

## EXECUTIVE SUMMARY

### ENVIRONMENTAL IMPACT ASSESSMENT OF BALANCE CORRIDOR 5

1. Chennai, the capital city of the state of Tamil Nadu, is part of the Chennai Metropolitan Area (CMA) that is home to over 8 million people and plays a vital role in the economy of South India.<sup>1</sup> Like other metropolitan areas in the country, CMA is currently facing the challenges of accelerated urbanization growth that have considerably strained the area's transportation system. The increase in economic activities has boosted the regional economy and job creation, which in turn necessitates improvement in ease of travel and connectivity.
2. Chennai Metro Rail Limited (CMRL), a joint venture of the Government of India (GoI) and the Government of Tamil Nadu (GoTN) with equal equity ownership, is responsible for implementing, operating, and maintaining the city's metro system. CMRL developed the Comprehensive Mobility Plan for CMA in 2015 and identified three corridors (corridors 3, 4, and 5) for the second phase of the Chennai Metro Rail to alleviate CMA's transportation capacity constraints.
3. GoI requested the Multilateral Development Banks<sup>2</sup> (MDBs) to assist the implementation of 29.142 km line connecting Chennai Mofussil Bus Terminal (CMBT) to Okkiyam Thoraipakkam Metro (Ok. Tho) including 28 stations (CMBT and Ok. Tho stations are not included in the 28 stations per the detailed design consultant). This section (Balance C5) forms part of Chennai Metro Rail Corridor 5 sharing 4 stations in common with Corridor 4, allowing interchange with Corridor 3, Corridor 1 and Corridor 2 of Phase I Metro and MRTS and connecting with suburban railway system. Remaining section of the Corridor 5 from Madhavaram to CMBT which is being financed by Japan International Cooperation Agency (JICA) constitutes one of the Associated Facilities to Balance C5.
4. The capital cost of Balance C5 including taxes and duties for December 2018 is estimated at USD 1,037 million, USD 107.51 million as compensation for land and structures, and Resettlement & Rehabilitation (R&R). It is estimated that project will be implemented over a period of 53 months from the date of award of civil works. CMRL will take full responsibility of the implementation of Corridor 5.
5. As per provisions of the EIA Notification 2006 and its subsequent amendments by the Ministry of Environment, Forests and Climate Change (MoEF&CC), Metro Rail Projects are exempted from requirements of Environmental Clearance (EC). However, as the alignment passes through Nanmangalam Reserved Forest between Velakallu and Medavakkam Koot Road, the forest clearance of alienation of forest land to non-forest use will be required. Tree felling permission is required only for Private forest, hill area or sandalwood trees: therefore separate permission not required for the Balance C5.
6. As per MDBs' Environmental and Social Policies<sup>3</sup>, this project has been categorized as 'A' due to the significant impacts anticipated. Environmental impact assessment (EIA) was conducted accordingly. The EIA report comprising baseline data on existing conditions of physical, ambient and ecological environment, together with the identified and anticipated environmental impacts and proposed mitigation measures, has been prepared in accordance with GoI's legislative framework and MDBs' policies.

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<sup>1</sup> Indian National Census, the Census Organization of India, 2011.

<sup>2</sup> Asian Development Bank (ADB) and Asian Infrastructure Investment Bank (AIIB).

<sup>3</sup> ADB's Safeguard Policy Statement (SPS) 2009, and AIIB's Environmental and Social Framework (ESF).

7. The implementation of the Corridor 5 is expected to generate environmental and socio-economic benefits in terms of decreasing air pollution from replacing the diesel-fueled transportation and from traffic congestion and serving the growing travel demand.

8. As per the proposed alignment and design details, standard Gauge (1435mm) will be adopted with a minimum track center distance of 4000 mm, 16-ton maximum axle load capacity and a design speed of 80 kmph. The elevated station is generally located on the road median at 140 m long and 24 m wide and is a three level structure, with a minimum vertical clearance of 5.50 m under the concourse. To reduce physical and visual impact of the elevated station, stations have been made transparent with minimum walls on the sides. Signaling system shall be adopted for Balance C5 in line with the remaining section of Corridor 5. Rolling stock is of light weight stainless steel/aluminum body for energy efficiency. Universal accessibility has been reflected in the design following international best practices. Green building features like rainwater harvesting, solar energy panels at elevated stations' roofs, will be considered in station design.

9. The terrain along Balance C5 alignment is mostly flat, no more than 3 m above mean sea-level. The soil along the alignment is clayey, sandy and hard rock. Balance C5 alignment is located about 2km from the Guindy National Park, however, the wildlife clearance is not required but project activities will strictly follow the guidelines issued by MoEF&CC regarding the prohibited, regulated and permitted activities and consultations with the Tamil Nadu Forest Department. The alignment is approximately 1km away from Nanmangalam lake which is home to a number of bird species; it also runs along existing road passing through Pallikaranai marshland which is also home to a wide variety of birds and other fauna. Diversion of 7,570 sq.m scrub forest land will be required for the stretch traversing the Nanmangalam Reserve Forest. 305 trees are likely to be felled along the corridor up to Ok. Tho.

10. Despite the seemingly abundant sources of water, Chennai suffers continuously from water stress since the entire basin is dependent on rainfall. Water samples has been collected from 7 locations and tested for its quality as per the IS 10500 (drinking water standard). The outcome of the analysis shows most of the key water quality parameters are well within the prescribed permissible limits except for Total Dissolved Solids (TDS) at Global Hospital, turbidity at Alwarthirunagar and Global Hospital, calcium at MIOT Hospital and Medavakkam junction, aluminium at Global Hospital, kaplana Hospital at Adambakkam, Madipakkam Koot Road and Velakallu bus, hardness at MIOT Hospital, Medavakkam junction and Global Hospital and mercury at alwarthirunagar and MIOT Hospital.

11. Ambient air quality (AAQ) monitoring has been conducted for the sensitive receptors along the Balance C5. The outcome of the AAQ results shows that Particulate Matter, Sulphur Dioxide (SO<sub>2</sub>) and Nitrogen Dioxide (NO<sub>2</sub>) were within the permissible level of National Ambient Air Quality Standards (NAAQS). Concentration of Carbon Monoxide (CO) exceeded the permissible level of NAAQS in all the monitoring locations but was within WHO guideline.

12. The Ambient Noise Levels monitored at 7 locations along the alignment were above the national and international permissible limits. Noise levels were also monitored at 10 sensitive locations belonging to the silence zone, with 50% slightly exceeding Gol standards of 50dB the daytime limit (none per WHO guideline of 55dB), and none exceeding 40dB the night-time limit. The predominant source of ambient noise at monitored locations is due to road traffic. All the monitoring stations are located on urban arterials and regional highways. A noise study is ongoing and the full baseline will be updated prior to contractor's mobilization.

13. Peak VdB vibration level at 6 out of 8 monitored locations is found to exceed acceptable criteria for ground borne vibration prescribed by the Federal Transit Administration (FTA) USA and Railway Design and Standards Organization (RDSO) India which are more valid for operation of this project. However the observed levels at all 8 locations ranging from 0.049 mm/sec to 2.090 mm/sec are well below the construction vibration damage criteria for blasting as per Indian authorities, the Directorate General of Mines Safety (DGMS) and that Central Institute of Mining and Fuel Research (CMFRI or CMRI) which are relevant only if blasting is undertaken during construction. A full baseline will be collected prior to contractor's mobilization to elaborate the current baseline.

14. Based on the analysis of project and environmental settings, a detailed assessment of potential impacts with respect to project location and design, construction and operation has been carried out. For each of the anticipated adverse impacts, mitigation measures have been proposed as part of the Environmental Management Plan (EMP). The key positive environmental impacts of Balance C5 include reduced use of private vehicle leading to exhausted gas reduction; road congestion status; road safety improvements; increased accessibility and mobility, and a modest reduction in greenhouse gas emissions. The main residual negative impacts of Balance C5 include fugitive and point source dust emission, noise from construction and operation, disposal of large quantities of construction wastes, and occupation and community health and safety, which are mainly temporary and localized, and can be well managed through implementation of EMP and good international industry practice.

15. The main mitigation measures proposed are as follows: (i) to plant twelve saplings for each tree to be cut as against ten saplings ordered for infrastructure projects by the Honorable Madras High Court, with estimated compensatory afforestation cost in place accordingly; (ii) noise reduction measures (i.e. noise barriers at sensitive receptor locations); and (iii) reuse of excavated material where feasible and disposal of construction waste in a regulated manner. Balance C5 will take into consideration the climate change effects of an anticipated continuous increase in ambient temperature, intensity of cyclones and storm surge, heavy precipitation events, and sea level rise in the future. The alignment being elevated inherently contributes to climate adaptation of flooding risks. Climate mitigation to be integrated into Balance C5 design include: (i) using solar panels on station buildings and roofs to reduce the extensive use of grid-generated electricity supplied to the station for its operation and maintenance; and (ii) through better station roof design, providing for rainwater harvesting by channeling rainwater through gutters and pipes to either harvesting pits in the ground or to recharge groundwater.

16. Various alternatives such as modes of transport, alignment, proposed design etc. have been considered and analyzed for its likely impacts on various environmental and social parameters. Additionally, an evaluation of potential environmental and social impacts in terms of 'with' and 'without' project situation has been considered for the justification of Balance C5.

17. Meaningful public consultations were carried out with communities on the alignment during EIA preparation and will continue before start of implementation of Balance C5 and throughout its implementation. Public consultations highlighted opinions of participants on benefits of Metro in terms of reducing congestion on roads. The EIA report and its Tamil executive summary will be disclosed at the CMRL and lenders' websites with hard copies at the project site.

18. Grievance Redress Mechanism (GRM) has been proposed for Balance C5 comprises the procedures to address grievances (i) first at the Project Implementation Unit level, (ii) second at Grievance Redress Committee (GRC), to ensure grievances from Project Affected Peoples (PAPs) and workers are addressed to facilitate timely project implementation. The

GRC will be formed which will have representatives from Contractors, General Consultant (GC), CMRL, local administration, and PAPs. Unsatisfied PAPs will have the option to escalate the grievances at any point of time.

19. An EMP with institutional arrangements, budgetary provisions, schedule for EMP implementation and its monitoring has been prepared, including appropriate mitigation measures, provisions related to occupational health and safety, labour camp and construction site management, traffic and public utility management etc. to address all impacts during Project pre-construction, construction and operation phases. The EMP forms part of the bidding document of the civil works contractors. In addition, stringent monitoring requirements and actions have been included in the Environmental Monitoring Plan (EMoP) on ambient impacts on air, water, and noise and vibration levels. Bi-annually monitoring reports will be prepared by GC and submitted to lenders through CMRL. A third-party monitor will also monitor work independently and submit verification reports to CMRL and lenders. The preliminary estimated cost of the EMP including implementation and monitoring is USD 3.78 million (INR 276 million). This cost estimate is exclusive of land acquisition and R&R cost.

20. Benefits far outweigh negative impacts. Overall, the major environmental impacts associated with Balance C5 are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices. The EMP and EMoP shall be revised if necessary, for any unanticipated impacts, during project implementation or if there is any change in the project design and with approval of lenders.