Ex-Ante Evaluation(for Japanese ODA Loan)

South Asia Division 1, South Asia Department

Japan International Cooperation Agency

1. Name of the Project

（１） Country: India

（２） Project Title: Mumbai Metro Line 3 Project (V))

（３） Project Site/ Target Area: Mumbai Metropolitan Area, the State of Maharashtra

（４） Loan Agreement: July 5, 2024

2. Background and Necessity of the Project

（１）Current State and Issues of the Urban Transportation Sector/Mumbai Metropolitan Area and Priorityin India

In India, rapid urbanization in recent years has led to a rapid increase in automobile registrations (from 55 million in 2001 to 230 million in 2016, India 2018 Statistical Yearbook), which has increased demand for road transportation, while public transportation infrastructure has not yet been developed. Especially in the eight major metropolitan areas of Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad, and Pune, traffic congestion caused by increased road traffic demand has become a serious problem, resulting in serious economic losses, urban environmental degradation due to air pollution, noise, and other automobile pollution, and health problems.

To address the above issues, the Government of India, in its Metro Rail Policy (latest version updated in 2017), has adopted a policy to promote the development of public transportation systems, including metro, rail, and bus systems, from the perspective of safety and energy efficiency, in addition to meeting the transportation demand and reducing traffic congestion associated with recent economic growth. In large cities, the construction of metro is particularly recommended for reasons such as providing mass transit without putting pressure on existing road capacity.

The Mumbai metropolitan area has a population of about 18 million, making it one of the largest metropolitan areas in India and one of the most densely populated cities in the world, with a population density of about 20,000 people/km2 (2011 Census). Like India as a whole, Mumbai's growth in automobile registrations has been significant, jumping from 1.01 million in 2001 to 3.53 million in 2018. The average driving speed of vehicles on the city's main roads is about 15 km/h (2017), resulting in severe traffic congestion. In addition,

as in other metropolitan areas such as Delhi and Bengaluru, the transportation sector accounts for a large amount of CO2 emissions, and the deterioration of the urban environment and associated health hazards have been reported, with PM2.5 values approximately five times higher than the WHO standard. On the other hand, it is difficult to secure land to expand the road network, and it is also difficult to respond by increasing the capacity of existing public transport such as buses, making the development of a mass rapid transit system a priority. To improve road traffic conditions in the Mumbai metropolitan area, reduce congestion in the existing public transportation system, and mitigate air pollution, the Government of Maharashtra formulated the Mumbai Metro Master Plan in January 2004, and has been promoting the plan, which focuses on the development of a mass rapid transit system totaling 9 lines, covering 147.4 km in length. Among them, the Mumbai Metro Line 3 Project (hereinafter referred to as the "Project"), which will connect the southern tip of Mumbai through the city center to the Mumbai International Airport and the northern suburbs of the city, is considered to be a project that should be implemented as soon as possible and is positioned as essential to alleviate traffic congestion and promote economic growth in the Mumbai metropolitan area.

（2）Japan’s and JICA’s Policy Cooperation and Operations in the Urban Transportation Sector(especially in relation to key foreign policies such as the Free and Open Indo-Pacific Partnership (FOIP))

Country Assistance Policy for India (March 2016), formulated by the Government of Japan, stipulates "strengthening connectivity" through the development of transport and other infrastructure as one of the priority areas to remove infrastructure bottlenecks to investment and growth, including the promotion of railways (including high-speed railways and urban railways) to strengthen connectivity within and between India's major industrial cities and economic regions. Another priority is "strengthening industrial competitiveness" through the development of urban infrastructure, etc. The policy also calls for promoting the development of transportation networks in metropolitan areas through the construction of metro lines, etc., in order to reduce traffic congestion, improve the efficiency of passenger and freight transportation, and improve the urban environment. This Project is consistent with the Country Assistance Policy for India and one of the Pillars of the New Plan for Free and Open Indo-Pacific (FOIP), “Addressing Challenges in an Indo-Pacific Way (Climate and Environment)”, as it will contribute to a low-carbon and decarbonized

transportation sector through the development of a transportation system in the Mumbai metropolitan area. In addition, the JICA Country Analysis Paper for India (March 2018) identifies the need for support for infrastructure development, including mainline railways, urban railways, roads, and ports, with a focus on industrial clusters such as special economic zones and economic corridors located in the eight metropolitan areas, the Delhi-Mumbai Industrial Corridor, and the Chennai-Bengaluru Industrial Corridor, in order to remove bottlenecks to economic growth. JICA also states in its Paper that it will promote cooperation to address environmental and climate change issues in support of sustainable and inclusive growth, and this Project is consistent with these policies and analyses.

In terms of ODA loans to India, as of May 31, 2024, 89 projects totaling 4,490,448 million yen have been approved for the transportation sector. Among these, ODA loans to the railway sector include support for metro projects in Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Ahmedabad, and Patna, with 56 ODA loans totaling 3,696,298 million yen as of the end of May. For this Project, Phase I (L/A signed in 2013, approved amount 71,000 million yen), Phase II (L/A signed in 2018, approved amount 100,000 million yen), Phase III (L/A signed in 2019, approved amount 39,928 million yen), and Phase IV (L/A signed in 2024, approved amount 58,943 million yen) have already been provided.

（3）Other Donors' Activities

The World Bank, under its Country Partnership Framework (for the Period FY18-FY22) for India, is promoting connectivity and logistics improvements to enhance industrial competitiveness and job creation, and has supported the Mumbai Urban Transport Project (2002 and 2010 approved, totaling US$848 million) and the Dedicated Freight Corridor Projects (2011, 2014, 2015, and 2022 approved, totaling US$2,970 million) among others.

The Asian Development Bank (ADB), under its Country Partnership Strategy (2023-2027), intends to promote support for modal shift and decarbonization of the transportation sector from automobiles to railways, and has already supported the Jaipur Metro (US$157 million approved, 2013) and the Bengaluru Metro Lines 2A and 2B (US$500 million approved, 2020), among others. ADB has also provided support for Mumbai Metro Lines 2A, 2B, and 7 through co-financing with New Development Bank（NDB）(ADB has committed US$926 million (2019) and NDB US$260 million (2018)), Chennai Metro Lines 3, 4, and 5 (ADB has committed US$1,131 million (2022), NDB US$347 million (2022),

etc.).

3. Project Description

（１） Project Description

① Project Objectives

The Project aims to cope with the increase of traffic demand in Mumbai by expanding the mass rapid transportation system, thereby promoting regional economic development and improving urban environment, through mitigation of traffic jams and decrease of pollution caused by increasing motor vehicles.

② Project Components

(a) Civil engineering work and building work (all lines underground: about 34 km, 26 underground stations, 1 above ground station)

(b) Rolling stock maintenance base facility
(c) Track work(d) Electric and machine work
(e) Signal and communication work
(f) Automated charge-receiving system
(g) Undergrund sectionventilation facility installation work
(h) Automatic elevating facility installation
(i) Rolling stock (248 cars)
(j) Others (rolling stock maintenance base work, station security facility)
(k) Consulting services (bidding assistance and, construction management, etc.)

All components above except (a) 1 aboveground station, (i) 38 out of 248 cars procured, and (j) are covered by yen ODA loans. Components not covered by ODA loans will be borne by India.

③ Project Beneficiaries (Target Groups)

Direct beneficiaries: Metro passengers (about 1.5 million/day) (2026)
Final beneficiaries: Residents of the Mumbai metropolitan area (about 18 million people) who will benefit from the Metro project, such as reduced traffic congestion, fewer road accidents, and less air pollution.

（２）Estimated Project Cost

680,692 million yen(Yen Loan Amount of this tranche: 84,261 million yen)

（３）Schedule (Cooperation Period)

September/2013-December/2026 (160 months) The Project will be completed when all the facilities are put into service (scheduled for January 2025)

（４）Project Implementation Structure

１）Borrower: President of India

２）Guarantor: N/A

３）Executing Agency: Mumbai Metro Rail Corporation Limited: MMRCL

４）Operation and maintenance system: Once the Project is completed, MMRCL will outsource the operation/maintenance to Delhi Metro Rail Corporation (DMRC).

（５）Collaboration and Sharing of Roles with Other Donors

１）Japan’s Activities: CSMT station of this Project (Line 3) is planned to connect with the CSMT station in “Mumbai Metro Line 11 Project”, for which a Preparatory Survey is being planned. The CSMT station is a World Heritage Site and the surrounding area is the heart of Mumbai's commercial capital, and the link with Line 11 is expected to not only enhance the mutual benefits of the two projects, but also improve connectivity in the Mumbai metropolitan area and contribute to further economic growth in the region. In addition, the BKC station under construction in this Project is expected to be linked to the BKC station of “ Mumbai - Ahmedabad High Speed Railway Project” currently supported by ODA loans, and synergies between the two projects are expected to be enhanced through improved connectivity.

２）Other Donors’ Activities:

As described in 2. (3) above.

（６）Environmental and Social Considerations

１）Environmental and Social Considerations

① Category: A

② Reason for Categorization:

This Project falls under one of the sensitive sectors (railway) and has one or more sensitive characteristics under “JICA Guidelines for Environmental and Social Considerations” (published in April 2010).

③ Environmental Permit

Although there is no obligation to prepare an environmental impact assessment (EIA) report concerning the Project in the domestic laws of India, it was already prepared in September 2012, and revised in November 2017 and in February 2020. In implementing the Project, it is necessary to obtain tree-cutting permission, forest clearance, and coastal regulation zone clearance by the time of initiation of work in some regions, and all such approvals had already been obtained by September 2019.

④ Anti-pollution measures

During construction, measures are being taken to ensure proper management of contaminants, construction vehicles, and heavy equipment. Regarding the impact on the ground during construction, since the shield construction method will prevent the ground from loosening and groundwater from flowing into the site, no significant impact due to ground settlement is expected. Once in service, mitigation measures will be implemented, including noise barriers, installation of an elastic rubber layer under the track to prevent vibration, and installation of a wastewater treatment facility at the rail yard to prevent water pollution.

⑤ Natural environment

Within the Project target region, the Aarey Colony district is located 1.5 km from the Sanjay Gandhi National Park, but there are no rare spieces of animals, etc. inhabit in the surrounding area, so the adverse effect on the natural environment is expected to be minimal. The Project requires a total of 3,826 trees to be cut down and 0.91 ha of mangrove forests to be cleared, and alternative reforestation is being implemented. Some residents protested against the cutting of trees at the proposed Cuffe Parade station site in the Colaba district, and on February 3, 2017, the residents filed a suit in the Mumbai High Court seeking an injunction against the Project, which was dismissed by the Supreme Court on May 18, 2017. MMRCL has been clearing trees from construction areas for which permits were obtained and suspended tree cutting in the subject area for the duration of the litigation, but resumed after the dismissal. Additionally, residents had campaigned against tree cutting over the construction of the Aarey Colony rolling stock depot, but in September 2019, the Mumbai High Court dismissed the residents' request for an injunction against the construction work. The executing agency undertook tree clearing work in response to the High Court ruling and completed it in October 2019 and is in the process of replanting trees in the area.

⑥ Social environment

The total land acquisition area for the Project is about 76.70 ha (of which about 2.51 ha is private land) and 2,858 households (8,508 persons) are affected. Of these, 2,017 households (6,781 persons) were resettled. MMRCL held discussions with the land acquisition and resettlement targets and proceeded according to the resettlement plan (based on the

New Land Acquisition Act and the Resettlement Policy of the Government of Maharashtra, etc.), which was formulated to meet the requirements of the JICA guidelines, and completed the land acquisition process in February 2021.

Regarding resettlement, relocation to temporary housing was completed in 2018, and relocation to permanent sites is expected to be completed in August 2025.

⑦ Other/Monitoring

In this Project, MMRCL monitors land acquisition and resettlement during construction, and the construction contractor monitors noise, vibration, soil, air quality, water quality, waste, etc., under the supervision of MMRCL. Once in service, MMRCL will monitor noise, vibration, air quality, water quality, and so forth. In addition, MMRCL is currently in the process of contracting a professional outside consultant with its own funds to acquire the land, resettle the residents, and monitor their living conditions after the relocation. During the public discussions on the EIA report for the Project, concerns regarding noise, air pollution, and construction debris disposal methods, as well as requests for nighttime construction restrictions, were raised by the local residents, and the executing agency has committed to and is implementing mitigation measures and monitoring, respectively. No specific objections to the Project have been raised by the residents.

（7）Cross-Sectoral Issues

① Climate change responses：This project will contribute to the reduction of greenhouse gas (GHG) emissions by reducing traffic congestion caused by the use of automobiles through the construction of a mass rapid transit system. The country's Nationally Determined Contribution (NDC) includes the use of a mass rapid transit system as one of the strategies for mitigation measures, and this Project is considered important. The climate change mitigation benefits of the Project (estimated GHG emission reductions) are expected to be approximately 261,968 tons of CO2 equivalent per year.

② Measures against infectious diseases: HIV/AIDS control measures for construction workers will be implemented by contractors during the construction phase.

③ Considerations for persons with disabilities: In accordance with Indian national laws and regulations, the station building and carriages (elevators,

toilets, internal broadcasting, Braille blocks, wheelchair spaces, etc.) are designed with consideration for use by all, including the elderly and disabled.

（８）Gender Category: ■GI(S) Gender Informed (Significant)

<Details of Activities/Reason for Categorization>

Through discussions with the executing agency, gender issues were identified, such as the inability of women to use public transportation in a safe and comfortable manner. This Project is classified as GI (S) because it plans to introduce women-only cars, install priority seating for passengers who need assistance, including women, and install surveillance cameras in station buildings and trains to ensure that women can use the Metro in safety and comfort, and to monitor the results and progress of these efforts. For these reasons, the Project is classified as a “gender activity integration project”.

（９）Other Important Issues: Urban development is underway in the BKC and Worli districts, through which Metro Line 3 passes, and Japanese companies are also involved in large-scale real estate development and other projects. It is expected that the development of the metro through the Project will have a synergistic effect with these developments and contribute to further economic growth in the commercial city of Mumbai.

4. Targeted Outcomes

（１）Quantitative Effects

１）Outcomes (Operation and Effect Indicators)

Indicator		Baseline （Actual value in 2014）	Target (2027) (2 years after project completion）
Operating rate (%/year)		-	87
Running distrance(1,000 km/day)		-	113
Number of running trains (day)	Cuffe Parade-BKC	-	502
	BKC-Aarey		270
Volme of transportation (million people, km/day)		-	18.3
Income from Passenger(million rupee/day)		-	60.91

２）Impact

（２）Qualitative Effects

Reducing pollution, mitigating climate change, improving convenience by ensuring on-time travel, economic development of the Mumbai metropolitan area, reducing traffic congestion and improving the urban environment, and reducing health hazards from air pollution.

（３）Internal Rate of Return

Based on the assumptions listed below, the economic internal rate of return (EIRR) for the Project is 14.3%, and the financial internal rate of return (FIRR) is 5.2%.

【EIRR】

Cost: Project costs, operation and maintenance costs (all excluding taxes)

Benefit: Effects of reduction in travel time for metro and road transport users, Effects of reduction in vehicle maintenance costs for road transport users, Effects of reduction in road traffic accidents, Effects of reduction in emissions of environmentally hazardous substances from road transport, and Effects of reduction in the cost of road transport infrastructure maintenance.

Project Life: 30 years

【FIRR】

Cost: Project costs, operation and maintenance costs (all excluding taxes)

Benefit: Passenger revenue, advertising revenue

Project Life: 30 years

5. External Factors and Risk Control

（１）Preconditions: N/A

（２）External Factors: N/A

6. Lessons Learned from Past Projects

In the ex-post evaluation of the “Delhi Mass Rapid Transit System Project” (ODA loans to India) and its Phase 2 operations (evaluated in 2010 and 2015 respectively), it has been pointed out that improving access around metro stations is an issue, and lessons have been learned that it is desirable to coordinate with other transportation agencies operating public transit systems, such as feeder buses.

In this project, MMRDA is coordinating connections and other matters with the bus lines operated by Brihanmumbai Electric Supply and Transport and the Mumbai Metro Lines 1 and 2 and monorail operated by the Mumbai Metropolitan Region Development Authority (MMRDA).

7. Evaluation Results

JICA has been supporting metro projects in metropolitan areas, and this Project will contribute to the balanced economic development of the Mumbai metropolitan area by reducing traffic congestion and traffic pollution, which is in line with India's agenda, development policies and the cooperation policies of Japan and JICA. In addition, the Project is considered to contribute to the achievement of the SDGs Goal 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all", Goal 9 "Build resilient infrastructure", Goal 11 "Make cities inclusive, safe, resilient and sustainable", and Goal 13 "Take urgent action to combat climate change and its impact", and therefore, it is highly important for JICA to support the implementation of the Project.

8. Plan for Future Evaluation

（１）Indicators to be Used

As indicated in Sections 4.

（２）Future Evaluation Schedule

Ex-post evaluation: 2 years after the project completion

END

Appendix: Map of Mumbai Metro Line 3 Project (V)

Appendix:

Map of Mumbai Metro Line 3 Project (V)

（Source: Mumbai Metropolitan Region Development Authority (MMRDA)）

Legend

・Line 1：Light blue line　(in service since 2014)

・Line 2：Blue line（Partially in service 2022）

・**Line 3：Red line（This Project）**（All lines scheduled to be in service in 2025）