

The Third tier is an independent monitoring mechanism at the Central level. Under this tier, the retired senior engineers termed as National Quality Monitors (NQMs) are engaged for inspections of road works. The works for inspection are selected at random. The basic objective of this tier is to identify systemic issues and bring it to the notice of the executing agency to enable them to take appropriate steps so that the issues are not only addressed for the work inspected but the systemic improvements are also brought in the working of PIUs. The reports of NQMs are closely monitored for action at all levels. The intervention of the senior retired officers has contributed considerably in bringing about the consciousness on quality through experience sharing by these officers. At-site guidance provided by these officers has helped field staff in better understanding of specifications and good construction practices.

- vii. **Maintenance:** The contract provides for defect liability for 5 years after construction along with routine maintenance for 5 years by the same contractor. There is a provision of two bills of quantities, one for construction and another for routine maintenance on lump-sum basis amount every year for 5 years and the contractor is required to offer not only for construction but also for maintenance separately. This provision is to help in delivery of better quality roads because if the quality of road is compromised by the contractor during construction, much more money would be required during the routine maintenance rendering the contract uneconomical for the contractor.
- viii. **Online Monitoring, Management and Accounting System:** A web based online monitoring, management and accounting system has been developed under the programme. The online system and website is being managed and maintained in collaboration with NIC and CDAC. This online system is being used as decision support tool for the various levels of functionaries and adequate information about the programme is readily available to the citizens which are providing clear transparency in programme implementation.
- ix. **Operations manual and Programme Monitoring:** All the operations starting from planning to maintenance have been systematically laid down in a 'Operations Manual'. The Operations Manual has helped the implementation agencies in sorting out day to day problems and has proved a ready reference. Monthly monitoring of physical and financial progress is carried out. A well-developed quarterly monitoring is also done on the critical parameters like contract management, quality management and financial management. To

understand the emerging issues and to ensure effective interaction with the executing agencies and the other partners in programme implementation, regional review meetings are organized at different State headquarters.

The targets of the programme and the latest progress (till June, 2011) are given in the following Table.

Table 1.2: Achievement of PMGSY across the country

Item	Target	Cleared under the Programme	Completed
Number of Habitations	1,36,464	1,09,010	79,281
Length of New Connectivity Roads (Km)	3,67,673	2,56,425	1,95,692
Up-gradation Total 3,74,844 km. Up-gradation(60%) and renewal(40%) by the States	2,24,000	1,64,212	1,32,516

***Source:** National Rural Roads Development Agency

The Programme will continue to be implemented during the 12th Plan period also.

Working Group on Rural Roads under Transport for Formulation of 12th Plan:

To improve the delivery mechanism for effective implementation of the Programme, the Working Group has been formed under the Chairmanship of the Secretary Rural Development with following members:-

1. AS/FA, Ministry of Rural Development
2. Sr. Consultant (Tpt.), Planning Commission
3. Advisor (Tpt.), Planning Commission
4. Director, Central Road Research Institute, CRRRI, New Delhi
5. Directors, National Rural Roads Development Agency (NRRDA), New Delhi
6. Representative from Department of Expenditure, Ministry of Finance.
7. Representative from Ministry of Road Transport & Highways (MORTH)
8. Representative from NABARD
9. Representative from DONER

10. Principal Secretary, PWD, Government of Gujarat
11. Engineer in Chief, PWD, Government of Haryana
12. Engineer in Chief, PWD, Government of West Bengal
13. Engineer in Chief, PWD, Government of Mizoram
14. Engineer in Chief, PWD, Government of Karnataka
15. Engineer in Chief, PWD, Government of Rajasthan
16. Engineer in Chief, PWD, Government of Maharashtra
17. Engineer in Chief, PWD, Government of Jammu & Kashmir
18. Engineer in Chief, PWD, Government of Bihar
19. Engineer in Chief, PWD, Government of Arunachal Pradesh
20. Engineer in Chief, PWD, Government of Tamil Nadu
21. Joint Secretary (Commerce), Ministry of Commerce
22. Professor, IIT, Delhi
23. Professor, IIT, Roorkee
24. Professor, NIT, Jorhat, Assam
25. Representative, State Technical Agency (STA)
26. Representative, Science & Technology Mission.
27. Directors (Road Connectivity), Department of Rural Development, Ministry of Rural Development.
28. Former Director (Tech), NRRDA – Co-opted Member
29. Former Director (PIII), NRRDA – Co-opted Member
30. Joint Secretary (Road Connectivity), Department of Rural Development, Ministry of Rural Development

The Terms of Reference for the Working Group are given below:

1. To analyse the financial and the physical progress of the development of the rural road network during the first four years of 11th Five Year Plan, pointing out the constraints faced and the corrective actions required to be taken in the preparation of the 12th Five Year Plan.
2. To recommend a policy framework for the development of rural roads in the 12th Five Year Plan based on the experience of the previous years' work done under PMGSY and Bharat Nirman. The framework should be made keeping in mind the perspective of the next decade beyond 12th Plan-vision 2021 taking a grasp of various issues and the following points:
 - 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 up-gradation 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 12th five year plan indicating targets that can be monitored easily, financial outlays and their year-wise phasing during the plan period. While formulating the plan, various aspects should be examined carefully such as to provide 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 progress of funds spent during first four years of 11th Plan and assess actual requirement of funds for the Twelfth 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. Integrated Planning of Roads having different functionality and Inter-model coordination.
12. Study on connectivity status of the roads constructed under different schemes with reference to All Weather and its structural entity.
13. Developing integrated system of GIS survey.
14. Planting of fruit bearing trees along rural roads and suggesting working model for Vriksha Rojgar Yojana.
15. To examine any other matter considered important by the Working Group.

During the meeting took place on 15th June, 2011, the working group decided to constitute seven Sub-Groups on following important issues relating to completion of targets set under PMGSY:

- 1) Perspective planning for 12th Five Year plan, Mobilization of Resources and to re-look into design of Scheme to propose sharing model
- 2) Capacity building for SRRDAs, Contractors, Engineers, Training Institutions etc.
- 3) Maintenance Management of Rural roads
- 4) Adopting GIS architecture in Rural roads including R&D and environment
- 5) Quality Assurance in Rural roads(Other than GIS)
- 6) Grievance Redressal, Sevottam, Citizen Charter and CPGRAM in Rural Roads
- 7) Development of LWE & IAP Area Rural Road

1.2 Main Problems, their scope and impact on the society

Around 70% of Indian population resides in rural India consisting of approximately 0.6 million villages mainly lacking in basic infrastructure and connectivity. The rural population is mainly engaged in agricultural practices which have very low productivity. Because of lack of connectivity non-agricultural occupations in rural India are very less and also have low productivity levels. In present scenario, if India is to continue on its path of healthy growth rate, then efforts must be made to make sure that this growth is inclusive. We cannot afford to neglect rural India.

Due to lack of connectivity, the rural areas are isolated and awareness level among rural people is very low. PMGSY aims in achieving this connectivity thereby providing access to health centres, education, market and opportunities for non-agricultural jobs.

Problems with roads constructed under PMGSY:

- Roads constructed under PMGSY are undergoing premature failures due to the incidence of traffic with heavy loaded vehicles, particularly in the areas where mining activity is prevalent. Such failures are reported from the states of Chattisgarh, Orissa and Jharkhand to a larger scale and in some stray cases from other states.
- The rural roads constructed under PMGSY, being of higher quality with standards specifications for rural traffic are likely to attract traffic with heavy loads in the following circumstances:
 - After the road is constructed, the land use in the hinterland might have been altered, resulting in the generation of higher levels of traffic, which is likely to use the facility created for rural connectivity.
 - When the alternative routes available expected to carry heavy traffic, might have not been kept in good condition with appropriate strengthening and maintenance. This situation will result in diverted traffic from the normal route to the newly constructed PMGSY roads, which otherwise are not meant for it. This unexpected diversion with heavily loaded vehicles when allowed to ply on the rural road definitely causes premature damage of the rural roads not designed for carrying heavy loads.

The rural roads under PMGSY are normally designed for the rural traffic, duly considering the normal rural traffic such as tractors, mini buses and occasional normal buses and trucks, whose cumulative damaging effect in terms of Vehicle Damage Factor (VDF) will be in the order of a little more than 1. However, when the heavy loaded mining trucks use the rural roads, the Vehicle Damaging Factor may go up-to of 4-6, which itself speaks about the extent of damage it can cause.

1.3 Goals and Objectives

Main Goals and objectives of this project are compiled below:

- First and foremost objective of my project is to understand main features and objectives of PMGSY
- Analysis of the scheme and its achievement so far in terms of providing connectivity across the country
- Its impact on rural socio-economic conditions
- Future strategies that can be adopted for maintaining the already existing rural roads
- Usage of alternative technologies that can be employed to reduce the cost of road construction

2. Methodology

2.1 Literature Search

Literature survey was the main component of my research work as my project is based on analysis of PMGSY scheme. So in order to understand it better I had to read through various texts. Texts which I had read include the section of 10th five year plan which deals with PMGSY, impact assessment of PMGSY by ministry of rural development, amendments done in PMGSY in 12th five year plan. I have also read research papers which show the correlation of rural development due to increased Government spending on rural infrastructure mainly on road construction, the paper were:

- “Linkage between government spending, growth and poverty in India and China” by Shenggen Fan
 - “Demonstrating a correlation between infrastructure and national development” by Taylor and Francis
- I’ve also gone through some text given in PMGSY home page (<http://www.pmgysy.nic.in/>) which helped me in understanding the main goals and objectives of the programme. Also, on the website were the NRRDC (National Rural Road Development Committee) report which was very useful in understanding the achievements and drawbacks of PMGSY.
- I’ve read the impact assessment of PMGSY as given by NRRDC report.
- Read the goals and objectives of CRRI (Central Road Research Institute) established with a sole purpose to assist the technical requirements of road construction under PMGSY.
- Impact of PMGSY roads in the state of Madhya Pradesh.
- Success Story of PMGSY in various states.
- Read following case studies related to use of alternate technologies in road construction which can also be cost effective:
- **Use of Fly ash for road construction by Vimal Kumar**, Scientist ‘G’ & Head, Fly ash unit, Department of Science and Technology, Ministry of Science and Technology, GoI
 - **Use of Jute Geotextiles in rural road construction by Tapobrata Sanyal**, Chief Consultant, NJB, Ministry of Textiles, GoI

2.2 Field Visits

I visited four villages viz. *Bhadruk, Sabhakheda, Bhauli* and *Kundri* in order to grasp more knowledge about the social and economic issues faced by the villagers prior to the construction of roads and what positive changes do they realize now after the construction of roads.

2.3 Meetings and Interviews

My interaction with my mentor Smt. Alka Upadhyay, CEO Rural Development Authority MP, was mainly via mail. In the start of the project she told me to familiarise myself with PMGSY, its goals and objectives, when was it formed, what was the purpose of forming it.

Then she gave me the task to read through various papers viz. papers by Shenngan Fan and by Taylor & Francis which demonstrated the linkage between Government spending on infrastructure and decrease in rural poverty.

I visited a nearby village which was benefitted by PMGSY as suggested by my mentor. It helped me a lot in understanding the real life problem the villagers face due to lack of connectivity then and the upliftment in lives of the people now due to construction of roads. Highest impact was on education of the school going children. Number of students drastically increased. Night schools were also operational for education of women and old men.

She suggested me to look into some cost effective alternate road construction technologies which would benefit the future prospects of PMGSY.

3. Current NGO and Government Efforts

Government launched PMGSY on 25th December, 2000 as a poverty alleviating strategy. Efforts on the part of the government are that they have set up NRRDC (National Rural Road Development Committee) whose main objective is to monitor the quality of road work done across the country. The main objectives of NRRDC are given below:

- Identification of unconnected habitations in India
- Deciding the road length for the total rural road connectivity
- Specifications of the roads according to soil conditions
- Volume of funds needed for the project & contribution from State and Central Government
- Funds from foreign and other sources
- Possibility of raising the funds through bonds
- Suggestions to implement the project in a time bound manner, process of tendering etc...

A CRRI (Central Road Research Institute) is also established by the government and its main objectives are:

- To develop specifications and manuals for construction of low cost roads for different regions of country
- To carry out applied research for investigation, construction and maintenance of different types of roads and runway including studies on related materials such as aggregates, bitumen, cement, etc... with a view to effecting economy and achieving greater serviceability
- To develop appropriate tools, machinery, equipment and instrumentation for adapting technologies as related to highway engineering
- To carry out research and development activities in all aspects of roads under varying climatic and traffic conditions
- To render technical advice and consultancy services to various organisations in road and related fields
- To collaborate with other institutions for R&D studies concerning roads.

4. Results and Discussions

4.1 Findings from the literature

i. National Rural Road Development Agency (NRRDA):

The National Rural Roads Development Agency (NRRDA) was established on 14th January, 2002 under the Societies Registration Act – XXI of 1860 to extend support to the programme through advice on technical specifications, project appraisal, quality monitoring and management of monitoring systems. The Agency has been conceived as a compact, professional and multi-disciplinary body to provide necessary technical and management support to the Ministry of Rural Development and to the State Governments for effective implementation of the programme.

The main Objectives of NRRDA are:

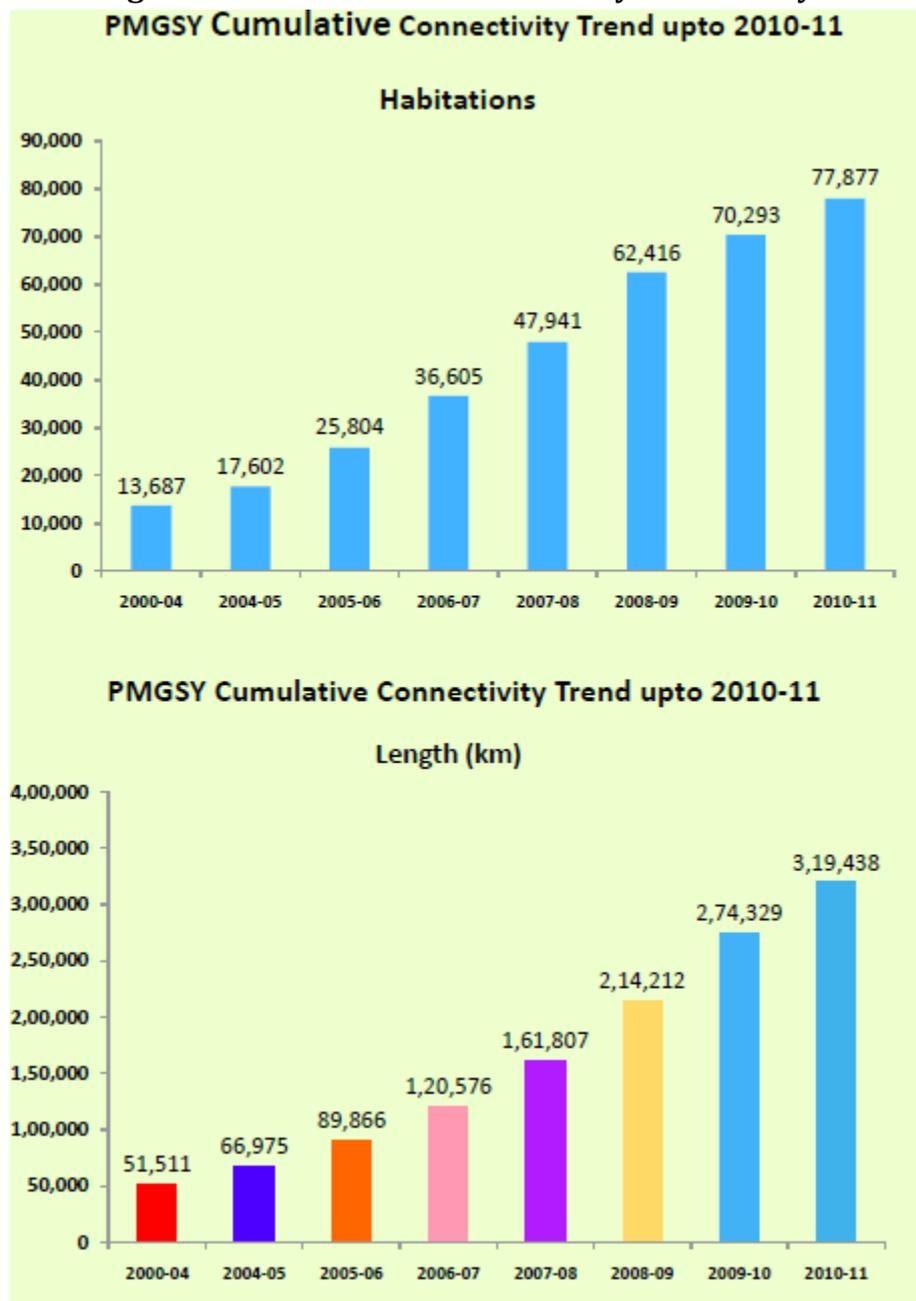
- To discuss with different Technical Agencies and arrive at appropriate Designs and Specifications of Rural Roads and, thereafter, to assist the Ministry of Rural Development in prescribing the Designs and Specifications of Rural Roads, including Bridges and Culverts.
- To determine the tasks to be performed by the Principal Technical Agencies and State Technical Agencies.
- To appoint reputed Technical Institutions as Principal Technical Agencies and State Technical Agencies to perform the tasks to be entrusted to them.
- To render assistance to States or Union Territories in preparing District Rural Roads Plans.
- To scrutinize or arrange to scrutinize the proposals received from States and Union Territories for consideration by the Ministry of Rural Development.
- To oversee and inspect or arrange to inspect through Independent Monitors, the execution of the road-works cleared by the Ministry and being implemented by States or Union Territories through their Executing Agencies.
- To appoint serving or retired Engineers, Academicians, Administrators and other Agencies, with experience in Rural Roads, as Independent Monitors to ensure proper execution of road works by the State Agencies.
- To Monitor the progress of the road-works with particular reference to time frame for completion, Technical Specifications, Project Appraisal and Quality Control methods.

- To set up an “On-line Management and Monitoring System”, incorporating both intranet and internet-based system, for obtaining updated information to facilitate a ready viewing and screening of data.
- To send periodic reports to the Ministry of Rural Development on the progress of implementation of road works by the States or Union Territories.
- To Monitor the planning for and plantation of fruit bearing and other suitable trees on both sides of the rural roads undertaken by the States or Union Territories, under the Pradhan Mantri Gram Sadak Yojana.
- To monitor the expenditure incurred by the States or Union Territories in implementation of the Pradhan Mantri Gram Sadak Yojana, with reference to the funds released by Ministry of Rural Development through expenditure reports obtained from the States or Union Territories and through ‘On-line Management and Monitoring System.
- To take up Research activities relating to Rural Roads, including execution of Pilot Projects.
- To Study and Evaluate different Technologies in respect of Rural Roads and to take up pilot projects involving different technologies.
- To enter into collaboration with Institutions, Agencies or Bodies of repute, both national and international, in respect of Rural Roads.
- To arrange suitable Training Programmes for officers of the Ministry as well as the State Governments or Union Territories concerned with the implementation of the Rural Roads Programme in reputed institutions.
- To Advise on Measures to improve the Quality and Cost-norms of the Rural Roads.
- To publish books, literature, take up or arrange for production of publicity material, print, audio or audio-visual in respect of the Pradhan Mantri Gram Sadak Yojana.
- To organise and sponsor Workshops and Seminars in respect of Rural Roads.
- To purchase, lease and hire equipment or machinery required in the construction of rural roads.
- To take up such activities as necessary to further the objective of the Programme and assist the Ministry of Rural Development in Planning and Implementation of the Pradhan Mantri Gram Sadak Yojana and such other related Programmes as may be taken up.

Physical Achievements of PMGSY as stated by NRRDA:

- Under PMGSY, so far (up to 31st March 2011) 77,877 habitations have been connected by all-weather roads measuring 3,19,438 km length of New Connectivity and Up-gradation. During the year underreport, 7,584 habitations have been connected by all-weather roads measuring 45,109 km length of New Connectivity and Up-gradation.

- **Figure 4.1 : Cumulative Connectivity achieved by PMGSY**



- **Source:** Annual Report 2010-11 of NRRDA

ii. **Impact assessment of PMGSY as given by NRRDC report:**

The main impact of the scheme was on the following parameters:

- **Impact on Agriculture:**
 - Construction of PMGSY roads has resulted in increased and easier movements of the farmers and their produce and has thus increased agricultural profit.
 - Problem of not being able to access the markets during monsoon has been solved. This impact was greatly felt in states of West Bengal, Himanchal Pradesh, and Mizoram, Assam etc...
 - Positive impact on agricultural infrastructure. Use of motorized equipment like tractors, threshing machines for cultivation leading to more efficient, time saving and profitable process of cultivation.
 - Transport of chemical fertilizers and pesticides became easy.
 - Considerable change in cropping pattern has been seen in states of Himanchal Pradesh, Assam etc... They changed it from food crops to cash crops(such as ginger, jute, sugarcane)

- **Impact on Employment:**
 - More opportunities of self-employment are available now due to construction of roads. Many housewives have started small scale industries like making pickles, papads, boris(lentil cakes), murir moa (puffed rice balls)etc...
 - In states of Tamil Nadu, Madhya Pradesh and Mizoram, on farm employment opportunities have increased due to shift from grains to cash crops and also multiple cropping.
 - People go to nearby towns and villages for odd jobs like selling woods, dairy products and locally made items like pickles, papads etc...
 - Non -farm opportunities like opening of shops, small business, and cottage industries has increased in the States of Himachal Pradesh, Madhya Pradesh, Mizoram, Tamil Nadu and Uttar Pradesh.
 - Besides, road connectivity has led to expansion of local industries, which in turn has generated employment opportunities.

- **Impact on Industry:**
 - An impact on the existing small industries was observed in terms of easier access to raw materials, availability of commercial vehicles to transport bulk product to the markets etc ... This has led to economies of scale, particularly in the state of Assam and Mizoram.

- Pottery and Brick making industry of Orissa are benefitted due to PMGSY roads
- Cottage industry of Tamil Nadu, Handloom industry of west Bengal and Agro industry of Assam are benefitted by PMGSY roads
- **Impact on Health:**
 - There has been an overall improvement in access to health facilities like PHC's (Public Health Centre)
 - Positive impacts were observed with regard to increase in accessibility to preventive and curative health care facilities; better management to infectious diseases and attending to emergencies due to faster access to health facilities
 - Road connectivity and better transport system had enabled families to opt for institutional deliveries in hospital outside the village
 - Due to easier and faster availability of health care facilities the infant and child mortality rate have decreased tremendously
- **Impact on Education Sector:**
 - Improvement in accessibility to educational facilities. This has resulted in increased school enrolment and school attendance in all states
 - PMGSY road connectivity has increased the number of girls going to school. Parents are more confident about sending their daughters to school unescorted
 - Greater inclination of parents to send their boys and girls for higher education
- **Impact on Social Aspects:**
 - The construction of the PMGSY road has led to an increase in frequency of visits by Government officials. This is likely to result in better implementation of various Government schemes and programs.
 - There has been an increase in the visits of grass root level functionaries like health workers/Auxiliary Nurse and Midwives(ANMs), Village Level Workers(VLWs) and Village Anganwadi Worker (VAWs)
 - Improvement of post and telegraph facilities
 - Marriage alliance radius has increased substantially
 - Mobility of women has increased as they can now travel in buses and cycles

- **Impact on Transport Facilities:**
 - The benefits of rural connectivity have been felt most in Mizoram and Rajasthan where PMGSY roads have made it easier for the beneficiaries to cope with the difficult terrain.
 - Increase in ownership of bicycles and two-wheelers
 - Improvement in public and private transport system

- **Impact on Urbanisation:**
 - Rapid change from traditional to modern ways of life
 - Phenomenon of Neon light attraction has drawn the villagers to the town entertainments
 - Ownership of television and other electronic gadgets have increased
 - The states of Mizoram, Tamil Nadu, and West Bengal reported conversion of kuchcha houses to pucca houses.
 - Most visible change was in term of sudden escalation of prices of land adjacent to the PMGSY roads. This had led to an increase in the sale of land for commercial purposes.

- **Impact on Poverty Alleviation:**
 - A spin-off benefit of PMGSY roads has been on the income level of the habitants benefiting from these roads. The roads, directly or indirectly have provided opportunities for farm and non-farm employments as well as self-employment.
 - With the improvement in farm and non-farm employment opportunities, beneficiaries in all the states reported increase in their average household income.

iii. Impact of PMGSY on Madhya Pradesh:

To study the impact of rural road constructed four districts were covered under the study viz. Bhopal, Dhatia, Dhar and Umaria which are spread across the MP state. In each district three completed PMGSY roads were selected each connecting a minimum of two habitations, one of which has population of 1000 or more. Total of 12 completed roads and 24 habitations in 1000+ category were covered under the study.

Impact on various parameters:

- **Agriculture:**

- The key indicators which have been used for assessing the impact of completed PMGSY roads on agriculture are:

- increase in the usage of chemical fertilizers
- pesticides and improved seeds
- Change in the cropping pattern
- increase in mechanization of agriculture
- increase in rearing goats/ sheep
- increase in dairy production and increase in poultry farming

- The Tables below summarize the responses of a cross section of respondents at household and village level both road wise and district wise:

Table 4.1: Impact on Agriculture and allied activities

		Usage of chemical fertilizers, seeds and pesticides have increased	Change in cropping pattern observed (from food grains to cash crop)	Increase in motorized agriculture vehicles and equipment	Increase in selling of milk	Increase in the no. of families rearing goats/sheep for commercial purpose	Increase in poultry production for commercial purposes
Bhopal	Rd 1	0	43	12	42.9	0	0
	Rd 2	0	0	0	16.7	0	0
	Rd 3	0	20	0	50	0	0
	Total	0	21	4	36.5	0	0
Datia	Rd 4	70	70	20	12	0	0
	Rd 5	55	60	30	65	0	0
	Rd 6	45	65	40	60	0	0

	Total	56.7	65	30	45.7	0	0
Dhar	Rd 7	70	80	55	80	25	25
	Rd 8	75	80	40	20	25	5
	Rd 9	60	55	10	45	20	5
	Total	68.3	71.7	35	48.3	23.3	11.7
Umaria	Rd 10	15	100	60	0	5.3	11
	Rd 11	10	100	30	42.9	0	14.3
	Rd 12	10	95	55	5	0	0
	Total	11.7	98.3	48.3	16	1.8	8.4

Source: www.pmgysy.nic.in

Table 4.2: Impact at Village level

		Usage of chemical fertilizers, seeds and pesticides have increased	Change in cropping pattern observed (from food grains to cash crop)	Increase in motorized agriculture vehicles and equipment	Increase in selling of milk	Increase in the no. of families rearing goats/sheep for commercial purpose	Increase in poultry production for commercial purposes
Bhopal	Rd 1	0	43	12	42.9	0	0
	Rd 2	0	0	0	16.7	0	0
	Rd 3	0	20	0	50	0	0
	Total	0	21	4	36.5	0	0
Datia	Rd 4	70	70	20	12	0	0
	Rd 5	55	60	30	65	0	0
	Rd 6	45	65	40	60	0	0
	Total	56.7	65	30	45.7	0	0
Dhar	Rd 7	70	80	55	80	25	25
	Rd 8	75	80	40	20	25	5
	Rd 9	60	55	10	45	20	5
	Total	68.3	71.7	35	48.3	23.3	11.7
Umaria	Rd 10	15	100	60	0	5.3	11
	Rd 11	10	100	30	42.9	0	14.3
	Rd 12	10	95	55	5	0	0
	Total	11.7	98.3	48.3	16	1.8	8.4

Source: www.pmgysy.nic.in

- The data presented in the Tables show that significant change in cropping pattern, rearing of goats and sheep, poultry farming and production of milk are yet to take place in six villages/ habitations of the district of Bhopal.

• **Health:**

- The impact on health was assessed by using indicators like access to PHCs, availability of vehicles or mode of transport to hospitals, Sub-health centres and district hospitals, increase in the visits of health worker, decrease in the incidences of major diseases/ illness and increase in child birth in hospitals etc.
- The Table below (Table 4) shows the percentage of affirmative responses from the respondents about these indicators.

Table 4.3: Impact on Health

Indicators		Improved access to PHCs, Sub Centres and District Hospital	Increase in the number of visits of health worker	* Decrease in incidences of major diseases / illness like Malaria, Diarrhoea etc.	#: Greater availability of vehicles or mode of transport to hospitals	\$ Increase in the number of child birth in hospitals
Bhopal	Rd 1	81	0	100	71.4	95.2
	Rd 2	79.2	0	83.3	79.2	100
	Rd 3	72	20	80	60	64
	Total	77.4	6.7	87.8	70.2	86.4
Datia	Rd 4	100	85	85	100	100
	Rd 5	100	95	90	95	90
	Rd 6	55	65	65	75	75
	Total	85	81.7	80	90	91.7
Dhar	Rd 7	95	60	85	95	90
	Rd 8	100	70	100	100	95
	Rd 9	100	55	100	90	100
	Total	98.3	61.7	95	95	95
Umaria	Rd 10	94.7	100	57.9	100	15.8
	Rd 11	100	95.2	85.7	95.2	9.5
	Rd 12	95	95	95	95	5
	Total	96.6	96.7	79.5	96.7	10.1

Source: www.pmgysy.nic.in

* : the respondents merely stated that in case of occurrence of diseases like malaria, diarrhoea etc., the road will facilitate the visit of medical and paramedical personnel in short time as well as transportation of required medicines/ vaccines etc.

#: Private vehicles are available, some villagers have bought own vehicles, therefore, vehicles may be hired at any time.

\$: the respondents have indicated that existence of the road has facilitated transportation to hospitals in complicated cases of child birth.

• **Education:**

- The indicators which have been used to assess the status of education are: increase in the number of boys and girls going to school for middle and high schools education and increase in the number of availability of teachers in the school.
- It may be noted at the outset that most of the villages are having primary schools where children, both boys and girls, can go and study but for higher study, they need to go to towns which was difficult particular for girl students because of absence of transport facilities.
- Percentages of affirmative responses of respondents for different districts is given in the following table

Table 4.4: Impact on Education

Indicators		Increase in the number of boys going to school for middle and high school education	Increase in the number of girls going to school for middle and high school education	Increase in the availability and number of teachers in school
Bhopal	Rd 1	12	60	12
	Rd 2	15	83.3	15
	Rd 3	20	50	12
	Total	15.7	64.4	13
Datia	Rd 4	100	85	100
	Rd 5	85	76	76
	Rd 6	55	55	55
	Total	80	72	77
Dhar	Rd 7	95	95	95
	Rd 8	95	95	95
	Rd 9	100	100	100
	Total	96.7	96.7	96.7
Umaria	Rd 10	100	100	42.1
	Rd 11	100	100	38.1
	Rd 12	95	95	85
	Total	98.3	98.3	55.1

Source: www.pmsgsy.nic.in

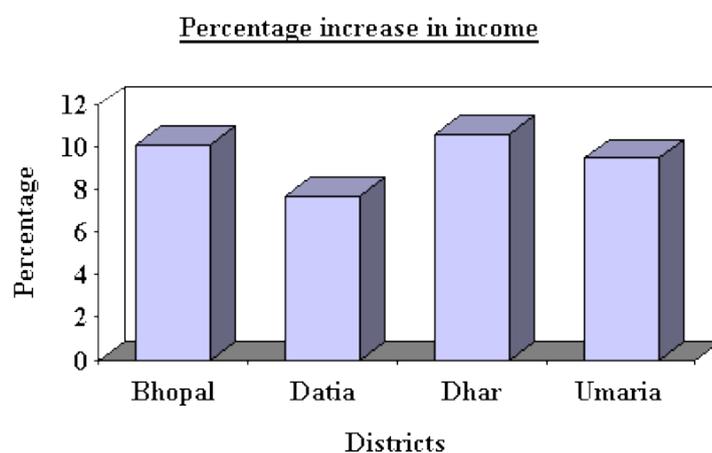
• **Income:**

Table 4.5: Impact on Income of people in four districts of MP

District	Earlier Average Income of the households (In Rs.)	Average Income of the households after the construction of PMGSY (in Rs.)*	Difference (In Rs.)	Percentage
Bhopal	17214	18958	1744	10.1
Datia	15750	16966	1216	7.7
Dhar	17423	19275	1852	10.6
Umaria	16066	17605	1539	9.5

Source: www.pmsgy.nic.in

Figure 4.2: Percentage increase in four districts



Source: www.pmsgy.nic.in

- It can be observed that the average incomes of the households have recorded increases in the range of 7.7-10.6 per cent.
- Significantly, households having incomes in the range of Rs.25000-40000 (middle range) have realized higher increase in income by 25-40 per cent.
- The major reason appears to be change in cropping pattern and market access.

iv. **“Linkages between Government Spending, growth, and poverty in India & China” by Shenggen Fan**

The main objective of this paper is to present a synthesis of the links between government spending-in areas such as agricultural R&D, irrigation, rural education, and infrastructure (including roads, electricity, and tele-communication)-and economic growth and poverty reduction in India and China. The results showed that government expenditure on roads had the largest impact on rural poverty. Increase in investment in roads by Rs. 100 billion decreases the rural poverty by 0.9%. For each Rs. 1 million increase in investment in roads, 165 poor people would be lifted above poverty line as shown in the following table. It is because Investment in roads not only reduces rural poverty through productivity growth, but also increases non-agricultural employment opportunities and leads to higher wages.

Table 4.6: Effects of Additional Government expenditures on poverty and productivity in India

Table 1: Effects of Additional Government Expenditures on Poverty and Productivity in India, 1993

Expenditure variable	Elasticities				Marginal impact of spending Rs 100 billion at 1993 prices				Number of poor reduced /Rs million spent	
	Poverty		TFP		Poverty		TFP			
					(percent)					
R&D	-0.065*	(2)	0.296*	(1)	-0.48*	(2)	6.98*	(1)	91.4*	(2)
Irrigation	-0.007	(5)	0.034*	(4)	-0.04	(6)	0.56*	(3)	7.4	(5)
Roads	-0.066*	(1)	0.072*	(2)	-0.87*	(1)	3.03*	(2)	165.0*	(1)
Education	-0.054*	(3)	0.045*	(3)	-0.17*	(3)	0.43*	(4)	31.7*	(3)
Power	-0.002	(6)	0.0007	(5)	-0.015	(8)	0.02*	(5)	2.9	(7)
Soil and water	-0.0004	(7)	0	(6)	-0.035*	(7)	0	(6)	6.7*	(6)
Rural development	-0.019*	(4)	n.a.		-0.15	(5)	n.a.		27.8*	(4)
Health	-0.0007	(8)	n.a.		-0.02	(4)	n.a.		4.0	(8)

Source: Fan, Hazell and Thorat, 1999

Note: Numbers in parentheses are ranks. TFP is total factor productivity. n.a. is not available.

* denotes significant at the 5 percent level.

The overall picture for public investment can be summarised as follows:

- The State level data revealed that many types of government spending in India has resulted in reduction of rural poverty, and many of them have contributed to growth in agricultural productivity. Rural roads and agricultural research have the largest impact on agricultural growth and poverty reduction. Many investments in rain fed areas of eastern India offer the largest impact on rural poverty, but also contribute to higher growth in comparison with investments in the more-favoured irrigated areas.
- In China, government investment in agricultural R&D and rural education had the highest impact on both growth and poverty reduction.

Progress done by China:

China is one of the few developing countries that have made remarkable strides in reducing the total number of poor people during past two decades. Per capita income in rural China was extremely low before the reforms in 1978. In 1978 average income per rural resident was only about US\$ 150. China was one of the poorest countries in the world, and 33% of the total rural population was below poverty line. The situation changed dramatically after introduction of rural reforms in 1978. Per capita increased from 220 yuan in 1978 to 522 yuan in 1984, a growth rate of 15% a year. Thus, because of the reforms introduced, 11% of the rural population only remained below poverty line by 1984.

China's poverty alleviating strategy developed in three steps:

- Before 1984, social welfare programmes were used mainly to subsidize poor families, and no formal strategy existed
- From 1984-1995, the government pursued a strategy of regional targeting whose objective was to alleviate by developing regional or local economies. Because the extremely poor community was concentrated in remote areas with limited access to roads and other infrastructure, this regional development policy did not trickle down to them.
- After 1996, the government adopted a food-for-work programme intended to build the necessary infrastructure in poor rural areas. The scheme provided a fund through which roads, irrigation, and other projects were carried out by extremely poor farmers in exchange of food vouchers or money.

v. **Demonstrating a correlation between infrastructure and national development: by Taylor & Francis**

This paper demonstrates a correlation between the extensiveness of infrastructure and national development. This was achieved by considering kilometres of paved roads, kilometres of rail, kilometres of paved runways, quality of shipping ports and quality of urban infrastructure. Data were collected from a variety of sources including the World Bank and the United Nations databases. Measures of the quantity or extensiveness of the infrastructures were normalized based on the populations of the various countries, transforming them into per capita measures. The 'paved roads per capita index' is established by dividing the km of paved roads in a country by the country's population. The assumption is that the more extensive the paved road infrastructure relative to the population of a country is, the more productive the countries industries and labour will be, resulting in higher national development. This effect comes from the fact that roads in general are the first link employed to reach local and international markets through a country's multimodal system. In fact, roads are the most flexible mode of transportation, providing accessibility to the vast majority of households and industry.

Results and Analysis:

- Analysis from the world bank for human development over the past 30 years reveals that countries like China and India have significantly advanced in HDI scale
- It is theorised that the basis of the increase in HDI associated with China and India is increased investment in infrastructure projects that have brought about significant economic and social improvements.
- Accumulated investments on infrastructure per capita lead to higher levels of GDP per capita, with developed countries moving from GDP per capita levels in the vicinity of US\$1000(in 1980) to between US\$40000-50000 in 2009. Also, for developing countries the correlation is same but under much more modest levels of GDP per capita(<US\$ 10000)

Figure 4.3: Infrastructure investments and economic growth: (a) developed countries (b) developing countries

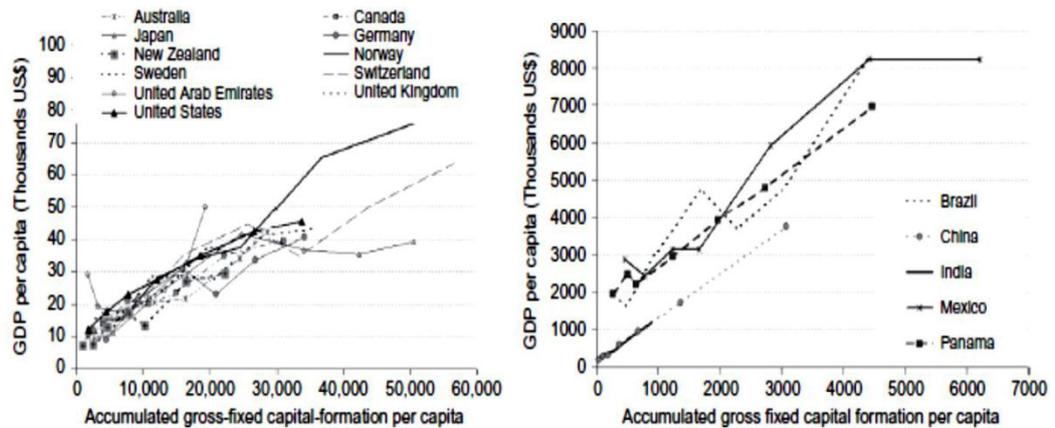
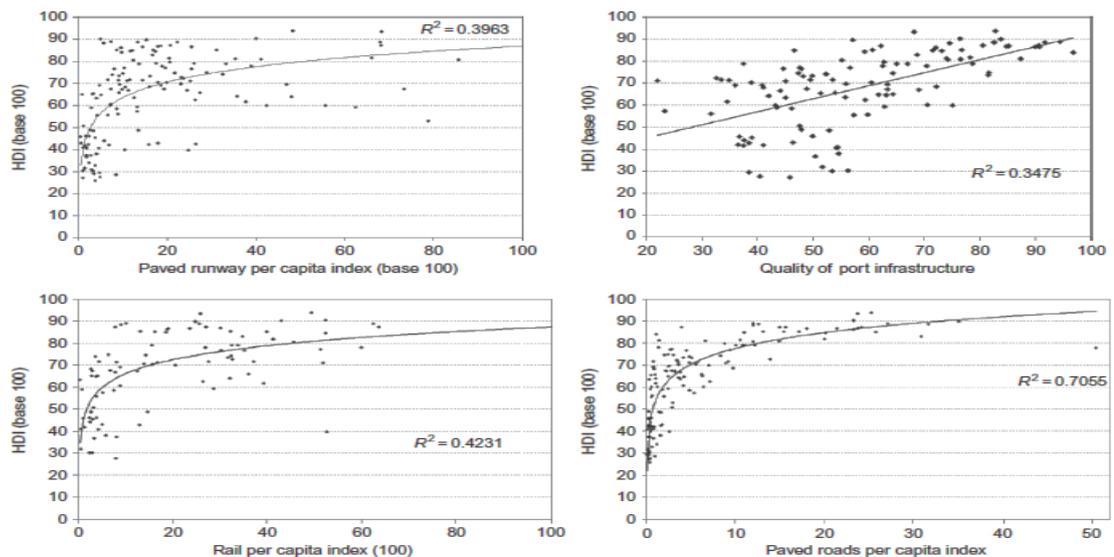


Figure 1. Infrastructure investments and economic growth: (a) developed countries, (b) developing countries.

- The following figure examines the role of individual networks of infrastructure on encouraging human development, and is a plot of the HDI against the infrastructure indicators like ‘paved runway per capita index’, ‘quality of port infrastructure index’, ‘railway per capita index’ and ‘paved roadway per capita index’
- These graphs show mixed results and do not reflect good correlations in all four cases. While there is a good correlation between quantity of paved roads and HDI ($R^2 = 0.70$)

Figure 4.4: Reliance of human development on individual networks of infrastructure.



vi. Use of Fly Ash for Road Construction: by Vimal Kumar

Abstract:

Fly ash is a finely divided mineral residue of burning coal which possess very excellent geotechnical and pozzolanic properties and thus making it apt for construction activities like building of roads, embankments etc... Fly ash based construction materials include cement, concrete, bricks, blocks, tiles, pavers and kerb-stones are easy to use and of consistent quality.

Use of fly ash in road construction can also help in improving the socio-economic condition of rural areas by generation of employment and business through manufacture of fly ash based products, their usage in rural development schemes, development of fly ash supply chain, improvement of agricultural yield and land resource management, etc. with fly ash.

Fly ash: a pozzolanic material:

The pozzolanic property of fly ash as represented by its lime reactivity, high surface area and low un-burnt carbon makes it suitable for manufacture of fly ash-sand-lime-gypsum or fly ash-sand-cement bricks, blocks, tiles and other building materials.

Fly ash when added to common soils with or without small percentage of lime, improves the strength of mud blocks. Hand operated machines which require very low power input are made available for the manufacture of fly ash bricks and fly ash mud blocks in rural areas which require very low capital investment. Small scale setups with investment of around Rs. 20 lakh in plant and machinery are also available for production of fly ash bricks that can be easily consumed in rural development projects.

Advantages of fly ash for road construction:

- Light weight as compared to conventionally used local construction materials. This will, therefore, cause lesser settlements. It is especially attractive for road construction over weak sub grades such as alluvial clay or Black Cotton soil (BC soil)
- Higher value of CBR (California Bearing Ratio) as compared to silty or clayey soil leads to a more efficient design of road pavement.
- Amenable to stabilization with lime or cement depending on its pozzolanic property.
- Pozzolanic hardening property imparts additional strength to the road pavements.
- Can be compacted over a wide range of moisture content. This will result into less variation in density with changes in moisture content.
- Easy to handle and compact because it is light-weight material and there is no large lumps to be broken down.
- Can be compacted using either vibratory or static roller.
- High permeability ensures free and efficient drainage. After rainfall, water gets drained out freely ensuring better workability than soil, especially during monsoons.

- Conserves good earth and other conventional construction material, thereby protecting the environment.

Despite above reasons Fly ash usage is not prominent because of its cost effects. Present rate of Fly ash bricks is Rs.2-3 per piece whereas normal bricks cost Rs. 0.55-0.60 per piece. Although the quality of roads and pavements formed are very good but due to cost inefficiency, presently the use of fly ash in road construction is limited in our country.

vii. Use of Jute Geotextiles in rural road construction: by Tapobrata Sanyal

Abstract:

Geotextiles belong to a class of technical textiles that have varied applications in geotechnical engineering. The engineered fabric improves soil behaviour through processes of *separation, filtration, drainage and reinforcement*. Developed countries invariably use geotextiles made out of man-made fibres in road construction, for control of erosion, consolidation of soil and stabilization of slopes. In India we have the advantage of abundance of jute fibres supported by an industry that has century-old experience in making of any type of jute fabric.

Purpose of usage of Jute Geotextiles:

- To strengthen the sub-grade for ensuring both longer life of the pavement and economy.
- Geotextiles—be it man-made or natural—acts as a separator between the sub-grade and the base course of the pavement overlying it, prevents migration of the top soil particles, helps dissipate development of overpressure by draining off water across and along its own plane.
- The aforesaid functions help consolidate the soil without extraneous mechanical intervention. Soil consolidation being a time-dependent process, the road sub-grade becomes self-reliant with the passage of time.
- JGT scores over man-made geotextiles due to its eco-concordance and price competitiveness, its excellent drapability (the best among all geotextiles), high secant modulus, initial strength and roughness co-efficient.

Despite its good performance receptivity of JGT and response from the end-using organizations leave much to be desired. Immediate focus should be to standardize JGT in different soil-related applications.

4.2 Finding from the fields and impact on the theoretical focus of the project

I visited villages in and around **Lucknow, Uttar Pradesh** viz. *Bhadhrukh, Sabhakheda, Bhauli* and *Kundri*. My visit consolidated my literature findings considerably. The residents of these villages suffered a lot prior to construction of roads. The main points of the findings are summarised below:

- **Mahesh**, a farmer by profession, a resident of *Bhadhrukh* village said that prior to construction of roads it was very difficult to transport crops to main market. Many of the goods get damage because of pits in the *kuchha* roads. Also, the time taken for travel was very high due to which many of their produce get rotten away by the time they reach the main market. Hence, they were at loss despite all their efforts. Due to construction of roads use of motorized vehicle such as tractors became prominent which not only helped in transportation but also helped them in agricultural produce due to easy access to fertilizers and pesticides from urban areas.
- **Surajpal**, a college going student, a resident of *Sabhakheda* village said that prior to the construction of roads there were no primary school in his village and thus he was not able to get proper education in his childhood so he has to start his education that is why he is 20 years old yet still in 12th standard.
- **Chotelal**, a painter by profession, a resident of *Bhauli* village said that due to construction of roads access to public health centres PHC's have increased drastically which helped in reducing the mortality rate. Earlier when there were no roads, whenever there was a patient who required urgent medical attention at night then it was very difficult to reach PHC's due to lack of connectivity, also, since there were no roads in the area so there were no electric pole hence no light during the night which made night travel much more difficult. Due to construction of roads there is a provision for electricity as poles have been installed on the either sides of roads. Also, health care facilities are also easily accessible.
- **Vijay**, a carpenter by profession, a resident of *Kundri* village said that due to construction of roads a rapid urbanisation of the village took place. He was able to find work in city area which fetched more wage. Also, many villagers started their own departmental store because of good connectivity thereby increasing standard of living of the people in the village.

4.3 Gap analysis

Rural infrastructure development is high on Government's priority, as evidenced from the President's Address to Parliament on 25 February 2005, when he spoke of 'Bharat Nirman' as a business plan for rebuilding rural India. This theme was further elaborated by the Finance Minister in his Budget Speech to Parliament on 28 February 2005, when he identified the six components of Bharat Nirman:- drinking water, minor irrigation, rural housing, rural roads, communications and rural electrification. In so far as rural roads is concerned, Bharat Nirman goals envisage providing connectivity to all habitations of 1000 and above (500 and above in the case of Hill States including North East, Tribal and Desert Areas) by 2009. This is a restatement of the original PMGSY goals announced on 15 August 2000, which could not be met by the original target year of 2003 due to funding constraints. The 'business plan' mentioned in the context of Bharat Nirman is expected to concentrate on finding ways and means of meeting the funding gap.

It is estimated that about Rs. 48,000 crore will be required to meet Bharat Nirman goals, as given below:-

Table4.7: Funds required for Bharat Nirman

(Rs. in crore)

	Up to 2003-04	Bharat Nirman(phase I-A)2004-10	Phase I-B (up-to end of 11th plan)	Phase II (beyond 11th plan)
NC 1000+, 500+habs.	12611			
NC to balance habs. Of 1000+ in all states		21511	NA	NA
NC to balance eligible habs. Of 500+		10672*	NA	13678
NC 250+ habs.		NA	NA	10942*
CN Modernisation		13000	13006	30392
Capacity Development & QM		2013	1537	2750
Total	12611	47236	14543	57762

(NC: New Connectivity, CN: Core Network) *Hill & NE states, Desert and Tribal areas only

Source: www.pmgysy.nic.in

Taking into account the funds in sight on account of the accruals of cess on HS Diesel (@ Rs. 1.50/litre) and through 3ADB loans and 2 World Bank loans already in the pipeline, a net funding gap of Rs. 17,835 crore needs to be met if Bharat Nirman goals are to be met, as given below:-

**Table 4.8: Funding for the programme by different means
(Rs. in crore)**

	9th plan 1997- 2002	10th plan 2002-07	11th plan up to 2009-10	Remaining years (2010-12)	Total (Rs. In crore) Bharat Nirman upto 2009-10 End 11th plan	
Cess	5000	14582	12180	8820	31762	40582
WB/AD						
B	NA	2050	8200	NA	10250	10250
Funding						
Gap	NA	NA	NA	NA	17835	23558
Total	5000	16632	20380	8820	59847*	74390

(*comprises Rs. 12611 crore for projects upto 2003-04 ad Rs. 47236 crore for 2004-10)

Source: www.pmgysy.nic.in

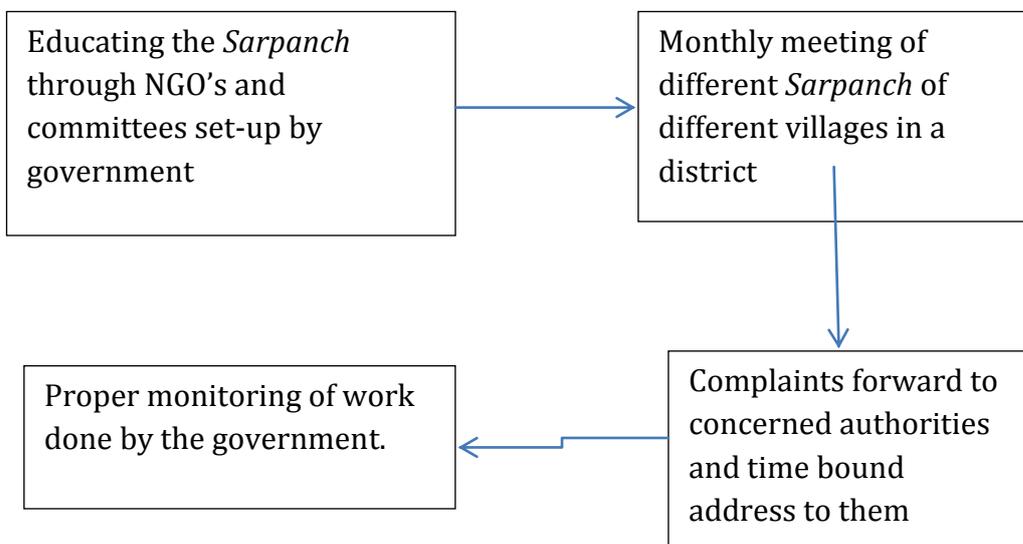
Although there were some discrepancies in fund allocation to different states by the government still achievements in many states have been remarkable. Where on one hand states like Assam, Bihar, Jharkhand etc.. still lacks connectivity due to insufficient allocation of funds to state government there are states like Madhya Pradesh, Tamil Nadu etc.. which have done diligent work required and PMGSY in these states is a great success. Some of the success stories are given below:

- In **Madhya Pradesh** (Manawar Semalda Langoor Ajandokoti road in Dhar district) Rajinder of Neshupur Mohalla of Langoor village registered an increase in annual income from Rs. 8,000 to Rs. 15,000 due to marketing of his agricultural produce and milk outside his village. He changed his agricultural cropping pattern from food crops to cash crops and started selling in the nearby wholesale market.
- Venkatesh, a 16-year-old illiterate handicapped boy (Marungai village Thanjavure block, **Tamil Nadu**) was not able to do anything and thus was confined to his home. New NGOs have started working in the area post PMGSY road construction and he was presented with tricycle. He can now lead an independent life. With bank loan etc, he is trying to open a tea or a grocery shop of his own. The road has brought in a new ray of hope in his life.
- Koorameerpur village (Chajilet block, Moradabad district, **Uttar Pradesh**) established a forward and backward linkage on one hand and growth centres on the other, post PMGSY road construction. The village had a very poor connectivity but there has been change in the traffic flow of the region. The farmers deliver the raw materials directly to the factory and income levels have increased.

5. Recommendations, Scope and Strategy for Implementation

Based on my research and my findings I have following proposals to make:

- The *Sarpanch* of villages should be made more aware of the proper channels through which he should file an application for road construction in his village. As there are many villages in the interior of the country that lack connectivity. In that case, the village *Sarpanch* should file a complaint to *Tehsil* which will forward it to Municipal Community and then their complaint will reach PWD. Many of the villages lack connectivity as the village head are not diligent enough in their work. Government has to take care of entire nation hence; the villages whose head took responsibility got connectivity first.



➤ Funds Related - Recommendations

- Share in Cess on Petrol be also made available for rural roads
- Budgetary Support needs to be increased considerably in the coming years.
- On completion of the current phase of PMGSY, PMGSY-II should be launched on cost sharing basis between Centre and State (Lower State share for the Hill States, Desert Areas, Tribal (Schedule V areas) and LWE(Left Wing Extremists)/ IAP(Integrated Action Plan) districts, and further lower share for International Border Blocks in Hilly states).

6. Suggestions for future work

Since this internship program was for limited period of time of two months only so there were bound to be many aspects of the project which were unexplored. Some of the aspects which were untouched or require further detailed study are listed below:

- The cost effective analysis of the alternate technologies suggested in the report.
- Research on road construction technologies other than mentioned in the report and their cost analysis.
- Comparative Study among two states, one in which PMGSY was affective in alleviating poverty and other in which it was not that successful.
- The necessary provisions in the program to achieve the objectives, like defining the design of rural roads and its. Cost analysis, sharing between and state.
- While studying the impact analysis of PMGSY on MP state, I wasn't able to do any field visit due to time constraint which could have been a major contributing factor for my findings.
- Study budget allocation to different states and their use in proper implementation.

7. Conclusion

The primary functions of transportation include mobility, connectivity and accessibility. Road transport in general and rural transport in particular provides door to door service, thus ensures accessibility to nooks and corners of the country. It has been realized that the absence of All Weather Road Connectivity is a major impediment in the development of rural areas, since lack of access results in isolation and remoteness of rural masses and thereby depriving them of opportunities of employment, health care, education, etc. Over and above, lack of connectivity increases the vulnerability of such communities during events of natural disaster.

The two case studies by Shenggen Fan and Taylor & Francis revealed that Government spending on rural road construction results in highest Human Development Index (HDI) of around 0.70.

Though construction of PMGSY roads have resulted in upliftment of the social and economic status of the rural people there is still a long way to go before it achieves its primary goal of connecting good all-weather roads across the country thereby reducing poverty as it was launched with the sole purpose of alleviating poverty from the country. The funds allocated from the government are not being properly used in some states while other states have done remarkably well.

While the construction of PMGSY roads is being executed smoothly, proper attention should be given to the maintenance of already constructed roads. Here the use of alternate technologies like use of fly ash and jute geotextiles come in handy. The material made up of these ingredients has high resistive power, high durability and longer life.

8. References

- [1] 12th five year plan
- [2] PMGSY web home page (<http://www.pmgysy.nic.in/>)
- [3] CRRI home page (<http://www.crri.gov.in/>)
- [4] Fan Shenngen, Linkages between Government Spending, Growth, and Poverty in India and China
- [5] Taylor et al Francis, "Demonstrating a correlation between infrastructure and national development"
- [6] Impact Assessment of PMGSY (<http://pmgysy.nic.in/downloads/ImpAsses-Eng.pdf>)
- [7] Impact of PMGSY on MP(<http://pmgysy.nic.in/pmp122.asp>)
- [8] Planning Commission site
(http://planningcommission.nic.in/aboutus/committee/wrkgrp12/transport/wgrep_rural.pdf)
- [9] Government Suggestions and Recommendations
(<http://pmgysy.nic.in/pmg1251.asp>)

9. Appendix A

Meetings and Interviews

- **Date:** May 16, 2012

Time: 7:00 PM

Duration of Discussion: 20 minutes

Discussion:

1. Introduced myself and about the project.
2. Requested reading material and how to start my project.

- **Date:** : May 18, 2012

Time: 8:00 PM

Duration of Discussion: 30 minutes

Discussion:

1. Clarified with her about my project topic and the material she gave me to study.
2. Got a new topic on socio-economic impact of rural roads on rural population instead of land acquisition and rehabilitation scheme.

Action Items before next discussion:

1. Read about PMGSY and familiarise myself with its goals and objectives [1 day]

- **Date:** May 19, 2012

Time: 5:00 PM

Duration of Discussion: 20 minutes

Discussion:

1. Asked specifically about my task for 1st week.
2. Got an assignment to familiarize myself with Pradhan Mantri Gram Sadak Yojna (PMGSY), to prepare a brief study on program and its provisions.

Action Items before next discussion:

1. Prepared a brief report and presentation about the task of my first week

- **Date:** May 23, 2012

Time: 4:25 PM

Discussion:

1. Informing her about my first week task and asking whether I missed some portions
2. Asked her about my second week's task
3. She mailed back at 1:41 pm on May 26, 2012
4. Giving me my next week's task.

- **Date:** May 26, 2012

Time: 1:41 PM

Discussion:

1. She mailed me back giving my next week's task
2. I had to find out impact of PMGSY on MP state.

- **Date:** May 31, 2012

Time: 10:24 AM

Discussion:

1. Informing her about my second week task and asking whether I missed some portions
2. Asked clarification about my third week task

- **Date:** June 3, 2012

Time: 9:22 AM

Discussion:

1. She mailed me back giving me my next week's task

- **Date:** June 8, 2012

Time: 3:56 PM

Discussion:

1. Mailed her Informing her about my third week task and asking whether I missed some portions

- **Date:** June 18, 2012

Time: 2:11 AM

Discussion:

1. Mailed her forwarding my midterm report and presentation and asked for her feedback.

- **Date:** July 2, 2012

Time: 12:01 PM

Discussion:

1. Mailed her at 12:01 pm
2. Informing her about my ideas for my last week task.
3. Also asking about what my recommendation should be about in my final report

- **Date:** July 2, 2012

Time: 6:46 PM

Discussion:

1. She mailed back giving me some sites where I can find the reading material for the information I required.

- **Date:** July 4, 2012

Time: 7:36 PM

Discussion:

1. She mailed me Asking me to resend my midterm project report and other weekly reports as she was relatively free that weekend

- **Date:** July 5, 2012

Time: 10:39 AM

Discussion:

1. I mailed her back attaching my midterm and other weekly reports. Also, asking again about the conclusion and recommendation part.

- **Date:** July 6, 2012

Time: 5:27 PM

Discussion:

1. Mailed her asking query about my final report for “recommendation and suggestion” part.

- **Date:** July 11, 2012

Time: 8:23 PM

Discussion:

1. She mailed me to tell me her views about my midterm report and other weekly reports.

Appendix B

- The following table shows the number of habitations connected and the length of the roads completed under PMGSY as stated in Annual report of NRRDA

Table A.1: number of habitations connected and the length of the roads completed under PMGSY

Habitations connected & Length Completed under PMGSY			
S. No.	State	Habitations connected upto March 2011	Length Completed upto March 2011 (Km)
1	Andhra Pradesh	1235	19175.57
2	Arunachal Pradesh	255	2925.94
3	Assam	6169	10107.26
4	Bihar	4996	12236.36
5	Chattisgarh	5848	18408.52
6	Goa	2	158.7
7	Gujrarat	2289	7156.4
8	Haryana	1	4296.07
9	Himachal Pradesh	1826	9264.37
10	Jammu & Kashmir	783	1884.15
11	Jharkhand	2691	6162.24
12	Karnataka	269	13682.15
13	Kerala	354	1273.79
14	Madhya Pradesh	10125	46518.2
15	Maharashtra	1072	18755.43
16	Manipur	174	2588.94
17	Meghalaya	141	964.76
18	Mizoram	127	1972.18
19	Nagaland	84	2639.98
20	Orissa	6076	19913.6
21	Punjab	406	4362.6
22	Rajasthan	10418	48166.86
23	Sikkim	142	2326.20
24	Tamil Nadu	1925	9095.66
25	Tripura	1224	1985.49
26	Uttar Pradesh	11074	39314.26
27	Uttarakhand	581	3412.01
28	West Bengal	7590	10690.75
	Grand Total	77877	319438.44

Source: Annual Report 2010-11 of NRRDA

- The following table shows the proposals cleared under PMGSY during 2008-09, 2009-10, 2010-11

Table A.2: proposals cleared under PMGSY during 2008-09, 2009-10, 2010-11

Proposals cleared under PMGSY during 2008-09, 2009-10 and 2010-11

#	State	2008-09				2009-10				2010-11			
		Value in Crores	No of Roads	Length in Km	Habitations Benefitted	Value in Crores	No of Roads	Length in Km	Habitations Benefitted	Value in Crores	No of Roads	Length in Km	Habitations Benefitted
1	Andhra Pradesh	1756.97	1260	5070.65	647					626.40	187	639.01	26
2	Arunachal Pradesh	563.91	104	862.48	127	401.57	64	583.02	164	461.99	44	654.98	6
3	Assam	5078.40	2582	7677.39	4077								
4	Bihar	10133.06	5627	20062.05	9587	695.13	418	1228.98	587				
5	Chhattisgarh	1111.80	1049	3819.82	1045								
6	Goa												
7	Gujarat	394.58	466	1567.74	378	130.38	221	438.86	262				
8	Haryana	371.79	67	697.17	1	241.63	69	611.32	0				
9	Himachal Pradesh	48.70	19	145.14	13	243.97	194	639.87	203				
10	Jammu & Kashmir	1200.26	440	2259.43	551					1463.21	470	2239.01	487
11	Jharkhand	973.12	669	3122.31	2396	882.07	935	3281.62	1537				
12	Karnataka	619.33	308	2069.80	0	810.22	429	2787.98	0	33.96	24	105.26	0
13	Kerala	230.47	200	533.54	0					256.27	220	621.46	0
14	Madhya Pradesh	2586.40	1935	8917.85	80	878.16	642	2953.32	919	102.53			
15	Maharashtra	268.36	128	824.07	59	188.97	154	630.89	21	1717.98	1057	6252.72	105

#	State	2008-09				2009-10				2010-11			
		Value in Crores	No of Roads	Length in Km	Habitations Benefitted	Value in Crores	No of Roads	Length in Km	Habitations Benefitted	Value in Crores	No of Roads	Length in Km	Habitations Benefitted
16	Manipur	363.66	131	1157.37	145					231.68	69	736.57	106
17	Meghalaya	128.54	36	183.54	40								
18	Mizoram	227.89	47	560.84	45								
19	Nagaland	54.04	11	205.20	13					402.56	122	590.43	
20	Orissa	4036.79	2076	10127.18	1964								
21	Punjab					432.58	71	925.92	0	235.36	36	499.37	0
22	Rajasthan	804.97	337	3496.87	0	665.08	229	2726.98	1				
23	Sikkim	254.56	105	488.69	86	117.83	54	275.53	47				
24	Tamilnadu	1324.63	2409	5113.63	45								
25	Tripura	223.27	65	339.70	64								
26	Uttar Pradesh	2821.77	1310	7968.26	206	87.67	38	272.53	24	179.95	224	403.27	224
27	Uttarakhand					419.21	133	1204.53	189	339.04	100	981.27	121
28	West Bengal	1210.22	609	2894.31	2004					717.41	356	1484.53	867
	Total	36787.48	21990	90165.05	23573	6194.47	3651	18561.34	3954	6768.33	2909	15207.88	1942

Source: Annual Report 2010-11 of NRRDA

- Following Table shows target and achievements of PMGSY in achieving connectivity of habitations up till now.

Table A.3: Connectivity of habitations - Target and Achievements under PMGSY/Bharat Nirman Programme (habitations in numbers)

Habitation	Total target Completion Upto 10 th FYP	Expected Completion During 07-09	Expected completion during 10-12	Overall Targets for 11 th FYP	Balance work for 12 th FYP	Core Network estimates
1000+	25371	34484		34484	0	59855
500+	14584	9154	19778	28932	37680	81466
250+	2511		14888	14888	14052	31451
Total	42736	43638	34666	78304	51732	172772

Source: www.pmgysy.nic.in

RAKSHAK FOUNDATION

Rakshak Foundation is a 501(c)(3) non-profit organization headquartered in Santa Clara, California. It partners with Rakshak Foundation NGO, New Delhi, India. It researches different public policy issues and creates awareness about them. Rakshak Foundation sponsors Seminars on public policy matters, sponsors activities to involve the youth in social issues including volunteerism and supports programs to help the needy. Rakshak's Summer Internship Program is aimed at providing an opportunity to highly motivated college students to work on complex real life social/national problems under the mentorship of experts and policy makers.

2784 Homestead Rd, #235
Santa Clara, California - 95051
United States of America

Tel: +1 (408) 329-1492
Email: secretary@rakshakfoundation.org

www.rakshakfoundation.org