

المجلس العالمي للبصمة الكربونية
GLOBAL CARBON COUNCIL



**Project
Submission
Form**

V4.0- 2022

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COVER PAGE- Project Submission Form (PSF)	
BASIC INFORMATION	
Title of the Project Activity as per LON/LOA	Hyderabad Metro Rail (MRTS)
PSF version number	1.0
Date of completion / Updating of this form	18/10/2022
Project Owner(s) as per LON/LOA <small>(Shall be consistent with De-registered CDM Type B Projects)</small>	L&T Metro Rail (Hyderabad) Limited
Country where the Project Activity is located	India
GPS coordinates of the project site(s)	17° 23' 13.7040" N (17.387140) 78° 29' 30.0624" E (78.491684)
Eligible GCC Project Type as per the Project Standard <small>(Tick applicable project type)</small>	<input type="checkbox"/> Type A: <input type="checkbox"/> Type A1 <input checked="" type="checkbox"/> Type A2 <input checked="" type="checkbox"/> Sub-Type 1 <input type="checkbox"/> Sub-Type 2 <input type="checkbox"/> Sub-Type 3 <input type="checkbox"/> Sub-Type 4 <input type="checkbox"/> Type A3 <input type="checkbox"/> Type B – De-registered CDM Projects:¹ <input type="checkbox"/> Type B1

¹ Owners of Type B projects shall fill in the form provided in Appendix 7.

	<input type="checkbox"/> Type B2
Minimum compliance requirements	<input checked="" type="checkbox"/> Real and Measurable GHG Reductions <input checked="" type="checkbox"/> National Sustainable Development Criteria (if any) <input checked="" type="checkbox"/> Apply credible baseline and monitoring methodologies <input checked="" type="checkbox"/> Additionality <input checked="" type="checkbox"/> Local Stakeholder Consultation Process <input checked="" type="checkbox"/> Global Stakeholder Consultation Process <input checked="" type="checkbox"/> No GHG Double Counting <input checked="" type="checkbox"/> Contributes to United Nations Sustainable Development Goal 13 (Climate Action)
Choose optional and additional requirements <small>(Tick applicable label categories)</small>	<input checked="" type="checkbox"/> Do-no-net-harm Safeguards to address Environmental Impacts <input checked="" type="checkbox"/> Do-no-net-harm Safeguards to address Social Impacts <input checked="" type="checkbox"/> Contributes to United Nations Sustainable Development Goals (in addition to Goal 13)
Applied methodologies including version No. <small>(Shall be approved by the GCC or the CDM)</small>	ACM0016: Mass Rapid Transit Projects --- Version 5.0 ²
GHG Sectoral scope(s) linked to the applied methodology(ies)	GHG-SS #7. Transport

² <https://cdm.unfccc.int/methodologies/DB/PPZC6A7B2DFBT0MC46OK0AROF64FKE>

Applicable Rules and Requirements for Project Owners	Rules and Requirements	Version	
(Tick applicable Rules and Requirements)	<input checked="" type="checkbox"/> ISO 14064-2		
	<input checked="" type="checkbox"/> Applicable host country legal requirements /rules		
	<input checked="" type="checkbox"/> GCC Rules and Requirements ³	<input checked="" type="checkbox"/> Project Standard	3.1
		<input type="checkbox"/> Approved GCC Methodology (XXXXX)	
		<input checked="" type="checkbox"/> Program Definitions	3.1
		<input checked="" type="checkbox"/> Environment and Social Safeguards Standard	3.0
		<input checked="" type="checkbox"/> Project Sustainability Standard	3.0
		<input checked="" type="checkbox"/> Instructions in Project Submission Form (PSF)-template	4.0
		<input checked="" type="checkbox"/> Clarification No. 01	1.0
		<input type="checkbox"/> Clarification No. 02	
		<input type="checkbox"/> Clarification No. 03	
		<input checked="" type="checkbox"/> Clarification No. 04	1.0
		<input type="checkbox"/> Clarification No. 05	
		<input checked="" type="checkbox"/> Standard on avoidance of double counting	1.0
		<input type="checkbox"/> Add rows if required	
<input checked="" type="checkbox"/> CDM Rules ⁴	<input type="checkbox"/> Approved CDM Methodology (ACM0016)	5.0	
	<input type="checkbox"/> TOOL 1- Tool for the demonstration and assessment of additionality		
	<input type="checkbox"/> TOOL 02- Combined tool to identify the baseline scenario and demonstrate additionality		
	<input checked="" type="checkbox"/> TOOL 07- Tool to calculate the emission	7.0	

³ GCC Program rules and requirements: <http://www.globalcarboncouncil.com/resource-centre/>

⁴ CDM Program rules: <https://cdm.unfccc.int/Reference/index.html>

		factor for an electricity system	
		<input type="checkbox"/> TOOL 19- Demonstration of additionality of microscale project activities	
		<input type="checkbox"/> TOOL 21- Demonstration of additionality of small-scale project activities	
		<input type="checkbox"/> TOOL 23- Additionality of first-of-its-kind project activities	
		<input type="checkbox"/> TOOL 24- Common practice	
		<input type="checkbox"/> TOOL 27- Investment analysis	
		<input type="checkbox"/> TOOL 32- Positive lists of technologies	
		<input type="checkbox"/> Guidelines for objective demonstration and assessment of barriers	
		<input checked="" type="checkbox"/> TOOL 18- Baseline emissions for modal shift measures in urban passenger transport	1.0
		<input checked="" type="checkbox"/> TOOL 5- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation	3.0
		<input checked="" type="checkbox"/> TOOL 3- To calculate project or leakage CO2 emissions from fossil fuel combustion	3.0
	<input type="checkbox"/> Add rows if required		
Choose Third Party Project Verification by approved GCC Verifiers⁵	<input checked="" type="checkbox"/> GHG emission reductions (i.e., Approved Carbon Credits (ACCs)) <input checked="" type="checkbox"/> Environmental No-net-harm Label (E⁺) <input checked="" type="checkbox"/> Social No-net-harm Label (S⁺)		

⁵ **Note:** GCC Verifiers under the Individual Track are not eligible to conduct verifications for GCC Project Activities whose

<p>(Tick applicable verification categories)</p>	<p><input checked="" type="checkbox"/> United Nations Sustainable Development Goals (SDG⁺)</p> <p><input type="checkbox"/> Bronze SDG Label</p> <p><input checked="" type="checkbox"/> Silver SDG Label</p> <p><input type="checkbox"/> Gold SDG Label</p> <p><input type="checkbox"/> Platinum SDG Label</p> <p><input type="checkbox"/> Diamond SDG Label</p> <p><input checked="" type="checkbox"/> CORSIA requirements (C⁺)</p> <p><input checked="" type="checkbox"/> Host Country Attestation on Double counting</p>
<p>Declaration by the 'Authorized Project Owner⁶ and focal point'</p> <p>(Tick all applicable statements⁷)</p>	<p>The Project Owner(s) declares that:</p> <p>Generic Requirements applicable to all Project Types:</p> <p><input checked="" type="checkbox"/> We confirm that the Project Activity complies with the eligibility of the applicable project type (A1, A2, A3, B1 or B2) as stipulated by the Project Standard and relevant clarifications.</p> <p><input checked="" type="checkbox"/> We confirm that the Project Activity shall start or have started operations, and shall start or have started generating emission reductions, on or after 1 January 2016.</p> <p><input checked="" type="checkbox"/> We confirm that the Project Activity is eligible to be registered under the GCC program.</p> <p>We shall ensure the following for the Project Activity (tick at least one of the two options):</p> <p><input checked="" type="checkbox"/> No outcomes (e.g., emission reductions, environmental attributes) generated by the Project Activity under GCC will be claimed as carbon credits or environmental attributes under any other GHG/non-GHG⁸ program, either for compliance or voluntary purposes, during the entire GCC crediting period; or</p> <p><input type="checkbox"/> If the project activity has been issued with carbon credits or environmental attributes of compensating nature⁹ by any other GHG/</p>

owners intend to supply carbon credits (ACCs) for use within CORSIA.

⁶ The Project Owner means the legal entity or organization that has overall control and responsibility for the Project Activity

⁷ **Consequences in case of Non-compliance with declaration statements:**

If at any point in time non-compliance with the declared statements is established as a result of negligence, fraud or wilful misconduct of the GCC Project Owner/s the GCC project activity will be disqualified, and the registration of the proposed Project Activity will be rejected.

⁸ Non-GHG programs could be such as I-REC facilitating reliable energy claims with Renewable Energy Certificate (REC) schemes

⁹ The environmental attributes of compensating nature are those which are used by captive users (e.g.,



	<p>non-GHG program, either for compliance or voluntary purposes, the ACCs will be claimed only for the remaining crediting period (subject to a maximum of 10 years of crediting period including the periods under other programs and GCC program) for which carbon credits/ environmental attributes of compensating nature have not been issued by any other GHG/ non-GHG program.</p> <p>Specific requirements applicable to respective Project Types:</p> <p><u>For Project Type A1:</u></p> <p><input type="checkbox"/> For Project Type A1, we confirm that the Project Activity is NOT registered as a GHG Project Activity in any other GHG/non-GHG program or any other voluntary program and has not issued or will not issue credits under any other program.</p> <p><u>For Project Type A2 (Sub-Type 1):</u></p> <p><input checked="" type="checkbox"/> For Project Type A2 Sub-Type 1, we confirm that the Project Activity is NOT registered as a GHG Project Activity in any other GHG/non-GHG program or any other voluntary program and has not issued or will not issue credits under any other program.</p> <p><u>For Project Type A2 (Sub-Type 2 or Sub-Type 3):</u></p> <p>For Project Type A2 Sub-Type 2 or Project Type A2 Sub-Type 3, we confirm that for Project Activity, which has been registered with CDM or any GHG/non-GHG Program and we shall (tick at least one of the two options):</p> <p><input type="checkbox"/> Submit a proof for deregistration from CDM; or</p> <p><input type="checkbox"/> Submit a signed & stamped public undertaking, stating that the Project Owner will never submit any request for Issuance of ACCs or request for renewal of crediting period to CDM-EB or under article 6.4 or any authority after submission to GCC Program and shall formally inform CDM-EB or authority under article 6.4 or any authority after submission to GCC Program.</p> <p><input type="checkbox"/> For Project Type A2 Sub-Type 2 or Project Type A2 Sub-Type 3, we confirm that the Project Activity is NOT included as a component Project Activity (CPA) in any registered GHG Programme of Activities (PoA) or any other functionally equivalent grouped/aggregated activities under any GHG program (such as the CDM or any other voluntary program).</p> <p><u>For Project Type A2 (Sub-Type 4):</u></p> <p>For Project Type A2 Sub-Type 4, we confirm that the Project Activity has been included in a registered CDM-POA and we shall (tick at least one of the two options):</p> <p><input type="checkbox"/> Submit the proof for exclusion of CPA(s) from registered CDM-POA prior to the date of initial submission to the GCC Program; or</p>
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corporates/industries) for offsetting their GHG emissions

	<p><input type="checkbox"/> Submit the proof of exclusion of CPA(s) from the registered CDM-PoA after the request for registration has been submitted to GCC Program but before the final decision is made by the GCC Steering Committee.</p> <p><u>For Project Type A3:</u></p> <p><input type="checkbox"/> For Project Type A3, we confirm that the Project Activity is NOT registered as a GHG Project Activity in any other GHG/non-GHG program or any other voluntary program and has not issued or will not issue credits under any other program.</p> <p><u>For Project Type B1 or B2:</u></p> <p>For Project Type B1 or Project Type B2, we confirm that for Project Activity, which has been registered with CDM or any GHG/non-GHG Program and we shall (tick at least one of the two options):</p> <p><input type="checkbox"/> Submit a proof for deregistration from CDM; or</p> <p><input type="checkbox"/> Submit a signed & stamped public undertaking, stating that the Project Owner will never submit any request for Issuance of ACCs or request for renewal of crediting period to CDM-EB or under article 6.4 or any authority after submission to GCC Program and shall formally inform CDM-EB or authority under article 6.4 or any authority after submission to GCC Program.</p> <p>Requirements to avoid double counting:</p> <p>We intend to submit or have submitted a written attestation¹⁰ (Host Country Letter of Authorization - HCLOA) from the host country's national focal point or focal point designee for CORSIA eligible units generated beyond 31 December 2020 at the following stages¹¹ (tick at least one of the three options):</p> <p><input type="checkbox"/> The initial submission for GSC; or</p> <p><input type="checkbox"/> Along with the submission for a request for registration (after Project Verification is completed); or</p> <p><input checked="" type="checkbox"/> Along with the submission for a request for the first or subsequent issuance of ACCs.</p> <p>Project specific requirements:</p> <p><u>CORSIA specific requirements:</u></p> <p><input type="checkbox"/> We confirm that bundled projects or grouped projects shall have registered crediting period starting on or after 1 Jan 2016 for the grouped/aggregated</p>
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¹⁰ In case of any change of Host Country Letter of Authorisation (HCLOA) the project owner shall inform the GCC operations team immediately

¹¹ If the host country attestation is not submitted at the initial submission of GSC, the project can be tagged with an indicative CORSIA flag if it's confirmed to be submitted later. If the host country attestation is not submitted at the request for registration, the project can be tagged with an indicative CORSIA flag if at least the PSF and Verification Report confirms to submit this letter, at first issuance. If the host country attestation is not submitted at request for first issuance, the ACCs will not be tagged as CORSIA (C+) compliant if this letter is not submitted.

	<p>project as a whole.</p> <p><input checked="" type="checkbox"/> We confirm that the Project Activity meets all the requirement of the CORSIA Eligible Emissions Units¹² required for GCC projects and does not fall under the excluded unit types, methodologies, programme elements, and/or procedural classes.</p> <p><input checked="" type="checkbox"/> We confirm that the Project Activity aims to achieve at least Silver or higher SDG+ label (i.e., positively impact at least 3 or more United Nations Sustainability Development Goals).</p> <p><input checked="" type="checkbox"/> We confirm that the Project Activity will be implemented in a country which is UN member state¹³.</p> <p>Provide details (if any) below for the boxes ticked above:</p>
	<p>The Project Owner(s) declares that:</p> <p><input checked="" type="checkbox"/> All the information provided in this document, including any supporting documents submitted to the GCC or its registry operator IHS Markit at any time, is true and correct.</p> <p><input checked="" type="checkbox"/> They understand that a failure by them to provide accurate information or data, or concealing facts and information, can be considered as negligence, fraud or willful misconduct. Therefore, they are aware that they are fully responsible for any liability that arises as a result of such actions.</p> <p>Provide details below for the boxes ticked above</p>
<p>Appendixes 1-9</p>	<p>Details about the Project Activity are provided in Appendixes 1 through 9 to this document.</p>
<p>Name, designation, date and signature of the Focal point (as per LON/LOA)</p>	<p>On behalf of L&T Metro Rail (Hyderabad) Limited</p>  

¹² CORSIA Eligible Emissions Units containing approval and conditions for GCC Program: <https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Emissions-Units.aspx>

¹³ The list of UN member states countries can be found at <https://www.un.org/en/about-us/member-states>

	Signature: Name: Atul Sanghal Designation: Director Authorized Representative: Emergent Ventures India Pvt. Ltd. Date: 18/10/2022

1. PROJECT SUBMISSION FORM

Section A. Description of the Project Activity

A.1. Purpose and general description of the Project Activity

>>

The purpose of project activity is to establish and operate a new rail based mass rapid transit system (MRTS) in the city of Hyderabad for passenger transport. In a pre-project scenario people in the city moved using a mix of private and public modes of transit (baseline). It is expected that new MRTS will displace a part of the passenger trips of these pre-project modes which comprise of two wheelers, passenger cars, taxis, autos and buses, even though these will continue to play the important role of moving people from one place to another in the city. Since moving people using MRTS is more energy efficient on per passenger-kilometer basis compared to the pre-project modes, it is expected that MRTS will induce significant GHG emission reduction during the project lifetime through mode shift from pre-project modes. The project activity is implemented by L&T Metro Rail (Hyderabad) Limited (LTMRHL) which has a concession agreement with the Government of (erstwhile Andhra Pradesh) Telangana for a period of 35 years and extendable by another 25 years.

MRTS in the project activity comprises of three rail corridors with a total length of approximately 69 km.

Route	Length (km)	No of stations
Corridor 1: Miyapur to LB Nagar	29.2	27
Corridor 2: JBS to MGBS	11	08
Corridor 3: Nagole to Raidurgam	29	22
Cumulative	69.2	57

There are three major interchanges connections on the three corridors – 1) Ameerpet on corridors 1 & 3, 2) MGBS on corridors 1 & 2, and 3) Parade Ground on corridors 2 & 3. All three corridors are open to public movement with initial commissioning in Nov 2017.

The baseline (pre-project scenario) to MRTS is use of public and private modes of transit in the city which comprises of two wheelers, passenger cars, taxis, autos and buses. As of 2017, public transport systems (buses and MMTS) contributed less than 45% mode share of the city ridership of about 8 million of which approx. 96.3% came from buses and remaining 3.7% from MMTS. The city bus service is divided into four categories as below:

Type	Seating pattern	Share in bus transit
Ordinary bus	2X2; 45 seating, 18 standing	61%
Metro Express	2X2; 45 seating	25%
Metro Delux	2X2; 37 seating	9%
District Ordinary & Mofussil	3X2; 54 seating	5%

MMTS runs on Corridor I: Lingampally-Hyderabad (Nampally) and Corridor II: Lingampally-Secunderabad-Falaknuma with a daily ridership of approx. 0.125 million (2017). However project activity is outside the influence area of MMTS and is not likely to displace passenger trips in MMTS.

The project boundary encompasses the passenger trips completed on the MRTS within the urban zone of the Hyderabad city and is based on the origins and destinations of passengers using MRTS. Project boundary also includes the power plants connected physically to the electricity system that supply power to the project, and the captive power plants. MRTS in the project activity is run on electricity and electricity is sourced from a number of sources i.e. grid and solar rooftop power plants installed at stations and in depots. The key elements of MRTS include the rolling stocks, tracks, stations, ticketing infrastructure, information systems, administrative support etc.

The baseline of the project activity is the continued use of current public & private modes of transit along the MRTS route and baseline emissions are those generated in these modes in the absence of the project activity. Project emissions are based on the fuel and/or electricity consumed by the MRTS (direct project emissions). Emission reductions are achieved through reducing GHG emissions per passenger-kilometer, comparing conventional modes of transport with MRTS. It is estimated that the project activity will effect a cumulative GHG emission reduction of **1,969,326 tCO₂e over 10 year period** of project activity with average annual reduction of **196,932 tCO₂e**.

The project activity is expected to contribute to sustainable development in a number of ways which is explained as below:

Socio-economic development:

There are direct gains from the project activity in terms of generation of direct employment and indirect livelihood opportunities in and around the project site during and after the construction phase and for the operation and the upkeep of the project. The social impact of metro also includes improved social wellbeing as a result of less time lost in congestion, less respiratory diseases due to less particle matter pollution, and fewer accidents per passenger transported.

Environmental development:

Since project activity displaces more-GHG intensive transport modes (e.g. an existing fleet of buses and private modes operating under mixed traffic conditions) by less-GHG-intensive MRTS, there are numerous environmental benefits from their operations such as less GHG emissions, less air pollutants. This is achieved through a more efficient transport system and through using electricity as energy source.

Technological development:

MRTS is a modern and efficient mass transit mode adopted by cities across the world and slowly picking up in the host country.

A.2. Location of the Project Activity

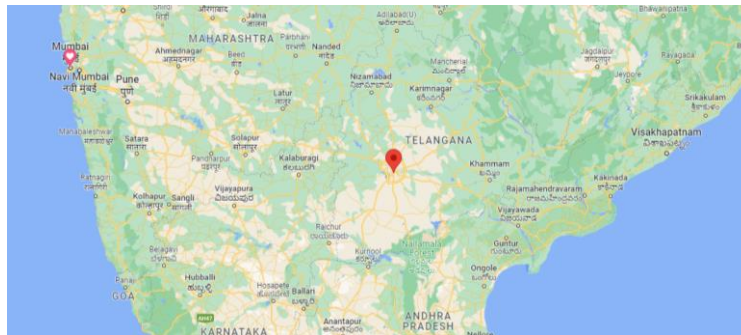
>>

MRTS in the project activity comprises of three rail corridors in Hyderabad city, state of Telangana, in India.

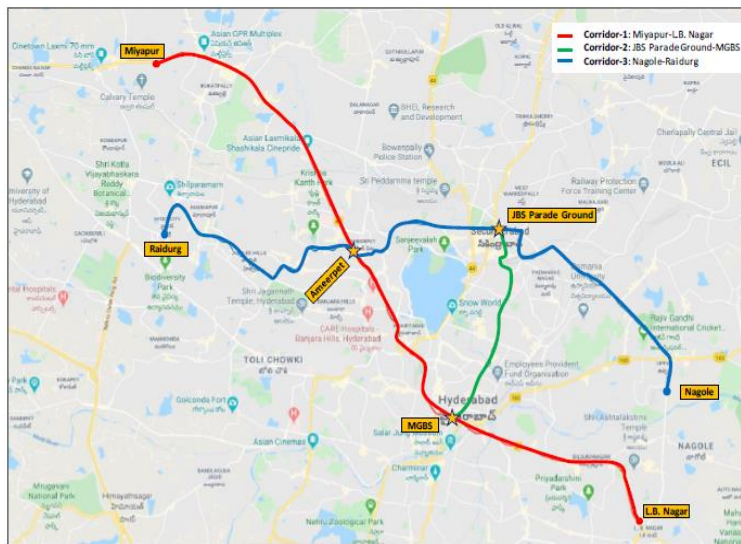
Address and geodetic coordinates of the physical site of the Project Activity		
Physical address	Latitude*	Longitude*
City: Hyderabad District: Hyderabad State: Telangana	17° 23' 13.7040" N (17.387140)	78° 29' 30.0624" E (78.491684)

Note: Geo-coordinates to presented in degree minute seconds as well in decimal place format (4 decimal places)

Pictorial representation of the project activity location



Location of Hyderabad city in India



MRTS Route map in the Hyderabad city

A.3. Technologies/measures

>>

The key elements of MRTS include the rolling stocks, tracks, stations, ticketing infrastructure, information systems, administrative support etc.

Rolling stocks:

- 171 Nos. of cars¹⁴
- Modern & light weight
- Regeneration facility
- Passenger Information System
- Space for wheelchair
- Longitudinal seats, Grab Poles and Rails for standing passengers
- Air-conditioned with humidity control
- Mobile and laptop charging points
- Fire safety & security

Track:

- Mainline – Ballastless, Depots – Ballasted
- Min. Radius of curve – 120m.
- Wear Resistant Rails : 1080 grade (Tata Steel)

Stations:

- 57 stations on three corridors
- Open Stations with 3 levels

Signaling & train control:

- CBTC Moving Block System (Thales Seltrack)
- Supports bi-directional movement
- Semi-automatic operating mode (STO) with ATS, ATP, ATO & ATB
- Train Detection : Primary (radio) and secondary (axle counter)
- All 3 corridors managed centrally in OCC
- Back-up Control Centre (BCC) for emergency situations

Communication system:

- Passenger Information Display System (PIDS)
- Public Announcement System
- CCTV with Video Analytics
- Telephone System
- Access Control
- TETRA Radio
- Clock System

Automatic fare collection system:

- Contactless system (tokens & smartcards)
- Closed loop system
- Ticket Vending Machines / Manual Ticketing
- Bank Combo Card
- Common ticketing planned for Hyderabad
- Auto Top-up, Online Top-up and ATM Top-up

¹⁴ This number might change in future basis flow of tariff.

Power supply & traction:

- Incoming power supply at 132 kV
- 4 RSS (Nagole, Yousufguda, MGBS and Miyapur)
- Outdoor and GIS type RSS
- 25 kV AC overhead traction system
- Connected load 18.2 MVA

Solar power supply:

Installed capacity is 8.35 MWp. These are rooftop projects of kWp capacities installed at stations and in depots.

There is no technology transfer in the project activity.

A.4. Project Owner(s)

Location/ Country	Project Owner(s)	Where applicable ¹⁵ , indicate if the host country has provided approval (Yes/No)
India	L&T Metro Rail (Hyderabad) Limited	Not applicable

A.5. Declaration of intended use of Approved Carbon Credits (ACCs) generated by the Project Activity

>> The Project Activity is expected to generate ACCs for a full 10-year crediting period and supply the credits to offset the following GHG emissions:

Period		Name of the Entities	Purpose and Quantity of ACCs to be supplied
From	To		
26/11/2018	25/11/2028	L&T Metro Rail (Hyderabad) Limited	1,969,326 ACCs over 10 year period.

Project owner confirms that the carbon credits (ACCs) from the Project Activity shall not be double counted. The project activity is being registered only with GCC and no other carbon standard.

A.6. Additional requirements for CORSIA

>>

¹⁵ For example, *Project Coordination Form* is to be filled-in by Project Owners for projects located in Qatar. A written attestation from the host country's national focal point or the focal point's designee, as required by CORSIA (Refer section A.5 of the PSF guidelines).

Refer to **Section E** of this document for details on compliance to the Environment and Social Safeguards Standard to ensure that the Project Activity does not cause any net harm to the environment or society.

Also refer to **Section F** of this document for details on compliance to the Project Sustainability Standard to ensure that the Project Activity demonstrates the level of contribution towards achieving the United Nations Sustainability Development Goals (SDGs).

During project registration stage host country attestation/ approval on double counting from the Host country (India) focal point is not available. The same shall be submitted at the stage of request for issuance to meet the eligibility requirement of CORSIA.

Section B. Application of selected methodology(ies)

B.1. Reference to methodology(ies) and tools applied in the project

>>

The project activity applies approved Large Scale Consolidated Methodology as below.
ACM0016: Mass Rapid Transit Projects; Version 5.0¹⁶

The methodology also refers to following approved versions of the tools:

TOOL03: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion¹⁷; Version 3.0

TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation¹⁸; Version 3.0

TOOL18: Baseline emissions for modal shift measures in urban passenger transport¹⁹; Version 1.0

B.2. Applicability of methodology(ies) and tools applied in the project

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The methodology **ACM0016, Version 5.0** is applicable to the project activity under the following conditions:

Condition	Status of project activity
para 3: The methodology is applicable for the implementation of Mass Rapid Transit Systems (MRTS), such as segregated Bus Rapid Transits (BRT) bus lanes or rail-based lines, that replaces existing bus routes operating under mixed traffic conditions	The project activity involves a new installation of Rail based Mass Rapid Transit Systems (MRTS) that replaces existing bus routes operating under mixed traffic conditions. Hence the methodology is applicable to the project activity.
para 4: The project may involve one or more of	The project activity involves construction of a

¹⁶ <https://cdm.unfccc.int/methodologies/DB/PPZC6A7B2DFBT0MC46OK0AROF64FKE>

¹⁷ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v3.pdf>

¹⁸ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-05-v3.0.pdf>

¹⁹ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-18-v1.pdf>

<p>the measures listed below:</p> <p>(a) The construction of a new rail-based infrastructure (e.g. new rail lines);</p> <p>(b) The expansion of an existing rail infrastructure (e.g. extension of an existing rail line);</p> <p>(c) The construction of new segregated BRT bus lanes;</p> <p>(d) The extension of bus lanes of existing BRT systems or expansions of existing BRT systems (i.e. adding new routes and lines).</p>	<p>new rail-based infrastructure for Mass Rapid Transit Systems (MRTS) and hence meets the applicability condition.</p>
<p>para 5: For projects involving BRTs, the following specific provisions apply:</p> <p>(a) Only BRT systems without feeder route are eligible under this methodology ;</p> <p>(b) The buses used in the routes that were replaced by the project MRTS can be retired or relocated to another part of the network;</p> <p>(c) The project activity may be based on existing road infrastructure, but the bus lanes shall be separated physically from mixed traffic.</p>	<p>The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS) and does not involve BRTs; hence this condition does not apply.</p>
<p>para 6: Fuels including (liquefied) gaseous fuels or biofuel blends, as well as electricity can be used in the baseline or project case. The following conditions apply in case of biofuels:</p> <p>(a) The project buses shall use the same biofuel blend (same percentage of biofuel) as commonly used by conventional comparable urban buses in the country i.e. the methodology is not applicable if project buses use higher or lower blends of biofuels than those used by conventional buses;</p> <p>(b) The project buses shall not use a significantly higher biofuel blend than cars and taxis.</p>	<p>The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS) and does not involve use of buses; hence this condition does not apply.</p>
<p>para 7: The methodology is applicable for urban or suburban trips. It is not applicable for interurban transport.</p>	<p>The project activity is for urban or suburban trips within Hyderabad. Hence meets the applicability condition.</p>
<p>para 9: The methodology is applicable if the most plausible baseline scenario is the continuation of the use of current modes of transport. Hence the condition meets the applicability condition.</p>	<p>Most plausible baseline scenario for the project activity is the continuation of the use of current modes of transport. Hence meets the applicability condition.</p>
<p>para 10: The methodology is not applicable for:</p> <p>(a) Operational improvements (e.g. new or larger buses) of an already existing and operating bus lane or rail-based MRTS;</p> <p>(b) Bus lanes replacing an existing rail-based</p>	<p>The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS) and does not involve -</p> <p>a) Operational improvements (e.g. new or larger buses) of an already existing and operating bus</p>

<p>system i.e. the existing urban or suburban rail infrastructure shall remain fully (in its full length) operational; (c) The implementation of air- or water-based transport systems.</p>	<p>lane or rail-based MRTS, b) Use of buses and c) The implementation of air- or water-based transport systems.</p> <p>Hence the condition does not apply.</p>
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Also, the applicability conditions of applied tools are explained below:

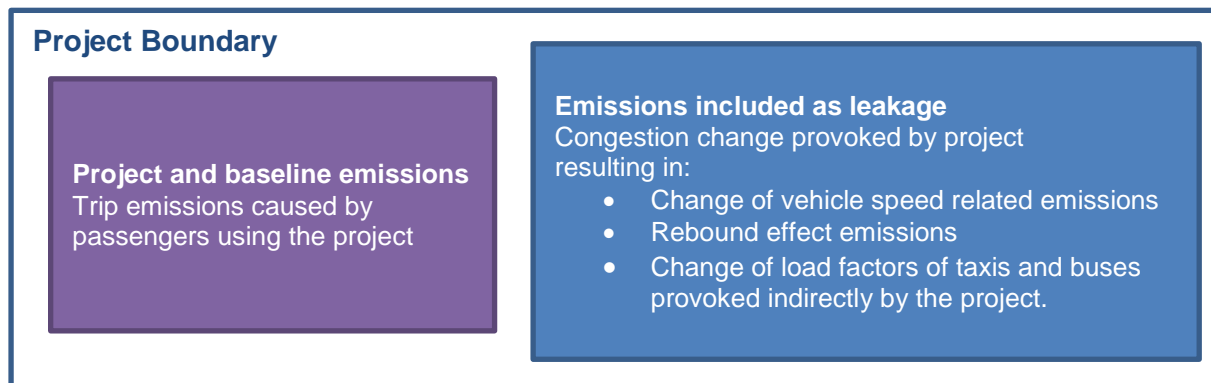
Condition	Status of project activity
<p>TOOL18 <i>Para 03: The tool is applicable to project activities in urban passenger transport that implement a measure or a group of measures aimed at a modal shift to urban public transit such as metro, bus rapid transit (BRT), light rail and trams.</i></p>	<p>Refer to section B.4 of PSF.</p> <p>The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS). Hence this tool is applicable.</p>
<p>TOOL 05 <i>Para 05: If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption:</i></p> <p><i>(a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer;</i></p> <p><i>(b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or</i></p> <p><i>(c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from</i></p>	<p>Refer to section B.4 of PSF.</p> <p>The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS) which consumes electricity from grid.</p> <p>Hence Scenario A is applicable.</p>

<i>the captive power plant(s) and the grid.</i>	
<p>TOOL 03 <i>Para 02: This tool provides procedures to calculate project and/or leakage CO2 emissions from the combustion of fossil fuels. It can be used in cases where CO2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.</i></p>	<p>Refer to section B.6 of PSF.</p> <p>The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS) which consumption of fossil fuel in Generator. Hence this tool is applicable.</p>

B.3. Project boundary, sources and greenhouse gases (GHGs)

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The project boundary encompasses the passenger trips completed on the MRTS within the urban zone of the Hyderabad city and is based on the origins and destinations of passengers using MRTS. Project boundary also includes the power plants connected physically to the electricity system that supply power to the project, and the captive power plants. MRTS in the project activity is run on electricity and electricity is sourced from a number of sources i.e. grid, solar rooftop power plants installed at stations and in depots. The key elements of MRTS include the rolling stocks, tracks, stations, ticketing infrastructure, information systems, last-mile connectivity through various independent service providers, administrative support etc.



The table below provides an overview of the emissions sources included or excluded from the project boundary for determination of baseline and project emissions.

Source		GHG	Included?	Justification/Explanation
Baseline	Mobile source emissions of different modes of transport (buses, passenger cars, motorcycles, taxis), which the passengers of the MRTS system would have taken in the absence of the project MRTS	CO ₂	Included	Main emission source
		CH ₄	Excluded	Minor emission source
		N ₂ O	Excluded	Minor emission source

Project Activity	Direct emissions from the operation of the project MRTS	CO ₂	Included	Main emission source
		CH ₄	Excluded	Minor emission source
		N ₂ O	Excluded	Minor emission source

	Indirect emissions from the different modes of transport used by the passengers of the MRTS, from their point of origin to the MRTS entry station, and from the MRTS exit station to their final destination	CO ₂	Included	Main emission source
		CH ₄	Excluded	Minor emission source
		N ₂ O	Excluded	Minor emission source

B.4. Establishment and description of the baseline scenario

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As per para 38 of ACM0016: Mass Rapid Transit Projects; Version 5.0, the baseline scenario is the continued use of pre-project public & private modes of transit for passenger movement (possibly expanded using additional vehicles) since project activity is additional.

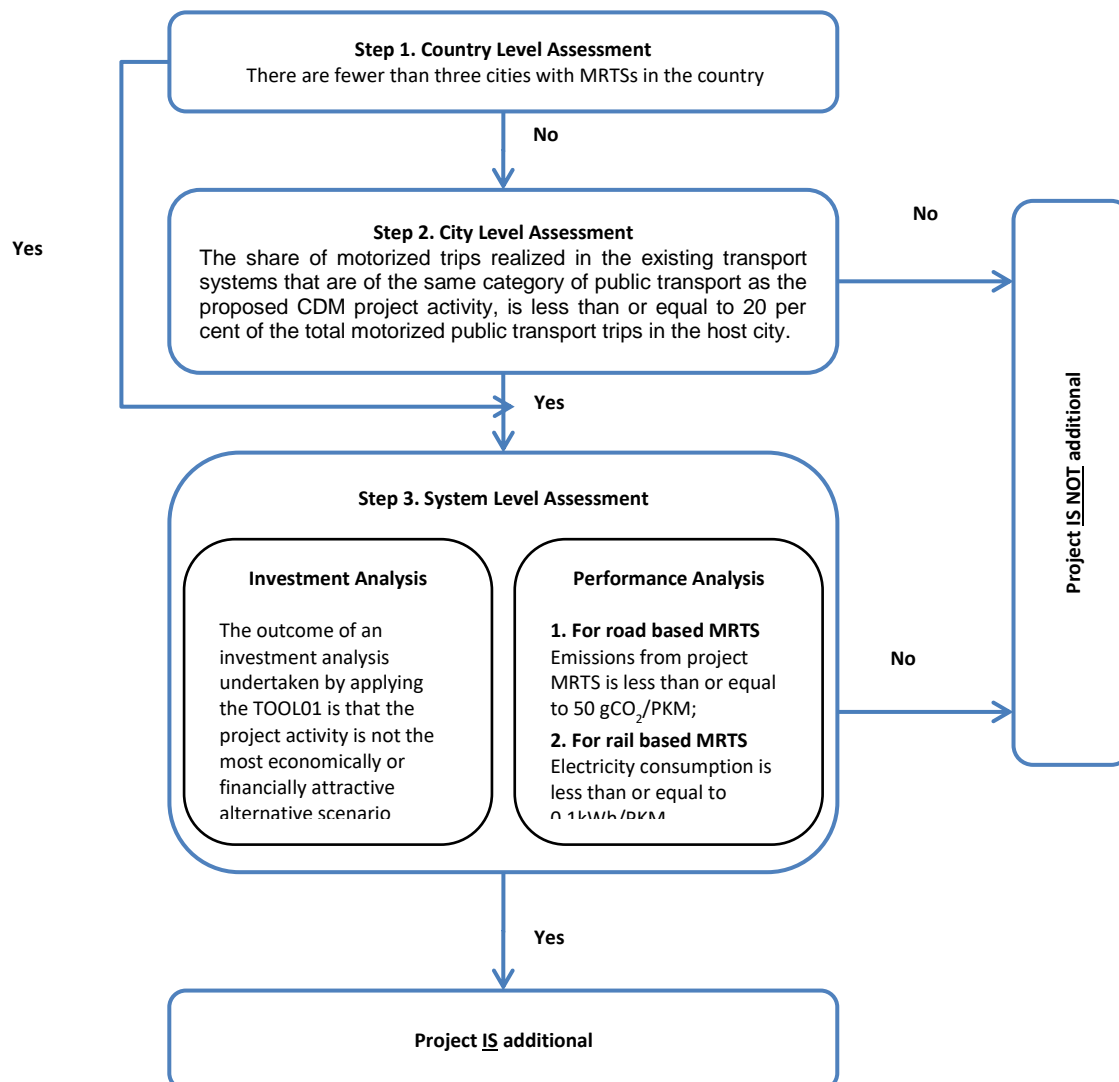
B.5. Demonstration of additionality

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The additionality of a GCC Project shall be demonstrated by applying the following approach having two components: (i) A Legal Requirement Test; and (ii) An Additionality Test either based on a Positive List test or a projects-specific additionality test.

The project activity is a Type A project and hence requires to undergo a Legal Requirement Test. However the projects as in the project activity are not mandated by law or regulations and are entirely a voluntary action. The project is additional as per paragraph 46 of GCC Project Standard V3.1.

The project activity does not fulfill the criteria of positive list as provided in CDM Tool 32: "Methodological Tool – Positive List of Technologies" and hence additionality of the project activity is demonstrated through a project specific additionality test. For the demonstration and assessment of additionality "ACM0016: Mass Rapid Transit Projects; Version 5.0" has been applied. The methodology provides for MRTS projects, which are implemented in countries other than LDCs and which are not first-of-its-kind, a step-wise approach to demonstrate and assess the additionality of a project.



Step 1: Country level assessment

The project activity is a new rail-based Mass Rapid Transit Systems (MRTS) undertaken in India. There are more than three cities with MRTS that started commercial operation in the host country of the project activity prior to the start of the project activity. The PO signed various agreements for the design, procurement and construction of the project activity in 2012 and started commercial operation of the first phase in Nov 2017.

Currently there are 15 MRTS projects operational in India²⁰. Of these only three started operation prior to 2012. Delhi MRTS is a registered CDM project. Since the number of cities with MRTS (excluding systems developed as carbon project activities) is not equal to three cities, Step 2 is excluded and Step 3 is analyzed.

²⁰ <https://themetrorailguy.com/metro-rail-projects-in-india/>

City	Operator	Start date of operation	Prior to project activity	Carbon Scheme	Ref
Kolkata Metro, West Bengal	Metro Railway & KMRC	24-Oct-84	Yes		
Delhi Metro, Delhi-NCR	DMRC	24-Dec-02	Yes	CDM	4463
Bangalore Metro, Karnataka	BMRCL	20-Oct-11	Yes		
Gurgaon Rapid Metro, Haryana	RMRG (now DMRC)	14-Nov-13	No	CDM	6430
Mumbai Metro, Maharashtra	MMOPL, MMRC & MMOCL	08-Jun-14	No	CDM	4670
Jaipur Metro, Rajasthan	JMRC	03-Jun-15	No		
Chennai Metro, Tamil Nadu	CMRL	29-Jun-15	No		
Lucknow Metro, Uttar Pradesh	UPMRCL	06-Sep-16	No		
Kochi Metro, Kerala	KMRL	19-Jun-17	No		
Hyderabad Metro, Telangana	HMRL	29-Nov-17	No		
Noida Metro, Uttar Pradesh	NMRC	25-Jan-19	No		
Ahmedabad Metro, Gujarat	GMRC	06-Mar-19	No		
Nagpur Metro, Maharashtra	Maha-Metro	08-Mar-19	No		
Kanpur Metro, Uttar Pradesh	UPMRCL	29-Dec-21	No		
Pune Metro, Maharashtra	Maha-Metro & Pune IT City Metro Rail Ltd.	06-Mar-22	No		

Step 2: City level assessment

This step is excluded as explained in Step 1.

Step 3: System level assessment

Two options are provided for the system level assessment of the project activity.

- a) Conduct an investment analysis; or
- b) Conduct a performance analysis

For the project activity, option b) is chosen.

Conduct a performance analysis

As per this option, MRTS shall demonstrate that the forecasted electricity consumption of the rail-based systems is less than or equal to 0.1 kWh/pkm.

For this purpose the annual amount of electricity consumption by the MRTS for rail-based systems shall be based on expected efficiency and energy source, annual number of passengers expected to travel in the MRTS and an average distance that these passengers are expected to travel in the MRTS when the project will reach its planned capacity. This analysis shall be conducted ex ante for the purpose of additionality demonstration.

Accordingly calculation for forecasted electricity consumption has been carried out as presented below.

Parameter	Unit	Value
Daily ridership	number	1,568,782

Average trip distance	km	12.65
Yearly ridership	number	572,605,430
Total passenger km travelled per annum	pkm	7,243,458,690
Total estimated electricity consumption per annum	kWh	55,218,077
Forecasted electricity consumption per passenger-km	kWh/pkm	0.008

As forecasted electricity consumption of the MRTS is estimated to be much less than 0.1 kWh/pkm, hence, the project activity is additional.

B.6. Estimation of emission reductions

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B.6.1. Explanation of methodological choices

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Baseline emissions:

According to TOOL18, Version 1.0, baseline emissions from urban passenger transport are calculated based on the number of passengers transported under a project activity and the average emission factor per baseline mode of transport, from which project passengers shifted.

The estimation is to be carried out in following steps:

Step 1: Determine relevant vehicle categories

Following motorized vehicle categories are applicable in the city of project activity

- Two Wheeler
- Passenger Car
- Taxi
- Auto
- Bus

Step 2: Determine the emission factor per kilometre for each relevant road based vehicle category

Each vehicle category of Step 1 is differentiated for the fuel type.

Vehicle category	Fuel types
Two Wheelers	Petrol
Passenger Car	Petrol, diesel
Taxi	Petrol, diesel
Auto	Petrol, diesel, CNG
Bus	Diesel

For each vehicle category and fuel type, an emission factor per vehicle kilometer is calculated as

$$EF_{KM,i,x} = \left[\sum_n [SFC_{i,n,x} \times NCV_{i,n} \times EF_{CO2,n} + SEC_{i,x} \times EF_{CO2,x}] \times \frac{N_{i,n,x}}{N_{i,x}} \right]$$

$EF_{KM,i,x}$	= Emission factor per kilometre of vehicle category i in year x (g CO ₂ /km)
$SFC_{i,n,x}$	= Specific fuel consumption of vehicle category i using fuel type n in year x (mass or volume units of fuel/km)
$NCV_{i,n}$	= Net calorific value of fuel n used in vehicle category i (MJ/mass or volume units of fuel)
$EF_{CO2,n}$	= Emission factor for fuel type n (g CO ₂ /MJ)
$SEC_{i,x}$	= Specific electricity consumption of vehicle category i using electricity in year x (kWh/km)
$EF_{CO2,x}$	= Emission factor for electricity in year x (g CO ₂ /kWh)
$N_{i,n,x}$	= Number of vehicle-kilometers of category i driven in year x (VKM) or number of vehicles of category i in year x (units)
$N_{i,x}$	= Fuel types used by vehicle category i in year x
i	= Road-based vehicle categories (passenger car (C), bus (B), motorcycle (M), etc)
x	= Most recent calendar year for which data is available. Data shall not be older than three years.

For taxis, personal cars and two wheelers, instead of estimating the emission factor $EF_{KM,i,x}$ a default emission factor for new vehicles has been obtained from the source provided in the TOOL.

Since vehicle-km data for each vehicle category is not available, share of vehicles for each fuel type shall be used.

Step 3: Determine the emission factor per passenger-kilometre

The emission factors per passenger kilometre (PKM) are determined for each vehicle category as follows:

Fuel based transport system. The emission factor per PKM for fuel based transport systems (e.g. road-based vehicles) are calculated as follows:

$$EF_{PKM,i,x} = EF_{KM,i,x} / OC_{i,x}$$

Where

$EF_{PKM,i,x}$	= Emission factor per passenger-kilometre of vehicle category i in year x (g CO ₂ /PKM)
$EF_{KM,i,x}$	= Emission factor per kilometre of vehicle category i in year x (g CO ₂ /km)
$OC_{i,x}$	= Average occupancy rate of vehicle category i in year x (passengers)
i	= Road-based vehicle categories (such as passenger car (C), bus (B), motorcycle (M))
x	= Most recent calendar year for which data is available. Data not older than three years

Step 4: Determine baseline emissions

Option 1 of the methodology is used. Baseline emissions are determined based on the shares of

passengers shifted from baseline vehicle categories i to the project urban public system(s) and an average trip distance on each relevant vehicle category. Baseline emissions are estimated as follows:

$$BE_y = \left(\sum_i (IR_i)^{t+y-1} \times EF_{PKM,i,x} \times SD_i \right) \times PD_y \times 10^{-6}$$

Where:

- BE_y = Baseline emissions in year y (t CO₂eq)
- IR_i = Technology improvement factor for vehicle category i per year (ratio)
- T = Time difference (in years) between the year for which data is available for vehicle category i and the year of establishing standardized baseline or start date of GCC project in case the tool is used for determine baseline emissions of GCC project
- $EF_{PKM,i,x}$ = Emission factor per passenger-kilometre for electricity-based or road-based vehicle category i in year x (g CO₂eq/PKM)
- PD_y = Number of passenger-kilometres travelled by the project system in year y (PKM)
- i = Vehicle categories (such as passenger car (C), bus (B), motorcycle (M) or rail based urban transit (R))
- y = Crediting year when emissions reductions are estimated

Project emissions:

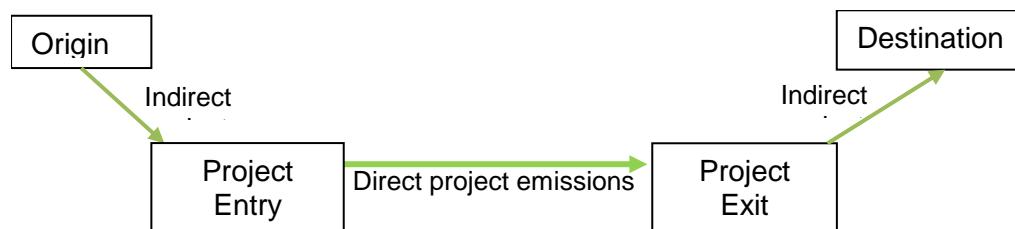
According to Methodology “Mass Rapid Transit Projects ” Version 5.0, project emissions are based on the fuel and/or electricity consumed by the MRTS (direct project emissions) plus emissions caused by project passengers from their trip origin to the entry station of the project and from the exit station of the project to their final destination (indirect project emissions)

Project emissions are calculated as follows:

$$PE_y = DPE_y + IPE_y$$

Where:

- PE_y = Project emissions in year y (tCO₂)
- DPE_y = Direct project emissions in year y (tCO₂)
- IPE_y = Indirect project emissions in year y (tCO₂)



Direct Project Emissions:

Direct project emissions are determined based on the fuel and electricity consumed by the project system.

$$DPE_y = DPE_{FC,y} + DPE_{EC,y}$$

Where:

$DPE_{FC,y}$ = Direct project emissions from fuel consumption in year y (tCO₂)

$DPE_{EC,y}$ = Direct project emissions from electricity consumption in year y (tCO₂)

Since MRTS in the project activity consumes only electricity, direct emissions from fuel consumptions are ignored.

Direct project emissions from electricity consumption

The methodology provides two alternatives to determine project emissions from electricity consumption depending on data availability.

- Alternative A: Use of electricity consumption data
- Alternative B: Use of specific electricity consumption and distance data

Accordingly, Alternative A shall be used.

As per TOOL05, project emissions due to electricity consumption shall be estimated as:

Emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows

$$PEEC = \sum EC_{PJ,,} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Where:

$PEEC,$ = Project emissions from electricity consumption in year y (t CO₂ / yr)

$EC_{PJ,,}$ = Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)

$EF_{EL,,}$ = Emission factor for electricity generation for source j in year y (t CO₂/MWh)

$TDL_j,$ = Average technical transmission and distribution losses for providing electricity to source j in year y

The project activity is installation of a new rail-based Mass Rapid Transit Systems (MRTS) which consumes electricity from grid. Hence Scenario A of TOOL05 is applicable. Option A1 is used.

$$EF_{EL,j,y} = EF_{grid,CM,y}$$

Emission factor for electricity:

The project activity utilizes electricity mainly from the connected grid and to some extent rooftop solar projects installed at the stations and in depots. Since solar power is GHG free the emission factor for this part of electricity is zero. For grid electricity, emission factor is calculated as reflected in the combined margin (CM) calculations described in “TOOL07: Tool to calculate the emission factor for an electricity system”.

So, for baseline emissions include CO₂ emissions from electricity generation in power plants that are displaced due to the project activity and is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO₂e/kWh) calculated in a transparent and conservative manner as: Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in “Tool to calculate the emission factor for an electricity system” (Version 07.0).

The combined margin of the electricity grid is sourced from “**CO₂ Baseline database for the Indian Power Sector**“ **Version 17.0 dated October 2021** of Central Electricity Authority of India²¹ which follows Tool to calculate the emission factor for an electricity system”.

The baseline emission factor ($EF_{\text{grid,CM,y}}$) is calculated as a combined margin (CM), consisting of the combination of operating margin ($EF_{\text{grid,OM,y}}$) and build margin ($EF_{\text{grid,BM,y}}$) factors according to the following steps. Calculation for this combined margin is based on data from an official source publicly available.

Step 1: Identify the relevant electricity systems

Historically, the Indian power system was divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covered several states. As of 31 December 2013, all regional grids had been integrated and were operating in synchronous mode, i.e. at same frequency, hence forming one unified Indian Grid. Hence, unified Indian Grid is the relevant electricity system for the purpose of estimating Grid Emission Factor.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option 1 is chosen and only grid connected power plants are included in the calculation.

Step 3: Select a method to determine the operating margin (OM)

There are four following methods prescribed which can be used for calculating OM.

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch Data Analysis OM, or
- (d) Average OM.

Project proponent follows option (a) i.e. Simple OM for estimation of Operating Margin emission factor.

The Simple OM method can only be used where low-cost/must run resources constitute less than 50% of total grid generation in recent five years. As observed in the table below less than 20% is provided by low cost must run power plants. Simple OM has been selected also because the

²¹ <https://cea.nic.in/cdm-co2-baseline-database/?lang=en>

required disaggregated data is available in India.

Parameter	2016-17	2017-18	2018-19	2019-20	2020-21
Gross Generation Total (GWh)	11,51,479	12,01,877	12,47,575	12,44,853	1,227,904
Net Generation Total (GWh)	10,72,839	11,21,567	11,65,160	11,62,971	1,147,523
Share of Must-Run (Hydro/Nuclear) (% of Net Generation)	14.6%	14.3%	14.5%	17.0%	16.5%

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (t CO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The results of $EF_{grid,OM,y}$ calculation are as in the table below.

Parameter	2018-19	2019-20	2020-21
Simple Operating Margin	0.9603	0.955	0.941
Net Generation in Operating Margin (GWh)	9,95,957	9,65,009	958,218

Since ex-ante option of calculating OM is considered, a three year weighted average based on the most recent available data is calculated.

So, $EF_{grid,OM,y} = 0.9522$

Step 5: Calculate the build margin (BM) emission factor

Option 1 has been chosen to calculate BM.

The results of $EF_{grid,BM,y}$ calculation are as in the table below.

Parameter	2020-21
Build margin (not adjusted for imports) (tCO ₂ /MWh)	0.8653

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor (EF) is based on Weighted Average CM.

Since it is neither solar nor wind power project, following weights have been considered for the calculation of CM.

$W_{OM} = 0.50$ & $W_{BM} = 0.50$

The results of $EF_{grid,CM,y}$ calculation are as in the table below.

Parameter	OM	BM	CM
Combined margin (tCO ₂ /MWh)	0.9522	0.8653	0.9088

Indirect Project Emissions:

Indirect project emissions are those caused by passengers from their point of origin (O) up to the project activity entry station, and from the project activity exit station up to the final destination (D):

Indirect project emissions are determined based on the equation below:

$$IPE_y = P_y \times \sum_i (D_{ind,i,1-4} \times EF_{pkm,i,1-4} \times 10^{-6})$$

Where:

IPE_y	=	Indirect project emissions in year y (tCO ₂)
P_y	=	Total number of passengers transported in year y
$EF_{pkm,i,1-4}$	=	Emission factor per passenger-kilometer of mode i in years 1 and 4 of the crediting period (gCO ₂ /pkm)
$D_{ind,i,1-4}$	=	Average indirect project trip distance of surveyed passengers using mode i in years 1 and 4 of the crediting period (km)

Leakage:

According to Methodology “Mass Rapid Transit Projects ” Version 5.0, potential sources of leakage emissions from a MRTS project are:

- (a) Changes in occupancy of the baseline transport system, that is, the project may potentially increase or decrease the occupancy rate of the baseline vehicles (i.e. buses and taxis); and
- (b) Reduced congestion in remaining roads (because passengers shifted from cars and motorcycles to the project, resulting in higher average speed of baseline vehicles), plus a rebound effect;
- (c) Upstream emissions of gaseous fuels, if the project vehicles consume more gaseous fuels than baseline vehicles.

Leakage emissions are calculated based on equation below:

$$LE_y = LE_{LF,Z,y} + LE_{LFT,y} + LE_{CONG,y} + LE_{UP,y}$$

Where:

LE_y	=	Leakage emissions in year y (tCO ₂)
$LE_{LF,Z,y}$	=	Leakage emissions due to change of load factor of buses in year y (tCO ₂)
$LE_{LFT,y}$	=	Leakage emissions due to change of load factor of taxis in year y (tCO ₂)
$LE_{CONG,y}$	=	Leakage emissions due to change in congestion in year y (tCO ₂)
$LE_{UP,y}$	=	Leakage emissions due to upstream emissions of gaseous fuels in year y (tCO ₂)

Since project activity does not consume gaseous fuels, leakage due to upstream emissions of gaseous fuel is not considered.

As per paragraph 57, as a conservative approach, leakage is only considered if the total annual effect is to reduce estimated emission reductions and where total net leakage effects are negative ($LE_y < 0$), project participants should assume $LE_y = 0$.

Leakage due to the change in load factor of buses

As per paragraph 59, load factor changes are monitored in years 1 and 4 of the crediting period for the entire larger urban zone of the city.

As per paragraph 60 leakage source is only included if the load factor of buses has decreased by more than 10 per cent.

Leakage due to change in load factor of buses is calculated as -

$$LE_{LF,Z,y} = \max \left[\frac{N_{Z,1-4} \times AD_Z \times EF_{km,Z,y} \times \left(1 - \frac{ROC_{Z,1-4}}{ROC_{Z,x}} \right)}{10^6}; 0 \right]$$

Where:

- $N_{Z,1-4}$ = Number of buses in years 1 and 4 of the crediting period (buses)
- AD_Z = Average annual distance driven by baseline buses (km/bus)
- $EF_{km,Z,y}$ = Emission factor per kilometer for baseline buses in year y (gCO_2/km)
- $ROC_{Z,1-4}$ = Average occupancy rate relative to the capacity of baseline buses in years 1 and 4 of the crediting period (%)
- $ROC_{Z,x}$ = Average occupancy rate relative to the capacity of baseline buses in year x (%)
- x = Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whichever is earlier

The average annual distance driven by baseline buses (AD_Z) is determined based on the distance driven by the different bus sizes (small, medium, large) and the number of the different bus sizes

$$AD_Z = \frac{\sum_i DD_{Z,s,x}}{\sum_s N_{Z,s,x}}$$

Where:

- $DD_{Z,s,x}$ = Total distance driven by bus size s in year x (km)
- $DD_{i,L}$ = Total distance driven by large (L) buses i in year x (km)
- N_k = Number of buses of size k in year x

- s* = Bus sizes: small (S), medium (M) and large (L)
- x* = Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whichever is earlier

The average occupancy rate relative to the capacity of buses is:

$$ROC_Z = \frac{OC_{Z,t}}{CV_{Z,t}}$$

Where:

- $OC_{Z,t}$ = Average occupancy of buses in the period *t* (passengers)
- $CV_{Z,t}$ = Average capacity of buses in the period *t* (passengers)
- t* = Period of time when the parameters are measured: most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whatever is earlier (*x*) or years 1 and 4 of the crediting period

Leakage due to a change in load factor of taxis

As per paragraph 63, the load factor of taxis is monitored in the years 1 and 4 of the crediting period. This leakage is calculated as follows:

$$LE_{LFT,y} = \max \left[\frac{N_{T,1-4} \times AD_T \times EF_{km,T,y} \times \left(1 - \frac{ROC_{T,1-4}}{ROC_{T,x}} \right)}{10^6}; 0 \right]$$

Where:

- $LE_{LFT,y}$ = Leakage emissions due to a change in load factor of taxis in year *y* (tCO₂)
- $N_{T,1-4}$ = Number of taxis in years 1 and 4 of the crediting period (taxis)
- AD_T = Average annual distance driven by baseline taxis (km/taxi)
- $EF_{km,T,y}$ = Emission factor per kilometer for baseline taxis in year *y* (gCO₂/km)
- $ROC_{T,1-4}$ = Average occupancy rate relative to the capacity of baseline taxis in years 1 and 4 of the crediting period (%)
- $ROC_{T,x}$ = Average occupancy rate relative to the capacity of baseline taxis in year *x* (%)
- x* = Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whichever is earlier

The average occupancy rate relative to the capacity of taxis is

$$ROC_T = \frac{OC_{T,t}}{CV_{T,t}}$$

Where:

- $OC_{T,t}$ = Average occupancy of taxis in the period t (passengers)
- $CV_{T,t}$ = Average capacity of taxis in the period t (passengers)
- t = Period of time when the parameters are measured: most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the CDM-PDD for validation, whatever is earlier (x) or years 1 and 4 of the crediting period

Leakage due to reduced congestion

As per paragraph 68, the implementation of the project activity may have the following overall impacts on congestion:

- (a) The project system may reduce the road space available for conventional buses and individual transport modes, which, in turn, may increase the congestion on that reduced road capacity and, therefore, lead to higher emissions;
- (b) An implementation of the project system may provide a new road infrastructure. In this case, the project system will likely attract passengers from conventional modes of transport; as a consequence, the number of vehicles that will travel on the affected roads will reduce, resulting in reduced congestion. In this case, reduced congestion may have the following impacts relevant for GHG emissions:
 - (i) Induced traffic effect (or rebound effect), i.e. more trips of passenger cars on the “affected roads”;
 - (ii) Changes in vehicle speed effect, i.e. change of emissions due to a reduced or increased speed of cars on “affected roads”.

As per paragraph 69, where the implementation of the project activity leads to a reduction of road capacity available for individual motorised transport modes, the impact of changes in congestion shall be monitored in the end of years 1 and 4 of the crediting period. In other cases monitoring of these changes is not required.

To determine the additional road capacity, available to the transport modes remaining in operation, as a result of the implementation of project activity in the year when the project is intended to reach its planned capacity:

$$ARS_y = \sum_y \frac{BSCR_y}{N_{z,x}} \times SRS_x - \frac{RS_x - RS_y}{RS_x}$$

Where:

- ARS_y = Additional road capacity available to individual motorised transport modes in year y when the project is intended to reach its planned capacity (in percentage)
- $BSCR_y$ = Cumulative bus units displaced by the project on the trunk lanes as a result of the project in year y (number of vehicles)
- $N_{Z,x}$ = Total number of buses in the public transportation system in use in year x (units)
- SRS_x = Share of road space used by public transport in year x (in percentage).
- RS_x = Total road space available in year x (lane-kilometers)
- RS_y = Total available road space in the project in year y (lane-kilometers)
- x = Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whichever is earlier. Data not older than three years

As per paragraph 73, if ARS_y is negative, then the road capacity in that year is reduced and leakage emissions due to increased congestion as a result of the reduced road capacity due to the project activity ($LE_{CONG,y}$) are to be quantified based on the equation below. If ARS_y is positive, $LE_{CONG,y}$ is assumed to be zero and no monitoring is required.

$$LE_{CONG,y} = \max[(LE_{REB,y} + LE_{SP,y}); 0]$$

Where:

- $LE_{REB,y}$ = Leakage emissions due to induced traffic / rebound effect in year y (tCO₂)
- $LE_{SP,y}$ = Leakage emissions due to change in vehicle speed in year y (tCO₂)

Determination of emissions due to induced traffic/rebound effect

The rebound effect for the affected roads is calculated as follows:

$$LE_{REB,y} = \sum_i \frac{[TD_{i,1-4} \times EF_{KM,i,1-4} \times (N_{i,1-4} - N_{i,x} + N_{i,MS,y})]}{10^6}$$

Where:

- $LE_{REB,y}$ = Leakage emissions due to rebound effect in year y (tCO₂)
- $TD_{i,1-4}$ = Average trip distance driven by vehicle category i on the affected roads in years 1 and 4 of the crediting period (km)
- $EF_{KM,i,y}$ = Emission factor per kilometer for vehicle category i in years 1 and 4 of the crediting period (gCO₂/km)

- $N_{i,1-4}$ = Number of vehicle category i using the affected roads in years 1 and 4 of the crediting period (cars, taxis)
- $N_{i,x}$ = Number of vehicle category i per annum using the affected roads in year x (cars, taxis)
- $N_{i,MS,y}$ = Number of vehicle category i per annum not used anymore due to mode shift to the MRTS in year y (cars, taxis)
- i = Vehicle category: passenger cars (C) and taxis (T)
- x = Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whichever is earlier. Data not older than three years.

The number of cars and taxis per annum not used anymore due to mode shift to the MRTS in years 1 and 4 of the crediting period is:

$$N_{i,MS,y} = \frac{MS_{i,1-4} \times P_y}{OC_{i,x}}$$

Where:

- $MS_{i,1-4}$ = Net share of passengers using the MRTS which would have used mode i in years 1 and 4 of the crediting period y (%)
- P_y = Passengers transported by the project in year y (passengers)
- $OC_{i,x}$ = Average occupancy rate of vehicle category i year x (passengers)
- i = Vehicle category: passenger cars (C) and taxis (T)
- x = Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the PSF for validation, whichever is earlier. Data not older than three years.

Determination of emissions due to changes in vehicle speed

Leakage emissions due to changes in vehicle speed are determined only for cars and taxis.

$$LE_{SP,y} = \sum_i \frac{[N_{i,1-4} \times TD_{i,1-4} \times (EF_{KM,VP,i,1-4} - EF_{KM,VB,i})]}{10^6}$$

Where:

- $LE_{SP,y}$ = Leakage emissions due to changes in vehicle speed of cars and taxis in year y (tCO₂)
- $N_{i,1-4}$ = Number of cars/taxis using the affected roads in years 1 and 4 of the crediting period (cars, taxis)
- $TD_{i,1-4}$ = Average trip distance made by cars/taxis on the affected roads in years 1 and 4 of the crediting period (km)

- $EF_{KM,VP,i,1-4}$ = Emission factor per kilometer for cars/taxis at the project speed in years 1 and 4 of the crediting period (gCO₂/km)
- $EF_{KM,VB,i}$ = Emission factor per kilometer for cars/taxis at the baseline speed (gCO₂/km)
- i = Vehicle category: passenger cars (C) and taxis (T)

The project speed on the affected roads is monitored in the end of years 1 and 4 of the crediting period.

For Emission factor per kilometer of cars/taxis at the project speed and baseline speed, default relationship between the speed dependency factor and emissions for passenger cars developed by CORINAIR is used :

$$\frac{EF_{km,VP,i,1-4}}{EF_{km,VB,i}} = \left(\frac{V_{P,1-4}}{V_B} \right)^{-0.7}$$

Where:

- $EF_{km,VB,i}$ = Emission factor per kilometer for cars/taxis at the baseline speed (gCO₂/km)
- $EF_{km,VP,i,1-4}$ = Emission factor per kilometer for cars/taxis at the project speed in years 1 and 4 of the crediting period (gCO₂/km)
- V_B = Average speed of cars/taxis prior to the project start (km/h)
- $V_{P,1-4}$ = Average speed of cars/taxis on affected roads in years 1 and 4 of the crediting period (km/h)

Emission reductions:

Emissions reductions are calculated as:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

- ER_y = Emission reductions in year y (t CO₂e/yr)
- BE_y = Baseline emissions in year y (t CO₂/yr)
- PE_y = Project emissions in year y (t CO₂e/yr)
- LE_y = Leakage emissions in year y (tCO₂)

Refer section B.6.3 for sample calculations.

B.6.2 Data and parameters fixed *ex ante*

>>

Data / Parameter Table 1.

Data / Parameter:	SFC _{i,n,x}																		
Methodology reference	Tool 18 Version 1.0																		
Data unit	L/km																		
Description	Specific fuel consumption of vehicle category <i>i</i> using fuel type <i>n</i> in year <i>x</i> included in the sample																		
Measured/calculated/default	Default																		
Data source	<table border="1"> <tr> <td>TW – petrol</td> <td>Tool 18</td> </tr> <tr> <td>Car – petrol</td> <td>Tool 18</td> </tr> <tr> <td>Car – diesel</td> <td>Tool 18</td> </tr> <tr> <td>Taxi – petrol</td> <td>Tool 18</td> </tr> <tr> <td>Taxi – diesel</td> <td>Tool 18</td> </tr> <tr> <td>Auto – petrol</td> <td>Manufacturer's specification</td> </tr> <tr> <td>Auto – diesel</td> <td>Manufacturer's specification</td> </tr> <tr> <td>Auto – CNG</td> <td>Manufacturer's specification</td> </tr> <tr> <td>Bus – diesel</td> <td>Manufacturer's specification</td> </tr> </table>	TW – petrol	Tool 18	Car – petrol	Tool 18	Car – diesel	Tool 18	Taxi – petrol	Tool 18	Taxi – diesel	Tool 18	Auto – petrol	Manufacturer's specification	Auto – diesel	Manufacturer's specification	Auto – CNG	Manufacturer's specification	Bus – diesel	Manufacturer's specification
TW – petrol	Tool 18																		
Car – petrol	Tool 18																		
Car – diesel	Tool 18																		
Taxi – petrol	Tool 18																		
Taxi – diesel	Tool 18																		
Auto – petrol	Manufacturer's specification																		
Auto – diesel	Manufacturer's specification																		
Auto – CNG	Manufacturer's specification																		
Bus – diesel	Manufacturer's specification																		
Value(s) of monitored parameter	<table border="1"> <tr> <td>TW – petrol</td> <td>0.02</td> </tr> <tr> <td>Car – petrol</td> <td>0.06</td> </tr> <tr> <td>Car – diesel</td> <td>0.05</td> </tr> <tr> <td>Taxi – petrol</td> <td>0.06</td> </tr> <tr> <td>Taxi – diesel</td> <td>0.05</td> </tr> <tr> <td>Auto – petrol</td> <td>0.04</td> </tr> <tr> <td>Auto – diesel</td> <td>0.04</td> </tr> <tr> <td>Auto – CNG</td> <td>0.04</td> </tr> <tr> <td>Bus – diesel</td> <td>0.33</td> </tr> </table>	TW – petrol	0.02	Car – petrol	0.06	Car – diesel	0.05	Taxi – petrol	0.06	Taxi – diesel	0.05	Auto – petrol	0.04	Auto – diesel	0.04	Auto – CNG	0.04	Bus – diesel	0.33
TW – petrol	0.02																		
Car – petrol	0.06																		
Car – diesel	0.05																		
Taxi – petrol	0.06																		
Taxi – diesel	0.05																		
Auto – petrol	0.04																		
Auto – diesel	0.04																		
Auto – CNG	0.04																		
Bus – diesel	0.33																		
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr> <td>Type of meter</td> <td></td> </tr> <tr> <td>Location of meter</td> <td></td> </tr> <tr> <td>Accuracy of meter</td> <td></td> </tr> <tr> <td>Serial number of meters</td> <td></td> </tr> </table> <p>Not Applicable</p>	Type of meter		Location of meter		Accuracy of meter		Serial number of meters											
Type of meter																			
Location of meter																			
Accuracy of meter																			
Serial number of meters																			
Calculation method (if applicable)	Not applicable.																		
QA/QC procedures	Not applicable.																		

Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter Table 2.

Data / Parameter:	$N_{i,n,x} / N_{i,x}$																						
Methodology reference	Tool 18 Version 1.0																						
Data unit	-																						
Description	Share of vehicle-kilometers or vehicles in vehicle category <i>i</i> using fuel type <i>n</i> in year <i>x</i>																						
Measured/calculated/default	Not Applicable																						
Data source	Survey																						
Value(s) of monitored parameter	<table border="1"> <tr><td>TW – petrol</td><td>1</td></tr> <tr><td>Car – petrol</td><td>0.7</td></tr> <tr><td>Car – diesel</td><td>0.3</td></tr> <tr><td>Car – CNG</td><td>0</td></tr> <tr><td>Taxi – petrol</td><td>0.3</td></tr> <tr><td>Taxi – diesel</td><td>0.7</td></tr> <tr><td>Taxi – CNG</td><td>0</td></tr> <tr><td>Auto – petrol</td><td>0.7</td></tr> <tr><td>Auto – diesel</td><td>0.25</td></tr> <tr><td>Auto – CNG</td><td>0.05</td></tr> <tr><td>Bus – diesel</td><td>1</td></tr> </table>	TW – petrol	1	Car – petrol	0.7	Car – diesel	0.3	Car – CNG	0	Taxi – petrol	0.3	Taxi – diesel	0.7	Taxi – CNG	0	Auto – petrol	0.7	Auto – diesel	0.25	Auto – CNG	0.05	Bus – diesel	1
TW – petrol	1																						
Car – petrol	0.7																						
Car – diesel	0.3																						
Car – CNG	0																						
Taxi – petrol	0.3																						
Taxi – diesel	0.7																						
Taxi – CNG	0																						
Auto – petrol	0.7																						
Auto – diesel	0.25																						
Auto – CNG	0.05																						
Bus – diesel	1																						
Measurement/Monitoring equipment (if applicable)	<table border="1"> <tr><td>Type of meter</td><td></td></tr> <tr><td>Location of meter</td><td></td></tr> <tr><td>Accuracy of meter</td><td></td></tr> <tr><td>Serial number of meter</td><td></td></tr> </table> <p>Not applicable.</p>	Type of meter		Location of meter		Accuracy of meter		Serial number of meter															
Type of meter																							
Location of meter																							
Accuracy of meter																							
Serial number of meter																							
Calculation method (if applicable)	Not applicable.																						
QA/QC procedures	Not applicable.																						
Purpose of data	Calculation of baseline emissions.																						
Additional comments	This is ex-ante fixed.																						

Data / Parameter Table 3.

Data / Parameter:	NCV _{i,n}									
Methodology reference	Tool 18 Version 1.0									
Data unit	MJ/kg									
Description	Net calorific value of fuel <i>n</i> used in vehicle category <i>i</i>									
Measured/calculated/default	Default									
Data source	IPCC 2006									
Value(s) of monitored parameter	<table border="1"> <tr> <td>Petrol</td> <td>44.3</td> </tr> <tr> <td>Diesel</td> <td>43.0</td> </tr> <tr> <td>CNG</td> <td>48.0</td> </tr> </table>		Petrol	44.3	Diesel	43.0	CNG	48.0		
Petrol	44.3									
Diesel	43.0									
CNG	48.0									
Measurement/Monitoring equipment (if applicable)	<table border="1"> <tr> <td>Type of meter</td> <td></td> </tr> <tr> <td>Location of meter</td> <td></td> </tr> <tr> <td>Accuracy of meter</td> <td></td> </tr> <tr> <td>Serial number of meter</td> <td></td> </tr> </table> <p>Not applicable.</p>		Type of meter		Location of meter		Accuracy of meter		Serial number of meter	
Type of meter										
Location of meter										
Accuracy of meter										
Serial number of meter										
Calculation method (if applicable)	Not applicable.									
QA/QC procedures	Not applicable.									
Purpose of data	Calculation of baseline emissions.									
Additional comments	This is ex-ante fixed.									

Data / Parameter Table 4.

Data / Parameter:	OC _{i,x}											
Methodology reference	Tool 18 Version 1.0											
Data unit	Passengers											
Description	Average occupancy rate of vehicle category <i>i</i> in year <i>x</i>											
Measured/calculated/default	Not Applicable											
Data source	Baseline Survey											
Value(s) of monitored parameter	<table border="1"> <tr> <td>TW</td> <td>1.44</td> </tr> <tr> <td>Car</td> <td>2.58</td> </tr> <tr> <td>Taxi</td> <td>2.69</td> </tr> <tr> <td>Auto</td> <td>2.60</td> </tr> <tr> <td>Bus</td> <td>31.83</td> </tr> </table>		TW	1.44	Car	2.58	Taxi	2.69	Auto	2.60	Bus	31.83
TW	1.44											
Car	2.58											
Taxi	2.69											
Auto	2.60											
Bus	31.83											

Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter Table 5.

Data / Parameter:	EF _{CO2,n}	
Methodology reference	Tool 18 Version 1.0	
Data unit	g CO2/J	
Description	Emission factor for fuel type n	
Measured/calculated /default	Default	
Data source	IPCC 2006	
Value(s) of monitored parameter	Petrol	69.3
	Diesel	74.1
	CNG	56.1
Measurement/ Monitoring equipment (if applicable)		
	Type of meter	
	Location of meter	
	Accuracy of meter	
	Serial number of meter	
	Not applicable.	
Calculation method (if applicable)	Not applicable.	
QA/QC procedures	Not applicable.	
Purpose of data	Calculation of baseline emissions.	
Additional comments	This is ex-ante fixed.	

Data / Parameter Table 6.

Data / Parameter:	$EF_{KM,i,x}$										
Methodology reference	Tool 18 Version 1.0										
Data unit	g CO ₂ /km										
Description	Emission factor per kilometre of vehicle category <i>i</i> in year <i>x</i>										
Measured/calculated/default	Calculated										
Data source	Not Applicable										
Value(s) of monitored parameter	<table border="1"> <tr> <td>TW</td> <td>45.896</td> </tr> <tr> <td>Car</td> <td>96.382</td> </tr> <tr> <td>Taxi</td> <td>136.099</td> </tr> <tr> <td>Auto</td> <td>57.370</td> </tr> <tr> <td>Bus</td> <td>541.671</td> </tr> </table>	TW	45.896	Car	96.382	Taxi	136.099	Auto	57.370	Bus	541.671
TW	45.896										
Car	96.382										
Taxi	136.099										
Auto	57.370										
Bus	541.671										
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr> <td>Type of meter</td> <td></td> </tr> <tr> <td>Location of meter</td> <td></td> </tr> <tr> <td>Accuracy of meter</td> <td></td> </tr> <tr> <td>Serial number of meter</td> <td></td> </tr> </table> <p>Not applicable.</p>	Type of meter		Location of meter		Accuracy of meter		Serial number of meter			
Type of meter											
Location of meter											
Accuracy of meter											
Serial number of meter											
Calculation method (if applicable)	Not applicable.										
QA/QC procedures	Not applicable.										
Purpose of data	Calculation of baseline emissions.										
Additional comments	This is ex-ante fixed.										

Data / Parameter Table 7.

Data / Parameter:	IR_i
Methodology reference	Tool 18 Version 1.0
Data unit	
Description	Technology improvement factor for vehicle category <i>i</i> per year
Measured/calculated/default	Default
Data source	Tool 18 Version 1.0
Value(s) of monitored parameter	0.99

Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter Table 8.

Data / Parameter:	EF _{grid,CM,y}
Methodology reference	TOOL7
Data unit	tCO ₂ e/MWh
Description	Combined margin CO ₂ emission factor for the project electricity system in year y
Measured/calculated /default	Calculated
Data source	"CO ₂ Baseline database for the Indian Power Sector" Version 17.0, October 2021
Value(s) of monitored parameter	0.9088
Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter Table 9.

Data / Parameter:	$TDL_{j,y}$								
Methodology reference	Tool 05 Version 3.0								
Data unit	%								
Description	Average technical transmission and distribution losses for providing electricity to source j in year y								
Measured/calculated/default	Not Applicable								
Data source	National Load Despatch Centre data								
Value(s) of monitored parameter	2.6%								
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr> <td>Type of meter</td> <td></td> </tr> <tr> <td>Location of meter</td> <td></td> </tr> <tr> <td>Accuracy of meter</td> <td></td> </tr> <tr> <td>Serial number of meter</td> <td></td> </tr> </table> <p>Not applicable.</p>	Type of meter		Location of meter		Accuracy of meter		Serial number of meter	
Type of meter									
Location of meter									
Accuracy of meter									
Serial number of meter									
Calculation method (if applicable)	Not applicable.								
QA/QC procedures	Not applicable.								
Purpose of data	Calculation of baseline emissions.								
Additional comments	This is ex-ante fixed.								

Data / Parameter Table 10.

Data / Parameter:	$DD_{z,s,x}$
Methodology reference	ACM0016 Version 05
Data unit	Km
Description	Total distance driven by bus size s in year x
Measured/calculated/default	Not Applicable
Data source	Data from bus companies (company records), municipal transit authorities or specific studies done by the project proponent or a third party.
Value(s) of monitored parameter	-

Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Calibration frequency
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter Table 11.

Data / Parameter:	$N_{z,s,x}$
Methodology reference	ACM0016 Version 05
Data unit	Number of buses bus size s in year x
Description	Number of buses in use in the baseline
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities based on vehicle registration statistics from the respective city or data from vehicle control stations (technical and emission control stations).
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed. Bus sizes: small (S), medium (M) and large (L).

Data / Parameter Table 12.

Data / Parameter:	RS _x								
Methodology reference	ACM0016 Version 05								
Data unit	Km								
Description	Total road space available in year x								
Measured/calculated/default	Not Applicable								
Data source	Official statistics or studies conducted by the project proponent or a third party								
Value(s) of monitored parameter	-								
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr> <td>Type of meter</td> <td></td> </tr> <tr> <td>Location of meter</td> <td></td> </tr> <tr> <td>Accuracy of meter</td> <td></td> </tr> <tr> <td>Serial number of meter</td> <td></td> </tr> </table> <p>Not applicable.</p>	Type of meter		Location of meter		Accuracy of meter		Serial number of meter	
Type of meter									
Location of meter									
Accuracy of meter									
Serial number of meter									
Calculation method (if applicable)	Not applicable.								
QA/QC procedures	Not applicable.								
Purpose of data	Calculation of baseline emissions.								
Additional comments	This is ex-ante fixed. Road space baseline based on official information. Reduced road space based on construction plans (reduced road space is lanes which were eliminated due to dedicating bus lanes to the project system)								

Data / Parameter Table 13.

Data / Parameter:	RS _y
Methodology reference	ACM0016 Version 05
Data unit	Km
Description	Total road space available due to the project activity
Measured/calculated/default	Not applicable
Data source	Official statistics or studies conducted by the project proponent or a third party.
Value(s) of monitored parameter	-

Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed. Road space based on official information and on construction plans. During the crediting period the actual RS _y implemented should be checked against the ex ante expectation. If there are differences, the Project Proponent should demonstrate why it does not affect the project design (i.e. by applying equation 9 again), or request a Post Registration Change to incorporate or eliminate the leakage calculation

Data / Parameter Table 14.

Data / Parameter:	AD _T
Methodology reference	ACM0016 Version 05
Data unit	km /taxi
Description	Average annual distance driven by taxis
Measured/calculated /default	Not applicable
Data source	Municipal transit authorities or taxi operators.
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	
	Type of meter
	Location of meter
	Accuracy of meter
	Serial number of meter
	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter Table 15.

Data / Parameter:	V_B								
Methodology reference	ACM0016 Version 05								
Data unit	km/h								
Description	Average total speed and average speed under circulation is measured								
Measured/calculated/default	Not applicable								
Data source	Municipal transit authorities or studies ordered by project proponent. Vintage maximum three years, if no major infrastructure or policy (e.g. licence plate scheme or new traffic signalling) changes have occurred since the last major change								
Value(s) of monitored parameter	-								
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr> <td>Type of meter</td> <td></td> </tr> <tr> <td>Location of meter</td> <td></td> </tr> <tr> <td>Accuracy of meter</td> <td></td> </tr> <tr> <td>Serial number of meter</td> <td></td> </tr> </table> <p>Not applicable.</p>	Type of meter		Location of meter		Accuracy of meter		Serial number of meter	
Type of meter									
Location of meter									
Accuracy of meter									
Serial number of meter									
Calculation method (if applicable)	Not applicable.								
QA/QC procedures	Not applicable.								
Purpose of data	Calculation of baseline emissions.								
Additional comments	This is ex-ante fixed.								

Data / Parameter Table 16.

Data / Parameter:	$TD_{Z,x}$, $TD_{T,x}$, $TD_{C,x}$
Methodology reference	ACM0016 Version 05
Data unit	Km
Description	$TD_{Z,x}$: Total distance driven by public transport buses in year x $TD_{T,x}$: Total distance driven by public transport taxis in year x $TD_{C,x}$: Total distance driven by passenger cars in year x
Measured/calculated/default	Not applicable
Data source	Official statistics (vehicle registration data; transportation statistics)
Value(s) of	-

monitored parameter						
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr><td>NA</td></tr> <tr><td>Type of meter</td></tr> <tr><td>Location of meter</td></tr> <tr><td>Accuracy of meter</td></tr> <tr><td>Serial number of meter</td></tr> </table> <p>Not applicable.</p>	NA	Type of meter	Location of meter	Accuracy of meter	Serial number of meter
NA						
Type of meter						
Location of meter						
Accuracy of meter						
Serial number of meter						
Calculation method (if applicable)	Not applicable.					
QA/QC procedures	Not applicable.					
Purpose of data	Calculation of baseline emissions.					
Additional comments	<p>This is ex-ante fixed.</p> <p>Data can be either with or without informal transport as long as the above mentioned parameters are from the same data source. In general, data including only formal transport is of a better data quality and should thus be taken</p>					

Data / Parameter Table 17.

Data / Parameter:	$N_{i,x}$					
Methodology reference	ACM0016 Version 05					
Data unit	Number of vehicles					
Description	Number of vehicles of vehicle category i per annum using the affected roads in year x					
Measured/calculated /default	Not applicable					
Data source	Municipal transit authorities or studies ordered by project proponent. Vintage maximum three years					
Value(s) of monitored parameter	-					
Measurement/ Monitoring equipment (if applicable)	<table border="1"> <tr><td>NA</td></tr> <tr><td>Type of meter</td></tr> <tr><td>Location of meter</td></tr> <tr><td>Accuracy of meter</td></tr> <tr><td>Serial number of meter</td></tr> </table> <p>Not applicable.</p>	NA	Type of meter	Location of meter	Accuracy of meter	Serial number of meter
NA						
Type of meter						
Location of meter						
Accuracy of meter						
Serial number of meter						
Calculation method (if applicable)	Not applicable.					
QA/QC procedures	Not applicable.					

Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

B.6.3. Ex-ante calculation of emission reductions

>>

As per methodology ACM0016, the net emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (t CO ₂ e/yr)
BE_y	=	Baseline emissions in year y (t CO ₂ /yr)
PE_y	=	Project emissions in year y (t CO ₂ e/yr)
LE_y	=	Leakage emissions in year y (tCO ₂)

Baseline emissions:

Baseline emissions are estimated according to Methodological tool “Baseline emissions for modal shift measures in urban passenger transport” Version 1.0 (refer B.6.1).

Using the tool calculations of baseline emissions for year 1 are presented as below:

$$P_y = 492,141,545$$

Vehicle Category	Si	Di	EF _{PKM,i,x}
TW	22.5%	12.65	31.87
Car	16.8%	12.65	53.10
Auto	24.1%	12.65	37.20
Bus	36.6%	12.65	28.36

$$BE_y = 0.99 \cdot (22.5\% \cdot 12.65 \cdot 31.87 + 16.8\% \cdot 12.65 \cdot 53.10 + 24.1\% \cdot 12.65 \cdot 37.20 + 36.6\% \cdot 12.65 \cdot 28.36) \cdot 492,141,545 = 218,423 \text{ tCO}_2\text{e}$$

Project emissions:

Project emissions are estimated according to methodology ACM0016 - “Mass Rapid Transit Projects” Version 5.0 (refer B.6.1):

$$PE_y = DPE_y + IPE_y$$

Direct emissions:

$$DPE_y = DPE_{FC,y} + DPE_{EC,y}$$

$DPE_{FC,y}$ - Direct project emissions from fossil fuel consumption

Since MRTS in the project activity consumes only electricity, direct emissions from fuel consumptions are not applicable.

Hence $DPE_{FC,y} = 0$

$DPE_{EC,y}$ - Direct project emissions from electricity consumption

TOOL05 is used to estimate project emissions from electricity consumption

Emission factor for electricity generation

$EF_{grid,CM,y} = 0.9088 \text{ tCO}_2/\text{MWh}$

Electricity consumed by the project vehicle n from the electricity consumption source j

$EC_{PJ,j,y} = 55,218 \text{ MWh}$

Average technical transmission and distribution losses for providing electricity

$TDL_{j,y} = 2.60\%$

Project emissions from electricity consumption

$$DPE_{EC,y} = EF_{grid,CM,y} * EC_{PJ,j,y} / (1 - TDL_{j,y}) = 0.9088 * 55,218 / (1 - 2.6\%) = 51,519 \text{ tCO}_2 \text{ (First year)}$$

Indirect Project Emissions

Indirect project emissions are considered to be zero assuming origin and destination are same for baseline and project for the passengers that shifted to MRTS.

Hence project emissions are estimated as:

$$PE_y = DPE_y + IPE_y = 51,519 - 0 = 51,519 \text{ tCO}_2 \text{ (First year)}$$

Leakage emissions:

No changes are expected in the factors that result in leakage emissions, hence, ex ante leakage emissions associated to these sources are considered to be zero. Ex post leakage will be determined by survey carried out in the first and fourth year of crediting period.

$$LE_y = 0$$

Emission reductions:

$$ER_y = BE_y - PE_y - LE_y = 218,423 - 51,519 - 0 = 166,904 \text{ tCO}_2 \text{ (First year)}$$

B.6.4. Summary of ex ante estimates of emission reductions

>>

Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
Year 1	218,423	51,519	0	166,904
Year 2	225,077	51,519	0	173,558
Year 3	231,577	51,519	0	180,058
Year 4	237,924	51,519	0	186,404
Year 5	244,120	51,519	0	192,601
Year 6	252,162	51,519	0	200,643
Year 7	258,981	51,519	0	207,462
Year 8	265,638	51,519	0	214,119
Year 9	272,136	51,519	0	220,617
Year 10	278,478	51,519	0	226,959
Total	2,484,516	515,191	0	1,969,326
Total number of crediting years	10			
Annual average over the crediting period	248,451	51,519		196,932

B.7. Monitoring plan

>>

B.7.1. Data and parameters to be monitored ex-post

>>

Data / Parameter Table 18.

Data / Parameter:	D _i		
Methodology reference	Tool 18 Version 1.0		
Data unit	Kilometres		
Description	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i		
Measured/calculated /default	Not Applicable		
Data source	Survey		
Value(s) of monitored parameter applied	TW	12.65	
	Car	12.65	
	Taxi	12.65	

with basis	Auto	12.65	
	Bus	12.65	
Measurement/ Monitoring equipment			
	Type of meter(s)		
	Location of meter(s)		
	Accuracy of meter(s)		
	Serial number of meter(s)		
	Calibration frequency		
	Date of Calibration/ validity		
	Reference No. of Calibration Certificates		
	Calibration Status		
Frequency of Measuring/reading Recording frequency	Survey of the project passengers in year 1 and 4 of the first crediting period asking about the entry and exit stations in the project system and noting electricity-based or road-based vehicle category <i>i</i> each surveyed passenger used prior to shifting to the project system (<i>S_i</i>)		
Calculation method (if applicable)	Not Applicable		
QA/QC procedures	-		
Purpose of data	Calculation of baseline emissions.		
Additional comments	-		

Data / Parameter Table 19.

Data / Parameter:	S _i	
Methodology reference	Tool 18 Version 1.0	
Data unit	%	
Description	Share of passengers who shifted from electricity based or road-based vehicle category <i>i</i>	
Measured/calculated /default	Not Applicable	
Data source	Survey	
Value(s) of monitored parameter applied with basis	TW	22.5%
	Car	16.8%
	Taxi	0.0%
	Auto	24.1%

	Bus	36.6%
Measurement/ Monitoring equipment		
	Type of meter(s)	
	Location of meter(s)	
	Accuracy of meter(s)	
	Serial number of meter(s)	
	Calibration frequency	
	Date of Calibration/ validity	
	Reference No. of Calibration Certificates	
	Calibration Status	
Frequency of Measuring/reading Recording frequency	Not Applicable	
Frequency of Measuring/reading Recording frequency	Survey of the project passengers in year 1 and 4 of the first crediting period asking about electricity-based or road-based vehicle category <i>i</i> each surveyed passenger used prior to shifting to the project system and noting the entry and exit stations in the project system ($D_{i,y}$). The data from the survey in year 1 shall be used for the first three years of the first crediting period while the data from the survey in year 4 shall be used until the end of the crediting periods of the project activity	
Calculation method (if applicable)	Not Applicable	
QA/QC procedures		
Purpose of data	Calculation of baseline emissions.	
Additional comments	-	

Data / Parameter Table 20.

Data / Parameter:	P_y
Methodology reference	Tool 18 Version 1.0
Data unit	Passengers
Description	Number of passengers travelled by the project system in year <i>y</i>
Measured/calculated /default	Measured
Data source	Automated fare collection system
Value(s) of monitored parameter applied with basis	492,141,545 (estimated for first year)

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Monitored annually
Calculation method (if applicable)	Not Applicable
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions.
Additional comments	-

Data / Parameter Table 21.

Data / Parameter:	$EC_{PJ,i,y}$
Methodology reference	Tool 05 Version 3.0
Data unit	MWh/yr
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Measured/calculated /default	Measured
Data source	Direct measurement or calculated based on measurements from more than one electricity meters
Value(s) of monitored parameter applied with basis	55,218 (first year)

Measurement/ Monitoring equipment		
	Type of meter(s)	-
	Location of meter(s)	Refer B.7.4
	Accuracy of meter(s)	0.2S
	Serial number of meter(s)	Refer B.7.4
	Calibration frequency	This will be as per applicable laws and practices including CEA 2006 and Central Electricity Authority (Installation and Operation of Meters) (Amendment) Regulations, 2019
	Date of Calibration/ validity	To be confirmed during verification
	Reference No. of Calibration Certificates	To be confirmed during verification
	Calibration Status	To be confirmed during verification
Frequency of Measuring/reading Recording frequency	Continuous measurement and monthly recording	
Calculation method (if applicable)	Not Applicable	
QA/QC procedures	When the Main Metering System and/or any component thereof is found to be outside the acceptable limit of accuracy or otherwise not functioning properly, energy meters will be repaired, re-calibrated or replaced as soon as possible. This will be done by the relevant agency of the state with project owner having no control over the procedure and timing.	
Purpose of data	Calculation of project emissions.	
Additional comments	-	

Data / Parameter Table 22.

Data / Parameter:	$EF_{pkm,i,1-4}$
Methodology reference	ACM0016 Version 05
Data unit	tCO ₂ /pkm
Description	Emission factor per passenger-kilometer of mode <i>i</i> in years 1 and 4 of the crediting period <i>y</i>
Measured/calculated /default	Calculated
Data source	Calculated based on equations 2 and 3 from the "TOOL18: Baseline emissions for modal shift measures in urban passenger transport".
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	Type of meter(s)	
	Location of meter(s)	
	Accuracy of meter(s)	
	Serial number of meter(s)	
	Calibration frequency	
	Date of Calibration/ validity	
	Reference No. of Calibration Certificates	
	Calibration Status	
	Not Applicable	
Frequency of Measuring/reading Recording frequency	Calculated based on the “TOOL18: Baseline emissions for modal shift measures in urban passenger transport”, through surveys conducted in the end of years 1 and 4 of the crediting period,.	
Calculation method (if applicable)	As per the “TOOL18: Baseline emissions for modal shift measures in urban passenger transport”.	
QA/QC procedures	As per the “TOOL18: Baseline emissions for modal shift measures in urban passenger transport”.	
Purpose of data	Calculation of project emissions.	
Additional comments	-	

Data / Parameter Table 23.

Data / Parameter:	$DPE_{EC,y}$
Methodology reference	ACM0016 Version 05
Data unit	tCO ₂
Description	Direct project emissions from electricity consumption in year <i>y</i>
Measured/calculated /default	Calculated
Data source	Calculated based on the TOOL05
Value(s) of monitored parameter applied with basis	55,218 (First year)

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	As per the TOOL05
Calculation method (if applicable)	As per the TOOL05
QA/QC procedures	As per the TOOL05
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter Table 24.

Data / Parameter:	$N_{i,1-4}$
Methodology reference	ACM0016 Version 05
Data unit	Number of vehicles
Description	Number of vehicles category <i>i</i> in years 1 and 4 of the crediting period
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities based on vehicle registration statistics from the respective city or data from vehicle control stations (technical and emission control stations)
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Studies conducted at the end of years 1 and 4 of the crediting period
Calculation method (if applicable)	Not Applicable
QA/QC procedures	
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter Table 25.

Data / Parameter:	$EF_{km,i,1-4}$
Methodology reference	ACM0016 Version 05
Data unit	gCO ₂ /km
Description	Emission factor per kilometer for vehicle category <i>i</i> in years 1 and 4 of the crediting period
Measured/calculated /default	Calculated
Data source	Calculated based on equation 1 from the TOOL18
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Calculated based on surveys conducted at the end of years 1 and 4 of the crediting period, based on the TOOL18.
Calculation method (if applicable)	As per the TOOL18
QA/QC procedures	As per the TOOL18
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter Table 26.

Data / Parameter:	$OC_{i,t}$
Methodology reference	ACM0016 Version 05
Data unit	Passengers
Description	Average occupancy of vehicle category <i>i</i> in the period of time <i>t</i>
Measured/calculated /default	Measured
Data source	Municipal transit authorities or surveys conducted by the project proponent or a third party
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Studies/surveys conducted at the end of years 1 and 4 of the crediting period
Calculation method (if applicable)	Not Applicable
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	Based on visual occupancy studies for all vehicle categories. For buses the occupancy rate is based on boarding-alighting studies, electronic smart tickets or on visual occupancy studies with expansion factors for routes served to determine the average occupancy rate along the entire route. As an alternative for buses, the occupancy rate can be based on average trip distance of bus passengers, total passengers and total distance driven of buses. For taxis, the driver should not be counted.

Data / Parameter Table 27.

Data / Parameter:	$CV_{i,t}$
Methodology reference	ACM0016 Version 05
Data unit	Passengers
Description	Average capacity of vehicle category <i>i</i> in the period <i>t</i> (passengers)
Measured/calculated /default	Measured
Data source	Official statistics
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Studies/surveys conducted at the end of years 1 and 4 of the crediting period
Calculation method (if applicable)	Not Applicable
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter Table 28.

Data / Parameter:	BSCR _y
Methodology reference	ACM0016 Version 05
Data unit	Number of vehicles
Description	Cumulative bus units displaced by the project on the trunk lanes as a result of the project in year y
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities, official statistics or studies ordered by project proponent
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Yearly
Calculation method (if applicable)	Not Applicable
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	Used to calculate ARS_y . The number of buses circulated in trunk lanes prior to the construction of the project activity that have ceased to circulate in trunk lanes due to the project activity are to be considered. These buses can be retired or used in another part of the network

Data / Parameter Table 29.

Data / Parameter:	$TD_{i,1-4}$
Methodology reference	ACM0016 Version 05
Data unit	Km
Description	Average trip distance driven by vehicle category i on the affected roads in years 1 and 4 of the crediting period
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities or project owner
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Surveys conducted at the end of years 1 and 4 of the crediting period
Calculation method (if applicable)	Not Applicable
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	Electronic or visual tracking of samples of vehicles entering/exiting the affected roads registering the entry and the exit point and measuring the distance by GPS or other means

Data / Parameter Table 30.

Data / Parameter:	MS _{i,1-4}
Methodology reference	ACM0016 Version 05
Data unit	Percentage
Description	Net share of passengers using the MRTS which would have used mode <i>i</i> in the years 1 and 4 of the crediting period
Measured/calculated /default	Measured
Data source	Survey conducted by an external survey company
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	The survey is conducted at the end of years 1 and 4 of the crediting period
Calculation method (if applicable)	Not Applicable
QA/QC procedures	As per ACM0016 Version 05 for the survey design.
Purpose of data	Calculation of project emissions.
Additional comments	Only used for leakage calculation of rebound effect (reduced amount of cars and taxis)

Data / Parameter Table 31.

Data / Parameter:	$V_{P,1-4}$
Methodology reference	ACM0016 Version 05
Data unit	km/h
Description	Average speed of cars/taxis on affected roads in years 1 and 4 of the crediting period
Measured/calculated /default	Measured
Data source	Municipal transit authorities or studies ordered by project proponent
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	
	Type of meter(s)
	Location of meter(s)
	Accuracy of meter(s)
	Serial number of meter(s)
	Calibration frequency
	Date of Calibration/ validity
	Reference No. of Calibration Certificates
	Calibration Status
	Not Applicable
Frequency of Measuring/reading Recording frequency	Once at the end of years 1 and 4 of the crediting period
Calculation method (if applicable)	Not Applicable
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	<p>On-board measurements determining the total average speed and the average moving speed (when circulating) on the affected road based, e.g. on GPS measuring. The same methodology as for determination of V_B should be used.</p> <p>Average speed required for calculation of the rebound effect refers to total distance divided by total time, on the affected road.</p> <p>Average moving speed required for calculation of the speed effect refers to speed under moving conditions i.e. total distance divided by time under movement (total time minus standstill time of vehicle), on the affected road.</p> <p>Taxis and passenger cars are treated identical. This condition should be monitored for each affected road</p>

For Parameters to be monitored for E+/S+ assessments and SDG labels (positive impacts)

Data / Parameter Table 32.

Data / Parameter:	CO₂ Emissions
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.

Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Project activity directly contributes to GHG emission reductions through generation of renewable energy and displacement of emission intensive energy in the connected grid.											
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG	<table border="1"> <tr> <td colspan="2" data-bbox="482 522 1401 552"></td> </tr> <tr> <td data-bbox="482 560 790 615">Parameter to be monitored</td> <td data-bbox="797 560 1401 615">CO2 Emissions Reductions</td> </tr> <tr> <td data-bbox="482 623 790 678">Frequency of monitoring</td> <td data-bbox="797 623 1401 678">Yearly</td> </tr> <tr> <td data-bbox="482 686 790 741">Legal /regulatory / corporate limits (if any)</td> <td data-bbox="797 686 1401 741">Not Applicable</td> </tr> <tr> <td data-bbox="482 749 790 779">QA/QC</td> <td data-bbox="797 749 1401 779">Not Applicable</td> </tr> </table>				Parameter to be monitored	CO2 Emissions Reductions	Frequency of monitoring	Yearly	Legal /regulatory / corporate limits (if any)	Not Applicable	QA/QC	Not Applicable
Parameter to be monitored	CO2 Emissions Reductions											
Frequency of monitoring	Yearly											
Legal /regulatory / corporate limits (if any)	Not Applicable											
QA/QC	Not Applicable											
Remarks												

Data / Parameter Table 33.

Data / Parameter:	Job created											
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.											
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Project activity will result into jobs created during the construction and operational phases.											
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG	<table border="1"> <tr> <td colspan="2" data-bbox="482 1444 1401 1474"></td> </tr> <tr> <td data-bbox="482 1482 790 1537">Parameter to be monitored</td> <td data-bbox="797 1482 1401 1537">Long-term jobs (> 1 year) and Short-term jobs (< 1 year)</td> </tr> <tr> <td data-bbox="482 1545 790 1600">Frequency of monitoring</td> <td data-bbox="797 1545 1401 1600">Yearly</td> </tr> <tr> <td data-bbox="482 1608 790 1663">Legal /regulatory / corporate limits (if any)</td> <td data-bbox="797 1608 1401 1663">Not Applicable</td> </tr> <tr> <td data-bbox="482 1671 790 1701">QA/QC</td> <td data-bbox="797 1671 1401 1701">Not Applicable</td> </tr> </table>				Parameter to be monitored	Long-term jobs (> 1 year) and Short-term jobs (< 1 year)	Frequency of monitoring	Yearly	Legal /regulatory / corporate limits (if any)	Not Applicable	QA/QC	Not Applicable
Parameter to be monitored	Long-term jobs (> 1 year) and Short-term jobs (< 1 year)											
Frequency of monitoring	Yearly											
Legal /regulatory / corporate limits (if any)	Not Applicable											
QA/QC	Not Applicable											
Remarks												

B.7.2 Data and parameters to be monitored for E+/S+ assessments (negative impacts)

>>

Data / Parameter Table 34.

Data / Parameter:	Hazardous Waste	
Purpose:	To demonstrate compliance of Hazardous Waste aspects to legal/regulatory/corporate requirements or to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.	
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Uncontrolled handling of end-of-life equipment, e-waste and other hazardous waste may lead to contamination of soil. The hazardous waste shall be stored and disposed-off as per the guidance of national/local laws and regulations.	
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG		
	Parameter to be monitored	Quantity of hazardous waste handled safely
	Frequency of monitoring	Yearly
	Legal /regulatory / corporate limits (if any)	As per national/local law/regulations.
	QA/QC	The records of hazardous waste generated and managed will be maintained for future verification

Program of Risk Management Actions to mitigate risk related to aspect (if any for aspects assessed to be harmful)	S.No.	Action and targets	Responsibility	Resource Requirement	Target to be Achieved by (insert date)	Key Performance Indicators (KPI)	Targets achieved on (insert date)
	1	Hazardous waste shall be stored and safely disposed-off	L&T Metro Rail (Hyderabad) Private Limited	Need Based	As per national/local law/regulations.	Quantity of hazardous waste handled safely.	To be monitored
	2	End-of-life equipment	L&T Metro Rail (Hyderabad) Private Limited	Need Based	As per national/local law/regulations.	Quantity of hazardous waste handled safely.	To be monitored
	3	E-waste	L&T Metro Rail (Hyderabad) Private Limited	Need Based	As per national/local law/regulations.	Quantity of hazardous waste handled safely.	To be monitored
	4	Battery waste	L&T Metro Rail (Hyderabad) Private Limited	Need Based	As per national/local law/regulations.	Quantity of battery waste handled safely.	To be monitored
	5						
	6						
	Date of Closing the Program:						

B.7.3. Sampling plan

>>

This is not applicable to the project activity.

B.7.4. Other elements of the monitoring plan

>>

The monitoring plan prescribed the project activity describes about monitoring organization, parameters to be monitored, monitoring practices, QA and QC procedures, data storage and archiving.

Monitoring organization

The Chief Operating Officer (COO) of Hyderabad Metro is responsible for overall project monitoring supported by line departments. All departments maintain their corresponding data records and report to COO. Electrical department monitors and maintain Energy data. Fare collection department is responsible for Ridership data, whereas revenue department is responsible for surveys and related data.

Parameters requiring monitoring

The parameters will be monitored as per section B.7.1 and B.7.2 above.

Energy Monitoring

The metering will be done at the receiving feeder using energy meters.

Energy Meters

There are energy meters installed for the measurement of power withdrawn from the connected grid for the traction of rolling stock.

ALL RSS 132KV TT MFM Details						
S.No	Receiving Substation	Feeder Name	MFM Make	Serial Number	Model	Accuracy
1	Uppal	TT-1	Schneider	34133221560	Conzerv-EM6400	0.2
2		TT-2	Schneider	34133221558	Conzerv-EM6400	0.2
3	Miyapur	TT-1	Schneider	34131931276	Conzerv-EM6400	0.2
4		TT-2	Schneider	34132851021	Conzerv-EM6400	0.2
5	MGB	TT-1	Schneider	34140430657	Conzerv-EM6400	0.2
6		TT-2	Schneider	34140430651	Conzerv-EM6400	0.2
7	Yusufguda	TT-1	Schneider	34132718009	Conzerv-EM6400	0.2

The data is recorded at the central level through scada.

QA/QC procedures

When the meters and/or any component thereof is found to be outside the acceptable limit of accuracy or otherwise not functioning properly, meters will be repaired, re-calibrated or replaced as soon as possible. The calibration will be carried out as per applicable laws and practices including CEA 2006 and Central Electricity Authority (Installation and Operation of Meters) (Amendment) Regulations, 2019.

Traffic related Monitoring

Ridership data is recorded through automated fare collection system.

In accordance with methodology, surveys will be conducted once in the years 1 and 4 of the crediting period. The data from the survey in year 1 shall be used for the first three years of the first crediting period while the data from the survey in year 4 shall be used until the end of the crediting periods of the project activity.

Data storage and archiving

All the data items monitored will be kept for two years after the end of crediting period or till the last issuance of ACCs for this project activity whichever occurs later. The monitored data will be presented to for future verifications.

Section C. Start date, crediting period type and duration**C.1. Start date of the Project Activity**

>>

27/11/2017 is the start of operation of first section and the last section was made operational on 08/02/2020.

C.2. Expected operational lifetime of the Project Activity

>>

30 years, 0 months

C.3. Crediting period of the Project Activity

>>

C.3.1. Start and end date of the crediting period

>>

Start date: 26/11/2018

End date: 25/11/2028

C.3.2. Duration of crediting period

>>

10 years, 0 months

>>

Section D. Environmental impacts

D.1. Analysis of environmental impacts

>>

M/s Environment Protection Training & Research Institute (EPTRI) Hyderabad was engaged to carry out the Environment & Social Assessment report for the Hyderabad Metro Project (MTRS). Monitoring was carried out from 29/04/2003 – 20/05/2003.

A. Ambient Air Quality

Pre-project scenario

The RPM and TSPM are exceeding the stipulated standards as per the NAAQM in all the stations monitored in the pre-project scenario. Although the SO₂ and NO_x is within the standard limit in all the station, they have shown higher value almost close to the standard limit of 80 µg/m³ at station M. J. Market and Dilsukhnagar.

Construction phase

Air dust will be generated at various stages of construction operations such as excavation, foundation works, loading and transportation of material. Suspended particulate matter (SPM) and respirable dust are the main pollutants during construction. Most of the dust arises from excavation and transportation operations. The fugitive dust released may cause immediate effect on the workers who are directly exposed. The impact on air is mainly localized in nature i.e., within 2 to 3 km.

Mitigation plan

Impacts would be short term in nature and limited only to the construction period. Dust suppression systems (water spray) will be used. Construction materials shall be fully covered during transportation to the project site by road.

Operational Phase

The advent of this Hyderabad Metro Rail System project, in general, will create positive impacts on traffic flow, congestion on the roads and associated ambient air pollution with respect to the studied parameters like particulate matter, SO₂ and NO_x on both the corridors.

Mitigation plan

Project will create positive impacts. No mitigation plan is required

B. Ambient Noise Quality

Pre-Project scenario

The review of the result shows that all the point along the corridors have recorded higher values than the stipulated limits of 65 dB(A) for Leq day and 55 dB(A) for Leq night. This may be due heavy traffic along the corridor.

Construction phase

The most important source of noise in the construction area is the concrete mixer machines, compressors, pumps, dumpers. Noise level will be increased due to running of machinery and vehicular movement in the area. The impacts are localized.

Mitigation plan

Machines having high standards shall be deployed so that minimum levels of noise & vibrations are produced during the construction work with excavators having vibration isolators. Silencers provided in the machines to modulate the noise generated by machines will be regularly checked for its effectiveness. For noise pollution control, the D.G. sets will be kept in an acoustically treated room. Noise generating units like the machinery area, canteen etc. are well insulated with enclosed doors. Earmuffs will be used while in high noise areas. Stationary machinery and equipment will be properly enclosed by enclosures and vibration pads for minimizing noise generated due to vibration of machinery.

Operation Phase

After the MRTS system in Hyderabad the ambient noise levels may decrease, as most of the present ambient noise level are due to the vehicular related.

Mitigation plan

Project will create positive impacts. No mitigation plan is required

C. Ground water Quality

Pre-Project scenario

At many places ground water exceeds the desirable limits for alkalinity, hardness and iron and is contaminated. Ground water can be used for human consumption only after filtering and disinfecting.

Construction phase

The impact on water environment due to this activity is minimal, however, during excavation and foundation works the surface run-off may get contaminated with suspended solids. The activity may not result in lowering of ground water levels and the consequent drying up/depletion of yield from wells in the vicinity may not arise.

Mitigation plan

Project will create minimal impacts for short duration. No mitigation plan is required.

Operational Phase

The ground water scenario may not have any impact at all with the project. But, if plans are to use the ground water for utilities and for consumption purposes in the stations along the corridors, proper care must be taken to treat and disinfect the water before put to use.

Mitigation plan

Project will create no impacts. No mitigation plan is required.

D. Green Cover

Construction phase

The total trees affected are 125 on first corridor and 174 in the second corridor, which falls under 5 m of alignment on each side. In third corridor, 1181 trees are identified for felling.

Mitigation plan

The afforestation will be done in nearby areas to cover the green covers lost due to the project, as has been covered by the Government's Water, Land, and Trees Act of 2002.

D.2. Environmental impact assessment and management action plans

>>

Refer details of section D.1 above.

Section E. Environmental and social safeguards

>>

E.1. Environmental safeguards

>>

Impact of Project Activity on		Information on Impacts, Do-No-Harm Risk Assessment and Establishing Safeguards							Project Owner's Conclusion		GCC Project Verifier's Conclusion (To be included in Project Verification Report only)		
		Description of Impact <i>(positive or negative)</i>	Legal/voluntary corporate requirement / regulatory/voluntary corporate threshold Limits	Do-No-Harm Risk Assessment (choose which ever is applicable)			Risk Mitigation Action Plans for aspects marked as Harmful		Performance indicator for monitoring of impact		Ex-ante scoring of environmental impact	Explanation of the Conclusion	3 rd Party Audit
				Not Applicable	Harmless	Harmful	Operational Controls	Program of Risk Management Actions	Monitoring parameter frequency monitoring and of	Ex- Ante scoring of the environmental impact (as per scoring matrix Appendix-02)			
<p>Environmental Aspects on the identified categories²² indicated below.</p>	<p>Indicators for environmental impacts</p>	<p>Describe and identify anticipated and actual significant environmental impacts, both positive and negative from all sources (stationary and mobile) during normal and abnormal/emergency conditions, that may result from the construction and operations of the Project Activity, within and outside the project boundary, over which the Project Owner(s) has/have control.</p>	<p>Describe the applicable national regulatory requirements /legal limits / voluntary corporate limits related to the identified risks of environmental impacts.</p>	<p>If no environmental impacts are anticipated, then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as Not Applicable</p>	<p>If environmental impacts exist but are expected to be in compliance with applicable national regulatory /stricter voluntary corporate requirements and will be within legal/voluntary corporate limits by way of plant</p>	<p>If negative environmental impacts exist that will not be in compliance with the applicable national legal/ regulatory requirements or are likely to exceed legal limits, then the Project Activity is likely to cause</p>	<p>Describe the operational controls and best practices, focusing on how to implement and operate the Project Activity, to reduce the risk of impacts that have been identified as 'Harmful at least to a level that is in compliance with applicable legal/regulatory requirements or industry best practice or stricter voluntary corporate</p>	<p>Describe the Program of Risk Management Actions (refer to Table 3), focusing on additional actions (e.g., installation of pollution control equipment) that will be adopted to reduce or eliminate the risk of impacts that have been identified as Harmful.</p>	<p>Describe the monitoring approach and the parameters (KPI) to be monitored for each impact irrespective of whether it is harmless or harmful. The frequency of monitoring to be specified as well including the data source.</p>	<p>-1 0 +1</p>	<p>Confirm the score of environmental impact of the project with respect to the aspect and its monitored value in relation to legal /regulatory limits (if any) including basis of conclusion.</p>	<p>Describe how the GCC Verifier has assessed that the impact of the Project Activity against the particular aspect and in case of "harmful impacts" how has the project adopted Risk Mitigation Action Plans to mitigate the risks of negative environmental impacts to levels that are unlikely to cause any harm as well as the net positive impacts of the project with respect to the most likely baseline alternative.</p>	

²² sourced from the CDM SD Tool and the sample reports are available (<https://www4.unfccc.int/sites/sdcmicrosite/Pages/SD-Reports.aspx>)

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					design and operating principles, then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as Harmless /If the project has a positive impact on the environment mark it as "harmless" as well.	harm (may be un-safe) and shall be indicated as Harmful	requirements					
Reference to paragraphs of Environmental and Social Safeguards Standard		Paragraph 12 (a)	Paragraph 13 (c)	Paragraph 13 (d) (i)	Paragraph 13 (d) (ii)	Paragraph 13 (d) (iii)	Paragraph 13 (e) (i)	Paragraph 13 (e) (ii)	Paragraph 12 (c) and Paragraph 13 (f)	Paragraph 22		Paragraph 24 and Paragraph 26 (a) (i)
Environment - Air	SO _x emissions (EA01)											
	NO _x emissions (EA02)											
	CO ₂ emissions (EA03)	Project activity is expected to reduce CO2 emissions by replacing fossil fuels based vehicular traffic		Not applicable					Refer B.7.1 Table 32	+1	It is expected that the project will continue to operate for its lifetime with proper upkeep.	
	CO emissions (EA04)											
	Suspended particulate matter (SPM) emissions											

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	(EA05)											
	Fly ash generation (EA06)											
	Non-Methane Volatile Organic Compounds (NMVOCs) (EA07)											
	Odor (EA08)											
	Noise Pollution (EA09)											
	Others (EA10)											
	Add more rows if required and corresponding notation with EA as prefix)											
Environment - Land	Solid waste Pollution from Plastics (EL-01)											
	Solid waste Pollution from Hazardous wastes	Hazardous waste like waste oil, lubricants, Transformer oil drums at site might have negative environmental impacts if not managed well.	Hazardous and Other Wastes (Management and		Harmless		Hazardous waste will be sent to the designated recyclers. Hazardous		Refer B.7.2 Table 34	+1	The environmental risk of hazardous waste will be managed in line	

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(EL02)		Transboundary Movement) Rules, 2016.				waste shall be stored and disposed-off as per the national/local law				with prevailing laws and regulations.	
<i>Solid waste Pollution from Bio-medical wastes (EL03)</i>											
<i>Solid waste Pollution from E-wastes (EL04)</i>	E-waste generation in the form of damaged equipment is anticipated through the operation of the project.	E-waste (Management) Rules 2016 and amendment(s)		Harmless		E-waste shall be stored and disposed-off as per the national/local law		Refer B.7.2 Table 34	+1	The environmental risk of e-waste will be managed in line with prevailing laws and regulations.	
<i>Solid waste Pollution from Batteries (EL05)</i>	Battery waste generation is anticipated through the operation of the project.	Batteries (Management and Handling) Rules, 2001		Harmless		Battery waste shall be stored and disposed-off as per the national/local law		Refer B.7.2 Table 34	+1	The environmental risk of battery waste will be managed in line with prevailing laws and regulations.	
<i>Solid waste Pollution from end-of-life products/equipment (EL06)</i>	Some of the equipment at site might have negative environmental impacts if not managed well after their end-of-life.	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.		Harmless		The damaged equipment waste will be sent to the designated recyclers.		Refer B.7.2 Table 34	+1	The environmental risk of damaged equipment will be managed in line with prevailing laws and regulations.	
<i>Soil Pollution from Chemicals (including Pesticides, heavy metals, lead,</i>											

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	<i>mercury) (EL07)</i>											
	<i>land use change (change from cropland /forest land to project land) (EL08)</i>											
	<i>Others (EL09)</i>											
	<i>Add more rows if required</i>											
Environ ment - Water	<i>Reliability/ accessibilit y of water supply (EW01)</i>											
	<i>Water Consumpti on from ground and other sources (EW02)</i>											
	<i>Generation of wastewate r (EW03)</i>											
	<i>Wastewate r discharge without/wit h insufficient treatment (EW04)</i>											
	<i>Pollution of Surface,</i>											

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	Ground and/or Bodies of water (EW05)											
	Discharge of harmful chemicals like marine pollutants / toxic waste (EW06)											
	Others (EW07)											
	Add more rows if required											
Environment – Natural Resources	Conserving mineral resources (ENR01)											
	Protecting/enhancing plant life (ENR02)											
	Protecting/enhancing species diversity (ENR03)											
	Protecting/enhancing forests (ENR04)											
	Protecting/enhancing other depletable natural resources (ENR05)											

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	Conserving energy (ENR06)											
	Replacing fossil fuels with renewable sources of energy (ENR07)											
	Replacing ODS with non-ODS refrigerants (ENR08)											
	Others (ENR09)											
	Add more rows if required											
Net Score:		+5										
Project Owner's Conclusion in PSF:		The Project Owner confirms that the Project Activity will not cause any net harm to Environment.										
GCC Project Verifier's Opinion:		The GCC Verifier certifies that the Project Activity [is not likely to cause any] or [is likely to cause] net harm to the environment...										

E.2. Social Safeguards

>>

Impact of Project Activity on		Information on Impacts, Do-No-Harm Risk Assessment and Establishing Safeguards						Project Owner's Conclusion		GCC project Verifier's Conclusion (To be included in Project Verification Report only)	
		Description of Impact (positive or negative)	Legal requirement /Limit, Corporate policies / Industry best practice	Do-No-Harm Risk Assessment (Choose which ever is applicable)			Risk Mitigation Action Plans (for aspects marked as Harmful)	Performance indicator for monitoring of impact.	Ex-ante scoring of environmental impact	Explanation of the Conclusion	3 rd Party Audit
				Not Applicable	Harmless	Harmful					
Social Aspects on the identified categories²³ indicated below.	Indicators for social impacts	Describe and identify actual and anticipated impacts on society and stakeholders, both positive or negative, from all sources during normal and abnormal/emergency conditions that may result from constructing and operating of the Project Activity within or outside the project boundary, over which the project Owner(s) has/have control	Describe the applicable national regulatory requirements / legal limits or organizational policies or industry best practices related to the identified risks of social impacts	If no social impacts are anticipated, then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as Not Applicable	If social impacts exist but are expected to be in compliance with applicable national regulatory requirements/ stricter voluntary corporate limits by way of plant design and operating principles then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as Harmless ,	If negative social impacts exist that will not be in compliance with the applicable national legal/regulatory requirements or are likely to exceed legal limits, then the Project Activity is likely to cause harm and shall be indicated as Harmful	Describe the operational or management controls that can be implemented as well as best practices, focusing on how to implement and operate the Project Activity, to reduce the risk of impacts that have been identified as Harmful .	Describe the monitoring approach and the parameters (KPI) to be monitored for each impact irrespective of whether it is harmless or harmful. The frequency of monitoring to be specified as well. Monitoring parameters can be quantitative or qualitative in nature along with the data source	-1 0 +1	Confirm the score of the social impacts of the project with respect to the aspect and its monitored value in relation to legal/regulatory limits (if any) including basis of conclusion	Describe how the GCC Verifier has assessed that the impact of Project Activity on social aspects (based on monitored parameters, quantitative or qualitative) and in case of "harmful" aspects how has the project owner adopted Risk Mitigation Action / management actions plans and policies to mitigate the risks of negative social impacts to levels that are unlikely to cause

²³ sourced from the CDM SD Tool and the sample reports are available (<https://www4.unfccc.int/sites/sdcmicrosite/Pages/SD-Reports.aspx>)

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					project having positive impact on society. To the BAU / baseline scenario must also mark their aspect as "harmless"						any harm. Also describe the positive impacts of the project on the society as compared to the baseline alternative or BAU scenario.
Reference to paragraphs of Environmental and Social Safeguards Standard		Paragraph 12 (a)	Paragraph 13 (c)	Paragraph 13 (d) (i)	Paragraph 13 (d) (ii)	Paragraph 13 (d) (iii)	Paragraph 13 (e) (i)	Paragraph 12 (c) and Paragraph 13 (f)	Paragraph 23		Paragraph 24 and Paragraph 26 (a) (ii)
Social - Jobs	Long-term jobs (> 10 year) created/lost (SJ01)	There is a positive impact of the project activity on the creation of long term jobs during its operational life time.	Not Applicable	Not Applicable				Refer B.7.1 Table 33	+1	For operating & maintenance of the project, personnel will be required to be deployed.	
	New short-term jobs (< 1 year) created/lost (SJ02)	There is a positive impact of the project activity on the creation of jobs during its construction and operational life time.	Not applicable.	Not Applicable				Refer B.7.1 Table 33	+1	For operating & maintenance of the project, personnel will be required to be deployed.	
	Sources of income generation increased/reduced (SJ03)										

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	<p>Avoiding discrimination when hiring people from different race, gender, ethnics, religion, marginalized groups, people with disabilities (SJ04)</p> <p>(Human rights)</p>										
Social - Health & Safety	<p>Disease prevention (SHS01)</p>										
	<p>Occupational health hazards (SHS02)</p>										
	<p>Reducing / increasing accidents /Incidents/fatality (SHS03)</p>										
	<p>Reducing / increasing crime (SHS04)</p>										
	<p>Reducing / increasing food wastage</p>										

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	(SHS05)										
	Reducing / increasing indoor air pollution (SHS06)										
	Efficiency of health services (SHS07)										
	Sanitation and waste management (SHS08)										
	Other health and safety issues (SHS09)										
	Add more rows if required										
Social - Education	specialized training / education to local personnel (SE01)										
	Educational services improved or not (SE02)										

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	<i>Project-related knowledge dissemination effective or not (SE03)</i>										
	<i>Other educational issues (SE3)</i>										
	<i>Add more rows if required (SE04)</i>										
Social - Welfare	<i>Improving/deteriorating working conditions (SW01)</i>										
	<i>Community and rural welfare (indigenous people and communities) (SW02)</i>										
	<i>Poverty alleviation (more people above poverty level) (SW03)</i>										
	<i>Improving/</i>										

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	<i>deteriorating wealth distribution/ generation of income and assets (SW04)</i>										
	<i>Increase d or / deteriorating municipal revenues (SW05)</i>										
	<i>Women's empowerment (SW06)</i> <i>(Human rights)</i>										
	<i>Reduced / increased traffic congestion (SW07)</i>										
	<i>Exploitation of Child labour (Human rights)</i> <i>(SW08)</i>										
	<i>Minimum wage protection (Human rights)</i>										

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(SW09)											
Abuse at workplace. (With specific reference to women and people with special disabilities / challenges) (Human rights) (SW10)											
Other social welfare issues (SW11)											
Avoidance of human trafficking and forced labour (Human rights) (SW12)											
Avoidance of forced eviction and/or partial physical or economic displacement of											

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<p>IPLCs (Human rights) (CW13)</p>											
<p>Provisions of resettlement and human settlement displacement (Human rights) (CW14)</p>											
<p>Resilient infrastructure with affordable and equitable access for all,</p>	<p>There is a positive impact of the project activity on in providing quality, reliable, sustainable and resilient infrastructure, with a focus on affordable and equitable access for all</p>	<p>Not applicable.</p>					<p>Refer B.7.1 Table 20</p>	<p>+1</p>		<p>MRTS is technologically advanced, convenient and safe public transport system. It will result in convenient and safe access to public transport.</p>	
<p>Net Score:</p>	<p>+3</p>										
<p>Project Owner's Conclusion in PSF:</p>	<p>The Project Owner confirms that the Project Activity will not cause any net harm to society.</p>										
<p>GCC Project Verifier's Opinion:</p>	<p>The GCC Verifier certifies that the Project Activity [is not likely to cause any] or [is likely to cause] net harm to society.</p>										

Section F. United Nations Sustainable Development Goals (SDG)

>>

UN-level SDGs	UN-level Target	Declared Country-level SDG	Defining Project-level SDGs				GCC Project Verifier's Conclusion (To be included in Project Verification Report only)	
			Project-level SDGs	Project-level Targets/Actions	Contribution of Project-level Actions to SDG Targets	Monitoring	Verification Process	Are Goal/Targets Likely to be Achieved?
<p>Describe UN SDG targets and indicators</p> <p>See: https://unstats.un.org/sdgs/indicators/indicators-list/</p>	Describe the UN-level target(s) and corresponding indicator no(s)	Has the host country declared the SDG to be a national priority? Indicate Yes or No	Define project-level SDGs by suitably modifying and customizing UN/ Country-level SDGs to the project scope or creating a new indicator(s). Refer to previous column for guidance.	Define project-level targets/actions in line with new project level indicators chosen. Define the target date by which the project Activity is expected to achieve the project-level SDG target(s).	Describe and justify how actions taken under the Project Activity are likely to result in a direct positive effect that contributes to achieving the defined project-level SDG targets	Describe the monitoring approach and the monitoring parameters to be applied for each project-level SDG indicator and its corresponding target, frequency of monitoring and data source	Describe how the GCC Verifier has verified the claims that the project is likely to achieve the identified Project level SDGs target(s).	Describe whether the project-level SDG target(s) is likely to be achieved by the target date (Yes or no)
<p>Goal 1: End poverty in all its forms everywhere</p>								
<p>Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p>								

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Goal 3. Ensure healthy lives and promote well-being for all at all ages									
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all									
Goal 5. Achieve gender equality and empower all women and girls									
Goal 6. Ensure availability and sustainable management of water and sanitation for all									
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all									
Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all	8.5 By 2030, achieve full and productive employment and decent work for all women and men, including	Yes	Generation of Direct and indirect employment		Project activity is already installed and is in operation resulting in employment generated.	Project activity is already installed and is in operation resulting in employment generated.	Refer B.7.1 Table 33		

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	for young people and persons with disabilities, and equal pay for work of equal value								
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	Yes	Provide quality, reliable, sustainable and resilient infrastructure, with a focus on affordable and equitable access for all	Ridership in MRTS	Yearly	Project will displace public transport with technologically advanced, convenient and safe MRTS. It will result in affordable and equitable access to public transport.	Refer B.7.1 Table 20		
Goal 10. Reduce inequality within and among countries									

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<p>Goal 11. Make cities and human settlements inclusive, safe, resilient, and sustainable</p>									
<p>Goal 12. Ensure sustainable consumption and production patterns</p>									
<p>Goal 13. Take urgent action to combat climate change and its impacts</p>	<p>13.a Implement the UN Framework convention on climate change</p>	<p>Yes</p>	<p>GHG emission reductions through displacement of emission intensive public and private modes of transit in the city</p>	<p>Installation of MRTS Approx. 1.9 million tCO₂e reduction over 10 years</p>		<p>Project activity is already installed and is in operation.</p>	<p>Refer B.7.1 Table 32</p>		
<p>Goal 14. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development</p>									
<p>Goal 15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p>									

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Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels									
Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development									
SUMMARY						Targeted		Likely to be Achieved	
Total Number of SDGs						03		03	
Certification label (Bronze, Silver, Gold, Platinum, or Diamond) for the ACCs as defined in the PSF						Silver		Silver	

Section G. Local stakeholder consultation

G.1. MODALITIES FOR LOCAL STAKEHOLDER CONSULTATION

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The consultations for this project were carried out on 15/01/2013 at L&T Metro Rail (Hyderabad) Project Office Uppal Pre-Casting Yard Opp: Uppal Bus stand, Shanti Nagar, Besides Pochamm Temple Uppai, Hyderabad-39.

Scope of consultation:

Following were the main objectives of the consultation:

- Promote public awareness and improve understanding of the local people about the proposed project;
- Assessment of possible requirement of improvements;
- Solicit the views of affected communities/individuals on environmental and social problems;
- Improve environmental and social soundness;
- To settle problems with mutual consent; and
- Create accountability and sense of local ownership during project implementation.

Group of stakeholders involved:

Government authorities (Police Commissioner, Pollution Control Board, Greater Hyderabad Municipal Corporation, Metropolitan Commissioner, National Highways Authority Of India, Principal Secretary - Municipal Administration & Urban Development Department (Govt. of AP), Traffic police, Designated National Authority, Ministry Of Urban Development), Dean -India School Of Business and local community around the site were part of the consultation. Local People who were consulted were mostly from Chaitanyapuri, Mehidipatnam, Nagole, Kukatpally, Ameerpet, Begumpet, Jubli Hills, Maredpalli, Madhapur, Kondapur, Santosh Nagar, and Erragadda.

Means of inviting stakeholders' participation:

Stakeholders were invited through invitation letters and newspaper advertisement in Times of India dated 08/01/2013. Discussions were held with the local people. Meetings & discussions were also conducted as part of the consultation process with the local authorities.

Information made available to stakeholders:

The stakeholders were introduced about the details of MRTS. It was also explained to the stakeholders that MRTS will reduce the environmental impacts of combustion of fossil in conventional mode of transport, such as impacts from greenhouse gases and other air pollution emissions. Stakeholders were also informed regarding CSR activities.

G.2. SUMMARY OF COMMENTS RECEIVED

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All the respondents, communities in and around study area were aware about the MRTS project and expressed their support and cooperation for project activity. They seem to have some concerns related to the development of MRTS project in their area as listed below:

- Due to MRTS auto driver may lose their job
- During construction of MRTS, traffic related problems may arise.
- Due to construction there may be increased pollution like dust in air.
- How grievances related to property damage and property acquisition will be handled.

G.3. CONSIDERATION OF COMMENTS RECEIVED

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The concerns raised are listed in the table below –

SN	Concerns & expectations	Addressal of concerns
1	Job lost to auto driver	Explained that autos and buses shall become first and last mile to metro. Cases from Delhi and Bengaluru explained.
2	Traffic issues during construction	Explained that only median area to be blocked for construction using lean construction mechanism and effective diversion of traffic by officials if required.
3	Pollution during construction	Explained that all segments are precast in casting yards (equipped with pollution control mechanism) outside the city to cause minimum pollution and disruption to city.
4	Property damage and property acquisition	Explained that property acquisition/ Utility diversion procedure, grievance redressal and compensation are as per the government norms and guidelines.

Stakeholders were happy that there will be traffic reduction, noise reduction, pollution reduction and job opportunities due to MRTS project.

Section H. Approval and authorization

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Not applicable.

APPENDIX 1. CONTACT INFORMATION OF PROJECT OWNERS

Project Owner name (as per LON/LOA)	L&T Metro Rail (Hyderabad) Limited
Country	India
Address	Hyderabad Metro Rail Administrative Building Hyderabad Metro Rail Depot, Uppal Main Road Uppal, Hyderabad – 500039
Telephone	+91-40-22080000
Fax	N.A.
E-mail	MD.CEO@ltmetro.com
Website	ltmetro.in
Contact person	Vijaya Bhaskara Reddy Kalakota

APPENDIX 2. AFFIRMATION REGARDING PUBLIC FUNDING

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The project is financed through a mix of debt and equity. There is no ODA funding involved in the project activity.

APPENDIX 3. APPLICABILITY OF METHODOLOGY(IES)

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Refer section B.6.1 of PSF.

APPENDIX 4. FURTHER BACKGROUND INFORMATION ON EX ANTE CALCULATION OF EMISSION REDUCTIONS

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Refer section B.6.2 of PSF.

APPENDIX 5. FURTHER BACKGROUND INFORMATION ON MONITORING PLAN

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Refer section B.7 of PSF.

Project Submission Form

**APPENDIX 6. SUMMARY REPORT OF COMMENTS
RECEIVED FROM LOCAL STAKEHOLDERS**

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Refer section G.3 of PSF.

APPENDIX 7. SUMMARY OF DE-REGISTERED CDM PROJECT OR PROJECTS FROM OTHER GHG / NON-GHG PROGRAMS (TYPE B)

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<i>Complete this form in accordance with the instructions attached at the end of this form.</i>	
Program Name	
Project registration number	
Date of registration in the program	
Title of the Project Activity	
Project de-registration reference number	
Date of de-registration of the Project	
Project Participants <small>(Authorized by the host / annex 1 country letter of approval)</small>	
Country where the project is located	
Applied methodology(ies) <small>(Provide reference and version number(s))</small>	

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<p>Pre-registration changes to the Project Activity (Tick as applicable)</p>	<p>Pre-registration Changes</p>	<p>Reference number</p>	<p>Approved</p>	<p>Provide a summary of pre-registration changes</p>
	<p>Deviations from approved baseline and monitoring methodology</p>		<p><input type="checkbox"/></p>	
	<p>Deviations from applied Tool & Guidance</p>		<p><input type="checkbox"/></p>	
	<p>Deviations from the rules</p>		<p><input type="checkbox"/></p>	
	<p>Other.....</p>		<p><input type="checkbox"/></p>	
<p>Post-registration changes to the Project Activity (Tick as applicable)</p>	<p>Post registration Changes</p>	<p>Reference number</p>	<p>Approved</p>	<p>Provide a summary of post-registration changes</p>
	<p>Change in project design</p>		<p><input type="checkbox"/></p>	
	<p>Request for revision of monitoring plan</p>		<p><input type="checkbox"/></p>	
	<p>Request for change in start date of crediting period</p>		<p><input type="checkbox"/></p>	
	<p>Renewal of crediting period</p>		<p><input type="checkbox"/></p>	
	<p>Temporary deviations</p>		<p><input type="checkbox"/></p>	
	<p>Other.....</p>		<p><input type="checkbox"/></p>	

Crediting Period(s)	Crediting period(s)		Period (start & end dates)	ERs as per registered PDD/MR/Project documents	Credits issued	
	Crediting Period (Shall start on or after 1 Jan 2016)	Fixed 10 year				
		Renewable (7 years, with 2 approved renewals)	1 st			
			2 nd			
			3 rd			
	Period for which Credits have been issued					
	Period for which Credits have been requested but not issued					-
	Period for which Credits have never been requested for issuance (No monitoring reports submitted)					-
Period for which Credits have never been requested for issuance prior to CDM de-registration					-	
Remaining Crediting period, after de-registration, for which Credits have not been issued by the program , subject to a ceiling of 10 years as allowed under the GCC Program					-	

Project Submission Form

Details of Previous Issuance Requests	Issuance Request	Period (start & end dates)	ERs as per registered PDD	Quantity of Credits requested to be issued	Quantity of Credits issued
	1 st				
	2 nd				
	3 rd				
	4 th				
	5 th				
	Add rows				
	Total				
List any open issues in the Validation and last Verification Report (e.g., FARs, if any) and how they have been addressed					
Any other relevant information that has not been reported in the registered documents and that may have adverse impacts on the environmental integrity of the Project Activity					
Provide the list of all the registered documents related to this project, as available on the program’s website and the corresponding URLs.					

Appendix 8. FURTHER INFORMATION ON DETERMINATION OF BUNDLE IN PROJECT ACTIVITY.

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Appendix 9. PUBLIC DECLARATION FOR A2 (Sub Type 2 and 3), B1 & B2 PROJECTS ON NON CONTINUATION FROM CDM/GHG/NON-GHG PROGRAMS.

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Project Submission Form

DOCUMENT HISTORY

Version	Date	Comment
V 4.0	27/09/2022	<ul style="list-style-type: none"> ▪ Revised version released on approval by Steering Committee as per GCC Program Process. ▪ Revised version contains following changes: <ul style="list-style-type: none"> ○ Introduced A3 type projects A2 project sub-types. ○ Included revised Declaration by the 'Authorized Project Owner and focal point' on GCC requirements. ○ Included modified format for E+/S+/ SDG assessment. ○ Revised instructions for filling in the PSF. ○ Editorial changes to the document.
V 3.2	31/12/2020	<ul style="list-style-type: none"> ▪ The name of GCC Program's emission units has been changed from "Approved Carbon Reductions" or ACRs to "Approved Carbon Credits" or ACCs.
V 3.1	17/08/2020	<ul style="list-style-type: none"> ▪ Editorial revisions made <ul style="list-style-type: none"> ○ Revised Table in section B.7.2 on Monitoring-program of risk management actions ○ Revised Table in section E.1 on Environmental Safeguards ○ Revised Table in section E.1 on Social Safeguards ○ Revised Table in section F on United Nations Sustainable Development Goals (SDG)
V 3.0	05/07/2020	<ul style="list-style-type: none"> ▪ Revised version released on approval by Steering Committee as per GCC Program Process. ▪ Revised version contains following changes: <ul style="list-style-type: none"> ○ Change of name from Global Carbon Trust (GCT) to Global Carbon Council (GCC). ○ Considered and addressed comments raised by Steering Committee: <ul style="list-style-type: none"> ➤ during physical meeting (SCM 01, dated 29 Oct 2019, Doha Qatar); and ➤ electronic consultations EC01-Round 01 (15.09.2019 – 25.09.2019), EC01-Round 02 (27.03.2020 – 27.06.2020). ○ Feedback from Technical Advisory Board (TAB) of ICAO on GCC submission for approval under CORSIA²⁴;

²⁴See ICAO recommendation for conditional approval of GCC at https://www.icao.int/environmental-protection/CORSIA/Documents/TAB/Excerpt_TAB_Report_Jan_2020_final.pdf

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V 2.0	25/06/2019	<ul style="list-style-type: none">▪ Revised version released for approval by the GCC Steering Committee.▪ Revised version includes additional details and instructions on the information to be provided, consequent to the latest developments world-wide (e.g., CORSIA EUC).
V 1.0	01/11/2016	Initial version released under the GCC Program Version 1

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