

## Japanese ODA Loan

### Ex-Ante Evaluation(for Japanese ODA Loan)

#### Office for Indian High Speed Rail, South Asia Department Japan International Cooperation Agency

##### 1. Name of the Project

(1) Country: Republic of India (India)

(2) Project: Project for the Construction of Mumbai-Ahmedabad High Speed Rail (V)

(3) Project Site / Target Area: State of Gujarat, State of Maharashtra, and Union Territory of Dadra and Nagar Haveli and Daman and Diu (Total Population: about 170 million (2011))

Loan Agreement: December 21st, 2023

##### 2. Background and Necessity of the Project

(1) Current State and Issues of the Railway Sector and the Priority of the Project in India

In recent years, India's remarkable economic growth, population growth, and urbanization have led to a rapid increase in domestic rail passenger transport. The volume of passenger transport in 2019 reached approximately 1.7 times, compared with in 2000 (Ministry of Railways (MoR) of India, 2020). In 2020, the volume of passenger transport temporarily decreased due to the pandemic, while the trend was toward recovery in 2021. On the other hand, track capacity as of 2014 was only about 50% of the amount expected to be needed for passenger transport in 2032 (DFCCIL, 2014). Furthermore, existing conventional rail lines are facing frequent delays and other problems, therefore, development of a smooth passenger and freight transport system are needed in India. In particular, the states of Maharashtra and Gujarat, which account for more than 20% of India's total GDP as of 2021 (Reserve Bank of India, 2021), are expected to continue stable economic growth over the next 30 years (Planning Commission of India, 2014), and JICA's "Joint Feasibility Study for Mumbai-Ahmedabad High Speed Railway Corridor (hereinafter referred to as the "F/S Survey")" for the "Project for the Construction of Mumbai-Ahmedabad High Speed Rail (hereinafter referred to as "the Project")" estimates that the number of daily passengers between Mumbai and Ahmedabad on the four type of transportation mode (air, rail, long-distance bus, and automobile) will increase approximately 9.8 times

from 2014 (approximately 154,000 passengers) to 2053 (approximately 1.5 million passengers), and approximately 200,000 of these passengers will use the High Speed Rail in 2053.

Under these circumstances, in the "Indian Railway Vision 2020" formulated in December 2009, the MoR of India has set forth the development of High Speed Rail lines in addition to the modernization of conventional lines and the enhancement of transportation capacity. In 2012, the "the Expert Group for Modernization of Indian Railways" established by the MoR to implement this policy, recommended that the Mumbai-Ahmedabad section be designated as the highest priority section and that High Speed Rail projects be promoted. Furthermore, in December 2015, the Prime Minister of Japan and India agreed in a joint statement that the Mumbai-Ahmedabad section "will be developed with the use of Japanese high speed rail technologies (i.e. the Shinkansen system) and experiences" and that "both sides will take necessary steps so that financial and technical assistance for the Mumbai-Ahmedabad High Speed Railway (MAHSR) project will be provided by relevant Japanese institutions". At the Japan-India summit meeting in March 2023, the two leaders welcomed the signing of a yen loan for the fourth phase of the high-speed rail project and confirmed that they would continue to make steady progress in the high-speed rail project, a flagship project of Japan and India. As described above, the Project is positioned as an important project in the Indian Railways Sector Development Policy.

## (2) Japan's and JICA's Policy Cooperation Policy and Operations in the Railway Sector

The Country Development Cooperation Policy for India (March 2016) indicates "Enhancing Connectivity" through the development of transportation infrastructure and other infrastructure as a priority area. The Policy promotes development of railways (including High Speed Rail and metro) to enhance connectivity within major industrial cities and economic zones and between regions in India with a view to eliminate infrastructure bottlenecks to investment and growth. In addition, the JICA Country Analysis Paper for India (March 2018) analyzes the need for support for infrastructure development, including main railway, metros, roads, and ports, to eliminate bottlenecks to economic growth. Also, to support sustainable and inclusive growth, the JICA will promote cooperation in addressing environmental and climate change issues, and the Project is in line with these policies and analyses. Furthermore, the Project is in

line with JICA's Global Agenda for Transportation, which focuses on "Promoting Urban Transportation." Furthermore, it has been repeatedly confirmed in the Japan-India Joint Statement and at the Japan-India Summit that the Project will be promoted as a flagship project between the two countries. In addition, the Project will contribute to SDGs Goal 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"; Goal 9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"; Goal 11 "Make cities and human settlements inclusive, safe, resilient and sustainable" and Goal 13 "Take urgent action to combat climate change and its impacts".

### (3) Other Donors' Activities

The World Bank supports the Mumbai Urban Transport Project (USD 848 million, approved in 2002 and 2010) and the development of the Dedicated Freight Corridor (USD 4,932 million, approved in 1994, 2011, 2014, 2015 and 2022). The Asian Development Bank (ADB) supports Jaipur Metro (USD 176 million, approved in 2014), Bengaluru Metro line 2A/2B (USD500 million, approved in 2021) and jointly supports Mumbai Metro line 2A/2B and 7 with New Development Bank (NDB) (ADB: USD 926 million (2019), NDB: USD 260 million respectively (2018)) and Chennai Metro line 3/4 (ADB: USD 350 million, NDB: USD 347 million respectively (2022)).

## **3. Project Description**

### (1) Project Description

#### 1) Project Objective

The Project aims to develop a high-frequency transportation system by constructing a high-speed rail along an approximately 500-km section between Mumbai in Maharashtra and Ahmedabad in Gujarat, with the use of Japanese High Speed Rail technologies, thereby improving the connectivity in India and contributing to the broad economic development of the target area.

#### 2) Project Components

- a) Civil Engineering/Construction Work (Viaducts section: about 450km, Tunnel section: about 25km (including undersea tunnel), Others (Particular Bridge etc.): about 25km, Station building (12 stations))
- b) Railroad Track Construction Work
- c) Electrical/Mechanical Work

- d) Depot Construction Work
- e) Procurement of Rolling Stocks/Track Inspection Vehicles
- f) Procurement of Inspection/Maintenance Car
- g) Consulting Services (construction supervision (quality control, safety management, Environmental and Social Consideration Support), Technology transfer to improve executing agency's capacity to supervise construction, etc.)

3) Project Beneficiaries (Target groups)

- a) Direct beneficiaries: Customers using the high-speed rail (approx. 200,000 per day (the demand forecast in 2053, F/S survey)) and the personnel of the executing agency who will attend the training for the operation and maintenance of the Project, etc.
- b) Final beneficiaries:
  - The residents living along the high-speed rail line who will benefit from the reduction of traffic congestion, traffic accidents, and air pollution
  - The related parties and the local residents who will benefit from the economic effects of the development around the high-speed rail stations, etc.

(2) Estimated Project Cost

1,806,282 million yen (F/S basis. Currently under review between the Government of India and the Government of Japan, in light of subsequent changes in the economic environment and other factors.) (Japanese ODA Loan for Tranche (V): 400,000 million yen)

(3) Schedule

Under discussion between the Government of India and the Government of Japan.

(4) Project Implementation Structure

- 1) Borrower: President of India
- 2) Guarantor: None
- 3) Executing Agency: National High Speed Rail Corporation Limited (hereinafter referred to as "NHSRCL")
- 4) Operation and Maintenance Agency : Same as above 3)

(5) Collaboration and Sharing of Roles with Other Donors

### 1) Japan's Activity

In association with the Project, the following Technical Assistance under Finance and Investment Account has been implemented.

Name of JICA Project	Period	Relationship with the Project
Joint Feasibility Study for Mumbai-Ahmedabad High Speed Railway Corridor (F/S Survey)	December 2013 – June 2015	<ul style="list-style-type: none"> <li>• Preparatory Survey of the Project</li> </ul>
The Detailed Design Study of the Mumbai - Ahmedabad High Speed Railway Project	December 2016 – February 2024 (Planned)	<ul style="list-style-type: none"> <li>• Detailed design study of the Project (D/D).</li> <li>• Basic design, detailed design, preparation of tender documents and tender assistance regarding the Project as well as Construction of Training Institute for MAHSR Project.</li> <li>• Developing various regulations related to construction/operation/maintenance of high speed rail and drafting a training plan for training lecturers.</li> </ul>
Capacity development of the Construction of High Speed Railway Corridor	August 2017 – March 2024 (Planned)	<ul style="list-style-type: none"> <li>• Technical assistance to NHSRCL by making good use of experiences as a bullet train operator in Japan</li> </ul>
The Detailed Design Study for the Electrical packages of the Mumbai-Ahmedabad High Speed Rail Project	January 2022 – March 2025 (Planned)	<ul style="list-style-type: none"> <li>• Detailed design study of the Electrical Packages</li> </ul>
Experts for Acting on behalf of Employer's	January 2022 –	<ul style="list-style-type: none"> <li>• On behalf of Employer's Works for Detailed Design</li> </ul>

Name of JICA Project	Period	Relationship with the Project
Works for Detailed Design Documents of Electrical Packages for Mumbai-Ahmadabad High Speed Rail Project	March 2025 (Planned)	Documents of Electrical Packages
Technical Cooperation Project for Station Area Development (SAD) along selected stations of Mumbai-Ahmedabad High Speed Rail (MAHSR) project	February 2023 – December 2026 (Planned)	<ul style="list-style-type: none"> <li>Capacity building for planning and managing station area development in state governments, municipalities and urban development corporations.</li> </ul>
Technical assistance for Mumbai-Ahmedabad High Speed Rail Project during construction phase	April 2023 – March 2025 (Planned)	<ul style="list-style-type: none"> <li>As an advisor for the Project <ul style="list-style-type: none"> <li>- Respond to consultation from the executing agencies on overall construction of high-speed rail and individual technical issues</li> <li>- Provide advice to facilitate coordination with Japanese counterparts</li> <li>- Arrange meetings to visit Japan.</li> </ul> </li> </ul>

## 2) Other Donors' Activity

None in particular

## (6) Environmental and Social Consideration

### 1) Category: A

### 2) Reason for Categorization:

The Project falls into the railway sector and has influential characteristics, both being shown in the JICA Guidelines for Environmental and Social Considerations (proclaimed in April 2010).

### 3) Environmental Permit:

Although preparation of an Environmental Impact Assessment (EIA) Report is not required under the domestic law in India, it was prepared by the NHSRCL in July 2015, and an updated version reflecting the subsequent change in the project plan, etc. was prepared in August 2018.

#### 4) Anti-Pollution Measures:

During construction, air pollution and water pollution concomitant with drilling and construction machine operation are being handled by watering, the use of dustproof sheets, wastewater treatment plants, etc. Regarding the waste, excavated soil generated by the tunnel construction is being reused in the section for the embankment, etc., and the rest of the soil is properly being disposed of at designated disposal sites. In the section of tunnel construction, the ground is solid and implementation of appropriate construction methods is planned to prevent loose ground and the inflow of groundwater; therefore, a serious impact due to ground subsidence is not expected. Regarding noise and vibration concomitant with the blasting work, operation time will be limited to minimize the impact on neighborhoods. With respect to noise, vibration, etc. due to running cars when in operation, countermeasures such as the installation of soundproof walls are being taken to minimize the impact. Regarding the noise/vibration of the tunnel portion and the elevated portion, it is aimed to be reduced by the maintenance of the railroad track on a regular basis and compliance with the speed limit.

#### 5) Natural Environment:

The target area of the Project extends through the core zone and the buffer zone of Thane Creek Flamingo Sanctuary, the buffer zone of Sanjay Gandhi National Park, and the buffer zone of Tungreshwar Wildlife Sanctuary. It was confirmed that Environmental Clearance for development in these was obtained on April 24, 2019. Around the Thane Creek Flamingo Sanctuary, mangrove swamps spread over flamingos inhabit. The impact on flamingos and the surrounding ecosystems will be minimized by setting the railroad track to 30 m of an undersea tunnel section underground. The additionally formulated management plan for the above three districts will be followed to minimize the impacts. Furthermore, logging of about 101 ha of forest land and about 29 ha of mangrove forest will be performed in association with the development of the railyard and the railroad track, etc. With respect to felling forests, alternative tree planting is performed by Forest Department in each state.

#### 6) Social Environment:

The Project involves the land acquisition of about 1,389 ha and relocation of 4,450 households, and they will be proceeded according to the Resettlement Action Plan based on the domestic laws in India and JICA guidelines. Affected citizens were given an explanation of the project outline, environmental and social consideration policy, compensation policy, etc. through census survey based on individual visits and residents' consultations. According to the minutes of the residents' consultations, no dissenting voice on the Project has been confirmed in particular. Financial compensation, vocational training and other livelihood restoration assistance are being provided to the affected residents in accordance with the Resettlement Action Plan. In addition, an indigenous peoples' plan was created for designated tribes residing in target areas, in accordance with the domestic laws in India and JICA guidelines as well as the results of residents' consultations, and then the agreements on the implementation of the Project with those tribes have been confirmed.

#### 7) Other/Monitoring:

During the construction, contractors and monitoring consultants will monitor the air quality, water quality, noise, vibration, waste, vegetation, ecosystem, etc. under the supervision of the NHRCL, and while operating the service, NHRCL will monitor the noise, vibration, vegetation, ecosystem, etc. Also, the NHRCL will conduct monitoring of resident relocation, land acquisition, and livelihood recovery support measures. NHRCL conducts the monitoring and reports these results to JICA.

#### (7) Cross-Sectoral Issues

- 1) Climate Change: The Project aims at a modal shift from automobiles, buses, etc. The estimated GHG emission reductions from the Project (per year after the full-opening of the Project) are approximately 670,000 tonnes/year (CO<sub>2</sub> equivalent), contributing to climate change measures (mitigation) (secondary objective).
- 2) Consideration for Disabilities: In accordance with the domestic law of India, the design of stations and Rolling Stock takes disabled persons into consideration (i.e. Elevators, escalators, toilet, station announcements, textured paving blocks to guide the blind, wheelchair spaces). In relation to



the gender measures of the Project (e.g. women's restrooms and nursing rooms in the stations and trains), the Project encourages the study of the possible accommodations (e.g. multipurpose restrooms) for disabled women.

- 3) **Preventions Measures of Infectious Diseases:** NHRCL has incorporated provisions requesting contractors to participate in HIV/AIDS prevention activities in contracts. In addition, as a part of its efforts to prevent the spread of COVID-19 infection, NHRCL has agreed to implement a list of measures (36 in total) during the formulation and implementation of the Project, and clarified the required activities, such as the development work environments (including preparing epidemic prevention equipment and promoting the code of conduct), supervision with respect to epidemic prevention, and awareness-raising campaigns. NHRCL is supposed to make quarterly reports with respect to the implementation statuses of the measures so as to ensure that the impact of COVID-19 is being carefully watched and the executing agency flexibly and appropriately implement the measures throughout the project implementation period.

#### (8) Gender Category: GI(S) (Gender Activity Integration Project)

##### <Details of Activities/Reason for Categorization>

In the Indian railway sector, safety and comfort for women is a challenge; therefore, the project plans to install CCTV in station, women's restrooms and nursing rooms in stations and trains and provide training for female staff. In addition, as of December 2022, there is the challenge to address that the female staff ratio which is 7.3% of NHRCL's staff is still lower than the expected. The Project has a training plan for the women empowerment. Therefore, the Project was classified as a Gender Activity Integration Project. It is expected that female staff have continued to be employed.

#### (9) Other Important Issues

It is expected that Japanese technologies will be used for Core system packages such as Rolling Stock, Electrical Equipment, Inspection/Maintenance Car and Depot in the Project.

#### 4. Targeted Outcomes

##### (1) Quantitative Effects

###### 1) Outcomes (Operation and Effect Indicators)

Indicator	Baseline (Actual value in 2018)	Target [2 years after the commencement of commercial operation]
1. Number of Operations (number/day)	—	70
2. Passenger Transportation Volume (million passengers- km/day)	—	18.04
3. Travel Distance (thousand km/day)	—	354.0
4. Transportation Time (minutes)	— (Approximately 325 minutes when using a conventional line express train)	127
5. Operating rate (%)	—	87.5

##### (2) Qualitative Effects

To improve the efficiency of the transportation network for inter-city travel by providing high-frequency mass passenger transport between Mumbai and Ahmedabad, and to promote broader economic development in the target area.

##### (3) Internal Rate of Return

Based on the following premise, the economic internal rate of return (EIRR) is about 8.20% and the financial internal rate of return (FIRR) is about 6.06%.

###### [EIRR]

Cost: Project, operation and maintenance expenses (excluding tax)

Benefits: Fuel saving effect, vehicle operation cost reduction effect, travel time reduction effect, air pollution mitigation effect, accident cost reduction effect, etc.

Project Life: 50 years

[FIRR]

Cost: Project cost, operation and maintenance expenses

Benefits: Fare and non-fare incomes (including advertisement revenue and station development revenue)

Project Life: 50 years

## **5. External Factors and Risk Control**

### (1) Preconditions

None in particular

### (2) External Factors:

Aggravation of political and economic situations in India and the surrounding area of the project target, as well as natural disasters

## **6. Lessons Learned from Past Projects**

In similar projects in the Indian railway sector, there have been cases where third-party organizations not stipulated in the contract were involved in the design and approval process, which caused delays in decisions by the executing agency leading to further delays in the projects. In these projects, the contractors and consultants indicated that the Indian side set unrealistic targets for the opening of the entire line, and as a result, only construction sections that had been completed by that time were partially opened.

In the Project, when problems arise that cannot be resolved between the contracting parties, including the above-mentioned cases, the joint committee meeting under the co-chairmen representing the governments of Japan and India, which serves as the highest decision-making body of the Project, technical expert committee which discuss various issues of the Project from technical aspects and steering committee where Consultant and Contractor would discuss the progress of work will be held to resolve problems.

## **7. Evaluation Results**

The Project will connect Mumbai, the capital of Maharashtra, the second largest city in India, and Ahmedabad (the last station is Sabarmati) in Gujarat, the fifth largest city in India and a rapidly growing commercial and industrial center in recent years, in about two hours which is the almost 40% of the time of the conventional express trains. The Project will contribute to the improvement of

passenger transportation capacity and the realization of safe transportation services by developing automatic train control and communication systems and introducing Rolling Stock for High Speed Rail along with Japan's Shinkansen system. The Project is in line with India's development challenges and policies, as well as the cooperation policy and analysis of Japan and JICA. And there is a strong need to support the implementation of the Project as it is considered to contribute to SDGs Goal 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"; Goal 9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"; Goal 11 "Make cities and human settlements inclusive, safe, resilient and sustainable" and Goal 13 "Take urgent action to combat climate change and its impacts".

#### **8. Plan for Future Evaluation**

(1) Indicators to be Used

As indicated in Section 4.

(2) Future Evaluation Schedule

Ex-post evaluation: Two years after the commencement of commercial operation

END

Attachment: Map of the Mumbai-Ahmedabad High Speed Rail Project

## Map of the Mumbai-Ahmedabad High Speed Rail Project



Map of the Project site  
(Created by JICA based on the F/S Survey)