

The Federative Republic of Brazil  
The Government of State of Para

Study on Effects of GHG Emission Reduction  
Expected from Belem Metropolitan Trunk Bus  
System Project

**Final Report (Summary)**

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## List of Abbreviations

The Study	Study on effects of GHG emission reduction expected from Belem Metropolitan Trunk Bus System Project
The 2010 Preparatory Survey	The Preparatory Survey for Belem Metropolitan Bus Transport System Project In The Federative Republic of Brazil
The 2003 F/S	Feasibility Study on the Improvement of Transport System in the Metropolitan Area of Belem in the Federative Republic of Brazil
AM	Approved Methodology
BRT	Bus Rapid Transit
CDM	Mecanismo de Desenvolvimento Limpo
CER	Certified Emission Reduction
C/P	Counterpart
CTBel	Transport Company of Belem Municipality
DCP	Documento de Concepcao de Projeto
D/D	Detail Design
DNA	Designated National Authority
DOE	Designated Operational Entity
E/N	Exchange Notes
GHG	Green House Gas
ICGCC	Interministerial Commission on Global Climate Change
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
L/A	Loan Agreement
MRV	Measuring, Reporting and Verification
NGTM	Nucleus of Administration of Metropolitan Transport
OD	Origin and Destination
ODA	Official Development Assistance
SEPE	State Secretariat of Strategic Projects
SETRAN	Executive Secretariat of Transports



## Executive Summary

### 1. BACKGROUND OF THE PROJECT

JICA agreed and undertook in 2003 the Feasibility Study on Improvement of Transport System in the Metropolitan Area of Belem (hereafter referred to as the 2003 F/S). Subsequently in 2010, JICA again agreed to undertake the Preparatory Survey for Belem Metropolitan Bus Transport System Project (hereafter referred to as the 2010 Preparatory Survey). The 2010 Study reviewed and updated the findings and proposals of the 2003 Study to help formulate a project suitable for applying to the Japan's ODA Loan.

The 2010 Preparatory Survey proposed the trunk bus project that would service on Av. Almirante Barroso, BR-316, Av. Augusto Montenegro, the Centro and Icoaraci area. The proposal came to be known as the Y-net development because of the shape of the proposed trunk bus network. In view of the huge capital outlay needed for the entire project, however, the State of Para Counterpart (hereafter referred to as the Counterpart) concluded that the project should be divided into two phases in terms of the level of demand. Phase I implements the trunk bus system on Av. Almirante Barroso, BR-316 and the Centro area, or the I-net development. The remainder of the Y network will be implemented in Phase II sometime after 2014. Accordingly, the expected application to the Japan's ODA Loan concerns the I-net development of the trunk bus system.

The Study is a supplementary study on the I-net development which involves the review over the demand forecast and the estimation of Greenhouse Gas (GHG) emission reductions.

### 2. PURPOSE AND SCOPE OF THE STUDY

The Study reviews the demand forecast in accordance with the reduced scope of the trunk bus project to I-net development. Similarly, the GHG emission reduction is estimated to see if the scale of reductions is sufficient to warrant the CDM application. In addition, the Study suggests a scenario of institutional development for the Counterpart to undertake in readiness to the successful CDM application of the trunk bus project.

### 3. STUDY PROJECT

The Outline of the Project is shown below.

#### (1) Study Area

The study area is the same as the 2010 Preparatory Survey, namely, three cities of Belem, Ananindeua and Marituba in the metropolitan area of Belem.

#### (2) Target Year

The Study schedules that the proposed trunk bus project will come into operation at the end of 2015.

#### (3) Study Project

As already mentioned, the trunk bus project to be submitted for the Japan's ODA Loan is the I-net development with project components as listed below. See Figure 1.2-1 for the locations of the project components.

- Trunk bus exclusive lane on Av. Almirante Barroso, trunk busway on BR-316 and trunk bus priority lanes in the Centro: total extension of 27.1km
- One bus terminal : Marituba
- One bus station: Aguas Lindas
- Bus stops: 28 locations

#### (4) Basic Policy of Study

The most important output of the Study is the analysis of GHG emission reductions regarding the I-net development for the Japan's ODA Loan. Accordingly, the details of the project proposal in the 2010 Preparatory Survey are utilized to scale down and review the demand forecast and other procedural steps necessary for estimating emission reductions.

### 4. STUDY DURATION

The Study commenced in February 2011 and ended in September 2011.

### 5. THE CONTENTS OF THE STUDY

#### (1) TRAVEL DEMAND FORECAST

##### *Basic Policy*

- The demand forecast of the present Study uses the travel demand models developed by the 2010 JICA Preparatory Survey, with no basic revisions attempted on the model structure.
- The forecast uses the OD tables compiled by the 2010 JICA Preparatory Survey: namely, the 2009 OD tables derived from the traffic surveys and the forecast OD tables for the target years 2013, 2018 and 2025.
- The OD tables for the years mentioned above are interpolated to update the travel demand forecasts for the years in between.

##### *Conditions of Forecast*

- Target years of the demand forecast: 2016 (the first year of the trunk bus operation) and 2025 (the last year of the crediting period of GHG emission reductions).
- Trunk bus routes: the I-net portion of the initially proposed Y-net development.
- The present and the future road network and the existing bus routes: latest data obtained from the Counterpart, CTBel and other related agencies.
- OD tables used for demand forecast: interpolated from the tables prepared by the 2010 JICA Preparatory Survey.

##### *Results of Forecast*

- Daily trunk bus passengers  
2016: approximately 249,900 persons  
2025: approximately 303,600 persons
- Total trunk bus operation  
2016: approximately 17,400 vehicle kilometers  
2025: approximately 19,400 vehicle kilometers

#### (2) REDUCTION OF GHG EMISSIONS

- The CDM application of the trunk bus project uses AM0031 "Baseline Methodology for Bus Rapid Transit Projects."
- Estimated emissions of greenhouse gases are converted to CO<sub>2</sub>.
- The mode after the project comes into operation is trunk bus.
- The modes for the baseline scenario are large bus and small bus.



- The total emission reductions by the trunk bus operation are estimated to be 499,011 tCO<sub>2eq</sub> during the credited period of 10 years, or 49,901 tCO<sub>2eq</sub> per annum.

### (3) MRV SYSTEM DEVELOPMENT FOR THE TRUNK BUS PROJECT

- The establishment of the system and procedure of measuring, reporting and verification (MRV) is essential to ensure the effectiveness, the transparency and the equity of emission reduction/mitigation efforts among the parties concerned. Especially regarding the developing countries, the crucial issue is how to enhance the transparency of their mitigation efforts through MRV activities.
- At present, there are yet no internationally accepted rules about how to establish and operate the MRV system. However, the MRV procedure will be set in motion after 2013 when it is highly likely that the international MRV rules and standards will be agreed upon and take effect. All interested countries and parties are now individually taking preparatory steps towards the eventual MRV standardization.
- The possibility of GHG emission reductions by the trunk bus project has already been quantitatively assessed and in consultation and agreement with the Brazilian side, the quantified assessment results have been set up as indicators with which to evaluate the subsequent project performance in emission reduction. Because of the scaling-down of the project, the assessment of emission reductions is now being updated more strictly on the basis of more precise data.
- The updated assessment data will be duly agreed upon by JICA and the State Government of Para before the project implementation. Then, the assessment data will be publicly released pending the consent of the State Government of Para.

### (4) CDM APPLICATION AND REGISTRATION

- The estimated CER sales over 10 years amount to US\$0.6~3.8 million.
- The additionality of the proposed trunk bus project is arguably sufficient.
- The conditions in Belem justify the use of AM0031 “Baseline Methodology for Bus Rapid Transit Projects” for the CDM application.
- It is possible to justify Japan’s ODA financing of the proposed trunk bus project.
- It is concluded therefore that the proposed trunk bus project is likely to get CDM approval and registration.
- The remaining issues concern (i) the selection of project participants and the flow design of CER transfers, (ii) increasingly lengthening process of crediting approval and (iv) financial burden of performing MRV activities.

### (5) MRV SYSTEM AFTER CDM REGISTRATION

- The public consortium will manage the MRV system.
- The role of the public consortium consists of (i) collection and compilation of monitored data and other relevant information, (ii) examination of the monitoring reports submitted by the commissioned consultants and (iii) submission of the reports to a DOE for verification.
- The role of consultants consists of (i) collection of monitored data and other relevant information, (ii) monitoring surveys, (iii) calculation of the emission reductions, (iv) quality control of measurement and analysis and (v) drafting monitoring reports and answering questions/demands from the DOE over the reports.
- The CO<sub>2</sub> emission reduction is calculated as a difference between the baseline scenario

and the actual emissions. Accordingly, monitoring is required to collect the measured data concerning the parameters and other indicators employed by the CDM-approved methodology (i.e., AM0031).

## 1. INTRODUCTION

### 1.1. BACKGROUND OF THE PROJECT

The State of Para is located in the northern part of the Federal Republic of Brazil and its metropolitan area of Belem has the aggregate population of about 2.1 million. Belem is the commercial center and the urban sprawl has been spreading from the city outward to nearby suburbs. Along with urbanization and population growth, the traffic congestion has been intensifying in the metropolitan area. Public transport is provided by bus services which are concentrated on a few arterial roads connecting to the Centro. Excessive bus operation is one of the causes of traffic congestion on these roads. For example, nearly 90% of the peak hour passenger traffic on Av. Almirante Barroso used bus services in 2009. With intensifying traffic congestion, the problem of air pollution has become serious. The metropolitan situation calls for a more efficient public transport system.

The State Government of Para realized the urgent need of a public transport project which would improve the problem in the metropolitan area of Belem and requested JICA to work on such a project. JICA subsequently agreed and undertook in 2003 the Feasibility Study on Improvement of Transport System in the Metropolitan Area of Belem (hereafter referred to as the 2003 F/S). Subsequently in 2010, JICA again agreed to undertake the Preparatory Survey for Belem Metropolitan Bus Transport System Project (hereafter referred to as the 2010 Preparatory Survey). The 2010 Study reviewed and updated the findings and proposals of the 2003 Study to help formulate a project suitable for applying to the Japan's ODA Loan.

The 2010 Preparatory Survey proposed the trunk bus project that would service on Av. Almirante Barroso, BR-316, Av. Augusto Montenegro, the Centro and Icoaraci area. The proposal came to be known as the Y-net development because of the shape of the proposed trunk bus network. In view of the huge capital outlay needed for the entire project, however, the State of Para Counterpart (hereafter referred to as the Counterpart) concluded that the project should be divided into two phases in terms of the level of demand. Phase I implements the trunk bus system on Av. Almirante Barroso, BR-316 and the Centro area, or the I-net development. The remainder of the Y network will be implemented in Phase II sometime after 2014. Accordingly, the expected application to the Japan's ODA Loan concerns the I-net development of the trunk bus system.

The Study is a supplementary study on the I-net development which involves the review over the demand forecast and the estimation of Greenhouse Gas (GHG) emission reductions.

### 1.2. PURPOSE AND SCOPE OF THE STUDY

#### (1) Purpose of Study

The purpose of the Study is the followings.

- The Study reviews the demand forecast in accordance with the reduced scope of the trunk bus project to I-net development. Similarly, the GHG emission reduction is estimated to see if the scale of reductions is sufficient to warrant the CDM application. In addition, the Study suggests a scenario of institutional development for the Counterpart to undertake in readiness to the successful CDM application of the trunk bus project.

In March 2010, the JICA on the Japan's ODA Loan applications reviewed the trunk bus project, noting the change from the Y-net to the I-net development. At the time, the down-scaling of emission reductions could be done only roughly from the original estimates of the 2010 Preparatory Survey on the Y-net development. It was thought necessary to review the demand forecast based on the I-net development and then estimate the GHG emission reductions with more accuracy. In addition, UNFCCC COP15 held at Copenhagen agreed on the importance of measuring, reporting and verification (MRV) in CDM project activities. The Counterpart needs technical capacity building to manage the trunk bus project as a CDM project activity.

## **(2) Study Area**

The study area is the same as the 2010 Preparatory Survey, namely, three cities of Belem, Ananindeua and Marituba in the metropolitan area of Belem.

## **(3) Target Year**

The Study schedules that the proposed trunk bus project will come into operation at the end of 2015.

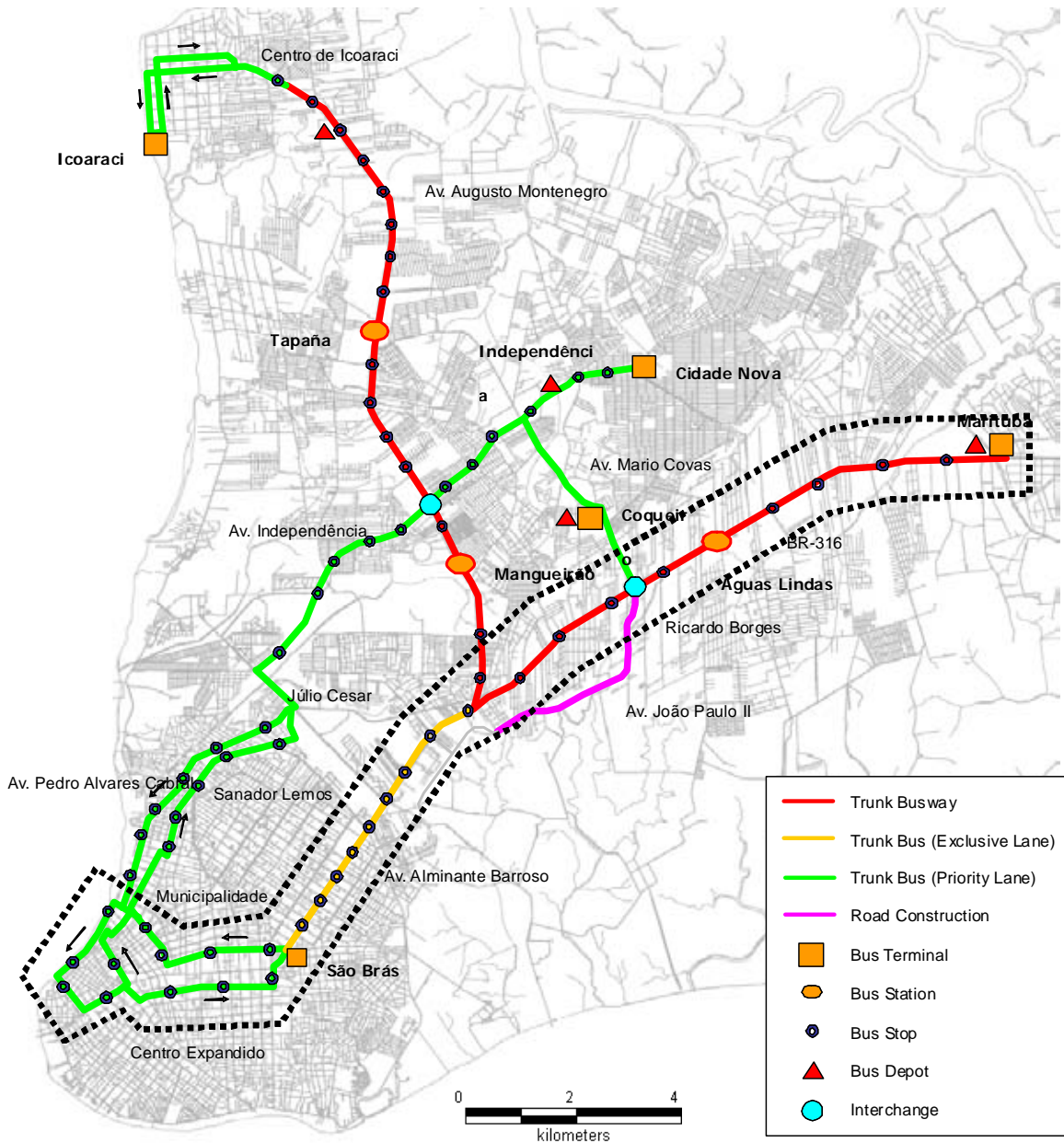
## **(4) Study Project**

As already mentioned, the trunk bus project to be submitted for the Japan's ODA Loan is the I-net development with project components as listed below. See Figure 1.2-1 for the locations of the project components.

- Trunk bus exclusive lane on Av. Almirante Barroso, trunk busway on BR-316 and trunk bus priority lanes in the Centro: total extension of 27.1km
- One bus terminal : Marituba
- One bus station: Aguas Lindas
- Bus stops: 28 locations

## **(5) Basic Policy of Study**

The most important output of the Study is the analysis of GHG emission reductions regarding the I-net development for the Japan's ODA Loan. Accordingly, the details of the project proposal in the 2010 Preparatory Survey are utilized to scale down and review the demand forecast and other procedural steps necessary for estimating emission reductions.

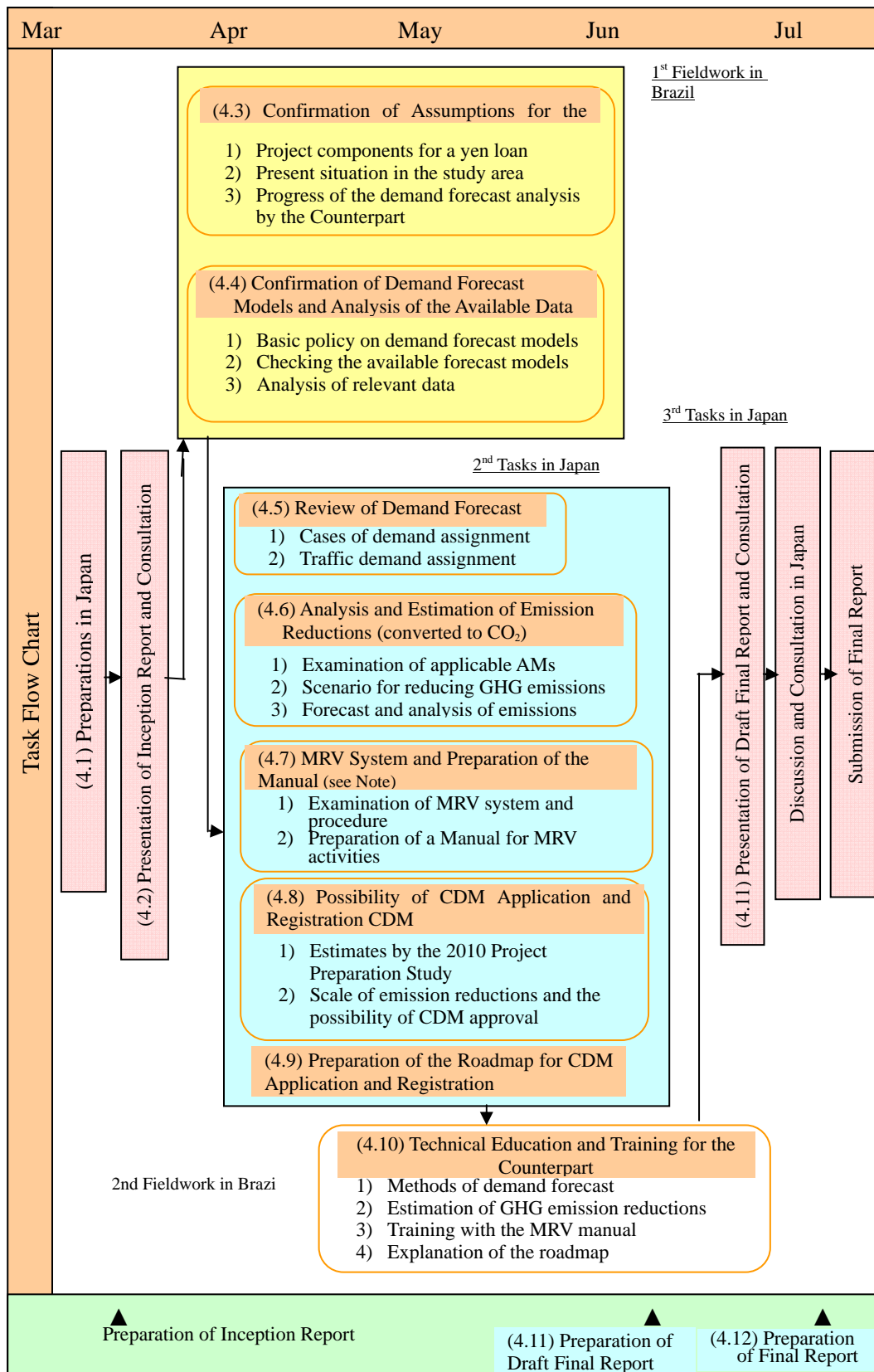


Note: the I-net development is shown by the dotted line.

Figure 1.2-1 The Trunk Bus System for I-net Development

### 1.3. OUTLINE OF THE STUDY

The schedule of the Study per task is shown by the flow chart in Figure 1.3-1.



Note: The Study item No. 4.7 is divided into the following two Chapters in the course of the Study.  
 1) Chapter 4: MRV System Development for the Trunk Bus Project  
 2) Chapter 6: Monitoring System on CDM Project  
 'Preparation of a Manual for MRV activities' in Item No. 4.7, 2) changes the title as 'Monitoring System on CDM Project'.

Figure 1.3-1 Flow Chart of the Study

## 1.4. OUTLINE OF THE PROPOSED TRUNK BUS SYSTEM

The major characteristics of the trunk bus project formulated by the 2010 Preparatory Survey are described below. The Study focuses on the I-net development shown in Figure 1.2-1.

### (1) Trunk Bus System Plan

The trunk bus system is composed of trunk bus, feeder bus and existing conventional bus. Their respective roles in the system are that trunk buses in integration with feeder buses transport the dwellers in the outlying suburbs to the metropolitan CBD and that the conventional buses service passengers without direct access to the trunk bus routes. The trunk buses are operated on the exclusive busways or lanes, while conventional buses and other motorized vehicles are not allowed to use these busways or lanes. Suburbs are serviced by the fleet of feeder buses. Articulated double-body buses with 160 passenger capacity (up to 200 passengers during peak hours) are introduced to increase the transport capacity and raise the speed of service. The feeder services are provided by smaller buses with 50 to 70 passenger capacity suited to suburban roads with narrow width. In order to shorten boarding and alighting time, passengers have to buy tickets before entering bus stop facilities just like the passengers on the railways.

### (2) Trunk Bus Road Plan

The trunk buses run on (i) trunk bus exclusive road, (ii) exclusive lanes and (iii) priority lanes. The trunk bus exclusive roads are completely segregated by concrete structure from the through traffic roadway and shut out other vehicles including conventional buses. Exclusive lanes are partially segregated by chatter bars from the roadway. Priority lanes are provided on the same roadway and give priority to the trunk bus during peak hours.

### (3) Trunk Bus Terminals and Bus Stops

Four terminals are proposed to accommodate the passenger transfers between trunk and feeder bus and to provide the parking facility for the fleet. Three bus stations are proposed for the locations where large plots are not available. In order to increase the transport capacity of trunk bus services, bus stops are provided with a bus passing lane in order not to obstruct the through traffic.

## 1.5. IMPLEMENTATION SCHEDULE OF THE PROPOSED TRUNK BUS SYSTEM

The Study initially scheduled the start of trunk bus operation at the end of 2014. However, the delayed Exchange of Notes and other procedures for the Japan's ODA Loan suggest the need to adjust the scheduling. In consultation with the Counterpart, the start of operation has been rescheduled with the following consideration.

- 1) The Exchanged of Notes with its associated procedure is now nearly a year overdue.
- 2) Since the E/N signed on June 30 in 2011, the initial schedule is moved forward accordingly. On the assumption that the preparation for selecting consultants begins sometime after that, the schedule is coordinated.
- 3) In consultation with the Counterpart, it has been agreed that the construction works will be completed near the end of 2015 and that the trunk bus operation will start before the end of the year.

## 2. TRAVEL DEMAND FORECAST

### 2.1. BASIC POLICY FOR DEMAND FORECAST

The basic policy for the Study is as follows.

- 1) The demand forecast uses the models developed in the 2010 Preparatory Survey and adds no basic change to the models themselves. In other words, the Study utilizes the OD tables for the years 2009, 2013 and 2025 for the demand forecast.
- 2) Three OD tables mentioned above are interpolated to obtain tables for the target years revised for the Study.

### 2.2. DEMAND FORECAST MODELS

The Study relies on the demand forecast models developed by the 2010 Preparatory Survey.

### 2.3. REVIEW OF DEMAND FORECAST

#### 2.3.1. TARGET YEARS AND CASES OF DEMAND ASSIGNMENT

By taking into consideration the then effective implementation schedule of the trunk bus project, the 2010 Preparatory Survey set the primary target year at 2018, with 2013 for the short term and 2025 for the perspective long term. As mentioned earlier in Section 1.5. of Chapter 1, however, the completion of the project will be later than the initially scheduled. In consultation with the Counterpart, it has been agreed that the project completion will be toward the end of 2015 and that the start of trunk bus operation would better be rescheduled to 2016. Moreover, the Study takes up the year 2025 as the primary target year for demand forecast, because the crediting period chosen for the possible CDM application of the trunk bus project is 10 years, over which the emission reductions must be estimated.

#### 2.3.2. ASSUMPTIONS OF DEMAND FORECAST

Basic assumptions of the demand forecast in the Study are explained below.

##### (1) Routing of Trunk Bus Services

The trunk bus routes used for the demand forecast constitute the I-net portion extracted from the Y-net development proposed by the 2010 Preparatory Survey. The Study employs the same trunk bus operation plan as that in the 2010 Preparatory Survey such as the normal and express service of the trunk bus operation including boarding and alighting at bus stops and fare system.

##### (2) Review of Road- and Traffic-related Data

###### 1) *Review of Road Network*

In consultation with the Counterpart, the current statuses of those road segments opened after the 2010 Preparatory Survey and the future plans of those road projects scheduled to be completed by the respective target years of 2016 and 2025 are input to the road network database.

###### 2) *Review of Existing Bus Lines*

The newest information is obtained from CTBel regarding the existing bus lines and added to the bus line database. The bus lines change to 177 lines from 168 lines in the 2010 Preparatory Survey.

Following the reasoning presented in the 2010 Preparatory Survey, those bus lines that compete with the proposed trunk bus routes by 70% or more of their respective line length are to be



discontinued. The cut ratio of 70% or more would discontinue 16 existing bus routes and retain 161 routes. This is input to the database for the demand forecast.

### (3) Making of OD Tables

The OD tables for 2011 (base year), 2016 and 2025 are interpolated from the OD tables of 2009, 2013 and 2018 compiled by the 2010 Preparatory Survey.

### 2.3.3. RESULTS OF DEMAND FORECAST

The demand forecast pertains to the trunk bus project of I-net development, which will be financed by the Japan's ODA Loan. In addition to the forecasts of daily trips which would be necessary to estimate GHGs emissions and the reductions thereof for the possible CDM application, the Study has made the forecasts of peak hour trips, which are the basic input to the stage of detailed design.

#### (1) Daily Passenger Trips

Daily passenger trips by trunk bus are required for the estimation of GHGs emission reductions which might justify or not justify the CDM application. Table 2.3-1 shows the details of the forecasts of daily passenger trips by the proposed trunk bus system. Daily trunk bus passengers are estimated to be 249,900 passengers in 2016, increasing to 303,600 by 2025. Vehicle kilometers of the trunk bus fleet would be 17,400 in 2016, reaching 19,400 by 2025. Trunk bus passengers, all together, would travel 2,482,500 passenger kilometers daily in 2016 and the figure would rise to 3,003,500 passenger kilometers in 2025.

Table 2.3-1 Daily Passenger Trips by the Trunk Bus System

Year	Service	Passengers		Vehicle Kilometers		Passenger Kilometers		Average Trip Length (km)
		(passengers)	Share	(vehicle km)	Share	(passenger km)	Share	
2016	Local	88,884	35.6%	7,637	43.8%	845,763	34.1%	9.5
	Express	160,980	64.4%	9,781	56.2%	1,636,785	65.9%	10.2
	Total	249,864	100.0%	17,418	100.0%	2,482,548	100.0%	9.9
2025	Local	109,039	35.9%	8,960	46.2%	1,039,368	34.6%	9.5
	Express	194,517	64.1%	10,428	53.8%	1,964,082	65.4%	10.1
	Total	303,556	100.0%	19,388	100.0%	3,003,450	100.0%	9.9

#### (2) Peak Hour Trips

##### 1) Trunk Bus Passengers at Major Route Cross-sections

Table 2.3-2 shows trunk bus passengers (one way) at six major locations. The location No. 3 (cf. Figure 2.3-1 for location) between Rod. Mário Covas and Entroncamento on Rod. BR-316 has the largest number of trunk bus passengers, reaching 10,000 in 2016 and 13,200 in 2025 in the morning peak hour. Nearly 30% of bus passengers on this road section would use the trunk bus. The location No. 4 between Entroncamento and the Centro on Av. Almirante Barosso has the next largest trunk bus passengers, numbering 8,600 in 2016 and 11,600 in 2025 in the peak hour.

Table 2.3-2 Trunk Bus Passengers by Major Route Cross-sections (per peak hour, one way)

No.	Raod	2016			2025		
		Conventional Bus	Trunk Bus	Total	Conventional Bus	Trunk Bus	Total
1	Rod. BR-316	7,879	4,437	12,316	10,495	4,846	15,341
		64.0%	36.0%	100.0%	68.4%	31.6%	100.0%
2	Rod. BR-316	9,510	9,442	18,952	12,433	12,560	24,993
		50.2%	49.8%	100.0%	49.7%	50.3%	100.0%
3	Rod. BR-316	27,601	9,964	37,565	34,080	13,239	47,319
		73.5%	26.5%	100.0%	72.0%	28.0%	100.0%
4	Av. Almirante Barroso	39,100	8,624	47,724	48,468	11,589	60,057
		81.9%	18.1%	100.0%	80.7%	19.3%	100.0%
5	Av. Governador José Malcher	34,948	301	35,249	39,125	427	39,552
		99.1%	0.9%	100.0%	98.9%	1.1%	100.0%
6	Av. Gentil Bittencourt	7,471	111	7,582	7,969	109	8,078
		98.5%	1.5%	100.0%	98.7%	1.3%	100.0%

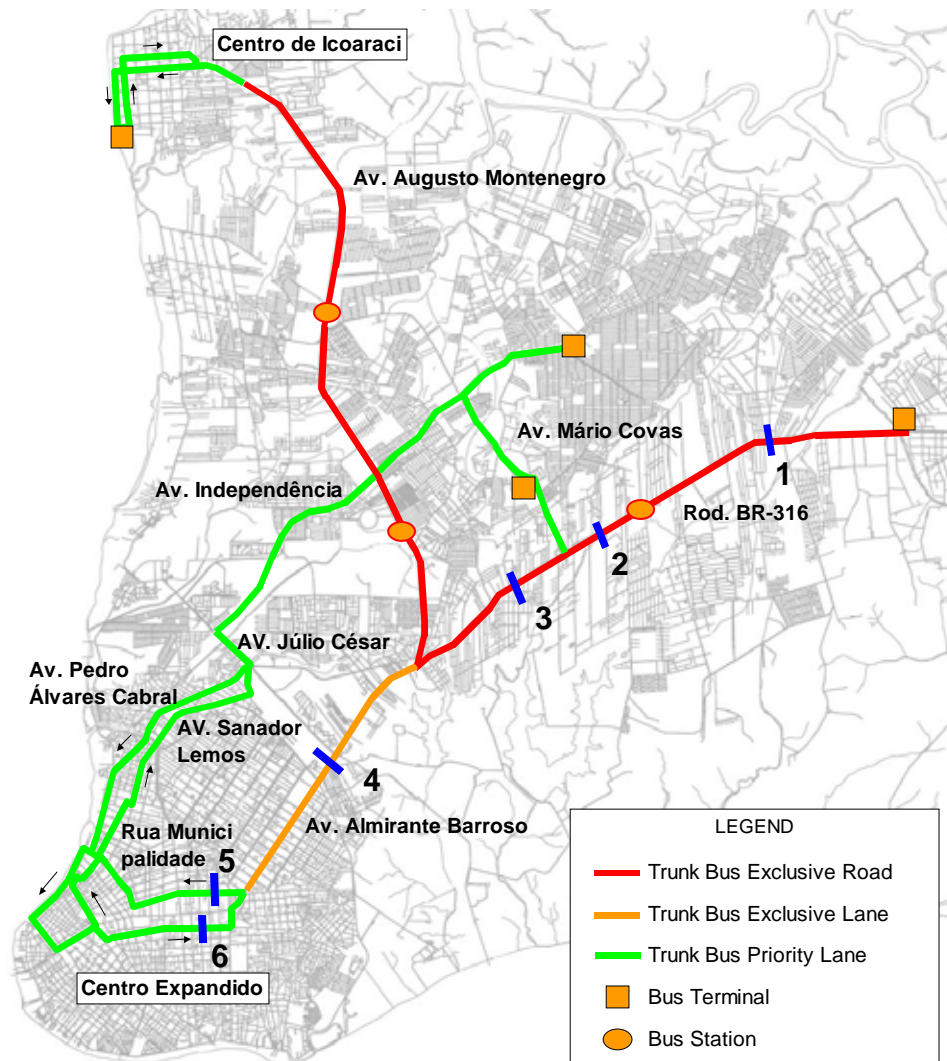


Figure 2.3-1 Location of Major Route Cross-sections of the Trunk Bus System

## 2) Service Frequency per Route Section

Figure 2.3-2 shows the service frequency on two route segments. In 2016 when the trunk bus system would come into operation, the frequency is 34 services per hour along the segment from Marituba to Águas Lindas (service head of 106 seconds) and 56 services from Águas Lindas to São Brás (service head of 64 seconds). After ten years of trunk bus operation, the frequency would rise to 43 services (service head of 84 seconds) in the former segment and 73 services (service head of 49 seconds) in the latter segment.

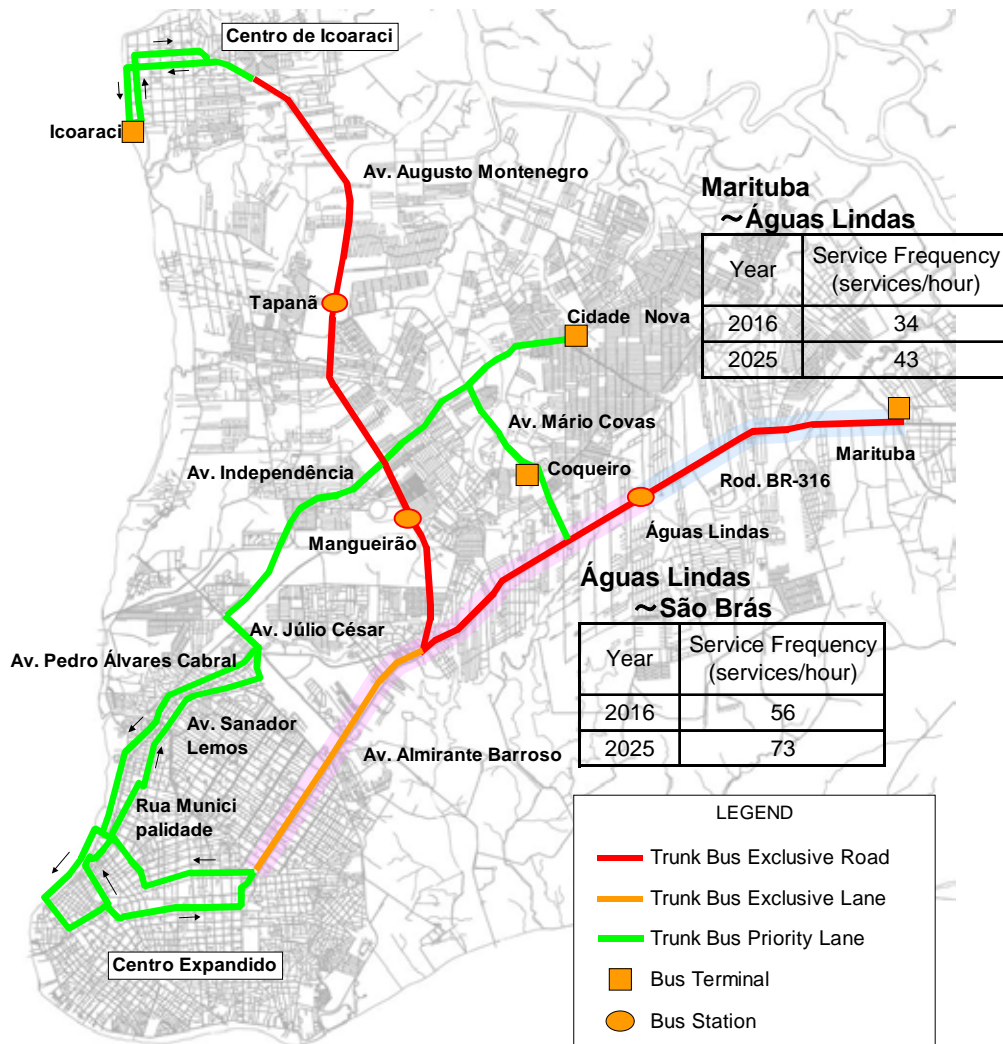


Figure 2.3-2 Peak Hour Service Frequency per Route Section (One Way)

### 3. REDUCTION OF GHGS EMISSIONS

#### 3.1. APPROVED METHODOLOGY (AM)

As of August 2011, there are three AMs for the CDM transport sector: namely, AM0031, “Baseline Methodology for Bus Rapid Transit Projects” AM0090, “Modal shift in transportation from road transportation to water or rail transportation” and ACM0016 “Baseline Methodology for Mass Rapid Transit Projects”. AM0090 deals with the modal shift from road to water or rail transport and therefore does not suit the proposed project. ACM0016 is a methodology for Mass Rapid Transit Projects. In order to secure applicability of ACM0016, the bus must be operated on the segregated bus lane exclusive of private vehicles. Therefore, ACM0016 is not applied to the project.

On the other hand, AM0031 was originally developed to get the CDM approval on BRT Bogota Colombia: TransMilenio Phases II to IV. It is judged appropriate to use AM0031 in the preparation of the proposed BRT project in Belem for CDM application.

#### 3.2. ANALYSIS OF GHGS EMISSION REDUCTION

The GHGs emission reduction is estimated by applying AM0031 to the baseline scenario and the proposed BRT project.

- The emission estimation concerns the I-net development of the BRT system.

##### 3.2.1. SCENARIO FOR EMISSION REDUCTION

The project proposes the construction of trunk busways on the existing roadways and the introduction of articulated buses. This will establish the mass transit system with improved operation speed and ensure the substantial upgrading of public transport service in Belem. The GHGs emission reduction is expected mainly from three sources, namely, 1) downsizing of the present conventional bus fleet, 2) decrease of traffic congestion levels in the entire metropolitan area and 3) replacement of antiquated conventional buses by new articulated buses.

By applying AM0031 to the proposed scenario of trunk bus development, the GHGs emissions are estimated both for the project and the baseline situation (without the project), and the difference between the two estimates signifies the emission reduction realizable by the project implementation. Figure 3.2-1 shows the illustration of estimation of GHG’s emission reduction.

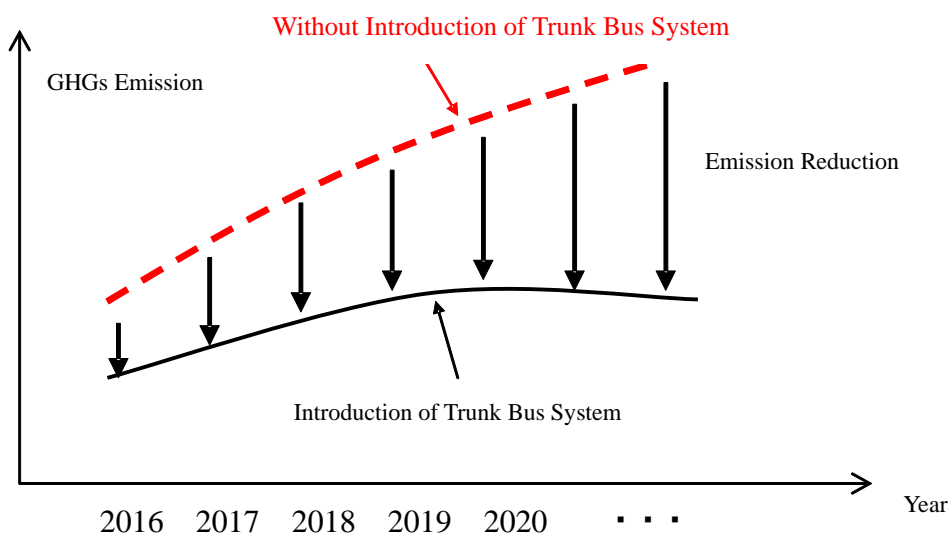


Figure 3.2-1 Estimation of GHG's Emission Reduction

### 3.2.2. CREDITING PERIOD

The emission reduction by the trunk bus system is estimated by assuming the CDM starting date of Jan. 1, 2016 and the crediting period of 10 years.

### 3.3. ESTIMATION OF GHGS EMISSION

Table 3.3-1 shows the emission reduction by CDM project implementation. The baseline emission during 10 years is estimated to add up to 598,931 tCO<sub>2eq</sub>. The project emission for the same duration is estimated to be 99,888 tCO<sub>2eq</sub>. Emission leakage will be 32 tCO<sub>2eq</sub>. Thus, the CDM emission reduction during the crediting period totals 499,011 tCO<sub>2eq</sub>, or 49,901 tCO<sub>2eq</sub> per year.

Table 3.3-1 Emission Reduction during Crediting Period Unit : tCO<sub>2eq</sub>

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	total
ER <sub>v</sub>	47,692	48,051	48,632	49,130	49,763	50,076	50,491	50,885	51,518	52,772	499,011
BE <sub>v</sub>	57,208	57,640	58,339	58,946	59,714	60,105	60,622	61,117	61,901	63,339	598,931
PE <sub>v</sub>	9,513	9,585	9,705	9,812	9,949	10,026	10,128	10,228	10,380	10,563	99,888
LE <sub>v</sub>	3	4	3	4	2	3	3	3	3	4	32

If the diversion to passenger cars is 3% instead of the assumed zero, the emission reduction would be 518,019 tCO<sub>2eq</sub>, or 19,008 tCO<sub>2eq</sub> (3.8%) more than the case of zero diversion. It is judged that the 3% diversion would have no significant influence.

Furthermore, the emission reduction is estimated regarding the future introduction of the hybrid bus. However, the transport emission factor for the hybrid bus is yet unavailable from IPCC. Therefore, the emission reduction is estimated by the ratio of green house gas reduction (90%) of the hybrid bus relative to the diesel engine bus, as announced by the bus manufacturer (Electra Inc.). Then, the reduction would be 588,139 tCO<sub>2eq</sub> over the same period, or 89,129 tCO<sub>2eq</sub> (17.9%) more than the diesel engine bus.

## 4. MRV SYSTEM DEVELOPMENT FOR THE TRUNK BUS PROJECT

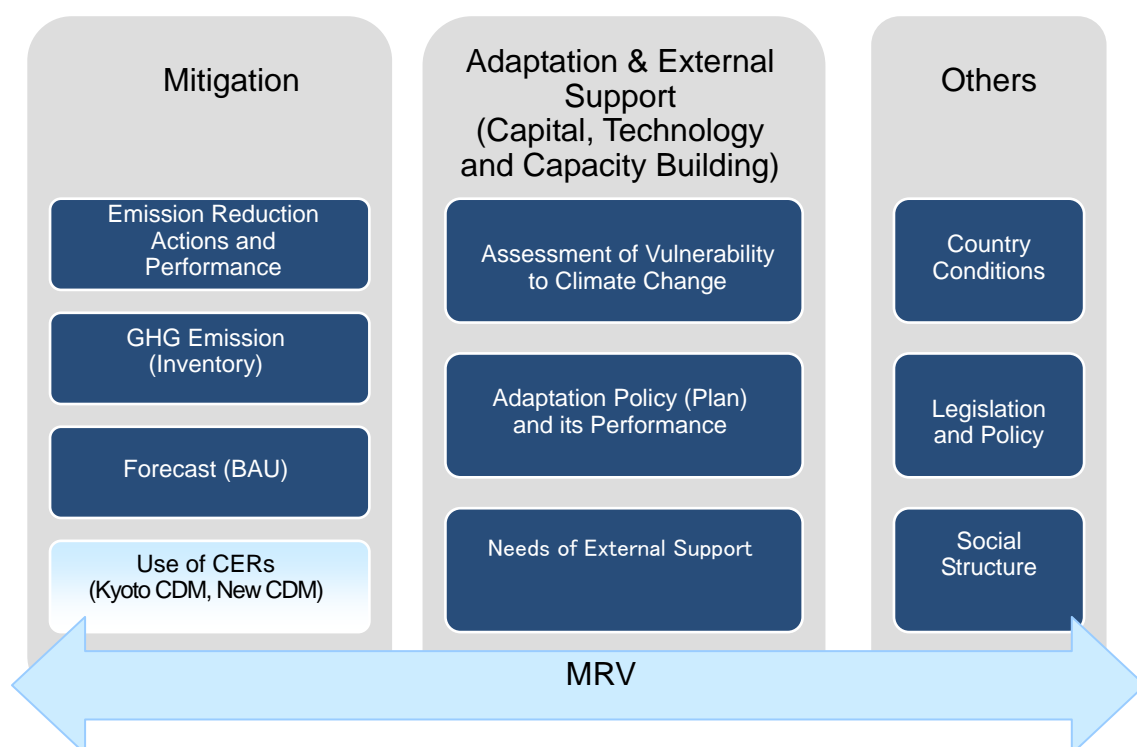
### 4.1. OUTLINE OF MRV SYSTEM

Regarding the GHG emission reduction targets and the “nationally appropriate mitigation actions (NAMA)” of the developing countries, one of the important steps is the establishment of the system and procedure of measuring, reporting and verification (MRV). The MRV process will ensure the effectiveness, the transparency and the equity of emission reduction/ mitigation efforts among the parties. Especially among the developing countries, the crucial issue is how to enhance the transparency of their mitigation actions.

The Copenhagen Accords of the 15th UNFCCC Conference of Parties (COP15) contain the description specifying the biennial country reports by the developing countries on their mitigation actions including the emission inventory. It is supposed that the internationally acceptable MRV procedure be applied to those mitigation actions that are supported by external assistance. Independent actions without external support are subject to the nationally accepted MRV procedure and the resulting findings are presented for international consultation and analysis

MRV activities will become increasingly important because they are essential to grasp with accuracy emission reductions in each country and the impacts of external financial and technical supports on mitigation actions. Indeed, MRV activities are integral to wide-ranging interactions and negotiations related to the Framework of Global Climate Change as shown in Figure 4.1-1.

At the present moment, there are yet no internationally accepted rules about the establishment and the operation of the MRV system. However, the MRV procedure will be set in motion after 2013 when it is highly likely that the international MRV rules and standards will be agreed upon and take effect. All interested countries and parties are now individually taking preparatory steps towards the eventual MRV standardization.



Source: Institute of Global Environmental Strategy (IGES), *Measuring, Reporting and Verification: The Recent Trend and the Future Prospect of Discussions over the Next Framework of Global Climate Change*, Tokyo, December 2010.

Figure 4.1-1 Extensive Role of MRV in Clean Development Activities

## 4.2. PRESENT STANCE OF JICA REGARDING MRV PROCEDURE

Assuming, as judged from the on-going discussions over MRV rules, that the application of the MRV procedure to global warming mitigation projects become the international standard after 2013, JICA currently adopts the following steps regarding its lending to mitigation projects, with the proviso that the procedure would be appropriately revised along the progress of international MRV standardization.

- 1) The evaluation of a proposed mitigation project includes the quantitative assessment of its GHG emission reductions. CDM methodologies are consulted, among others, to perform such assessment.
- 2) In consultation and agreement with the host country or the host party, the quantified assessment results are set up as indicators with which to evaluate the subsequent project performance in emission reduction.
- 3) In consultation and agreement with the host country or the host party, the data of project assessment before lending decisions are officially announced. In the JICA procedure, the projects financed by Japan's ODA Loan are subjected to quantitative evaluation after two years since completion. This post-evaluation requires the statistical data prepared at the time of project appraisal.

The proposed trunk bus project in Belem has already passed the steps 1) and 2) above. Because of the scaling-down of the project, the assessment of emission reductions was updated on the basis of more precise data in the Study. The results of the updated assessment will be included in the agenda of loan negotiation between JICA and the State Government of Para (the updated data will be presented in the Project Memorandum at the signing of the Loan Agreement). Then follows the step 3) mentioned above. Namely, the assessment data will be made public pending the consent of the State Government of Para.

A Japan's ODA Loan project could be applied to the Clear Development Mechanism, when the project is judged highly likely to get the CDM approval, when the project host party has the clear intention of applying to the CDM procedure, and when the conditions for CDM application are satisfactorily met (e.g., strictly executed estimation of GHG emission reductions, favorable business environment for CER transactions, regular monitoring of emission reductions, validation and verification by DOEs, etc.). As for the proposed trunk bus project, the intention of the Brazilian side has been made clear at the time of loan negotiation between JICA and the State Government of Para, and recorded explicitly in the Memorandum of Understanding that were undersigned on March 10, 2011 by two parties.

## 5. CDM APPLICATION AND REGISTRATION

### 5.1. POSSIBILITY OF CDM REGISTRATION

#### 5.1.1. SIZE OF EMISSION REDUCTION

##### (1) Emission Reduction and Expected CER Acquisition

As mentioned in Chapter 3, the project activity emission of 99,888 tCO<sub>2eq</sub> and the emission leakage of 32 tCO<sub>2eq</sub> over 10 years means a reduction of 499,011 tCO<sub>2eq</sub> in relation to the baseline emission of 598,931 tCO<sub>2eq</sub>. In other words, the annual average emission reduction by the trunk bus project would be 49,901 tCO<sub>2eq</sub>.

The sales of certified emission reductions (CERs) are estimated for three alternative cases of low, medium and high, following the practice of BRT Bogota Colombia: TransMilenio Phases II to IV. The expected sales of CERs would amount to US\$3/tCO<sub>2eq</sub>, US\$10/tCO<sub>2eq</sub> and US\$18/tCO<sub>2eq</sub>, respectively, for the low, medium and high cases. According to the recent JBIC/Nikkei reporting on CER transactions<sup>1</sup>, the sales price ranges between US\$15.0/ tCO<sub>2eq</sub> and US\$20.2/ tCO<sub>2eq</sub> in 2010.

Unless the CER price plummets down considerably, the expected sales of CERs could cover the cost of monitoring and the verification fees paid to the DOE.

##### (2) Transfers (sales) of CERs

The issued CERs are distributed to the project participants according to their pre-agreed shares. Project participants in most CDM projects in Brazil are project executing or operating entities of the country and funds, banks and private companies of Annex I countries. The project executing parties acquire the entire CERs, or part thereof, and then transfer (or sell) them to the participating funds and banks. The transfers of this kind are now quite common. In recent years, unilateral CDM projects in which only the national parties participate have been increasing steadily in Brazil. The CER business is widely accepted in Brazil and CDM consultants and specialists act as brokers. The business environment for CER transactions is adequately developed in Brazil.

#### 5.1.2. ADDITIONALITY

To get the CDM approval, it is necessary to demonstrate in the Project Design Document (PDD) that a proposed project activity is additional to the situation where the said activity should be absent. The additionality is defined (cf. CDM Modalities and Procedures, Paragraph 43) as the reduction of anthropogenic emissions of greenhouse gases below those that would have occurred in the absence of the registered CDM project activity (i.e., baseline emissions). To prove the additionality, the project proponent must comply with the specifications of a CDM-approved baseline methodology. Many CDM-approved methodologies, including AM0031 selected for the trunk bus project, stipulate that the additionality be demonstrated by following the procedure specified in the “Tool for the Demonstration and Assessment of Additionality.”

The present Study focuses on the I-net trunk bus project which is a scale-down from the initial Y-net project proposed in the 2010 JICA Preparatory Survey. The I-net development excludes the trunk busway on Av. Augusto Montenegro and the trunk bus priority lanes in the Icoaraci area, but the trunk bus system itself remains unchanged. Because the scale-down concerns only the road network, it is arguable that the additionality of the proposed trunk bus system as demonstrated by the above-mentioned procedure should remain valid.

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<sup>1</sup> Japan Bank of International Cooperation (JBIC) and Nihonkeizai Shimbun Digital Media



### 5.1.3. AM0031 AND ITS APPLICATION

For the CDM project preparation, it is necessary to ascertain the availability of approved methodologies (AM). The proposed trunk bus project in Belem satisfies the necessary conditions for applying AM0031 which was developed and approved for BRT projects.

When no AM is available, the project proponent must develop a new methodology and get the formal approval of the CDM Executive Board. The process calls for time-consuming and intensive efforts. The profile of the trunk bus project satisfies the conditions of AM003 application, as mentioned above, and therefore the CDM application can go ahead without the protracted process of methodology development and approval.

### 5.1.4. CDM AND ODA

The Marrakech Accords of 2001 stipulated that CDM project activities should not be financed by ODA budgets. The project executing party needs to demonstrate in the national process of CDM application that the proposed CDM project activity would not be in contravention of the Accords, by attaching the official memorandum from the Brazilian side (project executing party) testifying to that effect.

### 5.1.5. POSSIBILITY OF CDM APPROVAL ON THE PROPOSED PROJECT

The possibility for the trunk bus project to get CDM registration is favorable. Firstly, as mentioned earlier, the project is estimated to realize the annual emission reduction of 49,901 tCO<sub>2eq</sub>. Secondly, the project has the demonstrable additionality and the justifiable compliance with the ODA-related injunction. Thirdly, Japan has already financed a few CDM projects from its ODA budget. Lastly, the project preparation can use the suitably available AM.

## 5.2. ROADMAP FOR CDM APPLICATION AND REGISTRATION

The Study Team prepared a road map to facilitate the activities required of the public consortium, covering the examination of D/D details to ascertain the possibility of CDM application, the preparation and submission of necessary documents to get the CDM approval and registration and the monitoring over the project operation.

The road map for the MRV process was drawn up in consultation with the counterpart agency of the Study by taking into account the schedule of project preparation and implementation, on the one hand, and the normal practices in Brazil of CDM application and registration, on the other.

- Formation of the CDM project management system: The first preparatory step is to establish a central institutional locus for developing the CDM-related procedure of monitoring. A new department or section need be created inside the public consortium to handle the necessary institutional development and initiate the MRV procedure.
- Facilitation of the CDM application procedure: The consultants prepare the draft PDD in the CDM-required format. The available DOE is selected concurrently for the evaluation and inspection of the draft PDD.
- Preparation and submission of application documents: After the formal DOE approval by the validation report, the PDD documents must be finalized and translated into Portuguese as DCP documents. The DCP, or the PDD written in Portuguese, is requisite in CDM application because only the documents written in Portuguese are legally binding in Brazil. The DCP documents are then submitted to ICGCC (Interministerial Commission on Global Climate Change) for examination and approval. The ICGCC approval is the final domestic step of the CDM procedure.
- Modification and revision: If the ICGCC approval is conditional, the Executive Secretary of ICGCC (Ministry of Science and Technology) sends a letter specifying what needs to be modified or revised. In such a case, the project documents must be properly modified or revised to obtain the ICGCC approval.

- Submission of application documents to the CDM Executive Board: After the ICGCC approval, the project documents will be submitted to the CDM Executive Board for examination and registration.
- Completion of CDM registration: After the approval by ICGCC, the project application is forwarded to the CDM Executive Board for examination, and when found satisfactory, the project is formally registered as a CDM project activity.
- Establishment of monitoring system: The project monitoring starts after CDM registration. At this stage, therefore, it is necessary to establish the system of monitoring for project operation.
- Start of project monitoring: The MRV system handles the collection and analysis of data relevant for project monitoring and the reporting thereof.

Table 5.2-1 Roadmap for CDM Application and Registration

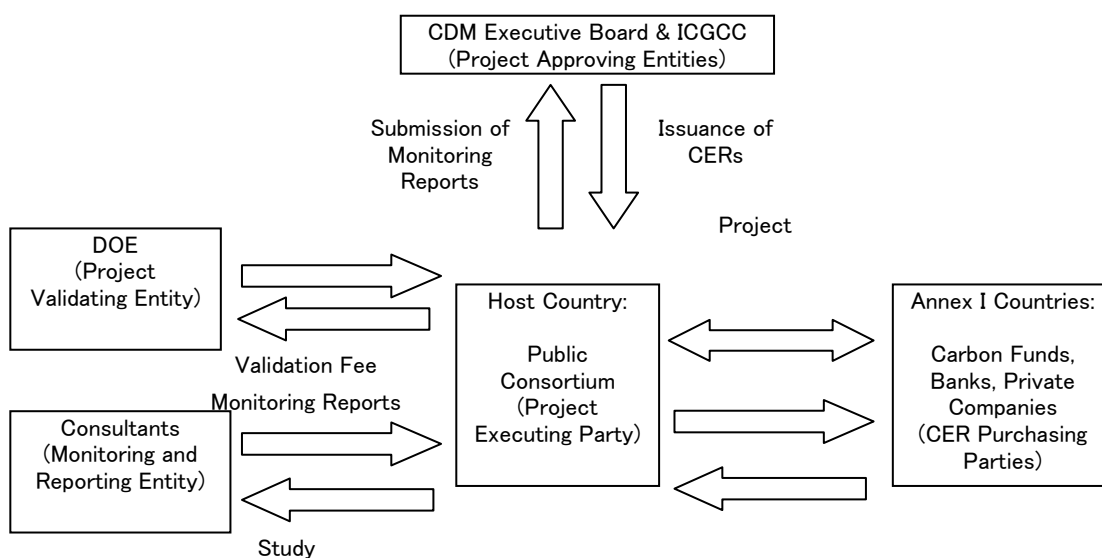
	2011	2012	2013	2014	2015	2016	2017
<b>Implementation Plan for Trunk Bus System</b>							
Procedure of ODA Loan Process							
Selection of Consultant							
Pre-Qualification (PQ)							
Bidding by Consultants							
Consultant Contract, L/C Opening							
Construction of Trunk Bus System							
Detailed Design							
Tendering Assistance							
Management and Supervision							
Construction of Trunk Bus System							
Operation of Trunk Bus System							
<b>CDM Procedure</b>							
Formation of MRV System and Procedure							
Executing Entity							
Technical Training							
Modifications and Improvements of MRV System							
Procedural Activities							
Selection of Consultant							
Preparation of PDD Draft Final by Consultant							
Selection of DOE							
Preparation of Application Documents							
DOE Contract							
Finalization of PDD							
Translation of PDD to DCP							
Validation by DOE							
Preparation of Other Documents							
Submission of Application Documents to ICGCC							
Modifications and Revisions of Application Documents							
ICGCC Approval (End of National Application Procedure)							
Procedural Activities after ICGCC Approval							
Consultations with ICGCC							
Declarations of Project Participants							
Review of MRV System and Procedure							
Submission of Project Documents to CDM EB							
Modifications and Revisions of Documents							
Completion of CDM Registration							
Establishment of MRV System and Procedure							
Start of Monitoring							
Data Collection							
Support to Country Data Analysis							
Preparation of Monitoring Report							

### 5.3. ISSUES IN CDM APPLICATION AND REGISTRATION

#### 5.3.1. DECLARATIONS OF CDM PROJECT PARTICIPANTS AND CER TRANSACTIONS

The required documentation for CDM application includes the declarations of project participants and the transactional scheme of acquired CERs.

Probable participants in the Belem BRT project and the image of CER transactions among them are shown in Figure 5.3-1. The declared participants in a CDM project have to establish the ratios of sharing CERs. The purchasers of CERs must exchange emission reduction purchase agreements (ERPAs), with the public consortium. The transfers (or sales) of CERs must be transacted in accordance with ERPA stipulations. The terms of purchase agreements must be carefully thought out and worded in order to avoid unnecessary risks to the participants.



Note: ERPA (Emission Reduction Purchase Agreement)

Figure 5.3-1 Project Participants and the Flow of CER Transactions in the Proposed Project

#### 5.3.2. PROLONGED PROCESS FROM CDM REGISTRATION TO CER ACQUISITION

The average elapse of time between CDM registration and CER acquisition based on monitoring procedure become more long term. Apparently, monitoring and reporting activities of the quality level readily verifiable by DOEs impose an increasingly heavy burden on the project executing parties.

Regarding the transport sector, the projects required on average 267 days (about 9 months) to complete the verification process by the respective DOEs. The duration is about 50% longer than the CDM projects of other sectors. This is partly because CDM projects in the transport sector are yet very few. It might be said that the experience and expertise in monitoring and verification activities are yet inadequately developed.

Brazil has no registered CDM project in the transport sector. Accordingly, it is better to allow adequate time span in scheduling for the procedural activities of measuring, reporting and verification.

### **5.3.3. COSTS OF MONITORING AND REPORTING**

Supposing that the proposed trunk bus project in Belem successfully seeks CDM registration, the project executing party, the public consortium, would have to bear the responsibility of monitoring and reporting. It would be a heavy burden for the consortium to prepare the monitoring reports to the quality level required by the DOE verification. For example, the interview survey has to be conducted six times a year, incurring considerable expenditure on the part of the consortium.

The Study expects that the estimated CER sales in the range of US\$0.6 and 3.8 million would meet the costs of monitoring, reporting and verification. However, the growing period of time between CDM registration and CER acquisition suggests that the public consortium must secure an adequate amount of budget for monitoring during the waiting period.

### **5.4. IMPORTANCE OF CDM REGISTRATION FOR THE PROPOSED PROJECT**

The Government of Para State was the first in Brazil to launch community greening projects (Municípios Verdes) and has been actively supporting various environmental conservation efforts. The proposed trunk bus project in Belem is consistent with the environmental policy stance of the State Government of Para. The implementation of the project according to the CDM protocol will effectively appeal the conservation efforts in the State of Para. The project not only brings monetary benefits in the form of CER acquisition but makes an effective public relations statement about the public administration.

## **6. MONITORING SYSTEM ON CDM PROJECT**

### **6.1. OUTLINE OF MONITORING SYSTEM AND PROCEDURE**

#### **6.1.1. MONITORING SYSTEM ON CDM REGISTRATION OF PROPOSED PROJECT**

The 2010 Preparatory Survey estimated the GHG emission reduction realizable by the implementation of the trunk bus project. The said Study examined furthermore the possibility of registration in the Clean Development Mechanism (CDM) and acquisition of the Certified Emission Reduction (CER). The Clean Development Mechanism was proposed in the Kyoto Protocol of 1997 and subsequently launched.

The Counterpart Team of the Study intends to seek CDM registration of the proposed trunk bus project. Accordingly, the project host party must establish the system and procedure of monitoring and actually undertake monitoring activities.

#### **6.1.2. PROJECT HOST PARTY RESPONSIBLE FOR MONITORING SYSTEM AND PROCEDURE**

##### **(1) Public Consortium**

Through the discussions with the Counterpart Team, the Study Team understands that the public consortium would shoulder the responsibility of CDM application and the accompanying monitoring activities. The Counterpart Team will soon begin to examine the possible organizational set up appropriate for the consortium to establish and manage monitoring activities.

##### **(2) Role of the Public Consortium in CDM Application**

The expected role of the project host party in the process of CDM application and registration is explained in some detail.

- 1) Before CDM Application
  - Formation of the CDM project management system
  - Various adjustments associated with PDD preparations
- 2) During Application Procedure
  - Submission of the application documents with the forward letter to ICGCC
  - Various adjustments before submitting the nationally approved project documents to the CDM Executive Board
- 3) After CDM Approval and Registration
  - Writing and submission of monitoring reports
  - Submission of CDM-related data to ICGCC

### **6.2. PREPARATION FOR CDM APPLICATION AND APPROVAL**

#### **6.2.1. PROCEDURE OF CDM APPLICATION IN BRAZIL**

The national procedure of CDM application is well established in Brazil. The ICGCC (Interministerial Commission on Global Climate Change) is acting as the designated national authority (DNA) as required by the Clean Development Mechanism. ICGCC meets every two months, or six times a year, to examine applied project documents. Figure 6.2-1 shows the national procedure of CDM application and approval.

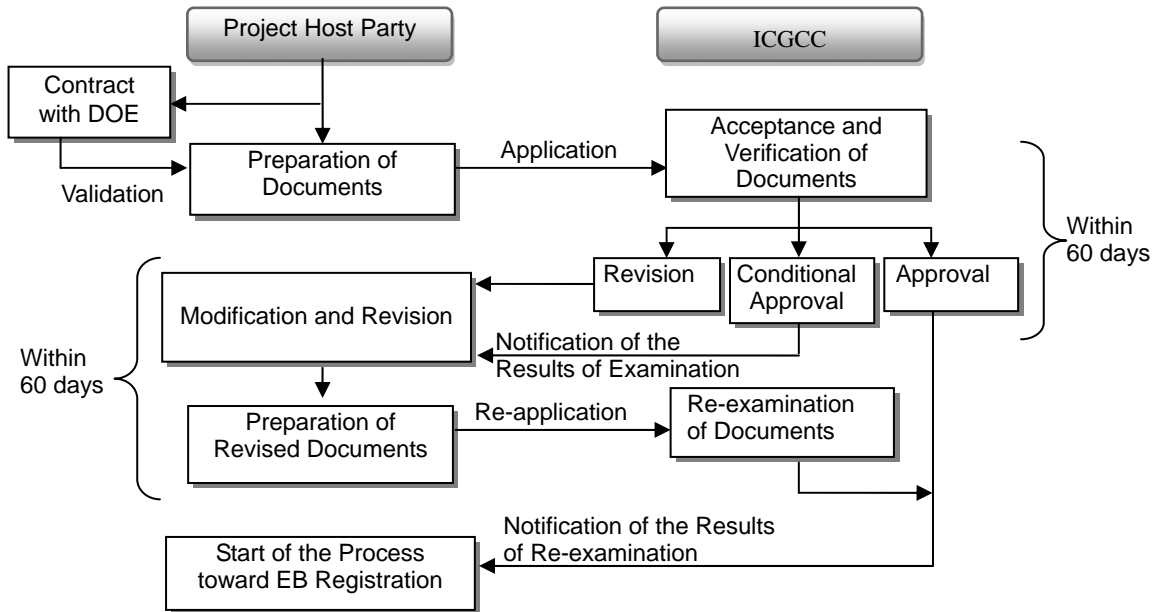


Figure 6.2-1 National Procedure of CDM Application and Approval

### 6.2.2. PROCEDURE FOR EB REGISTRATION AFTER ICGCC APPROVAL

After ICGCC approval in Brazil, the application procedure is brought up to the CDM Executive Board. When the proposed project activity is approved and registered at this level, it becomes a CDM project. The procedural steps after ICGCC approval are as follows.

- The letter of approval sent from the ICGCC Executive Secretary to the applicant
- Submission by the DOE of PDD and other documents to the UNFCCC Secretariat
- Close examination by CDM Executive Board members of the application documents, and when judged satisfactory, CDM registration

### 6.2.3. OUTLINE OF PDD

According to the latest form in force (Version 3), the PDD contents are structured as follows.

<p>Contents</p> <p>A. General description of project activity</p> <p>B. Application of a baseline and monitoring methodology</p> <p>C. Duration of project Activity / crediting period</p> <p>D. Environmental impacts</p> <p>E. Stakeholders' comments</p> <p>Annexes</p> <p>Annex 1: Contact information on participants in the project activity</p> <p>Annex 2: Information regarding public funding</p> <p>Annex 3: Baseline information</p> <p>Annex 4: Monitoring plan</p>
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### 6.2.4. STEPS UP TO CDM APPROVAL

The public consortium starts the preparation of CDM application while the D/D work is underway. The D/D stage would begin with the posting of consultants' pre-qualifications, followed by bidding by consultants and the selection of a consultant for D/D. After the completion of D/Ds, contractors are selected for construction works. When the construction is over, the trunk bus system begins its operation after the test run.

As mentioned earlier in the roadmap for CDM registration in Section 5.2 of Chapter 5, the CDM-related preparation is initiated concurrently with this process in consideration of study results of a Detailed Design Stage.

### 6.3. ORGANIZATIONAL SETUP FOR MONITORING

#### 6.3.1. ORGANIZATION FOR MONITORING SYSTEM

The public consortium newly organized for the trunk bus operation will act as the project host party in the CDM-related monitoring process. The actual monitoring tasks and the reporting of the findings will be undertaken by the consultants in contract with the consortium. Figure 6.3-1 shows the outline of the monitoring system and procedure for the trunk bus project.

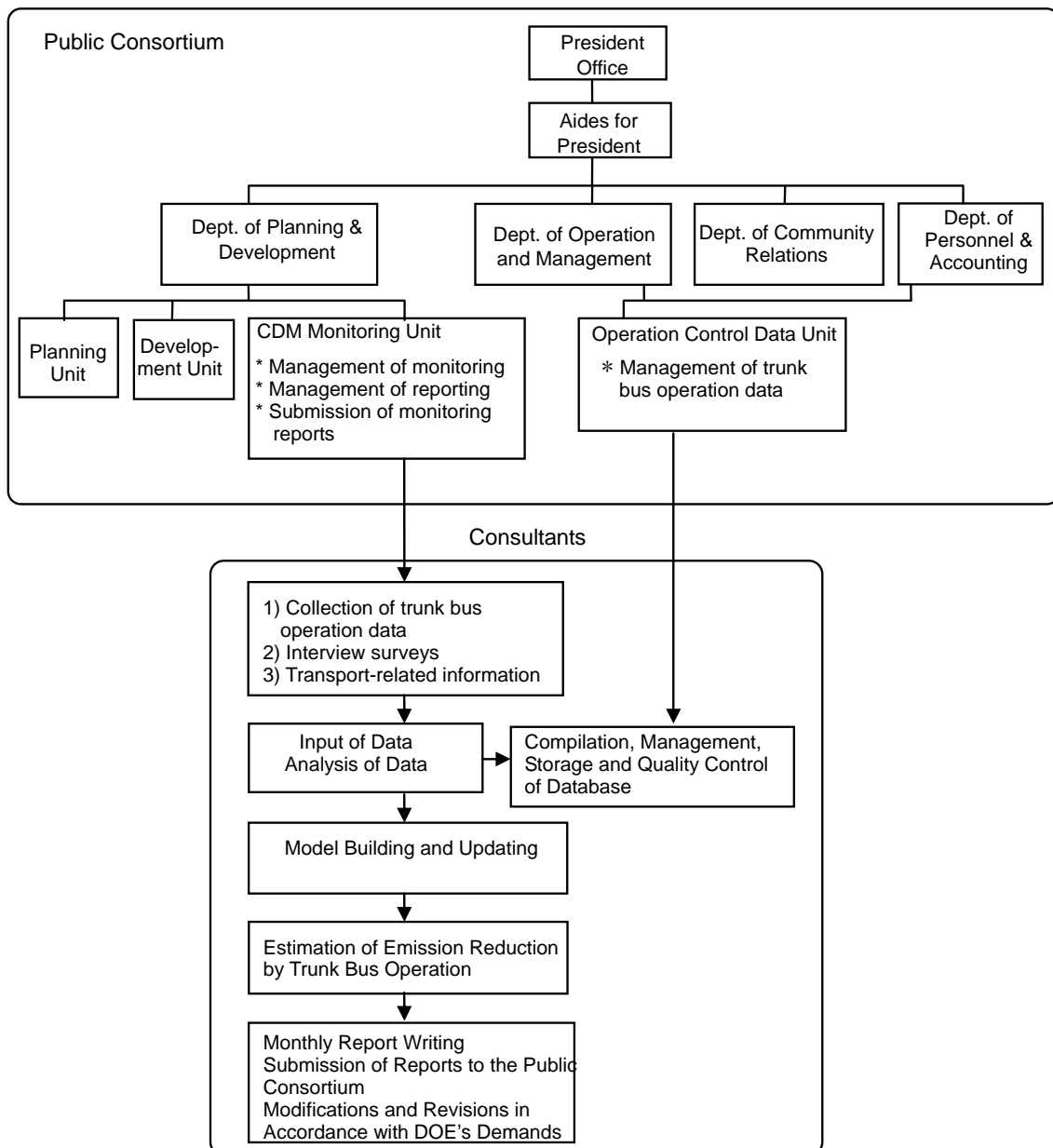


Figure 6.3-1 Outline of Monitoring System on CDM Project



### **6.3.2. ROLE OF THE PUBLIC CONSORTIUM**

The tentative organizational structure of the public consortium has been under consideration. There would be four operational departments: namely, Planning and Development, Operation and Management, Community Relations and Personnel and Accounting. The CDM monitoring unit might be set up in the Dept. of Planning and Development. This unit will be in charge of four monitoring activities listed below. The actual undertaking of these tasks is to be contracted out to consultants. The public consortium checks the contents of the monitoring reports from the consultants and forwards them to the DOE for verification.

The main responsibilities of the public consortium are as follows.

1. Collection and compilation of all the monitored data about the trunk bus system
2. Quality control of the database and information as stipulated in the manual
3. Keeping the documents in custody in the manner and at the timing as stipulated in the manual
4. Inspection and evaluation of the monitoring reports submitted by the consultants

### **6.3.3. ROLE OF CONSULTANTS**

The private sector consultants that win the contracts conduct various tasks of monitoring and write up the reports. Their tasks must be carried out strictly according to the monitoring plan included in the PDD and the procedure stipulated in the approved methodology used in the PDD.

- 1) Data Collection
- 2) Estimation of CO<sub>2</sub> Emission Reductions
- 3) Quality Control of Database
- 4) Interactions with DOE (Designated Operational Entity)

## **6.4. MONITORING PLAN**

### **6.4.1. OUTLINE OF MONITORING PLAN**

The basic requirement of the monitoring plan is to estimate the baseline emissions and the actual reduced CO<sub>2</sub> emissions by the project activity. The procedure consists of collecting measurable data and other relevant information and estimating the emission reductions by using the collected data and the parameters stipulated in the approved methodology (AM).

### **6.4.2. APPLICATION OF AM0031**

#### **(1) Outline of AM0031**

The CDM approved methodology chosen for the trunk bus project is AM0031: namely, "Baseline Methodology for Bus Rapid Transit Projects." The applicability of this AM was examined in some detail in the 2010 Preparatory Survey. AM0031 is applicable to those bus projects that aim to reduce GHG emissions by the construction and operation of trunk bus systems. It is suited to the projects which try to expand the existing bus system by adding bus routes and other facilities.

#### **(2) Scenario for GHG Emission Reductions**

The trunk bus project in Belem proposes to construct trunk bus exclusive road on the right of way of some existing roads and operate a fleet of articulated buses with large passenger capacity. The project provides Belem with a mass rapid transit system which would transport passengers more efficiently at rapid operational speed. The number of the operated bus fleets will be substantially reduced, thus easing the chronic problem of traffic congestion during peak hours.

AM0031 is used to estimate the emissions with the project and the emissions without the project (baseline emissions). The difference between the two is the emission reduction resulted from the trunk bus project.

#### **6.4.3. METHODS OF DATA COLLECTION**

##### **(1) Data Monitoring of Trunk Bus Operation**

The actual GHG emissions are calculated from the measurable performance of the trunk bus system in operation.

##### **(2) Data Monitoring for the Baseline Scenario**

The estimation of the baseline emissions requires the modal shares in the supposed absence of the trunk bus system. As mentioned earlier, it is necessary to understand the modal choices of the trunk bus passengers if the trunk bus system should not be in service. Interview surveys need be conducted to measure the stated preferences of modal shift among the trunk bus passengers.

The modal split obtained from SP surveys is then input to the demand forecast model. The resulting modal traffic share provides the database for AM0031 to estimate the baseline emissions.

#### **6.4.4. CONTENTS OF MONITORING REPORTS**

The monitored measurable data, the modal traffic forecast based on such data and the emission estimates are written up as monitoring reports. The reports must be submitted to the third party DOE for verification.