CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

BRT Bogotá, Colombia: TRANSMILENIO Phase II to IV
Version 6.2 (PDD for second renewal crediting period)
08/06/2012
UNFCCC Ref. Number: 0672

A.2. Description of the project activity:

The project proponent is applying for a 2nd crediting period (renewal of crediting period) from 01/01/2013 to 31/12/2019.

This section has been taken from the registered PDD with minor eliminations to update the description based on actual development.

The goal of TRANSMILENIO is to establish a sustainable mass urban transport system based on a Bus Rapid Transit (BRT) system. TRANSMILENIO phase II-IV which is the project presented is an extension of phase I. Phase I is not part of this CDM project.

Core aspects of TRANSMILENIO are:

- A new infrastructure consisting of dedicated lanes, large capacity buses, and elevated bus stations that allow pre-board ticketing and fast boarding. Smaller units offering feeder services to main stations are integrated in the system.
- A new integrated fare system allowing for free transfers.
- Improved bus management system moving from many small independent enterprises competing at bus-to-bus level to a consolidated structure with formal enterprises competing for concessions.
- Centralized coordinated fleet control providing monitoring and communications to schedule services and real-time response to contingencies.
- Reduction of the existing fleet of buses through a scrappage program. Through scrapping of more than 9,000 buses TRANSMILENIO retires more than 1/3rd of all conventional buses and reduces the risk of a declining efficiency (load factor) in the remaining system.

The objective of TRANSMILENIO is to establish an efficient, safe, rapid, convenient, comfortable and effective modern mass transit system ensuring high ridership levels.

TransMilenio System is a public-private partnership (PPP), in which the public sector is responsible for the investment to deploy the required infrastructure (segregated lanes, stations, terminals, etc.), while the private sector is responsible for the investment of the bus fleet, the ticket selling and validating system, and for the operation of the trunk and feeder services.

TransMilenio Phases are implemented gradually. TransMilenio System has as main environmental aspect that the resource efficiency of transporting passengers in Bogotá is improved i.e. emissions per passenger trip are reduced compared to the situation without project. This is realized through following changes:

- Improved efficiency: new and larger buses are used which have an improved fuel efficiency per passenger transported compared with those used in absence of the project.
- Mode switching: The BRT system is more attractive to clients due to reduced transport times, increased safety, reliability and comfort. It can thus attract private car or taxi users with higher emission rates to switch to public transport.
- Load increase or change in occupancy: BRT systems have a centrally managed organisation dispatching vehicles. The occupancy rate of vehicles can thus be increased due to organizational measures.

The project contributes to **sustainable development** in a significant manner:

- Improved environment through less GHG and other air pollutant emissions, specifically CO_2, particle matter, and NO_x. This is achieved through a more efficient transport system and through new buses.
- Improved social wellbeing as a result of less time lost in congestion, less respiratory diseases due to less particle matter pollution, less noise pollution and fewer accidents per passenger transported[1].
- Creation of more than 1,500 temporary construction jobs for unskilled workers of the surrounding communities for construction works of Phase II[2].
- Economic benefits mainly on a macroeconomic level. Bogotá can improve its competitive position by offering an attractive and modern transit system and can reduce the economic costs of congestion.

The project complies with all legal requirements of the environmental legislation of Colombia, enforced by the Environmental Secretaria SDA (Secretaría Distrital de Ambiente). It also complies with the social and environmental guidelines issued by IDU (Instituto de Desarrollo Urbano). All environmental permits required have been granted.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host)	TransMilenio S.A. Corporación Andina de Fomento - CAF	No
The State of the Netherlands	Corporacion Andina de Fomento - CAF acting as intermediary for the benefit of the State of the Netherlands for the purchase of Emission Reductions represented by its Ministry of Housing, Spatial Planning and the Environment.	Yes
The State of the Netherlands	The Netherlands' Ministry of Infrastructure and the Environment ("IenM")	Yes

[1] In Phase I a reduction of 89% of fatal accidents and of 83% of accidents with passengers injured was registered (see D. Hidalgo, TRANSMILENIO: Un Sistema de Transporte Masivo en Buses de Alta Capacidad y Bajo Costo para Bogotá, Colombia, 1/2003)

[2] IDU, Registro generación de empleo de las localidades de Bosa y Ciudad Bolívar. Tramo 3; contrato 242-03, 2006

Switzerland	Grütter Consulting AG	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Colombia

A.4.1.2. Region/State/Province etc.:

Capital District

A.4.1.3. City/Town/Community etc:

Bogotá

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project is located within the metropolitan area of the city of Bogotá, Colombia. The geographical coordinates of Bogotá are $4^0$35´53´´ North and $74^0$4´33´´ West (equivalent to 4.598 Latitude and -74.076 Longitude).

A.4.2. Category(ies) of project activity:

Sectoral scope 7: Transport

A.4.3. Technology to be employed by the project activity:

This section has been taken from the registered PDD updating the description based on actual development.

Features of the BRT system of TransMilenio System include exclusive right-of-way lanes, rapid boarding and alighting, free transfers between lines, pre-board fare collection and fare verification, enclosed stations, clear route maps, real-time information displays, automatic vehicle location technology to manage vehicle movements, modal integration at stations, effective reform of the existing institutional structures for public transit, clean vehicle technologies and excellence in marketing and customer service. The BRT TransMilenio System is considered as model-case for a modern mass urban transit system and is being replicated by various cities world-wide.

From an organizational viewpoint the system has regulators, managers and operators:

- Ministerio de Transporte (Ministry of Transport, public entity)[3] is in charge of national policies of transport; the Secretaria Distrital de Movilidad (Mobility Secretariat of District, public entity)[4] which is the regulatory authority in matter of transport in the Municipality of Bogota D.C.
- Ministerio de Minas y Energia (Ministery of Mines and Energy)[5] is in charge of national policies of fuels (quality, blend, biofuel, among others).
- Ministerio de Ambiente y Desarrollo Sostenible (Ministry of the Environment and Sustainable Development) is in charge of national policies of environment regarding the technologies of vehicles, regulations of mitigation measures of environmental impacts, among others. This Ministry is the Designated National Authority of Colombia.
- Secretaria Distrital de Ambiente (Environment Secretariat of District)[6] is the environmental authority in Bogota D.C., which issues technical concepts and authorizations regarding the environmental permissions.
- Instituto de Desarrollo Urbano (Urban Development Institute)[7] is a public entity and constructs the trunk and maintains the urban and feeder (feeder, complementary and special) route infrastructure.
- TRANSMILENIOS.A. as system manager, which plans, manages and controls the BRT system.
- Private operators, which invest in buses and operate the trunk, urban and feeder (feeder, complementary and special) route of the System. Operators have contracts awarded in an open and competitive bidding process by TRANSMILENIO S.A.
- Private operators, which buy, install and operate the ticketing and tariff system and are responsible for fare collection and distribution, and provide the technology for controlling of the System. The operators manage the SIRCI[8] (System Integrated of Collection, Control, Information and Service to the User). The operators have a contract awarded in an open and competitive bidding process by TRANSMILENIO S.A.

The entities that take part in the development and monitoring of the CDM Project are:

TRANSMILENIO S.A. through a member of the Environmental Area, an unit of the Advisor Office of Planning attached to this office is responsible for handling the CDM project data will be in charge of managing all data in relation to the CDM project, including responsibility for data collection, quality assurance, reports and data storage.

Grütter Consulting AG (private entity) is the project developer and the Andean Development Corporation (CAF[9]), a Multilateral Bank is project developer and participant of the CDM Project and buyer of the CERs.

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[3] www.mintransporte.gov.co

[4] www.movilidadbogota.gov.co

[5] www.minminas.gov.co

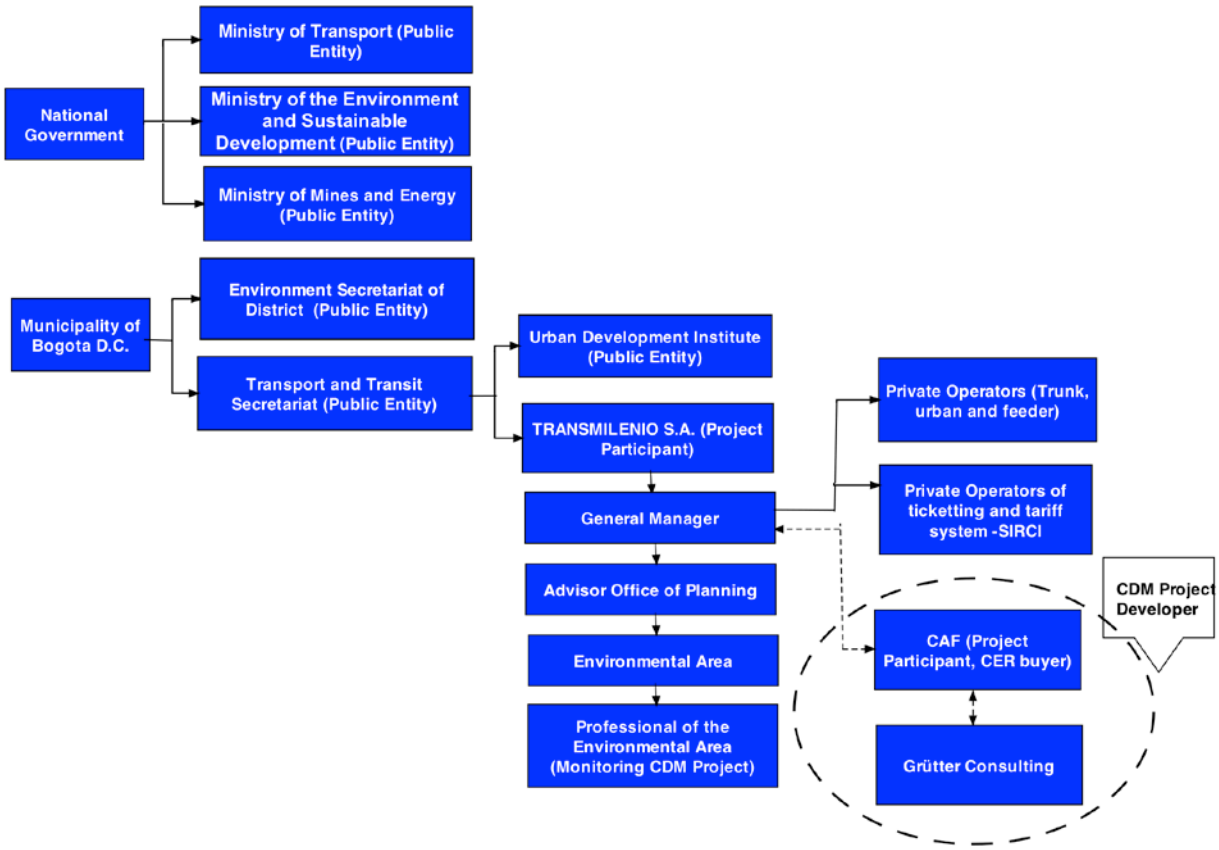
[6] www.secretariadeambiente.gov.co

[7] www.idu.gov.co

[8] Sistema Integrado de Recaudo, Control e Información y Servicio al Usuario

[9] www.caf.com

Figure 1: Organizational Structure



The technology deployed has 4 main components. Infrastructure, buses, transit management and fare system.

Infrastructure

The project establishes dedicated bus lanes including new bus-stations and integration stations located at the end of dedicated bus lanes to ensure a smooth transfer to feeder lines. Each station has a modular design with obstacle-free waiting areas and elevated level-access to articulated buses with a high platform. Stations have access ramps for mobility-impaired passengers and selected stations have bicycle parking and storage facilities. While the new infrastructure are trunk routes the BRT system includes trunk as well as feeder routes called "integrated transport system" SITP[10].

Bus Technology

Bus technology used are to a minor extent Euro II buses (compulsory since model-year 2001) and to a majority Euro III units as well as more recent Euro IV and Euro V. For the phase IV no definition of standards has yet been made. Bus technology for new phases might change e.g. using hybrids. This

[10] Sistema Integrado de Transporte Público – SITP

however does not affect the project system or the methodology. Buses operating on trunk routes are new articulated buses with a capacity of 160 persons or bi-articulated buses with a capacity of 240 persons with platform-level access including room for disabled persons. Feeder buses are maximum 12 years old (thereafter they need to be retired) and in their majority buses with a capacity of 70-90 passengers, while also including medium sized and smaller units. The emissions of TransMilenio System buses are significantly lower compared to conventional buses operating in Bogotá in the baseline, which were mostly Euro 0 or older. All operators of trunk routes have their own filling stations and regular controls are realized to ensure that emission specifications are met.

The technology used can be considered Environmentally Sound Technology (EST) and is significantly better than the Business As Usual technology used currently for buses in Colombia.

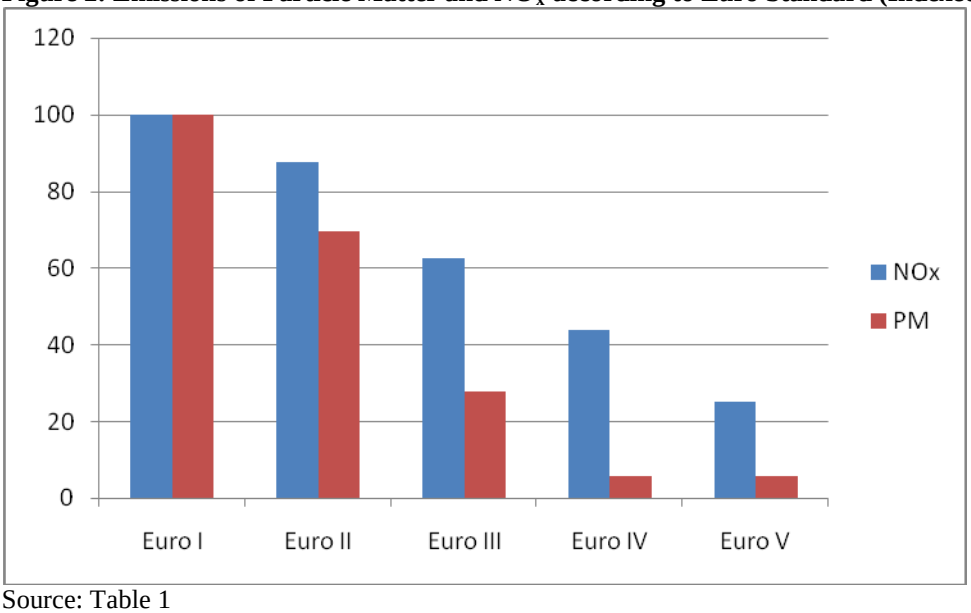
The following table shows the emissions of buses depending on the Euro-Category, while Figure 2 shows the emission reductions of particle matter and NO_x which constitute the main pollution problem of diesel engines.

Table 1: European Emission Limits for Heavy Duty Vehicles (g/kWh)[11]

	Test cycle	NOx	Particulate Matter
Euro I	ECE R-49	8.0	0.36
Euro II	ECE R-49	7.0	0.25
Euro III	ESC and ELR	5.0	0.1
Euro IV	ESC and ELR	3.5	0.02
Euro V	ESC and ELR	2.0	0.02

Source: http://www.dieselnet.com/standards/eu/ld.php

Figure 2: Emissions of Particle Matter and NO_x according to Euro Standard (Indexed)[12]



Source: Table 1

[11] CO is not included as HDVs do not emit significant amounts of this pollutant

[12] Euro 0 standard had no particulate limits

Transit Management

The operational fleet centre manages bus dispatch, informs passengers, produces reports and maintains records. All buses (trunk route buses as well as feeder buses) are equipped with a Global Positioning System (GPS) linked to the operation centre. The novelty of the operational fleet centre is that an efficient management of bus fleets can take place optimizing load factors through coordinated scheduling of service. The transit system operates on concessions eliminating competition at bus-to-bus level. Also passengers have real-time information about the next available bus on trunk routes and are informed of potential transit problems.

Fare System

The system is based on pre-board ticketing for trunk buses and on-board ticketing for feeder units which use in their majority magnetic ticketing [13]. This streamlines the boarding process and optimizes operations. The fare system integrates feeder and main lines. Fare collection is centralized and managed by a private company through a concession.

The following table lists the trunk routes of the CDM project completed as of 31/12/2011 while the following table lists the projections for the 2nd crediting period. Concerning feeder routes the system is in the process of integrating the entire baseline bus systems as feeder routes into the BRT system. This integration should be completed by 2012 i.e. prior commencement of the 2nd crediting period.

Table 2: Infrastructure Completed by the Project (as of 31.12.2011)

Phase	Trunk route	Distance in km	Completion date
Phase II	Americas	13.0	2003
Phase II	NQS	19.3	2006
Phase II	Suba	10.0	2006

Table 3: Infrastructure Planned by the Project

Phase	Trunk route	Distance in km	Expected Completion date
Phase III	Calle 26	12.2	2012
Phase III	Carrera 10	9.5	2012
Phase III	Carrera 7	13.0	2013
Phase IV	Av. Boyacá	35.0	2017
Phase IV	1º de Mayo	11.0	2019
Phase IV	Carrera 68	20.0	2022
Phase IV	Calle 13- Calle 19	15.0	2024
Phase IV	Av. Ciudad de Cali	11.0	2026

Source: IDU/TRANSMLIENIO, File 25

[13] Some feeder lines do not have on-board ticketing i.e. passengers will only buy a ticket when boarding the trunk units; passengers of these feeder buses, if they thereafter do not use a trunk bus, are not counted.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_{2e}
2013	490,916
2014	560,674
2015	554,173
2016	536,947
2017	642,093
2018	630,907
2019	636,716
Total estimated reductions (tonnes of CO_{2e})	**4,052,426**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tCO_{2e})	**578,918**

A.4.5. Public funding of the project activity:

There is no Official Development Assistance in this project and the project will not receive any public funding from Parties included in Annex I. Funding is from the national and the district government through budgetary allocations and does not include any official development assistance and is not counted towards the financial obligations of Annex 1 parties.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

As of Registered PDD with Ref No: 0672
AM0031 Version 3.1.0 "Baseline Methodology for Bus Rapid Transit Projects"
First crediting period: 01/01/2006 to 31/12/2012 (Renewable)

Additionally following tool was used in the registered PDD:

- Tool for the demonstration and assessment of additionality (Version 2)

For Renewal of crediting period:
AM0031, Version 4.0.0 "Bus Rapid Transit Projects"

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

This section has been updated based on the new methodology version which includes changes in applicability conditions.

The methodology is applicable to project activities that reduce emissions through the construction and operation of a Bus Rapid Transit (BRT) system for urban road based transport. The following table relates the applicability conditions of the methodology with the proposed project.

Table 4: Applicability Conditions

Applicability condition	Project situation
Any fuels, including (liquified) gaseous fuels or biofuel blends, as well as electricity, can be used in the baseline or project case. The following condition applies: In the case of biofuels, project buses must use the same biofuel blend (same percentage of biofuel) as commonly used by conventional comparable[14] urban buses in the country, i.e. the methodology is not applicable if project buses use higher or lower blends of biofuels than those used by conventional buses. In addition, the project buses shall not use a significantly higher biofuel blend than cars and taxis.[15]	Resolution 18 1266 of 14/07/2010 of the Ministry of Mines and Energy regulates that diesel sold in Bogota shall have a biodiesel content of 7% starting August 15th 2010[16]. The biodiesel share can change over time based on Resolutions realized by Government. Therefore the biofuel content in diesel is monitored based on official regulations as published by the Ministry of Energy and Mines. The project buses use diesel with this compulsory share of biodiesel. The same is true for all remaining baseline buses or other vehicles using diesel as the percentage of biodiesel is defined by the Ministry and identical for any user of diesel in Bogota. No special blend or different diesel is used by project units. Gasoline vehicles use an 8% biofuel blend (ethanol) since 01/01/2010 based on Resolution 18 2368 dated 29th December 2009[17]. Project buses thus do not use a higher blend of biofuels than cars and taxis.
The project activity BRT system is road-based. The baseline public transport system and other public transport options are road- or rail-based (the methodology excludes air and water-based systems from analysis). However, the methodology is not applicable if the project activity BRT system replaces an urban rail-based Mass Rapid Transit System (MRTS), i.e. if the MRTS stops operating after project implementation due to the project activity	The BRT is road based and replaces road-based transport options. No rail-based transit system operates in Bogota. The only rail-based transport mode is a tourist train in Bogota which is however not a mass transit mode and which also only runs 1 trip per day on weekends and public holidays (http://www.turistren.com.co/)
The methodology is applicable if the analysis of possible baseline scenario alternatives leads to the result that a continuation of the use of the current modes of transport is the baseline scenario.	Section B.4. of the PDD identifies the baseline as a continuation of the current public transport system

[14] Comparable means of the same fuel type e.g. project buses using diesel are compared with conventional buses using diesel etc. The comparison is made for each year of monitoring based on official fuels sold. The term commonly used refers to the majority of units.

[15] Project proponents wishing to consider project busses with a higher biofuel blend may propose a revision of this methodology based on future EB guidance on biofuels use.

[16] 3rd paragraph of Considerations, File 11

[17] File 12

All applicability conditions for using the methodology AM0031 Version 4.0.0 are thus fulfilled.

B.3. Description of the sources and gases included in the project boundary

This section has been updated based on the new methodology version which includes changes in gases included.

The spatial project boundary is the metropolitan area of Bogota. It is based on the origins and destinations of passengers using the project system and is based on the outreach of the new project system including BRT trunk routes as well as feeder routes.

Figure 3 outlines the conceptual project boundary and table 5 gases included.

Figure 3: Conceptual Project Boundary

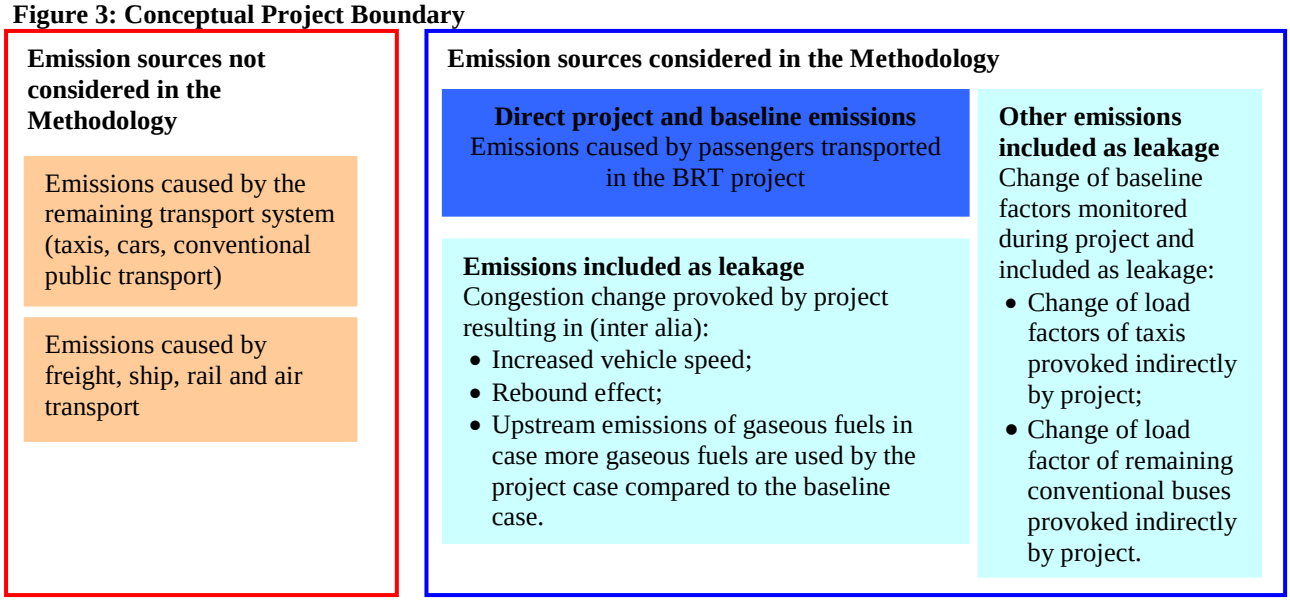


Table 5: Emissions Sources Included in or Excluded from the Project Boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Mobile source emissions of different modes of road transport for passengers which use BRT system (buses, passenger cars, motorcycles, taxis)	CO_2	Yes	Major emission source
		CH_4	Yes	Included only if gaseous fuels are used and excluded for liquid fuels CH_4 emissions are a minor emission source of the total CO_2e emissions in diesel/gasoline vehicles. Neglecting these emissions in baseline as well as project emissions is conservative as fuel consumption and thus also CH_4 emissions are reduced through the project

	Source	Gas	Included?	Justification / Explanation
		N_2O	No	N_2O emissions are a minor source of the total CO_2e emissions in diesel/gasoline vehicles. Neglecting these emissions in baseline as well as project emissions is conservative as fuel consumption and thus also N_2O emissions are reduced through the project
Project Activity	BRT bus emissions (feeder and trunk routes)	CO_2	Yes	Major emission source
		CH_4	Yes	Included only if gaseous fuels are used. See explanation above
		N_2O	No	See explanation above

TransMilenio System operates trunk routes and feeder routes. The following table relates the trunk routes of TransMilenio Phase I to IV as originally planned during PDD formulation. For actual implementation and updated projections 2nd crediting period see table 2 and 3 section A.4.3.

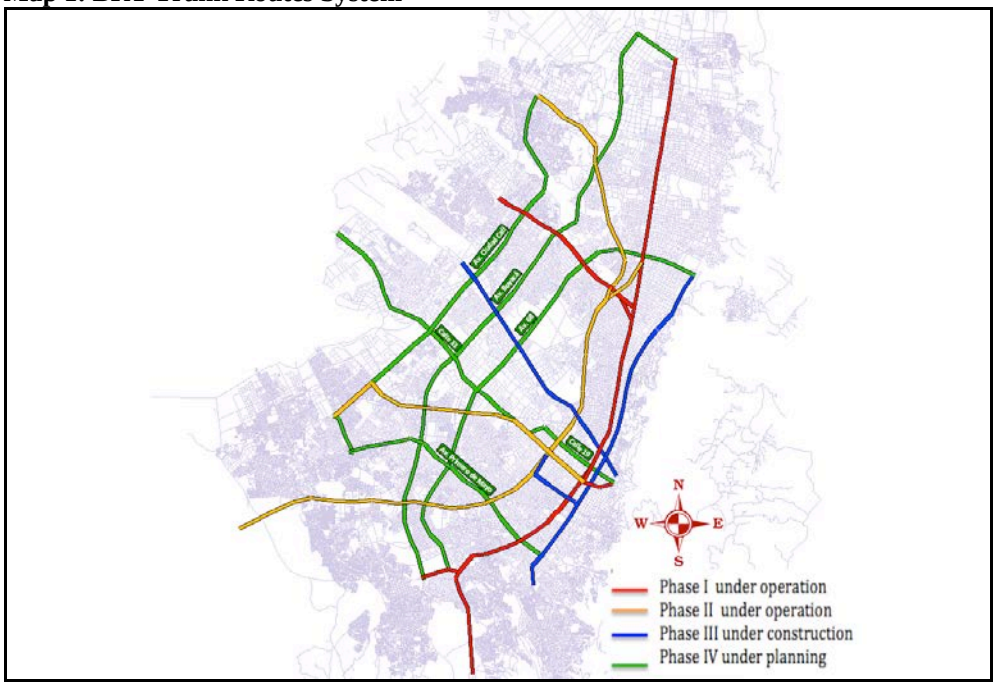
Table 6: Projected Trunk Routes TRANSMILENIO (Phase I-IV) (as of 2006)

Phase	Trunk route	Projected Distance	Projected Completion Date
Phase I	Calle 80	10.1 km	2000
Phase I	Caracas	21.8 km	2000
Phase I	Autonorte	10.3 km	2000
Phase II	Americas	13.0 km	2003
Phase II	NQS	19.3 km	2006
Phase II	Suba	10.0 km	2006
Phase III	Calle 26	13.9 km	2007
Phase III	Carreras 10 and 7	22.5 km	2008
Phase III	Av. Boyaca	26.6 km	2009
Phase IV	Avenida 68	25.7 km	2011
Phase IV	Calle 13	7.1 km	2012
Phase IV	Av. Ciudad de Cali	14.7 km	2014
Phase IV	Av. 1 de Mayo	12.3 km	2015
Total phases I-IV		207.3 km	

Source: TRANSMILENIO S.A. and IDU, 2006; Phase I is not part of the CDM project

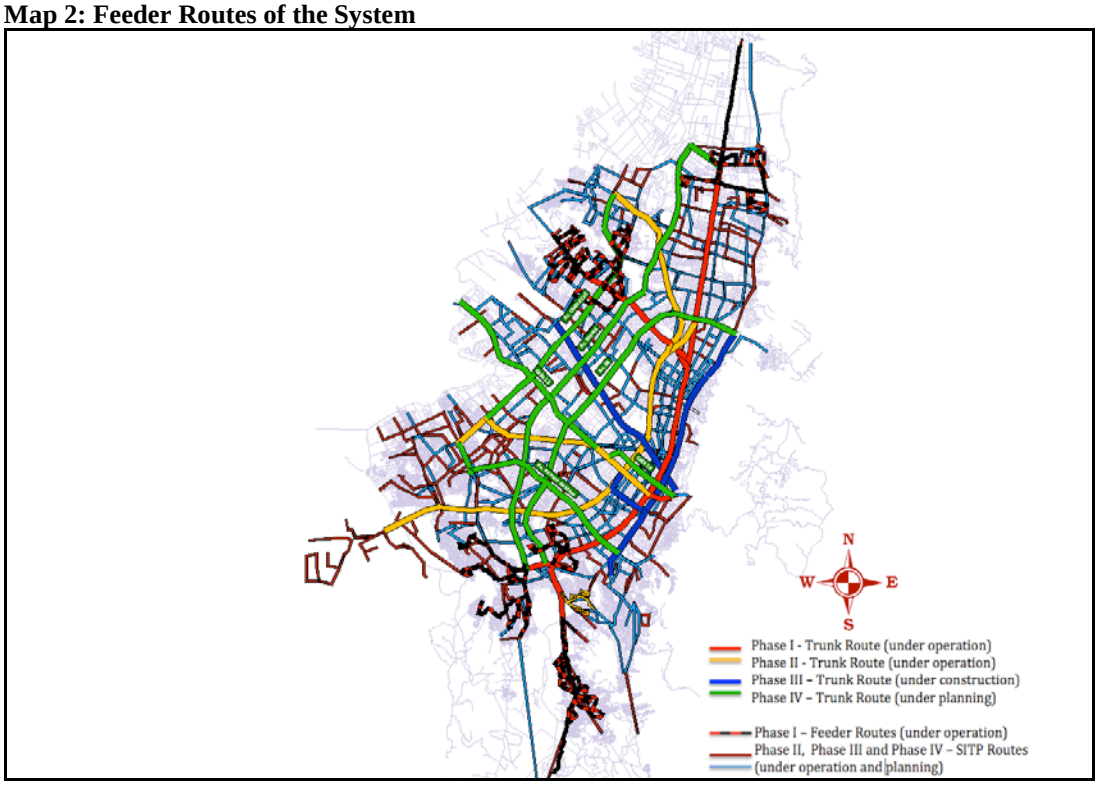
Map 1 shows the updated map with currently operating trunk routes (including Phase I trunk routes not part of the project) and planned trunk routes.

Map 1: BRT Trunk Routes System



Map 2 shows the feeder routes updated.

Map 2: Feeder Routes of the System



Trunk as well as feeder route locations, distances and routings might still change as the current information is based on planning data and projections. These are constantly updated based on the actual experience gained with the already operating BRT lanes as well as based on normal city development.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The first part of this section has been taken from the registered PDD (section B2) without any changes.

Steps followed to identify the baseline are:

- Step 1: Identify all alternatives
- Step 2: Analyze options using the latest version of the "Tool for the demonstration and assessment of additionality"
- Step 3: If step 2 results in more than one possible scenario, the baseline scenario is the one with the lowest emissions.

Step 1: Identification of Alternatives

The baseline alternatives assessed are:

1. Establishment of a rail-based public transport system
2. Complete operational restructuring of the public transport system
3. Continuation of the current system including improvements based on national, regional or local policies. The continuation of the current system includes the continuation of TransMilenio phase I.
4. Implementing the project (TransMilenio phase II and following) without CDM

Step 2: Analysis of Alternatives

ALTERNATIVE 1: RAIL-BASED SYSTEM

The alternative is a rail based system for high passenger capacity. The national planning department of Colombia compared in the year 2000 as potential alternatives a BRT with a metro based system for the city of Bogotá[18]. The metro was considered as inferior to the BRT due to various reasons:

- The estimated infrastructure investment for the metro was estimated in more than double than for the BRT system (4,007 million USD versus 1,970 million USD).
- The investment cost per kilometre was estimated at 107 million USD versus 5 million USD for the BRT system. The cost per kilometre is thus more than 20-times higher for metro than for the BRT alternative.
- The cost benefit calculation including social and environmental benefits calculated at shadow prices were double for the BRT versus the metro.
- The coverage of public transport in the area of Bogotá is far superior with a BRT system compared to metro.

[18] República de Colombia, Departamento Nacional de Planeación, Documento Conpes 3093, Bogotá 15.11.2000

This alternative is not feasible for Bogotá due to its large capital investment, the relatively bad cost-benefit relation and the low coverage. The main reason, as in most cities, is clearly the huge capital layout. The above cited official document clearly favours BRT over metro. The alternative metro was thus rejected by Bogotá. Based on this TransMilenio Phase I in conjunction with a continuation of the existing transport system was implemented. A rail based system is thus clearly **not** the baseline.

ALTERNATIVE 2: OVERALL ORGANIZATIONAL RE-STRUCTURING OF THE TRANSPORT SYSTEM

This scenario implies a completely integrated, centrally managed and re-structured transport system which is a comprehensive and complete change of the current public transport system. Currently the transport system is atomized in Bogotá with many individual bus owners competing between each other for passengers. The proposed re-organization would include a centrally managed control of all units, dispatching them upon demand, a management and integration of tariffs, a re-definition of routes and significant structural changes from current operations relying on independent small bus-owners to transit operators embedded in a centrally controlled operation centre of fleet.

The barrier to implementing such a system is clearly of organizational and management nature with the considerable risk of non-functioning and the resistance to change of the existing transport sector. To manage such a change the entity in charge of transport management needs to be very strong and the involved parties i.e. the existing transport companies, need to agree upon the change. The Secretaría de Tránsito y Transporte (STT) in charge of public transport planning in Bogotá however has significant institutional weaknesses[19]. Indications of this weakness are also that emitted decrees such as 114-2003 or 115-2003 which planned to change some structural elements of the existing transport fleet were not or only partially implemented[20]. Also elements of decree 533-2002 which changed the tariff structure to include as an element the occupancy rate thus trying also to reduce the over-supply of buses was challenged successfully in court[21] by the transport companies thus returning to a tariff-system legally defined in 1998. No city in Latin America with a comparable transport system to Bogotá has to the moment implemented successfully a comprehensive urban transport system integrating formal and informal individual bus owners[22]. The chance of success in re-organizing atomized public transport sectors such as the one in Bogotá was and is considered as very small as resistance to change from the existing often partially informal transport sector is high, the involved regulatory authorities are weak and free-riders (the informal sector) would undermine the approach of the whole system.

The barriers to implementing this alternative are thus of organizational nature, lack of know-how on how to implement the change, high resistance to change from current bus operators, especially informal ones and a complete lack of successful cases in comparable surroundings. For Bogotá this alternative was thus considered as non-feasible basically due to the organizational challenge involved as well as the low

[19] See e.g. analysis made in Jorge Acevedo, Transporte urbano en Bogotá: bases para una política integral, Foro Económico, Regional y Urbano, No. 3, 1996; Ardila Arturo, Tránsito y transporte en la Bogotá que queremos, revista Foro, Separata Especial, 9/1998; JICA, Estudio del Plan Maestro del Transporte Urbano de Santa fe de Bogotá en la República de Colombia, informe final, IDU, 1996

[20] See Arturo Ardila, La olla de presión del transporte público en Bogotá, revista de ingeniería universidad de los andes, 5.2005

[21] Tribunal Administrativo de Cundinamarca, sección primera, subsección A, expediente No. 25000-23-24-000-2003-00224-01, Bogotá, 26.5.2005

[22] Plans for such an integration haven been realized e.g. by Santiago de Chile but have not yet been implemented.

success potential and the high risk of such an alternative. It is thus considered as a non-feasible alternative for the future. The re-organization alternative is thus clearly not the baseline.

ALTERNATIVE 3: CONTINUATION OF THE CURRENT TRANSPORT SYSTEM (INCLUDES TRANSMILENIO PHASE I)

A continuation of the current transport system complies with all applicable legal and regulatory requirements. The implementation of Phases II to IV of TRANSMILENIO is not conditioned by Colombian, regional or local law. Phase II is not a compulsory implementation following Phase I as financial means have to be secured independently for each phase on part of the District.

A continuation of the current system has various advantages compared to all other options:

- No political resistance from the existing transport sector as well as from other political pressure groups favouring public investment in other sectors such as education, health or security or opposing increased public spending.
- No large-scale public investment requiring additional income/tax sources.
- Lowest risk of all options.
- The political benefit of a new transport system has already been reaped with phase I of TransMilenio which is part of this BAU scenario. Expanding the system attracts no additional political gains while financial resources cannot be used for other more attractive and novel options outside the transport sector.

A continuation of the current transport system is the most attractive alternative. Public authorities must not engage in large investments, nor do they embark upon risky structural changes to transport nor do they have to confront resistance to change from the transport sector. The continuation of the current situation is thus clearly a realistic and attractive alternative.

ALTERNATIVE 4: IMPLEMENTATION OF THE PROJECT WITHOUT CDM

The alternative of the project without CDM is not considered as viable and thus not BAU due basically to three important barriers which have been identified for the second and further phases of TransMilenio System:

- Investment barrier: Costs per kilometre are significantly higher than anticipated and significantly higher than in Phase I. The District of Bogotá must thus bear much higher investments for phase II and following than originally anticipated. As in any investment project this results in a barrier to continue investing if no alternative income sources can be identified. While the first Phase of TransMilenio System was implemented successfully (operations started end of December 2000) severe financial difficulties have resulted in a risk of non-continuation. Financial consolidation and the go-ahead for phase II were only achieved after accruing sales of GHG offsets as additional funding sources.
- Political barrier: The interest of the new administration in investing in new phases is limited as other public investment projects are higher on the current political agenda.
- Resistance of the existing transport sector. This resistance has grown relative to phase I as formerly only a limited part of the city was affected while phases II to V encompass a large part of the city. Bus owners thus fear to loose income and especially the informal transport sector for many reasons has resistance to change to a formal transport system.

The barriers presented here are discussed in major detail in section B.3. That section demonstrates that in absence of the CDM the project would not happen. The project is thus not BAU and not the baseline.

The most probable alternative in the future in absence of the project is thus a continuation of the current road-based transport system. This is thus the baseline for this project.

KEY STEPS TO DETERMINE THE BASELINE

The baseline methodology involves two main steps:

1. Determination of emissions per passenger transported per vehicle category. This is calculated ex-ante, including the usage of a fixed technology change factor. The baseline emission factor is adapted to potential changes in trip distance and type of fuel used by passenger cars if the surveys indicate that changes in trip distance or type of fuel used would lead to lower baseline emission factors.
2. Baseline emissions: These are calculated ex-post based on the passengers transported by the project and their modal split. Core baseline parameters used for calculating the baseline emission factors are reviewed through a survey, with changes only being applied if the baseline emissions factors would be lower than original factor. Passengers transported by the project are recorded by TRANSMILENIO.

The following section is new.

The renewal of the crediting period requires validating that “the original project baseline is still valid or has been updated taking account of new data where applicable” ("Procedures for Renewal of the Crediting Period of a Registered CDM Project Activity" (version 06), paragraph A.1). In order to assess the validity of the original baseline, the “Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period (version 03.0.0)” was used.

Point 6 of the tool indicates that there are different scenarios that could be identified as the baseline scenario for a CDM project activity. For the purpose of the renewal of the crediting period, it is important to differentiate between four different scenarios. The scenario relevant for the project is that the project participants do not undertake an investment but an investment to provide comparable outputs or services is undertaken by a third party (or parties). Passengers would use a mix of different transit means in absence of the project including public transit in its traditional form provided by private bus operators.

The tool specifies under point 7 that, at the renewal of the crediting period, the baseline scenario should not be reassessed but there should be an assessment of whether the baseline emissions will be affected. In such case, the baseline emissions should be updated.

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

There is no mandatory national or sectoral policy for establishing a BRT i.e. a continuation of the selected baseline complies with all national and sectoral policies. Private as well as public transit means are

allowed to operate as long as they comply with safety and emission regulations (of the individual vehicles). A national urban mass transit policy exists[23]- however latter is not mandatory and has only a promotional character[24]. The current baseline therefore complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period. The original baseline is therefore still valid.

Step 1.2: Assess the impact of circumstances

As mentioned above the baseline scenario is an investment of other actors in transit means including cars, taxis, motorcycles and traditional buses to cater for the transit demand. The tool specifies under point 7 that, at the renewal of the crediting period, the baseline scenario should not be reassessed but there should be an assessment of whether the baseline emissions will be affected. Baseline emissions are re-calculated based on updated baseline emission factors for all baseline modes of transit. The detailed calculation is described in section B.6.3 of this document. Therefore, the original baseline scenario is still valid, and the emission that results from this scenario has been aptly reassessed.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

According to the Tool this sub-step is only applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology. This is not the case in the project and therefore Step 1.3. is not applicable to the project.

Step 1.4: Assessment of the validity of the data and parameters

Assess whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated. Baseline data and parameters have been updated. See Section B.6.2 and B.6.3.

Step 2: Update the current baseline and the data and parameters

Step 1.2. and 1.4 showed that the current baseline needs to be updated.

Step 2.1: Update the current baseline

Update the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period. See section B.6.3. for calculations.

Step 2.2: Update the data and parameters

[23] File 1, 2

[24] See section 1, File 1

If the application of Step 1.4 showed that the data and/or parameter(s) that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project participants should update all applicable data and parameters, following the guidance in Step 1.4. See for details Section B.6.2.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The following section has been taken from the registered PDD without any changes.

The additionality of the project is determined using the "Tool for the demonstration and assessment of additionality (version 2)" of 28.11.2005.

STEP 0. PRELIMINARY SCREENING BASED ON THE STARTING DATE OF THE PROJECT ACTIVITY

The project participants wish to have the crediting period starting prior to the registration of their project activity.

1. To be applicable for an early starting date the project must provide evidence that the starting date is between 1.1.2000 and 18.11.2004 (the date of the registration of a first CDM project activity): Construction for the first lane of Phase II commenced March 2002 (lane "Americas"). The first lane was operational December 2003 (source: IDU). Both dates are between 1.1.2000 and 18.11.2004.
2. The extended deadline for early starting date decided upon at COP/MOP 1 applies to the proposed project as it submitted a new baseline methodology (NM0105 as well as the revised methodology NM0105rev.) before December 31st 2005.
3. The project must provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity: The District of Bogotá signed a contract with the CAF in 2001 including the TransMilenio CDM project[25]. Prior to this the potentials of CDM were discussed and considered as viable, thus leading to the contract signature with the CAF to develop the project as a CDM one. Additional funds from CDM were considered a critical element to continue with Phase II of TransMilenio System.

The project thus complies with all conditions to apply for a crediting period starting prior to the registration of the project activity. The starting date of the crediting period is 1.1.2006.

STEP 1. IDENTIFICATION OF ALTERNATIVES TO THE PROJECT ACTIVITY CONSISTENT WITH CURRENT LAWS AND REGULATIONS

Potential alternatives are such that achieve in comparable circumstances similar mobility targets of involved actors.

Sub-step 1a: Define alternatives to the project activity

The potential alternatives are:

[25] See CO_EX dated 14.11.2001 Annex C

1. Establishment of a rail-based public transport system
2. Complete operational restructuring of the public transport system
3. Continuation of the current system including improvements based on national, regional or local policies. The continuation of the current system includes the continuation of TransMilenio phase I.
4. Implementing the project (TransMilenio phase II and following) without CDM

Alternative 1 of a rail-based public transport system is not a viable alternative and thus not further considered due to following facts[26]:

- The estimated infrastructure investment for the metro was estimated in more than double than for the BRT system (4,007 million USD versus 1,970 million USD). The metro system would however have a coverage of only 8% of the city (10% of trips) while the BRT system would have a coverage of 85% (80% of trips)[27]. Per trip coverage metro would thus be around 16 times more expensive than the BRT system.
- The investment cost per kilometre was estimated at 107 million USD for metro versus 5 million USD for the BRT system. The cost per kilometre is thus more than 20-times higher for metro than for the BRT alternative.
- The cost benefit calculation including social and environmental benefits calculated at shadow prices were double for the BRT versus the metro.

Based on these calculations the government of Colombia concluded that metro was financially non-viable and that a BRT system is far more attractive than metro.

Alternative 2 of a complete restructuring of the public transport system implies a completely integrated, centrally managed and re-structured transport system which is a comprehensive and complete change of the current public transport system. Currently the transport system is atomized in Bogotá with many individual bus owners competing between each other for passengers. The proposed re-organization would include a centrally managed control of all units, dispatching them upon demand, a management and integration of tariffs, a re-definition of routes and significant structural changes from current operations relying on independent small bus-owners to transit operators embedded in a centrally controlled operation centre of fleet. The barrier to implementing such a system is clearly of organizational and management nature with the considerable risk of non-functioning and the resistance to change of the existing transport sector. To manage such a change the entity in charge of transport management needs to be very strong and the involved parties i.e. the existing transport companies, need to agree upon the change. The Secretaría de Tránsito y Transporte (STT) in charge of public transport planning in Bogotá however has significant institutional weaknesses[28]. Indications of this weakness are also that emitted decrees such as 114-2003 or 115-2003 which planned to change some structural elements of the existing transport fleet

[26] República de Colombia, Departamento Nacional de Planeación, Documento Conpes 3093, Bogotá 15.11.2000

[27] The first figure corresponds to spatial coverage, the 2nd to trip coverage. Former is different to latter due to different concentration of population per square meter depending on location.

[28] See e.g. analysis made in Jorge Acevedo, Transporte urbano en Bogotá: bases para una política integral, Foro Económico, Regional y Urbano, No. 3, 1996; Ardila Arturo, Tránsito y transporte en la Bogotá que queremos, revista Foro, Separata Especial, 9/1998; JICA, Estudio del Plan Maestro del Transporte Urbano de Santa fe de Bogotá en la República de Colombia, informe final, IDU, 1996

were not or only partially implemented[29]. Also elements of decree 533-2002 which changed the tariff structure to include as an element the occupancy rate thus trying also to reduce the over-supply of buses was challenged successfully in court[30] by the transport companies thus returning to a tariff-system legally defined in 1998. No city in Latin America with a comparable transport system to Bogotá has to the moment implemented successfully a comprehensive urban transport system integrating formal and informal individual bus owners[31]. The chance of success in re-organizing atomized public transport sectors such as the one in Bogotá was and is considered as very small as resistance to change from the existing often partially informal transport sector is high, the involved regulatory authorities are weak and free-riders (the informal sector) would undermine the approach of the whole system. The barriers to implementing this alternative are thus of organizational nature, lack of know-how on how to implement the change, high resistance to change from current bus operators, especially informal ones and a complete lack of successful cases in comparable surroundings. For Bogotá this alternative was thus considered as non-feasible basically due to the organizational challenge involved as well as the low success potential and the high risk of such an alternative. The re-organization alternative is thus clearly not the baseline.

The only viable potential alternatives analyzed thus in the further steps are a continuation of the current public transport system or the project without CDM.

Sub-step 1b. Enforcement of applicable laws and regulations

All alternatives proposed comply with all applicable legal and regulatory requirements. Continuation of the current transport mode complies with legal requirements. The implementation of Phases II to IV of TransMilenio is not conditioned by Colombian, regional or local law. Phase II is not a compulsory implementation following Phase I as financial means have to be secured independently for each phase on part of the District.

The potential alternatives 1 and 2 have been analyzed and have been excluded as being non-viable in chapter B.2. (identification of the baseline). They would however also comply with legal and regulatory requirements.

STEP 2: INVESTMENT ANALYSIS

The investment analysis is not realized. Infrastructure in the case of TransMilenio is 100% public financed and has no direct returns. The public financed component is not repaid. Tariffs in TransMilenio System cover only operational costs excluding infrastructure costs. The direct financial return of the project is thus 0 (no direct income).

STEP 3: BARRIER ANALYSIS

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

[29] See Arturo Ardila, La olla de presión del transporte público en Bogotá, revista de ingeniería universidad de los andes, 5.2005

[30] Tribunal Administrativo de Cundinamarca, sección primera, subsección A, expediente No. 25000-23-24-000-2003-00224-01, Bogotá, 26.5.2005

[31] Plans for such an integration haven been realized e.g. by Santiago de Chile but have not yet been implemented.

Two important barriers exist for the implementation of the second and further phases of TransMilenio:

- Investment barrier: Costs per kilometre are significantly higher than anticipated and significantly higher than in Phase I. The District of Bogotá must bear much higher investments for phase II and following than originally anticipated. The District of Bogotá is forced to identify alternative finance sources to continue with phase II as resources are limited from the surtax on gasoline established for this purpose. The main barrier is thus the much higher than anticipated investment which limits the ability and reduces the willingness of the administration to further invest in TransMilenio.
- Resistance of the existing transport sector. This resistance has grown relative to phase I as formerly only a limited part of the city was affected while phases II to V encompass a large part of the city. Bus owners thus fear to loose income and especially the informal transport sector has resistance to change to a formal transport system for a variety of reasons.

Investment Barrier

The District does not receive any income from the investment in infrastructure of TransMilenio. No direct returns on capital are received. The investment in TransMilenio thus competes in a political agenda with a wide array of other investment opportunities, which also have economic, social and environmental benefits including inter alia investment in education and schooling, investment in public health or a reduction of public debt and/or public spending with the possibility to reduce taxes. Without significant public investment the private sector would not be willing to invest in new transport schemes due to lack of profitability and a too high risk.

The most important barrier is the financial or investment barrier which is detailed in continuation. The financial barrier is basically for the District of Bogotá which needs to cover 36% of the infrastructure costs. The resources from the national government cover 64% of total investment costs and are assured through a national decree[32]. The District which is the project owner must assure the remaining 36%.

The barrier which the District confronts for phase II and following of TransMilenio is the following:

- Stagnating or reduced income from the fuel surcharge as well as other sources to finance TransMilenio phase II.
- Sharply increased investment cost for phase II. The investment cost for phase II is far higher than anticipated.

The combination of an eroding income base with increased costs is a lack of resources to invest further in TransMilenio. The significant deficit is a main barrier for implementing phase II. The District is thus dependent on alternative income sources to cover at least a portion of this deficit and thus be able to go ahead with the project.

[32] The share 36% District and 64% National Government is based on an agreement between the District and the National government of financial obligations towards TRANSMILENIO 2004 to 2011 showing a total sum of 1,837,383 million Pesos (pesos of 2003) with 1,183,678 million (64%) from the national government and 653,705 million (36%) from the District. This corresponds basically to the distribution established originally for all phases in the official planning document Conpes 3093 where a share of the National Government of 66% was projected (República de Colombia, Departamento Nacional de Planeación, Conpes 3093, 15.11.2000, Table 3)

Income Sources Phase II

The District relies on 50% of a fuel surcharge levied specially for this purpose to finance its share of the total public investment. The surtax on fuel consumption is levied at the pump on the consumption of gasoline and diesel fuel in the district. In 1996 the rate was 13% and by 1998 it went to 20%. Originally each municipality could set its rate. After many drivers in Bogotá began to fuel in adjacent municipalities with significantly lower rates, Congress stepped in and established rates that can vary only between 18% and 20%[33]. Revenues from the fuel surtax are thus limited and cannot be increased significantly as Bogotá is already at the maximum rate[34]. An important additional funding source of the capital District for phase I of TransMilenio were also significant non-recurrent capital receipts. The largest single influx was thereby the capital reduction of the city Power Company, EEB, which facilitated large investments in TransMilenio phase I in 1999 and 2000[35]. This source of revenue has however dried up and is not available anymore for phase II. Sources of revenue which are destined for investment in TransMilenio are thus limited and potentially lower for phase II and following than for phase I.

Investment Cost Phase II

The investment cost of phase I was much higher than anticipated. The following table compares the projected investment with the actual cost of Phase I in USD of 2000.

Table 7: Comparison Projected and Actual Investment Phase I TransMilenio (million USD 2000)

Trunk road	Length (km)	Projected cost	Actual cost	Surplus cost
Calle 80	10	42.6	97.8	55.2
Caracas	21	69.0	111.4	42.4
Autopista Norte	10	42.3	72.8	30.5
Total average cost per kilometre		**3.75**	**6.68**	**2.93**

Sources:

- Projected cost and lenght: República de Colombia, Departamento Nacional de Planeación, Conpes 3093
- Actual cost: Instituto de Desarrollo Urbano; USD 2003 are converted to USD 2000 using OECD deflator; based on real kilometres built
- Total cost per km is adjusted for actual cost to the actual km constructed: 42.2 km (planned: 41.0 km)

The cost overrun per kilometre is with nearly 80% very significant. Based on these higher costs new projections of real construction costs for phase II were realized. The major reasons for the cost increase experienced include:

- Significant changes in the construction method of trunk routes;
- Design and construction changes in stations and related components, e.g., traffic signalling or bike deposit stations;
- A higher investment in alternative routes during the construction phase;

[33] See World Bank, report 24941-CO, project appraisal document on a proposed loan in the amount of USD 100 million to the capital district of Bogotá, page 105, 14.2.2003; Since the decision on Phase II the maximum level has been increased to 25%. This improves the financial income situation for Phase III (construction start 2007)

[34] The fuel surtax is dependent on the fuel usage in the city and thus also dependent on macroeconomic parameters.

[35] Phase I was constructed between 1998 and 2000 entering into operations in the year 2000 (source: IDU)

- Significantly higher than expected costs for land acquisition due to higher than expected prices and a larger quantity of land being bought as trunk routes were only allowed to a limited degree to replace existing road space;
- Intersections between trunk routes not foreseen originally;
- An increase in the price of raw material, basically steel used for stations;
- Increased environmental requirements;
- Trunk routes constructed in Phase II include 5-year maintenance contracts not included formerly[36].

Based on the experience of Phase I the construction designs of trunk routes, stations and complimentary infrastructure changed significantly leading to increased costs. The significant increase of cost is thus due to expanded and unforeseen requirements concerning construction of trunk routes and related elements as well as to the lack of experience with this type of construction. With the experience of phase I costs of Phase II and subsequent were thus adjusted based on much more reliable data and experience. The following table compares the originally planned with the new projected cost of phase II. It compares directly the cost per kilometre as distances were also changed between the two planning stages.

Table 8: Comparison of Original and New Projected Cost Phase II (million USD 2000)

Trunk road	Originally projected cost per km	New projected cost per km	Surplus cost per km
Américas	5.7	10.1	4.4
NQS	3.8	14.1	10.3
Suba	3.9	13.0	9.1
Average	**4.31**	**12.61**	**8.3**

Sources:

- Originally projected cost: República de Colombia, Departamento Nacional de Planeación, Conpes 3093
- Actual cost: Instituto de Desarrollo Urbano; USD 2003 are converted to USD 2000 using OECD deflator; based on new projected kilometres; excluding finance cost as this was not included in the original planning
- Note: the average is based on the total cost divided by the total number of kilometres

The following table compares the originally projected cost based on the distances definitely included in the new planning for phase II with the new projected cost for phase II

Table 9: Comparison of Original and New Projected Total Cost Phase II (million USD 2000)

Originally projected cost Phase II	New projected cost Phase II	Cost surplus Phase II
186	532	346

Sources:

- Originally projected cost: República de Colombia, Departamento Nacional de Planeación, Conpes 3093; adapted to the new projected trunk routes and distances for phase II (Américas, NQS and Suba)
- Actual cost: Instituto de Desarrollo Urbano; USD 2003 are converted to USD 2000 using OECD deflator; excluding finance cost as this was not included in the original planning

Deficit Phase II

The following table shows the additional cost or deficit for the District based on a fixed distribution of 36% of costs borne by the District.

[36] See Plan Marco Sistema TransMilenio, IDU and TRANSMILENIO, 2003

Table 10: Additional Non-Projected Costs Phase II for the District of Bogotá (million USD of 2000)

Total additional cost	Cost Participation District	Additional cost district
346	36%	125

Bogotá District thus has a significant financial deficit for TransMilenio Phase II due to net additional and non-projected costs of 125 Million USD for phase II. These additional funds are not available and new income sources are politically difficult to tap or legal restrictions exist. The continuation and financial viability of the project is thus questionable if no additional revenue sources can be tapped. In the face of these financial problems the new phases were not implemented as originally planned and additional revenue sources were sought[37]. TransMilenio phase II and following were thus stopped till new and additional financial resources could be secured. 2002 an agreement could be signed with the CAF in which TRANSMILENIO opts for the CDM as an additional finance source. The additional income through the sale of GHG emission reductions in the global market alleviates the financial deficit of Phase II in a significant manner and thus allows the District to go ahead with this Phase.

The interest of the administration in investing in new phases is also limited as other public investment projects especially social ones are prioritized by the new administration. Expanding an existing system is difficult to sell and not that attractive from a media point of view as embarking on new projects. The political barrier increased additionally as higher than projected investment costs mean that scarce funds would have to be quit from other departments provoking resistance from these sectors.

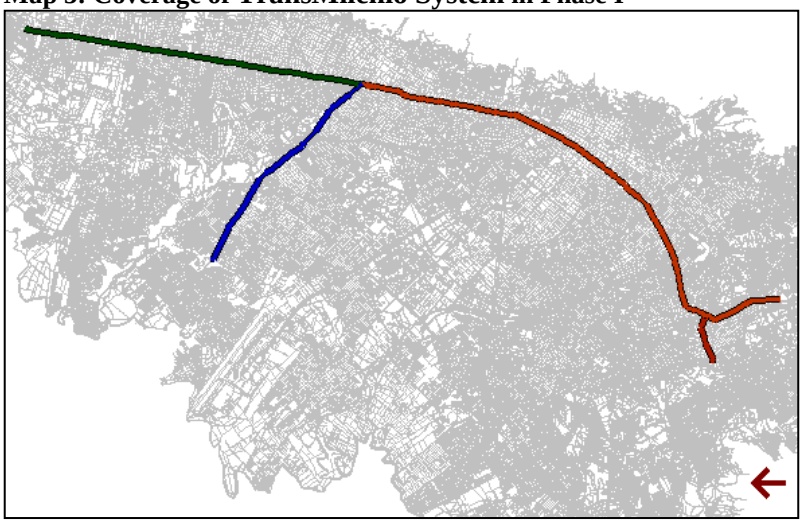
Resistance from the Existing Transport Sector

Phase I of TransMilenio had a coverage of passenger demand of around 10% (see map 3) i.e. 10% of all trips are realized through TransMilenio while the remaining 90% of trips are realized through the conventional transport system[38].

[37] Originally implementation of phase II should have started 2001

[38] Alcaldia Mayor de Bogotá, Secretaría de Tránsito y Transporte; Asistencia Técnica a la Secretaría de Tránsito y de Transporte de Bogotá para la Reorganización del Sistema de Transporte Público Colectivo, contrato realizado por Logitrans por encargo del PNUD, 2003, page 86

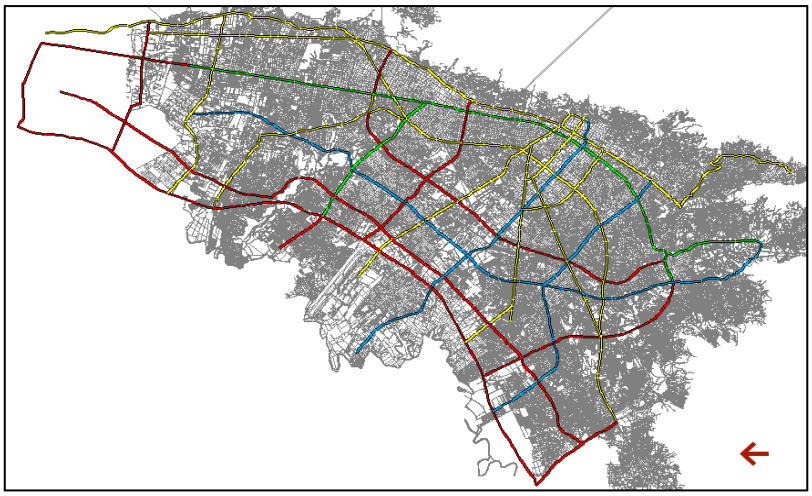
Map 3: Coverage of TransMilenio System in Phase I



Source: TRANSMILENIO

Coverage of TransMilenio System phase II to IV is in contrast more than 70% (see map 4)[39]. Phase II alone would already reach a coverage of nearly 40%. Alone in Phase II 55 of 67 transport companies operating in Bogotá would be affected[40]. With the project the remaining coverage of the existing transport sector would thus shrink to only 30%, a very limited market.

Map 4: Expected Coverage of TransMilenio System in 2016



Source: TRANSMILENIO

[39] Acaldia Mayor de Bogotá, Secretaría de Tránsito y Transporte; Asistencia Técnica a la Secretaría de Tránsito y de Transporte de Bogotá para la Reorganización del Sistema de Transporte Público Colectivo, contrato realizado por Logitrans por encargo del PNUD, 2003, page 86

[40] Alcaldia Mayor de Bogotá, Secretaría de Tránsito y Transporte; Asistencia Técnica a la Secretaría de Tránsito y de Transporte de Bogotá para la Reorganización del Sistema de Transporte Público Colectivo, contrato realizado por Logitrans por encargo del PNUD, 2003, page 88

Phase I was thus not considered a serious competition by the existing transport sector basically due to:

- Limited coverage of 10%;
- Limited absolute competition as the city at the same time grows and thus in absolute numbers the influence of TransMilenio phase I is even less than 10%.
- The traditional transport system expected that the new system would not or only partially work. An indicator of this perception is that no public transport company participated as operators of TransMilenio phase I. Companies who took the risk and participated as operators of TransMilenio phase I had previously not been active in urban public transport in Bogotá.

With phase II and following the traditional transport sector however confronted a serious problem. If they would not integrate into TransMilenio they would loose their economic base. The integration was however for a certain amount of companies not feasible due to organizational, legal or economic conditions and for other companies, especially informal companies with a track record of evading taxes, financially not attractive. The traditional transport sector thus had significantly higher resistance against an expansion of TransMilenio compared to TransMilenio Phase I.

The barrier analysis clearly shows that the additional and non-anticipated investment cost together with an increasing resistance to an expansion of TransMilenio from existing transport companies makes the alternative of implementing the project without CDM non-feasible. The project is thus not the baseline.

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The alternative of a rail-based system has even higher financial barriers than the proposed project. For a detailed discussion of its barriers see sub-step 1.A. This alternative is clearly non-feasible and the identified barriers would prevent its implementation. This alternative is thus eliminated from consideration.

The alternative of a complete re-organization faces primarily organizational barriers and resistance of the existing transport sector to change. For a detailed discussion of this alternative see sub-step 1.A. The identified barriers would thus also prevent the implementation of this alternative. This alternative is thus eliminated from consideration.

The third alternative identified is a continuation of the current transport system. A continuation of the current system faces no investment barrier. The existing public transport companies do not offer any resistance to a continuation of the current system – they favour this alternative as they can continue their current business practice. A continuation of the current public transport system of Bogotá is thus a viable alternative. The identified barriers would not prevent the continuation of the current transport system.

STEP 4. COMMON PRACTICE ANALYSIS

Sub-step 4a. Analyze other activities similar to the proposed project activity

There is no precise definition of what constitutes a BRT system. Features of complete BRT systems such as TransMilenio include exclusive right-of-way lanes, rapid boarding and alighting, free transfers between lines, pre-board fare collection and fare verification, enclosed stations, clear route maps, real-time information displays, automatic vehicle location technology to manage vehicle movements, modal

integration at stations, effective reform of the existing institutional structures for public transit, clean vehicle technologies and excellence in marketing and customer service[41].

In Latin America comparable BRT projects have only been realized in few cities including basically[42]:

- Curitiba (1974), and partially Sao Paulo (1975), Goiania (1976) and Porto Alegre (1977) in Brazil
- Quito, Ecuador in 1996
- Bogotá, Colombia, phase I of TransMilenio

Curitiba

The Curitiba project is more than 3 decades old. Although widely promoted it was not replicated and can thus not be considered as BAU. The other 3 cities mentioned in Brazil have only implemented the BRT system partially. Brazil also has a GNI which is nearly 80% higher than that of Colombia, thus stressing the concept of "comparable access to finance"[43].

Quito

Quito has a similar project called "Trolebus" implemented a decade ago. However this project had a foreign subsidy worth over 70% of the total investment financed through concessional credits by the Government of Spain with an ODA participation[44]. "The system was constructed in two phases thanks to receiving governmental finance from Spain...The finance was concessionary and beneficial for the country (50% ODA and 50% in OECD conditions)[45]"

Bogotá

In Bogotá the first phase of TransMilenio was financed by the national government together with the Bogotá district. However since implementation of this first phase various important factors have changed making the investment barrier significantly higher. The cost increase is significant compared to the cost originally planned. This was shown in the former chapter.

Overall Assessment

Considering the large number of cities in Latin America 3-6[46] examples of BRTs is very little. Of these the only really comparable case is TransMilenio Phase I in Bogotá as Brazil has nearly the double of GDP

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[41] GTZ, Bus Rapid Transit, version 2.0, 2005

[42] GTZ, Bus Rapid Transit, version. 2.0, 2005; other sources do not include Sao Paulo and Porto Alegre (Darío Hidalgo, Comparación de Alternativas de Transporte Público Masivo – Una Aproximación Conceptual, in Revista de Ingeniería 21, 5-2005)

[43] GNI per capita of Brazil in the year 2000 : 3'650 USD ; in Colombia : 2'050 ; source : World Bank economic indicators

[44] Source: http://www.trolebus.gov.ec/secciones/historia.html

[45] Literal translation from the official website of Trolebus, Quito: http://www.trolebus.gov.ec/secciones/historia.htmln

[46] 3 considering Quito, Bogotá and Curitiba; 6 including the other 3 Brazilian cities

per capita compared to Colombia and is thus in a different financial situation and the Quito system was largely financed through ODA and a concessional credit. The continuation of TransMilenio is thus surely **not** common practice. The fact that TransMilenio is widely used as example[47] and visited by many cities worldwide also shows the innovative nature of the project.

Various cities in South America as well as other regions are now in the process of planning BRT projects comparable to the TransMilenio one. Similar projects under planning but not yet operational as of 1.1.2006 are, e.g., in Colombia in Cali, Cartagena, Pereira or Barranquilla or BRT projects are under planning in Lima (Peru), Guayaquil (Ecuador), Insurgentes in Mexico City (Mexico) or Santiago de Chile (Chile). Noteworthy is that all these projects are finding severe financial constraints and all are considering CDM finance as an important aspect. All above mentioned cities are under negotiation or have closed contracts for carbon finance[48]. This indicates clearly that the investment barrier is a major issue in all these projects and that CDM can play an important role in surpassing this barrier thus promoting widely BRT projects with numerous positive sustainability implications beyond climate change.

The survey of similar project activities in other countries shows clearly that BRT projects are singular and not common practice. Although BRT projects have been planned in various countries after the success of Curitiba these plans have not resulted in concrete implementations with exception of Quito which had access to ODA sources and of the first phase of TransMilenio in Bogotá. Since Phase I of TransMilenio however the financial picture changed significantly thus creating barriers for the implementation of Phase II and following. Other similar projects underway include CDM finance as an important source of additional finance. It can thus be concluded that similar activities without ODA or CDM finance are not common practice and are only carried out on a very exceptional base.

Sub-step 4b. Discuss any similar options that are occurring

As mentioned in the former subchapter the similar projects occurring or under planning without CDM finance are singular and not common practice. Even these singular cases have significant differences compared to the project proposed including:

- Access to ODA finance (case of Quito);
- Significantly lower investment barriers (in the case of Bogotá TransMilenio phase I) than the current barrier. See arguments and differences listed in Step 3a.

The steps realized above clearly show that implementing the project is not the baseline and is not a viable alternative under BAU.

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[47] E.g. in GTZ, Bus Rapid Transit, version 2.0, 2005 or in IEA, Bus Systems for the Future, 2002

[48] See Guayaquil: http://www.cordelim.net/cordelim.php?c=456 Colombian projects: http://www.cecodes.org.co/cambio_climatico/ocmcc.htm#7 (with other cities negotiations for CDM are being realized basically on behalf of CAF and the World Bank), Insurgentes see PPD presented with the proposed NM0158; Santiago de Chile: PDD Transsantiago published on the website of DNV: http://www.dnv.com/certification/climatechange/Projects/ProjectList.asp?whichpage=33&pagesize=10&Country=&DontCreate=True ; The BRT project in Lima has prepared the PIN financed through the World Bank; see National Strategy Study for the CDM Peru, 2003

STEP 5. IMPACT OF CDM REGISTRATION

The impact of a CDM registration is on all identified barriers:

- The financial barrier is alleviated through the financial transfers resulting from the sale of CERs.
- The political risk barrier which was identified as part of the financial barrier is alleviated through the signature of an international contract to sell CERs.
- The resistance of existing transport companies can be alleviated partially through offering alternative employment opportunities. The financial resources of a sale of CERs can assist in this task.

Impact of CDM Registration on the Investment Barrier

As important barrier the additional investment cost was identified. The major impact of the approval and registration of the project as a CDM activity is an alleviation of this financial barrier. TransMilenio has for this purpose realized an agreement with CAF. CAF covers through this agreement all upfront and transaction costs. The income obtained through the sale of CERs depends basically on the price at which the reductions can be sold, the status of the project and the delivery schedule and quantities. The level of the price depends also on many international market factors including the level of GHG emissions of Annex I countries under BAU, the sales strategy of Russia considering its large amount of hot air and the extent to which Annex I countries will rely on domestic emission reductions versus trading[49].

At the time of negotiation of the CDM contract in early 2001 the price expectation used by the project was based upon the recently completed and thus "state-of-the-art" "National Strategy Study for the Implementation of the CDM in Colombia" (NSS program of the World Bank, 8/2000). Prices expected with entry into force of Kioto were at this time between 7 and 44 USD/tCO_2[50]. The range used for estimates in the study were 19 USD per ton in the upper range, 10 USD as average price and 3 USD for the weak price scenario. Price scenarios since then have tended to shift upwards. A recent World Bank study of potential CER prices estimated the average price at 11 USD/tCO_2 +/- 50% with a low price scenario of 5 and a high price scenario of 15 USD.[51] Point carbon reports February 2006 prices between 6 and 24 USD per tCO_2[52]. The price range estimated in the NSS is thus more on the low side compared to current price expectations. Nevertheless the price range values published in NSS are used to demonstrate the CDM impact as they represent the information available to the project at the time of taking a decision to go forward with the project or not.

[49] See e.g. CERT (Carbon Emission Reduction Trade) metamodel developed for the World Bank by grütter consulting

[50] Page 49

[51] Estimating the Market Potential for the CDM: Review of Models and Lessons Learned, PCF plus, June 2004

[52] Pointcarbon, CDM and JI Monitor 7.2.2006; € values converted to USD based on the Interbank exchange rate 1.2.2006

Table 11: Estimate of Income through the Sale of CERs (low, medium, high price scenario)[53]

	USD 3/tCO_{2eq}	USD 10/tCO_{2eq}	USD 19/tCO_{2eq}
Projected Total CERs first crediting period	1,726,000	1,726,000	1,726,000
Expected Income in USD first crediting period	5,200,000	17,300,000	32,800,000

Source: Data generated by the author

The expected additional income from the sale of CERs is between 5 and 33 million USD for the first crediting period only. Assuming a renewal of crediting periods plus the expected system expansion expected total income with constant USD is on average (with a price of 10 USD/tCO_{2eq}) around 80 million USD reaching up to 170 million USD[54]. Bogotá District has a financial gap of 125 million USD. In relation to this gap the projected income from the sale of CERs is very significant and can cover a substantial part of the gap or deficit. The financial barrier can thus be alleviated in a significant manner through the sale of CERs.

Impact of the CDM Registration on Political Resistance

The political resistance to implementing Phase II and following can be reduced considerably due to following reasons:

- The additional CDM finance available can contribute significantly to alleviate the projected deficit (see above) and resolves to a large part the politically difficult financial hurdle for TransMilenio phase II and following. Additional income sources are thus secured.
- The income from the sale of CERs will only occur in case of implementing and operating the new phases such as planned. This leads to a significant pressure also on newly entering public administrations to continue the efforts as otherwise resources would be lost. The contract for sales of CERs thus reduces the discontinuation risk of future phases of TransMilenio.
- The national and international prestige of TransMilenio is considerably increased. The GHG offsets are internationally recognized and externally verified. This increases not only the credibility of the project but also highlights the impact of the policies followed and thus improves the prestige and the image of involved institutions. This international recognition is highly appreciated, especially as Bogotá tries to improve the image of its city with TransMilenio.
- The GHG reductions are calculated and verified based on an approved methodology by the UNFCCC. Bogotá can thus claim to improve the global as well as the local environment. These claims are sustained through the registration as a CDM project thus increasing the political attractiveness of implementing further phases.

Impact of the CDM Registration on Resistance from the Existing Transport Sector

The resistance of the existing transport sector can be reduced by using the additional funds available for either re-training persons involved in existing transport entities and/or by trying to incorporate more existing transport enterprises as TransMilenio operators even if this results in marginally higher prices. TransMilenio plans to integrate the existing transport companies in Phase II to a higher degree by giving

[53] Rounded reduction tons; Prices based on the NSS Colombia, 2000

[54] Based on price of 19 USD/tCO_{2eq} Calculations for crediting periods 2 and 3 based on ERs of 500,000 tCO_{2eq} per annum.

them certain advantages in the bidding process. The additional costs provoked from this change are feasible also due to the additional expected income from the sale of CERs.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The following section has been updated due to changes of the methodology version.

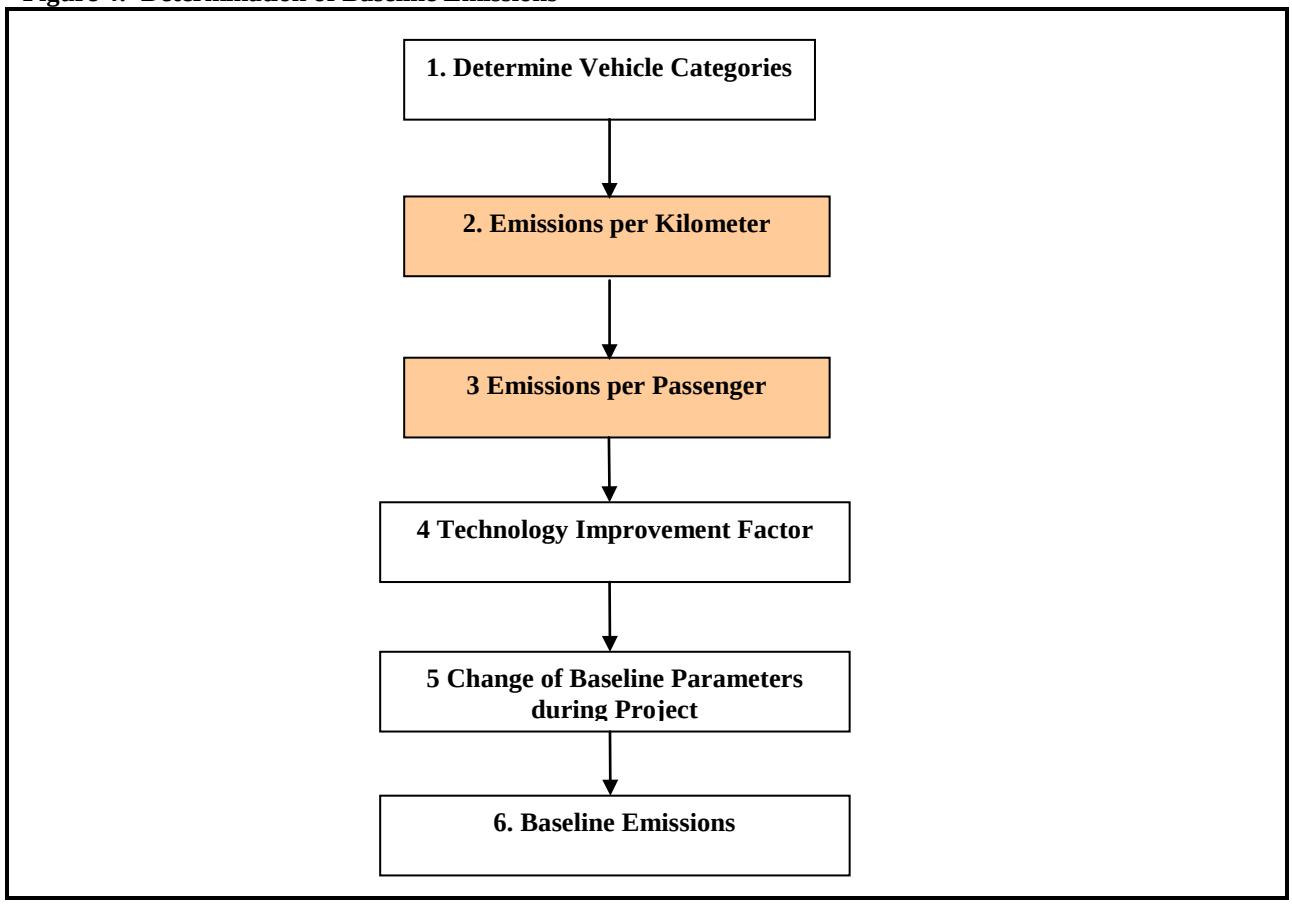
BASELINE EMISSIONS

Baseline emissions are estimated using two main steps:

1. Determination of emissions per passenger transported per vehicle category: This is calculated *ex ante*, including the usage of a fixed technology change factor. The baseline emission factor is adapted to potential changes in trip distance and type of fuel used by passenger cars if the surveys indicate that changes in trip distance or fuel type used would lead to lower baseline emission factors;

2. Baseline emissions: are estimated *ex post* based on the passengers transported by the project and their modal split. Core baseline parameters used for calculating the baseline emission factors are reviewed through an annual survey, with changes only being applied if the baseline emissions factors would be lower than the original factor. The system operator records passenger numbers.

Figure 4: Determination of Baseline Emissions



Baseline emissions are determined through a sequence of the following steps:

1. Determine Vehicle Categories

Identify relevant vehicle categories, which include:

- Buses, differentiating large, medium and small buses, if appropriate;
- Passenger cars;
- Taxis;
- Motorcycles.

Criteria for identifying the categories are as follows:

- At a minimum, public transport, non-motorised transport and induced traffic have to be included;
- Conditions to include categories with reliable data on fuel consumption and load factors;
- Only include categories that are relevant for the BRT project. If the project will only generate credits from public transport without modal shift, then passenger cars, taxis and motorcycles need not be included;

- Differentiate relevant fuel types for each category. Diesel, gasoline and gas (CNG or LPG) are listed separately if a minimum of 10% of vehicles of the respective category use such a fuel, while the threshold for zero-emission[55] fuels is minimum 1%. The 10% threshold is justified, as GHG emission differentials between diesel, gasoline and gaseous fuels are less than 20%;
- In case of a system extension, the currently operating system is not included as a vehicle category.

2. Determine Emissions per Kilometre for Vehicle Categories

CO_{2e} emissions per kilometre are calculated, fixed *ex ante* for the project period, based on the consumption of each fuel type, the CO_2e emissions per litre of fuel and the fraction of vehicles using the specific fuel type.

- CO_2 emissions are estimated on the basis of the carbon content of the fuel;
- CH_4 and N_2O emission factors: CH_4 emissions are a function of the fuel and engine type, and any post-combustion controls. N_2O emissions are technology based for each fuel type, vehicle category, installed control technologies and local data such as average driving speeds, temperatures, and altitude. The emission factors are transformed into CO_{2eq} using GWP factors approved by the Conference of the Parties to the UNFCCC. CH_4 and N_2O emissions from gaseous fuels shall be accounted for. They can be ignored for liquid fuels, such as diesel and gasoline, as CH_4 and N_2O emissions constitute a minor emission source for liquid fuels.

Two methods are possible to determine the relevant CH_4 and N_2O emission factors of gaseous fuels:

(1) Local measured emission factors based on a reliable data source to be detailed in the PDD;

(2) The pre-determined default value per vehicle category is used (described later in this section). The default value per vehicle category is the technology with the lowest sum of CO_{2e} emissions of N_2O and CH_4. This ensures a conservative approach.

Alternative 1 is preferred. However, using the default value is a conservative approach.

If electricity is used by vehicles the emissions are calculated based on the latest approved version of the "Tool to calculate project, baseline and or leakage emissions from electricity consumption". No baseline vehicles in the project case use electricity.

In case biofuel blends are used the biofuel share is calculated with a CO_2eq emission factor equal to zero.

This equation calculates emissions per km for vehicles of different vehicle categories.

$$EF_{KM,i} = \sum_x \left[SEC_{x,i} \times \left(EF_{CO2,x} + EF_{CH4,x} + EF_{N2O,x} \right) \times \left(\frac{N_{i,x}}{N_i} \right) \right] \quad \textbf{(1)}$$

[55] Zero-emission in the context of operating emissions and not well-to-wheel or life-cycle emissions; this includes hydrogen.

Where:

$EF_{KM,i}$	=	Transport emissions factor per distance of vehicle category *i* (gCO_2e per kilometer driven)
$SEC_{x,i}$	=	Specific energy consumption of fuel type *x* in vehicle category *i* (litre / kilometer, kWh/km, kg/km, m^3/km)
$EF_{CO2,x}$	=	CO_2 emission factor for fuel type *x* (gCO_2 per litre)
$EF_{CH4,x}$	=	CH_4 emission factor for gaseous fuel type *x* (gCO_2e per litre, based on GWP)
$EF_{N2O,x}$	=	N_2O emission factor for gaseous fuel type *x* (gCO_2e per litre, based on GWP)
N_i	=	Total number of vehicles in category *i*
$N_{i,x}$	=	Number of vehicles in vehicle category *i* using fuel type *x*

If less than 10% of vehicles in a specific vehicle category are gasoline, diesel, CNG or LPG powered then this respective fuel can be omitted for simplicity purposes. In alternative vehicles the threshold value is 1%.

Two methodological alternatives are proposed for the fuel consumption data (in order of preference):

- Alternative 1: Measurement of fuel consumption data using a representative sample for the respective category and fuel type. To ensure a conservative approach the lower 95% confidence level of the sample measurement shall be taken;
- Alternative 2: Use of fixed values based on the national or international literature. The literature data can either be based on measurements of similar vehicles in comparable surroundings (e.g. from comparable cities of other countries) or may include identifying the vehicle age and technology of average vehicles circulating in the project region and then matching this with the most appropriate IPCC default values. The most important proxy to identify vehicle technologies is the average age of vehicles used in the area of influence of the project. To determine if either US or European default factors apply either local vehicle manufacturer information can be used (in the case of having a substantial domestic vehicle motor industry) or a source of origin of vehicle imports.

A technical improvement factor is thereafter introduced. The technology improvement factor results in dynamic emission factors for the different units. See Step 3.

3. Calculate Emissions per Passenger per Vehicle Category

This step calculates emission factors showing the emissions per passenger per average trip for each vehicle category.

This equation is used to determine the emissions per passenger transported for passenger cars, taxis or motorcycles. All data used is determined *ex ante*. A change in the occupancy rate of taxis is registered as leakage of the project.

$$EF_{P,i} = \frac{EF_{KM,i} \times TD_i}{OC_i} \quad \textbf{(2)}$$

Where:

$EF_{P,i}$	=	Emissions factor per passenger before project start, where $i = C$ (passenger cars), M (motorcycles) or T (taxis) (grams per passenger)

$EF_{KM,i}$ = Emissions factor per distance of category *i* (gCO_2e per kilometer driven)

OC_i = Average vehicle occupancy rate of vehicle category *i*[56] (passengers)

TD_i = Average trip distance for vehicle category *i* (kilometers)

The formula below shall be used in case fuel consumption data is based on specific fuel consumption (SFC) values obtained through sampling or from literature:

$$EF_{P,i} = \frac{EF_{KM,i,S} \times DD_{i,S} + EF_{KM,i,M} \times DD_{i,M} + EF_{KM,i,L} \times DD_{i,L}}{P_i} \quad \textbf{(3)}$$

Where:

$EF_{P,i}$ = Emissions factor for buses for before project start (gCO_2e per passenger)

$EF_{KM,i,S}$ = Emissions from small buses (gCO_2e per kilometer)

$DD_{i,S}$ = Total distance driven by small buses (kilometer)

$EF_{KM,i,M}$ = Emissions from medium buses (gCO_2e per kilometer)

$DD_{i,M}$ = Total distance driven by medium buses (kilometer)

$EF_{KM,i,L}$ = Emissions from large buses (gCO_2e per kilometer)

$DD_{i,L}$ = Total distance driven by large buses (kilometer)

P_i = Passengers transported by buses in the baseline

The time period for the number of passengers and the distance they travel must be equal (e.g. one year or one month). All data used is determined *ex ante*. A change in the occupancy rate of buses is registered as leakage of the project.

In case the fuel consumption of buses is based on total fuel consumed by the baseline bus system, no differentiation between bus size shall be made and the following formula shall be used:

$$EF_{P,i} = \frac{\sum_x FC_x \times NCV_x \times EF_x \times IR}{P_i} \quad \textbf{(4)}$$

Where:

$EF_{P,i}$ = Emissions factor for buses for before the project start (gCO_2e per passenger)

FC_x = Total fuel type *x* consumed by the baseline bus system prior to the project start

NCV_x = Net calorific value of fuel type *x* consumed by the baseline bus system prior to the project start (J/mass or volume unit)

EF_x = Emission factor of fuel type *x* consumed by the baseline bus system prior to the project start

IR = Technology improvement factor

P_i = Passengers transported by buses in the baseline

[56] In the case of taxis the driver is not counted and only passengers are included in the occupancy rate.

3. Technological Change

Under business as usual conditions emission factors per vehicle category per fuel type may change due to:

- Vehicles are replaced with more efficient ones;
- Vehicles in stock tend to increase emissions based on wear and tear.

For simplicity purposes, a constant average improvement rate per annum is established per vehicle category. The improvement rate is applied to each calendar year. The year 0 is the year for which specific fuel consumption data was collected or determined. Emissions per vehicle category are multiplied with the corresponding technology improvement factor. The default technology improvement factors per vehicle category are included in the appendix A of thee methodology.

4. Change of Baseline Parameters During the Project Crediting Period

The change of baseline parameters is only necessary if the project includes a modal shift (change from passenger cars, motorcycles or taxis to BRT). In this case, some parameters used for calculating the baseline emission factors could change over time:

- The load factor or the number of passengers per vehicle. The load factor is potentially influenced indirectly by the project. This factor is included in the monitoring of leakage of the project and thus not included in the baseline calculations;
- The distance driven by passengers using the BRT system might change or not be equivalent to the average distance driven used to calculate the baseline emission parameter. This factor is monitored through the annually conducted survey of passengers using the project system (see corresponding monitoring methodology);
- Type of fuel used by passenger cars. This factor is only relevant for people who have switched from cars to public transport. The annual passenger survey monitors the fuel used by passengers switching from passenger cars to the BRT system and adjusts the corresponding baseline emission factor for passenger cars.

The methodology only takes into account those changes in passenger emission factors that lead to a reduction in baseline emissions.

The baseline emissions per passenger trip for taxis, passenger cars and motorcycles are adjusted annually with a correction factor for changing trip distances.

$$CD_{i,y} = \frac{TD_{i,y}}{TD_i} \quad \textbf{(5)}$$

Where:

$CD_{i,y}$ = Correction factor for changing trip distance in category *i* for the year *y*, where *i* = *T* (taxis), *C* (passenger cars) or *M* (motorcycles)

TD_i = Average trip distance in kilometers in category *i* before the project start

$TD_{i,y}$ = Average trip distance in kilometers in category in year *y*

Note: The adjustment is only made if $TD_{i,y} < TD_i$ to ensure a conservative approach.[57]

4.1. Change of Fuel Used by Passenger Cars

For passengers that, in absence of the project, would have used a passenger car, the type of fuel used by their cars is determined via a survey (see Monitoring Methodology). Equation (1) is used to re-calculate the new emission factors for passenger cars. The same threshold values for fuel types apply as described in Step 1 (determination of vehicle categories).

The applicability condition for applying this change in fuel type used for passenger cars is: $EF_{KM,C,y} < EF_{KM,C}$. In other words, the baseline emission factor is only changed, if the new emission factor is lower than the original emission factor.

Determination of Baseline Emissions

The baseline emissions for all passengers transported are calculated. This is differentiated according to the mode of transport, which the person would have used in absence of the project. Passengers transported are determined through the project (activity level of the project). The system operator shall report the total amount of passengers transported by the project.

$$BE_y = \sum_i \left(EF_{P,i,y} \times P_{i.y} \right) \times 10^{-6} \quad \textbf{(6)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2e)

$EF_{P,i,y}$ = Emissions factor per passenger in vehicle category i in year y (grams per passenger)

$P_{i.y}$ = Passengers transported by the project (BRT) in year y that without the project activity would have used category i, where i = Z (buses, public transport), T (taxis), C (passenger cars), rail-based urban mass transit (R) or M (motorcycles)[58] (millions of passengers)

$$EF_{P,i,y} = EF_{P,i} \times IR_{i,t} \times CD_{i,y} \quad \textbf{(7)}$$

Where:

$EF_{P,i,y}$ = Emissions factor per passenger in vehicle category i in year y (gCO_2e per passenger)

$EF_{P,i}$ = ~~E~~missions factor per passenger before the project start, where $i = T$ (taxis), C (passenger cars) or M (motorcycles) (gCO_2e per passenger)

$CD_{i,y}$ = Correction factor for changing trip distance in category i for the year y, where $i = T$ (taxis), C (passenger cars) or M (motorcycles)

$IR_{i,t}$ = Technology improvement factor at year t for vehicle category i

[57] Larger distances would increase baseline emissions per passenger trip. The project emissions resulted from larger trip distances are however fully recorded as project emissions are based on total fuel consumed.

[58] NMT and induced transport (IT) are not included as emissions are 0 for this category in the baseline.

t = Vintage of fuel consumption data (in years) used for calculating the emission factor in year y[59]

See applicability condition for $CD_{i,y}$ (Equation 5: The adjustment is only made if $TD_{i,y} < TD_i$). For passenger cars, $EF_{KM,C,y}$ is annually adjusted as described above, considering the applicability condition of reduced emissions per kilometer.

Emissions from passengers who in absence of the project would have used rail-based mass transit systems (R) are counted as $EF_{P,R,y} = 0$ grams per passenger.

$$P_{i,y} = P_y \times S_{i,y} \quad \textbf{(8)}$$

Where:

$P_{i,y}$ = Passengers transported by the project which in absence of the latter would have used transport type i, where $i = Z$ (buses, public transport), T (taxis), C (passenger cars), M (motorcycles), NMT (non-motorized transport), R (rail-based urban mass transit) and IT (induced transport, i.e., would not have traveled in absence of project) (millions)

P_y = Total passengers transported by the project monitored in year y (millions)

$S_{i,y}$ = Share of passengers transported by the project who in absence of the latter would have used transport type i, where $i = Z$ (buses, public transport), T (taxis), C (passenger cars), M (motorcycles), NMT (non-motorized transport), R (rail-based urban mass transit) and IT (induced transport, i.e., would not have traveled in absence of project) (%)

Induced travel is included in leakage calculations (induced travel in passenger cars) as well as in the baseline (induced travel in public transport).

PROJECT EMISSIONS

The project emissions are only from the new project transport system. All emissions from trips undertaken in the new system need to be included (i.e., both on trunk routes and feeder lines).

Total emissions can be calculated in one of the two ways, depending on data availability. If records exist, the data quality of both alternatives is equal. Reliable data are, e.g. based on electronic measurement of fuel consumption or data monitored by the bus company managing the units. For both alternatives, specific fuel consumption data (i.e., consumption per distance driven) needs to be crosschecked in the QA system. Cross-checks include a comparison over time within the same company, as well as a comparison with, e.g. other companies operating BRT systems using the same type of buses.

Alternative A: Use of Fuel Consumption Data

This alternative is based on the total fuel consumed. For BRTs using liquid fossil fuels, the project emissions from fossil fuel consumption shall be estimated using the latest version of the 'Tool to calculate project or leakage CO_2 emissions from fossil fuel consumption.' The following guidance is provided for applying the tool:

[59] E.g. "t=7" for the year 2007 if the fuel data is from the year 2000.

- The parameter $PE_{FC,j,y}$ in the tool corresponds to the project emissions from the project transport system that uses fossil fuels in year *y*; and
- Element process *j* corresponds to the combustion of fuel type *x* in the project vehicles.

The BRT currently only uses liquid fuels. In case of future usage of gaseous fules equation 9 of the methodology would be used. In case of future usage of electricity on the latest approved version "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" would be used.

Alternative B: Use of Specific Fuel Consumption and Distance Data

This alternative uses as a basis fuel efficiency data (i.e. consumption per kilometre driven).

$$EF_{KM,j,y} = \sum_{x} \left[SEC_{j,x,y} \times \left(EF_{CO2,x} + EF_{CH4,x} + EF_{N2O,x} \right) \right] \quad \textbf{(9)}$$

Where:

$EF_{KM,j,y}$	=	Emissions factor per distance for project bus category *j* in year *y* (gCO_2e per kilometer)
$SEC_{j,x,y}$	=	Specific energy consumption of fuel type *x* in project bus category *j* in year *y* (litre per kilometer)
$EF_{CO2,x}$	=	CO_2 emission factor for fuel type *x* (gCO_2 per litre)
$EF_{CH4,x}$	=	CH_4 emission factor for gaseous fuel type *x* (gCO_2e per litre, based on GWP)
$EF_{N2O,x}$	=	N_2O emission factor for gaseous fuel type *x* (gCO_2e per litre, based on GWP)

Fuel-efficiency data is derived from annual data reported by the bus companies operating the units either of all units or of a representative sample of comparable units (comparable technology, vintage and size). To ensure a conservative approach, the specific fuel consumption of comparable vehicles, if based on sample measurement, should be taken as the upper 95% confidence level of the sample measurement conducted. This ensures a conservative approach, providing that project emissions are not overstated.

If the CDM project includes only parts of a larger activity, the fuel used for the CDM project is separated from the total fuel used. The separation is done (in order of preference) by the following means:

- By operators: This method is used if certain operators are assigned to certain parts of the project;
- By distance driven: The fuel share for each part of the project is based on the share of kilometers per project part;
- By passengers: The fuel share for each part of the project is based on the share of passengers per part of the project (based on the entry points of passengers).

In the project case Phase I of the BRT is not included in the project. The separation is done by passengers.

Total project emissions are calculated from the following equation.

$$PE_y = \left[\left(EF_{KM,TB,y} \times DD_{TB,y} \right) + \left(EF_{KM,FB,y} \times DD_{FB,y} \right) \right] \times 10^{-6} \quad \textbf{(10)}$$

Where*:*

PE_y	=	Project emissions in year *y* (tCO_2e)
$EF_{KM,TB,y}$	=	Emissions factor per distance for trunk buses in year *y* (gCO_2e per kilometer)
$DD_{TB,y}$	=	Total distance driven by trunk buses in year *y* (million kilometers)
$EF_{KM,FB,y}$	=	Emissions factor per distance for feeder buses in year *y* (gCO_2e per kilometer)
$DD_{FB,y}$	=	Total distance driven by feeder buses in year *y* (million kilometers)

LEAKAGE

The following leakage sources are addressed:

(1) Change in load factor of the baseline transport system due to the project, i.e., the project potentially influences the occupancy rate of the remaining vehicles. This is monitored in the year 1 and 4 of the crediting period;

(2) Reduced congestion in remaining roads, provoking higher average vehicle speed, plus a rebound effect. The total impact of congestion is monitored in the year 1 and 4 of the crediting period, in case the implementation of the project activity leads to a reduction of road space (e.g. the project utilises an existing road by separating one of its lanes to be exclusively used by the project BRT), and not monitored, in case the implementation of the project activity does not lead to a reduction of road space (e.g. the project provides a new road infrastructure); The project provides additional road space. Therefore this leakage is not monitored.

(3) In case of more gaseous fuel are used in the project than in the baseline case, the upstream emissions of gaseous fuels should be included. No leakage emissions should be included if in the baseline more or an equal amount of gaseous fuel are used than in the project as this would lead to negative leakage (conservative approach). The project uses no gaseous fuels and therefore no leakage upstream emissions of gaseous fuels are included.

For the sake of a conservative approach, leakage is only considered if the total annual effect is to reduce estimated emission reductions.

1. Change in Load Factor

The project could have a negative impact on the load factor of taxis or the remaining conventional bus fleet. Load factor changes of taxis and buses are thus monitored in the year 1 and 4 of the crediting period. Leakage is only included if the load factor changes by more than 10 percentage points, as certain variations in the load factor caused by external circumstances are normal. The methodology also considers load factor changes in taxis if they are included as vehicle category by the project, thus claiming credits from a modal shift from taxis to the BRT system. In the case of lower load factors, it is assumed that this change has occurred immediately after the last measurement, and the leakage calculation for this year includes the sum of load-factor leakage of all years since the last monitoring. This ensures a conservative approach. To avoid the risk of having to include *ex post* leakage from former years, the project proponent can monitor the load factor annually.

$$ROC_{i,y} = \frac{OC_{i,y}}{CV_{i,y}} \quad \textbf{(11)}$$

Where:

$ROC_{i,y}$ = Average occupancy rate relative to capacity in category *i* in year *y*, where *i* = Z (buses) or *T* (taxis)

$OC_{i,y}$ = Average occupancy of vehicle in category *i* in year *y* (persons)

$CV_{i,y}$ = Average capacity of vehicle *i* in year *y* (persons)

In the case of public transport, the occupancy rate is measured in relation to the bus capacity, as bus sizes may change over time or before/after project. $ROC_{i,y}$ shall be monitored directly through visual surveys.

This equation determines leakage emissions from change of load factors in buses.

$$LE_{LF,Z,y} = EF_{KM,Z} \times VD_Z \times N_{Z,y} \times \left(1 - \frac{ROC_{Z,y}}{ROC_{Z,0}}\right) \times 10^{-6} \quad (12)$$

Where:

$LE_{LF,Z,y}$ = Leakage emissions from change of load factor in buses in year *y* (tCO_2e)

$EF_{KM,Z}$ = Baseline transport emissions factor per distance for buses (gCO_2e per kilometer)

VD_Z = Annual distance driven per vehicle for buses before the project start, determined *ex ante* (kilometres)

$N_{Z,y}$ = Number of buses in the conventional transport system operating in year *y*

$ROC_{Z,y}$ = Average occupancy rate relative to capacity of conventional buses in year *y*, based on the most recent study of occupancy rates

$ROC_{Z,0}$ = Average occupancy rate relative to capacity of buses before start of project

$$VD_Z = \frac{\sum_{k=S,Md,L} DD_{Z,k}}{\sum_{k=S,Md,L} N_{Z,k}} \quad (13)$$

Where:

VD_Z = Distance driven per bus before the project start (kilometers)

$DD_{Z,k}$ = Total distance driven by buses of size *k* (kilometers)

$N_{Z,k}$ = Number of buses in the conventional transport system of size *k*, where *S, Md* and *L* stands for small, medium and large buses, respectively

Note: If $ROC_{Z,0} - ROC_{Z,y} \leq 0.1$ then $LE_{LF,Z,y} = 0$, i.e., if the occupancy rate of buses is not reduced by more than 0.1 then the project has had no negative effect (leakage).

This equation determines leakage emissions from a change in load factors of taxis.

$$LE_{LF,T,y} = EF_{KM,T} \times VD_T \times N_{T,y} \times \left(1 - \frac{OC_{T,y}}{OC_{T,0}}\right) \quad (14)$$

Where:

$LE_{LF,T,y}$	=	Leakage emissions from change of load factor in taxis in year *y* (tCO_2e)
$EF_{KM,T}$	=	Emissions factor per kilometre for taxi baseline (gCO_2e per kilometer)
VD_T	=	Average distance driven by taxi on before the project starts (kilometres)
$N_{T,y}$	=	Number of taxis operating in year *y*
$OC_{T,y}$	=	Average occupancy rate of taxi in year *y* (passengers only: Driver not counted)
$OC_{T,0}$	=	Average occupancy rate of taxi before the project start (passengers only: Driver not counted)

Note: If $OC_{T,0} - OC_{T,y} \leq 0.1$ then $LE_{LF,T,y} = 0$, i.e. if the occupancy rate of taxis is not reduced by more than 0.1 then the project has had no negative effect (leakage).

The measurement of the occupancy rate is based on representative surveys, which register all taxis passing the survey points. Taxis without passengers are counted as "0" occupancy rate. Only circulating taxis are counted.

2. Impact of Reduced Congestion on Remaining Roads

An implementation of a BRT project may have differing overall impacts on congestion. On the one hand, a project BRT system may be implemented on an existing road by dedicating one or more of the lanes of the road to be exclusively used by the project BRT (with an exception of emergency vehicles). This will result in a reduced road capacity available to the vehicles operating on that road prior to the project activity, which, in turn, may increase the congestion on that reduced road capacity and, therefore, lead to higher emissions. On the other hand, an implementation of the project BRT may provide a new road infrastructure. In this case, the project BRT will likely attract passengers from conventional modes of transport and reduce the number of vehicles on the affected roads and, therefore reduce congestion. In this case, reduced congestion may have the following impacts relevant for GHG emissions:

- "Rebound effect" leading to additional trips and thus higher emissions;
- Higher average speeds and less stop-and-go traffic leading to lower emissions.

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.[60] 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.

The project does not reduce road space and does not take away road space. This is based on the Decree 190 of 2004 which includes the POT (Plan de Ordenamiento Territorial) of each trunk lane which indicates that lines are added and not taken away from mixed traffic roads[61]. Therefore equations 16 to 22 of the methodology are not used.

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[60] Emission reductions due to the speed increase of the traffic flow generally overweights the increase in emissions resulting from the traffic induction of passenger cars as a result of reduced congestion.

[61] File 24

3. Upstream Emissions of Gaseous Fuels

Upstream leakage of gaseous fuels is only included if project vehicles consume more gaseous fuels than baseline vehicles. As the project does not use gaseous fuels this section is not included.

Total Leakage

$$LE_y = LE_{UP,y} + LE_{LF,Z,y} + LE_{LF,T,y} + LE_{CONG,y} \quad \textbf{(15)}$$

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2e)
$LE_{UP,y}$	=	Leakage upstream emissions of gaseous fuels during the year *y* (tCO_2e)
$LE_{LF,Z,y}$	=	Leakage emissions from change of load factor in buses in year *y* (tCO_2e)
$LE_{LF,T,y}$	=	Leakage emissions from change of load factor in taxis in year *y* (tCO_2e)
$LE_{CONG,y}$	=	Leakage emissions from reduced congestion in year *y* (tCO_2e)

If $LE_y < 0$, then leakage is not included;
If $LE_y > 0$, then leakage is included.

The impact of induced traffic (additional trips) provoked through the new transport system is addressed directly in the project emissions and is not part of the leakage. This is addressed by including as project emissions the trips of passengers, who, in absence of the BRT project, would not have realized the trip.

EMISSION REDUCTIONS

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(16)}$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e)
BE_y	=	Baseline emissions in year *y* (tCO_2e)
PE_y	=	Project emissions in year *y* (tCO_2e)
LE_y	=	Leakage emissions in year *y* (tCO_{2e})

B.6.2. Data and parameters that are available at validation:

The following section has been updated.

Data / Parameter:	**$SEC_{G,C}$**
Data unit:	litre/km
Description:	Specific energy consumption gasoline cars
Source of data used:	Grütter Consulting, 2011, File 7
Value applied:	0.097
Justification of the choice of data or description of	Based on sample of vehicles in Bogota. Lower 95% confidence level is taken. The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10

measurement methods and procedures actually applied :	which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size in the specific case is 10 units while the actual sample size taken is 39 units and thus much more than required. The recorded value is compared to the IPCC values for passenger cars reported. Values reported by IPCC range from 11.8 l/100km to 22.2 l/100km for US vehicles (Table 1.27) and from 8.1 l/100km to 11.2 l/100km for European vehicles (Table 1.36). The recorded value is thereby with 9.7 l/100km at the lower end and this although it is based on urban driving (higher fuel consumption than the average value reported which is a mix of driving conditions) and although Bogota is at high altitude (2,625 meter above sea level) which leads to increased fuel consumption of vehicles[62]. The registered PDD had a SEC of cars of 11.7 l/100km i.e. significantly higher than the new value even taking into account an annual improvement factor of 1% (default value of the methodology). Above listed aspects all indicate that the value taken is conservative.
Any comment:	Bio-fuel blend of 8% based on Resolution 18 2368 dated 29th December 2009 of the Ministry of Mines and Energy, File 12. Emissions are only calculated on the fossil share of the blend. 100% of vehicles gasoline based on File 9 (the registration statistic shows 2% diesel cars but based on AM0031 p. 13 if less than 10% of vehicles in a specific vehicle category are gasoline, diesel, CNG or LPG powered then this respective fuel can be omitted for simplicity purposes).

Data / Parameter:	**$SEC_{G,T}$**
Data unit:	litre/km
Description:	Specific energy consumption gasoline taxis
Source of data used:	Grütter Consulting, 2011, File 5
Value applied:	0.069
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on sample of vehicles in Bogota. Lower 95% confidence level is taken. The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10 which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size in the specific case is 10 units while the actual sample size taken is 33 units and thus much more than required. The recorded value is also compared to the IPCC values for passenger cars reported. Values reported by IPCC range from 11.8 l/100km to 22.2 l/100km for US vehicles (Table 1.27) and from 8.1 l/100km to 11.2 l/100km for European vehicles (Table 1.36). The recorded value is thereby with 6.9 l/100km lower than any recorded value although it is based on urban driving (higher fuel consumption than the average value reported which is a mix of driving

[62] Less oxygen results in incomplete combustion; more need to drive in full throttle

	conditions) and although Bogota is at high altitude (2,625 meter above sea level) which leads to increased fuel consumption of vehicles[63]. The registered PDD had a SEC of taxis of 11.7 l/100km i.e. significantly higher than the new value even taking into account an annual improvement factor of 1% (default value of the methodology). Above listed aspects all indicate that the value taken is conservative.
Any comment:	Bio-fuel blend of 8% based on Resolution 18 2368 dated 29th December 2009 of the Ministry of Mines and Energy, File 12. Emissions are only calculated on the fossil share of the blend. 100% of taxis gasoline based on File 9. (The registration statistic shows 6% diesel taxis and 2% gaseous taxis but based on AM0031 p. 13 if less than 10% of vehicles in a specific vehicle category are gasoline, diesel, CNG or LPG powered then this respective fuel can be omitted for simplicity purposes).

Data / Parameter:	**$SEC_{G,M}$**
Data unit:	litre/km
Description:	Specific energy consumption gasoline motorcycles
Source of data used:	Grütter Consulting, 2011, File 4
Value applied:	0.038
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on sample of vehicles in Bogota. Lower 95% confidence level is taken. The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10 which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size in the specific case is 14 units while the actual sample size taken is 30 units and thus much more than required. The recorded value is also compared to the IPCC values for motorcycles reported. Values reported by IPCC range from 9.3 l/100km to 11.2 l/100km for US vehicles (Table 1.33) and from 4.0 l/100km to 5.1 l/100km for European motorcycles >50cc[64] (Table 1.42). The recorded value is thereby with 3.8 l/100km lower than the lowest recorded IPCC value although Bogota is at high altitude (2,625 meter above sea level) which leads to increased fuel consumption of vehicles[65]. The registered PDD had no motorcycles included. Above listed aspects all indicate that the value taken is conservative.
Any comment:	Bio-fuel blend of 8% based on Resolution 18 2368 dated 29th December 2009 of the Ministry of Mines and Energy, File 12. Emissions are only calculated on the fossil share of the blend. 100% of motorcycles gasoline based on File 9

Data / Parameter:	**$SEC_{D,Z,L/M/S}$**
Data unit:	litre/km

[63] Less oxygen results in incomplete combustion; more need to drive in full throttle

[64] All motorcycles recorded had a cc > 50cc

[65] Less oxygen results in incomplete combustion; more need to drive in full throttle

Description:	Specific energy consumption diesel large, medium and small buses
Source of data used:	Grütter Consulting, 2011, File 6
Value applied:	Large: 0.307 Medium: 0.292 Small: 0.208
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on sample of vehicles in Bogota. Lower 95% confidence level is taken. The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10 which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size for large buses is 10 units while the actual sample size taken is 61 units, for medium buses 9 units and the actual sample size is 54 units and for small buses 5 units and the actual sample size is 51 units and thus for all cases the sample size taken is much more than required. The recorded value of large buses is compared to the IPCC values for heavy duty vehicles (HDVs) reported. This includes buses and trucks. Values reported by IPCC for HDVs range from 41.7 l/100km to 45.5 l/100km for US vehicles (Table 1.32) and 29.9 l/100km for European vehicles (Table 1.39). The recorded value is thereby with 30.7 l/100km near to the lowest value reported although Bogota is at high altitude (2,625 meter above sea level) which leads to increased fuel consumption of vehicles[66]. The registered PDD had a SEC of large buses of 45.5 l/100km i.e. significantly higher than the new value even taking into account an annual improvement factor of 1% (default value of the methodology). IPCC has no value for medium sized buses. The registered PDD had a SEC of medium buses of 31.5 l/100km i.e. higher than the new value even taking into account an annual improvement factor of 1% (default value of the methodology). IPCC has no value for small buses. The registered PDD had a SEC of small buses of 17.5 l/100km. This value is lower than the recorded value. However the original value was not based on measurements or on local data but on relating the vehicle technology with default IPCC values for Light Duty Vehicles which include not only small buses but also small trucks and therefore the value taken in the registered PDD is only a very gross estimate. Above listed aspects all indicate that the values taken for buses are conservative.
Any comment:	Bio-fuel blend of 7% based on Resolution 18 1266 of 14/07/2010 of the Ministry of Mines and Energy, File 11. Emissions are only calculated on the fossil share of the blend. 100% of vehicles diesel based on File 10. (The registration statistic shows 1% large gasoline buses, 3% medium sized gasoline buses, 1% medium sized gaseous buses and 6% small gasoline buses but based on AM0031 p. 13 if less than 10% of vehicles in a specific vehicle category are gasoline, diesel, CNG or

[66] Less oxygen results in incomplete combustion; more need to drive in full throttle

	LPG powered then this respective fuel can be omitted for simplicity purposes).

Data / Parameter:	**$DD_{Z,L/M/S}$**
Data unit:	km
Description:	Distance driven of large, medium and small buses baseline per day
Source of data used:	Secretaría de Movilidad, 2011, File 10
Value applied:	Large buses: 173 Medium buses: 171 Small buses: 225
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daily distance driven. Monthly distance based on 23 days (see File 10)
Any comment:	

Data / Parameter:	**DD_T**
Data unit:	km
Description:	Distance driven of taxis per day
Source of data used:	Grütter Consulting, 2011, File 14
Value applied:	235
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daily distance driven. Annual distance taken for leakage calculation is 85,775 km (based on 365 days) which is conservative as the taxi is unlikely to operate 365 days per annum.
Any comment:	

Data / Parameter:	**OC_C**
Data unit:	Passengers
Description:	Average occupation rate of cars
Source of data used:	Grütter Consulting, 2011, File 3
Value applied:	1.55
Justification of the choice of data or description of measurement methods and procedures actually applied :	Upper 95% confidence interval taken The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10 which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size is 86 units while the actual sample size taken is 42,578 units and thus the sample size taken is much more than required. The occupation rate of the registered PDD was 1.37 and thus lower than the new value which indicates also the conservativeness of the new value (baseline emissions are lower if the occupation rate is higher).
Any comment:	

Data / Parameter:	**OC_T**

Data unit:	Passengers
Description:	Average occupation rate of taxis
Source of data used:	Grütter Consulting, 2011, File 3
Value applied:	1.09
Justification of the choice of data or description of measurement methods and procedures actually applied :	Excludes driver Upper 95% confidence interval taken The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10 which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size is 298 units while the actual sample size taken is 28,201 units and thus the sample size taken is much more than required. The occupation rate of the registered PDD was 0.81 and thus lower than the new value which indicates also the conservativeness of the new value (baseline emissions are lower if the occupation rate is higher).
Any comment:	The same study is performed again year 1 and 4 of the crediting period for leakage monitoring.

Data / Parameter:	**OC_M**
Data unit:	Passengers
Description:	Average occupation rate of motorcycles
Source of data used:	Grütter Consulting, 2011, File 3
Value applied:	1.14
Justification of the choice of data or description of measurement methods and procedures actually applied :	Upper 95% confidence interval taken The sample size is checked based on the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" Version 02.0 point 10 which indicates for large scale projects a 95% confidence interval with a 10% error bound. The required sample size is 35 units while the actual sample size taken is 15,020 units and thus the sample size taken is much more than required. The registered PDD did not include motorcycles.
Any comment:	

Data / Parameter:	**P_Z**
Data unit:	Passengers
Description:	Passengers trips in the baseline per day
Source of data used:	Secretaría de Movilidad, 2011, Table 2, p. 8, File 20 for passengers and Grütter Consulting, 2011, File 21 for number of buses per trip and Secretaría de Movilidad, 2011, File 10 for number of buses per size
Value applied:	4,092,185
Justification of the choice of data or description of measurement methods and procedures actually applied :	Same data source as for daily distance driven of buses and for number of buses and therefore consistency in data used for emissions per passenger. Calculated based on number of passengers per bus size per day multiplied with number of buses per size divided by number of buses used per trip. Number of large buses: 7,491 (File 10) Number of medium buses: 4,009 (File 10) Number of small buses: 4,977 (File 10)

	Number of passengers per day large buses: (306+293)/2 = 299.5 (average of two ages of buses) (File 20) Number of passengers per day medium buses: 229 (File 20) Number of passengers per day small buses: 198 (File 20) Number of buses used per trip: 1.01 (File 21) Calculation: P_Z = (299.5*7,491+229*4,009+198*4,977)/1.01= 4,092,185
Any comment:	

Data / Parameter:	**$TD_{C,T,M}$**
Data unit:	km
Description:	Average trip distance of users of passenger cars, taxis and motorcycles
Source of data used:	Market Team, 2010, File 8
Value applied:	passenger cars: 12 taxis: 10 motorcycles: 14
Justification of the choice of data or description of measurement methods and procedures actually applied :	Survey monitors the trip distance and latter is adjusted in case the monitored trip distance is lower than the baseline trip distance. Based on average value of the 6 BRT surveys realized in the year 2010 for cars, taxis and motorcycles.
Any comment:	

Default factors used from the methodology are not listed again in the PDD. Default factors used are:

- Technology improvement factor for buses, cars and taxis (AM0031 Table A.2).
- Emission factor per liter of fuel for various vehicle types (AM0031 Table A.1.).

Parameters listed in the methodology but not used for calculations are:

- SRS: SRS is not required as the project adds road space (AM0031 p.21; the calculation of ARS (formula 16) of the methodology will always show a positive value if $RS_{PJ} > RS_{BL}$ which is the case in the project.[67])
- RS_{BL} and RS_{PJ} are not required as the project adds road space (AM0031 p.21; the calculation of ARS (formula 16) of the methodology will always show a positive value if $RS_{PJ} > RS_{BL}$ which is the case in the project.[68])
- V_B is not required as the project adds road space and therefore congestion leakage is not included (AM0031 p.21)

[67] File 24

[68] File 24

- $EF_{CO2,upstream,CH4}$ is not included as the project uses no gaseous fuels.
- $EF_{CO2,upstream,LNG}$ is not included as the project uses no gaseous fuels.
- FC_X fuel used by baseline buses is not included as the calculations are based on SEC_Z.

B.6.3 Ex-ante calculation of emission reductions:

BASELINE EMISSIONS

Data is based on projections of passenger numbers and their mode participation which can have significant variations compared to actual values due to difficulties of exact projections in transport.

Table 12: Estimated Baseline Emissions (tCO_2)

2013	2014	2015	2016	2017	2018	2019
1,117,514	1,199,968	1,206,919	1,199,243	1,302,210	1,297,973	1,330,049

For details of calculations see Annex 3.

PROJECT EMISSIONS

Table 13: Estimated Project Emissions (tCO_2)

2013	2014	2015	2016	2017	2018	2019
626,598	639,294	652,746	662,295	660,117	667,066	693,333

For details of calculations see Annex 3.

LEAKAGE EMISSIONS

No leakage emissions are projected as no change of the occupation rate of taxis and buses is previewed in the years 1 and 4. This is based on the monitoring of the 1st crediting period which also showed no changes of the occupation rate parameters.

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
2013	626,598	1,117,514	0	490,916
2014	639,294	1,199,968	0	560,674
2015	652,746	1,206,919	0	554,173
2016	662,295	1,199,243	0	536,947
2017	660,117	1,302,210	0	642,093
2018	667,066	1,297,973	0	630,907
2019	693,333	1,330,049	0	636,716
Total (tCO_{2e})	**4,601,450**	**8,653,876**	**0**	**4,052,427**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

The following section has been updated.

Data / Parameter:	**P**
Data unit:	Passengers
Description:	Passengers transported by project
Source of data to be used:	TRANSMILENIO S.A.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	**Table 14: Projected Passengers (millions)** **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** 1,974 | 2,141 | 2,175 | 2,182 | 2,393 | 2,409 | 2,494 Projections based on File 25
Description of measurement methods and procedures to be applied:	Data on passenger numbers is generated from Card Users. The flow data of the passenger system is generated when the passengers cross the turnstiles located in the trunk bus stations or at the entry of feeder buses. Equipment used for passenger records is not calibrated. Frequency: daily collection aggregated monthly.
QA/QC procedures to be applied:	Operations department cross-checks data with fares paid.
Any comment:	Project passengers are calculated as total passengers minus Phase I passengers. Phase I passengers are such that enter stations of trunk routes of phase I. All other passengers are project passengers. Passengers entering stations which cater to trunk routes of more than 1 phase are separated proportionally to the number of trunk routes serving that station.

Data / Parameter:	**S_i**
Data unit:	%
Description:	Share of passengers which in absence of the project would have used mode *i*
Source of data to be used:	Survey realized by independent 3rd Party
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Modal distribution of BRT users: ➢ Buses: 90% ➢ Passenger cars: 3% ➢ Taxis: 5% ➢ Motorcycles: 1% ➢ Non-Motorized Transport and Induced Traffic: 1% Projections based on average of all 6 surveys realized in the year 2010; Market Team, 2010, File 8
Description of measurement methods and procedures to be applied:	Survey based on AM0031 with details in Annex 3 Frequency: The year 1 and 4 and the test-retest survey in the year 1 only of the crediting period
QA/QC procedures to be applied:	Survey QA/QC see Annex 3

Any comment:	The mode distribution is based on a survey. The percentage is calculated as number of respondents using mode x / total valid respondents. The percentages used for the projections are the simple average of the 6 surveys made in the year 2010.

Data / Parameter:	**$FC_{PJ,D}$**
Data unit:	Liter
Description:	Total diesel fuel consumed by the project (trunk and feeder buses)
Source of data to be used:	TRANSMILENIO S.A.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	**Table 15: Projected Fuel Consumption Project (million liters)** 2013: 253; 2014: 258; 2015: 264; 2016: 268; 2017: 267; 2018: 270; 2019: 280 For projections trunk buses (articulated and bi-articulated) based on SFC performance of such buses in TransMilenio System in the year 2010 (File 13), large feeder buses based on TransMilenio records of 2010 (File 13) and medium and small feeder buses based on SFC of baseline buses of same size year 2011 (File 16). The SFC is multiplied with the projected distance driven for each bus size category (File 25)
Description of measurement methods and procedures to be applied:	Based on reports of operators with records of fuel consumption or on distance driven and SFC based on samples. Monthly record if total fuel consumption and one annual sample if based on SFC. Variations are possible due to different bus models used, variations resulting from routes and frequency, load factor variances and driver variances. Trunk bus and most feeder bus operators have their own filling station. All filling stations are certified under the requirements of the Decree 1521 issued by the Ministry of Mining and Energy on 04/08/1998 (File 15). Art. 30 of this decree states how the calibration is performed. Art 31 of the same decree describes in detail the measurement procedure including the required precision level. Frequency: monthly for total fuel consumption and annual if SFC. The biofuel content of fuels is based on the regulations of the Ministry of Mines and Energy and recorded annually. It must be shown that conventional comparable urban buses use the same biofuel blend as project buses. Project fuel consumption is based on the relation project passengers / total passengers multiplied with the total fuel consumption of TransMilenio
QA/QC procedures to be applied:	In case of total fuel consumption values the QA is made with control of the specific fuel consumption. Distance driven is therefore recorded. If deviations of specific fuel consumption are above normal fluctuations (due e.g. to changing load factors, ambient conditions and driver) then data is checked for consistency and potential errors. In case of deviations further controls are performed e.g. with fuel invoices. In case of SFC control with previous years. In case of SFC based on a sample the upper 95% confidence level is taken.
Any comment:	Bio-fuel blend of 7% based on Resolution 18 1266 of 14/07/2010 of the Ministry of Mines and Energy, File 11. Emissions are only calculated on the fossil share of the blend.

	Actual values are monitored. Projections are calculated based on: Specific fuel consumption bi-articulated trunk buses: 72 l/100km (File 25) Specific fuel consumption articulated trunk buses: 61 l/100km (File 13) Specific fuel consumption large feeder buses: 39 l/100km (File 13) Specific fuel consumption medium feeder buses: 29 l/100km (File 6a) Specific fuel consumption small feeder buses: 21 l/100km (File 6a) Distance driven per year per bus category based on File 25 (annex 3 A.7) FC = SFC*DD summarized over all categories. See detail in Annex 3

Data / Parameter:	**$TD_{C/T/M}$**
Data unit:	Kilometres
Description:	Trip distance of project passengers which in absence of the BRT would have used passenger cars, taxis or motorcycles
Source of data to be used:	Survey realized by independent 3rd Party
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No change to baseline projected; Baseline values used: TD_C: 12 TD_T: 10 TD_M: 14
Description of measurement methods and procedures to be applied:	The annual survey is based on a questionnaire, which is representative. Data from the annual survey is however only used if this results in lower baseline emissions (i.e. lower trip distances are monitored than the original baseline data). The trip distance is based on the bus entry station and the bus exit station including distances driven with feeder units. Frequency: The year 1 and 4 and the test-retest survey in the year 1 only of the crediting period
QA/QC procedures to be applied:	QA/QC procedures of survey see Annex 3
Any comment:	

Data / Parameter:	**OC_T**
Data unit:	Passengers
Description:	Average occupation rate of taxis
Source of data to be used:	Specific studies realized by third party
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No change to baseline projected. Baseline value reported: 1.09 passengers (excludes driver) This assumption is also based on no change after project implementation monitored in Bogota. See verification report TRANSMILENIO 2009 (published on www.unfccc.int).
Description of measurement methods and procedures to be applied:	Monitoring realized in the year 1 and 4 of the crediting period. Same methodology is used as for baseline study. Leakage change of occupation rate of taxis is only included if changes >10 percentage points of OC_T are registered. If results show negative changes > 10 percentage points of the occupancy rate, this change is included in the leakage calculation for all years since the last monitoring of the occupation rate.

QA/QC procedures to be applied:	Upper 95% confidence level is taken idem to baseline study.
Any comment:	Used for calculating leakage load factor of taxis. Leakage load factor change taxis has to be included if the occupation rate of taxis drops below 0.98 (1.09=100%; 90% = 0.98)

Data / Parameter:	**ROC_Z**
Data unit:	%
Description:	Average occupation rate of buses relative to capacity
Source of data to be used:	Secretaria Distrital de Movilidad de Bogotá or 3rd party study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No change to baseline projected. Baseline value reported: 62% (Secretaria Distrital de Movilidad de Bogotá, 2011, File 22) This assumption is also based on no change after project implementation monitored in Bogota. See verification report TRANSMILENIO 2009 (published on www.unfccc.int).
Description of measurement methods and procedures to be applied:	Monitoring realized in the year 1 and 4 of the crediting period. Same methodology is used as for baseline study. Leakage change of occupation rate of taxis is only included if changes >10 percentage points of ROC_Z are registered. If results show negative changes > 10 percentage points of the occupancy rate, this change is included in the leakage calculation for all years since the last monitoring of the occupation rate.
QA/QC procedures to be applied:	Same study procedure also during monitoring
Any comment:	Used for calculating leakage load factor of buses. Leakage load factor change buses has to be included if the occupation rate of buses drops below 52% (62%-10%). 62% is the baseline value. 10% is deducted based on AM0031 p.19

Data / Parameter:	**N_T / N_Z /N_C**
Data unit:	Taxis / Buses
Description:	Number of taxis/buses/cars in Bogota
Source of data to be used:	Secretaría de Movilidad
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No change to baseline projected
Description of measurement methods and procedures to be applied:	No projection available and no change of occupation rate is previewed. If no change of occupation rate occurs the parameter needs not be monitored. Frequency: year 1 and 4 of crediting period. Data for taxis and buses is only required if the load factor of taxis and/or buses is more than 10% lower than the baseline value. Data for cars is only required if the survey of BRT passengers has shown a change of fuel used which results in higher baseline emissions.

QA/QC procedures to be applied:	
Any comment:	Used to calculate leakage load factor.

All the above monitored data will be stored for 2 years after the end of the crediting period.

Parameters listed in the methodology but not used for calculations are:

- NCV is not required as the project uses the default emission factors per liter of fuel as provided in the methodology Appendix A Table A1.
- EF_{CO2} is not required as the project uses the default emission factors per liter of fuel as provided in the methodology Appendix A Table A1.
- EF_{CH4} is not required as no gaseous fuels are used.
- EF_{N2O} is not required as no gaseous fuels are used.
- V_P is not required as the project adds road space and therefore congestion leakage is not included (AM0031 p.21)

B.7.2 Description of the monitoring plan:

This section has been updated based on the latest published monitoring report period 01/01/2011 to 31/12/2011.

The area in charge of the CDM project monitoring is the "environment area" inside the Deputy Management. This unit is under direct supervision of the CEO of TRANSMILENIO S.A. TRANSMILENIO S.A. is certified by ISO 9001-2000 [69], ISO-14001 [70], OHSAS18001 [71], and NTCGP1000[72]. The staff in charge of monitoring receives back-up support and quality control services by Grütter Consulting AG.

The monitoring plan has two aims: to ensure the environmental integrity of the project activity and to ensure that the data monitoring requirements are closely aligned with the current practice of the project operator. The monitoring methodology for the project is based on measuring the total emissions of the new transport system. From a methodological viewpoint data is basically derived from measurements.

A (Spanish) CDM monitoring manual has been realized for TRANSMILENIO and staff has been familiarized with this manual in a special training course realized in 2006. The Manual defines responsibilities and procedures, has a section on all data variables to be monitored.

The Environmental Area is in charge of managing all data in relation to the CDM project including responsibility for data collection, quality assurance, reports and data storage. The Environmental Management Specialized Professional is responsible for handling the CDM project data.

[69] File 16

[70] File 17

[71] File 18

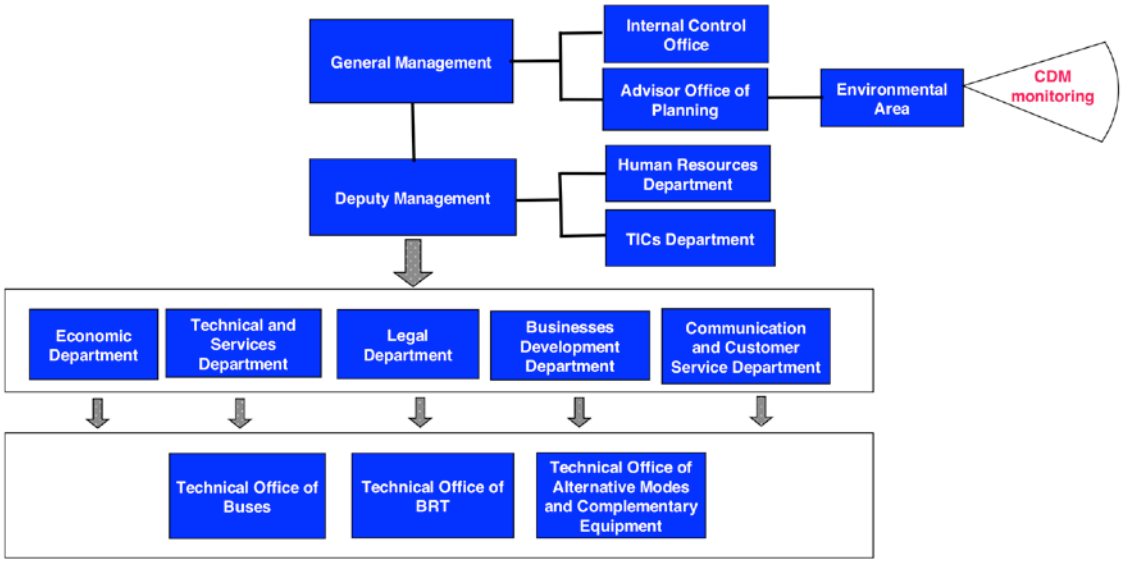
[72] File 19

The responsibilities of the Environmental Management Specialized Professional are:

1. Collect in the required frequency all data for the monitoring of the CDM project;
2. Perform data and information quality control;
3. File all documents in the manner and timing that this manual demands;
4. Collect, if required, additional data;
5. Prepare an annual monitoring report in collaboration with Grütter Consulting;
6. Answer all inquiries and additional information requests by the Designated Operational Entity (DOE) and UNFCCC regarding the CDM verification report in collaboration with Grütter Consulting.

All data must be filed electronically. Hard copy reports and mails are to be scanned so there is an electronic copy.

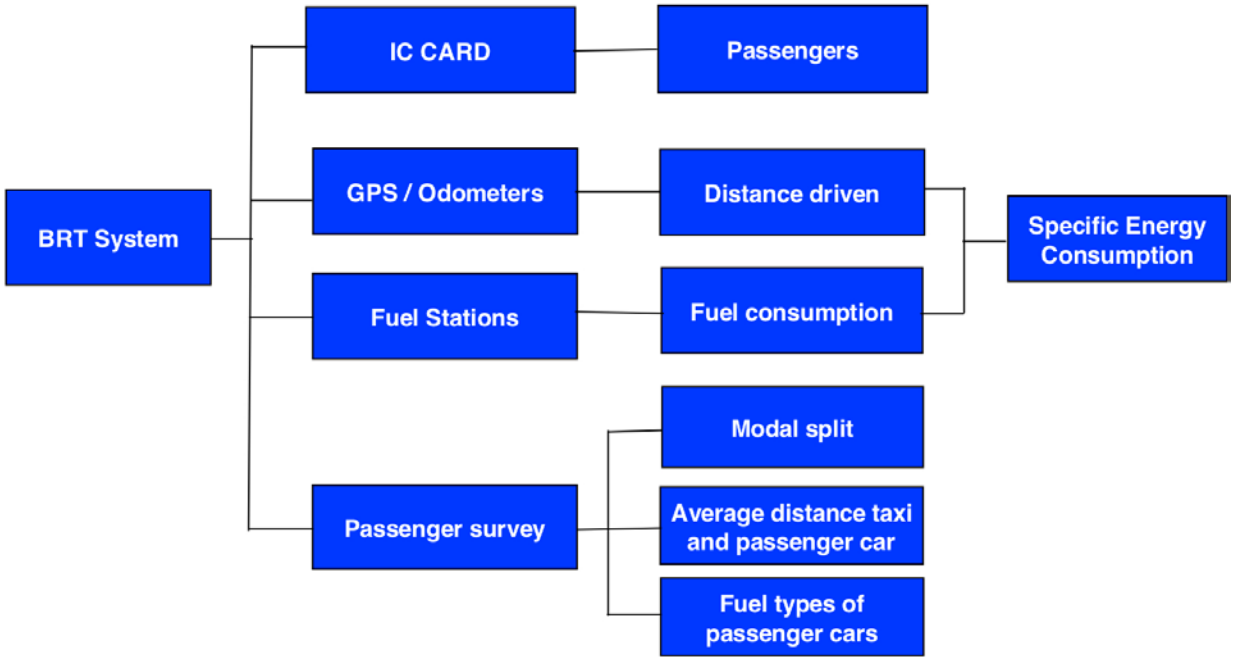
Figure 5: Organization Structure BRT TRANSMILENIO



Data for the monitoring comes from the structure presented in Figure 2.

- Passenger data is the sum of the IC Card result.
- Distance driven is obtained by using the odometers and GPS devices on the buses.
- Total fuel consumption consumed is recorded directly at the fuel stations.
- The passenger survey is carried out by an external third party.

Figure 6: Overview Data Sources



For further details on Monitoring see published Monitoring Report year 2011 on the UNFCCC website.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Completion date: 15/12/2011

The PDD as well as the methodology used for this PDD was developed by Grütter Consulting AG. Staff involved in the elaboration of this PDD are Dr. Jürg M. Grütter, CEO and Susana Milena Ricaurte Farfán, Colombia Country Manager for Grütter Consulting AG.

Contact person: Jürg M. Grütter
jgruetter@gmail.com
www.transport-ghg.com

Grütter Consulting AG is not a project participant.

The PDD was realized on behalf of CAF. CAF is a project participant.
For CAF: Camilo Rojas Garcia, Technical Coordinator PLAC^{+e}, crojas@caf.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

03/2002

C.1.2. Expected operational lifetime of the project activity:

30 years (infrastructure)

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

1st crediting period 01/01/2006

2nd crediting period 01/01/2013

C.2.1.2. Length of the first crediting period:

The length of the 1st crediting period was 7 years, 0 months

The length of the 2nd crediting period will be 7 years, 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

This section was taken from the registered PDD

The project complies with all legal requirements of the environmental legislation of Colombia, enforced by the Department of Environmental Affairs (DAMA). It also complies with the social and environmental guidelines issued by IDU (Instituto de Desarrollo Urbano) and the CAF. All environmental permits required have been granted.

Phase II and following of TransMilenio do not require an environmental licence (in contrast to phase I) as TransMilenio is included in the "Plan de Ordenamiento Territorial, POT"[73]. For the construction of trunk roads IDU has received a global environmental licence based on the Environmental Guidelines granted by DAMA according to resolution 991 of 2001.

Based on the resolution 991 of 2001 IDU in cooperation with DAMA issued environmental guidelines[74]. According to these guidelines trunk roads built for TransMilenio are classified as infrastructure with a potentially significant environmental impact (category "C"[75]) and thus require an EIA (Environmental Impact Assessment) and an Environmental Management Plan (EMP) from the contractor. The EIAs are realized in segments of trunk roads according to assigned contracts. IDU issues for this purpose the requirements concerning the EIA and the contractor selected for the respective trunk road segment realizes the EIA and proposes and implements an environmental management plan. The contractor must present a program for the implementation of the EMP called PIPMA[76]. This document contains in detail the environmental action plan which the constructor will realize to comply with all the conditions specified in the guidelines issued by IDU. He is also responsible for acquiring all required permits e.g. for cutting trees. Based on the PIPMA checklists with indicators are established to supervision the correct execution of the environmental management plan. Based on these checklists a supervision of the implementation of the environmental management plan by the contractor is realized on a monthly base by IDU. The guidelines of IDU establish the corrective actions and the consequences of non-attainment of environmental goals.

The global environmental licence of TransMilenio System as included in the "Plan de Ordenamiento Territorial, POT" is valid for all phases. For the construction of trunk roads IDU has received a global environmental licence based on the Environmental Guidelines granted by DAMA according to resolution 991 of 2001. For individual segments of trunk roads IDU will again demand EIA and environmental management plans. However Phase III contracts for construction have not yet been awarded and phase IV has not yet been designed in detail. As the constructor as first task has to perform an EIA latter are only realized after contract award and therefore EIAs are not yet available for phase III and following.

For the operation of TransMilenio System "Planes de Manejo Ambiental PMA" (environmental management plans) need to be presented and approved by DAMA for each depot bus station at maximum 6 months after starting operations[77]. Thereafter every semester a follow-up report has to be delivered to DAMA. Phase II has three depot stations. "Patio de las Americas" has initiated operations 1.1.2006, "Patio de Sur" has initiated operations April 15th 2006 and "Patio de Suba" April 29th 2006. El "Patio de

[73] See Decree 1220 of April 21st, 2005 of the Ministry of Environment

[74] IDU, Guia de Manejo Ambiental para el Desarrollo de Proyectos de Infraestructura urbana en el Distrito Central

[75] See page 7 of guidelines

[76] Programa de Implementacion del Plan de Manejo Ambiental

[77] The bus stations include the parking lot for buses, the maintenance area as well as the operation of buses.

las Americas" has been granted all required permits. The other two depots are as of July 15th 2006 realizing their respective environmental management plan.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

This section was taken from the registered PDD

The environmental impact of the project is considered highly positive. Following environmental impacts are expected from Phase II to IV of TransMilenio:

- Reduction of around 7,000t of particle matter over the first crediting period. This is a significant share of total particle matter in Bogotá. Particle emissions are one of the main responsible pollutants for respiratory diseases.
- Reduction of more than 50,000t of NO_x over the first crediting period. NO_x is next to NMHCs a pre-cursor responsible for ground ozone formation.
- Reduction of more than 800 tons of sulphur dioxide over the first crediting period due to reduced fuel consumption in the project versus baseline case of buses.

Reductions are calculated in a conservative manner. Additionally emission reductions occur due to a modal switch reducing the number of passenger cars and taxis circulating comparing the project with the baseline.

Transboundary air pollution is a particular problem for pollutants that are not easily destroyed or react in the atmosphere to form secondary pollutants. Typical transboundary air pollutants are carbon monoxide, PM10, non-methane VOCs[78] and NO_x (resulting potentially in ground-level ozone which again is a major component of smog) or sulphur dioxide (SO_2 together with NO_x are primary precursors of acid rain). The most important in the case of diesel based mass transport systems are PM10, NO_x and sulphur dioxide. The direct impact on transboundary air pollution is not estimated as no data is available on this part. It is however clear that the project has a positive impact on a potential transboundary air pollution due to reduced emissions of air pollutants (PM, NO_x, SO_2 basically) due to the project and quantified above.

Next to less air pollution the project also has the environmental benefit of reduced noise pollution due to a reduced amount of vehicles, an improved traffic fluidity with less stop-and-go traffic and more modern units.

Phase II has realized for the construction phase all EIAs and environmental management plans as required by the environmental guidelines established by IDU. All permits were granted and the implementation of the environmental management plans were supervised by IDU. The potential impacts of the construction are stated in the respective EIAs and the environmental management plans. They are dependent on the respective segment of each trunk road for which an individual construction contract was signed with a third party (EIAs and environmental management plans are made for each segment of a trunk road which has been granted to a constructor). The complete list of all potential impacts are thus individually described in each EIA. The potential impacts are typical of road construction such as cutting trees, debris, noise and air pollution during construction etc.

[78] Volatile Organic Components

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

This section was taken from the registered PDD

Main stakeholders identified include the general public, persons living near construction sites of trunk routes and owners as well as drivers of existing (baseline) buses.

General Public

They are the users of the public transport system and the prime beneficiaries due to a reduced travel time, less congestion (also relevant for users of private vehicles) and an improved air quality. TRANSMILENIO realizes through a professional company monthly customer satisfaction surveys. The quality of services offered is thus monitored on a regular base and complaints of clients are received. Stakeholders and system users as well as the public in general can also realize complaints or remarks through the website of TRANSMILENIO[79] or a phone hotline (number 195). The persons realizing a complaint receive a direct answer through the same mechanism as used for the complaint. An example of the involvement of the public in the development of TransMilenio is e.g. their participation in the determination of routes (see Logitrans, 2003, Parte III Análisis de Solicitudes de la Comunidad). Records of all complaints as well as of follow-up measures are maintained by TRANSMILENIO. Complaints concern e.g. excess of velocity, full buses, delays etc. Monthly all complaints are categorized according to type of complaint and media through which complaint has been made (e.g. written, hotline, Internet). Based on these reports corrective measures are taken by TRANSMILENIO.

During the period 2004/5 TRANSMILENIO participated in 36 fairs realized in all communities of the District of Bogotá attending questions of users concerning Phase II and informing about the expansion of TransMilenio.

2005 TRANSMILENIO received for instance more than 25,000 questions, comments or complaints realized by 48% per phone and by 38% through e-mail/Internet. 46% of all interventions were complaints, 44% requests for information and the rest suggestions on how to improve services.

Persons Living Near to Construction Sites

Persons living near to construction sites or sites where major bus-stations are built are potentially affected by these activities. IDU has established near to construction sites focal points where the local community can deposit their concerns. IDU maintains records of all complaints received as well as the actions taken towards these complaints. These points allow for dissemination of information and to address concerns of the community. The focal points also encourage the community to participate in workshops dealing with topics such as public space management or environmental aspects. IDU in cooperation with DAMA issued environmental guidelines[80]. The guidelines include as part of the environmental management plan

[79] http://www.transmilenio.gov.co/transmilenio/frameset_gneral_us.htm

[80] IDU, Guía de Manejo Ambiental para el Desarrollo de Proyectos de Infraestructura urbana en el Distrito Central

a social management plan compulsory for contractors of trunk routes of TransMilenio [81]. This plan shall facilitate the participation of the community in the construction process (information and attend community requests basically), foster positive social impacts and mitigate negative ones. Strategies used include the establishment of focal encounter points [82] including their committee (leaders of the community), information points and a dissemination strategy. The guidelines issued by IDU detail activities and methodologies to be followed by the contractor, which, based on these guidelines proposes the social management plan. Checklists with indicators are established to ascertain the implementation of the social management plan. These are controlled on a monthly base by IDU.

Owners and Drivers of Baseline Buses

Owners and drivers of the existing (baseline) public transport system fear to suffer economic losses. The strategy followed by TRANSMILENIO to resolve this potential problem includes two components:

- Inclusion of affected persons in the operation of TransMilenio: For TransMilenio phase II (in contrast to phase I) the bidding process was changed giving a significant incentive for owners of traditional public transport buses to participate in TransMilenio. While this had no weight in Phase I in Phase II 200 out of 1'400 possible points were given according to the participation of individual bus owners in the capital of the bidder. The result was that Phase II could attract a share-participation of 23% of former bus owners in the transport companies operating the trunk-routes of TransMilenio (1'850 bus owners) and 31% in the feeder routes (4'985 former bus owners) thus including sucessfully a significant proportion of potentially affected stakeholders[83].
- Financial compensation: The scrappage program pays gives a financial incentive for bus owners for their vehicle. To attract buses this financial incentive needs to be higher than the residual market value of the vehicle. Due to the scrappage program bus owners thus receive a financial compensation which allows them the opportunity to invest in a new business venture. Around 50% of participants in the round-tables indicated that they would be interested in entering other business fields instead of transport[84].

For new phases Bogotá organized various roundtable meetings with small and micro transport enterprises owners of one or few buses with the objective of democratizing the system i.e. including more small enterprises in TransMilenio.

Additionally the District of Bogotá realized May 9th 2006, 5 roundtable meetings with stakeholders of phase II and III of TransMilenio. These meetings are continued (in a weekly manner) to encounter acceptable solutions for Phase III. All important associations grouping individual bus-owners take part in these round-tables.

[81] Component "B" of the PIPMA (Plan to implement the environmental management plan); see page 17 of guidelines

[82] Puntos CREAs (Centro de Reunion, Encuentro y Atencion en obra)

[83] Source: TRANSMILENIO 2005

[84] TRANSMILENIO, 6/2006

E.2. Summary of the comments received:

This section was taken from the registered PDD

Market de Colombia" realizes the monthly customer surveys on behalf of TRANSMILENIO. They also make a summary report of comments received. A complete list of all monthly complaints is available. The evaluation is consolidated in a general service index.

Complaints of bus owners refer basically to their non-inclusion in phase I of TransMilenio as the bid structure favoured implicitly large and well organized companies.

Phase II has realized for the construction part a social management plans as required by the environmental guidelines established by IDU for all segments of all trunk roads. The implementation of latter was controlled on a monthly base by IDU following the pre-established checklists. Comments considering trunk road constructions are diverse and include information requests, access to roads, traffic caused etc.

E.3. Report on how due account was taken of any comments received:

This section was taken from the registered PDD

"Market de Colombia" realizes the monthly customer surveys on behalf of TRANSMILENIO. They also make a summary report of comments received. The evaluation is consolidated in a general service index. Persons depositing complaints, remarks or questions receive a direct feedback from TRANSMILENIO relying on the same communication channel (e.g. mail, phone) as used by the person depositing a claim. The monthly service record is fed into the quality assurance program of TRANSMILENIO leading to a continuous improvement of services offered. TRANSMILENIO has a service improvement plan which is based on the evaluation reports mentioned above. Aspects included concern both infrastructure as well as operational issues. Also dialogue meetings with involved stakeholders have been strengthened. Possible outcomes are e.g. an increase of bus frequency, improved maintenance etc. Outcomes of meetings are posted on the website of TRANSMILENIO www.transmilenio.gov.co

The remarks received from people living near to construction sites were followed-up and integrated by IDU. Records of all requests and complaints per trunk road segment as well as the respective corrective action are documented by IDU. All comments received at CREAs are documented including name and contact details of person realizing the request, date, request itself, classification of request, date and contents of response to the request as well as corrective actions taken. One of the elements to improve stakeholder acceptance was to employ basically persons from the neighbourhood in the construction activities. More than 30% of qualified and nearly 70% of unqualified staff was employed in Phase II from the neighbouring communities[85].

The results of the roundtables and the discussions with bus owners resulted in significant changes in the way how small enterprises participate in phases II and following of TransMilenio. This was achieved by changing the public bid structure and points given to participating companies. The share of small

[85] Source: TRANSMILENIO Informe 82: Cuadro consolidado de generación de empleo

enterprises could be increased drastically through this measure thus showing clearly the positive response of TRANSMILENIO to criticism of the conventional transport sector.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	TransMilenio S.A.
Street/P.O.Box:	Av. El Dorado 66-63
Building:	Antiguo Edificio de la Energía
City:	Bogotá D.C.
State/Region:	Distrito Capital
Postcode/ZIP:	
Country:	Colombia
Telephone:	57 1 2203000
FAX:	57 1 2203000
E-Mail:	deysi.rodriguez@transmilenio.gov.co
URL:	www.transmilenio.gov.co
Represented by:	
Title:	Specialized Professional Environmental Management
Salutation:	Ms
Last Name:	Rodriguez
Middle Name:	Yasmin
First Name:	Deysi
Department:	Planning Advisory Office
Mobile:	57 3118767723
Direct FAX:	57 1 3249870
Direct tel:	57 1 2203000 ext. 1119
Personal E-Mail:	deysi.rodriguez@TRANSMILENIO.gov.co

Organization:	Corporación Andina de Fomento - CAF
Street/P.O.Box:	Carrera 9 No 76 - 49 Piso 7
Building:	Ing. Baring
City:	Bogotá
State/Region:	
Postcode/ZIP:	
Country:	Colombia
Telephone:	(57.1) 744 94 44
FAX:	(57.1) 313 27 21/87
E-Mail:	mtorres@caf.com
Website URL:	www.caf.com
Represented by:	
Title:	Head of the PLAC+e
Salutation:	Ms
Last Name:	Torres
Middle Name:	
First Name:	Mary
Department:	Environment Direction

Mobile phone:	
Direct FAX:	(571) 313 27 21/87
Direct tel:	(571) 743 73 53
Personal e-Mail:	mtorres@caf.com

Organization:	The Netherlands' Ministry of Infrastructure and the Environment ("IenM")
Street/P.O.Box:	Rijnstraat 8
Building:	
City:	The Hague
State/Region:	
Postcode/ZIP:	2515 XP
Country:	The Netherlands
Telephone:	0031 – 70 – 339.5199
FAX:	0031 – 70 – 339.1306
E-Mail:	cdm.dna@minvrom.nl
URL:	
Represented by:	
Title:	Head of Unit, Climate Change International
Salutation:	Mr.
Last Name:	Goote
Middle Name:	
First Name:	Maas
Department:	Directorate for International Affairs
Mobile:	
Direct FAX:	0031 – 70 – 339.1306
Direct tel:	0031 – 70 – 339.5199
Personal E-Mail:	cdm.dna@minvrom.nl

Organization:	Grütter Consulting
Street/P.O.Box:	Thiersteinerstr 22
Building:	
City:	Reinach
State/Region:	
Postcode/ZIP:	4153
Country:	Switzerland
Telephone:	00591 2214 83 11
FAX:	
E-Mail:	jgruetter@gmail.com
URL:	www.transport-ghg.com
Represented by:	
Title:	CEO
Salutation:	Mr.
Last Name:	Grütter
Middle Name:	Michael
First Name:	Jürg

Department:	
Mobile:	00591 705 82 987
Direct FAX:	
Direct tel:	00591 2214 83 11
Personal E-Mail:	jgruetter@gmail.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Official Development Assistance in this project and the project will not receive any public funding from Parties included in Annex I.

Annex 3

BASELINE INFORMATION

A.1. BASELINE EMISSIONS

A.1.1. Formulas

$$EF_{KM,i} = \sum_{x} \left[SEC_{x,i} \times \left(EF_{CO2,x} + EF_{CH4,x} + EF_{N2O,x} \right) \times \left(\frac{N_{x,i}}{N_i} \right) \right]$$

where:

$EF_{KM,i}$	Transport emissions factor per distance of vehicle category *i* (gCO_{2e} / km)
$SEC_{x,i}$	Specific energy consumption of fuel type x in vehicle category *i* (litre/ km)
$EF_{CO2,x}$	CO_2 emission factor for fuel type *x* (gCO_2 / litre)
$EF_{CH4,x}$	CH_4 emission factor for fuel type *x* (gCO_{2e} / litre)
$EF_{N2O,x}$	N_2O emission factor for fuel type *x* (gCO_{2e} / litre)
N_i	Total number of vehicles in category *i*
$N_{x,i}$	Number of vehicles in vehicle category *i* using fuel type *x*

$$EF_{P,i} = \frac{EF_{KM,i} \times TD_i}{OC_i}$$

where:

$EF_{P,i}$	Emission factor per passenger transported before project start for vehicle category *i* (gCO_{2eq})
$EF_{KM,i}$	Emission per kilometer of category *i* (gCO_{2eq}/km)
TD_i	Average trip distance for vehicle category *i* (km)

OC_i Average vehicle occupancy rate of vehicle category *i*[86] (no unit)

$$EF_{P,Z} = \frac{EF_{KM,Z,S} \times DD_{Z,S} + EF_{KM,Z,M} \times DD_{Z,M} + EF_{KM,Z,L} \times DD_{Z,L}}{P_Z}$$

where:

$EF_{P,Z}$ Emission factor per passenger transported buses baseline (before project start) (gCO_{2eq})
$EF_{KM,Z,S}$ Emissions per kilometer small buses (gCO_{2eq}/km)
$DD_{Z,S}$ Total distance driven (kilometer) by small buses (km)
$EF_{KM,Z,M}$ Emissions per kilometer medium buses (gCO_{2eq}/km)
$DD_{Z,M}$ Total distance driven (kilometer) by medium buses (km)
$EF_{KM,Z,L}$ Emissions per kilometer large buses (gCO_{2eq}/km)
$DD_{Z,L}$ Total distance driven (kilometer) by large buses (km)
P_Z Passengers transported by buses in the baseline (no unit)[87]

$$BE_y = \sum_i \left(EF_{P,i,y} \times P_{i.y} \right) \times 10^{-6}$$

where:

BE_y Baseline emissions in year *y* (tCO_{2e})
$EF_{P,i,y}$ Transport emissions factor per passenger in vehicle category *i* in year *y* (tCO_{2e} / passenger)
$P_{i,y}$ Passengers transported by the project (BRT) in year *y* that without the project activity would have used category *i*, where *i* = Z (buses, public transport), T (taxis), M (motorcycles) or C (passenger cars)[88] (passenger).

[86] In the case of taxis the taxi driver is not counted

[87] Passengers using on the same trip various buses are counted as one passenger as formula (4) is for emissions per passenger trip

[88] NMT and IT are not included as emissions are 0 for this category in the baseline

$$EF_{P,i,y} = EF_{P,i} \times IR_{i,t} \times CD_{i,y}$$

where:

$EF_{P,i,y}$ Transport emissions factor per passenger in vehicle category *i* in year *y* (tCO_{2e} / passenger)
$EF_{P,i}$ Transport emissions factor per passenger before project start (tCO_{2e} / passenger)
$CD_{i,y}$ Correction factor for changing trip distance in category *i* for the year *y*, where *i* = T(taxis) or C (passenger cars)
$IR_{i,t}$ Technology improvement factor at year *t* for vehicle category *i*
t Age in years of fuel consumption data used for calculating the emission factor in year *y*

$$P_{i,y} = P_y \times S_{i,y}$$

where:

$P_{i,,y}$ Passengers transported by the project which in absence of latter would have used transport type *i*, where *i*= Z (buses, public transport), T (taxis), C (passenger cars), NMT (non-motorized transport), M (motorcycles) and IT (induced transport, i.e. would not have travelled in absence of project) (passengers).
P_y Total passengers transported by the project monitored in year *y* (passengers)
$S_{i,,y}$ Share of passengers transported by the project which in absence of latter would have used transport type *i*, where *i*= Z (buses, public transport), T (taxis), C (passenger cars), NMT (non-motorized transport), M (motorcycles) and IT (induced transport, i.e. would not have travelled in absence of project) (%).

A.1.2. Data Used

Table A.1. Baseline Parameters

Parameter	Description	Value	Unit	Source
SEC_C	Specific energy consumption cars	9.7	l/100km	File 7
SEC_T	Specific energy consumption taxis	6.9	l/100km	File 5
SEC_M	Specific energy consumption motorcycles	3.8	l/100km	File 4
$SEC_{Z,L}$	Specific energy consumption large buses	30.7	l/100km	File 6
$SEC_{Z,M}$	Specific energy consumption medium buses	29.2	l/100km	File 6
$SEC_{Z,S}$	Specific energy consumption small buses	20.8	l/100km	File 6
$EF_{CO2,G,C/T/M}$	CO_{2e} emission factor gasoline cars, taxis, motorcycles	2,313	gCO_2/l	AM0031

$EF_{CO2,D,Z}$	CO_{2e} emission factor diesel buses	2,661	gCO_2/l	AM0031
IR	Technology improvement factor buses, taxis, cars	0.99	no unit	AM0031
IR	Technology improvement factor motorcycles	0.997	no unit	AM0031
OC_C	Occupation rate cars	1.55	passengers	File 3
OC_T	Occupation rate taxis	1.09	passengers	File 3
OC_M	Occupation rate motorcycles	1.14	passengers	File 3
TD_C	Trip distance passenger car	12	km	File 8
TD_T	Trip distance taxi	10	km	File 8
TD_M	Trip distance motorcycle	14	km	File 8
Used for P_Z	Number of buses used per passenger per trip baseline	1.01	No unit	File 21
Used for P_Z	Number of passengers per bus per day	Large bus: 300 Medium bus: 229 Small bus: 198	Passengers	File 20
P_Z	Passenger trips baseline buses per day	4,092,185	passengers	calculated
$DD_{Z, L/M/S}$	Distance driven baseline large/medium/small bus per day	Large: 173 Medium: 171 Small: 225	Km	File 10
S_i	Share of passengers using mode *i* for the baseline trip	See table A2	%	File 8
P	Passenger trips realized by the project	See table A5	passenger trips	File 25
	Biofuel percentage in Gasoline	8	%	File 12
	Biofuel percentage in Diesel	7	%	File 11

Table A2. Baseline Mode Share of Surveyed Passengers (File 8)

Mode	Share of passengers using this mode
Passenger car	3%
Taxi	5%
Bus	90%
NMT incl. Induced	1%
Motorcycle	1%

Table A3. Emissions per Kilometre of Modes (gCO_2/km)

	2013	2014	2015	2016	2017	2018	2019
Bus	650	643	637	630	624	618	612
Passenger car	202	200	198	196	194	192	190
Taxi	144	143	141	140	139	137	136
Motorcycle	79	79	79	79	78	78	78

Table A4. Emissions per Passenger-Trip of Modes (gCO_2/passenger)

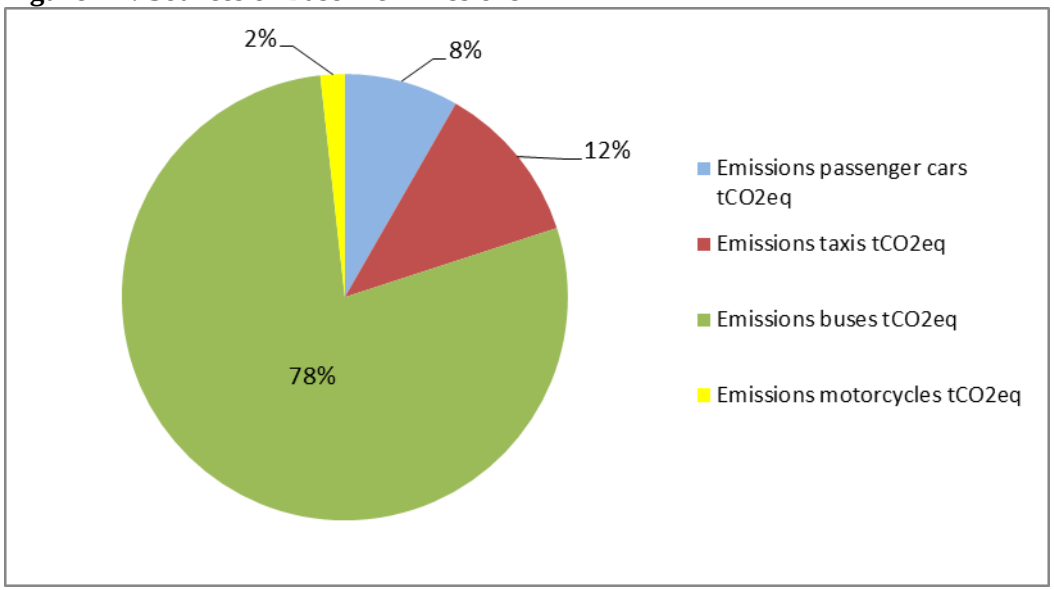
	2013	2014	2015	2016	2017	2018	2019
Bus	492	488	483	478	473	468	464
Passenger car	1,566	1,551	1,535	1,520	1,505	1,489	1,475
Taxi	1,324	1,311	1,298	1,285	1,272	1,259	1,247
Motorcycle	974	971	968	965	962	960	957

A.1.3. Results

Table A5. Baseline Emissions

Parameter	unit	2013	2014	2015	2016	2017	2018	2019
Passenger trips project	passengers	1,973,967,205	2,140,762,559	2,174,645,392	2,182,371,617	2,393,391,230	2,409,399,035	2,493,564,743
Baseline emissions from cars	tCO_2	92,751	99,582	100,146	99,497	108,027	107,662	110,308
Baseline emissions from taxis	tCO_2	130,684	140,310	141,105	140,190	152,208	151,694	155,423
Baseline emissions from buses	tCO_2	874,851	939,286	944,611	938,487	1,018,940	1,015,497	1,040,461
Baseline emissions from motorcycles	tCO_2	19,229	20,791	21,057	21,068	23,036	23,120	23,856
Total baseline emissions	**tCO_2**	1,117,514	1,199,968	1,206,919	1,199,243	1,302,210	1,297,973	1,330,049

Figure A1: Sources of Baseline Emissions



A.2. PROJECT EMISSIONS

A.2.1. Formulas

$$PE_y = \sum_x \left[TC_{PJ,x,y} \times (EF_{CO2,x} + EF_{CH4,x} + EF_{N2O,x}) \right]$$

where:

PE_y	Project emissions in year *y* (tCO_{2e})
$TC_{PJ,x,y}$	Total consumption of fuel type *x* in year *y* by the project (liter)
$EF_{CO2,x}$	CO_2 emission factor for fuel type *x* (gCO_2 per liter)
$EF_{CH4,x}$	CH_4 emission factor for fuel type *x* (gCO_{2e} per liter)

$EF_{N2O,x}$ N_2O emission factor for fuel type *x* (gCO_{2e} per liter)

A.2.2. Data Used

Table A6. Project Parameters

Parameter	Description	Value	Unit	Source
$SEC_{TB,Bi-Art}$	Average fuel consumption trunk buses bi-articulated diesel	l/100km	72	File 25
$SEC_{TB,Art}$	Average fuel consumption trunk buses articulated diesel	l/100km	61	File 13
$SEC_{FB/L}$	Average fuel consumption large feeder buses diesel	l/100km	39	File 13
$SEC_{FB/M}$	Average fuel consumption medium feeder buses diesel	l/100km	29	File 6
$SEC_{FB/S}$	Average fuel consumption small feeder buses diesel	l/100km	21	File 6
DD	Distance driven of trunk buses articulated and feeder buses	See table A7	km	File 25
TC	Total fuel consumed project buses	See table A7	liter	Calculated
P	Passengers transported by the project	See table A7	Passengers	File 25

Table A7. Passengers Transported and Fuel Consumed

Parameter	2013	2014	2015	2016	2017	2018	2019
Trunk buses bi-articulated (km)	21,262,567	21,978,792	22,694,317	22,935,935	32,075,487	32,412,739	35,181,573
Trunk buses articulated (km)	59,309,640	61,316,819	63,320,087	63,976,312	73,183,277	73,943,656	80,263,509
Feeder buses large (km)	185,919,204	189,205,895	193,195,016	196,038,290	256,653,471	259,374,547	309,017,467
Feeder buses medium (km)	361,392,469	367,285,673	373,274,978	379,361,949	285,683,602	288,687,373	247,262,333
Feeder buses small (km)	112,689,292	114,526,909	116,394,492	118,292,530	73,314,753	74,085,608	62,104,741
Diesel fuel consumed (liters)	253,198,714.55	258,328,878.04	263,764,432.76	267,623,298.59	266,743,121.73	269,550,988.65	280,164,980.21
Passengers	1,973,967,205	2,140,762,559	2,174,645,392	2,182,371,617	2,393,391,230	2,409,399,035	2,493,564,743

A.2.3. Results

Table A8. Project Emissions

Parameter	unit	2013	2014	2015	2016	2017	2018	2019
Total project emissions	tCO_2	626,598	639,294	652,746	662,295	660,117	667,066	693,333

A.3. EMISSION REDUCTIONS

A.3.1. Formulas

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	Emission reductions in year "y" (t CO_2e/yr)
BE_y	Baseline emissions in year "y" (t CO_2e/yr)
PE_y	Project emissions in year "y" (t CO_2/yr)
LE_y	Leakage emissions in year "y" (t CO_2/yr)

A.3.2. Results

Table A9. Emission Reductions in tCO_2

Parameter	2013	2014	2015	2016	2017	2018	2019	Total
Baseline emissions	1,117,514	1,199,968	1,206,919	1,199,243	1,302,210	1,297,973	1,330,049	8,653,876
Project emissions	626,598	639,294	652,746	662,295	660,117	667,066	693,333	4,601,450
Leakage emissions	0	0	0	0	0	0	0	0
Emission Reductions	**490,916**	**560,674**	**554,173**	**536,947**	**642,093**	**630,907**	**636,716**	**4,052,426**

A.4. DETAILS OF SURVEY TO IDENTIFY MODE OF TRANSPORT

The methodological design of the survey follows the methodology and is detailed during project execution based on the actual passenger flow numbers. The procedures as detailed in the methodology will be followed.

Technical Summary Data Sheet of the Survey
Strategy and sample design in the BRT TransMilenio passenger survey

Parameter	Main parameter: • Baseline emissions; Secondary parameters and inputs: • Proportion of passengers proportion using each mode of transport, with the project and in absence of the project; • The average distance travelled by the modes taxi, car and motorcycle with the project.
Target population	Passengers over 12 years using the BRT TransMilenio.
Sample frame	Passenger flow in all the trunk stations of the BRT TransMilenio. The survey is made on the trunk routes only.
Sample design	Two staged probabilistic design: • First stage: stratified – simple random sampling (SRS); • Second stage: systematic sampling based on passengers flow per station. Stratum: Stations. Sub stratum: Days in the week and hours.
Relative error level (CV)[89]	For the survey a global desired level of precision (relative standard error or coefficient of variation – CV) between 5% and 10% for the parameters of interest, which implies at the same time having precision levels of 90/10 is targeted.
Coverage	Urban area where BRT TransMilenio operates.
Size of Universe	Generally, in one day the BRT TransMilenio mobilizes around 6 million passengers.
Sample size	The sample size is estimated to be around 3-5,000 surveys in the measuring week with a re-test sample size of around 50% of the original sample[90]. The exact number will be determined based on the actual passenger volumes per hour and per station and also based on results of the passenger surveys conducted in the year 2011 and 2012 (last 2 years of 1st crediting period).
Pilot Test	The project is entering its 2nd crediting period. Surveys are done on a bi-monthly base with a smaller sample size since 2006.
Sample frequency	Year 1 and 4 of the crediting period with 1 re-test in year 1.

[89] Relative error level refers to the coefficient of variation (CV), which is calculated as the ratio between the standard deviation of the average and the population average.

[90] The re-test sample size is determined based on the variances encountered in the original sample

Method of information collection	The information will be obtained through the face-to-face application of the established questionnaire on a random base.
Consistency of the survey results	The internal consistency of the results of the survey must be carefully checked. The reliability will be measured using the Cronbach's alpha. A reasonable coefficient is over 0.7, values over 0.9 should be rechecked to avoid redundancy of data. In case the survey does not demonstrate internal consistency in their results, it will be rejected and another survey could be arranged.

TRANSMILENIO QUESTIONNAIRE FOR MODAL SPLIT SURVEY

Registered are the interviewer, date, place and time.

Question 1:
"Assuming that the BRT TransMilenio you are currently using would not exist: What mode of transport would you have used for this specific trip you are doing currently".
For the interviewer:

- *person during the year in general.*
- *To clarify mention that you are comparing TransMilenio with the public transport The question is related to this specific trip and not to the trips realized by the system existing formerly respectively with the public transport system which still exists in parts of the city not served by TransMilenio*
- *Persons which cannot relate it to any mode of transport are taken as induced traffic (conservative default parameter)*

Multiple choice **answers to question 1:**
(only tick one; if the passenger would have used more than one transport mode for the trip he is realizing currently then tick the mode which involves the longest distance):

1. conventional bus based public transport (not TransMilenio)
2. private car → please go to 2A
3. taxi → please go to 3A
4. motorcycle→ please go to 4A
5. per foot
6. per bicycle
7. I would not have made the trip (induced traffic)

Question 2: If the passenger responds with the answer 2 then ask:

2A. Do you or your family own a car or do you have access to a car (e.g. car-sharing) ?
a. NO b. YES
If the passenger responds with NO this specific questionnaire is deemed as non-consistent and removed from the final counting

2B. What fuel type does the car use to which you have access?

☐ gasoline ☐ diesel ☐ gas (CNG, LNG or LPG) ☐ electric ☐ I don't know ☐ other:…….

2C. What is the starting point of your trip (origin) and which is the final (destination) point? Please name the station our location where you first boarded a bus belonging to TransMilenio (trunk or feeder unit) and where you will make the final stop?

For the interviewer: Please advise the passenger that the original departing and final point is required. This may include bus transbording such as first using a feeder line and then a main line. It is thus the origin and final destination of the passengers trip and not of the ride on this specific bus-line.

Origin (departing point): ……
Destination (final point): ……

Question 3: If the passenger responds with the answer 3 then ask:

3A. Have you used in the last 12 months a taxi ?

a. NO b. YES

If the passenger responds with NO this specific questionnaire is deemed as non-consistent and removed from the final counting

3B. What is the starting point of your trip (origin) and which is the final (destination) point? Please name the station our location where you first boarded a bus belonging to TransMilenio and where you will make the final stop?

For the interviewer: Please advise the passenger that the original departing and final point is required. This may include bus transbording such as first using a feeder line and then a main line. It is thus the origin and final destination of the passengers trip and not of the ride on this specific bus-line.

Origin (departing point): ……
Destination (final point): ……

Question 4: If the passenger responds with the answer 4 then ask:

4A. Have you used in the last 12 months a motorcycle?

a. NO b. YES

If the passenger responds with NO this specific questionnaire is deemed as non-consistent and removed from the final counting

4B. What is the starting point of your trip (origin) and which is the final (destination) point? Please name the station our location where you first boarded a bus belonging to TransMilenio and where you will make the final stop?

For the interviewer: Please advise the passenger that the original departing and final point is required. This may include bus transbording such as first using a feeder line and then a main line. It is thus the origin and final destination of the passengers trip and not of the ride on this specific bus-line.

Origin (departing point): ……
Destination (final point): ……

Annex 4

MONITORING INFORMATION

The monitoring follows the Monitoring Manual and the details of the methodology as well as PDD Monitoring is already being made since 1.1.2006 and has been verified annually with CERs being issued. For further details on monitoring see the Monitoring Reports as approved, latest versions, on the UNFCC website. See also details in section B.7.1 for parameters and section B.7.2. for processes.

Parameters Monitored by Project

ID	Parameter	Description	Frequency	Source
1		Type of fuel used by conventional buses (biofuel contents)	Annual	MME or fuel distributer
2	FC_{PJ}	Total fuel consumed by project buses (trunk and feeder units)	monthly	TRANSMILENIO S:A: based on reports by operators
3	DD_{PJ}	Total distance driven by project buses (trunk and feeder units)	monthly	TRANSMILENIO S:A: based on reports by operators
4	P	Passengers project	monthly	TRANSMILENIO S:A:
5	S_i	Share of passengers which in absence of the project would have used mode *i*	2013 and 2016	External survey company
6	$TD_{C/T/M}$	Trip distance of project passengers which in absence of the BRT would have used passenger cars, taxis or motorcycles	2013 and 2016	External survey company
7	OC_T	Average occupation rate of taxis	2013 and 2016	External company or institution
8	ROC_Z	Average occupation rate of baseline buses relative to capacity	2013 and 2016	Secretaria Distrital de Movilidad de Bogotá or 3rd party study
9	$N_{T/Z/C}$	Number of taxis/buses/cars in Bogota	2013 and 2016	Secretaria de Movilidad

Appendix 1: List of Documents Used/Cited

File 1, Republica de Colombia, Conpes 3260, 2003
File 2, Republica de Colombia, Conpes 3368, 2005
File 3a/b, Grütter Consulting, occupation rate studies, 2011
File 4a/b, Grütter Consulting, SFC motorcycles, 2011
File 5a/b, Grütter Consulting, SFC taxis, 2011
File 6a/b, Grütter Consulting, SFC buses, 2011
File 7a/b, Grütter Consulting, SFC cars, 2011
File 8, Market Team, TRANSMILENIO passenger surveys (6 units), 2010
File 9, Secretaria de Movilidad, vehicle registration statistics, 2011
File 10, Secretaria de Movilidad, letter concerning bus statistics, 10/08/2011
File 11, Ministerio de Minas y Energía, Resolución Número 18 1266 de Julio 14 de 2010
File 12, Ministerio de Minas y Energía, Resolución Número 18 2368 de Diciembre 29 de 2009
File 13, Grütter Consulting, CER Monitoring spreadsheet 2010, 2011
File 14, Grütter Consulting, distance driven of taxis, 2011
File 15, Ministerio de Minas y Energía, Decreto 1521 de 1998
File 16, SGS, ISO 9001:2008 certificate of TRANSMILENIO valid until 14/09/2013
File 17, SGS, ISO 14001:2004 certificate of TRANSMILENIO valid until 14/09/2013
File 18, SGS, OHSAS 18001:2007 certificate of TRANSMILENIO valid until 14/09/2013
File 19, SGS, NTCGP 1000:2004 certificate of TRANSMILENIO valid until 14/09/2013
File 20, Secretaria de Movilidad, Cálculo de la Tarifa Tecnica para el Servicio Público de Transporte Colectivo para Bogota D.C., 2011
File 21a/b, Grütter Consulting, survey number of buses used per trip, 2011
File 22a/b, Secretaria Distrital de Movilidad de Bogotá, occupation rate buses, 2011
File 23, Metrobus, SFC buses, 2011
File 24, Decree 190 of 2004, POTs trunk roads and letter TransMilenio, 2011
File 25, TRANSMILENIO, SFC bi-articulated buses and projections, 2011
