



सत्यमेव जयते

Ministry of Rural Development
Government of India



Pradhan Mantri
Gram Sadak Yojana



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



PMGSY

**India's Rural Road Development:
Experience and Looking Ahead**

May 2022



Ministry of Rural Development
Government of India



Pradhan Mantri
Gram Sadak Yojana



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

PMGSY

India's Rural Road Development: Experience and Looking Ahead

May 2022

@ 2022 The International Bank for Reconstruction and Development/The World Bank
1818 H Street NW
Washington DC 20433, USA
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

All rights reserved

This volume is the product of the staff of the International Bank for Reconstruction and Development/The World Bank. The findings, interpretations, and conclusions expressed in this volume do not necessarily reflect the views of the Executive Directors of the World Bank or the Governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Rights and permissions

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development/The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission to photocopy or reprint any part of this work, please send a request with complete information to the Copyright Clearance Centre Inc., 222 Rosewood Drive, Danvers, MA 01923, USA; telephone: 978-750-8400; fax: 978-750-4470; Internet: www.copyright.com.

All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, The World Bank, 1818 H Street NW, Washington DC 20433, USA; fax: 202-522-2422; e-mail: pubrights@worldbank.org.



Foreword

PMGSY: India Rural Roads Development: Experience and Looking Ahead

In December 2000, the Ministry of Rural Development (MoRD), Government of India (GoI) initiated a flagship program, known as “PMGSY: Pradhan Mantri Gram Sadak Yojana or Prime Minister’s Rural Roads Program” aimed at empowering rural India by providing all-weather road access to all habitations with population greater than 500 (250 in hill states, deserts, tribal, and backward districts). Subsequently, the ambit of the scheme has been widened to include upgradation of major rural links and through routes to boost rural economy and access to socio-economic services.

PMGSY has been a game changer in the way rural roads are planned, designed, constructed, and managed in India. Over the last 2 decades, PMGSY has delivered about 7 lakh km of all-weather rural roads. The program has a well-structured implementation framework including a defined core network to prioritize project selection, standardized procedures, and comprehensive guidelines and manuals for effective implementation. Many states in India have started to use the “PMGSY framework” for their own state-level rural road programs.

The World Bank has been a long-standing partner of MoRD and is engaged with PMGSY since its inception through active dialogues, workshops, technical assistance, and a series of lending operations. The Bank has shared many good practice examples for rural roads with MoRD to address the key sector issues which have been incorporated in the design of PMGSY.

To commemorate the 21 years of the PMGSY program, this report has been prepared to enable stakeholders associated with rural roads in other countries to learn from and imbibe the successful experience of the management of rural roads in India, and the good operational procedures, business practices and sector approaches in the PMGSY program which have gone a long way in seeding long term sector and socio-economic impacts.

I would like to thank the World Bank team and NRIDA colleagues for leading this initiative and preparing this insightful report.

Finally, I am grateful to Hon’ble Minister, Rural Development, Shri Giriraj Singh for his tremendous encouragement and mentorship of the program. I am thankful to Hon’ble Ministers of State, Rural Development Sadhvi Niranjana Jyoti and Shri Faggan Singh Kulaste for their unstinted support. I am indebted to Shri Nagendra Nath Sinha, Secretary, Ministry of Rural Development for his constant guidance and support for betterment of PMGSY.

(Dr. Ashish Kumar Goel)
Additional Secretary (RD) &
Director General, NRIDA



Table of Contents

Foreword	iii
Acknowledgements	vi
Abbreviations	vii
Executive Summary	1
1. Introduction	2
2. The Journey	3
3. Program Features	5
4. The Impact	18
5. States Performance: A Comparative Analysis	23
6. Relevant Global Experience	28
7. Looking Ahead	31
References	36



Acknowledgements

The report “PMGSY- India Rural Road Development- Experience and Looking Ahead” has been prepared by the World Bank Transport Global Practice of the World Bank Group. The study was supported by the National Rural Infrastructure Development Agency (NRIDA) and Ministry of Rural Development (MoRD).

The activity was led by Reenu Aneja, and the team comprised of Dr. Arun Kumar, Rashi Grover, Lakshmi Narayan and the Deloitte team. The team especially wish to thank Mr. Hideki Mori (Acting Country Director); Mr. Guangzhe Chen (Regional Director, South-Asia Infrastructure); Mr. Shomik Mehndiratta (Practice Manager, Transport, South-Asia) and Mr. Arnab Bandyopadhyay (Program Leader)– for their insightful inputs and assistance during the preparation of this document.

We gratefully acknowledge the cooperation and support provided by NRIDA, Ministry of Rural Development led by Dr. Ashish Kumar Goel, Additional Secretary and Director General and his team, particularly, Dr. I. K. Pateriya, Director, Mr. Devinder Kumar, Director (MoRD), Mr. B. C. Pradhan, Consultant Director, Mr. Rakesh Kumar, Deputy Director, and Mr. Satyendra Prasad, Joint Director, NRIDA throughout this assignment especially in organizing consultations and providing insightful inputs. The team also wishes to acknowledge the officials from various state governments, SRRDAs, and other experts for their insightful feedback and suggestions for preparation of the report.

Experts from within and outside the Bank provided critical inputs at various stages of the report. Expert comments from Mr. D. P. Gupta, Mr. Ashok Kumar, Mr. K. B. Bansal, Ms. Neha Vyas, Mr. Arun Sharma, Ms. Manvinder Mamak, and Ms. Arushi Sood were pivotal in ensuring that the report captures various facets of the PMGSY program.

Abbreviations

ADB	Asian Development Bank
AMP	Annual Maintenance Plan
CN	Core Network
CRRI	Central Road Research Institute
DLP	Defect Liability Period
DPR	Detailed Project Report
DRRP	District Rural Roads Plan
ESMF	Environmental and Social Management Framework
GIS	Geographic Information System
GoI	Government of India
GRRIS	Geospatial Rural Road Information System
HSD	High Speed Diesel
IAP	Integrated Action Plan
IIT	Indian Institute of Technology
ILO	International Labor Organization
IRC	Indian Roads Congress
JE	Junior Engineer
KP	Knowledge Product
MDB	Multilateral Development Bank
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIS	Management Information System
MLA	Member of Legislative Assembly
MoRD	Ministry of Rural Development, Government of India
MP	Member of Parliament
NIC	National Informatics Centre

NQM	National Quality Monitor
NRIDA	National Rural Infrastructure Development Agency
OMMAS	Online Management, Monitoring and Accounting System
PCI	Pavement Condition Index
PIU	Project Implementation Unit
PMGSY	Pradhan Mantri Gram Sadak Yojana
PRI	Panchayati Raj Institution
PTA	Principal Technical Agencies
PWD	Public Works Department
R&D	Research and Development
RCIP	Rural Connectivity Investment Program
RMPL	Routine Maintenance Priority List
RRP	Rural Roads Project
RWD	Rural Works Department
SBD	Standard Bidding Document
SHG	Self Help Groups
SQM	State Quality Monitor
SRRDA	State Rural Road Development Agency
SSR	State Schedule of Rates
STA	State Technical Agencies



Executive Summary

Started in 2000, the Pradhan Mantri Gram Sadak Yojana (PMGSY), or Prime Minister's Rural Roads Program of India, has witnessed the construction and upgrade of more than 704 thousand km of roads connecting around 172 thousand habitations. The program has evolved over the years with progressively higher financial contributions from states and has offered significant benefits to users on travel, economic opportunities, agriculture, and capital accumulation both socially and financially.

PMGSY roads have enabled citizens to travel to areas that offer better prices for their produce and have helped them to avail employment opportunities outside villages and in non-farm activities. While this movement to non-farm activities may have impacted agricultural costs, it has increased income levels per family and has also enabled better access to education and healthcare.

These successes may be attributed to the program's innovative strategies and its mix of centralized

planning with a localized implementation model. The implementation of concepts like District Rural Roads Plan (DRRP), Core Network/Candidate Roads, Standard Bidding Document, and transect walk ensure transparency and community participation at the heart of the program. The program also has a three-tier quality control mechanism that provides multiple quality checks that help deliver quality across all phases. It also has a five-year Defect Liability Period (DLP) - composite contract, with the contractor/agency entrusted with building the roads to encourage high quality construction.

This report captures the highlights of the PMGSY's journey over the past two decades – its models that have helped the program and areas that may require support. Looking ahead, it also presents some ideas/suggestions that can be incorporated in future programs.

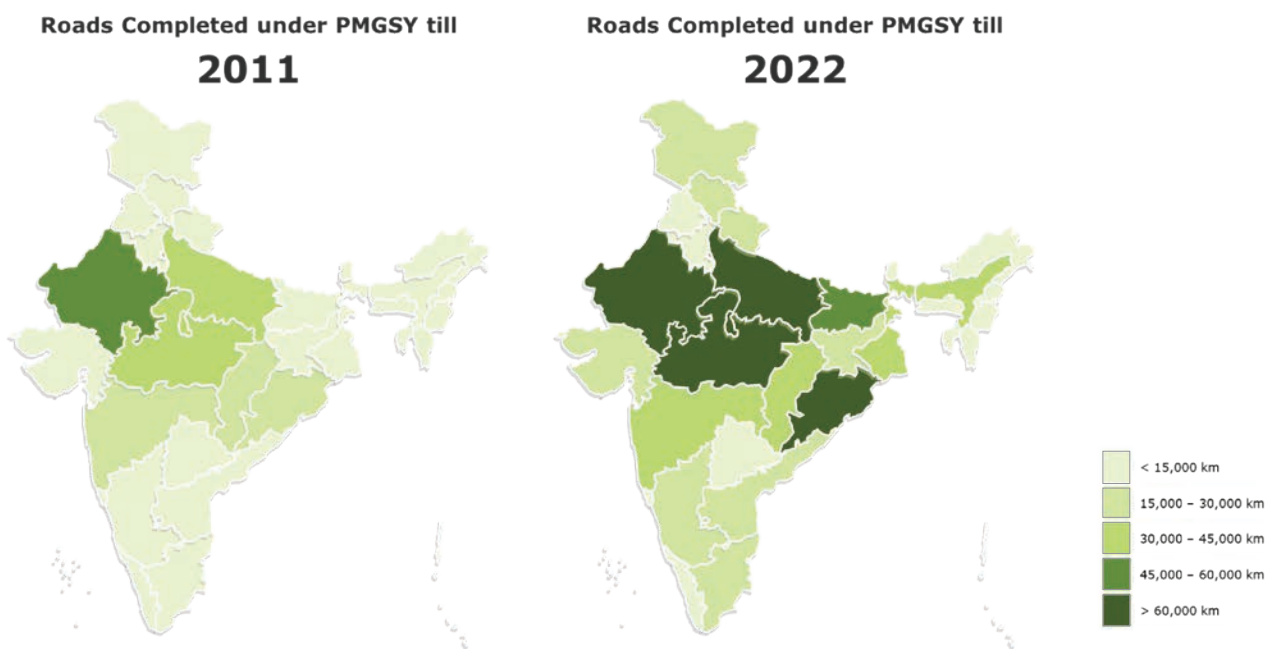
1. Introduction

Started in the year 2000 to enhance rural connectivity as a strategy for poverty alleviation, the Pradhan Mantri Gram Sadak Yojana (PMGSY), or Prime Minister's Rural Roads Program of India, has expanded the rural roads network with the construction and upgradation of more than 704 thousand km of roads connecting 172 thousand habitations¹.

The program has also introduced a paradigm shift across the entire lifecycle for rural roads – the way roads are planned, designed, built, and maintained, with robust institutional and governance mechanisms. The program's journey over the past

two decades has provided significant contribution and learnings in these areas. It also highlighted a culture of partnerships with stakeholders and multilateral agencies - the World Bank and the Asian Development Bank (ADB) who supported the program with innovative approaches and strategies for successful implementation.

This Report captures the highlights of PMGSY's 20 years – its implementation models, lessons, and partnerships that have enabled the program to deliver value to rural road users across India.



Two decades of journey – from 2000 till March 2022

183+ Thousand Works Cleared	704+ thousand km Roads Built & Upgraded	172+ Thousand Habitations connected	US\$36 Billion (1 USD = INR 76.52) Total Expenditure
---	---	---	---

¹ PMGSY, March 2022; <http://omms.nic.in/>



2. The Journey

The PMGSY program, at its inception in the year 2000, focussed on ensuring all-weather connectivity to eligible unconnected habitations with population up to 500+ in plain area and 250+ in Special category States (North-East states, Jammu and Kashmir, Himachal Pradesh, Uttarakhand), tribal and desert areas. The program achieved over 70% of its sanctioned targets by 2013, however, concerns regarding lack of road maintenance emerged due to low contracting capacity, and poor maintenance practices and inadequate ownership of newly constructed roads at the state level. As the program expanded, it also highlighted the need to integrate new construction with the existing road network by connecting habitations with markets².

Accordingly, the second phase of the program, PMGSY-II, was launched in 2013 aimed to upgrade selected rural roads that connected villages with rural market centres and hubs. Selection of roads was based on their economic potential and their role in facilitating the growth of rural market centres and rural hubs resulting as a catalyst in self-employment and livelihood generation.

Further, to provide better connectivity to regions impacted by Left Wing Extremism (LWE), special provisions were made to provide connectivity to

The PMGSY journey evolved from providing all-weather roads connectivity in Phase I to integrating the road network and facilitating connections with rural market centres and hubs, agricultural and senior secondary schools and hospitals in subsequent phases.

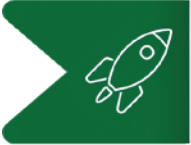


habitations with population category of 100-249. In 2016, Rural Connectivity Projects for Left Wing Extremism Affected Areas (RCPLWEA) was launched as a separate vertical under PMGSY.

With the implementation of PMGSY I & II, most of the eligible habitations were connected and implementation and absorption capacity of states got strengthened. In 2019, the program evolved to PMGSY III with special focus on social and economic centres aimed at consolidation of existing rural road network. It aims to further the connectivity approach by upgradation of existing through routes and major rural links that connect habitations with agricultural and rural markets (GrAMs), higher secondary schools, and health facilities. In this current phase, the program strives to facilitate easier and quicker movement of agricultural produce to help farm production and minimize the spoilage of perishable goods. PMGSY-III aims to provide easy and affordable access to schools and health facilities.

2 PMGSY II and PMGSY III Guidelines

Progressively, the component of funding for construction by the central government was reduced and shifted to state governments from PMGSY I to PMGSY III. This was done to provide greater regional ownership. This decentralised program implementation approach fostered a partnership between Central and State governments and contributed to the success of the program.

FIGURE 1: Evolution of PMGSY program

	 PMGSY I	 PMGSY II	 PMGSY III
Year	2000	2013	2019
Objective	Provide all-weather road connectivity to all eligible unconnected habitations in rural areas with population above 500 person (250 for hilly, desert, and tribal regions).	Upgrade existing rural roads based on their economic potential and role in facilitating the growth of market centers and hubs in rural areas.	Upgrade existing through Routes and major rural links that connect habitations to Gramin Agricultural Markets, schools and hospitals.
Program Focus	Roads are selected from the defined Core Rural Road Network which provide access to a larger population and serve other habitations as well	Identified existing Through Routes (TRs), Major Rural Links (MRLs) and Link Routes (LRs) based on <ol style="list-style-type: none"> Its role in facilitating the growth of rural market centres Economic Potential Condition of the road 	Existing TRs and MRLs connecting habitations, inter-alia, to Gramin Agricultural Markets (GrAMs), Higher Secondary Schools and Hospitals based on the population served by the concerned road and social infrastructure.
Funds* for Construction	100% sponsored by the Central Govt.	<ul style="list-style-type: none"> <u>General States*</u> – 75% Central Govt. share and 25% State Govt. share <u>Special Category State</u> – 90% Central Govt. share and 10% State Govt. share 	<ul style="list-style-type: none"> <u>General States*</u> – 60% Central Govt. share and 40% State Govt. share <u>8 North-Eastern States, Himachal & Uttarakhand</u> – 90% Central Govt. share and 10% State Govt. share <u>Union Territories</u> – 100% Central Govt. share
Funds for Maintenance	Fully borne by the State Government		

* Note: Sharing pattern of PMGSY was changed to 60:40 between the Centre and States for all General States w.e.f. from 24 November 2015.



3. Program Features

The program has a well-structured national implementation framework including: a defined core network to prioritize project selection; standardized procedures for engineering design and contract execution; an e-procurement system; independent quality monitoring; five-year inbuilt maintenance in civil works contracts to create construction quality incentives and strengthen sustainability; a web-based 'On-line Management, Monitoring, and Accounting system' (OMMAS) and a comprehensive Operations Manual for implementation. PMGSY has been a game changer in the way rural roads are managed in India. Many states have started to use the PMGSY framework for their state-level rural road programs. Over the last two decades, the program is credited with introducing best practices for rural roads in the Indian contexts such as national roll-out of E-Marg for maintenance management, new and green technologies and promoting use of sustainable and local materials and

human resource policy and others. Another example is the adoption of a Detailed Project Report (DPR) for rural roads development. The program's partner, the World Bank furthered this by introducing concepts like citizens'-based tracking and community participation and environment and social management framework (detailed in section VIII).

The program was also successful in introducing good practices. For example, roads in India, except for National Highways, are the states' responsibility and the PMGSY program adopted a decentralized implementation model with respective state agencies while the Central Government provided the financial assistance for construction and program oversight.

Figure 2 presents the highlights of the program, and the subsequent sections capture details of program's critical features.

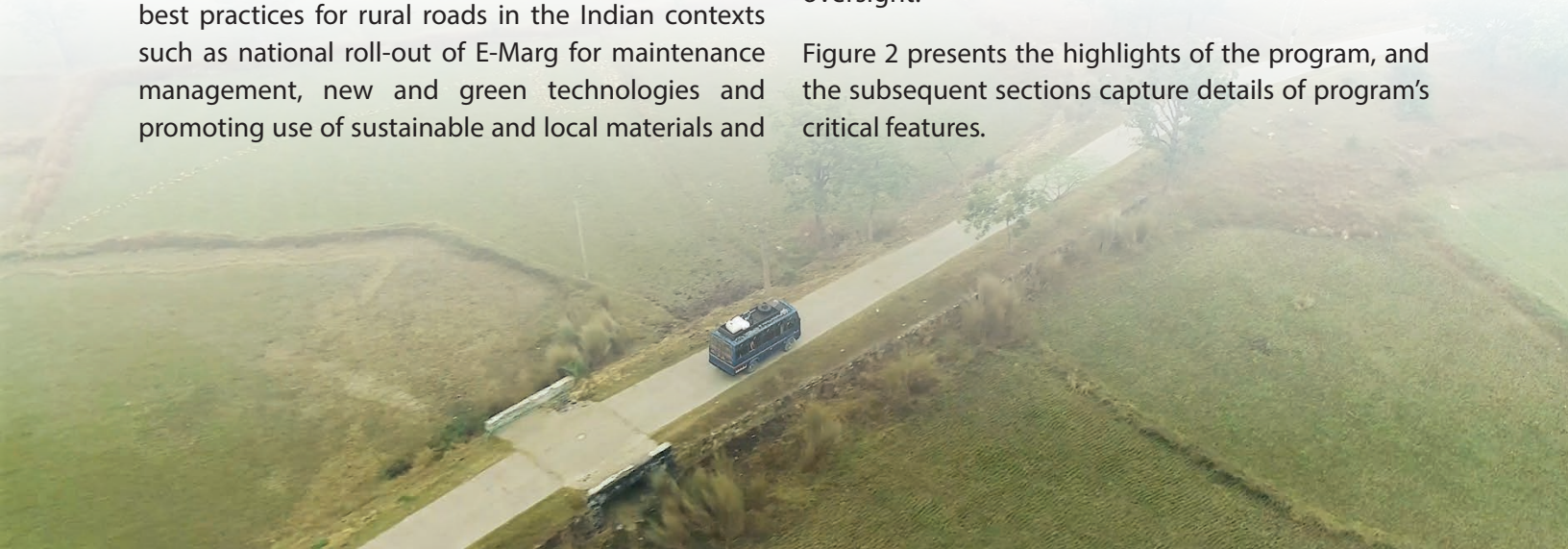


FIGURE 2: Key features of the PMGSY program



I. Institutional Structures & Partnerships

The PMGSY program adopted a centralized planning and monitoring model with localized implementation approach. It introduced dedicated institutions to implement this model including National Rural Infrastructure Development Agency (NRIDA) at the national level and State Rural Roads Development Agency (SRRDA) in all states which are the principal organisations for program implementation. The NRIDA provides technical support and guidance to the project, and SRRDAs execute the program at the state level by bringing in the local expertise as required. By providing a clear set of guidelines and detailed operations manual for defining roles and responsibility for each agency and procedures, the program minimises any ambiguity or conflict during implementation thus minimising any delays.

The Program also partnered with multi-lateral development institutions such as the World Bank and ADB for providing financial and technical support which has led to introduction of global best practices in the management of rural roads. They also assisted NRIDA in improving program design by supporting the Authority to align the respective states' rural roads plan with Sustainable Development Goals (SDG) about low carbon and climate resilience. Discussions with stakeholders also highlighted that the World Bank and ADB provided global insights, training, and manuals for the program that further supported the program to build its institutional capacity.

The program formally introduced sub-contracting by incorporating relevant provisions in Standard Bidding Documents (SBD). The strategy enhanced the contractor's capacity at the local level and provided an opportunity for wider participation in bidding stages.

Stakeholder discussions also highlighted the evolution of institutional structures within the program. For example, NRIDA and SRRDAs were initially envisaged as temporary institutions. The program's enhancement of their roles and responsibilities highlighted the importance of professional management in the program and confirmed their roles. Some stakeholders informed

The decentralised approach of program implementation and robust planning and monitoring through dedicated institutional structure of NRIDA and SRRDAs have been instrumental to the success of the program. This also led to widespread realization that rural roads need continued professional management. Agencies like the World Bank have also supported the strengthening of delivery framework by strengthening the capacity of institutions, business processes and systems through technical assistance, training, and capacity building, that have helped enhance the institutional capacity and facilitated the program in meeting its vision.

that PMGSY implementation is more successful in states with a dedicated agency like SRRDA, in comparison to states where the implementation is under the state's Public Works Department (PWD).

PMGSY introduced formal mechanisms for partnerships with non-government agencies across multiple levels. For example, the implementing agencies at state level partner with leading technical institutes or State Technical Institutes (STAs). The STAs are entrusted with the independent technical review of DPRs to ensure their conformity with applicable standards. The STAs also support local Project Implementation Units (PIUs) with the technical know-how regarding the latest industry practices on project implementation.

II. Planning

Introducing new and relevant practices in rural road planning in India from preparing plans to the scrutiny of proposals.

The planning process for rural roads in PMGSY starts with preparing a District Rural Roads Plan (DRRP), that captures the district's existing and proposed road network and is used to identify the optimal road alignment via the use of GIS-based systems. By capturing all the relevant roads, habitations, and market related details in a single platform, the approach enables planners to identify the optimal strategy to identify new roads for development and upgrade that align with the program's vision.

The planning process of the roads have evolved with subsequent phases of the program. DRRPs at PMGSY-I focussed on core road networks via the concept of Through Routes (TR) and Link Routes (LR). The approach was expanded in PMGSY-II and PMGSY-III to identify TR, Major Rural Links (MRL), and LR in line with the evolving objectives of the program.

For efficient planning and prioritization, a network planning algorithm called “Trace Map” was developed by NRIDA to identify and rank rural roads serving the maximum population. The strategy involves tracing the route from each rural habitation to its nearest facilities and aggregating this information to identify the importance of each road segment. Recommendations from the algorithm, community, and democratically elected representatives are combined to prepare a pool of Candidate Roads that are then ranked to prepare a Comprehensive Upgradation and Consolidated Priority List (CUCPL) based on utility value.

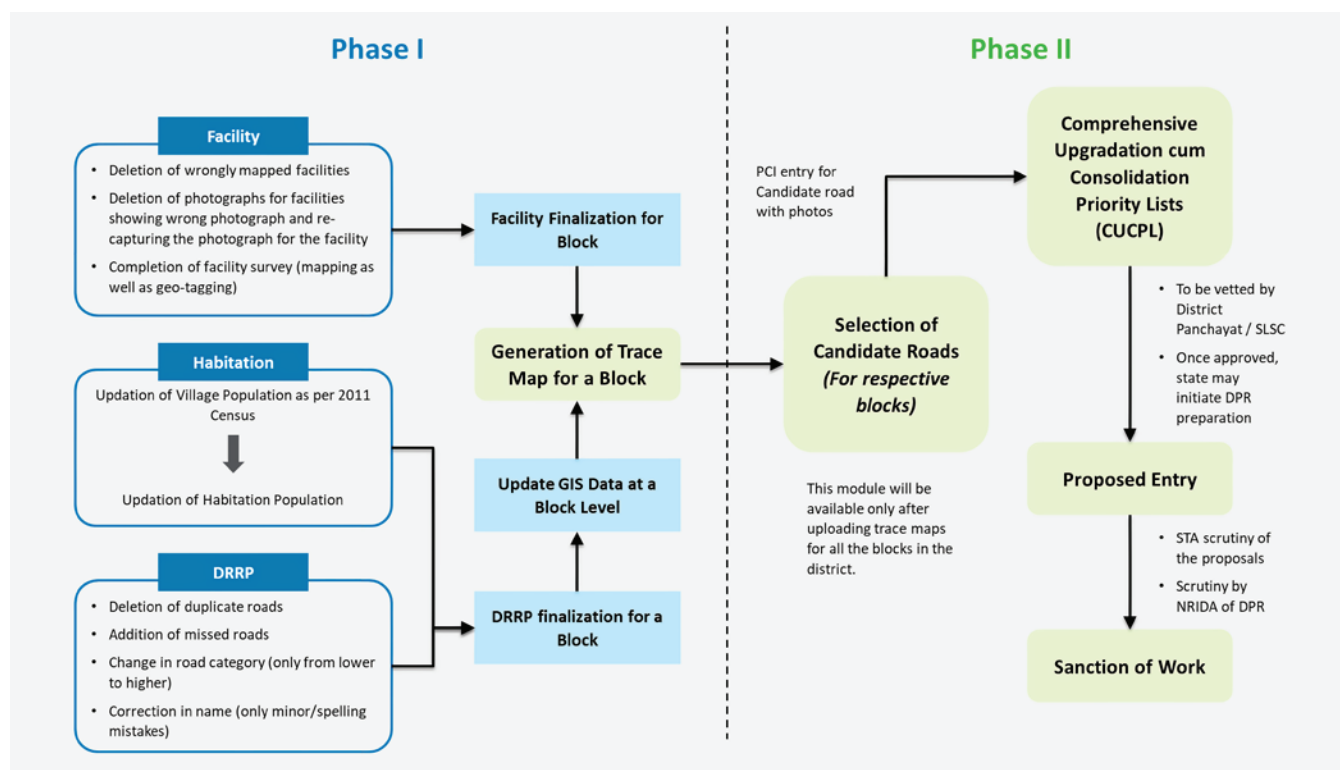
The prioritization matrix to rank roads across different parameters using technology and smart engineering is among the new features introduced by the program in PMGSY-III and ensures that the selection of roads

PMGSY program has introduced sound planning processes for rural roads. The approach involves viewing different roads and points of interest on a unified platform. Roads are then scored and prioritised based on pre-identified criteria to ensure bias-free road selection.

is based on ‘objective parameters’ according to the score ranking. It also helps the program address opinions from different stakeholders on the roads and be unbiased in the selection of roads. The PMGSY-III mandates uploading data in a GIS platform (GeoSadak) linked with OMMAS to ensure that senior stakeholders have a comprehensive view of the program.

The accompanying flowchart (Figure 3) captures an overview of different aspects of the program’s planning process. Stakeholders advise that PMGSY planning, and preparation of District Master Plans are among the program’s most critical elements. Stakeholders also highlighted the program’s emphasis on developing individual master plans for each district, ensuring objective evaluation of all projects at a centralized level.

FIGURE 3: Planning process for PMGSY roads



III. Procurement

The PMGSY program emphasizes on quality and timeliness and has adopted strategies to align procurement processes accordingly.

The NRIDA, one of the primary implementing agencies of the program, developed a set of Standard Bidding Document or SBDs, for PMGSY projects in consultation with Multilateral Development Banks (MDBs) like the World Bank.

The SBDs made it easier for State agencies to prepare the bidding documents and reduced the bidding process timelines. The tender notices were uploaded on OMMAS and enabled contractors to easily track tender openings and plan their submissions accordingly. The standardization enabled state agencies to conduct a centralized evaluation of the bid capacity of contractors and reduced the risk of contractors' misrepresenting their capacity.

The program is credited with formally recognizing sub-contracting via the SBDs. This measure introduced emerging contractors in the rural road construction industry, who subsequently upgraded themselves to more significant projects and evolved as prime contractors. This strategy has created a new class of contractors specialized in rural roads leading to wider participation in various contracts. The enhanced contractor capacity is demonstrated by increase in hiring of staff and procurement

The PMGSY program is credited with introducing a standard set of bidding documents across the country that shortened the bidding process timelines, improved transparency, and enhanced contractor's confidence in the system.

It formally introduced sub-contractors via the Standard Bidding Documents and helped growth of contracting industry and introduction of new contractors for rural roads industry. Going ahead, the program may need to streamline the contractor training approach and develop strategies to mainstreaming new technologies and strengthen implementation capacity to improve performance.

of equipment. Studies in the state of Karnataka indicate that there was 1.5 times increase in engineers employed by the contractors to maintain and monitor the quality on site. The trend continues in the adoption of newer equipment suited for construction as demonstrated by a seven-fold increase in the use of vibratory rollers and 2.3 times increase in the use of hot mix plants.

The program emphasized training of contractor personnel at regular intervals to ensure that contractors have sufficient capacity to deliver the program. Discussions with stakeholders however indicate that the training programs are not being conducted frequently, and that the program may need to address this aspect. There were instances where the contractors reported same equipment use across projects. The program may need to develop a centralized equipment database to track and monitor equipment availability and reduce such duplication.

IV. Quality Control

PMGSY program is credited with introducing a three-tier quality control system for rural roads in the country. The executing agency - Project Implementation Unit (PIU) is responsible for monitoring quality and supervising the laboratory set up by the contractor and is the first tier of quality control. The second tier is State Quality Monitors, or SQMs, engaged by the state governments and independent of PIUs. The third tier consists of Independent Monitors (Individuals) designated as National Quality Monitors (NQMs) empanelled by the NRIDA. NQMs and SQMs are experts consisting of senior retired officers with extensive experience and their performance is evaluated regularly.

The NQM and SQM inspections are envisaged to help improve quality control processes and provide feedback for improvement. SQMs are expected to ensure that each work is inspected across the three construction stages; NQMs are assigned monthly schedule by NRIDA covering two districts of the state. NQMs and SQMs use Quality Management System (QMS) mobile application during field visits

The three-tier quality control focus on regular inspections and monitoring during execution stage has helped improve roads' quality over the years. Although need to be also applied to DPR stage, many states have adopted similar three-tier mechanism in state programs.

to ensure that the uploaded images and observations have relevant geo-tagged details. Figure 4 captures details of additional reports expected to be submitted

by NQMs and SQMs that help improve the quality processes and delivery of the program.

The multi-pronged strategy has helped the program improve the quality levels over the years. As seen in the Figure 5 and Figure 6, the percentage of works highlighted as unsatisfactory has steadily reduced over the years for different category of works – highlighting the success of the approach in delivering better quality roads across India.

FIGURE 4: Reports to be submitted by NQMs and SQMs

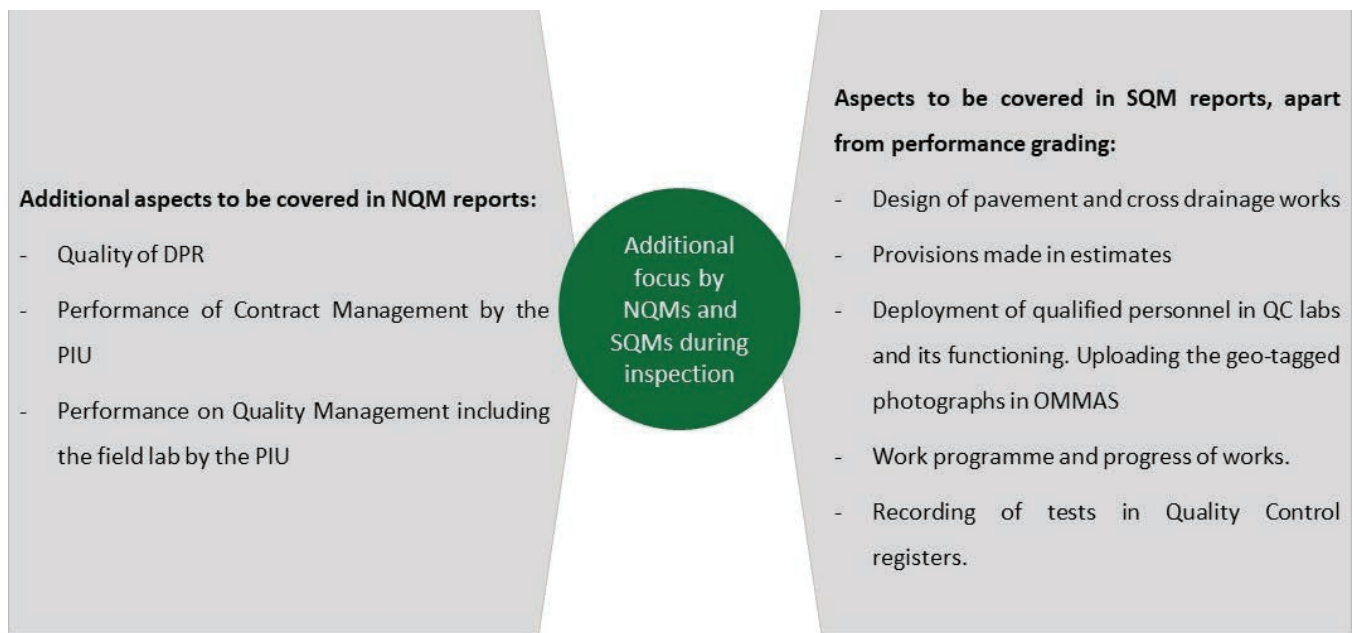


FIGURE 5: Works highlighted as Unsatisfactory by NQMs over the years

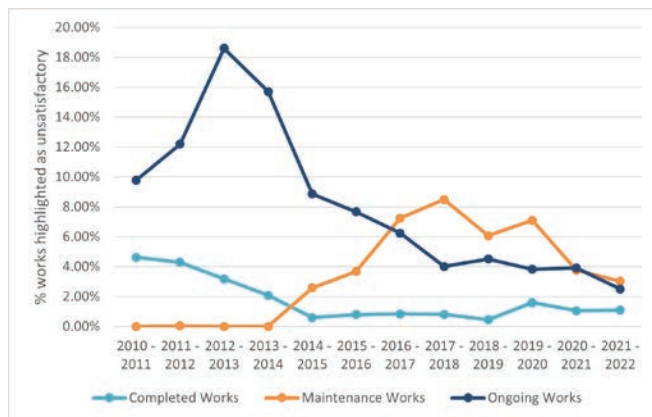
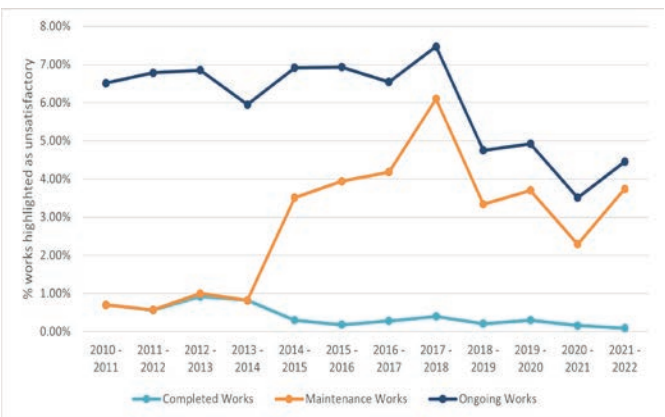


FIGURE 6: Works highlighted as Unsatisfactory by SQMs over the years



V. Environment and Social Safeguards

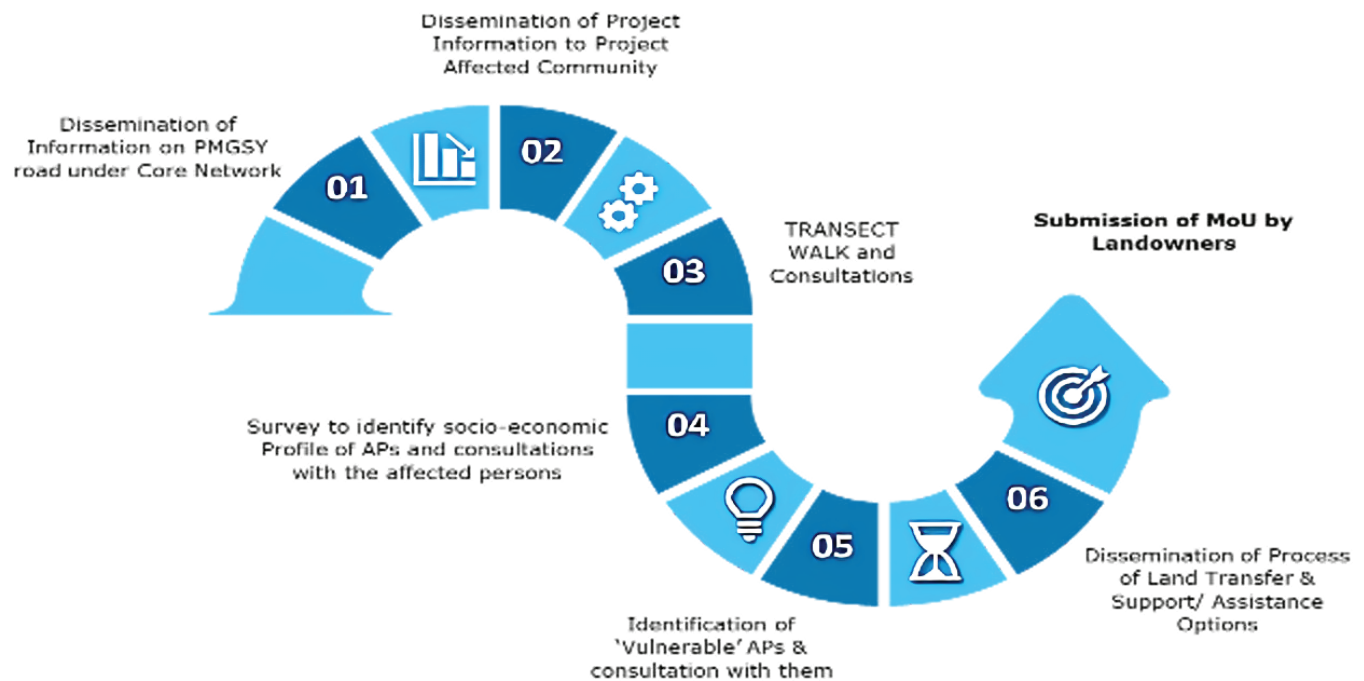
The PMGSY program has specific mechanisms within its guidelines to ensure that the suggestions and concerns of the local community are incorporated within the program and give a sense of ownership to the community of the local assets.

The program mandates placing signboards capturing the details of the program within 15 days of allocation of the works. These boards capture critical details of the project like its name, length, cost, timelines, and contractor details. By placing the relevant information in public domain, the program ensures transparency across each stage and gives the local community an opportunity to highlight issues with relevant agencies. To further enhance the program's alignment with the community, the program has adopted innovations like the "Meri Sadak" (My Road) mobile application that enable citizens to report issues with road condition and track the status of their complaints.

The program has adopted community centric approach via signboards, transect walk and feedback through mobile applications that have enhanced community participation and introduced transparency. It also has adopted best-in-class environmental guidelines that can reduce the environmental impact of the construction.

The program has also formally incorporated 'transect walk' during DPR preparation phase where people make the choices. Suggested by the World Bank, representatives of local communities walk the entire stretch of the proposed road so that their concerns can be considered at the design stage itself. For example, if the community believes that the project threatens a cultural site or important water source, then alternative routes are explored. Similarly, if the proposed route crosses a less privileged villager's land then the road alignment is adjusted to ensure that the land is not acquired. These strategies help minimize land acquisition related issues in subsequent stages.

FIGURE 7: Key aspects of Transect Walk for Community Participation



The PMGSY Program incorporates requisite environmental standards at the design stage itself. For example, it has included World Bank approved Environment and Social Management Framework (ESMF) and Environmental Codes of Practice (ECoPs).

The guidelines ensure better management of project risks and improve environmental and social performance, consistent with good international practices.



“Meri Sadak” – Ongoing User Participation (using mobile app)

The “Meri Sadak” mobile application is an e-governance initiative of MoRD under the Digital India program to empower citizens and provide ownership among local communities. This app has million + downloads and enables citizens to submit their feedback/complaints related to pace of construction, abandoned works, quality of work, etc. of PMGSY roads. The citizen receives an interim reply against complaint within 7 days and final redressal within 60 days.

VI. Technology, Innovation and Research & Development

The PMGSY program has introduced new and green technologies for construction of rural roads. The program’s Technology Vision 2013 mandated construction of a minimum of 15% road length using new technology and locally available materials – an initiative supported by the World Bank. The initiative aimed to enhance time efficiency and economic development while reducing environmental impact and maintenance costs. More than 114 thousand kilometres have been approved for construction using new technologies, with completion of more than 66 thousand kilometres. The initiative has helped introduce more than 40 technologies including waste plastic, cold mix technology, cell filled concrete, stabilization using cement and lime, nano technology, full depth reclamation (FDR) are in use. Adoption of these technologies has helped deliver savings in fuel and natural resources and reduced the roads’ carbon footprint. Figure 8, highlights few of the technologies piloted within the program and the kilometres covered via them, while Figure 9 highlights a few states adopting these technologies.

The program has also focused on introducing innovations in management of rural roads. The program has a structured approach to help prioritize

The program has piloted new technologies and helped in mainstreaming these via relevant IRC codes. Measures to enhance contractor and PIU capacity and wider sharing of lessons will enhance the adoption further.

roads for construction and maintenance. It also incorporates technology across the entire road life-cycle - mobile application for quality related inspections and for registration of public grievances, e-marg for maintenance monitoring, and OMMAS for overall project monitoring. Further, need based research projects are assigned to premier technical institutions such as IITs, CRRI, etc.

The program was complemented by ADB-funded Rural Connectivity Investment Program (RCIP), that aimed to upgrade select rural roads and build capacity in the state of Assam, Chhattisgarh, Odisha, Madhya Pradesh and West Bengal. As a part of RCIP, a total of 30 Rural Road Network Management Units (RRNMU) were established in the shortlisted states based on the existing PIUs for rural roads to provide effective management of the rural road network. The support also included establishment of one Rural Connectivity Training and Research Centres (RCTRC) in each state to conduct systematic training of engineers and support a sustainable practice-oriented research on rural roads.

FIGURE 8: Key Technologies piloted in PMGSY roads

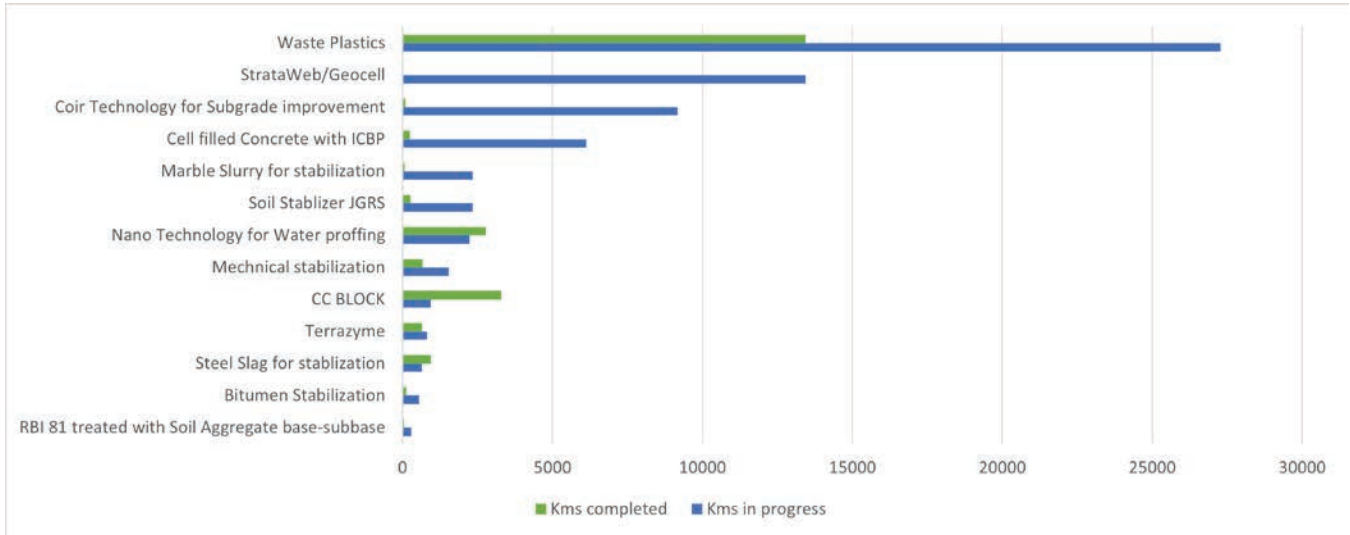
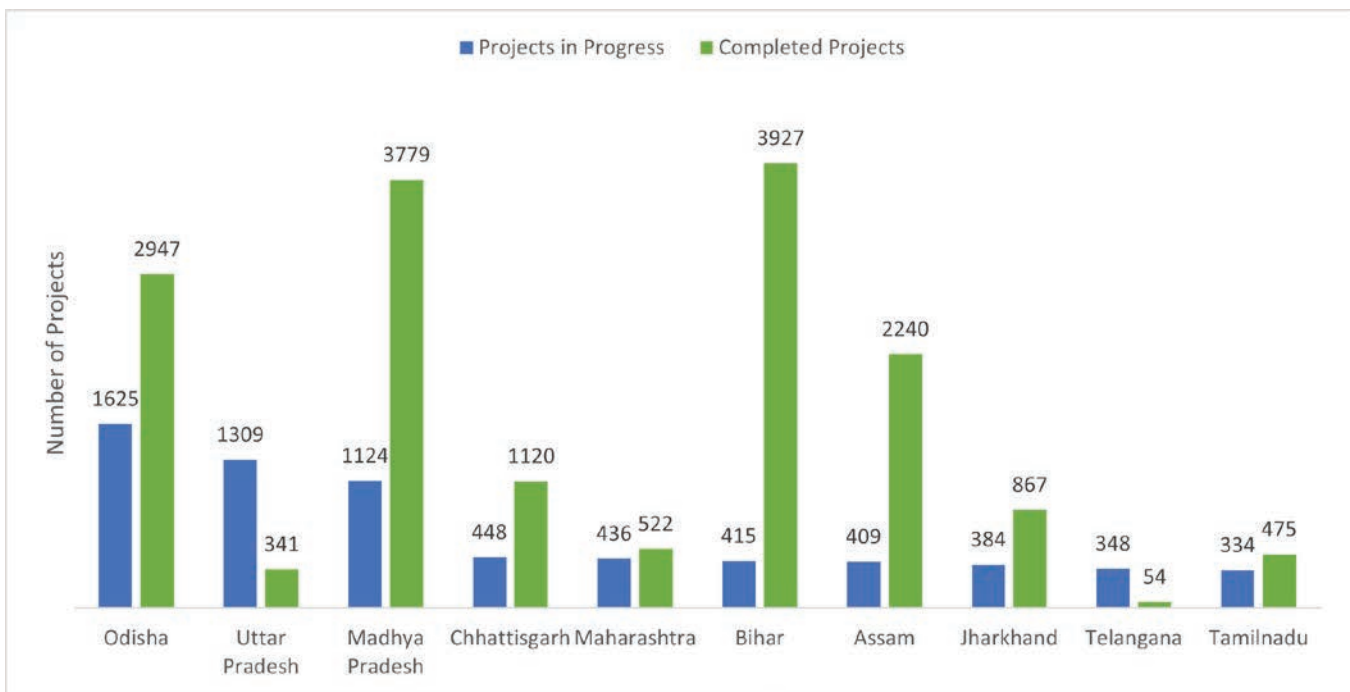


FIGURE 9: Technology adoption across states



Waste Plastic Technology

Waste plastic is shredded & coated over aggregate & mixed with hot bitumen and the resulted mix is used for pavement construction. Under PMGSY, more than 25,900 km of roads have been constructed using Waste Plastic across the country.



Cell-Filled Concrete (CFC) Technology

CFC pavement consists of formwork of plastic cells over the compacted subgrade/subbase, filled with concrete or stones. More than 2,500 km of road length has been constructed using CELL Filled Concrete under PMGSY across the country.



Stretching



Pouring



Compaction



Finishing

Cold Mix

Cold Mix technology is field application of bituminous surfacing course using cold mix binders and has much lower fuel requirements. Around 17,000 km of roads have been constructed under the PMGSY program Cold Mix technology.



VII. Asset Management

The PMGSY program has successfully built all-weather roads across villages throughout India and has introduced a new approach for maintaining these assets. The program included a Defect Liability Period (DLP) of five years via a composite contract with the contractor/agency entrusted with building the roads.

The DLP concept is different from the traditional approach of paying contractors upon the volume of maintenance work done which had the risk of additional payments for higher maintenance and potentially incentivized the contractor to not construct good roads in the first place. Contractors are paid for maintenance during the five-year DLP period basis fixed pre-defined rates and are not required to submit separate quote for these aspects.

NRIDA is working towards extending the approach for additional five years post the initial DLP period via “Performance-Based Contracts” that specify minimum standards for maintenance and pay contractors upon successful adherence.


To further complement the model, PMGSY has introduced ‘e-MARG’, a mobile application that provides a consolidated window for maintenance works tracking and monitoring. The application was first launched in Madhya Pradesh and then

The program has introduced both formal and informal models towards maintenance approach. Awarding of maintenance works for five years to construction contractor gives incentives for better quality and durable construction at initial stage. Community based informal models like Marg Mitra and Self-Help Groups demonstrate the importance of involving community in maintenance. Introduction and nation-wide roll out of E-marg has brought a paradigm shift in maintenance management and monitoring and states are gradually adopting the system for non-PMGSY road network too.

rolled across India. It aims to assist all stakeholders, implementing agencies and contractors responsible for road maintenance. The contractors raise the bill as per specified rates, and the engineers record the videos and images of the road highlighting the condition and raising deductions owing to deficiencies in roads performance, if applicable. Figure 10 captures further details of the advantages offered by e-MARG based solutions.

The program is further evolving with World Bank supporting the agencies to pilot community-based maintenance contracts in partnership with women self-help groups in Uttarakhand, Meghalaya, and Himachal Pradesh. The pilot involved 30-50 women

FIGURE 10: Advantages offered by the e-MARG solution³



	Bill Submission	Inspections	Payments	Analytics
Traditional Approach	<ul style="list-style-type: none"> Manual Submissions No control/record date, or frequency, of submission 	<ul style="list-style-type: none"> Inspection triggered by Bill Submission – a bad road with no bill may not be inspected No permanent inspection records 	<ul style="list-style-type: none"> Manual verification of vouchers and deduction of taxes/penalties Payment details entered in separate accounting software 	<ul style="list-style-type: none"> Limited to total expenditure on roads
e-MARG Approach	<ul style="list-style-type: none"> One click based e-Bill submission Regular alerts for Bill Submission 	<ul style="list-style-type: none"> Ensures bi-monthly inspections The inspections are tagged and saved as evidence 	<ul style="list-style-type: none"> Automatic payments and taxes/penalty deductions Automatic updates in accounting software 	<ul style="list-style-type: none"> Process level monitoring: Reports, reviews, GIS and photographs

³ Alka Upadhyay et al, 2022, Performance Assessment of Roads: An Innovation and Use of Emerging Technologies in Rural Roads Maintenance Management

taking over routine maintenance for PMGSY roads. These pilot projects successfully achieved the objective of requisite maintenance while providing productive employment and helping increase income from non-farm activities.

In Madhya Pradesh and Rajasthan, the Agencies have also successfully integrated initiatives like “Marg Mitra” (Friend of the road) to involve the local community in road maintenance. The initiative involves an identified person (Marg Mitra - Road Friend) maintaining close contact with the respective PIU and the contractor regarding road condition and highlighting any issues with the road.

The success of these initiatives highlights the importance of involving the community in roads maintenance, and NRIDA may consider adopting strategies to enable respective states to develop their model towards the same. These initiatives should also be aligned with strengthening of SQM capacity to ensure that the program delivers consistent quality in road assets created across India.

VIII. The World Bank Contribution

The World Bank partnered with the Government of India to support the PMGSY since its inception in 2000 through a series of lending operations and technical assistance with the objective of improving rural livelihoods and alleviating poverty. Total Bank support of \$2.1 billion was extended to the selected districts in the states of Jharkhand, Himachal Pradesh, Rajasthan, Uttar Pradesh, Bihar, Meghalaya, Uttarakhand, Punjab, and Tripura between 2004 and 2020. While the investment support was limited to nine states, technical assistance was provided to the entire program (all states and union territories in the country). During this time, the Bank has supported innovations, best practices, and governmental changes in PMGSY.

With a strong national focus, a common set of operating procedures were developed under the Bank support in 2004. These included overall operations, technical design, quality control and accounting, data-based investment decisions by establishing a

The World Bank has invested \$2.1 billion in the country's flagship Pradhan Mantri Gram Sadak Yojana, directly benefitting almost 19,000 habitations through 48,000 km of village roads. Leveraging its relatively small share in financing PMGSY nationwide, the Bank has used its involvement to promote and support many reforms and governance changes that have improved delivery of PMGSY in particular and management of the rural roads network in India.

core network that defines optimal road connectivity of the habitations with nearby markets, agricultural centers, health centers, hospitals, institutions, and other services. This approach brought objectivity and transparency to where the roads would be prioritized.

With a view to keep the roads serviceable and minimise asset value losses, states have begun to establish asset management framework and its implementation to deliver an efficient and quality network to the rural population. It introduced a web-based centralized database, the Online Management, Monitoring, and Accounting System (OMMAS), which provides detailed information on all PMGSY projects, their procurement status, finances, and progress in construction. All information related to the release of funds and their utilization, status of progress of work and quality monitoring reports has been made available in the public domain. This ensures greater transparency and the use of real time information at all levels – national, state, and district. The Bank introduced the concept of Innovative performance-based maintenance Contracts.

A quality monitoring system was developed that has brought in standardization and accountability. It streamlined the construction process and improved the quality of the roads both built and upgraded. A quality assurance handbook was developed and is one of the “good practices” instituted by the program.

An e-procurement system, and a procurement and contract management manual were introduced to streamline the process and introduce uniformity. This has significantly reduced the bid evaluation time. It has also introduced transparency, enabling

procurement of works to be carried out in a fair manner, ensuring better value for money and more reasonable contract prices.

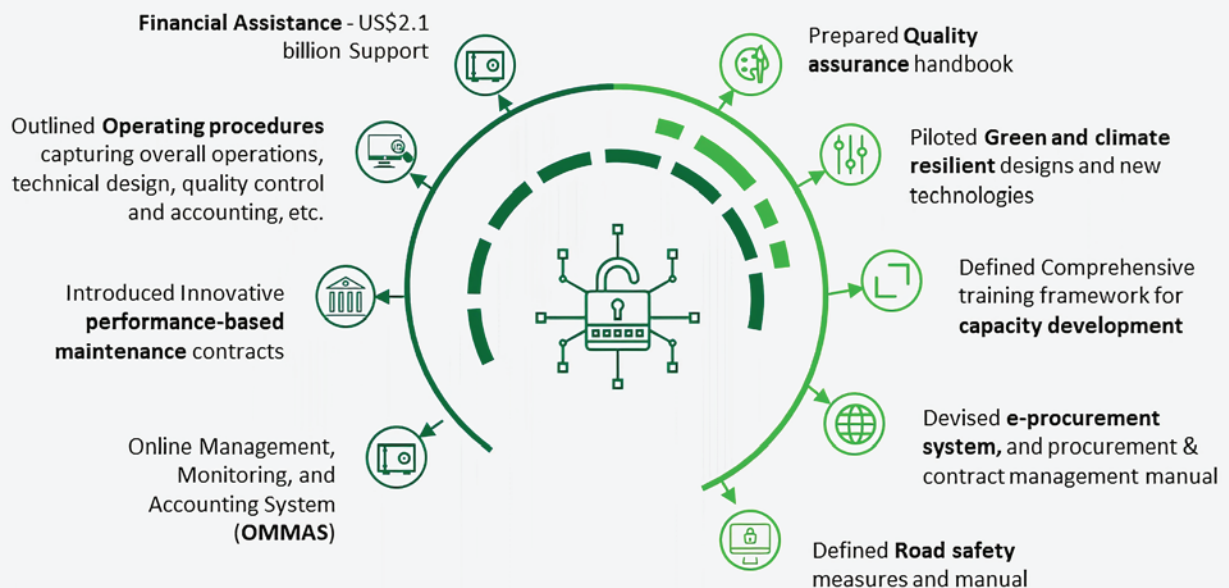
Road safety measures were introduced in the design and a manual was developed. An action plan developed by the state of Bihar is being used as a template by other states.

The World Bank introduced the use of green and climate resilient designs and new technologies. This is with a view to ensure that roads are built with sustainable industrial by products, local and marginal materials, and recycled materials as far as feasible. This will bring environmental benefits and are likely to provide savings of about 25 percent in unit costs. To support this endeavour, the Bank has also supported MoRD and NRIDA in preparation

of Guidelines for Environmentally Optimized Designs for low Volume Roads and Study on Green Construction Materials for Low Volume Roads. These would assist rural road practitioners to achieve the goal of mainstreaming the use of locally available, low-cost material and environmentally optimized designs in rural road construction, which would in turn help India transition towards a low-emissions, climate-resilient development path in the future.

The World Bank contributed to the development of a comprehensive training framework to empower road agencies and the construction industry in latest technologies, and best practices for rural roads. Special emphasis was placed on providing training to women engineers and contractors. Over 40,000 field officers have been trained.

World Bank's Contribution





4. The Impact

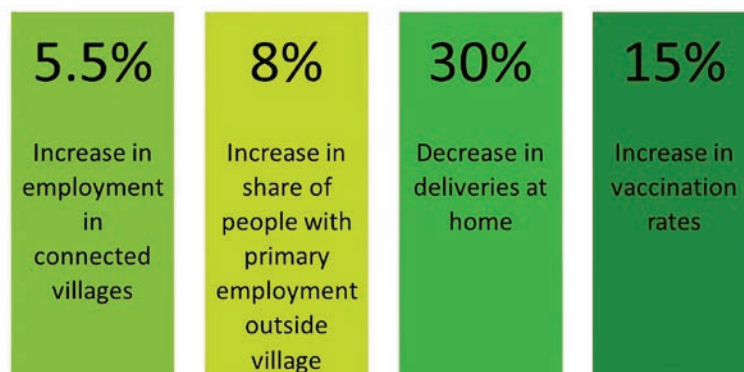
At the beginning of the twenty-first century, the 300 million+ citizens in rural India faced significant issues with transportation infrastructure that adversely impacted their economic opportunities. For example, due to bad roads, the produce market was severely limited, and so were the job opportunities. Getting quality healthcare and education was equally challenging. Over the past two decades, the PMGSY journey has positively impacted local areas and offered significant benefits to users on travel patterns, economic opportunities, agriculture, and wealth and human capital accumulation. A World Bank evaluation of the program identified the following significant changes offered by the program:

- 1. Increased economic opportunities** for both men and women: Men switched to non-farming occupations outside the village, and women took over farming opportunities close to home.
- 2. Better farm-to-market connectivity** and enhanced farmers' access to markets. The connected villages were

able to increase the share of crops transported to the market for sale.

- 3. Positive impact on social capital formation:** Middle and high school children had one more year of schooling due to PMGSY roads, while deliveries at home were reduced by 30 percent.

The subsequent sections capture further details on PMGSY program's impact on rural areas and its benefits to citizens' on travel patterns, economic opportunities, agriculture, and wealth and human capital accumulation⁴.



⁴ World Bank, 2021, The Road to Opportunities in Rural India: The Economic and Social Impacts of PMGSY



I. Travel Patterns

Impact evaluation of the PMGSY program conducted by the World Bank for Himachal Pradesh, Madhya Pradesh, and Rajasthan between 2009 and 2017 highlighted the program's impact in improving village accessibility. The connected habitations reported a marked reduction in travel time with an average reduction of approximately six minutes for every kilometre travelled.

The program also improved farm-to-market connectivity and enabled farmers to travel farther to locations with better crop prices. The percentage of food grain crops transported to market, in surveyed habitations, was 4% in 2009. This number increased to 12% post connectivity. The farmers also travelled an additional 8.9 km to sell their crops – representing 88% increase in distance travelled.

The program helped reduce the travel time for connected habitations and enabled farmers to travel to locations that offered better prices. It also improved the ownership of personal modes of transport and availability of public transport, although the adoption remains low due to poor quality/frequency of public transport.

PMGSY roads also improved public transport access to the connected habitations. An analysis demonstrates that new roads helped increase availability of public bus services by 12.8% with a similar impact noted in availability of auto-rickshaws⁵. However, the availability of better quality of roads also enabled users to switch from public transport to private modes of transport. An additional factor in moving to private mode could have been the poor quality of public transport services offered.

5 Asher and Novosad; 2020; Rural Roads and Local Economic Development

II. Economic Opportunities

The PMGSY program can be credited with triggering a change in the employment structure in rural India. The improved road connectivity enabled villagers to travel outside villages and opt for non-farm-based employments. In 2009, around 36% people in unconnected habitations reported non-farm activities as their primary occupation. The number increased to 48% by 2019 post PMGSY connectivity. Similarly connected habitations reported eight points increase in primary employment outside of villages. States like Himachal Pradesh, Madhya Pradesh, Mizoram, Tamil Nadu, and Uttar Pradesh have shown a marked rise in non-farm activities like new shops and cottage industries due to better access to the market.

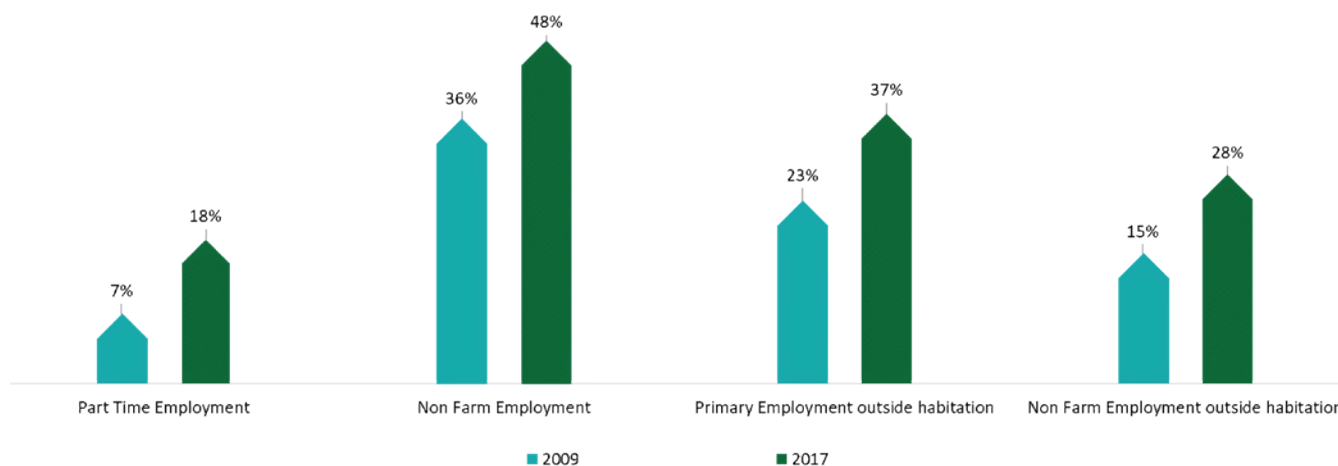
The program also positively impacted women's employment with studies highlighting a 9% increase in the likelihood of women working as a result of PMGSY roads⁶. This trend may be attributed to the shift in non-farm employments – as men shifted

The program has enabled villagers in connected habitations avail employment opportunities outside villages and in non-farm activities. PMGSY roads also increased participation of women in the labour force and helped increase the overall employment rate by 5%.

to non-farm jobs outside villages, women stepped in to fill in the pool of farm jobs at village levels. The entry of women workforce was among the key factors behind a 5.5% increase in employment rate (World Bank's Impact evaluation of the program). In addition to providing employment opportunities in the villages, the program also enabled women to take up jobs outside villages. An analysis in the Sagar district (Madhya Pradesh) noted that around 72% of respondents reported a positive effect on women's employment since the roads allow women to go outside (of villages) for work.

Figure 11 highlights the impact of the program across different categories of employment.

FIGURE 11: The near universal PMGSY impact across different job categories (2017)



⁶ Aggarwal, S; 2018; Do rural roads create pathways out of poverty? Evidence from India



III. Agriculture

The PMGSY program triggered a shift in employment structure to non-farm activities leading to limited impact on agricultural outcomes.

A recent study by the World Bank reported that the program's effect on agricultural yields, or investments, was almost insignificant. The program enabled movement of workforce from villages for non-farm jobs leading to an increase in wages. This consequently resulted in higher agricultural production costs as a new road reduces the availability of agricultural workers (10.1 percentage points⁷) with an equivalent rise in wages.

The low impact on agricultural outcomes could be mitigated via development of agricultural value chains. Some of these strategies could include working on agricultural logistics to ensure that farmers have an incentive to shift to higher paying, and highly perishable crops. Recent studies suggest that road connectivity, especially in remote villages, enabled farmers to diversify the crop pattern⁸.

While the program improved farm-to-market connectivity and increased access to economic opportunities, it triggered movement of workforce (especially men) from villages to non-farm employment in construction, manufacturing, and services. Investments in agricultural value chains that help farmers get a better price for perishable commodities and incentivise crop diversification may help enhance program's contribution to agriculture.

Studies conducted by the International Labor Organization (ILO) in Bihar, Jharkhand, Rajasthan, and Uttar Pradesh also indicated a shift in cropping patterns to fruits and vegetables accompanied by higher adoption of fertilizers and seeds.

The PMGSY-III program is aligned in this direction as it aims to connect habitations to agricultural markets and farmers to get remunerative prices for perishable goods like fruits and vegetables. These strategies could assist the program achieve the desired objectives in agricultural production and enhance program's impact on agricultural outcomes.

7 Asher and Novosad; 2020; Rural Roads and Local Economic Development

8 Shamdasani 2021; Rural Road Infrastructure & Agricultural Production: Evidence from India



IV. Wealth and Human Capital Accumulation

Improved rural connectivity, a goal of the PMGSY program, has facilitated increase in economic opportunities in connected habitations. It has increased access to schools and healthcare, leading to substantial human capital accumulation – a benefit that can translate into long-term poverty reduction.

PMGSY roads have demonstrated a positive impact on schooling enrolments. Studies suggest that PMGSY roads helped high/middle school children have additional 0.7 years, or 9% increase, of schooling. There was no significant differential impact between either girls or boys, suggesting gender parity in program's adoption with regards to schooling patterns.

The program positively impacted health-related aspects, and studies indicate that the share of household members going to local towns or

The program has had a positive impact on human capital, with both girls and boys benefitting equally from the program for capital accumulation. The impact demonstrated the role of transportation in improving human capital index in India.

villages in 2017 was much higher than in 2009. The percentage of at home childbirths had a 30% reduction in connected habitation. The decline was higher in habitations that were far from urban agglomerations indicating the positive impact of accessibility in remote areas. Studies from Arunachal Pradesh suggest that 84% of the respondents agree with better health facilities post road construction⁹.

The program does not reflect a similar pattern on wealth generation, with studies indicating a statistically insignificant increase in asset ownership. Further studies may be required to better understand the link between employment generation and asset ownerships to help adopt interventions to fully reap the benefits of the program.

⁹ Lendo and Nayak, 2021



5. States Performance: A Comparative Analysis

Overall, the states performed differently when viewed from the perspective of: Habitation and Road Connectivity; Procurement; Works Sanctioning and Award; Construction Timelines; Contract Financial Closure and Cost of Road Construction. These are summarised below:

I. Habitation Connectivity

As on March 2022, the program was able to connect around 98.95% of the eligible habitations with 26 States and UTs reporting more than 95% connectivity. States including Gujarat, Haryana, Jharkhand, Karnataka, Punjab, Rajasthan and Tamil Nadu recorded 100% habitation coverage. Even hilly states of the country, such as Himachal Pradesh, Jammu & Kashmir¹⁰, Uttarakhand, Arunachal Pradesh,

Nagaland, Manipur and Meghalaya, achieved more than 91% connectivity despite tough terrain and unfavourable working conditions.

II. Works Sanctioning and Award

The average time taken to award PMGSY-III works has reduced from 5.4 months in 2019-20 to 5.0 months in 2021-22¹¹. The difference in the award times in different states reflects the efficiency in program management, availability, and willingness of contractors to undertake certain works.

The Table 1 provides a snapshot of the average time taken from works' sanction date to award in PMGSY-III works across selected states¹².

10 The state of Jammu and Kashmir was reconstituted as per Jammu and Kashmir Reorganization Act, 2019. However, for the purpose of the paper, the erstwhile state has been considered as a single unit for analysis

11 Source - NRIDA

12 Data captured for PMGSY-III works for 2020-21; The National average timelines for this duration was 4.9 months

TABLE 1: Time taken to award PMGSY-III works for selected states

Average Time Taken to Award PMGSY-III Works (in months)	States
Less than 4 months	Madhya Pradesh, Telangana, Assam and Tamil Nadu
More than 4 months and less than 4.9 months (National Average)	Andhra Pradesh, Haryana, and Uttar Pradesh
More than 4.9 months and less than 7 months	Odisha, Kerala, Rajasthan, Punjab, Gujarat and Chhattisgarh
More than 7 months	Maharashtra and Bihar

III. Construction Timelines

The mean completion time (tender approval to completion) across the country was 898 days, with nearly half of the states taking more than 970 days. However, after 2016, the mean completion time dropped significantly from 898 days to 705 days with nearly half the states taking less than 674 days, probably due to the fact that most of the projects being taken up now are upgradation projects and also there is more focussed monitoring.

The states, namely Punjab, Haryana, Gujarat, Rajasthan, Uttar Pradesh, Karnataka, Andhra Pradesh, and Tamil Nadu did better on their completion timelines since inception despite relatively large state size and scale of works undertaken. This may be attributed to continuous learning and adequate dissemination of knowledge and overall capacity building for the duration of the program.

Initially, states with longer construction times included the hilly and north-eastern states, Jharkhand, Odisha, and Kerala. Most of these states have however

FIGURE 12: Completion timelines across states

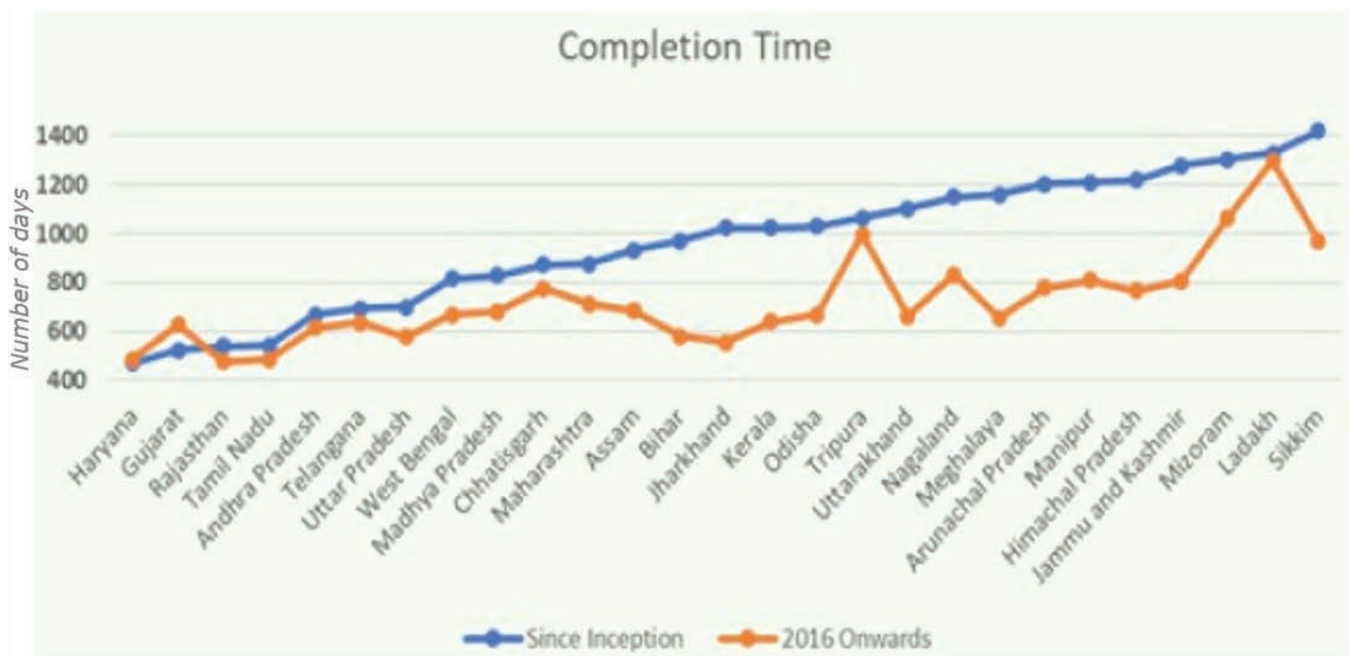


TABLE 2: Road completion statistics across states

SN	State	Sanctioned Road Length (km)	Connected Road Length (km)	Road Completion %	Remaining Road Length (km)
1	Madhya Pradesh	92,648.68	84,693.27	91.41%	4,885.40
2	Uttar Pradesh	77,257.28	60,471.92	78.27%	15,735.21
3	Rajasthan	75,331.61	72,331.59	96.02%	698.83
4	Odisha	74,757.67	65,021.09	86.98%	7,341.53
5	Bihar	60,850.67	56,045.67	92.10%	2,929.64
6	Chhattisgarh	45,003.22	41,538.01	92.30%	2,258.39
7	West Bengal	37,087.17	36,330.69	97.96%	450.58
8	Assam	31,471.31	30,515.26	96.96%	815.23
9	Maharashtra	30,947.32	26,820.23	86.66%	3,531.20
10	Jharkhand	30,518.08	27,405.14	89.80%	2,486.17
11	Karnataka	23,978.18	21,665.92	90.36%	2,265.40
12	Tamil Nadu	23,711.49	21,565.10	90.95%	1,976.41
13	Himachal Pradesh	21,859.23	19,624.25	89.78%	1,940.16
14	Uttarakhand	20,282.78	18,592.64	91.67%	1,521.13
15	Jammu & Kashmir	19,078.34	17,335.85	90.87%	1,481.62
16	Andhra Pradesh	18,972.53	16,313.68	85.99%	2,154.84
17	Gujarat	15,731.00	13,777.26	87.58%	1,805.24
18	Arunachal Pradesh	14,386.97	12,065.97	83.87%	2,308.62
19	Telangana	14,229.89	11,659.35	81.94%	2,302.16
20	Manipur	11,672.94	9,431.28	80.80%	2,235.12
21	Punjab	10,364.03	8,528.25	82.29%	1,796.24
22	Haryana	8,110.67	7,188.13	88.63%	876.54
23	Tripura	5,239.87	4,705.18	89.80%	365.24
24	Sikkim	4,915.49	4,324.93	87.99%	535.67
25	Meghalaya	4,755.19	3,734.56	78.54%	1,016.01
26	Kerala	4,577.49	3,779.37	82.56%	765.50
27	Mizoram	4,482.73	4,063.13	90.64%	405.63
28	Nagaland	4,382.05	4,119.83	94.02%	262.22
29	Ladakh	1,207.45	890.44	73.75%	300.85
30	Andaman & Nicobar	199.95	44.73	22.37%	154.41
31	Goa	155.85	155.33	99.67%	-
32	Pondicherry	106.13	-	0.00%	106.13
	Total	788,273.25	704,738.04	89.40%	67,707.29

improved significantly over the last 5 years, with Meghalaya, Uttarakhand, Jharkhand, Kerala and Odisha showing significant reduction in completion times. States such as Bihar and Madhya Pradesh have also reduced construction time in recent years with improved program management. Some of the World Bank-supported states have shown significant progress in reducing construction times, possibly due to effective program management, monitoring, and implementation of good practices.

There have been instances where projects have been delayed possibly due to natural disasters, difficult terrain, non-availability of material, lack of skilled labour, and contractor non-performance. In the hilly and north-eastern states, more than five percent of the sanctioned roads have been delayed by more than two years. Nagaland and Himachal Pradesh have reduced the remaining length to be constructed to less than 10 percent. In Himachal Pradesh, this has been attributed to the authorities specifically focusing on expediting various kinds of forest and environmental clearances in parallel with the tender process.

The above Table 2 shows the length of roads completed and remaining lengths to be completed in each state. It indicates that out of a total of 737000 kilometres of sanctioned roads nearly 100000 kilometres still remain uncompleted.

States of Madhya Pradesh, Rajasthan, Odisha, Uttar Pradesh Bihar, West Bengal (1-5) with sanctioned road lengths in the order of 60000 km to 87000km had a completion rate of nearly 90 percent or above (with the exception of Uttar Pradesh, 97% complete). This also indicates that nearly 10 percent of the roads (6000 to 9000 km) remained uncompleted (with the exception of Uttar Pradesh).

States West Bengal, Maharashtra, Assam, Jharkhand, Tamil Nadu, Karnataka, and Himachal Pradesh (6-13) with sanctioned road lengths in the order of 20k to 45K had a completion rate of 80 to 87 percent (with the exception of Chhattisgarh where 10500 km of roads remained uncompleted). This indicates that nearly 1500 to 4000 km remained uncompleted.

States Andhra Pradesh, Uttarakhand, Gujrat, Telangana, Arunachal Pradesh, Punjab, and Manipur (14-21) with sanctioned road lengths in the order of 9000 to 19000 had a completion rate of 66 to 83 percent (with the exception of Jammu and Kashmir where nearly 6400 km of roads remained uncompleted). Nearly 1000 to 4500 km or roads remained uncompleted.

States Haryana, Tripura, Sikkim, Nagaland, Kerala, Mizoram, and Ladakh (22-30) had a sanctioned road length in the order of 4k to 6.5k. Nearly 9 to 20 percent of the roads (order of 300 to 900 km) remained uncompleted (with the exception of Meghalaya where nearly 50% of the roads remain uncompleted).

A detailed analysis would assist in identifying key factors that contributed to the delays so that measures can be taken to ensure road project delivery on time.

IV. Contract Financial Closure

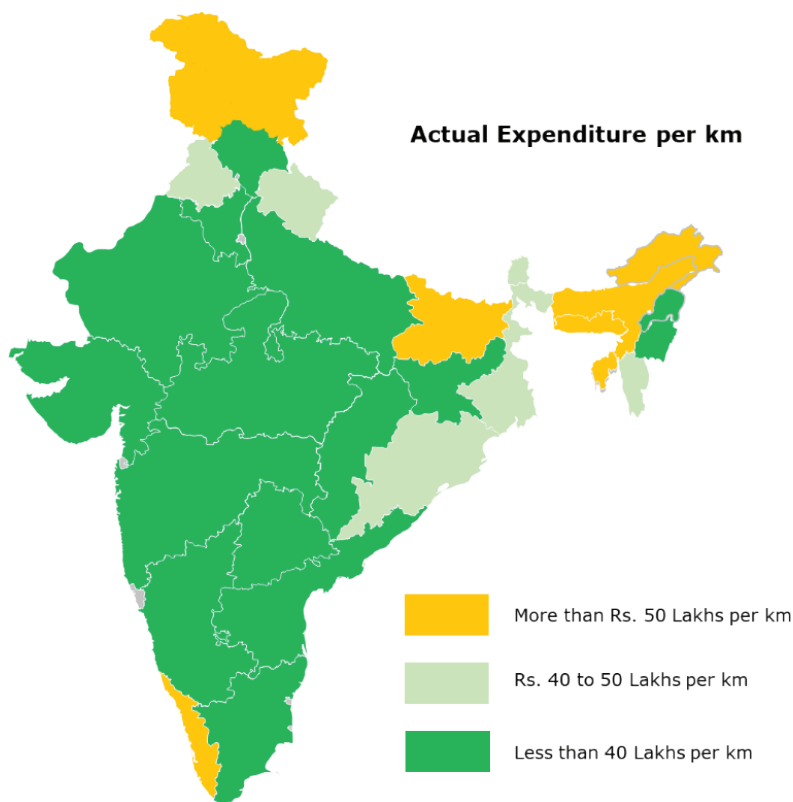
Time gap between the physical completion and the final payment to the contractor is deemed as Financial Closure. Since 2016, half of the states have taken less than 178 days for financial closure. The maximum time taken by any state was 308 days. This may be attributed to several factors including a systematic funds disbursement over the last few years.

An analysis is required to identify the reasons for such delay to ensure timely closure and that the contractors are not disadvantaged.

V. Cost of Road Construction

Jammu & Kashmir, Ladakh, Kerala and the North-Eastern states have reported higher construction costs primarily due to the terrain; Bihar has higher costs due to stone aggregates being sourced from other states. Hilly states like Himachal Pradesh, Nagaland, Sikkim, and Manipur have managed to deliver the PMGSY projects at a lower cost. One of the factors for low cost in these states can be attributed to the critical review of the design of structures and retaining walls with the DPR consultants during the design stage itself.

FIGURE 13: Financial performance across states



Nearly all the states, except Kerala, have managed to keep their cost per km lower than the approved cost. This was possibly due to provision from NRIDA that allowed only a 10 percent overrun in the budget which pushed the states to optimize costs to stay within the budget. This cost reduction could also be

an outcome of capacity augmentation of local construction industry leading to enhanced competition.

VI. Summary

From the above observations it is evident that primarily the hilly states/ union territories and the states affected by extremism have experienced delayed construction and connectivity, cost overruns due to difficult terrain, impact of climate change, availability of material among other factors. This indicates that such states may require their specific needs addressed.

For all states, overall, continued implementation and monitoring of various management processes, such as staff training and capacity building, appropriately adjusted designs, quality and speed of the procurement, financial management, and construction management would lead to further overall efficient and optimised rural network. Smart and innovative designs relevant to specific complex locations will also assist in reducing construction costs.



6. Relevant Global Experience

This section lists some good practices from eleven different countries¹³ where similar rural road programs have been undertaken. Countries include Timor-Leste, Bangladesh, Paraguay, Cambodia, Nigeria, Brazil, Kenya, Guinea-Bissau, South Africa, Chile, and Uganda

I. Timor-Leste – Road for Development Program¹⁴

Bio-engineering techniques were used to stabilize erosion-prone areas to support slopes and prevent landslides and erosions. Other practices included quality monitoring of roads through emerging and cost-effective technologies and use of dynamic cone penetrometers for quality control. Contracts included social safeguards such as: adherence to minimum wage and accident insurance for workers, design options to accommodate people with disabilities; equal wages for women and men; provision of protective gear and tools for workers.

II. Bangladesh – Rural Transport Improvement Program¹⁵

Training and capacity building helped streamline project implementation and built longer-term capacity within the government, including environmental management. A transparently negotiated system for adjusting price escalations helped mitigate time overruns, especially in challenging terrains with limited contractors with the required expertise. Contracts awarded after the rainy season had lower time overruns. To enhance road safety, black spots were meticulously monitored and attended to, on a priority basis.

III. Paraguay – Road Maintenance Project¹⁶

For road maintenance, Performance-based Maintenance Contracts were used with success.

¹³ These countries are chosen based on the discussions with stakeholders on similarities with the PMGSY program

¹⁴ https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-jakarta/documents/projectdocumentation/wcms_429567.pdf

¹⁵ <https://documents1.worldbank.org/curated/en/308311474487791162/pdf/000020051-20140626080343.pdf>

¹⁶ <https://www.worldbank.org/en/results/2018/06/27/mantenimiento-vial-paraguay>

Paraguay has adopted a sustainable long-term life cycle framework considering social, institutional, technical, economic, and environmental factors. It included the evaluation of rural roads, assessing maintenance needs and network conditions under affordable and efficient methodologies; implementing a computer tool that integrates all components required for the management of rural roads for better monitoring; considering the impact of the road on the nearby environment and minimizing it using suitable methods. The condition of roads and their impact on society were assessed considering short- and long-term needs. A pilot study has been undertaken to implement a maintenance management system module.

IV. Cambodia – Rural Road Improvement Project¹⁷

The Labor Gender Action Plan guided the government create equal job opportunities for both skilled and unskilled women. Equal wage was made mandatory and a minimum threshold for women's employment was included in the contract terms of reference. Road safety norms were made mandatory, especially on busy roads and those connecting schools and hospitals. Use of traffic signage and speed reduction measures were employed. In addition, community training and sessions were conducted to raise awareness about road safety.

V. Nigeria – Rural Access and Mobility Project

A Multi-Criteria Analysis was employed to select the roads to be identified for rehabilitation and maintenance. It included weightings for economic efficiency; accessibility and mobility; and social impact. The organizational structure allows interventions from other departments of the government to ensure minimal overlaps. Dedicated officers from different departments are posted as nodal persons for effective coordination between departments and expedited approval and execution. They involved the local community in the identification of project

intervention which helped the department prioritize roads important for the socio-economic development of the area and acceptance in the public.

For overall development, attention was needed on the way the road was built, such as to optimize its contribution to the development of the rural economy and to improve rural mobility. For this, employment of labour-intensive road works, methods and enhanced use of alternative transport means was promoted. This helped generate employment opportunities in the country and helped in overall rural development.

A holistic Environmental and Social Management Plan was developed to cater to socio-ecological aspects in the concerned regions. The major environmental activities included: environmental mitigation works; environmental monitoring activities; sensitization and awareness campaign; and institutional support and training.

VI. Brazil – São Paulo State Feeder Road Project

Ongoing evaluation and monitoring of the quality of works was undertaken through a representative control group. Physical aspects like travel time and reduced distance to the nearest healthcare facility, educational institutions, etc., were computed after the completion of work, and other aspects such as road conditions and traffic load were calculated after a specified time duration to get relatively accurate results. For school students, cycle tracks were built on a pilot basis in São Paulo and an increase of 31% school attendance was reported in two control regions (average). Training of the personnel required for the execution of works (contractors and engineers) resulted in the increase in efficiency and quality of the constructed roads.

VII. Kenya - KERRA Strategic Plan¹⁸

Online planning and estimating tools to improve coordination between government departments were implemented. The policy for maintenance,

¹⁷ <https://www.adb.org/projects/42334-014/main>

¹⁸ <https://www.kerra.go.ke/images/headers/KERRA-SP-2018-2022-Final.pdf>



especially vis-à-vis rural roads, is periodically revised to inculcate newer techniques and technologies. An accountable and prompt grievance redressal system, preferably online, helped the rural road authority address public issues. Proper surveys and feasibility studies helped the department save overhead charges resulting in efficient project planning. The introduction of liaison and a defined policy between funding bodies and the execution agency for the timely release of funds resulted in reduced time and cost overruns. Regularized training programs ensured subject matter expertise and effectiveness in executing the works. The engineers and contractors were kept periodically updated regarding evolving processes and technologies to provide the optimum utilization of funds and better performances.

VIII. Guinea-Bissau – Rural Transport Project¹⁹

To uplift the economy in Guinea-Bissau, it was recommended (by an ILO study) that roads be connected from the habitations to a national network of primary roads. Detailed studies revealed that different genders have different mobility needs and patterns as determined by gender norms. For this, suitable policies were designed, and designs were incorporated to cater to the needs of both the gender mobilities, especially vis-à-vis connectivity to healthcare and educational institutions.

IX. South Africa – Comprehensive Rural Development Program²⁰

The government demarcated planning and execution roles across different levels to ensure

swift and streamlined execution of works. The senior management was involved in planning works and formulation of policy, adequately supporting the government's vision for rural infrastructure development and economic growth. The planning and policy forum comprised other government departments to ensure minimal hindrances during execution. The executing body was decentralized and was monitored by a planning forum.

X. Chile – Rural Infrastructure Project

A territorial development framework plan was developed with emphasis on low-cost, self-financed approaches to rural infrastructure closely linked to income-generating methods. This maximized the social impact of the investment. The Ministry of Social Development formulated and adopted the new methodology for the economic evaluation of rural infrastructure sub-projects.

XI. Uganda – Uganda Roads and Bridges Project²¹

To develop maintenance culture, maintenance units were set up responsible for regular routine maintenance, including activities like desilting and clearing drainage, vegetation clearance, culvert, and bridge cleaning. Road users were involved in aspects such as road identification, planning, rehabilitation, and maintenance. They also assisted with monitoring and reporting of the defects on the road. Private participation was encouraged, and the contract also included clauses that involved the local community, especially women.

19 <https://thedocs.worldbank.org/en/doc/637241579711672712-0050022020/original/PolicyBriefGuineaBissauRuralTransportProject.pdf>

20 <http://onlinepubs.trb.org/Onlinepubs/conf/1995/cp6/v1/cp6v1-043.pdf>

21 <https://blogs.worldbank.org/nasikiliza/uganda-building-resilient-and-community-responsive-road-infrastructure>



7. Looking Ahead

Over the last 21 years substantial road work has been completed under the PMGSY program. Roads and bridges have been built providing connectivity to villages, habitats have been benefited by access to schools, medical facilities, agricultural produce being transported to wider markets, women employment has increased among many other benefits to the society at large.

This road network now needs to be managed to preserve infrastructure, development and implementation of a robust organisational and governance framework, skilled staff, and facilities to maintain road and bridge assets, use sustainable material in construction and maintenance, ensure roads are safe for commuters, enhanced use of public transport, fostering entrepreneurship in developing local enterprises for employment and economic opportunity for the rural community.

This section provides an overview of what should be addressed as next steps to achieve sustainable goals of the PMGSY Program and more broadly the entire rural roads program at the national level.

I. Sustainable Road Asset Management Infrastructure

Nearly 7.04 Lakh kms of roads have been constructed at a cost of nearly US\$36 bn. These are to be maintained to a given level of service to ensure all weather connectivity to rural population. Over a period, the usage of this network will grow resulting from rural development. This will result in increase in passenger and commercial vehicles. This increased traffic and especially commercial vehicles carrying goods will require increased road maintenance and periodic road strengthening. To meet these objectives, annual budgeting forecasts will be required both for maintenance and rehabilitation. Assessment of the road condition on a periodic basis, development of road deterioration models, improvement interventions will form the basis of budget needs, life cycle assessments, identification of road candidates requiring improvement resulting in overall maintenance of the network to an optimal standard.

Although, PMGSY construction contracts have a 5-year inbuilt mandatory maintenance requirement and E-Marg for maintenance management, an overall asset management system is required that will contain a bank of road condition data along with traffic pattern and road improvements which will inform decision makers of the road candidates that require attention based on priority ranking and lifecycle assessments. The existing system (OMMAS and E-Marg) will require to be upgraded to a complete asset management system for rural roads. For road condition assessment, advanced technologies such as Drone should be considered.

II. Institutional Framework and Governance Structure

Management structures and implementation procedures have been improved in the states under the PMGSY program. A single specialized nodal agency should be identified in each state which will be responsible for overall governance, policy, planning, and management of all rural roads (PMGSY as well as non-PMGSY network) in the state.

To effectively manage maintenance and rehabilitation of the rural road network, an institutional framework for effective management and delivery is required. Consideration should be given to a decentralized approach with technical units in the local government administration across different categories of routine, periodic and emergency maintenance works.

III. Capacity Building (Staff and Resources)

For a successful rural road asset management program, skilled staff in different areas such as road construction, maintenance, quality control, project management, contract management, computer-based literacy are required. There is a need to develop a capacity building framework based on: skills required in the organisation to meet its aims and objectives, current staff skills which will lead to gap analysis and identification of specific training needs. Approaches

could include State-wise training needs assessments including SRRDAs, contractors, engineers, training institutions and incorporate training of trainers; District Panchayats/PRI to enable them to undertake maintenance.

Assessment should be made of provision of computers and internet facilities to the staff for attending online training modules, meetings, and overall effective communication. Consideration should be given for such facilities to be extended to Local contractors. Cloud based e-learning management systems should be developed which should provide training modules/courses on basic mandatory and foundational aspects for rural roads and bridges, road safety and other specific programme features.

Consideration should be given to invest in research, development and manufacture of construction and maintenance equipment specially focused for the rural road sector with dedicated five to eight percent of annual programme budget. Partnership alliances with construction equipment manufacturers should be considered.

IV. Reclassification of Rural Roads

India has a vast rural road network that connects widely distributed villages and habitations. A review should be undertaken to assess the merits of reclassification of rural roads with reference to various parameters such as: road utility, terrain/topography, climatic conditions, traffic intensity, population coverage, prevailing socio-economic status. There may be merits in bringing them under one ambit of dedicated departments responsible for management of different categories of rural roads. This will also assist in consolidating planning, funding, and network asset management.

V. Road Safety

Over 60% of roads accidents occur on rural areas. There is a need for the development and implementation of an overall road safety plan. Emphasis be placed on identification of black spots, improvement in design strategies, road safety audits. Special attention be

given around approaches to villages and within villages. Provision of safe walking and bicycle paths especially around village and rural road interfaces. Use of solar lighting on roads around approaches to villages should be considered.

Specific Road Safety plans be developed to ensure safety is embedded across the entire project cycle. This will include road safety audits during planning phase, during construction; quality monitoring any traffic controls/deviations during construction and opening to traffic. Safety should also be embedded in and integrated in overall asset management life cycle of the entire road network.

VI. Sustainable and Resilient Construction

Under the PMGSY program, a few states have experimented using marginal materials, industrial waste, and low grade locally available materials as base/subbase course in rural road construction. Their performance in most cases is being monitored. There have been many instances where specified quality construction material is being carted long distances making the rural road construction costly. This usage in rural roads also competes with building construction sector, and state and national highway construction industry. The biggest challenge is to evolve from piloting to mainstreaming these at the network level which requires both demand and supply-side constraints to be addressed. Further, mapping of location and quantity of such materials on state-by-state basis will assist in planning for use of such materials in road construction and maintenance.

VII. Climate Change Adaptation Across the Project/Road Life Cycle

Impact of climate change on the rural road infrastructure such as frequency and intensity of rain, sudden changes in temperature will need focused attention on design, construction, maintenance, and reconstruction, not only in the project lifecycle but on the whole of the life cycle of the road.

VIII. Rural Routine Maintenance Management Group

The rural routine maintenance group has been very effective in local level routine maintenance of roads. A framework and an action plan be developed to foster such groups with a view to develop from micro enterprises into small to mid-level contractors.

IX. Rural Road Transport Policy: National Level

There is a need for a transport systems approach to design and develop a sustainable transport policy focused for rural roads network and services. This should include creation of a dependable public transport systems and services including provision of adequate bus services and regularisation of services to schools, and health care facilities. This is also likely to cut down on the number of cars on the rural roads thereby minimising carbon emission, reduction in road accidents and potential savings for residents. Development of a rural road transport policy can be undertaken at the national level and two models can be considered: a) encouraging entrepreneurship mode and b) a basic public bus services to complement inter-village, intra- village, and rural urban travel.

X. Reporting of National Rural Road Assets

There is a need to develop road asset data including road condition. This will support the development of measurable standards and outcomes for the road network and road spending. Therefore, at the national level the country will achieve greater value for money in road expenditure leading to efficient road transport outcomes for the community. This will also assist in testing sustainable new private investment mechanisms in road infrastructure.

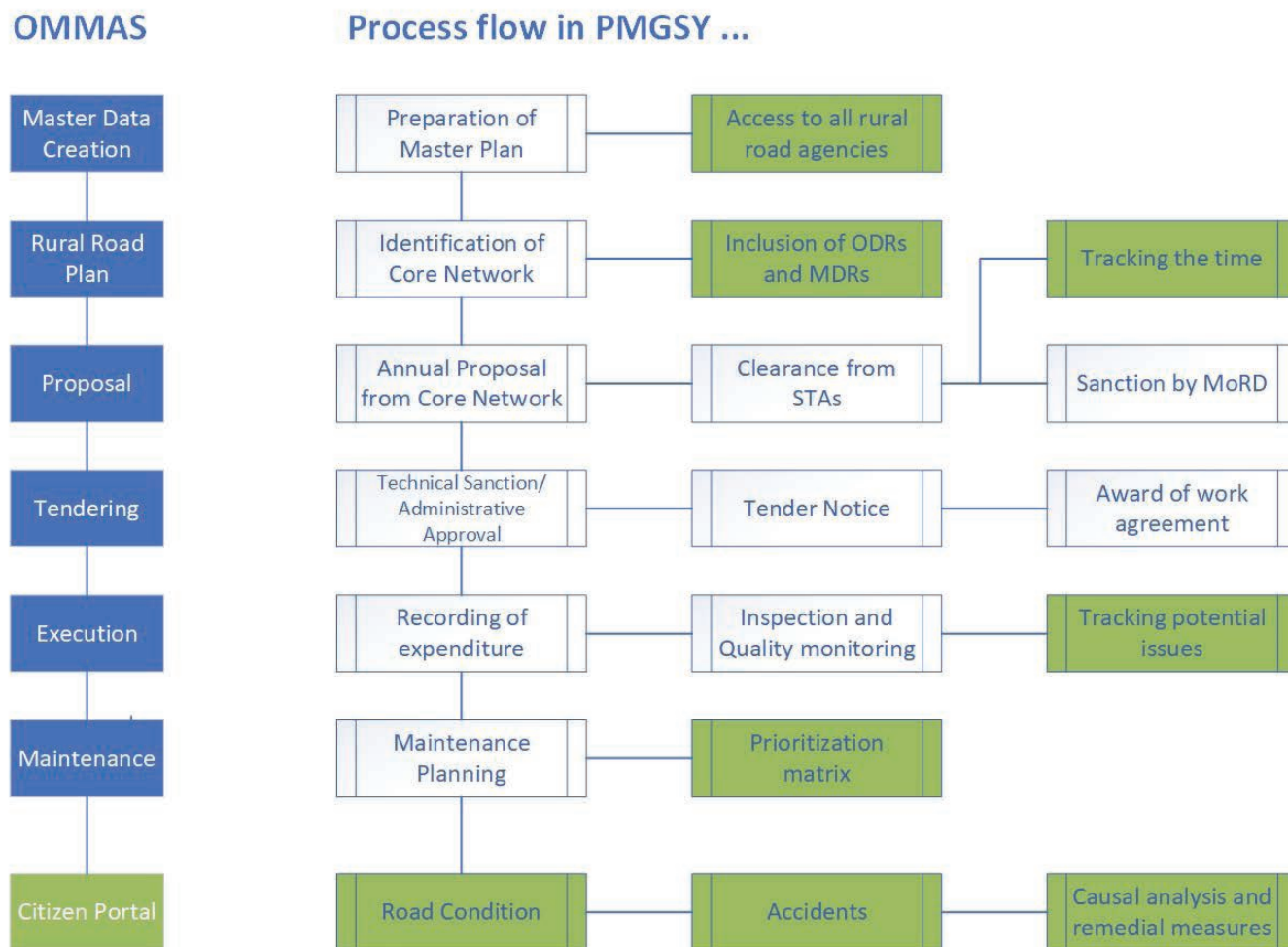
OMMAS should be expanded beyond PMGSY to be used as a National Rural Roads Portfolio Manager. It should include a full project cycle including payment to contractors. OMMAS can be an asset management tool as part of entire country plan. In addition to

local government roads, it can also include roads that are a shared responsibility between districts and states. The roles of the Road Portfolio Manager could include: independent high-level verification of asset management plans prepared by district/state governments and other road agencies; working with districts that are experiencing significant difficulty in their asset management systems to ensure they receive suitable engineering and other support with the development and implementation of their asset management plans; analysis of asset management plans to identify emerging trends; and providing advice to the central government on policy matters and on potential investment decisions. Figure 14 provides some additions (highlighted in green) that should be considered in addition to other factors after a thorough review.

XI. Agro-Logistics Infrastructure

The efficiency gains from the increased agricultural productivity are lost due to inefficient agro-logistics system. Improved rural infrastructure increases agricultural productivity by enhancing farmers' access to markets, inputs, credit, market information, and technology. Whereas, inefficient transport logistics infrastructure and services imply enormous (monetary and non-monetary) costs of production and marketing, and effectively wipe out much of the gains from sells, providing little incentive to farmers to increase outputs. Therefore, complementary investments are required in physical and digital agro-logistics infrastructure including focus attention on supply-chain connectivity and enabling policy, regulatory and institutional framework.

FIGURE 14: OMMAS proposed changes (highlighted with green)



XII. Small Scale Enterprises

PMGSY has provided road link-mobility. To get the advantage of this mobility and generate employment, steps can be taken to foster and facilitate labour intensive technologies specially for the unskilled villagers. Focus can be towards small-scale enterprises and assistance towards creating a favourable regulatory, legal and research environment and access to finance. Production can be in areas such as garments, leather-based goods, wood products.

XIII. Documentation of Lessons Learnt leading to Best Practices

Several states adopted different practices during planning, procurement, construction, and maintenance operations. A documentation of lessons learnt, including innovations, by each state both what worked well and what did not work will be a valuable source for future works. The documentation should also focus on issues in new technology adoption like contractor and PIU capacity to help identify challenges and usher in new development approach for rural roads.

The Pradhan Mantri Gram Sadak Yojana is perhaps among the most ambitious infrastructure projects in Indian history - and one that's more than just about building roads but about connecting people. Over the past decades, the program has upgraded its approach and aligned with the evolving needs of road users and their expectations.

As the program continues its journey in the next phase, it may need to expand its ambit and include other district roads linked with village roads within the program. The expansion will help users reap full advantages of schemes like One District One Product by providing enhanced connectivity and reducing the transportation costs associated with goods movement across the Indian hinterland. We believe that the transition will help the program continues its journey of connecting people and meeting the aspirations of road users not just in villages but across the country.



Latitude: 33.872386
Longitude: 75.190532
Elevation: 1940.2+25 mm
Accuracy: 12.0 m
Azimuth: 23° (NE)
Pitch: -1.7° (2.6°)
Time: 05-08-2022 15:53

References

- PMGSY, 2022; <http://omms.nic.in/>
- PMGSY II Guidelines, 2013
- World Bank, 2021, The Road to Opportunities in Rural India: The Economic and Social Impacts of PMGSY
- World Bank, 2021, <https://blogs.worldbank.org/transport/20-years-boosting-economic-opportunities-India-World-Bank-support-to-world-largest-rural-road-program>
- Asher and Novosad; 2020; Rural Roads and Local Economic Development
- Aggarwal, S; 2018; Do rural roads create pathways out of poverty? Evidence from India
- Asher and Novosad; 2020; Rural Roads and Local Economic Development
- Shamdasani 2021; Rural Road Infrastructure & Agricultural Production: Evidence from India
- Lendo and Nayak, 2021.
- Alka Upadhyay et al, 2022, Performance Assessment of Roads: An Innovation and Use of Emerging Technologies in Rural Roads Maintenance Management
- Performance Review – PMGSY (June 2019) (https://rural.nic.in/sites/default/files/PRC_PMGSY.pdf)
- ILO, https://www.ilo.org/wcmsp5/groups/public/-/asia/---ro-bangkok/---ilo-jakarta/documents/projectdocumentation/wcms_429567.pdf
- World Bank, 2014, ICR Review, <https://documents1.worldbank.org/curated/en/308311474487791162/pdf/000020051-20140626080343.pdf>
- World Bank, 2018, Transforming Paraguay's Road Maintenance Culture, <https://www.worldbank.org/en/results/2018/06/27/mantenimiento-vial-paraguay>
- ADB, 2022, Cambodia: Rural Roads Improvement Project II, <https://www.adb.org/projects/42334-014/main>
- Kenya Rural Roads Authority Strategic Plan, 2022, <https://www.kerra.go.ke/images/headers/KERRA-SP-2018-2022-Final.pdf>
- World Bank, Guinea Bissau-Rural Transport Project, <https://thedocs.worldbank.org/en/doc/637241579711672712-0050022020/original/PolicyBriefGuineaBissauRuralTransportProject.pdf>
- Jordaan and Mitchell, 2015, South African Experience, <http://onlinepubs.trb.org/Onlinepubs/conf/1995/cp6/v1/cp6v1-043.pdf>
- World Bank, 2002, Implementation Completion Report – Vietnam, documents1.worldbank.org/curated/en/767411468125680661/pdf/multi0page.pdf
- World Bank, 2020, Uganda: Building resilient and community-responsive road infrastructure, <https://blogs.worldbank.org/nasikiliza/uganda-building-resilient-and-community-responsive-road-infrastructure>



सत्यमेव जयते

Ministry of Rural Development
Government of India



Pradhan Mantri
Gram Sadak Yojana



THE WORLD BANK

IBRD • IDA | WORLD BANK GROUP