

Ex-Ante Evaluation (for Japanese ODA Loan)
South Asia Division 1, South Asia Department, JICA

1. Name of the Project

Country: India

Project: Delhi Mass Rapid Transport System Project (Phase 4) (I)

L/A signing date: March 26, 2021

2. Background and Necessity of the Project

(1) Current State and Issues of the Urban Transport Sector in India

Rapid urbanization has progressed in India recently and the number of registered automobiles has also been increasing rapidly (from around 55 million vehicles in 2001 to approximately 230 million vehicles in 2016), yet the development of public transportation infrastructure has not progressed and traffic jams due to increasing demand for road traffic have been a serious problem in major cities such as in Delhi, Mumbai, Kolkata and Bengaluru, etc., aggravating economic losses and health damage due to automobile pollution such as air pollution/noise, etc.

In order to deal with the above problems, the Government of India in its "Metro Rail Policy" (latest version updated in 2017) has set forth a policy promoting the development of public transportation systems such as metro, rail and bus, etc. from the viewpoint of safety/energy efficiency, etc. in addition to mitigating traffic congestion and dealing with the demand for transportation due to recent economic growth. Construction of a metro system in the metropolitan area is particularly recommended to enable high-volume transportation without putting undue pressure on existing road capacity.

As of 2016, the number of registered vehicles in Delhi was 9.71 million (according to India's Ministry of Statistics and Programme Implementation), which is even greater than that of other cities such as Bengaluru (approx. 6.11 million) or Chennai (approx. 4.94 million), and there is traffic congestion resulting from the increased number of automobiles. According to a survey of private enterprises, Delhi has recorded a level of congestion-related delay with travel by car taking approximately 1.47 times longer than when there is no congestion (placing Delhi 8th in the world as of 2020, according to this report covering 57 countries). Delhi has the most CO₂ emissions from the transport sector of any city in India, and air pollution due to the increase of automobiles, etc. has resulted in annual average PM2.5 emissions of about 10 times the WHO standard. Under such circumstances, the Government of National Capital Territory of Delhi has planned and promoted urban transportation maintenance based on the introduction of a mass rapid transport system with the aim of mitigating congestion and air pollution in the National Capital Territory of Delhi. In the Delhi Master Plan 2021 (partially revised in May 2010) that was

formulated by the Government of National Capital Territory of Delhi and approved by the Central Government, a rapid transport system is highlighted as playing a key role in the transport system of the National Capital Territory of Delhi for urban infrastructure to be maintained as of 2021. With a view toward implementation of this Master Plan, construction plans for Phases 1 to 4 are formulated and being implemented. The Delhi Mass Rapid Transport System Project (Phase 4) (hereinafter referred to as “the Project”) aims to deal with the increasing demand for transport by maintaining 3 priority corridors (extension of Lines 7 and 8, and new establishment of Line 10) out of the 6 corridors planned as part of the Phase 4 maintenance plan in the National Capital Territory of Delhi, and the Project is positioned as an important project in India’s urban transport sector.

(2) Japan and JICA’s Urban Transport Sector Policy and the Positioning of the Project

Country Assistance Policy for India (March 2016) formulated by the Government of Japan stipulates that the development of railways (including high speed railways and metros) shall be necessary in order to strengthen connectivity among major industrial cities and economic zones in India by setting forth “Enhancing Connectivity” through the development of transportation infrastructure, etc. as the priority area with the aim at resolving the infrastructure bottleneck against investment and growth. “Strengthening industrial competitiveness” through urban foundation maintenance, etc. is also set out as an important field for assistance, together with the promotion of transportation infrastructure, etc. in major metropolitan areas by constructing subways, etc. with the aim of mitigating traffic congestion, optimizing passenger/freight transport and improving the urban environment, etc. Also, in order to eliminate the bottleneck in economic growth, the JICA Country Analysis Paper for India (March 2018) provides an analysis that, mainly in the industrial agglomeration areas such as special economic zones and economic corridors located in the six major metropolitan areas in India and the Delhi – Mumbai Industrial Corridor, cooperation for measures to deal with environment and climate change issues are being promoted as a means of support continuous, comprehensive growth, and it is necessary to promote regional economic development facilitation and logistics optimization, and to support infrastructure development including arterial railroad, urban railway, roads, and harbors which contribute to increased investment from the foreign capital. The Project is consistent with these policies and analyses.

The Project is also expected to contribute to the achievement of Goal 9 (Build resilient infrastructure, promote sustainable industrialization and foster innovation), Goal 11 (Make cities inclusive, safe, resilient and sustainable), and Goal 13 (Take urgent action to combat climate change and its impacts) of the

Sustainable Development Goals (SDGs), so the Project's implementation is highly necessary.

(3) Other Donors' Activities

There has been funding from the World Bank for the Mumbai Urban Transport Project (approved in 2002 and 2010, total of USD 972 million) and the Eastern Dedicated Freight Corridor Project (approved in 2011, 2014 and 2015 total of USD 2,725 million). There has also been support from the Asian Development Bank (ADB) for the Jaipur Metro Rail Project (approved in 2013, USD 157 million), and cooperative financing with the New Development Bank for the Mumbai Metro Rail System Project (Lines 2A, 2B, 7; approved in 2019; approved amounts of USD 926 million from ADB and USD 260 million from co-financing). For the Delhi Mass Rapid Transport System Project, however, there is no assistance from other donors.

3. Project Description

(1) Project Objective

The objective of the Project is to cope with the increase of traffic demand in Delhi by expanding the mass rapid transportation system, thereby promoting regional economic development, improving urban environment and eventually mitigating climate change, through relief of traffic congestion and decrease of pollution caused by increasing motor vehicles.

(2) Project Site/Target Area

The National Capital Territory of Delhi (population: approx. 17 million)

(3) Project Components

- 1) Civil works (underground railway of approx. 27 km, above-ground/elevated railway of approx. 38 km, with underground stations (18) and elevated stations (26))
- 2) Signaling & train control system, electrical system, station facility construction, and automatic fare collection system, etc.
- 3) Procurement of rolling stock (484)
- 4) Consulting service (design review, construction supervision, etc.)

The fields covered by the ODA loan are civil works in the underground railway and stations of 1), parts of items 2) and 3), and item 4).

(4) Estimated Project Cost

384,416 million yen (Yen Loan Amount of this tranche: 119,978 million yen)

(5) Schedule

March 2021 to March 2027 (73 months in total). The commencement of operation for all the lines (March 2026) shall be the time of the Project's completion.

(6) Project Implementation Structure

- 1) Borrower: President of India

- 2) Guarantor: None
- 3) Executing Agency: Delhi Metro Rail Corporation Limited (hereinafter "DMRC")
 - 4) Operation and Maintenance Agency: Same as above
- (7) Collaboration with Other Schemes and Donors
 - 1) Japan's Assistance Activity: N/A
 - 2) Other Donors' Assistance Activity: N/A
- (8) Environmental and Social Consideration / Cross-Sectoral Issues / Gender Category
 - 1) Environmental and Social Consideration
 - ① Category: A
 - ② Reason of Categorization: The project falls into the railway sector under the JICA Guidelines for Environmental and Social Considerations (April, 2010).
 - ③ Environmental Permit: Although preparation of an Environmental Impact Assessment (EIA) Report regarding the Project is not required under the domestic law in India, a report was prepared by the DMRC in May 2018, subsequently revised in June 2020, and this has been internally approved by the DMRC.
 - ④ Anti-Pollution Measures: Regarding air quality, water quality, waste, noise and vibration during construction work, there are plans to ensure conformance to India's emissions standards and environmental standards by means of sprinklers and wastewater treatment, excavated earth treatment, and installation of noise barriers, etc. Regarding the impact on the ground during construction, no serious influence due to land subsidence is expected, since loose ground and the inflow of groundwater will be prevented by adopting the sheet pile construction method, etc. During operation phase, measures to mitigate noise will be taken by installing soundproof walls, as well as measures to mitigate vibration such as installing rubber beneath tracks, etc.
 - ⑤ Natural Environment: There are two nature reserves (Asola Bhatti Wildlife Sanctuary and Okhla Bird Sanctuary) within a 10 km radius from the Project routes, but there is no Project implementation within these reserves. Elevated/underground routes and some station buildings are planned for the Asola Bhatti Wildlife Sanctuary buffer zone. Since development has already advanced in this region, it is thought that the Project will have minimal additional impact on wild animals, etc., but the impact of noise and vibration on flora and fauna will be checked through prior surveys and monitoring. Trees and shrubs will be cut down, but replacements will be planted.

⑥ Social Environment: The Project requires the land acquisition amounting to a total area of about 0.50 ha and the involuntary relocation of 32 people (8 households). Both the land acquisition and the relocation of the residents will be implemented by the DMRC according to the land acquisition act, policy of Government of National Capital Territory of Delhi regarding the relocation of residents, etc., and resident relocation plans drawn up based on the JICA Environmental Guidelines. It is confirmed that there is no divergence from the JICA Environmental Guidelines regarding compensation standards, land acquisition or the resident relocation process, etc., and no objections have been lodged against the Project in consultation meetings with residents. Since the Project passes through an area of archaeologically and historically important monument designated by the domestic laws of India, a permit must be obtained from the Archaeological Survey of India (ASI), and this has been obtained for 5 of the 7 structures that could be affected, while acquisition of permits for the remaining 2 locations is ongoing as of January 2021.

⑦ Other/Monitoring: Under the supervision of the DMRC, during construction phase, contractors will monitor air quality, water quality, waste, noise and vibration, etc., and external consultants commissioned by the DMRC will monitor the same during operation phase. The DMRC and Forest Department will monitor the ecosystem during construction and operation phase. Also, together with the DMRC monitoring site acquisition and resident relocation, external consultants commissioned by the DMRC will carry out monitoring of land acquisition, relocation of residents and the living conditions of residents after relocation during construction and operation phase.

2) Cross-Sectoral Issues:

① Climate change: The Project is thought to contribute to mitigation of climate change as it contributes to the reduction of greenhouse gas emissions by promoting a modal shift. Note that the application of a mass rapid transport system is included as one of the strategies relating to mitigation policy in India's Nationally Determined Contribution (NDC), and the Project is highly regarded. In addition, the Phase 2 and Phase 3 of the Project are registered with the United Nations as Clean Development Mechanism (CDM) projects. Going forward, if a new framework is established for emissions trading in the international community, and the Project meets the requirements, the DMRC will register the Project for the new framework. The mitigation effect of the Project on the climate change (rough estimate of GHG emission reduction) is forecast to be about 138,172 tons/year of CO₂ equivalent (as of 2041).

② Consideration for Disabilities: In accordance with the domestic laws of India, station buildings and passenger cars (elevators, toilets, announcements, braille blocks, wheelchair space, etc.) that also take into consideration for usability for the elderly and persons with disabilities will be adopted. At the same time, station staff, crew members and all other frontline staff are being provided with customer care training.

③ Controlling AIDS/HIV: It has been confirmed with the DMRC that contracts with construction businesses include implementation of AIDS countermeasures such as activities to make workers aware of prevention, etc.

Moreover, at the time of screening, the executing agency agreed to a list of measures that must be taken when formulating projects and implementing projects (total of 36 items) to control COVID-19 infections. Items include the formulation and thorough adherence to behavior patterns for preventing infections, providing contractual consideration for contractors when infections increase, etc.

3) Gender Category:

■ GI(S) (Gender Activity Integration Project)

Activity Description / Reason for Classification: In the Project, measures such as introducing women-only cars, setting priority seats for passengers needing assistance (including women), and installing CCTV cameras in station buildings/trains are being taken in order to make women feel safe and comfortable when they use the metro. Also, as well as ensuring same wages for men and women on construction sites and providing facilities for female workers, female personnel will also be appointed to management position of project implementation. In addition, the DMRC is providing dormitories for female workers and is carrying out activities to increase awareness for the prevention of gender-based violence.

(9) Other Important Issues: N/A

4. Targeted Outcomes

(1) Quantitative Effects

Outcomes (Operation and Effect Indicators)

Indicator	Baseline (2020)	Target (2028) (2 years after Project completion)
Operation rate (% / year)		
Line 7 extension	—	92
Line 8 extension	—	92
Line 10	—	89

Running distance (thousand km / year)		
Line 7 extension	—	5,784
Line 8 extension	—	10,536
Line 10	—	5,364
Running distance of women-only cars (thousand km / year)		
Line 7 extension	—	964
Line 8 extension	—	1,756
Line 10	—	894
Number of trains (number of running trains / day / directions)		
Line 7 extension	—	104
Line 8 extension	—	187
Line 10	—	67
Transportation volume (million passenger – km / day)		
Line 7 extension	—	2.58
Line 8 extension	—	7.30
Line 10	—	3.59
Income from passenger (million Rupees / day)		
Line 7 extension	—	9.62
Line 8 extension	—	27.68
Line 10	—	14.03

Note: All numerical values are for sections to be constructed by the Project (only the extended sections of Lines 7 and 8, and from Aero City to Tughlakabad on Line 10).

(2) Qualitative Effects

Mitigation of traffic pollution, congestion and climate change in the National Capital Territory of Delhi, improvements in convenience through punctuality in scheduled travel times, economic development of the National Capital Territory of Delhi, and promotion of societal advances for women.

(3) Internal Rate of Return

According to the following preconditions, the Project's Economic Internal Rate of Return (EIRR) and the Financial Internal Rate of Return (FIRR) will be 19.7% and 7.2%, respectively.

[EIRR]

Cost: Project cost, operation and maintenance costs (both excluding tax)
Benefits: Shortening effect on traveling time for the users of metro and roads, reduction of vehicle maintenance costs for metro and road users, reduction of maintenance costs for road traffic infrastructure, traffic accidents decline and emission reduction effect of environmental pollutants.

Project Life: 30 years

[FIRR]

Cost: Project cost, operation and maintenance costs (including tax)

Benefits: Fare box revenue, advertisement revenue, and station commercial and front area development revenue, etc.

Project Life: 30 years

5. Preconditions and External Factors

- (1) Preconditions: None
- (2) External Factors: None

6. Lessons Learned from Past Projects and Application to the Project

Based on the ex-post evaluation results of the Metro Manila Strategic Mass Rail Transit Development Project, which is ODA loan project for the Republic of the Philippines (evaluation year 2008), etc., the establishment of a financially independent project implementation structure is highlighted as an important issue from the viewpoint of ensuring suitable operation, management and maintenance.

From the ex-post evaluation reports of India's Delhi Mass Rapid Transport System Project and Phase 2 of the same project (evaluation years 2010 and 2015), etc., reinforcement of the skills and abilities of internal personnel taking into account DMRC's continuous phase implementation has been evaluated as good practice. The highlighted reasons for this include aiming to improve the technical skills of internal personnel by having them gain experience through cooperation with ODA loan consultants as soon as possible, and contribution to dispersion of the metro technology by undertaking external projects such as training, etc. for other metro management organizations both domestically and abroad.

Based on the above lessons, a data collection survey which aims to propose reinforcement of DMRC's financial foundation, etc. will be carried out alongside the Project.

In addition, the same as previous phases of the Project, transfer of project management skills to DMRC personnel will continue through the consulting service of the Project.

7. Evaluation Results

The Project aims to cope with the increase of traffic demand in Delhi by expanding the mass rapid transportation system, thereby promoting regional economic development, improving urban environment and eventually mitigating climate change, through relief of traffic congestion and decrease of pollution caused by increasing motor vehicles and is consistent with the development issues and policies of India and the assistance policies and analysis of the Government of Japan and JICA. The Project is also expected to contribute to the achievement of Goal 9, Goal 11 and Goal 13 of SDGs, so there is a great necessity for assisting with the implementation of this Project.

8. Plan for Future Evaluation

(1) Indicators to be Used

As indicated in section 4 above.

(2) Timing of the Next Evaluation

Ex-post evaluation: 2 years after the Project's completion

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