Japan International Cooperation Agency (JICA)
Department of Transportation and Communications (DOTC)

The Project for Capacity Development on Transportation Planning and Database Management in the Republic of the Philippines

MMUTIS Update and Enhancement Project
(MUCEP)

Project Completion Report

December 2015

ALMEC Corporation
Oriental Consultants Global Co., Ltd.

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ABBREVIATIONS

BCDA	Bases Conversion and Development Authority
BGC	Bonifacio Global City
CNG	compressed natural gas
CPT	Counterpart Project Team
CY	calendar year
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highways
EDSA	Epifanio de los Santos Avenue
EW	east-west
GAA	General Appropriations Act
GIS	geographical information system
h	hour
HIS	household interview survey
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
LRTA	Light Rail Transit Authority
LTFRB	Land Transportation Franchising & Regulatory Board
MMDA	Metropolitan Manila Development Authority
MMUTIS	Metro Manila Urban Transportation Integration Study
MUCEP	MMUTIS Update and Capacity Enhancement Project
NEDA	National Economic and Development Authority
Northrail	North Luzon Railways Corporation
NS	north-south
OD	origin and destination
OJT	on-the-job training
PDM	project design matrix
PNR	Philippine National Railways
PSA	Philippine Statistics Authority
PT	public transportation
PUB	public utility bus
PUJ	public utility jeepney
Q&A	question and answer
RMC	route measured capacity
RTRS	Road Transit Rationalization Study
STRADA	System for Traffic Demand Analysis
TDM	transportation demand management
TDMU	Transportation Database Management Unit
TPU	Transport Planning Unit
UP NCTS	National Center for Transportation Studies of the University of the Philippines

1 Introduction

1.1 Background

The acceleration of economic activities and the concentration of population in Metropolitan Manila and other cities in the Philippines have caused severe social problems such as traffic congestion, traffic accidents, and deterioration of the living environment. In particular, the increase in private vehicle numbers has generated traffic congestion. In 2009, the number of registered vehicles in Metro Manila amounted to 1.77 million, or an increase of 11% from 2007 levels. In the same year, the number of traffic accidents was reported to have reached 64,747 cases[1]. To tackle these problems, but global warming issues as well which have recently captured the attention of leaders and policy makers, it is crucial not only to develop the public transportation (PT) network but also to integrate and strengthen linkages between and among transportation modes. In so doing, investments in an integrated infrastructure development will also support a sustainable economic growth.

The development of transportation infrastructure should be planned comprehensively and should include all transportation modes for land, sea, and air. In the Philippines, the Department of Transportation and Communications (DOTC), the overall entity responsible for national transportation policies, has managed air, rail, road, and sea transportation separately, and the relevant databases, which are required for solid national transportation planning, have also been managed independently of each other. To illustrate, the database related to transportation planning is managed not only by the DOTC, but other agencies as well, such as the Light Rail Transit Authority (LRTA), Philippine National Railway (PNR), and others. Compounding the situation is the lack of coordination between and among these agencies regarding such database aspects as data storage, sharing, and updating. Therefore, being the agency responsible for comprehensive transportation planning, the DOTC's capacity to develop and manage a transportation planning database and to formulate transportation policies should be strengthened. A transportation policy that will facilitate a modal shift from private cars to public transportation is highly needed especially in Metro Manila to alleviate traffic congestion and the resulting various environmental problems. Toward this end, the capacity for updating the transportation database developed during the "Metro Manila Urban Transportation Integration Study" (MMUTIS, 1999, Japan International Cooperation Agency) and for utilizing such database in planning the public transportation network in Metro Manila is essential.

In light of the above, the Government of the Philippines requested the Government of Japan to provide technical assistance to develop a policy framework on national transportation planning, comprehensive national transportation data building, and decision-making support system based on geographical information through this project entitled "The Project for Capacity Development on Transportation Planning and Database Management in the Republic of the Philippines" or MMUTIS Update and Capacity Enhancement Project (MUCEP), for short.

For this project, the DOTC served as the counterpart agency. However, in the Detailed Planning Survey for the project which JICA conducted from February to March 2011, it was found that the

[1] Comprising fatalities, injuries, and damage to property as reported by the Road Safety Unit of the Metropolitan Manila Development Authority (MMDA).

DOTC needed to develop its capacity in policy making. As a result of that survey as well, the target project area was changed from nationwide to Metro Manila only. In addition, the objective of the project was revised, i.e., to strengthen the capacity for transportation database management and public transportation network planning. Following the results of the survey, a Record of Discussion was exchanged on 29 July 2011 between JICA and the DOTC.

However, MUCEP got delayed for almost 15 months due to several factors, prompting the JICA Project Team (JPT) to propose a 15-month extension of the project period, which JICA approved in December 2013. As a result, the project will now end in December 2015.

1.2 Project Purpose

MUCEP's overall goal is to enable the DOTC to prepare a public transportation plan for Metro Manila. The project aims to improve public transportation planning for Metro Manila, including coordination among relevant agencies, to be spearheaded by the DOTC. The expected outputs of the project are listed below, while its performance indicators are shown in Table 1.1.

(a) **Output 1:** Improved capacity to manage the Metro Manila transportation database.
(b) **Output 2:** Improved capacity to plan the public transportation network of Metro Manila.
(c) **Output 3:** Improved capacity to coordinate and formulate policies on public transportation network development in Metro Manila.

Table 1.1 Verifiable Indicators for MUCEP

Item	Objectively Verifiable Indicator	Means of Verification
Overall Goal Public transportation plan for Metro Manila is prepared by the DOTC [1]	• Prepared public transportation plan for Metro Manila[1] based on an analysis of the new transportation database • Utilization of the new transportation database	• Records of utilization of the new transportation database • Survey questionnaires/ interviews • Report/ presentation material for public transportation plan for Metro Manila.
Project Purpose To improve public transportation planning for Metro Manila, including coordination among relevant agencies, spearheaded by the DOTC.	• An established management system for the new transportation database by 2014	• Approved documents on transportation database organization and management • Survey questionnaires/ interviews
Outputs 1. Improved capacity to manage the Metro Manila transportation database 2.Improved capacity to plan the public transportation network of Metro Manila 3.Improved capacity to coordinate and formulate policies on public transportation network development in Metro Manila	(1)-1 Updated MMUTIS transportation database (1)-2 Prepared manuals on traffic survey and database management (2)-1 Prepared manual on public transportation planning (2)-2 Proposed plan on public transportation network for Manila (3)-1 Effective agreements among stakeholders made in relevant meetings (3)-2 Agreed recommendations on transportation policy issues	• Baseline capacity survey sheets • Manuals • Training records • Updated database • Traffic survey and database management manuals • Public transportation network plan for Manila • Records of discussions on policy issues examined in the project • Reports on policy issues

[1] Public transportation plan for Metro Manila refers to, for example, public transportation plans for strategic corridors in relation to important transportation issues in Metro Manila (target implementation: 2-3 years)
Source: PDM4

2 Activities per Output

2.1 Output 0: Project Preparation

Establish a Transportation Database Management Unit within DOTC.
A Transportation Database Management Unit (TDMU) was initially proposed to be established in the DOTC. It was supposed to manage, maintain, update, and use the database system that the MUCEP would develop. Instead, the DOTC established the Transport Planning Unit (TPU) on 5 February 2014. Because its duties and responsibilities were expected to overlap with those of the TDMU, the JPT proposed the integration of the TPU and the TDMU to the DOTC. In the Cube training, TPU personnel were given priority. The TPU personnel were also officially instructed by the DOTC Undersecretary for Planning through a memorandum dated 10 December 2014 to participate in all capacity building activities of the MUCEP.

Prepare counterpart fund for the traffic surveys and operation of the Project.
The counterpart fund with which to procure consulting services for the government portion of the Household Interview Survey (HIS) in the rest of the MUCEP area, i.e., Metro Manila (except for the city of Manila), Rizal, southern Bulacan, northern Cavite, and northern Laguna, was sourced under GAA CY2011, in particular the Transport Studies Fund. The counterpart fund was approved on 1 January 2012 and included in the DOTC's Project Procurement Management Plan for CY 2012.

Establish a framework for collaboration and cooperation with relevant agencies and organizations.
The framework that serves as springboard for interagency collaboration and cooperation is the formation of the Counterpart Project Team (CPT), whose initial membership comprised three government agencies, namely, the DOTC as the main counterpart, the Department of Public Works and Highways (DPWH), and the Metropolitan Manila Development Authority (MMDA), as well as the academe-based center of excellence, the National Center for Transportation Studies of the University of the Philippines (UP NCTS).

The DOTC named representatives from its planning divisions and from its attached agencies, namely, the Land Transportation Office (LTO), Land Transportation Franchising & Regulatory Board (LTFRB), and PNR. Based on the expectation that the planned transportation projects of other government agencies in areas around the MUCEP area will affect traffic and the transportation system inside the MUCEP boundary, the DOTC added three more government agencies in the hopes that such contact will lead to better interagency coordination of plans and projects. These agencies are the LRTA, Bases Conversion Development Authority (BCDA), and North Luzon Railways Corporation (Northrail).

Since the first week of May 2012, the CPT has met weekly to discuss project issues and to be updated by the JICA Project Team (JPT) on project activities. In addition to their regular attendance and their willingness to be trained through lectures fieldwork, and exercises, the CPT members had shown their readiness to provide data, information, and resource persons needed by the JPT to implement traffic surveys and improve the MUCEP transportation database.

2.2 Output 1: Improved Capacity to Manage the Metro Manila Transportation Database

2.2.1 Activity 1.1 Develop a work flow to conduct traffic surveys and manage the transportation database in cooperation with the JPT members who will provide training to their DOTC counterparts

Training Courses on Transportation Surveys

A training course on transportation surveys started in May 2012, and all scheduled training sessions were finished. The course targeted MUCEP counterparts and other staff from counterpart agencies. The implementation of the surveys was part of the training course. Counterpart members joined the HIS conducted in the City of Manila and monitored the sites where the cordon and screen line surveys were conducted. Through these activities, they were exposed to the laborious work needed to generate planning data.

Table 2.1 Training Courses on Transportation Surveys

	Main Contents	Year	Date
1	Introduction to Transport Planning	2012	3 May
2	Concept of Trips, Objectives and Method of HIS	2012	10 May
3	HIS: Survey Items and Survey Sheet	2012	17 May
4	Sampling & Sample Rate, Expansion	2012	24 May
5	Structure of Database, Data Cleaning	2012	31 May
6	Cordon Line Survey and Screen Line Survey	2012	14 Jun
7	Data Adjustment	2012	21 Jun
8	Other Transport Surveys	2012	28 Jun
9	Recent Transportation Surveys in Metro Manila	2012	8 Nov
10	Bus Operation in EDSA	2012	15 Nov
	Data development	2014	6 Feb
11-1	HIS Data Analysis (1)	2014	19 Jun
11-2	HIS Data Analysis (2)	2014	26 Jun
11-3	HIS Data Analysis (3)	2014	3 Jul
11-4	HIS Data Analysis (4)	2014	10 Jul
11-5	HIS Data Analysis (5)	2014	24 Jul

2.2.2 Activity 1.2 Prepare tender documents for the traffic surveys, as well as procure and supervise survey implementation

Implementation of traffic surveys

The HIS in Manila, as well as the vehicle and passenger counts and OD interviews in the MUCEP cordon and screen lines (see Table 2.2 and Table 2.3), were implemented by the JICA Project Team through a subcontracting process monitored by JICA. The contractor, Transport and Traffic Planners Inc., was selected based on proposals from four local firms with various experiences in conducting similar surveys and had reliable and sufficient number of personnel.

These surveys were essential in order to update the MMUTIS transportation database. The following issues were considered: (i) survey methodology and sites should follow those used in

MMUTIS so that results can be used to update the MMUTIS transportation database, and (ii) the setup of the survey team should be appropriate in terms of the number of surveyors, number of samples, etc. to assure the accuracy and consistency of the results.

For the surveys indicated in Table 2.2, interviews and surveys were conducted from June to August 2012. For the HIS in the rest of the MUCEP area (see Table 2.4), field interviews were carried out from November 2013 to April 2014; survey forms and methodology were consistent with those used in the HIS conducted in the City of Manila.

Table 2.2 JICA-funded Transportation Surveys

Survey Type	Survey Size		
Household Interview Survey	Sampling Rate	:	1.0%
	Number of Samples	:	4,966 households (City of Manila)
Cordon Line Survey	Traffic Count	:	36 sites for 16 hours
		:	9 sites for 24 hours
	Vehicle Occupancy	:	31 sites for 16 hours
		:	8 sites for 24 hours
	OD Interview	:	1 site for 8 hours
		:	20 sites for 16 hours
		:	6 sites for 24 hours
Screen Line Survey	Traffic Count	:	34 sites for 16 hours
		:	16 sites for 24 hours
	Vehicle Occupancy	:	33 sites for 16 hours
		:	11 sites for 24 hours

Table 2.3 JICA-funded Cordon Line and Screen Line Surveys

Item	Cordon Line Survey		Screen Line Survey
	Outer	Inner	
Boundary/Line	MUCEP Area	Metro Manila	Pasig River, San Juan River/PNR
Survey Type	- Traffic Count - Vehicle Occupancy - OD Interview (except inner station)		- Traffic Count - Vehicle Occupancy
Survey Stations	Total=20 stations - 6 on roads - 13 on expressways - 1 on rail	Total=29 stations - 18 on roads - 3 on expressways - 3 at ferry terminals - 4 at airports - 1 on railway	Total=50 stations - 18 on EW (Pasig River) - 17 NS (San Juan River) - 15 NS (PNR)
Survey Period	24 h (3 stations) 16 h (17 stations)	24 h (10 stations) 16 h (19 stations)	24 h (16 stations) 16 h (34 stations
Vehicle Type	17 types		
Field Survey	Jun–Jul 2012		

Table 2.4 MUCEP Household Interview Survey

Item	JICA-funded HIS	DOTC-funded HIS
Survey Area	City of Manila	MUCEP Area (except Manila)
No. of Sample Households	4,966	46,222
Sampling Rate	1%	1%
Survey Schedule	May–Aug 2012	Oct 2013–Apr 2014

Assistance in implementing traffic surveys in MUCEP Area

The HIS for the rest of the MUCEP area (excluding the city of Manila) was managed principally by the DOTC counterparts, with the JICA Project Team providing technical assistance.

Compilation and Analysis of Survey Results

Survey results were organized to analyze current transportation characteristics according to the items listed below (see the technical report entitled ***Transportation Demand Characteristics based on the MUCEP Person Trip Survey***).

(i) Population (by zone, occupation, industry, gender, age, etc.);
(ii) Vehicle ownership and household income;
(iii) Basic unit of trip generation, etc.;
(iv) Volume of trip generation and attraction (by purpose, mode, facility, and time);
(v) Volume of trip distribution (by purpose and mode);
(vi) Modal shares (by purpose and zone); and
(vii) Others (travel speed, transfers, etc.).

2.2.3 Activity 1.3 Develop traffic forecasting model(s) based on survey results

Establishment of the demand forecast model

The MUCEP demand forecast model was established based on the updated road network and results of the HIS and traffic surveys. The model followed the conventional four-step model. Trip generation and attraction, which is the first step, was developed based on five trip purposes, i.e., to work, to school, private, business, and to home. The next step was developing trip distribution, which used the Fratar method. The modal choice model, which is the third step, was developed separately for car-owning and non-car-owning households because their modal choices are different. The last step is traffic assignment, wherein the highway assignment model was prepared for road transportation and the transit assignment model for public transportation modes. The model details are shown in this report's ***Manual vol.2: Travel Demand Forecasting*** (*see Chapter 3.1.2*).

Training Course on traffic demand forecasting

Fifteen (15) sessions on transport demand analysis and forecasting were given. The original plan was to handle the actual demand in Metro Manila based on the database to be developed in this study. However, because the DOTC-funded HIS for MUCEP areas other than the pilot study area of Manila was implemented substantially behind schedule, the original intention could not be carried out. Instead, the MMUTIS 1996 data and those of other JICA studies were used.

Meanwhile, the Cube training in demand forecasting started on 24 September 2014 with the following objectives:

(a) To learn the various applications of the Cube transportation planning software;
(b) To understand the various data preparation activities for traffic forecasting; and
(c) To develop skills in Cube scripting.

A total of 19 participants from the DOTC, its attached offices, and representatives from other MUCEP counterpart agencies were selected as trainees. Except for a few participants, it was observed that many were not well-exposed to transport data analysis and preparation. Majority of them did not have a working knowledge of geographic information system (GIS) and mapping techniques which hindered their effectiveness in developing traffic forecasting models.

During the course of the Cube training stated above, the CPT requested the JCT to change the training methods the latter used and to instead adopt more practical ways. That is, (i) to select a small pilot project, (ii) to apply Cube to evaluate the project, and (iii) to replicate the process in another project. To apply their new knowledge and skills in demand forecasting, the following pilot studies were selected by the DOTC and the CPT in separate meetings with the JCT:

(a) Study on the Bus Exclusive Lane on Ortigas Avenue;
(b) Study on the Introduction of CNG Buses as Provincial Bus Service between Metro Manila and Neighboring Areas; and
(c) Bonifacio Global City Public Transportation Improvement Study.

Table 2.5 Coverage and Schedule of Training in Traffic Demand Forecasting

	Main Contents	Year	Date
1	Composition of Database, Tabulation	2012	2 Aug
2	Estimation of Trip Rate	2012	16 Aug
3	Mobility by personal attribute	2012	23 Aug
4	Trip Production, generation and attraction	2012	30 Aug
5	Hourly change in demand Peak hour demand	2012	6 Sep
6	OD Table and OD Structure, Interzonal Impedance	2012	27 Sep
7	Trip Characteristics by Mode, Trip Length Distribution	2012	4 Oct
8	Drawing technique of OD volumes, Introduction of GIS(1)	2012	10 Oct
9	Highway Capacity and Service Level	2012	18 Oct
10	Drawings of Demand on Network, Introduction of GIS(2)	2012	25 Oct
11	Types and Characteristics of Urban Rail System	2012	24 Jan
12	Railway O&M Cost	2012	21 Feb
13	General Approach for Railway Planning	2013	28 Feb
14	Sketch Planning Approach	2013	14 Mar
15	Sketch Planning Approach for Transit Analysis	2013	21 Mar

Table 2.6 Coverage and Schedule of Cube Training

Date	Level	Topic
24 Sep 2014	Basic	General Framework for Transport Modeling Introduction to the Cube Product Line
26 Sep 2014		Existing and New Features in Cube City Transport Models Case Studies
1 Oct 2014		Cube Base user interface components Storing and Managing Cube Data in Geodatabases Editing Model Data in the GIS Window
3 Oct 2014		Working with the GIS Window Data Preparation Data Presentation
8 Oct 2014		Applying the forecasting system Case studies with Cube Cube reports
10 Oct 2014	Intermediate	Creating a new model catalog Adding an application to the catalog Defining catalog keys Using system keys and scenario-specific files Adding files to the data pane Running applications within Scenario Manager Saving the catalog Scenario editing and analysis
15 Oct 2014	Advanced	Cube scripting Matrix Program Record processing of database tables Highway traffic assignment Process templates External programs
17 Oct 2014		Introduction to PT Transit modeling process & PT phases Transit network Transit connectors Transit modeling control data in PT Path-Building & skimming process
22 Oct 2014		Mode choice modeling Transit assignment Advanced transit features
24 Oct 2014		Cube Analyst Drive and Cube Avenue
29 Oct 2014		Cube Dynasim

2.2.4 Activity 1.4 Update the MMUTIS transportation database

The results of the JICA portion of the HIS (i.e., that done in the City of Manila), as well as the screen and cordon line surveys within the MUCEP project area, which were carried out in 2012, were checked and cleaned. These and the results of the DOTC-funded HIS, which was carried out in 2013 and 2014, were combined in July 2014 to form the MUCEP transportation database. An analysis of the HIS database, however, showed a bias for low-income households, as shown by the low car ownership (4%). To correct the bias, the database was updated using the vehicle registration data for the MUCEP area as of October 2014. The database was finalized in January 2015.

The MMUTIS zoning system was also updated to fit the current administrative boundaries. The number of zones increased from 316 (MMUTIS) to 354 due to changes in the MUCEP area as a result of the improvements in transportation infrastructures and changes in land uses. While MUCEP's zoning system in Metro Manila was almost the same as that of MMUTIS, the number of zones in the adjoining provinces within the MUCEP area increased. Each traffic zone's current population represents the 2014 population forecast based on the 2010 census. Meanwhile, the socio-economic forecast for each zone was estimated based on the HIS distribution of employees and students, as well as on the estimated population by the Philippine Statistics Authority (PSA)[2].

The MUCEP demand forecast model was established based on the updated road network and results of HIS and traffic surveys. The model followed the conventional four-step model.

2.3 Output 2: Improved Capacity to Plan the Public Transportation Network of Metro Manila

2.3.1 Activity 2.1 For the JPT members to train DOTC counterparts in public transportation planning

For the further enhancement of the participants' understanding of public transportation planning, the basic principles of the MUCEP training program were first set as follows:

(i) Training would be conducted by a combination of classroom-style lectures/ exercises, fieldwork, and on-the-job training (OJT);
(ii) Lectures/ Exercises would be given, in principle, once a week on the most convenient day for the majority of the counterpart members (set on Thursday morning);
(iii) One lecture/exercise would take about two hours inclusive of a Q&A portion;
(iv) Lectures/Exercises would focus on knowledge and technology that are practical and needed by the DOTC and other counterpart agencies to carry out their tasks. Contents would be determined according to the baseline capacity of participants;
(v) As a rule, short exercises would be given during each lecture which could be done in 10–20 minutes; and
(vi) Fieldwork and OJT would be conducted for specific courses/activities to enhance the capacity of participants.

The method adopted for the training program on public transportation planning was changed in response to the request of the CPT that the training should focus on the actual application of Cube on selected small pilot studies. The CPT and the JCT agreed to adopt question-and-answer sessions instead of lectures and exercises. The CPT members were divided into two groups to study specific public transportation issues as pilot studies, i.e., the bus-exclusive lane on Ortigas Avenue and the Bonifacio Global City public transportation improvement project.

This approach seemed to work, because the CPT became more active during trainings and meetings, throwing increasingly practical questions to the JPT regarding their assigned pilot studies.

[2] Under the implementing rules and regulations of Republic Act 10625, or the Philippine Statistical Act of 2013, the National Statistics Office, National Statistical Coordination Board, Bureau of Agricultural Statistics, and Bureau of Labor and Employment Statistics were merged into one statistical body—the PSA.

Presented in the appendices are the final results of these studies (see ***Annex H***). In addition, the DOTC's Assistant Secretary for Planning and Finance requested the JPT to teach the CPT in making the bus demand study for areas east and north of Metro Manila. The report on this study was, however, omitted from this report, as well as from ***Progress Report No. 5***, at the request of the DOTC.

2.3.2 Activity 2.2 Identify planning conditions for public transportation network development in Metro Manila

To examine conditions in public transportation planning, data and information to formulate public transportation plans were collected. Information on ongoing and proposed public transportation projects in the MUCEP area was collected by the CPT members. Collected data and information were summarized and became the basis for subsequent discussions in Project Team meetings as regards the selection of the projects being studied by the CPT.

Future socio-economic indicators, such as population, employment, and car ownership, among others, were preliminarily estimated based on the trend at the macro level, i.e., city/municipality level. They were broken down into traffic zones vis-à-vis traffic demand forecasts in order to analyze traffic flow in detail. This work was completed in January 2015.

2.3.3 Activity 2.3 Jointly prepare alternative public transportation network plans for Metro Manila and forecast their respective traffic demands

To prepare alternative public transportation network and forecast demand, the DOTC and the CPT selected the following three topics for the conduct of pilot studies for which the latter's new skills and knowledge in Cube (and STRADA, partially) were applied:

1. Study on the Bus Exclusive Lane on Ortigas Avenue;
2. Study on the Introduction of CNG Buses as Provincial Bus Service between Metro Manila and Neighboring Areas; and
3. Bonifacio Global City Public Transportation Improvement Study

The profile of the pilot studies and assigned CPT members are shown in Table 2.7.

At the same time, the JPT extended assistance to the DOTC with regard to some prevailing PT issues. Using the MUCEP transportation database, the JPT prepared a comparative analysis of the Wenceslao and Aseana Stations of the LRT Line 1 South Extension to help the DOTC decide on the location of an intermediate LRT station. The DOTC also asked the JPT to determine the daily demand-supply gaps of bus and jeepney in the MUCEP area.

Table 2.7 Profiles of the Pilot Studies and CPT Assignment

1 Study on the Bus Exclusive Lane on Ortigas Avenue	(1)	Study Category	Impact Study		
	(2)	Objective	To analyze the impacts of introducing exclusive bus lanes along Ortigas Avenue between C5 and Greenhills.		
	(3)	Approach	With a new MUCEP OD matrix, highway assignment shall be conducted both under "with" and "without" project and comparative analysis is to be done to deduct the following indicators: ◆ Time savings accruing to bus/ jeepney passengers ◆ Time and cost savings/ loss accruing to car users ◆ Changes in traffic volume and congestion rate		
	(4)	Study Area	Ortigas Corridor between C5 and Greenhills		
	(5)	Remarks	◆ Pay attention to deal with vehicles turning left/ right from each segregated lane. ◆ Between EDSA and Greenhills, removal of side friction would be critical for project implementation, especially clearance of cars parking in front of both DOTC and La Salle High School.		
	(6)	Schedule	December 2014		
	(7)	Members	DOTC DPWH MMDA UP NCTS LRTA	Renato David Edna Olaguer Maximo Ewald M. Montana II Felicitas Sabas Sajid Kamid Allan Arquiza	Jasmin Marie Uson Gregorio Resuello Gabrielle Joyce Caisip Luisa Angangan
2 Study on the Introduction of CNG Buses as Provincial Bus Service between Metro Manila and Neighboring Areas	(1)	Study Category	Demand forecast		
	(2)	Objective	To examine the necessity and priority of new CNG bus routes. DOTC is currently implementing a CNG bus introduction program named the Natural Gas Vehicle Program for Public Transport (NGVPPT), wherein 200 CNG buses will operate on six routes as a pilot project.		
	(3)	Approach	Demand for bus transport shall be estimated by assigning the OD matrix of bus passengers on the present network.		
	(4)	Study Area	Selected corridors to the north, south, and east of Metro Manila		
	(5)	Remarks	◆ Bus routes in the program have starting points outside the MUCEP area and outer zones are too large to be regarded as an origin of a bus route. Some measures, such as zone subdivision or demand adjustment, will be needed. ◆ Competition with existing PUBs and PUJs shall be considered.		
	(6)	Schedule	December–January 2014		
	(7)	Members	JICA Project Team		
			DOTC MMDA	Renato David Edna Olaguer Luisa Angangan	Jasmin Marie Uson Gregorio Resuello Felicitas Sabas
3 BGC Public Transportation Improvement Study	(1)	Study Category	Feasibility study		
	(2)	Objective	To identify public transport mode and routes suitable for Bonifacio Global City (BGC), a newly developed urban core, which is currently poorly served by three bus lines.		
	(3)	Approach	◆ Zone subdivision ◆ Forecast for the near future ◆ Transit assignment ◆ Project evaluation		
	(4)	Study Area	Bonifacio Global City (BGC) including accesses		
	(5)	Remarks	Connection with existing stations of rail transit lines is to be considered.		
	(6)	Schedule	December 2014–March 2015		
	(7)	Members	DOTC BCDA LTFRB LRTA Northrail	Ronald Rundy Tuason Lemar Jimenez Rey Lim Joanne Elmedolan Lilia Coloma Celwyn Astronomia Luisito Constantino	Pamela Tadeo Nida Quibic Marites Penas Fidel Ayala Jr.

2.3.4 Activity 2.4 Jointly develop implementation strategies for the proposed public transportation network plan for Metro Manila

The strategies for public transportation network development were identified for each of the selected public transportation projects (see ***Annex H***). However, due to the small scale of the pilot studies, the overall public transportation development strategies for a wider area (e.g., MUCEP area) could not be formulated. The strategies on public transportation network development are currently being investigated by the RTRS2[3], which intends to establish public transportation development strategies for the entire Metro Manila by corridor. However, the report on EDSA corridor was submitted only at the end of October 2015, at which time MUCEP's training activities already ended.

The discussed recommendations, however, relate mainly to public transportation policy and are described in *Chapter 2.4*. It should be noted that the public transportation plan for Metro Manila should not be prepared based only on the MUCEP pilot studies but also on the results of other related studies, particularly the National Economic and Development Authority's (NEDA) Roadmap Study[4] and the DOTC's RTRS2.

2.4 Output 3: Improved Capacity to Coordinate and Formulate Policies on Public Transportation Network Development in Metro Manila

2.4.1 Activity 3.1 Identify policy issues in public transportation network development and prepare work plan to examine such issues

The following public transportation policies were discussed with the CPT and further examined utilizing the MUCEP transportation database to set basic policy directions:

(i) Fare policy for public transportation systems (railway, bus, jeepney, etc.), and
(ii) Rational evaluation method for PUB and PUJ franchise applications.

These two issues were studied as MUCEP pilot studies (see ***Manual vol.4: Policy Formulation***).

2.4.2 Activity 3.2 Establish working groups for each identified issue for inter-organizational coordination and examine respective countermeasures.

The two pilot studies mentioned above were carried out to test possible public transportation policies. The institutional framework was the same as that used in the earlier pilot studies, i.e., the CPT mainly from the DOTC's TPU undertook the studies, while the JPT provided close supervision and mentoring. The JPT supported the CPT in the analysis stage. For this, the updated transportation database of MUCEP and other information were fully utilized. The preparation of the guidelines and the training for these two studies overlapped due to the JPT's limited time left in their assignments in the Philippines.

[3] This refers to the DOTC-funded "Metro Manila Road Transit Rationalization Study: Developing Corridors." The first RTRS was funded by the World Bank.

[4] A JICA-funded study entitled "Formulation of Transportation Development Roadmap to Support Sustainable Development of Metropolitan Manila and Its Surrounding Areas" (2013–2014).

The JPT completed the manuals on transportation policy formulation (see ***Manual vol.4: Policy Formulation***) with the support of the DOTC's Transport Planning Unit and the MUCEP Counterpart Project Team. The volume comprises three parts, namely, Part 1 on public transportation policy options, Part 2 on setting public utility bus and jeepney fares, and Part 3 on evaluating franchise applications.

2.4.3 Activity 3.3 Conduct stakeholder meetings to enhance public participation and build consensus on the proposed countermeasures

The weekly meetings between the JPT and the CPT also became venues to build consensus on proposed public transportation policies. In these meetings, the JPT and the CPT discussed the pilot studies and possible public transportation policies, particularly those on fare setting and franchising of buses and jeepneys.

In relation to fare setting, the vehicle operating cost (VOC) was one of the most important data that was estimated and analyzed. The CPT updated the vehicle information contained in an Excel spreadsheet prepared by the JPT which included prices of vehicles, tires, and fuel. The DOTC and the LTFRB showed a keen interest in learning the methodology to calculate the VOC.

Through the process of building consensus between MUCEP's counterpart agencies, some methodologies regarding franchising were tested as an exercise to scientifically evaluate the franchise application of PUBs and PUJs. The JPT and the CPT recommended to the DOTC to change the current method of evaluating franchise applications inside the MUCEP area from route measured capacity (RMC) to transit assignment.

2.4.4 Activity 3.4 Summarize recommendations based on findings of the working groups

The third and last seminar was held jointly with the fifth and last Joint Coordinating Committee (JCC) meeting on 27 October 2015. The seminar and meeting disseminated the MUCEP findings and recommendations to the related agencies.

2.5 Output 4: Periodic Monitoring and Presentation of Outputs

JCC meetings and seminars

During the MUCEP period, five JCC meetings and three seminars were held, as prepared in the work plan. The highlights of the discussions during the JCC meetings are shown in ***Annex G***.

Table 2.8 Meetings and Seminars in MUCEP

Meeting	Date
JCC1	3 Jul 2012
PMT1	13 Dec 2012
JCC2	19 Aug 2014
Seminar 1	27 Aug 2014
JCC3	27 Feb 2015
JCC4	16 Jul 2015
Seminar 2	28 Jul 2015
JCC5 and Seminar 3	27 Oct 2015

Submission of the Work Plan/ Progress Report

Periodic monitoring and presentation of outputs in the form of the work plan and progress reports are listed in the table below.

Table 2.9 MUCEP Reports

Report	Submission Date
Work Plan	May 2012
Progress Report 1	Jul 2012
Progress Report 2	Sep 2014
Progress Report 3	Mar 2015
Progress Report 4	Aug 2015
Progress Report 5	Nov 2015
Project Completion Report	Dec 2015

Assistance with the Final Evaluation by JICA

On 5–18 July 2015, an Evaluation Team from JICA carried out the final evaluation of MUCEP. The JPT and the CPT collaborated with the Evaluation Team members by giving them necessary information and acceded to interview requests. The results of the final evaluation were submitted to the DOTC during the fourth JCC meeting held on 16 July 2015.

Conduct of baseline survey of CPT's capacity

On 15 October 2015, the endline survey was conducted among the CPT members to determine the results of capacity development. The CPT members accomplished the questionnaire, which aimed to determine their current knowledge of, and experience for, every transportation-related item.

The required knowledge, skills, and indicators for each output and activity are shown in Table 2.11. Results of the end-line survey were evaluated on the following five-level scale:

(i) **Newbie:** I don't know the process/concept;
(ii) **Novice:** I know the process/ concept, but I have never done it;
(iii) **Young Expert:** I have done it once, but I have not reported or presented the results;
(iv) **Expert:** I have done it twice or more/I have done it once and reported or presented the results; and
(v) **Senior Expert**: I have done it twice or more, and reported or presented the results.

The average scores in the series of surveys are shown in Table 2.10. Compared with the results of the baseline survey, the average level of knowledge and skills for each output for all CPT members clearly improved and achieved the numerical target: Output 1 increased from 2.08 to 3.82; Output 2, from 1.89 to 3.51; and Output 3, from 2.12 to 3.21.

Table 2.10 Average Scores per Output

Survey	Group	Output		
		1	2	3
Baseline Survey (May 2012)	CPT	2.08	1.89	2.12
	TPU	2.56	2.09	2.38
Endline Survey (Oct 2015)	CPT	3.82	3.51	3.21
	TPU	3.81	3.75	3.00

Source: JICA Project Team
Note: When the baseline survey was conducted, the TPU was not yet established. However, the two respondents who participated in that survey were already MUCEP counterparts. The number of respondents from the TPU was two for the May 2012 survey, three for the February 2015 survey, and four for the July 2015 and endline surveys.

Table 2.11 Required Knowledge, Skills, and Indicators per Project Output and Activity

Output	Indicator	Activity	Required Knowledge and Skill
1 Improved capacity to manage the Metro Manila transportation database (Indicator #1)	(1)-1 Updated MMUTIS transportation database	1-2 Prepare tender documents for the traffic surveys, as well as procure and supervise survey implementation.	1.2.1 Implementing Traffic Surveys
			1.2.2 Analyzing Traffic Survey Results
			1.2.3 Analyzing Transportation Demand
			1.2.4 Formulating Traffic Control Measures
		1-3 Develop traffic forecasting model(s) based on survey results.	1.3.1 Analyzing Transportation Demand using Macrosimulation
			1.3.2 Analyzing Transportation Demand using Microsimulation
		1-4 Update the MMUTIS transportation database.	1.4.1 Analyzing Origin-Destination (OD) Matrix
			1.4.2 Creating Transportation Planning Database
	(1)-2 Prepared manuals on traffic survey and database management	-	-
2 Improved capacity to plan the public transportation network of Metro Manila (Indicator #2)	(2)-1 Prepared manuals on public transportation planning	-	-
	(2)-2 Proposed plan on public transportation network for Manila	2-2 Identify planning conditions for public transportation network development in Manila.	2.2.1 Analyzing Traffic Demand for Public Transportation
			2.2.2 Knowledge of Development Planning for Metro Manila
			2.2.3 Knowledge of Existing Public Transportation and Road Network in Metro Manila
		2-3 Jointly prepare alternative public transportation network plans for Manila and forecast their respective traffic demands.	2.3.1 Building Transportation Demand Forecast Model(s)
			2.3.2 Analyzing Transportation Network
			2.3.3 Estimating Current Transportation Demand
			2.3.4 Assigning Demand on the Transportation Network
			2.3.5 Forecasting Transportation Demand
		2-4 Jointly develop implementation strategies for the proposed public transportation network plan for Manila.	2.4.1 Planning for Public Land Transportation (Bus, BRT, Jeepney, etc,.)
			2.4.2 Planning for Rail Transportation
			2.4.3 Implementing Transportation Management (TM) and Transportation Demand Management (TDM) Measures
3 Improved capacity to coordinate and formulate policies on public transportation network development in Metro Manila (Indicator #3)	(3)-1 Effective agreements among stakeholders made in relevant meetings	3-1 Identify policy issues in public transportation network development and prepare work plan to examine such issues.	3.1.1 Preparing Urban Plans to Secure Transportation Space
			3.1.2 Formulating Private Finance Initiative / Public-Private Partnership (PPP) Schemes
			3.1.3 Conducting Economic/ Financial Evaluation, Environmental Assessment
		3-2 Establish working groups for each identified issue for inter-organizational coordination and examine respective countermeasures.	3.2.1 Knowledge of Transportation Policies, Laws, and Issues in the Philippines
			3.2.2 Examining Countermeasures for Transportation Issues
		3-3 Conduct stakeholder meetings to enhance public participation and build consensus on the proposed countermeasures.	3.3.1 Planning and Conducting Stakeholder Meetings
			3.3.2 Building Consensus among Stakeholders
	(3)-2 Agreed recommendations on transportation policy issues	3-4 Summarize recommendations based on findings of the working groups.	3.4.1 Synthesizing Recommendations into Reports

Table 2.12 Baseline and Endline Scores per Required Skill and Knowledge for Output 1

Expected Output	Required Skill and Knowledge		Score		Growth Rate (%)
			Baseline	Endline	
Output 1: Management of the Metro Manila Transportation Database	1.2.1	Implementing Traffic Surveys	2.79	4.00	144
	1.2.2	Analyzing Traffic Survey Results	3.14	3.78	120
	1.2.3	Analyzing Transportation Demand	2.71	4.44	164
	1.2.4	Formulating Traffic Control Measures	2.00	3.00	150
	1.3.1	Analyzing Transportation Demand using Macrosimulation	1.50	3.89	259
	1.3.2	Analyzing Transportation Demand using Microsimulation	1.29	3.67	285
	1.4.1	Analyzing Origin-Destination (OD) Matrix	1.64	4.22	257
	1.4.2	Creationg Transportation Planning Database	1.57	3.56	226

Source: JICA Project Team

Table 2.13 Baseline and Endline Scores per Required Skill and Knowledge for Output 2

Expected Output	Required Skill and Knowledge		Score		Growth Rate (%)
			Baseline	Endline	
Output 2: Planning the Public Transportation Network of Metro Manila	2.2.1	Analyzing Traffic Demand for Public Transportation	1.79	3.89	218
	2.2.2	Knowledge of Development Planning for Metro Manila	2.79	3.56	128
	2.2.3	Knowledge of Existing Public Transportation and Road Network in Metro Manila	3.14	3.89	124
	2.3.1	Building Transportation Demand Forecast Model(s)	1.21	3.67	302
	2.3.2	Analyzing Transportation Network	1.79	4.00	224
	2.3.3	Estimating Current Transportation Demand	1.50	3.67	244
	2.3.4	Assigning Demand on the Transportation Network	1.36	3.33	246
	2.3.5	Forecasting Transportation Demand	1.36	3.67	270
	2.4.1	Planning for Public Land Transportation (Bus, BRT, Jeepney, etc,.)	2.50	3.89	156
	2.4.2	Planning for Rail Transportation	1.57	2.33	148
	2.4.3	Implementing Transportation Management (TM) and Transportation Demand Management (TDM) Measures	1.79	2.67	149

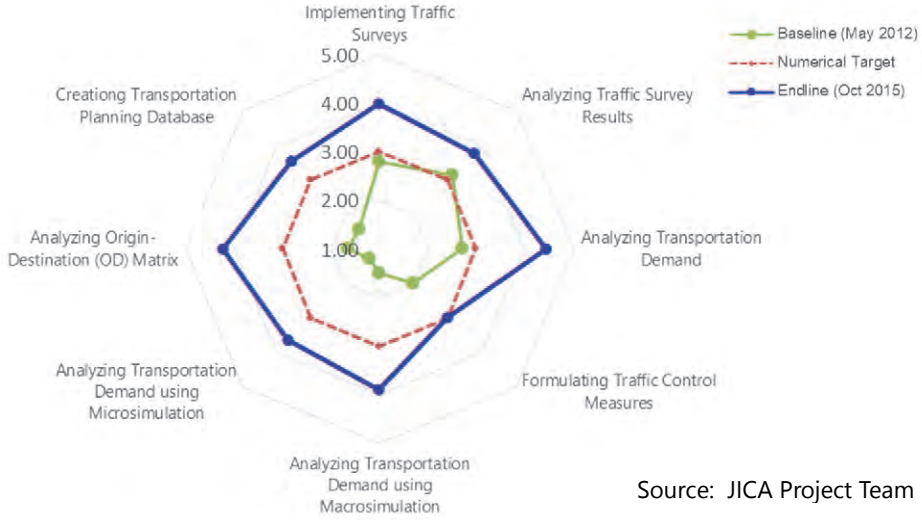
Source: JICA Project Team

Table 2.14 Baseline and Endline Scores per Required Skill and Knowledge for Output 3

Expected Output	Required Skill and Knowledge		Score		Growth Rate (%)
			Baseline	Endline	
Output 3: Policies on Public Transportation Network Development in Metro Manila	3.1.1	Preparing Urban Plans to Secure Land Acquisition	1.29	2.00	156
	3.1.2	Formulating Private Finance Initiative (PFI) / Public-Private Partnership (PPP) Schemes	1.50	2.11	141
	3.1.3	Conducting Economic/ Financial Evaluation, Environmental Assessment	1.64	2.67	162
	3.2.1	Knowledge of Transportation Policies, Laws, and Issues in the Philippines	3.43	4.33	126
	3.2.2	Examining Countermeasures for Transportation Issues	2.14	4.00	187
	3.3.1	Planning and Conducting Stakeholder Meetings	2.29	3.78	165
	3.3.2	Building Consensus among Stakeholders	2.57	3.22	125
	3.4.1	Synthesizing Recommendations into Reports	2.71	3.56	131

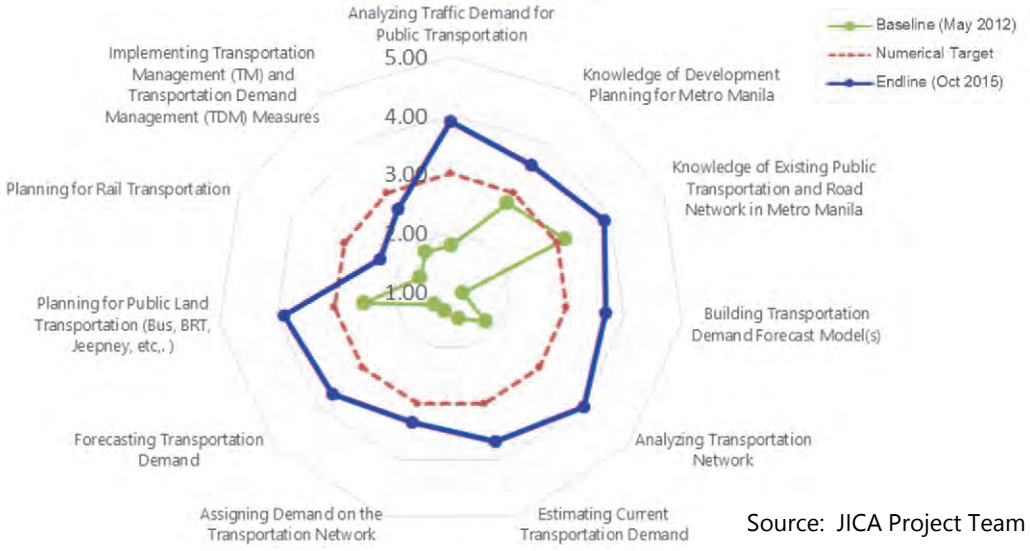
Source: JICA Project Team

Figure 2.1 Required Knowledge and Skills for Output 1



Source: JICA Project Team

Figure 2.2 Required Knowledge and Skills for Output 2



Source: JICA Project Team

Figure 2.3 Required Knowledge and Skills for Output 3

Source: JICA Project Team

3 Achievement of Output

3.1 Output 1: Improved Capacity to Manage the Metro Manila Transportation Database

3.1.1 Indicator 1-1: Updated MMUTIS Transportation Database

The updated MMUTIS Transportation Database (the MUCEP Database) was completed as described in *Chapter 2.2.4*. Table 3.1 shows the structure of the database. The JPT drafted an application form which the DOTC's Assistant Secretary for Planning and Finance already approved. Potential database users should fill out this form when requesting for copies of the MUCEP database. They should provide the following information: name, position, organizational affiliation, address, phone number, e-mail address, and purpose for using the MUCEP data. Additional justifications for requesting the data may be asked of the requesting party. The DOTC's Assistant Secretary for Planning and Finance reviews the requests and approves them when the reasons given are considered to be appropriate. In principle, it is only the processed data which are given when requests are approved; the master file is only available to selected DOTC offices.

MUCEP data is available for related agencies and institutions. Requests for MUCEP data are addressed to the DOTC's Assistant Secretary for Planning and Finance. Requesting parties are asked to provide the following information: name, position, organizational affiliation, address, phone number, e-mail address, and purpose for using the MUCEP data. Additional justifications for requesting the data may be asked of the requesting party. The Assistant Secretary reviews the request and approves it when the usage of the database is considered to be appropriate. Two documents have already been approved. In principle, the master file is only available to selected DOTC offices, while the processed data are made available to other parties when requests are approved.

3.1.2 Indicator 1-2: Prepared Manuals on Traffic Survey and Database Management

Manuals on Traffic Surveys
Manuals on transportation surveys were prepared to assist the DOTC in implementing transportation surveys to update the MUCEP transportation database (see ***Manual vol. 1: Traffic Surveys***). The manuals describe the methodologies used in the MUCEP surveys, the objectives of such surveys, the methodology for practical implementation, organization of the survey team, necessary materials, and other considerations. The manuals are practical, understandable, detailed, and supported by photos, examples, and charts. For example, the manual on HIS illustrates the concept of a "trip," explaining it in detail with specific examples. Meanwhile, the manual on traffic count survey clarifies the classification of vehicles with photos and includes a sample survey form and instructions on how to utilize it.

Manual on Travel Demand Forecasting
Demand forecasting as part of transportation planning is done to estimate the impact of any improvement project, such as the construction of new roads and rehabilitation of old railways, as well as the impact of any policies, such as tolls, fare level of public transportation, truck ban, and road pricing, on the transportation system. This manual describes the travel demand model using

Cube and includes an initial transit assignment model system (see ***Manual vol.2: Travel Demand Forecasting***).

Manual on Database Management

Acceding to the request of the CPT, the JPT prepared the manual on database management (see ***Manual vol.5: Database Management***). This manual is composed of seven parts, namely:

(i) Overall Description of the Database;
(ii) Household Interview Survey (HIS) Data;
(iii) Cordon Line Survey and Screen Line Survey Data;
(iv) Demand Forecast Data;
(v) GIS Data;
(vi) Database Management; and
(vii) Database Updating.

Table 3.1 shows the structure and description of the database.

Table 3.1 MUCEP Database Structure

Folder and File Name			Description	Format
00_Manual	Manuals on Traffic Survey.docx		Guide to conducting surveys and comprises three parts, i.e., household interview survey, cordon line survey, and screen line survey.	Word
	Manual on Demand Forecasting.docx		Guide to analyzing travel demand and modeling as part of transportation planning.	Word
	Manuals on UT Planning.docx		Guide to transportation planning and comprises three parts: (i) Transportation Demand Characteristics based on MUCEP Person Trip Survey expounds on the abovementioned survey methods, their purpose and coverage including zoning; (ii) Transport Planning Manual serves as a guide to preparing a transport plan using analytical tools; (iii) Public Transportation Planning Manual explores the current public transportation system in the area of study and the planning process; and (iv) Project Evaluation Manual focuses on financial and economic evaluation.	Word
	Manuals on Policy Formulation.docx		Guide to formulating policies and comprises three parts, i.e., public transportation policy options, setting of public utility bus and jeepney fares, and evaluation of franchise applications.	Word
	Manual on Database Management.docx		Guide to understanding and using the MUCEP Database.	Word
01_Survey_Form	HIS_forms.pdf		4 forms: household information, information on HH members, daily trip information, perception survey on transportation development.	PDF
	OD_Interview_Survey_Form s.doc		4 forms to obtain data on origin and destination of four groups of trip makers (private mode driver, public mode driver, public mode passenger, and freight vehicle driver) by vehicle type, hour, and trip purpose	Word
	Traffic_Count_Survey_Form.xls		Form to obtain data on intercity vehicular traffic movement covering OD distribution by vehicle type (17 modes) and trip purpose every 15 minutes	Excel
	Veh_Occupancy_Survey_Form.xls		Form to obtain data on intercity passenger traffic movement covering OD distribution by vehicle type (17 modes) and trip purpose every 15 minutes	Excel
02_HIS	Results	1_HH.xlsx	Answers to HIS Form 1 on household characteristics	Excel
		2_HHM.xlsx	Answers to HIS Form 2 on HH member characteristics	Excel
		3_Trip.xlsx	Answers to HIS Form 3 on daily trips of interviewees	Excel

Folder and File Name				Description	Format
		4_Frm.xlsx		Answers to HIS Form 4 on perception survey on transportation development	Excel
	Zone	Zone_List-MUCEP.xlsx		Mucep zone system	Excel
		Zone-Barangay(MUCEP).xlsx		Correspondence table of HIS code (MUCEP code) and MUCEP zone	Excel
03_Cordon	Count	OC_Occ1hr.xlsx		Results of cordon line survey	Excel
		OC_TVol1hr.xlsx		Results of cordon line survey	Excel
	Interview	FormA.xlsx		Results of survey among private mode drivers	Excel
		FormB.xlsx		Results of survey among public mode drivers	Excel
		FormC.xlsx		Results of survey among public mode passengers	Excel
		FormD.xlsx		Results of survey among freight mode drivers	Excel
		Airport.xlsx		Results of survey among air passengers	Excel
		Ferry_PNR.xlsx		Results of survey among ferry passengers	Excel
04_Screen	SLS_Occ1hr_V17.xlsx			Results of screen line survey	Excel
	SLS_TVol1hr.xlsx			Results of screen line survey	Excel
05_Socio_Frame	Socio_Frame.xlsx			Population in 2014, 2020, 2025, 2030, and 2035.	Excel
11_OD	Cube	2014	MUCEP_Trp2014_Lnk_MD14_z432.mat	2014 OD table for 14 modes; in Cube format.	Cube
			MUCEP_Trp2014_Lnk_MD05_z432_forHighwayASG.mat	2014 OD table for 5 modes for highway assignment; in Cube format.	Cube
			MUCEP_Trp2014_Lnk_PP05_z432.mat	2014 OD table for 5 trip purposes for highway assignment; in Cube format.	Cube
		2020	MDL2020_interpolation.mat	2020 OD table for 5 modes based on 2014 and 2025 OD; in Cube format.	Cube
		2025	MDL2025.mat	2025 OD table for 5 modes; in Cube format.	Cube
		2035	MDL2035.mat	2030 OD table for 5 modes; in Cube format.	Cube
	STRADA	2014	MUCEP_Trp2014_Lnk_MD14_z432.aod	2014 OD table for 14 modes; in STRADA format.	Cube
			MUCEP_Trp2014_Lnk_MD05_z432_forHighwayASG.aod	2014 OD table for 5 modes for highway assignment; in STRADA format.	STRADA
			MUCEP_Trp2014_Lnk_PP05_z432.aod	2014 OD table for 5 purposes for highway assignment; in STRADA format.	STRADA
		2020	MDL2020_interpolation.aod	2020 OD table for 5 modes based on 2014 and 2025 OD; in STRADA format.	STRADA
		2025	MDL2025.aod	2025 OD table for 5 modes; in STRADA format.	STRADA
		2035	MDL2035.aod	2030 OD table for 5 modes; in STRADA format.	STRADA
		Transit	MUCEP_Trp2014_Lnk_Public_z432.aod	2014 OD table for transit assignment; in STRADA format.	STRADA
12_Zoning	A007	Area007-035_Index.xlsx		Zoning system of 7 zones.	Excel

Folder and File Name				Description	Format
		Zone_List-Modify.xlsx			Excel
		CenU07			MapInfo
		Zoning_MUCEP_Area7			MapInfo
		Area7.pzn			STRADA
	A008	Area008-035_Index.xlsx		Boundaries 8 zones (large zones) under the MUCEP project area.	Excel
		Zone_List-Modify.xlsx			Excel
		CenU08			MapInfo
		Zoning_MUCEP_Area8			MapInfo
		Area8.pzn			STRADA
	A009	Area009-035_Index.xlsx		Boundaries of 9 cities and municipalities under the MUCEP project area.	Excel
		Zone_List-Modify.xlsx			Excel
		CenU09			MapInfo
		Zoning_MUCEP_Area9			MapInfo
		Area9.pzn			STRADA
	A035	Area035_Index.xlsx		Boundaries of 35 cities and municipalities under the MUCEP project area.	Excel
		MUCEP_Area35			MapInfo
		Muni-CenU35			MapInfo
		Area035.pzn			STRADA
	Z082(Muni_City)	A_CityMunBoundary_SA_MUCEP2012_UTMWGS84		Boundaries of 82 cities and municipalities under the MUCEP project area.	MapInfo
		Muni-Cen			MapInfo
		Area432-082.pzn			STRADA
	Z089(Muni_City_and_Division)	Zone_List-Modify2.xlsx		Boundaries of 89 medium zones (cities and municipalities) under the MUCEP project area.	Excel
		A_CityMunPlusBoundary_StudyA			MapInfo
		Muni-Cen			MapInfo
		Area432-089.pzn			STRADA
	Z432	Zoning_MUCEP.xlsx		Boundaries of 432 small zones/traffic analysis zones under the MUCEP project area.	Excel
		Zoning_MUCEP			MapInfo
13_Network_and_ PAR	Cube	2015	NET2015.net	Road and rail network in 2014.	Cube
		2025	NET2025.net	Road and rail network in 2025.	Cube
		2035	NET2035.net	Road and rail network in 2035.	Cube
		Tranist	Pub_2014.lin	Transit line in 2014.	Cube
		CUBE_Model	Assignment_MUCEP.zip	Cube assignment model including highway assignment model and transit assignment model.	Cube
	STRADA	2015	Network2015.int	Road and rail network in 2014 and assignment parameter	STRADA
			2015.par		STRADA
			Run_2015.acn		STRADA

Folder and File Name				Description	Format
			Net2015		MapInfo
		2025	Network2025.int	Road and rail network in 2025 and assignment parameter	STRADA
			Network2025.csv		STRADA
			2025.par		STRADA
		2035	Network2035.int	Road and rail network in 2035 and assignment parameter	STRADA
			Network2035.csv		STRADA
			2035.par		STRADA
		Transit	Net2012-2_Z432_rev2-D_Pub-2.int	Transit line in 2014 and assignment parameter	STRADA
			Pub2014-Capa2.tnt		STRADA
			2014_for_rev2.tpa		STRADA
21_GIS	DataDocumentation_MUCEP_GIS.xls			GIS data explanation	Excel
	10_Administrative	A_BarangayBoundary_SA_MUCEP2012_UTMWGS84		Barangay boundaries[5]	MapInfo
		A_BarangayCenter_SA_MUCEP2012_UTMWGS84		Point file of all barangays	MapInfo
		A_BarangayBoundary_SA_MMUTIS1996_UTMWGS84		Barangay boundaries	MapInfo
		A_CityMunBoundary_SA_MUCEP2012_UTMWGS84		Municipal boundaries in the project area	MapInfo
		A_CityMunBoundary_MM_MMUTIS1996_UTMWGS84		Municipal boundaries in the project area	MapInfo
		A_ProvBoundary_SA_MUCEP2012_UTMWGS84		Provincial boundaries	MapInfo
		A_RegionBoundary_Luzon_NSO2000_UTMWGS84		Regional boundaries	MapInfo
	20_NaturalConditions	N_LagunaLake_SA_MUCEP2012_UTMWGS84		Laguna Lake boundary	MapInfo
		N_WaterBody_SA_MUCEP2012_UTMWGS84		Laguna Lake, Pacific Ocean, West Philippine Sea	MapInfo
	30_Infrastructures	I_Roads_MM_MMUTIS1996_UTMWGS84		Metro Manila roads	MapInfo
		I_Roads_Prov_MMUTIS1996_UTMWGS84		Provincial roads	MapInfo
		I_RoadsPrimary_SA_MMUTIS1996_UTMWGS84		Primary roads	MapInfo
		I_RoadsSecondary_SA_MMUTIS1996_UTMWGS84		Secondary roads	MapInfo
		I_RoadInventory_Natl_DPWH2011_UTMWGS84		National roads inventory	MapInfo
		I_RoadCondition_Natl_DPWH2011_UTMWGS84		National roads with road condition attributes	MapInfo
		I_Railway_SA_DOTC2012_UTMWGS84		Railway alignment	MapInfo
		I_RailSta_SA_DOTC2012_UTMWGS84		Railway stations	MapInfo
		I_Ports_Natl_DPWH2011_UTMWGS84		National ports	MapInfo
		I_Airports_Natl_DPWH2011_UTMWGS84		National airports	MapInfo
		I_RoadCL_MM_MMDA_UTMWGS84.shp		Metro Manila roads	shapefile
		I_RoadPoly_MM_MMDA_UTMWGS84.shp		Metro Manila roads	shapefile
	99_Others	O_OutmostCordonLoc_MUCEP_2012_UTMWGS84		Outermost cordon line locations	MapInfo

[5] Barangay boundaries are originally from MMEIRS for Metro Manila and NSO for outside Metro Manila. Some barangays were updated based on the LGU maps. Check Bgy tab for details.

Folder and File Name			Description	Format
		O_StudyArea_MUCEP_2012_UTMWGS84	MUCEP project area based on the updated barangay boundaries	MapInfo
		O_Zoning_SA_CTIIHSH_2009_UTMWGS84	Zones with data from the covered barangay	MapInfo
		O_ZoningMed_SA_CTIIHSH_2009_UTMWGS84	Medium zones	MapInfo
		O_ZoningSml_SA_CTIIHSH_2009_UTMWGS84	Small zones	MapInfo
		O_Zoning_SA_MMUTIS_1996_UTMWGS84_AllOrig	Small and medium zones with bgy names and codes	MapInfo
		O_ZoningMed_SA_MMUTIS_1996_UTMWGS84	Medium zones	MapInfo
		O_ZoningSml_SA_MMUTIS_1996_UTMWGS84_All	Small zones	MapInfo
		O_ZoningMed_SA_MMUTIS_1996_UTMWGS84_All	Medium zones	MapInfo
		O_ZoningSml_SA_MMUTIS_1996_UTMWGS84	Small zones	MapInfo
		O_StudyArea_MMUTIS_1996_UTMWGS84z	MMUTIS study area	MapInfo
		O_OutmostCordonLoc_MUCEP_2012_UTMWGS84	Outmost cordon locations	MapInfo
		O_NSScreenline_MM_MUCEP_2012_UTMWGS84	North to south screen line	MapInfo
		O_EWScreenline_MM_MUCEP_2012_UTMWGS84	East to west screen line	MapInfo
	MetroManila	MetroManilaRoad	Road network	MapInfo
		MetroManilaRoad.shp	Road network	shapefile

3.2 Output 2: Improved Capacity to Plan the Public Transportation Network of Metro Manila

3.2.1 Indicator 2-1: Manual on Public Transportation Planning

The manuals on public transportation planning were drafted during the period of July 2012–August 2014. Finalization of this manual was done by incorporating the results of the MUCEP pilot studies (see ***Manual vol. 3: Urban Transportation Planning***). This volume comprises the following:

(i) Part 1 Manual on Urban Transportation Planning: Serves as a guide for the preparation of a transportation plan and provides a step-by-step approach to transportation planning analysis with the use of analytical tools to realize the expected outputs;
(ii) Part 2 Manual on Public Transportation Planning: Explores the current public transportation system in the study area and the planning process; and
(iii) Part 3 Manual on Project Evaluation: Discusses the financial and economic components of evaluation.

3.2.2 Indicator 2-2: Proposed Plan on Public Transportation Network for Manila

Examination of Future Conditions in Public Transportation Planning
Data and information that would help in formulating public transportation plans were collected during the project period. These include information on ongoing and proposed public transportation projects in the MUCEP area, which was collected by the CPT members. Such data and information were summarized and became the basis for subsequent discussions in Project Team meetings as regards the selection of pilot studies to be carried out by the CPT. Future socio-economic indicators, such as population, employment, and car ownership, were preliminarily estimated based on trends at the macro level, i.e., city/municipality level. They were broken down into traffic zones vis-à-vis traffic demand forecast in order to analyze traffic flow in detail.

Preparation of Strategies on Public Transportation Network Development
Based on the decision of the DOTC and the CPT, the following three pilot studies were selected for which the latter's new skills and knowledge in Cube (and STRADA partially) were applied:

(i) Study on the Bus Exclusive Lane on Ortigas Avenue;
(ii) Study on the Introduction of CNG Buses as Provincial Bus Service between Metro Manila and Neighboring Areas; and
(iii) Bonifacio Global City Public Transportation Improvement Project

The strategies on public transportation network development were identified for each of the selected pilot studies. However, due to their small scale, the overall public transportation development strategies for a wider area (e.g., MUCEP area) could not be formulated.

After the pilot studies were carried out, the JPT discussed with the CPT about possible recommendations on improving the public transportation in the entire Metro Manila. The discussed recommendations, however, relate mainly to public transportation policy and are described in *Chapter 2.3.2*. It should be noted that the public transportation plan for Metro Manila should not be prepared based only on the results of the MUCEP pilot studies but also on the

findings and recommendations of other related studies, particularly NEDA's Roadmap Study[6] and the DOTC's RTRS2.

Although there was an expectation that the RTRS2 outputs could be used in MUCEP's pilot studies, this was not realized because the outputs could only be submitted in January 2016, The RTRS2 intends to establish public transportation development strategies for the entire Metro Manila and to prepare plans for the three corridors of Roxas Boulevard, EDSA, and Alabang–Zapote Road.

3.3 Output 3: Improved Capacity to Coordinate and Formulate Policies on Public Transportation Network Development in Metro Manila

3.3.1 Indicator 3-1: Agreed Recommendations on Transportation Policy Issues

At the beginning of MUCEP, there were issues it was expected to address, and these are as follows:

(i) Improvement in traffic connectivity;
(ii) Traffic management to prioritize public transportation;
(iii) Transportation demand management;
(iv) Pre-evaluation of permits and licenses of jeepney and bus routes;
(v) Policy on public transportation fares; and
(vi) Traffic management for crossing intersections, U-turn slots, etc.

The final issues that were studied were decided jointly by the JPT, the CPT, and the DOTC, while bearing in mind the importance of ensuring that problem-solving techniques could be transferred to the CPT effectively within the project period. These issues became the topics of the pilot studies mentioned in *Chapter 2.3.3*, to wit:

(i) Bus priority traffic management on arterial roads (pilot study on exclusive bus lane on Ortigas Avenue);
(ii) Introduction of environment-friendly bus vehicle (pilot study on the introduction of CNG buses for provincial bus service); and
(iii) Improvement of public transportation in a large urban development area (pilot study on the improvement of public transportation in Bonifacio Global City).

In addition to the above-mentioned issues, the JPT discussed the following public transportation policies with the CPT and further examined them, utilizing the MUCEP transportation database to set basic policy directions:

(i) Fare policy for public transportation systems (railway, bus, jeepney, etc.), and
(ii) Rational evaluation method for PUB and PUJ franchise applications.

These two additional pilot studies were carried out to test possible public transportation policies. The institutional framework was the same as that used in the earlier pilot studies, i.e., the CPT mainly from the DOTC's TPU undertook the studies, while the JPT provided close supervision and

[6] A JICA-funded study entitled "Formulation of Transportation Development Roadmap to Support Sustainable Development of Metropolitan Manila and Its Surrounding Areas" (2013–2014).

mentoring. Regarding franchising, the JPT and CPT recommended the use of transit assignment instead of the RMC in evaluating applications for PT franchises inside the MUCEP area.

In addition to the pilot studies, discussions with the CPT were held since the beginning of this project—and as the need arose—on the results of recently concluded public transportation studies and proposed public transportation (railway and road-based) projects.

Manuals on Public Transportation Policy Formulation

The JPT completed the manuals on transportation policy formulation with the support of the DOTC's Transport Planning Unit and the MUCEP Counterpart Project Team. It comprises three parts, i.e., Part 1 on public transportation policy options, Part 2 on setting public utility bus and jeepney fares, and Part 3 on evaluating franchise applications.

Training in Public Transportation Policy Making

Based on the prepared manuals, the JPT supported the CPT in the analysis stage. For this, the updated transportation database of MUCEP and other information were fully utilized. The preparation of the manuals and the training were implemented concurrently due to the limited time availability of the JPT members.

3.3.2 Indicator 3-2: Effective Agreements among Stakeholders made in Relevant Meetings

In the weekly MUCEP meetings, the JPT and the CPT discussed the pilot studies and the resulting public transportation policies, particularly on PT fare setting and bus/jeepney franchising, to wit:

(i) Periodically revise PUB and PUJ fares;
(ii) Widen the use of stored-value cards;
(iii) Study TDM schemes (particularly inside EDSA);
(iv) Reorganize jeepney operations;
(v) Change evaluation method of franchise application from RMC method to transit assignment;
(vi) Periodically update the MUCEP database by the TPU and DOTC; and
(vii) For the TPU to keep records of requests for MUCEP database.

The above-mentioned actions were approved during the fifth Joint Coordinating Committee meeting held on 27 October 2015.

4 Challenges and Tactics

4.1 Delay in DOTC Procurement

Originally MUCEP was supposed to complete in August 2014. However, the project got delayed for almost 15 months due to several reasons, to wit:

(i) The project's Counterpart Project Team was only mobilized in April 2012, six months after project commencement. As a result, training in the Philippines started only on 3 May 2012 instead of upon project start;
(ii) Sourcing the budget for the government portion of the HIS—the DOTC eventually shouldered the full cost of the HIS under the Transport Studies Fund (from GAA CY 2011) instead of sharing the cost with other agencies as was earlier planned by the DOTC itself—likewise took considerable time, from the preparation of the Project Procurement Management Plan (PPMP) to the signing of the Approved Budget for the Contract, and
(iii) The first bidding for the consulting services for the DOTC-funded HIS, which was held from October to November 2012, resulted in failure, while the second bidding took almost nine months (from January to September 2013), before the project was awarded.

Based on the reasons stated above, the JPT proposed a 15-month extension of the project period, with the project ending in November 2015. JICA approved the request in December 2013, and the MUCEP's plan of operation was modified based on this new schedule.

4.2 Involvement of the TPU

Based on the original project design matrix (PDM_0), the DOTC was supposed to establish a Transportation Database Management Unit (TDMU) before the MUCEP started. The TDMU was supposed to manage, maintain, update, and use the database system which the MUCEP would develop.

Instead, the DOTC established the Transport Planning Unit on 5 February 2014 and assigned four regular DOTC employees as its staff. Because its duties and responsibilities were expected to overlap with those of the TDMU, the JPT proposed the integration of the TPU and the TDMU to the DOTC. In the Cube training, TPU personnel were given priority. The TPU personnel were also officially instructed by the DOTC Undersecretary for Planning through a memorandum dated 10 December 2014 to participate in all capacity building activities of the MUCEP.

The TPU actively participated in trainings and meetings such as changing the training style from lectures to question-and-answer sessions. They sometimes accompanied the HIS Team to learn more about actual site situations and field surveys. From April to May 2015, the three TPU staffers from the DOTC main office were assigned full time to MUCEP to carry out, under the tutelage of the JICA Project Team, the pilot study on the introduction of CNG buses in the north and east of Metro Manila. Then, from June to October 2015, all four TPU staffers—the fourth member is from the LTFRB—were assigned to MUCEP to undergo more intensive training through the implementation of pilot studies. As the lead counterpart agency, these reflected the DOTC's strong commitment to successfully complete MUCEP.

4.3 Question-and-Answer Training

As mentioned in *Chapter 2.2.1*, the method adopted for the training program on public transportation planning was changed in response to the request of the CPT to focus the training on the actual use of Cube in small pilot studies. The question-and-answer training style was adopted in response to the request of the CPT instead of lectures and exercises, which were initially used.

Through the whole training program, MUCEP members developed a good relationship. The stable partnership and open communication among the DOTC, DPWH, MMDA, UP NCTS, LRTA, LTFRB, BCDA, Northrail, PNR, local staff, and JICA experts gradually developed in the process of implementing project activities, especially the weekly trainings every Thursday and the training in Japan, which contributed much to fostering a good relationship among them. The implementation of various MUCEP activities was facilitated as a result of their joint work, diligence, and commitment.

4.4 Clarification about the Overall Goal

The JPT and the DOTC agreed that the "public transportation plan for Metro Manila" stated in the Overall Goal refers, for example, to public transportation plans for strategic Metro Manila corridors with important transportation issues. This required the modification of the means of verification stated in the PDM. Version 4 of this document, which was signed in the fourth JCC meeting on 16 July 2015, is shown in ***Annex A***.

4.5 JPT's Flexible Response to CPT's Needs

Even though the JICA Project Team had to follow a plan of operation, the Team changed the project schedule and approach to respond to the CPT's needs and requests, as long as the changes did not negatively affect the ultimate objective of the Project.

(i) Question-and-answer sessions were adopted for training instead of lectures and exercise;
(ii) The number of pilot studies increased from one to three, providing more chances for the CPT to use their learned skills and techniques; and
(iii) An additional manual was prepared (i.e., the Database Management Manual) and other activities (e.g., microsimulation) were undertaken in response to the needs of the CPT.

The JPT welcomed the CPT's proposed changes, because the Team believed that repeated exercises was key to improving the CPT's transportation planning skills, and the proposed changes were in line with this belief.

5 Achievement of Project Purpose

The project purpose stated in PDM_4 reads thus: "To improve public transportation planning for Metro Manila, including coordination among relevant agencies, spearheaded by the DOTC." To assess the level of achievement of this purpose, the verifiable indicator, i.e., the management system for the new transportation database is established by 2014, was checked. As specified in the joint terminal evaluation report submitted by the JICA Evaluation Team on 16 July 2015, the indicator was mostly achieved. And on 27 October 2015, during the joint conduct of the fifth JCC meeting and third seminar, the JPT presented the draft manual on database management to the JCC members, the CPT, and other participants. This draft was finalized and submitted as part of the final ***Progress Report No. 5*** in November 2015. It can thus be said that the indicator for the project purpose was achieved.

The manual includes a description of each data item in the database and how to use the database, thereby giving the Transport Planning Unit (TPU) guidelines on managing the database. However, the MUCEP database can only be used for 10 to 15 years. So, for it to contribute in achieving the MUCEP purpose—and eventually the MUCEP goal—it must be regularly updated, especially because significant changes in land use are expected to occur in the area covered by the database and as transportation technology continue to evolve.

However, large-scale surveys, which were done under MUCEP, are not recommendable when the TPU updates the database. What the TPU can do is to periodically (presumably once a year) request related agencies to submit their updated transportation data to the TPU. With such data, the JICA Project Team recommends the following:

(a) Road or Rail Networks: Change the condition of the road or rail links in the Cube and STRADA network files.
(b) Traffic Volume: Traffic count data must be collected by the DPWH and the MMDA.
(c) Socio-economic Data: The socio-economic database must be updated whenever census results are published every five years.
(d) Public Utility Vehicle Route Data: The transit route database should be updated every year.

6 Recommendations to Achieve the Overall Goal

The overall goal of MUCEP is for the public transportation plan for Metro Manila to be prepared by the DOTC. Here, the public transportation plan for Metro Manila refers, for example, to PT plans for strategic corridors in Metro Manila with important transportation issues (target implementation: 2–3 years). To assess the level of achievement of the goal, the verifiable indicators stated in the PDM are: (i) prepared public transportation plan for Metro Manila based on an analysis of the new transportation database, and (ii) utilization of the new transportation database. As of November 2015, the status of these indicators is as follows:

(i) Prepared public transportation plan for Metro Manila based on an analysis of the new transportation database: The DOTC's Assistant Secretary for Planning and Finance has a strong will to continue MUCEP and achieve its overall goal. It should be noted that the DOTC is developing the terms of reference for MUCEP 2. It intends to conduct traffic surveys outside the MUCEP 1 (this JICA-funded project) coverage to establish a transportation database that will help rationalize the public transportation network. When implemented, this project will also accelerate the capacity development of the DOTC staff. Reports and presentation materials for public transportation plans for strategic corridors in relation to important transportation issues in Metro Manila will be collected, reviewed, analyzed and monitored by the TPU after project completion.

(ii) Utilization of the new transportation database: The MUCEP database was officially introduced during the joint conduct of the fifth JCC meeting and the third seminar on 27 October 2015. The MUCEP database can now be used for planning purposes. Requesting parties have to submit request forms to the Office of the Assistant Secretary for Planning and Finance. The provision of data will be managed and recorded by the TPU. As of this writing, the database was already shared with two DOTC offices.

MUCEP's overall goal is expected to be achieved in three to five years after the project purpose has been achieved. To ensure that the MUCEP's overall goal is achieved, the JICA Project Team recommends the following:

- ***To continue the capacity development activities for the DOTC staff, with the TPU at the core of such activities; and***
- ***To involve the staff of other related agencies, particularly the MUCEP counterparts, in continuing and promoting a joint effort of enhancing the public transportation system in Metro Manila.***

ANNEXES

Project Design Matrix (PDM4)

Project Title: The Project for Capacity Development on Transportation Planning and Database Management — Duration: 4 years (2011-2015)
Target Group: Officers of Road Transportation Division and Rail Transportation Division, Department of Transportation and Communications (DOTC) and staff of relevant agencies
Target Area: Metro Manila — Date: 14 July, 2015

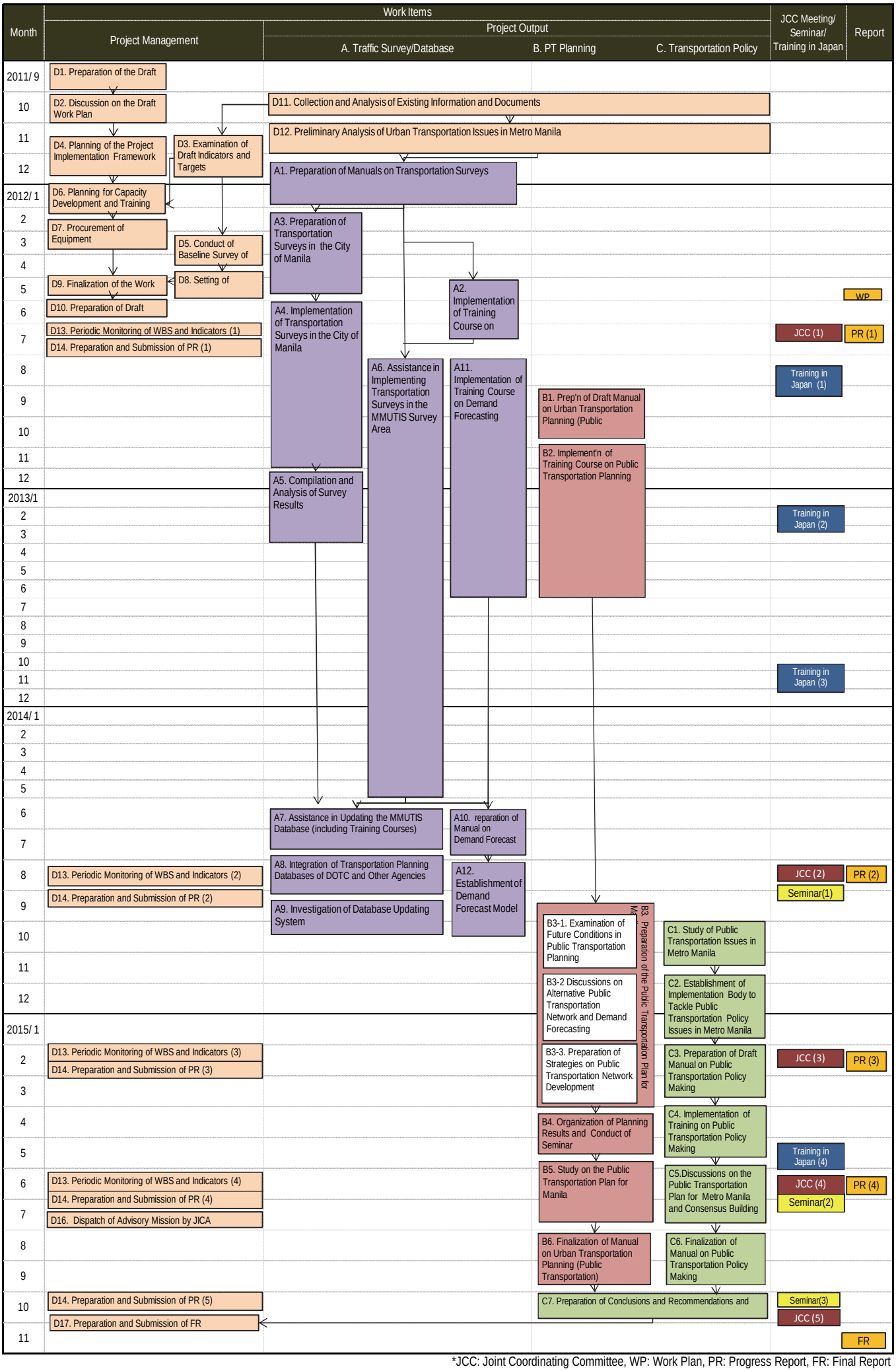
Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal Public transportation plan for Metro Manila is prepared by the DOTC.[1)]	• Prepared public transportation plan for Metro Manila[1)] based on an analysis of the new transportation database. • Utilization of the new transportation database.	• Records of utilization of the new transportation database. • Survey questionnaires / interviews. • Report/ presentation material for public transportation plan for Metro Manila.	
Project Purpose To improve public transportation planning for Metro Manila, including coordination among relevant agencies, spearheaded by the DOTC.	• The management system for the new transportation database is established by 2014.	• Approved documents on transportation database organization and management • Survey questionnaires / interviews	• Key counterparts are assigned to MUCEP even after project completion. • The database management system is sustained.
Outputs 1.Improved capacity to manage the Metro Manila transportation database 2.Improved capacity to plan the public transportation network of Metro Manila 3.Improved capacity to coordinate and formulate policies on public transportation network development in Metro Manila	(1)-1 Updated MMUTIS transportation database. (1)-2 Prepared manuals on traffic survey and database management (2)-1 Prepared manuals on public transportation planning (2)-2 Proposed plan on public transportation network for Metro Manila (3)-1 Effective agreements among stakeholders made in relevant meetings (3)-2 Agreed recommendations on transportation policy issues	• Baseline capacity survey sheets • Manuals • Training records • Updated database • Traffic survey and database management manuals • Public transportation network plan for Metro Manila • Records of discussions on policy issues examined in the project • Reports on policy issues	• Key counterparts are assigned to MUCEP even after project completion.
Activities **0 Project Preparation** 0.1 Establish a Transportation Database Management Unit within DOTC. 0.2 Prepare counterpart fund for the traffic surveys and operation of the Project. 0.3 Establish a framework for collaboration and cooperation with relevant agencies and organizations. 0.4 Prepare PDM_2 and PO_2 (operating plan) for MUCEP with numerical targets as verifiable indicators. **1 Development of the transportation database** 1.1 Develop a work flow to conduct traffic surveys and manage the transportation database in cooperation with the JPT members who will provide training to their DOTC counterparts. 1.2 Prepare tender documents for the traffic surveys, as well as procure and supervise survey implementation. 1.3 Develop traffic forecasting model(s) based on survey results. 1.4 Update the MMUTIS transportation database. **2 Public transportation planning** 2.1 For the JPT members to train DOTC counterparts in public transportation planning. 2.2 Identify planning conditions for public transportation network development in Metro Manila. 2.3 Jointly prepare alternative public transportation network plans for Metro Manila and forecast their respective traffic demands. 2.4 Jointly develop implementation strategies for the proposed public transportation network plan for Metro Manila. **3 Coordination and policy formulation** 3.1 Identify policy issues in public transportation network development and prepare work plan to examine such issues. 3.2 Establish working groups for each identified issue for inter-organizational coordination and examine respective countermeasures. 3.3 Conduct stakeholder meetings to enhance public participation and build consensus on the proposed countermeasures. 3.4 Summarize recommendations based on findings of the working groups. **4 Periodic Monitoring and Presentation of Outputs**		**Inputs** (Japanese side) (1)Experts to be dispatched in the following fields: a. Transportation Policy b. Urban Transportation Planning c. Transportation Modeling d. Transportation Survey/ Database e. Traffic Management f. Railway planning g. Economic Evaluation h. Terminal Planning (2) Traffic survey cost (cost sharing with GOP) (3) Counterpart training in Japan: Training courses include public transportation policy, transportation database, etc. (4) Provision of equipment: Equipment for the training courses, such as transportation analysis software and hardware, etc. (Philippines side) (1) Counterpart personnel (2) Provision of office space (3) Counterpart fund to conduct traffic surveys (cost sharing with JICA) as well as for operation and maintenance.	• Key counterparts are assigned to MUCEP even after project completion. **Pre-conditions** • Mandate of DOTC does not change. • A budget to implement the project is secured.

1) Public transportation plan for Metro Manila denotes for example public transportation plan for strategic corridors in relation to important transportation issues in Metro Manila (target 2-3 years).

Source: RD, PDM_3

Annex A: PDM4

Annex B: Flowchart

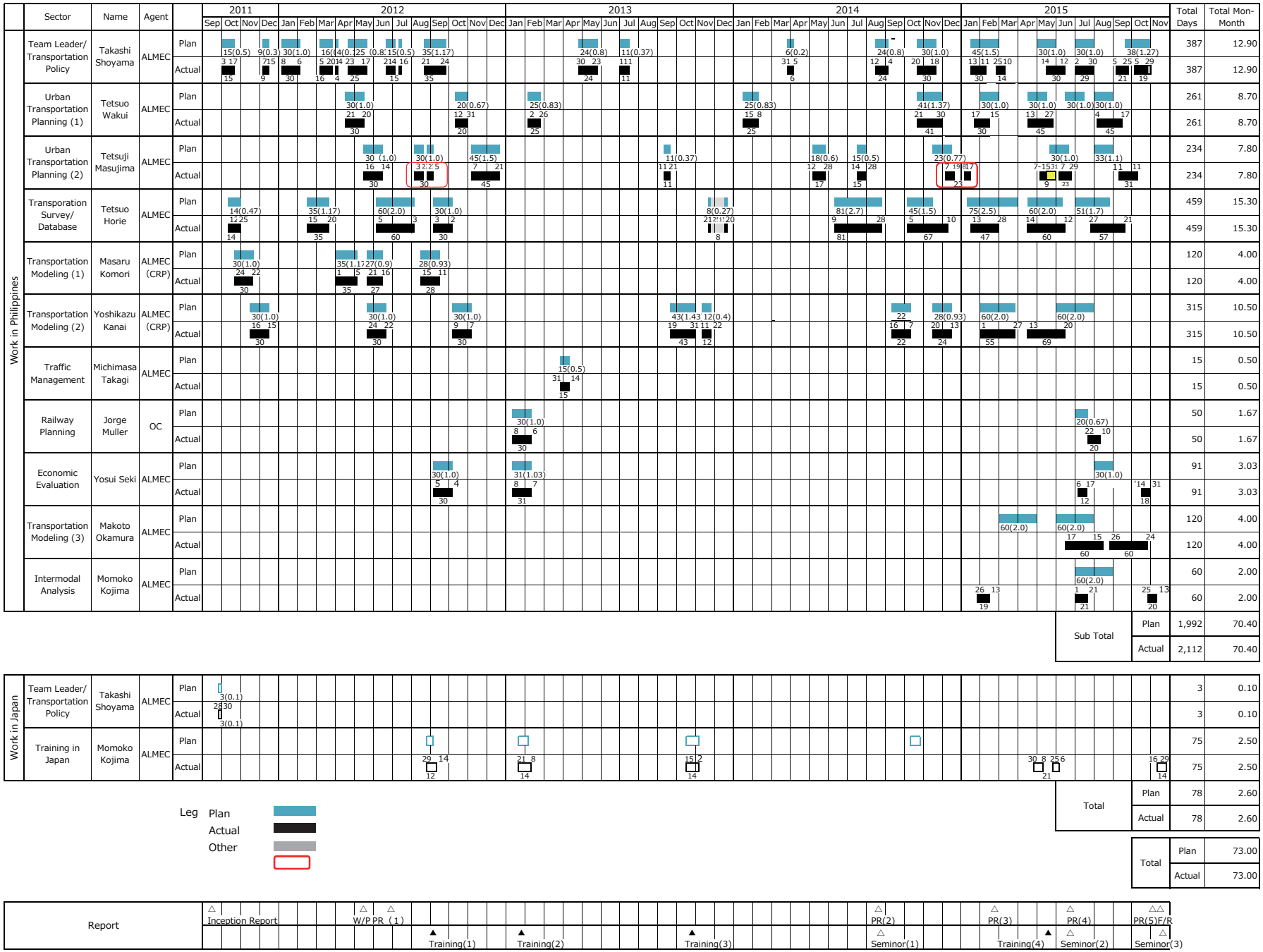


*JCC: Joint Coordinating Committee, WP: Work Plan, PR: Progress Report, FR: Final Report

Annex C: WBS

Project Purpose	Output		Activity		Work Item		Expected outputs/ indicators	Status
Transportation planning system including the coordination with relevant agencies targeting Metro Manila is improved by the initiative of DOTC	0	Project Preparation	0-1	Establish a Transportation Database Management Unit within DOTC	0-1	Establish a Transportation Database Management Unit within DOTC	TDMU Member List	TPU, instead of TDMU, was established on Feb 2014 by the special order of DOTC.
			0-2	Prepare counterpart fund for the traffic survey and operation of the Project	0-2	Prepare counterpart fund for the traffic survey and operation of the Project	CP fund	DOTC-funded HIS was done.
			0-3	Establish a framework for collaboration and cooperation with relevant agenceis and organizations	0-3	Establish a framework for collaboration and cooperation with relevant agenceis and organizations	Minutes of the Meeting, Minutes of Q&A	Weekly meetings were held within the related agencies during the MUCEP.
			0-4	Prepare PDM2 and PO2 with numerical targets as verifiable indicators	0-4	Prepare PDM2 and PO2 with numerical targets as verifiable indicators	PDM2,PO2	Completed in PR1.
	1	Capacity to manage the transportation database is improved targeting Metro Manila	1-1	Develop a work flow for the traffic surveys and manamgement of transportation planning database in cooperation with the JICA Experts who will provide training to their DOTC CP	A1	Preparation of Manuals on Traffic Surveys	Manual onTraffic Survey	Completed in PR5.
					A2	Implementation of Training course on traffic surveys	Training Programme, Trainee List	Attached in PR1-3.
			1-2	Prepare tender documents for the traffic surveys, as well as procure and supervise survey implementation	A3	Preparation of traffic surveys in the City of Manila	Contract Document of the Survey by Sub-contractor	Submitted to JICA.
					A4	Implementation of traffic surveys in the City of Manila	Manual on Traffic Survey, Survey Form	Completed in PR5.
							Database of the Survey Result (Metro Manila)	MUCEP Database was compiled.
					A5	Compilation and analysis of survey results	The result of traffic survey in Citiy of Manila	MUCEP Database was compiled.
					A6	Assistance in implementing traffic surveys in Metro Manila	Contract Document of the Survey by Sub-contractor	DOTC-funded HIS was done.
							Database of the Survey Result (excluding Metro Manila)	MUCEP Database was compiled.
			1-3	Develop traffic forecasting model(s) based on survey results	A10	Preparation of Manual on Traffic Forecasting Model	Manual on Traffic Forecasting Model	Completed in PR5.
					A11	Implementation of Training course on traffic forecasting model	Training Programme	Completed in PR3.
					A12	Establishment of traffic forecasting model	Traffic Forecasting Model	Completed in PR5.
			1-4	Update MMUTIS transportation planning database	A7	Assistance in updating the MMUTIS database (including Trainig course)	New DOTC database	MUCEP Database was compiled.
					A8	Integration of transportation planning database of DOTC and other agencies	New DOTC database integrated with the other agencies' database	MUCEP Database was compiled.
					A9	Investigation of database updating system	Minutes of Meeting	Based on the discussion in JCC4, the manual on the database updating was prepared in PR5.
	2	Capacity for public transportation planning is improved targeting Metro Manila	2-1	For JICA Experts to traing DOTC CP on public transportation planning	B1	Preparation of Draft Manual on Urban Transportation Planning (Public Transportation)	Manual on Urban Transportation Planning (Public Transportation) (draft)	Completed in PR5.
					B2	Implementation of Training course on public transportation planning	Training Programme, Attendance List, Attendance Report	Pilot studies were done in PR5.
					B6	Finalization of Manual on Urban Transportation Planning (Public Transportation)	Manual on Urban Transportation Planning (Public Transportation)	Completed in PR5.
			2-2	Identify planning conditions for public transportation network development in the polit area (Manila City)	B31	Examination of conditions in public transportation planning	Necessary Data and Information for Public Transportation Planning	Completed in PR5.
			2-3	Jointly prepare alternative public transportation network plans of the pilot area and forecast their respective traffic demands	B32	Discussion on alternative public transportation network and demand forecasting	Alternative Public Transportation Network Planning	Completed in PR5.
			2-4	Jointly develop implementation strategies for the proposed public transportation network plan for the pilot area	B33	Preparation of development strategies on public transportation network	Implementation Strategies for the Public Transportation Network Development	Pilot studies were done in PR5.
				-	B4	Organization of results of planning work and conduct of seminar	Handouts for the Seminar, Minutes, Attendance List	Attached in each PRs and the PCR.
				-	B5	Study of the public transportation plan for Metro Manila	The list of support and training for the project development	Pilot studies were done in PR5.
	3	Capacity in coordination and policy formulation for public transportation network development planning is improved targeting Metro Manila	3-1	Identify policy issues on public transportation network development and prepare work plan to examine the issues	C1	Study of public transportation policy issues in Metro Manila	Minutes of Meeting	Pilot studies were done in PR5.
			3-2	Establish working groups for each identified issue for inter-organizational coordination and examine respective countermeasures	C2	Establishement of implementation body to tackle public transportation policy issues in Metro Manila	Working Group Member List	The CP devided 3 groups for the pilot studies.
					C3	Preparation of Draft Manual onPublic Transportation Policy Making	Draft Manual on Public Transportation Policy Making	Completed in PR5.
					C4	Implementation of Training on public t ransportation policy making	Training Programme, Attendance List, Attendance Report	Pilot studies were done in PR5.
					C6	Finalization of Manual on Public Transportation Policy Making	Manual on Public Transportation Policy Making	Completed in PR5.
			3-3	Conduct stakeholder meetings to enhance public participation and building consensus on the proposed countermeasures	C5	Discussion on public transportation plan for Metro Manila and consensus building	Handouts for the Meeting, Minutes, Attendance List	Pilot studies were done in PR5. Manual on policiy formulation and urban transportation planning were compiled based on the consensus.
			3-4	Summarize recommendations based on the findings of the working groups	C7	Organization of conclusion and recommendations and conduct of seminar	Handouts for the Seminar, Minutes, Attendance List	Attached in the PCR.
	4	Periodical Monitoring and Presenting Outputs		-	D1	Preparation of Draft Work Plan	Work Plan (draft)	Completed.
					D2	Discussion on the Draft Work Plan	Minutes of Meeting	Presented in JCC1.
					D3	Examination of draft indicators and targets	Targets and Indicators (draft)	Presented in JCC1.
					D4	Planning of the Project implementation framework	JCC Member List	Shown in RD.
							PMT Member List	Shown in RD.
							CP Member List, CP Assignment Schedule, Working Environment	TPU, instead of TDMU, was established on Feb 2014 by the special order of DOTC.
					D5	Conduct of baseline survey of CP's capacity	Survey Form for Base Line Study, Suvey report	Completed in PR5.
					D6	Planning for capacity development and training program	Training Programme	Completed in PR5.
					D7	Procurement of equipment	Plan for Procurement of Equipment	Completed in PR4.
					D8	Setting of indicators and targets	Tragets and Indicators	Completed in PR1.
					D9	Finalization of the Work Plan	Work Plan	Work Plan was submitted to JICA and DOTC in May 2012.
					D10	Preparation of Draft WBS	WBS (draft)	Completed in PR1.
					D11	Collection and analysis of existing information and documents	List of Collected Data and Information	Completed in PR4.
					D12	Preliminary analysis of urban transportation issues in Metro Manila	-	Completed in PR1-3.
					D13	Periodical Monitoring and revision and analysis of WBS, indicators and targets	Minutes, Attendance List	Completed in PR1-5.
					D14	Submission of Progress Reports	Progress Report 1-5	Progress Report 1-5 were submitted to JICA and DOTC.
					D15	Assistance to the Mid-term Evaluation by JICA	-	The mid-term evaluation was not carried out.
					D16	Assistance to the Final Evaluation by JICA	-	Done in July 2015.
					D17	Assistance to JICA advisory mission	-	The JICA advisory mission was nott carried out.
					D18	Submission of the Final Report	Final Report (Project Complition Report)	Done in December 2015.

Source：Workplan



Annex D: Staffing Schedule

The 1st Training

Name of Training Course: Implementation of person trip surveys in metropolitan areas and application of results to transportation policies

Period of Training: 2012/8/29-2012/9/7

Agency	Name	Department	Title
DOTC	Engr. Robert G. Delfin	Road Transport Planning Division	Supervising Transportation Development Officer
	Engr. Ronald Rundy R. Tuazon	Rail Transport Planning Division	Senior Transportation Development Officer
	Ms. Jasmin C. Marie Uson	Road Transport Planning Division	Transportation Development Officer II
LRTA	Mr. Allan Arquiza	Corporate Planning and Research Division	Division Chief
MMDA	Mr. Michael M. Gison	Plans and Programs Formulation Div., Office of the AGM for Planning	Planning Officer V

The 2nd Training

Name of Training Course: Development of a transportation demand analysis model and public transportation planning

Period of Training: 2013/1/21-2013/2/2

Agency	Name	Department	Title
DOTC	Mr. Renato R. David	Road Transport Planning Division	Senior Transportation Development Officer
	Ms. Edna A. Olaguer	Road Transport Planning Division	Senior Transportation Development Officer
	Ms. Pamela B. Tadeo	Air Transport Planning Division	Senior Transportation Development Officer
BCDA	Mr. Rey Lim	Project management Division	Senior Infrastructure Development Officer
UP-NCTS	Ms. Reigna Jewel Ritz Macababbad-Racoma	Road Safety Research Laboratory	University Extension Specialist

The 3rd Training

Name of Training Course: 1) Framework for transportation policy making and implementation in metropolitan areas, 2) Development of public transportation networks, 3) Development scheme for transit terminals and surrounding areas

Period of Training: 2013/10/21-2013/11/2

Agency	Name	Department	Title
LTFRB	Ms. Nida P. Quibic	Management Information Division	Info Technical Officer III / Division Chief
DOTC	Mr. Robert Delfin	Road Transport Planning Division	Senior Transportation Development Officer
DOTC	Mr. Gregorio Resuello	Information Systems Division	Information Officer II
DPWH	Engr. Maximo Ewald Montana II	Project Management Office – Feasibility Studies (PMO-FS)	Engineer III

MMDA	Ms. Luisa P. Angangan	Office of Assistant General Manager	Planning Officer III
Northrail	Engr. Luisito A. Constantino	Engineering Department / Technical Management Division	Senior Civil Engineer/Design Specialist
Philippine National Railways	Ms. Joseline A. Geronimo	Station Operations Division (Area 1), Transportation Dept.	Division Manager

The 4th Training

Name of Training Course: Road Traffic Control and Traffic Management

Period of Training: 2015/5/25-2015/6/6

Agency	Name	Department	Title
DOTC	Mr. Lemar Jimenez	Road Transportation Planning Division	Senior Transportation Development Officer
DOTC	Ms. Edna Olaguer	Road Transportation Planning Division	Senior Transportation Development Officer
DOTC	Mr. Renato David	Road Transportation Planning Division	Senior Transportation Development Officer
DOTC	Ms. Jasmine Uson	Road Transportation Planning Division	Transportation Development Officer II
LRTA	Mr. Celwyn Astronomia	LRT Line 1 Extension Project, Technical & Engineering Services Division	Project Planning and Development Chief/Acting Division Manager
LTFRB	Ms. Joanne Elmedolan	Office of the Chairman	Legal Assistant II
MMDA	Ms. Felicitas Sabas	Planning Officer III	Metropolitan Development Planning Service
DOTC	Mr. Ronaldo Rundy Tuazon	Railway Transport Planning Division	Senior Transportation Development Officer

Provision of Software and Equipment

1. Carried by Experts

Description/Manufacture/Model	Price (Yen)	Destination	Condition[1]	Frequency of Use[2]	Remarks
N/A					
N/A					

[1] W=working, WG=working and in good condition, NW=not working.
[2] A=always (100% of the time), B=normally (80%), C=sometimes (50%), D=seldom (10%), E=never.

2. Procurement in Japan

Description/Manufacture/Model		Price (JPY)	Destination	Condition[1]	Frequency of Use[2]	Remarks
1. JICA STRADA (traffic analysis software)	5 licenses		PHL DOTC[3]	WG	B	Used during weekly counterpart trainings/ exercises.
2. Holux GPS logger	4 units		PHL DOTC	WG	C	Used during the period of traffic surveys in 2012

[1] W=working, WG=working and in good condition, NW=not working [2] A=always (100% of the time), B=normally (80%), C=sometimes (50%), D=seldom (10%), E=never.
[3] Upon JICA PHL's instructions, one license was given to the JICA-funded J-RUPP for the DPWH. It was received by the department's MIS on 10 December 2012.

3. Local Procurement

Description/Manufacture/Model		Price		Destination	Condition[1]	Frequency of Use[2]	Remarks
1. Cube version 6 including Base, Voyager, Avenue, Analyst, Dynasim, and maintenance fee for Year 1 (2014–2015) (traffic analysis software)	1 license	USD	39,940.00	PHL DOTC	WG	B	Used since January 2015 for the implementation of pilot studies.
2. Cube Training	1 time	USD	7,410.40	PHL DOTC	Not applicable	Not applicable	Carried out in September-November 2014.
3. ArcGIS Desktop (Basic Single Use)	1 license	PHP	180,000	PHL DOTC	WG	D	Used since April 2015 for the weekly counterpart trainings/ exercises.
4. Desktop Computers: • HP Pavilion P6-2114D • HP Pavilion P6-2314D • HP Pavilion H8-1390D	 2 units 6 units 2 units	PHP	423,762	PHL DOTC	WG	B	Used during weekly counterpart trainings/ exercises.
5. HP Designjet T-520 36 in Plotter (A0 size)		PHP	135,550	PHL DOTC	WG	D	For large-format printing.
6. Epson EB-X12 LCD Projector		PHP	29,880	PHL DOTC	WG	B	Used during weekly counterpart meetings/ trainings/ exercises and during Team meetings.
7. Canon Ixus 255 Digital Camera		PHP	14,498	PHL DOTC	WG	B	Used during weekly counterpart meetings/ trainings/ exercises.

[1] W=working, WG=working and in good condition, NW=not working.
[2] A=always (100% of the time), B=normally (80%), C=sometimes (50%), D=seldom (10%), E=never.

THE PROJECT FOR CAPACITY DEVELOPMENT ON TRANSPORTATION PLANNING AND DATABASE MANAGEMENT

MMUTIS Update and Capacity Enhancement Project (MUCEP)

HIGHLIGHTS OF THE FIRST JCC MEETING
3 July 2012, 2:00–4:00 P.M.
DOTC Training Room, Room 156, The Columbia Tower

ATTENDEES:

Agency		Name and Designation in Agency
1. DOTC[1]	Office of the Undersecretary for Planning	1. Atty. Jaime Raphael C. Feliciano, Director for Infrastructure Projects 2. Ms. Lorraine Chua, Project Officer
	Project Management Team	3. Mr. Ildefonso T. Patdu Jr., Asst. Secretary for Planning 4. Ms. Florencia Creus, Director for Planning Service
	Counterpart Members	5. Engr. Robert Delfin, Supervising TDO, Road TPD 6. Engr. Rene David, Senior TDO, Road TPD 7. Ms. Edna Olaguer, Senior TDO, Road TDP 8. Mr. Ronald Rundy Tuazon, Senior TDO, Rail TDP 9. Ms. Pamela Tadeo, Senior TDO, Air TPD 10. Mr. Gregorio B. Resuello, Info. Officer II, ISD
	Others	11. Ms. Ma. Cora Japson, Supervising TDO, Road TPD
2. MMDA		12. Mr. Michael Gison, Planning Officer V, Plans and Programs Formulation Div., Office of the AGM for Planning
		13. Ms. Felicitas Sabas, Planning Officer III, Office of the AGM for Planning
3. UP NCTS		14. Ms. Reigna Jewel Ritz Macababbad, University Extension Specialist, Road Safety Research Laboratory
4. LTFRB		15. Ms. Nida P. Quibic, Chief, MID
5. NEDA		16. Ms. Geraldine Bayot, Senior Economic Development Specialist
6. PNR		17. Mr. Junio M. Ragragio, General Manager
7. Northrail		18. Mr. Conrado K. Tolentino, President and Director
		19. Mr. Deo Leo n. Manalo, AVP Technical Management Division
8. Japanese Embassy		20. Mr. Masayuki Harigai, Second Secretary, Economics Section
9. JICA Philippine Office		21. Mr. Takahiro Sasaki, Chief Representative 22. Mr. Floro Adviento, Programme Manager 23. Ms. Eri Kakuta, Project Formulation Advisor
10. JICA Project Team		24. Mr. Takashi Shoyama, Team Leader/ Transportation Policy Specialist 25. Mr. Tetsuo Horie, Transportation Survey / Database
11. TTPI		26. Mr. Nabor Gaviola, President 27. Mr. Camillo Napone, Treasurer
12. MUCEP Staff		28. Ms. Momoko Ito, Team Assistant 29. Ms. Karen Hulleza-Luna, Project Coordinator 30. Ms. Rosenia Niebres, Project Assistant 31. Mr. Joseph Cabal, Project Staff

HIGHLIGHTS OF THE DISCUSSION:

1. Asec. Patdu called the meeting to order at 2:30 p.m.
2. **Project Progress:** Mr. Shoyama presented an overview of the project and reported the project activities carried out from October 2011 to June 2012, as well as some issues that need the JCC members' action.
   (a) **Overview:** Mr. Shoyama discussed the project's goal, objective, project outputs and their respective indicators, project area, activities and their corresponding schedules, an outline of ongoing surveys, equipment and software to be provided, databases to be integrated, MUCEP consultants, as well as the composition of the Project Management Team, Joint Coordinating Committee, and Counterpart Project Team (CPT).
   (b) **Activities:** He also explained the results of the baseline capacity survey done on the CPT members and other trainees, the schedule and topics for the local training program, the lectures and fieldwork carried out in May and June 2012, the number of local trainees, joint JPT and CPT meetings conducted, the draft plan for the overseas training, and the five participants (3 from the DOTC and one each from the MMDA and LRTA) to the August-September training in Japan.
   (c) **Issues:** During the discussion which followed the presentation, these issues were addressed, to wit:
      (i) **JCC Composition:** With JICA allowing the DOTC to decide on the JCC membership and the body not objecting to the request of the BCDA and Northrail to be included in the Joint Coordinating Committee, Asec. Patdu approved their inclusion to the group.
      (ii) **Project Office:** Mr. Delfin reported that signatures are being gathered from the DOTC Bidding and Awards Committee members on a resolution approving the procurement of an office space for MUCEP, after which the contract between the DOTC and the building owner would be drafted.
      (iii) **DOTC-funded HIS:** Mr. Delfin announced that the DOTC-funded portion of the HIS is already included in the Project Procurement Management Plan for CY 2012.
3. **Survey Progress:** Mr. Gaviola, survey chief from TTPI, the survey contractor, presented the progress of the household interview survey (HIS), as well as the cordon and screen line surveys up to June 30.
   (a) **HIS:** Mr. Gaviola said the survey has kept to its planned schedule, with about 47.3% (2,352 households) of the total target households (4,966 HHs) having been interviewed already as of June 30.
   (b) **Cordon/Screen Line Surveys:** Surveys in some stations were either finished or ongoing as of June 30. All surveys are scheduled to end by July 25.
   (c) **Data Processing:** During the last week of June, Mr. Gaviola said that they started validating accomplished HIS survey forms, as well as coding and encoding them.
4. **CPT Composition**
   (a) **Membership Expansion:** Asec. Patdu assured JICA and the JICA Project Team of the DOTC's support should there be a need to expand the composition of the Counterpart Project Team in order to achieve MUCEP's goal of a public transportation plan for Metro

Manila prepared by the DOTC.

(b) **JCC Members Representation in CPT:** In response to Mr. Ragragio's request to include their agency as counterparts and with JICA and the JICA Project Team posing no objection to it, Asec. Patdu asked Mr. Ragragio and the rest of the JCC members to write the DOTC regarding their wish to be included in the Counterpart Project Team.

(c) **Training in Japan:** The body was informed that the five CPT members who will join the first training in Japan are the following: (i) DOTC: Engr. Robert Delfin, Mr. Ronald Rundy Tuazon, and Ms. Jasmin Uson; (ii) MMDA: Mr. Michael Gison; and (iii) LRTA: Mr. Allan Arquiza.

5. **TDMU Composition:** Mr. Shoyama said that the JICA Project Team would inform the DOTC on the staffing requirements of the TDMU to facilitate its establishment.

6. **Other Matters**

(a) **Data on Colorum Vehicles:** On Asec. Patdu's question if the MUCEP surveys would capture data on "colorum" vehicles, Mr. Gaviola said that the MUCEP surveys would not provide this data and suggested that the DOTC might want to consider conducting a license plate survey to obtain provide such data.

(b) **Data on Passenger Diversion:** On Mr. Ragragio's question if passenger diversion from one transportation mode to another could be obtained from the MCUEP surveys, the JICA Project Team said this could be obtained from HIS data.

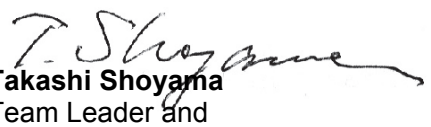
(c) **Data on Bus Operations:** On Asec. Patdu's question if bus data can be obtained from the ongoing surveys, Mr. Gaviola said this could not be done and suggested that the DOTC could once again require bus operators to submit forms showing data and information about their respective operations as was done before.

(d) **Quality of Survey Answers:** On the question of accuracy or correctness of survey answers, Mr. Gaviola said that it is difficult to gauge if interviewees deliberately give incorrect answers. He further said that based on his experience, answers given by an interviewee are eventually confirmed/debunked by his/her answers to other questions and that overall survey answers usually turn out to be credible.

7. **JICA's Requests:** Mr. Sasaki asked two things from the DOTC: one is to make the appropriate institutional arrangement to ensure that the department will use the MUCEP database in formulating policies on public transportation network development and, two, to ensure the timely release of funds for the DOTC portion of the MUCEP survey. At the same time, he praised the DOTC for its strong leadership of the project.

8. There being no other matters to discuss, the meeting adjourned at 4 p.m.

Noted by:



Takashi Shoyama
Team Leader and
Transportation Policy Specialist

THE PROJECT FOR CAPACITY DEVELOPMENT ON TRANSPORTATION PLANNING AND DATABASE MANAGEMENT

MMUTIS Update and Capacity Enhancement Project (MUCEP)

JOINT COORDINATING COMMITTEE MEETING No.2
19 August 2014, 2:00–4:00 PM
DOTC, Unit 167, The Columbia Tower

ATTENDEES:

Agency	Name	Designation in Agency	Designation in MUCEP[1]
DOTC[2]	1. Atty. Rene Limcaoco	Undersecretary for Planning[2]	Chairperson, JCC
	2. Atty. Sherielysse Reyes-Bonifacio	Asst. Secretary for Planning[2]	Vice Chairperson, JCC/ Project Director, PMT
	3. Ms. Florencia Creus	Director for Planning Service	Member, JCC / Proj. Manager, PMT
	4. Mr. Arnel Manresa	Chief, Road Transport Planning Division	Member, PMT
	5. Mr. Raphael Lavides	Chief, Air Transport Planning Division	
	6. Mr. Enrico Ferre	Chief, Water Transport Planning Division	
	7. Mr. Robert Siy	Senior Adviser, Office of the Usec. for Planning	
	8. Engr. Robert Delfin	Supervising TDO, Road TPD	Leader, Counterpart Project Team
	9. Engr. Rene David	Senior CDO, Road TPD	Member, CPT
	10. Ms. Edna Olaguer	Senior TDO, Road TDP	Member, CPT
	11. Ms. Jasmine Marie Uson	TDO II, Road TPD	Member, CPT
	12. Mr. Ronald Rundy Tuazon	Senior TDO, Rail TDP	Member, CPT
	13. Mr. Gregorio B. Resuello	Information Officer II, ISD	Member, CPT
	14. Ms. Beatriz Raine Bayudan	Tech'l Asst., Office of the Asec. for Planning	
DPWH[2]	15. Engr. Maximo Ewald Montaña II	Engineer III, Project Preparation Division, Planning Service	Member, CPT
MMDA[2]	16. Mr. Michael Gison	Planning Officer V, Office of the AGM for Planning	Member, CPT
UP NCTS[2]	17. Dr. Hilario Sean Palmiano	Director[2]	Member, JCC / Asst. PM, PMT
	18. Engr. Reigna Jewel Ritz Racoma	University Extension Specialist, Road Safety Research Laboratory	Member, CPT
LRTA[2]	19. Engr. Allan Arquiza	Corporate Planning Chief, CPRD	Member, CPT
LTFRB[2]	20. Ms. Nida Quibic	Chief, ISMD	Member, CPT
	21. Ms. Lilia Coloma	OIC, TED	
	22. Atty. Gonzalo Go, Jr.	Legal Office	
LTO[2]	23. Mr. Mohammad Yusoph Lamping	Director, Law Enforcement	
	24. Mr. Roberto A. Valera	Chief, IID	
NEDA[2]	25. Mr. Pablito Abellera	Supervising EDS	
	26. Mr. Jayson Mag-atas	EDS I	
PNR[2]	27. Mr. Estilito Nierva	Manager, Operations Department	Member, CPT
	28. Ms. Rosario Aquino	Manager, Corporate Planning Division	
BCDA[3]	29. Engr. Rey Lim	Senior Infrastructure Development Officer	Member, CPT
Northrail[3]	30. Engr. Rodel Limrañola	Manager, Contract and Claims	
	31. Engr. Bryan Encarnacion	Manager, Site Preparations	
Jap. Emb.	32. Mr. Ko Hirasawa	First Secretary, Economics Section	
JICA Philippine Office[2]	33. Mr. Eigo Azukizawa	Chief Representative	
	34. Ms. Eri Kakuta	Project Formulation Advisor	
	35. Mr. Patrick San Juan	Program Officer	
JICA Project Team	36. Mr. Takashi Shoyama		Member, JCC / TL and Comprehensive Transportation Planner[2]
	37. Mr. Tetsuo Horie		Demand Modeling Specialist
	38. Ms. Momoko Ito		Team Assistant
	39. Ms. Karen Hulleza-Luna		Project Coordinator
	40. Ms. Rosenia Niebres		Project Assistant

HIGHLIGHTS OF THE Q&A:

1. Engineer Delfin called the meeting to order at 2:00 p.m. After the participants' self introduction, Mr. Shoyama was asked to present.

2. **Project Progress:** Mr. Shoyama first introduced MUCEP by explaining the project's goal, objective, study area, revised MUCEP schedule, and the various surveys conducted under the project from 2012 to 2014. Mr. Horie then reported on the initial survey findings for 2012, such as daytime and nighttime population, number of trips, trips by mode, average occupancy by mode, generated and attracted trips by province and purpose, desired lines by mode, average travel times and trip distances by mode, as well as public and private modal shares. Meanwhile, Engineer Delfin shared past capacity development activities received by counterparts and the results of a baseline capacity survey done among the counterparts in May 2012. Finally, Mr. Shoyama presented a list of candidate case studies proposed by the counterparts. From this list, the DOTC would choose which the counterparts will carry out to put into practice what the counterparts learned under MUCEP. He also asked the JCC members to discuss the traffic simulation software MUCEP should buy for the DOTC.

3. **Q&A Portion**

   (a) **Initial Survey Findings**

   (i) Mr. Shoyama confirmed the following with Asec. Bonifacio: that it would be possible to cull other data from home trip information, such as the people's destinations after school or work; and that survey results could be used to determine if there is an oversupply or undersupply of public transport in all modes by corridor, not by route.

   (ii) Mr. Shoyama informed Mr. Gison that the survey results can already be used as reference as long as users remember that these are preliminary and therefore can change after some other variables have been considered.

   (iii) A NEDA representative asked about the long travel time of tricycles shown on slide 28. He suggested that the phrase "growth rate" should not have been used in referring to the change in average travel time from 1996 to 2012; instead it should have been called "deterioration rate" because the travel time increased. Mr. Horie said travel time and travel distance were analyzed separately. If the comparison between HIS 1996 and 2012 data covered the same average travel distance but resulted in increased travel time, then it is a matter of travel speed, but if the travel distance became shorter with the same travel time, it is also a matter of travel speed.

   (iv) Usec. Limcaoco asked if a 32% bus occupancy would be high or low, to which Mr. Horie replied that more than 30% would be high occupancy already.

   (v) Usec. Limcaoco also asked about the meaning of an average travel time of 90 minutes for buses. Mr. Horie answered that 90 minutes represented the average travel time from origin to destination, which is quite longer compared to that of other Asian cities. Mr. Shoyama added that the figure included walk time on both ends of the bus trip. Mr. Siy said this could mean the survey area has become much larger because it includes the four provinces adjoining the National Capital Region.

   (vi) Mr. Siy commented that the survey findings are very powerful information.

   (b) **MUCEP Database:** In reply to Dir. Creus's query on database format, Mr. Horie informed the body that the survey results database that would be turned over to the

DOTC would mainly be in Microsoft Excel, while the OD matrix would be in STRADA format and the road data in GIS format.

(c) **Traffic Simulation Software**

(i) Mr. Shoyama allayed the DOTC's concern about Cube's interoperability, saying that Cube data can easily be exported to other formats such as VISSIM, VISUM, STRADA, even GIS. He added that the Project Team is already using STRADA and, eventually, CUBE should the DOTC prefer this software.

(ii) While Dr. Palmiano agreed that MUCEP could purchase this for the DOTC, he said that the software that is being used by more agencies should be bought. He cited the MMDA which is now using VISSIM, although if the MMDA can buy Cube in the future, this would not be a problem. Mr. Guison of the MMDA posed no objection to MUCEP purchasing Cube. The agency uses VISSIM for traffic simulation for U-turns, traffic lights, bike lanes, etc. The LTO shares the UP NCTS's concern over data interoperability and ease in sharing information with other agencies. Meanwhile, Engineer Montana from the DPWH said that the software most commonly used should be purchased by MUCEP. He said the DPWH plans to procure VISSUM because it's more user-friendly and that they already have VISSIM, which is being used in simulation activities for the department's urban projects, flyovers and the like. Ms. Quibic from the LTFRB said they are not yet familiar with what software is compatible with SQL, which they are currently using.

(iii) Based on the opinions of the JCC members and Mr. Shoyama's recommendation, Asec. Bonifacio decided that MUCEP should purchase Cube version 6.

(d) **Cube Training:** Upon Usec. Limcaoco's request, Mr. Shoyama said he would ask the Cube distributor to start the training as soon as possible.

(e) **Candidate Projects**

(i) Mr. Guison of the MMDA asked about the deadline for short-listing candidate projects, to which Mr. Shoyama said the project which the counterparts would implement would be selected in September or October and that discussions would be done during the MUCEP CPT's weekly meetings.

(ii) Doctor Palmiano asked if these projects would be in the form of feasibility studies or practical studies. Mr. Shoyama said this is still subject for discussion, although considering the heavy workload of the CPT, projects should be at the pre-feasibility study level only.

(iii) Asec. Bonifacio asked if an EDSA bus rerouting project could be studied, but Mr. Shoyama said this would be difficult to implement. He instead suggested that a macro simulation in a certain area, such as Makati, be done, or policy formulation. Usec. Limcaoco asked if two or three routes on EDSA could be studied to determine the requisite number of buses. Mr. Shoyama said the work volume for that would be large. He added that in order to identify the number of buses, additional surveys should be conducted to determine such aspects as turn-around times, load factors, and average travel speed, among others. If DOTC has the budget for the surveys, he said the Project Team would support it. Usec Limcaoco said the DOTC could conduct the surveys provided the JPT could help in preparing the terms of reference, to which Mr. Shoyama agreed. Mr. Shoyama added that because EDSA has many

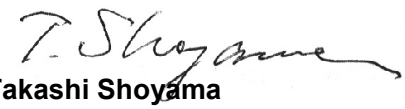
branch bus routes, the scope of the study should be limited. He said traffic should first be assigned to the transport network using Cube and before that the assignment model should be calibrated. Then various parameters should be adjusted to obtain the number of units plying the selected routes.

(iv) Asec. Bonifacio said that if the ITS (Integrated Transport Terminal) is already operational, the MUCEP CPT could select this as case study. Then, there would only be city buses to examine. It was eventually agreed that this topic would be discussed in another meeting.

(v) Mr. Shoyama also informed the body that MUCEP is not limited to one project alone. He said there could be two if the first selected project is a small one.

(vi) Dr. Palmiano said MUCEP is working on longer-term planning for public transportation, while the issues on specific routes and number of units required are more short-term concerns. He said that an ongoing study, the RTRS, will be more appropriate in answering the question on the number of buses needed on a particular route. Because MUCEP is a planning framework, its intention is to set up a framework to allow the DOTC and all related agencies to do a sound PT planning in the years to come.

Noted by:



Takashi Shoyama
Team Leader and
Transportation Policy Specialist

THE PROJECT FOR CAPACITY DEVELOPMENT ON TRANSPORTATION PLANNING AND DATABASE MANAGEMENT

MMUTIS Update and Capacity Enhancement Project (MUCEP)

JOINT COORDINATING COMMITTEE MEETING No.3
27 February 2015, 2:20–3:40 PM
Unit 156, The Columbia Tower

ATTENDEES:

Agency	Name	Designation in Agency	Designation in MUCEP[1]
DOTC[2]	1. Atty. Sherielysse Reyes-Bonifacio	Asst. Secretary for Planning[2]	Vice Chairperson, JCC/ Project Director, PMT
	2. Mr. Arnel Manresa	Chief, Road Transport Planning Div.	Member, PMT
	3. Mr. Gyengchul Kim	Special Adviser to the Secretary	
	4. Mr. Robert Siy	Senior Adviser, Office of the Usec. for Planning	
	5. Engr. Rene David	Senior CDO, Road TPD	Leader, Counterpart Project Team
	6. Ms. Edna Olaguer	Senior TDO, Road TDP	Member, CPT
	7. Ms. Jasmine Marie Uson	TDO II, Road TPD	Member, CPT
	8. Engr. Ronald Rundy Tuazon	Senior TDO, Rail TDP	Member, CPT
	9. Ms. Pamela Tadeo	Senior TDO, Air TDP	Member, CPT
	10. Ms. Beatriz Raine Bayudan	Technical Assistant., Office of the Asec. for Planning	
DPWH[2]	11. Ms. Christine J. Tolentino	Economist	
MMDA[2]	12. Mr. Michael Gison	Planning Officer V, Office of the AGM for Planning	Member, CPT
	13. Ms. Luisa Angangan	Planning Officer III	Member, CPT
	14. Ms. Felicitas Sabas	Planning Officer III	Member, CPT
UP NCTS[2]	15. Dr. Hilario Sean Palmiano	Director[2]	Member, JCC / Asst. PM, PMT
	16. Mr. Sajid Kamid	University Extension Specialist II	
LRTA[2]	17. Engr. Allan Arquiza	Corporate Planning Chief, CPRD	Member, CPT
LTFRB[2]	18. Ms. Jeannie D. Elmedolan	Legal Assistant	Member, CPT
PNR[2]	19. Mr. Gilbert J. Patulot	Department Manager, Engineering Division	
BCDA[3]	20. Engr. Rey Lim	Senior Infrastructure Development Officer	Member, CPT
Northrail[3]	21. Mr. Jesus Enrico Moises B. Salazar	Vice President	
	22. Engr. Luisito A. Constantino	Design Specialist, Technical Management Div.	Member, CPT
	23. Engr. Fidel Ayala Jr.	Systems Engineer	Member, CPT
JICA Philippine Office[2]	24. Mr. Toshihiro Shimizu	Project Formulation Advisor	Member, JCC
	25. Mr. Ryu-ichi Kuwajima	JICA Expert at DOTC	
JICA Project Team	26. Mr. Takashi Shoyama		Member, JCC / TL and Comprehensive Transportation Planner[2]
	27. Dr. Tetsuji Masujima		Urban Transportation Planner
	28. Mr. Tetsuo Horie		Demand Modeling Specialist
	29. Dr. Yoshikazu Kanai		Team Assistant
	30. Ms. Karen Hulleza-Luna		Project Coordinator
	31. Ms. Rosenia Niebres		Project Assistant

HIGHLIGHTS:

1. Assistant Secretary Bonifacio called the meeting to order at 2:20 p.m. After introducing Mr. Shimizu, who will take over from Ms. Eri Kakuta, Asec. Bonifacio gave the floor to Mr. Shoyama to present the project's progress and findings.

2. **Project Progress:** Mr. Shoyama first introduced MUCEP by stating the project's goal and objective. He then discussed the following topics:

   (a) **Progress of CD Activities of MUCEP:** From September 2014 to November 19, the DOTC's TPU staff and selected trainees from the MUCEP counterpart agencies attended the training for Cube, which is a transportation planning software that can be used in transport forecasting. Trainings were done twice a week every Wednesday and Friday afternoon for almost four hours. Upon the completion of the Cube training, preparation started for the implementation of pilot studies to be carried out by the Cube trainees and the MUCEP Counterpart Project Team (CPT) members (see 2 (b) below). From November 26 up to February 26, the group, together with the JICA Project Team (JPT), met to plan and work on the three pilot studies selected for implementation.

   In January 2015, the CPT were asked to accomplish a survey form to determine whether or not they have improved their knowledge and capacities, and the results are as follows:

   (i) In terms of managing a transportation database, their capacities improved beyond the target, especially in implementing surveys as well as in analyzing survey results and transportation demand, while their capacities in analyzing transportation demand using micro and macrosimulation remained below target;

   (ii) In terms of planning the public transportation network of Metro Manila, their knowledge of development plans as well the PT and road network in Metro Manila exceeded the target. However, other related aspects of this particular skill is still below target; and

   (iii) In terms of coordinating and formulating PT policies, the trainees and counterparts are still below the target for preparing urban plans and formulating PFIs.

   (b) **Pilot Studies by CPT:** The MUCEP Project Team recently changed the method of capacity development it applies from lectures and exercises to question-and-answer sessions to better help the CPT implement the selected pilot studies. Below is the progress of the pilot studies:

   (i) **Study on Bus Exclusive Lane on Ortigas Avenue:** This aims to assess the impact of introducing an exclusive bus lane along Ortigas Avenue between C5 and Santolan. The expected outputs are time savings accruing to bus/jeepney passengers, time and cost savings/loss accruing to car users, and changes in traffic volumes and lower congestion ratios. The study is expected to end in June. Preliminary findings show that it is only when the lane is used for high-occupancy vehicles (i.e., buses and jeepneys) that travel time during the morning peak is reduced (i.e., by 103 hours for eastbound traffic and 2,207 hours for westbound traffic).

   (ii) **BGC Public Transport Improvement Study:** This aims to improve public transport in this rapidly growing and highly urbanized area. As of reporting, the study still has to get data which is needed for the analysis, although the development of a traffic simulation model has started.

   (iii) **CNG Bus Introduction Study:** This aims to identify zones in the south of Metro Manila that need additional bus transport capacity. The process involved determining the number of PUB, PUJ, and UV/HOV passengers coming to MM, the capacity

(number of seats and round trips) of the existing bus fleet, population in the area. The study recommended the following:

- If daughter stations are limited to Batangas and Binan, continue with the Batangas–Metro Manila routes via Lipa or Sto. Tomas, and the Binan–Sta. Rosa/Metro Manila route in the short term; and
- If daughter stations will be developed at FTI, Baclaran, and Bacoor, open the following routes in the medium term: Calamba/ Cabuyao/ Los Banos–Metro Manila, Tagaytay/Silang–Metro Manila, Dasmarinas / Trece Martires–Metro Manila, and Tanza/ Rosario–Metro Manila via Bacoor / Imus.

(c) **Findings from the MUCEP Database:** To date, the following are some of the findings:

- Net trip per person in the MUCEP area is 2.26 a day.
- Walk trips dominated the trips inside the MUCEP area, followed by PUJs (19%), other land transport (16%), and motorcycle and passenger car at 8% each. Bus came in sixth at 7%.
- Average travel time in 2014 increased from 1980 and 1996 levels. For buses, trips lasted more than 90 minutes compared to more than 50 in 1980 and almost 80 in 1996. For private cars, travel time exceeded 60 minutes from more than 50 in 1980 and more than 30 in 1980.
- Average trip distances by mode in 2014 were 25.55 km by bus, 15.47 km by rail, and 14.82 km by UV/HOV.
- Of the generated trips in Metro Manila in 2014, 69.6% were made using public modes and 30.4% using private modes.

(d) **Preliminary Demand Forecast Model based on the MUCEP Database:** Mr. Shoyama presented figures showing forecasts on generated daily trips by 2020 and 2030, generated and attracted daily trips by purpose in 2030, OD pairs by 2020 and 2030, as well as daily traffic volume on all modes on the present network and on the network proposed by the transportation roadmap network by 2030.

(e) **Other Matters:**

(i) **Fourth and Final Training in Japan:** This is scheduled on 25 May to 6 June. Eight persons will undergo training in road traffic control and traffic management and will visit institutions in Tokyo, Toyama City, and Kanazawa City.

(ii) **CPT Participation in Pilot Studies:** Mr. Shoyama reiterated the need for the CPT members to attend more frequently and participate more actively in the meetings, trainings, and activities of the pilot studies.

3. **Q&A Portion**

- **Access to MUCEP Data:** Mr. Gison of the MMDA asked if they could use the MUCEP data and he was advised to course their requests for MUCEP through Asec. Bonifacio.

4. There being no other matters to discuss, the meeting adjourned at 3:50 p.m.

Noted by:

Takashi Shoyama
Team Leader, JICA Project Team

THE PROJECT FOR CAPACITY DEVELOPMENT ON TRANSPORTATION PLANNING AND DATABASE MANAGEMENT

MMUTIS Update and Capacity Enhancement Project (MUCEP)

JOINT COORDINATING COMMITTEE MEETING No.4
16 July 2015, 2:40–4:40 PM
Unit 156, The Columbia Tower

ATTENDEES:

Agency	Name	Designation in Agency	Designation in MUCEP[1]
DOTC[2]	1. Atty. Sherielysse Reyes-Bonifacio	Asst. Secretary for Planning[2]	Vice Chairperson, JCC/ Project Director, PMT
	2. Mr. Arnel Manresa	Chief, Road Transport Planning Div.	Member, PMT
	3. Engr. Rene David	Senior CDO, Road TPD	Leader, Counterpart Project Team
	4. Ms. Edna Olaguer	Senior TDO, Road TDP	Member, CPT
	5. Ms. Jasmine Marie Uson	TDO II, Road TPD	Member, CPT
	6. Engr. Ronald Rundy Tuazon	Senior TDO, Rail TDP	Member, CPT
	7. Ms. Pamela Tadeo	Senior TDO, Air TDP	Member, CPT
	8. Ms. Beatriz Raine Bayudan	Technical Assistant.,Office of the Asec. for Planning	
	9. Cep		
	10. Corina		
DPWH[2]	11. Macky		
MMDA[2]	12. Mr. Michael Gison	Planning Officer V, Office of the AGM for Planning	Member, CPT
	13. Ms. Luisa Angangan	Planning Officer III	Member, CPT
UP NCTS[2]	14. Dr. Hilario Sean Palmiano	Director[2]	Member, JCC / Asst. PM, PMT
	15. Mr. Sajid Kamid	University Extension Specialist II	
LRTA[2]	16. Engr. Allan Arquiza	Corporate Planning Chief, CPRD	Member, CPT
	17. Engr. Celwyn Astronomia		
LTFRB[2]	18. Ms. Joanne Elmedolan	Legal Assistant, Office of the Chairman	Member, CPT
PNR[2]	19. Ms. Joseline Geronimo	Department Manager, Engineering Division	
BCDA[3]	20. Jorge Turbolencia		Member, CPT
Northrail[3]	21. Engr. Luisito A. Constantino	Design Specialist, Technical Management Div.	Member, CPT
	22. Engr. Fidel Ayala Jr.	Systems Engineer	Member, CPT
JICA Philippine Office[2]	23. Mr. Noriaki Niwa	Chief Representative	Member, JCC
	24. Toshihiro Shimizu	Project Formulation Advisor	
JICA HQ	25. Mr. Tomoki Kanenawa		
	26. Dr. Mimi Sheikh		
	27. Mr. Toru Yoshida		
JICA Project Team	28. Mr. Takashi Shoyama		Member, JCC / TL and Comprehensive Transportation Planner[2]
	29. Dr. Makoto Okamura		Urban Transportation Planner
	30. Dr. Noriel Christopher Tiglao		Public Transportation Planner
	31. Ms. Momoko Kojima		Intermodal Analyst
	32. Ms. Karen Hulleza-Luna		Project Coordinator
	33. Ms. Rosenia Niebres		Project Assistant
	34. Ms. Peachie del Prado		Project Assistant

HIGHLIGHTS:

1. The meeting was called to order at 2:40 p.m.

2. **Welcome Remarks:** Assistant Secretary Bonifacio welcomed and thanked the participants to the 4th Joint Coordinating Committee meeting for MUCEP. She said that with the establishment of a robust database and the training of the department's planning staff, the DOTC is now closer to preparing a transport master plan to providing the public with a safe, efficient, integrated, and sustainable public transport system. She thanked the Japanese government for the invaluable aid they have provided and the JICA Project Team for having been very responsive to the DOTC requests.

3. **Opening Remarks:** Mr. Niwa, chief representative of the JICA Philippine Office, said that JICA is very happy to see the progress of the project, the counterpart agencies' commitment, and the project's achievements. He added that the outputs of MUCEP are timely and relevant to the planning for Metro Manila's public transportation sector, which is a necessary component to further expand the country's economic activities. Because there is still much work to be done, Mr. Niwa hoped that the Philippine government would continue the initiatives made in this project such as improving coordination among agencies involved in transportation planning, enhancing their knowledge and capacities, and using the transport database in policy making. Mr. Niwa was positive that the knowledge and information generated in MUCEP would be used to realize the "Dream Plan," which was the output of another JICA-funded project entitled *Mega Manila Transport Infrastructure Roadmap*. He gave the assurance that JICA would continue collaborating with the Philippine government, the DOTC in particular, to improve the country's transportation sector. He also thanked the DOTC for showing strong leadership in coordinating MUCEP with various agencies.

4. **Progress of MUCEP:** Mr. Shoyama and selected members of the Counterpart Project Team (CPT) shared the progress of MUCEP's capacity development (CD) activities from March to June 2015 and the project's next steps, to wit:

   (a) **MUCEP Goal:** Mr. Shoyama said that after discussions with the DOTC and the JICA Evaluation Team, MUCEP's goal, i.e., that the public transportation plan for Metro Manila is prepared by the DOTC, would be adjusted and made more specific. The Evaluation Team would explain this in their report.

   (b) **Coordination Activities:** During the current reporting period, the JICA Project Team (JPT) met with the DOTC several times to discuss technical concerns such as the LRT Line 1 South Extension and the introduction of CNG buses. The JPT likewise coordinated with the consultants of the DOTC-funded "Metro Manila Road Transit Rationalization Study: Developing Corridors" (RTRS) to clarify results of the MUCEP database and the outputs both studies.

   (c) **CD Activities:** From March to June 2015, the DOTC's Transport Planning Unit (TPU) staff and other members of the MUCEP CPT, including Cube trainees, attended the weekly meetings and exercises for the three pilot studies, i.e., Study on Bus Exclusive Lane on Ortigas Avenue, CNG Bus Introduction Study, and BGC Public Transport Improvement Study. The number of participants ranged from 11 to 20. Starting on April 16, however, up to the end of June 2015, the TPU was assigned to MUCEP on a full-time basis to undergo more intensive training as they carried out the pilot studies. During the current reporting period, the last CPT training in Japan was held. The training was conducted from 25 May to 6 June and included a study tour from Tokyo to Toyama City and Kanazawa city using a newly opened shinkansen line. The interest areas included the LRT, compact city development, traffic control, bus improvement, and transit-oriented

development.

(d) **CD Monitoring:** Changes in the CPT's level of knowledge and skills are monitored via progress surveys. When compared with the results of the first progress survey (January 2015), While results of the second progress survey (July 2015) for Output 1 on managing the Metro Manila transportation database, Output 2 on planning the PT network of Metro Manila, and Output 3 on formulating policies on PT network development in Metro Manila, levels either dropped slightly or became stagnant. This may be due to the fact that counterparts now understand the technical terms better than before vis-à-vis their current capacities. Overall, however, results for outputs 1 and 2 are satisfactory, both for the CPT and the TPU. However, for Output 3, the growth is not yet significant because they have been carrying out mainly transportation planning projects. In the next reporting (and last) period, pilot studies on policy development would start.

(e) **MUCEP Database:** To enhance the capacity of the DOTC and other agencies in managing the MUCEP database, the JPT would prepare a manual on database management. For requests by non-DOTC parties to access the MUCEP database, data request forms should be submitted to the DOTC's Assistant Secretary for Planning and Finance for her approval. In any case, confidential data, such as family names, telephone numbers, and addresses, cannot be disclosed.

(f) **Next Steps:**

- Submit the final version of the Progress Report 4 by the end of July.
- Hold MUCEP's second seminar on July 28, Tuesday, 1-4 p.m.
- Begin new pilot studies dealing with public transportation fare policy and PUB and PUJ franchising policy.

5. **Results of Pilot Studies Done by CPT:** Below is the progress of the pilot studies. Each would be carrying out further analysis in August.

(a) **Pilot Study 1: Study on Bus Exclusive Lane on Ortigas Avenue:** This pilot study aimed to assess the impact of introducing an exclusive bus lane along Ortigas Avenue between C5 and Santolan. The expected outputs are time savings accruing to bus/jeepney passengers, time and cost savings/loss accruing to car users, and changes in traffic volumes and lower congestion ratios. Results of the study are shown below. These findings will be elaborated through microsimulation, extensive scenario analysis (e.g., roadway capacity improvements, signal coordination, bus operational improvements), and transit modelling.

- At the corridor level, introducing the bus lane scheme would benefit users of the proposed exclusive lane; and
- At the network level and with the objective of achieving overall optimum performance, results indicated a negative impact.

(b) **Pilot Study 2: CNG Bus Introduction Study:** This aimed to identify zones in the south of Metro Manila that need additional public bus transport services. The study adopted a multi-criteria analysis to come up with a ranking of 20 zones that need additional bus fleet. The study recommended the following:

- In the short term: If daughter stations are limited to Batangas and Binan, continue with the Batangas–Metro Manila routes via Lipa or Sto. Tomas and the Binan–Sta. Rosa/Metro Manila route with additional 126 and 50 units, respectively; and
- In the medium term: If daughter stations will be developed at FTI, Baclaran, and Bacoor, open some routes.

(c) **Pilot Study 3: BGC Public Transport Improvement Study:** This aimed to determine the current public transport situation in the area and forecast transport demand, identify current and future deficiencies, as well as develop and evaluate measures to improve current and future public transport in this rapidly growing and highly urbanized area. The study adopted the following steps to come up with its findings: trip generation, trip distribution, modal split, OD adjustment, highway assignment, then transit assignment. The study found that the required number of bus units that should operate in the area is as follows: (i) peak hours: 19 units/hour, (ii) off-peak hours: 9 units/hour, and (iii) night time=1 unit/hour.

6. **Results of the Joint Terminal Evaluation:** Mr. Kanenawa informed the attendees that the evaluation aimed: (i) to review MUCEP's progress based on the Project Design Matrix (PDM) and Plan of Operation (PO), and assess the achievement of outputs, purpose, and overall goal; (ii) assess the Project based on the five evaluation criteria (shown below); (iii) examine the process of project implementation and identify hindering and enabling factors affecting the implementation; and (iv) recommend measures to take in the remaining period to improve project performance and identify lessons for new and ongoing projects. Results of the evaluation are as follows:

   (a) MUCEP was evaluated to be highly relevant, mostly effective, fairly efficient, fairly sustainable, and is expected to achieve its goal. Based on the five evaluation criteria, MUCEP has generated mostly good and positive results despite some concerns about its efficiency and sustainability. Overall, this project is evaluated to be satisfactory.
   (b) For the remaining project period, the Evaluation Team suggested the following: (i) establish a management system for the new transportation database; (ii) clarify the TPU's responsibilities and expected tasks after MUCEP; and (iii) modify PDM3 based on the actual situation. After the project, the Team recommends the continued application of the transportation planning skills and techniques learned during MUCEP.
   (c) The Team also recommended to specify in the PDM the target achievement time of the overall goal.

7. **Questions, Answers, and Comments**

   (a) **On the CNG Bus Introduction Study**

   - Mr. Turbolencia asked if the bus supply gap is filled by colorum vehicles. Engineer David said there is no way to determine this at the moment.
   - Attorney Sarmiento asked if Cabuyao being ranked 1 among the zones that need additional bus fleet means it has the biggest demand-supply gap. Engineer David said that Cabuyao ranked number 1 as a result of the five criteria used to study the zones, the demand-supply gap being one of these.

   (b) **On the MUCEP Database:** Attorney Sarmiento asked the DOTC if they could have the preliminary MUCEP findings on transportation and traffic characteristics to support the paper being done in the Lower House which aims to evaluate the transportation system. Asec. Reyes-Bonifacio said the department could share with the House committee the preliminary findings on trip origins and destinations. Mr. Shoyama also mentioned that the JICA Project Team (JPT) would present the updated transportation and traffic characteristics in Metro Manila in the planned seminar on July 28.

   (c) **On Continuity and Technology Transfer:** In view of the need for continuity and technology transfer, Attorney Sarmiento asked if there is a plan to enable the DOTC to extend MUCEP to other parts of the country.

(d) **On Coordination and Policy Making:** Attorney Sarmiento also suggested that MUCEP could consider involving Congress in seminars and other activities to help them in prioritizing bills, especially in light of a current plan to file a bill on national transportation planning.

(e) **On Target Expertise of CPT:** Doctor Palmiano asked what target level of expertise should the counterparts achieve. Mr. Shoyama said the target is to bring all counterparts to Level 3, young experts' level. However, the TPU should reach Level 4, experts' level. Although at the moment the weak aspect among the TPU is in policy formulation, he said this should be addressed when MUCEP implements two new pilot studies on policy formulation in the remaining project period.

8. **Closing Remarks:** Mr. Kanenawa said that to achieve the overall goal, the JPT and the DOTC should establish a management system for the new transportation database and to clarify the TPU's responsibilities and expected tasks after MUCEP ends. The DOTC should also continue applying the transportation planning skills and techniques learned during the project, expressing his hope for the DOTC to lead in public transportation planning in the Philippines and to optimize project achievements in collaboration with relevant agencies. He thanked the DOTC for its cooperation during the terminal evaluation period and the JPT for its efforts in developing the capacities of the department.

9. There being no other matters to discuss, the meeting adjourned at 4:50 p.m.

Noted by:

Takashi Shoyama
Team Leader, JICA Project Team

THE PROJECT FOR CAPACITY DEVELOPMENT ON TRANSPORTATION PLANNING AND DATABASE MANAGEMENT

MMUTIS Update and Capacity Enhancement Project (MUCEP)

JOINT COORDINATING COMMITTEE MEETING NO.5

AND SEMINAR NO. 3

27 October 2015, 8:00 AM–1:00 PM
Sapphire AB, Crowne Plaza Manila Galleria

ATTENDEES:

Agency	Name	Designation in Agency	Designation in MUCEP
DOTC	1. Atty. Sherielysse Reyes-Bonifacio	Assistant Secretary for Planning and Finance	Vice Chairperson, JCC/ Project Director, PMT
	2. Engr. Felicisimo Pangilinan Jr.	Deputy Director and OIC, Planning Service	Member, PMT
	3. Engr. Rene David	Senior CDO, Road TPD	Leader, CPT / TPU Staff
	4. Mr. Lemar Jimenez	Senior TDO, Road TPD	Member, CPT / TPU Staff
	5. Ms. Edna Olaguer	Senior TDO, Road TDP	Member, CPT / TPU Staff
	6. Ms. Jasmine Marie Uson	TDO II, Road TPD	Member, CPT
	7. Engr. Ronald Rundy Tuazon	Senior TDO, Rail TDP	Member, CPT
	8. Ms. Pamela Tadeo	Senior TDO, Air TDP	Member, CPT
	9. Ms. Ma. Filipinas Cabana	Supervising Transport Development Officer, Air TPD	
	10.Mr. Dennis Albano	Sr. Development Communication Officer, Water TPD	
	11.Ms. Ma. Concepcion Garcia	Technical Assistant, Office of the Undersecretary for Planning	
	12.Ms. Corina Alcantara	Project Dev't Officer, Office of the Asst. Secretary for Planning and Finance	
	13.Mr. Melchizedek Babilonia	Technical Assistant, Office of the Asst. Secretary for Planning and Finance	
DPWH	14.Engr. Maximo Ewald Montana II	Engineer III	Member, CPT
MMDA	15.Dir. Ma. Josefina J. Faulan	Asst. General Manger, Office of the AGM for Planning	Member, PMT
	16.Ms. Luisa Angangan	Planning Officer III, Office of the AGM for Planning	Member, CPT
	17.Ms. Felicitas Sabas	Planning Officer III, Office of the AGM for Planning	Member, CPT
UP NCTS	18.Dr. Hilario Sean Palmiano	Director	Member, JCC / Asst. PM, PMT
	19.Mr. Sajid Kamid	University Extension Specialist II	Member, CPT
LRTA	20.Mr. Honorito D. Chaneco	Administrator	Member, JCC
LTFRB	21.Engr. Ronaldo F. Corpus	Board Member	
	22.Atty. Mary Ann T. Salada	Chief of Staff, Office of the Chairman	
	23.Ms. Joanne Elmedolan	Legal Assistant, Office of the Chairman	Member, CPT/ TPU Staff
	24.Ms. Loida Balidoy	Information Technology Officer	Member, CPT
	25.Mr. Alex Macalaba	Data Entry Machine Operator III	
PNR	26.Ms. Joseline Geronimo	Division Manager, Station Operations	Member, CPT
BCDA	27.Engr. Rey S. Lim	Senior Infrastructure Dev't Officer	Member, CPT

Agency	Name	Designation in Agency	Designation in MUCEP
Northrail	28.Engr. Luisito A. Constantino	Design Specialist, Technical Management Division	Member, CPT
	29.Engr. Fidel Ayala Jr.	Systems Engineer	Member, CPT
JICA Philippine Office	30.Mr. Tetsuya Yamada	Senior Representative (representing Mr. Noriaki Niwa, Chief Representative)	Member, JCC
	31.Mr. Toshihiro Shimizu	Project Formulation Advisor	
ALMEC Corporation	32.Mr. Takashi Shoyama		Member, JCC / Team Leader and Comprehensive Transportation Planner
	33.Mr. Yosui Seki		Project Evaluation Specialist
	34.Ms. Momoko Kojima		Intermodal Analyst
	35.Ms. Karen Hulleza-Luna		Project Coordinator
	36.Ms. Rosenia Niebres		Project Assistant
	37.Ms. Christopher Hanna Pablo		Project Assistant
	38.Ms. Peachie del Prado		Project Assistant
STRIDE Consulting Inc.	39.Dr. Noriel Christopher Tiglao	President	Public Transportation Planner
SRDP Consulting Inc.	40.Engr. Joel F. Cruz	President	
	41.Engr. Donn Hernandez	Staff	GIS Specialist
House of Representatives	42.Atty. Franco Sarmiento	Supervising Legislative Staff, Office of Rep. Cesar Sarmiento	
De La Salle University	43.Engr. Raymond Abad	Student	
	44.Engr. Krister Roquel	Student	
Mapua Institute of Technology	45.Engr. Riches Bacera	Faculty / Researcher	
Caloocan City	46.Ms. Aurora Ciego	City Planning and Development Coordinator	
	47.Arch. Jonathan Himala	Planning Officer IV, City Planning and Development Office (CPDO)	
Makati City	48.Atty. Violeta Seva	Senior Advisor to the Mayor	
	49.Ms. Jennier Michelle Macas	Planning Officer II, CPDO	
	50.Mr. Jorge M. Calpo Sr.	Planning Officer, Public Safety Department	
Mandaluyong City	51.Mr. Gregorio Rapuson	Project Development Officer III	
	52.Mr. Roberto J. Javier	Zoning Officer II	
Navotas City	53.Mr. Lumer Danofrata	Planning Officer IV, CPDO	
	54.Mr. Joseph Yao	Staff, CPDO	
Pasay City	55.Mr. Jess Boses	Zoning Officer	
Pasig City	56.Mr. Alberto Dulay	OIC, Traffic and Parking Management Office	
	57.Ms. Lydia D. Gutana	Head, Traffic Engineering Office	
Quezon City	58.Mr. Pedro Garcia	Planning Officer IV, CPDO	
	59.Mr. Rosebert Porfo	Planning Officer IV, CPDO	
Valenzuela City	60.Mr. Rene I. Padolina	Project Development Officer IV	
	61.Mr. Fortune SJ Angeles	Project Evaluation Officer IV	
Province of Laguna	62.Engr. Pablo Del Mundo	Provincial Planning and Development Coordinator	
Province of Rizal	63.Engr. Sarah Jane Salvio	Engineer III, Provincial Engineering Office	

CPT: Counterpart Project Team JCC: Joint Coordinating Committee PMT: Project Management Team
OIC: Officer in Charge PM: Project Manager TPU: Transport Planning Unit

HIGHLIGHTS:

1. The meeting was called to order at 9:00 a.m.

2. **Welcome Remarks:** In her welcome remarks, Asec. Reyes-Bonifacio said that it is the DOTC's hope that with MUCEP, the department would be able to improve people's mobility. She added that while MUCEP is limited to Metro Manila and its surrounding areas, the DOTC is hopeful that the best practices that have been implemented in this project would be replicated in other cities in the Philippines because congestion is also a growing concern in highly urbanized cities outside Metro Manila. She expressed the hope of setting a good example in Metro Manila using the training and the learning obtained through MUCEP.

3. **MUCEP Findings and Recommendations:** Mr. Shoyama, MUCEP Team Leader, reported on the activities and outputs of MUCEP for the period of July–October 2015, to wit:

   (i) About 15 weekly meetings were held between the JICA Project Team (JPT) and the Counterpart Project Team (CPT) to discuss pilot studies, which included setting public transportation (PT) fares and evaluating public utility bus (PUB) and jeepney (PUJ) franchise applications. In addition, MUCEP set/organized 10 consultation meetings with the main counterpart agency (i.e., the DOTC) and a seminar, which was attended by various counterpart agencies.

   (ii) Results of the end-line survey among the CPT and the DOTC's Transport Planning Unit (TPU), which the JPT carried out in October to determine the impact of capacity development activities, showed great improvement from the results of the baseline survey done in May 2012. However, the TPU's average score of 3.00 on policy formulation, which was lower than the CPT's average score of 3.21, was attributed by the JPT to the TPU's realization, as a result of the pilot studies, that a scientific approach to policy formulation was difficult.

   (iii) MUCEP's outputs for the period are the following: transportation database of the project area; manuals on traffic surveys, travel demand forecasting, urban transportation planning, PT policy formulation, and transportation database management; as well as reports on pilot studies on the introduction of a bus lane on Ortigas Avenue and compressed natural gas-fuelled bus services from the north and east of Metro Manila, as well as the improvement of bus services in Bonifacio Global City. The most important, however, was the developed capacity of counterparts, particularly the TPU.

   (iv) As a result of the pilot studies, MUCEP recommended the following:

   - In setting PT fares and managing travel demand, the TPU should analyze vehicle operating costs, load factors, and operating speeds; widen use of stored-value cards; introduce travel demand management (TDM) schemes to encourage PT use; and reorganize PUJ operations.
   - To help evaluate PUB and PUJ franchise applications inside the MUCEP area, transit assignment instead of route measured capacity should be adopted as basis, while for outside the MUCEP area, applicants should submit additional data and information as basis for evaluation by the DOTC.

4. **Results of Pilot Studies Done by CPT**

   (a) **Pilot Study 1: Study on Bus Exclusive Lane on Ortigas Avenue:** Mr. Sajid Kamid from the UP NCTS presented the final microsimulation results of this pilot study which aimed to assess the impact of introducing an exclusive bus lane along Ortigas Avenue between C5 and Santolan. The pilot study came up with the following:

   - At the corridor level, introducing the bus (or bus + HOV) lanes would benefit users only. On the bus lane, there would be significant reductions in travel delay and vehicle queue, as well

as a remarkable increase in travel speed compared to the base case (i.e., no bus lane). On the lane for other vehicles, however, there would be increased delays at all intersections, as well as decreased speeds and longer queues at almost all intersections. At the network level, results also indicated a negative impact.

- To conclude that the bus lane would be useful in countering traffic congestion in Metro Manila, additional studies should be done, such as on lane design, costs, as well as financial and economic feasibility.

(b) **Pilot Study 2: CNG Bus Introduction Study:** Ms. Olaguer from the DOTC's RTPD presented the findings of this pilot study which aimed to identify zones that could be provided with CNG buses to cater to bus trips from the north and east of Metro Manila and vice versa. The pilot study recommended the following:

- Prioritizing five bus routes in the north and three in the east for short-term implementation, and six bus routes from the north to Metro Manila in the medium term;
- Adding 78 bus units in the high-priority eastern routes, 247 units in the high-priority northern bus routes, and 344 units in the medium-priority northern bus routes; and
- Limiting bus operations to a maximum distance route of 150 km one way, so that only one refilling station would be established. Should the round-trip distance exceed 300 km, another refilling station would have to be provided on the other side of the route.

(c) **Pilot Study 3: BGC Public Transport Improvement Study:** Ms. Elmedolan from the LTFRB presented the final findings of this pilot study, which aimed to determine the current PT situation in the area, forecast transportation demand, as well as develop and evaluate measures to improve current and future public transportation in this rapidly growing and highly urbanized area. The pilot study's findings and recommendations are as follows:

- The minimum number of bus units that should operate in the area by 2020 is as follows: (i) peak hour=30 units/hour, (ii) off-peak hour=14, and (iii) night time=2. By 2025, the numbers would be 32, 15, and 2, respectively.
- Creation of new bus routes to cater to passengers in unserved zones, modification of East Route to cover zones 1 to 3 by 2020 and 2025, and the addition of new bus units to operate within the BGC by 2020 and 2025 to serve increased bus demand.

5. **MUCEP Database and Its Management:** Mr. Shoyama presented the structure of, and responsibility over, the MUCEP transportation database, to wit:

- The MUCEP Database consists of 10 major items, namely: (i) database management manual; (ii) survey forms; (iii) HIS master file; (iv) cordon line survey results; (v) screen line survey results; (vi) socio-economic indicators; (vii) OD matrices by trip purpose and mode; (viii) zoning; (ix) network and assignment parameters; and, (x) GIS data.
- The base year of the database is 2014 with forecasts provided for 2020, 2025, and 2035. Database users should carry out their own forecasts especially when changes in land uses take place. The life of the database is usually up to 10 to 15 years only, after which large-scale surveys should again be conducted to update the forecasts.
- Parties requesting for MUCEP data should submit accomplished application forms to the DOTC's Assistant Secretary for Planning and Finance.
- The TPU should update the database by: (i) changing the condition of road or rail links in the Cube and STRADA network files with close coordination with DPWH, MMDA, etc.; (ii) collecting new traffic counts from the DPWH and MMDA every year; (iii) updating the socio-economic data when census results become available; and (iv) updating the transit route data every year.

6. **Open Forum**

(a) **On Sustaining the Project**

- Attorney Sarmiento from the House transportation committee asked what the next step would be to sustain the project, adding that Congress has pushed concerned agencies to prepare a rationalization plan which will serve as basis for issuing franchises or master plans to plan new roads and communities.
- Asec. Reyes-Bonifacio clarified that MUCEP's output is an OD database, not an optimal transit network plan for which the DOTC has already requested the JICA Project Team for assistance. However, the Team already advised her that preparing such a plan would take another year and was also outside MUCEP's scope. On the other hand, MUCEP has taught transportation agencies to take a network approach in transportation planning as opposed to the current process of using, say, the RMC methodology in franchise applications. The RMC, she explained, does not consider network impact. Sustainability shows when the government carries out the planning function, she said, because there is only one overseer or manager of the network. She also added that the government would look into non-profitable routes as opposed to the current system that looks only at what is profitable for operators, because while this is understandable, it does not enable the government to serve unprofitable routes to the detriment of the people living in such areas. There is also sustainability when transportation personnel know and understand the planning process, she added. Asec. Reyes-Bonifacio likewise mentioned that the DOTC has asked JICA to extend MUCEP for another year to carry out route planning and preparation of the optimal route network. She expressed the hope that JICA would still help the DOTC toward this end. Mr. Shoyama said he hoped that the TPU would be further institutionalized within the DOTC and that the TPU personnel would not leave the department any time soon.

(b) On Updating the MUCEP Database

- Mr. Pangilinan from the DOTC brought up the idea of including trip questions in the census to generate trip information at the national level.
- Asec. Reyes-Bonifacio said that this idea was already discussed with the Philippines Statistics Office, but the questionnaire became too long, so they are trying to whittle it down to a manageable length. She also mentioned that the DOTC has plans to tender a big data project that would use mobile data to update the MUCEP database. Mr. Shoyama said that including trip questions in the census could be achieved by shortening them and administering the longer census questionnaire to only 5 to 10 percent of the population, as practised in the US.

(c) On Accessing the MUCEP Database

- Ms. Faulan from the MMDA asked if their agency could submit a blanket request to the DOTC for copies of the database to distribute to the LGUs.
- Asec. Reyes-Bonifacio replied that such a request would be entertained as long as the application process which Mr. Shoyama explained earlier would be followed.

(d) On Using the MUCEP Manuals

- Dr. Palmiano from the NCTS asked which manuals could their center use as bases in developing training programs to build LGUs' capacity for transportation planning.
- Mr. Shoyama said all the manuals on the list could be used., Asec. Reyes-Bonifacio also mentioned that besides the MUCEP manuals, the World Bank did a capacity-building project for five cities and is planning to fund another batch to train LGU staff.

(e) On Introducing a Bus Lane on Ortigas Avenue

- Mr. Babilonia from the DOTC asked if the pilot study projected a modal shift.
- Mr. Shoyama responded that modal shift was not considered in the pilot study and that the JPT does not recommend the introduction of a bus lane on Ortigas Avenue.

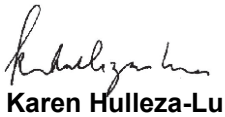
(f) On Using the Multi-criteria Analysis in the CNG Bus Study

- Mr. Pangilinan from the DOTC wanted to know the basis for the weights assigned to the five criteria used to rank the MUCEP zones for the supply of CNG buses.
- Mr. Shoyama replied that although the weights given to each criterion were slightly subjective, they were empirically decided.

7. **Closing Remarks:** Mr. Yamada said that JICA is very pleased that through MUCEP, several recommendations were identified, pilot studies were implemented, and the database was updated with the support of their partners. He expressed hope that the project's findings and recommendations would be strongly considered and pursued in light of the importance of transportation planning and management in sustaining the country's economic progress. He added that MUCEP would also help realize the transportation roadmap which outlines the infrastructure plan for Metro Manila and regions III and IV-A, as well as other projects JICA is discussing with the Philippine government. He said that JICA is optimistic that the government agencies involved in MUCEP could build on the gains of the project and coordinate among themselves to improve transportation policy making and planning for the benefit of all citizens. Mr. Yamada thanked the DOTC for leading the project and the other agencies for committing their time and resources to implement it.

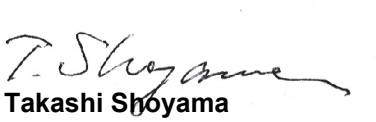
8. There being no other matters to discuss, the meeting adjourned at 11:30 a.m.

Prepared by:



Karen Hulleza-Luna
Project Coordinator

Noted by:



Takashi Shoyama
Team Leader, JICA Project Team

ANNEX H

Final Reports on Pilot Studies Done by the Counterpart Project Team

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ABBREVIATIONS

AADT	annual daily traffic
BCDA	Bases Conversion and Development Authority
BESC	Bonifacio Estate Services Corporation
BGC	Bonifacio Global City
BPO	business process outsourcing
BPR	Bureau of Public Roads
BTC	Bonifacio Transit Corporation
CBD	Central Business District
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highways
EB	eastbound
EDSA	Epifanio de los Santos Avenue
FBDC	Fort Bonifacio Development Corporation
GFA	gross floor area
HIS	household interview survey
HOV	high-occupancy vehicle
JICA	Japan International Cooperation Agency
JICA	Japan International Cooperation Agency
kph	kilometer per hour
LRTA	Light Rail Transit Authority
LTFRB	Land Transportation Franchising and Regulatory Board
m	meter
MMDA	Metro Manila Development Authority
MUCEP	MMUTIS Updated and Capacity Enhancement Project
NCR	National Capital Region
Northrail	North Luzon Railways Corporation
OD	origin-destination
PPHPD	passenger per hour per direction
PUB	public utility bus
PUJ	public utility jeepney
sec	seconds
STRADA	System for Traffic Demand Analysis
TAZ	Traffic Analysis Zone
UV	utility vehicle
V/C	volume capacity
WB	westbound

Part 1

STUDY ON THE BUS EXCLUSIVE LANE ON ORTIGAS AVENUE

1 INTRODUCTION

1.1 Background and Rationale

With transportation demand outpacing capacity expansion in many regions and metropolis in the Philippines like Metro Manila, transportation networks and roadways are facing increasing congestion issues. The provisions of public transport supportive strategies to reduce travel time, improve system reliability, and provide acceptable operational cost savings are becoming increasingly important.

In light of the above scenario, transportation management measures that seek to improve system and service capacity out of the existing resources are currently being explored by the Department of Transportation and Communications (DOTC) in order to come up with viable transportation solutions like roadway segment treatments through provision of exclusive bus or shared public transport lane within the corridor under study.

For the pilot case study, the chosen location for the bus lane introduction is Ortigas Avenue (see Figure 1.1). It is one of the major thoroughfares that connect major activity centers in the Metropolitan area. The said corridor serves as the primary artery connecting the populous and progressive towns of Rizal Provinces (Antipolo City, and the towns of Cainta, Taytay, Binangonan and Angono), Marikina City and Pasig City to Metro Manila. The western terminus of the highway is at San Juan City then travels through Ortigas Center and along the cities of Mandaluyong, Quezon, and Pasig.

1.2 Study Corridor

Ortigas Avenue has been suffering from the daily pressures of heavy traffic due to the commercial establishments and residential areas within its periphery. These trip generators are seen as the main culprits in the existence of the high volume of private vehicles in the corridor, which is aggravated by the public utility vehicles stopping for passengers just about anywhere along its stretch.

Moreover, informal terminals and longer dwell times at certain points along the thoroughfare produce chaotic traffic bottlenecks.

As a possible strategy to alleviate congestion along the heavy traffic corridor, the idea of implementing an Exclusive Bus Lane along Ortigas Avenue, covering approximately 5.1 kilometer-sections from C-5 to Santolan, has been envisioned.

Figure 1.1: Ortigas Corridor (C5 Libis–Santolan)

Source: Google Maps

The key idea is to strictly enforce dedicated lanes and bus stops along Ortigas Avenue to achieve a more reliable bus service and, in such a way, passenger travel times may be reduced.

Eventually, buses will gain improved potential in attracting public transport commuters. The move might, hopefully, lessen the volume of private vehicles.

1.3 Project Objectives

1) Concept Objective

The main objective of the pilot study is to improve operational performance of the buses in terms of travel time, speed, and reliability.

2) Case Study Objective

Meanwhile, the case study objectives are centered on the impact assessment of introducing an exclusive bus lane along Ortigas Avenue between C5 and Santolan. Although the more potential advantages are identified, the bus lane scheme may, however, imply trade-offs among the road users.

It is most likely that the possible positive impacts for the buses may inversely affect the general traffic. Thus, the planned bus lane scheme would be evaluated and assessed based on whether the concept objective is realizable or not.

1.4 Expected Output

Expected outputs of the pilot case study:

(i) Time savings accruing to bus/jeepney passengers
(ii) Time and cost savings/loss accruing to car users
(iii) Changes in traffic volume and congestion ratio

1.5 Methodology in General

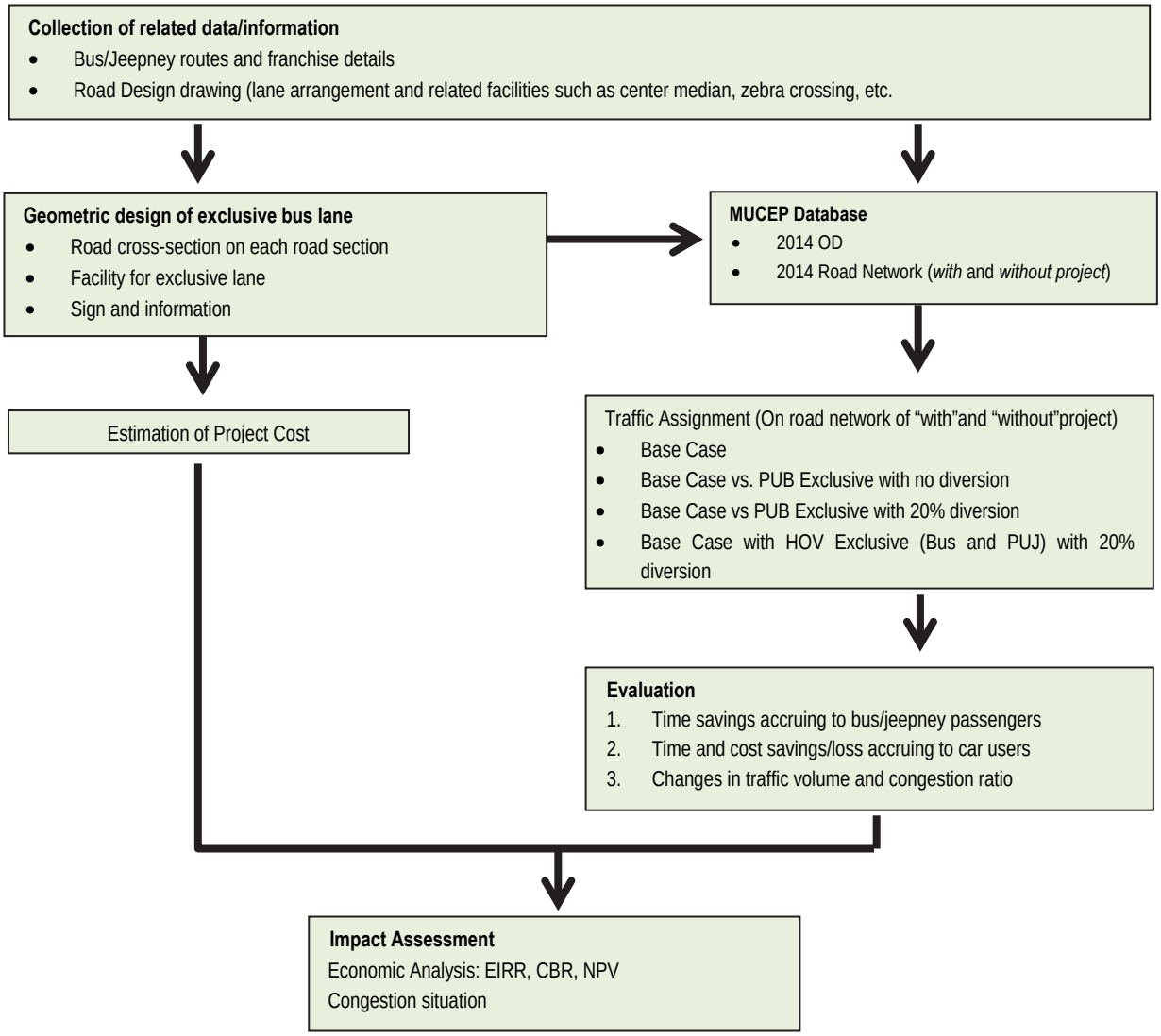
For the bus lane case, a variety of methods can be used to assess the impacts of the proposal. This would be based on the quantification of changes in operational indicators between the before and after scenarios.

The application of the possible approaches is initially limited to the analysis of the subject corridor.

Under the case study, the proposed general methodology for assessing the operational impacts caused by a bus lane scheme started from the collection and processing of the relevant secondary data at hand. Consequently, a series of corridor data preparation were carried out in order to be able to proceed to the necessary calculations, both by manual method and through the use of a transport/traffic modelling software. The process continued with the development of different case scenarios for the impact evaluations.

The diagram Figure 1.2 shows the process flow of the aforementioned methodology.

Figure 1.2: Process flow to assess the operational impacts of the bus lane scheme



1.6 Data Collection and Ocular Inspection

The case study team collected and compiled the existing secondary data necessary for the assessment of the traffic situation along Ortigas. The data gathered were intersection counts, annual daily traffic (AADT), list of public transport routes, corresponding number of operating units along the corridor and other relevant information; these were sourced mainly from the Department of Transportation and Communications, Metro Manila Development Authority (MMDA), and Department of Public Works and Highways (DPWH).

The study corridor's land use classification was then determined based on the available information in Google Maps. Preliminary assessment revealed that commercial land use is dominant in the subject corridor, then mostly residential in the adjacent areas. There are also hospitals, government offices, schools, and industrial establishments in the subject area.

One of the constraints observed is that the available data on traffic counts were conducted in 2010 and in limited stations only. Thus, in the analyses of traffic volume, there are links that used the same volume count and, as such, adjustments were applied to estimate the traffic volume for the base year.

The case study team also conducted an ocular inspection in the corridor to familiarize the study area.

Listed below are the available data for the assessment of the pilot project:

(i) Initial Project Plan on Selected Sections of Ortigas Avenue

(ii) Travel Time Survey (Santolan – Imelda Avenue)

(iii) Intersection Count

- Ortigas Ave./ Green Meadows (June 6, 2013)
- Ortigas Ave./Meralco Ave. (October 13, 2010)
- EDSA/ Ortigas Ave. (Sept. 19, 2013)
- Ortigas Ave/ Wilson (May 19, 2010)
- Ortigas Ave./ McKinley
- Ortigas Ave./ C-5
- Ortigas Ave./ Connecticut

(iv) Signal Timing Data

- Ortigas Ave./ Green Meadows (June 6, 2013)
- Ortigas Ave./Meralco Ave. (October 13, 2010)
- EDSA/ Ortigas Ave. (Sept. 19, 2013)
- Ortigas Ave/ Wilson (May 19, 2010)
- Ortigas Ave./ C-5
- Ortigas Ave./ Connecticut

(v) Section (Wilson – Connecticut)

(vi) Metro Manila AADT (2011, 2012, and 2013)

(vii) Pedestrian Count Survey

(viii) List of Bus Operators Plying Ortigas

(ix) LTFRB Metro Manila Publi Transport Routes and Franchised Units Inventory (2013)

(x) Metro Manila Land Use Map

2 CORRIDOR ANALYSIS - BPR FORMULA ANALYSIS

To analyse the impacts of introducing an exclusive lane along Ortigas Avenue, specifically the section from C-5 to Santolan, the case study team employed a macro-level approach to get a glimpse of the desired project performance indicators.

2.1 Spreadsheet Calculations

The team first conducted spreadsheet computations using the United States' Bureau of Public Roads (BPR) equation for both "with" and "without" the project scenarios.

The BPR equation (Eq.1) takes the form:

$$T_f = T_o * \left(1 + \alpha * \left[\frac{V}{C}\right]^{\beta}\right) \qquad \text{Eq. 1}$$

Where:

T = Balanced Travel Time (travel time adjusted based on assigned volume)

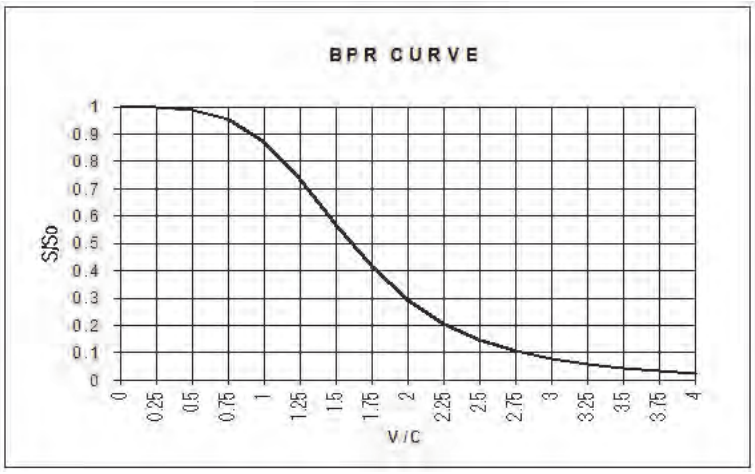
To = Free Flow Time (0.87 * time at practical capacity for iterative capacity restraint)

V = Assigned Volume

C = Practical Capacity of Link

The chart below is a sample of a BPR curve:

Figure 2.1: BPR Curve



Source: www.sierrafoot.org

With the intersection volume count and the 2014 MUCEP road network, preliminary assessments were conducted to calculate travel speed, congestion ratio, congestion time and, ultimately, passenger travel time saving/loss for the scenarios considered: (1) Base case, (2) Exclusive Bus Lane without traffic diversion, and (3) Exclusive Bus Lane with 20% traffic diversion.

2.2 Results Using BPR Formula

a) Average Travel Speed (Westbound AM Peak)

For westbound (WB) traffic in the base case scenario, Figure 2.2 revealed that although buses on the exclusive bus lane can obtain improved average speed, the general traffic on the other hand will tend to suffer a reduction.

Figure 2.3 showed almost the same hypothetical behavior; average speed of the general traffic will tend to decrease after the project will be in place.

Figure 2.4 is rather quite different especially in the case of the buses using the dedicated lane. Notably, in the first two kilometers of the corridor, the average travel speed is quite low. However, a slight increase can be seen in the succeeding kilometer, and then back to the decreasing trend, which is around 30 kph.

The speed of the general traffic in Base Case and Case 3 scenarios are almost identical.

Figure 2.2: Average traffic speed (AM Peak) for the Westbound Direction: General traffic (Base Case), general traffic and bus lane traffic under Case 1 scenario

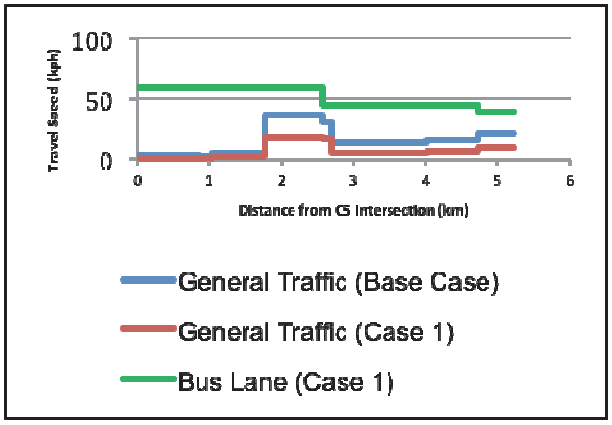


Figure 2.3: Average Traffic speed (AM Peak) for the Westbound Direction: General traffic (Base Case), general traffic and bus lane traffic under Case 2 scenario

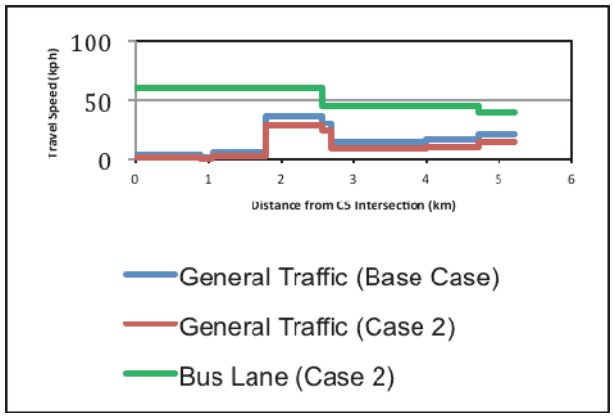
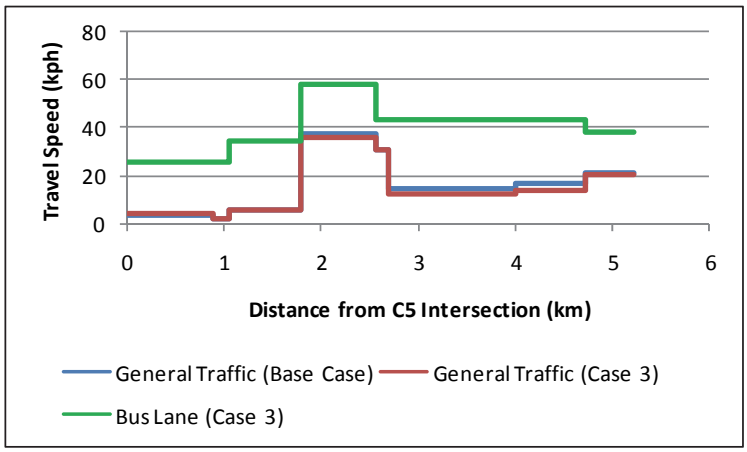


Figure 2.4: Average traffic speed (AM Peak) for the Westbound Direction: General traffic (Base Case) and General traffic and bus lane traffic under Case 3 scenario



Source: MUCEP Data

b) Average Travel Speed (Eastbound AM Peak)

For the eastbound (EB) traffic, Case 1 (Figure 2.5), the general traffic will tend to experience speed reduction in the first three kilometers of the corridor followed by an abrupt increase in the next few meters, then a sharp decline as the trip approaches Santolan. Bus lane users, on the other hand, travel with speed ranging from 40 to 60 kph towards the end of the corridor.

About the same speed characteristics can be observed in Figure 2.6 Case 2 scenario.

Figure 2.5: Average traffic speed (AM Peak) for the eastbound direction: General traffic (Base Case) and general traffic and bus lane traffic under Case 1 scenario

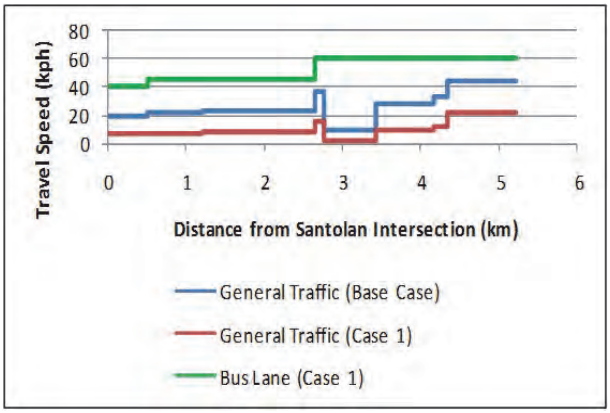
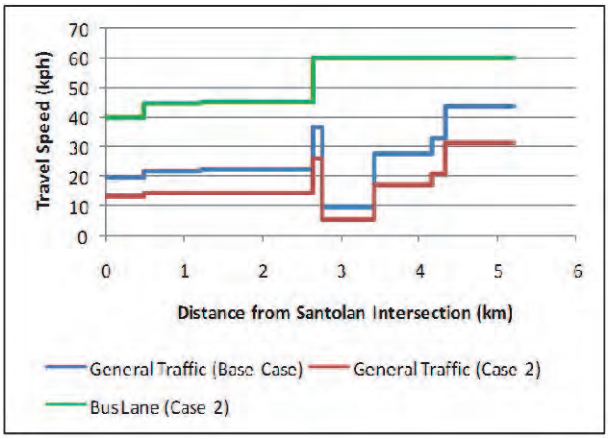


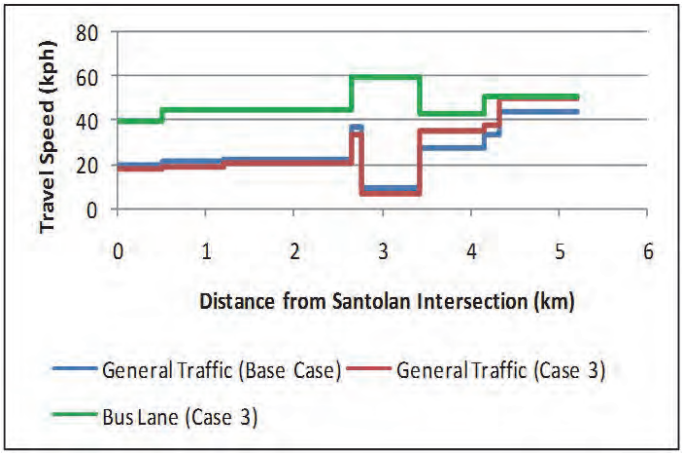
Figure 2.6: Average traffic speed (AM Peak) foor the eastbound direction: General traffic (Base Case) and general traffic and bus lane traffic under Case 2 scenario



Source: MUCEP Data

Figure 2.7 shows that general traffic in both Base Case and Case 3 scenarios will be in the status quo. Interestingly, bus lane users will get to experience speed reduction as the trip closes to Santolan perhaps due to the assumed 20% diversion traffic diversion.

Figure 2.7: Average traffic speed (AM Peak) for the eastbound direction: General traffic (Base Case) and general traffic and bus lane traffic under Case 3 scenario



Source: MUCEP Data

c) Travel Time Loss/Saving

Time loss/savings of passengers bound to the east and west with respect to the study corridor were also estimated. Comparing the values computed for the different case scenarios, the savings in terms of hours generally decreased.

Table 2.1: Total Passenger Time Loss/Savings (AM, Peak Hours)

Direction	Total Passenger Time Loss/Savings in Hours (AM Peak Hours)		
	Case 1	Case 2	Case 3
Eastbound	2012	508	103
Westbound	12,645	3,403	2,207

Source: MUCEP Data

3 MACRO SIMULATION ANALYSIS

3.1 Methodology

To further assess the abovementioned indicators, a software-based computing tool Cube was also utilized. The scenarios considered were the following:

(i) Case 1A (C5 – Santolan; Bus only)

(ii) Case 1B (C5 – Santolan; Bus only + HOV)

(iii) Case 2A (C5 – EDSA; Bus only)

(iv) Case 2B (C5 – EDSA; Bus only + HOV)

Case 1 takes the corridor section of C5 to Santolan while Case 2 is on C5 to EDSA. "HOV" or High Occupancy Vehicles in this particular method refers to the jeepneys only.

a) Assumptions

- 100% of buses and jeepneys will utilize the exclusive lan

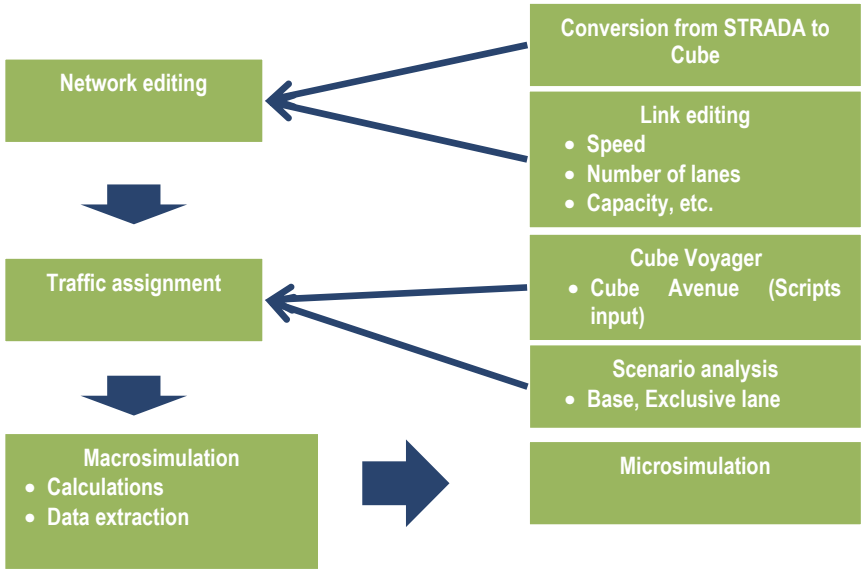
b) Limitations

- The network editing only involved lane and link information
- The computation using Cube software excluded penalties, like delays, *i.e.* intersection, parking, bus stops (location, average dwell times, etc.)
- The modelling used highway assignment technique

c) Methodology Using Cube software

The diagram below shows the methodology involved in using the Cube software.

Figure 3.1: Methodology Using Cube Software



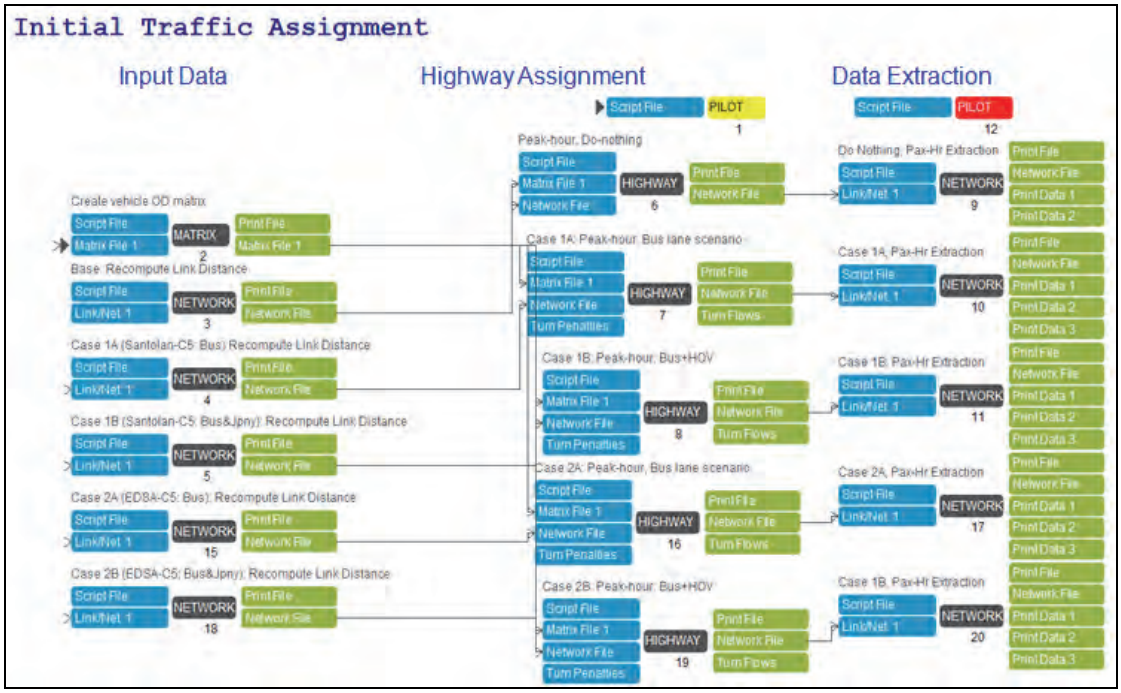
The network editing part involved conversion of the STRADA network from MUCEP project to become compatible with the Cube software. It also required link editing, wherein variables such as speed, number of lanes, capacity and the like have to be inputted. The next item was traffic assignment using the MUCEP origin-destination (OD) data. It is the

fourth step in the conventional transportation forecasting model, following trip generation, trip distribution, and mode choice. Cube then executes traffic assignment using its sub-tool "Cube Voyager," with the extension called "Cube Avenue" and, in this step, is also where scenario analyses are set up. Finally, microsimulation was performed. The resulting values of the performance indicators herein are the inputs for the microsimulation process.

d) Ortigas Corridor Traffic Model with Cube Software

The traffic assignment procedure using Cube software is illustrated in the figure below.

Figure 3.2: Ortigas Corridor Traffic Model with Cube software



Source: Cube software user interface

Basically, there were three major steps setup to complete the process: (1) Input data, (2) Highway assignment, and (3) Data extraction.

"Input Data" is where OD matrices' scripts are set up. "Highway Assignment" is a section where case scenarios are built up. "Data Extraction" is in itself a results collection point wherein values of performance indicators like speed, pax-hr, pax-km, congestion, and the like are generated.

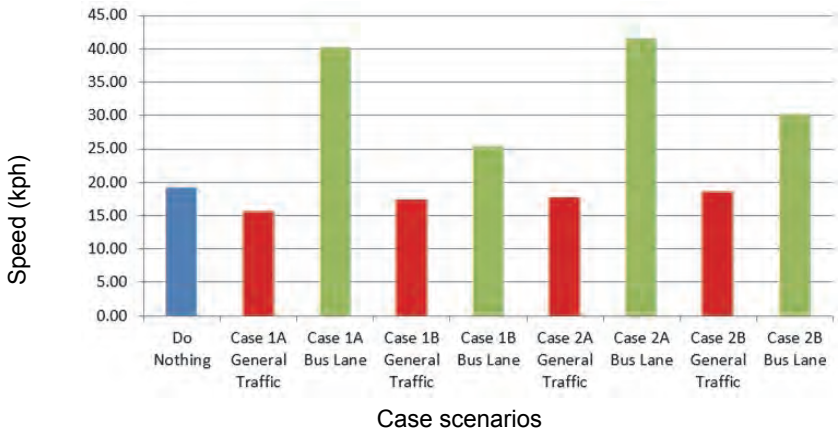
3.2 Results and Discussion

1) Results Using Cube Software

a) Average Travel Speed (Case 1, Case 2)

The graph for the average travel speed in kph was computed using Cube; shown in Figure 3.3.

Figure 3.3: Average Travel Speed in Ortigas



Source: MUCEP Data

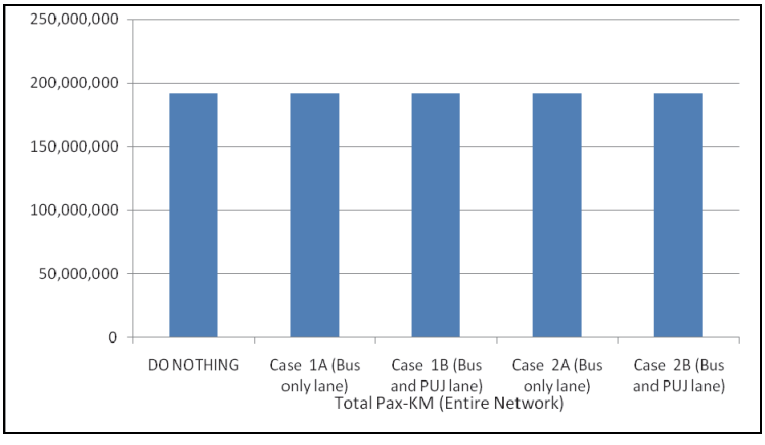
It can be observed that the speeds in both Case 1 and 2 decreased compared to the "do nothing" scenario. This can be attributed to the condition that the capacity of the corridor serving the general traffic has been reduced in order to accommodate the exclusive bus lane project. Expectedly, the speed in the dedicated bus lane rather doubled based on the "do nothing" status. It then decreased as jeepneys (HOVs) were loaded on the traffic stream.

The same behavior of speed changes can be observed in Case 2A and Case 2B.

b) Pax-km (Entire Network, Ortigas Corridor)

Figure 3.4 shows the passenger-kilometer (pax-km) chart for the entire network. Basically, the graph shows the overview of the possible distance travelled by the passengers using the existing transit vehicles. The values computed for the "do nothing" scenario and those of Cases 1 and 2 are obviously identical.

Figure 3.4: Pax-km for the Entire Network

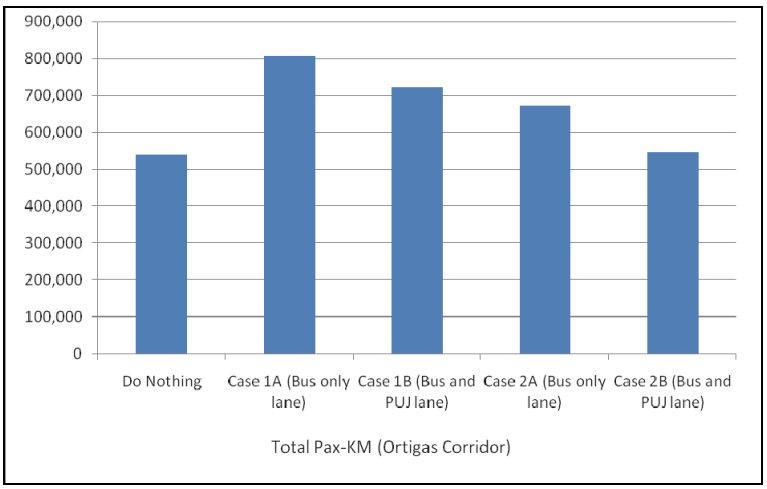


Source: MUCEP Data

Meanwhile in the Ortigas corridor, pax-km shows a rather different tendency. Compared to “do nothing,” the values of Cases 1A and 1B are considerably higher. The same can be observed in Cases 2A and 2B.

Interestingly, on a “case” to “case” level, the trend is decreasing perhaps due to the set up of the analysis where Case 2 (C5 to EDSA) is shorter than Case 1 (C5 to Santolan) in terms of section length.

Figure 3.5: Pax-km for Ortigas Corridor

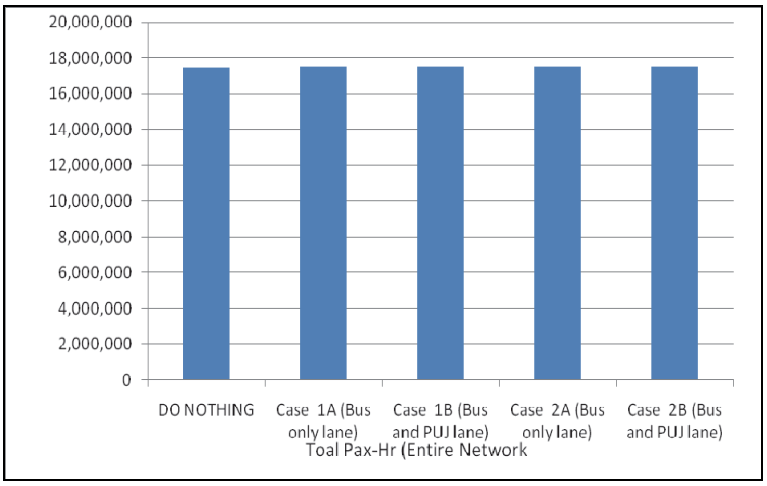


Source: MUCEP Data

c) Pax-Hr (Entire Network, Ortigas Corridor)

For this specific study, the parameter passenger-hour or pax-hr indicates the number of passengers served in the entire network during a specific peak hour. Figure 3.6 shows that “do nothing” and the two-case scenarios are somewhat similar in pax-hr values; there are no evident changes.

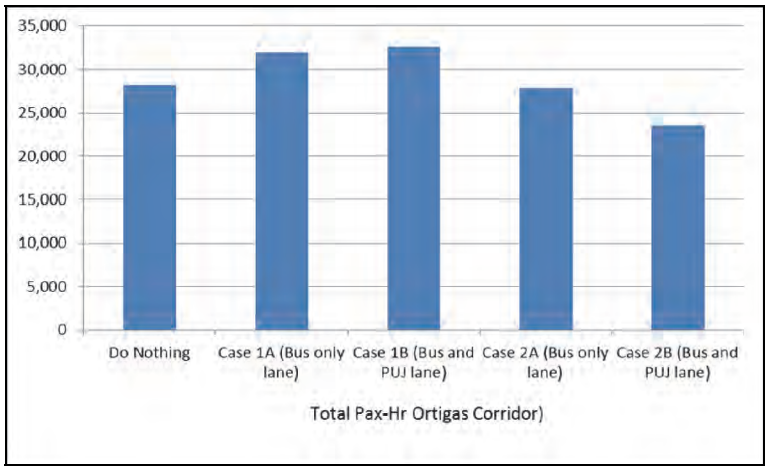
Figure 3.6: Pax-hr for Entire Network



Source: MUCEP Data

Passenger-hour for Ortigas corridor is clearly different from what has been observed for the entire network. Compared to "do nothing," pax-hr in Cases 1A and 1B are higher, while Cases 2A and 2B are slightly lower.

Figure 3.7: Pax-hr for Ortigas Corridor



Source: MUCEP Data

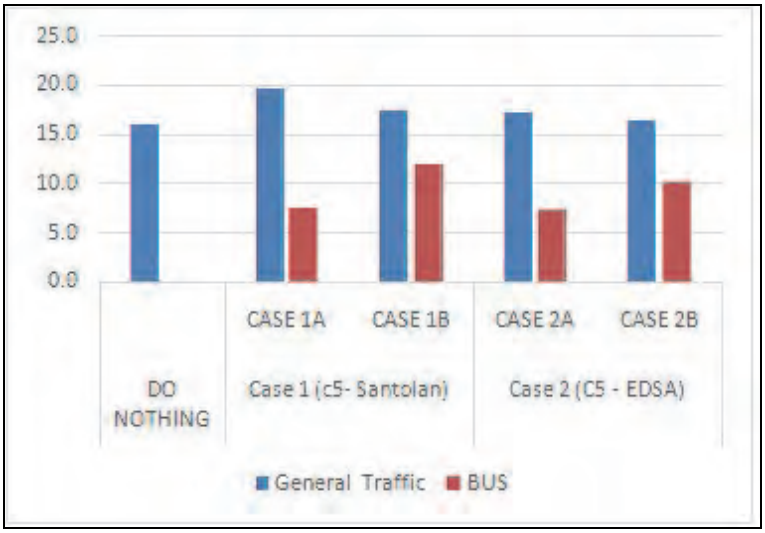
d) Average Travel Time (C5 to Santolan)

Average travel time is also among the factors evaluated in the macrosimulation efforts for this project. It is one of the most used variables in any transportation-related research and project undertakings geared towards measuring or evaluating system and service reliability.

For Ortigas exclusive bus lane, Figure 3.8 shows that the general traffic would tend to incur increased travel time when the project becomes operational. The same condition can be seen across two case scenarios.

The buses, on the other hand, will enjoy notable travel time improvement. However, it deteriorates as other users are loaded onto the exclusive lane.

Figure 3.8: Average Travel Time from C5 to Santolan (min)



Source: MUCEP Data

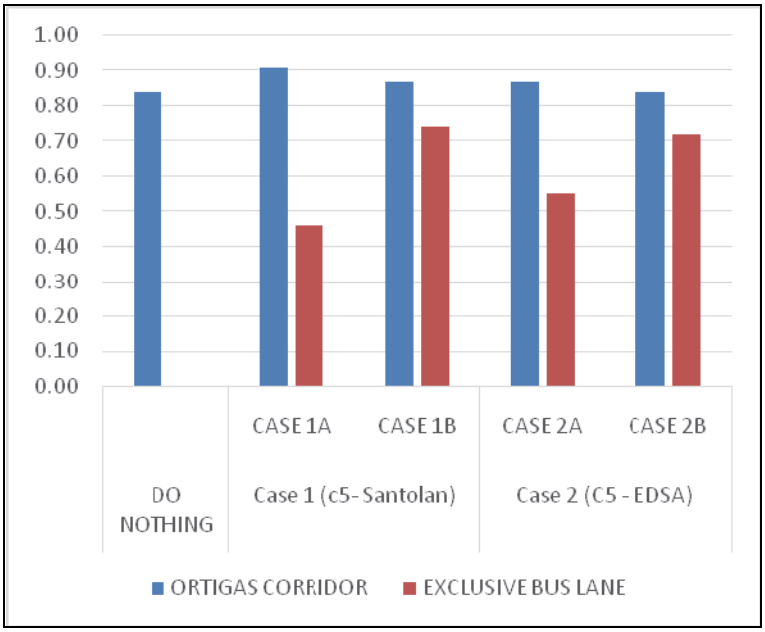
e) Congestion Ratio (C5 to Santolan)

Congestion ratio or volume capacity (V/C) ratio gives an overview of a road section, corridor, or network's traffic status. It gives an idea of how saturated a network is, in terms of traffic volume under reasonable traffic condition, given the existing road capacity.

The general idea is that, values closer to 1 signify that a road section is about to go over the traffic volume that it can accommodate. They may be classified as "near capacity", "at capacity", and "over capacity".

Looking at Figure 3.9 and comparing "do nothing" with the two-case scenarios, it can be assumed that there will be no improvement in terms of V/C. While "do nothing," initially, is already at the "near capacity" classification, implementing the project would only cause further deterioration of the traffic condition in the study corridor.

Figure 3.9: Congestion Ratio (Average V/C)



Source: MUCEP Data

Understandably, the situation in the exclusive bus lane is quite favorable because of its "exclusivity." However, the ratio increases when other vehicles are allowed to use the dedicated bus way. Table 3.1 best shows the image of the V/C ratio in terms of numerical values.

Table 3.1: Average Volume/Capacity Ratio

	Do Nothing	Case 1 (C5- Santolan)		Case 2 (C5 – EDSA)	
		Case 1A	Case 1B	Case 2A	Case 2B
Ortigas Corridor	0.84	0.91	0.87	0.87	0.84
Exclusive Bus Lane		0.46	0.74	0.55	0.72

Source: MUCEP Data

4 MICRO SIMULATION ANALYSIS

In order to further investigate the traffic situation on Ortigas corridor, a 1-hour microsimulation run has been conducted. The inputs were taken from the results of the macrosimulation activity that was performed at the outset of the data analysis.

For this part, three common traffic variables were considered for comparison, namely average delay, average speed, and queue – Expressed in seconds (sec), kilometer per hour (kph), and meters (m), respectively.

The case scenarios considered for this are the following:

(i) Case 1 – With exclusive bus lane; Buses only
(ii) Case 2 – With exclusive bus lane; Buses + HOV (Jeepneys)

Thus, the comparison is then centered on three items – Base condition, Case 1, and Case 2. After identification of the critical points along the corridor under study, the parameter values were calculated for the following:

- Ortigas Ave. **–** Col. B. Serrano (WB)
- Ortigas Ave. **–** C5 (EB)
- Ortigas Ave. **–** C5 (WB)
- Ortigas Ave. **–** EDSA (EB)
- Ortigas Ave. **–** EDSA (WB)

1) Delay on Bus Lane

Looking at the Base Case and Cases 1 and 2, it can be noted that the values increase as vehicle classifications are loaded into the exclusive bus lane.

Base scenario says that Ortigas Ave. **–** Col. B. Serrano (WB) has the biggest delay among the chosen intersections in the study corridor.

Comparing Cases 1 and 2, the values say that delay would tend to increase if high occupancy vehicles are also allowed to use the dedicated lane.

Table 4.1 shows the tabulated values of the delay variable.

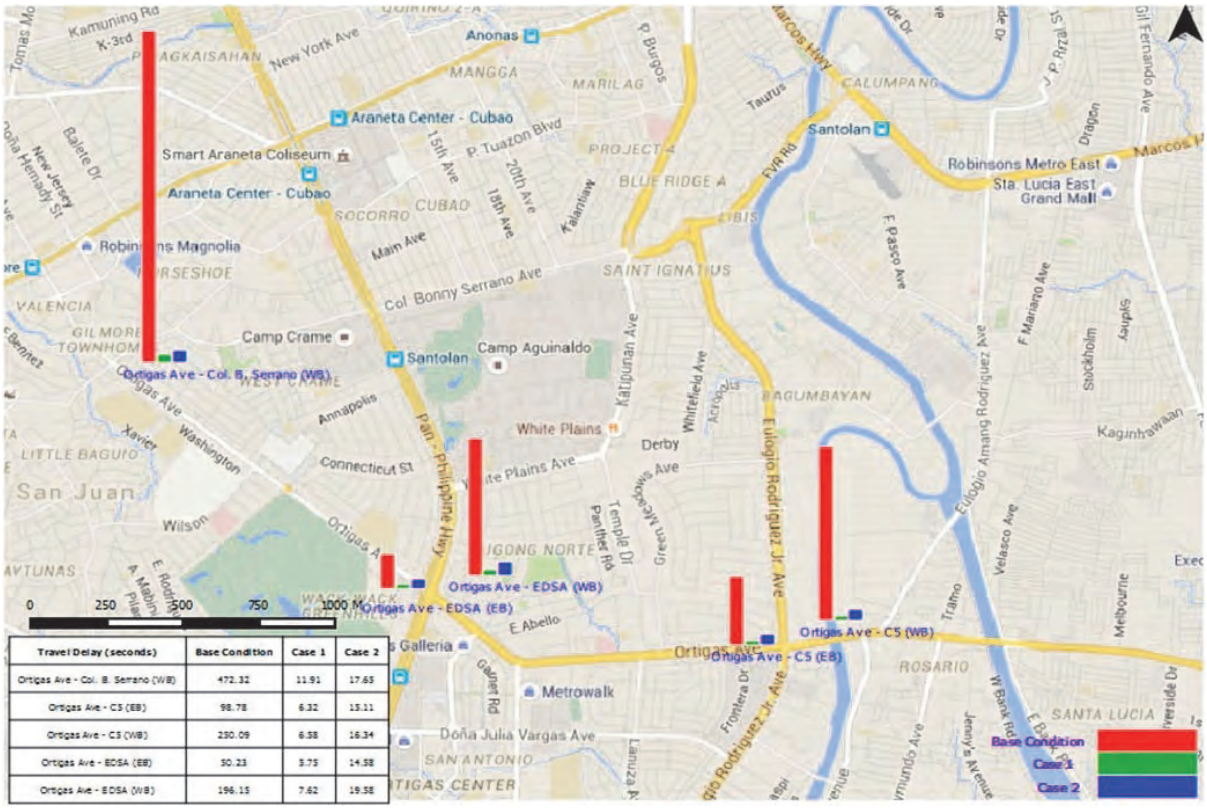
Table 4.1: Average Delay on Exculsive Bus Lane (sec)

Intersections	Base	Case 1	Case 2
Ortigas Ave. – Col. B. Serrano (WB)	572.32	11.91	17.65
Ortigas Ave. – C5 (EB)	98.78	6.32	15.11
Ortigas Ave. – C5 (WB)	250.09	6.58	16.34
Ortigas Ave. – EDSA (EB)	50.23	5.75	14.58
Ortigas Ave. – EDSA (WB)	196.15	7.62	19.58

Source: MUCEP Data

The road network map is shown in Figure 4.1 with the values of the average delays in seconds represented by bar charts.

Figure 4.1: Average Delay (sec)



Travel Delay (seconds)	Base Condition	Case 1	Case 2
Ortigas Ave - Col. B. Serrano (WB)	472.32	11.91	17.65
Ortigas Ave - C5 (EB)	98.78	6.32	15.11
Ortigas Ave - C5 (WB)	250.09	6.58	16.34
Ortigas Ave - EDSA (EB)	50.23	3.75	14.58
Ortigas Ave - EDSA (WB)	196.15	7.62	19.58

Source: Google Maps + Cube data

2) Speed on Bus Lane

Case 1 shows improvement of speed for the buses, relatively by more or less 50% based on the values in the Base Case scenario. A slight reduction can be observed if jeepneys (Case 2) are going to be loaded on the lane. The same trend can be seen in all of the intersections chosen for the microsimulation.

Table 4.2 shows the values of the speed variable.

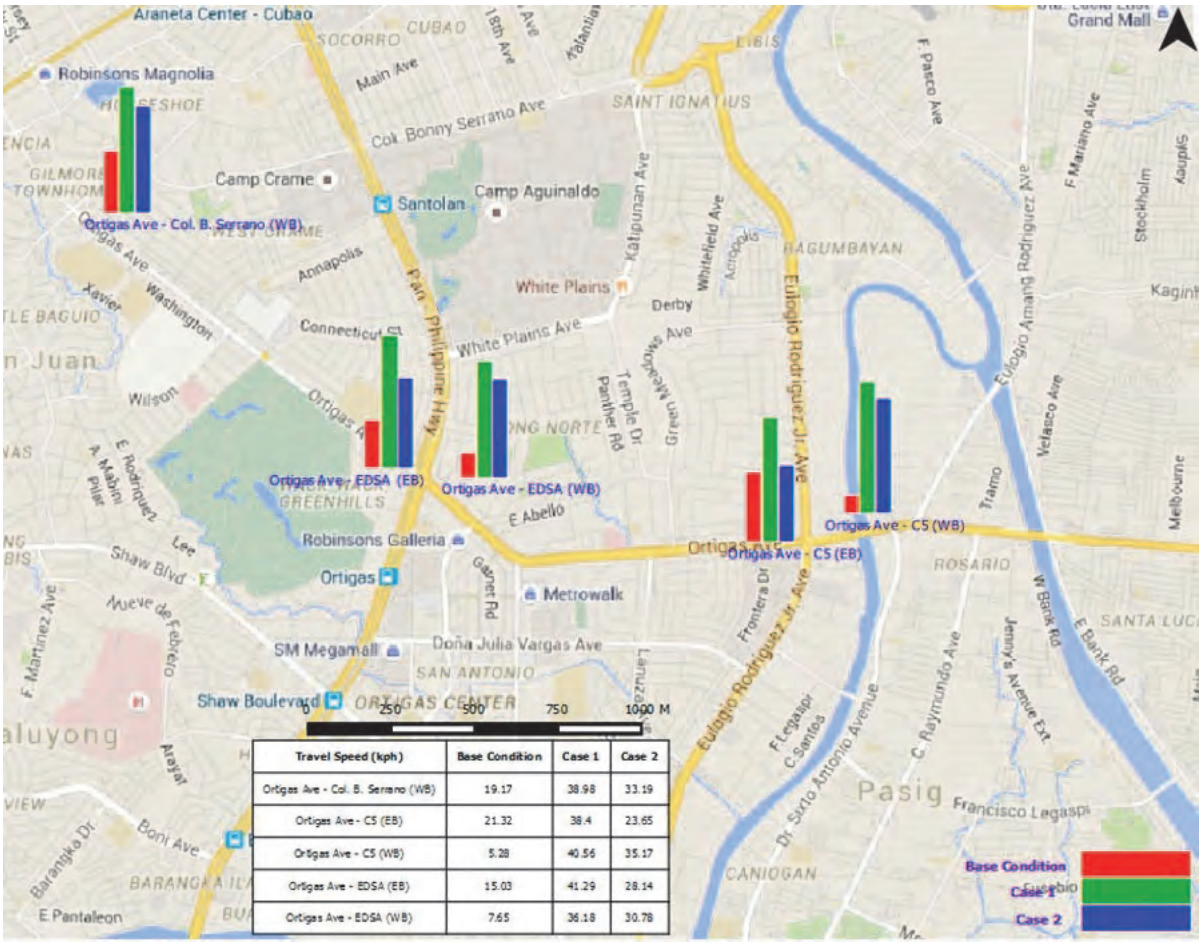
Table 4.2: Average Speed on Eclusive Bus Lane (kph)

Intersection	Base	Case 1	Case 2
Ortigas Ave. – Col. B. Serrano (WB)	19.17	38.98	33.19
Ortigas Ave. – C5 (EB)	21.32	38.4	23.65
Ortigas Ave. – C5 (WB)	5.28	40.56	35.17
Ortigas Ave. – EDSA (EB)	15.03	41.29	28.14
Ortigas Ave. – EDSA (WB)	7.65	36.18	30.78

Source: MUCEP Data

Figure 4.2 below shows the average speed charts as laid on the study corridor.

Figure 4.2: Average Speed (kph)



Travel Speed (kph)	Base Condition	Case 1	Case 2
Ortigas Ave - Col. B. Serrano (WB)	19.17	38.98	33.19
Ortigas Ave - C5 (EB)	21.32	38.4	23.65
Ortigas Ave - C5 (WB)	5.28	40.56	35.17
Ortigas Ave - EDSA (EB)	15.03	41.29	28.14
Ortigas Ave - EDSA (WB)	7.65	36.18	30.78

Source: Google Maps + Cube Data

3) Queue on Bus Lane

Queue values look interesting, when the length has been reduced from around 650 meters (Base Case) to about 90 meters in the case of Ortigas Ave. – Col. B. Serrano (WB). However, the situation worsens when other modes are added to the bus lane.

Table 4.3 shows the queue values calculated via simulation.

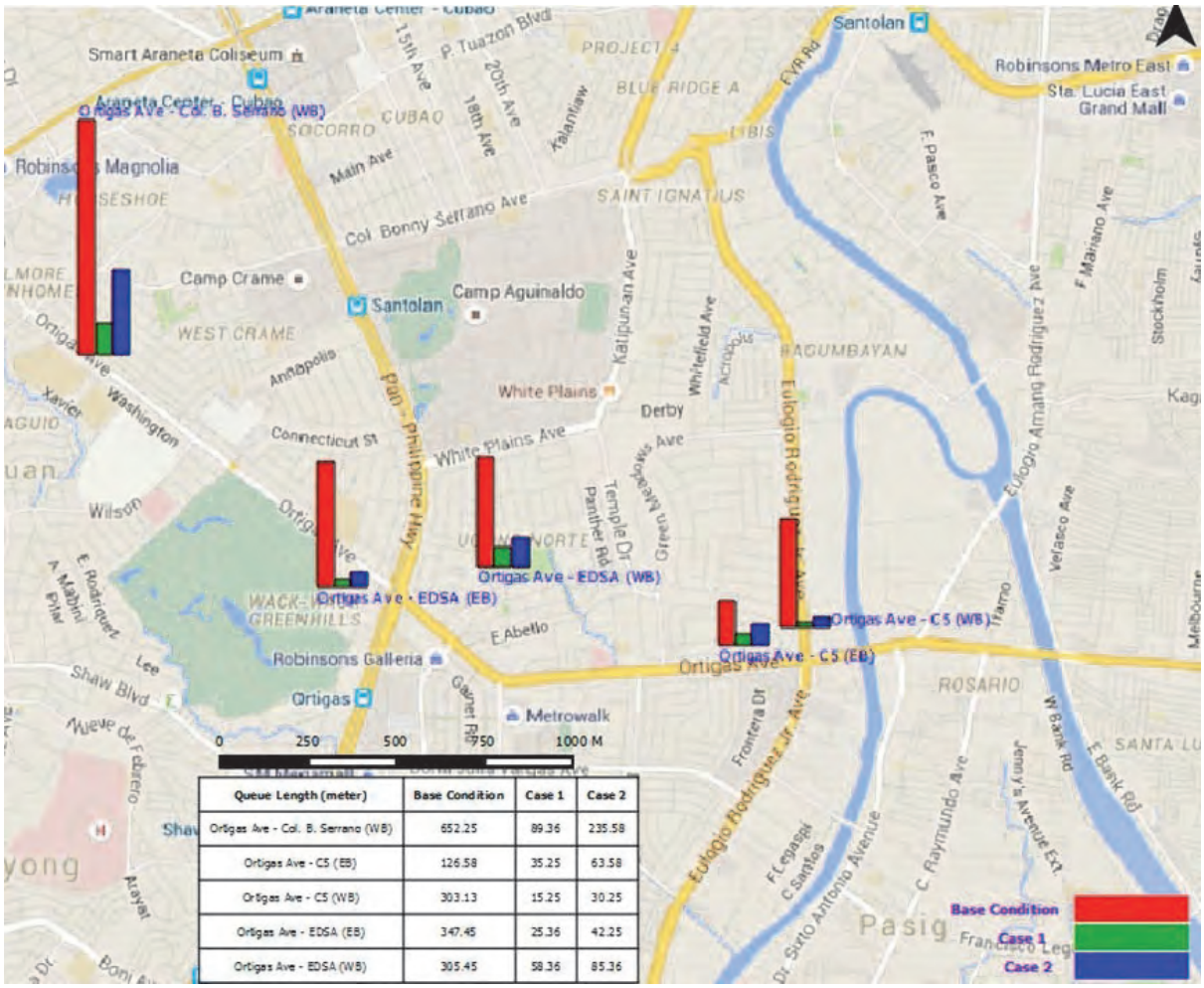
Table 4.3: Queue Length on Exclusive Bus Lane (meter)

Intersection	Base	Case 1	Case 2
Ortigas Ave. – Col. B. Serrano (WB)	652.25	89.36	235.58
Ortigas Ave. – C5 (EB)	126.58	35.25	63.58
Ortigas Ave. – C5 (WB)	303.13	15.25	30.25
Ortigas Ave. – EDSA (EB)	347.45	25.36	42.25
Ortigas Ave. – EDSA (WB)	305.45	58.36	85.36

Source: MUCEP Data

Figure 4.3 shows the bar charts representing the queue values computed for the exclusive bus lane.

Figure 4.3: Queue Length on Bus Lane (meter)



Queue Length (meter)	Base Condition	Case 1	Case 2
Ortigas Ave - Col. B. Serrano (WB)	652.25	89.36	235.58
Ortigas Ave - C5 (EB)	126.58	35.25	63.58
Ortigas Ave - C5 (WB)	303.13	15.25	30.25
Ortigas Ave - EDSA (EB)	347.45	25.36	42.25
Ortigas Ave - EDSA (WB)	305.45	58.36	85.36

Source: Google Maps + Cube Data

4) Delay on Car Lane

The delays on the car lanes are also calculated during the microsimulation process. The values showed tremendous increase in all of the chosen critical intersections, which can be primarily due to the reduction of the road capacity after the implementation of the exclusive bus lane.

Table 4.4 shows the values of the delays in the car lanes.

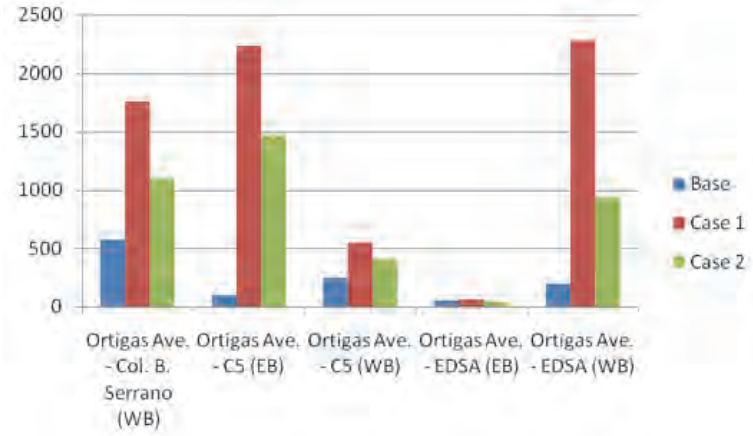
Table 4.4: Delays in the Car Lanes (sec)

Intersection	Base	Case 1	Case 2
Ortigas Ave. – Col. B. Serrano (WB)	572.32	1759.84	1096.49
Ortigas Ave. – C5 (EB)	98.78	2234.15	1465.23
Ortigas Ave. – C5 (WB)	250.09	548.42	402.34
Ortigas Ave. – EDSA (EB)	50.23	59.55	43.86
Ortigas Ave. – EDSA (WB)	196.15	2282.71	933.56

Source: MUCEP Data

Figure 4.4 shows the graph of the delays in the car lanes.

Figure 4.4: Delay on Car Lane (sec)



Source: MUCEP Data

5) Speed on Car Lane

In terms of speed, the values also showed negative impacts to the car lane users. The project tends to adversely affect the vehicles using the remaining lanes after the consideration of the exclusive bus lane.

Looking at Table 4.5, it can be inferred that traffic flow would succumb to an almost immobile state.

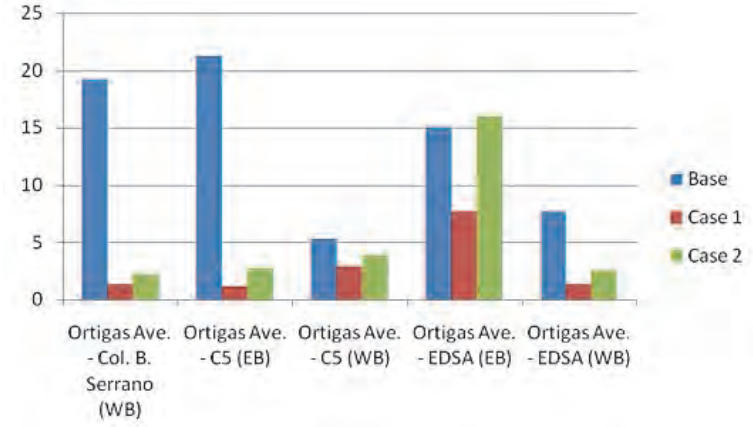
Table 4.5: Speed on Car Lane (kph)

Intersection	Base	Case 1	Case 2
Ortigas Ave. – Col. B. Serrano (WB)	19.17	1.36	2.17
Ortigas Ave. – C5 (EB)	21.32	1.14	2.77
Ortigas Ave. – C5 (WB)	5.28	2.90	3.85
Ortigas Ave. – EDSA (EB)	15.03	7.67	15.95
Ortigas Ave. – EDSA (WB)	7.65	1.32	2.54

Source: MUCEP Data

The following figure shows the bar chart representing the speed values car lanes.

Figure 4.5: Speed on Car Lane (kph)



Source: MUCEP Data

6) Queue on Car Lane

Queue length on the car lanes are shown in Table 4.6. An instant look at the values would show that reducing the capacity of the corridor by dedicating lanes for buses and high occupancy vehicles would tend to further deteriorate traffic condition. There is, however, a slight positive impact on intersections Ortigas Ave. – C5 (EB) and Ortigas Ave. – C5 (WB) where queue lengths are somewhat reduced.

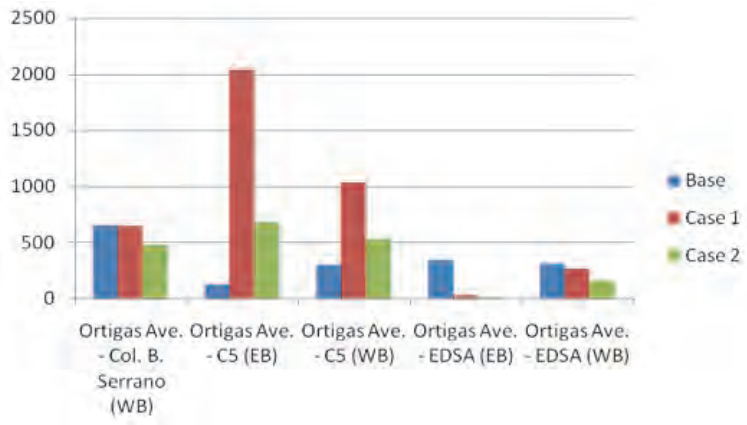
Table 4.6: Queue Length on Car Lanes (meter)

Intersection	Base	Case 1	Case 2
Ortigas Ave. – Col. B. Serrano (WB)	652.25	642.61	476.16
Ortigas Ave. – C5 (EB)	126.58	2043.63	684.33
Ortigas Ave. – C5 (WB)	303.13	1029.24	532.20
Ortigas Ave. – EDSA (EB)	347.45	22.72	8.65
Ortigas Ave. – EDSA (WB)	305.45	260.89	159.61

Source: MUCEP Data

Figure 4.6 shows the chart representing the queue lengths on the car lanes.

Figure 4.6: Queue Length on Car Lanes (meter)



Source: MUCEP Data

5 SUMMARY OF FINDINGS AND CONCLUSIONS

5.1 Summary of Findings

1) Corridor Analysis - BPR Formula Analysis

a) Westbound traffic (AM Peak)

Case 1

- Speed of the general traffic in Case 1 is lower compared to the base case scenario.
- Speed in the bus lane is significantly higher all throughout the length of the corridor.

Case 2

- Speed of the general traffic is almost identical with that of the condition in Case 1.

Case 3

- Speed of the general traffic is similar to what can be seen in Case 2.
- Speed in the bus lane decreased in the first two kilometers of the corridor, then rose to about 60 kph towards the succeeding 1 kilometer, then down to around 40 kph towards the end of the corridor.

b) Eastbound traffic (AM Peak)

Case 1

- Speed of the general traffic in the base case scenario decreased considerably; highest speed computed is around 20 kph.
- There is better speed performance in the bus lane; highest computed is around 60 kph.

Case 2

- The same speed impression for the users of exclusive bus lane.
- Speed of the general traffic somewhat improved compared to that of the observation in Case 1, but still lower than that of the base scenario.

Case 3

- Speed in the bus lane had fluctuations but better than the general traffic.
- Speed of the general traffic under Case 3 is almost the same with that in the base condition.

2) Macro Simulation Analysis

a) Average Travel Speed (Ortigas Corridor)

- Compared to “Do-Nothing”, speed of the general traffic in the entire network decreased in the 4-case scenarios.
- There is increased speed in the dedicated bus lane

b) Pax-km

- Almost the same for the entire network
- “Do-Nothing” vs. Cases 1 & 2: Increased
- Case 1 vs. Case 2: Case 2 is smaller than Case1 (Case 2 is shorter in length)

c) Pax-hr

- Almost the same for the entire network
- "Do-Nothing" vs. Cases 1 & 2: Increased (Pax-hr will increase due to increasing of pax-km)
- Case 1 vs. Case 2: Case 2 is smaller than Case1 (Case 2 is shorter in length)

d) Average Travel Time (Ortigas Corridor)

- "Do-Nothing" vs. Cases (Gen. traffic): Increased
- "Do-Nothing" vs. Cases (Bus): Deceased

e) Congestion Ratio

- "Do-Nothing" vs. Cases (Entire corridor): Increased
- "Do-Nothing" vs. Cases (Bus lane): Improved

3) Microsimulation Analysis

a) Delay

Bus lane

- Delay is reduced significantly compared to the base case scenario.

Car lane

- For both Cases 1 and 2, delay in all of the intersections increased.

b) Speed

Bus lane

- There is significant increase in speed, in both Cases 1 and 2.

Car lane

- Speed decreased in almost all of the intersections.

c) Queue

Bus lane

- Queue is reduced to a large extent (Case 1 and 2).

Car lane

- Queue worsened in almost all of the intersections analyzed.

5.2 Conclusions

Given the hypothetical values derived from the macro simulation efforts, under the conditions stipulated in the limitations and assumptions of the study team, it can be concluded that:

- If the project will be focused on the entire network alone, pax-km and pax-hr will not change dramatically, which means there will be no significant changes.

Within the premise of corridor analysis that is centered on the provision of improved facilities and related conditions for the buses, the project may be a viable option.

- In some cases, pax-km and pax-hr will tend to increase due to additional users. It is perhaps, due to certain improvements observed by the transit users, *i.e.* improved speed, service, etc.

For the exclusive bus lane, the values of delay, speed, and queuing are quite promising under the case scenarios considered. The effects of the dedicated lanes may greatly benefit the buses and the jeepneys. However, it is quite adverse towards the remaining vehicles left to use the corridor outside the exclusive lanes because the delay, speed, and queuing values generally showed negative trends.

In tune with the result of the macrosimulation analysis, it can be said that the exclusive bus lanes would only benefit its designated users.

In this study, the exclusive bus lane was evaluated from the aspect of travel demand by using macro/microanalysis tools. However additional studies including lane design, cost estimation, and financial/economic analysis are necessary in order to conclude whether the exclusive bus lane is useful as a countermeasure against traffic congestion in Metro Manila. Additionally, the action of DOTC according to its mandates will be a crucial element when it comes to project consideration and implementation.

5.3 Lessons Learned from the Pilot Study

First, the study team was able to establish modeling and analysis framework for a transportation network like what Metro Manila has, and in particular, the like of what can be seen in the Ortigas corridor.

Second, the team members had the opportunity to have a series of hands-on with a transport modeling software called Cube.

The abovementioned learning can be of great importance in the next similar undertakings.

5.4 Team Members

1. Jasmin Uson **–** Transportation Development Officer II, DOTC
2. Macky Montana – Engineer III, DPWH
3. Gabrielle Caisip – Engineer II, DPWH
4. Fely Sabas – Planning Officer III, MMDA
5. Luisa Angangan – Planning Officer III, MMDA
6. Sajid Kamid – Research and Extension Specialist, UP-NCTS
7. Allan Arquiza – Corporate Planning Chief, LRTA

Part 2

BONIFACIO GLOBAL CITY
PUBLIC TRANSPORTATION IMPROVEMENT STUDY

1 INTRODUCTION

1.1 Background of the Case Study

As part of the ongoing capacity enhancement training provided by the government of Japan through the Japan International Cooperation Agency (JICA) entitled, "The Project for Capacity Development on Transportation Planning and Database Management in the Republic of the Philippines," counterpart members of the project embarked to undertake a case study relative to a particular public transportation system issue/concern.

The main objective of the capacity enhancement project, otherwise known as MMUTIS Update and Capacity Enhancement Project (MUCEP), is to enable the Department of Transportation and Communications (DOTC) to prepare a public transportation plan of Metro Manila. It aims to improve public transportation planning for Metro Manila, including the coordination among relevant agencies, to be spearheaded by the DOTC.

The expected outputs of the project are the following:

(i) Output 0: Project Preparation.
(ii) Output 1: Improved capacity to manage the Metro Manila transportation database.
(iii) Output 2: Improved capacity to plan the public transportation network of Metro Manila.
(iv) Output 3: Improved capacity to coordinate and formulate policies on public transportation network development in Metro Manila.
(v) Output 4: Periodic monitoring and presentation of outputs.

Upon the approval of the DOTC and the counterpart members, this case study entitled, "The Bonifacio Global City Public Transport Improvement Study" was assigned to be undertaken by the counterpart members from DOTC, Bases Conversion and Development Authority (BCDA), Land Transportation Franchising and Regulatory Board (LTFRB), Light Rail Transit Authority (LRTA) and North Luzon Railways Corporation (NORTHRAIL).

1.2 Rationale of the Case Study

The Bonifacio Global City (BGC) is a rapidly growing and highly urbanized area located in Taguig City, in the southeast portion of Metro Manila. It is a city within a city due to its mixed land use characteristics.

As a rapidly growing and highly urbanized area, BGC is slowly experiencing the problem of traffic congestion on its road network which is also being experienced by other highly urbanized areas in Metro Manila. Owing to its rapid growth, the public transport service inside BGC is also becoming insufficient as evidenced by the long queues at bus stops during peak hours.

The study area or BGC is not connected to any mass transit or railway lines; its main public transport services are the BGC Bus and jeepneys (as feeders).

The above-mentioned characteristics and the availability of relevant data were the main considerations why BGC was chosen to be the study area of this case study.

1.3 Objectives of the Case Study

The objectives of the case study are the following:

(i) To develop a traffic model for BGC reflecting the current traffic situation using data generated from MUCEP and data gathered from relevant government agencies and private entities;

(ii) To evaluate the current public transport system servicing BGC and to identify the deficiencies in the system;

(iii) To develop and evaluate improvement measures to mitigate the identified deficiencies in the public transport system taking into account the policies of BGC and existing transport policies, rules and regulations;

(iv) To forecast the current public transport system (with improvement measures) to horizon years 2020 and 2025 and identify deficiencies in the system;

(v) To propose potential improvement measures to mitigate the identified deficiencies in the future public transport system; and

(vi) To document the process done for the case study, this will serve as the model for evaluation of public transport systems for districts similar to BGC.

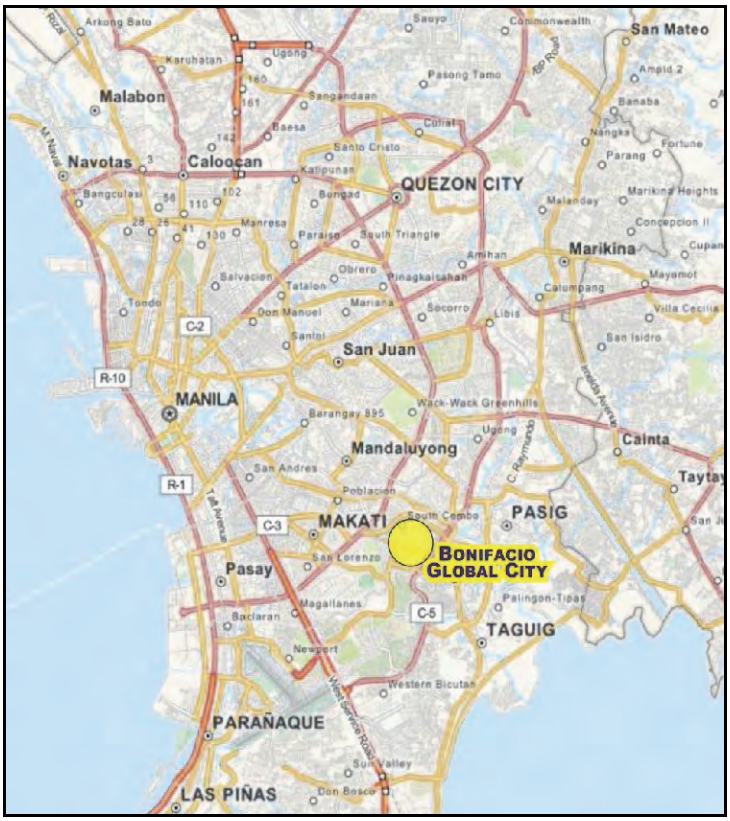
1.4 Case Study Area

The map of the case study area is shown in Figure 1.1. A physical tour on this area will give one an idea that it is a city within a city due to its mixed land use characteristics. In essence, it can be considered as a “compact city,” wherein it promotes low carbon development and a “walkable” city due to the proximity of the different land uses which includes business/office establishments, residential areas, commercial developments and institutional establishments.

BGC is considered as a private estate, including its roads. It is currently being managed by an estate manager, the Bonifacio Estate Services Corporation (BESC), a wholly-owned subsidiary of Fort Bonifacio Development Corporation (FBDC).

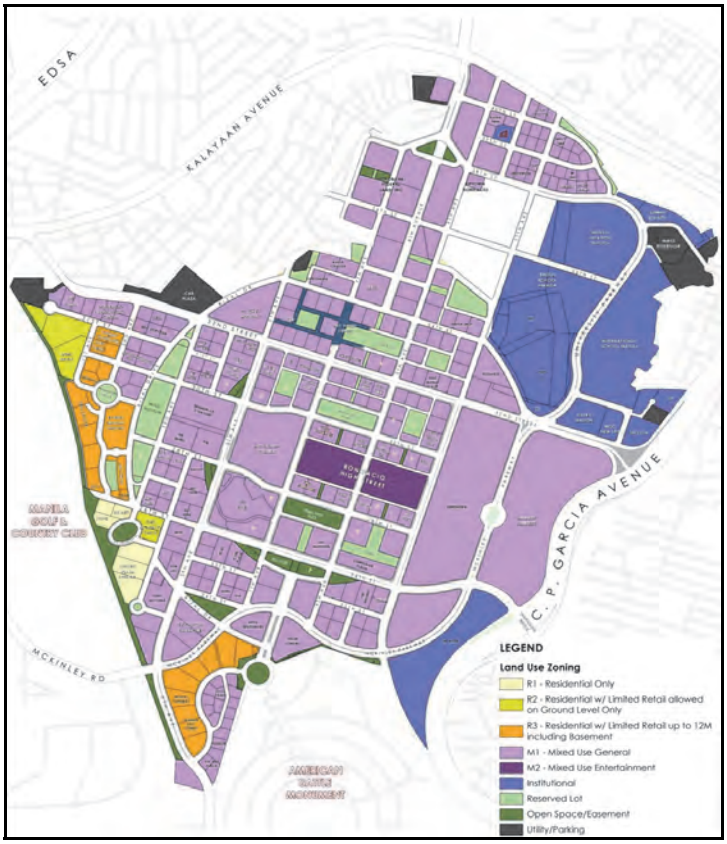
The current land uses in BGC is shown in Figure 1.2. The same map will show that majority of it land use is classified as “mixed-use” which is a combination of residential, office or commercial uses. Majority of the office buildings are being occupied by business process outsourcing (BPO) companies. Areas near Manila Golf and Country Club are devoted for residential use, while a large chunk on the northeast portion of BGC is for institutional use (mainly educational).

Figure 1.1: Case Study Area



Source: MapQuest

Figure 1.2: Current Land Uses in BGC

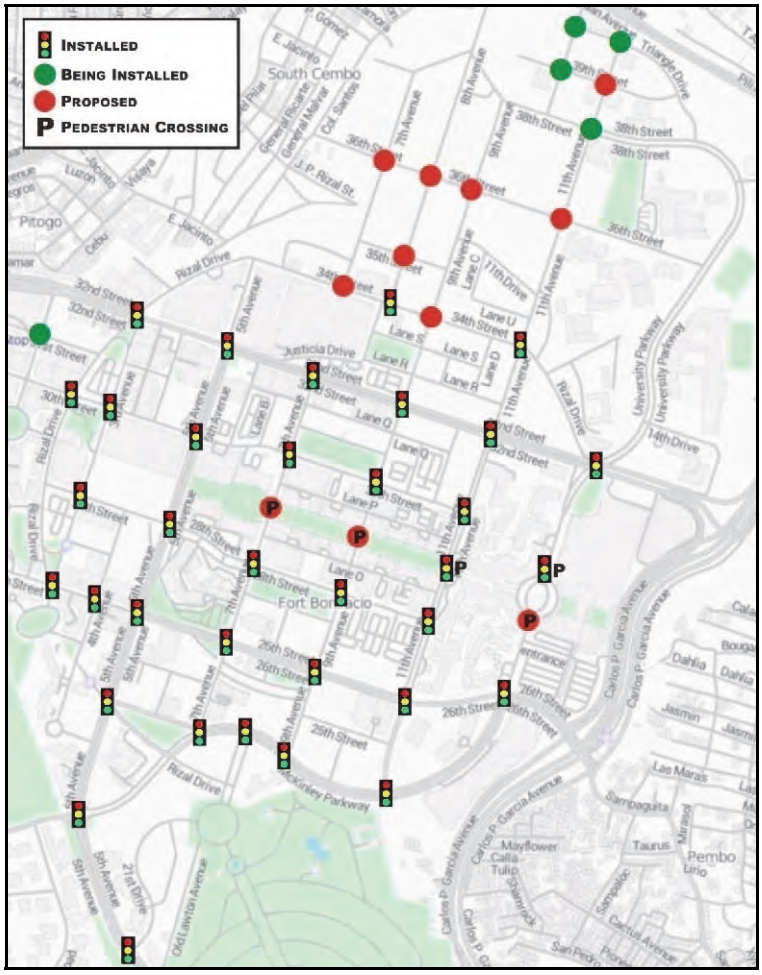


Source: BCDA

2 TRANSPORTATION SYSTEM IN BGC

The traffic signals inside BGC are installed in 33 major intersections and 2 pedestrian crossings. Their locations are shown in Figure 2.1 below. Each intersection has its own controller, except for two locations where the two intersections share one controller – The Rizal Drive / 30th Street and 3rd Avenue / 30th Street, and 4th Avenue / 26th Street and 5th Avenue / 26th Street.

Figure 2.1: Locations of Traffic Signals

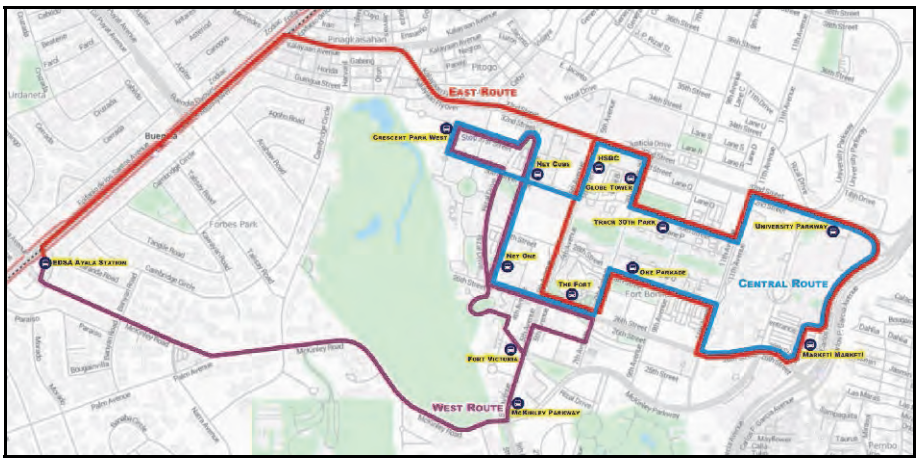


Source: FBDC; Open Street Map

The BGC Bus serves as the main public transport service inside BGC. It is managed by the FBDC affiliate Bonifacio Transit Corporation (BTC). BGC Bus operates 24 hours in its designated routes.

BGC Bus has three (3) regular routes: (a) Central Route, (b) West Route, and (c) East Route. They operate from Monday to Sunday from 6:00 AM to 10:00 PM. The map of the regular bus route is shown in Figure 2.2.

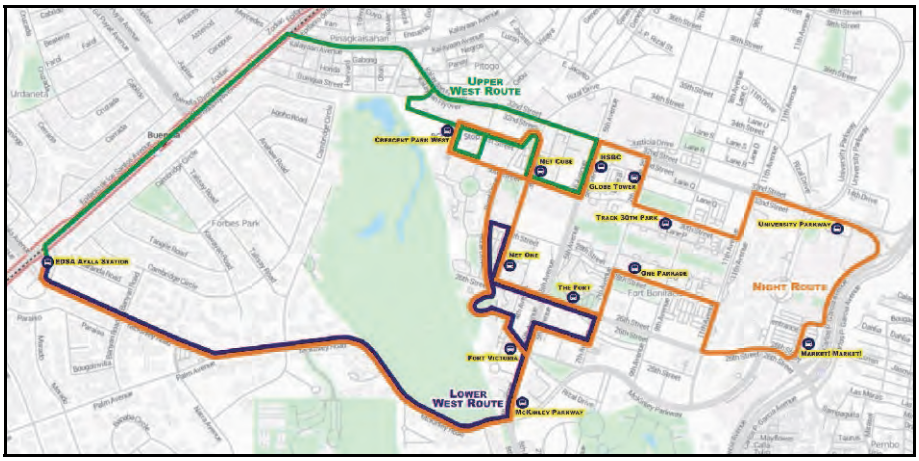
Figure 2.2: Regular BGC Bus Routes



Source: BTC; Map Open Street Map

To augment the services provided by the regular routes during peak hours, BGC Bus operates two (2) additional special routes: (a) Lower West Route and (b) Upper West Route. They operate during weekdays (Monday to Friday) from 6:00 AM to 10:00 AM and 5:00 PM to 10:00 PM. Further, BGC Bus also has the Night Route operation during off peak hours (10:00 PM to 6:00 AM), all days of the week (Monday to Sunday). The map of the special bus route is shown in Figure 2.3 below.

Figure 2.3: Special BGC Bus Routes



Source: BTC; Open Street Map

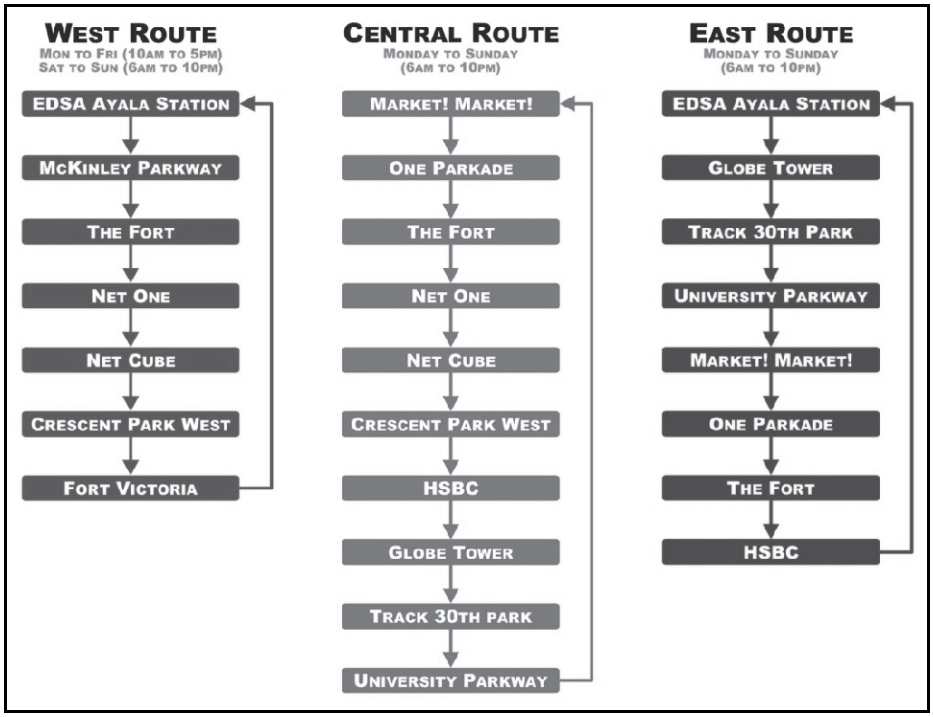
The current fleet size for BGC Bus is 45 buses, wherein 27 buses (including 8 new buses that were recently delivered) are directly owned by BTC while the remainder (18 buses) are provided by a third party bus operator (H.M. Transport). BTC had procured 15 new buses that will beef up its fleet size to 52 buses. There will be seven (7) more buses that will be delivered within 2015.

The BTC-owned buses are configured for commuter service and, thus, have lesser seats (seating capacity of only 37 passengers) and more spaces for standees (total bus capacity of 70 passengers). The third party buses are configured similar to other air-conditioned Metro Manila buses: Only one door near the driver and more seats for passengers (seating capacity of 56 passengers and total bus capacity of 65 passengers). The fare for the BGC Bus is ₱12.00 for all routes.

There are currently thirteen (13) bus stops – Twelve (12) inside BGC and one (1) outside

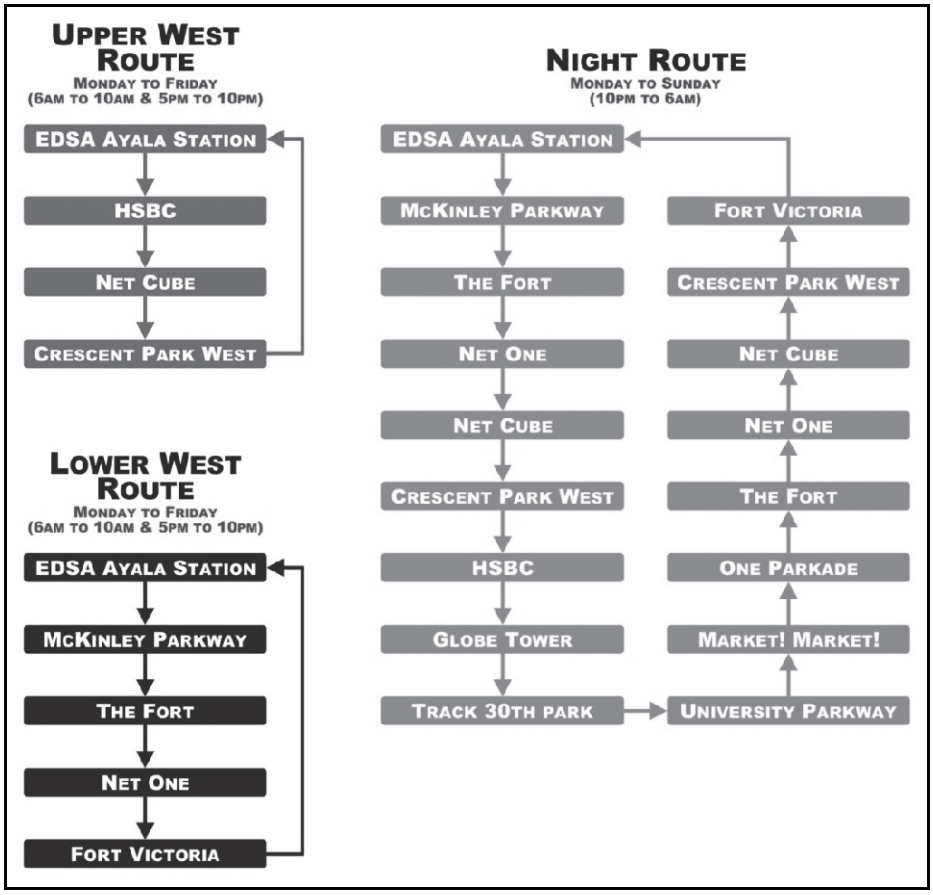
BGC (EDSA Ayala Station). The lists of different bus stops for regular and special routes are illustrated in Figures 2.4 and 2.5.

Figure 2.4: List of Bus Stops for Regular BGC Routes



Source: BTC

Figure 2.5: List of Bus Stops for Special BGC Routes

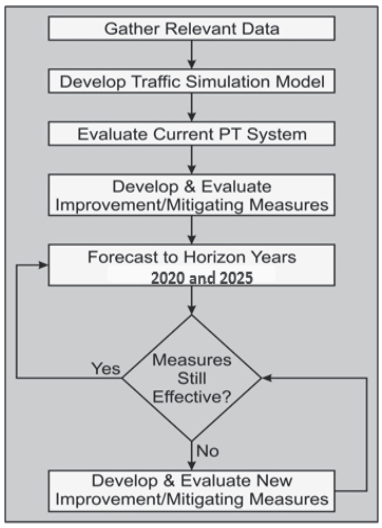


Source: BTC

3 METHODOLOGY

To better illustrate the flow of the different processes that were undertaken by the case study group, the work program in Figure 3.1 is hereby presented.

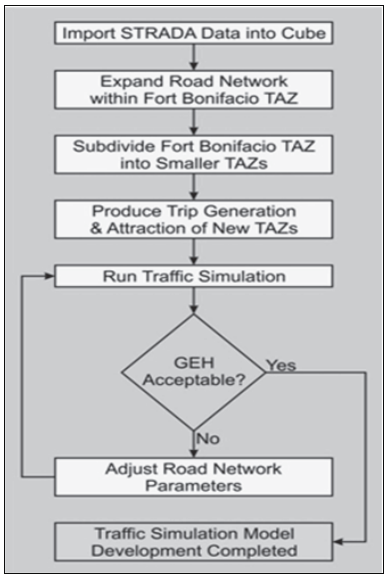
Figure 3.1: Work Program



The conventional four-step model in travel demand forecasting was used in order to develop the traffic simulation model. The key objective of the four-step model is to determine the present and future traffic volumes on the road network under various assumptions of road and land use changes.

The traffic simulation model is necessary in order for the proponents of the case study to evaluate the current public transport system within the study area and consequently to develop and evaluate improvement/mitigating measures. In developing the traffic simulation model of the public transportation system in BGC, Cube was used in the case study. Cube is a suite of software for transportation planning developed by Citilabs. Figure 3.2 below is the work program for the development of the traffic simulation model in Cube.

Figure 3.2: Work Program for the Development of Traffic Simulation Model

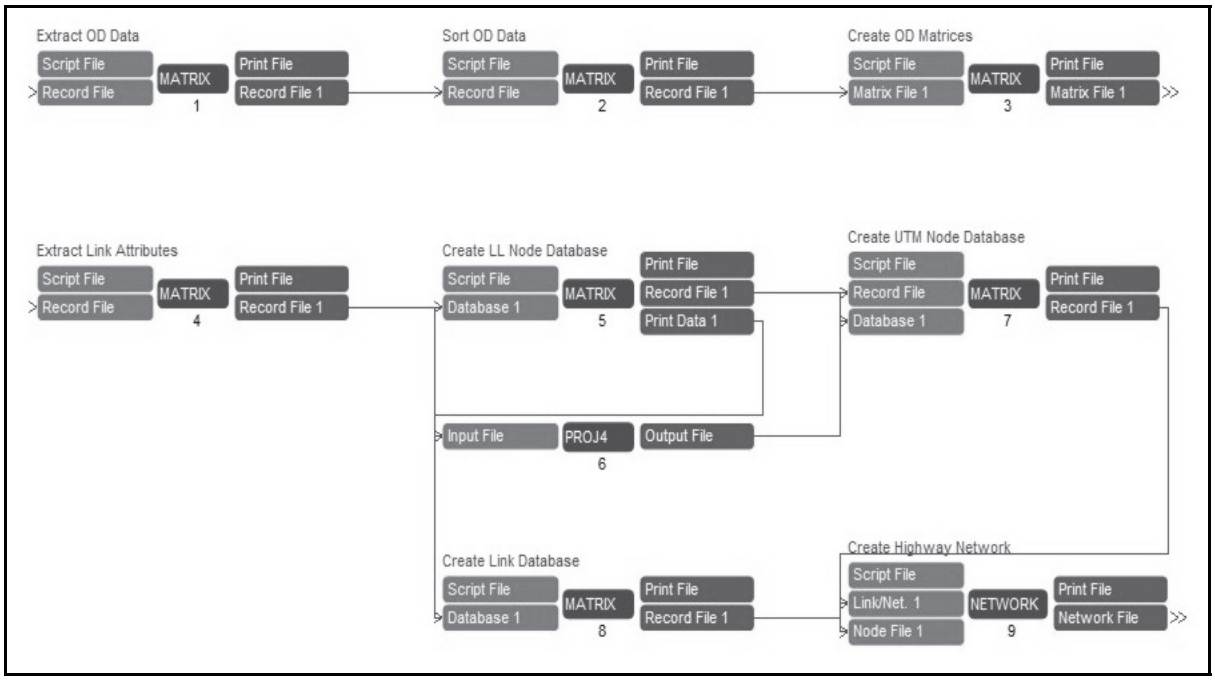


3.1 Data Preparation

The initial step in the development of the traffic simulation model is the importation of the Origin/Destination (OD) matrices and highway network data of MUCEP into Cube. The ultimate aim is to generate the OD matrices and the graphical highway network of BGC, which is needed in the first step of the four-step model in travel demand forecasting – The trip generation.

The OD matrices and highway network data of MUCEP were developed using the STRADA software, a transportation planning software suite developed by JICA for use in its technical cooperation projects in developing countries. Since the OD matrices and the highway network data of MUCEP are not compatible with Cube, it has to be imported into the software so that the data will be converted into a format that is compatible with and usable in Cube. Figure 3.3 shows the Cube flowchart for the importation of STRADA data into Cube.

Figure 3.3: Cube Flow Chart for Importation of STRADA Data Into Cube



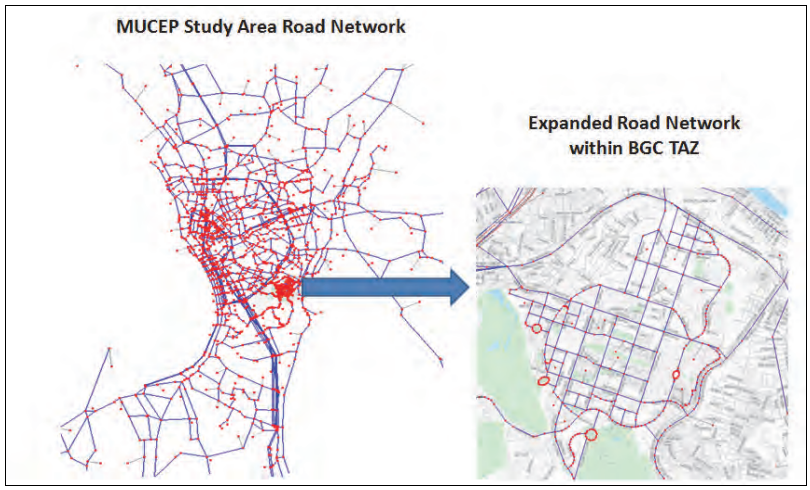
Source: Cube

The MUCEP Study Area Road Network within Fort Bonifacio Traffic Analysis Zone (TAZ) had to be expanded and then subdivided into smaller TAZs in order to develop the road network inside BGC as illustrated in Figure 3.4.

The MUCEP OD matrix was used in order to generate the vehicle OD matrix, which is used along with the highway network data of the MUCEP study area and the expanded road network within the BGC TAZ to extract the OD of the external zones (Figure 3.5).

The OD of the external zones is the basis in the generation of the G/A trips for external zones – Zones 17 to 25, as presented in Table 3.1. Extraction of the G/A from external zones is necessary to be able to determine the trip demands from external zones that pass through BGC and the trip demands from BGC to the external zones. External zones represent the ingress and egress of the TAZ (BGC).

Figure 3.4: MUCEP Study Area Road Network and the Expanded Road Network Within BGC TAZ



Source: Cube

Figure 3.5: Traffic Analysis Zones

Source: Open Street Map

Table 3.1: G/A Trips for External Zones

Zone	Prod	ATT
17	262158	257540
18	214419	197021
19	29964	20439
20	52417	91783
21	68361	61889
22	47236	46954
23	50447	32184
24	42693	57320
25	60851	63416

Source: Cube

The TAZ (Figure 3.6) is divided into sixteen (16) zones based on the locations of existing bus stops.

3.2 Trip Generation

Trip generation is the first step in the conventional four-step transportation planning process, widely used for forecasting travel demands. It predicts the number of trips originating in or destined for a particular traffic analysis zone and is used to calculate person trips using the formula below.

Total Person Trips = Σ (Floor Area x No. of People i/Floor Area x Trip Rates i)

Where i = Land Use Classification

The trip generation equations were established using the MUCEP Household Interview Surveys (HIS) data. The trips captured in the HIS data are classified into work, school, business, private, and home (Figure 3.6).

To be able to predict the number of trips originating in or destined within the BGC TAZ, several assumptions (Table 3.2) were made based on the existing conditions of BGC. The Gross Floor Area (GFA – Figure 3.7) of BGC has been converted into population (daytime and nighttime) based on land use and intensity per zone.

Table 3.4 shows the trip production/attraction by purpose of the internal zones (Zones 1-16) and Table 3.5 shows the trip production/attraction per zone (Zones 1-25).

Figure 3.6: MUCEP Trip Generation/Attraction Model

The MUCEP trip generation and attraction rates by trip purpose are as follows:

Work:
GENERATION = $0.3063P_N + 1124.83$
ATTRACTION = $0.7539W2_D + 0.9288W3_D + 630.78$

School:
GENERATION = $1.2885S1_N + 0.6961S2_N + 1046.67$
ATTRACTION = $1.0269S1_N + 1.1197S2_N + 824.10$

Business:
GENERATION = $0.2906W1_N + 0.1561(W2_N + W3_N) + 33837.62D + 1506.73$
ATTRACTION = $0.2579W1_D + 0.2006(W2_D + W3_D) + 27967.75D + 776.99$

Private:
GENERATION = $0.2001P_N + 0.0435P_D + 1986.04$
ATTRACTION = $0.2891(W1_D + W2_D + W3_D) + 0.4866(S1_D + S2_D) + 45019.16D + 1543.98$

Home:
GENERATION = $1.5509(W1_D + W2_D + W3_D) + 0.7956S1_D + 1.6794S2_D + 4339.60$
ATTRACTION = $0.8911P_N + 3868.03$

Source: MUCEP Data

Table 3.2: Assumptions in Converting GFA Into Population

Assumptions:	Values	
Occupancy rate for residential units	60%	
% Of GFA are family units	60%	
% Of GFA are studio units	40%	
GFA per family units	120	
GFA per studio unit	50	
# Residents per family unit	3	
# Residents per studio unit	1	
GFA per employee (office)	10	
GFA per employee (commercial)	25	
GFA per employee (institutional)	100	
GFA per customer (commercial)	10	
GFA per visitor (institutional 3)	250	
GFA per student (elementary)	20	
GFA per student (high school/university)	20	
% Residents working	60%	
% Primary night time worker	20%	908
% Secondary night time worker	16%	747
% Tertiary night time worker	64%	2,979
% Primary daytime worker	5%	2,824
% Secondary daytime worker	20%	11,305
% Tertiary daytime worker	75%	43,343
% Elementary students	60%	
% High school/University students	40%	
Dummy	0	

Source: MUCEP Data

Table 3.3: Zonal Data for BGC

Zonal Data for BGC					
Zone	Zone Name	Office	Residential	Commercial	Institutional
801	Uptown	97,432.7-0	60,790.53	323.89	4,124.06
802	North Bonifacio	130,998.43	172,049.03	84,032.88	0
803	University Park	0	0	0	131,429.37
804	Avida	196,466.24	213,576.10	3,030.69	0
805	Crescent Park West	125,244.98	247,762.14	1,404.56	0
806	Net Cube	180,318.03	44,008.98	153,131.35	6,100.00
807	HSBC	108,877.08	0	34,827.57	0
808	Globe Tower	128,553.08	25,499.23	25,847.65	0
809	Track 38th Park	166,010.28	0	45,031.54	0
810	University Parkway	0	212,425.60	196,773.05	65,712.26
811	Net One	146,876.31	335,040.71	33,116.48	0
812	The Fort	176,638.81	46,869.13	45,836.47	0
813	One Parade	67,208.19	167,728.34	72,396.36	0
814	Market Market	61,357.34	357,072.30	9,295.22	0
815	Fort Victoria	62,386.70	214,054.11	1,970.62	0
816	McKinley Parkway	39,532.84	414,393.01	0	0

Source: MUCEP Study Team

Table 3.4: Trip Generation/Attraction of Internal Zones (TAZ)

Zone	Work_G	Work_A	School_G	School_A	Business_G	Business_A	Private_G	Private_A	Home_G	Home_A	Zonetot_G	Zonetot_A	Total_G	Total_A
1	1147.19	4162.96	1063.07	840.56	1514.89	1625.01	2191.18	2748.95	10803.75	3933.08	16720.08	13310.56	16720.08	13310.56
2	1124.83	630.78	1046.67	824.10	1506.73	776.99	1986.04	1543.98	4339.60	3868.03	10003.87	7643.88	26723.95	20954.44
3	1124.83	1385.41	1046.67	824.10	1506.73	958.30	2218.55	3968.88	11214.72	3668.03	17111.49	11004.73	43835.44	31959.17
4	1124.83	2584.22	1046.67	824.10	1506.73	1245.96	2095.53	2210.36	7914.42	3868.03	13688.18	10732.67	57523.63	42691.84
5	1962.56	5117.42	1672.05	1456.97	1809.78	1854.35	2767.91	3074.76	12551.62	6305.19	20763.92	17808.70	78287.55	60500.54
6	1273.69	10885.01	1157.56	936.20	1560.60	3239.12	2673.02	5042.38	23107.04	4301.10	29771.91	24403.81	108059.46	84904.35
7	1124.83	4147.87	1047.67	824.10	1506.73	1621.60	2272.66	2744.03	10777.39	3868.03	16728.28	13205.63	124787.73	98109.98
8	1211.21	5504.61	1110.69	888.68	1537.97	1947.34	2371.37	3206.88	13260.38	4119.32	19491.62	15666.84	144279.35	113776.82
9	1124.83	5647.27	1046.67	824.10	1506.73	1981.50	2380.67	3255.45	13520.93	3868.03	19579.83	15576.35	163859.18	129353.17
10	1580.60	5451.91	1386.54	1167.84	1671.72	1934.48	3169.75	3727.34	14909.52	5193.99	22718.14	17475.55	186577.32	146828.72
11	1747.54	5244.07	1511.54	1294.58	1732.05	1884.64	2719.88	3117.84	12782.70	5679.64	20493.71	17220.77	207071.03	164049.49
12	1124.83	6540.09	1046.67	824.10	1506.73	2195.97	2429	3560.16	15155.58	3868.03	21262.81	16988.36	228333.83	181037.85
13	1124.83	3125.62	1046.67	824.10	1506.73	1375.98	2333.26	2395.09	8905.45	3868.03	14916.94	11588.82	243250.77	192626.67
14	1928.87	5439.43	1646.59	1431.02	1797.62	1931.67	3375.34	3184.62	13140.96	6207.17	21889.38	18193.91	265140.15	210820.58
15	1641.25	3273.68	1432.36	1214.53	1693.43	1411.60	2469.48	2445.68	9176.86	5370.42	16413.38	13715.92	281553.52	224536.49
16	2115.10	1759.19	1785.70	1571.83	1865.03	1048.03	2690.91	1929.06	6405.40	6748.96	14862.13	13057.07	296415.66	237593.56

Source: Cube

Table 3.5: Trip Generation/Attraction Per Zone

Zone	P	A	Zone	P	A
1	16720	13311	16	14862	13057
2	10004	7644	17	262158	257540
3	17111	11005	18	214419	197021
4	13688	10733	19	29964	20439
5	20764	17809	20	52417	91783
6	29772	24404	21	68361	61889
7	16728	13206	22	47236	46954
8	19492	15667	23	50447	32184
9	19580	15576	24	42693	57320
10	22718	17476	25	60851	63416
11	20494	17221			
12	21263	16988			
13	14917	11589			
14	21889	18194			
15	16413	13716			

Source: Cube

3.3 Trip Distribution

Trip distribution is the second component in the conventional four-step transportation planning process. This step matches trip makers' origins and destinations to develop a "trip table," a matrix that displays the number of trips going from each origin to each destination.

The Fratar Model is used to produce the trip matrix between origin and destination. Figure 3.7 shows the numerical representation of the OD based on trip generation of Zones 1–25.

Figure 3.7: OD Table Based on Trip Distribution

*1 Trip

	Sum	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	1091402	13664	7861	11317	11036	17415	24932	13579	16018	16018	17479	17040	17468	11917	17848	13551	12363	264660	202646	21017	94386	63644	48286	33096	58946	65215
1	16260	175	101	145	141	223	319	174	205	205	224	218	224	153	229	174	158	4755	3286	276	1265	864	643	442	782	879
2	9737	105	60	87	85	134	191	104	123	123	134	131	134	91	137	104	95	2848	1968	165	757	517	385	264	468	527
3	16655	179	103	149	145	229	327	178	210	210	229	224	229	156	234	178	162	4872	3366	282	1295	885	659	452	801	901
4	13325	143	83	119	116	183	262	143	168	168	184	179	183	125	187	142	130	3897	2693	226	1036	708	527	362	641	720
5	19556	211	121	174	170	268	384	209	247	247	269	263	269	184	275	209	190	5720	3953	331	1521	1039	773	531	941	1057
6	28862	311	179	257	251	396	567	309	364	364	398	387	397	271	406	308	281	8442	5833	489	2245	1533	1141	784	1388	1561
7	16282	175	101	145	142	223	320	174	205	205	224	219	224	153	229	174	159	4763	3291	276	1266	865	644	442	783	880
8	18904	204	117	169	164	259	371	202	239	239	260	254	260	178	266	202	184	5530	3821	320	1470	1004	747	513	909	1022
9	19059	205	118	170	166	261	374	204	241	241	262	256	262	179	268	203	186	5574	3852	323	1482	1012	754	518	917	1031
10	21757	234	135	194	189	299	427	233	275	275	300	292	299	204	306	232	212	6364	4397	369	1692	1156	860	591	1046	1176
11	19464	210	121	174	169	267	382	208	246	246	268	261	268	183	274	208	190	5692	3933	330	1514	1034	769	529	936	1052
12	20697	223	128	185	180	284	407	221	261	261	285	278	285	194	291	221	202	6054	4183	351	1610	1099	818	562	995	1119
13	14516	156	90	129	126	199	285	155	183	183	200	195	200	136	204	155	141	4247	2935	246	1129	771	574	394	698	785
14	20679	223	128	184	180	284	406	221	261	261	285	278	285	194	291	221	201	6048	4179	350	1608	1098	818	562	995	1118
15	15574	168	96	139	135	214	306	167	197	197	214	209	214	146	219	166	152	4555	3148	264	1211	827	616	423	749	842
16	13693	147	85	122	119	188	269	147	173	173	189	184	188	129	193	146	133	4005	2767	232	1065	727	541	372	659	740
17	255010	3893	2239	3224	3144	4961	7103	3869	4563	4563	4980	4854	4977	3395	5084	3860	3522	0	72317	6134	28110	19181	14294	9817	17392	19534
18	208757	2827	1626	2341	2283	3603	5159	2810	3314	3314	3616	3525	3614	2466	3692	2803	2558	76071	0	4453	20416	13935	10381	7130	12630	14190
19	29166	319	184	264	258	407	583	317	374	374	408	398	408	278	417	317	289	8684	5999	0	2306	1575	1172	805	1426	1604
20	51026	596	343	494	482	760	1088	593	699	699	763	744	763	520	779	592	540	16160	11174	939	0	2942	2191	1505	2665	2995
21	66544	757	435	627	611	965	1381	752	887	887	968	944	968	660	989	751	685	20543	14199	1192	5469	0	2780	1910	3382	3802
22	45980	515	297	427	416	657	941	512	604	604	659	643	659	450	673	511	466	14000	9675	812	3724	2543	0	1300	2303	2589
23	49107	543	313	450	439	692	991	540	637	637	695	677	695	474	710	539	492	14768	10203	855	3925	2681	1995	0	2427	2729
24	41557	470	270	389	380	599	858	467	551	551	602	586	601	410	614	466	425	12764	8822	740	3397	2320	1727	1186	0	2362
25	59235	675	388	559	545	860	1231	670	791	791	863	841	862	588	881	669	610	18304	12652	1062	4873	3328	2477	1702	3013	0

Source: Cube

3.4 Modal Split

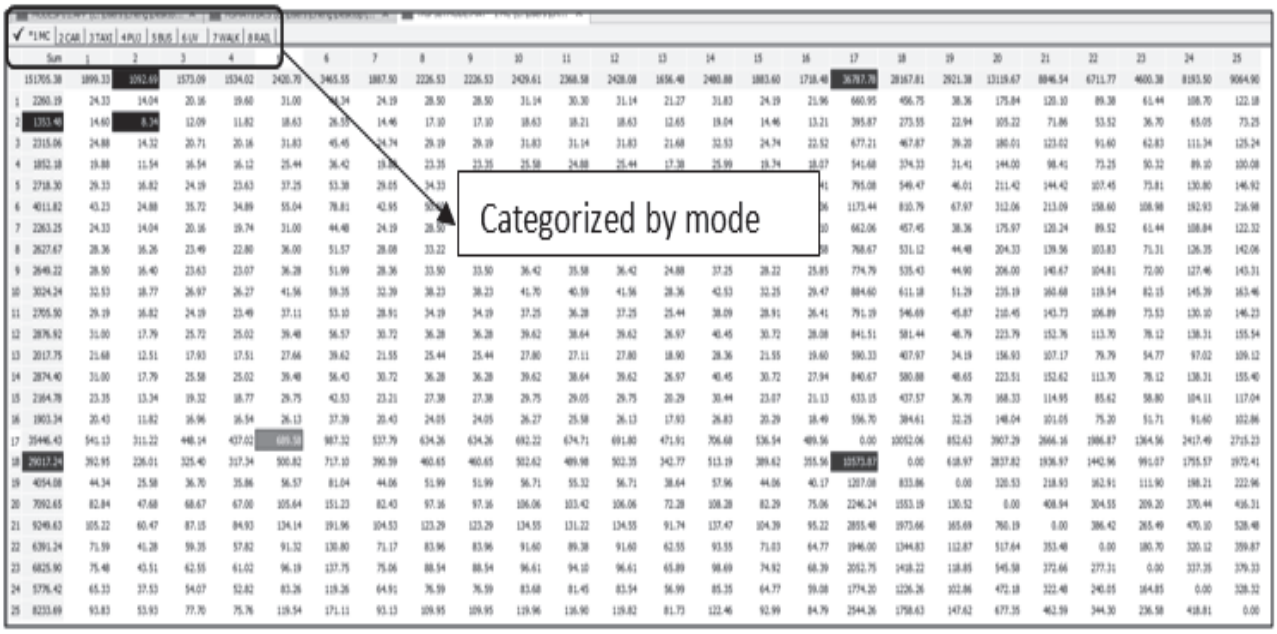
Trip distribution's zonal interchange analysis yields a set of origin destination tables which tells where the trips will be made; mode choice analysis allows the modeler to determine what mode transport will be used. The trips between and inside the BGC TAZ are split into trips using car, taxi, jeep (PUJ), bus, UV Express (UV), rail and walking.

The first step that was made was to compute the person trip by mode using shares from the MUCEP OD (Zone 92 – BGC). The second step was to compute vehicle trips using

MUCEP average occupancy (highway assignment). The third step was to compute person trip for transit assignment by adding bus and railway trips.

In Figure 3.8, is the process output of all the trips generated by the model as categorized into different modes.

Figure 3.8: Trips of All Modes



Source: Cube

3.5 OD Adjustment

OD Adjustment was conducted based on the Cordon Line Traffic Count Survey in the ingress and egress of BGC, to make the necessary correction to the trip generation model based on GFA.

Table 3.6 shows the daily cordon passenger trips (daily person trips going in and out of BGC TAZ) based on the survey conducted by the MMCBD Transit System Project around BGC.

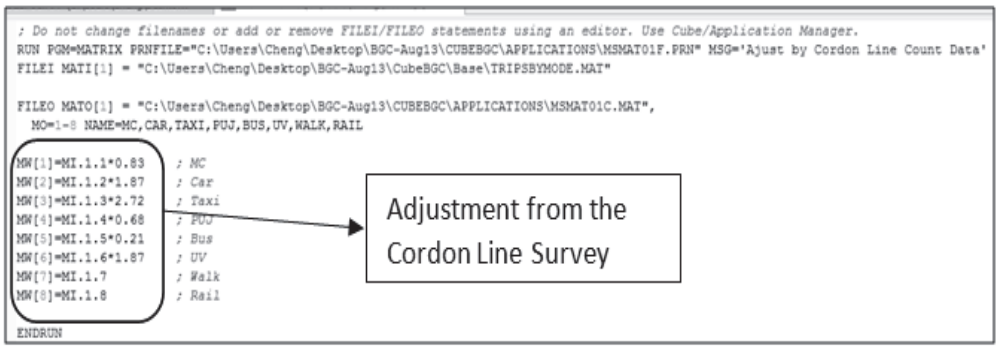
Figure 3.9 shows the necessary adjustments made in the script file. The output is reflected in Figure 3.10.

Table 3.6: Daily Cordon Passenger Trips

Station		Direction	Volume (pax)												
			Car/Jeep/Van/ SUV	Taxi	Mega-Taxi	Jeepney	Bus	School Bus	Tourist Bus	Delivery/ Pick-up	Truck	Tricycle	Motorcycle	Bicycle / Pedicab	Total
1A	Kalayaan Ave. / 8th Ave.	In													
		Out	10,215	4,659	73	17,298	125	237	-	349	136	106	2,758	67	36023
		Both	10,215	4,659	73	17,298	125	237	-	349	136	106	2,758	67	36023
1B	Kalayaan Ave. / 9th Ave.	In	1,004	238	18	31	-	-	-	26	43	-	212	72	1644
		Out	703	101	-	-	-	79	-	15	34	5	153	44	1134
		Both	1,707	339	18	31	-	79	-	41	77	5	365	116	2778
1C	Kalayaan Ave. / 10th Ave.	In	5,266	3,318	79	23,250	91	79	2	173	196	5	1,440	64	33963
		Out	241	919	-	202	-	-	-	13	28	7	193	22	1625
		Both	5,507	4,237	79	23,452	91	79	2	186	224	12	1,633	86	35588
1D	Kalayaan Ave. / 11th Ave.	In	453	560	8	-	11	-	-	54	6	5	271	74	1442
		Out	3,616	327	178	93	57	90	4	107	115	5	589	43	5224
		Both	4,069	887	186	93	68	90	4	161	121	10	860	117	6666
2	32nd St. (near C5 Road)	In	10,510	4,970	6,090	-	264	113	60	1,897	3,844	-	3,078	435	31261
		Out	22,729	9,508	965	20,795	4,049	40	16	1,507	550	-	7,961	427	68547
		Both	33,239	14,478	7,055	20,795	4,313	153	76	3,404	4,394	-	11,039	862	99808
3	25th St.	In	52,686	12,855	1,554	22,498	12,701	7	58	1,076	1,416	-	13,239	581	118671
		Out	19,752	12,440	1,188	110	-	-	-	1,579	1,378	4	11,539	1,018	49018
		Both	72,448	25,295	2,742	22,608	12,701	7	58	2,655	2,794	4	24,778	1,599	167689
4	Upper McKinley Road / C5 Road	In	22,340	10,742	1,811	-	992	25	2	508	327	-	6,780	257	43784
		Out	7,539	3,745	-	-	179	138	115	368	471	-	2,176	211	14943
		Both	29,879	14,487	1,811	-	1,171	163	118	876	798	-	8,956	468	58727
5	Lawton Ave. / bayan Road	In	11,638	6,918	111	12,497	-	41	-	1,048	945	170	8,858	473	42699
		Out	9,003	6,456	3,075	22,117	-	-	-	730	1,261	390	7,036	285	50353
		Both	20,641	13,374	3,186	34,614	-	41	-	1,775	2,206	560	15,894	758	93052
6	Lawton Ave. / Chino Roces Ave. Ext.	In	21,278	9,350	1,713	13,723	105	10	-	2,515	1,591	751	10,148	323	61517
		Out	25,137	8,347	566	8,824	445	16	-	1,603	1,241	179	7,750	500	54608
		Both	46,415	17,697	2,279	22,547	550	26	-	4,115	2,832	940	17,898	823	116125
7	Chino Roces Ave. Ext.	In	4,863	920	834	9,333	1,275	62	2	580	337	2,113	2,380	719	23418
		Out	11,248	4,767	1,755	8,343	703	44	-	1,494	459	1,763	5,731	1015	37322
		Both	16,111	5,687	2,589	17,676	1,978	106	2	2,074	796	3,876	8,111	1734	60740
8	McKinley / McKinley Parkway / 5th Ave.	In	20,225	9,434	4,808	1,040	246	64	-	789	979	-	5,433	144	43162
		Out	15,197	6,249	1,977	8,192	7,824	5	172	667	200	-	4,369	277	45129
		Both	35,422	15,683	6,785	9,232	8,070	69	172	1,456	1,179	-	9,802	421	88291
9	32nd St., (near Kalayaan Ave.)	In	52,437	17,656	274	9	10,225	49	-	987	228	17	8,546	190	90618
		Out	28,479	10,958	144	-	1,944	1	10	1,377	637	-	8,240	156	51946
		Both	80,916	28,614	418	9	12,169	50	10	2,364	865	17	16,786	346	142564
10	SM Aura Driveway	In	762	251	157	-	-	-	-	153	-	-	165	31	1519
		Out	3,042	1,424	305	-	-	-	-	95	886	-	1315	288	7355
		Both	3,804	1,675	462	-	-	-	-	248	886	-	1480	319	8874
Total		In	203,462	77,212	17,457	52,351	25,910	450	124	9,506	9,912	3,071	60,550	3,363	493,698
		Out	156,911	69,900	10,226	85,974	15,326	650	318	9,904	7,396	2,459	59,810	4,353	423,227
		Both	360,373	147,112	27,683	168,355	41,236	1,100	442	19,710	17,308	5,530	120,360	7,716	916,925

Data Source: MMCBD Transit System Project

Figure 3.9: Script File Mamat01f.S



Source: Cube

The next step is the computation of vehicle trips for highway assignment using MUCEP's Average Vehicle Occupancy Rate. In this process, Bus, Walk and Rail are excluded.

Computation of person trips for transit assignment was done, wherein PUJ, Bus and Rail are combined. The output of these steps is the OD matrix on PUB trips as seen in Figure 3.11.

3.6 Highway Network Assignment

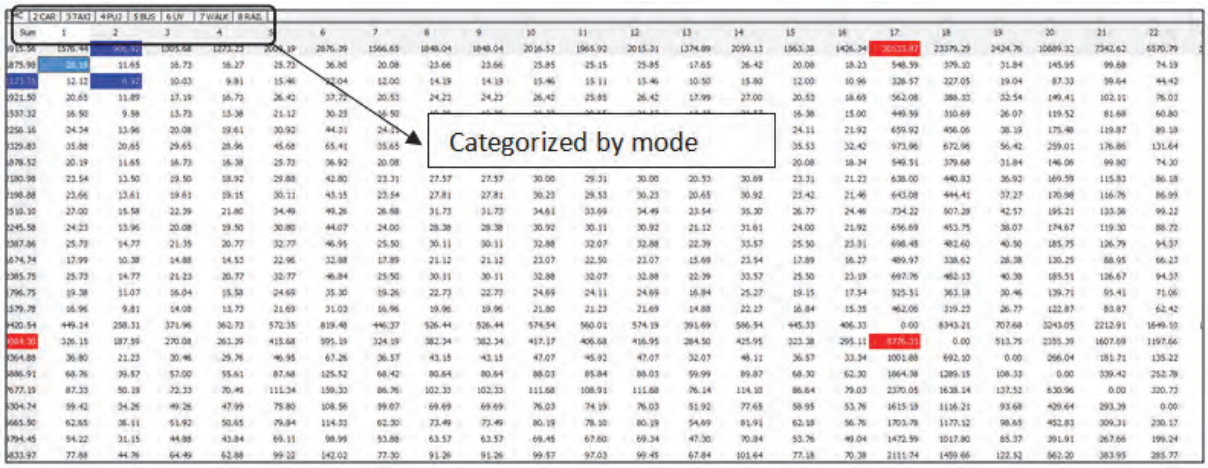
The fourth step in the conventional transportation planning model is traffic assignment or route choice which concerns the selection of routes (alternative called paths) between origins and destinations in transportation networks. To be able to determine the facility needs, cost and benefits, the number of travellers on each route and link of the network must be determined.

Trips by mode, except the public utility bus (PUB) trips, are loaded in the network to determine the volume of vehicles and travel speed on each road link.

One of the purposes of the highway network assignment is to determine the travel time and travel speed of bus that was utilized by the group in the findings and formulation of their analysis.

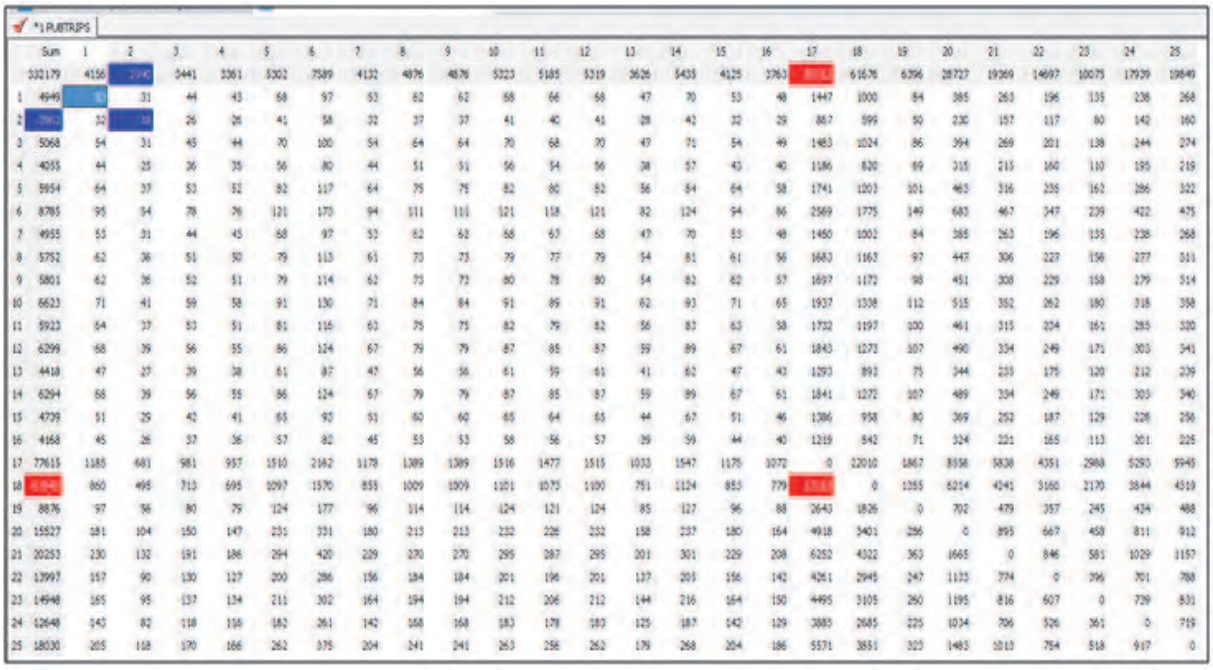
Figure 3.12 shows the volume of all modes of vehicles in the road network.

Figure 3.10: Adjusted OD by Mode



Source: Cube

Figure 3.11: OD Pub Trips Matrix



	Sum	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	332179	4156	2745	3441	3361	5302	7589	4132	4876	4876	5323	5185	5319	3626	5435	4125	3763	9018	91676	6396	28727	19369	14697	10075	17939	19849
1	4949	82	31	44	43	68	97	53	62	62	68	66	68	47	70	53	48	1447	1000	84	385	263	196	135	238	268
2	3961	32	18	26	26	41	58	32	37	37	41	40	41	28	42	32	29	867	599	50	230	157	117	80	142	160
3	5068	54	31	45	44	70	100	54	64	64	70	68	70	47	71	54	49	1483	1024	86	394	269	201	138	244	274
4	4055	44	25	36	35	56	80	44	51	51	56	54	56	38	57	43	40	1186	820	69	315	215	160	110	195	219
5	5954	64	37	53	52	82	117	64	75	75	82	80	82	56	84	64	58	1741	1203	101	463	316	235	162	286	322
6	8785	95	54	78	76	121	173	94	111	111	121	118	121	82	124	94	86	2569	1775	149	683	467	347	239	422	475
7	4955	55	31	44	43	68	97	53	62	62	68	67	68	47	70	53	48	1450	1002	84	385	263	196	135	238	268
8	5752	62	36	51	50	79	113	61	73	73	79	77	79	54	81	61	56	1683	1163	97	447	306	227	156	277	311
9	5801	62	36	52	51	79	114	62	73	73	80	78	80	54	82	62	57	1697	1172	98	451	308	229	158	279	314
10	6623	71	41	59	58	91	130	71	84	84	91	89	91	62	93	71	65	1937	1338	112	515	352	262	180	318	358
11	5923	64	37	53	51	81	116	63	75	75	82	79	82	56	83	63	58	1732	1197	100	461	315	234	161	285	320
12	6299	68	39	56	55	86	124	67	79	79	87	85	87	59	89	67	61	1843	1272	107	490	334	249	171	303	341
13	4418	47	27	39	38	61	87	47	56	56	61	59	61	41	62	47	43	1293	893	75	344	235	175	120	212	239
14	6294	68	39	56	55	86	124	67	79	79	87	85	87	59	89	67	61	1841	1272	107	489	334	249	171	303	340
15	4739	51	29	42	41	65	93	51	60	60	65	64	65	44	67	51	46	1386	958	80	369	252	187	129	228	256
16	4168	45	26	37	36	57	82	45	53	53	58	56	57	39	59	44	40	1219	842	71	324	221	165	113	201	225
17	77615	1185	681	981	957	1510	2162	1178	1389	1389	1516	1477	1515	1033	1547	1175	1072	0	22010	1867	8558	5838	4351	2988	5293	5945
18	8945	860	495	713	695	1097	1570	855	1009	1009	1101	1073	1100	751	1124	853	779	6518	0	1355	6214	4241	3160	2170	3844	4310
19	8876	97	56	80	79	124	177	96	114	114	124	121	124	85	127	96	88	2643	1826	0	702	479	357	245	434	488
20	15527	181	104	150	147	231	331	180	213	213	232	226	232	158	237	180	164	4918	3401	286	0	895	667	458	811	912
21	20253	230	132	191	186	294	420	229	270	270	295	287	295	201	301	229	208	6252	4322	363	1665	0	846	581	1029	1157
22	13997	157	90	130	127	200	286	156	184	184	201	196	201	137	205	156	142	4261	2945	247	1133	774	0	396	701	788
23	14948	165	95	137	134	211	302	164	194	194	212	206	212	144	216	164	150	4495	3105	260	1195	816	607	0	739	831
24	12648	140	82	118	116	182	261	142	168	168	183	178	183	125	187	142	129	3885	2685	225	1034	706	526	361	0	719
25	18030	205	118	170	166	262	375	204	241	241	263	256	262	179	268	204	186	5571	3851	323	1483	1010	754	518	917	0

Source: Cube

Figure 3.12: Volume of All Modes of Vehicles in the Road Network

Source: Cube

3.7 Transit Assignment

The PUB trips were used to compute for the travel demand per bus route using the Transit Assignment model.

Computation of walk trips was done through the creation of non-transit legs in the model.

The transit routes were created for the existing six (6) PUB routes to establish the base scenario.

Based on the current operational characteristics of buses in BGC, three (3) scenarios were considered, namely: Peak and off-peak hours and nighttime. The factors that were

used in the said scenarios were based on the traffic count by hour conducted in BGC and the MUCEP 24-hour traffic count. Figure 3.13 shows the sixteen (16) hour traffic count per hour per station in BGC; used in determining the peak hour (6%) and off-peak (5%) factors. Expansion factor based on MUCEP Traffic Count was used to expand the said survey up to twenty-four (24) hours; the basis in determining the nighttime factor of 1% as illustrated in Figure 3.14.

Figures 3.15 and 3.6 show the results of the model that represent the boarding and alighting, and passenger profile (line volume) of the Central Route. A similar model with data distinct to each of the remaining routes was also generated.

Analysis of the operation of buses in all routes based on the passenger per hour per direction (PPHPD) or the maximum line volume was conducted which will be shown in the findings of the study.

Figure 3.13: BGC Traffic Distribution by Hour by Station (From/To BGC)

Time Period	1A: Kalayaan Ave. - 8th Ave. - Lawton Ave.	1B: Kalayaan Ave. - 9th Ave.	1C: Kalayaan Ave. - 10th Ave.	1D: Kalayaan Ave. - 11th Ave.	2: C-5-32nd St. (Market!Market! PUJ/UVE Terminal)	3: C-5-26th St. (Market!Market! Bus Terminal)	4: C-5-Upper McKinley Rd.	5: Lawton Ave. - Bayani Rd.	6: Lawton Ave.-Chino Roces Ext./Pasong Tamo Ext. (GATE 3)	8: McKinley Rd.-5th Ave.	9: Kalayaan Flyover-32nd St. (in front of 2nd Ave.)	10: SM Aura Dr.	Total	Hourly Factor
Time Period	1A	1B	1C	1D	2	3	4	5	6	8	9	10	Total	
6:00	1,436	37	443	115	2,489	2,414	973	2,636	2,165	2,132	1,480	166	16,485	5.0%
7:00	1,698	115	643	233	2,793	2,989	983	2,993	2,767	2,840	1,800	213	20,065	6.1%
8:00	2,157	89	666	268	2,579	2,785	1,126	2,668	3,215	3,233	1,441	204	20,431	6.2%
9:00	1,913	67	699	156	2,726	3,034	1,252	2,391	2,697	2,882	1,403	212	19,432	5.9%
10:00	1,800	81	510	135	2,794	3,345	1,158	2,371	2,433	2,727	1,402	175	18,933	5.7%
11:00	1,119	38	242	128	2,699	3,068	1,111	2,152	2,320	2,872	1,333	191	17,274	5.2%
12:00	1,215	38	187	151	2,644	3,012	1,145	2,004	2,035	2,612	1,264	202	16,510	5.0%
13:00	1,274	54	637	125	3,066	3,141	1,162	2,007	2,253	2,969	1,194	155	18,038	5.5%
14:00	1,270	59	495	164	2,777	2,944	1,189	1,969	2,219	3,265	1,271	286	17,910	5.4%
15:00	1,508	81	713	219	3,348	2,894	902	1,996	2,108	3,168	1,200	293	18,429	5.6%
16:00	1,918	112	440	223	3,171	2,920	1,067	1,996	2,180	3,221	1,145	350	18,743	5.7%
17:00	2,119	148	722	356	3,377	3,531	1,104	1,996	2,757	3,044	1,245	365	20,764	6.3%
18:00	1,725	221	779	395	3,779	3,063	943	2,084	2,463	2,973	1,106	312	19,844	6.0%
19:00	1,385	169	573	417	3,287	2,956	932	2,022	1,927	2,630	1,016	299	17,613	5.3%
20:00	1,329	126	463	326	2,507	2,575	1,128	1,919	1,713	2,368	1,097	283	15,835	4.8%
21:00	972	44	342	192	2,089	2,036	953	1,796	1,781	2,071	1,255	230	13,761	4.2%
Total (unit)	24,837	1,479	8,556	3,605	46,125	46,709	17,127	35,001	37,032	45,007	20,654	3,936	290,069	
													330,678	

PEAK HOUR= 6%

OFF PEAK = 5%

Source: BTC

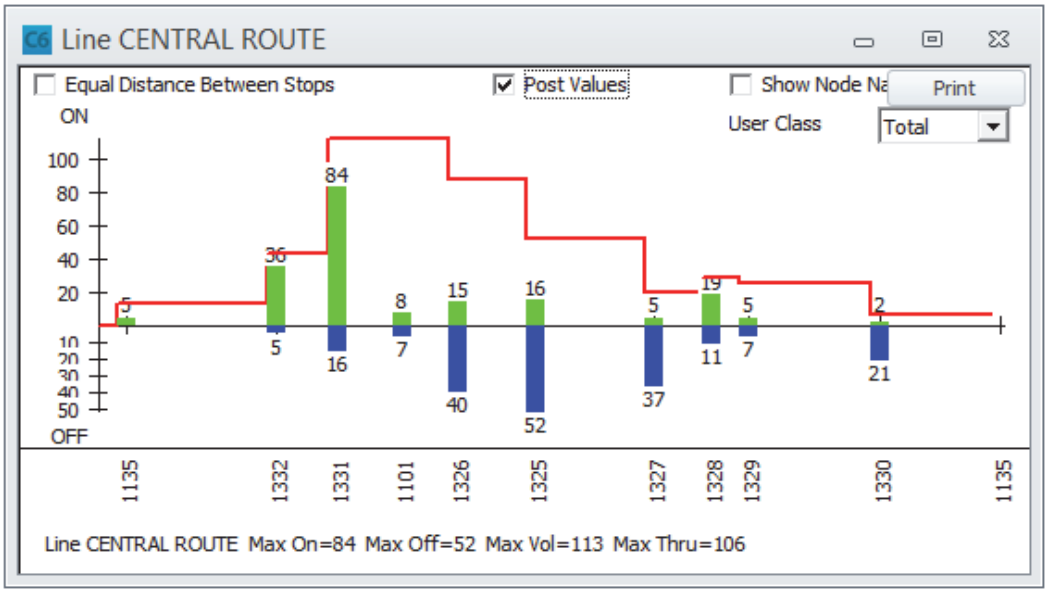
Figure 3.14: Expansion Factor Based on MUCEP Traffic Count

Both	Total	1,986,006
06:00 - 07:00	119,082	6%
07:00 - 08:00	139,117	7%
08:00 - 09:00	126,051	6%
09:00 - 10:00	118,901	6%
10:00 - 11:00	113,926	6%
11:00 - 12:00	108,624	5%
12:00 - 13:00	103,556	5%
13:00 - 14:00	105,674	5%
14:00 - 15:00	109,676	6%
15:00 - 16:00	109,426	6%
16:00 - 17:00	118,230	6%
17:00 - 18:00	126,995	6%
18:00 - 19:00	126,746	6%
19:00 - 20:00	111,617	6%
20:00 - 21:00	98,790	5%
21:00 - 22:00	85,913	4%
22:00 - 23:00	33,917	2%
23:00 - 00:00	24,842	1%
00:00 - 01:00	18,958	1%
01:00 - 02:00	13,908	1%
02:00 - 03:00	12,023	1%
03:00 - 04:00	12,636	1%
04:00 - 05:00	16,915	1%
05:00 - 06:00	30,483	2%

NIGHT TIME =

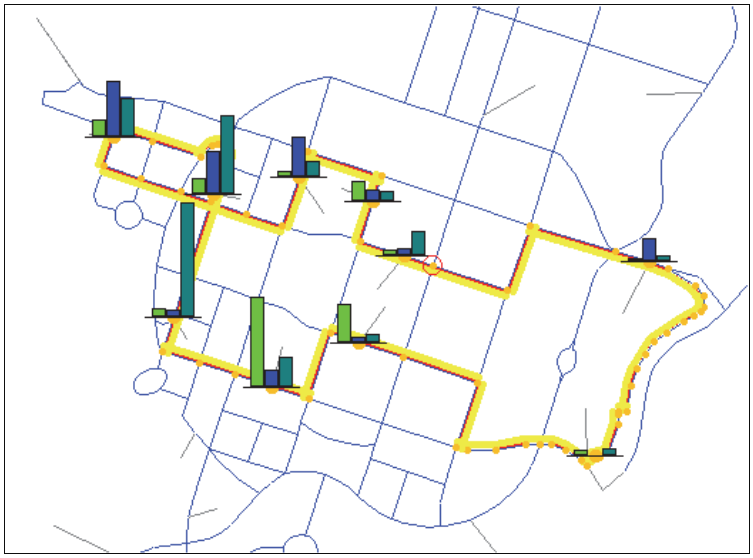
Source: MUCEP

Figure 3.15: The Result of the Model Which Represents the Boarding and Alighting, and Passenger Profile (Line Volume) of the Central Route



Source: Cube

Figure 3.16: The Result of the Model Which Represents the boarding and Alighting, and Passenger Profile (Line Volume) of the Central Route



Source: Cube

4 EVALUATION OF THE CURRENT SYSTEM

Calibration and validation of the model were conducted by the members of the study group based on the current operational characteristics of the BGC Transport Company as reflected in Table 4.1. The importance of developing a more realistic base scenario cannot be overemphasized as this was also used in forecasting the public transport system for the years 2020 and 2015.

Table 4.1: Operational Characteristics of BGC Bus

Parameter	Unit	Route				
		West	Central	East	Upper West	Lower West
Average Peak Hours Passengers	pax		180	335	677	604
Turnaround Time – Maximum	min	49	37	60	97	61
Turnaround Time – Average	min	37	26	52	48	41
Turnaround Time - Minimum	min	29	20	45	34	26

Source: BTC

Figure 4.1 below shows the daily passengers per link for the six (6) bus routes from Zones 1 – 25 from the results of the Transit Assignment. This figure shows which links zones have higher passenger demand and those links zones that have less passengers on a daily basis. The width of the links represents the volume of passengers – The thicker the line, the higher the passenger demand and vice-versa.

Figure 4.1: Daily Bus Passengers Per Link

Source: Cube

The minimum requirements of bus units during peak and off-peak hours and nighttime were identified. Peak and off-peak hours and nighttime were considered because some routes change according to the demands of the passengers, which is a unique operational characteristic of BTC.

Based on the data generated, the minimum requirement to meet the passenger demand during peak and off-peak hours and nighttime are:

(i) Peak Hour Requirement – 23 bus units/hour (4 routes)

(ii) Off-peak Requirement – 9 bus units/hour (3 routes)

(iii) Nighttime Requirement – 1 bus unit/hour (1 route)

The above was a result of the calculation of the different data generated from Cube for each particular route. These data are extracted from Cube and presented into charts and graphical data to provide a better illustration for the readers. For purposes of brevity, the details of the calculation and explanation of the technical terms are being made only for the Lower West Route. The same process and terms, however, applies in all other routes using the data applicable.

Table 4.2: Lower West Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol	Station
1026	214	-	240	Ayala EDSA
1190	102	9	333	McKinley Parkway
1331	219	285	268	The Fort
1101	59	58	269	Net One
1333	36	43	262	Fort Victoria
1190	7	102	167	McKinley Parkway
1026	-	141	26	Ayala EDSA
Max			333	pax
Bus Capacity			70	pax
Required Frequency			5	bus/hr
Route Distance			1.56	km
Travel Distance			61.00	min
Frequency by One Bus			0.89	times/hr/bus
No. of Required Buses			6	veh
Total Boarding			638	pax

Source: Cube
Line-1 Stations - represents the node number (bus stops) in the model.
Board - represents the number of passengers boarding on each bus stop.
Alight - represents the number of passengers alighting from the bus on each bus stop.
Line Volume – represents the total number of passengers in between one bus stop to the next bus stop (data from Cube).

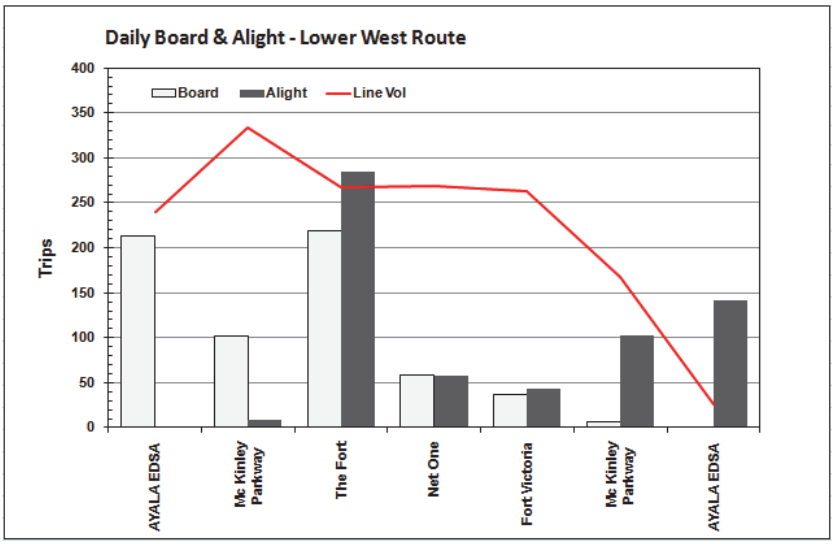
The maximum line volume (333) is divided by bus capacity (70 - information from BTC) that gives us the required frequency per hour. This means 5 buses are needed to satisfy the maximum line volume.

The required headway was computed based on required frequency (1 hour = 60 minutes; 60/4 buses = 15 minutes).

Route distance was calculated from the model (1.56 km).

Travel time was based from the report of BTC. The maximum travel time during peak hour is 61 minutes. Thus, the frequency of one bus unit is 0.89 times per hour. The number of required buses during peak hours in the Lower West Route is 6, which is derived by dividing the required frequency (5) over the frequency of one bus (0.89).

Figure 4.2: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Lower West Route)



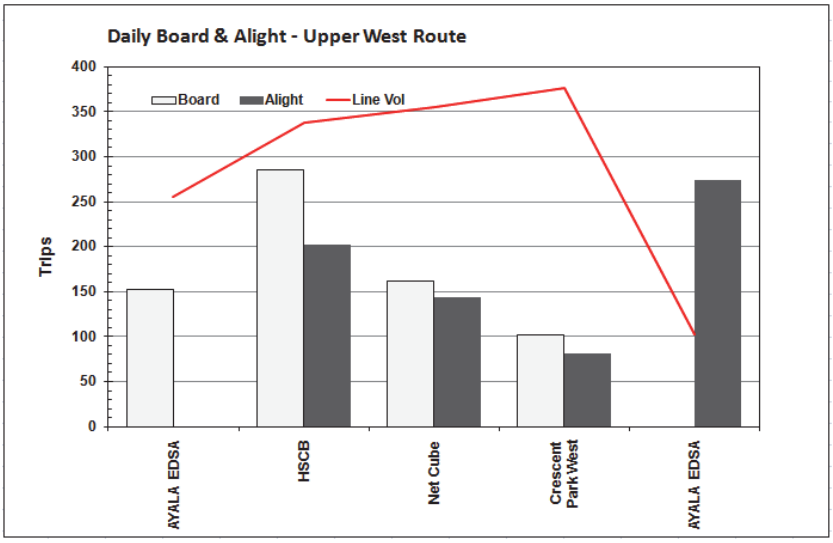
Source: Cube

Table 4.3: Upper West Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol	Station
1029	152	-	255	Ayala EDSA
1327	286	203	338	HSBC
1326	162	144	356	Net Cube
1325	102	81	377	Crescent Park West
1029	-	274	102	Ayala EDSA
Max			377	pax
Bus Capacity			70	pax
Required Frequency			6	bus/hr
Route Distance			1.33	km
Travel Distance			97.00	min
Frequency by One Bus			0.56	times/hr/bus
No. of Required Buses			11	veh
Total Boarding			702	pax

Source: Cube

Figure 4.3: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Upper West Route)



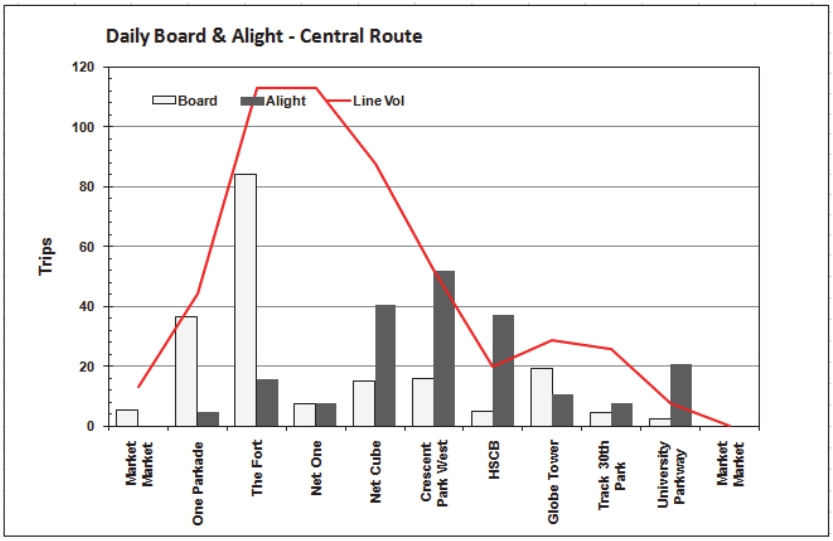
Source: Cube

Table 4.4: Central Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol	Station
1135	5	-	13	Market Market
1332	36	5	44	One Parkade
1331	84	16	113	The Fort
1101	8	7	113	Net One
1326	15	40	88	Net Cube
1325	16	52	52	Crescent Park West
1327	5	37	20	HSBC
1328	19	11	29	Globe Tower
1329	5	7	26	Track 30th Park
1330	2	21	7	University Parkway
1135	-	-	-	Market Market
Max			113	pax
Bus Capacity			70	pax
Required Frequency			2	bus/hr
Route Distance			3.07	km
Travel Distance			37.00	min
Frequency by One Bus			1.47	times/hr/bus
No. of Required Buses			2	veh
Total Boarding			196	pax

Source: Cube

Figure 4.4: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Central Route)



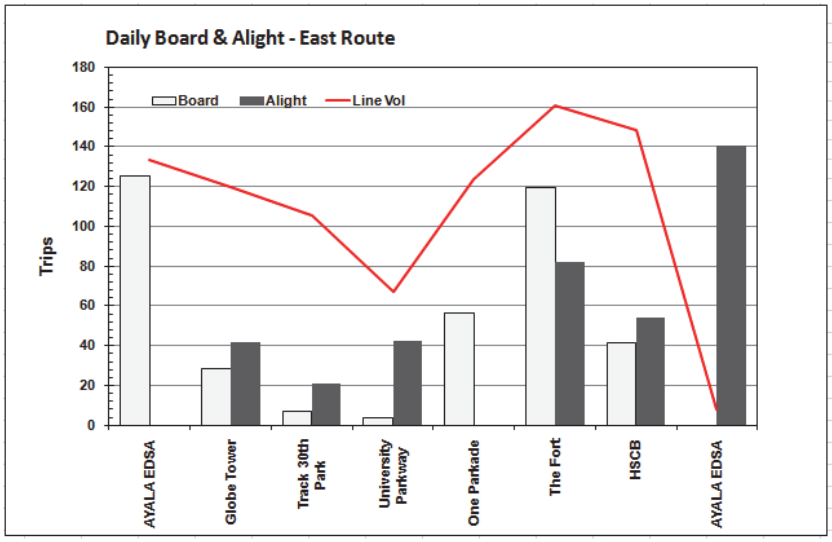
Source: Cube

Table 4.5: East Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol	Station
1029	126	-	133	Ayala EDSA
1328	29	42	120	Globe Tower
1329	7	21	105	Track 30th Park
1330	4	42	67	University Parkway
1332	57	-	124	One Parkade
1331	119	82	161	The Fort
1327	42	54	148	HSBC
1029	-	141	8	Ayala EDSA
Max			161	pax
Bus Capacity			70	pax
Required Frequency			3	bus/hr
Route Distance			3.03	km
Travel Distance			60.00	min
Frequency by One Bus			0.91	times/hr/bus
No. of Required Buses			4	veh
Total Boarding			382	pax

Source: Cube

Figure 4.5: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (East Route)



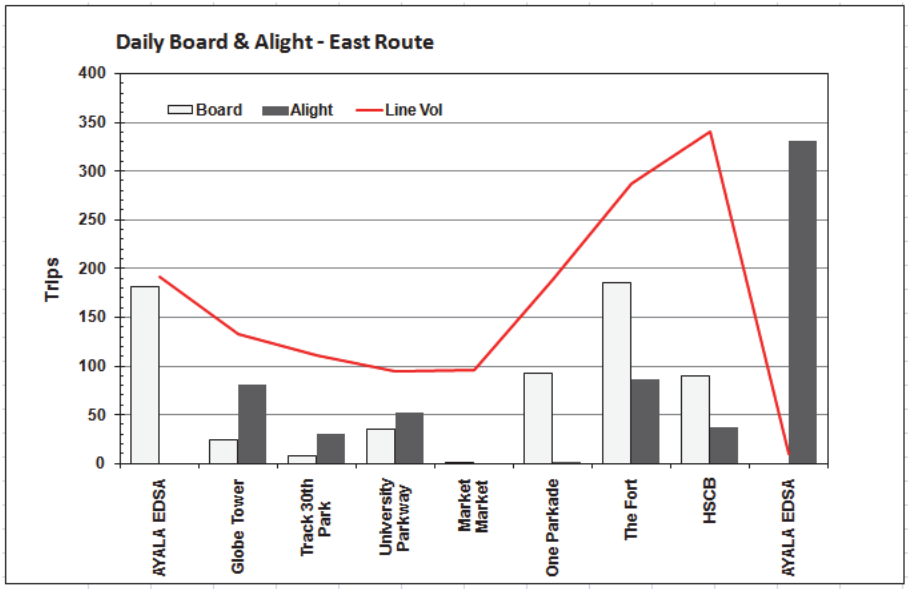
Source: Cube

Table 4.6: East Route (Off-Peak Hour)

Line 1 Stations	Board	Alight	Line Vol	Station
1029	182	-	191	Ayala EDSA
1328	24	81	133	Globe Tower
1329	8	30	112	Track 30th Park
1330	35	52	95	University Parkway
1136	1	-	96	Market Market
1332	93	0	189	One Parkade
1331	185	86	288	The Fort
1327	90	37	341	HSBC
1029	-	331	9	Ayala EDSA
Max			341	pax
Bus Capacity			70	pax
Required Frequency			5	bus/hr
Route Distance			3.03	km
Travel Distance			52.00	min
Frequency by One Bus			1.05	times/hr/bus
No. of Required Buses			5	veh
Total Boarding			618	pax

Source: Cube

Figure 4.6: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (East Route – Off-Peak)



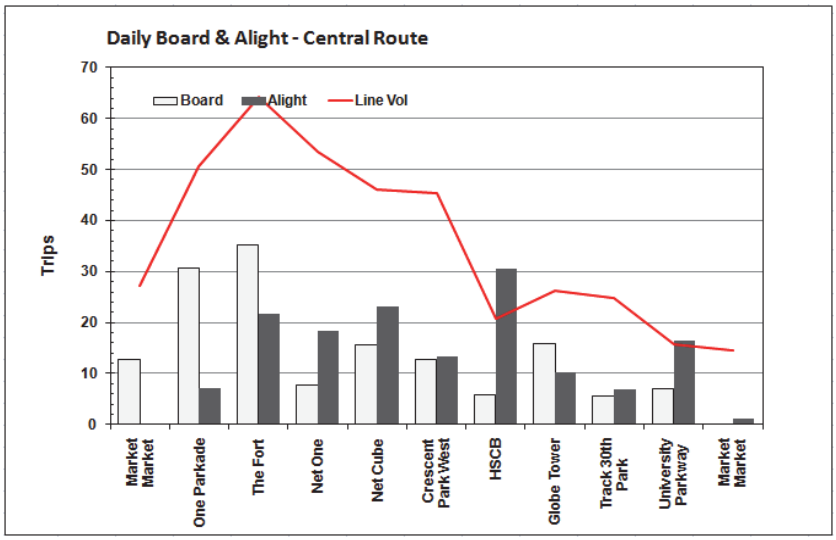
Source: Cube

Table 4.7: Central Route (Off-Peak)

Line 1 Stations	Board	Alight	Line Vol.	Station
1135	13	-	27	Market Market
1332	31	7	51	One Parkade
1331	35	22	64	The Fort
1101	8	18	54	Net One
1326	16	23	46	Net Cube
1325	13	13	45	Crescent Park West
1327	6	30	21	HSBC
1328	16	10	26	Globe Tower
1329	6	7	25	Track 30th Park
1330	7	16	16	University Parkway
1135	-	1	14	Market Market
Max			64	pax
Bus Capacity			70	pax
Required Frequency			1	bus/hr
Route Distance			3.07	km
Travel Distance			26.00	min
Frequency by One Bus			2.10	times/hr/bus
No. of Required Buses			1	veh
Total Boarding			149	pax

Source: Cube

Figure 4.7: Boarding and Alighting On Each Bus Stations/Stops and the Line Volume (East Route – Off-Peak)



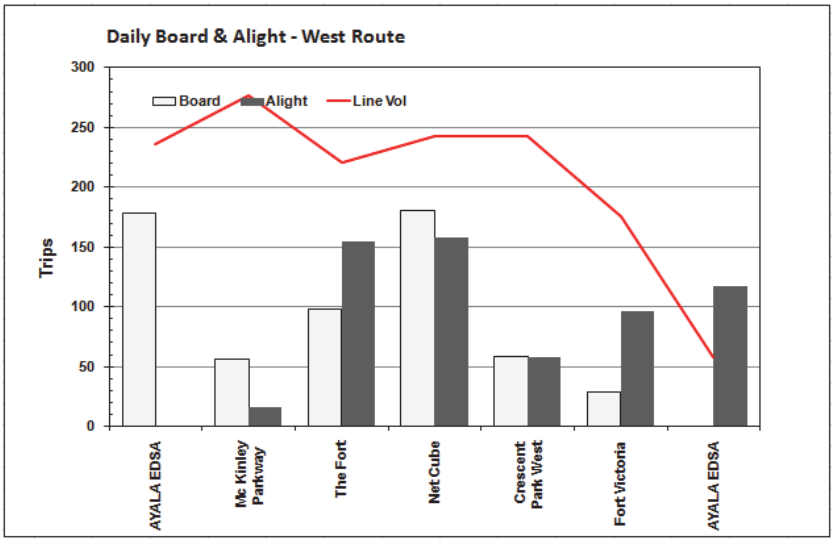
Source: Cube

Table 4.8: West Route (Off-Peak)

Line 1 Stations	Board	Alight	Line Vol.	Station
1026	178	-	236	Ayala EDSA
1190	56	16	277	McKinley Parkway
1331	98	154	221	The Fort
1326	181	158	243	Net Cube
1325	58	58	243	Crescent Park West
1333	29	96	176	Fort Victoria
1026	-	118	58	Ayala EDSA
Max			277	pax
Bus Capacity			70	pax
Required Frequency			4	bus/hr
Route Distance			2.22	km
Travel Distance			37.00	min
Frequency by One Bus			1.47	times/hr/bus
No. of Required Buses			3	veh
Total Boarding				pax

Source: Cube

Figure 4.8: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (West Route – Off-Peak)



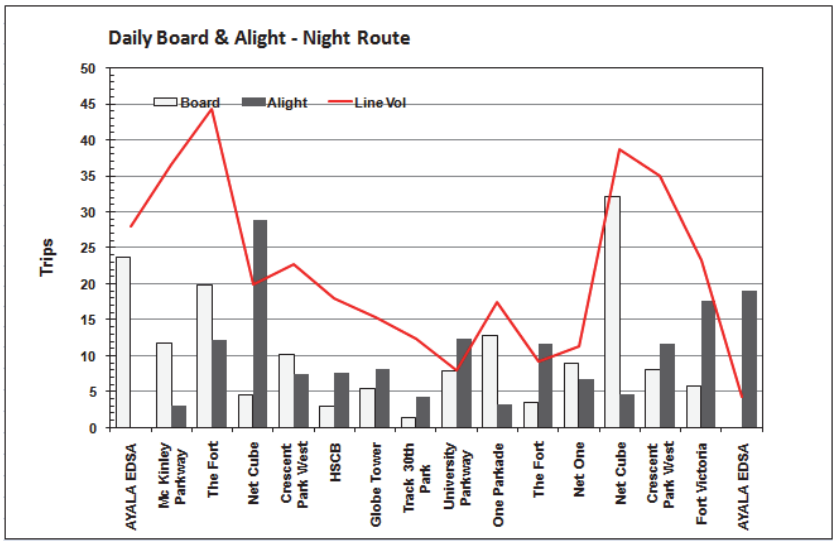
Source: Cube

Table 4.9: Nighttime Passenger Profile

Line 1 Stations	Board	Alight	Line Vol	Station
1026	24	-	28	Ayala EDSA
1190	12	3	37	McKinley Parkway
1331	20	12	44	The Fort
1326	5	29	20	Net Cube
1325	10	7	23	Crescent Park West
1327	3	8	18	HSBC
1328	6	8	15	Globe Tower
1329	1	4	12	Track 30th Park
1330	8	12	8	University Parkway
1332	13	3	17	One Parkade
1331	3	12	9	The Fort
1101	9	7	11	Net One
1326	32	5	39	Net Cube
1325	8	12	35	Crescent Park West
1333	6	18	23	Fort Victoria
1026	-	19	4	Ayala EDSA
Max			44	pax
Bus Capacity			70	pax
Required Frequency			1	bus/hr
Route Distance			5.29	km
Travel Distance			48.00	min
Frequency by One Bus			1.14	times/hr/bus
No. of Required Buses			1	veh
Total Boarding				pax

Source: Cube

Figure 4.9: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Nighttime)

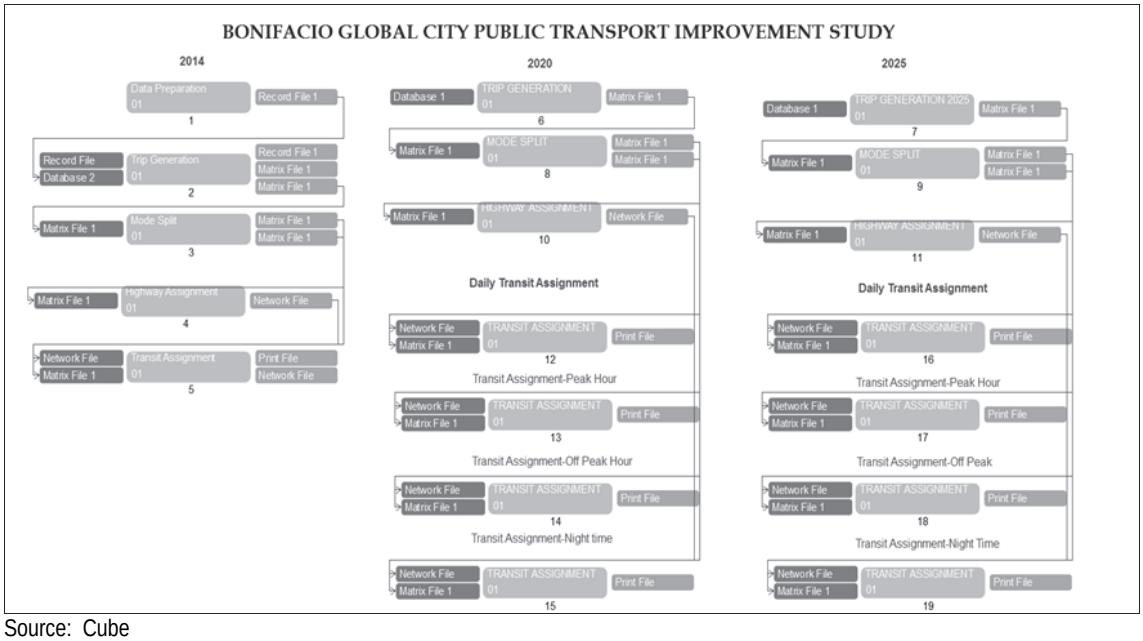


Source: Cube

5 FORECAST

In forecasting the future trips for the years 2020 and 2025, the same process was done by the case study group. The data used in forecasting the future trips for years 2020 and 2025 were based on the future GFA of BGC. The adjustment factor used was based on the population growth of the MUCEP study area. Figure 5.1 below illustrates the Cube Model of BGC for the years 2014, 2020, and 2025.

Figure 5.1: BGC Cube Model (2014, 2020 and 2025)



Source: Cube

Trip generation and attraction data for the year 2020 is illustrated in Table 5.1 and year 2025 in Table 5.2.

Table 5.1: Trip Generation/Attraction (2020)

Zone	P	A
1	44182	36621
2	46017	39346
3	17409	11115
4	36390	30557
5	26201	22541
6	38837	31703
7	24211	19494
8	25805	20990
9	30678	24904
10	24825	19170
11	30888	26851
12	32343	26544
13	23102	19748
14	37614	32184
15	25835	22052
16	17855	16301
17	288374	283294
18	235861	216723
19	32960	224843
20	57659	100961
21	75197	68078
22	51960	51649
23	55492	35402
24	46962	63052
25	66936	69758

Source: Cube

Table 5.2: Trip Generation/Attraction (2025)

Zone	P	A
1	44182	36621
2	46017	39346
3	17409	11115
4	42941	36560
5	26201	22541
6	38837	31703
7	27645	22380
8	25805	20990
9	30678	24904
10	24825	19170
11	30888	26851
12	32390	26583
13	23102	19748
14	37614	32184
15	25835	22052
16	18193	16786
17	308193	302764
18	252071	231618
19	35226	24028
20	61621	107900
21	80365	72757
22	55531	55199
23	59305	37836
24	50190	67385
25	71536	74552

Source: Cube

Figure 5.2 shows the daily passengers per link for the six (6) bus routes from Zones 1 – 25 for year 2020 also from the results of the Transit Assignment. This figure shows which links have higher passenger demand and those with fewer passengers on a daily basis. The width of the links represents the volume of passengers – The thicker the line, the higher the passenger demand and vice-versa.

Figure 5.2: Daily Bus Passenger Per Link (2020)

Source: Cube

The minimum requirements of bus units during peak and off-peak hours and nighttime for the years 2020 and 2025 were also identified. These times were considered because routes change according to the demands of the passengers in some routes, which is a unique operational characteristic of BTC.

The minimum requirement to meet the passenger demand during peak and off-peak hours and nighttime for 2020 is as follows:

(i) Peak Hour Requirement – 30 bus units/hour (4 routes)

(ii) Off-peak Requirement – 14 bus units/hour (3 routes)

(iii) Night time Requirement – 2 bus unit/hour (1 route)

The figures above were generated as a result of the calculation of the different data generated from Cube for each particular route. These data are also presented into charts and graphical data to provide a better illustration for the readers. For purposes of brevity, the details of the calculation and explanation of the technical terms are being made only for the Lower West Route. The same process and terms, however, applies in all other routes using the data applicable.

Table 5.3: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Lower West Route)

Line 1 Stations	Board	Alight	Line Vol.	Station
1026	288	-	345	Ayala EDSA
1190	165	12	497	McKinley Parkway
1331	291	428	360	The Fort
1101	140	80	419	Net One
1333	69	83	405	Fort Victoria
1190	9	167	246	McKinley Parkway
1026	-	189	57	Ayala EDSA
Max			497	pax
Bus Capacity			70	pax
Required Frequency			8	bus/hr
Route Distance			1.56	km
Travel Distance			61.00	min
Frequency by One Bus			0.89	times/hr/bus
No. of Required Buses			9	veh
Total Boarding			960	pax

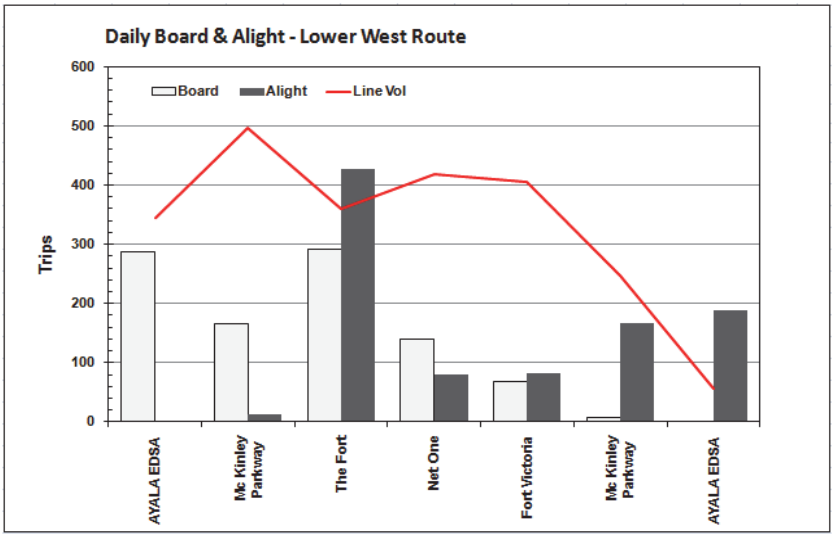
Source: Cube
Line-1 Stations - represents the node number (bus stops) in the model.
Board - represents the number of passengers boarding on each bus stop.
Alight - represents the number of passengers alighting from the bus on each bus stop.
Line Volume – represents the total number of passengers in between one bus stop to the next bus stop (data from Cube).

The maximum line volume (497) is divided by bus capacity (70 - information from BTC) that gives us the required frequency per hour; this means 8 buses are needed to satisfy the maximum line volume.

The required headway was computed based on required frequency (1 hour = 60 minutes; 60/4 buses = 15 minutes). The route distance was calculated from the model (1.56 km).

Travel time was based on the report of BTC. The maximum travel time during peak hour is 61 minutes, thus, the frequency of one bus unit is 0.89 times per hour. The number of required buses during peak hours in the Lower West Route is 9, which is derived by dividing the required frequency (8) over the frequency of one bus (0.89).

Figure 5.3: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Lower West Route)



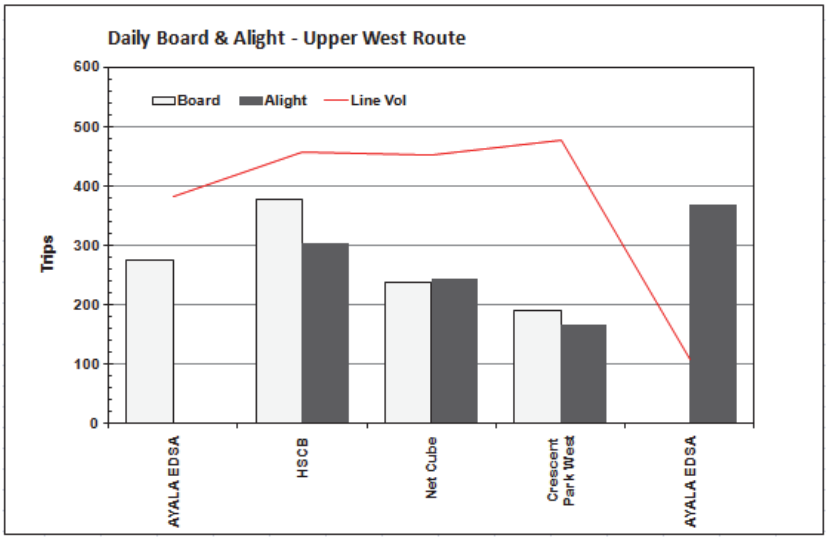
Source: Cube

Table 5.4: Upper West Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1029	275	-	382	Ayala EDSA
1327	378	303	457	HSBC
1326	239	243	452	Net Cube
1325	192	167	477	Crescent Park West
1029	-	370	107	Ayala EDSA
Max			477	pax
Bus Capacity			70	pax
Required Frequency			7	bus/hr
Route Distance			1.33	km
Travel Distance			97.00	min
Frequency by One Bus			0.56	times/hr/bus
No. of Required Buses			13	veh
Total Boarding			1,083	pax

Source: Cube

Figure 5.4: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Upper West Route)



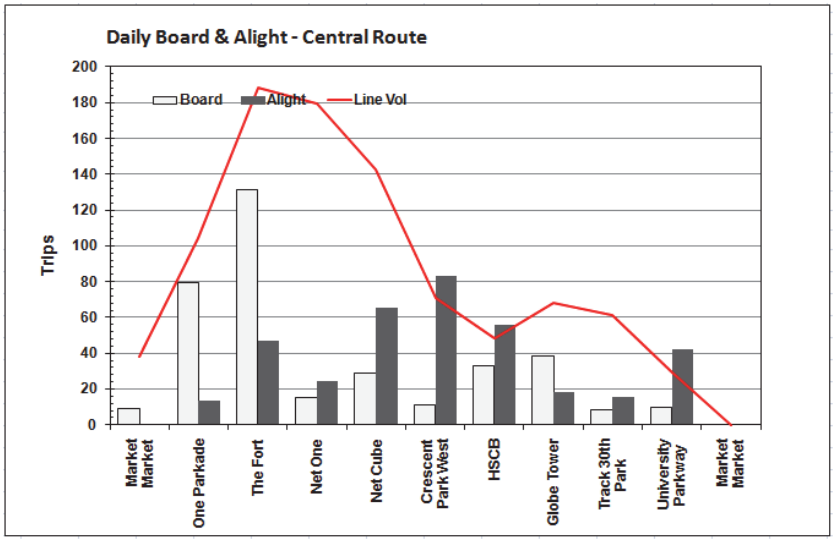
Source: Cube

Table 5.5: Central Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1135	9	-	38	Market Market
1332	80	14	104	One Parkade
1331	132	47	189	The Fort
1101	15	25	179	Net One
1326	29	65	143	Net Cube
1325	11	83	71	Crescent Park West
1327	33	56	48	HSBC
1328	38	18	68	Globe Tower
1329	9	15	61	Track 30th Park
1330	10	42	29	University Parkway
1135	-	-	-	Market Market
Max			189	pax
Bus Capacity			70	pax
Required Frequency			3	bus/hr
Route Distance			3.07	km
Travel Distance			37.00	min
Frequency by One Bus			1.47	times/hr/bus
No. of Required Buses			3	veh
Total Boarding			365	pax

Source: JICA Project Team

Figure 5.5: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Central Route)



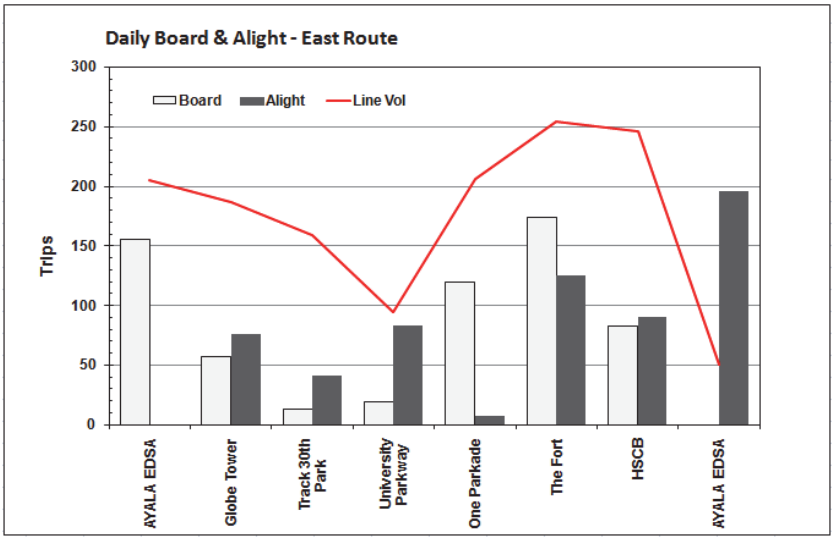
Source: Cube

Table 5.6: East Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1029	155	-	205	Ayala EDSA
1328	57	76	187	Globe Tower
1329	13	41	159	Track 30th Park
1330	19	84	94	University Parkway
1332	120	8	206	One Parkade
1331	173	125	254	The Fort
1327	83	90	246	HSBC
1029	-	196	51	Ayala EDSA
Max			254	pax
Bus Capacity			70	pax
Required Frequency			4	bus/hr
Route Distance			3.03	km
Travel Distance			60.00	min
Frequency by One Bus			0.91	times/hr/bus
No. of Required Buses			5	veh
Total Boarding			620	pax

Source: Cube

Figure 5.6: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (East Route)



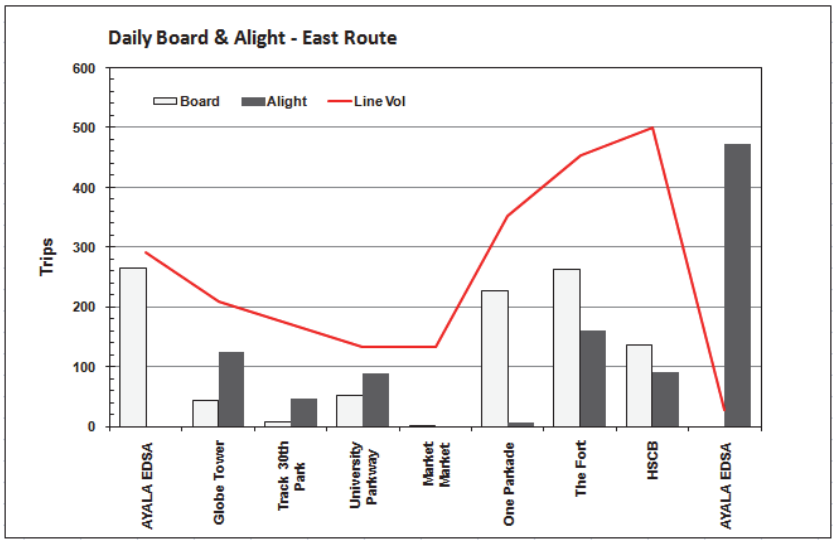
Source: Cube

Table 5.7: East Route (Off Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1029	264	-	292	Ayala EDSA
1328	43	125	210	Globe Tower
1329	9	47	172	Track 30th Park
1330	52	90	134	University Parkway
1136	0	-	134	Market Market
1332	226	7	353	One Parkway
1331	262	161	454	The Fort
1327	136	90	500	HSBC
1029	-	472	27	Ayala EDSA
Max			500	pax
Bus Capacity			70	pax
Required Frequency			8	bus/hr
Route Distance			3.03	km
Travel Distance			52.00	min
Frequency by One Bus			1.05	times/hr/bus
No. of Required Buses			8	veh
Total Boarding			992	pax

Source: Cube

Figure 5.7: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (East Route – Off-Peak)



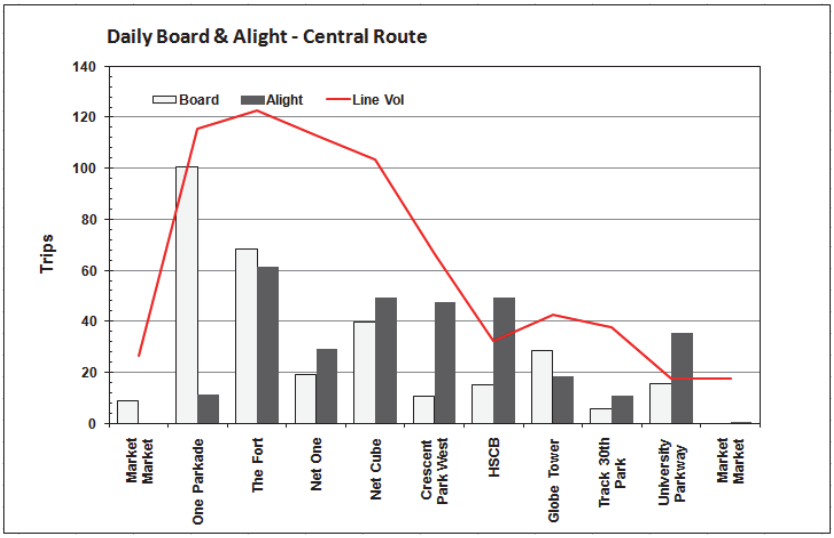
Source: Cube

Table 5.8: Central Route (Off-Peak)

Line 1 Stations	Board	Alight	Line Vol.	Station
1135	9	-	26	Market Market
1332	100	11	116	One Parkade
1331	68	61	123	The Fort
1101	19	29	113	Net One
1326	40	49	103	Net Cube
1325	11	48	66	Crescent Park West
1327	15	49	32	HSBC
1328	29	18	43	Globe Tower
1329	6	11	38	Track 30th Park
1330	16	36	18	University Parkway
1135	-	0	18	Market Market
Max			123	pax
Bus Capacity			70	pax
Required Frequency			2	bus/hr
Route Distance			3.07	km
Travel Distance			26.00	min
Frequency by One Bus			2.10	times/hr/bus
No. of Required Buses			1	veh
Total Boarding			312	pax

Source: Cube

Figure 5.8: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Central Route – Off-Peak)



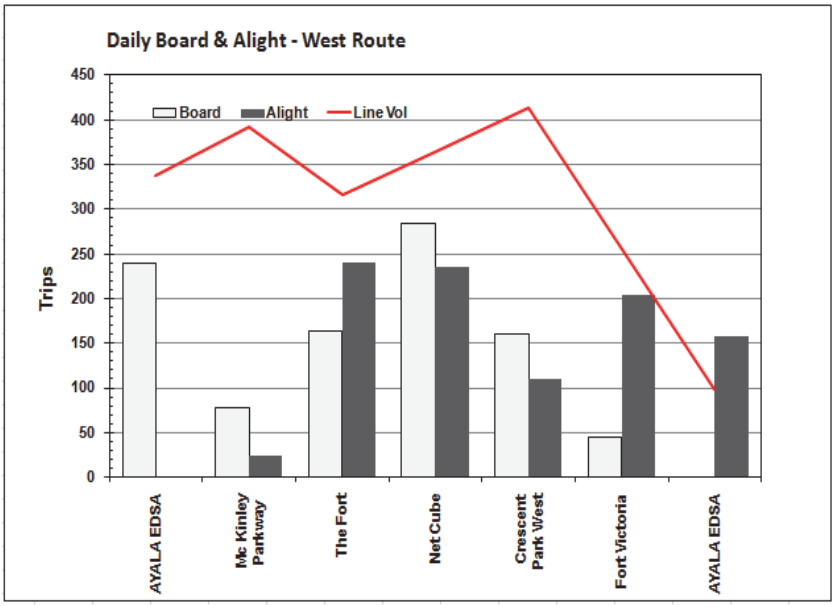
Source: Cube

Table 5.9: West Route (Off-Peak)

Line 1 Stations	Board	Alight	Line Vol.	Station
1026	240	-	338	Ayala EDSA
1190	79	24	392	McKinley Parkway
1331	163	240	316	The Fort
1326	284	235	364	Net Cube
1325	160	111	414	Crescent Park West
1333	45	203	256	Fort Victoria
1026	-	158	98	Ayala EDSA
Max			414	pax
Bus Capacity			70	pax
Required Frequency			6	bus/hr
Route Distance			2.22	km
Travel Distance			37.00	min
Frequency by One Bus			1.47	times/hr/bus
No. of Required Buses			5	veh
Total Boarding				pax

Source: Cube

Figure 5.9: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (West Route – Off-Peak)



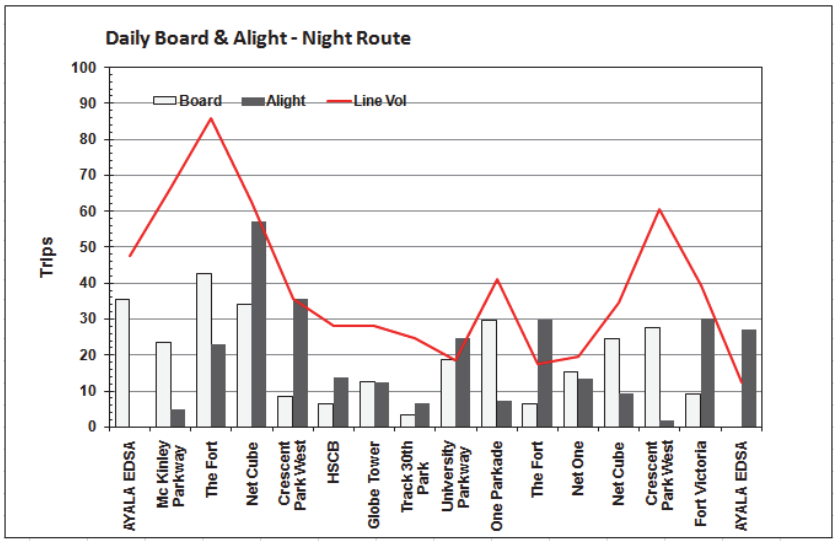
Source: Cube

Table 5.10: Nighttime Passenger Profile

Line 1 Stations	Board	Alight	Line Vol.	Station
1026	35	-	48	Ayala EDSA
1190	23	5	66	McKinley Parkway
1331	42	23	86	The Fort
1326	34	57	63	Net Cube
1325	9	36	36	Crescent Park West
1327	6	14	28	HSBC
1328	13	12	28	Globe Tower
1329	3	7	25	Track 30th Park
1330	19	25	19	University Parkway
1332	30	7	41	One Parkade
1331	6	30	18	The Fort
1101	15	14	19	Net One
1326	24	9	35	Net Cube
1325	28	2	61	Crescent Park West
1333	9	30	39	For Victoria
1026	-	27	12	Ayala EDSA
Max			86	Pax
Bus Capacity			70	Pax
Required Frequency			2	bus/hr
Route Distance			5.29	km
Travel Distance			48.00	min
Frequency by One Bus			1.14	times/hr/bus
No. of Required Buses			2	veh
Total Boarding				pax

Source: Cube

Figure 5.10: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Nighttime)



Source: Cube

Figure 5.11 below shows the daily passengers per link for the six (6) bus routes from Zones 1- 25 for year 2020; this is from the results of the Transit Assignment. This figure shows which links have higher passenger demand and those with fewer passengers on a daily basis. The width of the links represents the volume of passengers – The thicker the line, the higher the passenger demand and vice-versa.

Figure 5.11: Daily Bus Passenger Per Link (2025)

Source: Cube

The minimum requirement to meet the passenger demand during peak hour, off-peak hour and during nighttime for 2025 is as follows:

(i) Peak Hour Requirement – 32 bus units/hour (4 routes)

(ii) Off-peak Requirement – 15 bus units/hour (3 routes)

(iii) Night time Requirement – 2 bus unit/hour (1 route)

The figures above were generated as a result of the calculation of the different data generated from Cube for each particular route. These data are extracted from Cube and presented in charts and graphical data to provide a better illustration for the readers. For purposes of brevity, the details of the calculation and explanation of the technical terms are being made only for the Lower West Route. The same process and terms, however, applies in all other routes using the data applicable.

Table 5.11: Lower West Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1026	300	-	356	Ayala EDSA
1190	171	13	515	MacKinley Parkway
1331	290	443	362	The Fort
1101	145	84	423	Net One
1333	69	78	413	Fort Victoria
1190	9	169	253	McKinley Parkway
1026	-	196	57	Ayala EDSA
Max			515	pax
Bus Capacity			70	pax
Required Frequency			8	bus/hr
Route Distance			1.56	km
Travel Distance			61.00	min
Frequency by One Bus			0.89	times/hr/bus
No. of Required Buses			9	veh
Total Boarding			983	pax

Source: Cube
Line-1 Stations - represents the node number (bus stops) in the model.
Board - represents the number of passengers boarding on each bus stop.
Alight - represents the number of passengers alighting from the bus on each bus stop.
Line Volume – represents the total number of passengers in between one bus stop to the next bus stop (data from Cube).

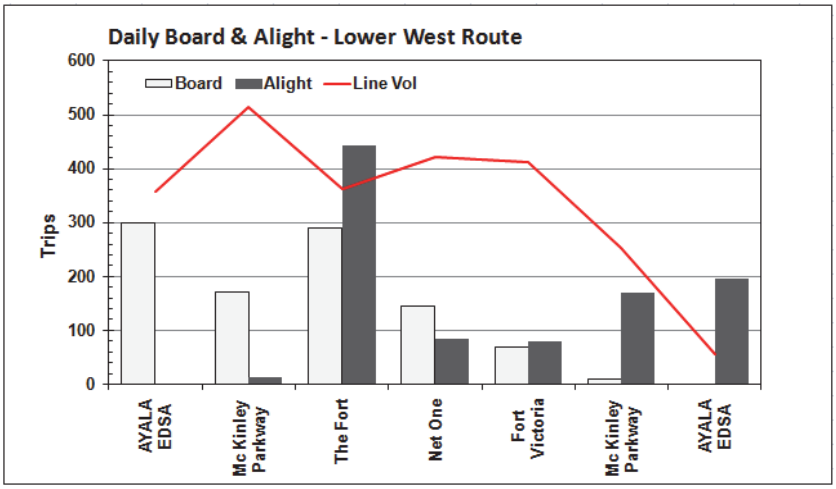
The maximum line volume (515) is divided by bus capacity (70 - information from BTC) that gives us the required frequency per hour. This means that 8 buses are needed to satisfy the maximum line volume.

The required headway was computed based on required frequency (1 hour = 60 minutes; 60/4 buses = 15 minutes).

Route distance was calculated from the model (1.56 km).

Travel time was based from the report of BTC. The maximum travel time during peak hour is 61 minutes. Thus, the frequency of one bus unit is 0.89 times per hour. The number of required buses during peak hours in the Lower West Route is 9, which is derived by dividing the required frequency (8) over the frequency of one bus (0.89).

Figure 5.12: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Lower West Route)



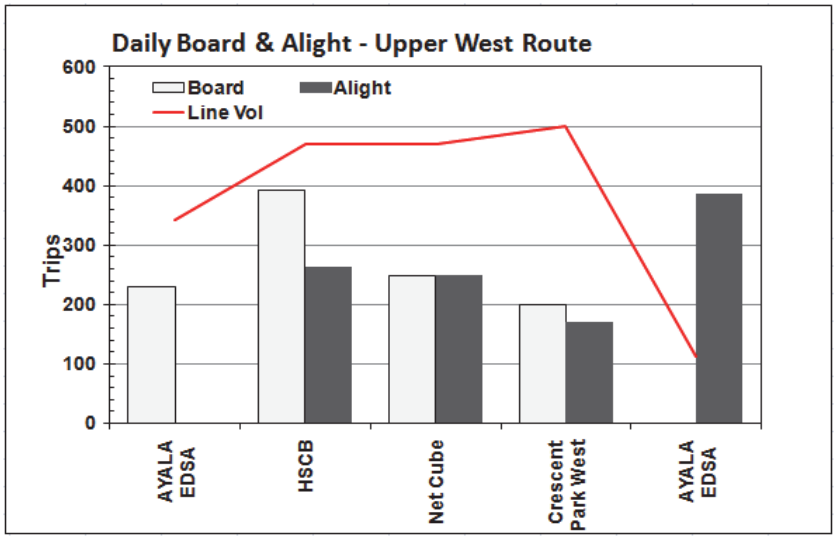
Source: Cube

Table 5.12: Upper West Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1029	230	-	342	Ayala EDSA
1327	392	263	471	HSBC
1326	248	249	470	Net Cube
1325	199	170	500	Crescent Park West
1029	-	387	112	Ayala EDSA
Max			500	pax
Bus Capacity			70	pax
Required Frequency			8	bus/hr
Route Distance			1.33	km
Travel Distance			97.00	min
Frequency by One Bus			0.56	times/hr/bus
No. of Required Buses			15	veh
Total Boarding			1,069	pax

Source: Cube

Figure 5.13: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Upper West Route)



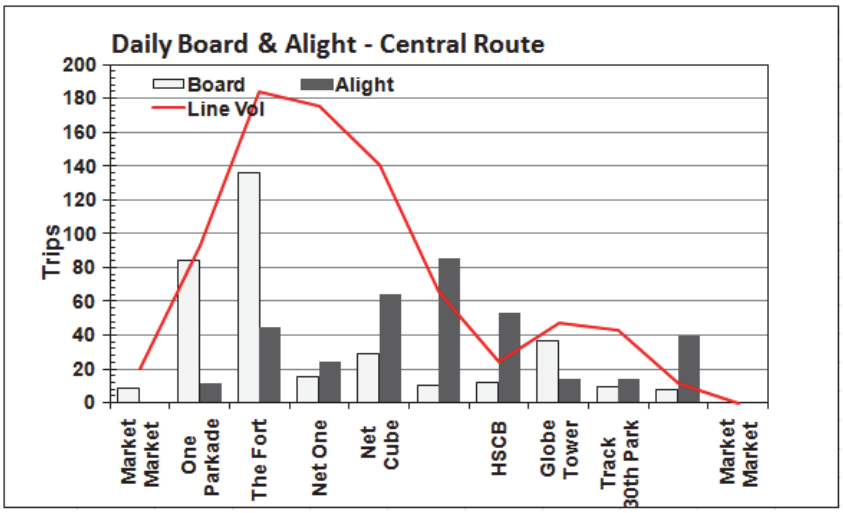
Source: Cube

Table 5.13: Central Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1135	8	-	20	Market Market
1332	85	11	93	One Parkade
1331	136	45	184	The Fort
1101	15	24	175	Net One
1326	29	64	141	Net Cube
1325	11	86	66	Crescent Park West
1327	12	53	25	HSBC
1328	37	14	47	Globe Tower
1329	9	14	43	Track 30th Park
1330	8	39	12	University Parkway
1135	-	-	-	Market Market
Max			184	pax
Bus Capacity			70	pax
Required Frequency			3	bus/hr
Route Distance			3.07	km
Travel Distance			37.00	min
Frequency by One Bus			1.47	times/hr/bus
No. of Required Buses			3	veh
Total Boarding			350	pax

Source: Cube

Figure 5.14: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Central Route)



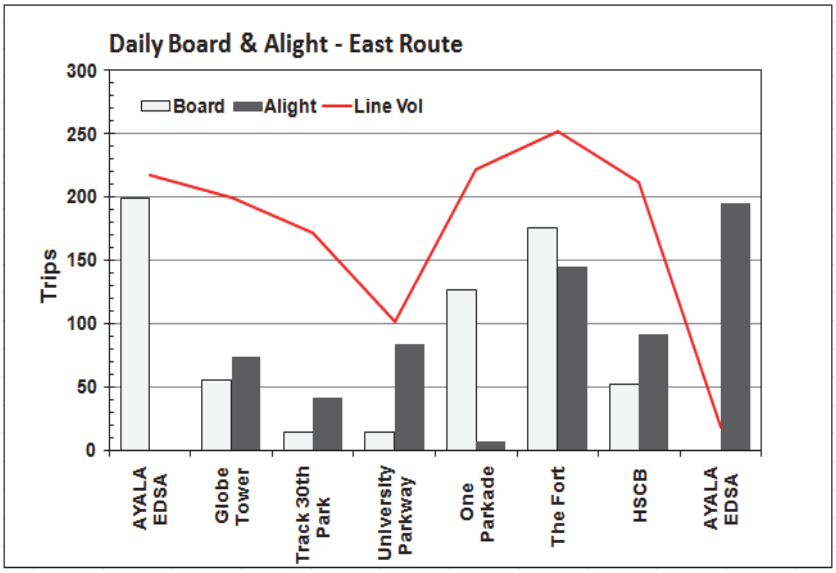
Source: Cube

Table 5.14: East Route (Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1029	199	-	217	Ayala EDSA
1328	56	73	199	Globe Tower
1329	14	42	172	Track 30th Park
1330	14	83	102	University Parkway
1332	127	7	222	One Parkade
1331	176	145	252	The Fort
1327	52	92	212	HSBC
1029	-	195	18	Ayala EDSA
Max			252	pax
Bus Capacity			70	pax
Required Frequency			4	bus/hr
Route Distance			3.03	km
Travel Distance			60.00	min
Frequency by One Bus			0.91	times/hr/bus
No. of Required Buses			5	veh
Total Boarding			638	pax

Source: Cube

Figure 5.15: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (East Route)



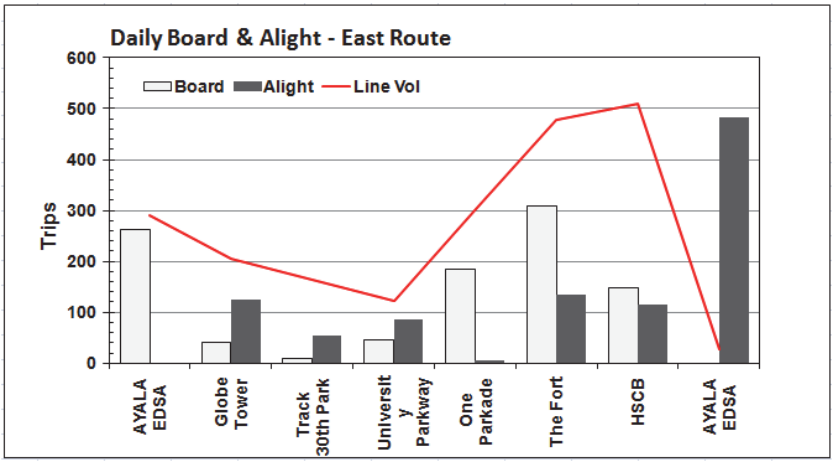
Source: Cube

Table 5.15: East Route (Off-Peak Hour)

Line 1 Stations	Board	Alight	Line Vol.	Station
1029	262	-	290	Ayala EDSA
1328	40	124	206	Globe Tower
1329	10	53	163	Track 30th Park
1330	45	86	122	University Parkway
1332	185	6	300	One Parkade
1331	310	133	477	The Fort
1327	147	114	510	HSBC
1029	-	482	28	Ayala EDSA
Max			510	pax
Bus Capacity			70	pax
Required Frequency			8	bus/hr
Route Distance			3.03	km
Travel Distance			52.00	min
Frequency by One Bus			1.05	times/hr/bus
No. of Required Buses			8	veh
Total Boarding			999	pax

Source: Cube

Figure 5.16: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (East Route – Off-Peak)



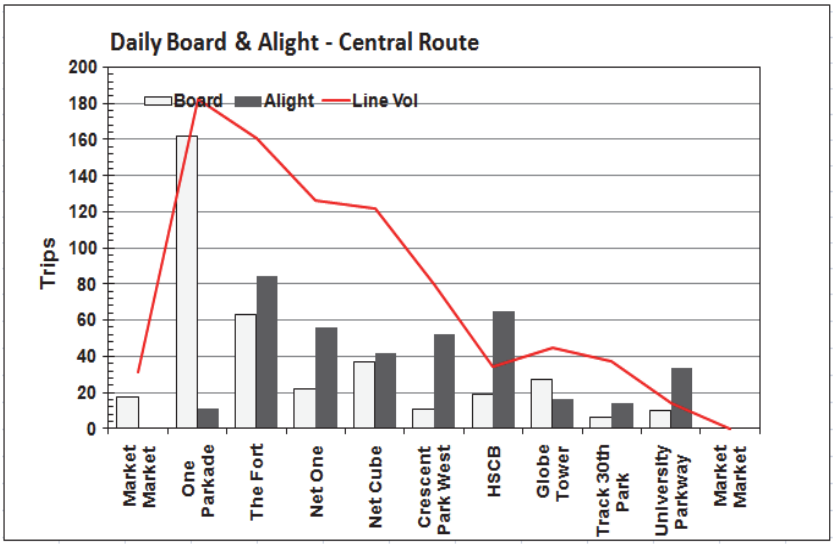
Source: Cube

Table 5.16: Central Route (Off Peak)

Line 1 Stations	Board	Alight	Line Vol	Station
1135	17	-	31	Market Market
1332	162	11	182	One PArkade
1331	63	84	161	The Fort
1101	22	56	127	Net One
1326	37	42	122	Net Cube
1325	11	53	80	Crescent PPark West
1327	19	65	34	HSBC
1328	27	16	45	Globe Tower
1329	7	14	37	Track 30th Park
1330	10	33	14	University Parkway
1135	-	-	-	Market Market
Max			182	pax
Bus Capacity			70	pax
Required Frequency			3	bus/hr
Route Distance			3.07	km
Travel Distance			26.00	min
Frequency by One Bus			2.10	times/hr/bus
No. of Required Buses			2	veh
Total Boarding			374	pax

Source: Cube

Figure 5.17: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Central Route – Off-Peak)



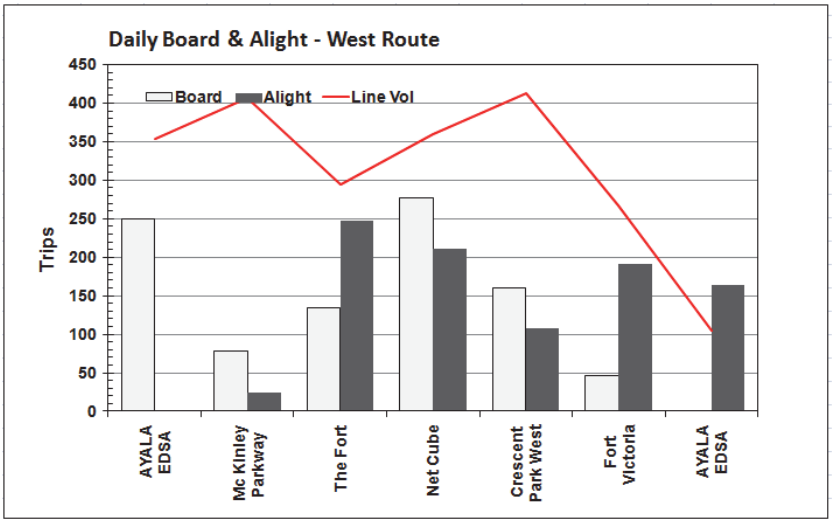
Source: Cube

Table 5.17: West Route (Off-Peak)

Line 1 Stations	Board	Alight	Line Vol	Station
1026	250	-	354	Ayala EDSA
1190	78	25	407	McKinley Parkway
1331	135	248	294	The Fort
1326	277	212	360	Net Cube
1325	160	107	413	Crescent Park West
1333	46	191	268	Fort Victoria
1026	-	163	104	Ayala EDSA
Max			413	pax
Bus Capacity			70	pax
Required Frequency			6	bus/hr
Route Distance			2.22	km
Travel Distance			37.00	min
Frequency by One Bus			1.47	times/hr/bus
No. of Required Buses			5	veh
Total Boarding				pax

Source: Cube

Figure 5.18: Boarding and Alighting On Each Bus Stations/Stops and the Line Volume (West Route – Off-Peak)



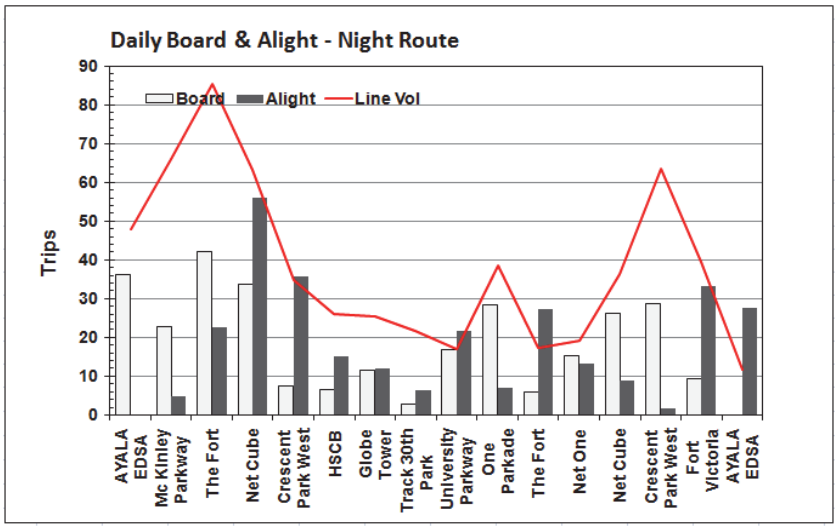
Source: Cube

Table 5.18: Nighttime Passenger Profile

Line 1 Stations	Board	Alight	Line Vol.	Station
1026	36	-	48	Ayala EDSA
1190	23	5	66	McKinley Parkway
1331	42	23	85	The Fort
1326	34	56	63	Net Cube
1325	7	36	35	Crescent Park West
1327	7	15	26	HSBC
1328	11	12	25	Globe Tower
1329	3	6	22	Track 30th Park
1330	17	22	17	University Parkway
1332	28	7	38	One Parade
1331	6	27	17	The Fort
1101	15	13	19	Net One
1326	26	9	36	Net Cube
1325	29	2	64	Crescent Park West
1333	9	33	39	Fort Victoria
1026	-	28	12	Ayala EDSA
Max			85	Pax
Bus Capacity			70	pax
Required Frequency			2	bus/hr
Route Distance			5.29	km
Travel Distance			48.00	min
Frequency by One Bus			1.14	times/hr/bus
No. of Required Buses			2	veh
Total Boarding				pax

Source: Cube

Figure 5.19: Boarding and Alighting on Each Bus Stations/Stops and the Line Volume (Nighttime)



Source: Cube

6 SUMMARY OF FINDINGS/RECOMMENDATIONS

Below, in Table 6.1, is the summary of the minimum requirements to meet the passenger demand during peak and off-peak hours and nighttime for the years 2014, 2020, and 2025.

Table 6.1: The Minimum Requirement

Summary of Minimum Requirements			
	2014	2020	2025
Peak Hour Requirement	23 bus units/hour (4 routes)	30 bus units/hour (4 routes)	32 bus units/hour (4 routes)
Off-Peak Hour Requirement	9 bus units/hour (3 routes)	14 bus units/hour (3 routes)	15 bus units/(3 routes)
Night Time	1 bus unit/hour (1 route)	2 bus/hour (1 route)	2 bus units/hour (1 route)

Source: Cube

The minimum number of bus units during the peak and off-peak hours and nighttime must be determined to meet the maximum passenger demand. These times were considered due to the unique operational characteristic of BTC. The routes catered by BGC buses change according to the demands of the passengers in some routes. These figures, however, merely represent the minimum number of buses that should be plying in the said routes especially during peak hours. It does not in any way give the ideal number of buses that should be operating within BGC. It should also be noted that the required number of buses during peak hours substantially covers the passenger demand during off-peak and nighttime.

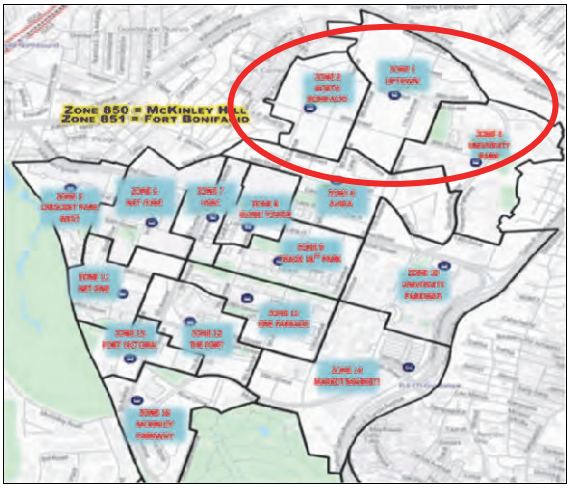
Based on the findings of the study, the following suggestions are hereby recommended by the case study group:

(i) The creation of new bus routes to cater passengers from other zones that are not covered by the existing bus services such as Zones 1–3. The identification and creation of the routes that would best cater to the needs of the riding public needs to be further studied and evaluated.

(ii) Modification of East Route to cover Zones 1–3 for 2020 and 2025. Emphasis is made on the East route because it is the route closest to Zones 1–3. The same emphasis is given to Zones 1–3 because the existing bus service does not sufficiently cover the said zones.

(iii) The addition of new bus units to operate within BGC for the year 2020 and 2025. Based on the Trip Generation/Attraction data for the years 2020 and 2025 a significant increase in number of passenger trips has been forecasted, hence the need to increase the number of bus units. The determination as to the appropriate number of units that should be operating within the study area for those horizon years can be further evaluated if directed.

Figure 6.1: Zone System



Source: BTC, Open Street Map