

## ECONOMIC AND FINANCIAL ANALYSIS

### A. Introduction

1. The State Government of Maharashtra initiated the Mukhya Mantri Gram Sadak Yojana (MMGSY) in 2015 to connect villages in rural areas and improve existing roads not covered under other rural accessibility improvement programs in India, such as the Pradhan Mantri Gram Sadak Yojana (PMGSY), a nationwide program to provide good all-weather road connectivity to unconnected villages.<sup>1</sup> The MMGSY aims to rehabilitate 30,000 kilometers (km) of rural roads over 5 years to improve remote rural communities' access to public facilities, markets, and goods. The proposed Maharashtra Rural Connectivity Improvement Project Additional Financing, together with the ongoing project, will improve selected rural road sections covered by the MMGSY program in 34 districts in the State of Maharashtra. Improvement of the rural road network is essential to the state government's effort to support the growth of agriculture and agribusiness, as farmer distress is a major socioeconomic problem in the state. The main output of the proposed additional financing is to improve 1,100 rural road sections and 230 bridges (about 2,900 km) to all-weather standards with climate-resilience and safety features. The improved roads will provide people living in rural communities in the state with increased economic opportunities and improved access to social services, thereby reducing poverty incidence in those communities.

### B. Macroeconomic Context

2. The state government has prepared its long-term strategic development plan, Vision 2030, based on the United Nations Sustainable Development Goals.<sup>2</sup> Vision 2030 identifies five areas to focus on to achieve sustainable, balanced, and inclusive socioeconomic development: agriculture and allied activities, industry, infrastructure, the social sector, and governance. The state will implement several major initiatives to achieve the goals of Vision 2030. Initiatives will concentrate on enhancing crop productivity, improving the yield and quality of horticulture and floriculture, reducing the cost of cultivation, introducing integrated farming systems, promoting group farming, conserving soil and water for moisture security, creating quality infrastructure for storage and processing to control waste, introducing post-harvest technology for value addition, promoting agricultural produce exports, and promoting the provision of credit for agriculture businesses.

3. Vision 2030 aims to provide quality, reliable, sustainable, safe, and affordable roads that are equally accessible by all. Rural connectivity is a key component of agriculture and rural development. Maharashtra's road network comprises 303,000 km of roads, and 67% of these are rural roads. Under Vision 2030, the government is planning a sustained effort to address improvements to the state's road network using a combination of its own resources and assistance from international development partners. This will include development of both major corridors and rural road networks. Under the PMGSY, as of November 2019 the Maharashtra state government had completed upgrading about 27,500 km of roads, connecting 10,842 settlements. The MMGSY targets 30,000 km of rural roads not covered under the PMGSY.

---

<sup>1</sup> Government of India, Ministry of Rural Development. [Pradhan Mantri Gram Sadak Yojana](#). New Delhi.

<sup>2</sup> State Government of Maharashtra, Planning Department. 2018. *Vision 2030*. Mumbai.

### C. Demand Analysis and Project Alternatives

4. Maharashtra has a large network of rural roads, but a large proportion of the network is in poor condition. The road and bridge sections of the proposed additional financing have been selected from prioritized lists included in each district's rural road plan. Roads and bridges have been prioritized based on the size of the population served, existing traffic levels, and pavement conditions as determined by the pavement condition index. Traffic levels in the project areas require a standard single lane configuration and bituminous paved surfacing to provide good service and ensure long-term sustainability. Without improvements, most of these road sections will become unusable for motorized vehicles in a few years. This will drastically increase transport costs to access market centers and social services for people living in rural communities in the state.

### D. Methodology and Data

5. **Economic analysis assumptions.** ADB carried out the economic analysis following ADB's guidelines and by comparing transport costs for the Department of Rural Development and transport users in the with- and without-project scenarios.<sup>3</sup> The analysis estimates unit vehicle operating costs (VOCs) using the highway development and management (HDM)-4 model. The analysis values additional financing project costs and benefits at 2020 prices, adopting a domestic price numeraire. The analysis uses a discount rate of 9% and a shadow exchange rate factor of 1.032 (estimated based on import and export trade data for India) for traded goods, and a shadow wage rate factor of 0.71 for unskilled labor.<sup>4</sup> The analysis uses an exchange rate of \$1=₹72.0. Road works mainly consist of pavement works with a life of 20 years, and the analysis assumes a salvage value of zero at the end of the 20-year analysis period. In the case of bridges, a 40-year life is considered, and accordingly the salvage value is calculated using the straight line depreciation method and included at the end of the analysis period. ADB obtained the data required for the analysis, including the existing road characteristics and project design, from the detailed project reports.

6. In the with-project scenario, the additional financing road sections will be improved to a standard single or intermediate lane configuration with bituminous base and surfacing. The improvement will also include measures to improve road safety and control speeds around curves and in commercial areas. The engineering design includes adequate cross-drainage provisions and provides for concrete pavement in commercial areas and in areas where pavement drainage is an issue. The improvements to the selected road sections will ensure an acceptable level of service and will also support routine maintenance of the rehabilitated roads over the project lifetime. As a result, it will be possible to maintain improved vehicle travel speeds over the analysis period.

7. **Vehicle characteristics and costs.** The improvement of the additional financing project road sections will result in savings for road users and for society as a whole in the form of reduced VOCs and time savings for passenger and freight traffic. These savings were estimated with unit values generated using the Highway Development and Management (HDM-4) model, using the following inputs: vehicle technical and operational characteristics, vehicle prices, tire prices, fuel

<sup>3</sup> ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

<sup>4</sup> Shadow exchange rate based on A. Lagman-Martin. 2004. *Shadow Exchange Rates for Project Economic Analysis: Towards Improving Practice at the Asian Development Bank*. Manila: ADB. The shadow wage rate is estimated based on agricultural and construction worker wage data from Labor Bureau, Ministry of Labor and Employment, Government of India. 2017. *Reports on wage rate in rural India*. Delhi. (July), and minimum wage data in Maharashtra from Labour Law Reporter. [Minimum Wages – Maharashtra](#).

prices, and maintenance and vehicle operation staff costs. The vehicle price, tire price, and staff costs are based on data from projects in the region. Economic fuel prices were derived by excluding all taxes and duties and considering a medium-term oil price of \$50 per barrel.

8. **Value of time for passengers.** The values of passengers' working and nonworking time were calculated based on wage rates in Maharashtra (Table 1). The unskilled labor component in the value-of-time calculation was multiplied by a shadow wage rate factor of 0.71. The value of nonworking time is taken as 25% of the value of working time.

**Table 1: Values of Passengers' Working and Nonworking Time**

State	Value of Working Time (\$ per hour)			Value of Nonworking Time (\$ per hour)		
	Bus	Two-wheeler	Car	Bus	Two-wheeler	Car
Maharashtra	0.94	1.60	3.29	0.23	0.40	0.81

Source: Asian Development Bank estimates.

9. **Traffic estimation and forecast.** The Maharashtra Rural Road Development Association (MRRDA) carried out classified traffic counts on the additional financing project road sections during project preparation; from these it derived average daily traffic flows—constituting “normal” traffic on the project road sections—of 89–411 vehicles per day. There is the potential for generated traffic as a result of the better roads and savings in VOCs. Once the roads are improved, traffic flows are expected to increase by 10% due to generated traffic, which is assumed to be a conservative estimate. The road sections are the most direct connections between rural settlements and urban centers. As such, traffic flows are not expected to increase as a result of the roads being used as alternative routes to other destinations. In the absence of historical data for traffic growth on the road sections, this analysis is based on the growth in vehicle numbers, population, and economic activity. The elasticity of traffic growth is estimated in relation to these parameters, and in turn used to make traffic projections.

10. The number of registered vehicles in Maharashtra has grown at 8.5% per year during 2013–2018. The number of registered two-wheeled vehicles and cars has grown at about 9.0% per year, while the number of goods-carrying vehicles has grown by 7%, and buses by 6%.<sup>5</sup> The state has the largest economy in India, and the growth rates of the state's economy and in the number of registered vehicles are close to national averages. The state's economy grew at 7.4% during 2013–2018 but growth slowed to 5.7% in 2019–2020. Considering the slowdown, the economy is expected to grow at 5%–6% during 2021–2023. The growth rate for registered vehicles in rural areas is expected to be lower than the state average, and growth rates over the analysis period have been derived accordingly. The traffic growth rates estimated for different vehicle categories for the traffic projections are in Table 2.

**Table 2: Traffic Growth Rates used in Projections**

Vehicle Type	2020–2025	2025–2030	2030–2035	Beyond 2035
Car, Van and Jeep	5.4	4.7	4.1	3.1
Two-wheeler	5.3	4.7	4.1	3.3
Bus	3.5	3.1	2.7	2.2
Goods Vehicles	3.8	3.3	2.8	2.2

Source: Asian Development Bank estimates.

<sup>5</sup> Government of Maharashtra, Planning Department, Directorate of Economics and Statistics. March 2018. *Economic Survey of Maharashtra* (for the years FY2013 to FY2018). Mumbai.

11. **Project benefits.** The proposed upgrading of the additional financing road sections will increase vehicle speeds compared with the present low speeds. Increased speeds and improved road conditions will benefit road users through reduced travel times and VOCs. Travel speeds in the without-project scenario average about 10–20 kilometers per hour, and driving is difficult to impossible during the rainy season. In the with-project scenario, average speeds estimated with the HDM-4 model are 30–40 kilometers per hour throughout the year. Proposed improvements will include enhanced road safety features to mitigate the potential for an increase in crashes with improved travel speeds. The project is also estimated to reduce greenhouse gas emissions by 2,919 tons of carbon dioxide equivalent per year. Because of the low traffic levels the savings in monetary terms from both improved road safety and reduced greenhouse gas emissions is not large, and is therefore not included in the analysis

12. The road upgrades will support government initiatives in agriculture to promote crop diversification, increase agricultural productivity, improve marketing, improve logistics (e.g., cold chains and warehouses), and develop agribusiness. The rural population in the project area will benefit greatly from improved access to nonfarm activities and expanded economic opportunities, which in turn will improve the quality of life for rural communities in these districts; these benefits are not quantified in the economic analysis.

13. **Project costs.** MRRDA prepared detailed designs and cost estimates for the additional financing project road and bridge sections. The design includes bituminous pavement (with a minimum thickness of 70 millimeters) for single- or intermediate-lane roads, provisions for adequate cross-drainage, concrete pavement in commercial areas, and road safety features.<sup>6</sup> The cost estimate includes (i) civil works, (ii) social and environmental measures, (iii) shifting utility infrastructure (i.e. electricity poles, water pipes), and (iv) physical contingencies. The economic costs of construction were derived by removing taxes from the financial construction costs and applying a shadow wage rate factor for unskilled labor and a standard conversion factor. The estimated financial cost is \$47,599–\$166,300 per km. The routine and periodic maintenance unit costs adopted are based on the unit cost estimates for the additional financing.

## E. Results of Economic Analysis

14. An economic analysis has been carried out for the additional financing road and bridge packages, and an updated analysis of the ongoing project and the overall project has been conducted, updated to 2020 cost levels (Table 3). The results indicate that both the proposed additional financing and the overall project have a rate of return well above the opportunity cost of 9%. The cash flow streams for the additional financing are in Table 4.

**Table 3: Results of Economic Analysis**

Project	EIRR (%)	ENPV (\$ million)
All roads in RCIP (Additional Financing)	17.0 (9.6–28.7) <sup>a</sup>	224.2
All roads in RCIP (Ongoing)	13.3	37.2
Overall RCIP (Ongoing + Additional Financing)	16.0	266.3

EIRR = economic internal rate of return, ENPV = economic net present value, RCIP = Rural Connectivity Improvement Project.

<sup>a</sup> Range of EIRR for the contract packages.

Source: Asian Development Bank assessment.

<sup>6</sup> Intermediate-lane roads have a carriageway width of 5.5 meters.

**Table 4: Cash-Flow Stream for the Additional Financing Project**  
(\$ million)

Year	Increase in Road Agency Costs		Decrease in Road User Costs		Net Benefits
	Capital Costs	Maintenance Costs	Vehicle Operating Costs	Time Costs	
2020	84.08	0.00	0.00	0.00	(84.1)
2021	252.25	0.00	0.00	0.00	(252.3)
2022	0.00	(2.43)	33.33	15.81	51.6
2023	0.00	(2.06)	35.22	17.39	54.7
2024	0.00	(1.77)	36.96	18.25	57.0
2025	0.00	(1.55)	38.57	19.04	59.2
2026	0.00	(1.38)	40.24	19.86	61.5
2027	0.00	18.52	41.99	20.72	44.2
2028	0.00	17.86	43.81	21.62	47.6
2029	0.00	(1.78)	45.70	22.55	70.0
2030	0.00	(16.51)	47.32	23.35	87.2
2031	0.00	(14.53)	48.98	24.17	87.7
2032	0.00	(14.87)	50.70	25.02	90.6
2033	0.00	19.18	52.47	25.89	59.2
2034	0.00	18.14	54.31	26.80	63.0
2035	0.00	(1.35)	55.92	27.60	84.9
2036	0.00	(1.46)	57.57	28.41	87.4
2037	0.00	(1.54)	59.27	29.24	90.1
2038	0.00	(1.59)	61.02	30.11	92.7
2039	0.00	18.83	62.82	30.99	75.0
2040	0.00	17.07	64.66	31.90	79.5
2041	(35.83)	(3.59)	66.56	32.84	138.8
				<b>EIRR (%)</b>	<b>17.0%</b>
				<b>ENPV @ 9%</b>	<b>224.2</b>

( ) = negative, EIRR = economic internal rate of return, ENPV = economic net present value.

Source: Asian Development Bank assessment.

15. Sensitivity analysis was carried out for the additional financing over the base case with respect to adverse changes in costs and benefits, as follows: (i) base cost and base benefits, (ii) 10% increase in capital costs and base benefits, (iii) base cost and 10% decrease in benefits, (iv) 2-year construction delay, (v) 10% increase in capital costs and 10% decrease in benefits. The analysis shows that the project overall has an economic internal rate of return of more than 9% in all sensitivity cases (Table 5).

**Table 5: Sensitivity Analysis Results**

Projects	Sensitivity Scenario (EIRR%)				
	Case I	Case II	Case III	Case IV	Case V
All Roads	17.0	15.5 (+78%)	15.3 (-43%)	15.9 (N/A)	13.9 (+/-28%)

EIRR = economic internal rate of return, NA = not applicable.

Note: Figures in bracket give the switching values for the variables considered. In Case V, the +/- indicates the percentage by which the costs increase and the benefits decrease to result in a net present value of 0.

Source: Asian Development Bank assessment.

## F. Distribution and Poverty Analysis

16. The project costs and benefits are shared among the project stakeholders, including government stakeholders, laborers, vehicle operators, and vehicle passengers. The poverty

headcount ratio for rural Maharashtra was 24.2% in 2012,<sup>7</sup> down from 29.6% in 2005; assuming a similar trend in poverty reduction, it was estimated that the poverty headcount ratio was about 19.0% in 2020. In addition, it is assumed that an equal proportion of the population in the project area remains vulnerable to poverty. Therefore, it is estimated that 38.0% of the population is poor or vulnerable. This analysis assumes that 50% of VOC savings will accrue to vehicle owners, while 50% will be passed on to the road users by the operators of public transport and freight vehicles. The poor and vulnerable are likely to accrue a portion of costs and benefits attributed to government and vehicle passengers as shown in Table 6. The project will increase the net income of project beneficiaries by an estimated \$244.3 million, of which \$82.1 million will accrue to the poor and vulnerable. The poverty impact ratio is estimated to be 33.6%.

**Table 6 Poverty Impact Assessment**

Item	Vehicle Owners	Vehicle Passengers	Unskilled Labor	State Government	Total
NPV (\$ million)	189.0	375.0	14.3	(334.0)	244.3
Share of costs and benefits accruing to the poor and vulnerable (%)	5	20.0	100	5.0	
Costs and benefits accruing to the poor and vulnerable (\$ million)	9.4	75.0	14.3	(16.7)	82.1
<b>Poverty Impact Ratio (%)</b>					<b>33.6</b>

( ) = negative, NPV = net present value.

Source: Asian Development Bank estimates.

## G. Financial Analysis

17. A financial analysis has been conducted in accordance with ADB guidelines,<sup>8</sup> with the objective of ensuring that the additional financing is financially sustainable. As this is a nonrevenue-generating project, the financial analysis focused on assessing the capacity of MRRDA and local governments to absorb the incremental operation and maintenance (O&M) costs associated with the project.

18. ADB conducted the analysis by (i) defining the rural road network in the state; (ii) assessing MRRDA's methodology for allocating budget funds for O&M of rural roads; (iii) identifying the budget allocation for O&M of different state entities and the rate of utilization of the allocation; (iv) estimating the incremental O&M costs associated with the proposed additional financing project, and its impact on MRRDA's overall O&M requirements; and (v) assessing the likelihood of adequate budget allocation to MRRDA to cover maintenance throughout the economic life of the rural roads improved under the project.

19. The state's road network comprises an estimated 303,000 km of roads, 67% (203,000 km) of which are rural roads (footnote 5). Long-term underinvestment has caused Maharashtra's road network to deteriorate, with rural roads in the worst condition. The state has improved about 25,000 km of roads under the PMGSY, and has initiated the MMGSY program to cover 30,000 km of rural roads not reached by the PMGSY (para. 1). The government is using its resources to construct 23,650 km of rural roads under the MMGSY. The proposed additional financing project aims to improve the condition of 1,100 rural roads and 230 bridges (2,900 km) to all-weather standards, incorporating safety features, climate resilience, and gender-inclusive features. The

<sup>7</sup> Intermediate-lane roads have a carriageway width of 5.5 meters.

<sup>8</sup> ADB. 2008. *Financial Due Diligence: A methodology note*. Manila; ADB. 2005. *Financial Management and Analysis of Projects*. Manila

rural road network to be covered by the proposed additional financing project represents about 1% of the total rural road network in the state and about 10% of the total rural road network under the MMGSY.

20. The Maharashtra Rural Development Department (RDD) is responsible for construction and maintenance of the rural road network. It receives fiscal allocations from the state government for road development and maintenance. MRRDA, under the RDD, is tasked with implementing road rehabilitation programs—including the proposed ADB-supported project—under the PMGSY and the MMGSY. MRRDA estimates its budget needs based on a road condition assessment and receives its budget allocation from the RDD.

21. Under the existing setup, rural roads rehabilitated under the PMGS and MMGSY schemes, including the proposed additional financing project, will not adopt toll collection during operation. Instead, the MRRDA will be responsible for maintaining these roads for 10 years, after which the roads and their maintenance will be turned over to local governments.

22. The economic life of the improved rural roads is measured as 20 years. The incremental O&M costs associated with rural roads improved under the additional financing project is estimated as follows: (i) regular maintenance of 1.1% of the investment cost annually during the first 5 years, and 3% of the investment cost annually from year 6 to year 20; and (ii) periodic maintenance of 20% of the investment cost every 7.5 years.

23. MRRDA conducts maintenance of roads improved under the PGMSY while improving new roads under the MMGSY. A review of the budgeted versus actual O&M expenditures under the PMGSY for 2014–2018 indicates that MRRDA receives insufficient funds for maintenance—specifically, only 34.6% of its annual maintenance needs (Table 6).

**Table 6. Operation and Maintenance Costs of  
Government Rural Roads Program—Past Performance**  
(\$ million)

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	Average
Estimated budget needs for O&M	49.8	51.6	53.6	55.6	57.7	53.7
Funds received for O&M	15.9	19.7	18.6	19.0	19.6	18.5
Utilization of funds for O&M	15.9	19.7	18.6	19.0	19.6	18.5
% of O&M needs received	32.0	38.1	34.7	34.3	34.0	34.6
Utilization rate, %	100.0	100.0	100.0	100.0	100.0	100.0

FY = fiscal year, O&M = operation and maintenance (routine and periodic).

Source: Maharashtra Rural Road Development Association

24. In order to better safeguard its rural road asset base, in August 2019 RDD adopted a rural road maintenance policy, applicable to MRRDA and local governments.<sup>9</sup> The policy objectives include (i) providing funds for maintenance of rural roads as a priority of fund allocation; (ii) formulating an action plan for time-bound removal of maintenance backlogs of the rural road network; (iii) undertaking efficient maintenance by using appropriate technology, state-of-the-art and effective repair treatments including new technology and equipment in rural road repair and maintenance management; and (iv) undertaking capacity building and organizational development of the human resources and agencies engaged in rural road construction and maintenance to ensure efficient rural road development and maintenance. According to the policy,

<sup>9</sup> Government of Maharashtra, Rural Development Department. *The Maharashtra Rural Roads Maintenance Policy* (Government Resolution No.: Grasayo-2019/C.R.77/Works-2). 2019. Mumbai.

the pavement condition index of each rural road will be updated every 2 years by the RDD and recorded in its database. An annual maintenance plan will be prepared based on the pavement condition index with prioritization of roads in accordance with the road priority index. The policy also outlines the norms for conducting routine and periodic maintenance activities.

25. Despite the aspirational policy, the analysis suggests it is unlikely that the MRRDA will have sufficient funds to conduct full routine and periodic maintenance on the roads improved under the project. In addition, it is estimated that local governments will have even fewer funds available for maintenance once they assume responsibility for the improved roads. Therefore, there is a risk that the improved roads may not attain their expected economic lifespans, and that new capital investments will be required prematurely.

26. To mitigate the risk of insufficient road maintenance, the additional financing project, as well as the ongoing project, will integrate the following measures and activities.

- (i) The same contractors that improved the roads will conduct routine maintenance for the first 5 years; this activity and budget will be included as part of the project, and the government will finance all maintenance costs.
- (ii) The project will develop manuals for performance-based maintenance.
- (iii) The project will develop training programs to improve the capacity of MMRDA local governments to: (a) maintain roads, (b) estimate accurately the required resources to maintain roads, and (c) prepare budget requests that prioritize maintenance over construction.
- (iv) The transaction technical assistance (attached to the ongoing project) will provide capacity building to MRRDA to improve its road asset management system.
- (v) The national and state governments will provide adequate and timely funding for proper road maintenance, and have provided assurances to that effect as part of the loan agreement.

27. Furthermore, ADB will seek additional assurances as part of the legal agreement that the national and state governments will provide the MRRDA and local governments with adequate funds for road maintenance throughout the estimated economic life of the improved roads under the additional financing project.