Project Verification Report

2021

COVER PAGE Project Verification Report Form (VR)	
BASIC INFORMATION	
Name of approved UCR Project Verifier / Reference No.	KBS Certification Services Limited (https://www.ucarbonregistry.io/CouRegistry/VerifierList)
Type of Accreditation	☒ CDM or other GHG Accreditation ☐ ISO 14065 Accreditation Name of the entity that provided the accreditation: UNFCCC Date of validity: 29/11/2019 to 28/11/2024 Web link of the active accreditation certificate and approval: https://cdm.unfccc.int/DOE/list/DOE.html?entityCode=E-0051
Approved UCR Scopes and GHG Sectoral scopes for Project Verification	Sectoral Scope 07: Transport
Validity of UCR approval of Verifier	15/01/2022 onwards
Completion date of this VR	19/01/2024

Title of the project activity	Delhi Metro, India
Project reference no. (as provided by UCR Program)	373
Name of Entity requesting verification service (can be Project Owners themselves or any Entity having authorization of Project Owners, example aggregator.)	Delhi Metro Rail Corporation Ltd.
Contact details of the representative of the Entity, requesting verification service (Focal Point assigned for all communications)	Name: Sh. S A Verma Designation: Executive Director Organisation: Delhi Metro Rail Corporation Telephone: 011-22754719 E-Mail ID: saverma_rs@yahoo.com
Country where project is located	India
Applied methodologies (approved methodologies by UCR Standard used)	ACM0016 ver. 4 - Mass Rapid Transit Project
GHG Sectoral scopes linked to the applied methodologies	Sectoral scope 7: Transport
Project Verification Criteria: Mandatory requirements to be assessed	☒ UCR Standard ☒ Applicable Approved Methodology ☒ Applicable Legal requirements /rules of host country ☒ Eligibility of the Project Type

	☒ Start date of the Project activity ☒ Meet applicability conditions in the applied methodology ☒ Credible Baseline ☒ Do No Harm Test ☒ Emission Reduction calculations ☒ Monitoring Report ☒ No GHG Double Counting ☐ Others (please mention below)
Project Verification Criteria: Optional requirements to be assessed	☒ Environmental Safeguards Standard and do-no-harm criteria ☒ Social Safeguards Standard do-no-harm criteria
Project Verifier's Confirmation: The *UCR Project Verifier* has verified the UCR project activity and therefore confirms the following:	The UCR Project Verifier KBS Certification Services Ltd., certifies the following with respect to the UCR Project Activity Delhi Metro, India. ☒ The Project Owner has correctly described the Project Activity in the Project Concept Note (dated 29/12/2023) including the applicability of the approved methodology ACM0016 ver. 4 - Mass Rapid Transit Projects and meets the methodology applicability conditions and has achieved the estimated GHG emission reductions, complies with the monitoring methodology and has calculated emission

	reductions estimates correctly and conservatively. ☒ The Project Activity is likely to generate GHG emission reductions amounting to the estimated 2,097,824 TCO_{2e}, as indicated in the PCN, which are additional to the reductions that are likely to occur in absence of the Project Activity and complies with all applicable UCR rules, including ISO 14064-2 and ISO 14064-3. ☒ The Project Activity is not likely to cause any net-harm to the environment and/or society ☒ The Project Activity complies with all the applicable UCR rules[1] and therefore recommends UCR Program to register the Project activity with above mentioned labels.
Project Verification Report, reference number and date of approval	GHG.23.VAL.016
Name of the authorised personnel of UCR Project Verifier and his/her signature with date	 Mr. Kaushal Goyal Managing Director

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PROJECT VERIFICATION REPORT

Executive summary

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KBS Certification Services Limited has been commissioned by “Delhi Metro Rail Corporation Limited (DMRC)” to perform independent verification of its registered UCR project, “Delhi Metro, India”, UCR Ref. No: 0373 for the reported GHG emission reductions for the given monitoring period 01/01/2013 – 31/12/2022 (both dates included). The UCR project must undergo independent third-party verification and certification of emission reductions as the basis for issuance of Carbon Offset Units (COUs).

Verification Objectives and Scope:

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the approved PCN and that all physical features (technology, project equipment,monitoring and equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The actual monitoring systems & procedures and monitoring report conforms with the requirements of the registered monitoring plan and the approved monitoring methodology;
- The data is recorded and stored as per the monitoring methodology and registered monitoring plan.

The scope of the verification is the independent and objective review and ex-post determination of the monitored reductions in GHG emission by the project activity. The verification is based on the review of the monitoring report, supporting information and

a) The latest PCN/01/;
b) Monitoring report/02/ for the monitoring period under verification including COU calculations sheets and all supporting documents;
c) The applied monitoring methodology/05/;
d) Relevant decisions, clarifications, and guidance from UCR/04/;
e) All information and references relevant to the project activities resulting in emission reductions

KBS has based on the recommendations in the latest version of UCR Verification Standard/04/ for project activity, employed a rule-based approach in the verification, focusing on the identification of significant reporting risks and the reliability of project monitoring.

Description of the Project:

The objectives of the project activity is to register Ph-I line of Delhi Metro system under UCR activity. Delhi Metro Rail Corporation Limited (DMRC) is responsible for the implementation of the project. The metro transportation system is more efficient compared to the traditional means of transportation achieved and calculated per passenger-kilometre. On average,

metro system has lower GHG emissions per passenger-kilometre than those used in the absence of the project activity, hence, results in GHG emission reductions.

The project was found implemented and operated in line with the information provided in the approved PCN/01/. The project activity is undergoing its verification and the monitoring period of the registered project activity is from 01/01/2013 – 31/12/2022 (including both dates). The total emission reductions claimed under the monitoring period as verified are 2,097,824 tCO2e.

Verification process:
The verification comprises a review of the monitoring report for the monitoring period from 01/01/2013 – 31/12/2022 (both days included) including monitoring parameters and monitoring plan, emission reduction calculation spread-sheet, monitoring methodology, and all related evidence provided by the project participant.

Methodology:
KBS follows a rule-based verification approach, wherein, as a first step, the contract review is undertaken as per the latest version of the UCR Standard/04/. A desk review of the project documentation is undertaken, which is followed by a site assessment by the members of the verification team in accordance with the latest version of UCR Verification standard/04/. The verification protocol provides transparent means to record the observations and compliances by the verification team members and the nonconformities, if any. The verification protocol is an internal document and is available on request.

Conclusion:
From the verification assessment, subject to successful closure of findings, KBS confirms that the project activity has been implemented and operated as per the approved PCN/01/ and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place. All the monitoring systems & procedures and monitoring reports confirm the requirements of the approved monitoring plan and the approved monitoring methodology. Based on the information reviewed and evaluated, we confirm that the implementation of the project has resulted in 20,97,824 tCO2e emission reductions during the period from 01/01/2013 – 31/12/2022 (Including both days).

Project Verification team, technical reviewer and approver

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Project Verification team

No.	Role	Last name	First name	Affiliation	Involvement in

				(e.g. name of central or other office of UCR Project Verifier or outsourced entity)	Doc review	Off-Site inspection	Interviews
1.	Team Leader	Kandari	Sanjay	Central Office	✓	✓	✓
2.	Technical Expert (TA 7.1)	Sanghal	Atul	External resource	✓		
3.	Trainee	Madan	Rishabh	Central Office	✓	✓	✓

Technical reviewer and approver of the Project Verification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of UCR Project Verifier or outsourced entity)
1.	Technical reviewer	ER	Prabhu	Ravi	Central office
2.	Expert to Technical reviewer (TA 7.1)	ER	Srivastava	Harshit	Central Office
3.	Manager Technical & Certification	IR	Francis	Margaret	Central Office
4.	Approver	IR	Goyal	Kaushal	Central Office

Means of Project Verification

Desk/document review

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A desk review is undertaken, involving but not limited to,

- A review of the data and information presented to verify their completeness, and to assess the nature, scale and complexity of the verification activity.
- A review of the monitoring methodology, the quality of monitoring equipment used, and the quality assurance and quality control procedures;
- An evaluation of data management and the QA/QC system in the context of their influence on the generation and reporting of emission reductions, to achieve the desired confidence in the project owner's GHG information.
- A complete list of documents evidence reviewed or referred in this report are included.

On-site inspection

Date of on site inspection: 27/12/2023			
No.	**Activity performed On-Site**	**Site location**	**Date**

1.	The project verification team conducted interviews with the project owner to confirm the information and to resolve issues identified in the document review.	New Delhi	27/12/2023
2.	An assessment of the implementation and operation of the project activity as per the PCN and UCR requirements		
3.	To validate that the project design, as documented is sound and reasonable, and meets the identified criteria UCR Standard Requirements and associated guidance		
4.	To assess conformance with the certification criteria as laid out in the UCR Standards;		
5.	To evaluate the conformance with the certification scope, including the GHG project and baseline scenarios; GHG sources, sinks, and reservoirs; and the physical infrastructure, activities, technologies and processes of the GHG project to the requirements of the GCC;		
6.	To evaluate the calculation of GHG emissions, including the correctness and transparency of formulae and factors used; assumptions related to estimating GHG emission reductions; and uncertainties; and		
7.	To determine whether the project could reasonably be expected to achieve the estimated GHG reduction/removals.		
8.	A review of information flows for generating, aggregating and reporting of the ex-ante monitoring parameters.		
9.	Interviews with relevant personnel to confirm that the operational and data collection procedures can be implemented in accordance with the Monitoring Plan		
10.	A cross-check between information provided in the submitted documents and data from other sources		
11.	A review of calculations and assumptions made in determining the GHG data and estimated ERs, and		
12.	An identification of QA/QC procedures in place to prevent, or identify and correct, any errors or omissions in the reported monitoring parameters		

Interviews

No.	Interview			Date	Subject
	Last name	First name	Affiliation		

1.	Sethi	Ankit	AM – Environment (DMRC)	27/12/2023	Project Boundary, Emission reduction calculations, Monitoring plan (feasibility of monitoring arrangements described in PCN), QA/QC procedures, responsibility of implementation of monitoring plan, data recording & storage procedures, Implementation plan
2.	Singh	Gurmurat	Manager – Traction (DMRC)		
3.	Singh	P N	SE – PSI (DMRC)		
4.	Chetan	Sunny	SE – PSI (DMRC)		
5.	Purohit	Riju	AM – S&T (DMRC)		
6.	Dubey	Shivdhar	Director (PRSD)		
7.	Garg	Pravin	Project Manager (PRSD)		
8.	Singh	Ashutosh	Supervisor (PRSD)		

Sampling approach

N/A

Clarification request (CLs), corrective action request (CARs) and forward action request (FARs) raised

Areas of Project Verification findings	No. of CL	No. of CAR	No. of FAR
Green House Gas (GHG)			
Identification and Eligibility of project type	-	-	-
General description of project activity	-	-	-
Application and selection of methodologies and standardized baselines	-	-	-
- Application of methodologies and standardized baselines	-	-	-
- Deviation from methodology and/or methodological tool	-	-	-
- Clarification on applicability of methodology, tool and/or standardized baseline	-	-	-
- Project boundary, sources and GHGs	-	-	-
- Baseline scenario	-	-	-
- Estimation of emission reductions or net anthropogenic removals	-	-	-
- Monitoring Report	01 (CL 03)	01 (CAR 02)	-
Start date, crediting period and duration	-	-	-
Environmental impacts	-	-	-
Project Owner- Identification and communication	-	-	-
ER sheet	01 (CL 02)	01 (CAR 02)	-
UCR Communications	01 (CL 01)	-	-
Others (please specify)	-	-	-
Total	03	02	-

Project Verification findings

Identification and eligibility of project type

Means of Project Verification	The project has been approved for verification under the UCR program with the project reference number 0373 (https://www.ucarbonregistry.io/Registry/Details?id=kdL92xBo%2B5tUETrkAiWTiA%3D%3D). The project has taken reference with the approved CDM methodology ACM0016 version 4.0/05/ and complies with the used methodology. The monitoring report complies with the approved PCN and the UCR Verification standard version 2.0/04/.
Findings	No findings were raised
Conclusion	The verification team confirms that the project is in line with the UCR standard version 6.0, UCR verification standard version 2.0 and UCR program manual version 4.0.

General description of project activity

Means of Project Verification

The objectives of the project activity is to register Ph-I line of Delhi Metro system under UCR activity. Delhi Metro Rail Corporation Limited (DMRC) is responsible for the implementation of the project. The metro transportation system is more efficient compared to the traditional means of transportation achieved and calculated per passenger-kilometre. On average, metro system has lower GHG emissions per passenger-kilometre than those used in the absence of the project activity, hence, results in GHG emission reductions.

The project was found implemented and operated in line with the information provided in the approved PCN/01/. The project activity is undergoing its verification and the monitoring period of the registered project activity is from 01/01/2013 – 31/12/2022 (including both dates). The total emission reductions claimed under the monitoring period as verified are 2,097,824 tCO2e.

The details of the Delhi Metro Phase-I are as follows:

1. Line 1: Shahdara – Rithala
   Network Length: 22 km

2. Line 2: Vishwavidyalaya - Central Secretariat
   Network Length: 11 km

3. Line 3: Dwarka Sector 9 – Indraprastha
   Network Length: 32.1 km

Commissioning dates of aforesaid corridors:

Line	Corridor Name	Network Length (in km)	Commissioning Date
Line-1	Shahdara – Tis Hazari	8.50	25/12/2002
	Tis Hazari – Inderlok	4.70	04/10/2003
	Inderlok – Rithala	8.80	31/03/2004
Line-2	Vishwavidyalaya – Kashmere Gate	4	20/12/2004
	Kashmere Gate – Central Secretariat	7	03/07/2005
Line-3	Barakhamba Road - Dwarka	22.80	31/12/2005
	Dwarka – Dwarka Sector 9	6.50	01/04/2006
	Barakhamba Road - Indraprastha	2.80	11/11/2006

The Delhi Metro Ph-I MRTS is a 65.1 km of transit system. The metro will run partially underground, partially at grade and partially elevated. Each train will have between 6 and 8 cars and will run frequencies between 3 and 12 minutes depending on lines, time of the day and passenger demand. Trains will be approximately 3.2 m wide modern rolling stock with stainless steel body. The capacity of a 6 car and 8 car broad gauge train is approx. 2,240 and 3,000 passengers respectively.

	The trains will run at an average speed of 35 kmph and maximum speed of 80 kmph. Long lasting track structure requiring minimum or no maintenance and ensuring high stability, safety, reliability and comfort is proposed for the MRTS system. The track structure proposed is of two types: • Ballast less tracks on Viaducts and inside tunnels • Normal ballasted tracks in depots During the site visit and desk review, verification team confirms that the description of the project is as per the approved PCN/01/
Findings	No findings were raised.
Conclusion	The verification team confirms that the project description contains all the relevant information required and is in line with the UCR standard version 6.0, UCR verification standard version 2.0 and UCR program manual version 4.0 and approved PCN.

Application and selection of methodologies and standardized baselines

(.a.i) Application of methodology and standardized baselines

<table>
<tr><td>Means of Project Verification</td><td>The project applies CDM methodology ACM0016, version 4.0:
‘Mass Rapid Transit Projects’ /05/ and no standardized baseline is used.

The applicability of the methodology is assessed below:

<table>
<tr><th>Applicability Condition under ACM0016, version 04</th><th>Verification team assessment</th></tr>
<tr><td>The project constructs a new rail-based infrastructure or segregated bus lanes.
• For rail systems, the project needs to involve the construction of a new infrastructure (new rail lines);
• For BRTs the project can be based on existing road infrastructure, but which separates physically bus lanes from mixed traffic.</td><td>The project activity is construction of a new rail-based infrastructure (Metro). The same has been checked by verification team from Detailed Project Report (DPR)/06/ during the desk review and on-site audit.

The project activity does not include BRT, hence this point is not applicable.

The verification team confirms that the criteria has been met.</td></tr>
<tr><td>The methodology is applicable for the segregated BRT bus lanes or the rail based MRTS replaces existing bus routes (e.g. through scrapping units or through closing or re-scheduling existing bus routes) operating under mixed traffic conditions</td><td>The MRTS under the project replaces passenger trips by the existing bus operations and result in the reduction in number of buses.

The same has been confirmed by verification team during desk review and traffic survey report/09/ shared by PP.</td></tr>
<tr><td>The methodology is not applicable for operational improvements (e.g. new or larger buses) of an already existing and operating bus lane or rail-based MRTS;</td><td>The project is a new rail-based system.

This has been confirmed by the verification team during on-site visit and review of DPR/06/</td></tr>
<tr><td>Fuels including (liquefied) gaseous fuels or biofuel blends, as well as electricity can be used in the baseline or project case. The following condition apply:</td><td>The project activity uses only electricity for its operations, whereas, the baseline modes of transport uses different types of fuels, including gaseous fossil fuels (gasoline and diesel) and CNG. However, as there is no other fuel consumption, except the traction energy (electricity by the project activity, The same has been verified during the on site visit and desk review of the DPR, there is no possibility of more consumption of gaseous fossil fuels by project activity. Hence, the condition, usage of more</td></tr>
</table>
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</table>

	gaseous fossil fuel in the project case is not applicable.
In the case of gaseous fossil fuels, the methodology is applicable if equal or more gaseous fossil fuels are used in the baseline scenario than in the project activity. The methodology is not applicable in its current form if more gaseous fossil fuel is used in the project activity compared to the baseline scenario.	The condition usage of more gaseous fossil fuel in the project case is not applicable.
The methodology is applicable for urban or suburban trips. It is not applicable for inter-urban transport.	The project activity is meant for urban transport in Delhi. The purpose of metro line is to connect the various parts of Delhi NCR. The same has been verified during the on-site visit and metro map/14/ available on the public domain.
The methodology is applicable if the most plausible baseline scenario is the continuation of the use of current modes of transport.	The identified baseline scenario of the project is continuation of current public transport system, as described and justified in 'Establishment and description of baseline scenario under baseline section of PCN. The same has been verified during the onsite visit.
The implementation of Air- and Water- based transport system	The project activity is a land based transport system. Hence this is not applicable.

Applicability conditions of "Tool for the demonstration and assessment of additionality", Version 07.0.0	The project uses performance analysis i.e. proves for rail based MRTS projects - Electricity consumption is less than or equal to 0.1kWh/pkm. This is demonstrated in ER spreadsheet (ex-ante). Notwithstanding that additionality demonstration is not a criterion under UCR scheme.

Applicability conditions under "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of	

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<tr><td></td><td>
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<tr><td>electricity generation”, version 03</td><td></td></tr>
<tr><td>This tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity and procedures to monitor the amount of electricity generated by the project power plant.</td><td>The project activity will consume electricity to maintain traction energy for propulsion of metro. This is evident from the DPR/06/. Thus, the tool is used to calculate direct project emissions from consumption of electricity.</td></tr>
<tr><td>The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption:

Scenario A: Electricity consumption from the grid.

Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).

Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s).</td><td>The project activity applies to Scenario A, where electricity will be consumed from the grid to maintain traction energy for the metro line. This is evident from the DPR/06/.

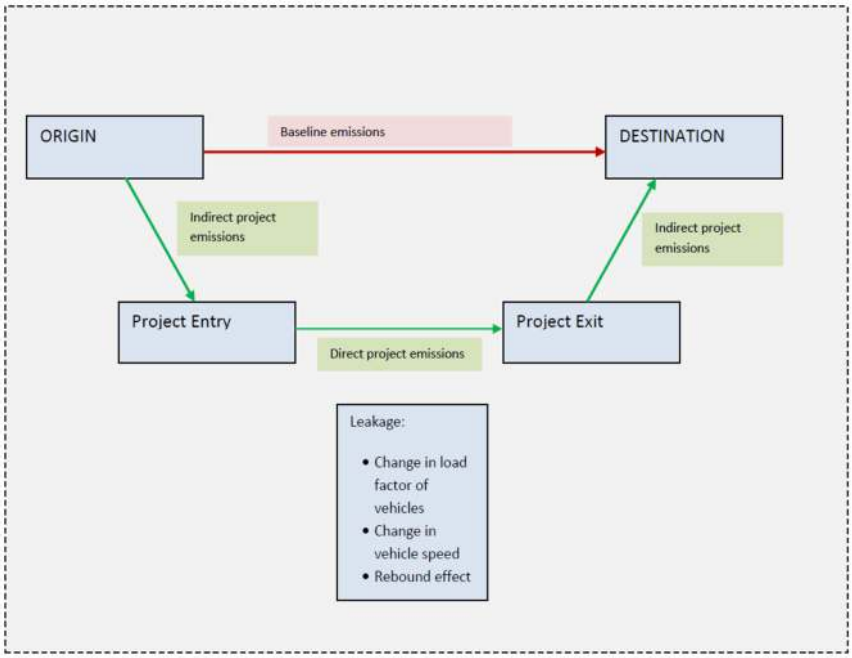
Hence scenario A is applicable.</td></tr>
</table>

<table>
<tr><td>“Baseline measures for modal shift measures in urban passenger transport” version 01.0</td><td><u>Applicable</u>
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, light rail and trams. The project activity is a metro system aimed at modal shift thus the tool is applicable.</td></tr>
</table>
</td></tr>
<tr><td>Findings</td><td>No findings were raised.</td></tr>
<tr><td>Conclusion</td><td>The verification team confirms that the applicability of the project is in line with the applied methodology and UCR standard version 6.0, UCR verification standard version 2.0 and UCR program manual version 4.0 and approved PCN.</td></tr>
</table>

(.a.ii) Clarification on applicability of methodology, tool and/or standardized baseline

Means of Project Verification	The latest available version of the methodology is version 05, however, PP has applied the version 04 of methodology as the baseline has been sourced from CDM PoA 9863/15/ and baseline is alike in the proposed UCR project. PP has sought the deviation to UCR in approved PCN. Verification team has checked the CDM PoA/15/ and approved PCN and hence it is acceptable.
Findings	No findings were raised.
Conclusion	The verification team confirms that the clarification for the applicability is according to the UCR requirements.

(.a.iii) Project boundary, sources and GHGs

Means of Project Verification	The project boundary includes the physical, geographical site(s) of the DMRC phase 1:  The verification team has assessed the project boundary with the approved PCN and found to be in line with the methodology.
Findings	No findings were raised.
Conclusion	The verification confirms that the project boundary contains all the relevant information required and is in line with the UCR requirements and approved PCN.

(.a.iv) Baseline scenario

Means of Project Verification	Baseline emissions include the emissions that would have happened due to the transportation of the passengers who use the project activity, had the project activity not been implemented. This is differentiated according to the modes of transport (relevant vehicle categories) that the passengers would have used in the absence of the project. Baseline emissions are calculated per passenger surveyed. For each passenger surveyed in Delhi Metro, the individual baseline emissions are

	calculated and multiplied with the individual expansion factor thus getting the baseline emissions of all passengers of the specific week surveyed. These are then multiplied with the total of the passengers of the period to arrive at baseline emissions. The following steps would be realised: Step 1: Conduct a survey, following the procedures presented in Appendix 4 of methodology, in which for each surveyed passenger, the trip distance per transport mode that would have taken place in the baseline is determined. Step 2: Calculate the individual baseline emissions for each surveyed passenger. Step 3: Apply an individual expansion factor to each surveyed passenger in accordance with the survey sample design, and summarize these to get the total baseline emissions of the period (week) surveyed. To get the annual (or monitoring period) baseline emissions the baseline emissions of the surveyed period (week) are calculated per passenger of the period (week) and multiplied with the total passengers transported per year (or monitoring period). Step 4: Take the lower limit of the 95% confidence interval as total baseline emissions. Baseline emissions are calculated as follows: $$BE_y = \frac{P_y}{P_{SPER}} \sum_p \left(BE_{p,y} \times FEX_{p,y} \right) \quad \text{(1)}$$ Where: BE_y = Baseline emissions in the year y (gCO_2) $BE_{p,y}$ = Baseline emissions per surveyed passenger p in the year y (gCO_2) $FEX_{p,y}$ = Expansion factor for each surveyed passenger p surveyed in the year y (each surveyed passenger has a different expansion factor) P = Total number of passengers in the year y P_{SPER} = Number of passengers in the time period of the survey (1 week) P = Surveyed passenger (each individual) y = Year of the crediting period The passenger survey has been checked by verification team during the site visit. PP has also provided the passenger survey sheet/08/ and the same has been calculated correctly in the ER sheet/03/. The survey was undertaken in the 1st, 4th and the 7th year, the survey was undertaken by the third party appointed by DMRC. The report of third party were verified and the survey methodology was also verified during the onsite assessment wherein the representative of third party were available.

	The baseline emission per surveyed passenger p is calculated based on the mode used, the trip distance per mode and the emission factor per mode: $$BE_{p,y} = \sum_i BTD_{p,i,y} \times EF_{pkm,i,y} \times 10^{-6}$$ _____ (2) Where: $BE_{p,y}$ = Baseline emissions per surveyed passenger p in the year y (gCO_2) $EF_{PKM,i,y}$ = Emission factor per passenger-kilometre of mode in the year y (gCO_2/PKM) $BTD_{p,i,y}$ = Baseline trip distance per surveyed passenger p using mode in the year y (PKM) p = Surveyed passenger (each individual) i = Relevant vehicle category y = Year of the crediting period **(1) Criteria for identifying the vehicle categories are as follows:** a) At a minimum, public transport, non-motorised transport and induced traffic have to be included; b) Conditions to include categories with reliable data on fuel consumption and load factors; c) Only include categories that are relevant for the MRTS project. If the project will only generate credits from public transport without modal shift, then passenger cars, taxis and motorcycles need not be included; d) Differentiate relevant fuel types for each category. Diesel, gasoline and gas (CNG or LPG) are listed separately if a minimum of 10 per cent of vehicles of the respective category use such a fuel, while the threshold for zero-GHG-emissionfuels is minimum 1 per cent. The 10 per cent threshold is justified, as greenhouse gas (GHG) emission differentials between diesel, gasoline and gaseous fuels are less than 20 per cent; e) In case of a system extension, the currently operating system is not included as a vehicle category. **Identification of the relevant vehicle categories (modes of transport)** Following vehicle categories have been identified as the applicable modes of transport in the absence of the project MRTS: 1. Buses 2. BRT 3. Urban rail 4. Metro (non-project existing metro) 5. Taxi 6. Passenger cars; 7. Two-wheelers and Motorcycles; 8. Auto rickshaws (motorized) 9. Bicycle or per foot 10. Others

If some vehicle categories are not explicitly identified or do not fit into one of the categories above; they should be entered in the survey as “others”. Baseline emissions of this category are counted as 0. The index i is used to identify each relevant vehicle category (mode of transport) included in the analysis. In indirect project emissions, the highest emission factor of all categories is taken if the survey respondent chooses the item “others”.

The traffic survey data/09/ has been done by the PP and shared to the verification team. During the onsite visit, the verification team has cross verified the survey data sheet with the available data maintained by the PP and confirms that the provided data is consistent with the data maintained by the PP.

(2) Determination of the emission factor per passenger-kilometer ($EF_{PKM,i,y}$)

Passenger-kilometer (PKM) is defined as the average passenger trip distance multiplied by the number of passengers. The emission factors per PKM are determined ex ante for each vehicle category. Any change in the occupancy rate of taxis and buses influencing the corresponding emission factors is monitored as leakage. The emission factor per PKM is calculated as follows:

(2.1) Emission factor per PKM for electricity-based transport systems (Existing metro rail):

$$EF_{PKM,i,x} = \frac{TE_{EL,i,x}}{P_{EL,i,x} \cdot D_{EL,i,x}} \times 10^6 \qquad (3)$$

Where:

$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometre for electricity-based vehicle category i in year x (gCO_2/PKM)
$TE_{EL,i,x}$	=	Total emissions from the electricity-based vehicle category i in year x (tCO_2)
$P_{EL,i,x}$	=	Total passengers transported per year by the electricity-based vehicle category i in year x (passengers)
$D_{ELI,xi}$	=	Average trip distance travelled by passengers using the electricity-based
x	=	vehicle category i in year x (km) Most recent calendar year for which data is available. Data not older than three years

The total emissions from the existing metro rail category i, $TE_{EL,i,y}$, is calculated, using the ‘Tool to calculate baseline, project and/or leakage emissions from electricity consumption’. When applying the tool, the parameter $EC_{BL,k,y}$ is taken as the amount of electricity used by the electricity-based vehicle category i for year y, consistent with the transportation of $PE_{L,i,y}$ passengers along the average distance $TD_{EL,i.}$

(2.2) For fuel-based vehicle categories identified above (bus/taxi/passenger car/Auto rickshaw/motorcycle), the emission factor per PKM is calculated as follows:

$$EF_{PKM,i,x} = \frac{EF_{KM,i,x}}{OC_{i,x}} \qquad \text{(4)}$$

Where:

$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometre of vehicle category i in year x (gCO_2/PKM)
$EF_{KM,i,x}$	=	Emission factor per kilometre of vehicle category i in year x (gCO_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

(2.2.1) Determination of the average occupancy rate (OC_i)

The average occupancy rate (OCi) of vehicle category i is determined based on occupancy studies for all vehicle categories i. For buses, besides the occupancy studies, the occupancy rate can also be based on boarding-alighting studies or electronic smart tickets, with expansion factors for routes served to determine the average occupancy rate along the entire route. For taxis, the driver should not be included.

Occupancy rate of taxis/motorcycles or passenger cars:

Load factor studies for taxis/motorcycles or passenger cars is carried out through occupancy as per Appendix 3 of ACM0016. The actual number of passengers excluding the driver of taxis is counted in a given point within a given time period.

The procedures to establish occupancy:

a) Locations, days and times for field study were defined, avoiding days immediately after or before a holiday.

b) Field data is collected. Coverage of the occupancy counts should be higher than 95% of the number of taxis that cross the checkpoint. One hundred per cent coverage is desired. To control this outcome, a separate vehicle count is advised. Data can be adjusted with the actual count

c) Occupancy is the number of passengers using the vehicle. The driver is not counted for taxis. Taxis without passengers were counted as no (zero) occupancy;

d) The total number of vehicles and the total number of passengers

was reported. The average occupancy rate of vehicles is the total number of passengers divided by the total number of vehicles in which counts were performed;

e) The study is realized in different locations of the larger urban zone of the city.

In the case of taxis and auto rickshaws, the driver is not included in the study.

The occupancy studies would be conducted as per the guidance provided under Appendices 1, 2 and 3 of the methodology.

Baseline emission estimated as per the above formulas, would determine the total emissions that would have occurred in the absence of the project activity, as a result of baseline trips made by the project passengers. Baseline emissions cover the entire emissions which would have been caused by the project passenger in absence of the project from his trip origin to his trip destination:

a) The origin and destination of the trip are assumed to be equal for the baseline as for the project case with an exception of induced traffic included only as project but not as baseline trips;
b) The trip distance and the modes used between O (origin) and D (destination) are however different in the baseline than in the project case;
c) The trip distance may vary as some passengers using the project MRTS may be willing to make detours due to the higher speed of the MRTS versus conventional bus transport.

To fully capture all the potential changes, the methodology compares emissions per O-D trip of the baseline with emissions per O-D trip of the project. The data to determine O-D mode(s) and distances per mode are derived from a representative survey of project passengers realized annually. Total baseline emissions are calculated thereafter annually based on these parameters, the emissions per pkm and the amount of passengers transported by the project.

(2.2.2) Determination of the emission factors per kilometre ($EF_{KM,i,x}$)

Differentiate relevant fuel types for each of the relevant road-based vehicle categories identified in Step 1. Vehicles in a vehicle category using diesel, gasoline, biofuel, biofuel blend, electricity or gas (compressed natural gas (CNG) or liquefied petroleum gas (LPG)) should be listed separately.

Estimating emission factor per kilometre based on the fraction of vehicles using a specific fuel type, the consumption of each fuel type and CO_2eq emissions per unit of fuel consumed:

$$EF_{KM,i,x} = \frac{\sum_{n}\left(SFC_{i,n,x} \cdot NCV_{i,n} \cdot EF_{CO2,n} + SECi,x.EFCO2,X\right)}{} .Ni,nx/\,Ni,x$$

_____(5)

Where,

	$EF_{KM,i,x}$	=	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)
	$NCV_{x,n}$	=	Net calorific value of fuel n used in vehicle category i (J/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)
	$N_{i,x}$		Number of vehicles – Kilometres of category i driven in year x (VKM) or number of vehicles of category i in year x (units)
	$N_{i,n,x}$	=	Number of vehicle – kilometres vehicle category i using fuel type n driven in year x (VKM) or number of vehicles in vehicle category i using fuel type n in year x (units)
	N	=	Fuel types used in 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 not older than three years.

Determining baseline emissions 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:

$$BE_y = \left(\sum_i (IR_i)^{t+y-1} \times EF_{PKM,i,x} \times D_i \times S_i \right) \times P_y \times 10^{-6} \quad \text{_____(6)}$$

Where:

BEy	=	Baseline emissions in year y (t CO_2eq)
R_i	=	Technology improvement factor[5] for vehicle category i per year (ratio)
Γ	=	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 project in case the tool is used to determine baseline emissions of project
$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometer for electricity-based or road-based vehicle category i in year x (g CO_2eq/PKM)
D_i	=	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i (km)
P_y	=	Number of passengers travelled by the project system in year y
S_i	=	Share of passengers who shifted from electricity-based or road- based vehicle category i (%)
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 The share of passengers Si (%) out of total number of passengers using the project system who have shifted from electricity-based or road-based vehicle categories i to the urban public system(s) established as CDM project activities as well as an average trip distance on each relevant vehicle category Di,y are determined from a survey of the project system by the project developers.(Note: in case of the development of a standardized baseline this parameter remains project specific and, therefore, project proponents, not DNAs, should collect these data). Surveys conducted in year 1st, 4th and 7th of the crediting period shall be used to determine: i. the entry and exit stations for each surveyed passenger to determine the average trip distance on each relevant vehicle category Di,y ii. the vehicle category from which each surveyed passenger had shifted to determine the share of passengers Si (%) out of total number of passengers using the project system who have shifted from each relevant vehicle category. 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 7th shall be used until the end of the crediting periods of the project activity. The survey was undertaken in the 1st, 4th and the 7th year, the survey was undertaken by the third party appointed by DMRC. The report of third party were verified and the survey methodology was also verified during the onsite assessment wherein the representative of third party were available. The total number of passengers shall be monitored annually, which when multiplied by the shares of passengers Si (%) who have shifted from electricity-based or road-based vehicle categories, respective trip distances on these vehicle categories Di,y and emission factors per passenger-kilometre $EF_{PKM,i,x}$ are used in equation (4) to calculate baseline emissions. The technology improvement factors provided in the tool is listed in the following table are applied: **Vehicle Category** / **Technology improvement factor (IR)** Buses / 0.99 Passenger cars / 0.99 Taxis / 0.99 Motorcycles (inc. Tricycles) / 0.99 For baseline scenario, PP has correctly identified the parameters and has provided the data (Passenger Survey sheets/08/, OC sheet/12/, Traffic survey sheet/09/). The same has been used and calculated correctly in the ER sheet. During the onsite visit and desk review, verification team

	has cross checked all the available data maintained by the PP on random basis.
Findings	No findings were raised.
Conclusion	The verification team confirms that the baseline of the project is in line with the approved methodology, UCR requirements and approved PCN.

(.a.v) Estimation of emission reductions or net anthropogenic removal

Means of Project Verification	In accordance with the applied methodology, the project owner has calculated emission reductions in the following manner:

$$ER_y = BE_y - PE_y - LE_y$$

Baseline emission calculations

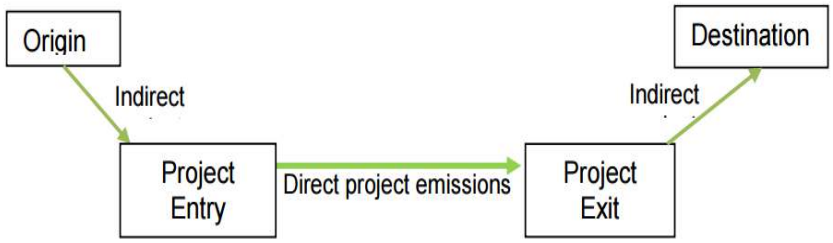
Baseline emission estimated as per the above formulas, would determine the total emissions that would have occurred in the absence of the project activity, as a result of baseline trips made by the project passengers. Baseline trips emissions are calculated based on the distance travelled by the passengers from their trip origin to trip destination and the mode of transport used to make the respective trip. The survey carried out for the purpose of determining the baseline trip distance and modes used, also covers the passenger those would not have made the trip in the absence of the project activity.

The origin and destination of the trip is assumed to be equal for the baseline as for the project case with exception of induced traffic included only as project but not as baseline trips. The trip distance and the modes used between O and D are however different in the baseline than in the project case. The trip distance may vary as some passengers using the project MRTS may be willing e.g. to make detours due to the higher speed of the MRTS versus conventional bus transport. To fully capture all potential changes the methodology thus compares emissions per O-D trip of the baseline with emissions per O-D trip of the project. The data to determine O-D mode(s) and distances per mode are derived from a representative survey of project passengers realized annually. Total baseline emissions are calculated thereafter annually based on these parameters, the emissions per PKM and the number of passengers transported by the project.

Year	Annual Passenger Flow	PSPER	Expanded baseline emission (gCO2e)	Baseline Emission (tCO_2e)
2013	37,78,69,718	10,53,692	1,46,66,85,591	5,25,975
2014	41,73,16,642	10,53,692	1,46,66,85,591	5,80,884
2015	43,18,13,922	10,53,692	1,46,66,85,591	6,01,063
2016	44,88,05,411	11,70,769	1,48,00,53,027	5,67,367
2017	42,98,61,254	11,70,769	1,48,00,53,027	5,43,418
2018	37,01,53,208	11,70,769	1,48,00,53,027	4,67,937
2019	36,85,00,577	10,71,324	1,40,78,57,948	4,84,257
2020	10,33,34,488	10,71,324	1,40,78,57,948	1,35,795
2021	14,36,43,596	10,71,324	1,40,78,57,948	1,88,766
2022	25,65,49,096	10,71,324	1,40,78,57,948	3,37,139

Project Emission calculations

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), as illustrated in Figure below.



Project emissions are calculated as follows:

$$PE_y = DPE_y + IPE_y \quad \text{(7)}$$

Where:

$PE_{,y}$, = Project emissions in the year y (tCO_2)
DPE_y = Direct project emissions in the year y (tCO_2)
IPE_y = Indirect project emissions in the year y (tCO_2)
y = Year of the crediting period

Determination of direct project emissions (DPEy)

Case 1: Use of fossil fuels in the project activity transport system (Not Applicable since Fuel consumption is not involved in the project activity).

Case 2: Use of electricity in the project activity transport system (Applicable). If the project activity involves electricity-based transport systems (e.g. electrical railway systems), the emissions from electricity consumption will be based on the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". The parameter $PE_{EC,y}$ in the tool corresponds to the direct project emissions from the project transport system in year y (DPEy). Only electricity consumed for train propulsion should be included in rail-based MRTS.

For calculation of direct project emissions which in this case is from the use of electricity in the project activity transport system, "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is to be used. The parameter $PE_{EC,y}$ in the tool corresponds to the direct project emissions from the project transport system in year y (DPEy). Only electricity consumed for train propulsion should be included in rail-based MRTS.

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad \text{(8)}$$

Where,

$PE_{EC,y}$ = Project emissions from electricity consumption in year y (tCO_2/yr)

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

$EF_{EL,j,y}$ = Emission factor for electricity generation for source j in year y (tCO_2/MWh)

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

j = Sources of electricity consumption in the project

Since electricity for train propulsion will be imported from grid, hence the baseline emission factor has been chosen in accordance with UCR guideline.

The combined emission factor for electricity consumption has been fixed ex ante as follows:

Grid	Unit	Value
Indian	tCO_2/MWh	0.9442

Traction Energy	Emission factor	TDL_y	DPEy
X	y	z	x*y*(1+z)

The traction energy will vary and depend on the estimated value from DPR or project feasibility report. Energy at high voltage will be received at Receiving Substation (RSS), internal transmission and distribution loss from RSS to Rolling stock would be recorded and measured.

In MRTS system, the Receiving Substation (RSS) supplies electricity to various lines of the MRTS system (both project and non-project lines). In the event, the RSS supplies dedicatedly to the project line, then the total reading of the meter for traction energy will be monitored and used for the calculation of direct project emissions.

In case the RSS supplies electricity to other lines of the MRTS system along with the project line, then the following formula will be used to calculate traction energy used by project line during the monitoring period:

$$TE_{CPA,y} = TE_{Total-RSS,y} * \frac{Car-km_{CPA-MRTS,y}}{Car-km_{RSS-Total,y}}$$

Where,

$TE_{CPA,y}$ = Traction energy consumed by project MRTS line in year y

$TE_{Total\text{-}RSS,\ y}$ = Total traction energy supplied by RSS in year y

$Car\text{-}km_{CPA\text{-}MRTS,y}$ = Total car-km of project MRTS line in year y

$Car\text{-}km_{RSS\text{-}Total,y}$ = Total car-km supplied traction energy by the RSS in year *y*

Year	Traction Energy (As per the	Emission factor in tCO_2/Mwh (As per UCR's Communication)	TDL	DPEy (Calculated)

	actual records)			
2013	1,70,115	0.9442	0.0095	1,62,148
2014	1,86,496	0.9442	0.0070	1,77,322
2015	1,90,956	0.9442	0.0085	1,81,833
2016	1,97,766	0.9442	0.0098	1,88,561
2017	1,97,352	0.9442	0.0084	1,87,905
2018	2,27,096	0.9442	0.0092	2,16,397
2019	2,25,709	0.9442	0.0090	2,15,032
2020	1,09,588	0.9442	0.0088	1,04,384
2021	1,47,227	0.9442	0.0088	1,40,235
2022	2,14,362	0.9442	0.0084	2,04,101

During the onsite visit to the Kashmere gate RSS, the verification team noted that the electricity provided by DISCOM at 66 kV level is metered. There is also a check meter at DMRC RSS at 66 kV level. The received electricity is passed through 2 transformer lines in parallel. One line steps down the electricity to 33 kV and the other line steps down the electricity to 25 kV. The 33 kV line is used for stations and the 25 kV line is used for traction. The RSS meters the energy in the 25 kV line. This 25 kV line is used for main line traction and traction at depots. The electricity consumption at depots is metered. The net energy used for main line traction is thus the difference of energy recorded at 25 kV line meter and the electricity consumed by the depot meters. This is the procedure adopted at all the RSS involved in the project activity. This derived value of main line traction energy is not directly utilized for estimation of emission reductions.

The data maintained at the RSS on hourly basis and the data provided to the verification team are monthly basis, The traction energy has been cross verified by the verification team and found to be consistent and to be in line with the applied methodology/05/ and approved PCN/01/.

Determination of indirect project emissions (IPE_y)

Indirect project emissions are those caused by passengers from their trip origin up to the project activity entry station, and from the project activity exit station up to the trip final destination. The survey realized identifies the origin, the project entry station, the project exit station and the final destination of the passenger and the modes used between the different points, e.g. bicycle from origin to project entry station and taxi from project exit station to final destination. The distances between origin and entry and between exit and destination are calculated based, e.g. on public transit routes, electronic maps and GPS, etc. The emission factors per passenger-kilometre used for indirect project emissions are identical to the baseline passenger-kilometre factors ($EF_{PKM,i,y}$).

The following steps would be followed to determine the indirect project emissions:

Step 1: A survey conducted, as per Appendix 4 of the Methodology ACM0016, to determine the trip distance per transport mode used to/from the project metro stations.

Step 2: Indirect project emissions for each surveyed passenger are calculated as per equation 10.

Step 3: Apply to each surveyed passenger an individual expansion factor in accordance with the survey sample design (as defined in Appendix 4 of the Methodology ACM0016) and summarize these to get the total indirect project emissions for the survey period (week). To get the annual (or monitoring period) indirect project emissions the indirect project emissions of the surveyed period (week) are calculated per passenger of the survey period (week) and multiplied with the total passengers transported per year (or period), as per equation 9 below.

Step 4: Apply the upper 95% confidence interval to the total indirect project emissions.

$$IPE_y = \frac{P_y}{P_{SPER}} \sum_p (IPE_{p,y} \times FEX_{p,y}) \times 10^{-6} \quad \text{(9)}$$

Where:
IPE_y = Indirect project emissions in the year y (g CO_2)
$IPE_{p,y}$ = Indirect project emissions per surveyed passenger p in the year y (g CO_2)
$FEX_{p,y}$ = Expansion factor for each surveyed passenger p surveyed in the year y (each surveyed passenger has a different expansion factor)
P_y = Total number of passengers in the year y
P_{SPER} = Number of passengers in the time period of the survey (1 week)
p = Surveyed passenger
y = Year of the crediting period

The indirect project emissions per surveyed passenger are calculated based on the transport mode used, the trip distance per mode and the emission factor per mode.

$$IPE_{p,y} = \sum_i IPTD_{p,i,y} \times EF_{pkm,i,y} \quad \text{(10)}$$

Where:

$IPE_{p,y}$ = Indirect project emissions per surveyed passenger p in the year y (g CO_2)
$IPTD_{,p,i,y}$ = Indirect project trip distance p per surveyed passenger using mode i in the year y (PKM)
$EF_{PKM,i,y}$ = Emission factor per passenger-kilometre of mode i in the year y (gCO_2/PKM)
i = Relevant vehicle category
p = Surveyed passenger
y = Year of the crediting period

Year	Annual Passenger Flow	PSPER	Expanded Project emission (gCO_2e)	Indirect project emission (tCO_2e)
2013	37,78,69,718	10,53,692	17,15,85,975	61,533
2014	41,73,16,642	10,53,692	17,15,85,975	67,957
2015	43,18,13,922	10,53,692	17,15,85,975	70,318
2016	44,88,05,411	11,70,769	18,55,91,235	71,145
2017	42,98,61,254	11,70,769	18,55,91,235	68,142
2018	37,01,53,208	11,70,769	18,55,91,235	58,677
2019	36,85,00,577	10,71,324	19,54,45,848	67,227
2020	10,33,34,488	10,71,324	19,54,45,848	18,852
2021	14,36,43,596	10,71,324	19,54,45,848	26,205
2022	25,65,49,096	10,71,324	19,54,45,848	46,803

Based on the surveyed passenger and the survey design the corresponding expansion factors are applied to calculate total indirect project emissions. Total indirect project emissions are determined based on the upper limit of the 95% confidence interval as results are based on a sample/survey. The same has been demonstrated in above include the following sources:

Emissions due to changes of the load factor of taxis and buses of the baseline transport system due to the project; ($LE_{LFB,y}$ and $LE_{LFT,y}$)
Emissions due to reduced congestion on affected roads, provoking higher average vehicle speed, plus a rebound effect; ($LE_{CON,y}$).
Upstream emissions of gaseous fuels ($LE_{UP,y)}$.

The impact on traffic (additional trips) induced by the new transport system is included as project emissions and thus is not part of leakage. This is addressed by including, as project emissions, the emissions from the trips of passengers who would not have travelled in the absence of the project.

The indirect project emissions is based on the Origin to Destination trip of the passenger. PP hired a third party survey analysis authority Probe Research & Social Development Pvt. Ltd. to do the passenger analysis survey, the survey sheet/08/, the survey was done as per the methodology requirements and sample survey questionnaire has been checked by the verification team, also the verification team has interviewed the survey party during the onsite visit and found to be in line with the applied methodology and approved PCN.

Leakage emissions are calculated as follows:

$$LE_y = LE_{LFB,y} + LE_{LFT,y} + LE_{Con,y} + LE_{UP,y}$$

_____ (11)

Where:

LE_y = Leakage emissions in the year y (tCO_2)

$LE_{LFB,y}$ = Leakage emissions due to change of load factor of buses in the year y (tCO_2)
$LE_{LFT,y}$ = Leakage emissions due to change of load factor of taxis in the year y (tCO_2)
$LE_{CON,y}$ = Leakage emissions due to change in congestion in the year y (tCO_2)
$LE_{UP,y}$ = Leakage emissions due to upstream emissions of gaseous fuels in year y (tCO_2)

As a conservative approach, it is assumed that for each components $LE_{LFB,y}$, $LE_{LFT,y}$, $LE_{CON,y}$, $LE_{UP,y}$ and $LE_{UP,y}$ only the positive value (leading to net emissions) is considered.

For ex ante calculation leakage is considered to be zero.

Determination of emissions due to change of load factor of buses ($LE_{LFB,y}$)

The project could have a negative impact on the load factor of the conventional bus fleet. Load factor changes are monitored for the entire city as the potential impact is not necessarily in the proximity of the project MRTS (buses can be used in other parts of the city). The load factor of buses is monitored in the years 1, 4, 7 and 10 of the crediting period, if fixed crediting period is chosen. Leakage from load factor change of buses is only included if the load factor of buses has decreased by more than 10 percentage points comparing the monitored value with the baseline value, and are calculated as:

$$LE_{LFB,y} = max\left\{\frac{1}{10^6} \times N_{B,y} \times AD_B \times EF_{km,B,y} \times \left(1 - \frac{OC_{B,y}}{OC_B}\right); 0\right\} \quad \text{(12)}$$

Where:
$LE_{LFB,y}$ = Leakage emissions due to change of load factor of buses in the year y (tCO_2)
$N_{B,y}$ = Number of baseline buses in the year y (buses)
AD_B = Average annual distance driven by baseline buses (km/bus)
$EF_{KM,B,y}$ = Emission factor per kilometre of baseline buses in the year y (gCO_2/km)
$OC_{B,y}$ = Average occupancy rate of baseline buses in the year y (passengers)
OC_B = Average occupancy rate of baseline buses prior project start (passengers)

For the purpose of determining the occupancy rate of buses, the study method of occupancy is chosen. The monitoring method will be used for the entire project monitoring period.

Determination of emissions due to change of load factor of taxis ($LE_{LFT,y}$)

The project could have a negative impact on the load factor of taxis. Taxis include cars as well as motorized rickshaws realizing taxi services. For both types of services, the load factor change is monitored separately. Load factor changes are monitored for the entire city as taxis operate all over the city and are not confined to deliver their services in certain areas. The load factor of taxis is monitored in the years 1, 4, 7 and 10 of the crediting period, as the fixed crediting period is chosen. This leakage is calculated as:

$$LE_{LFT,y} = max\left\{N_{T,y} \times AD_T \times EF_{km,T,y} \times \left(1 - \frac{OC_{T,y}}{OC_T}\right) \times \frac{1}{10^6}; 0\right\} \quad \text{(13)}$$

Where:

$LE_{LFT,y}$ = Leakage emissions due to change of load factor of taxis in the year y (tCO_2)
$N_{T,y}$ = Number of baseline taxis in the year y (taxis)
AD_T = Average annual distance driven per taxi (km/taxi)
$EF_{KM,T,y}$ = Emission factor per kilometre of taxis in the year y (g CO_2/km)
$OC_{T,y}$ = Average occupancy rate of taxis in the year y (passengers)
OC_T = Average baseline occupancy rate of taxis prior project start (passengers)
y = Year of the crediting period

The maximum load factor change attributed to taxis is the emission reductions due to passengers switching from taxis to the project (calculated by the emission factor per passenger-kilometre for taxis, the trip distance and the number of passengers transported by the project, which would have used taxis in absence of the project). This maximum condition is established as load factors might worsen citywide also due to factors external to the project and leakage from a load factor change taxis due to the project can at maximum be according to the number of passengers transported by the project who in absence of latter would have taken a taxi.

For the purpose of determining the occupancy rate of taxis, the study method of occupancy would be chosen. The monitoring method will be used for the entire project monitoring period.

The parameter emission factor per kilometre of baseline taxis in the year y ($EF_{KM,T,y}$) is calculated using the equation for $EF_{KM,i,y}$ presented in the tool "Baseline emissions for modal shift measures in urban passenger transport" section, substituting IEE for T (taxis).

Determination of emissions due to a change in load factor of motorized autorickshaws ($LE_{LFMR,y}$)

Similar to above, the determination of $LE_{LFMR,y}$ will also be determined in consideration of the same as a public mode of transport. The equation 13 will be used substituting 'T' (taxis) for 'MR' (motorised auto-rickshaws).

Determination of emissions due to reduced congestion ($LE_{CON,y}$)

The project activity may reduce the number of remaining buses and potentially other vehicles on roads used by mixed traffic and thus also congestion. It is not possible however to determine ex ante if this effect will result in positive leakage emissions (i.e. emissions increase) or negative leakage emissions (i.e. emissions reductions). Two effects resulting from reduced congestion are considered:

01. Induced traffic effect (or rebound effect), i.e. more trips of passenger cars on the affected roads.
02. Changes in vehicle speed effect, i.e. change of emissions due to reduced or increased speed of cars on affected roads.

In the case that 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 year 1 and 4 of the crediting period. In other cases (e.g. the project provides a new road infrastructure not taken from the existing road space in the city), monitoring of these changes is not required. This change in road capacity available for individual motorised transport modes may result from the reduction of road space due to the implementation of MRTS and/or a potential reduction of traffic flow due to the withdrawal of conventional public transport units as a result of the project activity.

To determine whether road capacity is reduced, the following procedure shall be applied:

Determination of the additional road capacity available to motorised transport modes

The following equation determines 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 MRTS is intended to reach its planned capacity:

$$ARS_y = \sum_y \frac{BSCR_y}{N_B} \times SRS - \frac{RS_{BL} - RS_{PJ}}{RS_{BL}} \quad (14)$$

Where:

ARS_y	=	Additional road capacity available to individual motorised transport modes in year y when the project MRTS is intended to reach its planned capacity (in percentage)
$BSCR_y$	=	Bus units retired as a result of the project in year y
N_B	=	Number of buses in use in year x
SRS	=	Share of road space used by public transport in the year x (in percentage)
RS_{BL}	=	Total road space available in year x (lane-kilometres)
RS_{PJ}	=	Total available road space in the project (= RSB minus kilometre of lanes that where reduced due to dedicating bus lanes to the project activity) (lane-kilometres)
x	=	Most recent calendar year for which data is available. Data not older than three years.

The following equation shall be used to determine SRS if no recent and good quality study is available which has calculated this parameter:

$$SRS = \frac{TD_B \times 2.5}{TD_B \times 2.5 + TD_T + TD_C} \quad (15)$$

Where:

SRS	=	Share of road space used by public transport in year x (in percentage)

	TD_B = Total distance driven by public transport buses in year x (kilometres) TD_T = Total distance driven in kilometres by taxis in year x (kilometres) TD_C = Total distance driven in by passenger cars in year x (kilometres) x = Most recent calendar year for which data is available. Data not older than three years. It is assumed that one bus occupies 2.5 times more road space than a personal car or a taxi. For all distance variables, the same vintage of data, the same spatial scope and the same time-span (e.g., one month or one year) is required. If ARS_y is negative, leakage emissions due to increased congestion, as a result of the reduced road capacity due to the project activity, shall be quantified as per the calculation of $LE_{CON,Y}$. If ARS_y is positive, $LE_{CON,y}$ is assumed to be zero. The project activity is applicable to rail-based MRTS, the implementation of which has no effect on the road capacity of the urban zone. Apart from that as a result of implementation of the MRTS, few number of bus units are to be retired in the route of the MRTS. Thus, $BSCR_y$ is positive, hence ARS_y is positive. Thus $LE_{CON,y}$ is assumed to be zero. The leakage calculation has been accepted by the verification team and found to be in line with the applied methodology/05/ **Emission Reductions**

Year	Baseline emissions (t CO_{2e})	Project emissions (t CO_{2e})	Leakage (t CO_{2e})	Emission reductions (t CO_{2e})
2013	5,25,975	2,23,682	0	3,02,294
2014	5,80,884	2,45,279	0	3,35,604
2015	6,01,063	2,52,151	0	3,48,912
2016	5,67,367	2,59,706	0	3,07,661
2017	5,43,418	2,56,047	0	2,87,371
2018	4,67,937	2,75,074	0	1,92,863
2019	4,84,257	2,82,259	0	2,01,998
2020	1,35,795	1,23,235	0	12,560
2021	1,88,766	1,66,441	0	22,326
2022	3,37,139	2,50,904	0	86,235
Total number of crediting years			10	
Total	**44,32,602**	**23,34,777**	**0**	**20,97,824**

Findings	No findings were raised.
Conclusion	The verification team confirms that the baseline of the project is in line with the approved methodology, UCR requirements and approved PCN.

(.a.vi) Monitoring Report

<table>
<tr><td>Means of Project Verification</td><td>The monitoring contains the following parameters as required:

<table>
<tr><th>S. No.</th><th>Parameter</th><th>Description</th></tr>
<tr><td>1.</td><td>$TE_{EL,i,y}$

Total emissions from the electricity based rail system in year y</td><td>The emissions from the electricity based rail system has been calculated in the ER sheet/03/ as per the CDM tool “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”

<table>
<tr><th>Year</th><th>tCO_{2eq}</th></tr>
<tr><td>2013</td><td>1,62,148</td></tr>
<tr><td>2014</td><td>1,77,322</td></tr>
<tr><td>2015</td><td>1,81,833</td></tr>
<tr><td>2016</td><td>1,88,561</td></tr>
<tr><td>2017</td><td>1,87,905</td></tr>
<tr><td>2018</td><td>2,16,397</td></tr>
<tr><td>2019</td><td>2,15,032</td></tr>
<tr><td>2020</td><td>1,04,384</td></tr>
<tr><td>2021</td><td>1,40,235</td></tr>
<tr><td>2022</td><td>2,04,101</td></tr>
</table>

The verification team has checked the ER sheet and tool and confirms that the emissions has been calculated correctly.</td></tr>
<tr><td>2.</td><td>$EC_{pj,\ y}$

Electricity consumed by project activity vehicles</td><td>The electricity consumed by the project activity has been measured at DMRC RSS and maintained by the operations and maintenance wing.

<table>
<tr><th>Year</th><th>Traction Energy</th></tr>
<tr><td>2013</td><td>1,70,115</td></tr>
<tr><td>2014</td><td>1,86,496</td></tr>
<tr><td>2015</td><td>1,90,956</td></tr>
<tr><td>2016</td><td>1,97,766</td></tr>
<tr><td>2017</td><td>1,97,352</td></tr>
<tr><td>2018</td><td>2,27,096</td></tr>
<tr><td>2019</td><td>2,25,709</td></tr>
<tr><td>2020</td><td>1,09,588</td></tr>
<tr><td>2021</td><td>1,47,227</td></tr>
<tr><td>2022</td><td>2,14,362</td></tr>
</table>

The data provided by PP are cross checked against the logbook records maintained at RSS during the onsite visit. The meters used for calibrated according to the meter technical details. Calibration details has been added as Annex 1. Calibration</td></tr>
</table>
</td></tr>
</table>

			certificates/13/ has been checked by the verification team and confirms that the meters are calibrated.
	3.	**TDL_y** Average technical transmission and distribution losses for Delhi	The transmission and distribution losses for the DMRC has been sourced from State Load Despatch Centre, Delhi. **Year** / **TDL** 2013 / 0.95% 2014 / 0.70% 2015 / 0.85% 2016 / 0.98% 2017 / 0.84% 2018 / 0.92% 2019 / 0.90% 2020 / 0.88% 2021 / 0.88% 2022 / 0.84% The data has been publicly available/11/ and checked by the verification team. The parameter has been correctly calculated in the ER sheet/03/.
	4.	**$TE_{Total\text{-}RSS, y}$** Total traction energy recorded at RSS level	The Total traction energy by the project activity has been measured at DMRC RSS and maintained by the operations and maintenance wing. **Year** / **Traction Energy recorded at RSS level** 2013 / 213,082 2014 / 232,378 2015 / 238,194 2016 / 249,423 2017 / 250,800 2018 / 283,006 2019 / 281,916 2020 / 141,875 2021 / 252,334 2022 / 267,386 The data provided by PP are cross checked against the logbook records maintained at RSS during the onsite visit. The meters used for calibrated according to the meter technical details. Calibration details has been added as Annex 1. Calibration

			certificates/13/ has been checked by the verification team and confirms that the meters are calibrated.
	5.	**Car-km$_{CPA-MRTS,y}$** Car-km of CPA (Phase 1) MRTS lie in year y	The data for Car-km of phase-1 are maintained by the Operations Control Center (OCC). **Values applied: 915,854,170 km** The data for Car-km has been provided by PP and that has been cross checked by the verification team during the onsite visit. The values provided are correctly used for calculation in the ER sheet/03/.
	6.	**Car-km$_{RSS-Total,y}$** Total car-km supplied traction energy by the RSS	The data for total Car-km of supplied traction energy by the RSS are maintained by the Operations Control Center (OCC). **Values applied: 1,784,820,127 km** The data for Car-km has been provided by PP and that has been cross checked by the verification team during the onsite visit. The values provided are correctly used for calculation in the ER sheet/03/.
	7.	**NCV$_{g,d,y}$** Net calorific value of gasoline and diesel in year y	The calorific value for Diesel and gasoline has been taken from IPCC guidelines. **Values applied:** **Diesel - 43** **Gasoline (petrol) - 44.3** The verification team has checked the ER sheet/03/ and the IPCC guidelines and confirms that the parameter has been taken and used for ER calculations.
	8.	**NCV$_{cng,y}$** Net calorific value of CNG in year y	The calorific value of CNG has been taken from IPCC guidelines. **Values applied: 39.2** The verification team has checked the ER sheet/03/ and the IPCC database and confirms that the parameter has been taken and used for ER calculations.
	9.	**EF$_{CO2,g,d,cng,y}$** CO_2 emission factor for gasoline,	The CO2 emission factor for gasoline, diesel and CNG has been taken from IPCC default values. **Values applied:**

		diesel and CNG in year y	**For baseline estimations:** **Gasoline: 67.5** **Diesel: 72.6** **CNG: 54.3** **For project emissions estimations:** **Gasoline: 73** **Diesel: 74.80** **CNG: 58.30** The lower limit has been taken for the baseline emissions and upper limit for the project emissions has been taken into account by the PP to maintain the conservativeness nature. The same has been checked by verification team and the values used are correctly used for ER calculations.
	10.	**$OC_{B,y}$/$OC_{T,y}$ /$OC_{MR,y}$** Average occupation rate of vehicle category *i* in year *y*. In particular, B stands for buses, and T for taxis	The average occupation rate of vehicle category has been taken by the Survey reports done by the PP. **OC** / **2013** / **2016** / **2019** Car Petrol: 2.8 / 2.8 / 2.9 Taxi: 3.5 / 3.5 / 3.6 Bus: 41.2 / 40.1 / 41.7 Auto: 2.8 / 2.8 / 2.8 2W: 1.5 / 1.6 / 1.5 The verification team has checked the survey reports/08/ and questionnaires/10/ and found to be correctly used in the ER calculations.
	11.	**P_y** Total passengers transported by the project activity transport system	The data for total passengers transported are being maintained by the OCC and report is generated daily at the end of the day. 2013: 37,78,69,718 2014: 41,73,16,642 2015: 43,18,13,922 2016: 44,88,05,411 2017: 42,98,61,254 2018: 37,01,53,208 2019: 36,85,00,577 2020: 10,33,34,488 2021: 14,36,43,596 2022: 25,65,49,096 The Automatic Fare Collection (AFC) System tracks the entry of each

			passenger through smart unique ID. The report by the AFC system has been maintained by the OCC that contains the number of passengers using the project vehicle. The same has been checked by the verification team during the onsite visit. The verification team has checked the AFCs during the station visit. The parameter has been correctly mentioned and used in the ER sheet for ER calculations.
	12.	**$N_{i,y}$/ $N_{B,y}$/$N_{T,y}$/$N_{MR,Y}$** Number of vehicles of vehicle category i circulating in the larger urban zone of the city. In particular B stands for buses, and T for taxis, MR for motorised auto-rickshaw, etc.	The number of vehicles in the city are sourced from publicly available data of Vahan Sewa Dashboard. **Values applied:** **No. of buses: 8,659** **No. of taxis: 50,274** **No. of Auto Rickshaws: 88,322** The data has been checked by the verification team and confirms that the parameter has been used correctly for ER calculations.
	13.	**Di** Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i	The average trip distance travelled by passengers are calculated according to the survey conducted by the PP. **Values applied: 17.94** The values has been checked by the survey reports/08/ provided by verification team and correctly used for ER calculations in the ER sheet/03/.
	14.	**Si** Share of passengers who shifted from electricity- based or road-based vehicle category i	The share (%) of passengers has been calculated using the Di which has been done by the survey conducted by the PP.
	15.	**$P_{EL,i,,y}$** Total passengers transported by baseline rail-system per year in the year *y*	The total passengers transported by baseline rail system has been taken from DMRC and Indian railways annual statistical statement. **Values applied: For sub-rail 15,56,060** The values are has been correctly mentioned and used for ER calculations.

	The monitoring report and parameters are found to be in line with the approved PCN and methodology applied.
Findings	CL 03 and CAR 01 were raised and closed successfully.
Conclusion	The verification team confirms that the calculations are in line with the methodology and done correctly.

Start date, crediting period and duration

Means of Project Verification	The project has a fixed crediting period of 10 years. The start date of the project is 01/01/2013 and end date is 31/12/2022. This has been verified by the verification team during the desk review process and during the onsite visit.
Findings	No findings were raised.
Conclusion	The verification team confirms that the project start date is in accordance with UCR requirements and approved PCN.

Positive Environmental impacts

Means of Project Verification	The project has multiple environment benefits as it replaces the partial grid electricity which avoids the equivalent emissions that have been generated. The project contributes to environmental improvement as it reduces the pollution levels in the city by using electricity instead of fossil fuels.
Findings	No findings were raised
Conclusion	The verification team confirms that the project has environmental benefits.

Project Owner- Identification and communication

Means of Project Verification	Delhi Metro Rail Corporation Limited has been identified as the project owner and all the communication with the UCR has been done by DMRC. This is been verified through the mail communication with the UCR.
Findings	No findings were raised.
Conclusion	The verification team confirms that project owner is as per UCR requirements.

Positive Social Impact

Means of Project Verification	The project has multiple social benefits as it is safe and efficient mode of transportation to ensure social wellbeing of the region. Metro reduces the travel time and helps on eliminating traffic congestions. It reduces the exposure of commuters to various gaseous and particulate matter pollutants.
Findings	No findings were raised.
Conclusion	The verification team confirms that the project has social benefits.

Sustainable development aspects (if any)

Means of Project Verification	NA
Findings	NA
Conclusion	NA

Internal quality control

>>
The draft and final verification report prepared by team leader is reviewed by an independent technical reviewer (having competence of relevant technical area himself/herself or through an independent technical area expert) to confirm the internal procedures established by KBS are duly followed and the verification report/opinion is reached in an objective manner and complies with the applicable UCR requirements.

The independent technical reviewer may approve or reject the draft verification report. The findings may be identified even at this stage, which needs to be satisfactorily resolved, before the request for issuance is submitted to UCR. The final decision is taken by the Manager Technical and Certification. The technical reviewer and Manager (Technical & Certification) can be the same person.

The final decision is authorized by Managing Director, KBS once the report is approved by the Manager (Technical & Certification).

Project Verification opinion

KBS Certification Services Ltd. has been contracted by “Delhi Metro Rail Corporation Limited (DMRC)” to undertake independent verification and certification for the greenhouse gas (GHG) emission reductions reported from the UCR Project activity “Delhi Metro, India” and UCR Reference Number 0373 for the monitoring period 01/01/2013 – 31/12/2022 (including both days) in the Monitoring Report Version 2.

The verification is based on the approved PCN and the monitoring report for this project. Our verification approach was based on the requirements as defined under the UCR Project Verification Standard.

The management of the DMRC is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Final Monitoring Report. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of the DMRC. The development and maintenance of records and reporting procedures are in accordance with the Monitoring Report.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the monitoring period 01/01/2013 – 31/12/2022 (including both days) based on the reported emission reductions in the Final Monitoring Report Version 2.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated. KBS confirms the following;

Verified and certified emission reductions reporting period: 01/01/2013 – 31/12/2022 including both days)

	Amount	Unit
Baseline emissions (BEy)	44,32,602	tCO2e
Project emissions (PEy)	23,34,777	tCO2e
Leakage emissions (LEy)	0	tCO2e
Emission reductions (ERs)	**20,97,824**	**tCO2e**

Abbreviations

Abbreviations	Full texts
UCR	Universal Carbon Registry
COUs	Carbon Offset Units
CDM	Clean Development Mechanism
GHG	Green House Gases
PCN	Project Concept Note
UNFCCC	United Nation Framework for Climate Change Convection
CERs	Certified Emission Reductions
DMRC	Delhi Metro Rail Corporation Limited
tCO2e	Tonnes of Carbon dioxide equivalent
RSS	Receiving Substation
OCC	Operation Control Center
AFC	Automatic Fare Collection
CNG	Compressed Natural Gas
LPG	Liquefied Petroleum Gas
PoA	Programme of Activities

Competence of team members and technical reviewers

>>

Personnel Name	Sanjay Kandari				
Schemes	☒ CDM	☒ GCC	☒ GS	☒ VCS	☒ Other GHG Schemes (UCR)
Qualified to work as					
Team Leader	☒	Technical Expert	☒		
Validator/Verifier	☒	Financial Expert	☒		
Technical Reviewer	☒	Local Expert	☒		
Area(s) of Technical Expertise					
Sectoral Scope		**Technical Area**			
SS 1: Energy industries (renewable/non-renewable sources)		TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar -			

	TA 1.2: Energy generation from renewable energy sources
SS 2: Energy distribution	TA 2.1. Energy distribution
SS 3: Energy demand	TA 3.1. Energy Demand
SS 13: Waste Handling and Disposal	TA 13.1 Waste Handling and Disposal
	TA 13.2 Manure
Approved by (Manager Competence & Training)	Manager C & T
Approval date	05-12-2020

Personnel Name	Atul Sanghal				
Schemes	☒ CDM	☒ GCC	☒ GS	☒ VCS	☒Other GHG Schemes (UCR)
Qualified to work as					
Team Leader	☐	Technical Expert	☒		
Validator/Verifier	☐	Financial Expert	☐		
Technical Reviewer	☐	Local Expert	☐		
Area(s) of Technical Expertise					
Sectoral Scope		**Technical Area**			
SS 7: Transport		TA: 7.1: Transport			
Approved by (Manager Competence & Training)		Shikha Sharma			
Approval date		27-10-2022			

Personnel Name:		Rishabh Madan	
Qualified to work as:			
Team Leader	☐	Technical Expert	☐
Validator/Verifier (trainee)	☒	Financial Expert	☐
Technical Reviewer	☐	Local Expert	☐
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
-		-	
Approved by (Manager C & T)		Shikha Sharma	
Approval date:		11/01/2023	

Personnel Name	Ravi Kumar Prabhu				
Schemes	☒ CDM	☒ GCC	☒ GS	☒ VCS	☒Other GHG Schemes (UCR)
Qualified to work as					
Team Leader	☒	Technical Expert	☒		

Validator/Verifier	☐	Financial Expert	☐
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope		**Technical Area**	
SS: 01: Energy industries (renewable/non-renewable sources)		TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar	
		TA 1.2: Energy generation from renewable energy sources	
SS 5: Chemical industry		TA 5.1 Chemical industry	
SS 12: Solvents use		TA 12.1 Chemical industry	
SS 13: Waste handling and disposal		TA 13.1. Waste handling and disposal	
Approved by (Manager Competence & Training)		Shikha Sharma	
Approval date		06-08-2022	

Personnel Name	Harshit Srivastava				
Schemes	☒ CDM	☒ GCC	☒ GS	☒ VCS	☒Other GHG Schemes (UCR)
Qualified to work as					
Team Leader	☐	Technical Expert	☒		
Validator/Verifier	☐	Financial Expert	☐		
Technical Reviewer	☐	Local Expert	☐		
Area(s) of Technical Expertise					
Sectoral Scope		**Technical Area**			
SS 7: Transport		TA: 7.1: Transport			
Approved by (Manager Competence & Training)		Shikha Sharma			
Approval date		18-07-2022			

Document reviewed or referenced

No.	Author	Title	References to the document	Provider
1	Project Proponent	Final Project Concept Note version 2.0	Project Concept Note v2.0 dt.29/12/2023	PP
2	Project Proponent	Monitoring report version 2.0	Monitoring report v2.0 dt. 29/12/2023	PP
3	Project Proponent	ER spreadsheet	ER sheet	PP
4	UCR	UCR Program Standard Ver 6.0 UCR Verification Standard Ver2.0 UCR Program manual Version 4.0	https://www.ucarbonregistry.io/Document?projectCategoryId=1	UCR

5	UNFCCC	CDM methodology ACM0016 “Mass Rapid Transit Projects”, Version 04	https://cdm.unfccc.int/methodologies/DB/PPZC6A7B2DFBT0MC46OK0AROF64FKE	UNFCCC
6	RITES Ltd.	Detailed Project reports	Detailed Project Report DMRC dt. May 1995, Jan 1999, March 2003, May 2003 and December 2003	PP
7	Project Proponent	Car-km and Traction sheet	-	PP
8	Project Proponent	Passenger Survey sheet	-	PP
9	Futuristic Engineers and Traffic Surveyors (FETS)	Traffic Survey sheet	-	PP
10	Probe Research & Social Development Pvt. Ltd.	Survey Questionnaire	-	PRSD
11	State Load Despatch Center, Delhi	Transmission & Distribution Loss	https://www.delhisldc.org/OaTxLossesyear.aspx	SLDC
12	Project Proponent	OC sheet	-	PP
13	Techcom systems	Calibration Certificates	Refer Annex 1	PP
14	Delhi Metro Rail Corporation Limited	Metro Map	https://www.delhimetrorail.com/map	DMRC
15	UNFCCC	CDM PoA 9863 CPA001: Delhi Metro under MRTS PoA	https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/BUIO4TKZRN6YGF7A10J5SVDPL2CMH3/view	UNFCCC

Clarification request, corrective action request and forward action request

Table 1. CLs from this Project Verification

CL ID	01	**Section no.**	UCR Communications	**Date:** 27/12/2023
Description of CL				
PP shall provide the updated PCN and corresponding ER spreadsheet after correcting the emission factor and adding the commissioning dates of respective corridors as per the communication between PP and UCR registry during the project’s approval.				
Project Owner’s response				**Date:** 29/12/2023
PCN and ER Spreadsheet updated as per the communication received from UCR.				
Documentation provided by Project Owner				
PCN v2.0 dated 29/12/2023 and Updated ER Sheet.				
UCR Project Verifier assessment				**Date:** 02/01/2024
The verification team has assessed the updated PCN and ER sheet. The emission factor and commissioning dates has been updated according to the UCR communications. Hence the CL01 is closed.				

CL ID	02	**Section no.**	ER sheet	**Date:** 27/12/2023
Description of CL				
During the onsite assessment, the verification team has observed that there were inconsistency in “Car Km” Line 2 value in the month of June 2015. PO shall clarify about the inconsistency in the value.				
Project Owner’s response				**Date:** 29/12/2023

Inconsistency in Car KM sheet has been rectified.
Documentation provided by Project Owner
Updated Car KM Sheet for the year 2013-2017 and 2018-2022.
UCR Project Verifier assessment **Date:** 02/01/2024
The verification team has assessed the Car Km sheet and ER sheet. The value has been rectified. Hence, CL02 is closed.

CL ID	03	**Section no.**	C.10	**Date:** 27/12/2023
Description of CL				
PP has not provided Traction energy sheet, PSPER data sheet, Survey analysis sheet and OC data sheet on sample basis. PP shall provide the same.				
Project Owner's response				**Date:** 29/12/2023
PP has provided Traction energy sheet, PSPER data sheet, Survey analysis sheet and OC data sheet on sample basis.				
Documentation provided by Project Owner				
Traction energy sheet, PSPER data sheet, Survey analysis sheet and OC data sheet.				
UCR Project Verifier assessment				**Date:** 02/01/2024
The verification team has checked the Traction energy sheet, PSPER data sheet, Survey analysis sheet and OC data sheet. The values provided in the ER sheet are consistent to the available data. Hence, CL03 is closed.				

Table 2. CARs from this Project Verification

CAR ID	01	**Section no.**	C.10	**Date:** 27/12/2023
Description of CAR				
The link for publicly sourced data parameters is not provided in the MR. PO shall include the same, for the transparency.				
Project Owner's response				**Date:** 29/12/2023
Link provided for Data and Parameter - No. of vehicles in Section C.10 of the Monitoring Report v2.0 dated 29/12/2023.				
Documentation provided by Project Owner				
Monitoring Report v2.0 dated 29/12/2023.				
UCR Project Verifier assessment				**Date:** 02/01/2024
PP has provided the link for the parameters in updated MR and ER sheet. Hence, CAR01 is closed.				

CAR ID	02	**Section no.**	ER sheet	**Date:** 27/12/2023
Description of CAR				
PP shall use ROUNDOWN/Roundup function in the ER sheet for conservativeness in the parameters for baseline and project emissions.				
Project Owner's response				**Date:** 29/12/2023
Roundup function applied in the Car KM Sheet and ER Sheet.				
Documentation provided by Project Owner				
Updated Car KM Sheet for the year 2013-2017 and 2018-2022 and Updated ER Sheet.				
UCR Project Verifier assessment				**Date:** 02/01/2024
PP has applied Roundup function in the ER sheet. Hence, CAR02 is closed.				

~~Table 3. FARs from this Project Verification~~

~~**FAR ID**~~	~~xx~~	~~**Section no.**~~		~~**Date:** DD/MM/YYYY~~
~~**Description of FAR**~~				

~~Project Owner's response~~	**~~Date:~~** ~~DD/MM/YYYY~~
~~Documentation provided by Project Owner~~	
~~UCR Project Verifier assessment~~	**~~Date:~~** ~~DD/MM/YYYY~~

Annexure-1

Calibration details of Energy Meters installed at Kashmere Gate RSS

Period	S. No. of energy meter	Make of energy meter	Date of calibration	Date of calibration according to the date of calibration	Due date of calibration according to the approved PCN
2012	215622	Satec	30/05/2012	29/05/2013	29/05/2014
2012	834614	Satec	30/05/2012	29/05/2013	29/05/2014
2013	215622	Satec	14/05/2013	14/05/2014	14/05/2015
2013	834614	Satec	14/05/2013	14/05/2014	14/05/2015
2014	215622	Satec	14/05/2014	14/05/2015	14/05/2016
2014	834614	Satec	14/05/2014	14/05/2015	14/05/2016
2015	215622	Satec	10/06/2015	09/06/2016	09/06/2017
2015	834614	Satec	10/06/2015	09/06/2016	09/06/2017
2016	215622	Satec	07/09/2016	06/09/2017	06/09/2018
2016	834614	Satec	01/09/2016	31/08/2017	31/08/2018
2017	215622	Satec	09/08/2017	08/08/2018	08/08/2019
2017	834614	Satec	09/08/2017	08/08/2018	08/08/2019
2019	215622	Satec	22/02/2019	21/02/2020	21/02/2021
2019	834614	Satec	22/02/2019	21/02/2020	21/02/2021
2020	215622	Satec	14/09/2020	13/09/2021	13/09/2022
2020	834614	Satec	15/09/2020	14/09/2021	14/09/2022
2022	215622	Satec	26/04/2022	26/04/2023	26/04/2024
2022	834614	Satec	11/05/2022	11/05/2023	11/05/2024

Note: The calibration frequency according to approved PCN and monitoring plan is once in 2 years. However, PP had undertaken it more frequent. Verification team has checked the calibration certificates during the on-site assessment and confirm that the calibrations are more frequent than the required frequency i.e. once in two years.