Monitoring report form for CDM project activity
(Version 06.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	Cable Cars Metro Medellin, Colombia	
UNFCCC reference number of the project activity	3224	
Version number of the PDD applicable to this monitoring report	1.4	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	25/10/2017	
Monitoring period number	2nd monitoring period	
Duration of this monitoring period	01/05/2012 – 25/04/2017	
Monitoring report number for this monitoring report	1.0	
Project participants	Empresa de Transporte Masivo del Valle de Aburra Ltda. (ETMVA) Centro Nacional de Produccion Mas Limpia y Tecnologias Ambientales Grütter Consulting AG	
Host Party	Colombia	
Sectoral scopes	07: Transport	
Applied methodologies and standardized baselines	"Cable Cars for Mass Rapid Transit System (MRTS)" AMS-III.U Version 1.0	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	5,839	45,982
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	96,823 (sum of 2013, 2014, 2015 and 2016 plus 8/12 from 2012 plus for 2017 based on 2016/365*115; all based on registered PDD)	

SECTION A. Description of project activity

A.1. General description of project activity

The project is the construction and operation of six cable cars in the city of Medellin, Colombia. All lines are operated by "Empresa de Transporte Masivo del Valle de Aburra Ltda. (ETMVA)". They are used as mass transit options in hilly areas of the city. The cable cars are an integral part of the metro system of Medellin with a pre-pay fare system and seamless transfer to the metro.

The baseline transport mode of cable car passengers is basically small and medium buses, cars and taxis. The cable car substitutes partially these conventional transport modes. Seamless transfer to the Metro allows for hassle free and lower cost travel. The cable car has per passenger-kilometer lower emissions than baseline modes of transit thus reducing GHG emissions.

The same technology is used for all cable cars. The cable car is operated by electricity using mono-cabins with a seating capacity of 8 persons and a maximum capacity of 10 persons.

Table 1: Core Technical Features

Item	Line K	Line J
Number of cabins	90	119
Slope length	2,072 m	2,700 m
Vertical rise	399 m	309 m
Hourly capacity per direction	3,000 p/h	3,000 p/h
Line speed	5 m/s	5 m/s
Maximum frequency	12 s	12 s
Travel time	7 min	9 min
Number of stations	4	4

Source: PDD Table 1

As of April 2012, the cable car lines J, K and L are implemented and fully operational. The cable car L has not been included in this Monitoring Report and no emission reductions are claimed for this line. The reason is that the passenger numbers on this line are too low to warrant the considerable additional monitoring costs associated with each cable car line. This is a conservative approach as no emission reductions are claimed. Line H and M have been constructed with Line H being operational since 17/12/2016. However, no monitoring has taken place of these lines and they have not been included in the report.

Table 2: Infrastructure Completed by the Project

Line	Distance	Completion date
Line K	2,1 km	2004
Line J	2.7 km	2008

Source: Table 2 Monitoring Report 1[1]

As mentioned the Line L with 4.5 km distance has been finished but has not been included in the monitoring report. The following table shows the relevant dates for the project activity.

Table 3: Relevant Dates of the Project Activity

Date	Action
11/04/2003	Construction Start Line K
07/08/2004	Operational start Line K
11/10/2006	Construction start Line J
03/03/2008	Operational start Line J
26/04/2010	Registration date of CDM project

Source: Table 2 Monitoring Report 1[2]

[1] https://cdm.unfccc.int/filestorage/W/8/U/W8UK93EAMTD6VYGIZ4PN5X2QSBRF7O/MR%201.0%20Jun8-12?t=NUd8b3c4NGFifDDGcBjr_6e05pp2jQYhtE1-

The project operated continuously during the entire crediting period.

The GHG emission reductions achieved in this monitoring period is 51,821 tCO_2.

A.2. Location of project activity

Host country

Colombia

Region/State/Province

Departamento de Antioquia

City/Town/Community

Metropolitan Area of Medellin

Physical/Geographical location

The spatial extent of the project boundary is the geographical area of trips of passengers using the cable car lines i.e. the metropolitan area of the city of Medellin in total.

The project geographical location is the city of Medellin. The geographical coordinates of Medellin are 6°14′9.33″N - 75°34′30.49″W.

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host)	Empresa de Transporte Masivo del Valle de Aburrá Ltda. (ETMVA)	No
Colombia (host)	Centro Nacional de Produccion Mas Limpia y Tecnologias Ambientales	No
Switzerland	Grütter Consulting AG	No

A.4. Reference to applied methodologies and standardized baselines

Cable Cars for Mass Rapid Transit System (MRTS)" AMS.III.U Version 1.0

"Tool to calculate the emission factor for an electricity system" Version 01.1.

A.5. Crediting period type and duration

Crediting period: 7 years renewable; starting date 26/04/2010
Crediting period corresponding to this monitoring period: 26/04/2010 to 25/04/2017

[2] https://cdm.unfccc.int/filestorage/W/8/U/W8UK93EAMTD6VYGIZ4PN5X2QSBRF7O/MR%201.0%20Jun8-12?t=NUd8b3c4NGFifDDGcBjr_6e05pp2jQYhtE1-

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

Lines J, K and L (defined in the PDD as line Arví) have been implemented and are fully operational. The same lines as listed in the PDD have been implemented. Line L is not included in the MR.

The cable car Line K has as stations Santo Domingo, Popular, Andalucia, and Acevedo, where it connects with the Metro. The cable car Line J has as stations La Aurora, Vallejuelos, Juan XXIII and San Javier, where it connects with the Metro.

The cable car technology was acquired from the French firm Pomagalski. The detachable grip monocable ropeway system allows cabin speed in the terminals to be limited to minimum values, in order that loading and unloading of passengers is easy and also accessible to disabled persons. Besides the main electric drive, the ropeway has provision for an auxiliary diesel drive which allows the passenger ropeway system to be operated at a low speed in emergency situations by way of independent hydrostatic transmission. As an alternative to this rescue drive, there is yet another (backup drive) also by hydrostatic transmission, which operates directly on the drive bull wheel. In a situation of irrecoverable failure, the cabins are transported by return to the stations by means of the rescue drives referred to above. In the very unlikely event of the haul rope not being able to function at all, the passengers will be evacuated by specialized rescue staff of ETMVA, resorting to vertical rescue equipment.

The PDD mentions three additional lines to be built one of which is operational since 17/12/2016 (Line H) and the others are under construction or with funding structured to start construction. They have not been monitored and no results are included in this report.

The project activity involves technology transfer. The cable car technology is an environmentally sound technology new for Colombia. Equipment is partially from France. Contracts include training of local staff in maintenance and operation of the system thus assuring technology and know-how transfer[3].

No special events influencing CER calculations have been registered during the monitoring period. The project was fully operational all the time except for maintenance of cable cars.

No event occurred during the monitoring period, which impacts the applicability of the methodology.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

No temporary deviations have been applied during this monitoring period.

B.2.2. Corrections

No corrections to project information or parameters fixed at validation have been approved during this monitoring period or have been submitted with this monitoring report

B.2.3. Changes to the start date of the crediting period

No changes to the start date of the crediting period have been approved during this monitoring period or have been submitted with this monitoring report.

B.2.4. Inclusion of monitoring plan

Not applicable.

[3] See Files 23a/b

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

A permanent change from the registered monitoring plan and the methodology in accordance with paragraph 262 of the VVS has been made and was approved by the EB with reference PRC-3224-01 as of 27/07/2013 (with the 1st monitoring report).

The change is that instead of electronic smart cards or turnpikes the project is counting the passengers not with an electronic or mechanical device when riding uphill i.e. changing from the metro to the cable-car. When going downhill the passengers pass a turnpike in accordance with the methodology. However, when going uphill and coming from the metro to use thereafter the cable car passengers do not pass turnpikes. The approach used is to count all passengers using the cable car uphill during a standard week and relating the uphill to the downhill passengers for this standard week. The expansion factor for both lines was established in the 1st monitoring report.

B.2.6. Changes to project design

No changes to the project design of the project activity have been approved during this monitoring period or have been submitted with this monitoring report.

SECTION C. Description of monitoring system

SECTION C. Description of monitoring system

The area in charge of the CDM project monitoring is the “Planning Department”. This unit is under direct supervision of the CEO of ETMVA. The Planning Department collects the information from other areas of ETMVA, the information of Electricity Consumption comes from the Operational Area of Integrated System (unit depending from Operational Management) and the information of Passengers Transported comes from the Marketing Area of Transportation (unit depending from Business and Social Management). The staff in charge of monitoring has received during the entire monitoring period back-up support and quality control services by Centro Nacional de Produccion Mas Limpia y Tecnologias Ambientales and Grütter Consulting AG.

Data for monitoring is based on:

- Electricity consumption is recorded through electricity meters.
- Passenger data is the sum of the IC Card usage, single tickets, plus a survey.
- Baseline modes with their trip distance and modes to/from the cable car with their trip distance are based on a passenger survey realized in year 1 and verified in the 1st monitoring report.

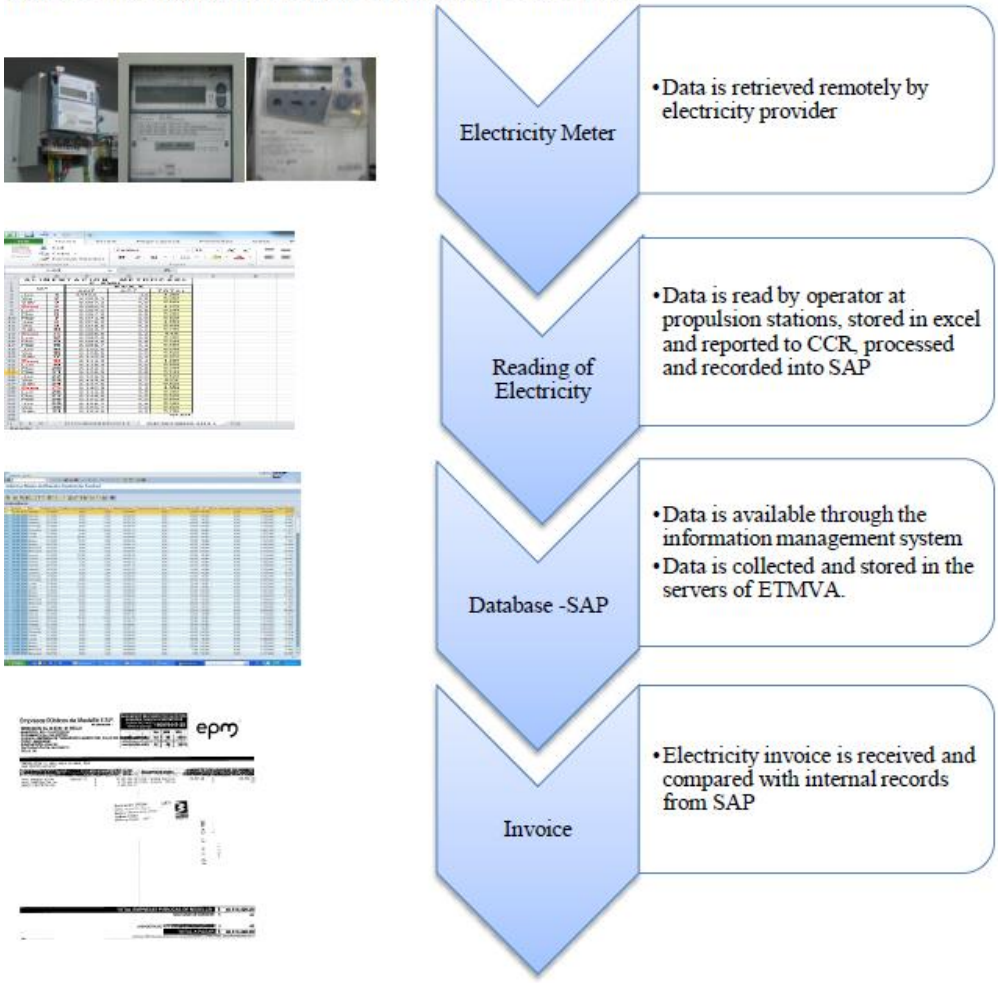
Parameter Electricity Consumption

The location of the propulsion station for line J is “La Aurora Station” and for line K it is “Acevedo Station”. These stations are equipped with electricity consumption meters independent from the Metro System. The meters have been installed and are operated and maintained by Empresas Publicas de Medellin, which is the electricity provider for all the cable car lines. In the case of the line K the electricity invoice does not differentiate the metro and the cable car - however there is an independent electricity meter for line K which is monitored by ETMVA.

The electricity provider retrieves the electricity consumption data via wireless modem for invoicing ETMVA. In addition, each day at the end of operations (at 24:00 hours) the station operator performs a reading of the electricity meter and records this figure in an Excel file. Then the operator makes a phone call to the technical operator in the Central Control Room (CCR) and reports the data. The technical operator also records the data in an Excel sheet and applies a pre-defined formulae to obtain the electricity consumption data in kWh. This figure is reported to the Operations Supervisor who records the data in the SAP system.

With this data, the Operations Supervisor generates a Daily Operations Report which contains the consumption for the whole system and for every station. This procedure is standardized in the quality management system of ETMVA (MST 164, number 4.5.6, and MST-106 operator responsibilities).

Figure 2: Information Flow Parameter Electricity Consumption



The QA of electricity consumption is based on comparing recorded data on a monthly basis with the invoices from the electricity provider. If a difference is found, a communication is issued directly to the electricity provider to identify the reason for the difference and the possibility of a measurement error. Under normal circumstances the data reported by the electricity provider is assumed to be the correct one because it is retrieved automatically via wireless. Electricity meters are installed by and belong to the electricity provider. The meters are sealed and cannot be manipulated by staff of ETMVA.

Parameter Passengers Transported

Data for transported passengers is generated from Edmonson type tickets and Civica card users, processed by turnstiles at the entrance of stations. However, in the stations that are directly connected with the metro being the Acevedo station of the Line K and the San Javier of the Line J there are no turnstiles that permit to count the quantity of passengers that are entering at these stations. In order to determine the total quantity of passengers in Line K and Line J, a one-week measurement of passengers entering at stations without turnstiles was performed during February of 2011 at the Lines K and J (reported in the 1st monitoring report). The number of passengers recorded at the turnstiles during the same week was then put into relation with the number of passengers recorded at stations without turnstiles thus calculating an expansion factor to determine total passengers derived from turnstile passengers recorded for all months (total passengers = passengers turnstile * expansion factor). When going downhill the passengers pass a turnpike in accordance with the methodology. However, when going uphill and coming from the metro to use thereafter the cable car passengers do not pass turnpikes. The reason is twofold:

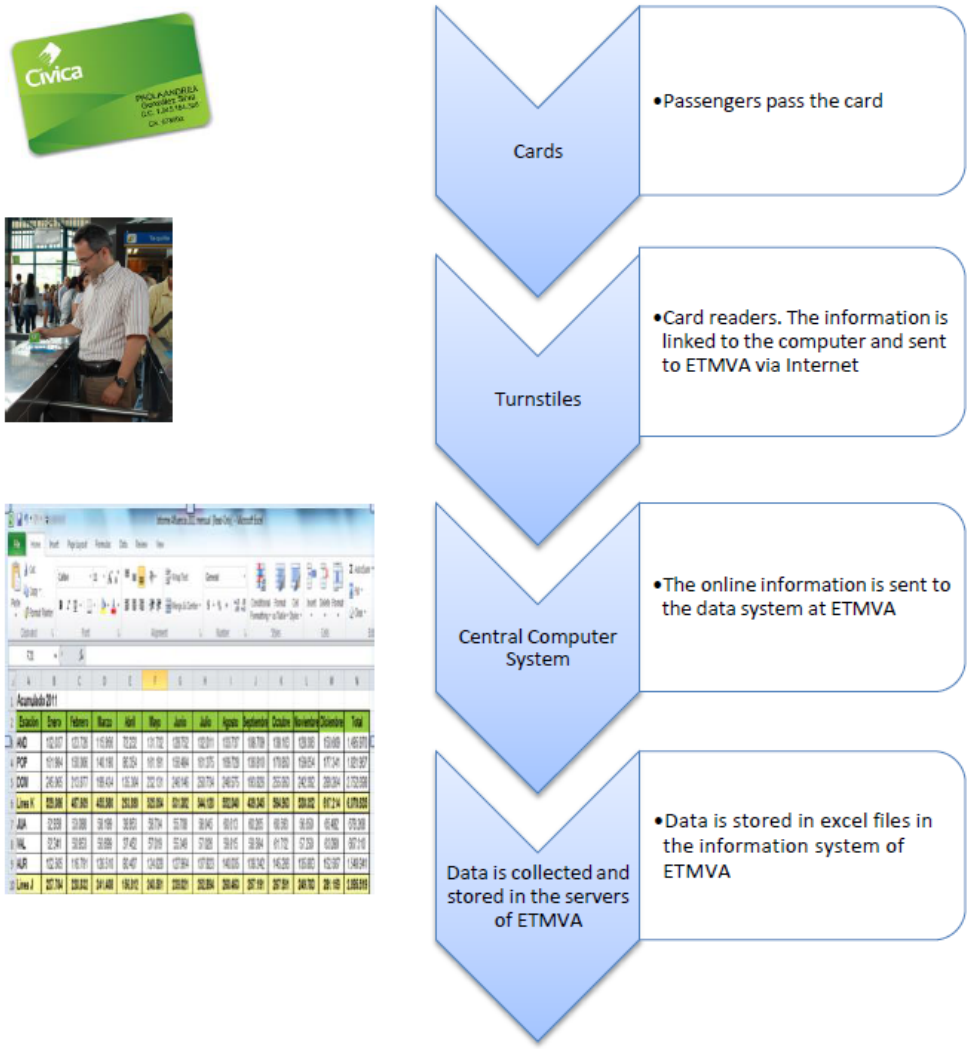
- The metro ticket includes also the cable car ride i.e. passengers have already paid for the ride and have already passed a turnpike when entering the metro. The metro thus has no financial incentive to install such turnpikes.
- As passengers come in waves (always when a metro train arrives) the passenger fluency would be hindered due to limited available space if turnpikes were installed which would make the transfer of passengers more complex.

The following rule was also established:

- If the monitored expansion factor > 2.0 then take 2.0 as expansion factor for calculations (based on logic of same amount of return trips).
- If the monitored expansion factor is < 2.0 then take the monitored expansion factor for calculations.

With this approach, the passenger data is always conservative and the change in the monitoring approach will not affect the conservativeness of monitoring or reduce the level of accuracy.

Figure 3: Information Flow Parameter Passengers Transported Using IC Cards



Passengers pass IC cards at cable cars stations to pass the turnstile. The turnstile opens if the IC card is valid and therefore records automatically the card and the passenger is recorded. IC card systems are used on most modern Mass Transport System as well as in metros as a highly reliable means to collect the fare and count passengers using the system. “Civica” is the Metro’s electronic admission contactless card system. “Civica” turnstiles are equipped with remote data transmission systems, which transfer the data to the ETMVA corporate network within which it is stored in a predefined format text file. This file is generated with a 4 day delay. The text file is then converted into excel by the Admittance Management division and automatically processed to integrate it with the data from single trip tickets. The processing of the data from “Civica” includes manually subtracting the trips made by ETMVA’s employees (known as Metro Standard

Trips), which are automatically categorized by the “Civica” system. The cards used belong to the Philips MIFARE RF Interface (Complies with ISO/IEC 14443 A). Their main characteristics are:

- Contactless transmission of data supply energy (no battery needed)
- Operating distance: Up to 100 mm (depending on antenna geometry)
- Operating frequency: 13.56 MHz
- Fast data transfer: 106 kbit/s
- High data integrity: 16 Bit CRC, parity, bit coding, bit counting
- Typical ticketing transaction: < 100 ms (including backup management)

For single trip tickets Edmonson tickets with a magnetic stripe which is introduced into and read by the turnstile at the station entrance are used. The Edmonson ticket turnstiles provide a paper receipt with the number of entered passengers every day. The station operator retrieves the receipt daily after the end of services and records the data in excel, and then informs the data to the Reserve Operator at the Central Control Room who records it in SAP. The station operator who opens the station also performs the same routine each day before start of commercial service. The data for station opening must match the data for closure from the previous night, otherwise the receipts must be checked and the error needs to be corrected.

The single tickets used have the following characteristics:

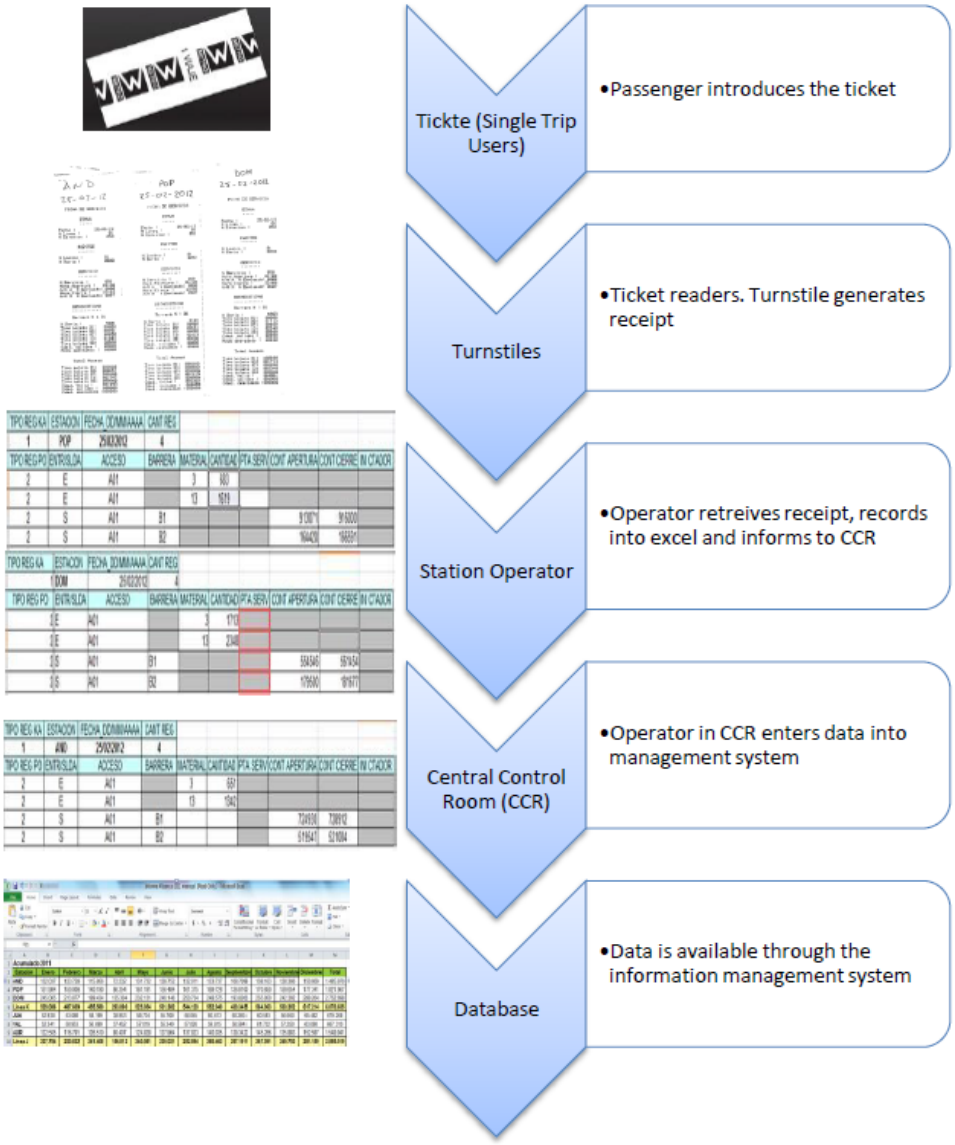
- Dimensions: Length 66 mm, width 30 mm, thickness 0.27 mm
- Magnetic characteristics:
  Coercivity: 20,000+-1,000 A/m.
  Density: 1.3 bit/mm.
  Coding: Fractionary phase.
  Strip width: 5 mm.

Any fault from the turnstiles is addressed following procedure MST-156. If the fault occurs more than 3 times during one shift then the turnstile is blocked and reported to the Technical Operator. Any faulty turnstile must be fixed before end of the service to be able to retrieve that day’s passenger data.

In addition to passengers who enter the system using the turnstiles, there are users who enter using the service entrances, e.g. persons with disabilities who cannot pass through the turnstiles. Also, admittance through the service entrance is allowed when turnstiles fail to allow for seamless entrance to the system. Passengers with a “Civica” card are processed with a portable card validating unit, which stores the data that can later be downloaded into the system. Passengers with Edmonson tickets are processed manually by the operator who retains and tears the ticket. Data from single trip Edmonson tickets is input manually into excel and sent to Admittance Management to be integrated with the consolidate passenger data.

The QA is performed according to instructive DR-0993-00 of the quality management system of ETMVA. In case an unusual number of passengers is reported (i.e. in comparison with historical data) a request is issued for the station operator to check the data and report it again. The “Cívica” system registers the physical and accounting use separately, i.e. the actual number of trips made and the amount of money collected due to the use of “Civica” cards. This also serves as quality control for the number of trips realized using “Cívica”.

Figure 4: Information Flow Parameter Passengers Transported Using Single Tickets



The parameters indirect project emissions and baseline emissions are calculated based on a passenger survey. The surveys were realized by the Centro Nacional de Produccion Mas Limpia y Tecnologias Ambientales in year 1 and were reported in the 1st monitoring report i.e. this is not monitored in this period again.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**$SFC_{T,D/G}$**
Unit	g/km
Description	Specific fuel consumption diesel/gasoline taxis
Source of data	Specific study ordered by CNPMLTA, 2008
Value(s) applied	Diesel units: 56 Gasoline units: 57
Choice of data or measurement methods and procedures	Sample study performed for PDD

Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**SFC_C**
Unit	g/km
Description	Specific fuel consumption passenger cars
Source of data	Specific study ordered by CNPMLTA, 2008
Value(s) applied	63
Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**SFC_M**
Unit	g/km
Description	Specific fuel consumption motorcycles
Source of data	Specific study ordered by CNPMLTA, 2008
Value(s) applied	18
Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**$SFC_{B,M/S}$**
Unit	g/km
Description	Specific fuel consumption diesel of medium and small buses
Source of data	Specific study made ordered by CNPMLTA, 2008
Value(s) applied	Medium units: 237 Small units: 160
Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**$N_{T,G/D}$**
Unit	Vehicles
Description	Number of taxis using gasoline/diesel
Source of data	Secretaria de Transporte, 2008
Value(s) applied	Gasoline: 20,820 (96%) Diesel: 845 (4%)
Choice of data or measurement methods and procedures	Registration statistics

Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**$NCV_{D/G}$**
Unit	MJ/kg
Description	Net calorific value of diesel/gasoline
Source of data	Academia Colombiana de Ciencias Exactas, Fisicas y Naturales realized for UPME (Unidad de Planeacion Minero Energetica) of the Ministry of Mines and Energy
Value(s) applied	Diesel: 42.67 Gasoline: 42.44
Choice of data or measurement methods and procedures	Official report
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**$EF_{CO2,D/G}$**
Unit	gCO2/MJ
Description	Carbon emission factor of diesel
Source of data	Academia Colombiana de Ciencias Exactas, Fisicas y Naturales realized for UPME (Unidad de Planeacion Minero Energetica) of the Ministry of Mines and Energy
Value(s) applied	Diesel: 73.9 Gasoline: 74.6
Choice of data or measurement methods and procedures	Official report
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**OC_B**
Unit	Passengers
Description	Average occupation rate of buses
Source of data	Specific study realized by Universidad Nacional, 2006
Value(s) applied	11
Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline, leakage and project emissions
Additional comments	

Data/Parameter	**OC_T**
Unit	Passengers
Description	Average occupation rate of taxis
Source of data	Specific study realized ordered by CNPMLTA, 2008
Value(s) applied	0.92

Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline, leakage and project emissions
Additional comments	

Data/Parameter	**OC_C**
Unit	Passengers
Description	Average occupation rate of passenger cars
Source of data	Specific study realized ordered by CNPMLTA, 2008
Value(s) applied	1.59
Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**OC_M**
Unit	Passengers
Description	Average occupation rate of motorcycles
Source of data	Specific study realized ordered by CNPMLTA, 2008
Value(s) applied	1.21
Choice of data or measurement methods and procedures	Sample study performed for PDD
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**$EC_{elec,metro}$**
Unit	kWh
Description	Electricity consumption of metro
Source of data	ETMVA, 2007
Value(s) applied	47,923,361
Choice of data or measurement methods and procedures	Official reports
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**P_{metro}**
Unit	Passengers
Description	Passengers transported of metro
Source of data	ETMVA, 2007
Value(s) applied	133,983,496
Choice of data or measurement methods and procedures	Official reports

Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**TD_{metro}**
Unit	Kilometer
Description	Average trip distance of metro passengers
Source of data	ETMVA, 2007
Value(s) applied	9.5
Choice of data or measurement methods and procedures	Official reports
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	**$EF_{CO2,Elec}$**
Unit	$kgCO_2/kWh$
Description	Carbon emission factor electricity
Source of data	a). Centro Nacional de Despacho (XM, Compañia de Expertos en Mercados S.A. E.S.P). Information System NEON. Sistema Neon de la Red Interconectada del Pais b). UPME (Unidad de Planeacion Minero Energetica) c). Intergovernmental Panel on Climate Change, 2006
Value(s) applied	0.3531
Choice of data or measurement methods and procedures	Official reports
Purpose of data/parameter	Baseline and project emissions
Additional comments	

D.2. Data and parameters monitored

Data/Parameter	**P**
Unit	Passengers
Description	Passengers transported by each cable car line
Measured/calculated/ default	Measured and calculated
Source of data	ETMVA, File 1
Value(s) of monitored parameter	Total: 112,239,600 Line K: 69,649,910 Line J: 42,589,690

Monitoring equipment	Data on passenger numbers is generated from Card Users, Single Trip Tickets and an expansion factor. The flow data of the passenger system is generated when the passengers cross the turnstiles located in the stations. The turnstiles register the total number of passengers. The expansion factor is based on a standard measurement week relating passengers total turnstile with passengers entering stations on the same line without turnstile. Equipment used for passenger records is not calibrated. Passenger cards meet the ISO/IEC 14443 A. Turnstiles are checked for correct operation by the station operator each day before service start according to procedure MST-164. Maintenance is performed according to procedure MSA-009. Operation faults are corrected according to procedure MST-156. The measurement made for the expansion factor is based on a full standard week counting of passengers performed in the year 1 (1st monitoring report). See for details section D3.
Measuring/reading/recording frequency	Continuous measuring with monthly aggregated reports for single trip and card users. Expansion factor determined once in monitoring period.
Calculation method (if applicable)	Sum of card and single trip users multiplied with expansion factor. The expansion factor for Line K is 2.02 The expansion factor for Line J is 2.12 If the monitored expansion factor > 2.0 then take 2.0 as expansion factor for calculations (based on logic of same amount of return trips). For both lines the monitored expansion factor is >2.0 and thus the more conservative value of 2.0 is taken to determine the total amount of passengers.
QA/QC procedures	Operations department cross-checks data with fares paid
Purpose of data/parameter	Baseline and Project emissions
Additional comments	For baseline and indirect project emissions passenger data is required per quarter. Quarters are: Jan-March; April-June; July-September; October-December

Data/Parameter	**$SP_{BL,i,s}$**
Unit	%
Description	Share of passengers in the quarter *s* of the respective year who would have used the baseline mode *i*
Measured/calculated/ default	Calculated based on survey
Source of data	CNPMLTA realized during the 1st Monitoring report; Not monitored anymore in this period.

Value(s) of monitored parameter	**Table 4: Share Passenger in Baseline per Mode for Cable Car Line K** **Mode** / **Q1** / **Q2** / **Q3** / **Q4** Car / 0.0% / 0.3% / 0.2% / 0.2% Taxi / 1.4% / 2.1% / 3.3% / 3.7% Motorcycle / 0.2% / 0.2% / 1.4% / 1.6% Bus / 151.8% / 137.8% / 117.0% / 144.3% Metro / 15.7% / 33.4% / 43.7% / 21.5% NMT or induced / 20.3% / 14.0% / 17.1% / 16.7% **Table 5: Share Passenger in Baseline per Mode for Cable Car Line J** **Mode** / **Q1** / **Q2** / **Q3** / **Q4** Car / 0.0% / 0.0% / 0.3% / 0.5% Taxi / 1.0% / 0.4% / 2.7% / 1.6% Motorcycle / 0.3% / 0.9% / 2.9% / 0.5% Bus / 158.9% / 135.9% / 117.5% / 142.2% Metro / 14.6% / 31.3% / 30.3% / 26.5% NMT or induced / 11.5% / 14.1% / 15.6% / 19.7%
Monitoring equipment	The share of passengers is based on a survey and not on monitoring equipment.
Measuring/reading/recording frequency	Based on 4 surveys for each Cable Car realized in 1st year of monitoring period (2008/2009)
Calculation method (if applicable)	The share per category *i* are calculated based on the passengers which would have used for at least part of their trip the vehicle mode *i* determined through the surveys divided with the amount of passengers surveyed. This is determined per survey which represents one quarter of a year. The sum can be more than 100% as passengers can use more than one mode for their trip e.g. bus plus metro.
QA/QC procedures	The survey is realized at a 95% confidence interval with a maximum 5% error margin. The survey was realized and verified in the 1st monitoring report.
Purpose of data/parameter	Baseline emissions
Additional comments	The share is calculated per quarter. It is calculated once only and not annually as the survey is conducted only once (see methodology point 19). Quarters are: Q1: January-March Q2: April-June Q3: July-September Q4: October-December

Data/Parameter	**$SP_{PJ,i\,s}$**
Unit	%
Description	Share of passengers using the project mode *i* in the quarter *s* of the respective year from trip origin to the project entry station and from project exit station to their final destination
Measured/calculated/ default	Calculated based on survey
Source of data	CNPMLTA realized during the 1st Monitoring report; Not monitored anymore in this period.

Value(s) of monitored parameter	**Table 6: Share Passenger in Project per Mode for Cable Car Line K** **Mode** / **Q1** / **Q2** / **Q3** / **Q4** Car 0.2% 0.0% 0.0% 0.0% Taxi 0.0% 0.2% 0.0% 0.2% Motorcycle 0.0% 0.0% 0.3% 0.4% Bus 4.6% 5.6% 1.4% 10.3% Metro 90.0% 94.6% 93.5% 90.2% NMT 105.3% 99.7% 104.8% 98.9% **Table 7: Share Passenger in Project per Mode for Cable Car Line J** **Mode** / **Q1** / **Q2** / **Q3** / **Q4** Car 0.0% 0.2% 0.2% 0.0% Taxi 0.0% 0.2% 0.0% 0.4% Motorcycle 0.2% 0.0% 0.0% 0.0% Bus 16.9% 15.1% 7.0% 22.6% Metro 90.8% 89.1% 82.0% 88.6% NMT 92.1% 95.4% 110.9% 88.4%
Monitoring equipment	The share of passengers is based on a survey and not on monitoring equipment.
Measuring/reading/recording frequency	Based on 4 surveys for each Cable Car
Calculation method (if applicable)	The share per category *i* are calculated based on the passengers which would have used the vehicle mode *i* determined through the surveys divided with the amount of passengers surveyed. This is determined per survey which represents one quarter of a year. The sum is 200% as passengers use one mode to the cable car from their trip origin and one mode from the cable car to their final destination.
QA/QC procedures	The survey is realized at a 95% confidence interval with a maximum 5% error margin. The survey was realized and verified in the 1st monitoring report.
Purpose of data/parameter	Project emissions
Additional comments	The share is calculated per quarter. It is calculated once only and not annually as the survey is conducted only once (see methodology point 19). Quarters are: Q1: January-March Q2: April-June Q3: July-September Q4: October-December

Data/Parameter	**$TD_{BL,i,s}$**
Unit	Kilometer
Description	Trip distance of passengers using in the baseline mode *i* in the quarter *s* of the respective year
Measured/calculated/ default	Calculated based on the survey
Source of data	CNPMLTA realized during the 1st Monitoring report; Not monitored anymore in this period.

Value(s) of monitored parameter	**Table 8: Trip Distance in Baseline per Mode for Cable Car Line K (km)** **Mode / Q1 / Q2 / Q3 / Q4** Car 0.0 0.0 10.8 7.5 Taxi 1.0 1.9 2.0 3.6 Motorcycle 17.0 11.8 2.0 6.9 Bus 8.0 7.8 7.5 7.1 Metro 6.5 20.9 22.5 12.3 **Table 9: Trip Distance in Baseline per Mode for Cable Car Line J (km)** **Mode / Q1 / Q2 / Q3 / Q4** Car 0.0 0.0 0.0 0.0 Taxi 6.6 0.0 2.3 1.6 Motorcycle 0.0 3.2 2.7 2.5 Bus 8.9 8.1 8.2 7.0 Metro 11.5 23.5 17.9 12.6
Monitoring equipment	The trip distance of passengers is based on a survey and not on monitoring equipment.
Measuring/reading/recording frequency	Based on 4 surveys for each Cable Car
Calculation method (if applicable)	The distance is calculated for each trip. The average distance is the average trip distance of users of the vehicle mode *i* of the people surveyed per quarter. For all distances the shortest possible route is taken based on electronic maps (if based on bus routes the shortest possible connection). This is conservative as potentially persons take longer but perhaps faster routes. Passengers can use more than 1 mode for their entire trip e.g. car plus bus. Therefore, average trip distances per mode are not idem to the origin-destination trip distance. For NMT no trip distance is calculated as NMT has 0 emissions and therefore baseline emissions of passengers using this mode are 0 independent of their trip length. For induced traffic no trip length is determined as per logic latter would be 0, next to having an EF of 0. Based on the methodology for the baseline trip distance the lower 95% confidence level of the monitored trip distance per mode shall be taken (AMSIIIU point 20). This has been calculated for each mode and for each quarter.
QA/QC procedures	The survey is realized at a 95% confidence interval with a maximum 5% error margin. The survey was realized and verified in the 1st monitoring report.
Purpose of data/parameter	Baseline emissions
Additional comments	The share is calculated per quarter. It is calculated once only and not annually as the survey is conducted only once (see methodology point 19). Quarters are: Q1: January-March Q2: April-June Q3: July-September Q4: October-December

Data/Parameter	**$TD_{PJ,i,s}$**
Unit	Kilometer
Description	Trip distance of passengers using in the project mode *i* in the quarter *s* of the respective year from their trip origin to the project entry station and from the project exit station to their final destination
Measured/calculated/ default	Calculated based on the survey
Source of data	CNPMLTA realized during the 1st Monitoring report; Not monitored anymore in this period.

Value(s) of monitored parameter	**Table 10: Trip Distance in Project per Mode for Cable Car Line K (km)** **Mode / Q1 / Q2 / Q3 / Q4** Car 4.3 0.0 0.0 0.0 Taxi 0.0 1.6 0.0 2.5 Motorcycle 0.0 0.0 1.5 7.5 Bus 5.5 7.6 4.5 5.7 Metro 8.2 9.0 8.6 9.4 **Table 11: Trip Distance in Project per Mode for Cable Car Line J (km)** **Mode / Q1 / Q2 / Q3 / Q4** Car 0.0 0.9 14.0 0.0 Taxi 0.0 3.8 0.0 7.6 Motorcycle 4.4 0.0 0.0 0.0 Bus 4.0 3.4 5.0 2.7 Metro 10.2 9.8 7.4 10.3
Monitoring equipment	The trip distance of passengers is based on a survey and not on monitoring equipment.
Measuring/reading/recording frequency	Based on 4 surveys for each Cable Car
Calculation method (if applicable)	The distance is calculated for each trip. The average distance is the average trip distance of users of the vehicle mode *i* of the people surveyed per quarter. For all distances the shortest possible route is taken based on electronic maps (if based on bus routes the shortest possible connection). For NMT no trip distance is calculated as NMT has 0 emissions and therefore project emissions of passengers using this mode are 0 independent of their trip length. Based on the methodology for the indirect project trip distance the upper 95% confidence level of the monitored trip distance per mode shall be taken (AMSIIIU point 27). This has been calculated for each mode and for each quarter.
QA/QC procedures	The survey is realized at a 95% confidence interval with a maximum 5% error margin. The survey was realized and verified in the 1st monitoring report.
Purpose of data/parameter	Project emissions
Additional comments	The share is calculated per quarter. It is calculated once only and not annually as the survey is conducted only once (see methodology point 19). Quarters are: Q1: January-March Q2: April-June Q3: July-September Q4: October-December

Data/Parameter	**EC_{PJ}**
Unit	MWh
Description	Electricity consumption per cable car
Measured/calculated/ default	Measured
Source of data	ETMVA, File 1
Value(s) of monitored parameter	Total: 21,586.663
Monitoring equipment	Each line of Cable Car is equipped with electricity consumption meters independent from the Metro System. See Table below for monitoring equipment used.
Measuring/reading/recording frequency	Continuous measuring with monthly aggregated reports.
Calculation method (if applicable)	N/A

<table>
<tr><td>QA/QC procedures</td><td>Electricity consumption is controlled with invoices.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Project emissions</td></tr>
<tr><td>Additional comments</td><td>There are two Electricity Meters, one for each Line: K and J.

Neither the monitoring methodology, nor the monitoring plan of the registered PDD specifies any requirements for calibration frequency and therefore the equipment is calibrated in accordance with national standards. An initial calibration is realized when the electricity meter is installed. Thereafter no more calibration is required according to Colombian regulations: Resolution 070-98 CREG (COMISION DE REGULACION DE ENERGIA Y GAS DE COLOMBIA)[4]. However, the electricity meters have been calibrated by the EPM Company, which supplies the electricity for the cable cars of the project, and which made the commissioning of the equipment.

Table 12: Electricity Meters
<table>
<tr><th>Line</th><th>Model / Type</th><th>Manufacturer</th><th>Serial number</th><th>Accuracy</th><th>Calibrations</th></tr>
<tr><td>Line K</td><td>SL761B020</td><td>ACTARIS</td><td>33011755</td><td>0.5</td><td>Initial calibration by “Laboratorio de Calibracion de Equipos de Medida de Energia y Gas” performed 19/12/2003 (certificate # 6219257) and most recent calibration by same company 01/08/2012 (certificate #50589)</td></tr>
<tr><td>Line J</td><td>ZMD405CT44.0007S2</td><td>LANDIS</td><td>88329316</td><td>0.5</td><td>Initial calibration by “Laboratorio de Calibracion de Equipos de Medida de Energia y Gas” performed 07/04/2007 (certificate # 24986) and most recent calibration by same company 01/08/2012 (certificate #50588)</td></tr>
</table>
Source: File 4</td></tr>
</table>

Data/Parameter	**OC**
Unit	Passengers
Description	Occupation rate of vehicles
Measured/calculated/ default	Measured and calculated
Source of data	Studies realized by Miriam Giraldo Ing. Consultora in the year 2012 (Files 6a, 6b, 6c, 6d, 6e) and Area Metropolitana, 2017 (File 7a and 7b); Baseline study realized by Universidad Nacional in the year 2006 (Files 5a and 5b)
Value(s) of monitored parameter	2012 (year 3 crediting period): 40% 2017: (year 7 crediting period): 38% Baseline: 31%
Monitoring equipment	Survey and EMME transport model
Measuring/reading/recording frequency	Year 3 and 7

[4] File 16

<table>
<tr><td>Calculation method
(if applicable)</td><td>Baseline value Line J 29.2% idem to 10.7 passengers (File 5a) and Line K 32.7% idem to 11.6 passengers (File 5b) with an average value of 31% or 11 passengers.

Study made 05/2012 by Miriam Giraldo Ing. Consultora (Files 6a to 6e) shows an average occupation rate for Line J of 37.6% (idem to 11.5 passengers) and of Line K 42.5% (idem to 11.8 passengers) with an average value of 40% or 12 passengers. The average occupation rate 2012 is thus clearly higher than the baseline value and therefore no leakage emissions are considered (based on AM0031 which is referenced for leakage emission calculations (see PDD p.25) – AM0031 Vs 6 point 55 which indicates that leakage is 0 if the baseline minus the monitored occupation rate ≤ 0.1). Calculation: 0.31-0.40 = -0.09 This is clearly less than 0.1 and therefore leakage = 0.

Study 2017 made based on model EMME (File 7a and 7b) resulting in an average occupation rate of 38%. Calculation: 0.31-0.38 = -0.07 This is clearly less than 0.1 and therefore leakage = 0.</td></tr>
<tr><td>QA/QC procedures</td><td>Table 13: Measurement OC 2012
<table>
<tr><th>Parameter</th><th>Line J</th><th>Line K</th></tr>
<tr><td>Number of measurements</td><td>315</td><td>732</td></tr>
<tr><td>Average</td><td>11.5</td><td>11.8</td></tr>
<tr><td>STDEV</td><td>2.51</td><td>2.77</td></tr>
<tr><td>standard error of average σ</td><td>0.141</td><td>0.102</td></tr>
<tr><td>Required sample size for 95% confidence interval and 0.1 relative precision level</td><td>84</td><td>90</td></tr>
<tr><td>CIW</td><td>0.55</td><td>0.40</td></tr>
<tr><td>Reliability (relative precision level)</td><td>0.024</td><td>0.017</td></tr>
</table>
Sample size Formulae:
$$N = \frac{1.96^2 \times SD}{AV \times 0.1^2}$$
Where N= requires sample size; SD = stand deviation; AV= average

Reliability:
$$R = \frac{0.5 \times (CIW)}{AV} \times 100\%$$
Where R = reliability level, CIW = Confidence Interval width, AV = average Checked at 95% confidence level; Result must be < 0.1 i.e. a relative precision level of error better than 10%.

The required sample size is for both lines far higher than the minimum required sample size (315 instead of 84 and 732 instead of 90) and the reliability level is with 0.024 and 0.017 far better than the requirement of 0.1.

The occupation rate for 2017 was based on origin-destination surveys realized and thereafter using the transport modelling tool EMME. This model is used to calibrate entries and exits of the metro. The model is managed and has been used since various years (not for the purpose of the cable car) by Metro de Medellin.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Leakage</td></tr>
<tr><td>Additional comments</td><td>Based on emission reduction share only buses contribute >10% to emission reductions i.e. based on the methodology and the PDD only the occupation rate of buses is monitored.</td></tr>
</table>

The following parameters listed in the PDD are not monitored:

- BLE_P: This is a calculated parameter based on the monitored parameters TD_{BL} and SP_{BL} and not a monitored parameter.
- IPE_P: This is a calculated parameter based on the monitored parameters TD_{PJ} and SP_{PJ} and not a monitored parameter.

D.3. Implementation of sampling plan

For bus occupation rate study see above. The results of the sample have been tested against the required minimum sample size and the reliability level has been calculated. The sample size is far higher than required at a 95% confidence level and the reliability levels are far better than required.

The passenger survey was realized in year 1 of the project and not during this monitoring period. This was reported and verified in the 1st monitoring report.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

Total Baseline Emissions

$$BE_y = \frac{\sum_s \sum_i P_{BL,i,s,y} \times TD_{BL,i,s,y} \times EF_{PKM,i}}{10^6} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in the year *y* (tCO_2)
$P_{BL,i,s,}$	Passengers transported by the project in the quarter *s* of the year *y* using mode *i* in the baseline (passengers)
$TD_{BL,i,s,y}$	Average trip distance of passengers using mode *i* in the baseline in the quarter *s* of the year *y* (kilometer)
$EF_{PKM,i}$	Emission factor per passenger-kilometer of vehicle category *i* (gCO_2/PKM)
Σ_s	Sum of the 4 surveys realized

Baseline Passengers per Mode

$$P_{BL,i,s,y} = P_{s,y} \times SP_{BL,i,s,y} \quad \textbf{(2)}$$

Where:

$P_{BL,I,s,y}$	Passengers transported by the project in the quarter *s* of the year *y* who would have used mode *i* in the baseline (passengers)
$P_{s,y}$	Passengers transported by the project in the quarter *s* of the year *y* (passengers)
$SP_{BL,i,s,\ y}$	Share of passengers transported by the project in the quarter *s* of the year *y* who would have used mode *i* in the baseline (%)

Emissions per PKM

$$EF_{PKM,i} = \frac{EF_{KM,i}}{OC_i} \quad \textbf{(3)}$$

Where:

$EF_{PKM,i}$	Emission factor per passenger-kilometer of vehicle category *i* (gCO_2/PKM)
$EF_{KM,i}$	Emission factor per kilometer of vehicle category *i* (gCO_2/km)
OC_i	Average occupation rate of vehicle category *i* prior project start (passengers)

Emissions per Kilometer per Vehicle Category

$$EF_{KM,i} = \sum_{x} \left[SFC_{x,i} \times NCV_{x} \times EF_{CO2,x} \times \frac{N_{x,i}}{N_{i}} \right] \times IR_{i}^{t} \quad \textbf{(4)}$$

Where:

$EF_{KM,i,}$	Emission factor per kilometer of vehicle category *i* (gCO_2/km)
$SFC_{x,i}$	Specific fuel consumption of vehicle category *i* using fuel type *x* prior project start (g/km)
NCV_x	Net calorific value of fuel *x* (J/g)
$EF_{CO2,x}$	Carbon emission factor for fuel type *x* (gCO_2/J)
$N_{x,I}$	Number of vehicles of category *i* using fuel type *x* prior project start (units)
N_i	Number of vehicles of category *i* prior project start (units)
IR_i^t	Technology improvement factor for the vehicle of category *i* per year *t*
t	Year counter for the annual improvement (dependent on age of data per vehicle category)

The emission factor is not constant but annually updated according to the technology improvement factor per vehicle category. The default technology improvement factor of the methodology is used.

The following table lists all parameters used for the calculations.

Table 14: General Baseline Parameters Used

$EF_{PKM,C}$	Emission factor per PKM cars	gCO_2/PKM	2012: 120 2013: 118 2014: 117 2015: 116 2016: 115 2017: 114	PDD Table 11 for 2012 to 2016 and for 2017 File 8 based on original CER sheet
$EF_{PKM,T}$	Emission factor per PKM taxis	gCO_2/PKM	2012: 187 2013: 185 2014: 183 2015: 181 2016: 180 2017: 178	PDD Table 11 for 2012 to 2016 and for 2017 File 8 based on original CER sheet
$EF_{PKM,M}$	Emission factor per PKM motorcycles	gCO_2/PKM	2012: 45 2013: 44 2014: 44 2015: 44 2016: 43 2017: 43	PDD Table 11 for 2012 to 2016 and for 2017 File 8 based on original CER sheet
$EF_{PKM,B}$	Emission factor per PKM buses	gCO_2/PKM	2012: 56 2013: 55 2014: 55 2015: 54 2016: 54 2017: 53	PDD Table 11 for 2012 to 2016 and for 2017 File 8 based on original CER sheet
$EF_{PKM,M}$	Emission factor per PKM metro	gCO_2/PKM	2012: 13 2013: 13 2014: 13 2015: 13 2016: 13 2017: 13	PDD Table 11 for 2012 to 2016 and for 2017 File 8 based on original CER sheet

Baseline Results

The following table shows the baseline emissions for the cable car line K for each quarter.

Table 15: Baseline Emissions Cable Car Line K

Parameter	Description	Unit	2012			2013			
			Q2 (since 1.5.)	Q3	Q4	Q1	Q2	Q3	Q4
	Average EF per passenger	gCO_2/passenger	701	635	640	685	690	626	629
BE	Baseline emissions	tCO_2	1,480	2,088	2,180	2,184	2,013	2,167	2,289
	IP emissions from car uses	tCO_2	0	9	6	0	0	9	6
	IP emissions from taxi users	tCO_2	16	41	85	8	22	42	90
	IP emissions from motorcycle users	tCO_2	2	4	17	5	3	4	18
	IP emissions from bus users	tCO_2	1,271	1,615	1,955	2,128	1,724	1,670	2,050
	IP emissions from metro users	tCO_2	192	420	117	42	265	442	125

2014				2015				2016				2017	
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2 (until 25.4.)
685	690	626	629	673	679	617	618	673	679	617	618	661	669
2,328	2,251	2,256	2,158	2,401	2,135	2,201	2,446	2,508	2,288	2,391	2,445	2,505	674
0	0	9	6	0	0	9	7	0	0	10	7	0	0
9	24	44	84	9	23	43	95	9	24	46	95	9	7
5	3	4	17	5	3	4	19	5	3	5	19	6	1
2,269	1,928	1,739	1,934	2340	1824	1689	2188	2,444	1,955	1,835	2,189	2,440	574
45	296	460	118	47	285	456	136	49	306	495	136	50	91

The following table shows the baseline emissions for the cable car line J for each quarter.

Table 16: Baseline Emissions Cable Car Line J

Parameter	Description	Unit	2012			2013			
			Q2 (since 1.5.)	Q3	Q4	Q1	Q2	Q3	Q4
	Average EF per passenger	gCO_2/passenger	713	625	606	812	702	615	596
BE	Baseline emissions	tCO_2	642	1,061	1,088	1,265	1,294	1,243	1,298
	IP emissions from car uses	tCO_2	0	0	0	0	0	0	0
	IP emissions from taxi users	tCO_2	0	20	9	19	0	23	10
	IP emissions from motorcycle users	tCO_2	1	6	1	0	2	7	1
	IP emissions from bus users	tCO_2	555	915	1,000	1,212	1,115	1,071	1,192
	IP emissions from metro users	tCO_2	86	120	78	34	176	142	94

2014				2015				2016				2017	
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2 (until 25.4.)
812	702	615	596	797	691	605	586	797	691	605	586	783	680
1,705	1,470	1,387	1,367	1,769	1,391	1,364	1,512	1,890	1,496	1,525	1,520	1,941	457
0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	26	11	26	0	25	12	28	0	28	12	29	0
0	3	8	1	0	3	8	1	0	3	8	1	0	1
1,633	1,267	1,195	1,255	1694	1196	1172	1386	1,810	1,287	1,311	1,394	1,858	392
0	200	159	100	48	192	159	112	52	207	178	113	54	64

The following table summarizes the baseline emissions

Table 17: Baseline Emissions in tCO_2

	01/05/2012 to 31/12/2012	2013	2014	2015	2016	01/01/2017 to 25/04/2017	total
Line K	5,748	8,653	8,993	9,183	9,632	3,179	45,388
Line J	2,790	5,100	5,928	6,036	6,431	2,398	28,684
Total	8,539	13,753	14,921	15,219	16,063	5,577	74,072

Total baseline emissions for the monitoring period are 74,072 tCO_2.

E.2. Calculation of project emissions or actual net removals

Total project emissions are the sum of indirect and direct project emissions

$$PE_y = DPE_y + IPE_y \quad \textbf{(5)}$$

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)

$$DPE_y = EF_{CO2,elec} \times EC_{PJ,y} \quad \textbf{(6)}$$

Where:

DPE_y	Direct project emissions in the year *y* (tCO_2)
$EF_{CO2,elec}$	Grid emission factor electricity (tCO_2/MWh)
$EC_{PJ,y}$	Electricity consumption cable car in the year *y* (MWh)

The grid emission factor was determined and fixed ex-ante and is constant at a value of 0.3531 tCO_2/MWh during the crediting period.

The following table shows the electricity consumption per cable car and the direct project emissions.

Table 18: Direct Project Emissions

	01/05/2012 to 31/12/2012	2013	2014	2015	2016	01/01/2017 to 25/04/2017	total
Line K electricity consumption in kWh	1,273,040	1,923,006	1,950,303	1,890,168	1,992,478	653,736	9,682,731
Line K Direct Project emissions in tCO2	450	679	689	667	704	231	3,419
Line J electricity consumption in kWh	1,491,501	2,458,211	2,425,755	2,360,653	2,347,649	820,163	11,903,932
Line J Direct Project emissions in tCO2	527	868	857	834	829	290	4,203

Indirect Project emissions:

$$IPE_y = \frac{\sum_s \sum_i P_{PJ,i,s,y} \times TD_{PJ,i,s,y} \times EF_{PKM,i}}{10^6} \quad \textbf{(7)}$$

Where:

IPE_y	Indirect project emissions in the year *y* (tCO_2)
$P_{PJ,i,s,y}$	Passengers transported by the project in the quarter *s* of the year *y* using mode *i* for trips to and from the project system (passengers)
$TD_{PJ,i,s,y}$	Average trip distance of passengers using mode *i* in the quarter *s* of the year *y* to and from the project system (kilometer)
$EF_{PKM,i}$	Emission factor per passenger-kilometer of vehicle category *i* (gCO_2/PKM)
Σ_s	Sum of the 4 quarterly surveys realized

Passengers per Mode:

$$P_{PJ,i,s,y} = P_{s,y} \times SP_{PJ,i,s,y} \quad \textbf{(8)}$$

Where:

$P_{PJ,i,s,y}$	Passengers transported by the project in the quarter *s* of the year *y* using mode *i* for trips to and from the project system (passengers)
$P_{s,y}$	Passengers transported by the project in the quarter *s* of the year *y* (passengers)
$SP_{PJ,i,s,y}$	Share of passengers transported by the project in the quarter *s* of the year *y* using mode *i* to and from the project systems (%)

The same EF_{PKM} are used for the indirect project as well as for the baseline emissions.

Indirect Project Emissions Results

The following table shows the indirect project emissions for the cable car line K for each quarter.

Table 19: Indirect Project Emissions Cable Car Line K

Parameter	Description	Unit	2012			2013			
			Q2 (since 1.5.)	Q3	Q4	Q1	Q2	Q3	Q4
	Average EF per passenger	gCO_2/passenger	135	108	145	111	135	108	145
IPE	Indirect project emissions	tCO_2	285	356	495	353	393	374	527
	IP emissions from car uses	tCO_2	0	0	0	3	0	0	0
	IP emissions from taxi users	tCO_2	1	0	3	0	2	0	3
	IP emissions from motorcycle users	tCO_2	0	1	5	0	0	1	5
	IP emissions from bus users	tCO_2	50	12	112	44	68	12	117
	IP emissions from metro users	tCO_2	234	343	376	306	323	362	401

2014				2015				2016				2017	
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2 (until 25.4.)
111	135	108	145	111	134	108	144	111	134	108	144	110	134
377	439	390	497	395	422	386	570	412	452	419	570	418	135
3	0	0	0	4	0	0	0	4	0	0	0	4	0
0	2	0	3	0	2	0	4	0	2	0	4	0	1
0	0	1	5	0	0	1	5	0	0	1	5	0	0
47	76	12	111	49	72	12	125	51	77	13	125	51	23
326	361	377	378	342	348	373	436	358	373	405	436	364	112

The following table shows the indirect project emissions for the cable car line J for each quarter.

Table 20: Indirect Project Emissions Cable Car Line J

Parameter	Description	Unit	2012			2013			
			Q2 (since 1.5.)	Q3	Q4	Q1	Q2	Q3	Q4
	Average EF per passenger	gCO_2/passenger	144	102	158	158	143	101	158
IPE	Indirect project emissions	tCO_2	129	173	284	246	264	205	344
	IP emissions from car uses	tCO_2	0	6	0	0	0	7	0
	IP emissions from taxi users	tCO_2	1	0	10	0	3	0	12
	IP emissions from motorcycle users	tCO_2	0	0	0	1	0	0	0
	IP emissions from bus users	tCO_2	26	33	61	58	52	39	73
	IP emissions from metro users	tCO_2	102	134	213	188	209	159	258

2014				2015				2016				2017	
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2 (until 25.4.)
158	143	101	158	157	143	101	157	157	143	101	157	157	142
332	300	229	362	349	287	228	405	373	309	254	407	388	96
0	0	7	0	0	0	7	0	0	0	8	0	0	0
0	3	0	13	0	3	0	14	0	3	0	14	0	1
1	0	0	0	1	0	0	0	1	0	0	0	1	0
78	59	43	77	81	56	43	85	87	60	48	85	89	18
253	238	178	272	267	228	178	306	285	246	199	308	298	76

The following table summarizes the project emissions

Table 21: Project Emissions in tCO_2

	01/05/2012 to 31/12/2012	2013	2014	2015	2016	01/01/2017 to 25/04/2017	total
Line K DPE	450	679	689	667	704	231	3,419
Line K IDP	1,136	1,647	1,702	1,772	1,853	553	8,664
Line J DPE	527	868	857	834	829	290	4,203
Line J IDP	587	1,059	1,222	1,269	1,344	484	5,964
Total PE	2,699	4,253	4,470	4,542	4,729	1,557	22,250

Total project emissions for the monitoring period are 22,250 tCO_2

E.3. Calculation of leakage emissions

No leakage calculations are included in accordance with the registered PDD and the methodology as the occupation rate of buses was higher in the monitoring than in the baseline period.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	74,072	22,250	51,821	5,839	45,982	51,821

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
51,821	96,823

E.6. Remarks on increase in achieved emission reductions

Monitored ERs are lower than ex-ante estimated ERs.

Emission reductions achieved are 54% of expected emission reductions. This is basically due to not entry into operations of the other cable car lines which in the PDD were projected to enter operations (Line C-Occ and Ext B).

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Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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