Report and Recommendation of the President to the Board of Directors

Project Number: 49469-007
January 2019

Proposed Loan
India: Mumbai Metro Rail Systems Project

This is the version of the document approved by ADB's Board of Directors that excludes information that is subject to exceptions to disclosure set forth in ADB's Access to Information Policy.

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 11 January 2019)

Currency unit	–	rupee (₹)
₹1.00	=	$0.0141895295
$1.00	=	₹70.474500

ABBREVIATIONS

ADB	–	Asian Development Bank
CAG	–	comptroller and auditor general
CTS	–	comprehensive transport study
DMRC	–	Delhi Metro Rail Corporation
EIRR	–	economic internal rate of return
GESI	–	gender equality and social inclusion
JICA	–	Japan International Cooperation Agency
km	–	kilometer
MMR	–	Mumbai Metropolitan Region
MMRDA	–	Mumbai Metropolitan Region Development Authority
O&M	–	operation and maintenance
PAM	–	project administration manual

NOTES

(i) The fiscal year (FY) of the Government of India and its agencies ends on 31 March. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2018 ends on 31 March 2018.

(ii) In this report, "$" refers to United States dollars.

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PROJECT AT A GLANCE

1. Basic Data — **Project Number:** 49469-007

Project Name	Mumbai Metro Rail Systems Project	**Department /Division**	SARD/SATC
Country	India	**Executing Agency**	Mumbai Metropolitan Region Development Authority
Borrower	Government of India		

	2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓	**Transport**	Transport policies and institutional development	12.00
		Urban public transport	914.00
		Total	**926.00**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 2: Access to economic opportunities, including jobs, made more inclusive	CO_2 reduction (tons per annum)	166,507
		Climate Change impact on the Project	Low
Environmentally sustainable growth (ESG)	Global and regional transboundary environmental concerns	**ADB Financing**	
	Urban environmental improvement	Mitigation ($ million)	926.00

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Governance and capacity development (GCD)	Institutional development	Effective gender mainstreaming (EGM)	✓
Partnerships (PAR)	Commercial cofinancing		
	International finance institutions (IFI)		

5. Poverty and SDG Targeting		**Location Impact**	
Geographic Targeting	No	Urban	High
Household Targeting	No		
SDG Targeting	Yes		
SDG Goals	SDG5, SDG8, SDG11		

6. Risk Categorization: Complex

7. Safeguard Categorization **Environment:** B **Involuntary Resettlement:** C **Indigenous Peoples:** C

8. Financing

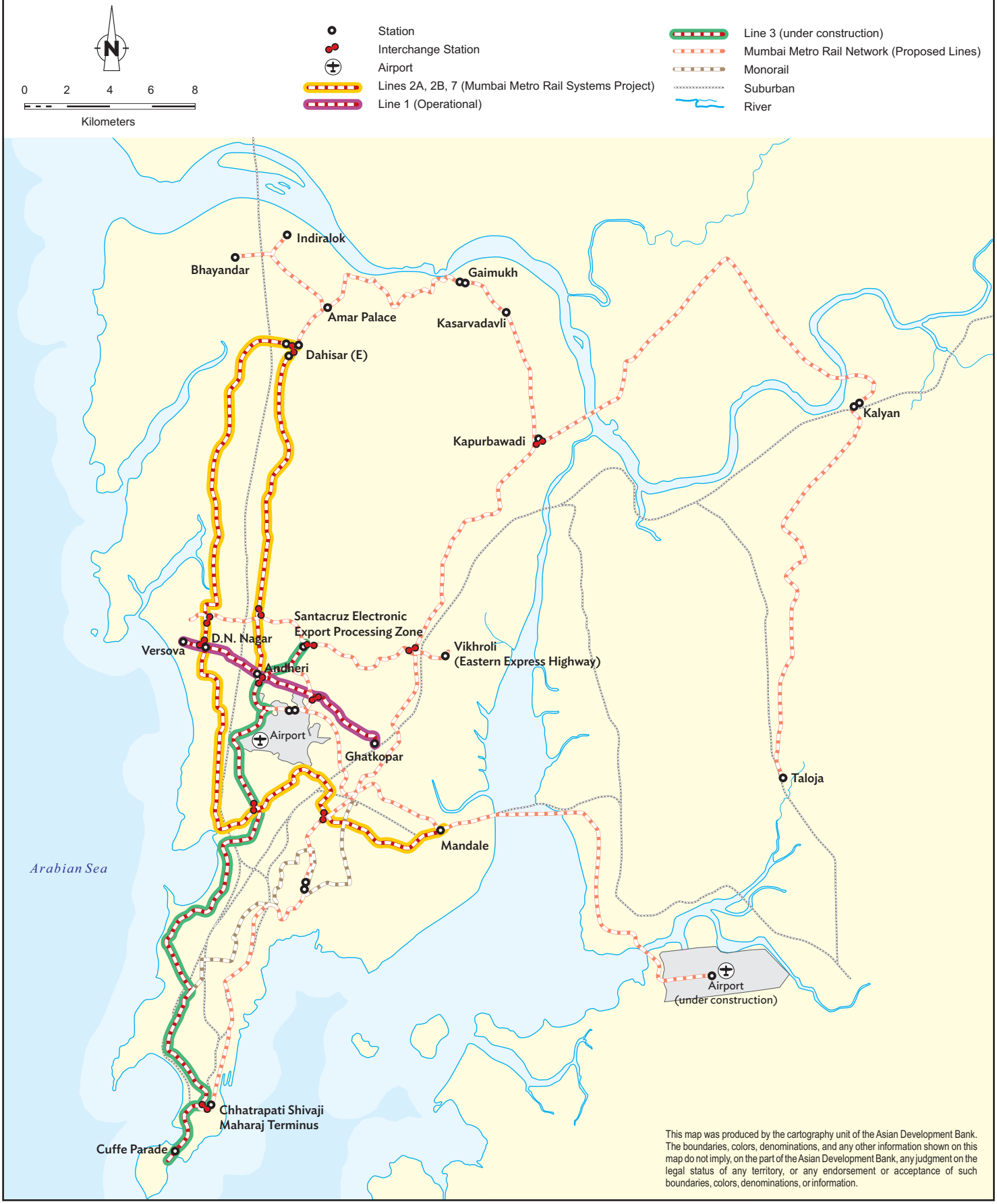
Modality and Sources	**Amount ($ million)**
ADB	**926.00**
Sovereign Project (Regular Loan): Ordinary capital resources	926.00
Cofinancing	**260.00**
New Development Bank - Project loan (Not ADB Administered)	260.00
Counterpart	**489.00**
Government	489.00
Total	**1,675.00**

Currency of ADB Financing: USD

Source: Asian Development Bank

INDIA

MUMBAI METRO RAIL SYSTEMS PROJECT



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I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan to India for the Mumbai Metro Rail Systems Project.

2. The project will support the implementation of the Mumbai Metro Rail System through the (i) design, manufacture, testing, and maintenance of 378 energy-efficient rolling stock carriages; (ii) procurement, installation, and testing of an advanced signaling, train control, and platform access system for 58 kilometers (km) of metro lines; and (iii) establishment of a Mumbai metro operations organization. The project will contribute to the development of a modern and safe rail-based urban transit system in Mumbai city, which will reduce pollution and traffic congestion, increase public transport ridership, and improve the overall quality of the city's transport system.

II. THE PROJECT

A. Rationale

3. **Mumbai Metropolitan Region.** Mumbai, the capital of the state of Maharashtra, is one of India's largest metropolitan areas, and is also known as the financial capital of India. The Mumbai Metropolitan Region (MMR) covers an area of about 4,355 square km with a population of more than 18 million.[1] The Municipal Corporation of Greater Mumbai is the largest constituent of the MMR, with a population of about 12 million and an area of about 440 square km.[2] The MMR makes a very substantial contribution to India's economy—the state of Maharashtra produced about 15% of India's gross domestic product, about 40% of which is estimated to be from the MMR.[3] The two ports in the MMR, Mumbai Port Trust and Jawaharlal Nehru Port Trust, handle more than 30% of India's sea trade.

4. **Transport problems.** The Mumbai metropolitan area lies along a north–south peninsula. The resulting geographic constraints result in Mumbai city having the second-highest population density in the world.[4] Mumbai's density and geography present enormous challenges to the transport system. Rail is the primary transport mode in the MMR, and the Western Railway and Central Railway form the peninsula's main north–south transport lines. The MMR's suburban rail route network totals nearly 400 km. The bus system is operated by the state-owned Brihanmumbai Electric Supply and Transport Undertaking and carries more than 5 million passengers per day in highly congested conditions.

5. Existing public transport systems in Mumbai are extremely crowded, unsafe, and slow, affecting primarily the poor, women, and children. The public transport share of trips has declined steadily—from 88% in 1994 to 78% in 2005, and 70% in 2015—but Mumbai's public transport mode share nevertheless remains one of the highest of any city in the world. Primary reasons for the decline are the expansion of the urban area and cross-axis (east–west) travel demand, both of which are not well-served by the existing public transport system. The suburban railway lines carry more than 7.5 million passengers per day often under "super dense crush load" conditions

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[1] Government of India, Office of the Registrar General and Census Commissioner. 2011. *Census: Population Enumeration Data*. New Delhi.

[2] Municipal Corporation of Greater Mumbai. 2016. *Year Book 2015, Part I.* Mumbai.

[3] Government of Maharashtra. 2018. *Economic Survey of Maharashtra: 2017–2018*. Mumbai; and G. Clark and T. Moonen. 2014. *Mumbai: India's Global City*. Washington, DC.

[4] World Economic Forum. 2017. *These are the world's most crowded cities*. Data are derived from the United Nations Habitat, 2013.

exceeding 14 passengers per square meter, making the Mumbai rail system the most crowded public transport system in the world. Each train carries about 5,000 passengers, compared to a design capacity of 1,750. Suburban trains have severe safety problems, with more than 3,000 fatalities per year, caused mainly by overcrowding and right-of-way encroachment. Those constraints and the overwhelming level of demand limit the speed of the rail service and its ability to accommodate more passengers. The inability of the current public transport system to meet the demand for travel has resulted in a 400% increase in private vehicles from 2008 to 2015.

6. Increased public transport capacity is crucial to address these severe transport problems; improve livability; provide safe and convenient mobility for the poor, women, and children; arrest the decline in public transport mode share; and enable the city to develop to its potential. Given the geographic and existing infrastructure constraints and extremely high population density, a metro rail system is the only reasonable alternative. As such, the government has developed a plan for 12 metro lines with a length of 276 km. Line 1 is operating, and the Metropolitan Mumbai Regional Development Authority (MMRDA) is implementing other lines. The Asian Development Bank (ADB) will assist the MMRDA in financing the procurement of rolling stock, signaling and train control systems, station access and platform systems; and support multimodal integration and access for Lines 2 and 7.

7. **Public transport development strategy.** The Government of Maharashtra realizes that the sustainable solution to address transport problems in Mumbai is to develop and expand rail-based public transport. In 2003, MMRDA commissioned the preparation of a masterplan for the Mumbai metro rail system. As part of the World Bank-assisted Mumbai Urban Transport Project, the MMRDA also prepared a comprehensive transport study (CTS) for MMR in 2005–2008, for the period up to 2031. The CTS sets out timeline goals for transportation and serves as a sector road map that focuses on increasing the metro and suburban rail networks and services. It will reduce road vehicles, lower emissions, and improve the urban environment and quality of urban life. Extending the metro rail system to supplement the existing suburban rail in Mumbai will help achieve the objectives of the CTS and the National Urban Transport Policy.[5] To ensure the efficiency and sustainability of the metro rail system, a viable operations organization with capacity to manage the metro system must be established. ADB's country partnership strategy for India, 2018–2022 recognizes the need to strengthen urban mass transit systems and to increase the environmental sustainability of cities through the development of metro rail systems.[6] This project is also included in the country operations business plan for India, 2019–2021.[7]

8. **Metro lines under operation and development.** Of the planned metro rail developments in the CTS, the contract for Line 1 between Andheri and Ghatkopar (11 km) was awarded to the Mumbai Metro One Private Ltd. in March 2007.[8] The line was completed in 2014 on a public–private partnership model. This single metro rail line carries about 400,000 passengers per day and reduced the travel time along the corridor from 71 minutes to 21 minutes, and also reduced traffic congestion by shifting travel demand from private vehicles and informal public transport modes to the metro. To expedite the implementation of the network, the Government of Maharashtra has decided to entrust the construction of new lines to the MMRDA. The scale of investment for the multiple lines is very large, and it is difficult for metro rail systems to meet equity return expectations. Hence, it is proposed to follow a model whereby the government finances the assets using its own funds and development assistance, and then outsources service

[5] Government of India, Ministry of Urban Development. 2006. *National Urban Transport Policy*. New Delhi.
[6] ADB. *Country Partnership Strategy: India, 2018–2022—Accelerating Inclusive Economic Transformation*. Manila.
[7] ADB. 2017. *Country Operations Business Plan: India, 2019–2021*. Manila.
[8] Mumbai Metro One Private Ltd. is a joint venture company owned by Reliance Infrastructure (69%), Veolia Transport (5%), and Mumbai Metropolitan Region Development Authority (26%).

contracts. This is the practice in most metros worldwide. The MMRDA will create a new metro rail organization and carry out selective aspects of operation and maintenance (O&M) with private sector participation.

9. Line 3 (Colaba–Bandra–Santacruz Electronic Export Processing Zone), which is an underground line of about 34 km is also being developed accordingly, with assistance from the Japan International Cooperation Agency (JICA).[9] For other lines, the MMRDA is seeking financing from development agencies, including ADB, JICA, and the New Development Bank. ADB proposed to provide financial assistance to the following lines: (i) Line 2A from Dahisar (Charkhop) to D. N. Nagar, (ii) Line 2B for D. N. Nagar–Bandra–Mandale, and (iii) Line 7 from Dahisar (East) to Andheri (East). The aggregate length of these lines is about 58 km. The MMRDA has already commenced the civil works of these lines using state funds.[10] ADB funding will be used to finance the rolling stock, signaling, platform access and safety systems, and multimodal integration, which will be mainly through systems supply and installation contracts.[11]

10. **Value added by ADB assistance.** Mumbai has a large suburban rail system, but safety remains a huge challenge, with over 3,000 deaths per year since 2006 as a result of overcrowding, people falling from the trains, and people crossing tracks. ADB assistance to the project will add value in the following ways:

(i) **Improve transport safety through high-level technology.** The project will reduce congestion on the existing suburban rail system and significantly improve transport safety by moving passengers to a modern, energy-efficient, comfortable, and safe transit system, with best-practice safety equipment such as platform doors and a fully grade-separated right-of-way.[12] ADB financing will help procure state-of-the-art carriages, equipped with surveillance systems and real-time track monitoring to ensure safety. ADB will also help implement the latest signaling technology and a communications-based train control system.

(ii) **Establish an efficient and sustainable metro rail organization.** The Mumbai metro operations organization will be responsible for the O&M of all metro lines in Mumbai. ADB support will help train staff; recruit qualified personnel; and develop standard operating procedures, training manuals, and aids, including procurement of training equipment such as simulators.

(iii) **Establish last-mile connectivity solutions.** Public transport systems often have poor last-mile connectivity that makes reaching the final destination a challenge for passengers. To overcome this limitation, ADB is helping the MMRDA to ensure last-mile connectivity through nonmotorized transport and electric vehicles.

B. Impact and Outcome

11. The project is aligned with the following impact: urban mobility in the MMR improved (footnote 5). The project will have the following outcome: efficiency, safety, and gender- and social-inclusiveness of rail-based urban transit system in Mumbai city increased.[13]

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[9] The metro rail line numbers are a legacy of previous studies and do not reflect priority of importance or sequencing.

[10] The civil works progress is about 40% on Lines 2A and 7, and about 15% on Line 2B. These civil works are being entirely funded by the government and do not involve ADB financing.

[11] New Development Bank is financing in parallel certain specific traction and power equipment to the extent of approximately $260 million. This will be under a separate contract and not administered by ADB.

[12] The Mumbai Metro rail will use grade of automation 4, the highest grade of automation that involves automatic train protection, operation, and control.

[13] The design and monitoring framework is in Appendix 1.

C. Outputs

12. **Output 1: Rolling stock operational.** This will include the design, procurement, testing, and commissioning for operation of 378 standard-gauge rolling stock carriages, comprising 63 train sets in a configuration of 6 cars each. The rolling stock will have built-in safety features; design features for the elderly, children, women, and differently abled; and will be energy-efficient. The rolling stock supplier will have an obligation under the contracts to remedy defects, to supply spare parts, and to provide training to the maintenance staff of the Mumbai metro operations organization for 2 years after the date of supply.

13. **Output 2: Signaling, train control, and telecommunications systems operational.** This includes the design, supply, installation, testing, and commissioning of a modern signaling and train control system using radio communications-based train control technology, including computerized interlocking and automatic train protection. Stations will have platform access systems and automatic platform edge doors fitted for the elderly, children, women, and differently abled to ensure a high level of operational safety.

14. **Output 3: Institutional support for Mumbai metro operations organization and last-mile connectivity provided.** Consulting support will be provided for the establishment of the Mumbai metro operations organization, which will be responsible for operating and maintaining all rail-based urban transit lines within the MMRDA territory. This will serve as a template for integrated operations for future lines. The MMRDA will develop gender equality and social inclusion actions for the Mumbai metro operations organization, and provide support for a metro operations and training center and procure special software, computer-based tutorials, simulators, other training aids and equipment to ensure readiness for O&M. Nonmotorized and electric vehicles will be piloted at select stations to enhance last-mile connectivity.

D. Summary Cost Estimates and Financing Plan

15. The project is estimated to cost $1,415 million (Table 1). Detailed cost estimates by expenditure category and by financier are included in the project administration manual (PAM).[14]

Table 1: Summary Cost Estimates

($ million)

Item		Amount[a]
A.	**Base Cost**[b]	
	1. Rolling stock operational (includes related equipment)	1,047.8
	2. Signaling, train control, and telecommunications systems operational[c]	230.8
	3. Institutional support for Mumbai metro operations organization and last mile connectivity provided	12.1
	Subtotal (A)	**1,290.4**
B.	**Contingencies**[d]	**52.0**
C.	**Financial Charges During Implementation**[e]	**72.6**
	Total (A+B+C)	**1,415.0**

[a] Includes taxes and duties of about $168 million. Such amount does not represent an excessive share of the project cost.
[b] In mid-2018 prices as of May 2018.
[c] Includes automatic fare collection, central control, and security equipment.
[d] Physical contingencies computed at 2% for supply items. Price contingencies computed at the average of 2.0% on foreign exchange costs and 5.5% on local currency costs; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

[14] Project Administration Manual (accessible from the list of linked documents in Appendix 2).

[e] Includes interest and commitment charges. Interest during construction for the ordinary capital resources loan has been computed at the 5-year United States dollar fixed swap rate plus an effective contractual spread of 0.5% and maturity premium of 0.1%. Commitment charges for the ordinary capital resources loan are 0.15% per year to be charged on the undisbursed loan amount.
Sources: Mumbai Metropolitan Region Development Authority and Asian Development Bank.

16. The government has requested a regular loan of $926 million from ADB's ordinary capital resources to help finance the project. The loan will have a 25-year term, including a grace period of 5 years; an annual interest rate determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility; a commitment charge of 0.15% per year; and such other terms and conditions set forth in the draft loan and project agreements.[15] Based on the straight-line method, the average maturity is 15.25 years, and the maturity premium payable to ADB is 0.10% per year.

17. The summary financing plan is in Table 2. ADB will finance the expenditures in relation to (i) procuring rolling stock, (ii) installing a signaling and train control system, and (iii) establishing the Mumbai metro operations organization. The MMRDA will finance all the civil works components including tracks, stations, and maintenance depot.

Table 2: Summary Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (regular loan)	926.00	65
Government	489.00	35
Total	**1,415.00**	**100**

Source: Asian Development Bank.

18. Climate mitigation is estimated to cost $926 million. ADB will finance 100% of mitigation costs. ADB financing will support climate change mitigation through the modal shift from road-based transport to lower-emission metro rail, reducing carbon dioxide emissions by about 166,507 tons per year.[16] Details are in the PAM.

E. Implementation Arrangements

19. The implementation arrangements are summarized in Table 3 and described in detail in the PAM. The MMRDA has engaged the Delhi Metro Rail Corporation (DMRC) for implementation support, and a consortium of firms as its general consultant. All procurement of goods and consultants will be undertaken in accordance with the ADB Procurement Policy (2017, as amended from time to time) and Procurement Regulations for ADB Borrowers (2017, as amended from time to time).

Table 3: Implementation Arrangements

Aspects	Arrangements
Implementation period	February 2019–December 2022
Estimated completion date	31 December 2022
Estimated loan closing date	30 June 2023

[15] Subject to the confirmation of MMRDA.
[16] In accordance with the 2014 Joint Multilateral Development Bank Approach to Climate Finance Reporting. African Development Bank, ADB, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, International Finance Corporation, and the World Bank. 2015. *2014 Joint Report on Multilateral Development Banks' Climate Finance*. Washington, DC.

Aspects	Arrangements		
Management			
(i) Executing agency	MMRDA acting on behalf of the Government of Maharashtra		
(ii) Implementation unit	Mumbai metro operations organization located in MMRDA headquarters in Mumbai. The Mumbai metro operations organization will function under the oversight of the Metropolitan Commissioner, MMRDA.		
Procurement	OCB (international advertisement)	four contracts[a]	$877,000,000
	OCB (national advertisement)	two contracts	$16,000,000
Consulting services	QCBS, FTP	200 person-months	$7,000,000
Retroactive financing and/or advance contracting	MMRDA will use advance contracting and retroactive financing for equipment and consulting services for the project. Retroactive financing will be up to 20% of the loan proceeds to finance expenditures incurred prior to loan effectiveness but not earlier than 12 months from the date of the legal agreements.		
Disbursement	The loan proceeds will be disbursed following ADB's *Loan Disbursement Handbook* (2017, as amended from time to time) and detailed arrangements agreed between the government and ADB.		

ADB = Asian Development Bank, FTP = full technical proposal, MMRDA = Mumbai Metropolitan Region Development Authority, OCB = open competitive bidding, QCBS = quality- and cost-based selection.

[a] Includes an indicative package for nonmotorized transport and electric vehicles under output 3: Institutional support for Mumbai metro operations organization and multimodal integration provided.

Source: Asian Development Bank.

III. DUE DILIGENCE

A. Technical

20. The technical viability is sound, with the use of proven technology. The technical designs and specifications are in accordance with applicable international standards. The executing agency prepared project reports, detailed designs, and specifications. As per the specifications, rolling stock will be of modern design, lightweight, made of stainless steel or aluminum, and with regenerative braking. Modern signaling systems will be used that employ communications-based train control technology to enhance safety and efficiency. Platform screen doors will be installed to separate the station platform from the train and to prevent accidents.

21. The climate risk screening indicated a low risk to the project. Mumbai is prone to flooding, and an increase in both extreme rainfall events and the number of wet days is predicted. Flooding is therefore the key climate risk. Climate models did not forecast temperature increase to be severe, with an average of 1.1°C–1.8°C during 2030–2050.[17] The entire metro rail line is elevated and will have a vertical minimum clearance of 5.5 meters, while the rail level will be about 9.5 meters above the road level. The risk of flooding of the metro rail lines is therefore very low.

B. Economic and Financial

22. **Economic analysis.** The economic evaluation of the project was conducted in accordance with ADB guidelines, and compared the project costs and benefits in with- and without- project cases, using a 9% discount rate, economic internal rate of return (EIRR), and net present value as decision criteria.[18] The project is expected to deliver significant benefits to society through savings in vehicle operating costs and travel time for both public transport and

[17] The Energy and Resources Institute. 2014. *Assessing Climate Change Vulnerability and Adaptation Strategies for Maharashtra: Maharashtra State Adaptation Action Plan on Climate Change*. New Delhi.

[18] ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

road users. The project will also deliver social and economic benefits from reduced road accidents, improved railway passenger safety, and reduced carbon dioxide emissions and air pollution, which have been quantified in the analysis. The EIRR for Lines 2A and 2B is estimated to be 16.5%, and for Line 7, 14.8%. The overall EIRR for the project is 16.1%, with a net present value of over ₹197 billion. The evaluation included a sensitivity analysis to investigate the economic viability of the project given adverse changes in costs and benefits. The EIRR remained above 9% under all scenarios, demonstrating that the project would remain economically viable given adverse changes in costs and benefits. The metro lines will also contribute significantly to Mumbai's economic growth by structuring land use and transport patterns.

23. **Financial sustainability.** The financial evaluation of the project was conducted in accordance with ADB guidelines.[19] It assessed the incremental costs and earnings that would accrue to the MMRDA as a result of the project, and calculated the financial internal rate of return. The project's weighted average cost of capital was estimated to be 2.83%. For the purposes of financial sustainability, capital costs include the costs of construction of the metro line and its associated facilities, including stations, a maintenance depot, and assets to be financed by ADB (rolling stock and signaling). O&M costs include all staff costs, unit maintenance costs, and energy costs. The evaluation assumes traffic at commencement of operations will be 25% of forecast, which is increased to forecast estimates in the fourth year after commencement. The project revenues include ticket sales, advertisements, and rentals at metro stations. All financial projections are made in 2017 rupees, in real terms. The estimated financial internal rate of return of the net cash flows for Lines 2A and 2B taken together is 5.02%, in real terms, which is above the weighted average cost of capital. Details are in the financial analysis.[20]

C. Governance

24. **Institutional capacity.** The MMRDA was established through legislation under the Mumbai Metropolitan Region Development Authority Act, 1974, and has been functioning for over 40 years. Its objective was to increase economic activity in the MMR by promoting infrastructure development and improving the quality of life. The broad responsibilities of the MMRDA include (i) preparing regional development plans, (ii) providing financial assistance for significant regional projects, (iii) providing help to local authorities and their infrastructure projects, and (iv) coordinating execution of project schemes in the MMR. The MMRDA conceives, promotes, and monitors key projects to develop new MMR growth centers, and makes improvements in sectors such as transport, housing, water supply, and environment. The metropolitan commissioner is a senior officer of the Government of Maharashtra and the functional head of the MMRDA. The MMRDA is one of the most empowered agencies in the state to raise capital and implement infrastructure projects. It has adequate capacity to implement this project.

25. **Financial management.** This is ADB's first project with the MMRDA, but the agency is quite familiar with the World Bank requirements, having implemented previous projects, and is working on large projects assisted by JICA. Fund flows are entirely through the budgetary process and revenue accruals from land development. All transactions are recorded through double-entry, accrual-based systems and are subject to statutory audit by the comptroller and auditor general (CAG) of India in line with India's constitutional provisions. Audited accounts are submitted to the state legislature. In addition, transaction audits are also carried out periodically during the year by the state accountant general to ensure conformity with relevant codes and standards. A financial management system based on off-the-shelf accounting software is used. Annual statements of

[19] ADB. 2005. *Guidelines on the Financial Management and Analysis of Projects*. Manila.
[20] Financial Analysis (accessible from the list of linked documents in Appendix 2).

project accounts are subject to audit by the accountant general, an arm of the CAG at the state level, in accordance with auditing standards promulgated by the CAG. A review of the audits from FY2015 to FY2017 indicates no major adverse audit comments. The MMRDA is a very large organization with multiple projects, and its responsiveness to ADB reporting requirements for a single project has yet to be tested; the financial management risk is therefore rated *moderate*.

26. **Procurement.** The project procurement risk is rated *low*. The MMRDA is experienced with procurement and consultant recruitment for the World Bank and JICA projects, regular procurement for its own projects, as well as in the use of public–private partnerships for some projects. The MMRDA has entrusted the DMRC with the complete work for Line 2A, as well as the procurement and commissioning of rolling stock, signaling, and platform access systems for the three lines.[21] The DMRC successfully developed and operates the Delhi metro rail network, which is the largest system in India. The DMRC has also prepared the detailed designs for most metro rail projects in India, and acts as an implementing agency or advisor in many metros and projects, including the ADB-financed Jaipur Metro project, and some outside the country.[22] ADB financing for this project will be primarily for three large goods supply contracts (rolling stock, signaling, and platform access systems); procurement commenced in May 2018. Project readiness is high. The procurement plan is in the PAM.

27. ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government and the MMRDA. The specific policy requirements and supplementary measures are described in the PAM.

D. Poverty, Social, and Gender

28. **Poverty.** This is an urban transport project in the MMR, and the project's zone of influence includes a population of about 12 million urban residents. In 2011, about 20% of the population in these districts lived in poverty. Business, urban services, and wage labor are the main sources of livelihood in the project area. An efficient metro rail system providing urban mass transit is an essential requirement for the MMR. This project will cater to about 2,000,000 passengers per day after operations stabilize; improve urban transport safety and comfort; and provide residents, especially the poor and vulnerable, with improved access to economic opportunities and social service facilities.

29. **Gender equality and social inclusion.** The project is classified *effective gender mainstreaming*. The MMRDA and ADB conducted extensive consultations with stakeholders in preparing a gender equality and social inclusion (GESI) action plan with well-defined activities, indicators, targets, and timeframes.[23] The GESI action plan provides activities integrated within the project design, including (i) gender-responsive and socially inclusive design features across all infrastructure; (ii) affirmative measures to enhance women's safe mobility such as "women-only coaches," mobile applications for women's security, and instruction boards with helpline numbers and color-coded directional signs; (iii) special initiatives such as priority e-ticket counters for the elderly and differently abled, separate ticketing counters and vending machines for women, reporting desks to address incidents of harassment, quotas to ensure a portion of commercial spaces in metro stations are assigned to enterprises owned by or operated by women, and

[21] The procurement and implementation of the civil works for Lines 2B and 7 is being done by MMRDA.

[22] ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Jaipur Metro Rail Line 1-Phase B Project*. Manila. The Project involves construction of underground rail infrastructure of 2.3 kilometers and two stations. Commercial operations for the project is targeted in Q3 2019.

[23] Stakeholders included state government entities in municipalities working in gender, academia, and civil society organizations; MMRDA women staff; staff at metro stations on Line 1; and women commuters.

establishment of a station staffed only by women. The project will help establish a gender-inclusive agency, the Mumbai metro operations organization, with attention to women's equitable employment, GESI aspects, and the transformative impacts of its operations. The multistakeholder GESI advisory committee will guide the project and will support the development of a GESI policy for the Mumbai metro operations organization. Toward project completion, the MMRDA will conduct an impact study to evaluate the project's socioeconomic impact on the lives of at least 2,000 Mumbai residents (40% women).

30. **Health.** The project will provide an additional safe transport system in an existing urban area and is not expected to significantly increase the incidence of sexually transmitted infections including HIV/AIDS, and human trafficking.

E. Safeguards

31. In compliance with ADB's Safeguard Policy Statement (2009), the project's safeguard categories are as follows.[24]

32. **Environment (category B).** The project scope for ADB's financing involves specific items of goods supply for Lines 2A, 2B, and 7 of the Mumbai Metro Rail network. No civil works are financed by ADB. The key long-term environmental impact anticipated is noise and vibration from the operation of the rolling stock. However, given the existing noisy conditions in the project area due to heavy road traffic, the incremental impacts are expected to be minimal. Some occupational health and safety impacts may also be experienced during the installation and operation of the rolling stock and signaling and telecommunication systems. However, these are expected to be minor and easily mitigated. The MMRDA prepared an initial environmental examination report, including an environmental management plan and environmental monitoring plan, for all three lines. The MMRDA and ADB agreed to closely monitor environmental impacts during project implementation.

33. The civil works for the three elevated lines are considered an "associated facility" in accordance with ADB's Safeguard Policy Statement because they are not funded under the project, but the viability and operation of the lines and the ADB-funded components are exclusively interdependent. An environmental due diligence review was carried out for the ongoing civil works to assess compliance with ADB's Safeguard Policy Statement. The review identified a few areas for improvement for which corrective measures have been prepared.

34. **Involuntary resettlement (category C).** The project scope for ADB's financing does not include civil works. The MMRDA has acquired private land and assets based on the provisions of national law, state law, and sector policy.[25] Due diligence with regard to involuntary resettlement safeguards implementation was conducted for the three lines to assess if safeguards are consistent with applicable ADB requirements. Due diligence reports indicate that MMRDA land acquisition and resettlement plans are prepared and implemented to ensure that (i) affected persons, including informal settlers, are compensated for lost assets prior to displacement and at replacement cost; (ii) income restoration programs are in place for those whose livelihood will be affected; (iii) there is meaningful consultation and information disclosure; (iv) the standard of living of displaced poor and other vulnerable groups is improved; and (v) there are mechanisms for

[24] ADB. Safeguard Categories.

[25] Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act, 2013; Maharashtra Notification on Resettlement and Rehabilitation, 2014; and Mumbai Urban Transport Project Resettlement and Rehabilitation Policy, 2000, developed to comply with World Bank safeguards.

grievance redress and monitoring. The MMRDA and ADB agreed to closely monitor land acquisition and resettlement during implementation, and carry out corrective measures if necessary.

35. **Indigenous peoples (category C).** The project is not expected to affect indigenous peoples' communities within the meaning of the Safeguard Policy Statement.

F. Summary of Risk Assessment and Risk Management Plan

36. Significant risks and mitigating measures are summarized in Table 4 and described in detail in the risk assessment and risk management plan.[26]

Table 4: Summary of Risks and Mitigating Measures

Risks	Mitigating Measures
Ridership projections are not realized owing to external factors such as inadequate feeder systems.	ADB is supporting the procurement of feeder vehicles that will ensure good last-mile connectivity and enhance the attractiveness of the metro.
Delays in construction of tracks due to unpredictable engineering problems may subsequently delay the commissioning of rolling stock and signaling, train control, and telecommunications systems.	Detailed soil tests have been conducted to assess the conditions and the engineering works are being closely monitored to avoid unexpected delays.

Source: Asian Development Bank.

IV. ASSURANCES

37. The Government of India, the Government of Maharashtra, and MMRDA have assured ADB that implementation of the project shall conform to all applicable ADB policies, including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the project administration manual and loan documents.

38. The Government of India, the Government of Maharashtra, and MMRDA have agreed with ADB on certain covenants for the project, which are set forth in the draft loan and project agreements.

V. RECOMMENDATION

39. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the loan of $926,000,000 to India for the Mumbai Metro Rail Systems Project, from ADB's ordinary capital resources, in regular terms, with interest to be determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility; for a term of 25 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and project agreements presented to the Board.

Takehiko Nakao
President

30 January 2019

[26] Risk Assessment and Risk Management Plan (accessible from the list of linked documents in Appendix 2).

DESIGN AND MONITORING FRAMEWORK

Impact the Project is Aligned with Urban mobility in the Mumbai Metropolitan Region improved (National Urban Transport Policy, 2006)[a]			
Results Chain	**Performance Indicators with Targets and Baselines**	**Data Sources and Reporting Mechanisms**	**Risks**
Outcome Efficiency, safety, and gender- and social-inclusiveness of rail-based urban transit system in Mumbai city increased	By 2023: a. Peak-hour, peak-direction traffic on metro rail system increased to 21,500 (2018 baseline: 0) b. Traffic accidents on the metro rail system reduced by 95% compared to the existing suburban railway system (2018 baseline: 3,000 fatalities per year) c. At least 60% of male, female, elderly, and differently abled customers have positive perceptions of the metro in terms of affordability, security, safety, reliability, connectivity, and comfort (2018 baseline: 0)	a. MMRDA statistics on ticket volume b. MMRDA statistics on metro accidents c. Mumbai metro operations organization's socioeconomic impact study	Ridership projections are not realized owing to external factors such as inadequate feeder systems.
Outputs 1. Rolling stock operational	By 2022: 1a. 63 train sets of 6-car train units procured and delivered (2018 baseline: 0) 1b. At least one carriage in every train reserved for women only (2018 baseline: NA) 1c. 100% of the carriages commissioned with priority seats for EWCD (2018 baseline: NA)	1a.–1c. MMRDA asset register	Delays in construction of tracks due to unpredictable engineering problems may subsequently delay the commissioning of rolling stock and signaling, train control, and telecommunications systems.
2. Signaling, train control, and telecommunications systems operational	By 2022: 2a. Signaling, train control, and telecommunications systems installed and commissioned on 58 route-kilometers of Lines 2A, 2B, and 7 of the metro rail system (2018 baseline: NA) 2b. EWCD-friendly platform access systems installed in Lines 2A, 2B, and 7 of the metro rail system (2018 baseline: NA)	2a.–2b. MMRDA asset register	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
3. Institutional support for the Mumbai metro operations organization and last-mile connectivity provided	3a. By 2021, the Mumbai metro operations organization's official mandate, vision and mission, and organizational structure approved by the Government of Maharashtra (2018 baseline: not approved) 3b. By 2022, MMRDA gender equality and social inclusion policy developed (2018 baseline: NA) 3c. By 2022, at least 10% of technical staff and 20% of nontechnical staff recruited in the Mumbai metro operations organization are women (2018 baseline 2018: 0)	3a. MMRDA completion report endorsed by the Urban Development Department of the Government of Maharashtra 3b.–3c. Staffing reports from MMRDA	Delays in approval of operational and organizational plans due to prolonged government processes.

Key Activities with Milestones

1. Rolling stock operational

1.1 Commence advance contracting for rolling stock by Q2 2018
1.2 Award contracts for supply of rolling stock by Q4 2018

2. Signaling, train control, and telecommunications systems operational

2.1 Commence advance contracting for signaling and platform access systems by Q2 2018
2.2 Award contracts for the supply of signaling and platform access systems by Q4 2018

3. Institutional support for the Mumbai metro operations organization and last-mile connectivity provided

3.1 Complete initial plan and structuring by Q2 2019
3.2 Award contracts for institutional and organizational structure support consultants by Q4 2019
3.3 Complete structuring plan and initial staffing for the Mumbai metro operations organization by Q4 2020

Project Management Activities

Project implementation unit established by Q1 2019
Counterpart funds available by Q1 2019

Inputs

ADB: $926.00 million (loan)
Government: $489.00 million

Assumptions for Partner Financing

Not applicable

ADB = Asian Development Bank; EWCD = elderly, children, women, and differently abled; MMRDA = Mumbai Metropolitan Region Development Authority; NA = not applicable; Q = quarter.

[a] Government of India, Ministry of Urban Development. 2006. *National Urban Transport Policy*. New Delhi.

Source: Asian Development Bank.

LIST OF LINKED DOCUMENTS

http://www.adb.org/Documents/RRPs/?id=49469-007-3

1. Loan Agreement
2. Project Agreement
3. Sector Assessment (Summary): Transport (Rail and Urban)
4. Project Administration Manual
5. Contribution to the ADB Results Framework
6. Development Coordination
7. Financial Analysis
8. Economic Analysis
9. Country Economic Indicators
10. Summary Poverty Reduction and Social Strategy
11. Risk Assessment and Risk Management Plan
12. Climate Change Assessment
13. Gender Equality and Social Inclusion Action Plan
14. Initial Environmental Examination

Supplementary Documents

15. Environment Due Diligence Report
16. Social Due Diligence Report