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IMPLEMENTATION COMPLETION AND RESULTS REPORT

(LOAN NUMBER 7995-IN)
(CREDIT NUMBERS 4848-IN & 4849-IN)
(LOAN NUMBER 8864-IN)

ON A

CREDIT

IN THE AMOUNT OF US$1,000 MILLION

AND A LOAN

IN THE AMOUNT OF US$1,000 MILLION

TO

India

FOR THE

PMGSY Rural Roads Project
March 15, 2022

Transport Global Practice
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective {September 27, 2021})

Currency Unit =	Indian Rupee (INR)
INR 74.35 =	US$1

FISCAL YEAR
April 1 – March 31

Regional Vice President:	Hartwig Schafer
Country Director:	Junaid Kamal Ahmad
Regional Director:	Guangzhe Chen
Practice Manager:	Shomik Raj Mehndiratta
Task Team Leader(s):	Reenu Aneja, Ashok Kumar
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ABBREVIATIONS AND ACRONYMS

AF	Additional Financing
AMS	Asset Management System
CAS	Country Assistance Strategy
C-DAC	Centre for Development of Advanced Computing
CPF	Country Partnership Framework
CRRI	Central Road Research Institute
COVID-19	Coronavirus Disease 2019
DRRP	District Rural Roads Plan
DLI	Disbursement-Linked Indicator
DLP	Defect Liability Period
DLR	Disbursement-Linked Result
DPR	Detailed Project Report
eMARG	electronic Maintenance of Rural Roads under PMGSY
GoI	Government of India
GDP	Gross Domestic Product
IAHE	Indian Academy of Highway Engineers
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IIT	Indian Institute of Technology
INR	Indian Rupee
IRC	Indian Roads Congress
LVR	Low Volume Road
PDO	Project Development Objective
MoRD	Ministry of Rural Development
NIT	National Institute of Technology
NQM	National Quality Monitor
NRIDA	National Rural Infrastructure Development Agency
NRRDA	National Rural Roads Development Agency
OMMAS	Online Management, Monitoring and Accounting System
P4R	Program for Results
PCI	Pavement Condition Index
PCMM	Procurement & Contract Management Manual
PISA	Poverty and Social Impact Analysis
PIU	Project Implementing Unit
PMGSY	Pradhan Mantri Gram Sadak Yojana
RRNMU	Rural Road Network Management Unit
RRP	Rural Roads Project
SDG	Sustainable Development Goal
SHG	Self Help Group
SQC	State Quality Coordinator
SQM	State Quality Monitor
SRRDA	State Rural Roads Development Agency
TA	Technical Assistance

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P124639	PMGSY Rural Roads Project
Country	**Financing Instrument**
India	Investment Project Financing
Original EA Category	**Revised EA Category**
Full Assessment (A)	Full Assessment (A)

Organizations

Borrower	Implementing Agency
Republic of India	National Rural Infrastructure Development Agency, Ministry of Rural Development

Project Development Objective (PDO)

Original PDO

The objective is to strengthen the systems and processes of the national PMGSY rural roads program for the expansion and maintenance of all-season rural access roads. The result will enhance the road connectivity to economic opportunities and social services for beneficiary communities in the participating states.

Revised PDO

The objective is to strengthen the systems and processes of the national PMGSY rural roads program for the expansion and maintenance of all-season rural accessroads. The result will enhance the road connectivity to economic opportunities and social services for beneficiary communities in the participating states.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
IDA-48480	379,400,000	279,399,877	246,577,908
IDA-48490	620,600,000	620,600,000	607,488,230
IBRD-79950	500,000,000	500,000,000	500,000,000
IBRD-88640	500,000,000	270,000,000	270,000,000
Total	**2,000,000,000**	**1,669,999,877**	**1,624,066,138**
Non-World Bank Financing			
Borrower/Recipient	0	0	0
Total	**0**	**0**	**0**
Total Project Cost	**2,000,000,000**	**1,669,999,877**	**1,624,066,139**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
20-Dec-2010	18-Feb-2011	18-Feb-2014	30-Nov-2015	15-Dec-2020

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
01-Dec-2013	350.64	Cancellation of Financing
20-Jan-2014	350.64	
03-Dec-2014	670.10	Change in Results Framework
04-Nov-2015	996.35	Change in Components and Cost Change in Loan Closing Date(s) Reallocation between Disbursement Categories
08-Jun-2016	1191.57	Change in Loan Closing Date(s)
29-Jun-2017	1352.82	Change in Loan Closing Date(s)
27-Oct-2017	1352.82	Change in Loan Closing Date(s)
12-Apr-2018	1352.82	Change in Loan Closing Date(s)
18-Jun-2018	1352.82	Additional Financing
23-Dec-2020	1497.49	Cancellation of Financing Reallocation between Disbursement Categories

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Moderately Satisfactory	Moderately Satisfactory	Modest

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	26-Jun-2011	Satisfactory	Satisfactory	150.00
02	01-Jan-2012	Satisfactory	Moderately Satisfactory	150.00
03	22-Dec-2012	Moderately Satisfactory	Moderately Unsatisfactory	150.00
04	16-May-2013	Moderately Satisfactory	Moderately Unsatisfactory	200.24
05	02-Aug-2013	Moderately Satisfactory	Moderately Satisfactory	350.24
06	07-Apr-2014	Moderately Satisfactory	Moderately Satisfactory	500.64
07	07-May-2014	Satisfactory	Moderately Satisfactory	500.64
08	30-Dec-2014	Satisfactory	Moderately Satisfactory	670.10

09	24-Jun-2015	Satisfactory	Satisfactory	996.35
10	22-Feb-2016	Satisfactory	Satisfactory	1102.47
11	15-Sep-2016	Satisfactory	Satisfactory	1338.79
12	18-Apr-2017	Satisfactory	Satisfactory	1338.79
13	06-Sep-2017	Highly Satisfactory	Satisfactory	1352.82
14	22-May-2018	Highly Satisfactory	Satisfactory	1352.82
15	28-Dec-2018	Highly Satisfactory	Satisfactory	1389.07
16	13-Jun-2019	Highly Satisfactory	Moderately Satisfactory	1403.50
17	13-Dec-2019	Moderately Satisfactory	Moderately Unsatisfactory	1415.32
18	25-Mar-2020	Moderately Unsatisfactory	Moderately Unsatisfactory	1440.73
19	30-Oct-2020	Moderately Unsatisfactory	Moderately Unsatisfactory	1474.33

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Transportation	**100**
Public Administration - Transportation	4
Rural and Inter-Urban Roads	96

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Private Sector Development	**100**
Jobs	100
Urban and Rural Development	**100**
Rural Development	100
Rural Infrastructure and service delivery	100

ADM STAFF		
Role	**At Approval**	**At ICR**
Regional Vice President:	Isabel M. Guerrero	Hartwig Schafer
Country Director:	N. Roberto Zagha	Junaid Kamal Ahmad
Director:	John Henry Stein	Guangzhe Chen
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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. During the period 1990 to 2010, India's economic growth rate had more than doubled from 1.9 percent during 1961-1990 to 4.6 percent in 1991-2008. Those employed in agriculture and living in rural areas had not benefited from the increased growth in the rest of the economy because of weaknesses in basic rural infrastructure; in particular, the poor condition of most parts of the existing rural road network limited socio-economic development. To address the gap in rural connectivity, the Government of India (GoI) launched the flagship Pradhan Mantri Gram Sadak Yojana (PMGSY) Program on December 25, 2000, to provide all-weather road access to all habitations with a population greater than 1,000. By 2010, the length of the new and improved rural road network under the program had reached 274,000 km and as a result 70,500 habitations had been connected.

2. The World Bank was engaged with the PMGSY program since its inception in 2000 and supported the Government initially through Technical Assistance (TA) activities that led to the development of key documents governing the Program[1]. The Rural Roads Project (RRP), approved in 2004 for an amount of US$400 million, was the first Bank project that supported PMGSY. By 2007-08, institutions/systems/practices developed under the RRP had been fully utilized by the Government. The PMGSY Rural Roads Project was conceptualized in 2010 for an amount of US$1.5 billion as the second in the series of World Bank-financed operations to support PMGSY. It built on previous experience in the sector and focused on improving the effectiveness of program delivery by strengthening systems and processes, and the sustainable management of the assets created. The project moved to a results-based approach by introducing Disbursement-Linked Indicators (DLIs) that included a mixture of intermediate outcomes, implementation performance or institutional change indicators, that build incrementally over the life of the project. This was also supplemented by an additional US$500 million through an Additional Financing (AF) operation to focus on emerging priorities such as road safety, climate resilience and green growth, asset management, and institutional capacity building.

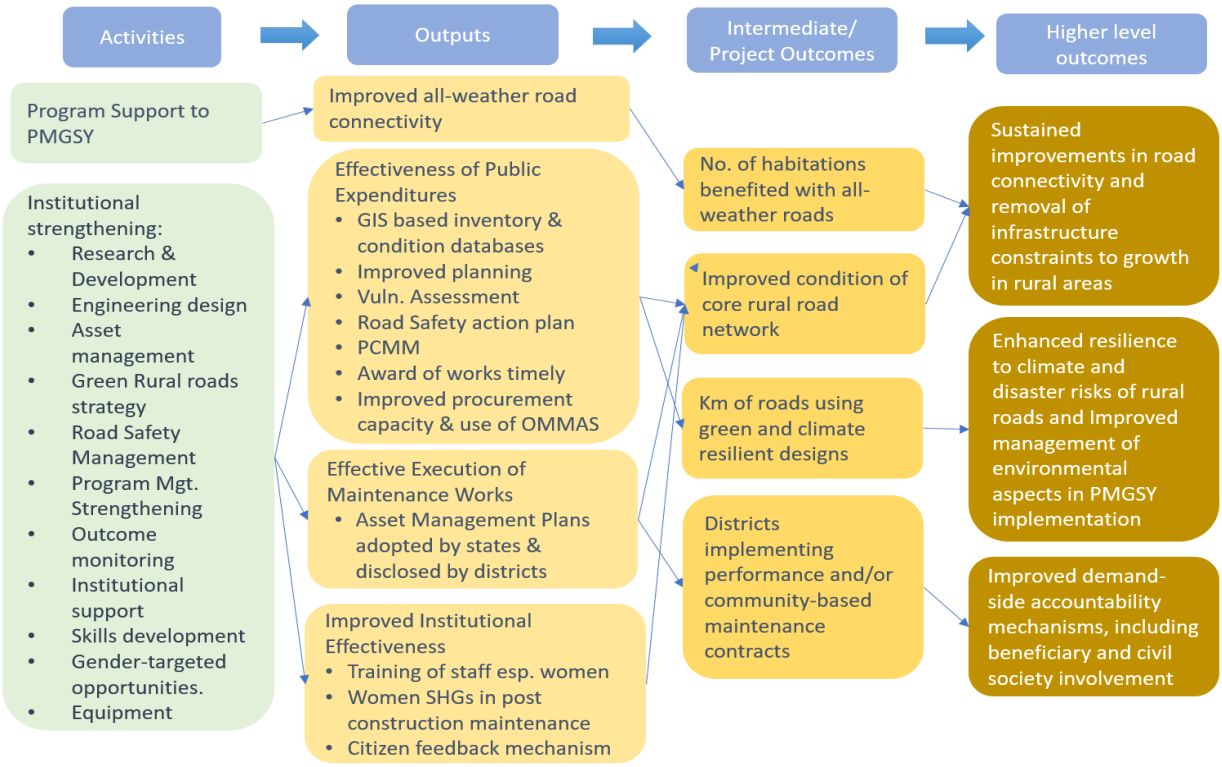
3. At appraisal, the project was deemed highly relevant to the priorities of GoI and the World Bank. The World Bank's India Country Assistance Strategy (CAS) FY09-122 aimed to support GoI's vision of connecting all of India's villages to all-weather roads, and help India achieve the long-term vision encapsulated in the plans of a country 'free of poverty and exclusion'. It was aligned with the first pillar of the CAS *Achieving rapid, inclusive growth*, which focused, among other areas, on removing infrastructure constraints to growth in rural areas. It would also support the second and third pillars of the CAS, i.e., *Ensuring development is sustainable* and *increasing the effectiveness of service delivery*, by focusing on improved management of environmental aspects in PMGSY implementation and enhancing the development effectiveness of public spending through improved demand-side accountability mechanisms, including beneficiary and civil society involvement.

Theory of Change (Results Chain)

4. Figure 1 provides the Theory of Change of the project that has been developed by the ICR team based on the PDO, the project description, and the results framework.

[1] The First book on Quality Control, Rural Roads Manual, the Operations Manual, and the Specification for Rural Roads.
[2] Country Strategy for The Republic of India for the period FY2009-2012, November 14, 2008, Report No. 46509-IN, International Bank for Reconstruction and Development, International Development Association, International Finance Corporation.

Figure 1: Theory of Change for the Project



Assumptions:
* The TA component is fully implemented.
* The Government adopts, trains, and uses maintenance techniques & other capacity building efforts.
* Good construction quality is achieved, and the constructed roads are adequately maintained, with sufficient investments in district road networks.
* Adequate interest on the part of Government and capacity to implement green & climate resilient designs.

Project Development Objectives (PDOs)

5. The objective of the Project was "to support the strengthening of the systems and processes of the Program for the expansion and maintenance of all-season rural access roads, resulting in enhanced road connectivity, and better economic opportunities and social services for beneficiary communities in the Participating States".

Key Expected Outcomes and Outcome Indicators

6. The key PDO indicators were formulated to measure the achievement of the PDO and are listed in table 1. The results under the program were formulated as a series of DLIs: (i) increasing the extent of habitation connectivity; (ii) improving the effectiveness of public expenditures through cost-effective and socially and environmentally responsible provision of all-weather access to habitations; and (iii) effective execution of maintenance works on the core rural roads network.

Table 1: Key PDO indicators under the Original Project

	PDO Indicators	Baseline	Target
1	Share of Rural Population with Access to an All-Season Road (Percentage)	67	72
2	Share of PMGSY rural roads with Pavement Condition Index (PCI) of 2.0≥ (Percentage)	12-80 in three states[3]	Average 55
3	Percentage reduction in travel time by beneficiaries	deleted at restructuring in 2014	

Original Components

7. The Project components are listed below:

(a) Component A: **PMGSY program financing (US$1,440 million):** civil works for the construction and rehabilitation of 24,000 km all-weather rural roads, and
(b) Component B: Institutional strengthening (US$60 million): supporting a technical assistance program designed to strengthen the capacity of relevant agencies to implement the program.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

Revised PDOs and Outcome Targets

8. The PDO was not revised during either the Additional Financing (AF) or during the multiple restructurings.

9. The PDO indicators and intermediate Disbursement-linked Indicators (DLI) indicators were modified twice, once through a restructuring in 2014 that aimed to improve the efficiency in the use of funds and to better align the reported expenditures and disbursements: one of the original PDO indicators was dropped, one was altered, while one left unchanged, and the DLIs were modified. In 2018, the PDO indicators were changed through the AF operation to reflect the modifications under the AF and to introduce additional outcome targets. The changes to the PDO indicators are summarized in Table 2.

Revised Components

10. The 2013 restructuring re-allocated about US$34 million from the TA component to the civil works component for better utilization of the overall loan/credit amount. It also entailed an allocation of US$1.36 million for payments to be made to the International Labor Organization (ILO); see the next section for further details.

11. The US$500 million AF in 2018 included US$150 million to meet a funding gap in the Project and US$350 million to introduce green and climate resilient construction in PMGSY, while widening the scope to tackle institutional, road safety, low carbon and climate resilience, gender-related matters, and other elements. In addition, the state of Tripura was added to the existing eight participating states. The list of new project activities added under the AF operation is given below. The AF also introduced Government counterpart funding of US$500 million.

[3] Rajasthan, Himachal Pradesh, and Uttar Pradesh, which had functioning road management systems.

Table 2: Changes in PDO indicators

	PDO Indicators	Baseline	Target	Comments
1	Share of rural population with access to an all-season road, percentage	67	72	Dropped. Indicator No. 6 below added instead
2	Improved condition of PMGSY roads (Network with Pavement Condition Index, PCI, >2, percentage)	50	68	Original target of 55 percent was increased under the AF
3	Percentage reduction in travel time by beneficiaries	N/A	N/A	Dropped in 2014
4	Improved effectiveness of public expenditure (Km of roads that used green and climate resilient designs)	0	2,000	Added under the AF
5	Improved asset management (no. of districts implementing performance / community-based maintenance contracts)	10	50	Added under the AF
6	No. of habitations benefitted with all-weather roads	0	2,000	Added under the AF

(a) Component A: PMGSY Program Financing (an additional US$970 million, including 50 percent counterpart funding)

(i) Sub-Component A1: Green and Climate Resilient Rural Roads. Civil works for the construction and/or rehabilitation/ improvement of about 5,500 km of priority rural roads and standalone bridges in nine states[4], as well as engineering features and new technologies for about 2,000 km of roads.

(ii) Sub-Component A2: Pilot Projects to Introduce New Technologies. Pilot projects to demonstrate the use of green and climate-resilient road designs, innovative bridges, new technologies and retrofitting road safety and climate-resilient measures in pilot sections for the rehabilitation of about 1,500 km of existing roads.

(iii) Sub-Component A3: Civil works for construction/ rehabilitation of about 4,000 km of rural roads and bridges under the Original Project in the eight participating states.

(b) Component B: Institutional Strengthening (an additional US$30 million, including 50 percent counterpart funding)

(i) Modifications to Sub-Component B1 (new numbering under AF): Asset management, Sub-Component B3: Skills development and gender-targeted opportunities, Sub-Component B5: Program Management Strengthening, Sub-Component B6: Research and development, Sub-Component B7: Outcome monitoring, and Sub-Component B9: Engineering design, project management and implementation[5].

(ii) Additions of Sub-Component B2: Green and climate-resilient rural roads strategy, Sub-Component B4: Road safety management, and Sub-Component B8: Rural transport services and agriculture supply chain[6].

Other Changes

12. As indicated in the Data Sheet, the Project was restructured nine times, including the approval of the AF, and the closing date was extended for a cumulative 31 months. Changes to the DLIs are shown in Table 3. Also, the project

[4] Bihar, Jharkhand, Meghalaya, Uttar Pradesh, Himachal Pradesh, Punjab, Uttarakhand, Rajasthan, and Tripura.
[5] Modified compared to the original Project scope.
[6] New component added as part of the AF.

was restructured in December 2020 to allow for the share of Bank financing to be retroactively increased from 50 to 100 percent, along with a cancellation of US$230 million from the loan; these changes enabled the Bank loan to be almost fully utilized.

Table 3: Changes in DLIs under the AF operation

DLI	Results Indicator	Changes introduced under AF operation
DLI 1	Extent of habitation connectivity achieved	Retained, but both description and target values were modified as part of the AF.
DLI 2	Effectiveness of public expenditures	Retained, but with 6 new units of measures identical to reflect new AF sub-components (see the *Revised component* section of this report).
DLI 3	Percentage of improved network under maintenance contracts	Retained but with new description and units of measures that include i) Asset Management Plans, ii) Planned maintenance Contracting and iii) Public disclosure of annual maintenance plans
DLI 4	Improved Institutional Effectiveness	New DLI introduced and includes two units of measures i) Staff accredited after Training and ii) Public Disclosure of Annual Performance Reports in OMMAS

Rationale for Changes and Their Implication on the Original Theory of Change

13. The first restructuring in December 2013 included the cancellation of US$100 million of the IDA credit to provide funds to the state of Uttarakhand for a disaster emergency response project. As indicated earlier, the AF met a funding gap in the Project, introduced green and climate resilient construction, and widened the scope. The changes in December 2020 enabled Bank financing to be almost fully utilized. The closing date extensions were required to complete the implementation of key institutional development activities and ongoing civil works. None of the changes introduced during project implementation affected the original theory of change.

II. OUTCOME

A. RELEVANCE OF PDOs

14. The Bank's Systematic Country Diagnostic (SCD) for India 2018 had identified improving connectivity as a priority and considered improving rural connectivity to be important to take people to opportunities. It stressed that adequate all-weather rural connectivity could lead to higher incomes, more occupational choices, foster female entrepreneurship, and improve educational and health outcomes. At completion, the project was aligned with the World Bank Group's (WBG's) Country Partnership Framework (CPF) for India FY18-22[7]. The PDO contributes directly to the first two focus areas of the CPF and indirectly to the third: *promoting more resource-efficient, inclusive, and diversified growth in the rural sector; improving connectivity and logistics;* and *investing in human capital*. The CPF notes that programs such as the PMGSY Rural Roads Program provide a platform for policy dialogue and innovation. PMGSY was one of the key programs of the GoI's Tenth (2002-07), Eleventh (2007-12) and Twelfth (2007-12) Five Year Plans in the transport sector. The AF (2018) continued to support GoI priorities of doubling farmers' incomes and contributing to attainment of relevant Sustainable Development Goals (SDGs).

15. The MoRD in its vision document (2019-24)[8] notes the gains made in terms of habitation connectivity, while stressing

[7] Country Partnership Framework for India for the Period FY18–22, July 25, 2018, Report No. 126667-IN, International Bank for Reconstruction and Development, International Finance Corporation, Multilateral Investment Guarantee Agency.
[8] https://rural.nic.in/sites/default/files/Vision_Document_2019_2024.pdf

the need to connect to all populations of size 250+, consolidate and upgrade (as part of PMGSY III) to improve connectivity of villages to markets, schools, and hospitals, and to work with states in order to build robust maintenance policies and dedicated funds for maintenance. Similarly, the 2018-22 vision laid out by NITI Aayog, the policy think-tank of the Government of India ("Strategy for New India@75", November 2018)[9] recognizes the PMGSY Program's efforts at accelerating the pace of connecting habitations and stresses the importance of transforming the rural economy through the creation of modern rural infrastructure and an integrated value chain system.

Assessment of Relevance of PDOs and Rating

16. Based on the above discussion, the relevance of the PDO to the current CPF and the GoI's current priorities is rated **High**.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

17. **Approach to Assessing Efficacy**. The phrasing of the PDO *to support the strengthening of the systems and processes of the Program for the expansion and maintenance of all-season rural access roads, resulting in enhanced road connectivity, and better economic opportunities and social services for beneficiary communities in the Participating States*, is complex. The efficacy of the project is being assessed primarily in terms of its immediate impact, i.e., enhanced road connectivity, and to a more limited extent towards the medium-term objective of providing better economic opportunities and social services for the beneficiary communities in the participating states. The former outcome is assessed primarily through indicators in the Results Framework, while the latter outcome is assessed through the findings of the various impact assessments of PMGSY carried out during the implementation of the project. Strengthening of systems and processes of the Program for the expansion and maintenance of all-season rural access roads contributes to the achievement on enhanced road connectivity and is discussed under the assessment of that outcome.

18. **Enhanced Road Connectivity**. The project aimed to increase the share of the rural population with access to all-season road. It constructed/ rehabilitated 48,000 km of roads in eight states and connected a total of 19,000 habitations by all-weather[10] roads (as of August 2021)[11]. The share of PMGSY rural roads with Pavement Condition Index (PCI) level of > 2 stood at 87%, compared to a target of 55%. The table below summarizes the extent of achievement of the two PDO level indicators to assess enhanced road connectivity.

[9] https://www.niti.gov.in/sites/default/files/2019-01/Strategy_for_New_India_2.pdf
[10] In total the PMGSY program (including the World Bank-financed projects) has connected 171,000 habitations, with a total length of 661,135 km of constructed/ rehabilitated roads. Out of these the total Bank financing contributed (through three operations) to connecting a total of 19,000 habitations and constructing/ rehabilitating 48,000 km of roads.
[11] Date of the latest generated data for the project (after project close).

Table 4: Achievement of PDO indicators

	PDO Indicators	Target	Achievement	Extent of achievement
1	Condition of PMGSY roads (Network with Pavement Condition Index PCI>2)	68%	87%	Exceeded
2	No. of habitations benefitted with all-weather roads	2,000	2,387[12]	Exceeded

19. **Strengthening of systems and processes of the Program for the expansion and maintenance of all-season rural access roads.** The project aimed to support the national and state-level systems of PMGSY to better support the expansion and maintenance of all-season rural road access through the institutional strengthening component, which targeted the improvement of the Program's policies, institutions, systems, and implementation mechanisms. Activities in this regard included: use of green and climate resilient designs on selected roads; improved asset management; improving the effectiveness of public expenditure; and improved institutional effectiveness. These are discussed below.

20. **Use of green and climate resilient designs and new technologies.** The Project supported the Government in the delivery of greener rural road infrastructure through pilot projects. The PDO indicator "Improved effectiveness of public expenditure - *Km of roads used green and climate resilient designs"* was used to assess the achievement of the pilot projects by measuring the length of roads constructed/rehabilitated using "Environmentally-optimized Design Guidelines for Low Volume Roads" (adopted by The National Rural Roads Development Agency, NRRDA)[13], the new design approaches introduced under Indian Roads Congress Guidelines IRC SP72 (issued in 2015), and the new technology Guidelines of PMGSY. The length of roads completed under the project using green and climate resilient designs and new technologies was 3,410 km, significantly exceeding the target of 2,000 km.

21. **Improved asset management.** Technical assistance under the project helped 19 states to establish road maintenance policies, and to prepare a generic framework for developing similar Asset Management Plans (AMPs). About 8,000 field officers received training in maintenance management under the original project. NRIDA also prepared a guidance note to assist the states to strengthen the financing framework for the maintenance of rural roads by mobilizing additional non-budgetary resources. Pilots to improve the sustainability of rural infrastructure through the introduction of the use of performance and/or community-based maintenance contracts in 14 states as part of the original project and were further scaled up under the AF. In addition, under the AF, NRIDA implemented "MARG" (an e-governance solution for maintenance of rural roads constructed under PMGSY) nation-wide to manage and monitor the maintenance of the rural roads network to ensure its serviceability through performance-based maintenance contracts and the status of day-to-day operations. At project completion, achievement under the indicator *the number of districts implementing performance and/or community-based maintenance contracts* reached 103, against a target of 50 districts.

22. **Effectiveness of Public Expenditure.** The project supported the overall governance for rural roads delivery by: (i) establishing an inventory database; (ii) operationalizing & capacitating GIS Cells in States; (iii) improving road safety management; and (iv) improving project management. The road and bridge inventory for 637 districts across the country where PMGSY works are being implemented have been prepared by on-site capturing of minimum 14

[12] It is to be noted that this target is the modified one introduced as part of the AF operation. It builds on what has been targeted under the parent operation, which was overachieved by the time of AF approval. Under the parent project 50,420 habitations were connected (against a target of 39,000).
[13] Now renamed National Rural Infrastructure Development Agency (NRIDA)

specific attribute layers of data and updating the same on Geospatial Rural Road Information System (GRRIS). However, the videography and few specific attributes like pavement thickness, composition etc. of the assets created under PMGSY with World Bank assistance have not been captured on GIS platform yet. The Government is planning to complete these activities using its own funds and thus significantly exceed the target of 20 districts with a comprehensive data base. Vulnerability assessments, that were to be conducted under the project by NRIDA for 5000 km of road sections, will now be conducted post-project, as there were no responsive bidders during the project period.

23. **Improved Institutional Effectiveness.** The project supported the training of Government officials, enhancing gender-based capacities, and the development of an effective citizen feedback mechanism. About 40,000 field officers were trained and several attended international study tours. Project personnel were especially sensitized on including women and those from marginalized and vulnerable communities, and on complying with social and environmental safeguards, ensuring road safety, and redressing grievances, and on the special measures needed for constructing roads in ecologically sensitive areas. Training on environmental, resettlement, and social issues helped in changing the outlook of people working on the program. The project, especially the AF, laid special emphasis on providing training to women engineers and contractors. Maintenance contracts were awarded to 35 female Self-Help Groups (SHGs), benefiting 700 women; the overall target of 2,000 is expected to be met post-project. A total of 10,600 acceptable[14] feedback messages were received through a mobile application (Meri Sadak), in addition to more traditional means such as e-mail and post, of which 90 percent were responded to, exceeding the target of 85 percent. To strengthen digital infrastructure, NRIDA has provided "Video Conferencing equipment/devices in 22 states for 518 Project Implementation Unit (PIU) offices, which proved to be extremely useful as per current trends due to the COVID-19 pandemic and ensured day-to-day interaction with the ground level implementation staff.

24. **Road Safety Management.** The project has incorporated road safety engineering measures in the designs of rural roads. A road safety manual was issued for the use of rural road engineers. In addition, a field guide for road safety inspections was prepared to retrofit road safety engineering measures in existing rural roads. Training material on road safety was prepared for rural road engineers. Meghalaya, Madhya Pradesh, Odisha, and Chhattisgarh have prepared Road Safety Action Plans (against the target of 10 states), while some others are currently preparing their respective plans.

25. **Environmental and Social Aspects.** The Environmental and Social Management Framework (ESMF) and the Environmental Codes of Practice (ECOPs) developed under the Project have been mainstreamed in the design and construction of both project roads and other PMGSY roads. The ESMF has been included in the PMGSY operations manual; environment, health, and safety provisions have been included in the Technical Specifications for Rural Roads (Red Book); and a standardized Environmental Management Plan (EMP) for managing construction stage impacts has been integrated in the Model/Standard Bid Document. Over 8,000 engineers in the participating states were trained in the ESMF.

26. **Strengthening Program Management.** Key and central program documents and tools were developed/improved, including the Detailed Project Report (DPR) Manual; the Online Management, Monitoring and Accounting System (OMMAS); the e-procurement system; and Procurement & Contract Management Manual. These helped in mainstreaming the overall operations, technical design, quality control and accounting, and safeguard provisions in

[14] The received feedback had to go through a filtering process to identify "acceptable" feedback, which were then processed further.

PMGSY. The use of OMMAS ensured greater transparency and use of real-time information at national, state, and district levels, and allowed managers to better plan and implement the work. It also enabled the collection of crucial data on vulnerable populations in a disaggregated manner. The system, including the manuals/guidelines, also evolved and matured over different phases of the PMGSY program and has now, along with these documents, been mainstreamed within the PMGSY program

27. **Better Economic Opportunities and Social Services for Beneficiary Communities.** Over the medium to long-term, improved rural connectivity is expected to lead to better economic opportunities and social services for beneficiary communities in the participating states. As such, no specific indicators were included in the project to measure and assess their achievement. However, during project implementation, impact assessments/evaluations and thematic studies were conducted by the Bank and other entities to assess the impacts of the program on socio-economic development. The studies, which also differentiate the impact by state and state type, are listed in Annex 7, and their key findings are summarized there.

28. Multiple studies have shown that rural roads, in particular those under PMGSY, have had positive impacts not only on poverty, but on many other socio-economic and human development indicators, and on almost all of the Sustainable Development Goals (SDGs).[15] These studies observed growth in small industries and businesses, and even an incremental shift out of agriculture and into non-farm labor. Some of the studies observed a trend towards urbanization in the immediate area where rural road connectivity improved.

29. A World Bank study on the economic and social impacts of PMGSY (2021)[16] documents the following major positive impacts: (i) PMGSY improved accessibility, particularly in hilly areas, and as a result people in hilly areas made more trips to work per week; (ii) PMGSY increased access to economic opportunities, triggering a change in the structure of employment in rural India from farm to non-farm employment, particularly non-farm employment outside the habitation; (iii) PMGSY improved farm-to-market connectivity, with PMGSY roads yielding an eight percent increase in the share of crops transported to markets for sale, a tripling over levels observed before PMGSY roads were built, but with limited impact on farming practices; and (iv) PMGSY roads had a positive impact on human capital formation in rural India, with boys and girls benefiting equally. Another recent paper[17] on PMGSY impacts on agricultural production (2021) provides evidence of the effects of improvements in transport infrastructure on production decisions in agriculture in remote villages in rural India, and found that the provision of hard-topped, all-weather roads led to *crop diversification, modernization of cultivation practices through the adoption of improved inputs and technologies, increased the hiring of labor, and the commercialization of farm output.*

Justification of Overall Efficacy Rating

30. The PMGSY program brought in a new paradigm of strong engineering, several technical and institutional innovations, including the incorporation of maintenance practices, and “good governance” in rural roads, setting as it were, a “gold standard” in the way centrally sponsored schemes are run in India. The project has achieved its short-term outcome of enhancing road connectivity in rural areas through infrastructure investments. The project’s contribution to strengthening the systems and processes of PMGSY for the expansion and maintenance of all-season

[15] Rural Roads and the SDGs, S. Vijay Kumar, The Energy and Resources Institute (TERI), April 2019
[16] The Road to Opportunities in Rural India: The Economic and Social Impacts of PMGSY, Matias Herrera Dappe, Muneeza Mehmood Alam, and Luis Andres, Mobility and Transport Connectivity Series, The World Bank Group, 2021.
[17] Rural Road Infrastructure & Agricultural Production: Evidence from India, Yogita Shamdasani, National University of Singapore (NUS), April 2021.

rural access roads is important not only for the short-term outcome but also for the medium-term effectiveness and efficiency of the rural road network. Given the medium-term nature of the outcome of better economic opportunities and social services for beneficiary communities, its achievement can only be extrapolated from the impact assessment studies of PMGSY conducted during the life of the project. These assessments indicate that the project will contribute to the achievement of this outcome. The overall efficacy of the project is therefore rated **Substantial**. The delivery of the ICRR was delayed by nine months to fully reflect the achievements of the project. The significant improvement in the pace of implementation after the operation closed has been captured in this ICR and has contributed to the overall efficacy rating[18].

C. EFFICIENCY

Assessment of Efficiency and Rating

31. At project closing an economic analysis was carried out on typical road sections ranging from 3.06 km (Uttar Pradesh) to 8.39 km (Uttarakhand), with the average being 3.67 km, and representative of the project PMGSY roads in the participating states using the same methodology used at appraisal. Table 5 below provides a comparison of the economic internal rates of return under the parent project and the AF at completion with the appraisal estimates. Annex 4 contains the details of the economic analysis.

32. **Design efficiency.** As discussed in the section on Efficacy, the PDO could have been better formulated**.** The parent project was appropriately designed with an investment component and a substantial institutional strengthening component that took the wider program governance requirements into consideration. Project costs were estimated based on prices experienced in the wider program. The design took into consideration the large geographical spread of the project and the large number of contracts involved. It adopted a results-based approach and allowed flexibility for improving and optimizing the design of individual roads through a national and state-level mainstreamed system (design prepared during project implementation following established design standards). The design of the AF operation was based largely on lessons learned during the implementation of the original project. It also took into consideration emerging development challenges such as road safety and climate change. The original DLIs were modified under the AF and a new DLI was added. The RF required modification during project implementation. In retrospect, the project should have been designed for a longer implementation period.

Table 5: Comparison of Economic Analysis Results

Details	Processing Stage (EIRR)	Completion Stage (EIRR)
PMGSY Rural Roads Project (2010 prices)	12.2%[a]	16.5%
PMGSY Rural Roads Project - Additional Financing (2018 prices)	22.3%[b]	21.7%

EIRR = Economic internal rate of return
Note: a. PMGSY Rural Roads Project PAD, 2010. b. PMGSY Rural Roads Project Paper, 2018

33. **Implementation efficiency.** The project required the loan closing date to be extended by a cumulative 31 months

[18] This rating is an improvement compared to the PDO rating in the project's final ISR (was Moderately Unsatisfactory). This is considered justifiable noting that i) the final restructuring (to effect frontloading of funds) of the project took place after the issuing of the final ISR, and ii) considerable progress was made in the project's activities after project close. It is to be noted that AF aimed to provide, amongst others, assistance to states that lack in capacity in preparation for PMGSY Phase-III (PMGSY-III) but PMGSY-III was approved by GoI on 10th July 2019 which is 14 months after the effective start of World Bank loan. Other unforeseen factors like general elections and COVID-19 adversely affected the planning and implementation of the project. The ministry had also sought extension of the project tenure to satisfactorily complete the objectives of the loan.

as explained in the section on *Key factors during implementation*. The COVID-19 pandemic negatively impacted the ability of states and contractors to implement the different contracts. The negative impacts of these delays on the economic viability of the project were offset by the final lower project costs as demonstrated by the results of the economic analysis. The timeline for implementing the activities under the AF operation was not sufficient (more details can be found in the *Key factors during project implementation* section). To address the issue, a restructuring was carried out in December 2020 to cancel funds under the AF loan and to frontload the remaining balance while increasing the Bank financing share (see section B of this report).

34. The project was implemented in compliance with Bank fiduciary and safeguard policies; see Section IV B. The AF operation and the restructuring exercises conducted under the project, particularly the DLI restructuring, loan cancellations and frontloading approval were proactive measures that contributed positively to the overall efficiency of implementation.

35. **Rating of Efficiency**. Based on the above discussion of economic, design, and implementation efficiencies, the overall efficiency of the project is rated **Modest.**

D. JUSTIFICATION OF OVERALL OUTCOME RATING

36. Given the rating of High, Substantial, and Modest respectively for Relevance, Efficacy, and Efficiency, the overall outcome of the project is rated **Moderately Satisfactory**.

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

37. The project supported women at three levels by reducing the transport burden faced by them: (i) improving access to economic opportunities; (ii) improving access to social services (schooling for girls and health care for women); and (iii) creating job opportunities during construction and maintenance. Uttarakhand state successfully piloted the use of female SHGs for off-carriageway maintenance contracts. This is being replicated in other states, e.g., Meghalaya, Himachal Pradesh, and Madhya Pradesh. Maintenance contracts were awarded to 35 female SHGs, benefiting 700 women, and this number will continue to increase. Project personnel were sensitized on gender aspects for increased inclusion of women**.** The project also provided training to female engineers and contractors.

Institutional Strengthening

38. The project's contribution to institutional strengthening is discussed in the section on Efficacy under *Strengthening of systems and processes of the Program for the expansion and maintenance of all-season rural access roads*. Of particular importance are: the use of the web-based OMMAS portal by all states as a regular tool for monitoring and management; mapping of all roads (including rural roads) by all states on the GIS based District Rural Road Plan (DRRP); adoption of MARG for maintenance management and the use of the Rural Roads Operations Manual, which integrates social and environmental safeguards, in the entire PMGSY program; the development of a Human Resources Professional Development Strategy/Training Framework for the Road Industry; and training of about 40,000 field engineers on a range of relevant topics.

Mobilizing Private Sector Financing

39. Due to the nature of the program (development of low-traffic rural roads), there was limited scope for utilizing private sector financing. However, most of the project civil works were carried out by small and mid-sized local contractors, which contributed to the development of contractors' capacities, improving industry standards, and the development of local markets for natural and environment friendly construction materials.

Poverty Reduction and Shared Prosperity

40. As discussed in the Efficacy section, PMGSY increased the rural population's access to economic opportunities, and triggered an incremental change in the structure of employment in rural areas from farm to non-farm employment, particularly non-farm employment outside the habitation. The program (and the project) had a positive impact on the development of human capital in rural India, with boys and girls benefiting equally in terms of education and health.

Other Unintended Outcomes and Impacts

41. The PMGSY program contributed to India's efforts to achieve the United Nations' SDGs, including, but not limited to, the "no poverty", "quality education", and "good health and well-being" SDGs. A more detailed analysis can be found in the discussion paper "*Rural Roads and the SDGs*"[19]. Also, and as discussed in the Efficacy section, the project contributed to mainstreaming new technologies and techniques in the construction of rural roads, which are now being widely applied. It also contributed to mainstreaming road safety concepts in rural roads.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

42. **Simple overall design**. The project had a simple design with clearly structured components, which was well suited to its wide geographical scope and large size. As discussed earlier under Efficacy, the PDO included both immediate attributable outcomes (enhancing road connectivity) as well as medium to long-term outcomes that are difficult to measure and attribute to the project.

43. **Delivering at scale**. The project, through its scale (number of habitations targeted, number of states, and size of funding), supported a transformational rural connectivity program. Several factors underpinned the success of delivering a Program at such a scale, including the adoption of a network-wide approach at the planning, implementation and supervision levels, as well as a centralized model at the strategic level to a decentralized approach at the implementation level. It was anchored to good set of processes, standards, and manuals.

44. **Results Framework**. The Results Framework had a logical flow from outputs to outcomes and ultimately the PDO element on connectivity. The indicator targets were appropriate and in line with the wider program ambitions and were population/habitation focused but within a framework applied uniformly across the country. However, the RF neither included an indicator for the medium-term element of the PDO on better economic opportunities and social services for beneficiary communities or beneficiary surveys to assess the project impact in these areas.

[19] Discussion Paper on Rural Roads and the SDGs, Mr. S. Vijay Kumar, TERI, April 2019.

45. **Use of Country Systems**. The project adopted the use of country systems for procurement and financial management, with some modifications to make them appropriate for a Bank financed project.

46. **Disbursement Linked Indicators**. The parent project adopted a three DLIs (with several sub-DLIs) for the entire loan amount. This was increased to four under the AF. The DLIs and the corresponding unit measures could have been streamlined at the time of the AF**.** More details on this are discussed in the following section.

47. **Stakeholder Consultations**. Stakeholder consultations were held at block/district levels prior to the initial selection of each road; with local communities along road alignments during the transect walk; the village community was included as part of design preparation. To ensure clarity for the target populations, simplified documentation and forms were used. In addition, citizens were involved during the construction stage to provide feedback on the program. Citizen information boards are provided on all PMGSY Roads. The quality monitors mandatorily seek feedback from the local communities, including women, and their inspection reports are available to the public through OMMAS. Citizens can also report to the implementing agencies on construction quality issues and road conditions using the mobile based application “Meri-Sadak”.

48. **Implementation Arrangements**. The project’s implementation arrangements were clear and sound, with MoRD responsible for overall implementation, supported by the NRIDA at the center and various State Rural Roads Development Agencies (SRRDAs) at the state level. The project's Operation Manual and PMGSY Guidelines clearly defined the consultation process, the selection criteria for roads, the flow of funds, certification of completed works, three tier quality assurance system, and the integration of all such data on OMMAS.

49. **Readiness for Implementation**. As a follow-on project within a larger program that was already under implementation, the project had a high level of readiness for implementation after Board approval.

B. KEY FACTORS DURING IMPLEMENTATION

50. **Implementation Capacity Differences between States**. Implementation efficiency varied quite widely between states due to their different capacities. States such as Jharkhand and Meghalaya needed extra support from NRIDA and Bank teams, e.g., mission workshops that facilitated state to state peer learning.

51. **Mid-Term Review**. The January 2014 mid-term review identified the need to improve asset management/maintenance practices and environmental and social safeguards management, as well as the need to revise project outcome indicators, restructure DLIs, and modify disbursement arrangements to improve efficiency in the use of funds and better align reported expenditures and disbursements. Other issues identified included: delays in works in remote locations; non-availability of aggregates; low contracting capacity; land disputes and forest clearance issues; and capacity issues in certain states.

52. **Procurement Delays**. During the initial years of implementation, there were delays in the procurement of civil works and uneven procurement of project management consultants by states, as well as slow procurement of the critically important project audit consultants. These issues were addressed through proactive Bank follow-up with the project agencies.

53. **Exogenous factors.** Project implementation was affected by serval exogenous factors like delay in approval of Phase-III of PMGSY (PMGSY-III), general elections of 2019 and State elections of Jharkhand and Rajasthan (large states) and

pandemic impact from 2019.

54. **Restructurings and AF**. As indicated in the Data Sheet and discussed in the section on *Significant Changes during Implementation*, the project was restructured nine times, including an AF, to address challenges encountered during implementation (including those highlighted during the MTR), as well as to provide additional support. The principal changes included changes to the RF and DLIs; activities under the two project components; cancellations and reallocations; and the closing date. The AF had an implementation period that was found to be inadequate to implement the targeted civil works due to the various issues discussed earlier (low-capacity environment and difficult hilly terrain, introducing new concepts such as climate resilient designs, and procurement challenges). The impact of limited time was further aggravated due to enforcement of the code of conduct prior to the national and state elections, unusually prolonged heavy rains and floods in many states, and the COVID-19 pandemic led lockdown and stoppage of work, which were further aggravated by shortages of labor and material.

55. **DLIs**: The inability to meet DLIs was one of the reasons for slow disbursements in initial years. The DLI matrix could have been somewhat clearer and more flexible to account for unforeseen challenges. For example, clear weightage could have been given in case habitations had been connected physically by all-weather roads but could not be utilized fully due to different reasons (e.g. safety concerns and incomplete features) and also cases where staff accreditation training (under institutional strengthening) were completed for only one module instead of two (due to COVID-19 situation). The formal restructuring of the DLIs in December 2014 attempted to address this concern.

56. **Program Evaluation**. The project was supported by an assessment of the wider program, which identified several areas for improvement that were reflected in the AF operation (refer to the section on *Rationale for Changes and Their Implication on the Original Theory of Change*).

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

57. As discussed in the Efficacy section and under *Key Factors during Project Preparation*, the PDO was complex, and included measurable short-term outcomes (i.e., connectivity) as well as medium-term outcomes that are difficult to measure and attribute to the project. The PDO indicators were designed to measure the connectivity element of the PDO but did not include indicators to measure the outcome “better economic opportunities and social services for beneficiary communities”. The baselines for the indicators were clear and the project verification audits clearly defined the methodology for data collection and analysis, as well as reporting responsibilities and timelines. The reporting media included the OMMAS and progress reports. As discussed in the section on *Changes during Implementation*, changes were made to the RF, including the DLIs, as part of the restructurings and AF to streamline some of the indicators and improve disbursements.

58. The overall design of DLIs was sound, with clearly defined and measurable disbursement-linked results (DLRs). The DLI matrix for the original operation could have been more flexible to account for unforeseen or rapid changes in external circumstances. The restructuring of the DLIs in December 2014 attempted to address this concern and accounted for the downward revision in the credit/loan.

59. The OMMAS contained detailed information on core network parameters, the projects funded under the PMGSY and

the status of their procurement, physical and financial progress, and other indicators. It provided the basis for monitoring the results of the project. The Project Implementation Units (PIUs) regularly entered key physical progress, financial and other data in the OMMAS, and the status of progress of work as well as quality monitoring reports were available in the public domain. In addition, independent project performance audit (PPA) consultants undertook detailed audits of about ten percent of PMGSY contracts in each participating state on a semi-annual basis to monitor the overall implementation of the PMGSY framework and the agreed procedures under the project. Monitoring arrangements under the original project continued under the AF.

M&E Implementation

60. Overall, the project M&E system was implemented as designed. Reports were produced timely and contained reliable and accurate data. The M&E system used sound methodology and quality control. The PPA consultant submitted regular, six-monthly performance audit reports. Under the AF, verification was conducted by a selected panel of National Quality Monitors (NQMs). Data on the indicators measuring access, extent of green and climate resilient road construction, and improved asset management were available from OMMAS, and the quarterly monitoring reports were verified by the performance audit consultant. Data on the condition of the core rural road network took longer to be compiled, was delayed due to the pandemic, and was not fully available at project closing.

M&E Utilization

61. M&E information was regularly communicated to the various national and sub-national counterparts involved in the project, as well as to non-governmental stakeholders (such as the public, associations of road users, etc.) The project indicators, particularly on road condition (which was also a DLI) were used to inform project management and decision making, especially on progress on construction/ rehabilitation and maintenance. Project disbursements were also guided by information on the achievement of DLI indicators as per PPA audit reports. The M&E reports influenced implementation in terms of bringing attention to lagging areas and contributed to decisions on restructuring, cancellations, and the AF. The OMMAS and MARG will be sustained after the conclusion of the wider PMGSY Program and will be an important addition to monitoring rural infrastructure delivery at the national and state levels.

Justification of Overall Rating of Quality of M&E

62. Based on the discussion above, the quality of M&E is rated as **Modest**. The rating is influenced by the lack of indicators that measure better economic opportunities and social services for beneficiary communities; the formulation of the PDO, which could have been leaner and shorter; and the design of the DLIs, which could have been more flexible.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

63. The project was classified as Category A and triggered the following Bank safeguard policies: Environmental Assessment (OP/BP 4.01); Natural Habitats (OP/BP 4.04); Forests (OP/BP 4.36); Physical Cultural Resources (OP/BP 4.11); Indigenous Peoples (OP/BP 4.10); and Involuntary Resettlement (OP/BP 4.12). Due to the nature of the project, an Environmental and Social Management Framework (ESMF) was used. Environmental Codes of Practice (ECoPs) with a specific focus on national materials/processes (including elements like bioengineering/plantation) were developed and created opportunities for community involvement. The ESMF and ECoPs were later included in the PMGSY Program, which is a major contribution of the Project in scaling and mainstreaming system improvements.

64. **Environmental Compliance.** The E&S aspects were mainstreamed in the Detailed Project Reports (DPRs) and bid documents. The Project helped introduce audits as part of the system through which operational issues/gaps could

be identified. Environmental safeguards performance at the end of the Project was rated 'Satisfactory' based on compliance with the requirements of the policies triggered, i.e., Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Forests (OP/BP 4.36), and Physical Cultural Resources (OP/BP 4.11).

65. **Social Compliance.** The project adapted the designs to safeguard vulnerable groups through design alterations and by assisting communities. It used a blend of country systems and simplified Bank processes through the ESMF to safeguard communities affected by the project. The project piloted a community monitoring initiative in five states, whereby trained community volunteers would supplement the efforts of the project agencies in overseeing quality assurance in road works. It supplemented the national grievance redress system through the "Meri Sadak" app, which served to empower citizens to lodge complaints on construction quality and the condition of PMGSY roads with a robust timeframe (interim reply within seven days and final redressal within 60 days) for addressing these concerns. Despite the number and geographical spread of the contracts, the project experienced very few disputes owing to the participatory approach followed. Given the differing capacities of the states, the approach towards land acquisition differed across states, e.g., in Punjab land was acquired as per the national land acquisition legislation, while in Uttarakhand there was direct purchase, and in other states voluntary land donation was adopted. The project complied with the triggered social safeguard (indigenous peoples and involuntary resettlement) policies.

66. **Financial management.** The project used OMMAS, which brought in transparency, discipline, and rigor. OMMAS generated the necessary accounting data and the quarterly interim financial reports, in a manner acceptable to both the project management and the Bank. The PIU complied with the financial management legal covenants, the required financial reports were provided on time for the respective reporting periods, and the project financial statements generated from OMMAS were audited and submitted timely to the Bank. The audited financial statements were acceptable to the Bank and there are no outstanding audit observations. The project's overall financial management arrangements are rated **'Satisfactory'**.

67. **Procurement.** The project used modified country systems for procuring and awarding civil works contracts. The modifications to the bid documents helped to bridge the shortfalls identified as part of the country system assessment conducted by the Bank. The project used the e-procurement system, which assisted in increasing transparency and efficiency of the process. It was introduced progressively from one state to another based on readiness and was linked to the project DLIs. During the initial stages, there were concerns over security, usability, etc. Over time the system gained more trust and support amongst the different states and proved successful. By 2013, GoI made the use of e-procurement system mandatory for all rural road projects. The Procurement & Contract Management Manual (PCMM) for the program was developed and adopted in 2012. The process introduced new contractual arrangements, which included the piloting of Output and Performance-Based Road Contracts (OPRC), labor intensive contracts (in coordination with the ILO) and combining construction and (five-year) maintenance in a single contract.

68. Rebidding was required in about 25 percent of the cases in 2012/2013 due to low levels of competition (an average of 1.1 bids per contract), particularly in remote areas. Changes made based on a Bank Procurement Performance Review in 2013/2014 led to improvements in the bidding process, which together with changes in management staff on the Government side, led to the successful award of about 7,000 contracts during April 2013 - March 2014. In 2020, the procurement of several contracts was negatively affected by the COVID-19 pandemic. The overall project procurement performance was rated as **'Satisfactory'**.

C. BANK PERFORMANCE

Quality at Entry

69. Project preparation met the various Bank requirements, with close attention paid to the strategic context of the project and its relevance to the Government development plans. The design of the project components and activities contained a good balance between measures designed to ensure timely delivery of quality infrastructure and technical assistance measures to develop the sector and the PMGSY program. To provide broad-based support to PMGSY, with a greater emphasis on overall results, the project was designed with a strong focus on strengthening the overall systems of the program both at the national level and at the level of the participating states.[20]

70. The designs of the parent project and the AF incorporated measures to address cross-cutting and emerging development challenges such as gender mainstreaming, road safety and climate change. The measures and activities included under the project were unique and, in many cases, innovative in their approach to enhancing women's capacities, building infrastructure resilience, maintenance management, and improving road safety. Project appraisal covered detailed technical reviews and assessments, as well as economic analysis. Environmental, social, and fiduciary aspects were adequately assessed at preparation/appraisal. Implementation arrangements were well developed and included clear descriptions of the roles of the different entities at the national and state levels.

71. The preparation of the AF benefitted considerably from a detailed assessment[21] of the PMGSY program, which was carried out during the implementation of the original operation. The assessment identified several deficiencies and new areas of focus, including the need to speed up implementation, address high construction costs, reduce variability in compliance with program procedures, harness the concepts of green growth and climate resilience, apply stronger road safety management, and to capture potential gender benefits. The AF included a list of additional activities that respond to the identified new focus areas to be improved.

72. Project risks were properly identified, and mitigation measures included, but were not limited to, the development of implementation capacities, increasing transparency, the establishment of dedicated documents/ standards and tools, the enforcement of quality monitoring systems, and design review processes. Nonetheless, the technical capacities of (some of) the implementing states were probably overestimated, and the related mitigation measures were inadequate, leading to initial implementation delays and slow disbursement. The designed project time frame did not prove adequate, given the scale of the project and the variation in the implementation capacities of the different states.

Quality of Supervision

73. The Bank conducted regular implementation support missions, with frequency increasing during key implementation milestones. The support initially focused on overcoming delays and expediting procurement and administrative steps. After the mid-term review and the subsequent project restructurings in 2014 and 2015, the Bank team took proactive measures to provide timely and effective advice to further accelerate the implementation of civil works and TA activities.

74. The task team worked closely with GoI to assess when extensions of the closing date were justified by implementation delays; see the section *Key Factors during Implementation* for details. Timely and consistent Bank support on fiduciary and safeguards aspects (see Section *Environmental, Social, and Fiduciary Compliance* for details) ensured that Bank

[20] A mixture of low-income lagging states (Rajasthan, Uttar Pradesh and Jharkhand), small special category upland states (Himachal Pradesh, Uttarakhand and Meghalaya) and a middle-income state (Punjab). Bihar was added as the eight-participating state.
[21] Assessment of Pradhan Mantri Gram Sadak Yojana (PMGSY): Improving its Design and Implementation, MoRD, 2017.

requirements in these important areas were complied with. The Bank team adopted a process of gradual advocacy and training on the climate resilience agenda to bring officials from the different states on-board, including through several workshops, training activities and missions. The diversity of the Bank team's expertise helped in providing guidance, when required, on technical standards, safeguards, and procurement. Overall, the Bank was proactive in providing implementation support, including restructuring when necessary to improve project performance, and the processing of additional financing to maximize the development impact of the project.

75. During the COVID-19 pandemic, the Bank was proactive in identifying possible further delays due to the pandemic related shutdown (from March 2020) and worked closely with GoI to keep abreast of the rapidly evolving situation and devise a plan of action to move forward. This included the expeditious processing of a GoI request to increase the Bank financing percentage from 50 to 100 percent to allow front loading of disbursements and the cancellation of US$230 million from the project. The Bank team continued to provide implementation support beyond the closing date to ensure the completion of the remaining activities.

76. The Bank Task Team Leaders were based in the country office and were supported by Headquarters based staff and consultants. The staff's long experience in the sector and knowledge of Indian conditions played a notable role in ensuring adequate implementation support for the project. Team composition reflected the project's supervision needs. Mission aide memoires and implementation status and results reports (ISRs) were well-written, and reflected progress, delays, and the challenges, and included candid ratings of the various parameters.

Justification of Overall Rating of Bank Performance

77. The Bank's sustained engagement with MoRD, NRIDA, and the SRRDAs over the course of the entire project is noteworthy and these efforts eventually paved the way for the generation of substantial outcomes. Given the moderate shortcomings during preparation, the Bank's overall performance is rated as **Moderately Satisfactory**.

D. RISK TO DEVELOPMENT OUTCOME

78. The development outcomes of the project are likely to be sustained. The key risk to sustaining these outcomes is the inability of the states to maintain their rural roads network. The Rural Road Network Management Units (RRNMU) set up under the project are equipped for routine maintenance and budgeting at the network level. Road Maintenance Management Systems (RMMSs) have been established to help in prioritizing the Annual Maintenance Plans (AMPs) for the entire road network each year; states such as Madhya Pradesh and Rajasthan have made significant efforts in establishing sound RMMSs that are fully computerized, user-friendly, and easily accessible. E-Marg (electronic Maintenance of Rural Roads), a digital platform to streamline maintenance-related tasks, is now being utilized by NRIDA and MORD. Five years of routine maintenance is contracted out under the project, along with the construction.

79. A key risk to preserving the rural infrastructure is the lack of consistency among states in the application of the asset management framework, including the variability of maintenance financing, the different levels of planning and implementation capacities, and the non-uniform application of state maintenance policies. GoI is committed to developing capacities in the states to ensure that greater consistency and sustainability is achieved. The Bank's continued engagement with the Government in the roads (and in particular rural roads) sector will also support these objectives.

80. Activities under the institutional development component were conceptualized and designed to be mainstreamed in the rural roads sub-sector at the national and state levels, with strong commitment from the central and state governments. Given the progress made under the project and the strong commitment of GoI in mainstreaming them, there are no special risks to the institutional development outcomes of the project.

V. LESSONS AND RECOMMENDATIONS

81. **The adoption of a network-wide approach when conceptualizing rural connectivity programs helps to create a strategic orientation as well as strong government commitment.** Due to the small number of target beneficiaries that a single rural road can serve, rural road projects tend to have a localized development impact and tend to receive lower priority in government spending. Adopting a network-wide approach through large-scale programs such as the PMGSY provides a clear long-term vision for the government on rural connectivity and generates commitment at the level of the state governments. The scale and the design of the PMGSY program is a good practice example for delivering rural connectivity programs.

82. **For large scale programs that span different jurisdictions (e.g., states, districts), the adoption of a model where the overall program is centralized at the planning level and decentralized in implementation can facilitate smooth implementation and the successful attainment of objectives.** The project included a wide geographical spread, diverse capacities in target states, and over 12,000 contracts spread over nine Indian states. The successful procurement and implementation of these contracts could only be realized because of the adoption of the adequate country systems, centralized planning and funding at central government level, and implementation by the states.

83. **The use of local institutions to introduce innovative techniques and technologies can accelerate and maximize developmental impacts.** The project successfully used various local research and academic institutions such as the Indian Academy of Highway Engineers (IAHE), the Central Road Research Institute (CRRI), the NIRD and SIRDs[22], the Road Research Institute (Assam), and the Indian Institutes of Management (IIMs) as partners and test beds for seeding and M&E of innovative technologies, and also for training of PMGSY engineers and staff.

84. **The use of targeted TA can generate sector-wide transformational results, including the development of human skills, systems improvements, and process enhancements.** The institutional development component was quite modest in terms of funding compared to the infrastructure component. However, it was successful in introducing new concepts and mainstreaming many of them. TA should target not only the smooth project implementation, but also sustain the target results and the development of the sector.

85. **The involvement of communities in maintenance arrangements can contribute not only to ensuring adequate small-scale maintenance but also in enhancing climate resilience.** Smaller scale maintenance activities such as clearing drains, cutting of shrubs, etc., can be difficult for contractors to attend to on a regular basis, particularly in remote areas. The involvement of local communities for maintenance through a contractual arrangement (as was piloted under this project) can help address this challenge. The practice can also be a positive addition to enhancing the resilience of roads (adaptation), where regular maintenance of drainage channels and slopes improves readiness for extreme weather events. The involvement of local communities also increases their sense of ownership, as it generates employment for local communities, particularly for women.

[22] National Institute of Rural Development and Panchayati Raj and State Institutes for Rural Development.

86. **The use of a results-based approach and the adoption of country systems can support the scaling up developmental impact.** The strengthening and adoption of country systems and the use of results-based approaches (through Disbursement-Linked Indicators) can help in facilitating large scale operations/ programs that comprise a large number of activities over a wide geographic spread, and hence maximize impact. Such approaches, however, require extensive preparation to ensure success, and the Bank processes and procedures proved mature and appropriate.

87. **The adoption of incremental advocacy processes, coupled with targeted training, can be very effective in introducing new focus themes.** Issues such as climate change resilience, road safety, and gender mainstreaming may be considered new and hence may not be fully embraced by certain government agencies. To ensure the successful implementation of such initiatives, the Bank should engage in an extended dialogue, coupled with extensive training. This approach was adopted under this project and yielded good results.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Number of habitations benefitted with all-weather roads

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved condition of core rural road network	Percentage	55.00 31-Mar-2018	68.00 15-Dec-2020		87.00 30-Dec-2020

Comments (achievements against targets):
Baseline of Original Project: Three states (Rajasthan, Himachal Pradesh and Uttar Pradesh) had road management systems that were basically functioning although in need of updating. In these states, between 12% and 80% of the roads had PCI levels > 2.

Target of Original Project: 55%.

Actual value at completion: was compiled and received by end February 2022.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

Number of habitations benefitted with all-weather roads	Number	0.00 31-Mar-2018	2,000.00 15-Dec-2020		1,200.00 15-Dec-2020

Comments (achievements against targets):

Beyond project closing date, and as of October 2021, 2,387 habitations had benefitted with all-weather roads.

1,200 habitations "effectively"[1] connected as on project closing date:

1,150 (habitations with completed roads); 1,313 (habitations with completed & in progress roads).

[1] As per the Verification Report of Disbursement Linked Indicators (DLIs) for the PMGSY Additional Financing, as of project closing 1,150 habitations had been connected with completed roads, while 163 habitations had been connected physically by all-weather roads but these could not be utilized fully due to safety concerns and incomplete features like roads signages, construction and compaction of shoulders. With an efficiency factor of these latter roads taken at 33 percent, 1,200 habitations on average were considered "effectively" connected and the same has been used here.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved effectiveness of public expenditure - Km of roads used green and climate resilient designs and new technologies	Kilometers	0.00 31-Mar-2018	2,000.00 15-Dec-2020		1,488.00 15-Dec-2020

Comments (achievements against targets):

Beyond project closing date, and as of October 2021, 3,410 km of roads using green and climate resilient designs and new technologies were constructed, significantly exceeding the target of 2,000 km.

As verified from OMMAS, 1,488 km (completed roads - 400 km and in-progress roads - 1,088 km) had been constructed as of project closing date.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved asset management - number of districts implementing performance and/or community based maintenance contracts	Number	10.00 31-Mar-2018	50.00 15-Dec-2020		103.00 15-Dec-2020

Comments (achievements against targets):
Six states involving 103 districts, against a target of 50 districts have adopted and implemented performance and/or community based maintenance contracts.

A.2 Intermediate Results Indicators

Component: Institutional Strengthening

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effectiveness of Public Expenditures - improved planning systems	Text	To be drafted 31-Mar-2018	Adoption of the Manual 15-Dec-2020		DPR Manual prepared and adopted 15-Dec-2020

Comments (achievements against targets):
DPR manual prepared by NRIDA and shared with all states executing works under PMGSY. DPRs based on this manual have been prepared by 13 states, and 5,657 works of length 44,189 km have been sanctioned and awarded.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effectiveness of Public Expenditures - Number of districts establishing GIS based road and bridge inventory and condition database	Number	2.00 31-Mar-2018	20.00 15-Dec-2020		637.00 15-Dec-2020

Comments (achievements against targets):
Two districts had successfully established GIS-based road & bridge inventories and condition databases. In addition, road and bridge inventories were established in 637 districts (covering almost all 28 states), with more work to be done to develop elements such as videography and pavement thickness/ composition data.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effectiveness of Public Expenditure - vulnerability assessment	Kilometers	0.00 31-Mar-2018	5,000.00 15-Dec-2020		0.00 15-Dec-2020

Comments (achievements against targets):
Vulnerability assessments, that were to be conducted under the project by NRIDA for 5000 km of road sections, will now be conducted post-project, as there were no responsive bidders during the project period.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effectiveness of Public Expenditures –award of civil works within 45 days of bids submission	Percentage	77.00 31-Mar-2018	90.00 15-Dec-2020		42.00 15-Dec-2020

Comments (achievements against targets):
Data were compiled after project close by the client and shared in February 2022.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effectiveness of public expenditure - Number of states having prepared road safety action plan	Number	0.00 31-Mar-2018	10.00 15-Dec-2020		4.00 15-Dec-2020

Comments (achievements against targets):

Meghalaya, Madhya Pradesh, Odisha, and Chhattisgarh have prepared Road Safety Action Plans (against the target of 10 states), while some others are preparing their respective plans

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effectiveness of Public Expenditures – procurement and contract management manual	Text	Draft under preparation 31-Mar-2018	Adopted 15-Dec-2020		Not finalized 15-Dec-2020

Comments (achievements against targets):
The revised MBD was prepared by NRIDA in consultation with the World Bank but not finalized which resulted in non adoption by participating states.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effective Execution of Maintenance Works - Number of states with asset management plans adopted	Number	0.00 31-Mar-2018	10.00 15-Dec-2020		2.00 15-Dec-2020

Comments (achievements against targets):

Technical assistance under the project helped to prepare a generic framework for developing similar Asset Management Plans (AMPs). Two states - Bihar & Assam prepared Asset Management Plans (AMP) for operation and maintenance of their rural roads. The Asset Management Plan of Bihar was shared with the World Bank. Government of Bihar has adopted the AMP for determining funds allotment and allocation of works for maintenance, re-carpeting, etc.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Effective Execution of Maintenance Works - Number of districts that publicly disclose annual maintenance plans	Number	0.00 31-Mar-2018	20.00 15-Dec-2020		27.00 15-Dec-2020

Comments (achievements against targets):
Chhattisgarh has prepared & disclosed its Annual Maintenance Plan through OMMAS/SRRDA website involving 27 districts. A detailed work program/requirement of funds has been calculated depending on the condition of roads at site.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved Institutional Effectiveness - Number of staff accredited after completing training	Number	0.00 31-Mar-2018	2,000.00 15-Dec-2020		2,007.00 15-Dec-2020

Comments (achievements against targets):

As of project closing date, 1,849 officials working for PMGSY projects had been provided training by different training institutes like IAHE, CRRI, ESCI, AITD, NICMAR etc. Online training had also been given to 158 officials (Total 2,007 staff trained). However these staff have been accredited on a single module, as against the required two. State Agencies had nominated their officials for only one training module in order to cover the maximum staff. Also, due to the COVID pandemic in the year 2019 various training programmes were cancelled which adversely affected the capacity building programme of the project.

However, beyond project closing and as of March 31, 2021, a total of 3,043 officers had been trained (Year 2020-2021) from reputed training institutions and various state level resources centers.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved Institutional Effectiveness - Number of districts with disclosure of annual performance reports	Number	0.00 31-Mar-2018	20.00 15-Dec-2020		27.00 15-Dec-2020

Comments (achievements against targets):
Chhattisgarh has prepared & disclosed its Annual Performance Report through OMMAS/SRRDA website involving 27 districts. A detailed work program/requirement of funds has been calculated depending on the condition of roads at site.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved Institutional Effectiveness - Number of workshops organized for	Number	0.00 30-Mar-2018	50.00 15-Dec-2020		0.00 15-Dec-2020

Gender based capacity enhancement					

Comments (achievements against targets):
The task is being organized on routine basis at SRRDA level. Exact number of workshops organized was still not received by the time of the issuing of the project's ICR.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved Institutional Effectiveness - Number of women benefitted through self-help groups engaged in post-construction maintenance contracts	Number	100.00 30-Mar-2018	2,000.00 15-Dec-2020		700.00 15-Dec-2020

Comments (achievements against targets):
In Uttarakhand, the State Mahila Mangal Dal (MMD) has been engaged for post construction maintenance work. Overall 35 Women Self Help Groups have been deployed for maintenance of 277.06 km of Road, each SHG consisting of 20 women. Overall 700 women have benefitted.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved Institutional	Percentage	0.00	85.00		89.00

Effectiveness - Effective citizen feedback mechanism		30-Mar-2018	15-Dec-2020		15-Dec-2020

Comments (achievements against targets):
89% of feedback from citizens on project roads received on mobile app (“Meri Sadak”) and through other means (e-mail, post, etc.) received, accepted and forwarded to concerned state(s) was responded to within 30 days.

B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1 Enhanced road connectivity	
Outcome Indicators	1. Improved condition of core rural road network (AF) 2. Improved effectiveness of public expenditure – Km of roads used green and climate resilient designs and new technologies (AF) 3. Number of habitations benefited with all-weather roads (AF)
Intermediate Results Indicators	1. Effectiveness of Public Expenditures - improved planning systems 2. Effectiveness of Public Expenditures - number of districts establishing GIS based road and bridge inventory and condition database 3. Effectiveness of Public Expenditure - vulnerability assessment 4. Effectiveness of Public Expenditures –award of civil works within 45 days of bids submission 5. Effectiveness of public expenditure - number of states having prepared road safety action plan 6. Effectiveness of Public Expenditures – procurement and contract management manual 7. Improved Institutional Effectiveness - number of staff accredited after completing training 8. Improved Institutional Effectiveness - number of workshops organized for Gender based capacity enhancement
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1. PMGSY Program Financing: Green and Climate Resilient Rural Roads; Pilot Projects to Introduce New Technologies; Rural Roads under the Original Project 2. Institutional Strengthening: Skills development and gender-targeted opportunities; road safety management; Engineering design, project management and implementation

Objective/Outcome 2 Better economic opportunities and social services for beneficiary communities in the participating states	
Outcome Indicators	1. Improved asset management - number of districts implementing performance and/or community-based maintenance contracts (AF)
Intermediate Results Indicators	1. Effective Execution of Maintenance Works - Number of states with asset management plans adopted 2. Effective Execution of Maintenance Works - Number of districts that publicly disclose annual maintenance plans 3. Improved Institutional Effectiveness - Number of districts with disclosure of annual performance reports 4. Improved Institutional Effectiveness - Number of women benefitted through self-help groups engaged in post-construction maintenance contracts 5. Improved Institutional Effectiveness - Effective citizen feedback mechanism
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1. Institutional Strengthening: Asset management; Program Management Strengthening

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Simon Ellis/ Ashok Kumar	Task Team Leader(s)
Anna Pinto Hebert	Senior Operations Officer
Aradhana Mathur	Environmental Specialist, Consultant
Asif Faiz	Rural Roads Specialist, Consultant
Bjorn Johannessen	Rural Roads Specialist, Consultant
Dhirendra Kumar	Procurement Specialist
Jeff Thindwa	Senior Social Development Specialist
Juan Quintero	Senior Environmental Specialist
Manvinder Mamak	Senior Financial Management Specialist
Natalya Stankevich	Governance Specialist
Neha Vyas	Environmental Specialist
Rajiv Sondhi	Sr. Finance Officer
Susanne Van Dillen	Economist, Consultant
Venkata Rao Bayana	Social Specialist, Consultant
Supervision/ICR	
Reenu Aneja, Ashok Kumar, Arnab Bandyopadhyay	Task Team Leader(s)
Aymen A. O. Ali	ICR Author
Arushi Sood	Financial Management Specialist
Arun Sharma	Technical and Resilience (Consultant)
D.P. Gupta	Institutional Strengthening (Consultant)
Gopalaswamy Srihari	Social Specialist
Lakshmi Narayanan	Team Member
K.B. Bansal	Technical (Consultant)
Manvinder Mamak	Senior Financial Management Specialist
Muthuthevar Boominathan	Economist (Consultant)
Neha Pravash Kumar Mishra	Senior Environmental Specialist

Pamela Patrick	Procurement Team
Radha Narayan	Procurement Team
Rajagopal S. Iyer	ICR Team Member
Rahmoune Essalhi	Team Member
Satyanarayan Panda	Procurement Specialist(s)
S. Vijay Kumar	Consultant
Rashi Grover	Consultant
Vinod Gautam	Environment Team (Consultant)
Venkata Rao Bayana	Senior Social Development Specialist

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY11	62.187	478,413.62
FY15	0	5,880.00
Total	**62.19**	**484,293.62**
Supervision/ICR		
FY11	32.834	262,156.91
FY12	62.607	322,672.00
FY13	76.289	316,471.86
FY14	63.702	264,281.80
FY15	39.922	222,908.58
FY16	18.989	426,678.51
FY17	20.729	183,736.90
FY18	35.887	220,711.36
FY19	9.475	48,540.13
FY20	32.118	130,677.26
Total	**392.55**	**2,398,835.31**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)		Actual at Project Closing (US$M)		Percentage of Approval (%)	
	Original	AF	Original	AF	Original	AF
Component 1: PMGSY Program Financing	1375.00	485.00	1375.00	260.00	100	53.6
Component 2: Institutional Strengthening	25.00	15.00	25.00	10.00	100	66.6
Total	**1400.00**	**500.00**	**1400.00**	**270.00**	**100**	**54.0**

ANNEX 4. EFFICIENCY ANALYSIS

A. Introduction

1. This Annex details the completion stage economic evaluation of the rural roads rehabilitated and constructed under the project.

2. The completed PMGSY Rural Roads Project was extended to 29,285 km on 8,332 roads in eight participating states. At the time preparing this analysis (August 2021), 27,772 km on 8,220 roads with an average road length of 3.38 km had been completed. The AF started in 2018 in eight participating states[23] and included civil works to support construction and/or rehabilitation/ improvement of about 5,500 km of priority rural roads and standalone bridges incorporating adequate climate resilience and road safety engineering features. This also included the use of green and climate-resilient designs and new technologies for about 2,000 km of roads. This sub-component would support balance civil works on about 4,000 km of rural roads and bridges in the eight participating states under the Original Project. In total, 11,750 km of roads under Sub-Component A1 (Green and Climate Resilient Rural Roads) and Sub-Component A3 (Rural Roads under the Original Project) were sanctioned during implementation. Of these, 4,605 km on 785 roads had been completed at the time of this analysis. In addition, Tamil Nadu and Odisha states together had completed 192 km of rural roads under Sub-component A1.

3. The ICR economic analysis considered only the roads that were completed by the time of the analysis (under the parent project and the AF operation. The economic analysis of the project at the preparation stage was based on the 'production surplus' approach in which (i) commercial benefits from increased agricultural productivity, (ii) educational benefits in terms of improved attendance, and (iii) improved access to health facilities were considered as the project benefits. The benefit estimation relied on limited sample survey results in Orissa State (2009). However, this production surplus approach is usually recommended for low volume roads with less than 100 vehicles per day (Dr Richard Robinson, 2012).[24] Beyond this level of traffic, the use of 'consumer surplus' approach with the projected vehicle trips based benefits is considered better due to the following reasons: (i) well-defined methodology of benefit estimation; (ii) relatively easy to get input data like daily traffic counts; (iii) all incremental economic and social activities related to the road improvements will be reflected in traffic; and (iv) it assigns priorities that reflect economic and social considerations, because people travel for a wide variety of reasons.

4. Based on these arguments, the economic analysis for the AF (2018) was based on the 'consumer surplus' approach, deviating from the approach followed in the parent project. Available guidelines and suggestions from the Indian Roads Congress (IRC), the Planning Commission, GOI and World Bank (GHG Analysis Road Improvement, Guidance Note, World Bank Group, February 2016 and CCGCE Guidance note on Social Value of Carbon in project appraisal, July 14, 2014) were used in the ICR economic analysis.

5. The economic analysis was undertaken on a typical road section with an average length of 3.67 km (the range is from 3.06 km in Uttara Pradesh state to 8.39 km in Uttarakhand state) for a total of 27,772 km of

[23] Punjab was not considered for additional financing and Tripura State was added in the program.

[24] 'A New Approach to quantifying economic and social benefits for low-volume roads in developing countries', Dr Richard Robinson, *Impact Assessment and Project Appraisal,* Volume 17, 1999 - *Issue 2*, Published on 20 February 2012. http://dx.doi.org/10.3152/147154699781767891

PMGSY roads. The average daily traffic level was 251 vehicles, varying from 117 vehicles in Tripura to 459 vehicles in Uttar Pradesh, with a modal split of 55 percent passenger, 34 percent goods, and 11 percent slow moving non-motorized vehicles, along with about 100 pedestrians. The key assumptions include 5 percent annual growth rate of traffic, incremental maintenance cost of US$0.001 million and US$0.025 million for routine and periodic maintenance per km respectively for bitumen roads, five-year and six-year periodic maintenance cycles for 'without' project and 'with' project scenarios, and six percent social discount rate (SDR). The impact of the coronavirus disease pandemic on the economy was taken into consideration when determining traffic growth assumptions.

6. The average cost of construction (INR 3.66 million per km under parent project and INR 4.34 million per km under the AF) were used as well as the construction period of 2011-2021. The primary benefits considered for the economic analysis include: (i) reduction in vehicle operating costs (VOCs) and travel time savings for vehicle users; and (ii) reduction in carbon emissions from vehicles using the improved roads.[25] All rural road improvement benefits, including increased agricultural productivity, increased employment accessibility, health and educational benefits (all to be considered under the 'production surplus' approach) are reflected in the increased travel trips considered under the present 'consumer surplus' approach.

7. The analysis showed a range of results with some states (mainly the small upland states) not passing or marginally passing the viability test at the given SDR of 6 percent and others easily surpassing it. However, the results for the PMGSY Rural Roads Project components show that the overall project is socially justified. The NPV is INR 89,369 million at 2010 prices and the IRR is 19.6 percent. For the AF, the results show that the overall project is socially justified with the NPV of INR 34,234 million at 2018 prices and the IRR at 21.7 percent.

B. Socio-Economic Survey

8. A recent discussion based socio-economic survey[26] (2016) was conducted on the project roads in one of the participating states with the objective of understanding the general nature of beneficiary feedback on rural road development from a Bihar rural community. The survey helped identify the major benefits of road connectivity investments from the beneficiaries' perspective. Opined benefits were both quantitative and qualitative in nature. However, the nature of quantitative benefits expressed in value terms was of only approximate use, as these were based on the depth of villagers' knowledge about their village. The discussions were arranged informally at convenient locations for villagers. The program area specific benefit profile from the socio-economic survey confirmed the general hypothesis of rural roads benefits discussed earlier.

[25] Based on Evaluation Study by Planning Commission, 2010, unit rates suggested by Indian Roads Congress (IRC) for motorized vehicles and World Bank Study for Andhra Pradesh (2000). Existing traffic based on primary survey (2017).
[26] Covering 20 rural connectivity roads spread over three out of ten Phase I project districts in Bihar state, the socio-economic survey was carried out during May-June 2016 by the STA Consultant with the support of BRRDA

C. Project Benefits

Traffic related Benefits

9. It was assumed that when villages are connected by an all-weather road, their vehicle generation pattern will change to approximately that found in presently connected villages, as arrived at from the earlier mentioned post evaluation study results (Table 4.4). Also, the average traffic volume data available for the project states provided by National Rural Infrastructure Development Agency (NRIDA)[27] were used in the analysis (Tables 4.5 & 4.6). The traffic was assumed to grow at five percent.

10. Savings in vehicle operating costs (VOC) and passenger time value for each vehicle type were adapted from the Indian Roads Congress (SP30, 2009) Guidelines28 with a suitable update to the 2010 / 2018 levels. Estimated unit values used for the analysis are shown in Tables 4.7 and 4.8. Considerable benefits in health, education, and other social sector areas (such as accessibility to markets, railway stations, bus stands, post offices, banks etc.,) in terms of reduced travel time and operating costs were reported from the evaluation study results. However, these accessibility benefits to social services will be reflected in the additional vehicular trips generated after road improvement. Thus, to avoid duplication of benefit calculations, only traffic related benefits in terms of VOC savings and savings in travel time were considered as the second benefit.

11. For benefit calculations, existing traffic and generated traffic are treated separately. Differences in unit rates of VOC and travel time were used to estimate the benefits for existing traffic (before upgradation). For generated traffic, 50 percent of the incremental VOC and time cost for the improved situation were treated as project benefits[29]. By using calculated traffic data and unit rates, the traffic related benefits were estimated for a road on an average. Using these estimated traffic related benefits per road and the total road network for 2017, project benefits for 2017 were estimated for all eight project states. With the assumption of 5 percent annual increase in traffic, benefits were estimated for future years.

Carbon Emission Reduction Benefits

12. Rural road improvements from earth/gravel to bitumen with related improvements will reduce vehicle operating costs (VOC) and fuel consumption. Reduction in fuel consumption will lead to a reduction in carbon emissions, which is a co-benefit in this project. Using the working model developed for the economic analysis, carbon emission reduction estimates have been derived using the available guideline - *GHG Analysis Road Improvement, Guidance Note, World Bank Group, February 2016*. Though the number of vehicles on the road due to the project would necessarily increase, with the reduced carbon emission rate due to the improved road surface the project will result in a marginal decrease in carbon/GHG emissions. With the assumptions of improved road surface under 'with project' scenario with reduced VOCs, related fuel consumption savings[30] and carbon emission rate (0.0023 ton/ liter)[31], the incremental annual carbon emissions for the completed project roads (27,772 km under PMGSY Rural Roads Project

[27] NRIDA is the national agency responsible for the implementation of PMGSY program in all states in India.
[28] Manual on Economic Evaluation of Highway Projects in India, 2009, Special Publications No. 30, Indian Roads Congress (IRC)
[29] Ibid
[30] Reduced fuel consumption estimated by assuming that travel speed will increase by 20 percent
[31] GHG Analysis Road Improvement, Guidance Note, World Bank Group, February 2016.

and 4,579 km under PMGSY Rural Roads Project AF), despite the number of vehicles on the road being expected to increase, the project is estimated to result in a marginal decrease in carbon/GHG emissions, mainly due to the considerably reduced carbon emission rates. Using carbon cost of US$43 per ton in 2022[32], the carbon emission related savings attributed to the project was estimated and considered in the economic analysis. However, for the economic analysis carbon emissions for the normal traffic and generated traffic were treated separately[33]. The resultant environmental benefit estimated for the project start year with suitable growth rate was considered for the economic analysis.

D. Results of the Economic Analysis

13. The excel based working model was developed for economic analysis by considering the economic construction cost and incremental annual maintenance/periodical maintenance costs, along with the project benefits during the analysis period of 20 years. The results of the base analysis and the sensitivity tests are shown in Table 4.1. The analysis showed all the project states combined as a program passed the economic viability test at the given SDR of 6 percent. The IRR for the overall project is 16.5 percent with an NPV of INR 85,214 million at 2010 prices for PMGSY Rural Roads Project and 21.7 percent with an NPV of INR 34,234 million at 2018 prices for the AF. Hence, both the parent project and the AF are socially justified and economically viable.

Table 4.1: Combined Results of Economic Analysis (Inclusive of Carbon Emission Savings Benefits)

S. No.	Sensitivity Scenario	PMGSY Rural Roads Project			PMGSY Rural Roads Project AF		
		EIRR	MIRR	ENPV @6% INR Million	EIRR	MIRR	ENPV @6% INR Million
1	Base Case	16.5%	10.2%	85,214	21.7%	11.4%	34,234
2	20% increase in O&M costs	16.0%	9.8%	79,261	21.0%	11.1%	32,421
3	20% decrease in project benefits	12.5%	8.6%	47,567	16.6%	9.8%	21,536

Note: EIRR - Economic Internal Rate of Return; MIRR - Modified Internal Rate of Return; ENPV- Economic Net Present Value discounted @6% SDR

[32] Guidance Note on Shadow Price of Carbon in Economic Analysis, 12 November 2017, World Bank Group

[33] For normal traffic, the difference in fuel consumption under 'without' and 'with' project scenarios is considered as savings and 50% of fuel consumption under 'with project' scenario of generated traffic is considered as savings.

ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

Comments of NRIDA / MoRD on Implementation Completion and Results Report (World Bank Version)

1. Implementation Completion and Results Report (ICRR) shared by the World Bank has been reviewed in detail by NRIDA. The draft ICR report is comprehensive, thorough, well prepared and addressed all the core points of the World Bank project.

2. MoRD / NRIDA has put in all efforts to achieve the target outcome of the World Bank project which were not achieved during the project tenure. It is to be noted that the World Bank Rural Roads Projects–II Additional Financing was signed with an objective to provide the assistance by the bank to the States lacking in capacity for PMGSY Phase-III (PMGSY-III) but the third phase of PMGSY was approved by Government of India (GoI) on 10 July 2019 which is 14 months after the effective starting date of World bank loan. Also the quantum of targets decided in the project worth 1 Billion US$ in 9 States was on the higher side to be achieved in a short tenure of 2.5 years. The impact of limited time was further aggravated by the delay in approval of PMGSY-III and various unforeseen factors like general elections of 2019 and State elections in the State of Jharkhand and Rajasthan (large states) and pandemic impact from 2019 and resulted in adversely affecting the planning and implementation of the project. The ministry had also sought extension of the project tenure in order to satisfactorily complete the objectives of the loan.

3. Despite the bottlenecks, the achievement of RRP-II Additional financing works is 80.31 % till 15 Dec 2021. The State wise achievement and expenditure is attached as Annexure-A.

4. PMGSY States as a whole have benefitted from the DLIs introduced in the RRP-II as well as in the RRP-II Additional financing. Introduction of GIS based DRRP, green and climate resilient designs, road construction by new-green technology, eMARG for performance-based maintenance for 5 years as well as post 5 years etc. are some important initiatives which paves way for the construction of economical, safer, green and rural roads of global standards. There is need to prepare and implement Asset management plans and Road safety action plans in all the PMGSY States in order to maintain these valuable assets. In addition, procurement of quality control equipment, setting up of Video conferencing facility and GIS cell up to SRRDAs/PIUs level, training of officials has direct bearing in improving the efficiency in implementation of PMGSY works.

5. The point wise comments on the draft documents are given as under: -

ICRR – World Bank Version clauses/para	Page No.	NRIDA/ MoRD Comments
Para A Point No. 1	5	The said para gives the overview of PMGSY scheme up to year 2010. The details given in the para should be updated up to year 2020 or 2021
Table No. 1 Point No. 2	7	The PCI data is being updated.
Para B Point No. 10	7	The year of restructuring mentioned in the para is 2013 – to be checked in terms of correct year as in above paras the year of

<table>
<tr><td></td><td></td><td>restructuring is 2014.</td></tr>
<tr><td>Point No. 14</td><td>10</td><td>PMGSY was one of the key programs in the transport program of the GoI's Tenth (2002-07), Eleventh (2007-12) and Twelfth (2007-12) Five Year Plans – this line has been repeated in the said para.</td></tr>
<tr><td>Point No. 19</td><td>10 & 11</td><td>1. The Annexure 9 mentioned in the para is not attached with the report.

2. Physical Progress of World Bank Projects up to 15th December 2021
<table>
<tr><th>S.No.</th><th>Project Name</th><th>Sanction Length (in km)</th><th>Completed Length (in km)</th></tr>
<tr><td>1</td><td>RRP-I</td><td>10584</td><td>10265</td></tr>
<tr><td>2</td><td>RRP-II</td><td>29281</td><td>28032</td></tr>
<tr><td>3.1</td><td>RRP-II AF</td><td>11770</td><td>6857</td></tr>
<tr><td>3.2</td><td>RRP-II AF G&CR</td><td>5720</td><td>2234</td></tr>
</table>
3. Details of Habitation Benefited under World Bank Projects
<table>
<tr><th>S.No.</th><th>Project Name</th><th>Habitation Benefited (Documented PAD)</th><th>Habitation Benefited (As per OMMAS)</th></tr>
<tr><td>1</td><td>RRP-I</td><td rowspan="2">50420 (This includes habitation benefited under RRP-I, RRP-II & Regular PMGSY funding in World Bank States)</td><td>5022</td></tr>
<tr><td>2</td><td>RRP-II</td><td>11772</td></tr>
<tr><td>3.1</td><td>RRP-II AF</td><td>-</td><td>1713</td></tr>
<tr><td>3.2</td><td>RRP-II AF (Retro Financing)</td><td>-</td><td>683</td></tr>
</table>
4. The % of roads having PCI > 2 is being updated</td></tr>
<tr><td>Table 4</td><td>11</td><td>1. Data is being complied for PCI value.
2. Number of habitations benefited is 2396 (up to 15th December 2021).</td></tr>
</table>

Point No. 21	11	The total number of roads sanctioned under RRP-II AF G&CR is **755** having a length of **5720 km** out of which the construction of **2234 km** roads have been completed till **15th December 2021.**
Point No. 22	11	The figure of 19 states having maintenance policy is to be updated to 27 states – Available on official website of PMGSY (*www.pmgsy.nic.in*)
		eMARG definition has been updated in the document
		Number of States/UT on eMARG is 30
Point No. 23	12	**The para has been updated**
		Vulnerability assessments, that were to be conducted under the project by NRIDA for 5000 km of road sections, will now be conducted post-project, as there were no responsive bidders during the project period – This statement seems to be a commitment from NRIDA end. However, no actions have been taken on the subject post completion of World Bank RRP-II AF.
Point No. 24	12	The number of field officers trained mentioned in the para is 40,000 – due to lack of digitized data NRIDA does not validate the number. However, as per the current yearly trend it can be said the figure is almost close to the actual number.
Point No. 31	14	The para has been updated
Point No. 32	14	Number of participating states should be updated to 9
Point No. 47	17	The para stated that NQMs report is in public domain – NQMs report are not in public domain. Also the NQM are not required to take the feedback from the public during their inspection.
Point No. 49	17	The project design adopted specific measures to strengthen the maintenance aspects including mandatory 5-year inbuilt maintenance in construction contracts and other measures pointed out in Efficacy section (refer para 21) and hence the sustainability of project outputs and outcomes – PMGSY is the first centrally funded scheme under which all works have inbuilt 5 years defect liability period. The contractor responsible for constructing the road is liable to maintain the road for 5 years post date of completion of the work. eMARG (electronic Maintenance of Rural Roads under PMGSY) an enterprise e-Governance solution for maintenance of rural roads constructed under PMGSY has been successfully implemented in 30 States, enabling NRIDA/SRRDA and Public to monitor the maintenance works carried out during DLP.
Point No. 54	18	**The para has been revised.**

Annexure-A Physical and Financial progress report of World Bank RRP-II Additional Financing (As on 15.12.2021)

Name of the State	Component	Sanctions				Work Progress			
		No of Works		Length of Works Sanctioned (KM)	Total Sanctioned Cost (in CR.)	No of Works Completed			Expenditure (in CR.)) (Roads + Bridges)
		Roads	Bridges			Roads	Bridges	Length in Km	
Bihar	AF	285	6	1721.39	861.34	212	3	1513.75	748.19
	AF (G&CR)	60	0	735.09	531.04	31	0	581.87	412.09
	Total	**345**	**6**	**2456.47**	**1392.38**	**243**	**3**	**2095.62**	**1160.28**
Himachal Pradesh	AF	240	10	1631.33	981.38	167	5	1261.30	685.38
	AF (G&CR)	178	0	1558.16	1117.25	85	0	950.19	635.69
	Total	**418**	**10**	**3189.49**	**2098.63**	**252**	**5**	**2211.48**	**1321.07**
Jharkhand	AF	317	42	1757.20	1070.13	264	24	1639.52	791.72
	AF (G&CR)	107	0	509.41	288.15	93	0	475.83	235.97
	Total	**424**	**42**	**2266.61**	**1358.28**	**357**	**24**	**2115.35**	**1027.69**
Meghalaya	AF	242	43	1393.04	952.73	104	3	922.50	565.94
	AF (G&CR)	81	0	397.14	316.68	22	0	191.92	144.49
	Total	**323**	**43**	**1790.18**	**1269.41**	**126**	**3**	**1114.42**	**710.43**
Tripura	AF	29	1	214.33	239.59	2	0	214.33	75.38
	AF (G&CR)	13	0	92.91	93.71	0	0	92.91	21.33
	Total	**42**	**1**	**307.24**	**333.30**	**2**	**0**	**307.24**	**96.71**

Name of the State	Component	Sanctions				Work Progress			
		No of Works		Length of Works Sanctioned (KM)	Total Sanctioned Cost (in CR.)	No of Works Completed			Expenditure (in CR.)) (Roads + Bridges)
		Roads	Bridges			Roads	Bridges	Length in Km	
Rajasthan	AF	237	0	2198.39	1139.06	173	0	1990.72	713.03
	AF (G&CR)	0	0	0.00	0.00	0	0	0.00	0.00
	Total	**237**	**0**	**2198.39**	**1139.06**	**173**	**0**	**1990.72**	**713.03**
Uttarakhand	AF	364	93	2854.40	1687.24	136	14	2164.98	932.70
	AF (G&CR)	256	0	2222.19	1282.10	105	0	1842.79	823.61
	Total	**620**	**93**	**5076.59**	**2969.34**	**241**	**14**	**4007.77**	**1756.31**
Tamil Nadu	AF	0	0	0.00	0.00	0.00	0.00	0.00	0.00
	AF (G&CR)	30	0	100.10	68.50	30	0	100.05	69.04
	Total	**30**	**0**	**100.10**	**68.50**	**30**	**0**	**100.05**	**69.04**
Odisha	AF	0	0	0.00	0.00	0.00	0.00	0.00	0.00
	AF (G&CR)	30	0	105.02	54.77	29	0	105.02	50.27
	Total	**30**	**0**	**105.02**	**54.77**	**29**	**0**	**105.02**	**50.27**
Total	AF	**1714**	**195**	**11770.07**	**6931.47**	**1058**	**49**	**9707.09**	**4512.34**
	AF (G&CR)	**755**	**0**	**5720.01**	**3752.20**	**395**	**0**	**4340.58**	**2392.49**
	Grand Total	**2469**	**195**	**17490.08**	**10683.67**	**1453**	**49**	**14047.7**	**6904.83**

ANNEX 6. SUPPORTING DOCUMENTS

1. Financing Agreement, PMGSY Rural Roads Project, Credit No. 4848-IN and 4849-IN, between India and International Development Association, January 14, 2011, including Amendments
2. Loan Agreement, Additional Financing for PMGSY Rural Roads Project, Loan No. 8864-IN, between India and International Bank for Reconstruction and Development, May 31, 2018, including Amendments
3. Project Appraisal Document, PMGSY Rural Roads Project, Report No. 57081-IN, November 26, 2010
4. Project Paper, Additional Financing for PMGSY Rural Roads Project, Report No. PAD2683-IN, May 4, 2018
5. Aide Memoires and Management Letters of the Preparation and Implementation Supervision Missions from 2008 to 2020, The World Bank.
6. Implementation Status and Results Reports, PMGSY Rural Roads Project, Sequence Nos. 1–19, 2011–2020
7. Country Strategy for India for the Period 2009–12, World Bank, Report No. 46509-IN, November 14, 2008
8. Country Partnership Framework for India for the Period 2018–22, World Bank, Report No. 126667-IN, July 25, 2018
9. Impact Evaluation of Pradhan Mantri Gram Sadak Yojana (PMGSY), Report No: AUS0000341; World Bank, 2019
10. Discussion Paper on Rural Roads and the SDGs, Mr. S. Vijay Kumar, TERI, April 2019
11. Rural Road Infrastructure & Agricultural Production: Evidence from India, Yogita Shamdasani, National University of Singapore (NUS), 2021
12. Assessment of Pradhan Mantri Gram Sadak Yojana (PMGSY): Improving its Design and Implementation, MoRD, 2017
13. Market Access and Structural Transformation: Evidence from Rural Roads in India. Sam Asher, Paul Novosad, April 20, 2016
14. Rural Road Development in India: An assessment of distribution of PMGSY project benefits in three states by gender and ascribed social groups, Report No: AUS5487 Republic of India, South Asia Sustainable Development Unit, The World Bank, June 12, 2014
15. Program Documents and website links:
    a. *https://pmgsy.nic.in/*; *http://omms.nic.in/*
    b. *https://emarg.gov.in/application_main.htm*; *http://www.pmgsy-grris.nic.in/*
    c. Model Bidding Document World Bank - *https://pmgsy.nic.in/sites/default/files/pdf/mbd.pdf*
    d. ESMF - *https://pmgsy.nic.in/world-bank*
16. Road Asset Management Plan, Bihar Rural Works Department, August 2016
17. Road Safety Audit of Rural Road projects in Bihar – A field Guide for Audit and Inspection, Bihar Rural Works Department, August 2017
18. Climate resilience strategy for Rural Roads in Uttarakhand and implementation guidelines, UPWD, 2018.
19. Detailed Efficiency Analysis of the Project.

ANNEX 7. SUMMARY OF IMPACT EVALUATION STUDIES FOR PMGSY

Study Title	**The Road to Opportunities in Rural India: The Economic and Social Impacts of PMGSY, Matías Herrera Dappe, Muneeza Mehmood Alam, and Luis Andres, Mobility and Transport Connectivity Series, The World Bank Group, 2021**
Key Findings	This report presents the results of an impact evaluation of PMGSY that uses a difference-in-difference approach and panel data from the states of Himachal Pradesh, Madhya Pradesh, and Rajasthan collected in 2009 and 2017. Key findings include: • **PMGSY improved accessibility, particularly in hilly areas.** On average, people travelled to their destinations, particularly work, in shorter time, thanks to improved connectivity, but they did not change the distance travelled. Reductions in travel time were greater in hilly areas. • **PMGSY increased access to economic opportunities, triggering a change in the structure of employment in rural India.** The improved accessibility provided by PMGSY roads triggered a shift from farm to non-farm employment, particularly non-farm employment outside the habitation. • **PMGSY improved farm-to-market connectivity, but it had limited impact on farming practices**. PMGSY roads yielded an eight-percent increase in the share of crops transported to markets for sale, a tripling over levels observed before PMGSY roads were built. • **PMGSY roads had a positive impact on human capital formation in rural India, with boys and girls benefiting equally.** Improved rural connectivity provides a long-term and sustained boost in the living standards of rural populations if it allows households to accumulate wealth and human capital. In the habitations studied, rural roads had a positive but small effect on the average wealth of households, equivalent to adding small appliances (like a pressure cooker and radio) to the household's assets.
Study Title	**Rural Road Infrastructure & Agricultural Production: Evidence from India, Yogita Shamdasani, National University of Singapore (NUS), 2021**
Key Findings	• This paper estimates the effects of improvements in infrastructure under a large rural road-building program on production decisions in agriculture. **Remote households that gain access to program roads diversify their crop portfolio, adopt modern agricultural technologies and increase hired-labor use.** • Supporting evidence suggests that program roads increase the mobility of agricultural workers by integrating village labor markets across space, in turn enabling the adoption of labor-intensive production practices. **These findings highlight the importance of last-mile connectivity in remote areas across the developing world.** • This suggests that there are **potential gains that can arise from coupling infrastructure projects with other commonly used policy instruments such as fertilizer and irrigation subsidies**. Further, given that treatment effects are heterogeneous across space, the paper argues that spatial targeting should be made an important consideration when designing such policy interventions. • Findings from the paper also demonstrate that **the gains that accrue to agricultural households extend beyond the households targeted by the program, highlighting the importance of incorporating network effects in the design of transport policy.**

Study Title	**Discussion Paper on Rural Roads and the SDGs, Mr. S. Vijay Kumar, TERI, 2019**
Key Findings	• This Paper attempts to use the **SDGs as an analytical framework to understand the role and potential of the rural road network.** Rural roads and the complementary policies and strategies in fact have impacts not only on poverty, but on many other socio-economic and human development indicators, and almost all the SDGs. • **Most of the impacts are positive, and even those with negative consequences can be managed for reducing adverse impacts.** The analysis in this Paper indicates that in the rural areas of India, not only must those responsible for achieving each SDG leverage the potential of the road connectivity for the purpose at strategy and implementational stages, but the authorities responsible for rural roads must make institutional, policy and management improvements to ensure that rural roads have the best potential for the purpose. • This would require the creation of coordination mechanisms like "State Road and Transport Development Boards" and regulatory systems like a "Rural Roads Management Act", as well as rational asset management strategies for the entire road network.
Study Title	**Market Access and Structural Transformation: Evidence from Rural Roads in India. Sam Asher, Paul Novosad, 2016**
Key Findings	• This paper finds that road construction **leads to a large reallocation of labor out of agriculture and into (manual) labor markets.** The results are strongest in locations close to large cities, where commuting and short-term migration are expected to be most profitable. Rather than facilitating growth of the non-farm sector in rural areas, road construction appears to facilitate the access of rural labor to external employment. These labor market outcomes are associated with a nearly ten percent increase in earnings. • **Findings of this paper suggest that the poor state of rural transportation infrastructure in developing countries must be taken seriously as a barrier to the efficient allocation of labor across space and sectors.** The paper finds no such evidence of a rise in migration following road construction, lending credence to research proposing factors other than the state of rural transport infrastructure to explain India's low rates of rural-urban migration. • This paper adds to a growing literature on the linkages in labor markets across space and suggests that **transportation infrastructure may be an important determinant of flows of capital and labor between rural and urban areas in developing countries.** • It provides evidence that workers can participate in non-agricultural labor markets without moving to cities when market access to urban areas is sufficiently high. It argues that India's low rate of structural transformation when compared to China may be due in part to its much lower rate of investment in transportation infrastructure.