DATA COLLECTION SURVEY ON DEVELOPMENT OF MEASUREMENT, REPORT AND VERIFICATION (MRV) SYSTEM IN URBAN RAILWAY SECTOR IN VIETNAM

FINAL REPORT

FEBRUARY 2021

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ALMEC CORPORATION

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Table of Contents

List of Figures and Tables

Abbreviations

ADB	Asian Development Bank
CO_2	carbon dioxide
CDM	Clean Development Mechanism
DONRE	Department of Natural Resources and Environment
DOT	Department of Transport
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HAIDEP	The Comprehensive Urban Development Programme in Hanoi Capital City of the Socialist Republic of Vietnam
HCMC	Ho Chi Minh City
HMC	Hanoi Metro One Member Company
JICA	Japan International Cooperation Agency
MARD	Ministry of Agriculture and Rural Development
MAUR	Management Authority for Urban Railways
MCPT	Management Center for Public Transport
MOCPT	Management & Operation Center for Public Transport
MOIT	Ministry of Industry and Trade
MONRE/DCC	Ministry of Natural Resources and Environment/ Department of Climate Change
MOT/DOE	Ministry of Transport/ Department of Environment
MPI	Ministry of Planning and Investment
MRT	Mass Rapid Transit
MRB	Hanoi Metropolitan Railway Management Board
MRV	Measurement, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NC	National Communication
NDC	Nationally Determined Contribution
PTA	Public Transport Authority
SPI-NAMA	Project to Support the Planning and Implementation of NAMAs in a MRV Manner (JICA)
TRAMOC	Public Transport Management and Operation Center
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Vietnam Railway Corporation
WB	World Bank

EXECUTIVE SUMMARY

INTRODUCTION

1. Since 2009, the Japan International Cooperation Agency (JICA) has supported Vietnam in the field of climate change such as by co-financing a program loan together with other donors and by providing a technical cooperation project that aim to enhance the capabilities of central and local governments through the development and implementation of Nationally Appropriate Mitigation Actions (NAMAs).

2. In this JICA-funded **Data Collection Survey on the Development of Measurement, Report and Verification (MRV) System in the Urban Railway Sector in Vietnam**, an MRV framework and methodology applicable to urban railway projects in the cities of Hanoi and Ho Chi Minh (HCM) was proposed, and greenhouse gas (GHG) emission reductions were estimated. Survey results aim to contribute the following:

   - Implementation of Vietnam's Nationally Determined Contribution (NDC) to reduce GHG emissions;
   - At the national level, formulation and promotion of an MRV circular by the Ministry of Natural Resources and (MONRE);
   - At the sector level, formulation and promotion of the MRV circular by the Ministry of Transport (MOT);
   - At the city level, promotion of the MRV system to users in Hanoi City and HCMC;
   - Quantification of GHG emission reductions in JICA-funded urban railway projects in Vietnam; and
   - Promotion of urban railway projects as a measure to reduce GHG emissions and air pollution in Vietnam and other countries.

3. This survey, which started in March 2019 and is scheduled to end in September 2020, focused on three (3) MRT lines, namely Line 1 and Line 2 in Hanoi City and Line 1 of HCM City.

PROPOSED MRV SYSTEM FOR THE URBAN RAILWAY SECTOR

4. To gauge the impact of an urban railway project, the JICA Team has proposed a methodology for calculating and monitoring GHG emission reductions using a simple but sufficient calculation formula, as well as data from daily routine operation and local default values (Figure S1).

$$ER_y = BE_y - PE_y$$

BE_y	Baseline emission in year y (tCO_2/year)
PE_y	Project emission in year y (tCO_2/year)
ER_y	Emission reduction in year y (tCO_2/year)

$$BE_y = \sum_i \left(PKM_y \times MS_{i,y} \times EF_{PKM,i} \times 10^{-6}\right) \qquad EF_{PKM,i} = \frac{EF_{KM,i}}{OC_i}$$

PKM_y	Transported volume by MRT in year y (passenger-km/year)
$MS_{i,y}$	Share of passengers using transport mode i in the baseline in year y
$EF_{PKM,i}$	CO_2 emission factor per passenger kilometer for transport mode i (gCO_2/passenger-km)
$EF_{KM,i}$	CO_2 emission factor of transport mode i (gCO_2/km)
OC_i	Average occupation rate of transport mode i (passenger/vehicle)
i	1; Passenger car, 2; Bus, 3; Motorcycle, etc.

$$PE_y = PKM_y \times EF_{PKM,MRT} \times 10^{-6}$$

PKM_y	Transported volume by MRT in year y (passenger-km/year)
$EF_{PKM,MRT}$	CO_2 emission factor per passenger kilometer for MRT (gCO_2/passenger-km)

Figure S1 Comparison of Baseline and Project Emissions to Calculate Emission Reductions

5. For operationalizing the proposed MRV system, various agencies will have to undertake specific tasks. Data collection and GHG emission calculation will be done by MRT operators and their management authorities. These data will be reported to the Department of Transport (DOT) of Hanoi and HCM cities, which will in turn share them with the cities' respective Departments of Natural Resources and Environment (DONREs). Sector-wise and city-wide MRV reports will be submitted regularly to the MOT and MONRE, respectively. Finally, MONRE will report all remarkable MRV activities to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat.

ESTIMATION OF GHG EMISSION REDUCTIONS FROM JICA-FUNDED MRT LINES

6. Currently, JICA financially supports three (3) MRT lines in Vietnam, i.e., Hanoi MRT Line 1 (Ngoc Hoi–Yen Vien, 28.6 km), Hanoi MRT Line 2 (Nam Thanh Long.–Tran Hung Dao, 11.5 km), and HCM MRT Line 1 (Ben Thanh– Suoi Tien Terminal, 19.7 km). But none of them was operational during the survey period.

7. The JICA Team estimated the lines' GHG emission reductions after operation by using various data such as existing traffic data, the results of the team's interview survey (around 2,000 residents and around 100 taxi/bus drivers per line) done in July and August 2019, traffic demand forecasts (previous relevant JICA reports), and international and local data (CO_2 emission factors among vehicle types).

8. Results showed that the estimated emission reductions of Hanoi Line 1, Line 2 and HCMC Line 1 are 54,541 tCO_2/year, 39,614 tCO_2/year, 56,877 tCO_2/year, respectively (Table S1). They are equivalent to 0.20 to 0.25 $kgCO_2$ emission reductions per passenger. Regarding public perception, the interview survey revealed a high interest in using the MRT. The shares of local residents who

were willing to use it were 66% (Hanoi Line 1), 30% (Hanoi Line 2), and 81% (HCMC Line 1). HCMC residents showed the highest share since they actually saw the railway structure and stations during the survey period.

Table S1 Estimated GHG Emission Reductions

Emission	Hanoi		HCMC
	Line 1	Line 2	Line 1
Baseline emission (tCO_2/year)	130,492	93,711	133,916
Project emission (tCO_2/year)	75,951	54,097	77,040
Emission reduction (tCO_2/year)	**54,541**	**39,614**	**56,877**

RECOMMENDATIONS

9. The following are recommended to the MOT, MONRE, and related agencies to implement an effective MRV system for urban railway in Vietnam:

   I. The MOT must formulate a circular stipulating the development of an electronic MRV system for the transport sector;

   II. Existing bureaucratic and statistical systems must be utilized to avoid excessive burden of data collection. The MOT and/or DOTs in both cities must prepare two important data in calculating GHG emission reductions. These are: (i) CO_2 emission factors per passenger-km by transport mode, and (ii) previous or alternative transport mode shares of MRT passengers in the baseline emission.

   III. MOT and MONRE must provide training opportunities to enable assigned staff to correctly undertake MRV-related work such as the calculation of GHG emission reductions. External assistance from donors, e.g., JICA, may be helpful especially in the early stages of implementing the MRV system.

   IV. A pilot project must be conducted to test the proposed MRV system right after the first MRT line starts operation in Vietnam, which will likely be HCMC MRT Line 1 or Hanoi MRT Line 2A.

1. Background and Objectives

1.1 Background

Vietnam is one of the countries that will be seriously affected by climate change. According to Vietnam's Second National Communication (NC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, the average temperature in the country increased by 0.5 to 0.7 degree Celsius over the past 50 years and the sea level rose 20 cm. Under these circumstances, in order to mitigate the negative effects of climate change, the Government of Vietnam submitted the Nationally Determined Contribution (NDC) on greenhouse gas (GHG) emission reductions to the UNFCCC in September 2015 and signed the Paris Agreement in 2016. The country's Ministry of Natural Resources and Environment (MONRE) submitted the draft Government Decree on "Roadmap and Measure for GHG Emission Reduction" to the Prime Minister's Office in December 2019. Once the revised Law on Environment Protection is passed by the National Assembly in October 2020, MONRE will draft a Decree on Climate Change Response which is expected to include the content of the draft Roadmap Decree for regulations on GHG mitigation. In 2021, under this new decree, MONRE will have to develop a Circular on the national MRV and following that guidance, each ministry will have to formulate their own circular on the measurement, reporting, and verification (MRV) of GHG emissions for each sector.

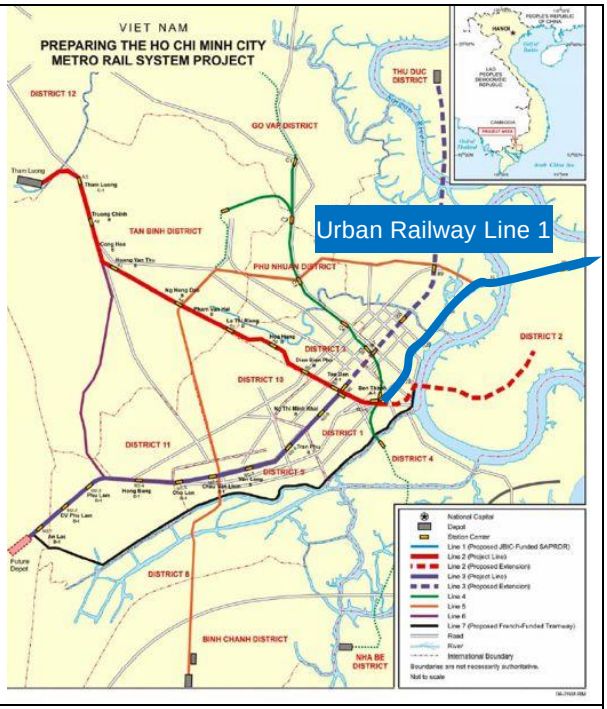
Regarding urban railway projects, which can also help reduce GHG emissions, the Ministry of Transport (MOT) prepared the urban railway development policy for both Hanoi and Ho Chi Minh cities in 2008, called the 2008 Master Plan. The Plan was revised in 2013 and 2017, and in each revision, the urban railway network was expanded, and the planned route length was extended. By 2018, Hanoi had a plan for 10 urban railway routes with a total length of 418 km. Ho Chi Minh City (HCMC) had a plan for eight urban railway routes with a total length of 169 km, in addition to three tram and monorail routes with a total length of 57 km (Figure 1-1). Currently, there is no urban railway in operation in both cities; however, by the middle of the 21st century, both cities will have urban railway networks that will be comparable to mega-cities in developed countries.

In the NDC, the development of public transportation, especially the fast mode of transit in large cities, is stated as one of the GHG mitigation actions in the transport sector in Vietnam.

Since 2009, JICA has implemented the Climate Change Program Loan in Vietnam called Support Program for Response to Climate Change (SPRCC) with co-financing from multiple donors. JICA has also supported the enhancement of capabilities of the central and local governments for the development and implementation of Nationally Appropriate Mitigation Actions (NAMAs) with a Technical Cooperation Project to Support for Planning and Implementation of Nationally Appropriate Mitigation Actions in a MRV Manner (SPI-NAMA). For future JICA activities, a new program to develop a policy framework for implementation of Vietnam's NDC is under consideration..

In this JICA-funded data collection survey, an MRV framework and methodology applicable to urban railway projects in Hanoi and Ho Chi Minh cities will be proposed, and GHG emission reductions will be estimated.

Hanoi City



Ho Chi Minh City

Source: Prepared by the JICA Study Team based on MOT figures

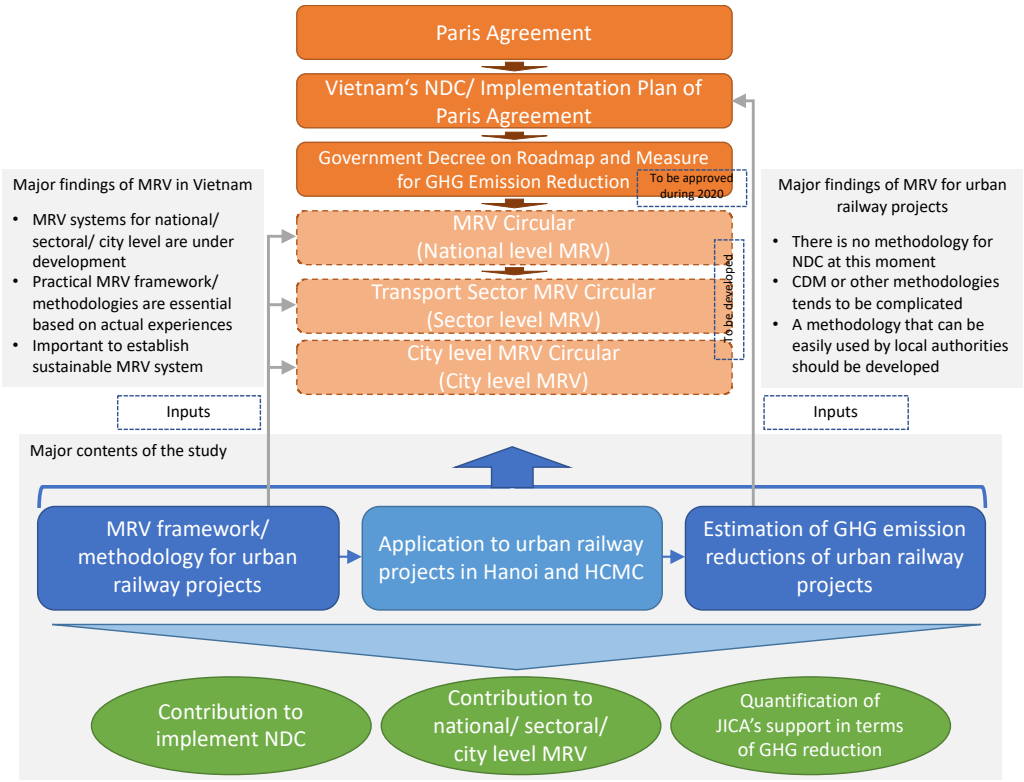
Figure 1-1 Urban Railway Development Plan of Hanoi City and Ho Chi Minh City and Target Lines of the Survey

1.2 Objectives

Through data collection, analysis, and proposal for an MRV framework/methodology on GHG emission reductions for three urban railway projects in Vietnam, i.e., Hanoi City's Urban Railway Line 1 and Line 2, and HCMC's Urban Railway Line 1, this Survey aims to contribute to the following:

- Implementation of Vietnam's NDC,
- Formulation and promotion of the MRV Circular of MONRE (national-level MRV),
- Formulation and promotion of the MRV Circular of the MOT (sector-level MRV),
- Promotion of MRV in Hanoi City and HCMC (city-level MRV),
- Quantification of GHG emission reductions of urban railway projects supported by JICA, and
- Quantification of GHG emission reductions of other urban railway projects in Vietnam and other countries, and promotion of practical MRV.

Figure 1-2 shows the background, issues, and contents of this Survey.

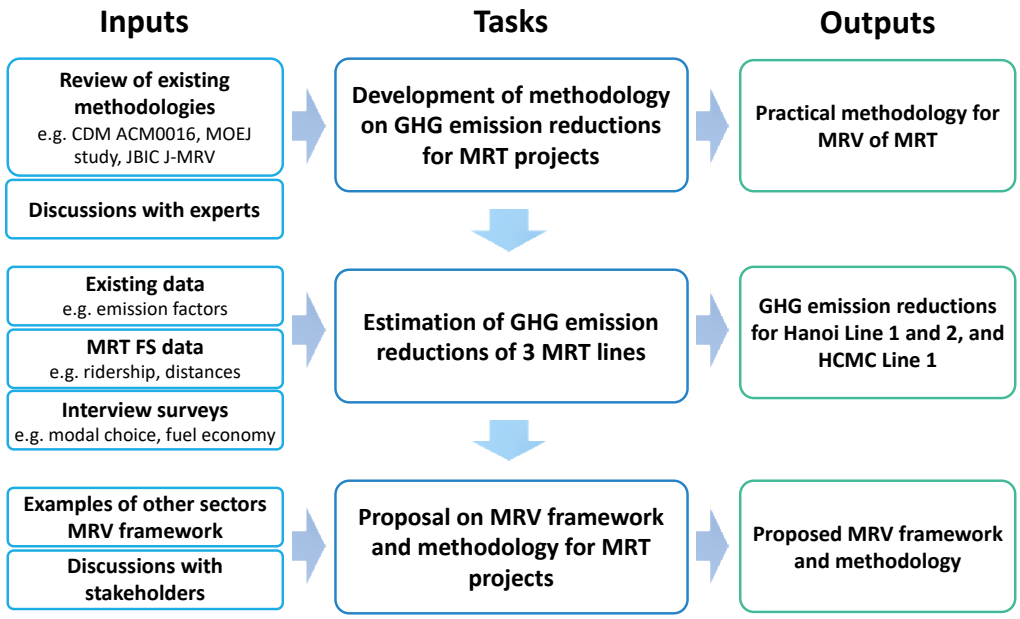


Source: JICA Study Team

Figure 1-2 Outline of the Survey

1.3 Survey Flow

Figure 1-3 shows the flow of this Survey.



Source: JICA Study Team

Figure 1-3 Study Flow

2. Development Status of Urban Railways in Hanoi City and Ho Chi Minh City

2.1 Status of Urban Railway Development in Hanoi City and Ho Chi Minh City

1) Hanoi City

The first urban railway plan in Vietnam was made in 1998 for Hanoi City. From 2004 to 2007, JICA assisted the Hanoi People's Committee in preparing a comprehensive urban development plan under the project entitled "The Comprehensive Urban Development Programme in Hanoi Capital City" or HAIDEP. HAIDEP identified four (4) MRT routes with a total length of 101 km. After HAIDEP, route-wide feasibility studies were conducted. The latest MRT network plan has been approved by Decision No. 519/QD-TTg (dated 31 March 2016) approving the transportation plan for Hanoi capital for 2030 with a vision up to 2050.

The latest official plan has nine (9) routes with a length of over 400 km in total. Among them, four (4) routes are under implementation (Figure 2-1 and Table 2-1).

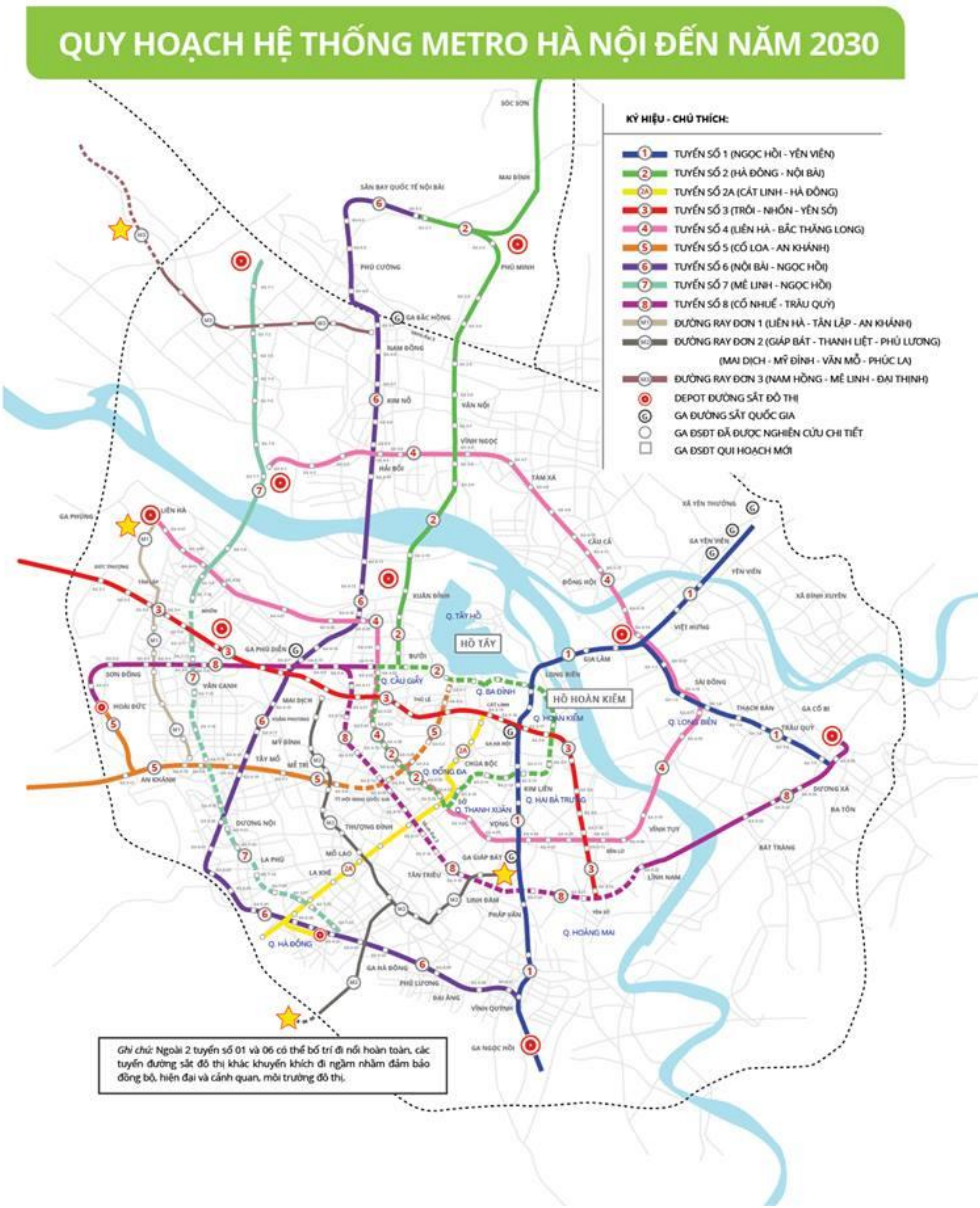
The earliest operation may be done by Line 2A (Cat Linh–Ha Dong, 14 km). The trial operation started in September 2018. As of October 2019, however, the date of system transfer from a Chinese engineering, procurement and construction (EPC) contractor to the Vietnamese owner (Hanoi Metropolitan Railway Management Board or MRB) is still uncertain due mainly to a safety certification process by a third party.

Line 3 is under construction, and it is expected to start operation in 2023. The construction schedule has not been determined for the two JICA-assisted projects of Line 1 and Line 2.

2) Ho Chi Minh City (HCMC)

In HCMC, Decision No. 568/QD-TTg (dated 8 April 2013) approved for the Adjustment of transportation development planning of HCMC by 2020 and vision after 2030. This latest MRT network plan proposed eight (8) routes with a total length of 167 km (Figure 2-2).

JICA assists the Management Authority for Urban Railways (MAUR), which is under the Ho Chi Minh People's Committee, to implement the Line 1 Project (Ben Thanh–Suoi Tien Terminal, 19.7 km) which will become operational by the end of 2021. In regard to the Line 2 Project (Tham Luong–Thu Thiem, 19.1 km), MAUR is currently undertaking land clearance and bidding preparation.



Source: Hanoi MRB

Figure 2-1 Approved Urban Railway Network Plan for Hanoi

Table 2-1 Status of Urban Railway Development in Hanoi

No.	Line	Length (km)			Status
		Elevated	Underground	Total	
1	Line 1: Ngọc Hồi–Yên Viên	28.6	-	-	Project under revision
2	Line 2: Nam Thăng Long–Trần Hưng Đạo	2.6	8.9	11.5	Project under revision
3	Line 2A: Cát Linh–Hà Đông	13.0	-	13.0	Ongoing
4	Line 3: Nhổn–Hanoi station	8.9	3.6	12.5	Ongoing

Source: Hanoi MRB

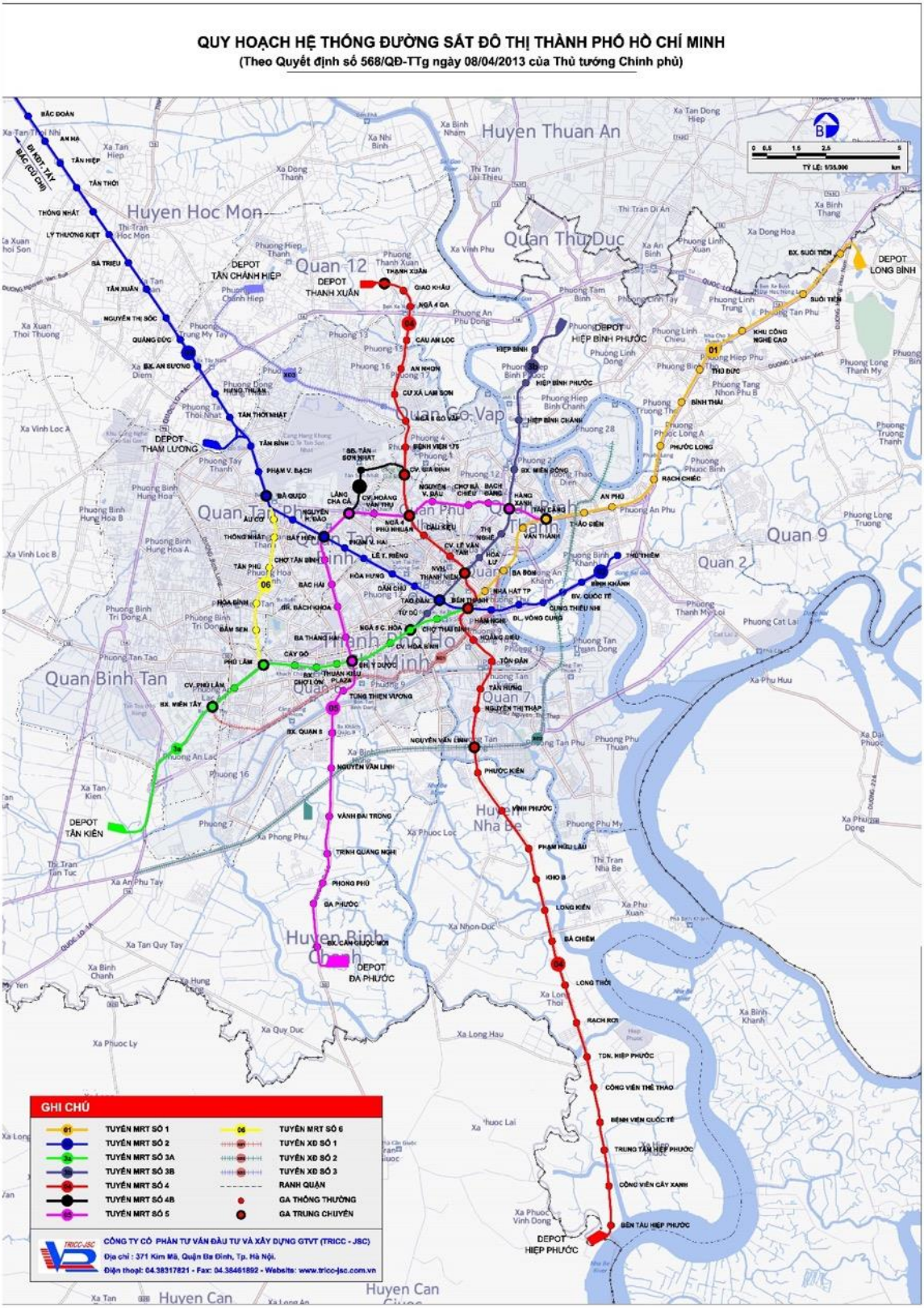


Figure 2-2 Approved Urban Railway Network Plan for HCMC

2.2 Establishment of Urban Railway Management and Operating Companies

JICA has extended several technical assistance projects on institutional and organizational preparation for urban railway management and operation. These are:

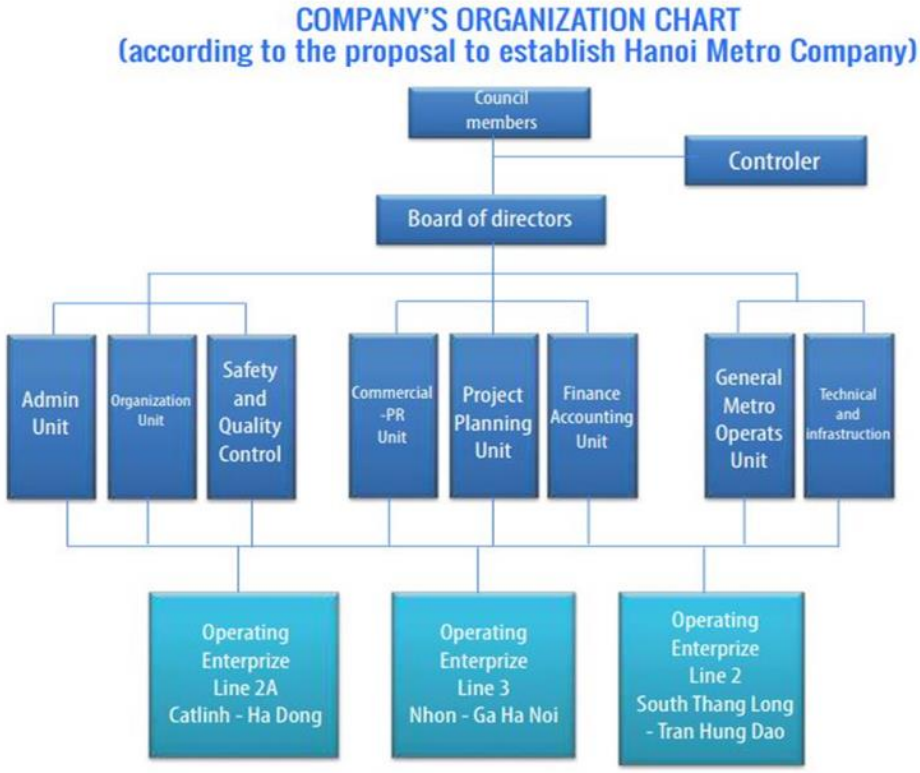
- The Project for Support on Setup of Operation & Maintenance Company of Urban Railways in HCMC (2011–2013)
- Technical Assistance Project to Strengthen the Capacity of Regulator and To Establish Operation and Maintenance Company of Metropolitan Railway Lines in Hanoi City (2013–2016)
- SAPI for Preparation of Management System of Urban Railways in HCMC (2014–2016)
- The Project for Strengthening Management Ability of Operation & Maintenance Company for the Opening of Urban Railway Line 1 in HCMC (TC2, 2018–ongoing)

Based on the above-mentioned project experiences and other local resources, urban railway operation and maintenance companies have been established in both the cities of Hanoi and Hochiminh. They are as follows:

Hanoi City: In June 2015, Hanoi Metro One Member Company Limited (HMC) was established under Decision no. 6266/QD-UBND of the Hanoi People's Committee to operate the Hanoi metro rail system. The organizational structure envisions the creation of individual operating enterprises for the respective metro lines once the lines have been transferred from the respective contractors (Figure 2-3).

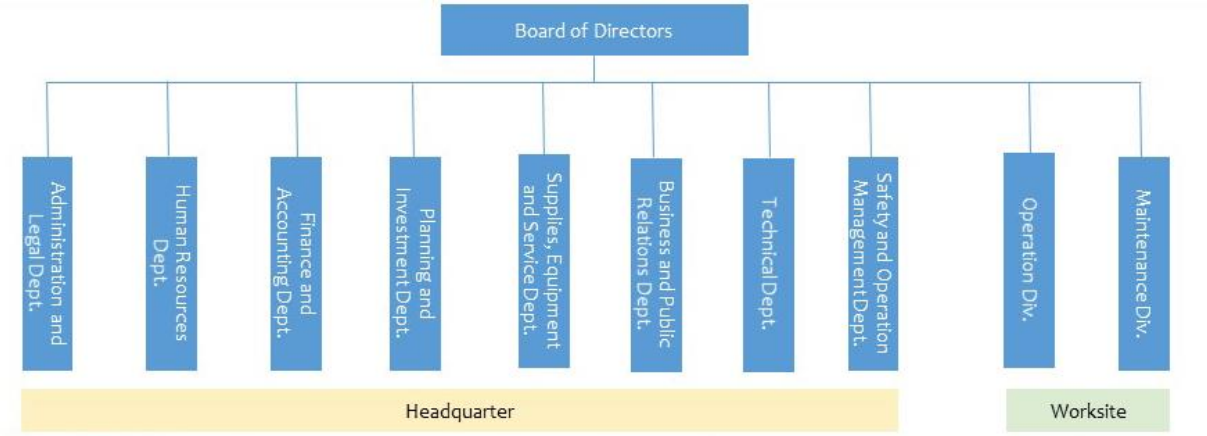
HCMC: In December 2015, the HCMC People's Committee established HCM Urban Railway Line 1 Co., Ltd. The company will be expanded to handle other metro lines as the metro network is developed further. Capacity development is currently undertaken in the ongoing JICA TC2 project (Figure 2-4).

These urban railway operations and maintenance companies will be able to produce essential primary data for the urban railway MRV system to be developed in this study. Therefore, this study paid attention to the companies and their preparation before the start of their operations in such matters as organizational structure, operations manual, staffing, and staff training.



Source: Hanoi Metro Company

Figure 2-3 Organizational Structure of Hanoi Metro Company



Source: JICA TC2 Project

Figure 2-4 Organizational Structure of HCMC Urban Railway Line 1 Co., Ltd.

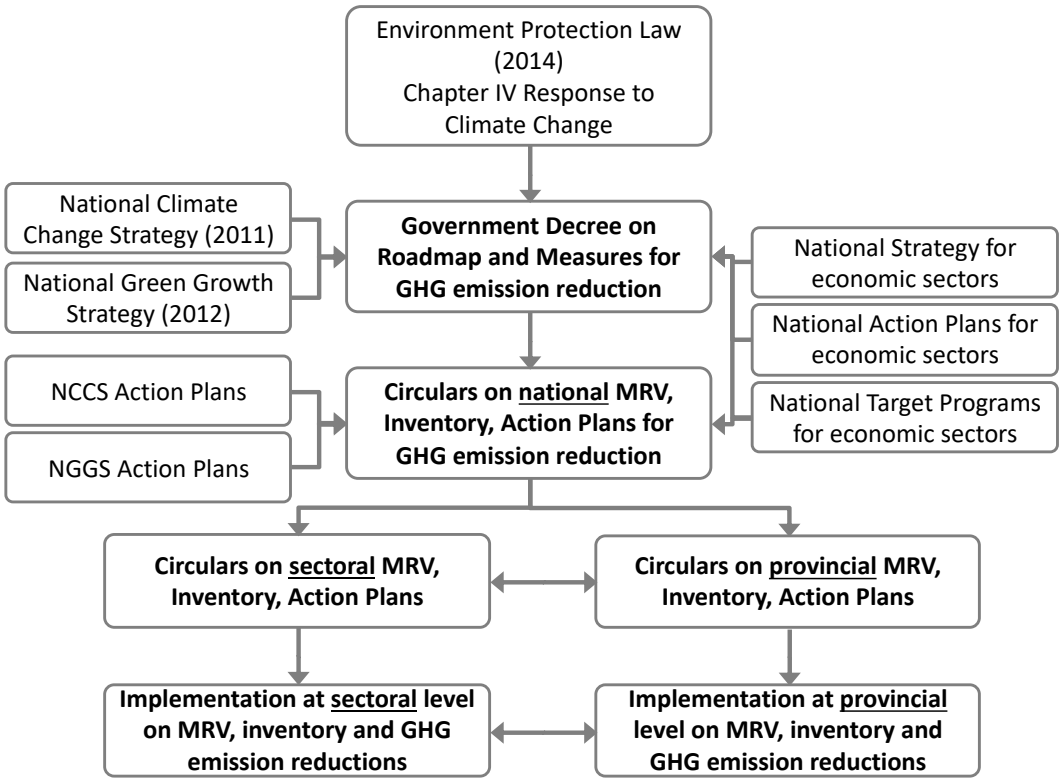
3. Status of MRV System in Vietnam

3.1 National MRV System

The development and operation of the national MRV system is one of the primary missions indicated in Decision No.2053/QD-TTg dated 28 October 2016 approving the plan to implement the Paris Agreement on climate change. As of this writing, the Vietnamese government has not started operation of the national MRV system for climate change mitigations, although the institutional design has been prepared by MONRE. Once the "Government Decree on Climate Change Response" under the new Law on Environment Protection is expected to be issued in 2021, necessary circulars will be formulated and followed (national MRV, sector-level MRV, city-level MRV), and the MRV system at each level is expected to be followed（Figure 3-1, Figure 3-2).

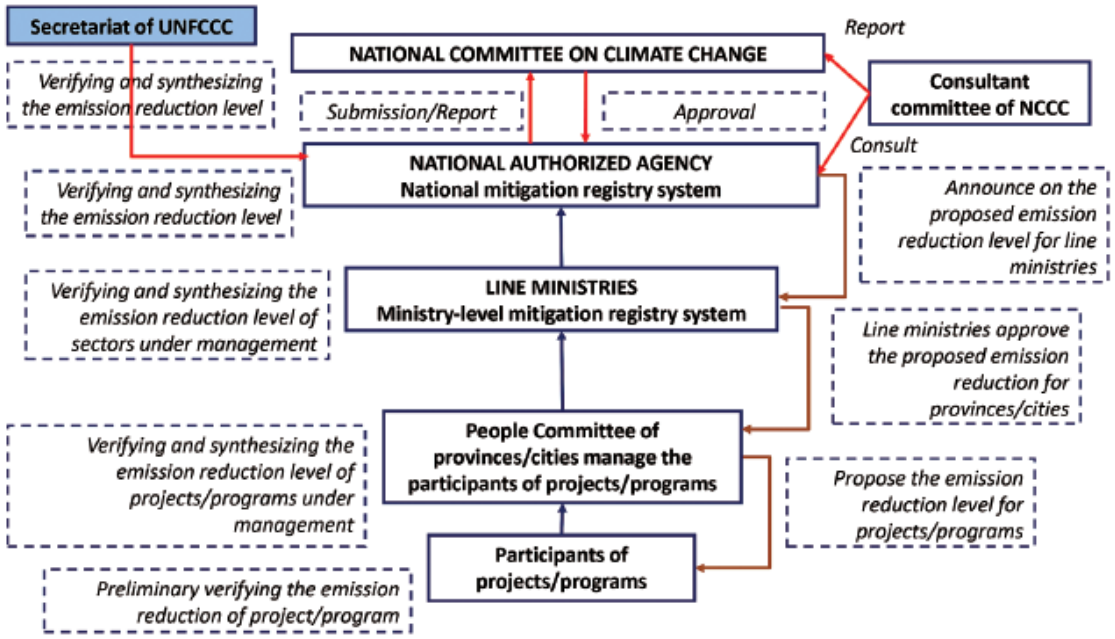
Sectoral MRVs are to be developed by the respective ministries (e.g., transport sector: MOT; industrial sector: MOIT; LULUCF sector: MONRE, MARD; agricultural sector: MARD; and construction sector: MOC).

In the current version of NDC which was submitted to the UNFCCC, urban railways are described as a promising climate change mitigation measure as it will encourage a passenger modal shift to mass transportation. The MRV of GHG emission reductions will be conducted both at the sectoral and city levels.



Source: Prepared by JICA Study Team on the figures of MONRE

Figure 3-1 Overview of the National MRV System



Source: The Second Biennial Update Report of Vietnam

Figure 3-2 MRV of GHG Emission Reduction Projects

3.2 MRV System for Urban Railway Projects

In Vietnam, the MRV methodology and organizational structure (MRV system) for urban railway projects have not yet been established. During almost the same period as the implementation of this JICA survey, ADB carried out TA-9055 VIE: Mainstreaming Climate Change Mitigation into National infrastructure-CS1 Development of MRV for CTF-funded Projects Consulting Service which developed and proposed an MRV system for CTF projects including urban railway projects. The UNDP also proposed an MRV system for railway projects.

While the ADB study focused on routes different from JICA's targets, but since both are targeting the same urban railway, the JICA Study Team worked closely with the ADB Team to come up with the same methodology to calculate and monitor GHG emission reductions. ADB produced the MRV guidelines for urban railway projects in Vietnam as one of its deliverables. The table of contents is shown below.

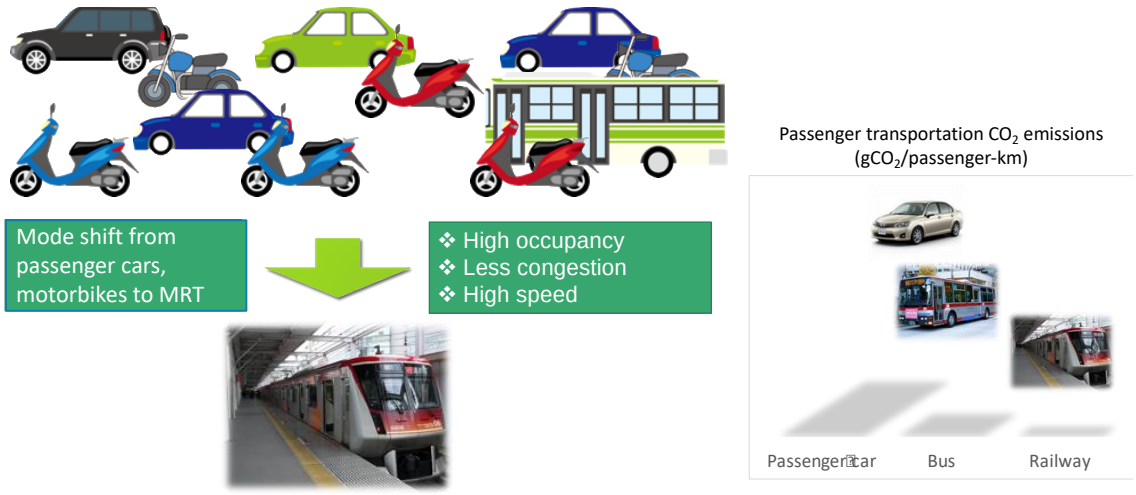
4. Analysis for the Development of an MRV System for Urban Railway

4.1 Logic of Emission Reductions through Urban Railway Projects

GHG emission reductions through urban railway projects are realized mainly through the following two logics（Figure 4-1）.

- Modal shift of passengers from existing motorized transport modes such as private cars, local conventional buses, and motorcycles to MRT which emit less emissions per passenger-kilometer, and
- Reduced traffic congestion on roads along the MRT route (on the other hand, which will have a potential to generate a rebound effect (i.e., increased road traffic) which leads to additional emissions).

The existing MRV methodologies for urban railways often deal with the first logic. In regard to the second logic, there are few methodologies, including for monitoring, because of the uncertainty of emission reductions and the need for traffic simulation for the estimation.



Source: JICA Study Team

Figure 4-1 Emission Reductions through Urban Railway Projects

4.2 Existing Methodologies

Various methodologies have been developed to estimate GHG emission reductions associated with passenger modal shift through urban railway projects (Table 4-1). The brief outlines and issues of these methodologies are given below and on the next page.

- Methodology for CDM credit (a): Extremely complicated and requires considerable labor and time to calculate and monitor emission reductions;
- Simplified methodology based on the CDM methodology (b): Emission reduction calculation and monitoring are simplified. No need to consider effects on surrounding roads (reduced congestion, rebound effects) and feeder trips. Most practical in calculating and monitoring emission reductions;
- Simplified methodology based on the CDM methodology (c): Emission reduction calculation and monitoring are simplified. No need to consider effects on surrounding roads. However, feeder trips should be considered; thus calculation is more complicated than (b); and
- Methodologies to evaluate impacts of the project (d, e, f, g, h): Calculation formula and monitoring method are simplified; however, it is not designed for practical and sustainable monitoring by host countries.

Table 4-1 Major Methodologies to Estimate GHG Emission Reductions associated with Passenger Modal Shift to Urban Railway

Title	Outline and issue	Implication for developing the methodology
a) CDM methodology: ACM0016: Baseline Methodology for Mass Rapid Transit Projects	A methodology for CDM credit projects. Interview survey among passengers (to know baseline means of transport and trip distances, etc.) is necessary to estimate baseline emission. Effects on surrounding roads (reduced congestion, rebound effects) should be considered. Emission reduction calculation and monitoring are overly complicated.	Simpler calculation Practical monitoring Default values for emission factors
b) MOE Japan: Methodology for JCM/BOCM: Modal Shift through Construction of MRT System (April 2013)	A methodology for bilateral offset crediting mechanism projects. Considering difficulties of the methodology a), emission reduction calculation and monitoring are simplified. No need to consider effects on surrounding roads (reduced congestion, rebound effects) and feeder trips.	The methodology that should be best referred to
c) MOE Japan: Methodology for JCM/BOCM: Modal Shift from Road-based Transport to MRT System (April 2013)	A methodology for bilateral offset crediting mechanism projects. No need to consider effects on surrounding roads (reduced congestion, rebound effects). Need to consider feeder trips, thus calculation and monitoring are complicated.	Simpler calculation Practical monitoring
d) GEF: Manual for Calculating GHG Benefits for Global Environment Facility	A methodology for ex-ante evaluation of GEF project. Estimated by TEEMP (The Transportation Emissions Evaluation Model for Projects) utilizing Excel spreadsheet. Easy to estimate with default	Provision of ex-post estimation (monitoring)

Title	Outline and issue	Implication for developing the methodology
Transportation Projects (2010)	values. It may not be suitable for ex-post evaluation (monitoring).	
e) JBIC: Methodology for J-MRV: No.5 Transport Projects in Urban Area (October 2012)	A methodology for ex-ante/ex-post evaluation of JBIC-supported projects. Very simple methodology, no need to consider effects on surrounding roads (reduced congestion, rebound effects) and feeder trips. Practical guideline/ manual should be prepared. Default values should be improved further to fit with specific projects.	Provision of practical explanation and guidance Default values for emission factors
f) JICA: Operation Manual for MRV on City-level Climate Change Mitigation Action, SPI-NAMA (October 2017)	A very simple methodology attached in the MRV Manual for HCMC officials, developed based on methodology b). No need to consider effects on surrounding roads (reduced congestion, rebound effects) and feeder trips. Practical guideline/ manual should be prepared. Default values should be improved further to fit with specific projects.	Provision of practical explanation and guidance Default values for emission factors
g) JICA: JICA Climate Finance Impact Tool / Mitigation ver.2.0: Methodology for Railway (Passenger) / Modal Shift (March 2014)	A methodology for ex-ante/ex-post evaluation of JICA-supported projects, developed based on methodology b). Very simple methodology, no need to consider effects on surrounding roads (reduced congestion, rebound effects) and feeder trips. Practical guideline/ manual should be prepared. Default values should be improved further to fit with specific projects.	Provision of practical explanation and guidance Default values for emission factors
h) UNDP: MRV system for actions to reduce emissions from the national railway and urban railway transport (May 2018)	A methodology for ex-ante/ex-post evaluation of both inter-city and urban railway projects in Vietnam, developed based on the methodology b). Very simple methodology, no need to consider effects on surrounding roads (reduced congestion, rebound effects) and feeder trips. Practical guideline/ manual should be prepared. Default values should be improved further to fit with specific projects.	Provision of practical explanation and guidance Default values for emission factors

4.3 Statistical Systems in Relation to MRV in Urban Railway

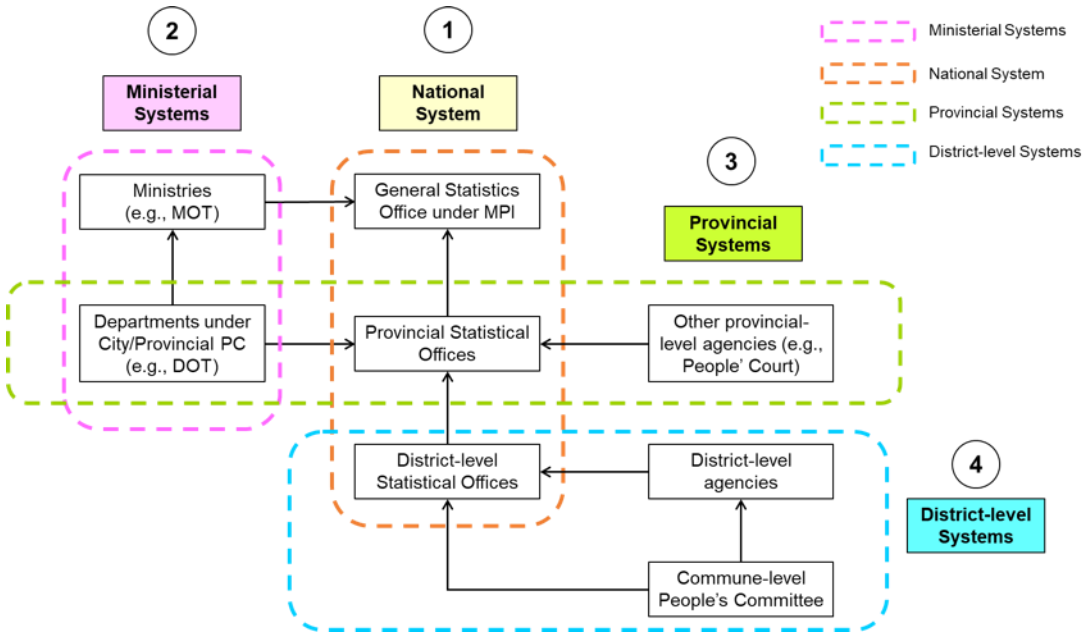
Statistical systems of Vietnam were reviewed to determine how existing statistical data can be utilized in implementing MRV in urban railway. Statistics on transport in Vietnam are stipulated in, for example, the Law on Statistics (2015) and Circular No. 48/2017/TT-BGTVT. Specific statistical indicators related to MRV in urban railway include passenger transport volume (passenger-km), fuel consumption, vehicle mileage, and number of public transport passenger.

1) Law on Statistics (2015, No.89/2015/QH13)

On 23 November 2015, the National Assembly of Vietnam promulgated the Law on Statistics, which is composed of seven (7) chapters and 72 articles.

In Article 12, there are four (4) types of statistical information systems, as follows: 1) national-level, 2) ministerial-level, 3) provincial-level, and 4) district-level, and reporting lines are summarized in Article 13 as shown in Figure 4-2. Transport-related statistics are collected by the DOT and submitted to the MOT or provincial statistical offices, then reported to the General Statistics Office under the MPI. National statistical data in the transport sector are listed in the appendix of the Law and consist of the following six (6) main indicators:

- Turnover (revenue) transport, storage and warehouse and auxiliary transport services;
- Volume of passenger transport and traffic (i.e., passengers & passenger-km);
- Volume of freight transport and traffic (i.e., tons & ton-km);
- Volume of cargo throughput;
- Number, current and newly increased handling capacity of inland waterway ports; and
- Number, current and newly increased transport capacity of airports.



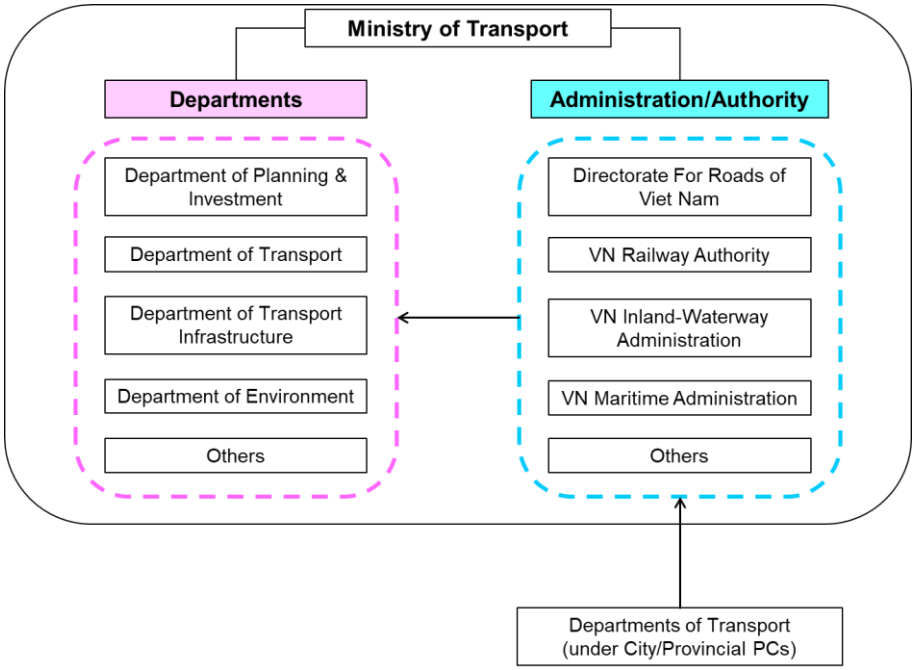
Source: JICA Study Team

Figure 4-2 Statistical Information Systems and Reporting System in Vietnam

2) Circular No. 48/2017/TT-BGTVT

On 13 December 2017, in accordance with the Law on Statistics, the MOT minister promulgated Circular No. 48/2017/TT-BGTVT providing the list of statistical indicators and general rules of report in the transport sector.

The general rule for reporting is shown in Figure 4-3. First, the provincial-level DOT has to collect statistical data and submit it to the Directorate for Roads and other authorities under the MOT. Second, the Directorate for Roads and other authorities must send the report to the MOT (via departments under the MOT).



Source: JICA Study Team

Figure 4-3 Reporting System in the Transport Sector

There are 32 main indicators in seven (7) groups, comprising: 1) transport infrastructure, 2) capital investment for transport infrastructure, 3) road vehicles, 4) fuel consumption in the transport sector, 5) outputs of transport operation, 6) labor, and 7) outputs of transport enterprises. Of these indicators, the statistics related to the MRV in urban railway are as follows:

Indicator Code. 406: Average fuel consumption of road vehicles (liter/km), including cars (9 seats and below), coaches (or inter-city buses), trucks, motorcycles, and others.

Indicator Code. 501: Average traveled distance of road vehicles (km/year). The types of vehicles are the same as above.

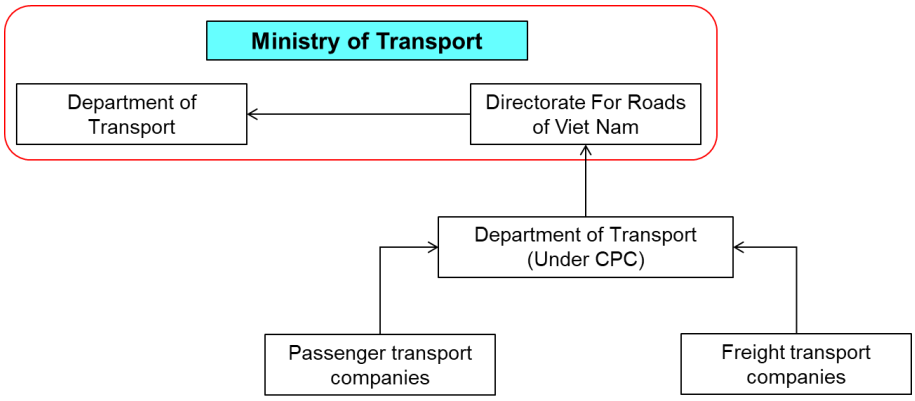
Indicator Code. 502: Public passenger transport (i.e., urban or interprovincial buses. Provinces collect such data as number of routes, number of vehicles, number of trips, average fare level, and subsidy).

The Vietnam Register has to report the data for indicator codes 406 and 501 to the Department of Environment under the MOT, while the Directorate for Roads of Vietnam (DRVN) is in charge of Indicator Code. 502 and must report it to the Department of Transport under the MOT.

3) Circular No. 63/2014/TT-BGTVT

On 10 September 2014, the government of Vietnam promulgated Decree No. 86/2014/ND-CP on "Business and Conditions for Business of Automobile Transport." For its implementing rules and regulations, the MOT promulgated Circular No. 63/2014/TT-BGTVT on "Regulations for Operation and Management of Automobile Transport and Supporting Services to Road Transport" on 7 November 2014.

Passenger and freight transport companies must report monthly the results of transport operation to provincial-level DOT, which in turn sends a monthly summary report to the Directorate for Roads of Vietnam (DRVN). Then, the DRVN reports to the MOT (Figure 4-4). The content of the report is dependent on the types of passenger transport companies. In case of bus services, the report includes the number of operating routes, number of vehicles, number of vehicle trips, and number of passengers.



Source: JICA Study Team

Figure 4-4 Reporting System in the Road Transport Subsector

4) Decision No. 543/QD-BGTVT

On 21 March 2018, the MOT promulgated Decision No. 543/QD-BGTVT on "Instructions to General Requirements for Survey Activity, Traffic Count Survey, Axle Load Survey and Traffic Forecast in Order to Formulate Construction Investment Projects on Road Transport Infrastructure," which stipulates the instructions when conducting OD surveys, such as the survey methods and requirements to be used, among other things.

5) Towards efficient data collection for MRV in urban railway

In Vietnam, statistics on passenger traffic are developed under various laws and regulations. For example, there are statistics on person-km of passenger traffic, fuel consumption and travel distance for each type of vehicle, and operations data of transport companies. However, at this moment, it seems it is not sufficient to prepare CO_2 emission factors (passenger-km base) for each transport mode, which is necessary for MRV in urban railway. Thus, it is necessary for the above laws and regulations to require

the collection of data on fuel economy, mileage, and occupancy of each transport mode. This facilitates MRV not only for urban railways but also for various projects in the transport sector and can also be effectively used in factor analysis of GHG emissions in the sector. Regarding data reporting in urban railway, referring to the existing statistical system, the smoothest process is for the MRT operating company to submit a monthly report to the city and provincial DOTs, and the DOTs in turn consolidate these into an annual report for the MOT.

4.4 Organizations in Relation to MRV in Urban Railway

In this section, the current roles of relevant ministries and agencies in Vietnam that may be related to MRV in urban railway sector are summarized.

1) MRT Operators

Since MRT projects have been carried out in Hanoi and Hochiminh cities, MRT operators were established in these cities. The main roles of MRT operators are: i) operation and maintenance of the urban railway system and infrastructure, and ii) passenger transport business.

Hanoi Metro Company (HMC): On 27 November 2014, the Hanoi People's Committee promulgated Decision No. 6266/QD-UBND establishing the Hanoi Metro Company.

HCMC Urban Railway Company No.1 (HURC1): On 1 December 2015, the HCMC People's Committee promulgated Decision No. 6339/QD-UBND establishing the HCMC Urban Railway Company No.1.

2) Management Authority of Urban Railway (MAUR)

Management authorities of urban railways were established in both Hanoi and HCMC. Their main roles are the preparation and implementation of MRT projects. They are the implementing agencies of urban railway projects, thus there has been no strategy or policy yet to reorganize them into the Public Transport Authority (PTA) in the future.

Hanoi Metropolitan Railway Management Board (MRB) : On 31 November 2001, the Management Authority for Tramcar and Public Transport Development and Management (MATPM) was established by virtue of Decision No. 97/2001/QD-UB. On 6 February 2007, the Hanoi PC issued Decision No. 528/QD-UBND revising MATPM's functions and tasks. In 2012, the Hanoi PC released Decision 925/QD-UBND establishing the MRB under the Hanoi PC. On 24 July 2017, the Hanoi PC came out with Decision 4883/QD-UBND amending MRB's functions, tasks, and organizational structure.

HCMC Management Authority for Urban Railway (MAUR or HCMC Metro): MAUR was established in accordance with Decision No. 119/2007/QD-UBND dated 13 September 2007.

3) Department of Transport (DOT)

Based on Decision No. 33/2016/QD-UBND of Hanoi PC and Decision No. 70/2010/QD-UBND of the HCMC PC, departments of transport (DOTs) became specialized agencies under the city people's committees, with the task of assisting the both PCs in carrying out state management of the transport sector covering roads, inland waterways, urban railways, transport services, traffic safety, and so on. Based on the regulations on transport statistics, MRT operators and MAURs provide data to the DOTs. Both Hanoi and HCMC PCs have a common strategy in establishing a PTA. In reality, HCMC PC already established a PTA under the DOT.

Hanoi DOT: In 2008, Hanoi PC re-established the Public Transport Management and Operation Center (TRAMOC) under Hanoi DOT virtue of by Decision No. 1112/QD-UBND. Up to now, TRAMOC is responsible for the state management of passenger bus transport business in terms of subsidy policy, fare policy, route planning, quality of service, and bidding for the provision of bus services. Based on Decision

No. 33/2016/QD-UBND dated 8 September 2016, TRAMOC should have been transformed into the Management Center for Public Transport (MCPT) under the DOT with the prime responsibility of state management of passenger transport business covering all types of public transport including urban railways. As of this moment, MCPT has not been established yet.

HCMC DOT: On 9 January 2018, HCMC PC promulgated Decision No. 79/QD-UBND reorganizing the Management & Operation Center for Public Transport (MOCPT) into the Management Center for Public Transport (MCPT) under the DOT. Based on this Decision, the MCPT would be responsible for state management of passenger transport business covering all types of public transport, including city buses, taxies, urban railways, and waterbuses. The MCPT would also be responsible for managing public transport infrastructure, excluding those for urban railways and waterbuses. The MCPT was already established in HCMC.

4) Department of Natural Resources and Environment (DONRE)

For urban railway projects, DONRE may have some tasks regarding the verification of EIA (environmental impact assessment) reports. In the construction and operation stages, MRT operators should monitor environmental indicators in accordance with the national technical regulations on air quality (QCVN 05:2013/BTNMT), noise and vibration (QCVN 26:2010/BTNMT & QCVN 27:2010/BTNMT, among others, and submit reports to DONRE.

5) Department of Environment, Ministry of Transport (DOE/MOT)

The DOE is an advisory body to the MOT minister in implementing state management regarding environmental protection, which include promulgation and implementation of legal documents, studies, plans, projects, and tasks on environmental protection in road transport, railway, inland waterway, maritime, and civil aviation. Therefore, the DOE has important roles in the MRV system for the transport sector in Vietnam.

6) Vietnam Railway Authority, Ministry of Transport (VRA/MOT)

The VRA has the advisory task of assisting the MOT in implementing state management of railway transport, covering passenger and freight transport, as well as railway infrastructure. In the management of railway infrastructure, the MOT is responsible for national railway, while CPCs oversee urban railways in accordance with the Law on Railway (2017) and Decree No. 56/2018/NĐ-CP on managing and protecting railway infrastructure. The VRA is responsible for promulgating and implementing legal documents on urban railways, such as Circular No. 33/2018/TT-BGTVT (dated 15 May 2018) and Circular No. 07/2020/TT-BGTVT (dated 12 March 2020), which stipulate the qualifications, tasks, and rights of railway staff; their training program; and issuance of certificates for train drivers. According to Circular No. 33/2018/TT-BGTVT, railway operators have to send VRA annual reports on their status.

7) Vietnam Railway Corporation (VNR)

The VNR is responsible for providing passenger and freight transport services by national railway and is not involved in urban railways.

4.5 Data Availability for the MRV for Urban Railway Sector

The Study Team examined whether or not the organizations listed in 4.4 could collect or generate various data necessary for calculating GHG emission reductions, of which the following four data items are particularly important among those proposed in Section 5.2. Table 4-2 shows the potential of each organization for collecting the four data items.

- PKM: Transported volume by MRT in year *y* (passenger-km/year)
- MS: Share of passengers using transport mode *i* in the baseline in year *y*
- EF: CO_2 emission factor per passenger-kilometer for transport mode *i* (gCO_2/passenger-km) or CO_2 emission factor of transport mode *i* (gCO_2/km)
- OC: Average occupancy rate of transport mode *i* (number of passengers/vehicle)

Table 4-2 Potential of Relevant Organizations for Data Acquisition

Organization	PKM	MS	EF	OC
MRT Operator	5	4	1	2
MAUR	2	2	1	2
DOT	4	4	2	5
DONRE	2	1	2	1
MOT/DOE	3	3	4	4
MOT/VRA	2	1	2	2

Note: To assess the organizatons' potential, they were ranked per data item from 1 (very low), 2 (low), 3 (neutral), and 4 (high) to 5 (very high).
Source: JICA Study Team

1) PKM

MRT operators have the highest potential to collect PKM, since they monitor the data daily or monthly through their ticketing systems. Note that the existing reporting system for transport statistics is: MRT Operators -> DOT -> MOT, then the DOT and the MOT can have such data via requests for data submission.

2) MS

The DOT and MRT operators have the highest potential to collect this data, because they may conduct annual interview surveys, such as customer satisfaction surveys. For instance, one of Hanoi Metro Company's (HMC) business sectors does marketing research and surveys, so HMC can conduct passenger interview surveys. On the other hand, the MCPT (DOT) can conduct such surveys since they are responsible for the inspection of passenger transport services by urban railways.

3) EF

This is the most important parameter but has not been published by the Government of Vietnam. The DOE/ MOT will have highest potential to collect and publish the EF since they have highest capability to access this data. According to Circular No. 48/2017/TT-BGTVT, the Vietnam Register (VR) is responsible for collecting data on fuel economy (i.e., VKT and fuel consumption) and report it to the DOE/MOT.

In the short term, it would be most appropriate that the DOE/MOT collect and publish these data on emission factors including the outputs of this Survey. In the medium to long term, the Study Team recommends that the MOT establish (or revise) a statistical system to collect and prepare data on fuel economy of motor vehicles in Vietnam, as is done by the MLIT in Japan.

4) OC

In the 2010s, large-scale household travel surveys were conducted by JICA or other donors in both Hanoi and HCMC. In recent years, such surveys were also conducted in transport projects, of which DOTs are the project owners, for instance, the Hanoi Transport Master Plan (2016) and the Project on Enhancement of Existing Traffic Control System in HCMC (2017–2018). Those data can be utilized in the short and medium term (up to 5 years). Therefore, the DOTs have the highest potential to collect this data. In the short term, the Study Team recommends the use of the outputs of this Survey or other existing survey results.

5. Proposal on an MRV System for Urban Railway Sector in Vietnam

In this chapter, the Study Team proposes an MRV system in urban railway sector in Vietnam.

5.1 Basic Approaches

Methodologies for urban railway projects tend to be complicated, requiring considerable labor and time at the time of evaluation after the project starts. Therefore, a practical and sustainable methodology, which require less burden/cost for local authorities, should be developed and proposed. Important approaches in developing the methodology are the following:

- Emission reductions are estimated in a reasonable and transparent manner,
- Simpler method and calculation formula to consider availability of data,
- Monitoring data can be obtained from daily routine operation of urban railways as much as possible, and
- Emission factors will be provided with local default values.

2) Reduced Traffic Congestion

Based on the above basic considerations, this methodology only includes in the calculation the logic (described in Section 4.1) that a modal shift from existing motorized transport to MRT will emit less emissions per passenger kilometer. The other logic that says a modal shift will result in reduced traffic congestion on roads along the MRT route is excluded from the calculation, because the quantification of emission reductions at the time of monitoring after the MRT starts operation is extremely difficult, even though it can be estimated in advance using simulation models.

3) Access/Egress Transport

Emission reduction through passenger modal shift is illustrated in Figure 5-1. The reduction is the difference between the emissions related to passenger trips (OD: Origin to destination) before and after the MRT operation. In Figure 5-1, after the MRT starts operation (project case), a passenger travels from an origin to a destination by motorcycle for 2 km, then by MRT for 10 km, before walking the final leg. In this case, the emission associated with the passenger trip is 290 gCO_2, assuming that the CO_2 emission factor for motorcycle and MRT are 45 and 20 gCO_2/passenger-km, respectively. On the other hand, if prior to MRT operation (baseline case), the passenger used a car and drove 12 km from the same origin to the destination, the emission would be 1,080 gCO_2, assuming that the CO_2 emission factor of passenger car is 90 gCO_2/passenger-km. Therefore, the emission reduction generated by this MRT passenger can be calculated as 790 g CO_2 (=1,080-290). In this way, it is possible to calculate the emission reductions of each passenger trip including access and egress transport. However, it is necessary to conduct a detailed interview survey on passenger trips, including access and egress transport, in the baseline case and project case, and the emission reduction calculation is complicated.

In this study, the Study Team proposes to simplify the calculation on access/egress transport by referring to the idea of methodology b) in Table 4-1. For example, in the above case, the passenger travel distance is fixed to the MRT travel distance (10 km) in both the baseline and the project cases. Emissions from access/egress transport are not included in both baseline and project cases. For the type of baseline transport, the typical transport mode used by passengers should be identified through interview survey, etc., and the share of each transport mode should be calculated (for example, 80% for motorbikes, 10% for buses, 10% for private cars). In this method, if there are 100 MRT passengers, the project emission will be 20 $kgCO_2$, which is calculated by 100 passenger x 10 km x 20 gCO_2/passenger-km. On the other hand, the baseline emission can be calculated as 48 $kgCO_2$ by 100 passenger x 10 km x (0.8 x 45 + 0.1 x 30 + 0.1 x 90), resulting in an emission reduction of 28 $kgCO_2$.

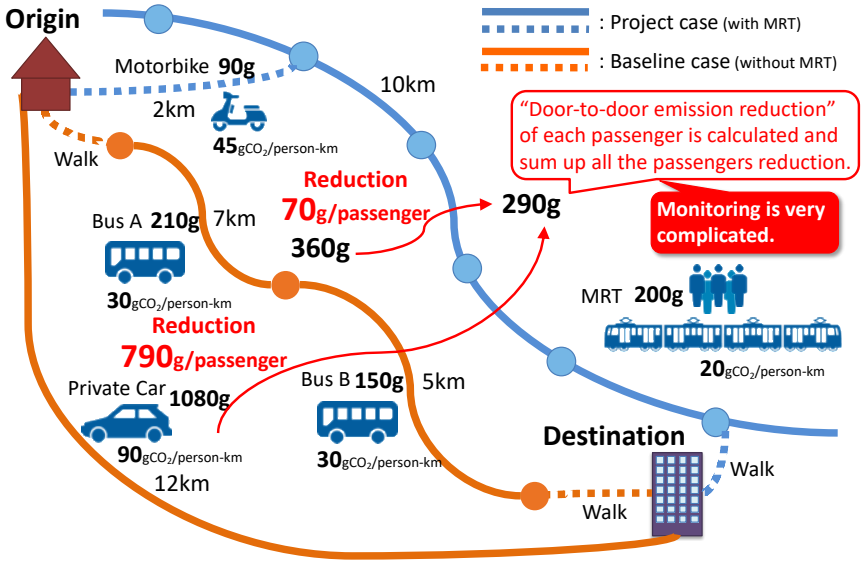


Figure 5-1 Calculation of Emission Reductions from Urban Railway Usage

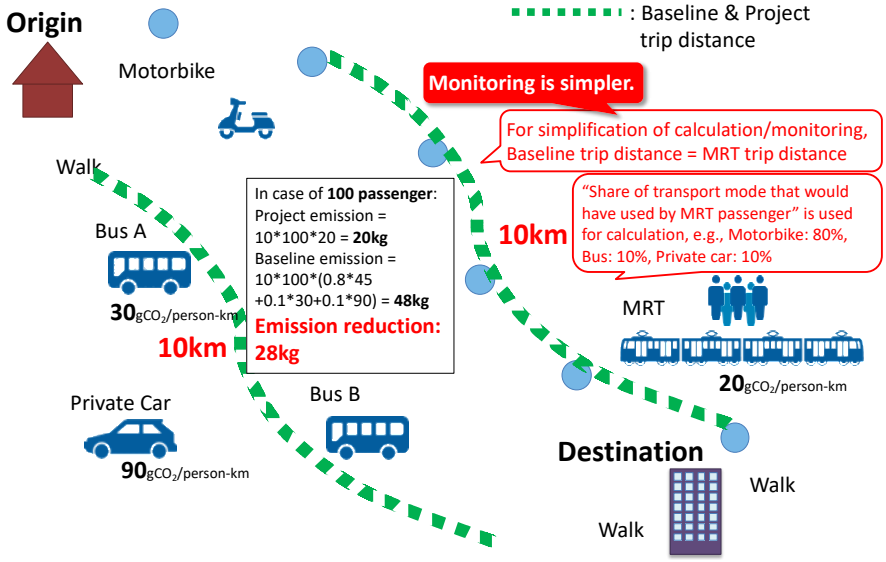


Figure 5-2 Simplified Calculation of Emission Reductions from Urban Railway Usage

5.2 Methodologies for Calculating and Monitoring GHG Emission Reductions

1) Outline of the Methodology

Table 5-1 shows the outline of the methodology.

Table 5-1 Outline of the Methodology for Calculating and Monitoring GHG Emission Reductions

Item	Outline
Applicability	The methodology is applicable for newly constructed or extension of urban railway systems for passenger (hereinafter MRT).
GHG	CO_2 (CH_4 and N_2O are neglectable)
Boundary	MRT route and surrounding area (more explicitly, the area where an MRT passenger travels)
Emission Reduction	Difference between baseline and project emissions. Baseline emissions: Emissions associated with trips of MRT passenger without the MRT project. Project emissions: Emissions associated with trips of MRT passenger.
Baseline Emission	Approach: Estimate emissions associated with transport modes that would have been used by MRT passengers without the MRT project Basic formula: [Baseline passenger transport volume (passenger-km) × CO_2 emission factor of baseline transport (tCO_2/passenger-km)] - In case there are several transport modes used, apply above formula using the modal share. - For simplification, “baseline passenger transport volume” is assumed as equal to “MRT passenger transport volume.” - Recommend to use emission factors which are provided by government authorities.
Project Emission	Approach: Estimate emissions from the MRT operation. Basic formula: [MRT passenger transport volume (passenger-km) × CO_2 emission factor of MRT (tCO_2/passenger-km)] - As to “MRT passenger transport volume,” for ex-ante estimation, use values provided in FS reports, and for ex-post calculation, use data that can be obtained by the project operator. - Recommend to use emission factors which are provided by government authorities.
Monitoring	Monitor MRT passenger transport volume (passenger-km). Recommend to set the modal share after the MRT starts operation.

2) Formula to Estimate Emission Reductions

Based on the basic approaches described in Section 5.1, a set of following formula, which is simplified the CDM methodology, "ACM0016 Mass rapid transit projects", is applied for this project. This formula is used in methodologies b), e), f), g), h) in Table 4-1 and is shown below.

$$\boldsymbol{ER_y = BE_y - PE_y}$$

BE_y Baseline emission in year *y* (tCO_2/year)

PE_y Project emission in year *y* (tCO_2/year)

ER_y Emission reduction in year *y* (tCO_2/year)

$$\boldsymbol{BE_y = \sum_i \left(PKM_y \times MS_{i,y} \times EF_{PKM,i} \times 10^{-6}\right)}$$

$$\boldsymbol{PKM_y = P_y \times TD_y}$$

$$\boldsymbol{EF_{PKM,i} = \frac{EF_{KM,i}}{OC_i}}$$

PKM_y Transported volume by MRT in year *y* (passenger km/year)

$MS_{i,y}$ Share of MRT passengers using transport mode *i* in the baseline in year *y*

$EF_{PKM,i}$ CO_2 emission factor per passenger kilometer for transport mode *i* (gCO_2/passenger-km)

P_y Number of passengers of MRT in year *y* (passenger/year)

TD_y Average trip distance of the passenger of MRT in year *y* (km)

$EF_{KM,i}$ CO_2 emission factor of transport mode *i* (gCO_2/km)

OC_i Average occupancy rate of transport mode *i* (passenger/vehicle)

i 1; Passenger car, 2; Bus, 3; Motorcycle, etc.

$$\boldsymbol{PE_y = PKM_y \times EF_{PKM,MRT} \times 10^{-6}}$$

PKM_y Transported volume by MRT in year *y* (passenger km/year)

$EF_{PKM,MRT}$ CO_2 emission factor per passenger kilometer for MRT (gCO_2/passenger-km)

Emission reduction is the difference between the baseline emission and the project emission. The baseline emission is an emission associated with transport modes that would have been used by an MRT passenger had there been no MRT project. The project emission is an emission associated with the MRT operation.

3) Monitoring Method

The following parameters should be monitored every year/period.

Table 5-2 Monitoring Parameters

Parameter	Monitoring Method
PKM_y Transported volume by MRT in year y (passenger km/year)	• Provided by the MRT operator. • The operator monitors/analyzes the data daily or monthly through ticketing system such as IC card system. • Daily or monthly data are compiled to obtain the annual transported volume.
P_y Number of MRT passenger in year y (passenger/year)	• *Set this parameter, in case PKM_y is not obtained directly.* • Provided by the MRT operator. • The operator monitors/analyzes the data MRT daily or monthly through ticketing system such as IC card system. • Daily or monthly data are summed up to obtain the annual figure.
TD_y Average trip distance of MRT passenger in year y (km)	• *Set this parameter, in case PKM_y is not obtained directly.* • Provided by the MRT operator. • The operator monitors/analyzes the data MRT daily or monthly through ticketing system such as IC card system. • Daily or monthly data are averaged to obtain the annual average trip distance.

The following parameters are set once before the project starts.

Table 5-3 Fixed Parameters

Parameter	Source
$MS_{i,y}$ Share of passengers using transport mode i in the baseline in year y	• Face-to-face interview with MRT passengers, more efficient ways such as through IC card ticketing system (Appendix 1 shows an example of a questionnaire) • Use the data obtained through this Survey • If available, update the data every two years
$EF_{PKM,i}$ CO_2 emission factor per passenger kilometer for transport mode i (gCO_2/passenger-km)	• Refer to values which are provided by existing studies, this Survey, MOT, and Vietnam Register • If available, update the data every two years • Table 6-1 shows examples of existing data
$EF_{KM,i}$ CO_2 emission factor of transport mode i (gCO_2/km)	• *Set this parameter, in case $EF_{PKM,i}$ is not available.* • Refer to values which are provided by existing studies, this Survey, MOT, and Vietnam Register • Table 6-1 shows examples of existing data
OC_i Average occupation rate of transport mode i (passenger/vehicle)	

5.3 MRV Organizational Structure

The Study Team proposes an organization to implement a series of MRV processes for the urban railway. The processes include the formulation of MRV plans, collection of data, calculation of emission reductions, preparation of monitoring reports, and verification. The Study Team identifies who should do what and a practical and sustainable MRV organizational structure. "Practical and sustainable" means carrying out MRV as efficiently as possible using the existing reporting system within the limited human and financial resources.

As described in Section 3.1, the MRV system for urban railway and the national MRV system have not yet been established in Vietnam, as of this writing. The details of the MRV systems will be stipulated in a decree on the national MRV, which will be approved in the near future, and in a circular on MRV in the transport sector.

Figure 5-3 and Table 5-4 show the proposed MRV organizational structure and the roles of each organization, based on interviews with the MOT, MONRE, and DONRE, among others. The Study Team recommends that this proposal be adopted when the national and sectoral MRV systems are operational.

The proposed organizational structure is based on the MRV proposal of JICA's "Project to Support the Planning and Implementation of NAMAs in a MRV Manner (Capacity Enhancement of Local Governments)" which is also referred to in the *Second Biennial Update Report of Vietnam*.

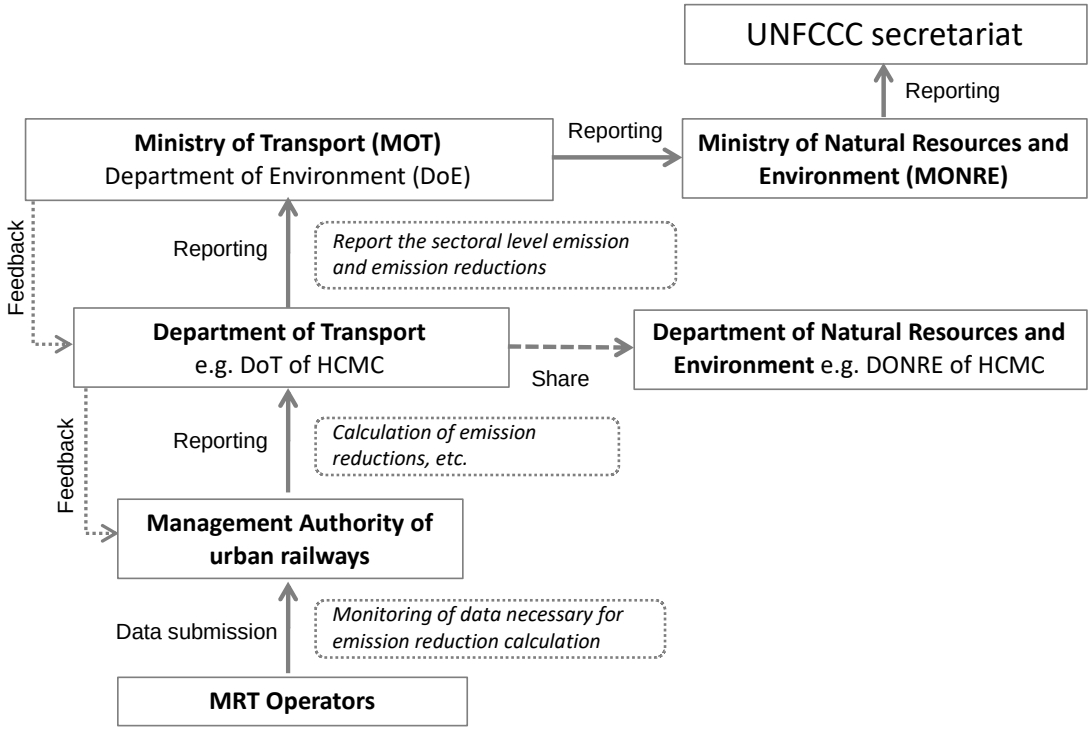


Figure 5-3 MRV Organizational Structure

Table 5-4 Roles and Responsibilities of Organizations Involved in MRV Systems

Organization	Role/Responsibility
MONRE	· Check and summarize MRV plans and monitoring reports submitted by MOT · Submit the contents of MRV activities to UNFCCC
MOT	· Approve MRV plans and monitoring reports submitted by DOT · Compile MRV plans and monitoring reports on the urban railway · Submit MRV plans and monitoring reports to MONRE
DONRE	· Check MRV plans and monitoring reports shared by DOT · Summarize these results as outputs of mitigation activities in the city
DOT	· Check MRV plans and monitoring reports submitted by the management authority of urban railways · Submit MRV plans and monitoring reports to MOT · Share MRV plans and monitoring reports to DONRE
Management Authority of Urban Railways, e.g., MCPT	· Prepare MRV plans for all MRT lines under its management · Monitor and prepare monitoring reports · Submit MRV plans and monitoring reports to DOT
MRT Operators	· Monitor necessary data for calculating emission reductions · Submit these data to management authority of the MRT

For reference, in the existing rules and roles of organizations, an MRV organizational structure that can be tentatively operated in the short term without the need for a decree/circular is proposed in Figure 5-4 and Table 5-5.

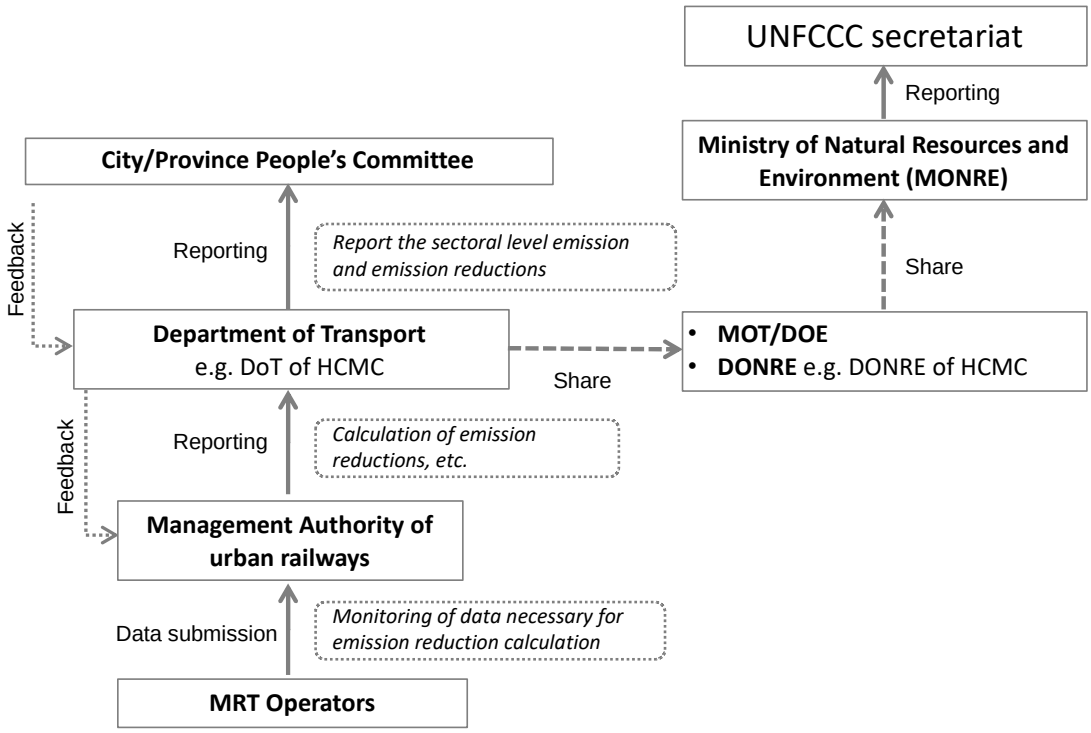


Figure 5-4 MRV Organizational Structure（for tentative operation in the short-term）

Table 5-5 Roles and Responsibilities of Organizations Involved（for tentative operation in the Short-Term）

Organization	Roles/Responsibility
MONRE	· Check and summarize MRV plans and monitoring reports shared by MOT · Submit the contents of MRV activities to UNFCCC
MOT	· Check MRV plans and monitoring reports shared by DOT · Summarize these results as outputs of mitigation activities in the transport sector · Share MRV plans and monitoring reports to MONRE
DONRE	· Check MRV plans and monitoring reports shared by DOT · Summarize these results as outputs of mitigation activities in the city · Share MRV plans and monitoring reports to MONRE
CPC	· Approve MRV plans and monitoring reports submitted by DOT
DOT	· Check MRV plans and monitoring reports submitted by the management authority of urban railways · Submit MRV plans and monitoring reports to Hanoi/HCMC PC · Share MRV plans and monitoring reports to MOT/DOE and DONRE
Management Authority of Urban Railways, e.g., MCPT	· Prepare MRV plans for all MRT lines under its management · Monitor and prepare monitoring reports · Submit MRV plans and monitoring reports to DOT
MRT Operators	· Monitor necessary data for emission reduction calculation · Submit these data to management authority of the MRT

5.4 MRV Procedure

The implementation procedure for MRV for urban railway is shown in Table 5-6. This procedure is based on the MRV proposal of JICA's "Project to Support the Planning and Implementation of NAMAs in an MRV Manner (Capacity Enhancement of Local Governments)" which was also referred to in the *Second Biennial Update Report of Vietnam*. As for "Verification" (V in MRV), the national process has not been decided yet, so here it is tentatively proposed as "Approval" by the related organizations.

Table 5-6 Implementation Procedure for MRV

Item	Outline	Responsible Organization
A. Planning		
A-1: Develop and submit MRV Plan	Describe project outline, methodology of GHG emission reduction calculation, organizational structure, etc.	Management authority of urban railways
A-2: Confirm and submit MRV Plan	Confirm, give comments and submit MRV Plan	DOT, DONRE
A-3: Approve MRV Plan	Approve MRV Plan and submit to MONRE	MOT
B. Implementation		
B-1: Collect/Measure and record data	Collect/Measure and record data that are necessary for GHG emission reduction calculation	MRT operators
B-2: Calculate GHG emission reductions	Calculate GHG emission reductions	Management authority of urban railways
B-3: Prepare monitoring report	Prepare monitoring report compiling calculated emission reductions and data used for the calculation	Management authority of urban railways
B-4: Submit monitoring report	Submit monitoring report annually	Management authority of urban railways
C. Approval		
C-1: Confirm and submit monitoring report	Confirm annual monitoring report	DOT, DONRE
C-2: Approve monitoring report	Approve monitoring report annually and submit to MONRE	MOT

A. Planning

A-1: Develop and submit MRV Plan

The management authority of urban railways prepares an MRV Plan on of GHG emission reductions for each urban railway project. The Plan needs to be developed only once and submitted to the DOT. Its contents are shown in Table 5-7, and the format is shown in Appendix 3.

A-2: Confirm and submit MRV Plan

The DOT reviews the submitted MRV Plan and provides advice and recommendations to the management authority of urban railways, if revisions are needed. DOT submits the reviewed MRV Plan to the MOT and shares it to DONRE.

A-3: Approve MRV Plan

The MOT approves the submitted MRV Plan and provides advice and recommendations to the DOT, if revisions are needed. The MOT submits the approved MRV Plan to MONRE.

Table 5-7 Contents of an MRV Plan

I. General information on the mitigation action
a) Name of the mitigation action
b) Involved organizations and their roles
c) Objectives
d) Technology introduced under the mitigation action
e) Target GHG type
f) Location
g) Timeframe
h) Cost of mitigation action
i) Benefits of mitigation action and contribution to sustainable development
j) Source of funding and supporting financial scheme
k) Information on international market mechanisms
II. Emission reduction calculation, monitoring and reporting
a) Logic of GHG emission reduction
b) Methodology to calculate GHG emission reduction
c) Estimated GHG emission reduction
d) Organizational structure for monitoring and reporting
e) Monitoring period
f) Monitoring method
g) QA/QC

B. Implementation

According to the MRV Plan, related organizations will conduct MRV which starts with the collection and measurement of data necessary for calculating GHG emission reductions. After emission reductions are calculated, a monitoring report is prepared.

B-1: Collect/Measure and record data

The MRT operator will conduct monitoring (obtain necessary data listed in Table 5-2 and Table 5-3) according to the MRV Plan and will prepare monitoring sheets monthly, quarterly, semi-annually, etc. The monitoring should be carried out according to the methods, procedures, and timeframes described in the approved MRV Plan. The MRT operator will collect and measure the data necessary for calculating the GHG emission reductions and will input it in the monitoring sheet. Collection of parameters, such as CO_2 emission factors that are difficult for the MRT operator to prepare, will be supported by the management authority of urban railways, the DOT, and the MOT.

B-2: Calculate GHG emission reductions

The management authority of urban railways will calculate GHG emission reductions annually, using data inputted in the monitoring sheet and CO_2 emission factors. Calculating GHG emission reductions will follow the formula shown in Section 5.2 and will use the GHG emission reduction calculation spreadsheet.

B-3: Prepare monitoring report

The management authority of urban railways will consolidate monitoring sheets and results of GHG emission reduction calculations into a monitoring report. The outline of the project needs to be described in the report. The contents and format of the monitoring report are shown in Table 5-8 and Appendix 4, respectively.

B-4: Submit monitoring report

The management authority of urban railways will submit the monitoring report to the DOT once a year.

Table 5-8 Contents of an Monitoring Report

I. General information on the mitigation action
a) Name of the mitigation action
b) Sector
c) Implementing entity
d) Name of the site
II. Results of monitoring
a) Date
b) Person in charge
c) Monitoring period
d) Emission reductions of the monitoring period

C. Approval

C-1: Confirm and submit monitoring report

The DOT will examine the monitoring report submitted by the management authority of urban railways. The following elements should be considered in examining the reports:

- Whether there is a lack of information and data, and
- Whether the monitoring has been adequately implemented in accordance with the MRV Plan.

The DOT will request the management authority of urban railways for revisions, if needed. The DOT will submit the confirmed monitoring report to the MOT and share it to DONRE.

C-2: Approve monitoring report

The MOT approves the monitoring report submitted by the DOT. If necessary, it will request the DOT to revise the report. The MOT submits the approved monitoring report to MONRE.

6. Estimation of GHG Emission Reductions

Estimating GHG emission reductions through the three target urban railway lines, namely, Hanoi Line 1, Hanoi Line 2, and HCMC Line 1, was conducted as follows:

- Collection of existing data: Existing data, such as demand forecast of each target MRT line, was collected.
- Implementation of interview surveys: Interview surveys among residents and transport operators along the target MRT lines were conducted to obtain primary data such as modal share and fuel economy.
- Estimation of GHG emission reductions: Emission reductions were calculated by applying the methodology proposed in Section 5.2 using existing data and the results of interview surveys.
- Comparison of emission reductions: Emission reductions were compared between with and without access/egress transport cases and compared with other urban railway projects.

6.1 Data Collection for Estimating GHG Emissions

Necessary and available data were collected for estimating GHG emissions reduction in accordance with the proposed draft methodology indicated in the previous section (Table 6-1). In the estimation, results of the interview surveys conducted in this project were applied, therefore data items b to d are described as a reference.

Table 6-1 Existing Data for Calculating GHG Emission Reductions

Item	Data	Source
a) Number of MRT Passengers (passengers/day)	*Hanoi UMRT Line 1 Do Maximum Scenario: 436,000, Do Committed Scenario: 597,000 *Hanoi UMRT Line 2 Do Maximum Scenario: 525,000, Do Committed Scenario: 556,000 *HCMC UMRT Line 1 Do Maximum Scenario: 653,000, Do Committed Scenario: 687,000	*1
Passenger-kilometer traveled by MRT (1,000 passenger-km/day)	*Hanoi UMRT Line 1 Do Maximum Scenario: 4,701, Do Committed Scenario: 7,882 *Hanoi UMRT Line 2 Do Maximum Scenario: 5,359, Do Committed Scenario: 5,614 *HCMC UMRT Line 1 Do Maximum Scenario: 7,769, Do Committed Scenario: 7,995	*1
Average Trip Distance by MRT (km)	*Hanoi UMRT Line 1 Do Maximum Scenario: 10.8, Do Committed Scenario: 13.2 *Hanoi UMRT Line 2 Do Maximum Scenario: 10.2, Do Committed Scenario: 10.1 *HCMC UMRT Line 1	*1

Item	Data	Source
	Do Maximum Scenario: 11.9, Do Committed Scenario: 11.6	
b) Share of MRT passengers using transport mode *i*	*Hanoi UMRT Line 1 (2030) Passenger car: 27.2%, Bus: 21.9%, Motorbike: 50.9% *Hanoi UMRT Line 2 (2020) Passenger car: 27.2%, Bus: 21.9%, Motorbike: 50.9% *HCMC UMRT Line 1 (2020) Passenger car: 2.8%, Bus: 7.3%, Motorbike: 89.9%	*2
c) CO_2 emission factor per passenger kilometer or fuel economy for transport mode *i*	Passenger car : 140, Bus : 23, Motorbike : 69, Taxi : 84 (gCO_2/passenger-km)	*3
	Passenger car : 11.94, Bus : 3.15, Motorbike: 31.14、Taxi : 12.96 (km/l)	*3
	Motorbike : 38.399 (gCO_2/km)	*4
	Notes: *Fuel economy of passenger car: In accordance with the Circular No. 48/2017/TT-BGTVT (The List of Statistical Indicators and General Rules of Report in Transport Sector), the Vietnam Register will collect the data once they have a budget for the statistical survey program. *Fuel economy of motorbike: In accordance with the Circular No.59/2018/BGTVT (Guiding Energy Labeling for Motorcycles, Mopeds Manufacturing, Assembling and Importing), the data are collected but these are catalogue values and not "real-world fuel economy". *Fuel economy of bus: Circular No. 65/2014/TT-BGTVT (norms of economic-technical framework applicable to public passenger transport by bus) provides standard values, but these do not reflect real-world fuel economy.	-
d) Average occupancy rate of transport mode *i* (passenger/vehicle)	*Hanoi Passenger car: 1.96, Bus: 25.66, Minibus: 10.15, Motorbike : 1.11, Taxi: 1.80 *HCMC Passenger car: 1.86, Bus: 23.36, Minibus: 6.50, Motorbike : 1.37, Taxi: 1.99	*1
	*Hanoi Passenger car: 1.63, Bus: 44.65, Motorbike : 1.18, Taxi: 2.39	*3
e) CO_2 emission factor of grid electricity (tCO_2/MWh)	0.8649 tCO_2/MWh	*5

*1: Data Collection Survey on Railways in Major Cities in Vietnam, METROS. JICA, 2016.
*2: New Mechanism Feasibility Study for Development of Mass Rapid Transit (MRT) Systems in Jakarta, Indonesia, and Hanoi and Ho Chi Minh, Viet Nam. Ministry of Environment Japan. March 2012.
*3: Promotion of Modal Shift from Road-based Transport to Mass Rapid Transit (MRT) System. Ministry of Environment Japan. April 2013.
*4: Son et al., The MATLAB Toolbox for GPS Data to Calculate Motorcycle Emission in Hanoi – Vietnam, 2012 International Conference on Environment, Energy and Biotechnology.
*5: MONRE, 2019
Do Maximum Scenario: Assumes all planned lines are in operation in 2030; the network will carry 3.2 million passengers a day.
Do Committed Scenario: A total route length of 94 km will transport a total of 1.8 million passengers a day.

6.2 Interview Surveys

In addition to the available or secondary data mentioned in Section 6.1, new or primary data has been generated during the Survey to understand the project stakeholders' conditions and expectations about urban railway projects that are the subjects of this Survey. Since project stakeholders along the MRT routes can be largely grouped into two, namely, local residents and local public transport operators, two types of interview surveys were conducted to collect the following information:

- Interview with local residents: Daily trip information (origin and destination, transport means, trip cost and time, etc.) and expectations regarding urban railway usage; and
- Interview with local public transport operators: Present operation (number of vehicles, service areas and routes, number of passengers per vehicle and trip, fuel type and consumption, etc.) and expectations regarding operational changes (number of vehicles, service areas, and routes) after an urban railway starts operation.

These interview surveys were conducted by subcontracting the surveys to TEDI, which was selected in a bidding process.

Details of the interview surveys are described below.

1) Survey duration

The surveys, which were implemented from 15 June 2019 to 8 August 2019, had three phases: (1): Preparation and planning; (2): Pilot interviews and official interviews; (3): Inputting and coding data.

2) Survey content

a. Interviews with residents along planned urban railway line

Part 1: General Information: Including address, occupation, income, and vehicle ownership.

Part 2: One Week-day Trip Information: Including trips during the day before the researcher's visit such as trip origin-destination, purpose, distance, and transport mode.

Part 3 Expectation regarding Urban Railway Usage: If using railway (trip purpose, transport mode for access/egress) or reasons for not using railway.

Part 4 Fuel Efficiency: Make and model of car/motorbike, year of purchase, type of fuel, fuel consumption, and occupancy.

b. Interviews with public transport service providers (taxi and bus drivers)

Part 1 General information: Including employer, income, and vehicle ownership.

Part 2 Service Area: Including number of trips, average number of trips per day, and frequent pick-up/drop-off points.

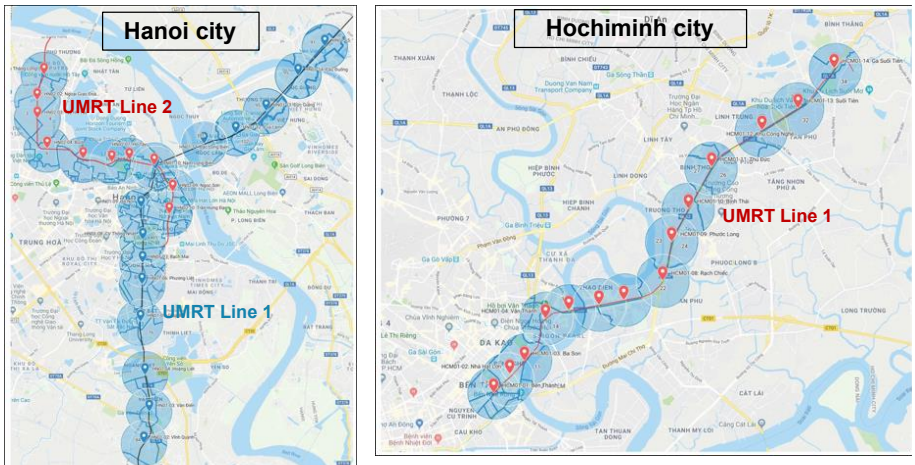
Part 3 Expectation regarding Urban Railway Usage: Opinions of taxi and bus drivers regarding their job when railway lines start operating.

Part 4 Fuel Efficiency: Engine capacity, type of fuel, and fuel consumption.

* See Appendix 1 for the questionnaire.

3) Survey Area

The interviewees are local residents living within a 1-km radius of the planned stations, as well as bus and taxi drivers along each line.



Survey area is within 1-km radius of MRT stations:

- Hanoi city: 15 stations (Line 1) & 10 stations (Line 2);
- Hochiminh city: 14 stations (Line 1)

Figure 6-1 Interview Survey Areas

4) Method of Interview

Local residents were interviewed on roads or in their homes, while taxi/bus drivers were interviewed along each line.

5) Survey Results

a) Outline

<u>Hanoi City's Urban Railway Line 1</u>

Residents: Conducted from 26 June 2019 to 8 July 2019; total sample = 2018. The details are shown in Table 6-2.

Taxi/Bus Drivers: Conducted from 1 July 2019 to 8 July 2019; total sample = 101. Taxi drivers were interviewed at Giap Bat Station, Bach Mai Hospital, and Long Bien Station. Bus drivers were interviewed at Giap Bat Station and Long Bien Station.

Table 6-2 Number of Samples for Hanoi City Urban Railway Line 1 by Station

No.	Station	No. of Samples
1	Ngoc Hoi	101
2	Vinh Quynh	100
3	Van Dien	102
4	Hoang Liet	201
5	Giap Bat	206

No.	Station	No. of Samples
6	Phuong Liet	204
7	Bach Mai Hospital	197
8	Thong Nhat Park	154
9	Hanoi	149
10	South of Long Bien bridge	100
11	North of Long Bien bridge	100
12	Gia Lam	100
13	Duc Giang	102
14	Cau Duong	100
15	Yen Vien	102
Total		2018

Hanoi City's Urban Railway Line 2

Residents: Conducted from 1 July 2019 to 16 July 2019; total sample = 2,000. The details are shown in Table 6-3.

Taxi/Bus Drivers: Conducted from 1st July 2019 to 6th July 2019; total sample = 100. Taxi drivers were interviewed on roads around the planned stations, such as Nguyen Hoang Ton Street, Vo Chi Cong Street, Lac Long Quan Street, and Ly Thuong Kiet Street. Bus drivers were interviewed at Gia Lam Station, Long Bien Station, Kim Ma Station, and Time City Station.

Table 6-3 Number of Samples for Hanoi City Urban Railway Line 2 by Station

No.	Station	No. of Samples
1	Nam Thang Long	199
2	Ngoai Giao Doan	201
3	Tay Ho Tay	167
4	Buoi	253
5	Quan Ngua	252
6	Bach Thao	148
7	Ho Tay	146
8	Hang Dau	232
9	Ngoc Son Temple	150
10	Tran Hung Dao	252
Total		2,000

HCMC's Urban Railway Line 1

Local Residents: Conducted from 20 July 2019 to 1 August 2019; total sample = 2,036. The details are shown in Table 6-4.

Taxi/Bus Drivers: Conducted from 31 July 2019 to 3 August 2019; total sample = 106. Taxi drivers were interviewed at commercial centers, such as Vincom Dong Khoi in District 1 and Cantavil and Vincom Thao Dien in District 2. Bus drivers were interviewed at the National University, Cho Lon Market, International University, and High Tech Park.

Table 6-4 Number of Samples for HCMC Urban Railway Line 1 by Station

No.	Station	No. of Samples
1	Ben Thanh	103
2	Opera House	97
3	Ba Son	52
4	Van Thanh	165
5	Tan Cang	110
6	Thao Dien	218
7	An Phu	157
8	Rach Chiec	143
9	Phuoc Long	182
10	Binh Thai	180
11	Thu Duc	245
12	High Tech Park	164
13	Suoi Tien	120
14	Suoi Tien Terminal	100
Total		2,036

b) Modal Shares

Table 6-5 shows the shares of current transport modes among the respondents who answered that they would use MRT in the future. The shares are shown under "representative mode base" and "passenger-km base." The results show that motorcycle has the highest proportion with over 80% for Hanoi Line 1 and Line 2 and over 90% for HCMC Line 1. The second-highest shares are for private car with 7.0%, 7.4% and 5.0% for Hanoi Line 1, Line 2, and HCMC Line 1, respectively.

Table 6-5 Current Transport Modes among Potential MRT Users

	Item	On foot	Bicycle	E-bicycle	Motor-cycle	E-Motor cycle	Private Car	Bus	Others	Total
Line 1 Hanoi	Representative mode base	134	127	86	2942	29	90	169	29	3606
		3.7%	3.5%	2.4%	81.6%	0.8%	2.5%	4.7%	0.8%	100%
	Passenger-km base	193	299	301	19055	86	1653	1493	494	23573
		0.8%	1.3%	1.3%	80.8%	0.4%	7.0%	6.3%	2.1%	100%
Line 2 Hanoi	Representative mode base	25	58	51	1119	8	40	45	11	1357
		1.8%	4.3%	3.8%	82.5%	0.6%	2.9%	3.3%	0.8%	100%
	Passenger-km base	65	124	134	5305	21	496	332	226	6702
		1.0%	1.9%	2.0%	79.2%	0.3%	7.4%	4.9%	3.4%	100%
Line 1 HCMC	Representative mode base	65	30	11	5013	0	136	90	39	5384
		1.2%	0.6%	0.2%	93.1%	0.0%	2.5%	1.7%	0.7%	100%
	Passenger-km base	66	91	21	31827	0	1732	671	282	34689
		0.2%	0.3%	0.1%	91.7%	0.0%	5.0%	1.9%	0.8%	100%

* Analyed using the samles who answered that they will use MRT.
* Representative mode base: Identify "one" representative mode of transportation if respondent used multiple type of transportation, in the order of "bus -> private car -> motor bike -> bicycle -> on foot".

c) Fuel economy

Table 6-6 shows fuel economy by transport mode which were obtained through the interview surveys.

Table 6-6 Fuel Economy

(Unit: km/liter)

Mode		Hanoi		HCMC	Average
		Line 1	Line 2	Line 1	
Private Car		12.5	10.0	11.4	11.1
	No. of Samples	34	58	44	136
Motorcycle		37.2	37.2	43.6	39.6
	No. of Samples	1,637	1,315	1,826	4,778
Taxi		11.4	12.7	11.1	11.8
	No. of Samples	51	68	50	169
Bus		3.5	3.2	3.0	3.3
	No. of Samples	50	32	21	103

d) Average occupancy rate

Table 6-7 shows average occupancy rate by transport mode which were obtained through the interview surveys.

Table 6-7 Average Occupancy Rates

(Unit: passenger/unit)

		Hanoi		HCMC	Average
		Line 1	Line 2	Line 1	
Private Car		2.3	1.8	2.3	2.1
	No. of Samples	47	67	42	156
Motorcycle		1.4	1.2	1.3	1.3
	No. of Samples	1,656	1,410	1,900	4,966
Taxi		2.5	2.3	2.2	2.3
	No. of Samples	51	68	50	169
Bus		31.1	22.5	37.4	29.4
	No. of Samples	49	32	21	102

e) Local residents' willingness of MRT usage

The interview survey asked local residents about their willingness of MRT usage. Table 6-8 Local Residents' Perception shows different attitude by MRT line, i.e., 66% on Hanoi City Line 1, 30% on Hanoi City Line 2 and 81% on HCM City Line 1. The highest willingness was given to HCMC Line which already showed railway structure and stations to the local residents during the survey period.

The survey further revealed that the reasons why the rest of local residents did not show their willingness of MRT usage. Two main reasons - 'private vehicle preference' and 'inconvenient route alignment' were commonly observed in their answers among 3 MRT lines

Table 6-8 Local Residents' Perception

			Hanoi		HCMC
			Line 1	Line 2	Line 1
Willing To Ride MRT		No. of Samples	1,340	609	1,629
		(%)	66	30	81
Not willing to Ride MRT	Due to private vehicle preference	No. of Samples	402	562	149
		(%)	20	28	7
	Due to inconvenient route alignment	No. of Samples	119	673	176
		(%)	6	34	9
	Due to long waiting time	No. of Samples	63	41	10
		(%)	3	2	less than 1
	Due to far station location	No. of Samples	28	25	10
		(%)	1	1	less than 1
	Due to pick pocket	No. of Samples	43	20	24
		(%)	2	1	1
	Due to poor network connection	No. of Samples	20	22	7
		(%)	1	1	less than 1
Others/Unknown		No. of Samples	3	48	0
		(%)	less than 1	2	0
TOTAL		No. of Samples	2,018	2,000	2,005
		(%)	100	100	100

6.3 Calculation of GHG Emission Reductions

The GHG emission reductions of each target urban railway lines were calculated using the methodology described in Section 5.2. Table 6-9 shows the parameters used in the calculation and which are described in sections 6.1 and 6.2.

Table 6-9 Parameters Used in Calculating GHG Emission Reductions

Parameter		Hanoi		HCMC	
		Line 1	Line 2	Line 1	
PKM_y Transported volume by MRT in year *y* (passenger-km/day)		7,882,000	5,614,000	7,995,000	1
$EF_{PKM,i}$ CO_2 emission factor per passenger-km for transport mode *i* (gCO_2/passenger-km)	Private car	96.1			2
	Motorcycle	43.5			
	Taxi	82.5			
	Bus	27.6			
	MRT	26.4			3
$MS_{i,y}$ Share of passengers using transport mode *i* in the baseline in year *y* (%)	Private car	7.0	7.4	5.0	4
	Motorcycle	80.8	79.2	91.7	
	Taxi	2.1	3.4	0.8	
	Bus	6.3	4.9	1.9	

*1: See Table 6-1
*2: Calculated using fuel economy (Table 6-6), ocupancy rates (Table 6-7) and following data
Density (kg/liter): Diesel Oil 0.84, Gasoline 0.73 (Diesel:TCCS 03:2015/PLX, Gasoline: TCCS 01:2018/SP）
Net Calorific Value (MJ/kg): Diesel Oil 43.0, Gasoline 44.3 (IPCC2006 Guidelines)
CO_2 emission factor (tCO_2/MJ): Diesel Oil 0.0000741, Gasoline 0.0000693 (IPCC2006 Guidelines)
*3: Estimated based on electricity consumption of MRT in Japan (0.0305kwh/per passenger-km: Average of 8 railway companies around Tokyo) and the grid emission factor (Table 6-1 e))
*4: See Table 6-5

Table 6-10 shows the GHG emission reductions for the three target lines. The estimated emission reductions of Hanoi Line 1, Line 2, and HCMC Line 1 are as follows: 54,541; 39,614; and 56,877 in tCO_2/year, respectively.

Dr. Nguyen Tu Lam of the Institute of Strategy and Policy on Natural Resources and Environmental (ISPONRE) uses the Asia-Pacific Integrated Model (AIM) to simulate effects of climate change mitigations in HCMC under SPI-NAMA. The GHG emission reduction from introducing the MRT was also simulated, and the estimated total reduction from introducing seven (7) lines is 414,000 tCO_2. HCMC Line 1, a single route, was estimated to generate a reduction of 56,877 tCO_2, which is generally consistent with Dr. Lam's estimate, if his estimate is divided the number of lines he studied.

Table 6-10 Estimated GHG Emission Reductions

Emission	Hanoi		HCMC
	Line 1	Line 2	Line 1
Baseline emission (tCO_2/year)	130,492	93,711	133,916
Project emission (tCO_2/year)	75,951	54,097	77,040
Emission reduction (tCO_2/year)	**54,541**	**39,614**	**56,877**

6.4 Comparison of GHG Emission Reductions

For reference, the Study Team compared the emission reductions between the method proposed in this Survey (hereafter referred to as JICA-proposed methodology, for ease of reference) and the more complicated method based on a CDM methodology (ACM0016 base: calculation of reduction amount including access and egress transportation). The CDM methodology requires more formulae and parameters to calculate emission reductions, and many surveys are required to obtain the needed data, which is very costly. It also requires the calculation not only of emissions from access/egress transport but also of the congestion reduction effects on surrounding roads along the MRT lines, in addition to emission reductions from modal shifts. However, in this Survey, only emissions from access/egress transportation are calculated, and excluded emissions resulting from reduced congestion. Emission reductions by both methodologies were calculated and compared (Table 6-11).

The emission reductions for each line calculated using the JICA-proposed methodology are smaller than the reductions calculated using the CDM methodology: For Hanoi Line 1, Line 2, and HCMC Line 1, the reductions are 83%, 70%, and 69%, respectively. The calculation by the JICA-proposed methodology can be described as conservative.

Table 6-11 Comparison between the JICA-proposed Methodology and CDM Methodology

Item	Proposed Methodology*1	CDM Methodology (ACM0016)*2
Calculation of ER	Simple	Complicated
No. of Formulae	4	18
No. of Parameters	5	24
Monitoring	Simple	Complicated
No. of Monitoring Parameters	3 (or 4)	14
Necessary Survey for Monitoring	- Interview survey (face-to-face or simpler approach) *Every two years (depending on the cycle of reporting to UNFCCC)	- Interview survey (face-to-face) - Occupancy rate survey - Vehicle speed survey - Vehicle count, etc. *1st and 4th year
Cost (1 MRT line per year)	Less than USD20,000 for the face-to-face survey	USD150,000 for all the above surveys
Estimated Emission Reductions (tCO_2/year)	Hanoi Line 1 : 54,541	Hanoi Line 1 : 65,453
	Hanoi Line 2 : 39,614	Hanoi Line 2 : 56,632
	HCMC Line 1 : 56,877	HCMC Line 1 : 82,026

*1: For simplification, assuming the baseline trip distances are equal to project (MRT) trip distance, i.e., excluding access/egress transport and emissions with congestion changes.
*2: Includes access/egress transport, i.e., door-to-door, emissions. Excludes emissions resulting from reduced congestion.

Table 6-12 compares the data/information required by the JICA-proposed methodology and the CDM methodology. Because the latter needs to calculate emissions from access/egress transportation, it also requires more surveys than the proposed methodology.

Table 6-12 Comparison of Needed Data/Information by the JICA-proposed Methodology and CDM Methodology

Needed Data/ Information	Proposed Methodology	CDM Methodology (ACM0016)
General information (e.g., age, gender, income, driver's license)	✓	✓
Trip data (with MRT)	-	-
Origin and destination	✓	✓
Purpose of trip	✓	✓
Frequency of trip	✓	✓
Entry station and exit station of MRT	✓	✓
Transport mode (origin to entry station, incl. transfers)	-	✓
Distance traveled (origin to entry station, incl. transfers)	-	✓
Transport mode (exit station to destination, incl. transfers)	-	✓
Distance traveled (exit station to destination, incl. transfers)	-	✓
Trip data (without MRT)	-	-
Whether passenger made the trip without the MRT	✓	✓
Origin and destination	✓	✓
Transport mode (origin to destination, incl. transfers)	-	✓
Transport mode (representative mode)	✓	-
Distance traveled (origin to destination, incl. transfers)	-	✓

Table 6-13 shows the GHG emission reductions of urban railway projects in Indonesia, Thailand, and India, as well as the results of past studies of Hanoi Line 1 and Line 2, and HCMC Line 1 which were conducted by the Ministry of Environment, Japan. The emission reductions per passenger for each project is shown in the table for a clearer comparison. The emission reductions per passenger of this Survey are 0.20 to 0.25 kgCO_2, and these values are significantly lower than the case of India (Delhi Metro: 0.75, Mumbai Metro One: 1.03) and Thailand (Purple Line: 0.76). This is because in Vietnam the modal shift to the MRT is expected to come mostly from users of motorbikes, which emit low CO_2 per passenger-km. In the case of India and Thailand, the higher percentage of shift has come from users of buses and private cars.

Table 6-13 Comparison among Urban Railway Projects/Other Studies

Project	Type	Length	Ridership	Baseline Emission	Project Emission	Emission Reduction	Emission Reduction/ Passenger	Source
		(km)	(pass./day)	(tCO_2/year)	($kgCO_2$/ passenger)			
Hanoi Line 1	Estimation	23.7	542,772	144,138	30,473	113,664	0.57	*1
Hanoi Line 2	Estimation	27.2	535,000	135,016	30,147	104,869	0.54	*1
HCMC Line 1	Estimation	19.7	620,000	135,925	21,440	114,485	0.51	*1
Jakarta South-North line	Estimation	23	629,900	175,535	59,967	115,569	0.50	*1
Hanoi Line 1	Estimation	23.7	*542,772*	92,466	54,199	38,267	0.19	*2
Hanoi Line 2	Estimation	10.9	535,000	69,434	27,855	41,579	0.21	*2
HCMC Line 1	Estimation	19.7	620,000	144,669	55,990	88,678	0.39	*2
Bangkok, Purple line	Actual Monitoring	20	26,000	18,735	11,125	7,250	0.76	*3
Bangkok, Airport Rail Link	Actual Monitoring	28.6	37,415	11,618	6,302	5,316	0.39	*4
Delhi Metro	Estimation	102	1,685,899	758,933	296,020	462,913	0.75	*5
Mumbai Metro One	Estimation	64	578,817	293,006	75,732	217,274	1.03	*6
Metro in Delhi, Kolkata, Chennai, and Bangalore	Actual Monitoring	-	-	-	-	720,000	-	*7
Hanoi Line 1	Estimation	27.2	597,000	131,378	75,951	55,427	0.25	*8
Hanoi Line 2	Estimation	34.4	556,000	94,302	54,097	40,206	0.20	*8
HCMC Line 1	Estimation	19.0	687,000	135,099	77,040	58,059	0.23	*8

*1: New Mechanism Feasibility Study for Development of Mass Rapid Transit (MRT) Systems in Jakarta, Indonesia, and Hanoi and Ho Chi Minh, Viet Nam. 2011. Ministry of Environment, Japan.
*2: JCM/BOCM Feasibility Study for Promotion of Modal Shift from Road-based Transport to Mass Rapid Transit (MRT) System. 2012. Ministry of Environment, Japan.
*3: Thailand, MOT
*4: MRV Demonstration Study usind Model Project "Transport Modal Shift through Construction of MRT System." 2012. Ministry of Environment, Japan.
*5: CDM Project Design Document "Metro Delhi"
*6: CDM Project Design Document "Mumbai Metro One"
*7: The Second Bienial Update Report of India
*8: This Survey

7. Dissemination and Outreach of the Survey

Table 7-1 shows activities on dissemination and outreach of this Survey.

Table 7-1 Activities on Dissemination and Outreach of this Survey

Activity	Outline
Meetings	• The field survey was conducted four (4) times, and each time, the Study Team had meetings with the following related organizations and donors to explain the progress of the Survey and to exchange opinions. • Related organizations: MOT/DOE, MONRE/DCC, MRB, DONRE, MAUR • Donors: ADB, WB, UNDP, GIZ • Research institutes: a. Dr. Dinh Van Hiep (Associate Professor, Institute of Planning & Transportation Engineering, National University of Civil Engineering) b. Dr. Ho Quoc Bang (Associate Professor, Vietnam National University Ho Chi Minh City), and c. Dr. Nguyen Tu Lam (ISPONRE) * See Appendix 5 to 8 for details.
Interim Report Meetings	• Outline Interim Report meetings were held in Hanoi and HCMC to report the progress of this Survey and to obtain the advice/opinion of relevant organizations, such as government agencies. Following the keynote speeches by Dr. Fukuda of Nihon University and Dr. Hiep of the National University of Civil Engineering (lectures on the contribution of urban railways to climate change and local environment), the Study Team reported on the survey progress and sought the opinions of participants. In the meeting in HCMC, the details of the development plan for urban railway Line 1 was provided. In these meetings, there were active discussions about the proposed MRV methodology and the necessary data for the calculation. The Study Team considered these comments in finalizing its proposal. • Hanoi City Date: 14:00–17:00, Monday, 4 November 2019 Participants: Related ministries, local governments, university and research institutes, donors, media, etc. Venue: Melia Hanoi Hotel • HCMC Date: 13:30–16:30, Tuesday, 5 November 2019 Venue: Sheraton Saigon Hotel & Towers Participants: Related ministries, local governments, university and research institute, donors, media, etc. * See Appendix 9 and Appendix 10 for details.
Expert Meeting	• Outline: The Expert Meeting was held to get the advice/ comments on the proposed MRV methodology. Vietnamese and Japanese transport and climate change experts, as well as government agencies related to urban railway projects, were invited. In the meeting, there were active discussions on the proposed MRV methodology and its organizational structure. The Study Team considered these comments in finalizing the proposal. • Date: 14:00–16:00, Friday, 21 February 2020

Activity	Outline
	• Venue: JICA Vietnam Office • Participants: See Appendix 11
Final Report Meeting	• Outline: The Final Report Meeting was held in Hanoi in order to report the study results and disseminate the proposed content. Due to the COVID-19 pandemic, Japanese team members couldn't attend it while they presented their outputs through internet instead. From HCM, DONRE, DOT and others attended the meeting. Dr. Hiep of the National University of Civil Engineering moderated the wrap-up session for question and answer and active opinion exchange. • Date: 9:00–12:30, Friday, 23 October 2020 Venue: Hotel de Parc Hanoi Participants: Related ministries, local governments, university and research institutes, donors, media, etc. * See Appendix 12 for details.
Media Coverage	• At the Interim Report meetings, the Study Team were interviewed by media such as VTC. Representatives from 15 media outlets, including Saigon Times, Hanoi TV, Communist Party of Vietnam Online Newspaper, and the Voice of Vietnam Online, reported about the meetings. • Prior to the Final Report Meeting, the Study Team received several written questions and answered them in video to the visual media. The meeting was reported by 11 news media in total. * See Appendix 13 for details.
Leaflet	• A leaflet was prepared to disseminate the progress and outputs of this Survey, as well as the benefits of urban railway projects. The leaflet was distributed at the Interim Report meetings, the Final Report Meeting and at the 12th EST regional forum held on 28–31 October in Hanoi. * See Appendix 14 for an image of the leaflet.

8. Recommendations

To promote an effective MRV system for urban railway in Vietnam, the Study Team offers its recommendations to the Vietnamese and Japanese side.

8.1 Recommendations to MOT, MONRE, and Related Authorities

1) The MOT is planning to formulate a circular stipulating the development of an electronic MRV system for the transport sector. Since the consensus of related organizations for an MRV system for the urban railway sector has already started in this Survey, the Study Team recommends its incorporation into the electronic system and its inclusion in the circular.

2) To effectively and efficiently promote the MRV system for the urban railway sector, it is important to utilize existing organizational systems and statistical systems to avoid excessive burden on related organizations in terms of data collection and consolidation. For example, regarding data reporting in urban railway, referring to the existing statistical system, the smoothest process is for the MRT operating company to submit a monthly report to the city and provincial DOTs, and the DOTs in turn consolidate these into an annual report for the MOT.

3) In calculating GHG emission reductions from urban railway projects, two of the most basic data items are: "CO_2 emission factor per passenger-km for each transport mode" (gCO_2/passenger-km) (calculate using fuel economy and average occupancy) and the "share of MRT passengers using transport mode i in the baseline if there were no MRT."

   For gCO_2/passenger-km, the Study Team recommends that the MOT collect data on fuel consumption and average number of passengers for each vehicle type and regularly prepare and publish the CO_2 emission factor (passenger-km base) in the same manner as MONRE publishes the grid emission factors. The effective way to realize it is to incorporate these parameters into the existing national statistical system. For example, it may be effective to include the necessary parameters to revise Circular No. 48/2017/TT-BGTVT (include the average number of passengers for each type of vehicle) and Circular No. 63/2014/TT-BGTVT (include fuel economy and average number of passengers). On the other hand, it is also recommended that transport companies, such as buses and taxis, count the average number of passengers as part of marketing and service improvement. These data will be important not only for the MRV for urban railway but also for factor analysis in the increase/decrease of GHG emissions in the transport sector in Vietnam. In Japan, the Ministry of Land, Infrastructure, Transport and Tourism and the Ministry of the Environment publish fuel consumption and CO_2 emission factors (in passenger-km base) by vehicle type every year and use these data for factor analysis of GHG emissions in the transport sector.

   As for the "share of MRT passengers using transport mode i in the baseline if there were no MRT," the Study Team believes it will be more efficient if the DOT and/or the MOT will collect/analyze the data when conducting surveys on urban transport in Hanoi City, HCMC, and elsewhere. At the same time, it is also recommended that MRT operators collect the data through passenger interviews as part of marketing and service improvement. On the other hand, in the future, when the IC card ticketing

system will be commonly used in the transport services, the share can be collected through the system in combination with mobile applications.

4) The MRV of GHG emissions is a completely new task for related organizations other than MOT/DOE, MONRE, and DONRE. Therefore, MONRE and MOT/DOE should provide trainings in MRV to related organizations. On the other hand, the MRV system in urban railway is not familiar to the MOT/DOE, MONRE and DONRE; therefore, trainings by experts, such as those from JICA, are necessary.

5) The MOT and MONRE should seek assistance from domestic and/or foreign experts to calculate and monitor GHG emission reductions, especially in the early stages of implementing the MRV system.

6) The Study Team also recommends the conduct of a pilot project when the first MRT line in Vietnam (such as Hanoi Line 2A) starts operation to test the proposed MRV system in an actual situation and to make necessary improvements to it. By doing so, the MOT and other related organizations can gain expertise and experiences in developing and implementing MRV systems.

8.2 Recommendations to JICA

1) In this Survey, the Team proposed an MRV system that takes into account the actual conditions in Vietnam. In the next step, it is necessary to apply the proposed MRV system to actual projects and improve the methodology and system. When the first MRT line in Vietnam (e.g., Hanoi Line 2A) starts operation, the Study Team proposes that a pilot project be carried out to apply the proposed MRV system and to enhance the capacity of related organizations to implement it. The image of the proposal is shown in Figure 8-1.

2) Since no organization in Vietnam is familiar with MRV in urban railway, it is necessary to provide training courses for related organizations such as MOT/DOE, MONRE, DONRE, DOT, MRT operating companies, etc.

3) To collect data required for MRV in urban railway more effectively and efficiently, needed data should be incorporated into the list of statistics of existing statistical systems in Vietnam. The Study Team recommends providing a training on statistical systems in the transport sector in Japan as reference for Vietnam.

4) Local experts pointed out the need to evaluate the impact of urban railway projects besides GHG emission. Toward this end, the Study Team recommends providing a training in evaluating the impact of urban railways on the local environment and the conduct of a case study on specific MRT lines.

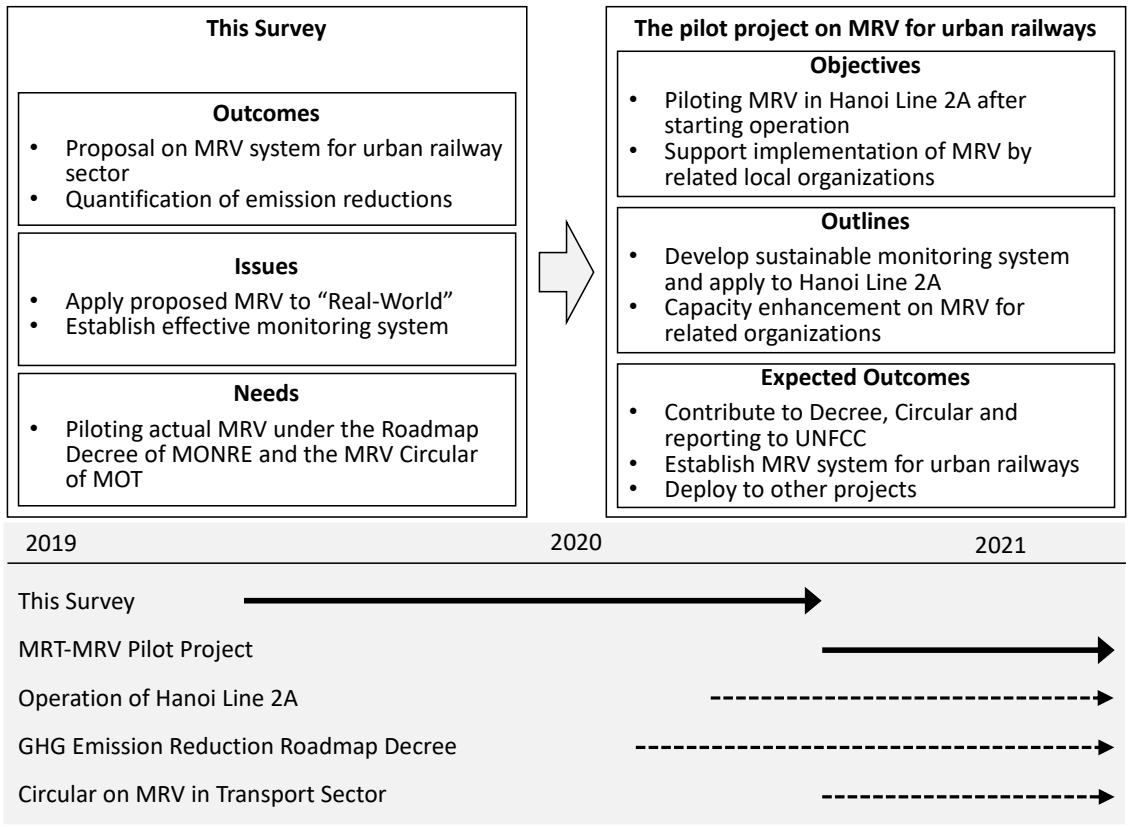


Figure 8-1 Proposal for a Pilot Project on MRV System for Urban Railway Sector

Appendix 1　Questionnaire for the Interview Surveys

資料５

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DATA COLLECTION SURVEY ON DEVELOPMENT OF MEASUREMENT, REPORT AND VERIFICATION (MRV) SYSTEM IN URBAN RAILWAY SECTOR IN VIETNAM

QUESTIONNAIRE FORM

LOCAL RESIDENTS ALONG PLANNED URBAN RAILWAY LINE

UMRT Line No.	
City	
Station ID	
Date	
Time	
Individual ID	
Name of Surveyor	

A. General information

1.	Full name:		Gender:		ID:
2.	Adress:				Code:
3.	Age:	□ < 18	□ 19-40	□ 41-60	□ > 60
4.	Phone number:				
5.	Vehicle Ownership:				

□ Bicycle	□ Electric Bicycle	□ Electric Motorbike	□ Motorbike	□ Car	□ Do not own vehicle

6. Purpose of using vehicle: □ For private □ For business (taxi, grab other services)……

7. Occupation

□ Agriculture & Forestry & Fishery	□ Manufacturing & Construction	□ Executive officer	□ Business	□ Physician or nurse
□ Teacher	□ Public administration officer	□ Housework	□ Student	□ Others

8. House type: □ Apartment □ Private House □ Rent

9. Income per person per month	□ < 5.000.000 VND	□ 5.000.000 - 10.000.000	□ > 10.000.000 VND

B. One week-day trip information [Trip > 500m only] Date: / /2019 (the day before the researcher visit)

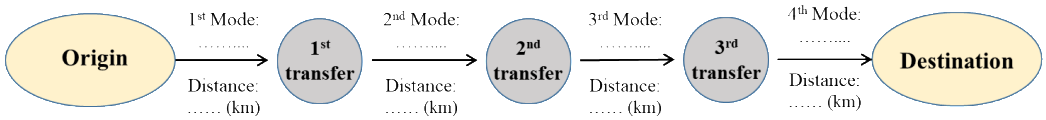
[1] First trip

□ Origin:……..Zone:……..

□ Destination: …….. Zone:…….

1.1. Purpose of trip □ Go to work □ Go to school □ Go shopping □ Go to hospital
□ Delivery kids to school □ Go home □ Others ……

1.2. Travel information



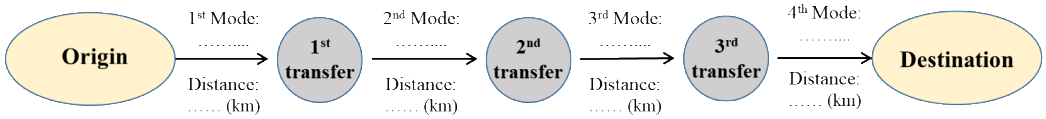
[2] Second trip

□ Origin:……..Zone:……..

□ Destination: …….. Zone:…….

2.1. Purpose of trip □ Go to work □ Go to school □ Go shopping □ Go to hospital
□ Delivery kids to school □ Go home □ Others ……

2.2. Travel information



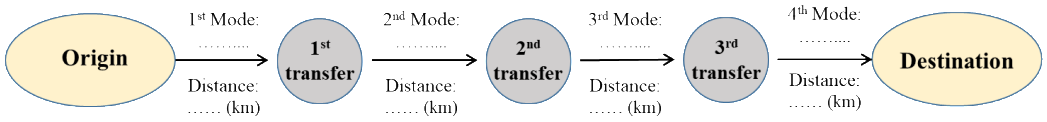
[3] Third trip

□ Origin:……..Zone:……..

□ Destination: …….. Zone:…….

3.1. Purpose of trip □ Go to work □ Go to school □ Go shopping □ Go to hospital
□ Delivery kids to school □ Go home □ Others ……

3.2. Travel information



[4] Forth trip

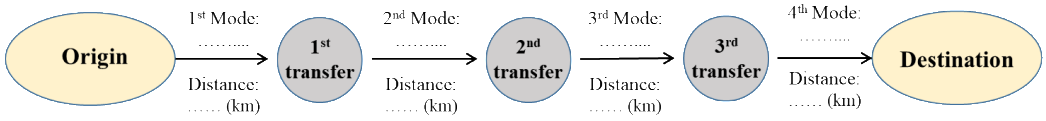
□ Origin:……..Zone:……..

□ Destination: ……..Zone:…….

4.1. Purpose of trip □ Go to work □ Go to school □ Go shopping □ Go to hospital

□ Delivery kids to school □ Go home □ Others ……

4.2. Travel information



[5] Fifth trip

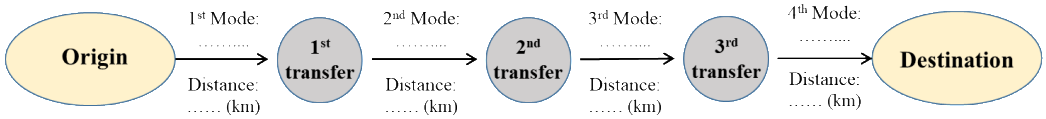
□ Origin:……..Zone:……..

□ Destination: ……..Zone:……..

5.1. Purpose of trip □ Go to work □ Go to school □ Go shopping □ Go to hospital

□ Delivery kids to school □ Go home □ Others ……

5.2. Travel information



The list of transportation mode

□ On foot (1) □ Bicycle (2) □ E-bicycle (3) □ Motorbike (4) □ E-motorbike (5)

□ Car (6) □ Bus (7) □ Others……. …(taxi, grab, rent-a-car…)

C. Expectation regarding Urban Railway Usage

C1. Are you willing to use Urban Railway Line… if it be operated? □ No [Move to C2] □ Yes [Move to C3]

C2. Why aren't you willing to use Urban Railway Line…..?

□ Being picked pocket □ Inconvenient route □ Have to wait

□ Station is far □ Bad connected network □ Prefer to use private vehicle

□ Others……

C3. What kind of trips you want to use Urban Railway Line…..?

□ Daily trips

C3.1. Purpose……

C3.2. Distance……..km

C3.3. Frequency of this trip: ……

□ Additional trips

C3.4. Purpose……

C3.5. Distance……..km

C3.6. Frequency of this trip: ……

C4. Assume that Urban Railway Line ..... is operated in HANOI, please answer below questions.

[1] First trip (at part B):

□ Will use MRT □ Won't use MRT □ Unsuitable MRT route

[2] Second trip (at part B):

□ Will use MRT □ Won't use MRT □ Unsuitable MRT route

[3] Third trip (at part B):

□ Will use MRT □ Won't use MRT □ Unsuitable MRT route

[4] Forth trip (at part B):

□ Will use MRT □ Won't use MRT □ Unsuitable MRT route

[5] Fifth trip (at part B):

□ Will use MRT □ Won't use MRT □ Unsuitable MRT route

The list of transportation mode (Access/Egress Mode)

□ On foot (1) □ Bicycle (2) □ E-bicycle (3) □ Motorbike (4) □ E-motorbike (5)

□ Car (6) □ Bus (7) □ Others……. …(taxi, grab, rent-a-car…)

D. Fuel efficiency (for vehicle used regularly)		
	For Car	**For Motorbike / E-Vehicle**
D1. How often do you refuel?	□ Everyday □ Once/week □ Once/month □ Others.....	□ Everyday □ Once/week □ Once/month □ Others.....
D2. How to refue □ Fill up tank □ Fixed amount of fuel / electricity □ Fixed amount of money	 .....liter .....VND	 .....liter or .....kWh .....VND
D3. Engine capacity:	cc	.....cc or .....kWh
D4. Maker of car/motorbike:		
D5. Model of car/motorbike:		
D6. Year of purchase:		
D7. Type of fuel: □ Gasoline (1) □ Diesel (2) □ Electricity (3) □ Other (4)		
D8. Travel distance for each refuel (estimate)	.....km	.....km
D9. Average fuel fee per week	.....VND	.....VND
D10. Average travel distance per week (estimate)	.....km	.....km
D11. Average number of people usually getting on (occupancy)	.....person	.....person

資料６

TEDI

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DATA COLLECTION SURVEY ON DEVELOPMENT OF MEASUREMENT, REPORT AND VERIFICATION (MRV) SYSTEM IN URBAN RAILWAY SECTOR IN VIETNAM

QUESTIONNAIRE FORM

BUS DRIVERS AND CONDUCTORS

UMRT Line No.	
City	
Station ID	
Date	
Time	
Individual ID	
Name of Surveyor	

A. General information

1. Full name: Gender:
2. Age: □ < 18 □ 19-40 □ 41-60 □ > 60
3. Phone number:
4. Years of work:…… years
5. Name of firm:
6. Working time (shift): ..... hours (From……To……)
7. Income per month: □ < 10.000.000 VND | □ 10.000.000 - 15.000.000 VND | □ > 15.000.000 VND

B. Service area

1. Bus route number:
2. Route information (from start point to end point):……..
   ……
3. Distance from start point to end point:……km
4. Average number of trips per shift:
5. Average number of passengers per trip:

C. Expectation regarding Urban Railway Usage

Assume that Urban Railway Line ..... is operated in HANOI, please show your opinion.

1. Number of passengers will be ...?	□ Increase	□ Decrease	□ No idea
2. Number of buses for this route will be ...?	□ Increase	□ Decrease	□ No idea
3. Bus route will be ...?	□ Change	□ No change	□ No idea
4. Your income will be ...?	□ Effect	□ No effect	□ No idea

D. Fuel efficiency

D1. Engine capacity: .....cc D2. Maker of engine: .....

D3. Model of engine:..... D4. Year of purchase:.....

D5. Type of fuel: □ Gasoline □ Diesel □ Electricity □ Other

D6. How to refuel

□ Fill up tank (.....littre) □ Fixed amount of fuel.....littre □ Fixed amount of money..... VND

D7.Petrol Station Location:.....

□ Belong to Bus Operator □ Public petrol station

D8. Travel distance/trips for each refuel (estimate).....km/trip

D9. Amount of fuel consumption for 100km: littre/100km

D10. Fuel fee for 100km:.....VND

D11. Travel distance for each shift (estimate).....km

TEDI

ALMEC VPI

DATA COLLECTION SURVEY ON DEVELOPMENT OF MEASUREMENT, REPORT AND VERIFICATION (MRV) SYSTEM IN URBAN RAILWAY SECTOR IN VIETNAM

QUESTIONNAIRE FORM

TAXI DRIVERS

UMRT Line No.	
City	
Station ID	
Date	
Time	
Individual ID	
Name of Surveyor	

A. General information

1.	Full name:		Gender:	
2.	Age:	□ < 18	□ 19-40	□ 41-60	□ > 60
3.	Phone number:			
4.	Years of work:…… years			
5.	Name of firm:			
6.	Working time (shift): …… hours (From……To……)			
7.	Income per month	□ < 10.000.000 VND	□ 10.000.000 - 15.000.000 VND	□ > 15.000.000 VND
8.	Vehicle ownership pattern	□ Private	□ Company	□ Co-owner (Private and Company)

B. Service area

1. Average number of passengers per trip per day:……persons
2. Average number of trip with passengers per day:……trips
3. Average distance per trip (with passengers):……km
4. Frequent pick-up points (districts):……
   ……
5. Frequent drop-off points (districts):……
   ……
6. Total distance travelled per day:……km

C. Expectation regarding Urban Railway Usage

Assume that Urban Railway Line ..... is operated in HANOI, please show your opinion.

1. Number of passengers will be ...?	□ Increase	□ Decrease	□ No idea
2. Number of taxies will be ...?	□ Increase	□ Decrease	□ No idea
3. Frequent pick-up and drop-off points will be ...?	□ Change	□ No change	□ No idea
4. Your income will be ...?	□ Effect	□ No effect	□ No idea

D. Fuel efficiency

D1. Engine capacity: .....cc D2. Maker of engine: .....

D3. Model of engine:..... D4. Year of purchase:.....

D5. Type of fuel: □ Gasoline □ Diesel □ Electricity □ Others

D6. How to refuel

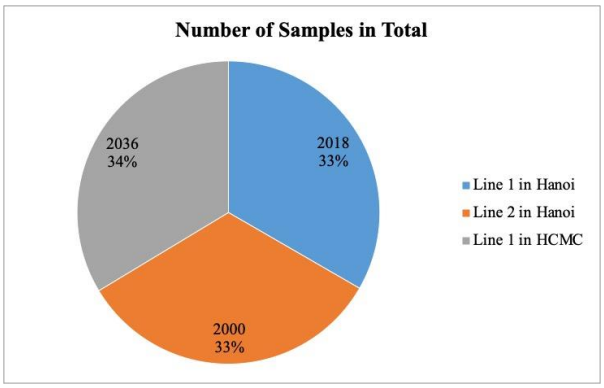
□ Fill up tank (.....littre) □ Fixed amount of fuel.....littre □ Fixed amount of money..... VND

D8. Travel distance for each refuel (estimate).....km

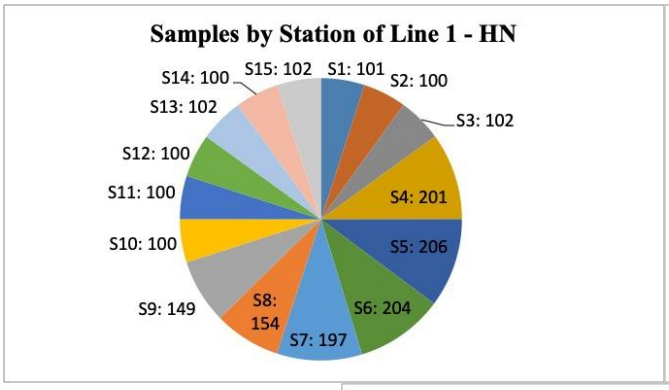
D9. Amount of fuel consumption for 100km: littre/100km

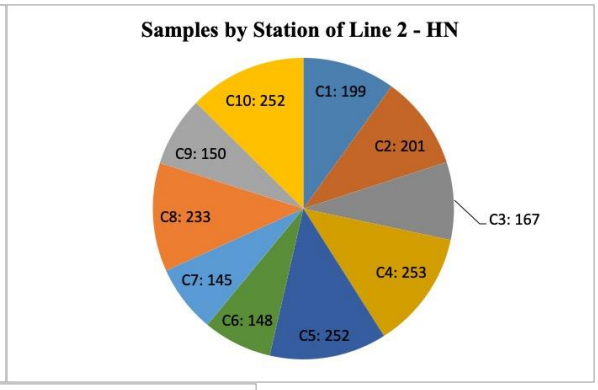
D10. Fuel fee for 100km:.....VND

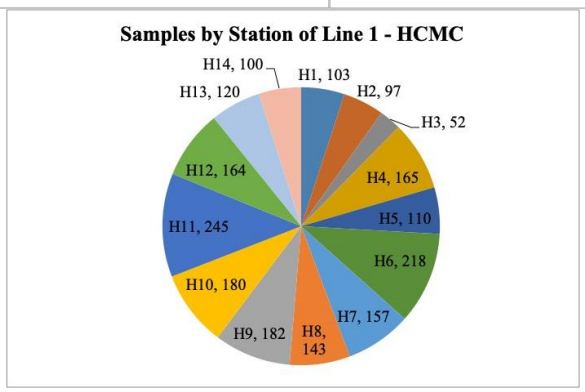
Appendix 2 Results of the Interview Surveys



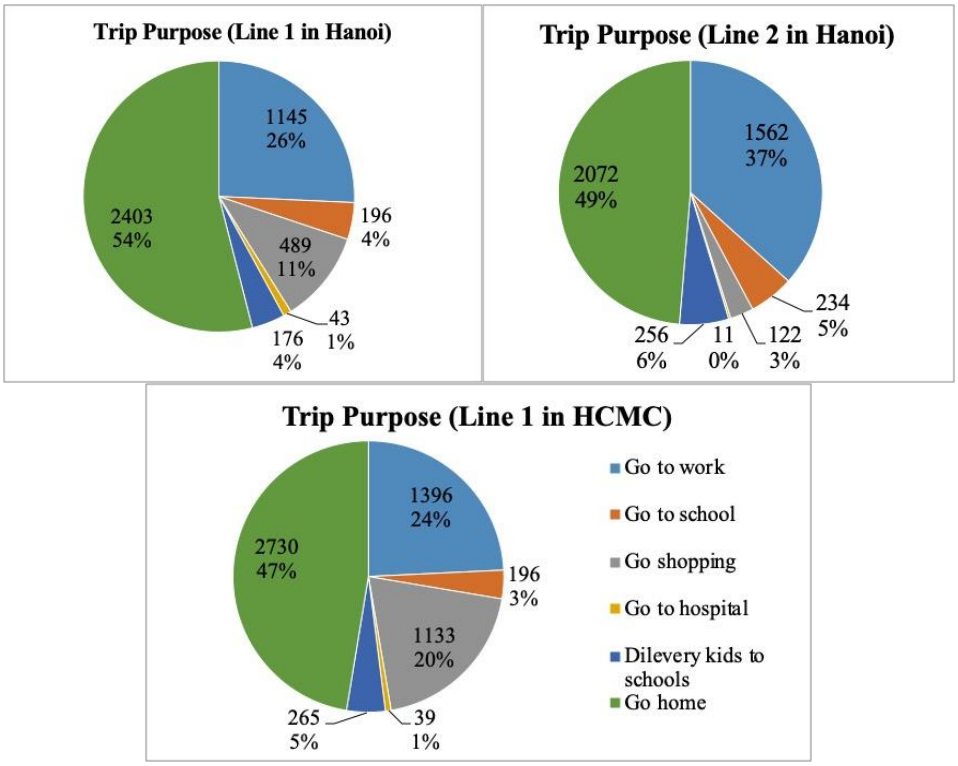
Number of samples by MRT lines



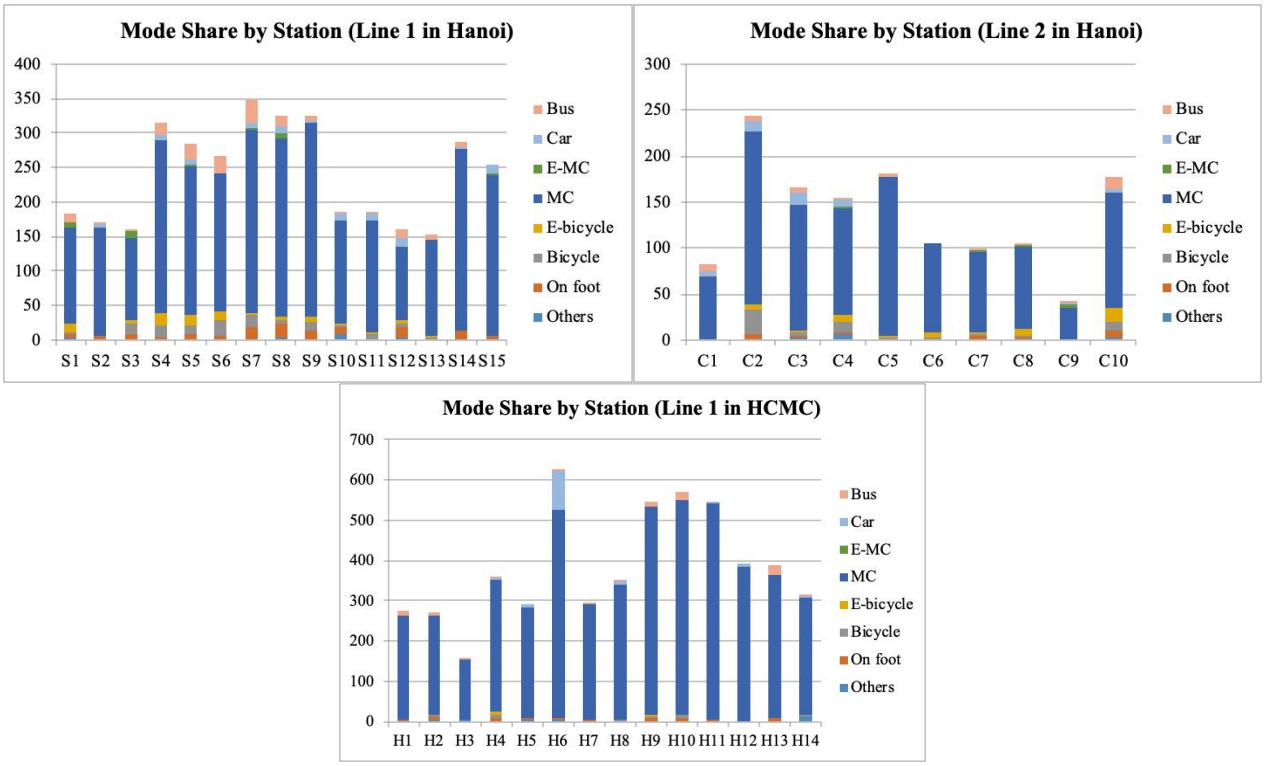




Number of samples by MRT stations



Purpose of trips



Current means of transportation by stations

Appendix 3 Format of the MRV Plan

The following form is provided based on the form proposed by JICA's "Project to Support the Planning and Implementation of NAMAs in a MRV Manner (Capacity Enhancement of Local Governments)" to the Government of Vietnam and HCMC.

MRV Plan
for Climate Change Mitigation Actions

Name of mitigation action:

Mitigation Implementing Entity:

Oversight Organization (s):

Legal basis

DD/MM/YYYY

Submitted by Mitigation Implementing Entity

1. General information on the mitigation action

1.1 Name of the mitigation action

1.2 Involved organizations and their roles

(Describe all major organizations and departments of HCMC involved in implementation of the mitigation action • *Describe name of the entities who are implementing the mitigation action* • *Specify which HCMC department(s) and agency(ies) will be the regulating departments and entities of the mitigation action)*

1.3 Objectives

(Describe objectives of the mitigation action e.g. to utilize unutilized energy source, to cope with local problems such as air pollution and water pollution, etc.)

1.4 Technology introduced under the mitigation action

(Describe the technology(ies) that have been installed to reduce/ avoid GHG emissions.)

1.5 Target GHG type

(*Select what types of GHG are reduced/ avoided through the mitigation action: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3)*

1.6 Location

(Describe the location that mitigation action takes place)

1.7 Timeframe

(Describe when the mitigation action started (preparation, construction/ installation, operation) and expected to end))

1.8 Cost of mitigation action

(Describe cost of the mitigation action or mitigation component of the project, including: • *Initial investment cost (where applicable, describe total cost of the entire project and cost of mitigation component)*

1.9 Benefits of mitigation action and contribution to sustainable development

(Describe what kinds of benefits will be brought to various beneficiaries by implementing the mitigation action, including: • *Social benefits (e.g. creation of jobs, opportunity for education)* • *Economic benefits (e.g. contribution to economic growth, improved energy condition, technology transfer)* • *Environmental benefits (e.g. reduced air pollution and water pollution)*

1.10 Source of funding and supporting financial scheme

(Describe the source(s) of funding to the mitigation action, including:

- *HCMC own budget*
- *Other national budget*
- *Support from donors and international agencies*
- *Others (specify the source))*

1.11 Information on international market mechanisms

(Describe whether the mitigation action has been or will be registered to any carbon market mechanism, such as:

- *International or bilateral carbon market mechanisms*
- *Clean Development Mechanism (CDM)*
- *Joint Crediting Mechanism (JCM)*
- *Others)*

2. Emission reduction calculation, monitoring and reporting

2.1 Logic of GHG emission reduction

(Explain how GHG emissions are reduced by the mitigation action. Describe both baseline GHG emissions (GHG that would be emitted without the mitigation action) and project GHG emissions (GHG that are emitted by implementing the mitigation action))

2.2 Methodology to calculate GHG emission reduction

(Describe only the name of the methodology(ies) applied or referred to in order to calculate GHG emission reductions of the mitigation action. Specify the version number and title of the methodology (e.g. approved small-scale CDM methodology AMS-I.D "Grid connected renewable electricity generation" Version 18.0)

2.3 Estimated GHG emission reduction

Estimated emission reductions:

2.4 Organizational structure for monitoring and reporting

(Describe the name of entities involved in MRV and their roles. A schematic diagram can be prepared to show the relationship among these entities, including responsible divisions/ position of monitoring management, responsible divisions/ position of monitoring of each parameter)

2.5 Monitoring period

2.6 Monitoring method

(Describe methods of direct measurement and/or data collection of each parameter, data collection interval of each parameter, default values applied and sources of the values)

2.6 QA/QC

(Quality assurance and quality check of the whole monitoring processes and data)

Annex

Annex I Applied methodology

(Describe details of each methodology applied to the mitigation action. Also describe complete equations for GHG calculation, items to be monitored, and items to be not monitored)

Appendix 4 Format of the Monitoring Report

The following form is provided based on the form proposed by JICA's "Project to Support the Planning and Implementation of NAMAs in a MRV Manner (Capacity Enhancement of Local Governments)" to the Government of Vietnam and HCMC.

Monitoring Report
for Climate Change Mitigation Actions

Name of mitigation action:

Monitoring period:

Mitigation Implementing Entity:

Oversight Organization Unit(s):

Legal basis

DD/MM/YYYY

Submitted by Mitigation Implementing Entity

Results of monitoring

1. Monitoring period

(Indicate the period the Mitigation Monitoring Report covers)

2. Emission reductions of the monitoring period

(Describe the result and steps of GHG emission reduction calculation using the applied methodology(ies) for the monitoring period)

3. Processes of the emission reduction calculation

(Describe the processes of GHG emission reduction calculation using the applied methodology(ies) for the monitoring period)

Annex

Annex I Monitored data during the monitoring period

(Include tables of monitored data and fixed (not monitored) data. And include monitoring/ measurement methods/ procedures. Also describe data sources and other supplementary information)

Appendix 5 Summary of the 1st mission

1. Outline

Objectives: To explain the Inception Report of the Survey to relevant organizations to share the understanding as well as to collect necessary information/data.

Period: 12th to 21st March, 2019

Members:

Ken Kumazawa, Project Manager/Urban and Transport Planning, ALMEC Corp.
Yasuki SHIRAKAWA, Climate Change/Transport Sector MRV, ALMEC Corp.
Minh Tu TRAN, Human Resource Development/Public Relations, ALMEC Corp.
Le Thi Thanh Nhan, Local Consultant, TDSI

2. Schedule of the visit

	Date	Time	Activities	Participants
1	March 12th	-	Arrive at Hanoi	
2	13th	10:00	JICA Vietnam Office	Mr. Murooka, Mr. Kasuya, Ms. Ha, Mr. Ichihara
		14:00	JICA Vietnam Office (Meeting with the representative of transport sector)	Mr. Murakami, Mr.Kasuya
		16:00	GIZ	Ms. Anna Pia Schreyoegg, Ms. Dang Thi Ly JICA: Mr. Kasuya, Ms. Ha , Mr. Ichihara, Ms. Matsuo
3	14th	9:30	MOT/DOE	Director General Mr. Tran Anh Duong, Mr. Hien JICA: Mr. Kasuya, Ms. Matsuo
		11:00	ADB MRV Workshop	-
		13:15	ADB	Mr. Mizusawa, Lê Hương Loan、Phạm Quang Phúc Consultants of the ADB project (VNECC): Đặng Hồng Hạnh、Cao Thị Thu Hương、Trịnh Bích Thủy Nguyễn Hồng Loan JICA: Mr. Kasuya
		16:30	MONRE/DCC	Director General Mr. Tang The Cuong, Deputy Director General Mr. Tan, Director Mr. Luong Quang Huy, Mr. Hung, Mr. Phuong JICA: Mr. Murooka, Mr. Kasuya, Ms. Ha
4	15th	9:00	MRB	MRB Mr. Ho Thanh Son and other officers
		11:00	Prof. Hiep	Dinh Van Hiep, Assoc. Professor, National University of Civil Engineering (NUCE), Hanoi, Vietnam JICA: Mr. Kasuya
5	16th	-	Information/data gathering and preparation of reports	
6	17th	-	Information/data gathering and preparation of reports	
7	18th	8:30	World Bank Urban Transport Workshop	
		13:50	World Bank	Ms. Jen Jungeun Oh JICA: Mr. Kasuya
		15:10	UNDP	Mr. Dao Xuan Lai、Mr. Jay Tyler Malette JICA: Mr. Kasuya, Ms.Ha
8	19th	14:00	HCMC DONRE	Deputy Director General Ms. Nguyen Thi Thanh My, Director Mr. Mai Tuan Anh DMHCC, Deputy Director Mr. Ha Minh Chau, Mr. Phoung、Ms. Linh JICA: Mr. Murooka, Mr. Kasuya, Ms. Ha, Mr. Ichihara
9	20th	9:00	MAUR	Mr. Duong Huu Hoa、Mr. TRAN Dang Thanh JICA: Mr.Kasuya
		14:15	Dr. Bang	Assoc. Prof. Ho Quoc Bang JICA: Mr. Kasuya, Mr. Ichihara
		16:20	JICA Vietnam Office	JICA: Mr. Kasuya
10	21st	-	Depart at HCMC Arrive at Narita	

3. Summary of the discussions

- Meeting with MOT/DOE

  Director General Mr. Duong expressed willingness to cooperate with this Survey. It was confirmed that the output of this Survey will be an important input to the MRV Circular which MOT will develop afterward. It was also advised that updates of necessary data for calculating emission reductions and consideration for consistency with the MRV methodology developed by ADB for urban railways.

- Meeting with MONRE/DCC

  Director General Mr. Cuong expressed willingness to cooperate with this Survey (with a letter). The methodology and calculated emission reductions need to be approved not only by MOT but also by MONRE, therefore this Survey is requested to work closely with MONRE and MOT. The focal points will be Mr. Tan and Mr. Huy.

- Meeting with HCMC DONRE/CCB

  Deputy Director General Ms. My expressed willingness to cooperate with this Survey and understood importance of the survey on MRV in urban railway sector. There was a request to submit a letter regarding the implementation of the Survey, and necessary arrangements should be discussed with the Ho Chi Minh City People's Committee Management Authority for Urban Railways (MAUR), which directly administrates urban railway projects in HCMC.

- Meeting with MRB in Hanoi and MAUR in HCMC

  MRB and MAUR understood importance of the Survey on MRV in urban railway sector and expressed willingness to cooperate with this Survey. MAUR had experiences on CDM survey in the past, and has knowledge of emission reduction methodologies. MAUR requested that before conducting the interview survey, JICA should send a letter addressed to the HCMC People's Committee (cc. to MAUR and DONRE).

- Meeting with other donors

  ADB has started to develop an MRV methodology for urban railway projects supported by ADB. Since the purpose is same as this Survey, it was confirmed that the final results should be well coordinated and consideration should be given to avoide double proposals to the Vietnamese government.

  Exchanged information on the latest situation in regard to supports on MRV and climate change in Vietnam with GIZ, World Bank and UNDP.

- Others

  Other activities were conducted such as the meeting with Dr. Hiep, contract with a local consultant, preparation for the supplemental survey, site visit of construction sites of urban railways.

Appendix 6 Summary of the 2nd Mission

1. Outline

Objectives: To report the progress of the Survey to relevant organizations and to observe the field interview surveys conducted in both Hanoi and Ho Chi Minh City.

Period: 21st to 27th July, 2019

Members:

Yasuki SHIRAKAWA, Ph.D., Climate Change/Transport Sector MRV, ALMEC Corp.
Minh Tu TRAN, Ph.D., Human Resource Development/Public Relations, ALMEC Corp.
Le Thi Thanh Nhan, Local Consultant, TDSI

2. Schedule of the visit

	Date	Time	Activities	Participants
1	July 21st	-	Arrive at Hanoi	
2	22nd	13:30	ADB	Mr. Mizusawa、Mr. Phuc Consultants of the ADB project (VNECC) : Ms. Hanh, Ms. Huong, Ms. Thuy JICA: Mr. Kasuya, Ms. Ha
		15:30	TEDI	-
3	23rd	14:00	MOT/DOE	Director General Mr. Duong, Mr. Lu, Mr. Hien JICA: Mr. Kasuya, Ms. Ha
		16:00	JICA Vietnam Office	Mr. Murooka, Mr. Kasuya, Ms. Ha, Ms. Matsuo
4	24th	10:00	MRB	Mr. Son (Head)
5	25th		Arrive at HCMC	-
			Visit the interview survey site	
6	26th	9:00	HCMC DONRE, HCMC MRT1 Operator	DONRE : Mr. Mai Tuan Anh DMHCC, Ms. Linh, Mrs. Phuong, Mr. Lan HCMC MRT1 Operator : Mr. Chau, Mr. Cong
		PM	Visit the interview survey site	-
7	27th	-	Depart at HCMC Arrive at Narita	-

3. Summary of the discussions

- MRV methodology

  As to the proposed emission reduction calculation formula, DOE/MOT advised that baseline and project emission should be calculated solely monitoring the parameter “MRT transport volume in passenger-km”, since it is difficult for MRT operators to obtain other parameters such as emission factors, and to consider simpler calculations. The JICA study team will consider more practical calculation method, especially on data acquisition.

- MRV organizational structure

  As to the proposed organizational structure for MRV of MRT projects, DOE/MOT, MRB and ADB prefers the Option 2, however, it should be revised in some points. HCMC DONRE commented the processes of Option 2 seems complicated. The JICA study team will revise the Option 2 in accordance with their comments.

- Interview Survey

  The interview surveys for Hanoi MRT Line 1 and Line 2 already finished and now in the process of data coding. As for HCMC MRT Line 1, the interview survey has been just started from 22nd July and progressing well.

- Interim Report Meeting

  The meetings, organized by JICA, are planned to be held in Hanoi and Ho Chi Minh City in October 2019. Details will be discussed and announced to each organization in due course.

- Dissemination activities

  At the SPI-NAMA workshop to be held in September and the report meetings of this Survey, the progress of the study will be delivered.

- Harmonization with ADB TA project

  ADB decided to utilize the same methodology as the JICA study to estimate emission reductions through operation of Hanoi MRT Line 3. It was agreed as well that we will harmonize both proposals on the MRV organizational structure.

Appendix 7 Summary of the 3rd Mission

1. Outline

Objectives: To organize the Interim Report Meetings (Workshops) in both Hanoi City and HCMC, and to report the progress of the Survey to relevant organizations and to have opinions/advices on the proposed MRV framework.

Period: 28th October to 8th November, 2019

Members:

Ken Kumazawa, Project Manager/Urban and Transport Planning, ALMEC Corp.
Yasuki SHIRAKAWA, Climate Change/Transport Sector MRV, ALMEC Corp.
Minh Tu TRAN, Human Resource Development/Public Relations, ALMEC Corp.
Le Thi Thanh Nhan, Local Consultant, TDSI

2. Schedule of the visit

	Date	Time	Activities	Participants
1	October 28th	-	Arrive at Hanoi (Shirakawa)	
2	29th	8:30	The 12th Asia EST Forum	
3	30th	14:00	MONRE/DCC Arrive at Hanoi (Kumazawa)	Deputy Director General Mr. Tan, Director Mr. Luong Quang Huy, Mr. Hung JICA: Mr. Kasuya, Ms. Matsuo
4	31st	14:00	Participation on the Seminar on Hanoi Line 2 extension and development plan	
5	November 1st	10:00	Vietnam Tokyo Metro One Member Limited Liability Company	General Director Mr. Naoshi Sakai
		13:00	JICA Vietnam Office	JICA: Mr. Murooka, Mr. Kasuya, Ms. Ha, Mr. Ichihara, Ms. Matsuo
		15:00	MOT/DOE	Director General Mr. Tran Anh Duong, Mr. Hien JICA: Mr. Ichihara, Ms. Matsuo
6	2nd	-	Preparation for Interim Report Meetings	
7	3rd	-	Field observation on Hanoi Line 2A, Line 3	
8	4th	10:00 14:00	ADB Interim Report Meeting (Hanoi) Arrive at HCMC	Mr. Phạm Quang Phúc Consultants of the ADB project (VNECC): Đặng Hồng Hạnh, Cao Thị Thu Hương, Mr. Tuan
9	5th	13:30	Interim Report Meeting (HCMC)	
10	6th	-	Arrive at Narita (Shirakawa)	
11	7th	-	Information/data gathering	
12	8th	-	Arrive at Narita (Kumazawa)	

3. Summary of the activities

- Interim Report Meeting

  Interim report meetings were held in both Hanoi City and HCMC. In Hanoi, major participants were relevant ministries, local government, universities/research institutes, donors and media. In HCMC, major participants were local government, universities/research institutes, IT company, media. Following the keynote speeches by Professor Fukuda of Nihon University and Associate Professor Hiep of National University of Civil Engineering (lectures on the contribution of urban railways to climate change and local environment), the Study Team made progress reports on the survey and had questions and opinions from participants. In the Meeting of HCMC, details of the development plan of urban railway Line 1 was provided. In these Meetings, there were active discussions about the proposed MRV methodology and necessary data for the calculation. The Study Team reflected these comments to the proposal.

- Discussions with related organizations

MOT/DOE: As well as confirming the agenda and contents of the Interim Report Meetings, discussions were made regarding the proposed MRV system and the calculation results of emission reductions. The Director General, Mr. Duong mentioned on the importance of urban railway sector in the MRV of transportation sector. It was commented that BaU should be defined in the MRV methodology. Also, it was pointed out that it is important to cooperate with ADB regarding the MRV in urban railway sector.

MONRE/DCC: As well as confirming the agenda and contents of the Interim Report Meetings, discussions were made regarding the proposed MRV system and the calculation results of emission reductions. MONRE expressed their appreciation that the Survey put efforts on developing Vietnam-specific emission factors based on the results of the interview surveys, but commented that the calculated emission reductions may be overestimated. Detailed explanation will be given at the time of next mission.

Vietnam Tokyo Metro One Member Limited Liability Company: The Study Team interviewed about the latest situation of urban railway development and organizational structure in Vietnam. Specifically, asked about the situation of each route regarding the organizational structure of operation and the data that can be collected in terms of GHG emission reduction calculation.

ADB: In relation to the ADB's technical cooperation on MRV in urban railway sector, discussed on the method to conduct the interview survey. Also discussions were made on how to set monitoring parameters (for example, mode share), and agreed that ADB and JICA will continue to closely communicate on developing the MRV methodology and organizational structure for the urban railway sector.

- Publicity

A leaflet was prepared regarding the progresses and results of the Survey as well as the benefits of the urban railway projects, and distributed it to the media at the Interim Report Meetings. A leaflet was the first version and it will necessary to be revised in order to input the updated results of the Survey, and will deliver at the Final Report Meeting and other workshops.

At the Interim Report Meetings, the Study Team were interviewed by media such as VTC. 15 media including Saigon Times, Hanoi TV, Communist Party of Vietnam Online Newspaper, the Voice of Vietnam Online reported the Meetings.

At the 12th EST Regional Forum held in Hanoi on October 28th to 31st, the Study Team deliver a presentation on contribution of urban railway projects as mitigations of climate change/air pollution.

Appendix 8 Summary of the 4th Mission

1. Outline

Objectives: To report the progress of the Survey to relevant organizations and to organize the Expert Meeting, and to receive opinions/advices on the proposed MRV system.

Period: 16th to 25th February 2020

Members:

Yasuki SHIRAKAWA, Climate Change/Transport Sector MRV, ALMEC Corp.
Minh Tu TRAN, Human Resource Development/Public Relations, ALMEC Corp.
Le Thi Thanh Nhan, Local Consultant, TDSI

2. Schedule of the visit

	Date	Time	Activities	Participants
1	February 16th	-	Arrive at Hanoi	
2	17th	10:00	JICA Vietnam Office	JICA: Mr. Kasuya, Ms. Ha
		14:00	MOT/DOE	Director General Mr. Tran Anh Duong, Mr. Hien JICA: Mr. Kasuya, Ms. Ha
3	18th	10:00	MONRE/DCC	Director Mr. Luong Quang Huy JICA: Mr. Kasuya
		15:00	GIZ	Ms. Dang Tuyet Ly JICA: Mr. Kasuya, Ms. Ha
4	19th	10:00	ADB	Mr. Phạm Quang Phúc JICA: Mr. Kasuya
		16:00	Assoc. Prof. Dr. Hiep	Assoc. Prof. Dr. Hiep (National University of Civil Engineering, IPTE)
5	20th	14:00	Dr. Lam	Dr. Nguyen Tung Lam (ISPONRE)
6	21st	14:00	The Expert Meeting	-
7	22nd	-	Arrive at HCMC	
8	23rd	-		
9	24th	14:00	HCMC DONRE	Dr. Mai Tuan Anh, Mrs. Vu Thuy Linh
10	25th	9:00	Dr. Hieu (Vietnam German University) Arrive at Narita	Dr. Nguyen Ngoc Hieu

3. Summary of the activities

- The Expert Meeting

  The expert meeting was held in order to have advices/ comments on the proposed MRV methodology. Vietnamese and Japanese transportation and climate change experts as well as government agencies related to urban railway projects were invited. At the Meeting, there were active discussions on the proposed MRV methodology and organizational structure. The Study Team reflected these comments to the proposal. In regard to the proposed MRV methodology, it was agreed on the proposed Option 2 method, and it was decided to further study the current statistic systems and surveys in Vietnam in relation to the data used for calculation, in order to examine how we can effectively collect necessary data. Regarding the organizational structure, it was decided to propose multiple options.

- Discussions with related organizations

  MOT/DOE: It was commented that the methodology has nothing to revise but the roles and responsibilities of related organizations should be clearly stated in the proposed organizational structure, as well as an additional proposal on more realistic organizational structure that can be implemented in short-term. It was recognized that emission factors and modal share should be continuously collected/prepared through some official statistical surveys.

  MONRE/DCC:

Although the methodology has become more sophisticated, it was suggested that the Study Team should show multiple year's emission reductions and co-benefits such as reductions of air pollutants. It was also suggested that the proposed organizational structure should follow the proposal of the SPI-NAMA.

DONRE: Agreed on the proposed methodology and the results. It was requested that the Study Team should show who should do what in the proposed organizational structure, and should add the reporting from DONRE to MONRE in the structure.

Assoc. Prof. Hiep: It was commented that the simplification of the methodology itself is not significant issue, however, the quality of the input data (emission factors, etc.) are important. It was suggested to propose periodic surveys and statistics in regard to the development of emission factors.

Dr. Lam: The proposed Option 1 is un-realistic in terms of resources to conduct interview surveys which are similar with OD surveys. The Option 2 is applicable and realistic. As for the propose organizational structure, it was advised to clarify who should do what (roles and responsibilities).

Dr. Hieu: It was commented that in the Option 2, access/egress transportation are not considered, however, in Vietnam, people will not walk to the station and use motorbike, thus some correction factors should be prepared.

ADB: The termination of TA on MRV is postponed for three months. It was requested to provide the method of preparation of vehicle emission factors in Japan.

GIZ: Exchange views on how to obtain fuel consumption for each sub-sector. It was requested to provide the method of Japanese case. It was commented that the Online MRV System which are supported by GIZ should utilize the proposed MRV in urban railway sector as a pilot case.

Appendix 9 Interim Report Meeting in Hanoi

1) Agenda

Data Collection Survey on Development of Measurement, Report and Verification (MRV) System in Urban Railway Sector in Vietnam

INTERIM-REPORT MEETING

Development of MRV framework and methodology for urban railway

AGENDA

1. **Time and Date**: 13:30-17:00, 4th November 2019
2. **Venue**: Melia Hanoi Hotel, 84B Ly Thuong Kiet Street, Hanoi
3. **Organizers**: Japan International Cooperation Agency (JICA) & ALMEC VPI
4. **Language**: Vietnamese - English (simultaneous interpretation)
5. **Agenda**

Time	Content
13:30 - 14:00	Registration
14:00 - 14:10	**Opening Remarks** Representative of JICA Representative of MOT
14:10 - 14:40	**Key Note Lecture 1 - Japan** "Japan and Thailand's Experiences on Urban Rail Development and Its Impact against Climate Change" *Prof. Atsushi Fukuda (Nihon University, Japan)*
14:40 - 15:10	**Key Note Lecture 2 - Vietnam** "Urban Railway Development in concerned with Environment Impact of Climate Change in Vietnam" *Associate Prof. Dinh Van Hiep (National University of Civil Engineering)*
15:10 - 15:30	**Coffee Break**
15:30 - 16:00	**Study Report 1** "Corridor-wide Interview Survey along the UMRT Line 1 and Line 2 in Hanoi" *Dr. Tran Minh Tu (JICA Study Team)*
16:00 - 16:30	**Study Report 2** "Proposals on MRV methodology and framework in urban railway sector in Vietnam" *Mr. Ken Kumazawa and Dr. Yasuki Shirakawa (JICA Study Team)*
16:30 - 16:50	**Q & A / Discussions**
16:50 - 17:00	**Closing** Representative of JICA Study team

2) Participants

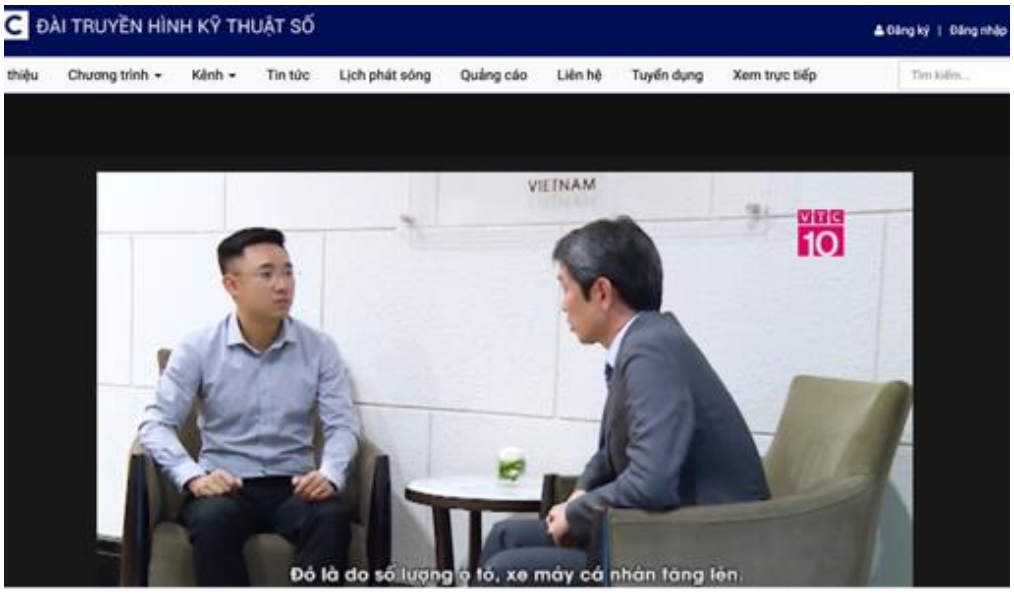
No.	Full Name	Position	Organization/Section/Division
MONRE			
1	Mr. Luong Quang Huy	Chief	Ozon protection & GHG Emission Mitigation Division, Department of Climate Change (DCC)
2	Mr. Vu Manh Long		Vietnam Institute of Meteorology, Hydrology and Climate Change (IMH)
3	Mr. Nguyen Trung Thang	Vice Chairman	Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE)
MOT			
4	Mr. Tran Anh Duong	Director General	Environment Department
5	Mr. Nguyen Ngoc Duong	Director General	Transport Department
6	Ms. Tran Thanh Mai		International Cooperation Department
7	Mr. Nguyen Hong Truong		Transport Department
8	Mr. Mai Van Hien		Environment Department
9	Mr. Nguyen Quoc Hung		Railway Project Management Unit
10	Mr. Dinh Van Tien		Science Technological Center for Environmental Protection in Transportation (CEPT)
11	Mr. Le Cong Thanh		Science and Technology Center for Urban Transport and Railways
12	Ms. Nguyen Diem Hang		Transport Development and Strategy Institute
13	Mr. Le Trong Nghia		Transport Development and Strategy Institute
14	Ms. Hoang Thi Hong Thuong		Center for Local Transport Research & Development, TDSI
15	Ms. Tran Thi Kim Thanh		Center for Local Transport Research & Development, TDSI
16	Mr. Tran Viet Ban	Deputy Director	Vietnam Railways
17	Mr. Vu Duc Minh	Head	Transport Engineering & Design Inc. (TEDI)
18	Mr. Pham Quang Hung	Head	Transport Engineering & Design Inc. (TEDI)
19	Mr. Le Thanh Hoang		Transport Engineering & Design Inc. (TEDI)
20	Ms. Nguyen Thi Hanh		Transport Engineering & Design Inc. (TEDI)
21	Ms. Nguyen Thi Minh Loan		Transport Engineering & Design Inc. (TEDI)
Local authorities			
22	Mr. Vu Ha	Deputy Director	Department of Transportation
23	Mr. Do Hoang Nam	Deputy Chief	Hanoi Metropolitan Rail Management Board (MRB)
24	Mr. Nguyen Quang Thien		MRB
25	Ms. Vu Thu Trang		MRB
26	Mr. Nguyen Quoc Chinh		MRB
27	Mr. Tran Minh Phuc		MRB
28	Ms. Cu Phong Lan		MRB
29	Ms. Ngo Thi Thoa		MRB
30	Ms. Nguyen T. Diem Hang		Hanoi Institute for Socio - Economic Development Studies
31	Mr. Hoang Ngoc Minh	Deputy Director G.	Hanoi Metro Company
Institutes & University			
33	Ms. Dang Thi Bich Thao		Policy & Economic Studies Institute, National University
34	Mr. Diep Anh Tuan		University of Transport and Communications
35	Prof. Dinh Van Hiep		Institute of Planning and Transportation Engineering (IPTE)
International Donor Organizations			
36	Mr. Jun Ichihara		SPI_NAMA Project
37	Ms. Yui Matsuo		SPI_NAMA Project
38	Ms. Le Thi Hoa		SPI_NAMA Project
39	Mr. Nguyen Thanh Duong	Consultant	ADB
40	Mr. Pham Quang Phuc	Consultant	ADB
41	Ms. Dao Thi Hien	Consultant	ADB
42	Ms. Dang Thi Hong Hanh	Consultant	ADB
43	Ms. Cao T. Thu Huong	Consultant	ADB
44	Ms. Axelle de Ferandy	Program Officer	French Dev't Cooperation Agency (AFD)
45	Ms. Garcia	Program Officer	French Dev't Cooperation Agency (AFD)
46	Mr. Kim Hyun Wrong		KOICA
47	Mr. Nguyen Nam	City Advisor	C40 Cities (Climate Leadership Group)

3) Photos


JICA
BÁO CÁO GIỮA KỲ
XÂY DỰNG PHƯƠNG PHÁP LUẬN VÀ KHUNG MRV
CHO LĨNH VỰC ĐƯỜNG SẮT ĐÔ THỊ
INTERIM REPORT MEETING
DEVELOPMENT OF MRV FRAMEWORK AND METHODOLOGY
FOR URBAN RAILWAY
Melia Hanoi Hotel, 4/11/2019
MELIA HANOI


BÁO CÁO GIỮA KỲ
XÂY DỰNG PHƯƠNG PHÁP LUẬN VÀ KHUNG MRV
CHO LĨNH VỰC ĐƯỜNG SẮT ĐÔ THỊ
INTERIM REPORT MEETING
DEVELOPMENT OF MRV FRAMEWORK AND METHODOLOGY
FOR URBAN RAILWAY

4) The news program of VTC



Appendix 10 Interim Report Meeting in Ho Chi Minh City

1) Agenda

Data Collection Survey on Development of Measurement, Report and Verification (MRV) System in Urban Railway Sector in Vietnam

INTERIM-REPORT MEETING

Development of MRV framework and methodology for urban railway

AGENDA

1. **Time and Date**: 13:00-16:30, 5th November 2019
2. **Venue**: Sheraton Saigon Hotel & Towers; 88 Dong Khoi, District 1, Ho Chi Minh City
3. **Organizers**: HCM Department of Natural Resources and Environment & Japan International Cooperation Agency (JICA)
4. **Language**: Vietnamese - English (simultaneous interpretation)
5. **Agenda**

Time	Content
13:00 - 13:30	Registration
13:30 - 13:40	**Opening Remarks** Representative of JICA Representative of DONRE
13:40 - 14:10	**Key Note Lecture 1** "Japan and Thailand's Experiences on Urban Rail Development and Its Impact against Climate Change" *Prof. Atsushi Fukuda (Nihon University, Japan)*
14:10 - 14:40	**Key Note Lecture 2** "Updated Preparation of HCMC UMRT Line 1 Project and Its Operating Body" *Mr. Ken Kumazawa (JICA Study Team)*
14:40 - 15:00	**Coffee Break**
15:00 - 15:30	**Study Report 1** "Corridor-wide Interview Survey along the UMRT Line 1 in Hochiminh City" *Dr. Tran Minh Tu (JICA Study Team)*
15:30 - 16:00	**Study Report 2** "Proposals on MRV methodology and framework in urban railway sector in Vietnam" *Mr. Ken Kumazawa and Dr. Yasuki Shirakawa (JICA Study Team)*
16:00 - 16:20	**Q & A / Discussions**
16:20 - 16:30	**Closing** Representative of JICA Study Team

2) Participants

No.	Full Name	Position	Organization/Section/Division
DONRE			
1	Mr. Hà Minh Châu	Deputy Chief	Climate Change & Hydro-Meteorology Div., DONRE
2	Mr. Huỳnh Lê Khoa	Deputy Chief	Climate Change & Hydro-Meteorology Div., DONRE
3	Ms. Vũ Thùy Linh	Expert	Climate Change & Hydro-Meteorology Div., DONRE
4	Ms. Nguyễn Thị Kim Liên	Expert	Climate Change & Hydro-Meteorology Div., DONRE
5	Mr. Trần Vĩnh Sa	Expert	Climate Change & Hydro-Meteorology Div., DONRE
6	Ms. Châu Trúc Phương	Expert	Climate Change & Hydro-Meteorology Div., DONRE
7	Mr. Nguyễn Ngọc Nguyễn	Expert	Climate Change & Hydro-Meteorology Div., DONRE
8	Mr. Nguyễn Duy Bình	Deputy Chief	Office for Climate Change
9	Ms. Phạm Thị Kim Ngân	Expert	Office for Climate Change
10	Ms. Trần Hồng Lan	Expert	Office for Climate Change
11	Ms. Hồ Thị Kim Thi	Expert	Office for Climate Change
Other departments in HCMC			
12	Mr. Hà Lê Ân	Deputy Director	Public Transport Management Center, Department of Transport
13	Mr. Lê Hải Đăng	Expert	Department of Construction
14	Mr. Nguyễn Xuân Trường	Researcher	Urban Management and Research Division
15	Ms. Nguyễn T. Huyền Trang	Expert	Urban Management and Research Division
16	Mr. Nguyễn Châu Tuấn	Expert	Technical Division, MAUR
Institutes & University			
17	Dr. Phạm Thị Anh	Chairwoman	Institute For Environmental And Transport Studies, Ho Chi Minh City University of Transport
18	Mr. Nguyen Trong Tan	Lecturer	Institute For Environmental And Transport Studies, Ho Chi Minh City University of Transport
19	Mr. Nguyen Quoc Bao	Lecturer	Center for Transport Scientific Research and Technology Development, Ho Chi Minh City University of Transport
20	Mr. Nguyen Ngoc Hieu	Lecturer	Faculty of Urban and Environmental Technology, Vietnam-Germany University
21	Mr. Le Dinh Anh Vu	Researcher	Research Center for Green House Gas & Climate Change, University of Natural Sciences
22	Ms. Vo Thi Tam Minh		Environment Faculty, University of Natural Sciences
23	Ms. Nguyen Chau My Duyen		Environment Faculty, Environment & Natural Resources University
24	Mr. Nguyen Hoang Phong		Environment Faculty, Environment & Natural Resources University
25	Mr. Bui Hoang Nhat Linh		Environment Faculty, Environment & Natural Resources University
26	Mr. Huynh Song Nhat	Researcher	Natural Resources & Geology Institute
27	Mr. Ha Ngoc Truong	Chairman	Association of Bridges, Roads and Port
Foreign firms			
28	Mr. Tashiro Mokoto		Fujitsu Limited
29	Ms. Asemi Yuki		Fujitsu Limited
30	Ms. Nguyen Thi Ngoc Bich		Fujitsu Limited
31	Ms. Do Ngoc Phuong Dung		ETM
32	Ms. Nguyen Hoai Tam		EIR
Mass Media			
33	Mr. Nguyễn Thanh Long		Natural Resources & Environment Journal
34	Ms. Nguyễn Quỳnh		Natural Resources & Environment Newspaper
35	Ms. Quốc Thành		Tuổi trẻ Newspaper
36	Ms. Lê Tứ		Tuổi trẻ Newspaper
37	Ms. Ái Vân		Nhân Dân Newspaper

3) Photos


BÁO CÁO GIỮA KỲ
XÂY DỰNG PHƯƠNG PHÁP LUẬN VÀ KHUNG MRV
CHO LĨNH VỰC ĐƯỜNG SẮT ĐÔ THỊ
INTERIM REPORT MEETING
DEVELOPMENT OF MRV FRAMEWORK AND METHODOLOGY
FOR URBAN RAILWAY


Kinh nghiệm Thái Lan và Nhật Bản
về xây dựng đường sắt đô thị và
tác động đối với BĐKH

Appendix 11 Expert Meeting

1) Agenda

AGENDA

1. **Time and Date**: 14:00-16:00, 21 February 2020 (Friday)
2. **Venue**: JICA Vietnam Office (16 Phan Chu Trinh)
3. **Organizers**: Japan International Cooperation Agency (JICA)
4. **Experts**:

   Transport Experts

   1. Prof. Atsushi Fukuda, Nihon University
   2. Assoc. Prof. Dinh Van Hiep (National University of Civil Engineering)

   Climate Change Experts

   1. Mr. Nguyen Khac Hieu, Senior advisor, IMHEN
   2. Dr. Nguyen Tung Lam, Director - Centre for Information, Consulting and Training, ISPONRE

   Ministries

   1. Representative of MOT
   2. Representative of MONRE
5. **Language**: English
6. **Agenda**

Time	Content
14:00 - 14:05	**Opening Remarks (Objectives of the Expert Meeting)** *Representative of JICA*
14:05 - 14:20	**Outline of "Data Collection Survey on development of Measurement, Report and Verification (MRV) system in urban railway sector in Vietnam"** *Representative of JICA*
14:20 - 14:40	**Draft methodology to quantify GHG emission reductions through urban railway projects, and estimation of ex-ante GHG emission reductions** *The Study Team*
14:40 - 15:20	**Q & A / Discussions**
15:20 - 15:30	**Draft MRV framework for urban railway projects** *The Study Team*
15:30 - 15:50	**Q & A / Discussions**
15:50 - 16:00	**Conclusion** *Representative of JICA*

2) Participants

Name	Position	Affiliation
Dr. Dinh Van Hiep	Associate professor	National University of Civil Engineering, Institute of Planning & Transportation Engineering
Dr. Atsushi Fukuda	Professor	Nihon University, Department of Transportation Systems Engineering
Dr. Nguyen Tung Lam	Director	Institute of Strategy and Policy on Natural Resources and Environmental (ISPONRE)
Mr. Mai Van Hien	-	Ministry of Transport, Department of Environment
Mr. Pham Quoc Cuong	Director	Vietnam Railway Authority, Department of Science, Technology and Environment
Mr. Pham Hai Trung	-	Hanoi Metropolitan Railway Management Board (MRB)
Mr. Vu Quang Anh	-	Hanoi Metropolitan Railway Management Board (MRB)

3) Photos




Appendix 12 Final Report Meeting

1) Agenda

"Data Collection Survey on Development of Measurement, Report and Verification (MRV) System including Methodology Development and GHG emissions Reduction Estimation in Urban Railway Sector in Vietnam"

FINAL REPORT MEETING

AGENDA

1. **Time and Date**: 9:00-12:30, 23rd October 2020
2. **Venue**: HOTEL de PARC Hanoi; 84 Tran Nhan Tong Street, Hanoi
3. **Organizers**: Japan International Cooperation Agency (JICA) & ALMEC VPI
4. **Language**: Vietnamese - English (simultaneous interpretation)
5. **Agenda**

Time	Content
9:00 – 9:30	Registration
9:30 – 9:50	**Opening Remarks** The representative of JICA Vietnamese Government (MONRE, MOT)
9:50 – 10:10	**Presentation 1:** "Update on the Status of the MRV System in the Transport Sector" *The representative of MOT*
10:10 - 10:30	**Presentation 2:** "Greater Opportunities of Climate Change Mitigation by Urban Railway Development in Hanoi City and HCMC" *Mr. Ken Kumazawa & Dr. Tran Minh Tu (JICA Study Team)*
10:30 - 11:00	**Coffee Break**
11:00 - 11:30	**Presentation 3:** "Proposals on MRV methodology and framework in urban railway sector in Vietnam" *Dr. Yasuki Shirakawa & Ms. Le Thi Nhan (JICA Study Team)*
11:30 - 12:00	**Q&A and Discussions** - Including information sharing from HCMC delegates about the city's undertakings against climate change *(Moderator) Associate Prof. Dinh Van Hiep (National University of Civil Engineering*
12:00 - 12:10	**Closing** The representative of JICA Vietnamese Government (MOT)

2) Participants

No.	Full Name	Position	Organization/Section/Division
Ministry of Environment & Natural Resouces (MONRE)			
1	Mr. Nguyen Tung Lam	Director	Training & Consulting Center, Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE)
2	Ms. Nguyen Thi Thu Ha		Training & Consulting Center, Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE)
3	Mr. Pham Nam Hung		Administration of Climate Change
4	Nguyen Thanh Bang		Vietnam Institute of Meteorology, Hydrology and Climate Change
5	Ms. Do Thi Huong	Editor-in-Chief	Science & Climate Change Journal
Ministry of Transport (MOT)			
6	Mr. Tran Anh Duong	General Director	Environment Department
7	Mr. Mai Van Hien		Environment Department
8	Ms. Tran Thanh Mai		International Deparment
9	Mr. Nguyen Hong Truong		Transport Department
10	Mr. TruongVan Duy		Vietnam Railways Administration (VNRA)
11	Mr. Le Ba Vuong		Railway Projects Management Unit (RPMU)
12	Nguyen Duc Linh		Vietnam Railways Corporation (VR)
13	Mr. Le Trong Nghia		Transport Development and Strategy Institute (TDSI)
14	Ms. Hoang Hong Thuong	Head	Center for Local Transport Research & Development (TDSI)
15	Mr. Vu Duc Minh	Deputy Head	Transport Engineering & Design Inc. (TEDI)
16	Mr. Pham Quang Hung	Deputy Director	Transport Engineering & Design Inc. (TEDI)
17	Mr. Dang Vu Hien	Expert	Environment Consulting Center (TEDI)
18	Ms. Nguyen Thi Hanh		Transport Engineering & Design Inc. (TEDI)
Local Companies			
19	Mr. Vũ Hồng Trường	Director	Hanoi Metro Company
20	Mr. Nguyen Van Ngoc		Hanoi Metro Company
21	Mr. Tran Tuan Hung		Hanoi Metro Company
22	Ms. Dao Thi Mai Anh		Vinbus
23	Mr. Nguyen Huu Tung		Vinbus
Institutes & Universities			
24	Prof. Dinh Van Hiep		Institute of Planning and Transportation Engineering (IPTE)
25	Dr. Ngo Quang Du		Transport University
26	Mr. Nguyen Van Quang		Vietnam-Japan Univesity
27	Mr. Nguyen Tuan Thinh	Vice Chairman	Hanoi Institute for Socio - Economic Development Studies
28	Mr. Nguyen Ngoc Thinh		Hanoi Institute for Socio - Economic Development Studies
29	Ms. Doan Minh Nga		Hanoi Institute for Socio - Economic Development Studies
From HCMC			
30	Mr. Le Huu Thanh		HCMC People's Committee
31	Dr. Mai Tuan Anh	Head	Department of Environement &Natural Resources
32	Mr. Nguyen Mau Phuc		Department of Transport
33	Mr. Nguyen Tat Thang		Department of Planning & Architecture
34	Mr. Le Thanh Trang		Department of Science & Technology
35	Mr. Trinh Tan Phat		Management Authority of Urban Railways (MAUR)
International Organizations			
36	Mr. Haga Akihiko		Embassy of Japan
37	Mr. Nguyen Anh Tuan	Program Officer	GIZ
Media			
38	Ms. Do Phuong Nga		Vietnam News Agency
39	Ms. Nguyen Khanh Duong		Vietnam News Agency
40	Ms. Do Thi Anh Huong		Vietnam Cable Television (VTC 10)
41	Mr. Pham Nhu Cuong		Television of Vietnam News Agency
42	Ms. Kieu Phuong Giang		Online Magazine of Communist Party
43	Mr. Phung Minh Tuan		Tuoi tre Newspaper
44	Mr. Viet Hung		On-line Vietnam Plus
45	Ms. Doan Tra My		Nhan Dan Newspaper
46	Kitagawa Katsuhiro		JIJI Press Hanoi
47	Mr.Okojima Hiroyoshi		NNA Vietnam

3) Photos


JICA
ALMEC
HỘI THẢO CUỐI KỲ
XÂY DỰNG PHƯƠNG PHÁP LUẬN VÀ KHUNG MRV
CHO LĨNH VỰC ĐƯỜNG SẮT ĐÔ THỊ
FINAL WORKSHOP
DEVELOPMENT OF MRV FRAMEWORK AND METHODOLOGY
FOR URBAN RAILWAY


HỘI THẢO CUỐI KỲ
DỰNG PHƯƠNG PHÁP LUẬN VÀ KHUNG MRV
CHO LĨNH VỰC ĐƯỜNG SẮT ĐÔ THỊ
FINAL WORKSHOP
FOR URBAN RAILWAY
HOTEL DU PARC HÀ NỘI, 23/10/2020

Appendix 13 Media Coverage

At the Interim Report Meetings, the Study Team were interviewed by media such as VTC and 14 media reported the Meetings in their newspaper/magazine.

	Name of media	News title	link
1	Bnews	Giám sát lượng phát thải khí thải nhà kính trong lĩnh vực đường sắt đô thị	https://bnews.vn/giam-sat-luong-phat-thai-khi-thai-nha-kinh-trong-linh-vuc-duong-sat-do-thi/139283.html
2	Public Security News	Nhật Bản hỗ trợ Việt Nam giám sát lượng phát thải của đường sắt đô thị	http://cand.com.vn/Giao-thong/Nhat-Ban-ho-tro-Viet-Nam-giam-sat-luong-phat-thai-cua-duong-sat-do-thi-568602/
3	Vietnam Economic News	Đường sắt đô thị đóng góp đáng kể vào mục tiêu quốc gia về giảm phát thải	https://congthuong.vn/duong-sat-do-thi-dong-gop-dang-ke-vao-muc-tieu-quoc-gia-ve-giam-phat-thai-127739.html
4	Communist Party of Vietnam Online Newspaper	JICA hỗ trợ giám sát phát thải khí nhà kính từ đường sắt nội đô	http://cpv.org.vn/khoa-giao/jica-ho-tro-giam-sat-phat-thai-khi-nha-kinh-tu-duong-sat-noi-do-541676.html
5	Laws Newspaper	JICA hỗ trợ giám sát lượng phát thải khí nhà kính của hệ thống đường sắt đô thị tại Hà Nội và TP HCM	https://baophapluat.vn/kinh-te/jica-ho-tro-giam-sat-luong-phat-thai-khi-nha-kinh-cua-he-thong-duong-sat-do-thi-tai-ha-noi-va-tp-hcm-478214.html
6	The Saigon Times	JICA studies greenhouse gas emission reductions in Vietnam	https://english.thesaigontimes.vn/72560/jica-studies-greenhouse-gas-emission-reductions-in-vietnam.html
7	Tax Magazine	JICA hỗ trợ giám sát lượng phát thải khí nhà kính hệ thống đường sắt đô thị.	http://tapchithue.com.vn/van-hoa-xa-hoi/158-van-hoa-xa-hoi/16931-jica-h-tr-giam-sat-lung-phat-thi-khi-nha-kinh-h-thng-dung-st-do-th.html
8	Enterprise Financial Magazine	JICA hỗ trợ Việt Nam giám sát phát thải khí nhà kính hệ thống đường sắt đô thị	https://taichinhdoanhnghiep.net.vn/jica-ho-tro-viet-nam-giam-sat-phat-thai-khi-nha-kinh-he-thong-duong-sat-do-thi-d9651.html
9	The Voice of Vietnam (VoV)	Đường sắt đô thị là giải pháp phương tiện giao thông phát thải thấp	https://vov.vn/kinh-te/duong-sat-do-thi-la-giai-phap-phuong-tien-giao-thong-phat-thai-thap-974944.vov
10	Procurement Newspaper	JICA hỗ trợ giám sát lượng phát thải khí nhà kính đường sắt đô thị Việt Nam	https://baodauthau.vn/dau-tu/jica-ho-tro-giam-sat-luong-phat-thai-khi-nha-kinh-duong-sat-do-thi-viet-nam-114133.html
11	Vietnam Net	JICA studies greenhouse gas emission reductions in Vietnam	https://vietnamnet.vn/en/sci-tech-environmennt/jica-studies-greenhouse-gas-emission-reductions-in-vietnam-585517.html
12	Center for Statistics and Science and Technology Information (DOST - HCMC)	JICA hỗ trợ giám sát phát thải khí nhà kính của hệ thống đường sắt đô thị	http://cesti.gov.vn/chi-tiet/9911/su-kien-kh-cn/jica-ho-tro-giam-sat-phat-thai-khi-nha-kinh-cua-he-thong-duong-sat-do-thi
13	Hanoi TV	JICA hỗ trợ giám sát phát thải khí nhà kính hệ thống đường sắt đô thị	http://hanoitv.vn/jica-ho-tro-giam-sat-phat-thai-nha-kinh-he-thong-duong-sat-do-thi-d126389.html
14	VTV	Nhật Bản hỗ trợ Việt Nam giám sát lượng phát thải của đường sắt đô thị	https://vtv.vn/trong-nuoc/nhat-ban-ho-tro-viet-nam-giam-sat-luong-phat-thai-cua-duong-sat-do-thi-20191107114808135.htm

Prior to the Final Report Meeting, the Japanese team member replied the questioned from the local visual media in video due to the remote communication brought about by the COVID-19. The 10 local news media and 1 Japanese one reported the meeting.

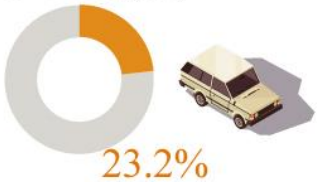
	Name of media	News title	link
1	Cong an nhan dan	Khảo sát của JICA: Đường sắt đô thị giúp giảm phát thải CO2	http://cand.com.vn/giao-thong/khao-sat-cua-jica-duong-sat-do-thi-giup-giam-phat-thai-co2-616903/
2	Phap luat moi truong	Đường sắt đô thị giúp Hà Nội và TP.HCM giảm 39 đến 56 tấn khí thải CO2 mỗi năm	https://phapluatmoitruong.vn/duong-sat-do-thi-giup-ha-noi-va-tp-hcm-giam-39-den-56-tan-khi-thai-co2-moi-nam/
3	Tien phong	Hanoi, HCMC's metro lines to reduce huge volumes of CO2: JICA survey	https://tienphongnews.com/hanoi-hcmcs-metro-lines-to-reduce-huge-volumes-of-co2-jica-survey-98068.html
4	Tin247	Khảo sát của JICA: Đường sắt đô thị giúp giảm phát thải C02	https://www.tin247.com/khao-sat-cua-jica-duong-sat-do-thi-giup-giam-phat-thai-c02-4-27786348.html
5	Vietnamnet	Commuters in Hanoi and HCM City willing to use metro: JICA survey	https://vietnamnet.vn/en/society/commuters-in-hanoi-and-hcm-city-willing-to-use-metro-jica-survey-683610.html
6	Vietnamnews	Commuters willing to use upcoming metros: JICA	Page: 2
7	Viettreader	Commuters in Hanoi and HCM City willing to use metro: JICA survey	https://vietreader.com/news/20509-commuters-in-hanoi-and-hcm-city-willing-to-use-metro-jica-survey.html
8	Bac Giang	Commuters in Hà Nội and HCM City willing to use metro	http://m.en.baobacgiang.com.vn/bg/society/344994/commuters-in-ha-noi-and-hcm-city-willing-to-use-metro.html
9	Tai chinh doanh nghiep	Đường sắt đô thị giúp giảm 151.000 tấn CO2/năm ở Việt Nam	https://taichinhdoanhnghiep.net.vn/duong-sat-do-thi-giup-giam-151000-tan-co2-nam-o-viet-nam-d16214.html
10	Tai chinh doi song	Sử dụng đường sắt đô thị giúp giảm phát thải nhà kính	https://taichinhdoisong.vn/Home/Details/fb71f376-b968-4ac1-b169-4f32be76317a
11	NNA Asia	鉄道シフト、CO2測定簡素化を JICA	https://www.nna.jp/news/show/2109925

Appendix 14 Leaflet

CO_2 Emission Reduction by Urban Railways

The shift of travel mode from private vehicles (cars, motorcycles) to urban rails (metro) contributes to reduction of CO_2 emission into the environment.

■ **CO_2/greenhouse gas from transport sector (*)**
(000 ton of CO_2/year)



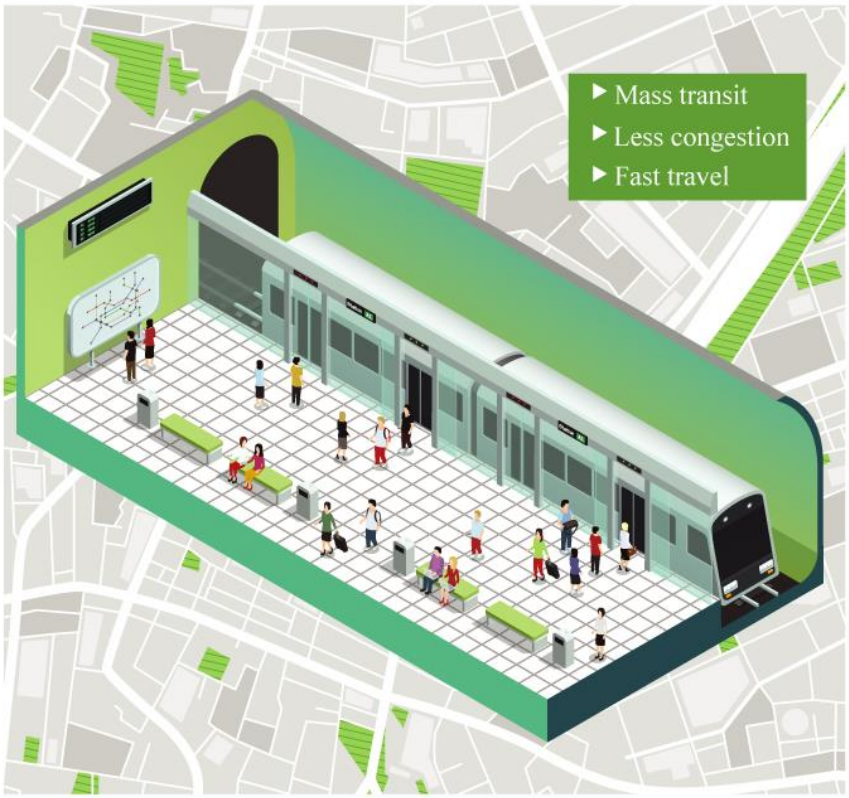
23.2%
of total CO_2 emission from energy sector comprises of CO_2 from fuel burnt by transport activities.
(2013)

Hanoi

66% of the respondents want to shift to urban railways (metro)

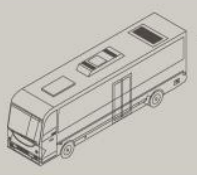
HCMC

81% of the respondents want to shift to urban railways (metro)

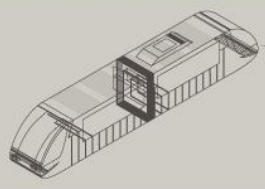


■ **CO_2 emission factors by modes (**)**
(gCO_2/passenger-km)

Car 96



Bus 27.6



Metro 26.4

■ **CO_2 emission from urban railways (***)**
(ton CO_2/year)

UMRT Line 1 (Hanoi)	UMRT Line 2 (Hanoi)	UMRT Line 1 (HCMC)
130,492	93,711	133,916
75,951	54,097	77,040
54,541	**39,614**	**56,877**

Emission if the urban railway project is not implemented

Emission if the urban railway project is implemented

Source: (*) Report updated every two years in Vietnam | (**) Survey results and IPCC 2006 | (***) Study outputs

DATA COLLECTION SURVEY ON DEVELOPMENT OF MEASUREMENT, REPORT AND VERIFICATION SYSTEM IN URBAN RAILWAY SECTOR IN VIETNAM

1. Objective and Targets

Objective:

- To contribute to implementation of Vietnam's NDC in regards of reducing greenhouse gas emission.

Targets:

- To contribute to formulation and promotion of MONRE's Circular on measurement, report and verification of geenhouse gas emission reduction (national level);
- To contribute to formulation and promotion of MOT's Circular on measurement, report and verification greenhouse gas emission reduction in the transport sector (sector level).
- To promote measurement report and verification of greenhouse gas emission reduction in Hanoi and Ho Chi Minh City (city level)
- To quantify greenhouse gas emission reduction in JICA-funded urban railway development projects
- To promote urban railway projects as a measure to reduce greenhouse gas emission and air pollution in Vietnam and other countries

2. Survey Area

- This survey focuses on three urban railway lines, including Line 1 und Line 2 in Hanoi and Line 1 in Ho Chi Minh City

3. Main Outputs

- Methodology to calculate greenhouse gas emission reduction for urban railway projects
- A framework on measurement, report and verification for the urban railway sector.

4. Survey Period: 2019 to 2020 (Japanese Fiscal Year).