Monitoring report form

(Version 04.0)

MONITORING REPORT	
Title of the project activity	Lanzhou Bus Rapid Transit (BRT) Project
Reference number of the project activity	6796
Version number of the monitoring report	2.0
Completion date of the monitoring report	17/02/2015
Registration date of the project activity	23/07/2012
Monitoring period number and duration of this monitoring period	1st monitoring period 01/01/2013 to 25/10/2014
Project participant(s)	Lanzhou Public Traffic Group Asian Development Bank, as Trustee of the Future Carbon Fund (FCF)
Host Party(ies)	China
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	Transport, sectoral scope 7 AM0031, Version 03.1.0, Baseline Methodology for Bus Rapid Transit Projects
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	5,744[1]
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	9,176
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	0
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	9,176

[1] 2014 according to PDD 11,487 tCERs; monitoring period 6 months instead of 12 months and thus annual CERs/2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Lanzhou Bus Rapid Transit (BRT) Project aims to meet the growing demand for urban public transport in Lanzhou by establishing a BRT system in Anning District of the city. The Lanzhou BRT consist of a new infrastructure of 12.3 kilometres of dedicated bus lanes, flexible operation making allowance for both new specialized BRT buses and existing buses, at-grade boarding and alighting, real-time bus operation information displays, pre-boarding fare collection and fare verification, free transfers between routes, automatic vehicle location technology, centralized control providing monitoring and communications to scheduling services and real-time response to contingencies.

The baseline scenario of the project activity is the continuation of the current public transport system in Lanzhou where passenger demands are met by various modes of transport including conventional 12 meter CNG-fuelled buses, CNG-fuelled taxis, gasoline-fuelled passenger cars, gasoline-fuelled motorcycles and non-motorized transport (NMT). The GHG emissions from trips that would have been made by BRT passengers using various modes of transport in the absence of the BRT system would form the baseline emissions. The project emissions are the actual fuel consumption attributable to the operation of BRT buses. Leakage emissions are caused by changes of traffic congestion and vehicle speed resulting potentially in a rebound and a speed effect of passenger cars plus potential changes of load factors of remaining buses and taxis. Difference between baseline and project scenarios in GHG emissions per passenger trip leads to the emission reductions, with leakage emissions taken into account.

The underlying basis on which the GHG emission reductions are derived methodologically is the higher resource efficiency of BRT system in transporting passengers as compared to various conventional modes of vehicle categories in urban transport system. The higher efficiency in resource utilization and the resultant lower emissions per passenger trip are attributable to a range of characteristics and factors associated with BRT operation and performance. Reductions are due to:

- Fuel-use efficiency improvement (per passenger transported) attributable to new and larger buses used by the BRT system as compared with vehicles used in the absence of the project.
- Mode switching of passengers from taxis, private cars and motorcycles characterized by higher emission rates to BRT system due to the availability and attractiveness of the system in terms of reduced transport time and increased safety, convenience and comfort.
- The flexible operation system integrating existing conventional bus fleets improving overall efficiency of public transport by providing a larger coverage of the BRT system in the district and allowing passengers to board and alight from a BRT route anywhere in the district where BRT routes are operating, not necessarily only along the BRT corridor.
- Load increase through centrally managed organization dispatching vehicles of BRT fleets. The occupancy rate of vehicles can thus be increased due to organizational measures.

Table 1 lists the relevant dates of the project activity.

Table 1: Relevant Dates of BRT Lanzhou

Date	Action
06/03/2011	Project starting date (construction contract)[2]
23/07/2012	CDM project registration date
28/12/2012	Operational start of project[3]

The project operated continuously during the entire crediting period.

The project only claims emission reductions for the period 26/04/2014 to 25/10/2014 as no monitoring of the project was realized prior 26/04/2014.

The total emission reductions achieved in this monitoring period are **9,176 tCO_2**

A.2. Location of project activity

[2] Registered PDD Table 4

[3] File 5

Host country

People's Republic of China

Region/State/Province

Province of Gansu

City/Town/Community

Lanzhou City

Physical/Geographical location

Located in Anning District of Lanzhou City. The corridor of 12.3km has two terminal stations being situated at Renshoushan (Latitude North 36°7'38.83" and Longitude East 103°40'56.09") and Xizhan (Latitude North 36°4'12.07" and Longitude East 103°46'1.28"), respectively The geographical boundary of the project is the routes from origin to destination used by the people. The geographical location of the project is thus the urban area of the city of Lanzhou.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (Host)	Lanzhou Public Traffic Group (public entity)	No
Sweden	Asian Development Bank, as Trustee of the Future Carbon Fund (FCF) (public entity)	No

A.4. Reference of applied methodology and standardized baseline

AM0031, Version 03.1.0, Baseline Methodology for Bus Rapid Transit Projects

Additionally following tools were used:

- Tool for the demonstration and assessment of additionality (Version 05.2)

A.5. Crediting period of project activity

Crediting period: 7 years renewable; starting date 01/01/2013

Crediting period corresponding to this monitoring period: 01/01/2013 to 31/12/2019

A.6. Contact information of responsible persons/ entities

Responsible for this Monitoring Report is:
Jürg Grütter
Grütter Consulting AG
Thiersteinerstr 22, 4153 Reinach, Switzerland
jgruetter@transport-ghg.com, www.transport-ghg.com

The person/entity is not a project participant.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

Features of the BRT system of Lanzhou include exclusive right-of-way lanes, rapid boarding and alighting, free transfers between lines trunk lines, pre-board fare collection and fare verification, clear route maps, real-time information displays, automatic vehicle location technology to manage vehicle movements, clean vehicle technologies and excellence in marketing and customer service. The technology deployed has 4 main components. Infrastructure, buses, transit management and fare system.

Infrastructure

A physically segregated BRT corridor with the length of 12.3 km has been established, with its two terminals being at Renshenshan and Xizhan respectively. Although the corridor is constructed mainly in Anning District, it also crosses the Yellow River and connects to the current city centre (Qilihe District), increasing the efficiency and convenience of the BRT as part of Lanzhou's urban public transport system.

A total of 19 BRT-specific stations along the corridor were constructed, with average spacing between stations being approximately 600 metres. All stations are strategically located at least 75 metres from intersections but close to existing bus stops. The length and width of the stations were determined based on demand surveys, and each station is equipped with a fare collection system, sliding doors for safety, light and water, and real-time bus operation information boards, space for bicycle parking and ramp for accessibility of passengers with disabilities.

Bus Technology

All existing conventional buses in Anning District are 12m CNG-fuelled buses. In addition to existing buses that will be remained as part of the BRT system, a number of new 12-18m Euro IV CNG-fuelled buses will be procured and used for selected routes of the BRT system. Hence, in the first few years of operation, the BRT system will be serviced by a combination of existing and new buses.

Transit Management

The transit management of the BRT system is realized through a centralized control and management centre employing intelligent transport system (ITS). Through GPS technology, real-time information on status, position and driven distance of buses equipped with GPS-based tracking system are tracked and transmitted to the centralized control and management centre, allowing for (1) immediate response to changes in passenger demand; (2) immediate response to equipment failures and security problems; and (3) efficient spacing between buses and avoidance of bus bunching. Advanced traveller information system is made available to provide passengers with real-time information displays at bus stations.

Fare System

Along the BRT corridor, pre-board fare collection and verification is realized through employing a combination of smart card technology and coin-based system at each station along the BRT corridor where fare validation turnstiles are installed.

The BRT is fully operational since 28/12/2012 in accordance with the PDD.

No special events have been registered during the monitoring period. The project was fully operational all the time.

Relevant dates are listed under Section A.1.

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

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

No temporary deviations have been applied during this monitoring period.

B.2.2. Corrections

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

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

No permanent changes from the registered monitoring plan, applied methodologies or applied standardized baseline have been approved during this monitoring period or are submitted with this monitoring report.

B.2.4. Changes to project design of registered project activity

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

B.2.5. Changes to start date of crediting period

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

B.2.6. Types of changes specific to afforestation or reforestation project activity

Not applicable

SECTION C. Description of monitoring system

The monitoring methodology is based on AM0031 Version 03.1.0.

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.

A (English-Chinese) monitoring manual has been realized for the Lanzhou BRT[4] and staff has been familiarized with this manual in a special training course[5]. The Manual defines responsibilities and procedures and has a section on all data variables to be monitored. The data section has for each data variable information on how to collect the required information, the frequency of collection, data units (including transformation of common data units), and quality control measures to be realized.

DATA GENERATION

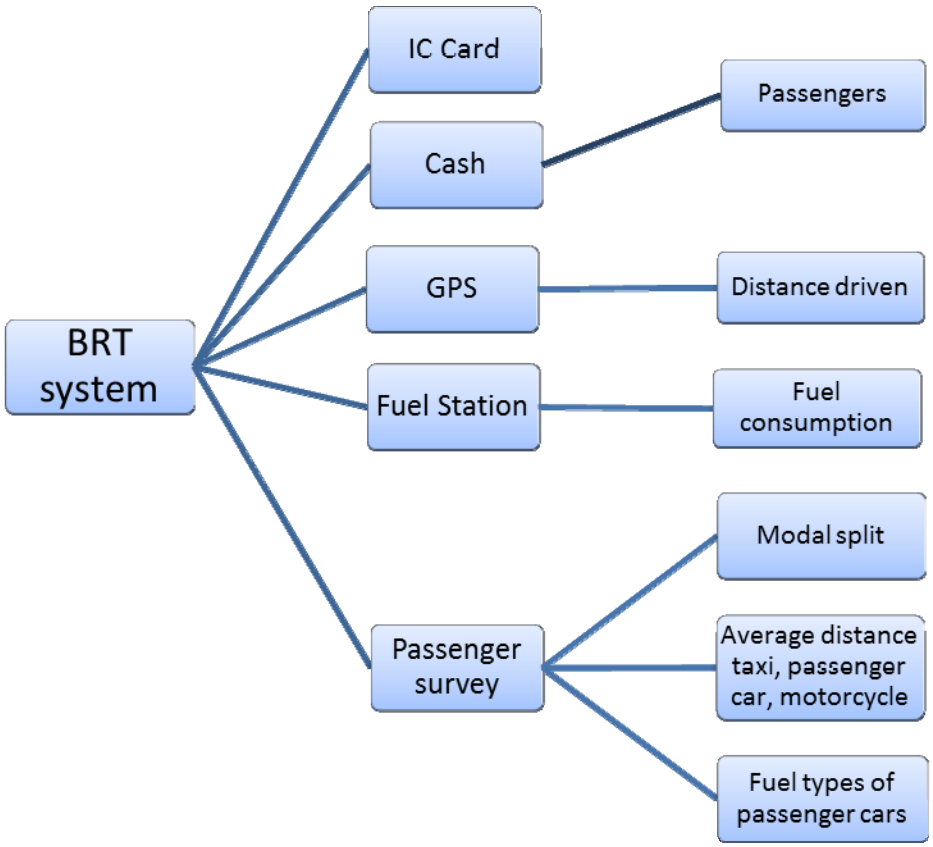
Data for the monitoring comes from the structure presented in Figure 1.

- Passenger data is the sum of the IC Card result and the total cash divided by the bus fare.
- Distance driven is obtained by using GPS devices on the buses.
- Fuel consumption is controlled by an IC Card system with a redundant manual verification.
- The passenger survey is carried out by an external third party.

[4] File 6

[5] File 7

Figure 1: Overview Data Sources

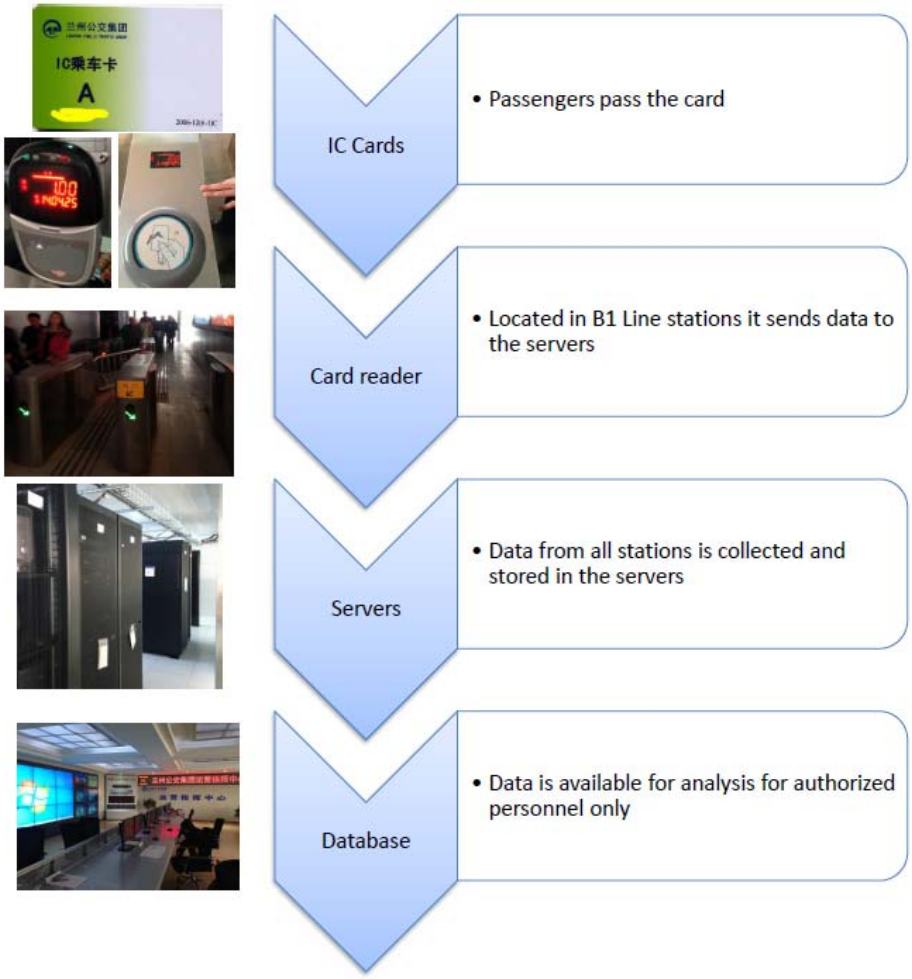


PASSENGERS TRANSPORTED

Data on passenger numbers is generated from IC card users and from cash payment.

Data from IC cards is gathered by the Lanzhou Bus Company. The Net Center of the company is in charge of gathering, processing and archiving the data within the central Database. The process to gather the IC Card data from the IC card system is shown in figure 2.

Figure 2: IC Cards Data Collection Process



Non-contact IC card technology is widely used in public transport and all card readers are powered by electricity. In case of malfunction the stations will immediately report to central and allow passengers to use the other Card readers available in the station. Extra card readers are available in case of need. Malfunctions are addressed immediately and considering the nature of the malfunction, proper operation is restored in general after within the same day. If the malfunction is due to a problem in the communication system or due to lack of electricity at the station, the card reader has an internal memory.

Data from passengers is gathered continuously throughout the day transferred directly to the central Database. In the server center digital backups are kept with an additional storage available at the servers from the telecommunications company.

Passengers pay through electronic smart cards or by cash. Cash is introduced in a special secure slot and collected daily at every bus depot from where it is transferred to the cash counting department. Bills and coins are separated, counted and reported. The results are then kept and processed by in a central office where all cash from all buses is taken and then reported to the central Database.

Figure 3: Cash Payment Procedure

Cash passenger numbers are derived by dividing the total cash collected through the fixed fare per passenger which is 1 yuan per ticket (1 ticket = 1 passenger)

FUEL CONSUMED

Every time a bus goes to refill it the driver shows his drivers card which keeps a record of the identity, bus number, time, how many m^3 of CNG was filled etc.. The gas station also keeps a manual record of all fillings with the name of the driver, the time, and the amount filled. This means that data recorded in the automated system also has a redundant manual control.

Figure 4: Driver ID Card and Fuel Form at Filling Station

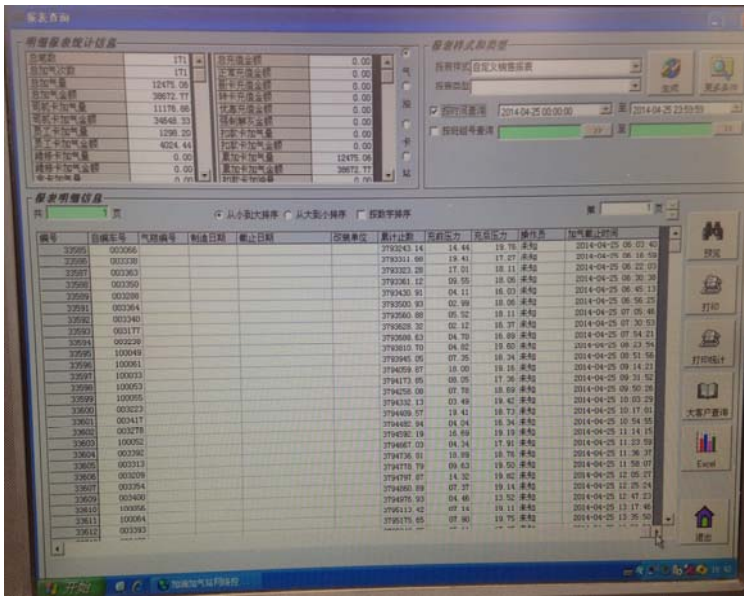
Reports are made for each bus on each line consisting of date, actual amount of fuel filled, signature of supervisor and bus ID. This data is also automatically uploaded to the data system in which digital records are made, stored and transferred to the data center.

Figure 5: Software for Data Management of Fuel Consumption at the Fuel Station

Figure 5 shows the software used for collecting all relevant data for fuel consumption. It is automated and connected to the main servers of the company. The data collected in the software is composed of ID number, card number, time, which pump was used, how much was filled, subtotal price of the filling, unit price,

balance remaining in the card of the driver, type of record, license plate of the bus, cylinder number and pressure before and after filling.

Figure 6: Database Contents for Fuel Consumption



The Lanzhou Bus Company works with a third company called the Gansu Province Measurement Institute to verify that all of its equipment for fuel filling is working appropriately. Latter conducts an investigation in-situ every 6 months where all elements are considered, including measuring valves for fuel filling and verifying the proper calibration of the 8 different pumps that compose the filling station.Fuel stations belong to third parties and the calibration of the fuel pumps follows China's law. Data is available for the total fleet and not a sample. Data plausibility control is carried out through specific consumption of fuel (m^3 per 100 km).

DISTANCE DRIVEN OF BUSES

Each bus has a MT2101&MT3001 HiSense GPS module installed. GPS and the processing of its data is organized by Zhengzhou Tiamaes Technology Co., Ltd. Its duties also include the maintenance and monitoring of the GPS system.

Figure 7: GPS Module[6]

[6] For GPS features, please see: http://www.hisense-transtech.com.cn/public_transit_solution_49.html

MT2101 intelligent vehicle terminal was developed by Qingdao Hisense Network Technology company as a dedicated automatic station, vehicle monitoring, vehicle scheduling and intelligent vehicle terminal data collection. The product uses the GPS positioning technology, GPRS/CDMA/3G wireless communication technology, RS485/RS422 bus technology, Ethernet interface technology and other modern information technology. MT2101 is a tailor-made product for the transport industry.

PASSENGER SURVEY

On April the 26th of 2014 the instruction for the Lanzhou BRT Modal Split survey was given by the China office of Grutter Consulting[7]. The training included an introduction to the contents of the survey, its objective and methodology. Special emphasis was made to the requirement of random questioning of passengers and to follow the distribution given in order to follow the patterns of passenger usage of the BRT. A survey trial was made in several stations with random passengers. Surveyors were supervised to check the proper conduction of the survey. The survey is realized directly by staff contracted and supervised by Grütter Consulting which is not a project participant. Grütter Consulting has designed the survey methodology and has realized and supervised such surveys in numerous BRT projects worldwide.

The survey objectives are:

- Determine the mode of transport passengers of the BRT would have used in absence of the project activity.
- Determine for passengers which would have used passenger cars in absence of the project the type of fuel used by the passenger car they would have taken in absence of the project.
- Determine for passengers who in absence of the project activity would have used taxis, passenger cars or motorcycles the trip distance on the project system.

The survey is realized to collect the following data:

1. Mode passengers would have used in the baseline;
2. Trip distance on the project system of passengers which respond with passenger cars, taxis and motorcycle;
3. Type of fuel used by cars for respondents of passenger cars.

The target population are the users of the BRT system of Lanzhou.

The survey principles

1. The sampling size is determined by the 95% confidence interval and the 5% maximum error margin which gives an indicative survey number of less than 500 units.
2. Sampling must be statistically robust and relevant i.e. the survey has a random distribution (random selection of passengers) and is representative of the persons using the project transport system. To ensure this principle the methodology to select persons for interviews is based on a systematic random sampling based on the flow of passengers per station per day. This is done by questioning every 5th passenger until they reach the required number of surveys per time bracket entering the station. The surveyor begins by questioning a passenger and then after finishing five passengers later they question again another passenger until they reach the required number of surveys. The survey is realized on all week days including weekends with the sample size per day being proportional to the number of passengers transported by the project per average week day. The number of surveys conducted per station is proportional to the average number of entry passengers at that station. Records of 1 week of passengers (entry station and passengers per day) are used to realize the survey design. Clustering of hours e.g. 6-9, 9-12, 12-15, 15-18 and of stations can be made.
3. Non-responses must be recorded on a separate list identifying time and station of the person which did not want to realize the interview.
4. Comments and other contextual events must be noted.
5. All original surveys are recorded and stored.
6. Surveys are conducted at bus stations when people wait for bus-boarding. It should be avoided to realize the survey with people de-boarding the bus as latter will not want to invest time in a survey thus potentially giving wrong answers.
7. Only persons over age 12 are interviewed
8. The selected weeks for surveys shall not correspond to a public holiday.

[7] File 8

For detailed information on the survey see Section D.3.

DATA STORAGE

Data for the Lanzhou Bus Communication Company is gathered and processed by the data center. The Lanzhou Bus Company through is network of servers updates and stores the data on passengers, fuel consumption and distance driven on a regular base to Grütter Consulting. Grütter Consulting makes a quality check of this data based on testing the plausibility of given data. Plausibility is checked by comparing given values with average, upper and lower boundaries as well as making a comparison with historic data.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	**$SEC_{CNG,T}$**
Unit:	m^3/100km
Description:	Specific energy consumption of CNG by taxis
Source of data:	Lanzhou Traffic Bureau
Value(s) applied):	8.0 m^3/100km for new vehicles; (9.0 m^3/100km for vehicles older than 1 year)
Purpose of data:	Baseline emission calculations
Additional comment:	All taxis in Lanzhou are CNG

Data / Parameter:	**$SEC_{G,C}$**
Unit:	litre/100 km
Description:	Specific energy consumption of gasoline by passenger cars
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project "China's Fuel Economy Standards for Passenger Vehicles" published in 2009 by Harvard Kennedy School
Value(s) applied):	7.84
Purpose of data:	Baseline emission calculations
Additional comment:	100% of cars use gasoline

Data / Parameter:	**$SEC_{G,M}$**
Unit:	litre/100 km
Description:	Specific energy consumption of gasoline by motorcycles
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual
Value(s) applied):	2.2
Purpose of data:	Baseline emission calculations
Additional comment:	All motorcycles use gasoline

Data / Parameter:	**$SEC_{CNG,Z}$**
Unit:	m^3/100 km
Description:	Specific energy consumption of CNG by buses
Source of data:	Lanzhou Public Traffic Group
Value(s) applied):	31.41
Purpose of data:	Baseline emission calculations
Additional comment:	All buses in Lanzhou are CNG

Data / Parameter:	$EF_{CO2,CNG}$
Unit:	gCO_2/m^3
Description:	CO_2 emission factor of CNG
Source of data:	IPCC 2006, Volume 2, Chapter 1, Table 1.4. Lanzhou Public Traffic Group
Value(s) applied):	1,970.8
Purpose of data:	Baseline and project emission calculations
Additional comment:	

Data / Parameter:	$EF_{CH4,CNG,Z}$
Unit:	gCO_2e/m^3
Description:	CH_4 emission factor of CNG for buses
Source of data:	IPCC 2006, Volume 2, Chapter 3, Table 3.2.4 Lanzhou Public Traffic Group
Value(s) applied):	515.8
Purpose of data:	Baseline and project emission calculations
Additional comment:	

Data / Parameter:	$EF_{N2O,CNG,Z}$
Unit:	gCO_2e/m^3
Description:	N_2O emission factor of CNG for buses
Source of data:	IPCC 2006, Volume 2, Chapter 3, Table 3.2.4 Lanzhou Public Traffic Group
Value(s) applied):	99.7
Purpose of data:	Baseline and project emission calculations
Additional comment:	

Data / Parameter:	$EF_{CH4,CNG,T}$
Unit:	gCO_{2e}/m^3
Description:	CH_4 emission factor of CNG for taxis
Source of data:	IPCC 2006, Volume 2, Chapter 3, Table 3.2.4 Lanzhou Traffic Bureau
Value(s) applied):	123.4
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	$EF_{N2O,CNG,T}$
Unit:	gCO_2e/m^3
Description:	N_2O emission factor of CNG for taxis
Source of data:	IPCC 2006, Volume 2, Chapter 3, Table 3.2.4 Lanzhou Traffic Bureau
Value(s) applied):	187.9
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	$EF_{CO2,G,C/M}$
Unit:	gCO_2/litre
Description:	CO_2 emission factors of gasoline for passenger cars and motorcycles
Source of data:	Appendix A “Parameters Used in Baseline Methodology” of AM0031
Value(s) applied):	Passenger cars = 2,313 Motorcycles = 2,313
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	$EF_{CH4,G,C/M}$
Unit:	gCO_2e/litre
Description:	CH_4 emission factor of gasoline for passenger cars and motorcycles
Source of data:	Appendix A “Parameters Used in Baseline Methodology” of AM0031
Value(s) applied):	Passenger cars = 11 Motorcycles = 29
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	$EF_{N2O,G,C/M}$
Unit:	gCO_2e/litre
Description:	N_2O emission factor of gasoline for passenger cars and motorcycles
Source of data:	Appendix A “Parameters Used in Baseline Methodology” of AM0031
Value(s) applied):	Passenger cars = 14 Motorcycles = 7
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	OC_T
Unit:	Passengers
Description:	Average occupancy rate of taxis
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	1.08
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	OC_C
Unit:	Passengers
Description:	Average occupancy rate of passenger cars
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	1.71
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	OC_M
Unit:	Passengers

Description:	Average occupancy rate of motorcycles
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	1.51
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	**P_Z**
Unit:	Passenger-trips
Description:	Passenger-trips realized with buses in the baseline
Source of data:	Lanzhou Public Traffic Group; Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	402,319,193
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	**$TD_{C,T,M}$**
Unit:	kilometer
Description:	Average trip distance of passenger cars, taxis and motorcycles in baseline
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	Passenger cars = 10.3km Taxis = 6.79 km Motorcycles = 5.99 km
Purpose of data:	Baseline emission calculations
Additional comment:	

Data / Parameter:	**N_Z**
Unit:	Buses
Description:	Total number of buses in Lanzhou
Source of data:	Lanzhou Public Traffic Group
Value(s) applied):	2,135
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**N_T**
Unit:	Taxis
Description:	Total number of taxis in Lanzhou
Source of data:	Lanzhou Traffic Bureau
Value(s) applied):	6,738
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**N_C**
Unit:	Passenger cars
Description:	Total number of passenger cars in baseline
Source of data:	Traffic Division of Lanzhou Public Security Bureau
Value(s) applied):	142,341

Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**VD_T**
Unit:	Kilometers
Description:	Annual distance driven per taxi on average before start of project
Source of data:	Lanzhou Traffic Bureau
Value(s) applied):	110,000
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**VD_Z**
Unit:	kilometer
Description:	Annual distance driven per bus before start of project
Source of data:	Lanzhou Public Traffic Group
Value(s) applied):	66,985
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**$ROC_{Z,0}$**
Unit:	%
Description:	Average occupancy rate relative to capacity of buses before start of project
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	34.69%
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**TR_C**
Unit:	trips
Description:	Number of daily trips realized by passenger cars in baseline
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project; Traffic Division of Lanzhou Public Security Bureau
Value(s) applied):	382,897
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	**SRS**
Unit:	%
Description:	Share of road space used by public transport in the baseline
Source of data:	Lanzhou Public Traffic Group; Lanzhou Traffic Bureau; Traffic Division of Lanzhou Public Security Bureau; Baseline Traffic Survey for CDM Development of Lanzhou BRT Project;
Value(s) applied):	6.15%
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	RSB / RSP
Unit:	km
Description:	Total road space available in the baseline / Total available road space in the project (= RSB minus road space dedicated to BRT lanes)
Source of data:	Lanzhou Municipal Engineering Administration Department; Lanzhou BRT Project Feasibility Study Report
Value(s) applied):	RSB = 446.62 km RSP = RSB – Road space dedicated to BRT lanes = 446.62 – 12.3 = 434.32km
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	$BSCR_w$
Unit:	buses
Description:	Bus units scrapped by project in year w, where w = 1 to y (NB: if buses are not scrapped, the estimated amount of retired buses is taken)
Source of data:	Lanzhou Public Traffic Group
Value(s) applied):	**Table 2: Estimated amount of retired buses per year**
Purpose of data:	Leakage emission calculations
Additional comment:	

	2013	2014	2015	2016	2017	2018	2019
BSCR	97	258	275	115	263	237	228
$BSCR_w$	354	612	887	1,002	1,265	1,502	1,730

Data / Parameter:	V_B / V_P
Unit:	km/h
Description:	Vehicle speed of passenger cars in baseline / project scenario
Source of data:	Baseline Traffic Survey for CDM Development of Lanzhou BRT Project
Value(s) applied):	V_B = 39.45; V_P = N/A (no data is available as BRT is yet to be operational)
Purpose of data:	Leakage emission calculations
Additional comment:	

Data / Parameter:	DD_Z
Unit:	kilometer
Description:	Total distance driven by all buses in the baseline
Source of data:	Lanzhou Public Traffic Group
Value(s) applied):	143,013,462
Purpose of data:	Baseline emission calculations
Additional comment:	

D.2. Data and parameters monitored

Data / Parameter:	P
Unit:	Passengers
Description:	Total passengers transported by the project
Measured/ Calculated / Default:	Measured
Source of data:	BRT operation statistics from Lanzhou Public Traffic Group (File 1)
Value(s) of monitored parameter:	21,949,168
Monitoring equipment:	Data on passenger numbers is generated from card users and cash payments. Passenger numbers based on entry statistics based on income from ticket sales through cash at stations and buses plus electronic tickets. See for details Section C 4.1.
Measuring/ Reading/ Recording frequency:	Continuous measuring (passengers enter continuously stations or buses and are recorded real time) with monthly aggregated reports.
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Non-contact IC card technology is widely used in public transport. All card readers are powered by electricity. In case of malfunction the buses are immediately taken out of service until the problem is fixed. Extra card readers are available in case of need. Malfunctions are addressed immediately and considering the nature of the malfunction, proper operation is restored in general after two days.
Purpose of data:	Baseline emissions
Additional comment:	Non-paying passengers (mainly those senior passengers with entitlement of ticket exemption) will not be counted and therefore actual passengers are greater than recorded. This contributes to data conservativeness and reliability.

Data / Parameter:	$TC_{PJ,C}$
Unit:	m^3
Description:	Total fuel (CNG) consumption by the project
Measured/ Calculated / Default:	Measured
Source of data:	BRT operation statistics from Lanzhou Public Traffic Group (File 1)
Value(s) of monitored parameter:	1,157,009
Monitoring equipment:	Based on reports per bus of fillings made per day at filling stations. The equipment is of independent filling stations. See Section C.The filling stations are not managed by the project but by independent companies. The calibration of the fuel pumps follows China's law.
Measuring/ Reading/ Recording frequency:	Daily with monthly aggregated reports.
Calculation method (if applicable):	Monthly data is based on 26th till 25th of next month.
QA/QC procedures:	Data plausibility control for is carried out through specific consumption of fuel (m^3 per 100km).
Purpose of data:	Project emissions

Additional comment:	

Table 3: SEC of BRT Lanzhou Buses (m^3/100km)

May 2014	June 2014	July 2014	August 2014	September 2014	October 2014
54	55	58	58	57	58

The average specific fuel consumption from January to October (includes months not included in this monitoring report but were fuel consumption and distance driven are available; see File 1) is 55.7 m^3/100km. Variations between May and October are in the order of maximum 5% to the average which is considered as minor.

Data / Parameter:	**P_i**
Unit:	Passengers
Description:	Passengers transported by the project who in the absence of the project would have taken transport mode "i" where Z = bus, T = taxi, C = car, M = motorcycle, NMT = Non-Motorized transit, IT = Induced traffic
Measured/ Calculated / Default:	Calculated
Source of data:	BRT operation statistics from Lanzhou Public Traffic Group and Grütter Consulting for surveys (File 1 and 9)
Value(s) of monitored parameter:	P_Z: 10,465,802 P_T: 6,238,619 P_C: 4,143,113 P_M: 667,185 P_{NMT}: 434,448 P_{IT}: 0
Monitoring equipment:	None
Measuring/ Reading/ Recording frequency:	For monitoring period
Calculation method (if applicable):	Calculation based on PxS_i
QA/QC procedures:	None
Purpose of data:	Baseline emissions
Additional comment:	

Data / Parameter:	**$TD_{C/T/M}$**
Unit:	Kilometres
Description:	Average trip distance of BRT passengers who in the absence of the BRT would have used passenger cars, taxis or motorcycles
Measured/ Calculated / Default:	Measured (individual trip distance) and calculated (average)
Source of data:	Survey realized by Grütter Consulting (independent 3rd Party) (File 9)
Value(s) of monitored parameter:	Distance of passengers which would have used passenger cars: 7.0 km Distance of passengers which would have used taxis: 6.2 km Distance of passengers which would have used motorcyles: 4.7 km
Monitoring equipment:	None, based on survey
Measuring/ Reading/ Recording frequency:	Based on bimonthly surveys realized June, August and October 2014

Calculation method (if applicable):	Based on average values of realized surveys
QA/QC procedures:	See section D3
Purpose of data:	Baseline emissions
Additional comment:	An adaptation of baseline emission factors cars, taxis and motorcycles due to changing trip distance is realized as the monitored values are lower than the baseline values. See Section E1.

Data / Parameter:	**X_C**
Unit:	None
Description:	Fuel type used from BRT passengers who in the absence of the BRT would have used passenger cars
Measured/ Calculated / Default:	Measured
Source of data:	Survey realized by Grütter Consulting (independent 3rd Party) (File 9)
Value(s) of monitored parameter:	Cars using gasoline: 100% Cars using diesel: 0% Cars using gaseous fuels: 0% Cars using alternative fuels: 0%
Monitoring equipment:	None, based on survey
Measuring/ Reading/ Recording frequency:	Based on bimonthly surveys realized June, August and October 2014
Calculation method (if applicable):	Based on average values of realized surveys
QA/QC procedures:	See section D3
Purpose of data:	Baseline emissions
Additional comment:	No adaptation of the baseline emission factor of cars is made as the monitored fuel types used are idem to the baseline fuel types.

Data / Parameter:	**S_i**
Unit:	%
Description:	Share of passengers who in the absence of the project would have taken transport mode "i"
Measured/ Calculated / Default:	Measured
Source of data:	Survey realized by Grütter Consulting (independent 3rd Party) (File 9)
Value(s) of monitored parameter:	Passengers which would have used a car: 19% Passengers which would have used a taxi: 28% Passengers which would have used a motorcycle: 3% Passengers which would have used a conventional bus: 48% Passengers which would have used NMT (Non-Motorized Transit):2% Passengers which would not have made the trip: 0%
Monitoring equipment:	None, based on survey
Measuring/ Reading/ Recording frequency:	Based on bimonthly surveys realized June, August and October 2014
Calculation method (if applicable):	Average values of all surveys realized in the monitoring period. Share of passengers mode "i" = Number of passengers which responded with mode "i" in survey / total number of people surveyed

QA/QC procedures:	The selection of persons for interviews is based on a systematic random sampling based on the flow of passengers per station per day. This is done by questioning every 5th passenger until they reach the required number of surveys per time bracket entering the station of the pilot line. The surveyor begins by questioning a passenger and then after finishing five passengers later they question again another passenger until they reach the required number of surveys. The survey is realized on all week days including weekends with the sample size per day being proportional to the number of passengers transported by the project per average week day. The number of surveys conducted per station is proportional to the average number of entry passengers at that station. See Section D3 for survey control details.
Purpose of data:	Baseline emissions
Additional comment:	

Data / Parameter:	**Policies**
Unit:	None
Description:	Policies that may affect baseline parameters
Measured/ Calculated / Default:	measured
Source of data:	Transport legislation sites
Value(s) of monitored parameter:	No new relevant policies 2014. Sources reviewed include: Ministry of Transportation (http://www.moc.gov.cn/) , the Energy Foundation (http://www.efchina.org/), the China Sustainable Transportation Centre (http://www.chinastc.org/home) and the GIZ sustainable transport China Blog (http://sustainabletransport.org/)
Monitoring equipment:	None
Measuring/ Reading/ Recording frequency:	Annually new relevant transport and fuel policies are listed and their potential influence or impact on the project is assessed.
Calculation method (if applicable):	None
QA/QC procedures:	None
Purpose of data:	Baseline emissions
Additional comment:	

Data / Parameter:	**$NCV_{NG,y}$**
Unit:	TJ/Gg
Description:	Net calorific value of the natural gas used by the project during the year “y”
Measured/ Calculated / Default:	measured
Source of data:	IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Table 1.2
Value(s) of monitored parameter:	50.4
Monitoring equipment:	None
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	None
QA/QC procedures:	None
Purpose of data:	Baseline, project and lekage emissions

Additional comment:	upper limit of the uncertainty at a 95% confidence interval

The following monitoring parameters are not required:

- **N_T/N_Z:** Required for leakage determination in year 3 and 7 only.
- **OC_T:** Required for leakage determination in year 3 and 7 only.
- **ROC_Z:** Required for leakage determination in year 3 and 7 only.

D.3. Implementation of sampling plan

Surveys are required for the passenger survey to determine mode used, trip distance per mode and fuel passenger cars.

PASSENGER SURVEY

Sampling Design

The survey is realized to collect the following data:

1. Mode passengers would have used in the baseline;
2. Trip distance on the project system of passengers which respond with passenger cars, motorcycles and taxis;
3. Type of fuel used by cars for respondents of passenger cars.

The target population is the users of the BRT system of Lanzhou.

Survey Principles are:[8]

1. The sampling size is determined by the 95% confidence interval and the 5% maximum error margin.
2. Sampling must be statistically robust and relevant i.e. the survey has a random distribution (random selection of passengers) and is representative of the persons using the project transport system.
3. The methodology to select persons for interviews is based on a systematic random sampling based on the flow of passengers per station per day.
4. Only persons over age 12 are interviewed.
5. The survey is realized bi-monthly at minimum.

The above listed survey principles have all been implemented.

Surveys were realized June, August and October 2014.

All these surveys were done by questioning every 5th passenger until they reach the required number of surveys per time bracket (plus reserve number) entering the station thus guaranteeing random selection. The surveyor begins by questioning a passenger and then after finishing five passengers they question again another passenger until they reach the required number of surveys. The survey is realized on all week days including weekends with the sample size per day being proportional to the number of passengers transported by the project per average week day. The number of surveys conducted per station is proportional to the average number of entry passengers at that trunk station. Records of 1 week of passengers (entry station and passengers per day) were used to realize the survey design. Clustering of hours e.g. 6-9, 9-12, 12-15, 15-18 and of stations is made. This is to ensure a representative survey. Data is registered by hand on paper by the surveyor. From the paper copy the data is transferred to an excel file.

The average value as resultant of these 3 surveys is taken for all calculations. Point 17 of the Standard for "Sampling and Surveys for CDM Project Activities and Programme of Activities", Version 04.1 of the UNFCCC indicates that "When sampling is undertaken, unless differently specified in the methodology applied, the sample mean (or proportion) value shall be used for the emissions reduction calculation, not the lower or upper bound of the confidence interval."

Collected Data

[8] In accordance with the registered PDD Annex 4C

The following table shows results of collected data.

Table 4: Survey Data

Parameter	Result
% of passengers which would have used a car	18.9%
% of passengers which would have used a taxi	28.4%
% of passengers which would have used a motorcycle	3.0%
% of passengers which would have used a bus	47.7%
% of passengers which would have used NMT	2.0%
% of passengers which would not have made the trip	0.0%
Average trip distance user cars (km)	7.0 km
Average trip distance user taxis (km)	6.2 km
Average trip distance user motorcycle (km)	4.7 km
Share of passenger cars gasoline	100%
Share of passenger cars diesel	0%
Share of passenger cars gaseous fuels	0%
Share of passenger cars electric or other	0%

Analysis of Collected Data

The number of surveys realized in this period is checked to see if the required 95% confidence interval of the survey and the 5% error level of the survey correspond and the average is thus reliable. The following table shows the analysis of the collected data.

The sampling size has been checked for a 95% confidence interval and a 5% relative precision level in accordance with the PDD is based on the following formulae[9]:

$$n \geq \frac{1.96^2 \times \frac{p \times (1-p)}{p^2}}{0.05^2}$$

Where:

n	sample size
p	proportion mode
1.96	95% confidence interval
0.05	relative precision level

The required number of surveys is calculated for the share of mode users buses which represent nearly 50% of respondents and thus the largest share. The required sample size is thereby 1,686 whilst the actual sample size is 2,224. We can see therefore that the sample number is sufficient to comply with the required 95% confidence interval and a 5% relative precision level.

To check the reliability of the survey the relative precision level is calculated using the following formulae[10]:

$$R = \frac{0.5 \times (CIW)}{p} \times 100\%$$

Where:

[9] See "Best Practices Examples Focusing on Sample Size and Reliability Calculations", EB 67, Annex 6, p.5, paragraph 23; N i.e. the total number of passengers is around 20 million and thus a very large size thus warranting the approximate equation

[10] See "Best Practices Examples Focusing on Sample Size and Reliability Calculations", EB 67, Annex 6, p.43, paragraph 224

R	Reliability (relative precision level)
CIW	width of confidence interval
p	proportion mode

CIW is the difference of the upper and the lower 95% confidence interval which is 1.96*standard error of proportion.

$$s\tan dard\_error\_of\_proportion = \sqrt{(1-f)\frac{pq}{n}}$$

Where:

f	sample proportion (n/N)
p	proportion mode
q	1-p
n	sample size
N	actual number

For the project the standard error of proportion is 0.011 with a resultant CIW at a 95% confidence level of 0.0415. The resulting reliability or the relative precision level is therefore 4% which is better than the 5% required by the methodology for the overall survey.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

Total Baseline Emissions

$$BE_y = \sum_i \left(EF_{P,i,y} \times P_{i,y}\right) \quad (1)$$

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 (gCO_{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), C (passenger cars), M (motorcycles).

The mode passengers would have used in absence of the project is determined through the mode survey.

Passengers per Category i

$$P_{i,y} = P_y \times S_{i,y} \quad (2)$$

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), M (motorcycles), NMT (non-motorized transport) and IT (induced transport, i.e. would not have traveled 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), M (motorcycles), NMT (non-motorized transport) and IT (induced transport, i.e. would not have traveled in absence of project) (%)

Adjustment to Change of Trip Distance

$$CD_{i,y} = \frac{TD_{i,y}}{TD_i} \quad (3)$$

Where:

$CD_{i,y}$ Correction factor for changing trip distance in category i for the year y, where i includes T (taxis) and C (passenger cars) (no unit)
TD_i Average trip distance in kilometers in category i before project start (km)
$TD_{i,y}$ Average trip distance in kilometers in category i in the year y (km)

Note: The adjustment is only made if $TD_{i,y}<TD_i$

Adjustment to Change of Fuel Used by Passenger Cars

For passenger cars $EF_{KM,C,y}$ is annually adapted according to changes in fuel composition of passenger cars. This is only made if the emission factor calculated is lower than the original emission factor used.

According to Annex 3 of EB69, "Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol", all emission reductions and removals achieved by CDM project activities in the second commitment period shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session in accordance with decision 4/CMP.7, and this requirement shall apply from 1 January 2013. The proposed monitoring period starts after 01/01/2013. Therefore the new GWPs of CH_4 and N_2O were used, thus requiring re-calculation of baseline emission factors per passenger per mode. This was realized using the original PDD data for the baseline emission factors per mode and adjusting these based on the new GWP.

2. PARAMETERS AND DATA USED

The following table lists the monitored baseline parameters used (see also Section D.2.).

Table 5: Monitored Baseline Parameters

Parameter	Unit	Description	Value	Source
P	Passengers	Project passengers	21,949,168	File 1
S_i	%	Share of project passengers using mode "i" in absence of the project	Cars: 18.9% Taxis: 28.4% Motorcycle: 3.0% Bus: 47.7% NMT: 2.0% Induced: 0.0%	File 9
X_C	%	Share of fuel type "x" used by passenger car users of BRT	Gasoline: 100% Diesel, Gaseous, electric and others: 0%	File 9
$TD_{C/T/M}$	Km	Trip distance of project passengers which in absence of the BRT would have used passenger cars, taxis or motorcycles	Cars: 7.0 km Taxis: 6.2 km Motorcycle: 4.7 km	File 9

The following parameters are not monitored but used for calculation purposes. Values are fixed ex-ante based on the registered PDD (see also Section D.1.).

Table 6: Baseline Parameters not Monitored (values for 2014)

Parameter	Unit	Description	Values	Source
$EF_{P,C}$	gCO_{2eq}/passenger	Emission factor per passenger transported of passenger car old GWP	1,063	PDD table A.4.
$EF_{P,T}$	gCO_{2eq}/passenger	Emission factor per passenger transported of taxis old GWP	1,103	PDD table A.4.
$EF_{P,M}$	gCO_{2eq}/passenger	Emission factor per passenger transported of motorcycle old GWP	202	PDD table A.4.
$EF_{P,Z}$	gCO_{2eq}/passenger	Emission factor per passenger transported of baseline buses old GWP	277	PDD table A.4.
X_C	%	Share of fuel type "x" used by passenger cars baseline	Gasoline: 100%	PDD table A1
$TD_{C/T/M}$	Km	Trip distance baseline passenger cars or	Cars: 10.3	PDD table A1

		taxis	Taxis: 6.8 Motorcycle: 6.0	
$EF_{P,C}$ Corrected	gCO_{2eq}/passenger	Emission factor per passenger transported of passenger car corrected for trip distance and new GWP	718	See calculation below
$EF_{P,T}$ Corrected	gCO_{2eq}/passenger	Emission factor per passenger transported of taxis corrected for trip distance and new GWP	1,008	See calculation below
$EF_{P,M}$ Corrected	gCO_{2eq}/passenger	Emission factor per passenger transported of motorcycles corrected for trip distance and new GWP	160	See calculation below
$EF_{P,Z}$ Corrected	gCO_{2eq}/passenger	Emission factor per passenger transported of buses corrected for new GWP	288	See calculation below
GWP CH_4 until 31.12.2012		Global warming potential of CH_4	21	Registered PDD B.6.2.
GWP CH_4 from 1.1.2013		Global warming potential of CH_4	25	http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
GWP N_2O until 31.12.2012		Global warming potential of N_2O	310	Registered PDD B.6.2.
GWP N_2O from 1.1.2013		Global warming potential of N_2O	298	http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

Adaptation to the change of trip distance must be made for cars, motorcycles as well as taxis as the trip distance is shorter than in the baseline (see following table).

Table 7: Trip Distance per Mode

Parameter	Unit	Passenger car	Taxi	Motorcycle
Baseline trip distance	km	10.3	6.8	6.0
Project trip distance	km	7.0	6.2	4.7
Adaptation of EF required due to lower trip distance Project compared to Baseline	Yes/No	Yes	Yes	Yes
CD (Correction Factor for Trip Distance)	None	0.676	0.908	0.790

The adaptation trip distance is made via the correction factor CD (see formulae 3 above). The EF baseline is multiplied with the CD.

$$CD_{i,y} = \frac{TD_{i,y}}{TD_i} \quad (4)$$

Where:

$CD_{i,y}$ Correction factor for changing trip distance in category i for the year y, where i includes T (taxis) and C (passenger cars) (no unit)

TD_i Average trip distance in kilometers in category i before project start (km)

$TD_{i,y}$ Average trip distance in kilometers in category i in the year y (km)

The survey registers that passenger cars as used by project passengers are gasoline powered idem to the baseline (see table below). Therefore no adaptation to fuel type used is made.

Table 8: Fuels Used by Passenger Cars

Parameter	Gasoline	Diesel	CNG/gaseous fuels	Electricity/0-emission
Baseline situation	100%	0%	0%	0%
Project situation	100%	0%	0%	0%

BASELINE RESULTS

Table 9: Baseline Emissions

Parameter	Unit	26/04/2014 to 25/10/2014
Passengers	passengers	21,949,168
Emissions cars	tCO_{2eq}	2,975
Emissions taxis	tCO_{2eq}	6,289
Emissions motorcycles	tCO_{2eq}	107
Emissions buses	tCO_{2eq}	3,014
Baseline Emissions	tCO_{2eq}	12,277

Source: CER spreadsheet (rounded values for cars, taxis, motorcycles and buses)

Calculations are presented in the spreadsheet.

Data of passengers and fuel consumption is recorded on a monthly base (with cut-off date being 25th of each month).

The total baseline emissions of the monitoring period are 12,277 tCO_{2eq}

E.2. Calculation of project emissions or actual net GHG removals by sinks

FORMULAES

$$PE_y = \sum_x \left[TC_{x,y} \times (EF_{CO2,x} + EF_{CH4,x} + EF_{N2O,x}) \right] \quad (5)$$

Where:

PE_y	Project emissions of buses in year y (tCO_{2e})
$TC_{x,y}$	Total consumption of fuel type x in year y (m^3)
$EF_{CO2,x}$	CO_2 emission factor for fuel type x (gCO_2/m^3)
$EF_{CH4,x}$	CH_4 emission factor for fuel type x (gCO_{2e}/m^3)
$EF_{N2O,x}$	N_2O emission factor for fuel type x (gCO_{2e}/m^3)

For all bus types the total fuel consumed is known and therefore Alternative A of the methodology is taken.

PARAMETERS AND DATA USED

The following table lists the monitored project parameters used (see also Section D.2.).

Table 10: Monitored Project Parameters

Parameter	Unit	Description	Value	Source
TC	m^3	Total CNG fuel consumed by project buses	1,157,009	File 1
DD_T	km	Distance driven of project buses	2,040,366	File 1

The following parameters are not monitored but used for calculation purposes. Values are fixed ex-ante based on the registered PDD (see also Section D.1.).

According to Annex 3 of EB69, "Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol", all emission reductions and removals achieved by CDM project activities in the second commitment period shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session in accordance with decision 4/CMP.7, and this requirement shall apply from 1 January 2013. The proposed monitoring period starts after 01/01/2013 and thus covers the 2nd commitment period. Therefore the new GWPs of CH_4 and N_2O were used.

Table 11: Project Parameters not Monitored

Parameter	Unit	Description	Value	Source
$EF_{CH4,Z}$	gCO_{2eq}/m^3	CH_4 emission factor of CNG powered buses old GWP until 31.12.2012	516	PDD B.6.2.
$EF_{N2O,Z}$	gCO_{2eq}/m^3	N_2O emission factor of CNG powered buses old GWP until 31.12.2012	96	PDD B.6.2.
$EF_{CO2,Z}$	gCO_{2eq}/m^3	CO_2 emission factor of CNG powered buses	1,971	PDD B.6.2.
$EF_{CH4,Z}$	gCO_{2eq}/m^3	CH_4 emission factor of CNG powered buses new GWP from 1.1.2013	614	See CER spreadsheet
$EF_{N2O,Z}$	gCO_{2eq}/m^3	N_2O emission factor of NG powered buses new GWP from 1.1.2013	100	See CER spreadsheet
GWP CH_4 until 31.12.2012		Global warming potential of CH_4	21	Registered PDD B.6.2.
GWP CH_4 from 1.1.2013		Global warming potential of CH_4	25	http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
GWP N_2O until 31.12.2012		Global warming potential of N_2O	310	Registered PDD B.6.2.
GWP N_2O from 1.1.2013		Global warming potential of N_2O	298	http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

PROJECT RESULTS

Table 12: Project Emissions

Parameter	Unit	26/04/2014 to 25/10/2014
CNG consumed	m^3	1,157,009
Project Emissions	tCO_{2eq}	3,102

Source: CER spreadsheet

Data of fuel consumption is recorded on a monthly base (with cut-off date being 25th of each month).

The total project emissions of the monitoring period are 3,102 tCO_{2eq}

For details see CER spreadsheet.

E.3. Calculation of leakage

$$LE_y = LE_{LF,Z,y} + LE_{LF,T,y} + LE_{CONG,y} \quad (6)$$

where:

LE_y Emissions leakage in year y (tCO_{2eq})
$LE_{LF,Z,y}$ Emissions Leakage from change of load factor in baseline buses in year y (tCO_{2eq})
$LE_{LF,T,y}$ Emissions Leakage from change of load factor in taxis in year y (tCO_{2eq})
$LE_{CONG,y}$ Emission Leakage from reduced congestion in year y (tCO_{2eq})

If $LE_y < 0$ then leakage is not included
If $LE_y > 0$ then leakage is included

Following leakage sources are included in the PDD (section B.6.1.):

1. Change of 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 on a regular basis during project execution.

2. Reduced congestion in remaining roads, provoking higher average vehicle speed, plus a rebound effect. The total impact of congestion is calculated ex-ante and not monitored.

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

Leakage load factors is monitored in years 3 and 7 i.e. not in the monitoring period of this report.

The reduced congestion leakage is negative due to a negative rebound leakage in the year 2014 and 0 speed leakage in the year 2014 (see registered PDD table 10). Therefore leakage emissions are 0 for the crediting period.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	12,277	3,102	0	9,176

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	5,744[11]	9,176

E.6. Remarks on difference from estimated value in registered PDD

The passenger number projected for the same period in the PDD is around 35 million passengers (1/2 year of 2014; see PDD table 12). This is in fact 60% more than actually achieved. Thus income from the project is surely less than projected. The fuel consumption projected for the period was around 3.6 million m^3 (1/2 year of 2014, see table 13) which is around factor 3 more than actually used. This is due to only using large articulated buses which require less fuel per passenger and using less buses than projected.

The main reason for the higher emission reduction is due to the larger modal shift than expected i.e. the number of passengers from taxis was expected to be only 8% and is now 28% and from cars 13% and is now 19%. Passengers from high emitting modes lead to higher emission reductions than passengers which would have come from traditional bus service.

[11] 2014 according to PDD 11,487 tCERs; monitoring period 6 months instead of 12 months and thus annual CERs/2

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	0	9,176

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Contact information of project participants and responsible persons/ entities

Organization:	Lanzhou Public Traffic Group
Street/P.O.Box:	No.493, Xijindong Road, Qilihe District
Building:	
City:	Lanzhou
State/Region:	Gansu Province
Postcode/ZIP:	730000
Country:	China
Telephone:	86-931-2650527
FAX:	86-931-2654631
E-Mail:	haibao@lzbus.com
URL:	http://www.lzbus.com
Represented by:	Hai Bao
Title:	Section Chief
Salutation:	Mr.
Last name:	Hai
Middle name:	
First name:	Bao
Department:	Department of Operation
Mobile:	13321222358
Direct FAX:	86-931-2654631
Direct tel:	86-931-2650527
Personal e-mail:	haibao@lzbus.com

Organization:	Lanzhou Public Traffic Group
Street/P.O.Box:	No.493, Xijindong Road, Qilihe District
Building:	
City:	Lanzhou
State/Region:	Gansu Province
Postcode/ZIP:	730000
Country:	China
Telephone:	86-931-2650527
FAX:	86-931-2654631
E-Mail:	haibao@lzbus.com
URL:	http://www.lzbus.com
Represented by:	Hai Bao
Title:	Section Chief
Salutation:	Mr.
Last name:	Hai
Middle name:	
First name:	Bao
Department:	Department of Operation
Mobile:	13321222358
Direct FAX:	86-931-2654631
Direct tel:	86-931-2650527
Personal e-mail:	haibao@lzbus.com

Organization:	Asian Development Bank, as Trustee of the Future Carbon Fund
Street/P.O.Box:	6 ADB Avenue

Building:	
City:	Mandaluyong City
State/Region:	Metro Manila
Postfix/ZIP:	1550
Country:	Philippines
Telephone:	+ 632 632 4444 local 70184
FAX:	+ 632 632 5114
E-Mail:	futurecarbonfund@adb.org
URL:	www.adb.org
Represented by:	
Title:	Director General
Salutation:	Mr.
Last Name:	Chander
Middle Name:	
First Name:	Seethapathy
Department:	Regional and Sustainable Development Department, RSDD
Mobile:	
Direct FAX:	+63 2 632 5114
Direct tel:	
Personal E-Mail:	c/o vkduggal@adb-fcf.org

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Document information

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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