EXECUTIVE SUMMARY

ENVIRONMENTAL IMPACT ASSESSMENT OF CORRIDOR 4

1. Chennai, the capital city of the state of Tamil Nadu, is part of the Chennai Metropolitan Area (CMA) that is home to over 8.65 million people and plays a vital role in the economy of South India.[1] 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 [2] (MDBs) to assist the implementation of the 26.8 km of Chennai metro corridor 4 upto depot entry, which consists of 16.5 km of elevated section and 10.3 km of underground section. This line has 4 stations in common with Corridor 5, offers interchange with Corridor 3, Phase I Metro and MRTS; it connects with suburban railway system. This alignment has been finalized after examining alternatives. The total capital cost of Corridor 4 is estimated to be USD 2.17 billion. It is estimated that project will be implemented over a period of 6 years from the date of commencement. CMRL will take full responsibility of the implementation of Corridor 4.

4. As per provisions of the Environmental Impact Assessment (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. However, the Light House to Foreshore Road section will fall in Coastal Regulatory Zone (CRZ) IA and II and CRZ clearance will be required as per CRZ Notification 2019.

5. This EIA 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' environmental safeguard policies[3]. In accordance with proposed packaging of Corridor 4, underground stretch, elevated stretch and depot will be financed by different MDB and constitute Associated Facilities to each package. The environmental impacts and mitigation measures of all 4 packages are analyzed in this report. Corridor 4 overall is expected to generate environmental and socio-economic benefits in terms of decreasing air pollution from traffic congestion and serving the growing travel demand. As per the MDB's safeguard policies, the Corridor 4 has been categorized as "Category A" due to the significant impacts anticipated during construction.

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[1] Indian National Census, https://www.census2011.co.in/census/metropolitan/435-chennai.html The Census Organization of India, 2011.

[2] Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB) and New Development Bank (NDB).

[3] ADB's Safeguard Policy Statement (SPS) 2009, AIIB's Environmental and Social Framework (ESF), and NDB's Environmental and Social Framework (ESF).

6. Corridor 4 consists of 12 underground stations from Lighthouse to Meenakshi College, 18 elevated stations from Power House to Poonamallee Bypass and one depot at Poonamallee Bypass. The depot will have capacity for 31 trains of 6 cars for maintenance and repairs of the operational rolling stock. 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 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. The underground station is two- or three-level station with entrances and ventilation shafts at the ground level, a concourse with ticketing and automatic fare collection system (AFCs) at the mezzanine level and finally 140 m long and 12 m wide island platforms at the lowest level. 25 kV AC traction system and Communication based Train Control (CBTC) Signaling system shall be adopted for Corridor 4. 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, energy efficient air conditioning and lightning will be considered in station design.

7. The terrain along Corridor 4 alignment is mostly flat, no more than 3 m above mean sea-level. The Geotechnical Investigation is ongoing with the results showing that the soils are slightly alkaline with dominant types of sandy and clay. The section of alignment from Light House to Foreshore Estate Road station is located in CRZ IA and II. The CRZ II stretch is defined as areas that have already been developed up to or close to the shore-line. 536 trees are likely to be felled along the corridor up to Poonamallee Bypass depot. Three assets, namely Santhome Church, Rosary Church and Our Lady of Light Shrine are located on at distance within 100m from Corridor 4.

8. Despite the seemingly abundant sources of water, Chennai suffers continuously from water stress since the entire basin is dependent on rainfall. Water quality was sampled at 9 locations. Most of the parameters are well within the prescribed permissible limits as per the Bureau of Indian Standards. However, the concentration of Total Dissolved Solids and Total Hardness are observed to be higher than the prescribed limits as per the IS for the water samples collected at Santhome Church this could be due to higher salinity and mineral content (Calcium and Magnesium) in the groundwater. .

9. Results of the air monitoring show that air quality was moderate, while the parameters of Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2) were within the permissible level of National Ambient Air Quality Standards (NAAQS) and World Health Organization (WHO) guideline. Particulate Matter was within NAAQS but exceeded WHO guideline. Concentration of Carbon Monoxide (CO) exceeded the permissible level of NAAQS in all the monitoring locations but was generally within WHO guideline. The noise levels monitored at 8 locations along the alignment were above the national and international permissible limits. Noise levels was also monitored at 30 sensitive locations belonging to the silence zone, with 60% slightly exceeding Ambient Noise Standard of 50dB the daytime limit (23.3% per WHO guideline of 55dB), and 1 out of 30 exceeding 40 dB the night-time limit. The peak particle velocity baseline values to demonstrate the vibration level at 11 out of 13 monitored locations is found to exceed acceptable criteria for ground borne vibration prescribed by Federal Transit Administration (FTA) USA and Railway Design & Standards Organisation (RDSO) India which are more valid for operation of this project. However the observed levels at all 13 locations are well below the construction vibration damage criteria for blasting which are relevant only if blasting is undertaken during construction as per Central Institute of Mining and Fuel Research (CMFRI) India. A full baseline will be collected prior to contractor's mobilization to elaborate the current baseline.

10. Based on analysis of project and environmental settings, a detailed assessment of potential impacts due project location and design, construction and operation has been carried out. For each of these adverse impacts, mitigation measures have been proposed. The key positive environmental impacts of Corridor 4 include reduced use of private vehicle leading to reduction in pollutants; road safety improvements; increased accessibility and mobility, and a modest reduction in greenhouse gas emissions. The main residual negative impacts of Corridor 4 include fugitive and point source dust emission, surface noise and vibration from excavation and demolition, disturbance to road traffic, disposal of large quantities of construction and demolition wastes, and occupation and community health and safety, which are mainly temporary and localized. The detailed analysis of noise and vibration is yet to be finalized. The results will be incorporated in the updated EIA prior to contractor's mobilization.

11. 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. Corridor 4 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. Several climate change considerations to be integrated into Corridor 4 design include: (i) installation of floodgates at stations with flooding risks; (ii) improving adaptability to seasonal thermal variations in the stations through the use of large open spaces for unrestricted air movement, cross-ventilation and ensuring that enclosed areas are well ventilated; (iii) designing for better adaptability to rising sea level/high tide/heavy flooding through the use of higher plinth levels and check valves for sewer lines in flood-prone areas and the use of resilient materials that can get wet and then dry out with minimal damage; (iv) 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 (v) 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.

12. Various alternatives such as modes of transport, alignment, proposed design etc. have been considered and analyzed for its likely impacts on various environmental parameters. Additionally, an evaluation of potential environmental impacts in terms of 'with' and 'without' project situation has been considered for the justification of Corridor 4.

13. Meaningful consultations were carried out with various stakeholders during EIA preparation and will continue throughout Corridor 4 implementation. Women felt that Corridor 4 will provide (i) better access to higher levels of education, health services (especially in emergencies), and social interactions; (ii) better transport option; and (iii) increase in leisure time. Concerns voiced by Project Affected Persons (PAPs) and stakeholders have been incorporated in Corridor 4 design. Individual consultation of PAPs will also be carried out during implementation. Information disclosure will follow the procedure for MDBs' Category A projects.

14. Grievance Redress Mechanism (GRM) has been proposed for Corridor 4 comprises the procedures to address grievances i) first at the Project Implementation Unit (PIU) level, ii) second at Grievance Redress Committee (GRC), to ensure grievances from PAPs and workers are addressed to facilitate timely project implementation. A 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.

15. An Environmental Management Plan (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, and traffic and public utility management etc. to address all impacts during Project pre-construction, construction and operation phases. The EMP has been developed in conjunction with general safety, health and environment provisions (which are included in the standard bidding document) and it forms part of the contract document of the contractors. Bi-annually monitoring reports will be prepared by GC and submitted to MDBs through CMRL. A third-party monitor will also supervise work independently and submit bi-annual reports to CMRL and MDBs. The preliminary estimated cost of the EMP including implementation and monitoring is USD 3.19 million (INR 227.9 million). This cost estimate is exclusive of land acquisition and resettlement & rehabilitation cost.

16. Benefits far outweigh negative impacts. Overall, the major social and environmental impacts associated with Corridor 4 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. In addition, stringent monitoring requirements and actions have been included in the Environmental Monitoring Plan (EMoP) on noise and vibration levels that will be generated during construction. CMRL shall ensure that the EMP and EMoP are included in Bill of Quantity and forms part of bid document and civil works contract. The same shall be revised if necessary, during project implementation or if there is any change in the project design and with approval of MDBs.

17. This EIA report is structured as following: (i) Introduction of background, methodology of preparation of the report; (ii) Policy and legal framework within which environmental safeguards for Corridor 4 shall be recommended and implemented; (iii) Project description with enumeration of salient features of Corridor 4 which have bearing upon its environmental impacts; (iv) Environmental baseline of Corridor 4 in terms of physical, ambient, and ecological baseline (socioeconomic baseline will be presented in Social Impact Assessment Report); (v) Identification of negative and positive impacts arising from pre-construction, construction and operation of Corridor 4 and respective measures to mitigate negative impacts and where feasible enhance generate positive impacts; (vi) Analysis of alternatives including its need and alternatives of technology and alignment; (vii) Consultations with stakeholders and plan for disclosure of project information; (viii) Mechanism for stakeholders to communicate grievances and suggestions and for their Redressal; (ix) EMP and institutional arrangement for implementation of environmental impact mitigation measures; and (x) Conclusion.