
VERIFICATION AND CERTIFICATION REPORT

Corporación Andina de Fomento (CAF)

**BRT Bogotá, Colombia:
TransMilenio Phase II-IV**

SGS Climate Change Programme

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Summary:			
<p>SGS United Kingdom Ltd has performed the third periodic verification of the CDM project BRT Bogotá, Colombia: TransMilenio Phase II-IV (UNFCCC Ref. 0672). The verification includes confirming the implementation of the monitoring plan of the registered PDD and the application of the monitoring methodology as per AM0031 Version 1, valid from 28 July 2006 onwards. A site visit was conducted to verify the data submitted in the monitoring report (version 1.0 dated February 5th, 2009).</p> <p>During the period January 1, 2008 to December 31, 2008, the implementation of the BRT Bogotá, Colombia: TransMilenio Phase II-IV project has resulted in reducing emissions per passenger trip compared to the baseline scenario. This has been achieved through the substitution of old buses to new and larger buses, along with mode switching of passengers from taxis and private cars to public transport and improved occupancy rates due to dispatching vehicles based on a centrally managed organisation.</p> <p>TransMilenio has implemented the new transit management scheme as well as the fare system prior to starting operations of phase II. Bus technology used in all buses operating in phase II is Euro II or Euro III. As identified in the first and second periodic verifications of the project, the infrastructure for Phase II has been completed as planned and all trunk routes of Phase II were fully operational in the first semester of 2006.</p> <p>The periodic verification exercise showed that the situation on site has not changed from the situation observed in the first and second periodic verifications and also that there has been no new construction (trunk routes) during the monitoring period.</p> <p>SGS confirms that the project is implemented in accordance with the validated and registered Project Design Document. The monitoring system is in place and the emission reductions are calculated without material misstatements. Our opinion relates to the project's GHG emissions and the resulting GHG emission reductions reported and related to the valid and registered project baseline and monitoring and its associated documents. Based on the information seen and evaluated we confirm that the implementation of the project has resulted in 68,813 tCO₂e during period 01/01/2008 up to 31/12/2008.</p>			
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CDM Verification			
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Abbreviations

AM	Approved Methodology
BRT	Bus Rapid Transit System
CAF	Corporación Andina de Fomento (Andean Development Corporation)
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CL	Clarification Request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNA	Designated National Authority
DOE	Designated Operational Entities
EB	Executive Board
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IDU	Instituto de Desarrollo Urbano (Institute of Urban Development)
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
PDD	Project Design Document
REF	Reference
UNFCCC	United Nations Framework Convention on Climate Change

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1. Introduction

1.1 Objective

SGS United Kingdom Ltd has been contracted by Corporación Andina de Fomento (CAF) to perform an independent verification of its CDM project BRT Bogotá, Colombia: TransMilenio Phase II-IV. CDM projects must undergo periodic audits and verification of emission reductions as the basis for issuance of Certified Emission Reductions (CERs).

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

- The emissions report conforms with the requirements of the monitoring plan in the registered PDD and the approved methodology; and
- The data reported are complete and transparent.

1.2 Scope

The scope of the verification is the independent and objective review and ex post determination of the monitored reductions in GHG emission by the project activity. The verification is based on the validated and registered project design document and the monitoring report. The project is assessed against the requirements of the Kyoto Protocol, the CDM Modalities and Procedures and related rules and guidance.

SGS has, based on the recommendations in the Validation and Verification Manual, employed a risk-based approach in the verification, focusing on the identification of significant reporting risks and the reliability of project monitoring.

The verification is not meant to provide any consulting towards the Client. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 Project Activity and Period Covered

This engagement covers emissions and emission reductions from anthropogenic sources of greenhouse gases included within the project boundary of the following project and period.

Title of Project Activity:	BRT Bogotá, Colombia: TransMilenio Phase II-IV
UNFCCC Registration Number:	0672
Monitoring Period Covered in this Report	01/01/2008 to 31/12/2008
Project Participants	Empresa Distrital de Transporte del Tercer Milenio (TRANSMILENIO S.A.) Corporación Andina de Fomento (CAF)
Location of the Project Activity:	City of Bogotá (Capital District), Colombia.

The CDM project covers TransMilenio Phases II to IV, which are being implemented gradually. Until the periodic verification, the Phase II has been completed. Spatially, project comprises of the main roads (trunk lines) and the arterial roads (feeder lines). By 2012 it is expected that TransMilenio will consist of¹:

- 130 km of new dedicated lanes (trunk routes) including new bus-stations
- Around 1'200 new articulated buses with a capacity of 160 passengers, operating on trunk routes and 500 new large buses operating on feeder lines.
- Daily 1.8 million passengers transported.

¹ All data mentioned is always exclusive of TransMilenio Phase I

The emissions of TransMilenio buses are significantly lower compared to conventional buses operating in Bogotá currently, which are mostly Euro 0 or older. Diesel used for trunk routes in TransMilenio contains significantly less sulphur than normal diesel available in Colombia. All operators of trunk routes have their own filling stations and regular controls are realized to ensure that emission specifications are met. Euro II norms and Euro III norms are followed for the majority of buses in phase II and III of the project. For the phase IV no definition of standards has yet been made. All trunk routes of Phase II were fully operational in the first semester of 2006. As confirmed, in 2008 no new trunk routes have been built and put into operation. Phase III is not yet in operation.

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 project has achieved emission reductions through an intervention in the following main areas:

- **Infrastructure:** This consists basically of 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.
- **Bus Technology:** Bus technology used in all buses operating in phase II are in accordance with Euro II or Euro III norms. Buses operating on dedicated lanes are new articulated buses with a capacity of 160 persons with platform-level access including room for disabled persons. Feeder buses are new buses with a capacity of 70-90 passengers.
- **Transit Management:** The operational fleet centre manages bus dispatch, informs passengers, produces reports and maintains records. All buses are equipped with a Global Positioning System (GPS) linked to the operation centre.
- **Fare System:** The system is based on pre-board ticketing using magnetic ticketing. 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.

2. Methodology

2.1 General Approach

SGS's approach to the verification is a two-stage process.

In the first stage, SGS completed a strategic review and risk assessment of the projects activities and processes in order to gain a full understanding of:

- Activities associated with all the sources contributing to the project emissions and emission reductions, including leakage if relevant;
- Protocols used to estimate or measure GHG emissions from these sources;
- Collection and handling of data;
- Controls on the collection and handling of data;
- Means of verifying reported data; and
- Compilation of the monitoring report.

At the end of this stage, SGS produced a Periodic Verification Checklist which, based on the risk assessment of the parameters and data collection and handling processes for each of those parameters, describes the verification approach and the sampling plan.

Using the Periodic Verification checklist, SGS verified the implementation of the monitoring plan and the data presented in the Monitoring Report for the period in question. This involved a site visit and a desk review of the monitoring report. This verification report describes the findings of this assessment.

2.2 Verification Team for this Assessment

Name	Role	SGS Office
Mayra Caradec	Lead Assessor	SGS Panama
Alessandra Treuherz	Local Assessor	SGS Panama
Siddharth Yadav	Expert	SGS UK

2.3 Means of Verification

2.3.1 Review of Documentation

The validated PDD, the monitoring report submitted by the client and additional background documents related to the project performance were reviewed. A complete list of all documents reviewed is attached in section 8 of this report.

2.3.2 Site Visits

As part of the verification, the following on-site inspections have been performed:

Location: City of Bogota, Colombia Transmilenio S.A: Av. El Dorado 66-63. Angelcom S.A.: Transversal 22 no. 19 – 19. Connexion Móvil S.A.: Patio Sur Calle 57Q No. 65-64 Sur SI02 S.A.: Patio Américas KR 86 BIS No 45 – 57 Sur	
Date: 01/04/2009 – 02/04/2009	
Coverage:	Source of Information / Persons Interviewed

<p><i>Overall Project Planning and management</i></p> <p><i>Methodology related issues and clarification on monitoring report and data reporting and processing</i></p> <p><i>Parameters related to the Project Activity</i></p> <ol style="list-style-type: none"> 1. Fuel consumption trunk (TC_{TB}) and feeder buses (TC_{FB}) (total TransMilenio) 2. Distance driven trunk (DD_{TB}) and feeder buses (DD_{FB}) 3. Passengers transported by TransMilenio all phases ($P_{TM,T}$), Phase I only ($P_{TM,I}$) and Phase II-IV "the project" (P_{PJ}) <p><i>Parameters related to the baseline</i></p> <ol style="list-style-type: none"> 4. Average trip distance of passengers using TransMilenio which in absence of latter would have used taxis (TD_T) or passenger cars (TD_C) 5. Share of passenger cars using fuel type "x" of passengers using TransMilenio which in absence of latter would have used a passenger car ($N_{x,C}$) 6. Share of passengers transported by TransMilenio who would have used transport mode "i" ($P_{PJ,i}$) 7. Policies that affect baseline <p><i>Leakage</i></p> <ol style="list-style-type: none"> 8. Amount of cement / asphalt used per km trunk road (CEM, ASP) 9. Length of trunk roads built with cement / asphalt (DT_{CEM} and DT_{ASP}) 8. Buses scrapped by project ($BSCR_w$) 9. Average age of scrapped buses (BA_{PJ}) 10. Average occupancy rate relative to capacity of conventional buses (ROC_z) 11. Average occupancy rate of taxi (OC_T) 	<p>CORPORACION ANDINA DE FOMENTO</p> <p>Mary Gómez Martha P. Castillo</p> <p>GRÜTTER CONSULTING</p> <p>Susana Ricaurte Farfán</p> <p>TRANSMILENIO S.A</p> <p>Deysi Rodriguez Aponte Jairo Fernando Paez Fernando Rojas Luis Guillermo Ehrhardt Oscar Ivan Chiquillo Martinez Raúl Roa Buitrago Camilo E. Losada Alexander Puentes Gómez Luis Bejarano Moreno</p> <p>ANGELCOM S.A.</p> <p>Gonzalo Herneq Guzman</p> <p>SI02 S.A.</p> <p>Carolina Cortés Manuel R. Roco Daniel Cabuya Martha Acuña Sandra Cárdenas</p> <p>CONNEXION MOVIL S.A.</p> <p>Nini Johanna Carrillo Alejandro Rumié P. Diana Cristina Reyes</p>
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2.4 Reporting of Findings

As an outcome of the verification process, the team can raise different types of findings

In general, where insufficient or inaccurate information is available and clarification or new information is required the team shall raise a Clarification Request (CL) specifying what additional information is required.

Where a non-conformance arises the team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- I. the verification is not able to obtain sufficient evidence for the reported emission reductions or part of the reported emission reductions. In this case these emission reductions shall not be verified and certified;
- II. the verification has identified misstatements in the reported emission reductions. Emission reductions with misstatements shall be discounted based on the verifiers ex-post determination of the achieved emission reductions

The verification process may be halted until this information has been made available to the assessors' satisfaction. Failure to address a CL may result in a CAR. Information or clarifications provided as a result of a CL may also lead to a CAR.

Observations may be raised which are for the benefit of future projects and future verification actors. These have no impact upon the completion of the verification activity.

Corrective Action Requests and Clarification Requests are detailed in Periodic Verification Checklist. The Project Developer is given the opportunity to “close” outstanding CARs and respond to CLs and Observations.

2.5 Internal Quality Control

Following the completion of the assessment process and a recommendation by the Assessment Team, all documentation will be forwarded to a Technical Reviewer. The task of the Technical Reviewer is to check that all procedures have been followed and all conclusions are justified. The Technical Reviewer will either accept or reject the recommendation made by the assessment team.

3. Verification Findings

3.1 Project Documentation and Compliance with the Registered PDD

The project documentation is in accordance with the PDD registered with the UNFCCC on 7th December 2006 and the approved methodology AM0031/Version 1. The 3rd monitoring period (01.01.2008 – 31.12.2008) is consistently reported according to the crediting period of the registered PDD and UNFCCC website information. During first verification of the project it was confirmed that there were no issues pending in the validation report.

It was verified that the monitoring report correctly reflects the monitoring plan and all the parameters included in the registered PDD. The monitoring approach for each parameter described in the PDD for monitoring the parameters is consistent in terms of unit, measurement procedures and monitoring frequency.

Also, QA/QC procedures implemented are consistent with the QA/QC described in the section D.3 of the registered PDD. In response to a Corrective Action Request raised in the 2nd verification, the project participant (PP) informed that Transmilenio would carry out an internal audit at the end of January every year to strengthen quality assurance and control procedures. This is in addition to the audit and control procedures that are carried out every month. An internal audit program (Ref. 19) and two audit reports (Ref. 17 and 18) were provided during site visit. Evidences of internal audits of the two operators that were sampled (Connexion Móvil and SI02) were verified (Ref. 17 and 18) which include audit report and checklist, audit plan, assistance list and copies of verified evidences. A general audit program for all operators was also provided (Ref. 19). The audits were centred on verifying the reliability and traceability of distance and fuel consumption data, therefore invoice data of each operator were verified against the reported values to Transmilenio. The results of the two audits were satisfactory. A recommendation of prompter invoice transactions because of common delays in reporting to Transmilenio was given in the audit reports (see page 1 – Ref. 17 and 18).

Also, in response to a Clarification Request (formerly named New Information Request) from the previous verification, Grutter Consulting informed that they would adapt the monitoring software for the period of 2008 to construct 15% benchmarks per operator for better comparability (and not only from the average of all operators) based on historic fuel consumption trends of 2006 and 2007. It was verified in the efficiency calculations (Ref. 26) that a $\pm 10\%$ benchmark was used, contrary to the 15% previously established, which is deemed more conservative. Please refer to section 3.2 for more details.

According to the methodology AM0031 Version 1, “the project boundary is defined by the passenger trips completed on the BRT project that is part of the public and private road-based passenger transport sector of the city in which project is realized. The physical delineation is determined by the outreach of the new BRT or public or private urban passenger transport project.” The project boundary consists of passenger trips completed in the project. Physically, this includes the trunk routes within the outreach of phase II (Americas, NQS and Suba) and excludes the routes built and operated in phase I of the project. As identified before in the first verification of the project, the new transit management scheme as well as the fare system became fully operational prior to January 1st, 2006. Certificates for project installation/contract were checked for the operators, all the components of the project as described in the monitoring report and discussed in the registered PDD (Phase-II onwards) have been installed and are operational. The following are the operators for Transmilenio:

Trunk Buses Operators:

1. SI 99
2. Ciudad Movil
3. Express del Futuro
4. Metrobus
5. Transmasivo
6. SI 02
7. Connexion Movil

Feeders Buses Operators:

1. ETMA
2. TAO
3. Al Norte 2
4. Al Capital
5. Citimovil
6. SI03

The 13 operators (trunks and feeders) work in both Phase I and Phase II-IV Routes. The monitoring period only includes Phase II-IV data, which is correctly applied in the monitoring report. According to the registered PDD, the operators are not assigned to specific phases of Transmilenio and serve Phase I as well Phase II destinations according to the central dispatch operator. Therefore, the separations of Phase II-IV from Phase I fuel consumption data is to be calculated based upon passengers' number boarding in the different stations, which complies with the methodology AM0031 Version 1. It has been verified that the fare system is based on pre-boarding magnetic ticketing, in compliance with the registered PDD. The operational fleet centre manages bus dispatch, passenger information, produces reports and maintains records. All the operations are linked and are monitored through the centralised monitoring system at Transmilenio headquarters.

According to the registered PDD, the project has chosen alternative A which monitors Project Emissions based on the Fuel Consumption. Alternative B described in the methodology includes the monitoring based on Kilometres data which will generate efficiency data to calculate Project Emissions. Even though the project uses alternative A, it also monitors the distance driven (Km) data for cross-checking. The data for fuel consumption is obtained from the operators mentioned above.

The bus technology used in all buses operating in phase II is in accordance with Euro II/ Euro III norms. All buses are equipped with Global Positioning System (GPS) for trunk and feeder routes, verified on site and illustrated in the first verification report.

The companies related to the project activity are the following:

- Trasmilenio Office. All data is received in or accessed from Transmilenio office by authorized personnel. This data is verified (through crosschecking) and sent to the consultant who prepares the CER Monitoring Report.
- Grutter Consulting is responsible for the preparation of the Monitoring Report.
- Angelcom S.A manages information on passengers transported by Transmilenio and the operations department. TransMilenio crosschecks data with fees paid.
- Institute of Urban Development (IDU) is responsible for planning and implementation of construction works. This involves collection of information and data processing.
- The Secretary of Traffic and Transport (Bogota) is the overall in charge of the operations in IDU.
- Company contracted to conduct the annual surveys. For the current monitoring period it was verified that a different company has been contracted: Market Team S.A. The contract between the company and Transmilenio has been verified and hard copies were provided (Ref.28).
- Operators for Trunk and Feeder Buses as described above. A site visit was carried out in two of the operators (SI02 and Connexion Movil). Please see details in sections below.

3.2 Monitoring Results

Based on the approved monitoring methodology, registered PDD and monitoring plan, monitoring parameters presented in the monitoring report were assessed. The following section discusses the issues raised for checking each parameter and their closure.

Fuel consumption trunk (TC_{TB}) and feeder buses (TC_{FB}) (total TransMilenio)

According to the registered PDD, the project has chosen alternative A which monitors project emissions based on the buses fuel consumption. The total fuel consumed by each bus operating on both trunk and feeder routes is measured each time the bus is re-fuelled at the fuel station. Calibrations are conducted periodically and calibrations certificates were verified during the site visit (Ref. 32, 33). Each bus is installed

with a steel chip bearing a unique ID number which is synchronised with the fuel dispensers. If there is any damage to the chip, the corresponding bus will not be recognized or validated by the system and as a result the dispensers will not open for fuel discharge. Consequently, the device is sent to maintenance and a new chip will be designated for the bus. This exchange of chips is controlled by Transmilenio. As verified, there is no risk of fuel consumption occurring without bus registration, or taking place in the name of another bus, as each vehicle must be recognized and validated once connected for fuel discharge, or else fuel would not be released. The manufacturer's specifications for the chip were checked during the verification of the first monitoring period. The specification mentions that the chip is factory lasered and has a guaranteed unique 64-bit registration number that allows for absolute traceability and error free device selection as no two parts are alike.

Fuel consumption data is registered electronically and automatically through the operator software at each station. This information contains other relevant data such as bus specifications and time of consumption. The amount of fuel consumed can be programmed to be viewed in various aggregates (e.g. daily, monthly, etc.). Data was verified directly from the software during site visit. For the purpose of cross-checking with the reported data, it was requested to view consumption data per month, which was found consistent with the data reported in the Monitoring Report.

There are 7 "patios" or depot stations, one belonging to each trunk operator:

1. Patio Norte – Ciudad Móvil
2. Patio Sur / BOSA – Connexion Móvil
3. Patio Américas – SI02
4. Patio USME – SI99
5. Patio SUBA – Transmasivo
6. Patio Calle 80 – Express del Futuro
7. Patio Tunal – Metrobus

There are two fuel suppliers for the Transmilenio buses, only one per station: Terpel and Exxon Mobil. Fuel suppliers at each station issue an invoice to the depot bus station where they are located. The patio operator then issues invoices to all operators that consumed fuel in that patio (e.g. Connexion Móvil consumes in Patio Norte and Patio SUBA – see Connexion Móvil invoices in Ref. 31). Thereafter, each operator of feeder and/or trunk buses reports monthly the fuel consumed to Transmilenio under a contractual obligation. As confirmed during site visit, the only manual registry that takes place is in the form of a receipt issued to the operators that consume fuel in a depot station with the purpose of allowing consumers to cross-check this data with the invoices. Data is registered in American Gallons units in the operator's site, sent to Transmilenio monthly where it is converted to Litres in the company software. Hence, all the data reported from each operator is available in the Transmilenio offices. Electronic data was checked and no inconsistencies were reported. Data collection procedures for fuel consumption were verified in compliance with section D.2.1.1 of PDD.

According to the monitoring methodology, section B.7, variations in the specific fuel consumption from the average factor need to be controlled. The PDD, section D.3, mentions that fuel consumption data per operator shall be statistically checked with average fuel consumption data of all operators. If deviations are above 10% then data shall be cross-checked e.g. with fuel receipts. As verified, the MVP monitoring software is configured to automatically detect those operator efficiencies that exceed the $\pm 10\%$ range of the pre-established average of 2006 for all operators. The established $\pm 10\%$ benchmark is given in the Transmilenio Monitoring Manual (Ref. 15, pg. 7), as 6.9 Km/gal and 5.1 Km/gal for trunk buses and as 12.3 Km/gal and 9.1 Km/gal for feeder buses. A print screen of the MVP software showing the benchmark control was provided (Ref. 16), which was also verified in its original format during the site visit. An exclamation mark appears next to the efficiency data of an operator whenever the value surpasses the $\pm 10\%$ range of average consumption of all operators. Clarifications are given in a separate summary to justify for the efficiency variation. Data was verified in relation to the pre-established benchmarks and quality control of MVP on the 10% range was verified correct. Hence, the $\pm 10\%$ benchmark control on specific fuel consumption was verified in compliance with the PDD and monitoring methodology.

Additionally, in response to a New Information Request from the previous verification, Grutter Consulting informed that they would adapt the monitoring software for the period of 2008 to construct 15% benchmarks per operator for better comparability (and not only from the average of all operators) based on historic fuel consumption trends of 2006 and 2007. This procedure is not required by the methodology or established in

the PDD, and is voluntarily performed as a double-check to ensure fuel consumption data accuracy and reliability. The average calculation of fuel consumption of 2006 and 2007 per operator is shown in an Excel spreadsheet (Ref. 26). Historical data was verified correct and consistent with the previous monitoring periods. It was verified in the efficiency calculations (Ref. 26) that a $\pm 10\%$ benchmark was used, contrary to the 15% previously established, which is deemed more conservative. Efficiency values were checked in relation to the 10% benchmark per operator. One operator was found to surpass its efficiency benchmark: in many months of 2008 (all but February and March), the specific fuel consumption of Connexion Movil was slightly above the $\pm 10\%$ range in relation to its historical efficiency values (see ref. 26). This has been justified in the Monitoring Report, pg. 17, which states that all data of the operator were controlled by the audit carried out in January by staff of TRANSMILENIO and Grütter consulting, as confirmed with audit evidences (ref. 17, 18 and 19). The Monitoring Report also shows in Graph A1 that Connexion Movil presents a continuous improvement in fuel efficiency since 2006 on a monthly base. It is also shown in Graph A2 of the report that the average performance of the operator is at the upper range but comparable to other operators. The variation was confirmed reasonable and consistent with the operator historical average.

Transmilenio also has an internal control system in the operations department that shows the efficiencies in Km/gal for all months of the year and a performance graph with the established limit of $\pm 10\%$ adapted from the CDM project activity. If efficiency values exceed this range, TM checks the maintenance routines and frequencies of the operator to verify if this has affected the specific fuel consumption of the operator.

A sample of two operators was chosen for this verification: SI02 y Conexión Movil. The selection of these operators is justified in the fact that these had not been visited before, that they are trunk operators, and for logistical reasons due to their proximity to the central offices of Transmilenio.

Evidences of the internal audit carried out on January 2009 on the two operators that were sampled (Connexion Móvil and SI02) were verified (Ref. 17 and 18) which include audit report and checklist, audit plan, assistance list and copies of verified evidences. A general audit program for all operators was also provided (Ref. 19). The audits were centred on verifying the reliability of distance and fuel consumption data, therefore invoice data of each operator were verified against the reported values to Transmilenio. The results of the two audits were satisfactory, with a recommendation of prompter invoice transactions because of frequent delays in reporting to Transmilenio (see page 1 of Audit Reports – Ref. 17 and 18).

Calibration certificates of the fuel dispensers in Connexion Movil for all the months of 2008 (monitoring period) were provided during site visit (Ref. 32) as well as a certificate of calibration of the fuel tank conducted in July 2008 (Ref. 17).

For SI02, calibration of the fuel tank was done in April 2008 (page 10 of Ref. 18). The calibration of the fuel dispensers was done in the months of January, March, April, May, June, July, August, September, November and December (see Ref. 33). In February and October calibration was not conducted because the fuel supplier (Terpel) was validating if calibration of dispensers could be done with a frequency of two months (see Ref. 34). It was verified that no specific calibration frequency is established in the PDD or in the methodology. As it is the utmost interest of the fuel supplier as well as station operators to guarantee the accuracy of fuel consumption data because of the commercial relationship among the two, data is subject to strict controls from each station operator. In addition, all fuel filling stations, including that of Connexion Movil and SI02, are regularly audited to verify compliance with the Norm 1521 of 1998 of the Ministry of Mining and Energy (refer to certificate by ICONTEC as well as Audit Report and checklist – page 5 to page 15 of Ref. 17). This norm establishes a procedure for calibration (refer to articles 30 and 31) yet no specific frequency (Ref. 39). Also, according to information provided by Terpel and Exxon Mobil (Ref. 41), there is no established frequency of calibration of dispensers recommended by the manufacturer. Furthermore, in a letter provided to Transmilenio Terpel informed that it recommends a frequency of calibration every 3 months, which has been complied with by SI02, pointing out that in 2008 a total of 10 calibrations were conducted out of 4 recommended. Terpel also stated that the fact of missing the dispenser calibrations in the months of February and November 2008 does not affect the quality of data (Ref. 40). Therefore, no risk was found in this variation of frequency that could affect the quality of fuel consumption data.

On the other hand, regular preventive maintenance is done to the fuel equipment in the stations by the station operator in conjunction with the fuel distributor (refer to Ref. 17 page 20). This maintenance includes calibration of the fuel tank and dispensers and verifying the condition of all measuring equipment at the fuel station. This maintenance is carried out as to ensure maximum fuel data reliability because of financial purposes of both parties (the operator and the fuel distributor).

Connexion Movil fuel consumption in Patio SUBA and Patio Auto Norte was verified in invoices of January, July and October (Ref. 31). Data was calculated and reported values of these 3 months were confirmed correct. SI02 fuel consumption was verified for the months of January, July and October. The invoices of the fuel supplier Terpel (Ref. 31) were verified and it was confirmed that for these months, no consumption of fuel of SI02 took place in other patios. It was observed in the January invoices that 5.15 gallons were charged to SI02 (Ref. 31) that were not included in the reported total fuel consumption to TM (Ref. 23). This was discussed with Transmilenio during site visit, who clarified that this represented an adjustment made by Terpel in relation to the previous months (2007), what can happen when the fuel supplied differs from the fuel consumed. As informed by the PP, this difference can happen due to fuel losses during the calibration or fuelling processes, also due to evaporation or temperature effect on the fuel expansion. The PDD states that the fuel receipts are used for cross-checking with the amount of fuel that was actually consumed, which is measured by the fuel dispensers, what has been confirmed through the internal system and invoices. Fuel suppliers have access to the operators' software to regularly cross-check the amount of fuel actually consumed by operators with the data of fuel supplied. If any differences are found between the fuel supplied and fuel consumed, these are charged to the operator located at the fuel station, who is considered responsible for the fuel losses. Hence, it could be confirmed that this amount of 5.15 gallons (adjustment made through a fuel receipt to the operator) is not to be included in the reported data for January 2008 as it does not represent a fuel consumed by the buses, neither impact the consumption data reported, and therefore does not affect ERs calculation.

Reports of operators for the months of January, July and October (Ref. 23) were cross-checked with data from the Environmental Management area in TM and also with the CER spreadsheet. These values were found in accordance with data in CER spreadsheet. Formulae applied in the provided CER Spreadsheet (Ref. 5) were verified and values are correctly applied and calculated according to the methodology.

Distance driven trunk (DD_{TB}) and feeder buses (DD_{FB}) (all TransMilenio)

The distance driven is measured by an automated measuring system (GPS) and recorded electronically (Km). Specifications of GPS were verified, confirming there was no change in equipment since the last verification. GPS-TimbleDSM12RS no.1670020182 is installed at the central control centre. The distance driven is also automatically registered on the paper discs installed on the dash Board for each Bus for secondary checks.

GPS automatically sends geo-referenced data to the software of Fleet Management at Transmilenio Control Centre. This parameter is only for quality control, hence significance is low, moreover the distance driven is double checked by operators and Transmilenio as this is the basis of payment to the operators.

Transmilenio has control of kilometres driven at real time through software that receives data from the GPS at the control centre. If a bus does not register in the system at a given time, Transmilenio communicates with the operator for verification. The system generates a data base and accumulates daily km for each operator and also for each bus individually. A report is sent weekly from the operation control area to environmental management area. This number does not include dead kilometres.

Total kilometres are reported by all operators in a consolidated report every week. Copies of these reports for the months of January, July, and October of all operators were verified (Ref. 23). These were cross-checked with data from the TM Operations Department (Ref. 30) and was confirmed correct. Data in the Monitoring Report and CER spreadsheet were also found in accordance to the electronic data at Transmilenio.

Passengers transported by TransMilenio all phases (PTM,T), Phase I only (PTM,I) and Phase II-IV, and Project (P,PJ)

Angelcom is the same company responsible for managing passenger data since the start of the project activity. A site visit was performed in the offices of Angelcom, where the passenger data flow was described as follows:

Data is first generated from the turnstiles at the bus stations. Every entrance and exit recorded at the turnstiles is sent to a computer located at each station. Passengers using only feeder buses are not counted i.e. the data reported is conservative and sub-estimates the project impact. All computers at the stations automatically transfer the data to the central information system at Angelcom. The information takes 2

seconds to arrive to Angelcom. Computers at the stations have a storage capacity of 8 days as data back-up.

The Operations Department at Transmilenio receives continuously and automatically a replica of the Oracle software (Oracle Replication Service) from Angelcom, S.A. (see Ref. 21). This data is sent in an encrypted format to TM and can therefore not be subject to manipulation; it serves merely for TM consultation of data. The Information Management System at Transmilenio collects data from the replica data base of Angelcom through the use of a filter, and generates a report of the data in a more comprehensible format. Software data can be crosschecked with fares paid in case of variation of data.

In case of electricity downturns, all computers at bus stations can continue to work independently. When communication between station computers and the central information system at Angelcom is recovered, all pending information is directly sent to Angelcom. Turnstiles register the number of passengers entering per day. According to the Operations Manager of Angelcom, an average of 1,500,000 passengers is recorded per day in the entrances. There are 115 bus stations with one computer each (68 in Phase I and 47 in phase II), which stores data for 8 days.

The system records include passenger data for paid and non-paid passengers, distributed into Phase I and Phase II (Ref. 21). The server records were crosschecked with the reported data in the CER spreadsheet (Ref. 5) and Monitoring Report (Ref. 3) for all the months of 2008. No difference was found between the values in the turnstile system and the Monitoring Report. Formulae applied in the provided CER Spreadsheet (Ref. 5) were verified and values are correctly applied and calculated according to the methodology.

Average trip distance of passengers using TransMilenio which in absence of latter would have used taxis (TD_T) or passenger cars (TD_C)

As mentioned in the registered PDD (section A.3.13), surveys are carried out through a third party on an annual basis for determining the above parameters. Transmilenio S.A has sub-contracted the work to Market Team, S.A. for the third monitoring period under contract dated as June 19th 2008. The contract between Transmilenio and the company was verified and found in accordance with the period when the surveys were conducted (From June 2008 to November 2008). Hard copies of the contract were provided (Ref. 28).

It was verified that during the third monitoring period 6 surveys were conducted (Ref. 9) – June, July, August, September, October and November 2008 and sent to CAF as electronic file (emails verified – Ref. 9). The results of the surveys were checked for the six months (data), and the format was found to be in accordance with the registered PDD (Annex 3).

Data for monthly distance averages is calculated from a data base which shows data of entry and exit of the system (Ref. 9). The data obtained from the 6 surveys is used in Transmilenio software which calculates the distance between these stations and calculates the average value for the respective month. Data verified in Transmilenio software database (Ref. 38) complies with the reported in the Monitoring Report Section 5.2.1. In case the annual average data obtained is higher than the baseline value (pre-fixed), than the baseline values is used.

The pre-fixed baseline value (PDD) is 7 km for taxis and 9 km for passenger cars, the monitored annual values for 2008 are 11 km and 12 km respectively, which are higher than the pre-fixed values, therefore the baseline values are taken (no adjustment is made). Values reported for taxis in 2006 and 2007 were 10km and 9km respectively, thus comparable to 11km reported in 2008. Likewise, values reported for passenger cars in 2006 and 2007 were 11km and 12km respectively, thus comparable to 12km reported in 2008.

It was verified that the formulas and values were correctly applied in the CER Spreadsheet, and reported in the Monitoring Report.

Share of passenger cars using fuel type “x” of passengers using TransMilenio which in absence of latter would have used a passenger car, N_{x,c} (Cars)

The Survey Reports provides the results for Passengers who would have used passenger cars and the fuel type their car is using. The data of fuel type of cars obtained from the 6 surveys are calculated to obtain a total value for each type of fuel. Final values are manually inputted into the Transmilenio software. Data from the 6 survey reports conducted – June, July, August, September, October and November 2008 – were

recalculated to crosscheck with the total value reported in the Monitoring Report. The following reported values were found correct:

- 0% of vehicles using alternative fuels
- 88.1 % of vehicles using gasoline
- 2.3 % of vehicles using diesel
- 9.6 % of vehicles using gaseous fuels

Data is only used if the share of vehicles using gaseous fuels is larger than 10% or if the share of vehicles using alternative fuels is larger than 1% (see PDD). The share of diesel vehicles is irrelevant as diesel GHG emissions would be higher than gasoline ones (PDD Table A.3.10.1) and changes to the fixed baseline emission factor are only made if the result leads to lower the baseline emission factors. As this is not the case in 2008 no adjustment must be made to the baseline emission factor of passenger cars.

Reported data in CER spreadsheet were verified against the survey results and were found correct. Calculations in spreadsheet were also verified and found in compliance with the methodology.

Share of passengers transported by TransMilenio who would have used transport mode “i”

The survey format /elements were checked and found to be in accordance with the registered PDD/AM0031 version 1. Data of Share of Passengers transported by Transmilenio who would have used transport mode “i” from the 2008 survey used is totalized from the monthly surveys and inputted in Transmilenio software database and used for calculation of baseline emission factors in the CER Spreadsheet. Quality control is based on values significantly higher than the average value of 2006 and 2007. The following data was reported for this parameter:

- 91.4% would have used conventional buses
- 2.4 % would have used passenger cars
- 5.5 % would have used taxis
- 0.5 % would have used NMT
- 0.2 % would not have made the trip

Data was recalculated using the survey reports and reported percentages were found to be correct. Values were found to be comparable to the values recorded in previous years, shown in table 3 of Monitoring Report. Formulas were verified to be correctly applied in the CER Spreadsheet.

Policies that affect baseline

Policies are checked through official websites of District of Bogotá: Ministry of Transport, Ministry of Energy and Mines, Ministry of Environment, Environmental District Secretary, and the Legal Regime of Bogotá. The Environmental Control Technician of Transmilenio verifies once a month the official websites of District of Bogotá provided below:

- 1) Ministry of Transport: <http://www.mintransporte.gov.co/Servicios/Normas/home.asp>
- 2) Ministry of Energy and Mines: http://www.minminas.gov.co/minminas/kernel/usuario_externo_normatividad/index.jsp
- 3) Ministry of Environment: <http://www.minambiente.gov.co/descarga/descarga.aspx>
- 4) Environmental District Secretary: <http://www.secretariadeambiente.gov.co/sda/libreria/php/inicio.php>
- 5) Legal Regime of Bogotá, D.C.: <http://www.alcaldiabogota.gov.co/sisjur/index.jsp>

Transmilenio also receives automatically news on every new policies related to the transport sector and local legislations. The Environmental Control Technician of Transmilenio receives daily editions of Notifax, which is a service of all the governmental entities of the District of Bogotá. The daily editions contain news about every new environmental norm in the district. A print screen of the editorial notes received daily was provided during the site visit (Ref. 22). Subsequently, all relevant norms are consolidated into a data base called “Normatividad Ambiental” in Access software, which automatically separates the news into categories through pre-established key words using Microsoft Visual Basic (See image 3 of Ref. 22). The Environmental Management Specialist at TM verifies the news data base and the district official websites for double-checking.

Two laws which could be applicable for the project were identified for the monitoring period of 2008:

1. Law 1205 of 2008 – National level which regulates the diesel quality. No influence on project or baseline parameters relevant for GHG (Ref. 7). Law 1205 de 2008 (Ref. 7) establishes the limits for sulphur concentrations in diesel (maximum of 500ppm) of public transportation systems, applicable since July 1st of 2008. It also sets a new limit of 50ppm to be valid from January 1st 2010 onwards.

2. Pacto calidad del aire Bogotá of 7.2.2008 which regulates the diesel quality in Bogotá; no influence on project or baseline parameters relevant for GHG (Ref. 8). The agreement “Pacto calidad del aire Bogotá” of 7.2.2008 (Ref. 8) establishes the commitments among the Municipality of Bogotá, Ecopetrol, the District Environmental Secretary and the Ministry of Environment to implement the necessary actions for achieving the goal of decreasing sulphur concentrations to 50ppm in 2010.

A report of sulphur concentrations realized by Ecopetrol for Transmilenio in 2008 (Ref. 14) showed a value of 415 ppm, which indicates compliance with Law 1205. None of these policies were found to affect the baseline. Official websites were verified and no other relevant policies that may apply to the project activity were found.

Amount of cement / asphalt used per km trunk road & Length of trunk roads built with cement / asphalt

It was informed that no construction took place during the monitoring period; hence certificates of construction / invoices were not available for checking. Therefore a written confirmation from the authorised official from IDU (Urban Development Institute, Govt. of Colombia) was requested in this regard. An official letter from Hector R. Marrugo Pardo, Transmilenio Management Department – IDU (Institute of Urban Development) dated January 21st 2009 confirms that no construction of trunk routes took place in the monitoring period of 2008 (Ref. 6).

Therefore leakage emissions due to construction in 2008 are correctly applied in the Monitoring Report, based on data of 2006 as no new construction activities took place in 2008. The value of 5,481tCO_{2eq} is correctly used for construction leakage. Formulae and values were correctly applied in the CER spreadsheet.

Buses scrapped by project

Data entered from the scrapping reports was checked (Ref. 10). Sample of 10 bus reports (from a total of 31) available from the office of Secretary of Transport and Traffic (Ref. 36) confirmed the figures. The register containing the details of the scrapped buses was checked against the original records. The records of the original files for all the scrapped buses are achieved by Transmilenio and the electronic database is also maintained.

Per each articulated bus introduced in the BRT system, an average rate of 7.7 units is scrapped (as stated in the registered PDD, pg. 9), which varies depending on the concession contract with operators. The scrapped units are based on small, medium and large buses. Small and medium sized buses are translated into large buses (relation 4:1 and 2: 1 according to PDD). The report of scrapped buses shows that 9 large buses and 22 medium buses were scrapped in order to introduce new articulated buses in 2008. The following conversion was verified: Small Buses: 0; Medium Buses: 22; Large Buses: 9; with a total of 20 scrapped buses, as reported in the Monitoring Report.

No errors in data generation, transfer and processing were spotted. It was verified that the formulas and values were correctly applied in the CER Spreadsheet, and reported in the Monitoring Report. Values of scrapped buses are used along with monitored average bus age of scrapped buses under the project activity to obtain data for emissions leakage due to reduced life-span of buses.

Average age of scrapped buses

According to the methodology, the average age of scrapped buses under the project activity ($BA_{p,i}$) shall be calculated based on scrapping reports. Average bus age of scrapped buses was verified in the scrapping reports (Ref. 36) and cross-checked with the registered data (Ref. 10) and Monitoring Report.

The average year of manufacturing for the different types of buses and the total number of buses scrapped for each type calculated were also verified correct, based on total of scrapped buses for 2008. The average

year of large buses was 1984, and of medium buses was 1981. Thus, the average between these two is 1982. The calculation procedure was verified in accordance with the methodology. The average year of 26 years (2008-1982) was correctly reported, and used to obtain data for emissions leakage due to reduced life-span of buses.

Average occupancy rate relative to capacity of conventional buses

According to the PDD, parameters for calculating leakage due to changing load factor of baseline buses and taxis are to be monitored in years 3 and 7. Therefore, the parameters related were reported for the monitoring period of 2008. The study for determining the average occupancy rate of conventional buses (ROC_z) and of taxis (OC_T) is conducted by the Secretaria Distrital de Movilidad of Bogotá on a regular basis. A letter from the Secretary provided along with the study confirms that the load factor study for 2008 was performed by the Secretary. Original records of the study conducted by the Secretary were provided, along with the calculations done by Grutter Consulting (Ref. 11).

According to the methodology described in the PDD, locations, days and times for field study must be defined. Suggested days are Tuesday to Thursday, avoiding days immediately after or before a holiday. Atypical seasons (school or university vacations) should be avoided. Data for the master stations should cover the period from 5.00AM to 23.00PM. As verified in the original records (Ref. 11), the study was conducted on a Tuesday, Wednesday and Thursday in April and May of 2008, which are reasonable months for the survey (not atypical season due to school or university vacations), and conducted from 5:00 to 23:00 in the days of 10/04, 17/04, 22/04, 23/04, 20/05, 22/05 and 29/05, complying with the established minimum of 5 days. The study was done in 15 strategic points in the city of Bogota, to cover all the routes with the minimum of points.

Load factor methodology also requires that study includes 6 occupation categories: A: nearly empty, B: some seated passengers; C: All passengers seated, D: some passengers standing, E: bus is full, F: passengers in front of registration (overloaded). Study was verified to include the 6 occupation categories indicated in the methodology. The total number of vehicles, number of available spaces (vehicle capacity) and the total number of passengers should be reported. The study was found to report number of buses, vehicle capacity and the estimated number of passengers per vehicle, thus in compliance with methodology.

The load factor methodology described in page 80 of the PDD states that occupation is the number of passengers divided by the vehicle capacity. In the study it was checked that average load factor per bus is calculated as demand over supply. Demand is the estimated amount of passengers per bus, and supply is the passenger capacity per type of bus, which is fixed according to the type of bus identified (Long Bus, Short Bus, Small Bus, Large Microbus, Small Microbus) (see records in Ref. 11). An average of load factor is done for all the buses sampled for each direction in the route. E.g. Route: C100 X AV SUBA Directions: E-W = 59.3%, W-E= 64.5%, etc. An average for each route is taken (e.g. 61.9%) and a final load factor average is done from all the routes measured in the study, resulting in a load factor of 61.4%.

According to the methodology of load factor buses described in pg. 80 of PDD, the average load factor is equal to the average load factor of each route multiplied by the total number of passengers in the route, divided by the total passengers in the network.

CL #1 was raised to request the PP to clarify how this procedure was applied in the calculations of buses load factor (File 6 Load factor TPC_ TPI). In response to CL #1, the PP said that the average load factor of buses was re-calculated based on the methodology described in the PDD. The average load factor of each route was multiplied by the number of passengers on that route and divided by the total number of passengers. The average load factor resulted in 61.2% contrary to the previous value of 61.4%. The monitoring report and CER spreadsheet were updated accordingly and calculations were verified and found to be correct in the excel spreadsheet files (see Ref. 11). Therefore, **CL #1 was closed out**. Yet, this does not change the final results, as the average load factor is above the limit of 56% (10% points lower than the baseline load factor of 66%). Therefore, no leakage of the load factor of remaining buses needs to be considered for this monitoring period. Formulae and values were correctly applied in the CER spreadsheet and reported in the Monitoring Report.

Average occupancy rate of taxi

Along with the average occupancy rate of conventional buses, this parameter is to be monitored in years 3 and 7, as explained in section D.2.3.1 of PDD. The study for determining the average occupancy rate of conventional buses (ROC_2) and of taxis (OC_T) is conducted by the Secretaria Distrital de Movilidad of Bogotá on a regular basis. A letter from the Secretary provided along with the study confirms that the load factor study for 2008 was performed by the Secretary. A sample of original records of the study conducted by the Secretary was provided, along with the calculations done by Grutter Consulting (Ref. 11).

According to the methodology described in the PDD, locations, days and times for field study must be defined. Suggested days are Tuesday to Thursday, avoiding days immediately after or before a holiday. Atypical seasons (school or university vacations) should be avoided. The study must be realized in different locations of the city during minimum 5 days. The times used in the cited study are the morning peak hours. As verified in the sample given (Ref. 11), the study was conducted on a Tuesday, Wednesday and Thursday in April and May of 2008, which are reasonable months for the survey (not atypical season due to school or university vacations), and conducted from 6 to 9am, which correspond to the morning peak hours. The study was realized in 7 days: 10/04, 17/04, 22/04, 23/04, 20/05, 22/05 and 29/05, complying with the established minimum of 5 days.

The taxi load factor determines the fraction of occupied taxis per amount of taxis measured and multiplies it by a default factor of 1.5 passengers per taxi. This is done in accordance with the registered PDD (pg. 82), which points out that the STT study only identifies “occupied” or “non-occupied” taxis. Hence, an average number of passengers per occupied taxi (1.5) is adopted from the Japan International Cooperation Agency. The PDD makes reference to the document “JICA, Estudio del Plan Maestro del Transporte Urbano de Santa fe de Bogotá en la República de Colombia, informe final, IDU, 1996”.

The average load factor of buses was 0.89, as verified in the calculations (Ref. 11) and the CER spreadsheet (Ref. 5). According to the registered PDD, pg. 82, no load factor leakage of taxis needs to be calculated if the result is 0.1 point plus/minus of original value. As the baseline load factor was 0.81, the established range is from 0.71 to 0.91. The result of 0.89 is thus within this range. Therefore, the distance driven and the number of taxis needs not be monitored. Formulae and values were correctly applied in the CER spreadsheet and reported in the Monitoring Report.

3.3 Remaining Issues, CAR's, FAR's from Previous Validation or Verification

In response to a Corrective Action Request raised in the 2nd verification, the PP informed that Transmilenio would carry out an internal audit at the end of January every year. This is in addition to the audit and control procedures that are carried out every month. In the previous verification it was checked that TM personnel were certified as integral internal auditors. Evidences of internal audits of the two operators that were sampled (Connexion Móvil and SI02) were verified (Ref. 17 and 18) which include the audit report and checklist, audit plan, assistance list and copies of verified evidences. A general audit program for all operators was also provided (Ref. 19). The audits were centred on verifying the reliability and traceability of distance and fuel consumption data, therefore invoice data of each operator was verified against the reported values to Transmilenio. The results of the two audits were confirmed satisfactory. A recommendation of prompter invoice transactions because of common delays in reporting to Transmilenio was given in the audit reports (see page 1 – Ref. 17 and 18).

Also, in response to a New Information Request from the previous verification, Grutter Consulting informed that they would adapt the monitoring software for the period of 2008 to construct 15% benchmarks per operator for better comparability (and not only from the average of all operators) based on historic fuel consumption trends of 2006 and 2007. It was verified in the efficiency calculations (Ref. 26) that a $\pm 10\%$ benchmark was used, contrary to the 15% previously established, which is deemed more conservative. Please refer to section 3.2 for more details.

3.4 Project Implementation

Project was implemented and equipment installed as described in the registered PDD. As verified during the first monitoring period verification conducted in 2006, the new transit management scheme as well as the fare system became fully operational prior to before January 1st, 2006. Also, the infrastructure for Phase II including trunk routes has been completed as planned and was fully operational in the first semester of 2006. In 2008 no new trunk routes have been built and put into operation, as confirmed by IDU (Ref. 6).

Phase III is not yet in operation. Table 1 of the Monitoring Report shows the operational infrastructure completed as of 31-12-2008.

3.5 Completeness of Monitoring

The reporting procedures reflect the content of the monitoring plan. The monitoring mechanism is effective and reliable.

3.6 Accuracy of Emission Reduction Calculations

The calculation of emission reductions is found to be correct. Responses to CL #1 and CAR #2 were satisfactory and these were discussed in Section 3.2 above and section 3.9 below, and closed. The details of the reported and the verified values for all parameters are listed in section 4.

3.7 Quality of Evidence to Determine Emission Reductions

Critical parameters used for the determination of the Emission Reductions are discussed above in section 3.2 above. All the data recorded is in compliance with the monitoring report.

3.8 Management System and Quality Assurance

The companies involved in the project have ISO 9001:2000 quality assurance systems implemented. Also, Transmilenio is currently in the process of implementation and certification of 14001 and 18001 to comply with the objective of strengthening institutional environmental management as established in agreement signed in 2008 between the National University of Colombia and Transmilenio (Ref. 20, page 4). Therefore we can affirm that the management system of the CDM project is in place; with the responsibilities properly identified and in place. Documentation on training carried out by operators Connexion Movil and SI02 was checked (Ref. 17 and 18). All staff is well qualified, sufficiently trained to understand the project's products and processes.

In order to verify data quality, the companies involved in the project work in accordance with a quality assurance procedure CDM Project Monitoring Manual (Ref. 15), which establishes the operational and management structure implemented. The Monitoring manual was revised on 03/09/2007 and was updated to version 3.1.1.

3.9 Data from External Sources

The values for the following parameters are adopted from the methodology AM0031 version 1:

- **EF_{CO₂,D}**: CO₂ emission factor diesel large bus (2,661 gCO₂e/litre)
- **EF_{CH₄,D}**: CH₄ emission factor diesel large bus (2 gCO₂e/litre)
- **EF_{N₂O,D}**: N₂O emission factor diesel large bus (21 gCO₂e/litre)
- **EF_{CEM}**: Emission factor for cement (0.99 tCO₂eq/t cement)
- **EF_{ASP}**: Emission factor for asphalt (0.03 tCO₂eq/t asphalt)
- **EF_{BM}**: Emission factor for bus manufacturing (42 tCO₂eq/ bus)
- **UEF**: Default factor for upstream emissions from fuel production (14%)

CAR #2 was raised because it was observed that CER spreadsheet showed a value of 2,684 gCO₂e / litre was used for CO₂ emission factor of diesel large bus. Project proponent explained that the emission factor shown in the CER spreadsheet for diesel large bus (2,684 gCO₂e/litre) represents the sum of the emission factors for the 3 separate gases; CO₂ = 2,661 grCO₂eq, CH₄ = 2 grCO₂eq, N₂O = 21 grCO₂eq); which are shown in the Monitoring Report, table 2 (Ref. 3) and PDD table A.3.1.1 (Ref. 1). The emission factors of each gas are summed as CO₂ equivalent emissions for the purpose of simplifying the calculation of total GHG emissions from large diesel buses. Values and terms were verified correct in CER spreadsheet (Ref. 5). **Therefore CAR #2 was closed out.**

The values for the following parameters are fixed ex-ante for each monitoring period in the registered PDD (Table A.3.10.2.):

- **EF_{P,C}**: Emission factor per passenger transported of passenger car (1,748 gCO₂eq / passenger for year of 2008)
- **EF_{P,T}**: Emission factor per passenger transported of taxis (2,299 gCO₂eq / passenger for year of 2008)

The values for the following parameters are fixed ex- ante for each monitoring period in the registered PDD (Table A.3.11.2.):

- **EF_{P,Z}**: Emission factor per passenger transported of baseline buses (911 gCO₂eq / passenger for year of 2008)

The values for the following parameters are fixed ex- ante in the registered PDD (tables A.3.3.1 & A.3.8.2):

- **BA_{BL}**: Average replacement age baseline scenario (40 years)
- **LE_{CONG}**: Emissions leakage from reduced congestion (-4,937 for year of 2008)

4. Calculation of Emission Reductions

<i>Parameter</i>	<i>Reported Value</i>	<i>Verified Value</i>
Fuel consumption trunk buses (TC _{TB})	50,580,912 litres	50,580,912 litres
Fuel consumption trunk buses (TC _{TB,PJ})	15,180,321 litres (only project)	15,180,321 litres (only project)
Fuel consumption feeder buses (TC _{FB})	11,203,274 litres	11,203,274 litres
Fuel consumption feeder buses (TC _{FB,PJ})	3,362,322 litres (only project)	3,362,322 litres (only project)
Distance driven trunk buses (DD _{TB})	85,513,572 kilometres	85,513,572 kilometres
Distance driven feeder buses (DD _{FB})	29,217,799 kilometres	29,217,799 kilometres
Passengers transported by TransMilenio all phases (P _{TM,T})	394,364,082 passengers	394,364,082 passengers
Passengers transported by TransMilenio Phase I only (P _{TM,I})	276,007,709 passengers	276,007,709 passengers
Passengers transported by TransMilenio Phase II-IV "the project" (P _{PJ})	118,356,373 passengers	118,356,373 passengers
Average trip distance of passengers using TransMilenio which in absence of latter would have used taxis (TD _T)	11 kilometres	11 kilometres
Average trip distance of passengers using TransMilenio which in absence of latter would have used passenger cars (TD _C)	12 kilometres	12 kilometres
Share of passenger cars using fuel type "x" of passengers using TransMilenio which in absence of latter would have used a passenger car (N _{x,C})	0% of vehicles using alternative fuels 88.1 % of vehicles using gasoline 2.3 % of vehicles using diesel 9.6 % of vehicles using gaseous fuels	0% of vehicles using alternative fuels 88.1 % of vehicles using gasoline 2.3 % of vehicles using diesel 9.6 % of vehicles using gaseous fuels
Share of passengers transported by TransMilenio who would have used transport mode "i" (P _{PJ,i})	91.4% would have used conventional buses 2.4 % would have used passenger cars 5.5 % would have used taxis 0.5 % would have used NMT 0.2 % would not have made the trip	91.4% would have used conventional buses 2.4 % would have used passenger cars 5.5 % would have used taxis 0.5 % would have used NMT 0.2 % would not have made the trip
Policies	1. Ley 1205 de 2008 – National level which regulates the diesel quality; 2. Pacto calidad del aire Bogotá of 7.2.2008 which regulates the diesel quality in Bogota. No policy which affects baseline parameters was implemented in 2008 and thus no adjustment is	1. Ley 1205 de 2008 – National level which regulates the diesel quality; 2. Pacto calidad del aire Bogotá of 7.2.2008 which regulates the diesel quality in Bogota. No policy which affects baseline parameters was implemented in 2008 and thus no adjustment is

	made	made
Amount of cement used per km trunk road (CEM)	0 tonnes	0 tonnes
Amount of asphalt used per km trunk road ASP	0 tonnes	0 tonnes
Length of trunk roads built with cement (DT _{CEM})	0 kilometres	0 kilometres
Length of trunk roads built with asphalt (DT _{ASP})	0 kilometres	0 kilometres
Buses scrapped by project (BSCR _w)	20 buses	20 buses
Average age of scrapped buses (BA _{PJ})	26 years	26 years
Average occupancy rate relative to capacity of conventional buses (ROC _c)	61.2%	61.2%
Average occupancy rate of taxi (OC _T)	0.89	0.89

Please see Section 3.9 for external data reported and verified.

The total project emissions of the monitoring period (1st January 2008 to 31st December 2008) are 49,768 tCO_{2eq}

The total baseline emissions of the monitoring period (1st January 2008 to 31st December 2008) are 118,582 tCO_{2eq}

The total leakage emissions of the monitoring period (1st January 2008 to 31st December 2008) are -5,219 tCO_{2eq} (negative). Please see the details for each data of leakage below:

- Leakage emissions due to construction in 2008 are: 5,481 tCO₂

Same value as reported in 2007 in the CER Monitoring report 2007 TransMilenio, 20.6.2008, Table A4 as no new constructions activities took place in 2008, in compliance with the methodology AM0031 version 1.

- Leakage emissions due to scrapping in 2008 are: 3,871 tCO₂

Value based on 2006 data (3,010 tCO₂) summed with 2007 data (819 tCO₂) and 2008 data (42 tCO₂) in compliance with the methodology AM0031 version 1.

- Leakage emissions due to upstream fuel production in 2008 are: -9,634 tCO₂

Value based on project emissions (49,768 tCO₂) baseline emissions (118,582 tCO₂) and UEF default factor from AM0031 version 1 for upstream emissions from fuel production (14%), and formula (PE-BE)*UEF, in compliance with the methodology AM0031 version 1.

- Leakage emissions due to congestion in 2008 are: -4,937 tCO₂

This parameter is not monitored but used for calculation purposes. Values are fixed ex-ante based on the registered PDD/ AM0031, Appendix A. AM0031 pg.14 mentions that the total impact of congestion will be calculated ex ante and not monitored; also Table A.3.8.2 PDD mentions the same value.

According to the methodology and for a conservative approach negative leakage is not claimed by the project as additional emission reduction and the leakage value is thus set at 0 tCO_{2eq}.

Emission	Reported Value (tCO _{2e})	Verified value (tCO _{2e})
1. Baseline Emissions	118,582	118,582
2. Leakage Emissions	0	0
3. Project Emissions	49,768	49,768
4. Emission Reductions (1-2-3)	68,813	68,813



Total emission reductions during the period 1st January 2008 to 31st December 2008 are 68,813 tCO_{2eq}

5. Recommendations for Changes in the Monitoring Plan

The monitoring plan is implemented and fulfils the requirements of the registered PDD and the approved methodology AM0031/version 1. No recommendations are made.

6. Overview of Results

Assessment Against the Provisions of Decision 17/CP.7:

Is the project documentation in accordance with the requirements of the registered PDD and relevant provision of decision 17/CP.7, EB decisions and guidance and the COP/MOP?

Yes. The results of the compliance assessment are recorded in the verification checklist which is used as an internal report only.

Have on-site inspections been performed that may comprise, inter alia, a review of performance records, interviews with project participants and local stakeholders, collection of measurements, observations of established practices and testing of the accuracy of monitoring equipment?

Yes. Alessandra Treuherz and Mayra Caradec visited the sites and undertook interviews, collected data, audited the implementation of procedures, checked calibration certificates and checked data, inter alia.

The results of the site visits are recorded in the verification checklist which is used as an internal report only.

The evidences have been checked and collected. The revised monitoring report is attached with this verification report.

Has data from additional sources been used? If yes, please detail the source and significance.

Data from registered PDD (ex-ante) and approved methodology AM0031 version 1 were used as below. Please also see Section 3.9 for more details.

The values for the above parameters are adopted from the methodology AM0031 version 1:

- *CO₂ emission factor diesel large bus*
- *CH₄ emission factor diesel large bus*
- *N₂O emission factor diesel large bus*
- *Emission factor for cement*
- *Emission factor for asphalt*
- *Emission factor for bus manufacturing*
- *Default factor for upstream emissions from fuel production*

The values for the above parameters are fixed ex-ante in the registered PDD:

- *Emission factor per passenger transported of passenger car*
- *Emission factor per passenger transported of taxis*
- *Emission factor per passenger transported of baseline buses*
- *Average replacement age baseline scenario*
- *Emissions leakage from reduced congestion*

Please review the monitoring results and verify that the monitoring methodologies for the estimation of reductions in anthropogenic emissions by sources have been applied correctly and their documentation is complete and transparent.

Yes. The monitoring methodology has been correctly applied and the monitoring report and supporting references are complete and transparent.

Have any recommendations for changes to the monitoring methodology for any future crediting period been issued to the project participant?

No recommendations for changes to the monitoring methodology are made to project participant.

Determine the reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the CDM project activity, based on the data and information using calculation

procedures consistent with those contained in the registered project design document and the monitoring plan.

The data used in anthropogenic emission reduction calculation is consistent with those contained in the registered PDD and monitoring plan. The emission reduction as per registered PDD was 230,201 tCO₂ for the year of 2008. The actual emission reduction has been verified as 68,813 tCO₂ for the same period. Differences on the estimated (expected) data in PDD and the obtained from the monitoring period were clearly justified in Section 6 of the Monitoring Report (“Comparison Monitored Emission Reductions with PDD”).

Identify and inform the project participants of any concerns related to the conformity of the actual project activity and its operation with the registered project design document. Project participants shall address the concerns and supply relevant additional information.

“No such non conformity of the actual project activity and its operation with the registered project design document has been observed.”

Post monitoring report on UNFCCC website

Yes, the monitoring report is available at ref. 0672 on UNFCCC website

<http://cdm.unfccc.int/Projects/DB/DNV-CUK1159192623.07/view>

7. Verification and Certification Statement

SGS United Kingdom Ltd has been contracted by Corporación Andina de Fomento (CAF) to perform the verification of the emission reductions reported for the CDM project BRT Bogotá, Colombia: TransMilenio Phase II to IV (UNFCCC Ref. 0672) in the period 01/01/2008 to 31/12/2008.

The verification is based on the validated and registered project design document and the monitoring report for this project. Verification is performed in accordance with section I of Decision 3/CMP.1, and relevant decisions of the CDM EB and CoP/MoP. The scope of this engagement covers the verification and certification of greenhouse gas emission reductions generated by the above project during the above mentioned period, as reported in BRT Bogotá, Colombia: TransMilenio Phase II to IV Monitoring Report Version 1.1 of April 29th 2009.

The management of the Corporación Andina de Fomento (CAF) is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Monitoring Report Version 1.1 of April 29th 2009. Calculation and determination of GHG emission reductions from the project is the responsibility of the management of the BRT Bogotá, Colombia: TransMilenio Phase II to IV project. The development and maintenance of records and reporting procedures are in accordance with the monitoring report.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/01/2008 to 31/12/2008 based on the reported emission reductions in the Monitoring Report Version 1.1 dated April 29th 2009 for the same period.

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

SGS confirms that the project is implemented as described in the validated and registered project design documents. Based on the information we have seen and evaluated, we confirm the following:

Project Title:	BRT Bogotá, Colombia: TransMilenio Phase II to IV
UNFCCC Reference Number:	0672
Registered PDD and Approved Used for Verification:	PDD Version 4.1, dated of September 6 th 2006
Methodology Used for Verification:	AM0031 Version 1, valid from 28 July 2006 onwards
Applicable Period:	01/01/2008 to 31/12/2008
Total GHG Emission Reductions Verified:	68,813

Signed on behalf of the Verification Body by Authorized Signatory

Signature:



Name: Siddharth Yadav

Date: 2nd July 2009

8. Document References

- /1/ PDD of BRT Bogotá, Colombia: TransMilenio Phase II to IV
Registered PDD version 4.1 dated September 6, 2006.
Available on UNFCCC website at:
<http://cdm.unfccc.int/Projects/DB/DNV-CUK1159192623.07/view>
- /2/ Methodology AM0031 “Baseline Methodology for Bus Rapid Transit Projects” Version 01.
Available on UNFCCC website at: <http://cdm.unfccc.int/methodologies/view?ref=AM0031>
- /3/ BRT Bogotá Colombia: TransMilenio Phase II to IV Monitoring Report (Monitoring Period 1.1.2008 – 31.12.2008) Version 1.0 dated 5th February 2009
Published Version on UNFCCC Website available at:
<http://cdm.unfccc.int/Projects/DB/DNV-CUK1159192623.07/view>
- /3/ BRT Bogotá Colombia: TransMilenio Phase II to IV Monitoring Report (Monitoring Period 1.1.2008 – 31.12.2008) Version 1.1 dated 29th April 2009.
- /4/ Validation Report of BRT Bogotá Colombia: TransMilenio Phase II to IV. No. 2006-1321. Dated as 2006-08-15.
Available on UNFCCC website at:
<http://cdm.unfccc.int/UserManagement/FileStorage/UPUWD3ZSZM1IT2Y09EBST6WQT96IJN>
- /5/ CERs Spreadsheet Version 1.0 – Project Emission Reductions calculation
- /5/ CERs Spreadsheet Version 1.1 – Project Emission Reductions calculation
- /6/ File 1 – IDU Letter of Confirmation of Trunk Roads Built Year 2008. Dated as 21-01-2009
- /7/ File 2 – Law 1205 of 2008. Dated as 14-07-2008
- /8/ File 3 – Pacto por una mejor calidad del aire para Bogotá, D.C. Dated as 07-02-2008
- /9/ File 4a - 4f Modal split surveys
- /10/ File 5 – Scrapped buses year 2008
- /11/ File 6 – Load factor Taxis and Buses
- /12/ File 7 – TORs load factor study buses
- /13/ File 8 – TORs load factor study taxis
- /14/ File 9 – ECOPETROL Sulphur in diesel 2008
- /15/ TM Monitoring Manual ver.3.1.1
- /16/ MVP Efficiency benchmark controls
- /17/ Connexion Movil Internal Audit

- /18/ SI02 Internal Audit
- /19/ Internal Audit Program
- /20/ Agreement National University of Colombia and TM
- /21/ Print screen of Passengers 2008
- /22/ Print screen of legislation updating process
- /23/ Monthly reports of operators - Jan, July, Oct
- /24/ Norm 1180 of 2003 - Non-applicability of environmental license to operators
- /25/ Norm 1220 of 2005 - Non-applicability of environmental license to operators
- /26/ Calculation of operator averages
- /27/ MVP Consumption and distance data 2008
- /28/ Contract Market Team - Dated as 19-07-2008
- /29/ Kilometres paid to operators - Jan, July, Oct
- /30/ Fuel consumption and distance driven
- /31/ Connexion Movil & Ciudad Movil Invoices - Jan, July, Oct
- /32/ Connexion Movil Calibration of Dispensers
- /33/ SI02 Calibration of Dispensers
- /34/ SI02 Calibration of Dispensers - Consolidated Excel document of calibrations 2008
- /35/ Print screen of Environmental Impacts results
- /36/ Scrapping certificates - Sample of 10 certificates of buses scrapped
- /37/ Sampling of scrapped buses certificates
- /38/ Average trip distance print screen
- /39/ Norm 1521 of 1998 - Ministry of Mining and Energy
- /40/ Letter from Terpel on calibration of dispensers
- /41/ E-mail on calibration Terpel & Exxon Mobil