FINAL REPORT

Main Text

1 INTRODUCTION

1.1 Study Background

Cavite is one of the most rapidly growing areas around Metro Manila. Its population was 2.1 million in 2000 and is predicted to increase to 4.1 million by 2015. This population growth, coupled with industrial and commercial development, has brought about serious traffic congestion in the area. The Cavite Busway Project has been proposed under these circumstances based on the following two studies:

A. Metro Manila Urban Transportation Integration Study (MMUTIS, JICA 1999)

This transport master plan for Metro Manila and its adjacent areas recommended the strengthening of public transport including mass urban transit between Metro Manila and Cavite where rapid urbanization and consequent worsening of traffic situation is being experienced.

B. Cavite-Laguna Urban Development and Environmental Management Project (World Bank 2000)

In consistency with MMUTIS, this study formulated transport development strategies for Cavite and Laguna, and identified transport improvement projects including the Cavite Busway Project.

The Project found it very important to construct an effective public transport system for Cavite which, if successfully implemented, is expected to be a good model for other areas. In this study, all concerned local government units (LGUs) participated in a number of seminars, workshops and coordination meetings in relation to the Project. Thus, aside from the central government, particularly the National Economic and Development Authority (NEDA) and the Department of Public Works and Highways (DPWH), the LGUs are well aware of the Project, providing a favorable condition for its implementation.

1.2 Objectives

This study intends to examine the feasibility of the proposed Cavite Busway System in accordance with the request of the Government of the Philippines. However, because this proposed project has been subjected to a wide consultation and consensus among related government organizations, the objectives of this study are not only limited to testing the feasibility of the Project but also to planning and proposing realistic solutions for the remaining project issues to accelerate project implementation. In addition, technology transfer to the Filipino counterpart staff is intended during the course of the Study.

1.3 Study Area

The three (3) municipalities of Bacoor, Imus and Dasmariñas in Cavite, where the proposed busway corridor is located, cover the primary study area. However, entire Cavite and a part of Metro Manila (Las Piñas, Parañaque and Pasay) were included in the Study depending on the characteristics of analysis. In addition, the area along the proposed busway corridor was studied in detail after the route was fixed and agreed upon.

Figure 1.1 Study Area of Past Studies

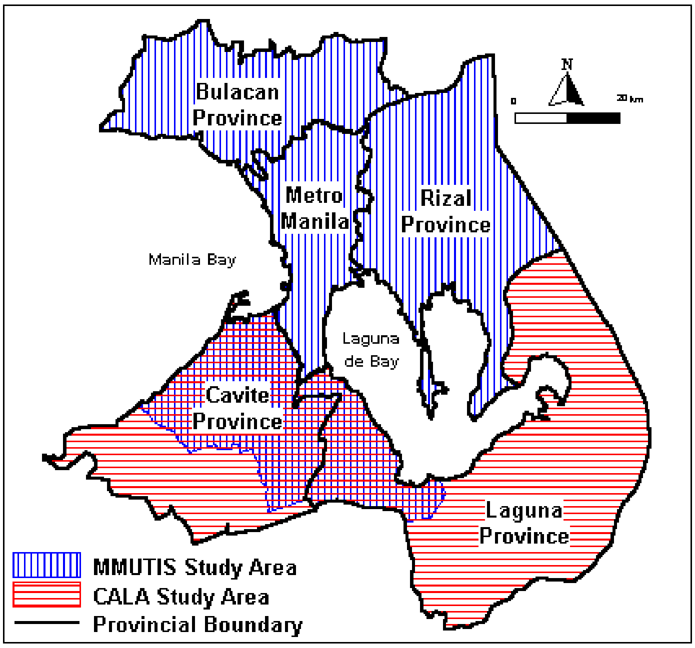
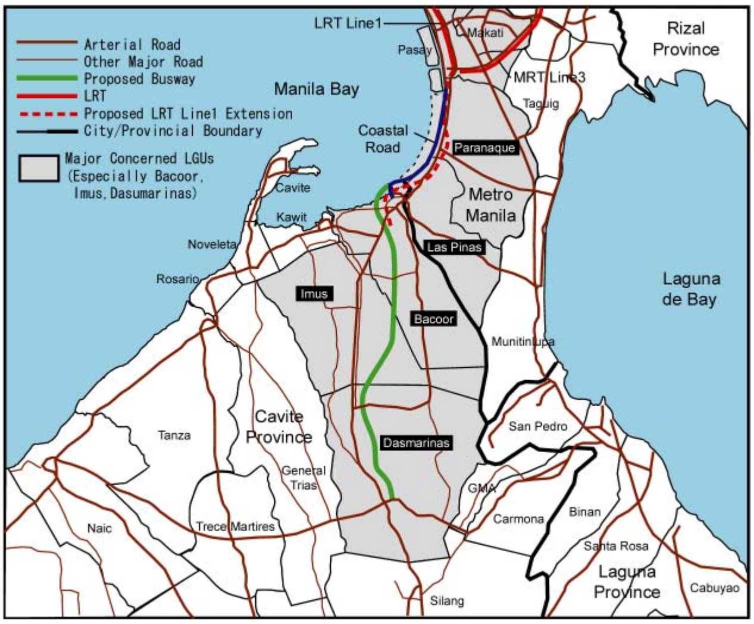


Figure 1.2 Study Area

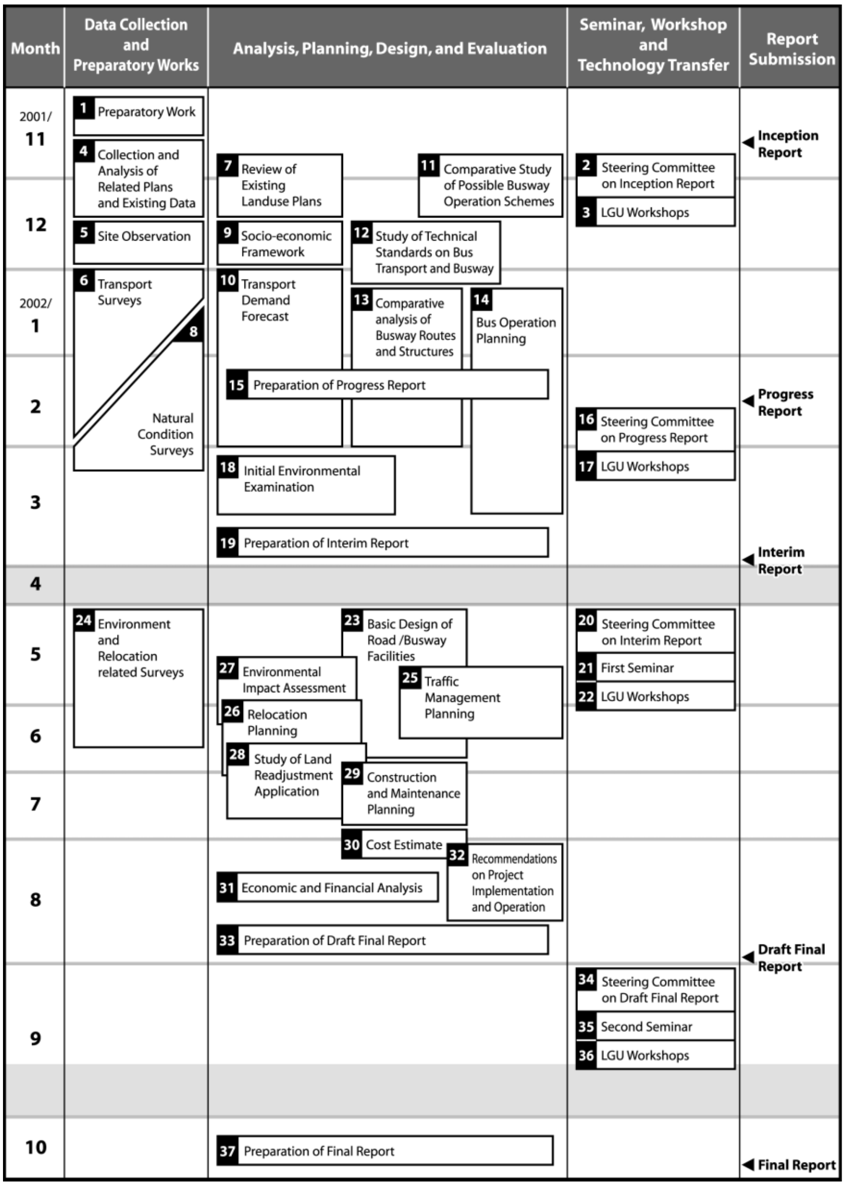


1.4 Study Methodology

The overall study framework presented in Figure 1.3 is composed of 2 major stages. Stage 1 included the following activities: 1) data and information collection, 2) transport and demand forecast, 3) determination of busway configuration (route, structure and other basics), 4) busway and bus operation planning, 5) submission of Inception Report, Progress Report and Interim Report, and 6) local government units (LGUs) workshops.

For Stage 2, the following activities were conducted: 1) basic design and cost estimation; 2) relocation and resettlement planning; 3) environmental analysis; 4) land readjustment planning; 5) traffic management planning; 6) economic and financial analysis; 7) submission of Draft Final Report and Final Report; and 8) seminars and LGU workshops.

Figure 1.3 Study Framework



1.5 Major Meetings/Seminars/Workshops Held during the Study

The following major meetings, project tasks and activities were conducted in accordance with the study framework (Table 1.1)

Table 1.1 Major Activities Conducted (November 2001 – August 2002)

Date	Activity	Participants	Outcome
Meetings and Presentations			
Nov. 21, 2001	Presentation of Inception Report to the GOP Study Team	NEDA, DPWH, Municipalities of Bacoor, Imus and Dasmariñas, JICA Advisory Team, JICA Study Team	Agreed that the JICA Study Team shall coordinate with concerned agencies such as DOTC, LRTA and MMDA in the planning of alignment options and bus stops/terminal development.
Nov. 29, 2001	1st Steering Committee Meeting	DPWH, NEDA, DOTC, MMDA, DILG, NCTS, Cavite LGUs, JICA Advisory Team, JICA Study Team	Approval of the Inception Report. The JICA Study Team shall take into consideration all the major ongoing projects in the project area.
Dec. 13, 2001	1st LGU Plenary Workshop	DPWH, NEDA, DOTC, JICA, Cavite LGUs, Private Sector, JICA Study Team	Agreed that the JICA Study Team shall refine the alignment options presented and shall develop implementation arrangement options, particularly on the possibility of a cost-sharing mechanism between the NG and the LGUs in the ROWA.
Feb. 18, 2002	Presentation of Progress Report to GOP Study Team	NEDA, DPWH, Municipalities of Bacoor, Imus and Dasmariñas, JICA Study Team	Agreed that concerned LGUs, DOTC and the LRTA shall be consulted on the proposed alignment.
Feb. 19, 2002	Initial meeting with Environmental Management Bureau-DENR	NEDA, DPWH, DENR, JICA Study Team	An EIS is required from the Project. During the Study period, consultations shall be conducted with affected project stakeholders.
Feb. 28, 2002	Coordination Meeting with DOTC	DOTC, NEDA, JICA Study Team	Discussion on the proposed busway alignment to complement with the LRT Line 1 extension.
March 1, 2002	2nd Plenary LGU Workshop	DPWH, NEDA, DOTC, MMDA, DENR, JICA, Cavite LGUs, Private Sector, JICA Study Team	Discussion on the Progress Report, specifically on the proposed busway alignment options.
March 5, 2002	2nd Steering Committee Meeting	DPWH, NEDA, DOTC, MMDA, DILG, JICA, Cavite LGUs, JICA Study Team	Approval of the Progress Report. The JICA Study Team shall conduct follow-up coordination meetings with various project stakeholders.
March 7, 2002	Coordination Meeting with Dasmariñas LGU	Municipal Mayor, LGU Project Team, JICA Study Team	Selection of preferred alignment by Dasmariñas LGU.
March 8, 2002	Coordination Meeting with Bacoor LGU	Municipal Mayor, LGU Project Team, JICA Study Team	Selection of preferred alignment by Bacoor LGU.

Table 1.1 Major Activities Conducted (November 2001 – August 2002) ***(Continued)***

Date	Activity	Participants	Outcome
March 12, 2002	Coordination Meeting with LRTA	LRTA, SNC Lavalin, JICA Study Team	Agreed that busway and LRT Line 1 extension shall complement each other. JICA Study Team shall initiate follow-up meetings with SNC Lavalin to ensure coordinated planning.
March 13, 2002	Coordination Meeting with One Asia	One Asia officials, JICA Study Team	Agreed that One Asia shall take into consideration the proposed alignment in their land use and development plans.
March 14, 2002	Coordination Meeting with Solar Resources	Dasmariñas Mayor, Solar Resources officials, NEDA, JICA Study Team	Agreed that Solar Resources shall prepare a land use plan according to the proposed alignment, in coordination with the JICA Study Team.
March 21, 2002	First Meeting of the Right of Way Acquisition Task Force	ROWA Task Force Members (DPWH, NEDA, DOTC, MMDA, JICA, Cavite LGUs, JICA Study Team)	General agreement on ROWA-related activities. Agreed that details of these activities and project issues shall be addressed in the small working groups.
May 6, 2002	Presentation of Interim Report to GOP Study Team	NEDA, DPWH, Municipalities of Bacoor, Imus and Dasmariñas, JICA Study Team	Agreed that more detailed discussions with LGUs and DPWH on the proposed TRUST concept be conducted.
May 14, 2002	1st Seminar: Presentation of the Interim Report	DPWH, NEDA, DOTC, MMDA, DENR, JICA, Cavite LGUs, Private Sector, JICA Study Team	Discussion on the Interim Report, specifically on the project issues (e.g. alignment, ROWA, institutional, etc.)
May 16-20, 2002	LGU Workshops	Municipal Mayors/Vice Mayors of busway LGUs, JICA Study Team	Discussion of the proposed CBS TRUST for ROWA prior to project implementation
May 23, 2002	3rd Steering Committee Meeting	DPWH, NEDA, DOTC, MMDA, NCTS, JICA, Cavite LGUs, JICA Study Team	Approval of the Interim Report. The JICA Study Team shall prepare cost estimates for each alignment option to aid decision-makers on the final alignment of the busway.
May 24, 2002	Coordination Meeting with Solar Resources	One Asia Officials, JICA Study Team	One Asia amenable to enter into a CBS TRUST Agreement.
May 29, 2002	3rd Plenary LGU Workshop	DPWH, NEDA, Cavite LGUs, Private Sector, JICA Study Team	Presentation and validation of the proposed CBS TRUST for ROWA prior to project implementation
Aug. 16, 2002	Presentation of Draft Final Report to GOP Study Team	NEDA, DPWH, Municipalities of Bacoor, Imus and Dasmariñas, JICA, JICA Study Team	Agreed that Study Team will confirm results of the demand forecast and initiate follow-up discussions with stakeholders re institutional arrangements.
Aug. 29, 2002	4th Plenary LGU Workshop	Cavite LGUs, JICA Study Team	Validation of Resettement Action Plan.
Sept. 3, 2002	Consultation with LGU municipal officials	Municipal Mayors of Bacoor, Imus and Dasmariñas	Consultation with the Mayors regarding the draft Memorandum of Agreement.

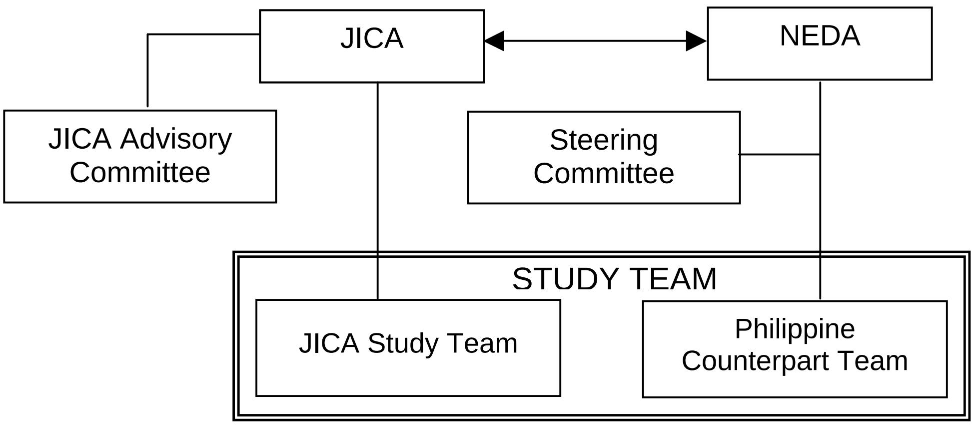
Table 1.1 Major Activities Conducted (November 2001 – August 2002) ***(Continued)***

Date	Activity	Participants	Outcome
Sept. 4, 2002	4th Steering Committee Meeting	DPWH, NEDA, DOTC, MMDA, DILG, NCTS, JICA, Cavite LGUs, JICA Study Team	Approval of the DFR. The GOP will formally submit a request to JICA for further assistance necessary to fully analyze the institutional arrangements for the busway.
Sept. 5, 2002	2nd Seminar: Presentation of the DFR	DPWH, NEDA, DOTC, MMDA, DILG, JICA, DILG, Cavite LGUs, Private Sector, JICA Study Team	Discussion on how the project can be realized, specifically on the institutional arrangements necessary for the successful implementation of the project.
Technology Transfer			
Feb. 26-27, 2002	Lecture/FGD with busway LGUs	LGU Project Teams of Bacoor, Imus and Dasmariñas, JICA Study	LGU Project Teams were provided a lecture on Modal Interchange Planning. Preliminary agreements on the respective alignment per municipality were reached.
February 27 & March 11	Lecture/FGD with busway LGUs	LGU Project Teams of Bacoor, Imus and Dasmariñas, JICA Study	LGU Project Teams were provided an overview of Resettlement Planning.
March 7-8, 2002	Lecture/FGD with busway LGUs	LGU Project Teams of Bacoor and Dasmariñas, JICA Study Team	LGU Project Teams were provided a lecture on Land Use Planning, particularly on land use planning along their respective busway corridors.
May 27-28, 2002	Lecture/FGD with busway LGUs	LGU Project Teams of Bacoor and Dasmariñas, JICA Study Team	LGU Project Teams were provided a lecture on Traffic Management.
Aug 7-8, 2002	Lecture/FGD with busway LGUs	LGU Project Teams of Bacoor and Dasmariñas, JICA Study Team	LGU Project Teams were provided a lecture on Land Readjustment.

1.6 Study Organization

The study organization is composed of the JICA Advisory Committee and the JICA Study Team on the Japanese side and the Steering Committee and the counterpart team on the Philippine side as shown in Figure1.4.

Figure 1.4 Study Organization



The following are the Members of the respective Committees/Teams:

JICA Advisory Committee Members

1) Mr. Takashi ARIYASU	Chairman
2) Mr. Toshihiko TAKAHASHI	Road Planning
3) Ms. Michiyo MACHIDA	Public Transport Planning
4) Mr. Ryutaro KONISHI	Public Transport Planning (successor)
5) Mr. Akira TAKESHIMA	Railway Planning

JICA Coordinator

1) Ms. Reiko FUNABA	Coordinator

JICA Manila Office

1) Mr. Hiroyuki ABE	Assistant Resident Representative
2) Mr. Takafumi YASUMOTO	Assistant Resident Representative (successor)

JICA Study Team Members

1) Mr. Takashi SHOYAMA	Team Leader / Public Transport Planning
2) Mr. Michimasa TAKAGI	Deputy Team Leader / Road Planning / Traffic Management
3) Mr. Naoshi OKAMURA	Transport Demand Forecast
4) Mr. Ricardo M. Yuzon Jr.	Planning and Design of Busway Facilities
5) Mr. Akitoshi IIO	Environmental Analysis
6) Ms. Beulah E. Pallana	Relocation Planning
7) Dr. Geronimo V. Manahan	Land Use Planning / City Planning
8) Mr. Hajime TANAKA	Project Implementation and Operation Planning
9) Mr. Tetsuo WAKUI	Economic and Financial Analysis
10) Mr. Ian Paterson	Topography / Geology
11) Mr. Borala L. Jayaratne	Meteorology / Hydrology
12) Mr. Toshio UENO	Road and Structure Design
13) Mr. Toshinari KOBAYASHI	Construction Planning / Cost Estimate
14) Mr. Masato KOTO	Transport Node Planning
15) Mr. Kazuyuki OTSUKA	Railway Planning
16) Mr. Kiyotaka HAYASHI	Land Readjustment
17) Dr. Tetsuji MASUJIMA	Transport Survey / Analysis
18) Dr. Shizuo IWATA	Transport Policy

19) Mr. Rene Santiago	PFI (Private Financing Initiative)
20) Ms. Lynn M. Sison	LGU Coordination

Steering Committee

1) Mr. Teodoro T. Encarnacion	Undersecretary, DPWH
2) Mr. Ayong S. Maliksi	Governor, Province of Cavite
3) Mr. Oskar D. Balbastro	Regional Director, NEDA Region IV-A
4) Mr. Samuel C. Custodio	Director for Planning, DOTC
5) Ms. Cora Cruz	Assistant General Manager, MMDA
6) Mr. Hussein Lidasan	Executive Director, UP NCTS
7) Mr. Ricardo C. Sigua	Executive Director, UP NCTS (successor)

Philippine Counterpart Team

1) Mr. Godofredo Z. Galano	Director, BOT, DPWH
2) Mr. Nestor V. Agustin	Regional Director, DPWH Region IV-A
3) Mr. Jaime Martinez	District Engineer, Province of Cavite
4) Ms. Criste Navida	EIAPO, DPWH
6) Ms. Liberty Abellon	Division Chief, EDD, NEDA Region IV A
7) Mr. Terry Galvante	Railway Division, DOTC
8) Mr. Jesse Francisco	MPDC, Municipality of Bacoor
9) Ms. Angelina Cantimbuhan	MPDC, Municipality of Imus
10) Mr. Moises Menguito	MPDC, Municipality of Dasmariñas
11) Mr. Chris T. Pablo	Project Manager, CALA Project

2 REVIEW OF THE BUSWAY DEVELOPMENT PLAN AND REGIONAL FRAMEWORK

2.1 Review of the Cavite-Laguna (CALA) Transport Study

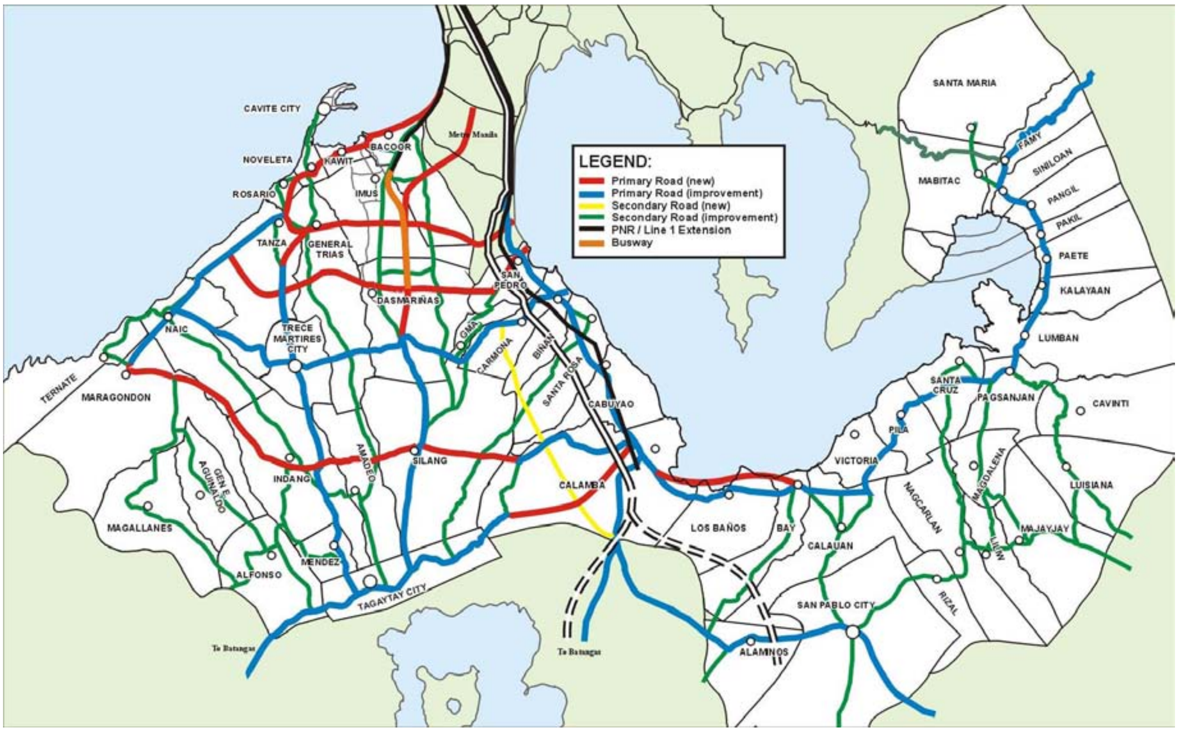
2.1.1 Outline of the Study

The CALA Transport Study (CALA Transport Strategy and Short-term Programs and Policies) was a follow-up technical assistance provided by the World Bank to Cavite and Laguna provinces as a component of the CALA Urban Development and Environmental Management Project. This Study had objectives relating to both long-term and short-term transport development in the area.

In the CALA Transport Study, the transport network plan was developed to follow the spatial development framework defined for the CALA area. The proposed transport development strategy was primarily road-centric, with rail and water ferry options secondary. The transport network for CALA to guide land use and private-sector led development is shown in Figure 2.1.

Among a number of transport projects for CALA, priority projects were identified as shown in Table 2.1. This priority transport package will require approximately ₱28.2 billion, which is 1.4 times bigger than most of the optimistic project with available funds. As such, not all the desired projects can be implemented in the short-term or even in the medium-term.

Figure 2.1 CALA Transport Network Proposed in the CALA Transport Study



Source: CALA Transport Study

Table 2.1 Priority Transport Projects Identified in the CALA Transport Study

Project Name		Amount (in million Pesos)
1. Cavite Busway System (excluding rolling stock)		4,079
2. Corridor Traffic Management Improvement	- MSR (Laguna) - Aguinaldo Corridor (Cavite) - Governor Drive (Cavite)	803 371 341
3. East-West Roads	- Tanza-Muntinlupa - Calibuyo-San Pedro - Bay-Calamba Bypass Road	3,869 4,517 715
4. Other Arterial Roads (no ROW cost)	- Primary Arterials (Except EW Roads) - Secondary Arterials	10,230 3,244
Total		28,169

Source: CALA Transport Study, 2000

2.1.2 Cavite Busway Project

The Cavite Busway System was recommended as one of the priority projects under the CALA Transport Study. A mass transit system in the form of a busway has been identified to meet the current and future transport requirement in CALA. The priority corridor under consideration was the highly congested coastal corridor in the province of Cavite, south of Metro Manila.

The pre-feasibility study of Cavite Busway System was conducted in the CALA Transport Study to evaluate the transport demand along the corridor, the assessment of alignment options, its relationship with the Light Rail Transit (LRT) routes and other transit modes, the busway characteristics and service levels, as well as the organizational and implementation aspects. A preliminary assessment of the economic and financial viability was also conducted. The concept plan for the Cavite Busway System is summarized below.

(1) Concept of Cavite Busway System

The busway, as defined in the CALA Transport Study, is a significant length of paved road used exclusively by designated categories of bus service or lines in order to achieve measurable improvements in service quality, journey time, reliability, and regularity. The facility may be within or adjacent to an existing highway but segregated from it, or follow a separate, exclusive alignment.

The busway concept is a lower-cost approach to mass transit that can provide the high capacity and flexible operations with less-demanding technologies. It is envisaged that a core of busway services would be provided in the corridor by a dedicated fleet of new buses. The system would be a high speed, high standard road for the exclusive use of designated busway services. Access for buses would be at each end of the busway and at several intermediate points near major settlements or other generators of activities, and at intersections with major highways.

The preliminary alignment under consideration is on a north-south alignment parallel to Aguinaldo Highway in Cavite, which will connect with the southern extension of the Metro Manila LRT network at Niog (Bacoor) or at an LRT station in the vicinity of the coastal expressway. Thus, the system can offer very fast journey times between the busway catchment area and a wide variety of destinations in Metro Manila.

Unlike LRTs, the busway services can operate on ordinary highways or roadways beyond the northern and southern termini. Although envisioned as "limited use" to the bus concessionaire, the busway itself could be “opened” to other bus operators – either in direct competition with the concessionaire (provided they meet service quality and busway access standards), or use the busway as a toll road without loading and unloading passengers. In both cases, users shall pay the appropriate access fee. The busway service operator shall use high quality buses operating on a frequent and regular headway. Services would start as a local link before joining the busway at the nearest access point, thereby reducing the number of interchanges on a journey. Park-and-ride provisions shall be made at key busway interchanges.

The busway alignment would be at-grade, but where it crosses roads, it would be grade-separated. All intersections with major routes would be grade-separated, with bus access and egress via ramps. To keep costs at a reasonable level, it may be appropriate to consider the closure of minor roads that are severed by the busway.

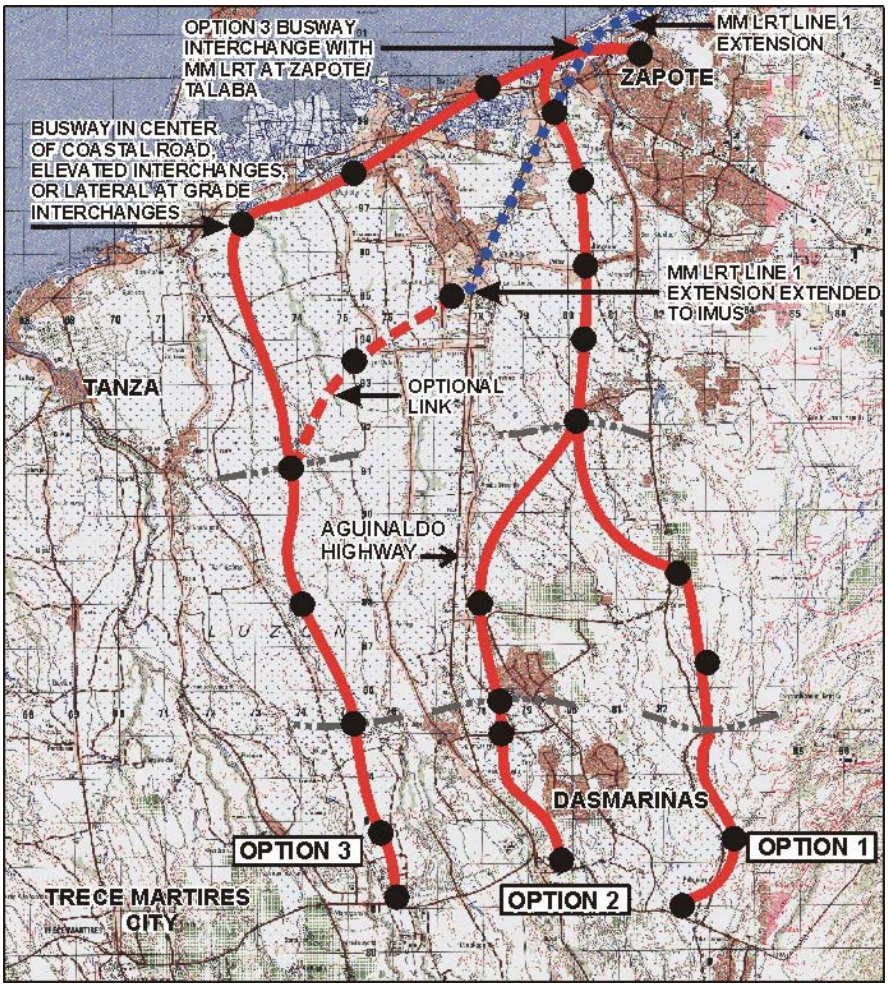
(2) Busway Alignment Options

Because of physical constraints and uncontrolled roadside developments, Aguinaldo Highway was evaluated to be not capable of providing lanes for busway system. Hence, a completely new alignment was considered. Three alignment options shown in Figure 2.2 were identified with particular emphasis on availability of ROW and minimum disruption to built-up areas. They are:

Option 1: Governor Drive to Niog via Pintong Gubat,
Option 2: Governor Drive to Niog via Dasmariñas, and
Option 3: Governor Drive to Imus or Niog via Santiago and General Trias

Out of three alignment options, Option 2 was chosen – starting from Palapala and running northward as close to Aguinaldo Highway before shifting eastward from Mambog area and connects with the southern extension of the LRT Line 1 at Niog area. The proposed at-grade busway will be 18.5km in length and shall be served by 8 stations. Further connection of the busway to the Manila-Cavite Coastal Expressway has been explored to directly link it with Metro Manila in the event the timing of implementation of the extended LRT Line 1 will be preceded by the busway.

Figure 2.2 Cavite Busway Alignment Options



Source: CALA Transport Study

(3) Project Cost and Economics

In the CALA Transport Study, indicative project cost for the Cavite Busway System was estimated at ₱4,625 million, of which ₱4,079 million was for the busway infrastructure and for government's account. The balance of ₱546 million was the cost of 100 units of new buses, inclusive of ancillary items like depot and spares, and proposed to be shouldered by a private concessionaire chosen through competitive tender. Although traffic demand forecasts point to a requirement of as much as 280 buses by year 2015, a bus fleet size of 100 was initially adopted for conservatism.

Preliminary economic analysis showed that the Cavite Busway Project is viable with an IRR of 22% under the conditions set in the CALA Transport Study.

2.2 Regional Framework and Socio-Economic Conditions

2.2.1 Gross Domestic Product (GDP)

Based on estimates, past trend and present profile of Gross Value Added (or GDP) in Cavite at current price is shown in Table 2.2.

In summary, the industry sector has consistently been contributing the largest share in the GDP of Cavite Province while the agriculture sector has the smallest contribution. While the service sector has the largest number of employment, its GDP contribution is smaller than the industry sector due to considerably lower labor productivity.

Table 2.2 Estimated GDP for Cavite by Type of Industry
(Current Prices, Million Pesos)

		YEAR								
		1990	1991	1992	1993	1994	1995	1996	1997	1998
CAVITE	Total	18,266	21,902	25,235	28,806	34,134	36,169	40,343	47,964	47,608
	agriculture	1,729	1,941	3,524	4,023	3,525	3,933	4,042	6,985	6,074
	industry	8,883	10,932	13,108	14,527	19,031	18,521	20,706	21,665	21,394
	service	7,654	9,029	8,602	10,256	11,579	13,715	15,595	19,314	20,141
Key City total	Total	-	-	-	-	-	-	-	13,374	13,342
	agriculture	-	-	-	-	-	-	-	607	456
	industry	-	-	-	-	-	-	-	6,229	5,822
	service	-	-	-	-	-	-	-	6,538	7,064
Bacoor	Total	-	-	-	-	-	-	-	6,076	6,391
	agriculture	-	-	-	-	-	-	-	76	76
	industry	-	-	-	-	-	-	-	2,843	2,708
	service	-	-	-	-	-	-	-	3,156	3,607
Dasmariñas	Total	-	-	-	-	-	-	-	3,896	3,685
	agriculture	-	-	-	-	-	-	-	76	76
	industry	-	-	-	-	-	-	-	2,166	2,031
	service	-	-	-	-	-	-	-	1,653	1,578
Imus	Total	-	-	-	-	-	-	-	3,403	3,266
	agriculture	-	-	-	-	-	-	-	456	304
	industry	-	-	-	-	-	-	-	1,219	1,083
	service	-	-	-	-	-	-	-	1,729	1,879
Other CAVITE	Total	-	-	-	-	-	-	-	34,665	34,266
	agriculture	-	-	-	-	-	-	-	6,377	5,618
	industry	-	-	-	-	-	-	-	15,436	15,571
	service	-	-	-	-	-	-	-	12,851	13,077

Source: CALA Transport Study

2.2.2 Population

Cavite is located just south of Metro Manila, and its proximity to the National Capital Region has led to a high level of urbanization and population increases similarly experienced by the metropolis.

In terms of population, Cavite province has a total population of just over 2 million, as of latest population census conducted in May 2000. Between 1990 and 2000, the province has experienced a rapid increase in population growth, brought about to a great extent by in-migration. Annual average population increases for the province was 6.9% between 1990 and 1995, decreasing to 5.0% between 1995 and 2000. For the 1990 to 2000 period, the average increase in population was 6.0% per year.

The three municipalities of Bacoor, Imus and Dasmariñas, which will be served by the Cavite Busway System, have the highest municipal populations in the province. In 1990, Bacoor had the highest municipal population in the province, followed by Dasmariñas and Silang. By 1995, Dasmariñas was the top ranked, followed by Bacoor and Imus. This same ranking still held for the 2000 population census.

Between 1980 and 1990, the rapid increase in Cavite's population, particularly for the urban areas, can be largely attributed to the squatter relocation program of Metro Manila (e.g., to GMA and Bagong Bayan in Dasmariñas), the development of affordable middle-income housing, and the 50-kilometer radius ban policy of Metro Manila on industries, discouraging further industrial activity within Metro Manila and promoting the industrial dispersal strategy. After 1990, this continuing increase in population has largely been brought about by intensive middle-income residential development; and the rapid industrialization brought about by the promotion of the Cavite-Laguna-Batangas-Rizal-Quezon (CALABARZON) growth area. Tables 2.3 and 2.4 show the population figures for the different Cavite municipalities during the census years 1990, 1995 and 2000.

Table 2.3 Population Growth Rate of Cavite Province

<table>
<tr><td>Year</td><td>1980</td><td colspan="2">1990</td><td colspan="2">1995</td><td>2000</td></tr>
<tr><td>Population</td><td>624</td><td colspan="2">964</td><td colspan="2">1,610</td><td>2,063</td></tr>
<tr><td>Growth rate</td><td colspan="2">1980-90</td><td colspan="2">1990-95</td><td colspan="2">1995-2000</td></tr>
<tr><td>Rate</td><td colspan="2">4.4</td><td colspan="2">7.6</td><td colspan="2">3.7</td></tr>
</table>

Source: National Statistics Office (NSO), 2001

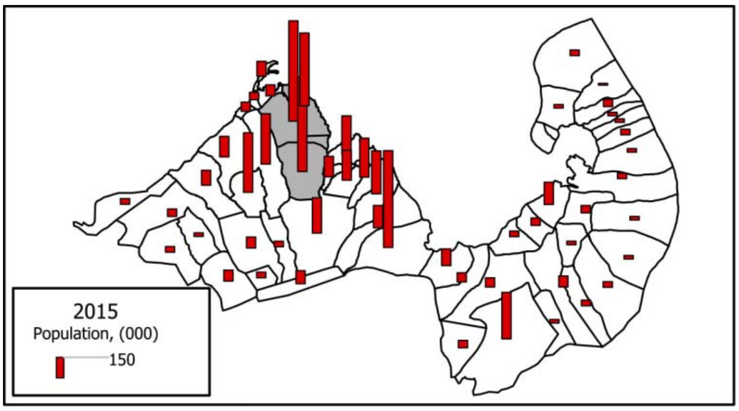
Table 2.4 Population in Cavite

		Population			Annual Growth Rate		
		1990	1995	2000	1990-95	1995-2000	1990-2000
	CAVITE PROVINCE	*1,152,575*	*1,610,324*	*2,063,161*	*6.9%*	*5.1%*	*6.0%*
District 1	Cavite City	91,629	92,641	99,367	0.2%	1.4%	0.8%
	Bacoor	**159,693**	**250,821**	**305,699**	**9.4%**	**4.0%**	**6.7%**
	Kawit	47,755	56,993	62,751	3.6%	1.9%	2.8%
	Noveleta	20,405	27,306	31,959	6.0%	3.2%	4.6%
	Rosario	45,407	54,086	73,665	3.6%	6.4%	5.0%
District 2	Trece Martires City	15,685	20,451	41,653	5.4%	15.3%	10.3%
	Carmona	28,242	35,686	47,856	4.8%	6.0%	5.4%
	Dasmariñas	**136,585**	**262,406**	**379,520**	**13.9%**	**7.7%**	**10.8%**
	Gen. Mariano Alvarez	65,962	86,824	112,446	5.6%	5.3%	5.5%
	General Trias	52,895	66,837	107,691	4.8%	10.0%	7.4%
	Imus	**92,140**	**177,408**	**195,482**	**14.0%**	**2.0%**	**7.8%**
	Tanza	61,779	77,839	110,517	4.7%	7.3%	6.0%
District 3	Tagaytay City	23,743	29,419	45,287	4.4%	9.0%	6.7%
	Alfonso	28,947	34,613	39,674	3.6%	2.8%	3.2%
	Amadeo	21,025	22,728	25,737	1.6%	2.5%	2.0%
	Gen. E. Aguinaldo	10,953	11,893	14,323	1.7%	3.8%	2.7%
	Indang	39,289	42,765	51,281	1.7%	3.7%	2.7%
	Magallanes	12,557	17,115	18,090	6.4%	1.1%	3.7%
	Maragondon	22,817	25,828	31,227	2.5%	3.9%	3.2%
	Mendez	17,649	20,321	22,937	2.9%	2.5%	2.7%
	Naic	51,631	58,046	72,683	2.4%	4.6%	3.5%
	Silang	93,807	124,062	156,137	5.8%	4.7%	5.2%
	Ternate	11,981	14,236	17,179	3.5%	3.8%	3.7%

Source: NSO, 2000.

Based on population projections made in the CALA Transport Study, a scenario was developed to represent the development framework for CALA's future. In this scenario, future urban hierarchy and different functions are assumed. Urban centers will grow to accommodate more population and economic activities. More strict land use control will take place in order to lead urbanization pressure to the direction conducive to the conceptual land use plan. It was also assumed that transportation network will be developed to serve the structure. Figure 2.3 illustrates this development scenario for CALA for 2015.

Figure 2.3 Population Projection for CALA



Source: CALA Transport Study

2.2.3 Industry

One issue is that the location of the manufacturing sector has a huge impact on how the future urban hierarchy and functions of new urban centers will be in CALA. Likewise, the locations of the industrial estates determine how the manufacturing sector employment would be allocated within CALA. As the industrial estates hold more than 80% of the manufacturing sector employment, their locations are to be planned or developed as a component of developing new urban centers.

Manufacturing activities could be divided into 5 clusters of industrial areas in CALA as shown in Figure 2.4. These are as follows:

Area No. 1: Cavite coastal industrial area - Rosario (Cavite Export Processing Zone) and Imus-Dasmariñas (along Aguinaldo Highway);

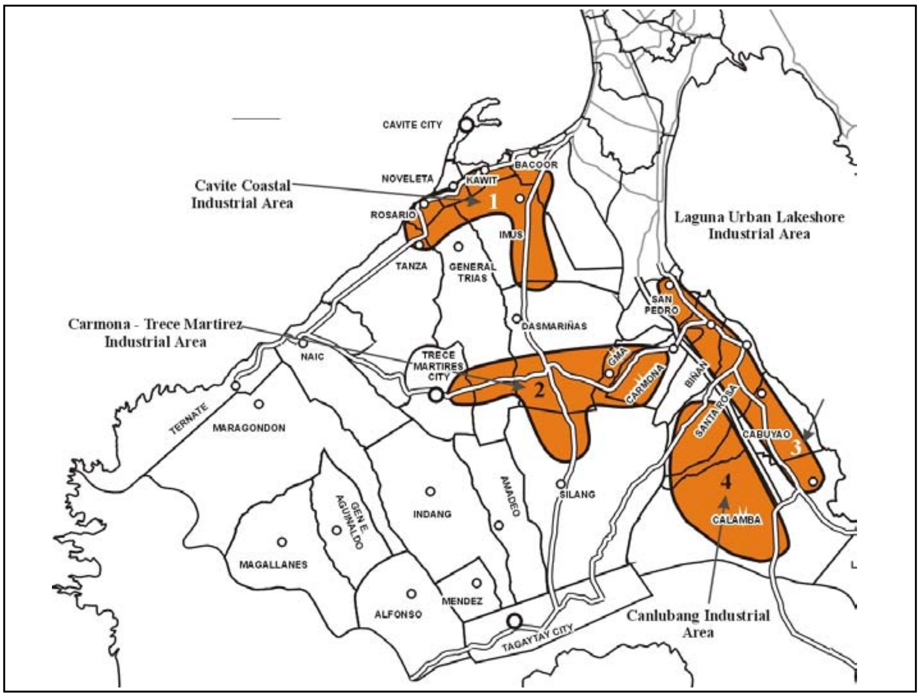
Area No. 2: Carmona-Trece Martires industrial area - Along Governor Drive in Carmona, GMA, Silang, Dasmariñas, General Trias, and Trece Martires;

Area No. 3: Laguna Urban Lakeshore industrial area - San Pedro-Calamba (old urban centers along Manila South Road);

Area No. 4: Canlubang industrial area - West of South Luzon Expressway in Carmona, Biñan, Santa Rosa, Cabuyao, Calamba; and

Area No. 5: San Pablo-Alaminos industrial area - San Pablo-Alaminos along major roads

Figure 2.4 Industrial Areas in CALA (based on CALABARZON Masterplan)



Source: CALA Transport Study

The province of Cavite has a number of roles including being a major commuter area supplying the Metro Manila area, as well as having its own industrial and agricultural base.

Table 2.5 Industrial Estates in the Study Area

Name of Industrial Estate	Location	Land area (ha)	Status
Imus Informal Industrial Center	Imus	200.0	Operational
Anabu Hills Industrial Estate	Imus	N.A.	Operational
First Cityland Heavy Industrial Centre	Dasmariñas	32.1	Operational
DBB-NHA Industrial Estate	Dasmariñas	8.6	Operational
First Cavite Industrial Estate	Dasmariñas	154.5	Operational
Dasmariñas Technopark	Dasmariñas	38.1	Operational

Source: Board of Investments (BOI)

(1) Commercial Centres

Large-scale commercial centres have been or are being developed such as SM City in Bacoor, Robinsons Commercial Complex and Makro Warehouse Complex in Imus, Walter Mart, Highway Plaza and New Dasmariñas Public Market Complex in Dasmariñas.

(2) Fish and Aquatic resources

The following fishery and aquatic resources are found in the vicinity of the project area.

Fishing Ground	Species
1. Coastal Waters	Squid, Hairtail, Nemepterids, Slipmouth, Tuna, Crustaceans, Herring, Molluscs, Grouper, Hasa-hasa, Anchovies, Mackerel
2. Seafarming	Oyster, Clams, Mussels
3. Brackish Fishponds	Bangus, Crabs, Sugpo, Tilapia

2.3 Provincial Urban Structure and Municipal Structure Plans

2.3.1 Urban Structure

Cavite's physical structure can be characterized by the sloping features from the southern highlands (Tagaytay, Alfonso, Magallanes) gradually sloping north-northwest towards the coastal areas (Rosario, Noveleta, Kawit, Cavite City). In between, gradual slopes and pockets of flatlands can be found.

The urban settlements in Cavite have flourished even during the Spanish era. Portions of the province were part of the friar estates. From these rural origins, the centers of these settlements have developed into the urban areas in present-day Cavite.

The slope from the southern highlands to the northwest coast has created a system of deeply-incised river gorges flowing mostly in a south to north / northwest manner. These waterway systems have acted as a major constraint in the development of a well-laid out road network. Most of the major roads in Cavite are oriented north-south, with linkages to Metro Manila in the Bacoor portion. Very few major east-west roads are present. The only major east-west road in the provincial road network is Governor’s Drive.

The structure of urban settlements in Cavite, therefore, has also been influenced by the configuration of its land transport network. The main road corridor in the province is Aguinaldo Highway, running north-south through the middle portion. This has been the province's inland urban corridor, starting from Bacoor in the north, linking Imus, Dasmariñas and Silang. The main east-west road – Governor’s Drive, links Carmona in the east, and passes through General Mariano Alvarez, Dasmariñas, General Trias, Trece Martires City, and Tanza westward.

With Dasmariñas at the junction of these two major corridors, it has been structured as a main urban center in the province. This is evident in its population growth over the past few years, as well as supported by other planning documents such as the Cavite-Laguna Urban Development and Environmental Management Study (Phase 2). This latest study proposed a bi-nodal urban development framework for the Cavite and Laguna provinces, with Dasmariñas as one node and Calamba as the other.

Table 2.6 lists the different categories or urban centers in Cavite, as defined in the Provincial Physical Framework Plan. Figure 2.5 shows the hierarchy of urban centers in Cavite as gleaned from the PPFP. Figure 2.6 on the other hand, shows the urban structure proposed in the CALA2 Urban Development Study.

Five LGUs in the southern portion of Cavite, namely Tagaytay City, Mendez, Alfonso, Amadeo, and Silang were part of the Tagaytay-Taal study area for which an integrated 20-year master plan was drafted in 1994, together with 10-year plans for the individual LGUs.

The long-term strategy for the development of the Tagaytay-Taal area is to declare the Taal Volcano caldera and the Taal Lake as a protected landscape under the National Integrated Protected Areas System (NIPAS) Law. The five Cavite LGUs were zoned as high value and productive agricultural zones, with emphasis to the

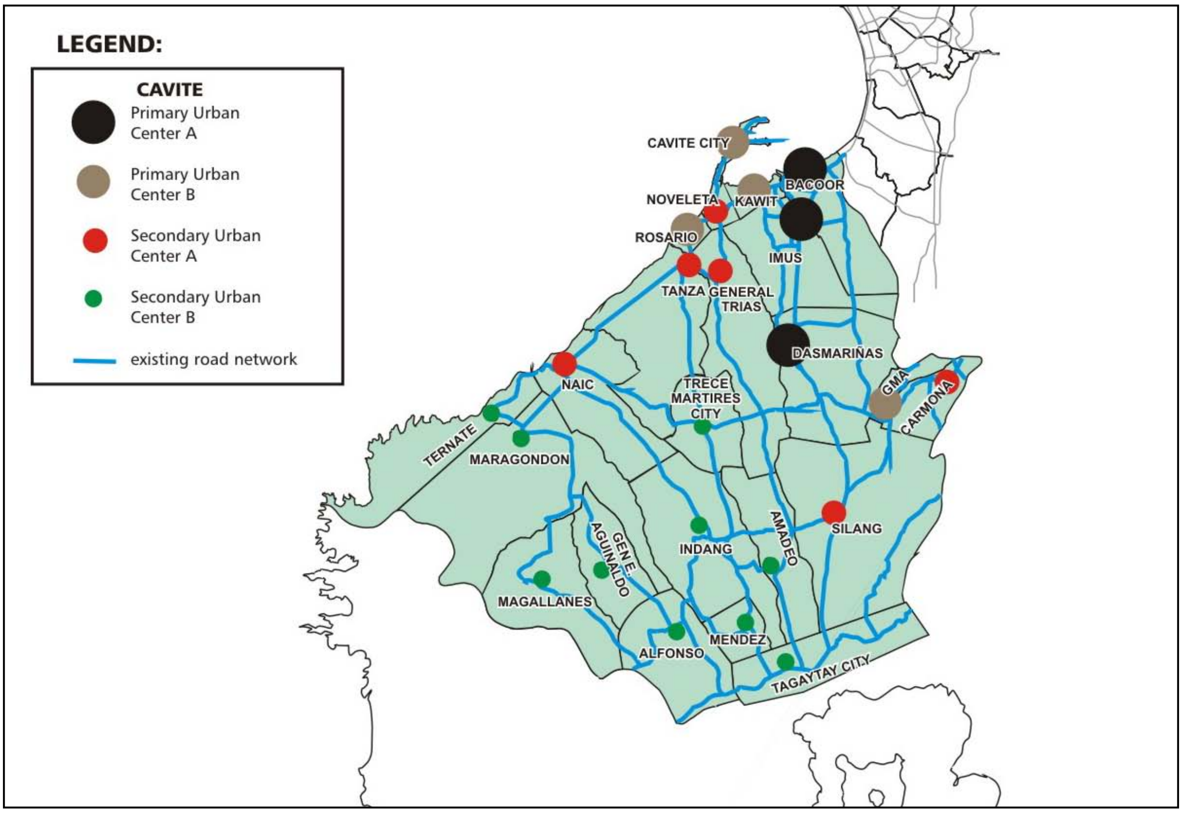
Tagaytay Ridge as a tourist strip. An additional overlay to the economic base of tourism services was introduced as sustainable services. For Tagaytay and its environs, the development of information and communication technology shall be encouraged, considering that the climatic and agricultural setting are conducive to these emerging technologies.

Table 2.6 Categories of Urban Centers in Cavite

Levels in Urban Hierarchy	Roles	Indicator Functions	Urban Population
Small/Medium City (Primary Urban Centre A)	International production and distribution centre	International port and airport, industry and commerce	>100,000
Large Town (Primary Urban Centre B)	Inter-regional centre	Specialist medical facilities, offices of NGAs and tourism facilities	>50,000
Medium Town (Secondary Urban Centre B)	Provincial services and administration	Comprehensive shopping, tertiary health and education services, processing and marketing	>25,000
Small town (Secondary Urban Centre B)	Small agri-processing and services	Entertainment, full range of convenience shops, extension services	>2,500

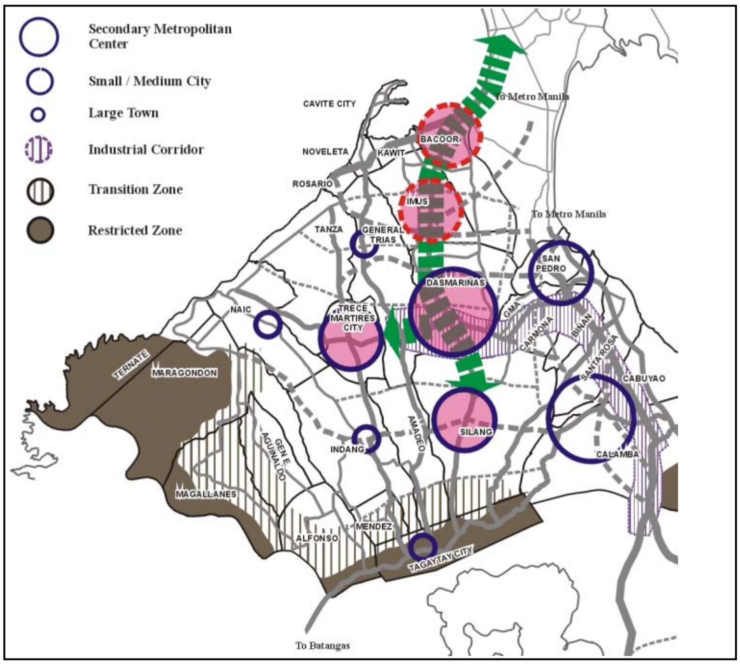
Source: CALA Transport Study

Figure 2.5 Hierarchy of Urban Centers, Cavite PPFP



Source: CALA Transport Study / Cavite Provincial Framework Plan

Figure 2.6 Urban Center Hierarchy (CALA Study)



Source: CALA 2 Urban Development Study

The long-term service overlay to the agricultural towns of Cavite shall be community-based applied research and development venues for interests in the biogenetic and volcanic sciences. Silang was deemed far from the threats of Taal Volcano and was recognized to be capable of absorbing larger rates of urbanization than the other towns in the plan. It was planned to take the role of being the agri-business center for the region. Along the concept of one special role for each town, the LGUs in the Tagaytay-Taal area were planned to assume specific livelihood development roles.

2.3.2 Municipal Structure Plans

(1) Historical Setting of the Busway Corridor

The Cavite Busway is envisioned to pass through Bacoor, Imus and Dasmariñas. For practical reasons, the alignment shall skirt away from the more populous areas as well as from the long-standing settlements of the towns. The alignment with its alternatives is expected to pass through the less-problematic areas of the three towns since right-of-way acquisition may slow down the progress of the construction. In this regard, the alignment may pass along former farmlands and the former *haciendas* of the Spanish friars. These lands were the setting of the bloody battles of the Philippine Revolution of 1896 to 1898. While the leaders and politicians of the revolution resolved their fractuous issues in the Cavite towns west of Binakayan, the eastern towns were settings of fierce battles. Alapan, in Imus was the first site where the Philippine Flag was unfurled in battle. The shorelines of Bacoor were the sites of fortifications against the Spanish soldiers. See-saw battles were waged in the farmlands and orchards of Imus and Dasmariñas. These were the sites of historic victories as well as tragic deaths on both sides of participants in the war.

The provision of a busway corridor in the Bacoor - Imus - Dasmariñas cluster will necessitate a change in planning activities for the three municipalities. Land use controls need to be instituted for the busway corridor in order to achieve the desired benefits from the system. If land uses and road access along the corridor is not managed carefully, the provision of the new transport system may not be able to service the transport needs of Cavite's commuters to the desired service levels.

In essence, land use and urban planning for Bacoor, Imus and Dasmariñas would need to consider the changes in urban structures and patterns that would be needed, and would be brought about, by the busway system.

Urban density along the corridor and peripheral areas may be increased to levels higher than what is achieved in the town centers at present. Having a higher capacity transport facility would allow for such an increase. However, other considerations need to be taken, in particular water supply.

Current municipal plans have been collected and are currently being assessed by the Study Team in relation to the required shifts with the introduction of a busway in the corridor.

(2) Bacoor

Bacoor, being the northernmost municipality and most proximate to Metro Manila, acts as the gateway to the southern parts of the metropolis from Cavite. Its road network configuration is not extensively developed, with urban and building development taking place faster than how access can be managed. The road network is configured in a way that vehicular traffic towards Metro Manila is funneled through the Niog-Zapote area leading towards the Manila-Cavite Coastal Road. Some areas of the municipality would need a circuitous route to be accessed from other parts.

Bacoor has prepared a Comprehensive Land Use Plan (CLUP) and Zoning Ordinance covering the period 2001 to 2011. The underlying themes of Bacoor's 10-year plan are for economic vitalization, protection of the environment and strengthening of human resources. Bacoor's plan recognized its need for an invigorated and diversified economic base, through redevelopment and in-fill development, including urban renewal through a revival of obsolete buildings. An enhanced infrastructure network catering to the needs of its residents is discussed in the plan.

The Bacoor CLUP classifies the municipality into six (6) general zone categories, with the location of each of the zone classifications. However, no land area distribution was included in the documents received by the consultants. Table 2.7 shows the proposed land use zones for Bacoor.

Table 2.7 Proposed Land Use Zones, Bacoor

Zone	Location
1. Urban Core Zone (UCZ)	Sineguelasan, Banalo, Alima, Campo Santo, Tubig Dagat, Daang Bukid, Digman, Kaingin, Dulong Bayan, Mabolo 1-3, Salinas 1-4, Habay 1 & 2, Real 1 & 2, all barangays of Panapaan, Talaba, Zapote and Aniban, Ligas 1 & 2, Niog 1, portions of mambog 1-4 and portions of Niog 2 & 3.
2. Urban Expansion Zone (UEZ)	Bayanan, Ligas 3, San Nicolas 1-3, all Queens Row, Molino 1, 2, 3, 5, 6 & 7, portion of Molino 4, portions of Mambog 1-4, and portion of Niog 3
3. Agricultural Development Zone (ADZ)	Portion of Molino 4
4. Ecological Development Zone (EDZ)	Portion of Molino 4
5. Light Industrial Zone (LIZ)	Niog 2 & 3
6. Coastal Development Zone (CDZ)	Coastal areas of Bacoor

Source: Municipality of Bacoor

Bacoor's CLUP also lists several infrastructure projects, foremost of which are transport projects which aim to "establish an efficient and effective transportation network", and "to improve traffic circulation". Strategies by which these would be achieved include the following:

- Opening of new roads
- Coordination with subdivision developers to open up private roads
- Construction of access / feeder roads
- Improvement and maintenance of existing roads and bridges
- Improvement of traffic management measures and facilities
- Strict enforcement of traffic rules and regulations

Other infrastructure projects that are proposed as part of the development plan cover drainage and sewerage, water supply, power, and communications. The Bacoor Plan also includes projects categorized under its Environment Management Plan.

There was no mention of the planned busway and the planned extension of LRT 1 to Bacoor in the document, or how these projects would affect land uses in the municipality.

(3) Imus

Imus is the municipality just south of Bacoor along the inland urban corridor served by Aguinaldo Highway. It used to be the capital of the province and has a rich history and tradition. In terms of urban structure, Imus still has a major portion of its land devoted to agricultural uses, although the process of converting these lands for purposes of more intense urban development is slowly going on.

A number of commercial establishments have been operational in Imus over the past few years, mostly located along Aguinaldo Highway. A major developer is also planning over the long term a business district in Imus, located in an area of about 1000 hectares (larger than the municipality of General Mariano Alvarez), between Aguinaldo Highway and Molino Road.

Land use distribution in Imus is as shown in Table 2.8.

Table 2.8 Land Use Distribution, Imus

Land Allocation	1995 Land Area (hectares)	Percent Distribution	Projected Land Req'ts, 2005	Total Area	Percent Distribution
Built-up Areas	**4088.00**	**42.14%**		**4088.00**	**42.14%**
Residential	1743.72	17.97%	123.89	1867.61	19.25%
Commercial	65.77	0.68%	0.00	65.77	0.68%
Institutional	24.48	0.25%	105.21	129.69	1.34%
Parks and Recreation	45.30	0.47%	0.00	45.30	0.47%
Roads	243.76	2.51%	503.27	747.03	7.70%
Cemetery	25.00	0.26%	0.00	25.00	0.26%
Dumpsites	0.00	0.00%	12.97	12.97	0.13%
Industrial	1939.97	20.00%	(745.34)	1194.63	12.31%
Agricultural	**1226.00**	**12.64%**		**1226.00**	**12.64%**
Total	**5314.00**	**54.78%**		**5314.00**	**54.78%**
Disputed	4387.00	45.22%		4387.00	45.22%
Grand Total	**9701.00**	**100.00%**		**9701.00**	**100.00%**

Source: Municipality of Imus

(4) Dasmariñas

Dasmariñas, over the past decade, has experienced a tremendous growth in population brought about by government policies such as resettlement outside Metro Manila, the CALABARZON plan for industrial development and the move of a number of educational institutions to the municipality, getting out of congested campuses in Metro Manila.

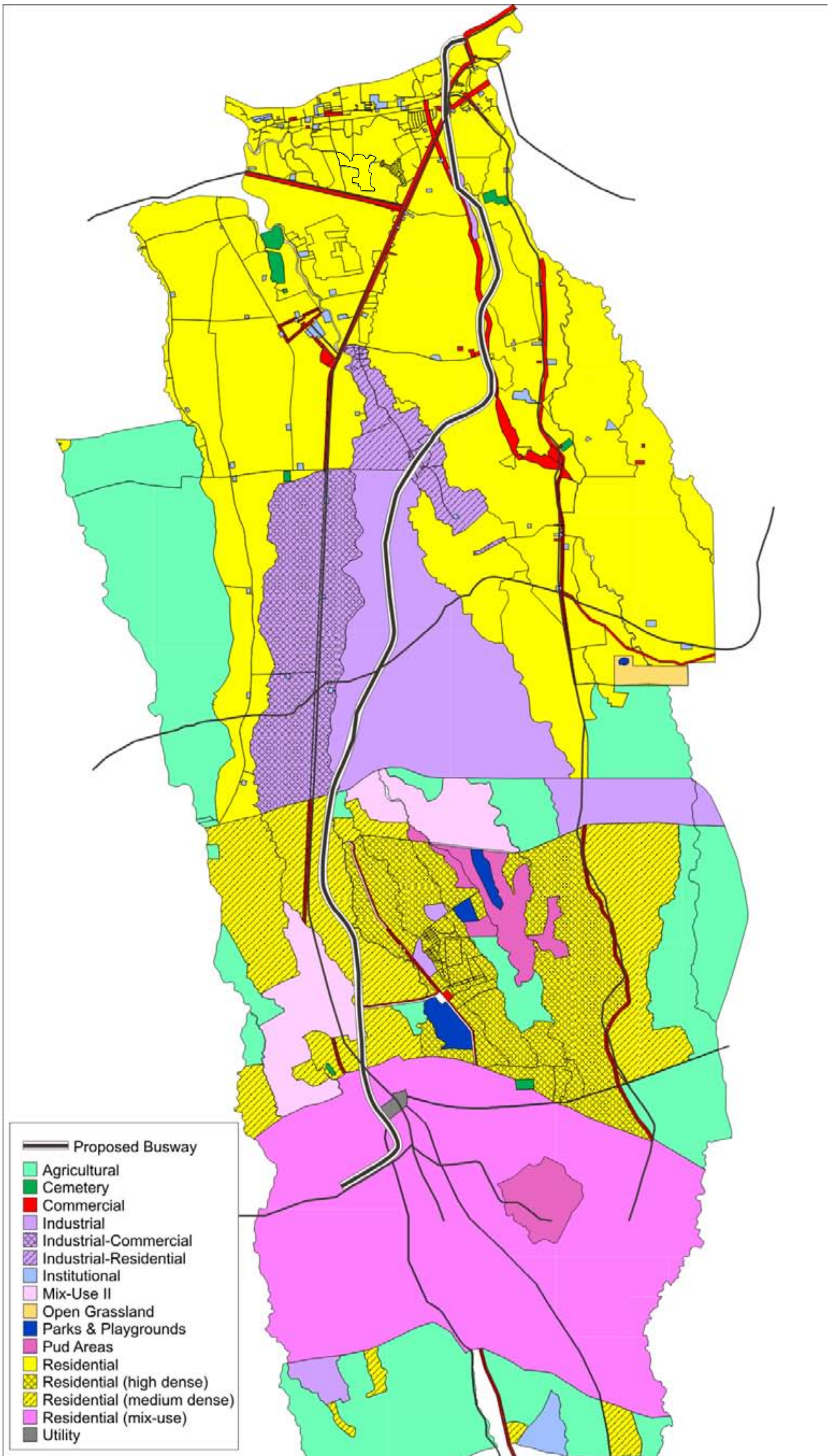
Dasmariñas lies at the junction of Cavite's two major road corridors, and this has also contributed to the urban development of the municipality. Drawing an arc of about 50 kilometers from the City of Manila, the swatch of land described will encompass Dasmariñas, Carmona and Canlubang. Couple this geographic feature with the government mandate that large educational institutions and manufacturing industries must move out of congested Manila and start relocating 50 kilometers away. The dispersal began in the mid-1970s, just after the effects of Martial Rule in the country started to seep into the planning systems. Large land owners had new reasons to skirt the agrarian reform laws and develop their properties under the urban land reform laws.

In Dasmariñas and southwards, educational, social and religious institutions started the exodus away from Manila. The Philippine Women's University, the Philippine Christian University, De La Salle University and the Polytechnic University of the Philippines, now established in Dasmariñas, were the educational institutions that pioneered the move. Manufacturing industries followed immediately by government's development of relocation sites for the urban poor, which concentrated in Dasmariñas. However, government agencies could hardly catch up in providing the best and most infrastructure, more so for mass transport (except for the Carmona spur line of the Philippine National Railways). These were the concerns and issues that exacerbated legitimate complaints of the resettlers. Only major roads were able to catch up with development. The PNR commuter train through Carmona deteriorated in service, as well as commuter train service to Laguna. Paliparan, Salitran and vicinity continued to absorb informal residents from Metro Manila, even lately. As supply of government lands used for urban functions began to dwindle, private lands were offered for development.

As the small properties will have to be consolidated, the larger purchasing costs of the lands were developed for economic housing and other higher and better uses. It is in this light that planned urban revitalization in the use of land accompanied by transport systems and infrastructure with food end environmental security must now anticipate future development. Today, Dasmariñas' planners recognize that "unmanaged" growth depletes the capacity of nature to support economic activity, a high standard of living and life itself. They know it is a mistake to define growth only in increases in population, but also must generate higher demands for housing, work places, establishments, roads, and schools.

Land use distribution in Dasmariñas is as shown in Table 2.9.

Figure 2.7 Proposed Land Use of Bacoor, Imus and Dasmariñas



Source: JICA Study Team, based on proposed land use maps submitted by the municipalities of Bacoor, Imus and Dasmariñas.

Table 2.9 Land Use Distribution, Dasmariñas

Land Allocation	1995 Land Area (hectares)	Percent Distribution	Projected Land Req'ts, 2005	Total Area	Percent Distribution
Built-up Areas	**5756.74**	**63.87%**		**6757.80**	**74.98%**
Mixed Use I	0.00	0.00%	2511.83	2511.83	27.87%
Mixed Use II	0.00	0.00%	282.25	282.25	3.13%
Residential	3868.27	42.92%	(1966.58)	1901.69	21.10%
Commercial	65.00	0.72%	155.00	220.00	2.44%
Institutional	180.30	2.00%	(74.00)	106.30	1.18%
Parks and Recreation	32.52	0.36%	18.44	50.96	0.57%
Roads	790.73	8.77%	(94.88)	695.85	7.72%
Cemetery	30.00	0.33%	17.00	47.00	0.52%
Dumpsites	5.00	0.06%	57.00	62.00	0.69%
Agro-Industrial	40.00	0.44%	395.00	435.00	4.83%
Special Use (PUD)	321.92	3.57%	0.00	321.92	3.57%
Napocor	123.00	1.36%	0.00	123.00	1.36%
Industrial	300.00	3.33%	(300.00)	0.00	0.00%
Agricultural	2045.56	22.70%	(215.36)	1830.20	20.31%
Open Grasslands	785.70	8.72%	(785.70)	0.00	0.00%
Water Bodies	425.00	4.72%	0.00	425.00	4.72%
Total	**9013.00**	**100.00%**		**9013.00**	**100.00%**

Source: Municipality of Dasmariñas

2.3.3 Land Suitability

The CALA Phase 2 Transport Study has presented a table showing the extent of urban development the land area of each municipality may be able to accommodate (Table 2.10). Figures are rough estimates of proportion of total municipal land area.

2.3.4 Institutional Strengthening for Urban Planning

With the recognition of the importance of urban planning to LGUs, the government bureaucracy has been legally established in the country when the Local Government Code of 1991 (Republic Act 7160) was promulgated. Most highly urbanizing local governments are confronted with a large number of development proposals from both the private and public sectors. Understandably, the capability of the staff of Municipal Planning and Development Offices (MPDOs) are overstretched. The lack of personnel exacerbates the issue on how to cope with the number of day-to-day tasks the staff must perform. Furthermore, additional responsibilities come to the MPDO staff whenever development studies / grants are given to the LGU.

Table 2.10 Land Suitability per City/Municipality
(Proportion of Land Suitable for Urban Development)

City / Municipality	Land Suitability For Urban Development			
	Not Suitable	Very low to low	Low to medium	Medium to high
Cavite City		1/1		
Bacoor		1/6	2/6	3/6
Kawit		1/1		
Noveleta		1/1		
Rosario		1/1		
Tanza		1/4	1/4	2/4
Naic		1/6	1/6	4/6
Ternate	3/4	1/4		
Maragondon	4/5	1/5		
Magallanes	2/3	1/3		
E. Aguinaldo		1/1		
Alfonso	1/6	5/6		
Indang			2/3	1/3
Amadeo		1/4	¼	1/2
Silang		1/4	¼	1/2
GMA			1/1	
Carmona			1/1	
Dasmariñas				1/1
Trece Martires				1/1
Gen. Trias			1/3	2/3
Imus			½	1/2
Tagaytay		1/1		
Mendez		1/1		

Source: CALA Transport Study

The need for planning staff who are professionally qualified has long been recognized by the Housing and Land Use Regulatory Board (HLURB) and the Department of the Interior and Local Government (DILG). As a remedial measure, incumbent personnel are given the opportunities to upgrade their education; team up with professional consultants and become recipients of technologies transferred to them. In some other ways, hands-on activities give the MPDO staff the new competencies for professional enrichment.

Still another institutional problem normally encountered by the local planning staff is the lack of up-to-date and modern tools for data gathering, planning analysis and simulations. This concern seeps down to who can do local planning data collection, how this can be updated regularly and how such can be managed over time. Can the local high schools and other educational institutions handle this for local governments?

Basic information necessary for a local planning agency is short if not missing. If these are available, they are not presented in standard formats (e.g. SI units, or following ISO standards), or not regularly updated. Despite the need for MPDOs to update their planning information base, even if manually, this will need some data management methods to store, systematize, update and retrieve. This is of particular importance when LGUs will need the planning information when making investment decisions.

Currently, the HLURB is ready to introduce a more effective manner in updating protocols for the CLUP and Zoning Ordinance. A strategic planning process is recommended. Seminars and workshops on how to apply the strategic approach is to be introduced by the agency through a guideline. This is shown in Figure 2.8.

It is also about time that the NAMRIA extends its mapping activities of planimetric 1:10,000 maps to the urbanizing areas of Cavite, Laguna and Batangas. There may be moves the provincial governments can take on behalf of the municipal governments to realize this.

As the staff of the MPDOs get to be more recognized for the roles they play in local development, their agencies will have to project a conscious effort to facilitate the free exchange of plans, experiences and prognostications. They have to incorporate some flexibility in the planning processes, for example in the setting of benchmarks, indicators and targets. Their importance will be appreciated when a new set of government officials assume their official positions. It is important to stress the role of the MPDO in the planning process. These are:

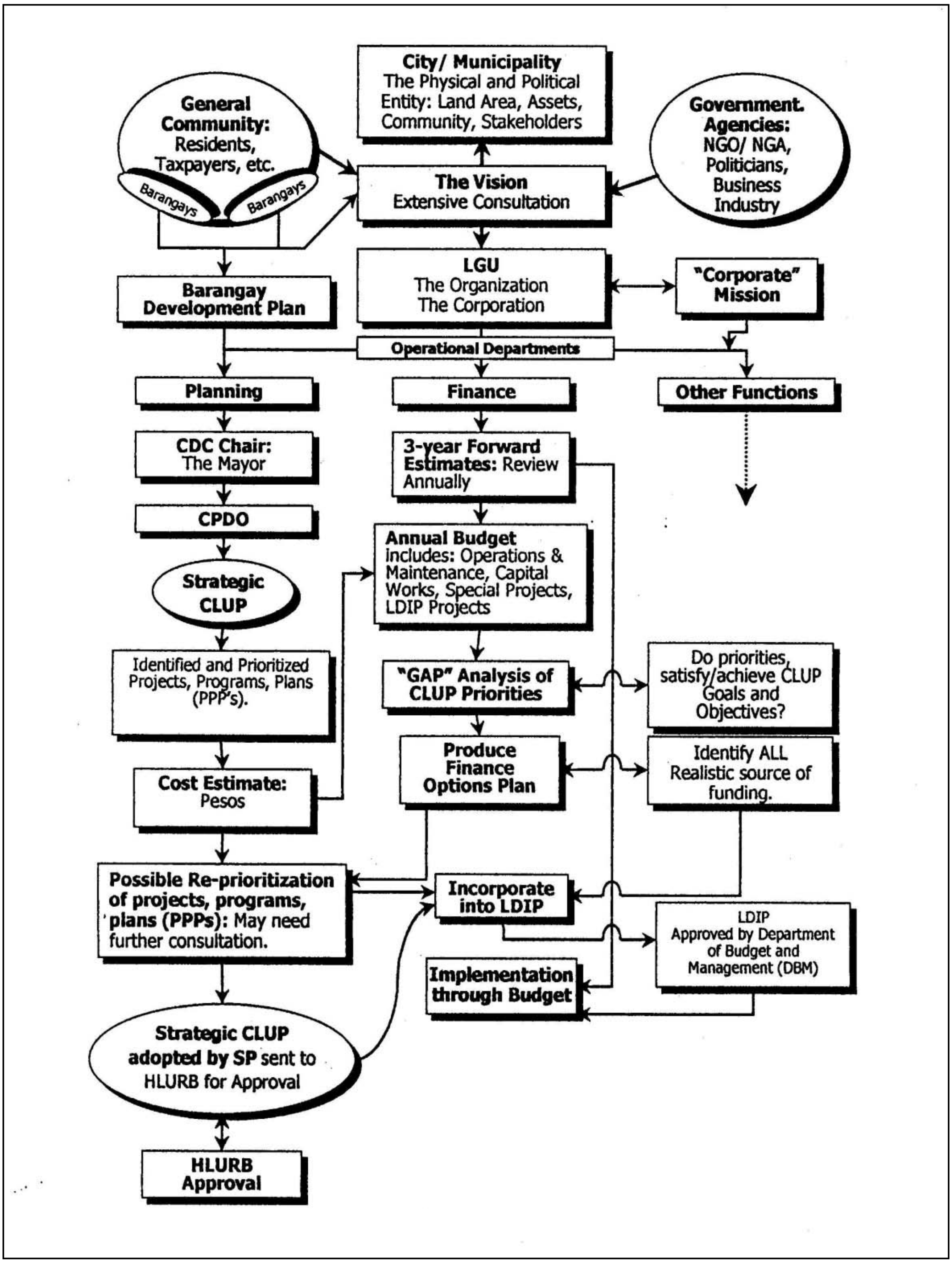
- To ensure that the organization responds effectively to changing external conditions;
- To acquire adequate tools for monitoring the prevailing conditions in the municipality;
- To understand the likely community changes and to respond to them; and
- To adjust to political situations as well as to technological change.

With the current situation in most MPDOs it is expected that they shall experience the blending of techniques for planning. They shall have the most opportunities to innovate, given the guiding inspiration of the local leaders. They are therefore expected to present planning solutions with graphic clarity, in standard formats for comparability and with congruent strategies in view. The MPDOs will have to think how to institutionalize in their work programs the thoughts on how to:

- Alleviate poverty
- Assure food security
- Apply environmentally-sound technologies
- Integrate transport systems with land use

- Preserve ecological balance
- Anticipate new technologies in communications, energy and information systems.

Figure 2.8 Institutional Framework for Urban Planning: The Strategic CLUP Process



Source: Planning Strategically: Guidelines for the Application of the Strategic Planning Process to the Preparation of the Comprehensive Land Use Plan (CLUP) and to Important Urban Area Issues and Problems. Approved by the HLURB 19 December 2001, through Resolution No. 724, series of 2001. Document released 02 April 2002.

3 PRESENT SITUATION ON THE BUSWAY CORRIDOR

3.1 Natural Condition

3.1.1 Topography

The topography of Cavite Province is a product of volcanic processes of the Southern Tagalog volcanic field. Nearby volcanic structures that have influenced the form of the area are Bataan, the Taal Lake Caldera and Mount Palay-palay. In general, land in Cavite Province slopes to the north, descending from the highlands of the Tagaytay Ridge which fringes the Taal Caldera, down to the coast at Manila Bay. This form can be seen most clearly in the satellite image shown in Figure 3.1.

River drainage in Cavite Province follows two patterns, a south to north direction in general, while in the east of the province and in neighbouring Laguna Province, drainage is eastwards flowing into Laguna de Bay lake. This is illustrated in Figure 3.2.

Land in the north of the province is flat or level, while in the south it becomes rolling to hilly, as the north-south aligned river valleys are deeply eroded. Broad classification can be made into four categories, as illustrated in Figure 3.3.

(1) Coastal Landscape

Coastal landscape is found along the shoreline of the low lying flat plain. Coastal landscape consists of beach ridges, active tidal flats and former tidal flats. The beach ridges show elongated mounds running parallel with the coastline. Active tidal flats are marshy and muddy areas. The former tidal flats are distributed more inland and are slightly higher than the active tidal flats. These areas are occasionally subject to seasonal flooding due to poor drainage ability. The Bacoor area is part of this classification.

(2) Alluvial Landscape

The alluvial landscape is composed of flat to nearly level alluvial plains formed by the alluvial deposits from rivers, hence most of this landscape is subject to occasional flooding. This landscape consists of freshwater marshes, river terraces and broad alluvial and minor alluvial plains, with the broad alluvial plains occupying over 70% of the area. The area from Bacoor towards Imus is part of this classification.

(3) Foothill Landscape

The foothill landscape is characterized as undulating plateau and piedmont. The elevation of the foothill landscape varies from around 15m above sea level near the coast to around 50m in the inland area. The area around Imus is part of this classification.

(4) Volcanic Slope Landscape

This has similar geomorphologic characteristics as the foothill landscape, but is given a separate classification due to the presence of an almost uniform slope dipping in the same direction with a parallel drainage system. The Municipality of Dasmariñas district is part of this classification.

Figure 3.1 Satellite Image

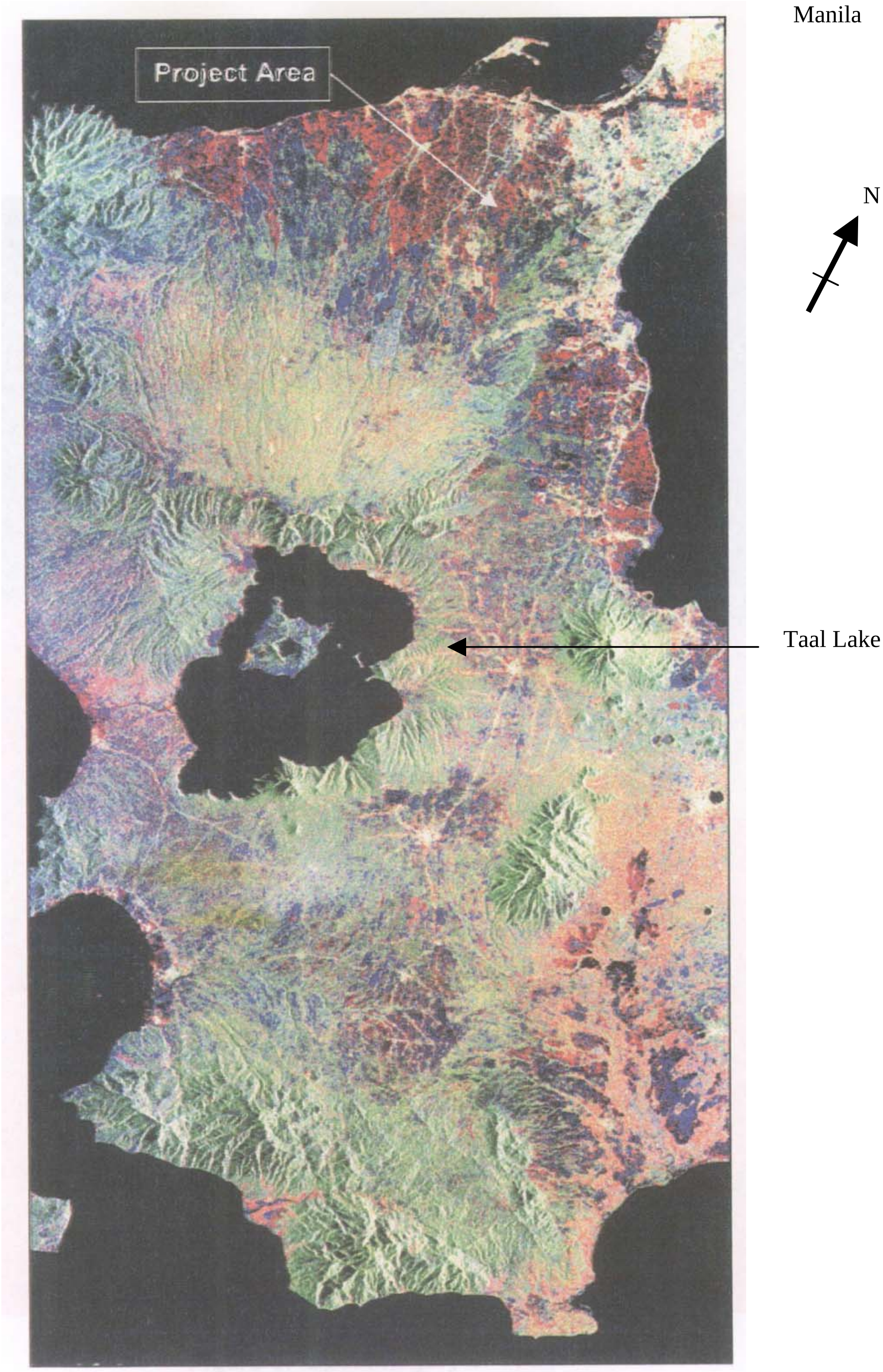


Figure 3.2 Major Watersheds

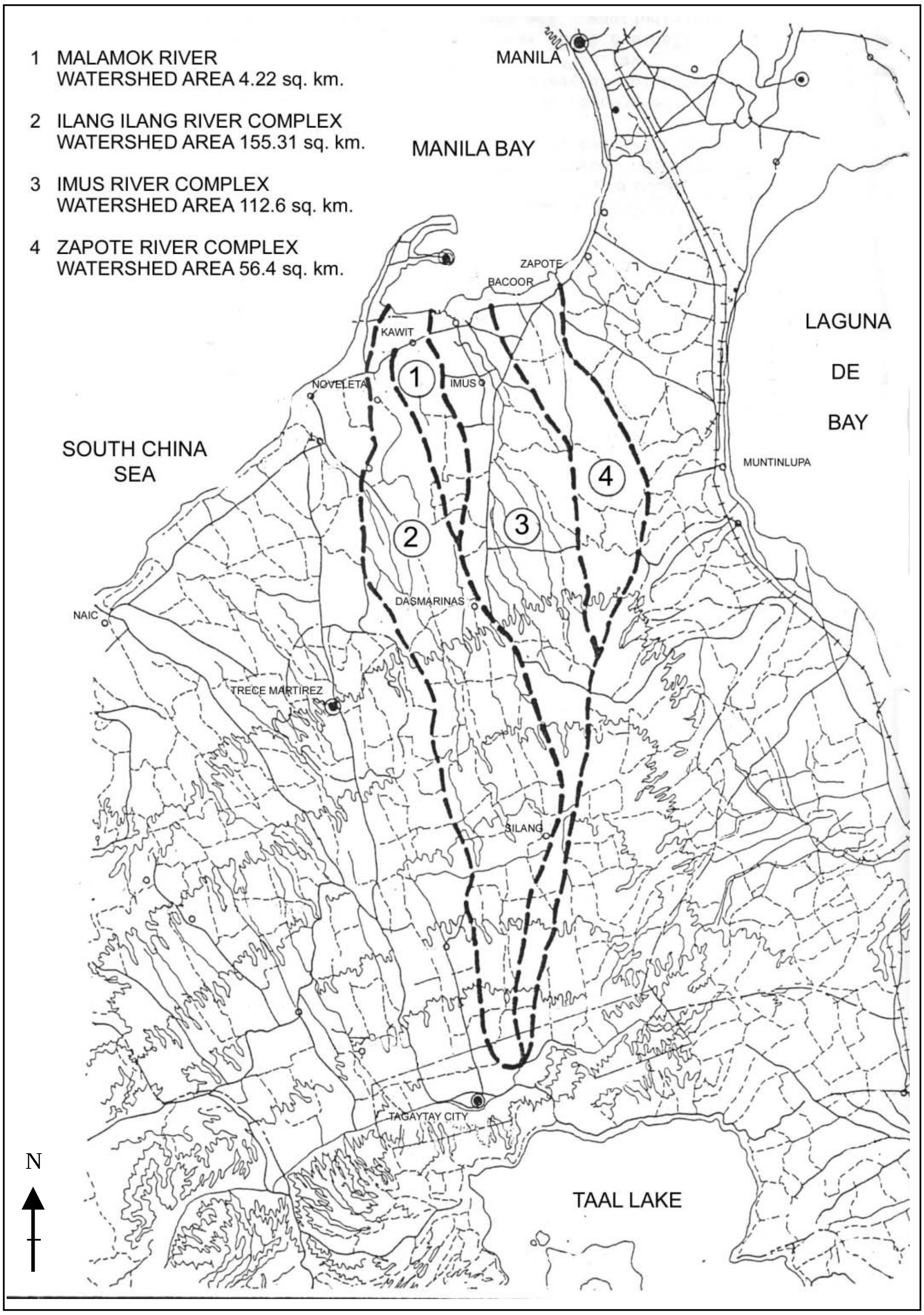
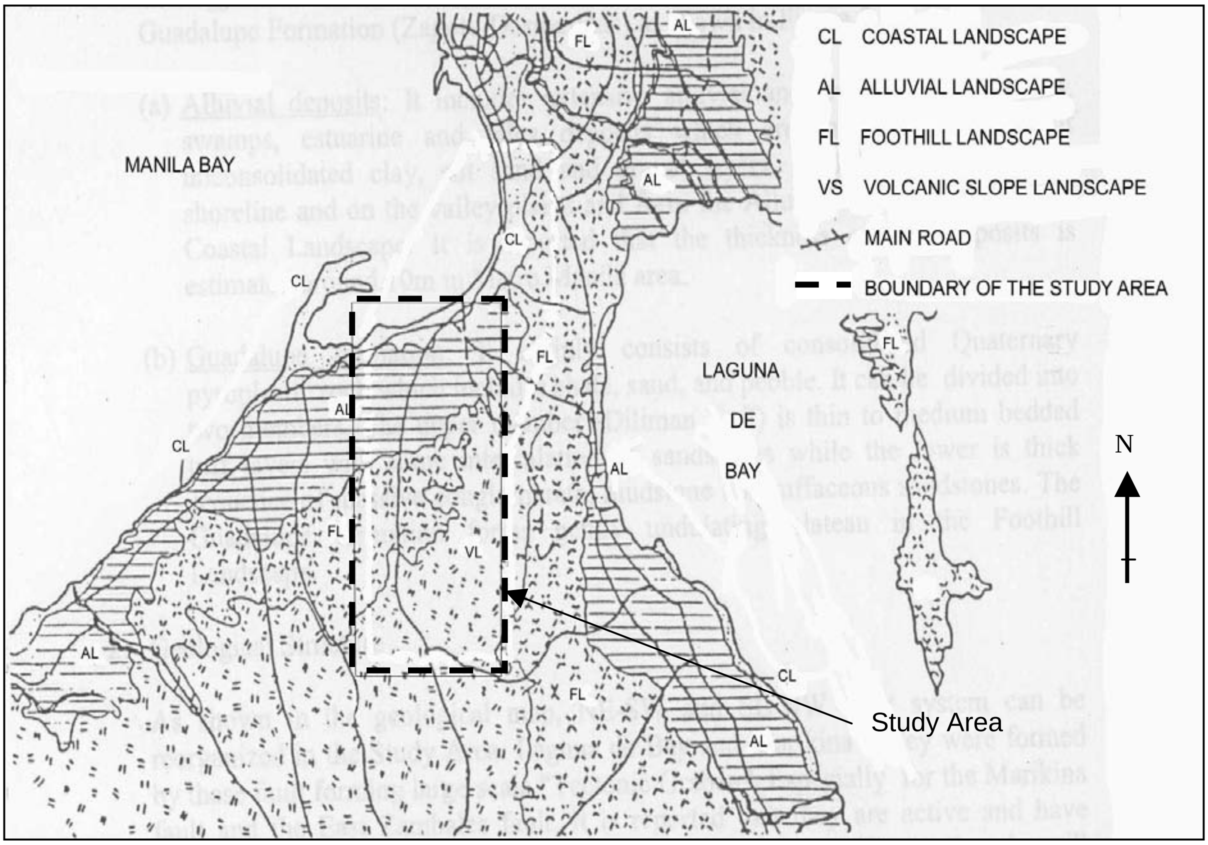


Figure 3.3 Topography



Source: Bureau of Soils

Table 3.1 Topographic Features of the Landscape

Landscape	Description	Slope (%)	Elevation (m)	Geology	Land Use
Coastal Landscape	Beach ridges, Active tidal flat	0-3	0-5	Marine sediment Alluvial deposits	Fish ponds, Rainfed paddy rice, Urban Area
Alluvial Landscape	Former tidal flat Fresh water marshes	0-3	2-20	Alluvial deposits	Urban area, Irrigated land, Rainfed paddy rice, Fruits
Foothill Landscape	Undulating plain, plateau, piedmont, valley plain	2-60	15-480	Tuff, volcanic rocks	Urban area, Irrigated land, Rainfed paddy rice, Fruits Sugarcane, Coffee, Secondary forest, Shrubs
Volcanic Slope Landscape	Volcanic footslope, Volcanic slope, Cinder cone	2-60	50-470	Tuff, Volcanic ash	Coconut, Coffee, Fruits, Upland rice, Sugarcane, Secondary forest

3.1.2 Geology

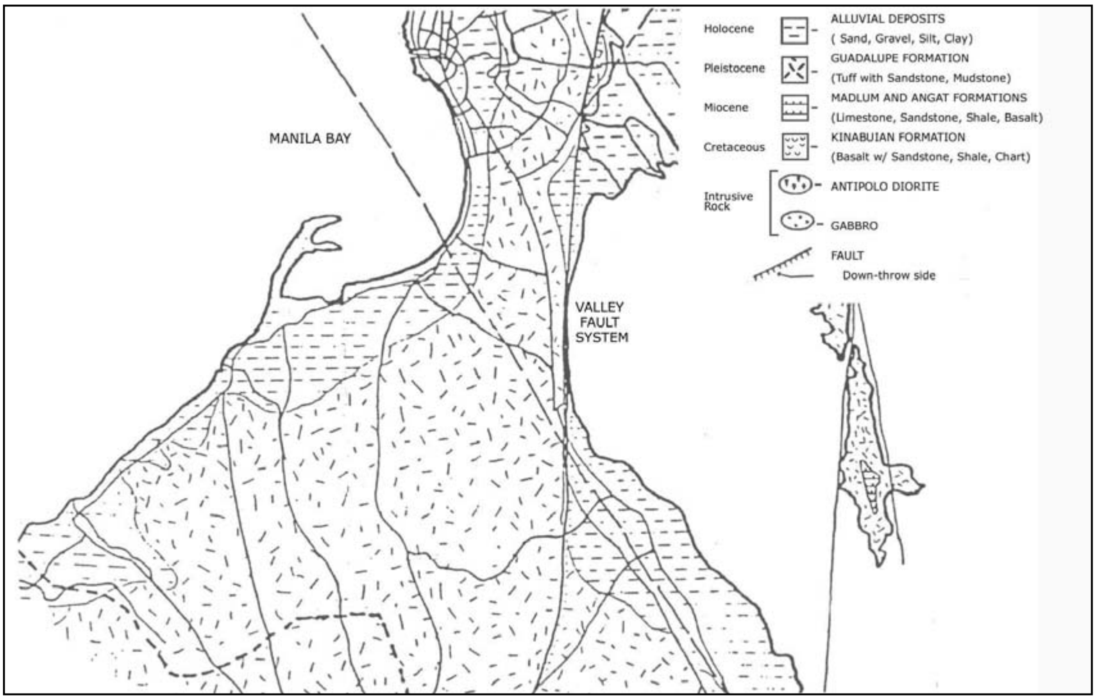
(1) Stratigraphy and Lithology

The geology of Cavite Province can be divided into two areas, as shown in Figure 3.4.

1) Alluvial deposits: Includes extensive alluvial deposits, deltas, swamps, estuarine, and talus deposits which are mostly composed of unconsolidated clay, silt, sand, and gravel layers. It is distributed along the shoreline and on the valley plains and forms the alluvial plain landscape and the coastal landscape. It is reported that the depth of this deposit is around 10m in the Metro Manila area.

2) Guadalupe formation: Mainly consists of consolidated Quaternary pyroclastic rock deposited by large eruptions of nearby volcanoes which includes shale, sand and pebbles. The rocks in the area are now classified as part of the Taal Formation since they were created by eruptions of Taal Volcano. More detailed field mapping carried out on behalf of the One Asia Corporation in their property identified five rock units as described in Annex A1. The oldest of these was deposited during the large-scale eruptions that formed Taal Lake; three units are associated with later eruptions of Taal and nearby volcanoes and the youngest is unconsolidated sediments associated with the present river system.

Figure 3.4 Geology

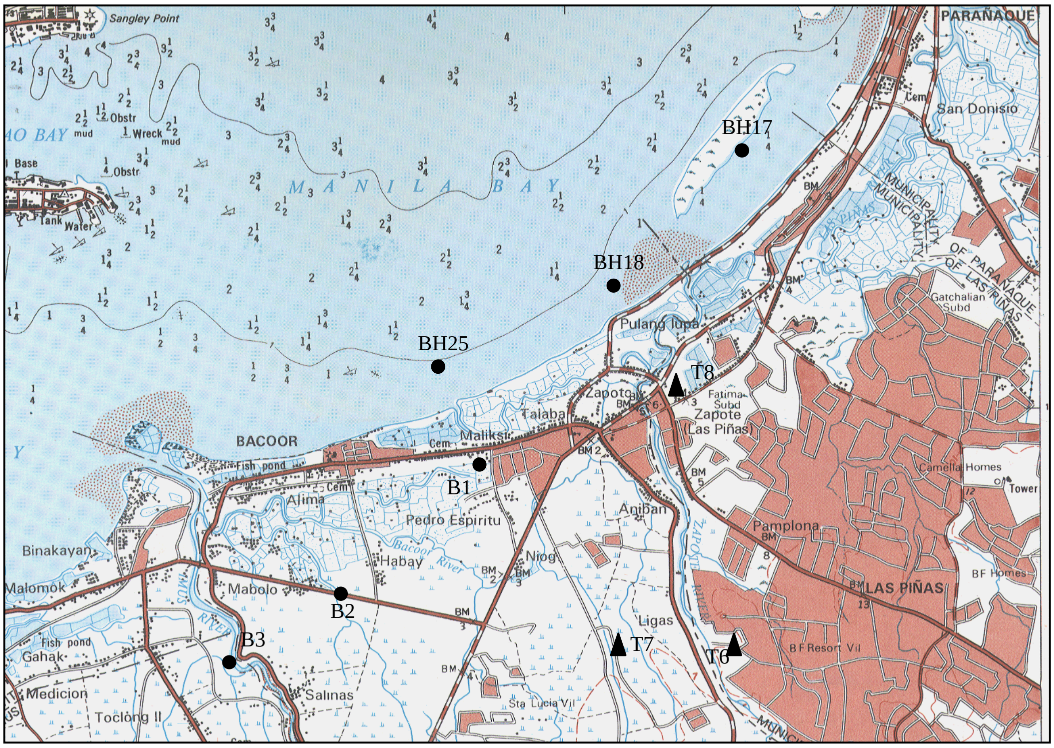


Source: Bureau of Mines

(2) Geotechnical Conditions

Geotechnical assessment of ground conditions for purposes of engineering design is summarized below. Relevant existing borehole or trial pit data was available at the locations shown in Figure 3.5, and is reproduced in Annex A2.

Figure 3.5 Existing Borehole Data



B1-B3 and T6-T8: Feasibility Study for Manila-Cavite Expressway (1991)
B17, 18, 25 : R1 South Extension Feasibility Study Report (1990)
Note: Water depths in fathoms

Foundation conditions are assessed as fair to good for the busway construction. The SPT blowcount of the intact Guadalupe tuff is over 50 and its unconfined compressive strength generally exceeds 2 Mpa, hence spread footings may be provided for structures, or short rock socket piles if the thickness of weathered overburden is large.

The alluvial soils in the coastal area are derived from transported volcanic deposits; they have generally low to medium clay content and limited thickness and settlement potential is not high. Hence, conditions for reclamation in the shallow waters are good, although any areas of soft clay would require particular treatment.

The alluvial deposits in the Manila area are unconsolidated loose sand and silt, with SPT blowcounts from 1 to 10 and 1% to 2.5% is reported as a usual design CBR value. The thickness of the alluvial deposits varies from place to place, and appears to be around 5-10m in the Bacoor area. Foundations to elevated structure would be expected to be bored or driven piles, end-bearing on the intact tuff.

The alluvial soils in the Bacoor area are described as being largely clayey and sandy silts with AASHTO classification ranging from A-4 to A-7 with group index not exceeding 10. Plastic clays and organic clays blanket the subgrade with thickness in the range of 20 to 40cm.

The region is susceptible to strong earthquakes and for seismic design, the value of peak ground acceleration appropriate to the Alluvial formation (soft soil) is 0.60g, and for medium soils, appropriate to the Guadalupe/Taal formation is 0.39g. These values are based on Seismic hazard maps produced by PHIVOLCS-USGS.

3.1.3 Climate and Hydrology

(1) General Climate

The climate in the Philippines is divided into four major types according to the climatic map prepared by Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) (Annex A3). Cavite province belongs to the climatic region-type 1 that is characterized by two pronounced seasons: dry season from November to April and wet season from May to October. These two seasons are caused by the northeast monsoon, two trade winds and southwest monsoon.

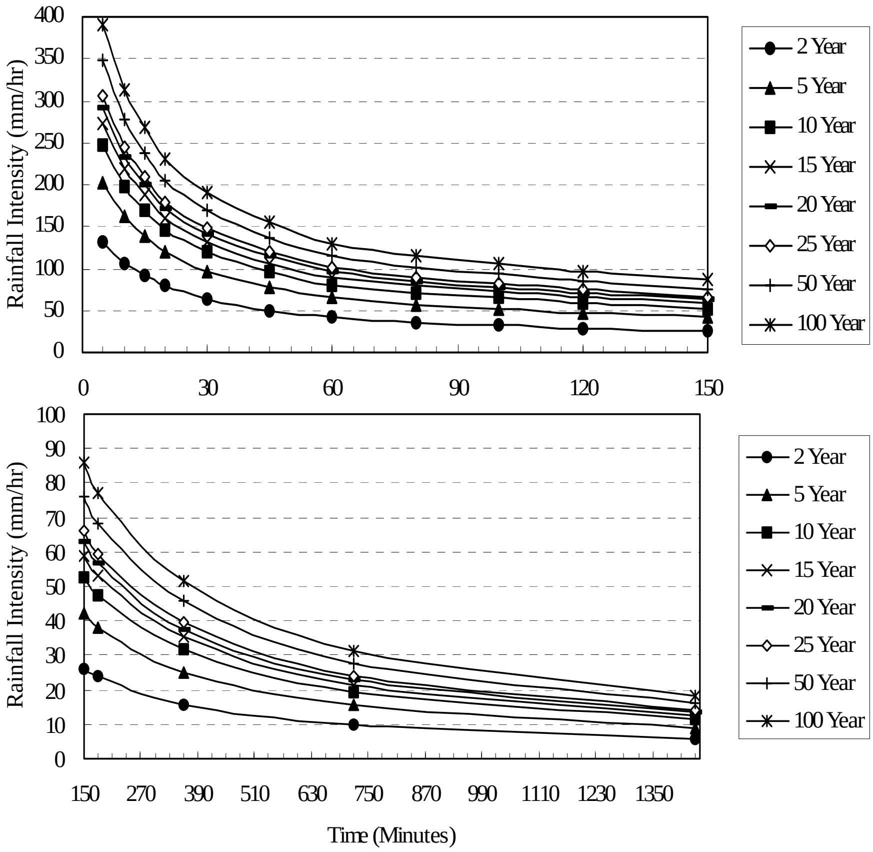
The northeast monsoon (November – February) is characterized as north-east wind with rather dry condition. Temperature during the northeast monsoon ranges between 22^{o}C and 33^{o}C with an average of about 26^{o}C. The trade winds are characterized as east wind from March to May and south-west wind from May to June with dry conditions for both periods. Average temperature during two trade winds is about 28^{o}C, with a maximum of 34^{o}C and minimum of 27^{o}C. The southwest monsoon (June – October) is characterized as south-west wind with high humidity and temperature variation is between 24^{o}C and 33^{o}C with an average of about 27^{o}C. In addition to the above seasonal characteristics, tropical cyclones also pass through the Philippines several times a year.

(2) Rainfall Data

PAGASA records the rainfall data in the country and also maintains the historical records of the data. Rainfall gauging stations located close to the project area are at Manila International Airport, Ambulong in Batangas and Sangley point in Cavite. Amount of annual rainfall in the project area ranges from 2000 mm to 2500 mm. Maximum daily rainfall data in each month in the last 25-40 years at these gauging stations are given in Annex A4. A comparison of climatological data of rainfall stations in the project area confirms that the entire project area experiences similar climatological characteristics. Figure 3.6 shows average monthly maximum 24-hr rainfalls during 1975 to 2000 at Sangley point, Cavite.

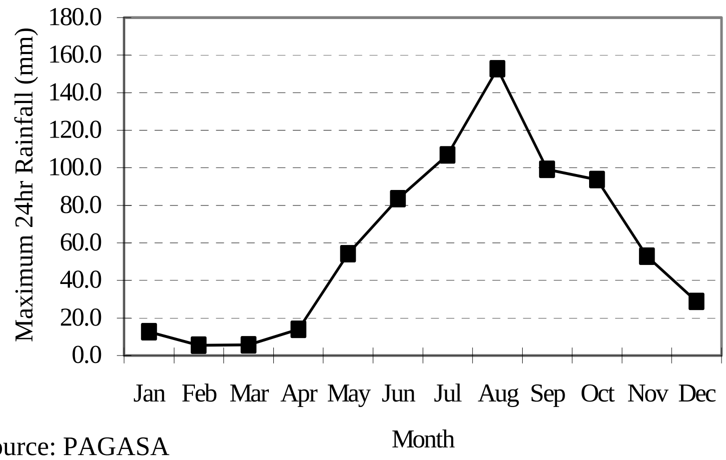
The intensity of rainfall for a given duration is the total rainfall divided by that duration. In hydrological analysis, maximum intensity of rainfall is a factor for the estimation of peak rate of runoff. The return period T can be defined as the number of years (period) that a particular extreme hydrological event could occur. The computed rainfall Intensity-Duration-Frequency (IDF) data for Sangley Point is given in Figure 3.7.

Figure 3.6 Average Monthly Maximum 24-hr Rainfall during 1975 to 2000 at Sangley Point, Cavite



Source: PAGASA

Figure 3.7 Rainfall Intensity – Duration – Frequency Curve for Sangley Point, Cavite

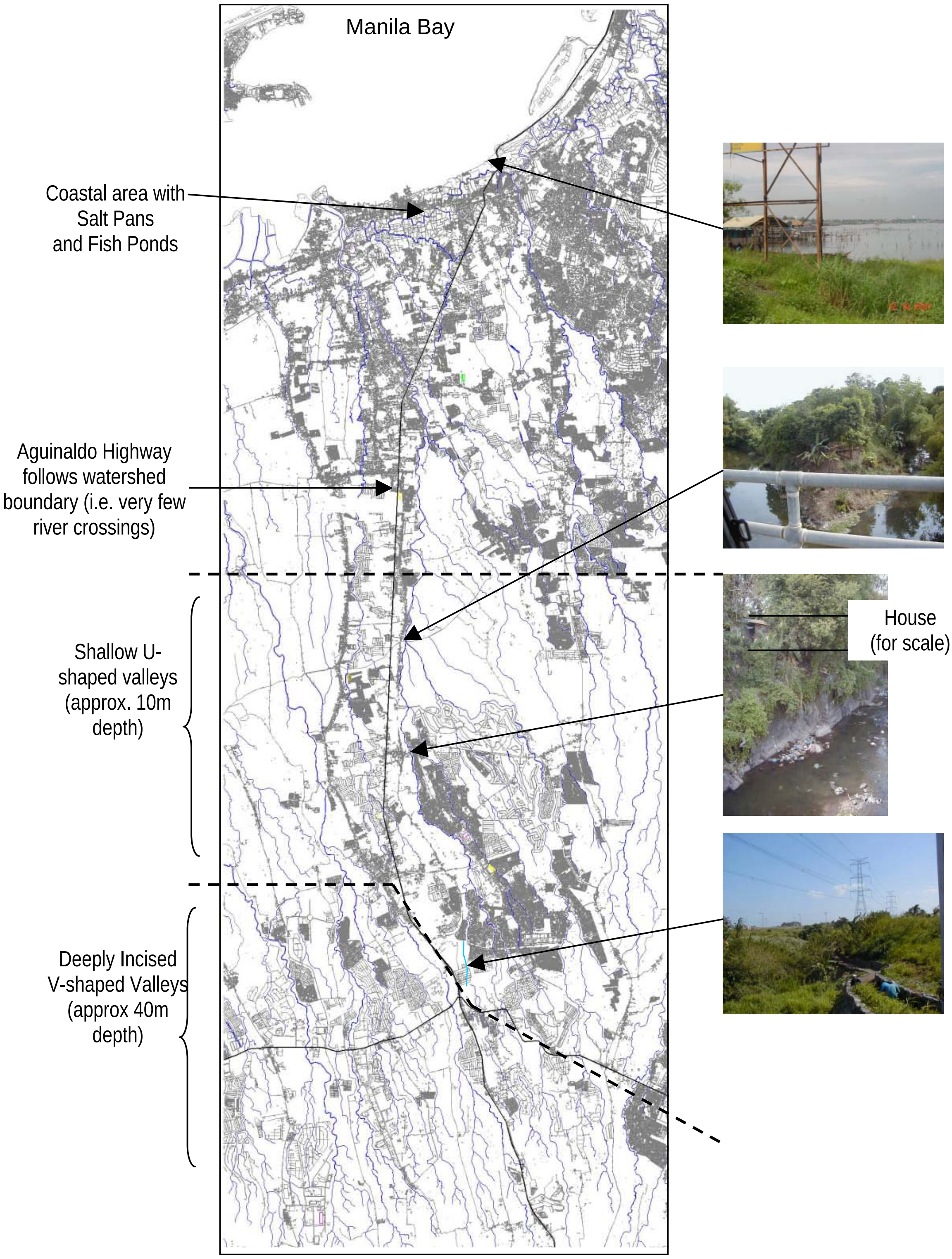


Source: PAGASA

(3) River

The major watersheds relevant to the busway project are shown previously in Figure 3.2. Figure 3.8 illustrates the major character of the rivers in the study area.

Figure 3.8 Nature of Rivers



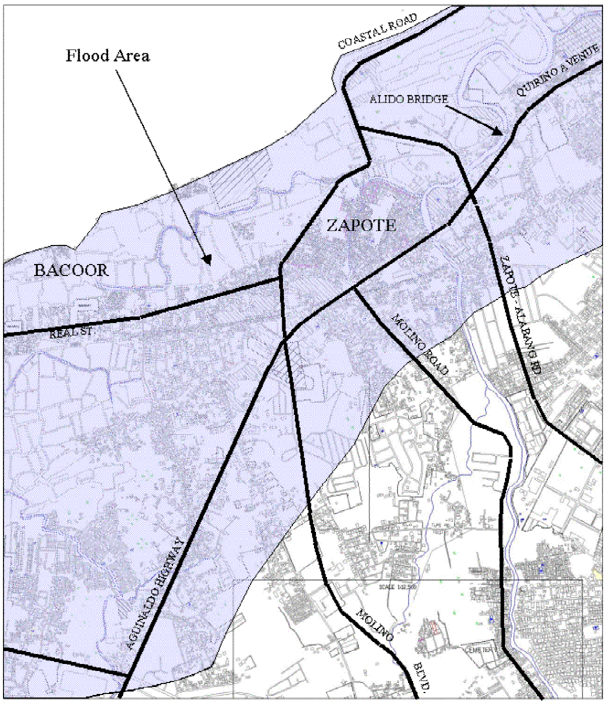
(4) Flood Prone Areas

According to the site investigations, there is no river flooding problem along the proposed road trace alignments except in Bacoor area. This confirms information as shown in Annex A6, which maps the flood prone areas in the country. To ascertain the extent of flood prone areas, and design flood elevations, hydrological analysis was carried out at the Alido bridge of Zapote river where the river cross-section could be simply measured. Existing water depths were also measured and thereby, prevailing river discharge under present condition (dry season) was calculated.

The findings of interviews with local residents also broadly confirms the extent of the area prone to flooding shown in Figure 3.9, and thus it can be used as flood levels suitable for use in design under present conditions.

According to the simulation results (Annex A7), high water elevation is 2.82 m MSL. Accordingly, the area marked in the Figure 3.10 would be inundated under a 50- year return period flood.

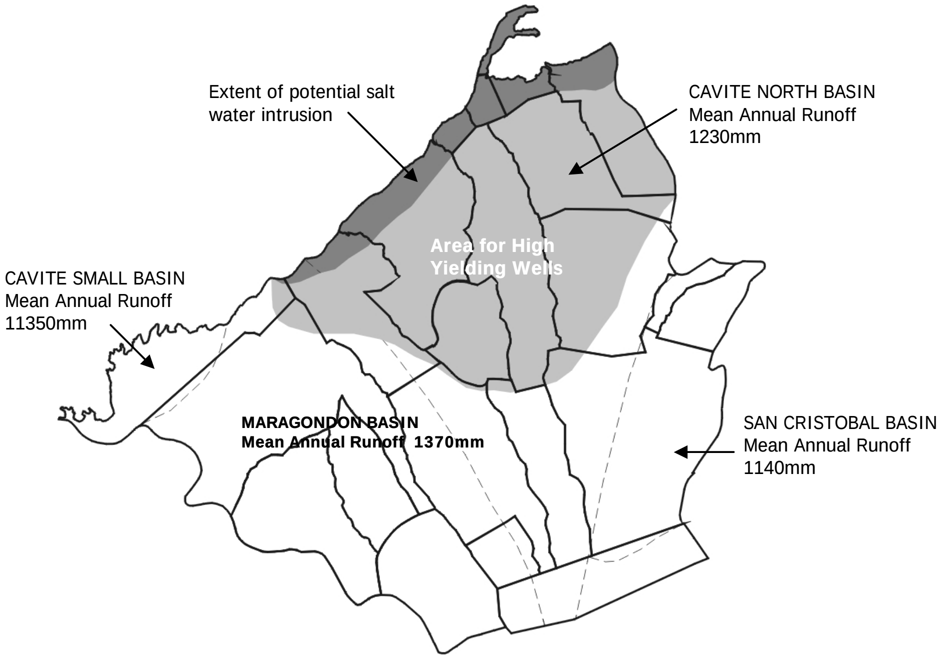
Figure 3.9 Flood Prone Areas in the Municipality of Bacoor



(5) Water Resources

The water resource potential in the busway areas of influence are good, except for the areas in Bacoor that are threatened by saltwater intrusion. However, with the growing number of industrial and residential sites in and around Imus, Dasmariñas and Silang, the future prospects for good ground water is beginning to get slim.

Figure 3.10 Water Resources Map for the Province of Cavite



Source: The Southern Tagalog Framework Plan of 1983, National Water Resources Council. As cited by G.V. Manahan in "Vulnerability of Cavite to Natural Hazards." SURP, Q.C. 1991

(6) Tide Levels

Tide levels are studied to obtain data for design of reclaimed land, in particular the required elevation of road section in the coastal area, and the marine ponds around Bacoor/Zapote.

Therefore, in determining the required elevation of reclaimed land in the coastal area, 1.9m MSL tide level for 50-year return period should be taken into account. Supporting data is shown in Annex A8.

3.1.4 Environmental Background

(1) Vegetation

Vegetation over the route is most commonly rice paddy in the coastal and alluvial areas, and pasture in the foothills. There are very limited areas of coconut grove in the valley west of Aguinaldo Highway near the intersection with Governor's Drive.

(2) Areas of Environmental Significance or Protected Areas

The NIPAS is the classification and administration of all designated protected areas to maintain essential ecological process and life support system.

According to the PPFP for Cavite, 1997-2002, there are no NIPAS protection lands of the first category in Bacoor, Imus and Dasmariñas.

Aside from the areas considered under NIPAS law, there are other areas that require rehabilitation, conservation and sustained development and management. This includes buffer strips along rivers and escarpments which applies to the Imus River and Bacoor River.

Another category of protected lands includes certain types of agricultural land. These are the Network of Protected Agricultural Areas (NPAA) or Network of Areas for Agricultural Development (NAAD). Under the network of protected agricultural areas (NPAA/NPAD), some agricultural areas are protected against any form of irreversible conversion such as urban uses. The main purpose is to preserve the highly suitable agricultural lands for the long term food security of the nation. The NPAA highly restricted agricultural land covers the entire municipalities of Bacoor, Imus and Dasmariñas. In spite of this restriction, however, these municipalities have over the past two decades been steadily urbanizing, and the Provincial Framework Plan has been continuously supporting this trend.

The Province is facing a serious problem of groundwater reserves depletion, and hence a project for increasing water infiltration in catchment areas was highlighted in the Framework Plan. This is being implemented by the Department of Environment and Natural Resources (DENR) in collaboration with the Provincial Government.

(3) Marine Environment

The marine environment in Manila Bay has been studied with respect to the proposed extension of the Coastal Road. The 1990 Feasibility Study contains extensive information, which is summarized in Annex A9.

(4) Natural Hazards

The major natural hazards in Cavite Province are earthquake, volano and flood.

Earthquake hazard has been discussed in Section 3.1.2 and may be accommodated in the design. Volcano hazard, on the other hand, is a real hazard in the Philippines but there are no feasible measures that can, on the other hand, be suggested in the current design to mitigate against damage caused by an eruption. Flooding is discussed in Section 3.1.3 and design will be carried out to protect the busway against flooding and to ensure that the design does not exacerbate conditions in existing flood-prone areas.

3.2 Road and Road Transport System

3.2.1 Road

(1) Existing Road Network

At present, the transport network in the Study Area is only composed of roads which are primarily of paved two-lane roads. Roads are administratively classified as national, provincial, municipal, and barangay roads as shown in Figure 3.11.

The Study Area is characterized by two main national roads: Aguinaldo Highway and Molino Road. They are running parallel with each other and are the roads which will be influenced most significantly by the proposed busway since it will be located between these two roads.

The traffic situation in the Study Area is already seriously being affected by chronic traffic congestion. With the rapidly growing population, the traffic congestion is anticipated to become further serious. This is one of the reasons why the busway, which will provide a stable and fast transport service, is being proposed.

(2) Number of Lanes

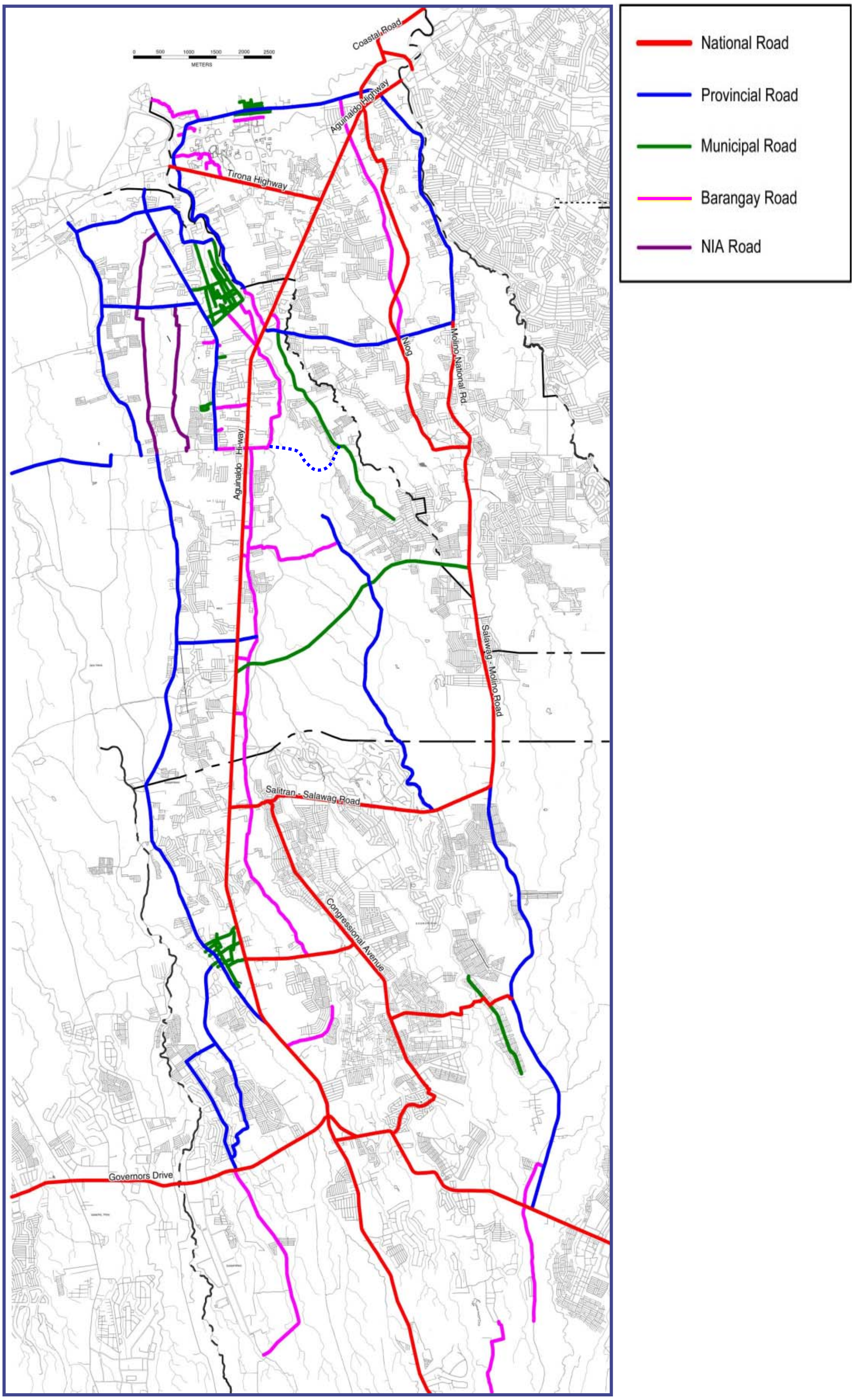
The number of lanes of the existing road network is shown in Figure 3.12. Broadly, national roads have wider road width than others. A whole stretch of Aguinaldo Highway running in parallel with the proposed busway is developed with four lanes width. Southern part of Molino Road, Salitran-Salawag Road and Molino Boulevard are developed with six-lanes width. Other provincial, municipal and barangay roads are primarily of two-lane roads.

(3) Surface Type

The surface type of roads in the Study Area is presented in Figure 3.13. Only Aguinaldo Highway, Molino Road and some roads are paved by asphalt. Other roads are primarily paved by concrete. Gravel and unpaved roads are very limited, mostly irrigation roads.

The existing condition of roads along the busway corridor is shown in Figure 3.14.

Figure 3.11 Existing Road Network in the Study Area



Source: JICA Study Team, based on road maps submitted by the municipalities of Bacoor, Imus and Dasmariñas.

Figure 3.12 Number of Road Lanes

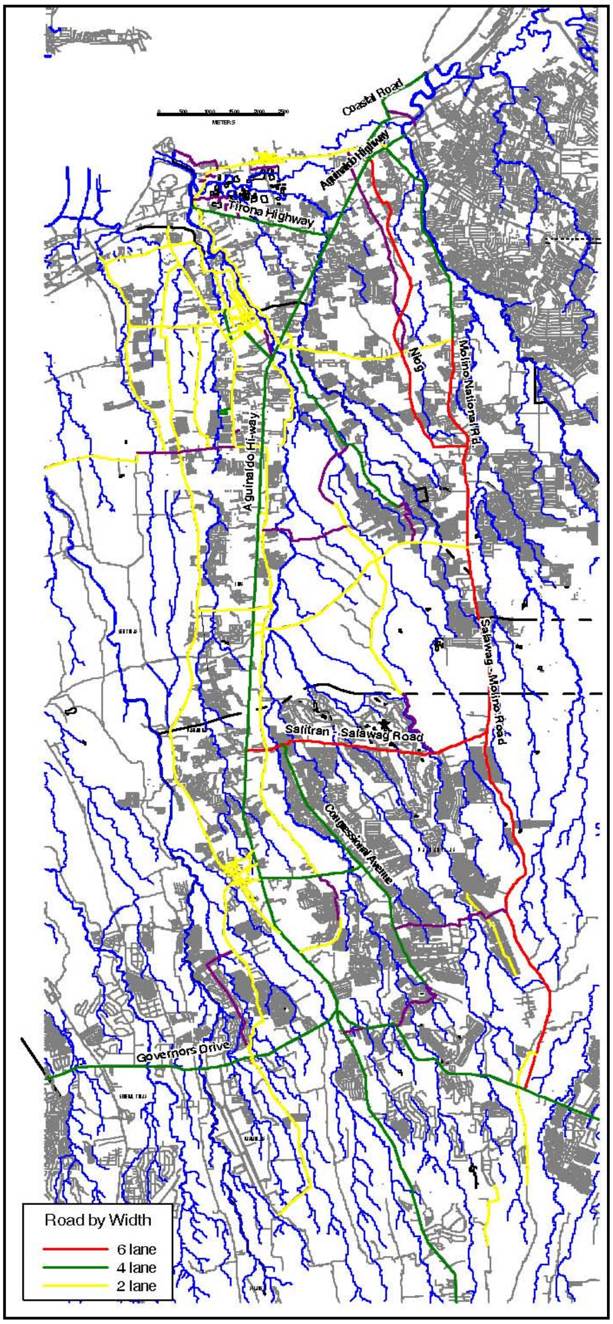
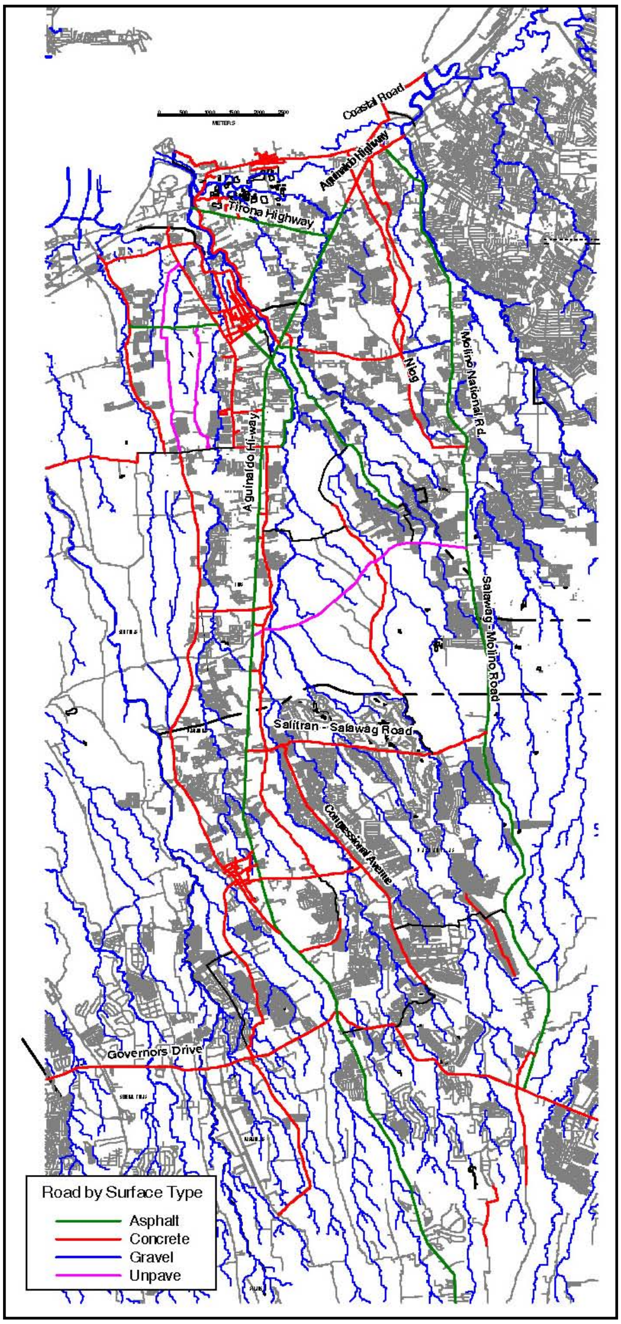


Figure 3.13 Road Surface Type



Source: JICA Study Team, based on data from the municipalities of Bacoor, Imus and Dasmariñas.

3.2.2 Road Traffic

(1) Traffic Volume

The results of traffic count survey conducted during the Study are shown in Table 3.2. Locations of survey stations are presented in Figure 3.15.

Within the Study Area, Costal Road has the highest traffic volume at 68,000 vehicles per day. Aguinaldo Highway has a traffic volume of 40,000 vehicles at the boundary of Bacoor and Imus and 33,000 vehicles at the boundary of Imus and Dasmariñas.

Higher traffic volume of buses was observed on Coastal Road (4,600), Aguinaldo Highway (1,300-1,900) and Real Road (2,600). Traffic volume of jeepneys is observed on most of major roads. More than 5,000 of jeepneys were observed on Quirino Avenue (10,300), Coastal Road (6,700) and Aguinaldo Highway (4,000-8,000). The dominant vehicle type observed on provincial roads is tricycle.

Figure 3.14 Existing Road Conditions

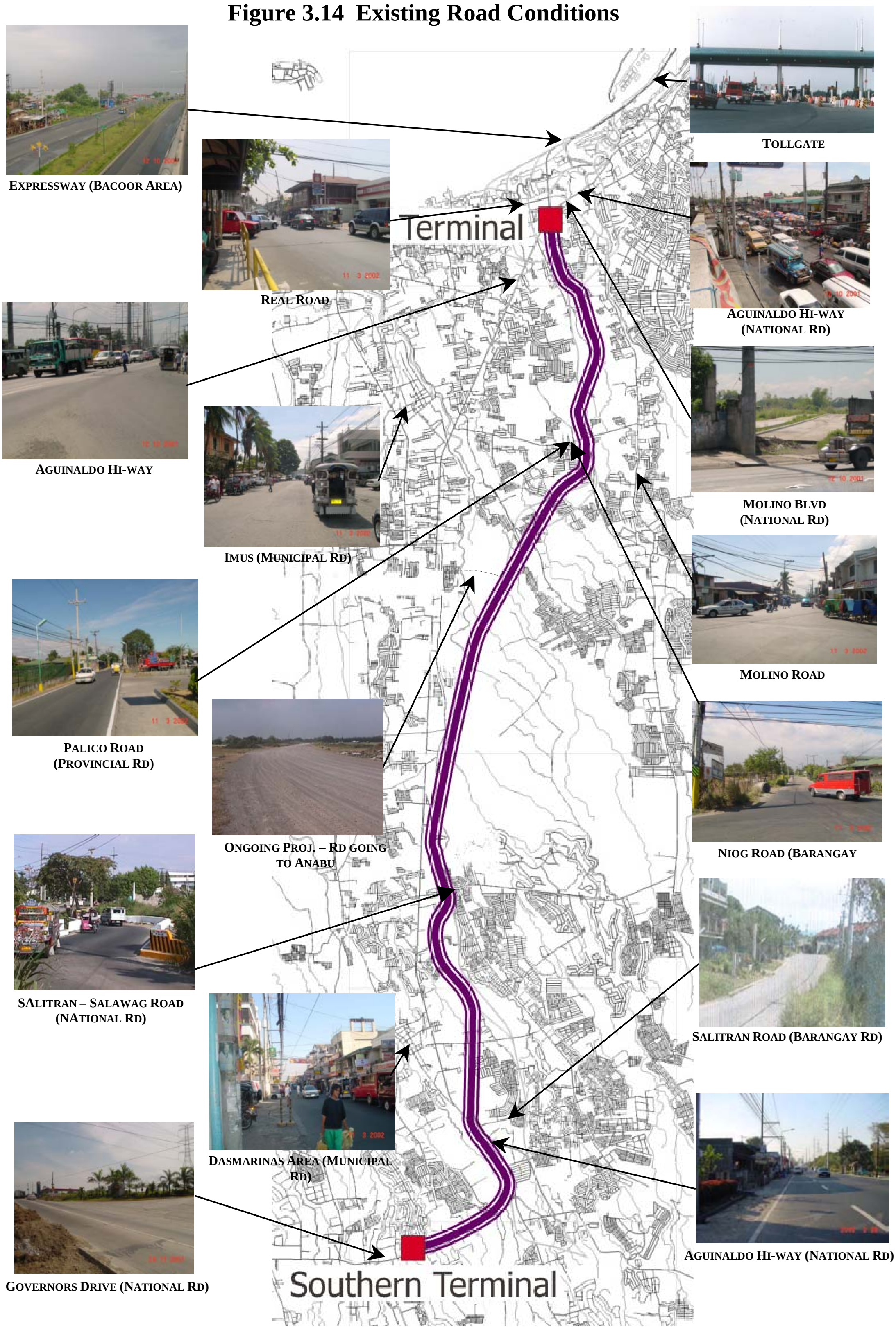
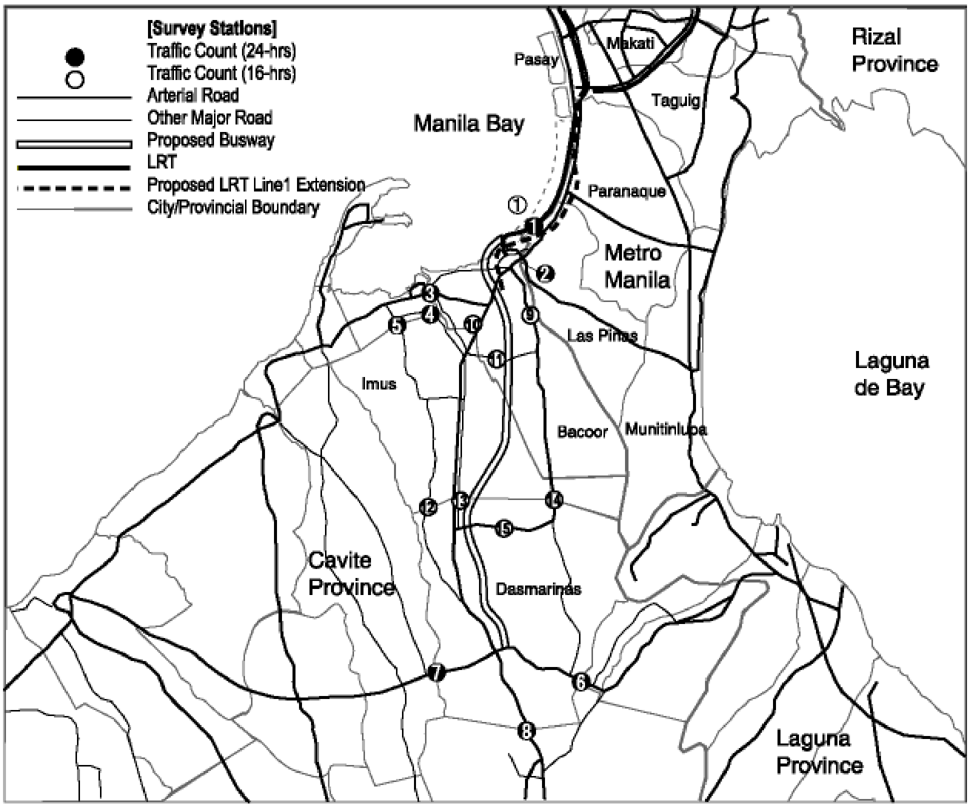


Table 3.2 Traffic Volume on Major Roads, 2002

No	Station (Boundary)	Car	Jeepney	Bus	Truck	Others	Total
1	Coastal Road (Bacoor-MM)	51,915	6,726	4,628	4,499	239	68,007
2	Quirino Avenue (Bacoor-MM)	7,808	10,301	1,326	781	5,896	26,112
3	Binakayan (Bacoor-Kawit)	11,041	4,887	2,620	1,527	4,496	24,572
4	Provincial Road (Imus-Kawit)	5,894	2,106	24	283	4,831	13,138
5	Provincial Road (Imus-Kawit)	2,357	142	7	236	6,901	9,643
6	Governor's Drive (Dasma.-GMA)	14,646	3,634	358	4,474	3,600	26,712
7	Governor's Drive (Dasma.-Gen.Trias)	14,029	4,892	746	3,048	1,609	24,324
8	Aguinaldo Highway (Dasma.-Silang)	7,295	2,823	860	1,550	673	13,201
9	Molino Road (Bacoor)	5,223	4,576	4	350	3,490	13,643
10	Aguinaldo Highway (Bacoor-Imus)	22,915	7,892	1,943	3,989	3,452	40,191
11	Provincial Road (Bacoor-Imus)	528	12	0	15	1,015	1,570
12	Provincial Road (Dasma.-Imus)	3,217	391	4	205	568	4,385
13	Aguinaldo Highway (Dasma.-Imus)	20,457	4,006	1,366	5,983	1,148	32,960
14	Molino Road (Dasma.-Imus)	1,640	2,748	0	1,506	2,071	7,965
15	East-West Road (Dasma.)	5,169	1,954	0	365	523	8,013

Unit: 24-hour average traffic volume for both directions

Figure 3.15 Location of Traffic Count Stations



(2) Average Passenger Occupancy

The survey indicated that the average passenger occupancy is about 1.9 persons for cars, 2.1 persons for taxis and trucks. As for public transport mode, average number of passengers including drivers is 10 persons for jeepneys, 15 persons for mini-buses and 39 persons for standard buses. It is found that the average passenger occupancy of public transport mode is relatively higher on major roads of Coastal Road, Aguinaldo Highway and Governor Drive (Table 3.3).

Table 3.3 Average Passenger Occupancy on Major Roads

No	Station (Boundary)	Car	Taxi	Jeepney	Mini Bus	Standard Bus	Truck
1	Coastal Road (Bacoor-MM)	2.0	2.3	12.8	26.9	40.5	2.0
2	Quirino Avenue (Bacoor-MM)	1.9	1.7	7.5	9.5	-	2.1
3	Binakayan (Bacoor-Kawit)	1.9	2.2	6.4	13.6	25.9	2.0
4	Provincial Road (Imus-Kawit)	1.8	1.6	9.5	-	-	2.5
5	Provincial Road (Imus-Kawit)	1.9	2.1	2.7	-	-	2.7
6	Governor’s Drive (Dasma.-GMA)	1.7	1.6	15.6	8.5	32.8	2.6
7	Governor’s Drive (Dasma.-Gen.Trias)	1.7	2.4	10.4	21.0	37.8	1.7
8	Aguinaldo Highway (Dasma.-Silang)	2.4	1.8	8.7	26.9	27.1	2.0
9	Molino Road (Bacoor)	1.9	1.8	9.6	-	-	1.9
10	Aguinaldo Highway (Bacoor-Imus)	1.7	2.0	11.5	19.4	45.4	2.2
11	Provincial Road (Bacoor-Imus)	1.8	1.9	12.8	-	-	2.1
12	Provincial Road (Dasma.-Imus)	1.9	2.1	11.4	-	-	2.2
13	Aguinaldo Highway (Dasma.-Imus)	2.0	2.0	10.5	11.2	28.7	1.9
14	Molino Road (Dasma.-Imus)	1.7	2.0	9.5	-	-	2.0
15	East-West Road (Dasma.)	1.9	2.2	8.7	-	-	1.9

Unit: Average 24-hour for both directions

(3) Travel Speed

Average travel speed of buses, jeepneys and cars on major routes in the Study Area are shown in Figures 3.16-3.18. Judging from the figures, characteristic of the traffic is identified as follows:

- In general, travel speed by direction is lower on northbound in AM-peak hours and on southbound in PM-peak hours.
- Travel speed of bus is normally higher than that of jeepneys on the same route due to less stop points.
- Some congested sections make considerable decline of travel speed.
- Average travel time of buses from Dasmariñas to Bacoor (19.5km) is about one hour.

Figure 3.16 Average Travel Speed of Bus

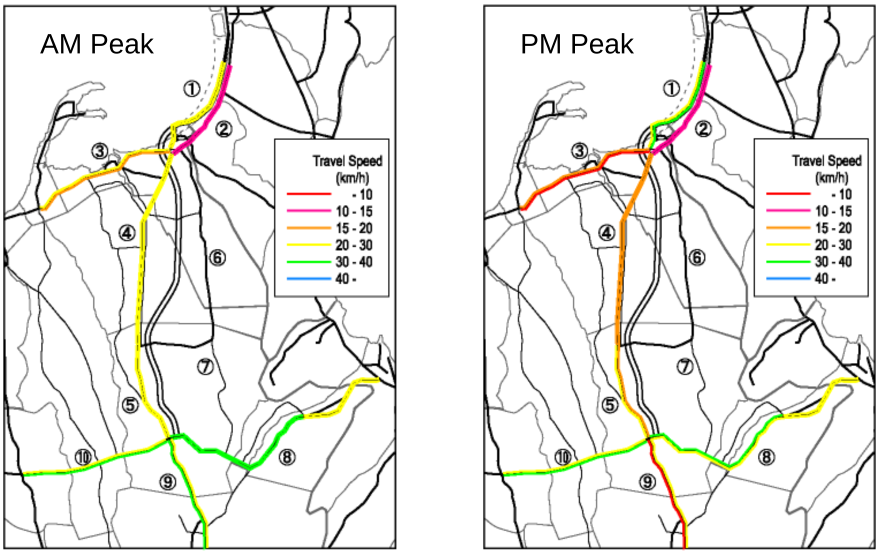


Figure 3.17 Average Travel Speed of Jeepney

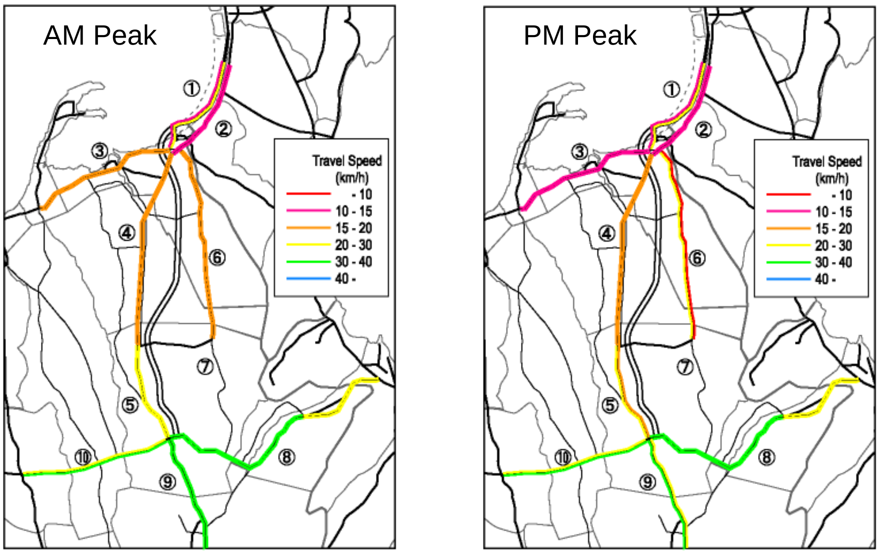
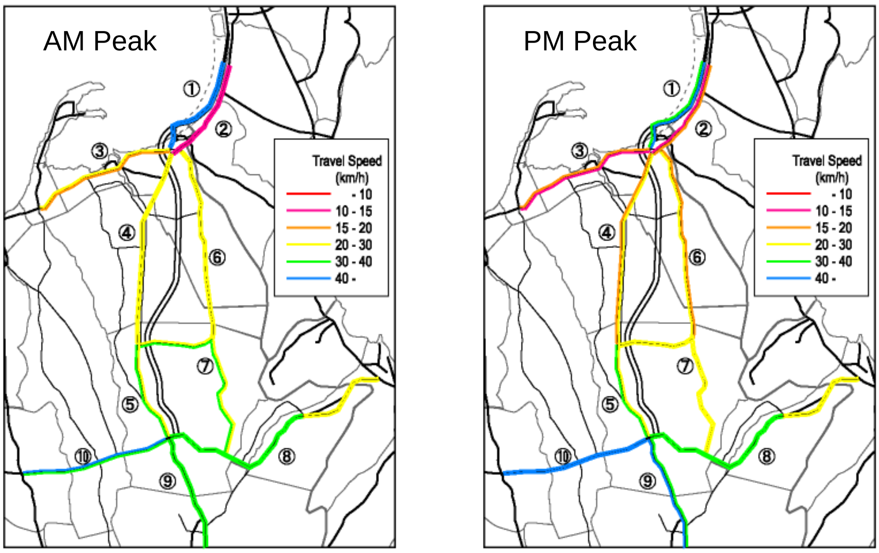


Figure 3.18 Average Travel Speed of Car



3.2.3 Public Transport Services

The bus routes operating in the Study Area are broadly divided into two groups indicating the main roads to which the buses are running (refer to route list in Appendix B). Both are mostly terminated at major areas in Metro Manila such as Baclaran, Pasay Rotonda, Lawton, Ayala Center, among others. The first route group is taking mainly Aguinaldo Highway originating from the town centers of the southern municipalities of Cavite Province. The second route group is mainly taking Real Road originating from the town centers of coastal and eastern municipalities of Cavite Province.

The routes of Jeepneys are covering most major roads in the Study Area. In general, the jeepney services shorter-length routes.

As shown in Figure 3.19, the existing traffic flow of buses are concentrated on Aguinaldo Highway and Real Road (2,000 vehs./day in each road) and Coastal Road (4,500 vehs./day). The distribution of jeepney traffic flow is basically similar with buses, but it is more spread to other minor roads (Figure 3.20).

Figure 3.19 Bus Traffic Flow

Figure 3.20 Jeepney Traffic Flow

3.2.4 Bus Operator Characteristics

Bus operator interview survey was conducted in this Study. In this section, major characteristics of bus operators are examined from the viewpoints of business scale and operation, etc.

(1) Fleet Characteristics

The total number of respondents for the interview survey was 36 bus operators. The number of owned buses and its breakdown by vehicle type vary by operator as shown in Figure 3.21. Range of fleet age is extensive as shown in Figure 3.22. The composition by age group is 31% of 4 years under, 36% of from 5 to 9 years and 33% of 10 years or over.

Figure 3.21 Number of Owned Buses by Fleet Type

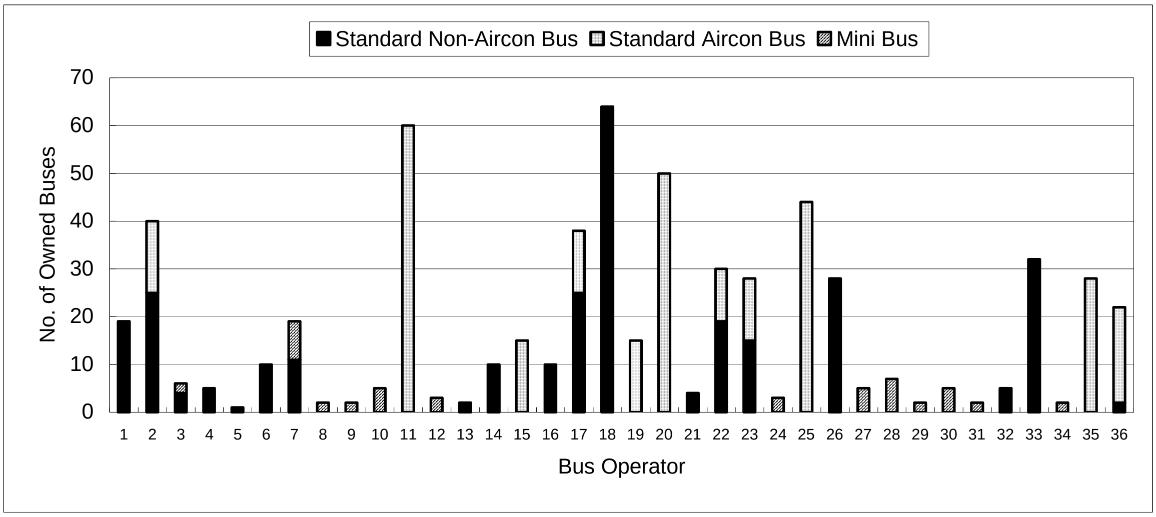
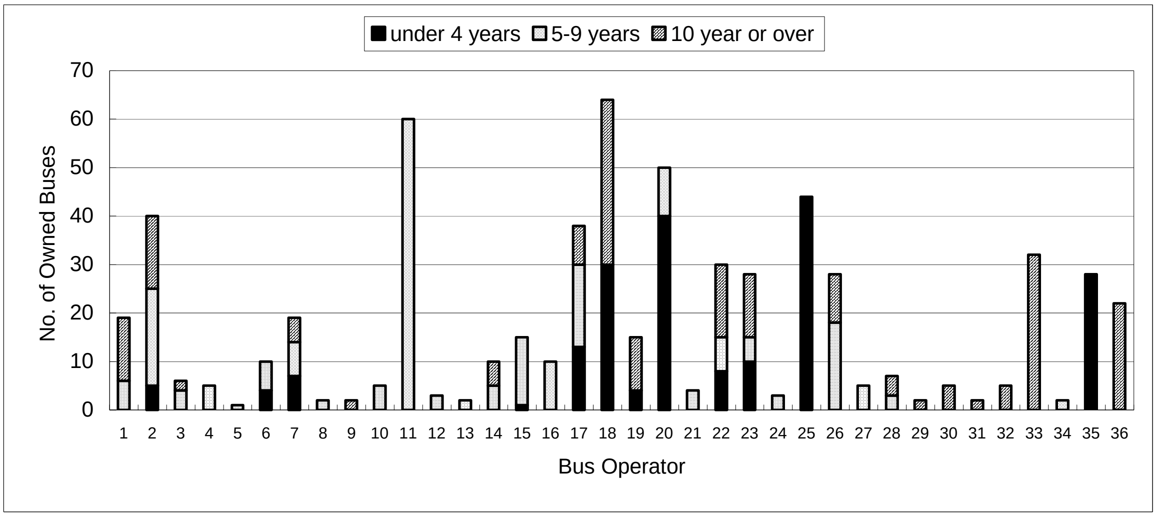


Figure 3.22 Number of Owned Buses by Fleet Age



According to the results of the interview survey, most of the respondent operators purchase the second hand fleet from local suppliers. For fleet acquisition, they normally get financing from local suppliers (33%) or banks (30%). The range of purchase price of fleets is shown in Table 3.4.

Table 3.4 Range of Purchase Price by Fleet Type

Fleet Type	Standard Non-Aircon Bus	Standard Aircon Bus	Mini Bus
Brand New (Assembled)	P 450-700 thousand	P 3.5-3.9 million	P 300-430 thousand
Second Hand	P 250-400 thousand	P 1.4-1.5 million	P 150-250 thousand

(2) Manpower Characteristics

The average number of personnel per fleet is shown by type of employee in Table 3.5. There are about 1.5 drivers and conductors each per fleet. Average working days per week is about 6 for any kind of employees. Average working hours per day for the employee related to bus operation is longer ranging 12-16 hours.

Average compensation by type of employee is shown in Table 3.6. Average commission rate of drivers, conductors and inspectors/Dispatchers are 24.4%, 16.4% and 12.5%, respectively.

Table 3.5 Average Number of Personnel and Working Days/Hours

	Average No. of personnel per fleet	Average working days per week	Average working hours per day
Driver	1.46	6.1	15.5
Conductor	1.45	6.1	15.5
Inspector & Dispatchers	0.18	6.0	12.7
Service & Supply Workers	0.17	5.9	7.8
Finance & Administrative Personnel	0.09	5.9	8.2
Executives & Managers	0.06	6.2	9.5

Table 3.6 Average Personnel Compensation

	Basic Wage per day	Fringe Benefit	Commission	Monthly
Driver	P 332	SSS/MED	24.4 %	P 9,588
Conductor	P 300	SSS/MED	16.4 %	P 8,594
Inspector & Dispatchers	P 254	SSS/MED	12.5 %	P 8,063
Service & Supply Workers	P 252	SSS/MED	-	P 5,144
Finance & Administrative Personnel	P 256	SSS/MED	-	P 9,021
Executives & Managers	-	SSS/MED	-	P 19,709

(3) Operational Characteristics

Table 3.7 shows a summary of the operational indices of bus operators.

Table 3.7 Operational Indices of Bus Operators

Items	Indices
Average No. of operating days per week	6.6 days
Average No. of operating hours per day	16.2 hours
Range in start time	2:00-16:00
Range in end time	12:00-1:00
Average dwelling time at end points/terminals	36.9 minutes
Average number of passengers per trip (passenger load factor)	42.2 pax
Average fuel consumption (bus-km/liter)	2.5 km/liter
Average frequency of cleaning per week	6.7 times
Average frequency of preventive maintenance per week	3.7 times
Average No. of crimes aboard per month	0.4 times
Average No. of traffic violations per month	7.6 times
Average No. of breakdowns/abandoned service per month	1.5 times
Average No. of complaints from passengers per month	1.1 times
Average No. of memos/disciplinary actions on crew per month	3.0 times
Labor Disruption (Average No. of days since start operation)	11.0 days

(4) Opinions on the Transport Development and Measures

In addition to specific questions on the current conditions, opinions of bus operators are examined. The transport development and measures are set as follows:

1) LRT/Busway

2) Palapala-Bacoor Expressway

3) Clean Air

4) Ticketing System

Tables 3.8-3.11 summarize the opinions of bus operators on the following:

Table 3.8 Opinions on LRT/Busway

Question	Answer of Bus Operators	
Will LRT/Busway pose a competition to your operations?	1) Yes 2) No	88.9% 11.1%
If Yes, will you modify your service?	1) Modify schedule 2) Change route or termination 3) Improve service 4) Reduce frequency	58.8% 29.4% 8.8% 3.0%
Would you prefer government or private sector to run or operate the LRT/Busway?	1) Government 2) Private sector	97.2% 2.8%

Table 3.9 Opinions on Paliparan-Bacoor Expressway

Question	Answer of Bus Operators	
A. Will you run your buses on this expressway and pay toll?	1) Yes 2) No	91.4% 8.6%
B. How much are you willing to pay for toll fee?	1) 1–5 pesos 2) 5–9 pesos 3) 10–14 pesos 4) 15–20 pesos	25.0% 21.9% 25.0% 28.9%
C. Will you still enter the expressway if your buses are prohibited from stopping along the entire route?	1) Yes 2) No	30.6% 69.4%
D. If buses make limited stops at designated areas?	1) Yes 2) No	91.7% 8.3%
E. Will you use the expressway only if there is a reduction in journey time?	Average reduction time: 36.5 min.	

Table 3.10 Opinions on Clean Air

Question	Answer of Bus Operators	
A. If government orders buses to convert to alternative clean-burning fuel other than diesel (e.g., LNG), will you comply?	1) Yes 2) No	91.7% 8.3%
B. Under what conditions will you do so?	1) Phased over 5 year? 2) Replace only older buses? 3) With soft loan from gov't? 4) LNG price should be cheaper than diesel?	42.4% 30.3% 51.5% 60.6%

Table 3.11 Opinions on Ticketing System

Question	Answer of Bus Operators	
A. Will you join a common ticketing system where passengers can buy stored value tickets and use the same on any bus or LRT line?	1) Yes 2) No	72.2% 27.8%
B. If yes, under what terms and conditions?	1) Daily collection or remittance 2) Machine is provided	100.0% 46.1%
C. If no, why not?	- Many people will be unemployed - Individual operators need daily cash - It is not applicable to small bus operators - Too complicated etc.	

3.3 Physical/Social Constraints on Busway Corridor

Existing physical/social conditions in the Study Area are shown in Figure 3.23 as presented by several photos. The major points will be discussed below, as follows:

3.3.1 Land Use

Land resource can be broadly categorized into forestland and alienable/disposable land. The approximate land use classification in Cavite (in terms of percentages to total land area) is broken down as shown in Table 3.12.

Table 3.12 General Land Use of Cavite

Land Use	Percentage of Land Area
Forest Lands	9%
Alienable/Disposable	
Agricultural	74%
Wetlands	1%
Built-Up Areas	16%

Source: Cavite Provincial Framework Plan.

Spatially, existing land use is presented in Figure 3.24 and its characteristics can generally be illustrated in Figure 3.25 and described as follows:

(1) Regarding residential land use:

- High density generally low to middle income residential areas is concentrated along major highways (behind strip commercial development) and in portions closest to/most accessible to and from Metro Manila.
- Medium density low to middle income residential areas are typical in urban cores along major highways
- Low density high income residential subdivisions

(2) Strip commercial development occurs along major highways near town centers or poblacions. Major shopping centers have emerged along Aguinaldo Highway (e.g., SM Bacoor, Robinson's and Walter Mart) where population concentration is large.

(3) The pattern of existing industrial development reflects the need for good transport links to Metro Manila. This could be the result of the “flight to the suburbs” of industries from Metro Manila for cheaper sites and to comply with the industrial ban policy in Metro Manila in the early 1980s, without necessarily having to be too far from suppliers, consumers and transshipment facilities in Metro Manila.

Figure 3.23 Physical/Social Constraints in the Study Area

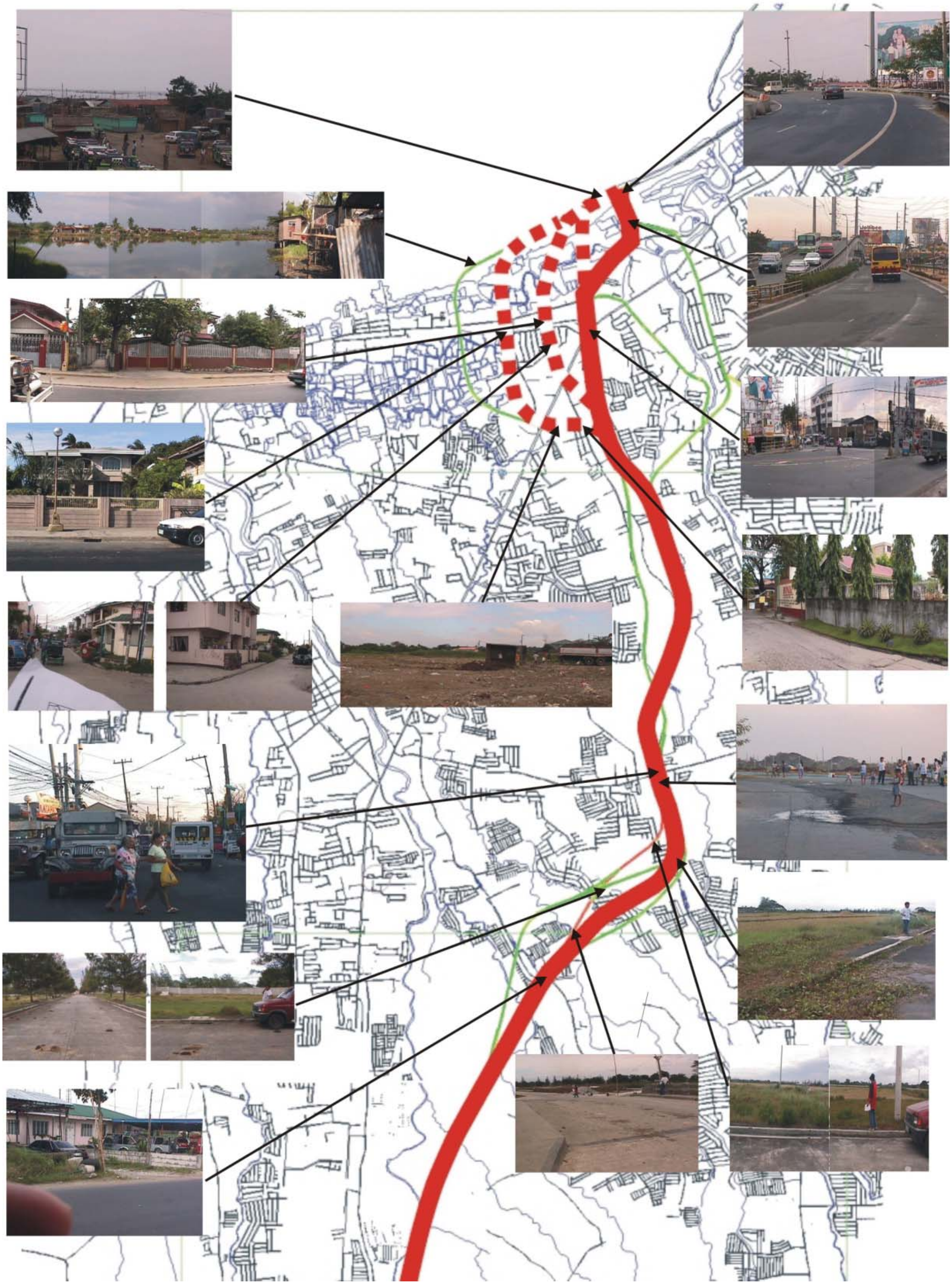


Figure 3.23 Physical/Social Constraints in the Study Area *(continued)*

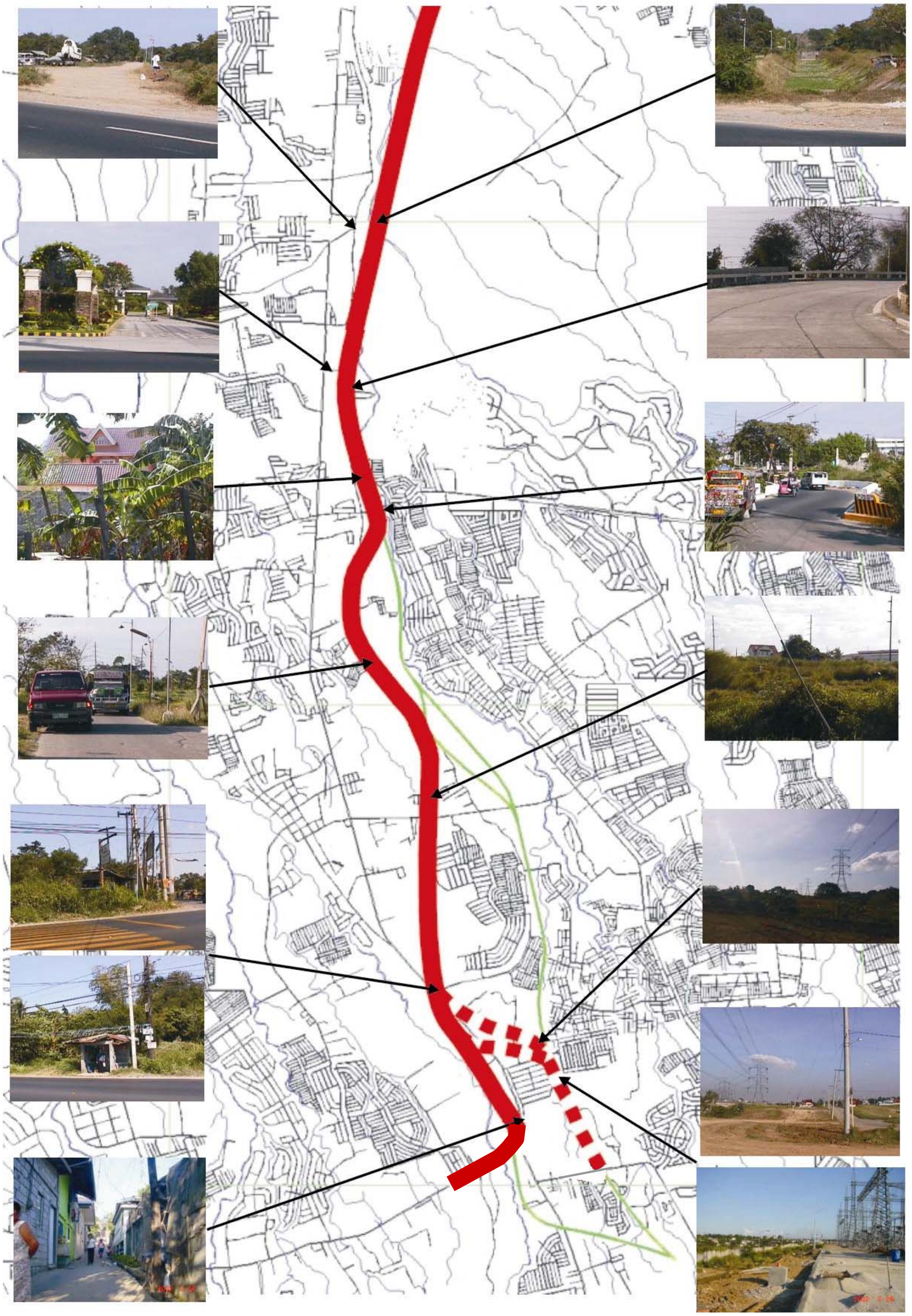
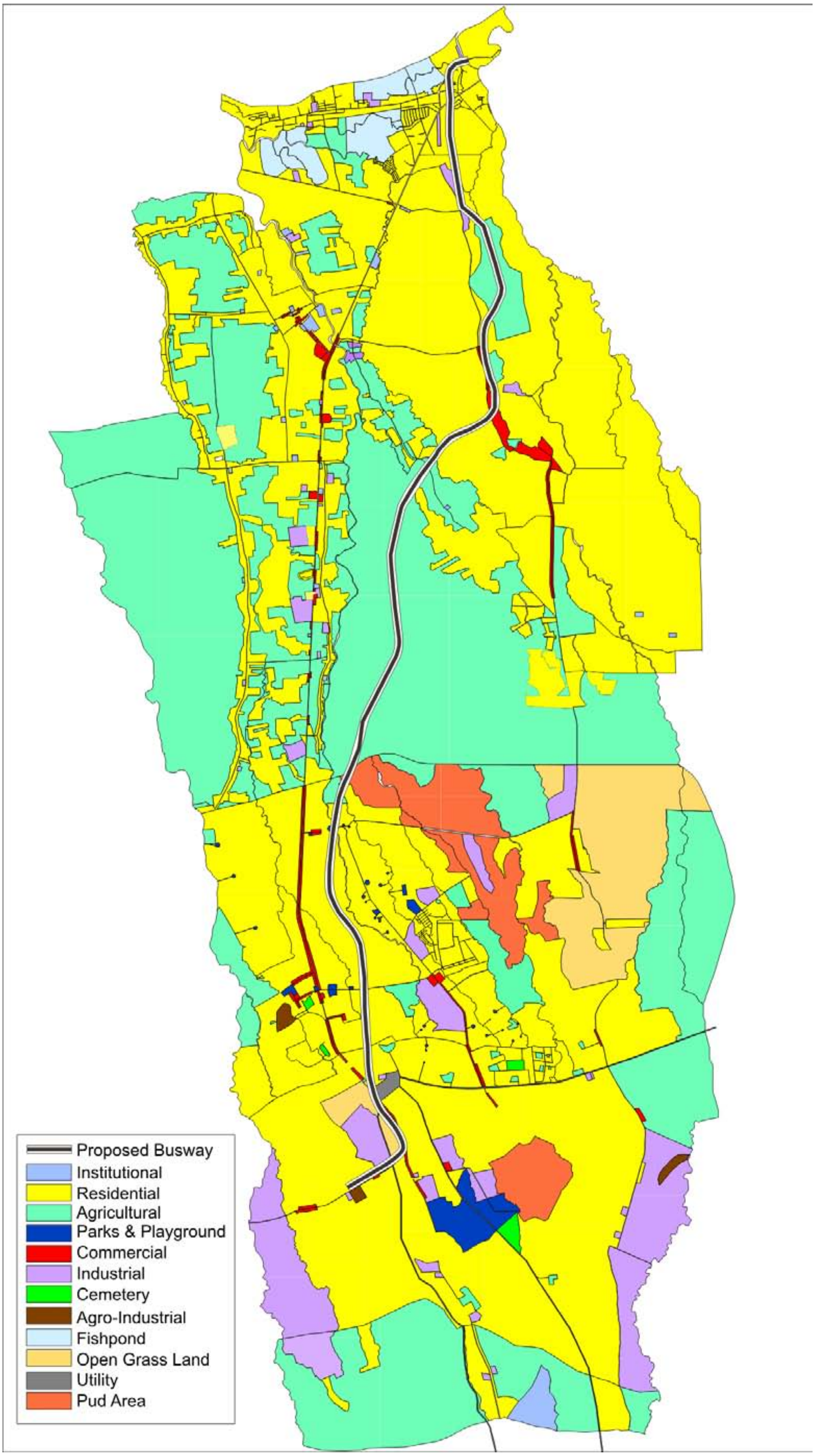
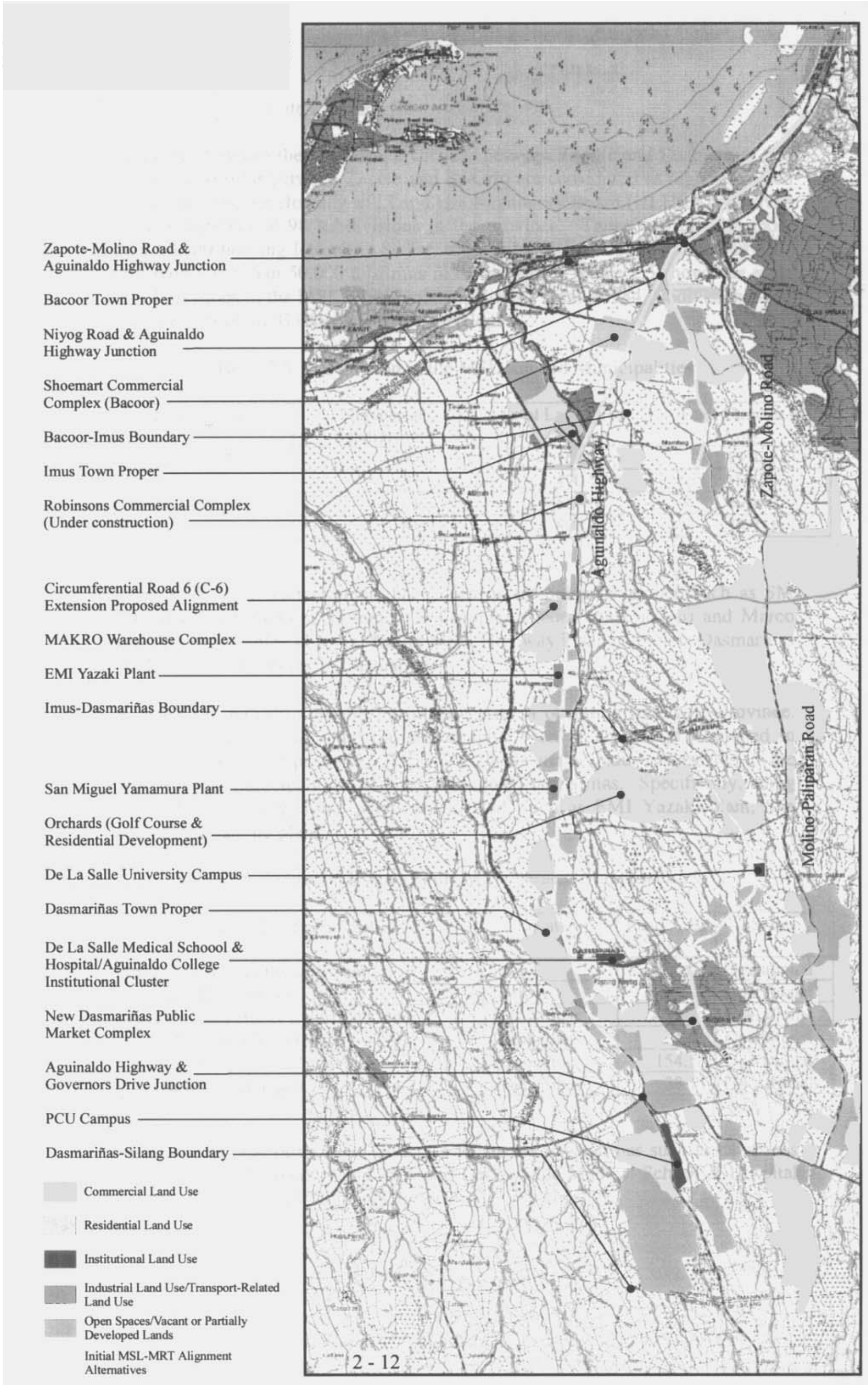


Figure 3.24 Existing Land Use in Bacoor, Imus and Dasmariñas



Source: JICA Study Team, based on existing land use maps submitted by the municipalities of Bacoor, Imus and Dasmariñas.

Figure 3.25 Major Land Use Features



Industrial enclaves are found in the Rosario-Imus Industrial Area and the Dasmariñas-Carmona Industrial Area along Governor's Drive. This has created an industrial corridor from west Laguna to Central Cavite and down to Metro Batangas.

(4) Eco-tourism infrastructures such as resort subdivisions and leisure parks are found in the Naic-Ternate area, the upland areas from Silang, Amadeo, Indang, Gen. E. Aguinaldo leading to Tagaytay and the Mt. Palay-palay and Mataas na Gulod National Park, going to Batangas on the Tagaytay Ridge.

(5) At least 8 (as of 1996) world-class golf courses are found in Cavite, particularly in the southern portion.

(6) Primary agricultural lands are abundant in certain portions, with marginal agricultural areas still existing in some zones.

(7) Secondary and primary forests in certain portions of Cavite are declared environmentally critical areas.

3.3.2 Bacoor

For Coastal Road - Talaba Diversion Road-Molino Boulevard:

- When the existing segment cannot meet future traffic demand anymore, widening and other related improvements will affect several structures along this stretch.
- Tight bends are encountered at the intersections of Talaba-Las Piñas Diversion Road and Real St.
- Basically, there are no social as well as environmental issues involved in this alignment. As a matter of fact, construction of a major portion of the alignment is partly completed (using the Molino Boulevard).

3.3.3 Imus

- The line will affect some residential areas that are partially developed and open areas for development. There are existing and on-going development in this section. The alignment will intersect earth road at the lower part of this section and this will serve as an access road for the future.

3.3.4 Dasmariñas

- The line will affect several houses at the intersection of Congressional Road. But along its route starting from Salawag-Salitran Road and while following the alignment of Salitran Road, no structures will be affected.
- A slightly tight bend is encountered as the line departs from the intersection of Salawag-Salitran Road toward Salitran Road.

- Few houses will be affected at the intersection of Congressional Road where the line starts. After this short section, the line traverses relatively open areas.
- More electrical power lines are located in the area. As it ends at the intersection of Governor's Drive, a high voltage electrical lines erected along the roadsides of Governor's Drive.
- Squatter areas near Vineyard Village will be affected by the alignment.
- The line traverses alongside the National Power Corporation (NPC) Substation, which is a high-risk area.

3.3.5 Others

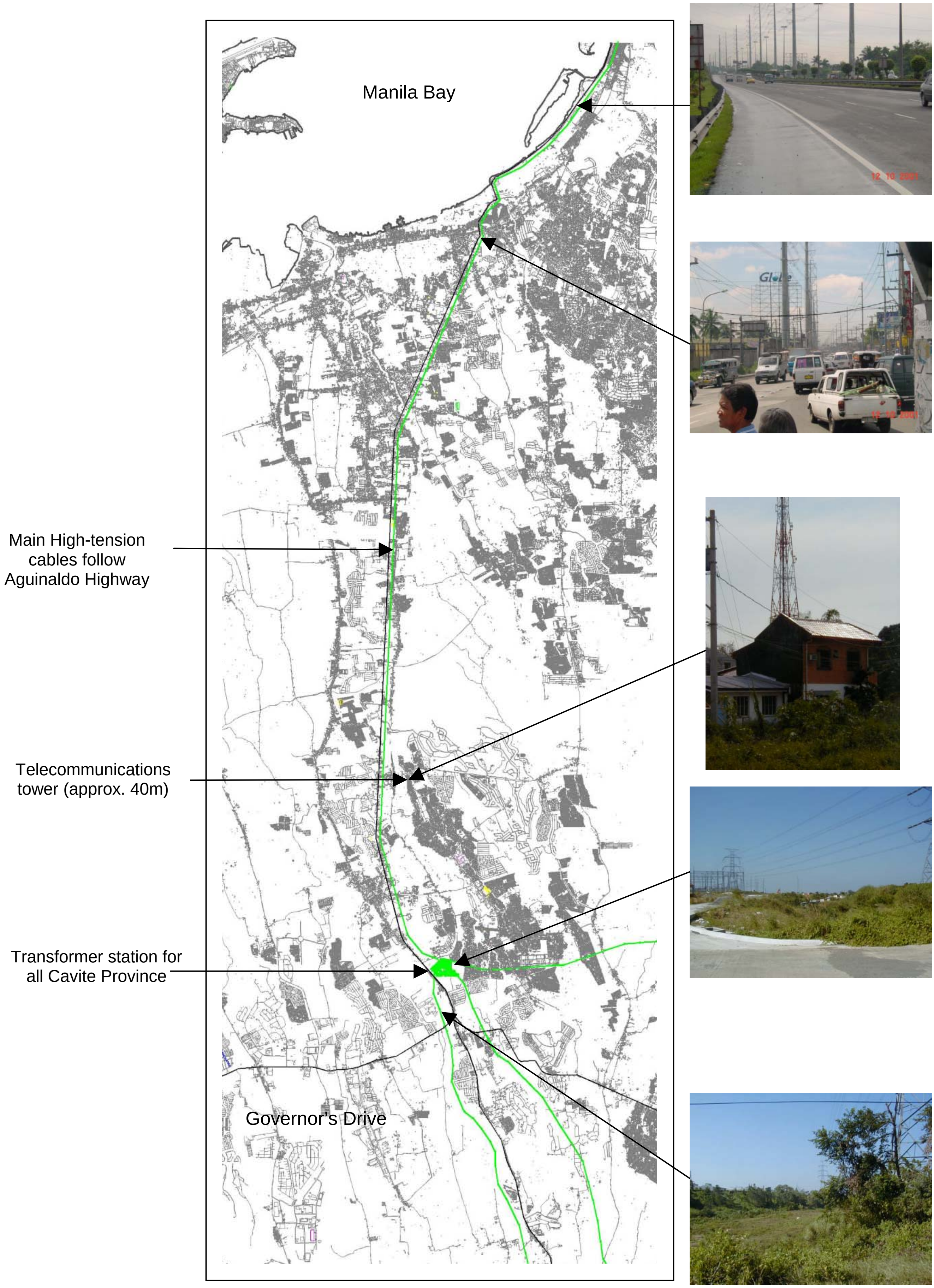
The electrical power grid has been established in Cavite Province with the main feeder line running alongside the Coastal Road and both sides of Aguinaldo Highway. The main substation for the province is located in Dasmariñas (Dasmariñas Substation). The backbone network is shown in Figure 3.26 together with images of the main features. Both MERALCO and NPC have facilities in the area as shown in Table 3.13.

Table 3.13 Electrical Power Facilities in the Study Area

Main trunk lines		Major subtransmission lines	
Rosario – Dasmariñas	115kV	Dasmariñas – Abubot – Rosario	115kV
Dasmariñas - Zapote	230kV	Dasmariñas – Pala pala – Silang	115kV
Tayabas – Dasmariñas	500kV	Dasmariñas – GMA – Binan	115kV
Calaca - Dasmariñas	230kV	Dasmariñas – TMC 2 – Ternate	115kV

In addition to the main substation at Dasmariñas, there is also a major substation in Bgy. Pala pala, located south-east of the Aguinaldo/Governor's intersection.

Figure 3.26 Electrical Power Grid Network in the Study Area



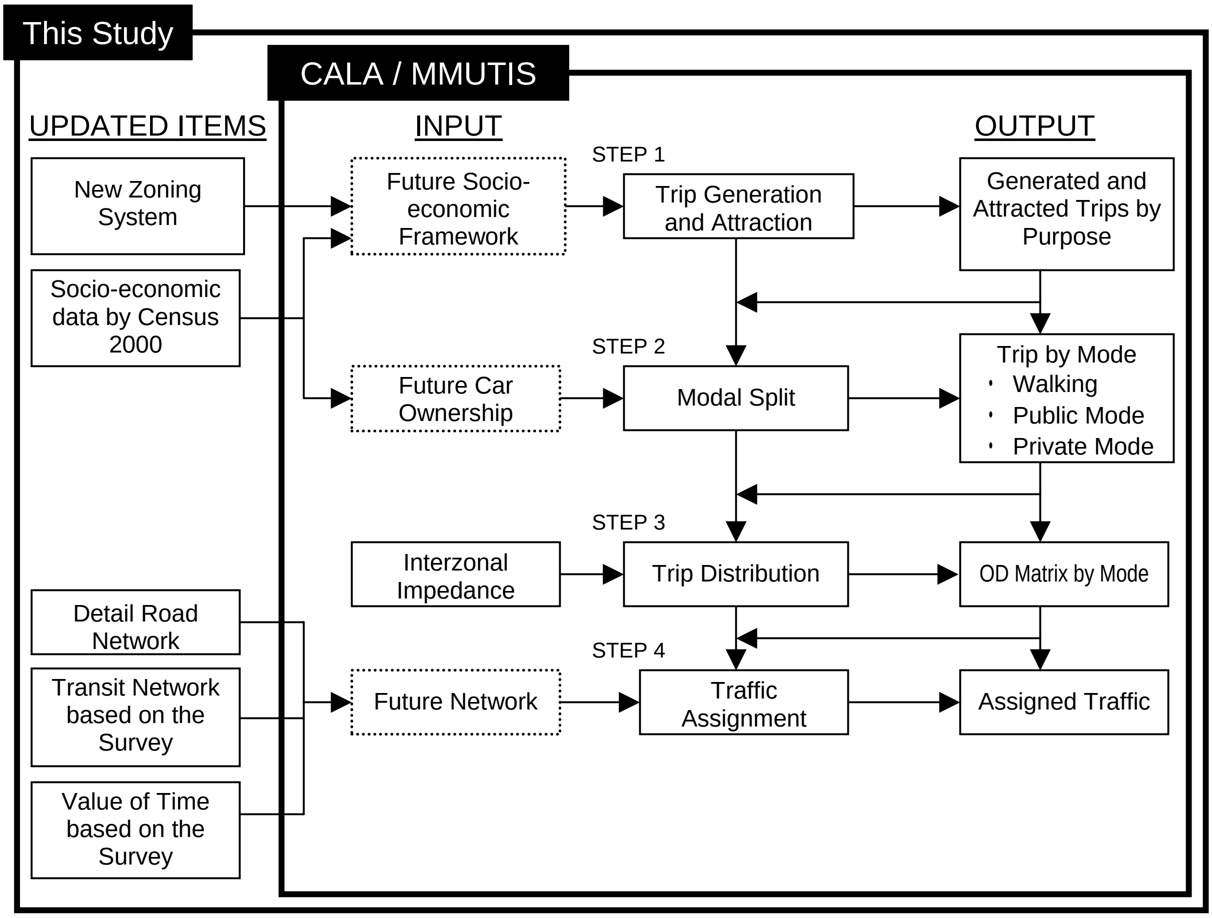
4 DEMAND FORECAST

4.1 Methodology

4.1.1 Data Processing Procedure

The demand forecast in this study was done as shown in Figure 4.1. This methodology of demand forecast and input data are basically the same as that used in the World Bank's CALA Transport Study. However, for this Study, it was necessary to update some input data, details of which are shown in Table 4.1

Figure 4.1 Framework for the Demand Forecast



Procedure of Assignment

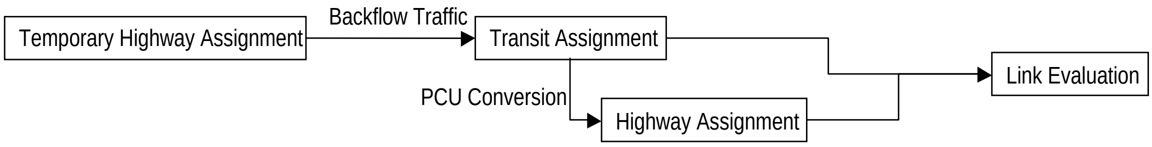


Table 4.1 Updated Input Data

Zoning:	To make a more detailed demand forecast, a zoning system (Figure 4.2) is prepared with Bacoor divided into 8 zones (2 zones in CALA Study), Imus divided into 10 zones (2 zones) and Dasmariñas divided into 12 zones (3 zones).
Land Use and OD Matrices:	Using the 1998 and 2005 OD matrices of the World Bank's CALA Transport Study, 2002 OD matrices were first estimated by interpolation. The future OD matrices for the years 2005, 2010 and 2015 were created according to the models of the World Bank Study. After this, the comparison between population data estimated by MMUTIS and the 2000 Census data was conducted by zone level. Based on this comparison and information on recent development projects, the adjustment ratio for each zone was determined and trip generation/attraction for each zone was adjusted accordingly. After this adjustment, since it seemed that the growth of traffic demand (population) was delayed for about 5 years compared to the previous forecasts, future OD matrices were recreated by sliding the OD matrices of World Bank's CALA Transport Study by 5 years (*i.e.* former 2015 trip generation/attraction as 2010).
Network:	Based on recent information on transport network development, the future network was slightly modified for years 2005, 2010 and 2015. For 2015 network, however, two cases were assumed considering the delay in road development; one with full network proposed by MMUTIS and the other with the same network as 2010 (Figure 4.3)
Transit Route:	Based on the transit route survey on the study area, routing and frequency of the routes are revised for the traffic demand analysis. For future situations, new bus and jeepney routes were assumed on the new roads intersecting the proposed busway.
Value of Time	Values of time for public and private transport users as of year 2002 were calculated by a SP (Stated Preference) Survey conducted for the Study. For future values, same growth rates as CALA study were adopted (See Table 4.2).

Figure 4.2 Zoning for this Study

Study Area

Province of Cavite

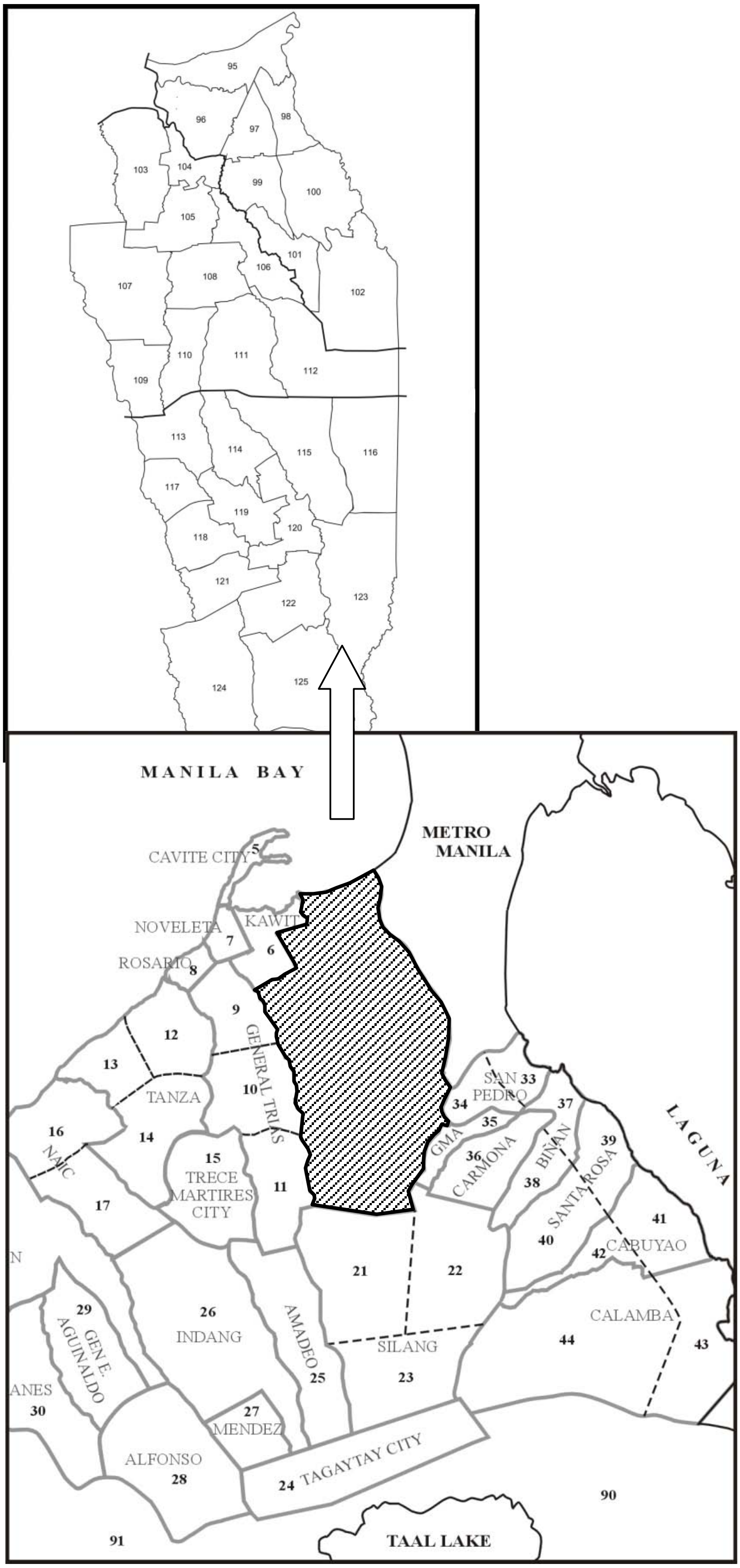


Table 4.2 Time Value (Pesos/h)

	2002	2005	2010	2015
Private Mode	79.3	86.8	97.3	107.1
Public Mode	44.2	48.4	54.3	59.7
Growth rate	-	1.09	1.23	1.35

Source: SP Survey for Road Users

Figure 4.3 Transport Network

2002

2015 (full)

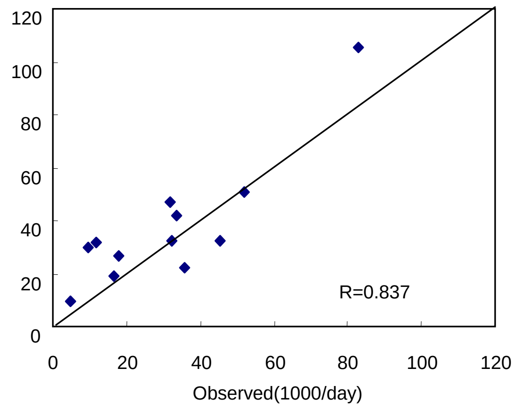
4.1.2 Calibration of the Model

In order to develop a calibrated model, the replication of the model was examined by comparing it with the data from the traffic count survey conducted in March 2002. Table 4.3 and Figure 4.4 show the results of the comparison between observed and estimated traffic volume (PCU) on major roads. Although the road network is considered to have been reasonably calibrated, the traffic volume estimated in the future road network has been adjusted considering the difference between the observed and the estimated traffic volume on the existing network.

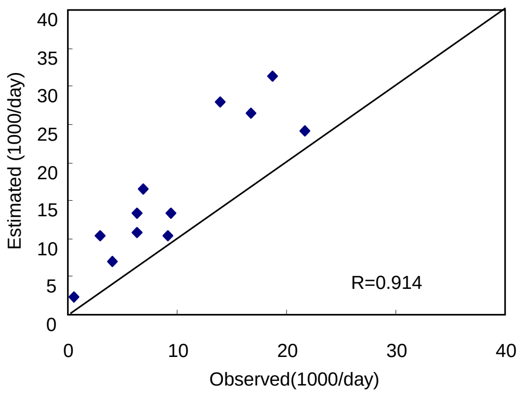
Table 4.3 Comparisons between Observed and Estimated Traffic Volume, 2002

Station (Boundary)	OBSERVED			ESTIMATED		
	Private (PCU)	Public (PCU)	Total (PCU)	Private (PCU)	Public (PCU)	Total (PCU)
Coastal Road (Bacoor-MM)	63,402	21,659	82,747	81,125	24,081	105,206
Quirino Avenue (Bacoor-MM)	15,657	18,767	33,760	10,876	31,285	42,161
Binakayan (Bacoor-Kawit)	19,355	13,881	31,925	18,795	28,003	46,798
Governor's Drive (Dasma.-GMA)	29,431	6,346	35,598	8,773	13,291	22,064
Governor's Drive (Dasma.-Gen.Trias)	23,258	9,203	32,088	22,051	10,468	32,519
Aguinaldo Highway (Dasma.-Silang)	11,843	6,385	17,798	15,616	10,791	26,407
Molino Road (Bacoor)	9,588	6,874	16,460	2,562	16,454	19,016
Aguinaldo Highway (Bacoor-Imus)	36,340	16,696	52,064	24,599	26,505	51,104
Provincial Road (Dasma.-Imus)	4,298	597	4,892	7,549	2,270	9,819
Aguinaldo Highway (Dasma.-Imus)	36,563	9,424	45,304	18,886	13,398	32,284
Molino Road (Dasma.-Imus)	7,476	4,122	11,598	24,621	6,923	31,544
East-West Road (Dasma.)	6,605	2,931	9,536	19,766	10,272	30,038

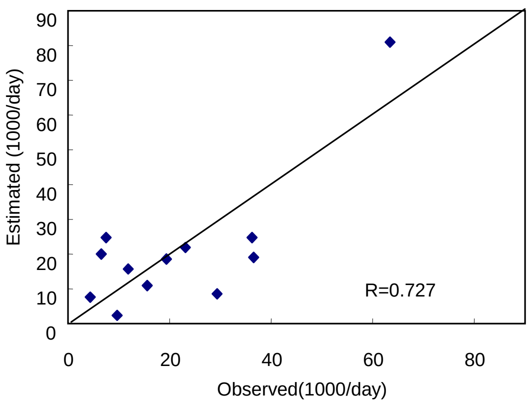
Figure 4.4 Scatter Plots of Observed and Estimated Traffic Volume (PCU), 2002



Total



Public



Private

4.2 Future Demand Forecasts

4.2.1 Assignment Cases

Traffic assignments for the cases shown in Table 4.4 were conducted in this Study. Busway was assumed to have 2 lanes and to be operated at 20km/h. LRT 1 was assumed to be existing after 2005(Baclaran – Bacoor). For the purpose of demand forecast, the proposed busway was assumed to start operation in 2005 (may be different from actual implementation schedule).

Table 4.4 Traffic Assignment Cases

Year / Cases of Traffic Assignment	2002	2005	2010	2015 (full network)	2015 (2010 network)
Without Busway					
With no road on busway alignment	x	x	x	x	x
With 2-lane road on busway alignment		x	x	x	x
With 4-lane road on busway alignment		x	x	x	x
With Busway					
With 2-lane busway + 2-lane service road		x	x	x	x
With 2-lane busway + 4-lane service road		x	x	x	x

4.2.2 Busway Traffic Demand

1) Number of Passengers

On 2005, the Busway would have a ridership of nearly 100,000 passengers/day. This is expected to increase to around 150,000 passengers/day in the next 5 years. Spurred by the expected development in Imus and Dasmariñas and the development of the first section of the East-West Road, it is expected that the demand on the busway along these sections will grow at a proportionately much higher rate. In 2015, assuming a comprehensive and extensive road network development in the Study Area, as proposed by MMUTIS, demand on the Busway would be stagnated. However, it is likely that such an extensive road development may not materialize and in such a case, demand on the Busway will continue to grow rapidly by as much as 70% in the succeeding 5 years after 2010.

Table 4.5 Busway Demand Summary

Service Road	4 lanes			2 lanes		
	No. of Pass/day	Ave. trip length (km)	Ave. Fare (P/ride)	No. of Pass/day	Ave. trip length (km)	Ave. Fare (P/ride)
2005	98,562	9.2	12.52	100,092	9.0	12.41
2010	141,246	9.4	12.64	155,002	8.7	12.32
2015 (full net)	155,801	9.2	12.55	174,530	8.6	12.27
2015 (2010 net)	239,491	8.8	12.34	224,783	9.1	12.51

2) Boarding/Alighting Passengers at each Bus station/stop

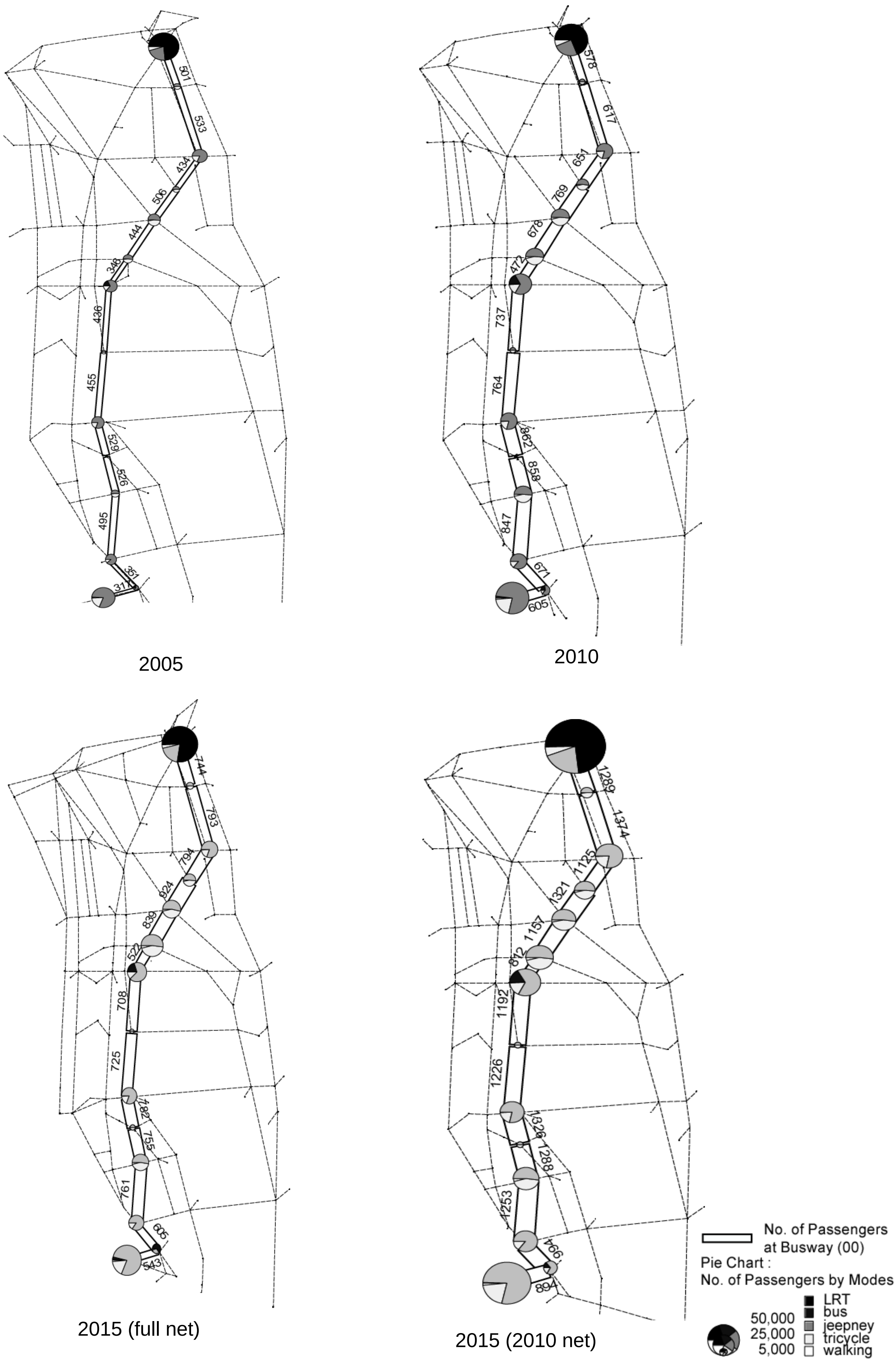
Boarding and alighting would be concentrated primarily at terminals. The Northern and Southern terminals would need to cater to around 60,000 passengers/day in 2010. In 2010, 7 of the 12 intermediate stations would be catering to more than 15,000 passengers/day. If the road network would be develop as proposed in MMUTIS from 2010 to 2015, traffic growth at intermediate stations would slow down; otherwise, traffic would continue to rapidly increase that, by 2015, 7 intermediate stations would be catering to more than 25,000 passengers/day. Meanwhile, terminal traffic will continue to increase as well. By 2015, traffic at northern and southern terminal will be around 128,000 and 89,000 passengers/day respectively. Similarly, if road network development is realized as proposed by MMUTIS, traffic growth at terminals will slow down since the modal share between bus and jeepney was assumed to be basically the same as the present public routes. There is a possibility that this modal relation will change significantly depending on the rerouting of public transport routes.

Table 4.6 Number of Boarding/Alighting Passengers at each Bus Station/Stop

	2010						2015 (full net)					
	LRT	bus	jeepney	tricycle	walking	Total	LRT	bus	jeepney	tricycle	walking	Total
Talaba	39,759	6	14,186	3,508	390	57,849	57,745	3	13,351	2,952	328	74,379
Ligas			2,037	1,638	182	3,857			2,645	2,083	231	4,959
Bayanan			12,101	2,992	332	15,425			15,922	3,520	391	19,833
Molino			6,219	5,002	555	11,776			6,935	5,462	607	13,004
Anabu			10,829	8,678	964	20,471			11,899	9,092	1,010	22,001
OneAsia Imus			10,825	8,740	971	20,536			16,664	13,527	1,503	31,694
Daang-Hari		4,838	17,711	4,513	501	27,563		5,252	17,087	3,240	360	25,939
Orchard			1,417	1,140	127	2,684			891	701	78	1,670
Salitran			14,807	3,661	407	18,875			15,094	3,337	371	18,802
Burol			199	160	18	377			1,422	1,120	124	2,666
Congressional			10,293	8,279	920	19,492			10,764	8,478	942	20,184
San Augstin			14,923	2,384	265	17,572			13,038	2,255	251	15,544
Para-para		1,531	4,018	994	110	6,653		4,036	1,746	386	43	6,211
Southern Terminal		1,067	46,585	11,519	1,279	60,450		1,959	42,006	9,287	1,033	54,285

	2015 (2010net)					
	LRT	bus	jeepney	tricycle	walking	Total
Talaba	93,661	47	27,484	6,919	769	128,880
Ligas			4,521	3,664	407	8,592
Bayanan			26,856	6,761	751	34,368
Molino			10,333	8,372	930	19,635
Anabu			14,142	11,341	1,260	26,743
OneAsia Imus			18,021	14,754	1,639	34,414
Daang-Hari		6,957	25,765	6,665	741	40,128
Orchard			1,807	1,464	163	3,434
Salitran			19,944	5,021	558	25,523
Burol			2,002	1,622	180	3,804
Congressional			14,629	11,854	1,317	27,800
San Augstin			21,879	3,602	400	25,881
Para-para		1,509	6,595	1,660	185	9,949
Southern Terminal		552	69,435	17,479	1,943	89,409

Figure 4.5 Passenger Volume on Busway



4.2.3 Road Traffic Demand

Table 4.7 and Fig. 4.6 summarize predicted key network performance indicators – traffic volume, average speed and V/C Ratio – under several scenarios and time periods. With respect to traffic volume, the Busway had little impact on the network. On the other hand, the development of service roads provide motorists another alternative and this will result in a shift in traffic demand as manifested in the lowered traffic volume at parallel links (*i.e.* Aguinaldo Highway and Molino Road).

Similarly, travel speeds are not significantly improved as a result of the Busway without the service roads. However, the development of the service roads helped balance the north-south traffic and higher travel speeds to as much +3.5kph can be attained.

In terms of V/C Ratio, several trends in network performance can be observed. Presently, the network V/C ratio is 1.02 with Governor's Drive having worst V/C ratio at 1.57. In the future, regardless of the development of service roads or the Busway, the situation in Governor's Drive would not improve much and that by 2015 the V/C ratio could worsen in 2015 and would be worst without the development of the East-West Roads. It seems apparent therefore that the completion of the full network is necessary to relieve the network by 2015 and attain a V/C Ratio of around 0.8.

Table 4.7 Results of Demand Forecast

	Busway	without			with	
	Service road	without	2lanes	4lanes	2lanes	4lanes
Traffic Volume (PCU/day)	**year 2002**					
	Service Road (Bacoor-Imus)	-				
	Service Road (Imus-Dasma)	-				
	Aguinaldo Highway (Bacoor-Imus)	51,104				
	Aguinaldo Highway (Imus-Dasma.)	32,284				
	Aguinaldo Highway (Dasma-Silang)	26,407				
	Molino Road (Bacoor)	19,016				
	Molino Road (Imus-Dasma)	31,544				
	Governor's Drive (Dasma-Gen. Trias)	32,519				
	Governor's Drive (Dasma-GMA)	22,064				
	year 2005					
	Service Road (Bacoor-Imus)	50,706	10,728	49,525	10,592	49,959
	Service Road (Imus-Dasma)	-	10,929	10,810	10,520	11,915
	Aguinaldo Highway (Bacoor-Imus)	54,563	59,035	48,801	57,284	46,502
	Aguinaldo Highway (Imus-Dasma.)	46,430	31,804	34,703	32,128	31,458
	Aguinaldo Highway (Dasma-Silang)	35,482	35,692	35,010	35,440	35,321
	Molino Road (Bacoor)	20,392	17,303	18,289	17,668	18,515
	Molino Road (Imus-Dasma)	53,350	36,659	37,725	37,494	39,257
	Governor's Drive (Dasma-Gen. Trias)	76,843	76,590	78,004	76,416	79,223
	Governor's Drive (Dasma-GMA)	44,852	43,164	44,434	43,009	44,205
	year 2010					
	Service Road (Bacoor-Imus)	48,213	15,522	46,318	18,966	53,002
	Service Road (Imus-Dasma)	-	12,465	18,622	15,377	14,765
	Aguinaldo Highway (Bacoor-Imus)	73,133	83,013	77,117	95,319	74,878
	Aguinaldo Highway (Imus-Dasma.)	77,393	61,763	61,024	61,021	64,623
	Aguinaldo Highway (Dasma-Silang)	39,547	39,918	40,767	43,046	42,626
	Molino Road (Bacoor)	22,319	24,172	19,172	20,930	19,251
	Molino Road (Imus-Dasma)	71,071	50,197	48,325	46,682	48,226
	Governor's Drive (Dasma-Gen. Trias)	113,835	116,452	118,434	118,056	121,517
	Governor's Drive (Dasma-GMA)	60,457	58,076	58,040	56,823	56,984
	year 2015 (full net)					
	Service Road (Bacoor-Imus)	22,845	4,892	34,952	3,454	43,120
	Service Road (Imus-Dasma)	-	7,371	8,634	4,851	9,881
	Aguinaldo Highway (Bacoor-Imus)	42,686	52,414	47,438	49,291	49,724
	Aguinaldo Highway (Imus-Dasma.)	50,407	46,596	47,623	46,679	45,845
	Aguinaldo Highway (Dasma-Silang)	34,134	32,312	32,561	30,609	31,196
	Molino Road (Bacoor)	31,709	36,172	38,346	41,787	40,685
	Molino Road (Imus-Dasma)	67,845	55,665	56,048	59,689	60,822
	Governor's Drive (Dasma-Gen. Trias)	59,306	60,398	60,575	58,525	58,288
	Governor's Drive (Dasma-GMA)	49,837	48,135	47,854	47,876	47,806
	year 2015 (2010 net)					
	Service Road (Bacoor-Imus)	49,251	12,913	53,396	19,085	51,866
	Service Road (Imus-Dasma)	-	18,790	21,806	19,633	17,787
	Aguinaldo Highway (Bacoor-Imus)	109,116	108,468	100,154	126,165	111,599
	Aguinaldo Highway (Imus-Dasma.)	105,297	79,520	79,966	80,240	76,621
	Aguinaldo Highway (Dasma-Silang)	41,814	41,988	42,311	47,352	47,632
	Molino Road (Bacoor)	33,424	33,557	23,916	31,080	24,771
	Molino Road (Imus-Dasma)	83,905	55,681	54,043	53,351	53,298
	Governor's Drive (Dasma-Gen. Trias)	149,446	152,934	153,211	153,587	152,819
	Governor's Drive (Dasma-GMA)	68,158	67,563	67,920	67,323	67,596

Table 4.7 Results of Demand Forecast *(Continued)*

	Busway	without			with	
	Service road	without	2lanes	4lanes	2lanes	4lanes
Average Speed (km/h)	**year 2002**					
	Service Road	-				
	Aguinaldo Highway	14.53				
	Molino Road	20.52				
	Govenor's Drive	6.03				
	All roads in Study Area	14.69				
	year 2005					
	Service Road	10.82	9.45	15.00	10.91	14.35
	Aguinaldo Highway	9.15	11.61	11.69	11.41	12.07
	Molino Road	9.72	11.98	11.41	12.72	11.75
	Govenor's Drive	4.00	4.00	4.00	4.00	4.00
	All roads in Study Area	12.17	15.86	16.50	16.27	16.80
	year 2010					
	Service Road	11.34	6.96	11.73	8.45	9.60
	Aguinaldo Highway	9.08	10.11	9.69	9.85	11.04
	Molino Road	9.69	9.04	8.59	8.69	8.88
	Govenor's Drive	5.45	5.47	5.48	5.61	5.58
	All roads in Study Area	9.33	13.48	14.17	13.65	13.91
	year 2015 (full net)					
	Service Road	25.31	19.91	22.66	21.38	20.16
	Aguinaldo Highway	19.57	19.90	20.78	21.21	22.05
	Molino Road	18.07	19.33	19.31	16.79	16.18
	Govenor's Drive	18.01	17.65	17.46	17.78	17.45
	All roads in Study Area	19.18	21.15	21.75	22.37	22.30
	year 2015 (2010 net)					
	Service Road	5.23	5.13	7.85	4.08	6.80
	Aguinaldo Highway	6.84	6.93	7.42	7.01	7.67
	Molino Road	6.37	6.01	6.49	7.13	6.79
	Govenor's Drive	4.80	4.99	5.09	5.33	5.57
	All roads in Study Area	7.32	10.89	11.40	10.93	11.58
Average VCR	**year 2002**					
	Service Road	0.33				
	Aguinaldo Highway	1.04				
	Molino Road	0.86				
	Govenor's Drive	1.57				
	All roads in Study Area	1.02				
	year 2005					
	Service Road	0.63	0.92	0.85	0.91	0.86
	Aguinaldo Highway	1.30	1.20	1.12	1.20	1.09
	Molino Road	1.23	1.03	1.06	1.02	1.06
	Govenor's Drive	4.59	4.56	4.67	4.47	4.65
	All roads in Study Area	1.35	1.15	1.11	1.15	1.12
	year 2010					
	Service Road	0.88	1.12	1.06	1.16	1.02
	Aguinaldo Highway	1.24	1.18	1.14	1.22	1.15
	Molino Road	1.35	1.27	1.16	1.23	1.14
	Govenor's Drive	2.95	2.98	3.01	2.98	2.96
	All roads in Study Area	1.36	1.15	1.12	1.19	1.15
	year 2015 (full net)					
	Service Road	0.27	0.61	0.60	0.60	0.65
	Aguinaldo Highway	0.84	0.84	0.81	0.81	0.81
	Molino Road	0.84	0.81	0.83	0.85	0.85
	Govenor's Drive	0.82	0.82	0.83	0.81	0.81
	All roads in Study Area	0.82	0.72	0.70	0.70	0.70
	year 2015 (2010 net)					
	Service Road	1.10	1.37	1.19	1.43	1.12
	Aguinaldo Highway	1.71	1.55	1.50	1.62	1.50
	Molino Road	1.79	1.62	1.39	1.50	1.31
	Govenor's Drive	3.59	3.69	3.70	3.63	3.62
	All roads in Study Area	1.69	1.46	1.36	1.48	1.38

Figure 4.6 Road Traffic Demand in the Study Area

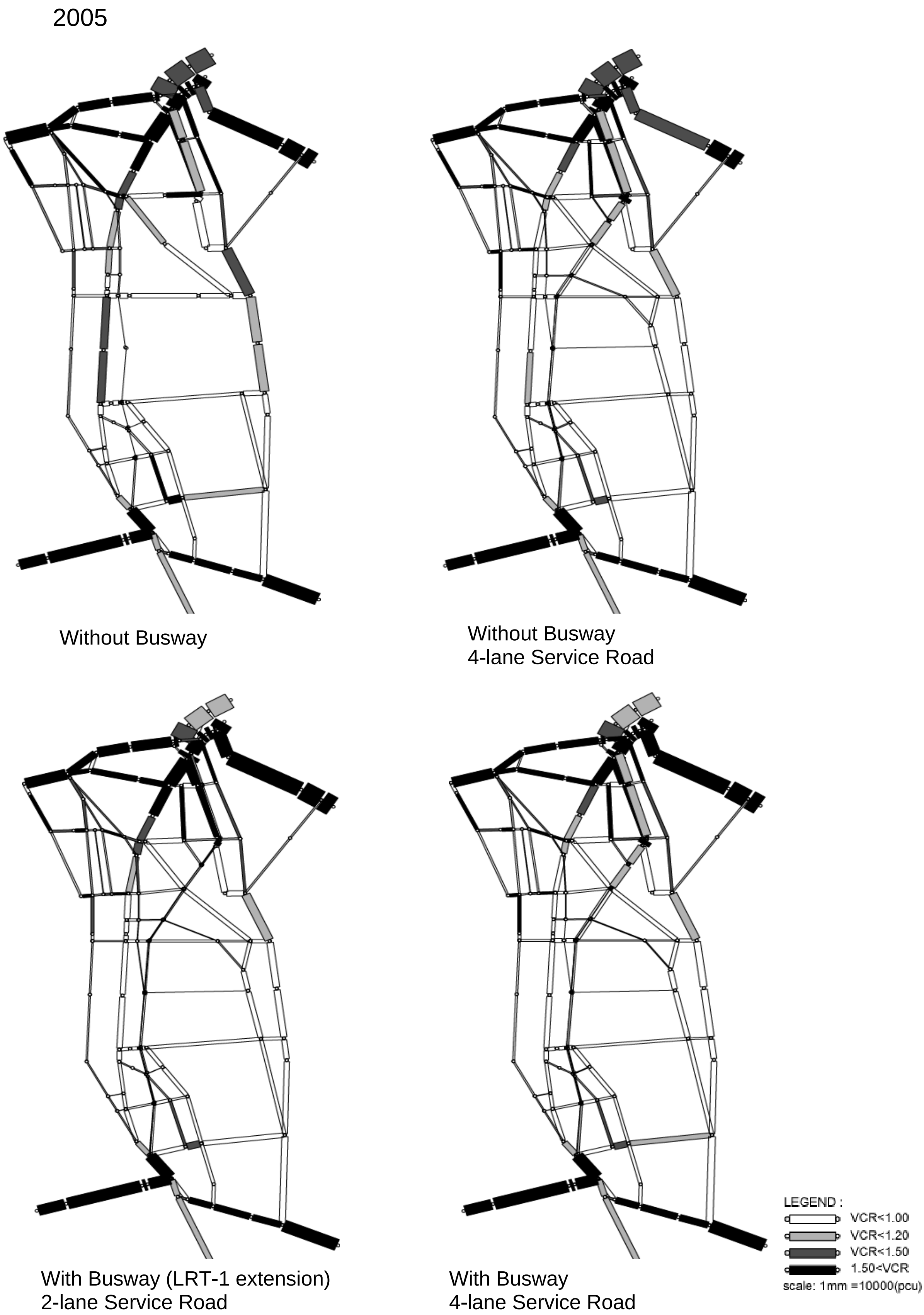


Figure 4.6 Road Traffic Demand in the Study Area *(Continued)*

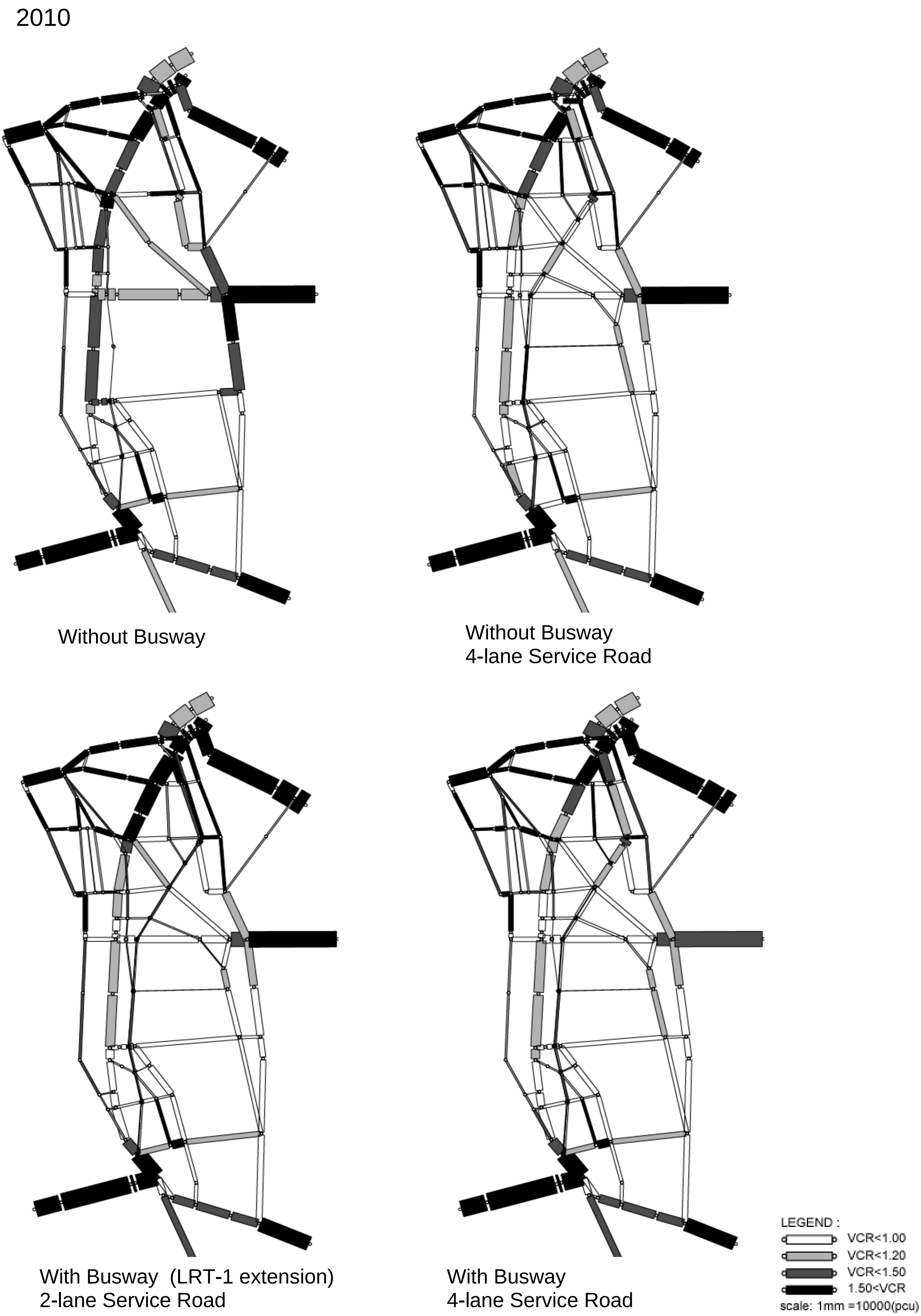


Figure 4.6 Road Traffic Demand in the Study Area *(Continued)*

2015 (full net)

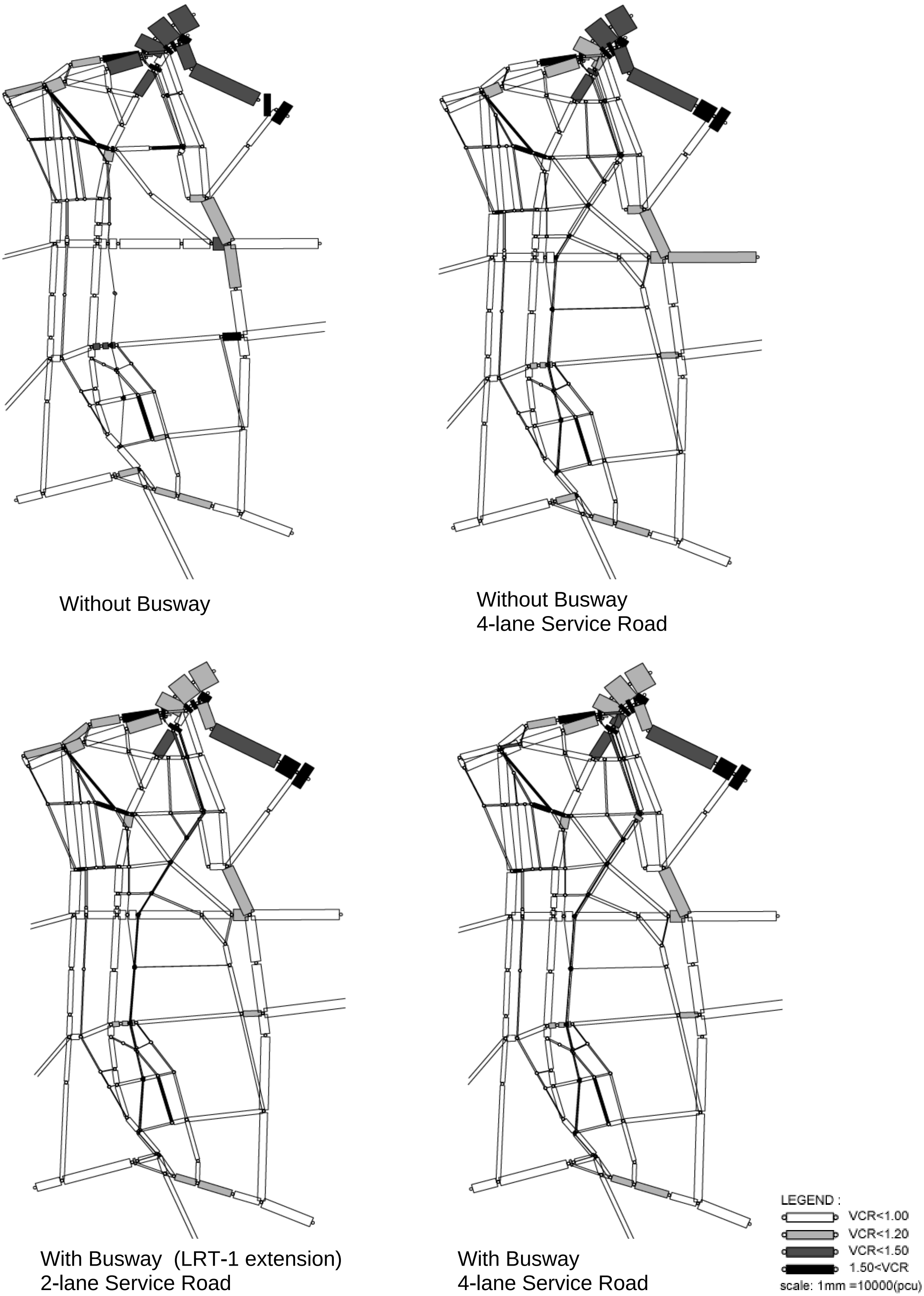
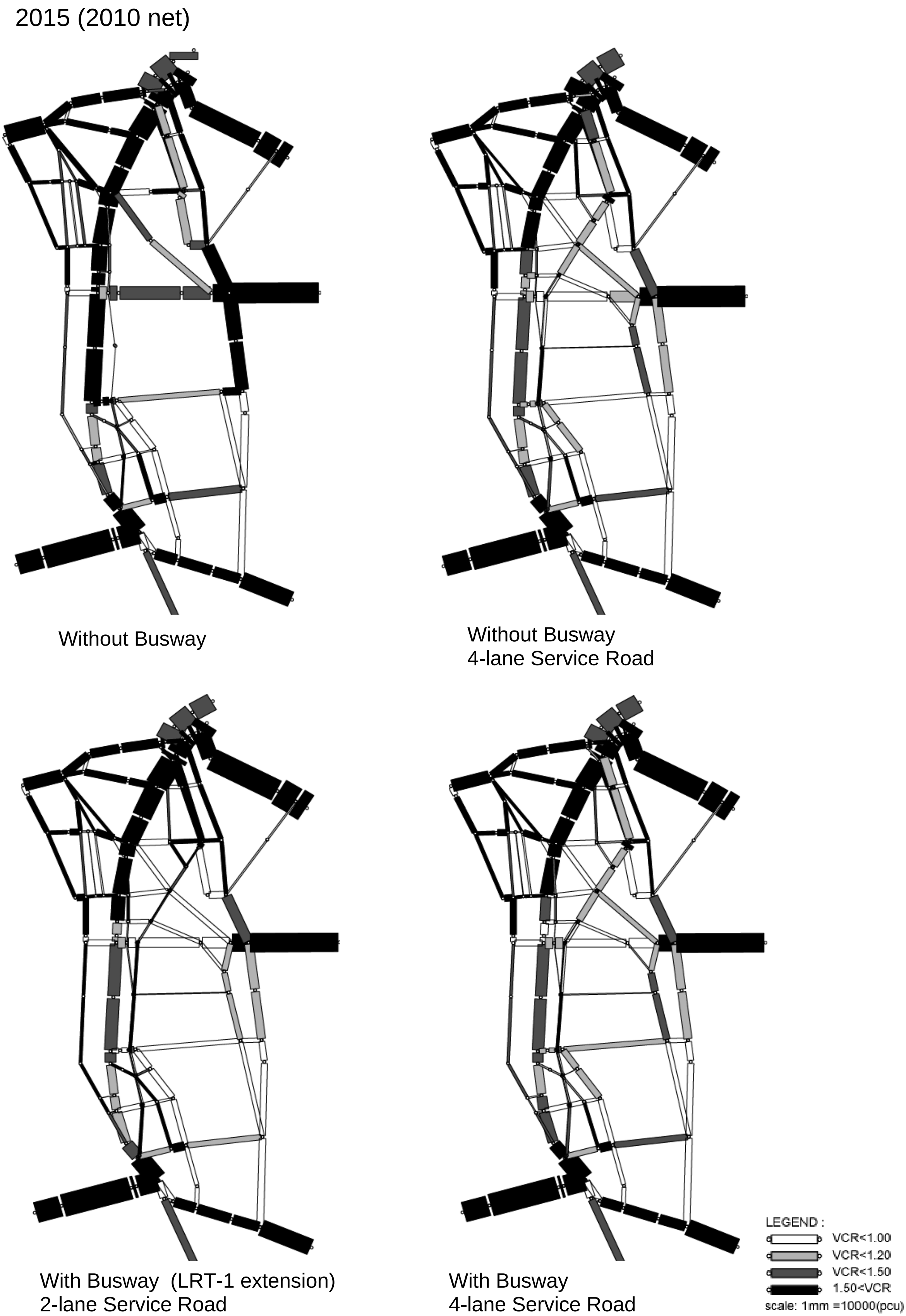


Figure 4.6 Road Traffic Demand in the Study Area *(Continued)*



Results show that the development of the busway, coupled with the service roads, is very significant to the traffic improvement in the area with an average of 30-50% increase in travel speed.

4.2.4 Traffic Demand Changes on Aguinaldo Highway and Molino Road

Since Aguinaldo Highway and Molino Road will run parallel to the proposed Busway, the Busway's impact on public transport demands in these roads are significant. A more detailed analysis on these two roads was made as shown in Table 4.5. This table shows the present traffic volumes of public transport (bus and jeepney) and private vehicles at Aguinaldo Highway and Molino Road. With the development of the Busway, it is projected that there will be a greater decrease in the number of operating buses than jeepneys at Aguinaldo Highway by about 15-20%. The numbers of operating jeepneys are projected to increase with the development of the Busway in some roads since it is expected that at some sections of Aguinaldo highway, in the Bacoor area for example, jeepneys can play the role of feeder transport to the Busway. But generally, however, the number of operating public transport will decrease by 10-30% in the existing parallel roads with the development of the Busway.

Because of the decrease in traffic volume of public vehicles on these roads, numbers of private vehicles will increase in some areas, especially in Bacoor. This is because there would be increase in passing thru traffic from western part of Cavite due to traffic improvement of the study area. Total volume of traffic will decrease by 10-20% in Aguinaldo and 10-30% in Molino Road.

Table 4.8 Traffic Volumes of Public Transport at Aguinaldo and Molino

(Number of Vehicles/day)

	(A) Without Busway				(B) With Busway +4lane serviceroad				{(B)-(A)}/(A)			
2002	BUS	JEEPNEY	PRIVATE	TOTAL	BUS	JEEPNEY	PRIVATE	TOTAL	BUS	JEEPNEY	PRIVATE	TOTAL
Aguinaldo Highway												
Bacoor	7,175	9,774	26,890	43,839								
Imus	4,956	4,377	19,364	28,696								
Dasmariñas	4,059	2,412	17,398	23,869								
Total	4,578	5,358	18,487	28,423								
Molino Road												
Bacoor		12,968	1,281	14,249								
Imus		7,339	11,873	19,212								
Dasmariñas		5,903	15,724	21,627								
Total		7,792	11,659	19,451								
2005												
Aguinaldo Highway												
Bacoor	8,979	21,394	21,008	51,381	7,324	21,151	22,355	50,829	-18.4%	-1.1%	6.4%	-1.1%
Imus	7,598	7,984	4,721	20,303	6,005	5,689	2,706	14,400	-21.0%	-28.7%	-42.7%	-29.1%
Dasmariñas	6,232	4,242	19,372	29,846	5,641	3,795	17,769	27,205	-9.5%	-10.5%	-8.3%	-8.8%
Total	6,584	9,845	14,858	31,287	5,595	8,796	14,010	28,401	-15.0%	-10.7%	-5.7%	-9.2%
Molino Road												
Bacoor		16,435	8	16,442		13,181	732	13,912		-19.8%	9653.3%	-15.4%
Imus		12,330	21,306	33,636		10,943	15,720	26,663		-11.3%	-26.2%	-20.7%
Dasmariñas		10,970	26,112	37,082		7,440	26,555	33,995		-32.2%	1.7%	-8.3%
Total		12,487	19,243	31,730		9,494	18,408	27,903		-24.0%	-4.3%	-12.1%
2010												
Aguinaldo Highway												
Bacoor	11,760	18,106	29,280	59,146	9,018	21,816	33,131	63,965	-23.3%	20.5%	13.2%	8.1%
Imus	9,978	8,834	30,100	48,912	7,280	5,915	26,115	39,310	-27.0%	-33.0%	-13.2%	-19.6%
Dasmariñas	8,234	4,187	39,078	51,499	6,963	3,470	42,621	53,054	-15.4%	-17.1%	9.1%	3.0%
Total	8,664	9,404	31,626	49,694	6,873	8,928	33,291	49,092	-20.7%	-5.1%	5.3%	-1.2%
Molino Road												
Bacoor		17,767	324	18,091		14,256	312	14,568		-19.8%	-3.7%	-19.5%
Imus		14,121	22,412	36,533		13,459	13,371	26,829		-4.7%	-40.3%	-26.6%
Dasmariñas		13,172	30,911	44,084		9,335	28,221	37,557		-29.1%	-8.7%	-14.8%
Total		14,404	22,225	36,629		11,345	18,719	30,064		-21.2%	-15.8%	-17.9%
2015 (full net)												
Aguinaldo Highway												
Bacoor	12,355	14,567	7,102	34,025	10,273	18,931	12,244	41,449	-16.8%	30.0%	72.4%	21.8%
Imus	9,943	7,892	14,975	32,810	7,927	6,395	15,743	30,065	-20.3%	-19.0%	5.1%	-8.4%
Dasmariñas	7,882	3,165	17,255	28,303	7,068	2,704	16,406	26,178	-10.3%	-14.6%	-4.9%	-7.5%
Total	8,617	7,934	13,841	30,392	7,337	8,100	15,629	31,066	-14.9%	2.1%	12.9%	2.2%
Molino Road												
Bacoor		17,687	9,071	26,758		14,965	19,532	34,497		-15.4%	115.3%	28.9%
Imus		19,107	35,638	54,745		18,464	33,262	51,726		-3.4%	-6.7%	-5.5%
Dasmariñas		9,766	43,734	53,500		6,783	46,800	53,582		-30.6%	7.0%	0.2%
Total		13,602	34,232	47,834		11,197	37,732	48,929		-17.7%	10.2%	2.3%
2015 (2010 net)												
Aguinaldo Highway												
Bacoor	14,220	23,285	60,140	97,645	10,438	27,110	60,223	97,771	-26.6%	16.4%	0.1%	0.1%
Imus	12,550	12,142	50,039	74,731	8,526	7,226	36,332	52,084	-32.1%	-40.5%	-27.4%	-30.3%
Dasmariñas	9,726	5,567	48,944	64,238	7,603	4,324	52,413	64,340	-21.8%	-22.3%	7.1%	0.2%
Total	10,471	12,365	47,540	70,376	7,759	10,915	46,232	64,905	-25.9%	-11.7%	-2.8%	-7.8%
Molino Road												
Bacoor		23,007	2,072	25,079		15,902	2,001	17,903		-30.9%	-3.5%	-28.6%
Imus		18,651	28,052	46,703		15,705	15,232	30,936		-15.8%	-45.7%	-33.8%
Dasmariñas		15,115	39,793	54,909		10,220	31,980	42,200		-32.4%	-19.6%	-23.1%
Total		17,655	28,802	46,457		12,702	21,596	34,298		-28.1%	-25.0%	-26.2%

4.3 Other Planning Issues

4.3.1 Demand Elasticity to Fare Rates

In order to test the demand elasticity to fare level, a series of traffic assignment were conducted on various fare levels. The flat fare system tends to discourage short-distance trips from using the Busway but will tend to attract more end-to-end or long-distance trips. On the other hand, charging high marginal rates for distance traveled could discourage longer trips. Table 4.9 compares key Busway indicators, namely: ridership, average trip length, average fare, and fare revenue, with respect to fare level and fare system. At the fixed rate of ₱10 for the first four (4) kilometers and ₱0.48 for every succeeding kilometer, performance indicators, most important of which is revenue, are the highest among other alternatives. Incidentally, it is the same rate charged by air-conditioned (A/C) buses. Practically, however, the fare rate of the proposed busway could be set at a reasonably higher level than the existing A/C buses, considering the quality of service provided by the busway.

Table 4.9 Busway Demand by Fare Level

	Year	Same as Air-con Bus*	Flat			10 pesos(for 4 km) + Distance-Proportional				
			P15	P20	P25	P0.6/km	P0.75/km	P1.00/km	P1.25/km	P1.50/km
No. of Passenger per Day	2005	98,562	57,362	14,883	7,200	83,256	75,328	61,761	53,240	46,112
	2010	141,246	95,124	35,788	13,003	98,948	85,877	98,948	85,877	74,256
	2015(full)	155,801	104,874	42,534	14,382	141,922	125,297	113,191	101,046	92,290
	2015(2010)	239,491	143,038	55,780	18,540	214,353	202,393	186,879	172,649	158,696
Average Trip Length (km)	2005	9.2	13.7	13.5	14.2	8.2	7.9	7.4	6.9	6.4
	2010	9.4	12.9	12.3	14.0	7.7	7.4	7.7	7.4	7.1
	2015(full)	9.2	12.3	12.0	13.2	8.5	7.6	7.0	6.6	6.4
	2015(2010)	8.8	13.0	12.4	14.1	7.8	7.4	7.0	6.7	6.5
Average Fare (Pesos/ride)	2005	12.52	15	20	25	12.55	12.97	13.45	13.72	13.73
	2010	12.64	15	20	25	13.81	14.44	13.81	14.44	14.98
	2015(full)	12.55	15	20	25	12.78	12.86	13.20	13.56	13.92
	2015(2010)	12.34	15	20	25	12.35	12.62	13.12	13.53	13.94
Fare Revenue (000pesos/day)	2005	1,234	860	298	180	1,045	977	831	730	633
	2010	1,785	1,427	716	325	1,366	1,240	1,366	1,240	1,112
	2015(full)	1,955	1,573	851	360	1,814	1,611	1,494	1,370	1,285
	2015(2010)	2,955	2,146	1,116	464	2,647	2,554	2,452	2,336	2,212

* ₱10 for first 4km and P0.48/km

4.3.2 Implication with LRT 1 Extension

In the analyses presented above, it was assumed that the LRT Line 1 Extension already exist when the proposed Busway starts operation. According to DOTC and LRTA, LRT Line 1 Extension is scheduled to be operational by 2005. However, there is still a possibility for the LRT Line 1 Extension Project to be delayed or suspended if the financial arrangement is not made successfully. Since the primary role of the CBS Project is to construct a Busway between Dasmariñas and Bacoor that can feed into the LRT, the failure in implementing LRT Line 1 Extension could cause tremendous problems for the CBS Project. In order to avoid these problems, the Study Team have decided to prepare a contingency plan assuming the LRT Line 1 Extension is not implemented as scheduled.

There is direct railway connection between Bacoor and Baclaran in the case of 'LRT-1 ext.' while in the case of 'Bus operation', the buses operating on the Busway proceed directly to Baclaran. On the other hand, there is neither busway nor LRT Line 1 from Bacoor to Baclaran in the 'Nothing' scenario, with only the existing public modes in operation.

Judging from the results of analysis, the existence of LRT Line 1 Extension increases the busway demand, indicating that they are feeding into with each other. The extension of busway service up to Baclaran seems to significantly contribute to public transport users of the corridor. In the engineering study of the proposed busway, a smooth linkage of the busway with the Coastal Road should be considered.

Table 4.10 Results of Demand Forecast (sensitivity of existence of LRT1 extension)

	Busway	without			with					
	Service road	without	2lanes	4lanes	2lanes			4lanes		
	Bacoor - Baclaran Operation	without	without	without	LRT-1 ext.	Bus Operation ((): within Busway)	Nothing	LRT-1ext.	Bus Operation ((): within Busway)	Nothing
No. of passengers in the Busway (/day)	year 2005	-	-	-	100,110	100,722 (64,732)	71,636	98,562	97,348 (61,446)	69,348
	year 2010	-	-	-	155,026	149,286 (106,146)	117,296	141,246	152,502 (105,768)	116,834
	year 2015	-	-	-	174,552	176,992 (103,222)	119,856	155,801	168,966 (103,334)	118,952
	year 2015 (2010 net)	-	-	-	224,802	221,898 (149,360)	165,546	239,491	233,046 (160,764)	177,492
Traffic Volume (PCU/day)	**year 2002**									
	Service Road (Bacoor-Imus)	-								
	Service Road (Imus-Dasma)	-								
	Aguinaldo Highway (Bacoor-Imus)	51,104								
	Aguinaldo Highway (Imus-Dasma.)	32,284								
	Aguinaldo Highway (Dasma-Silang)	26,407								
	Molino Road (Bacoor)	19,016								
	Molino Road (Imus-Dasma)	31,544								
	Governor's Drive (Dasma-Gen. Trias)	32,519								
	Governor's Drive (Dasma-GMA)	22,064								
	year 2005									
	Service Road (Bacoor-Imus)	50,706	10,728	49,525	10,592	13,612	10,809	49,959	50,224	50,074
	Service Road (Imus-Dasma)	-	10,929	10,810	10,520	11,860	10,540	11,915	11,158	12,150
	Aguinaldo Highway (Bacoor-Imus)	54,563	59,035	48,801	57,284	55,744	55,641	46,502	46,637	48,410
	Aguinaldo Highway (Imus-Dasma.)	46,430	31,804	34,703	32,128	29,810	31,068	31,458	31,101	31,600
	Aguinaldo Highway (Dasma-Silang)	35,482	35,692	35,010	35,440	34,916	35,373	35,321	35,625	35,230
	Molino Road (Bacoor)	20,392	17,303	18,289	17,668	17,503	17,528	18,515	18,008	18,048
	Molino Road (Imus-Dasma)	53,350	36,659	37,725	37,494	35,125	35,919	39,257	37,035	36,810
	Governor's Drive (Dasma-Gen. Trias)	76,843	76,590	78,004	76,416	75,610	76,412	79,223	78,692	78,555
	Governor's Drive (Dasma-GMA)	44,852	43,164	44,434	43,009	43,116	43,168	44,205	44,191	44,117
	year 2010									
	Service Road (Bacoor-Imus)	48,213	15,522	46,318	18,966	10,802	15,054	53,002	52,995	53,902
	Service Road (Imus-Dasma)	-	12,465	18,622	15,377	14,404	14,713	14,765	16,957	18,301
	Aguinaldo Highway (Bacoor-Imus)	73,133	83,013	77,117	95,319	83,212	82,188	74,878	71,571	70,780
	Aguinaldo Highway (Imus-Dasma.)	77,393	61,763	61,024	61,021	58,371	60,415	64,623	62,847	59,945
	Aguinaldo Highway (Dasma-Silang)	39,547	39,918	40,767	43,046	42,426	42,356	42,626	41,545	40,785
	Molino Road (Bacoor)	22,319	24,172	19,172	20,930	23,115	23,342	19,251	18,799	18,939
	Molino Road (Imus-Dasma)	71,071	50,197	48,325	46,682	47,750	47,336	48,226	46,861	46,944
	Governor's Drive (Dasma-Gen. Trias)	113,835	116,452	118,434	118,056	118,775	118,567	121,517	119,984	120,120
	Governor's Drive (Dasma-GMA)	60,457	58,076	58,040	56,823	56,844	56,987	56,984	56,855	56,884
	year 2015 (full net)									
	Service Road (Bacoor-Imus)	22,845	4,892	34,952	3,454	3,665	4,780	43,120	32,561	35,001
	Service Road (Imus-Dasma)	-	7,371	8,634	4,851	7,616	8,032	9,881	8,146	9,068
	Aguinaldo Highway (Bacoor-Imus)	42,686	52,414	47,438	49,291	49,264	52,227	49,724	49,167	47,543
	Aguinaldo Highway (Imus-Dasma.)	50,407	46,596	47,623	46,679	45,927	47,147	45,845	46,443	46,805
	Aguinaldo Highway (Dasma-Silang)	34,134	32,312	32,561	30,609	33,426	33,825	31,196	33,191	33,285
	Molino Road (Bacoor)	31,709	36,172	38,346	41,787	38,952	37,892	40,685	39,619	38,975
	Molino Road (Imus-Dasma)	67,845	55,665	56,048	59,689	57,888	57,347	60,822	58,236	58,109
	Governor's Drive (Dasma-Gen. Trias)	59,306	60,398	60,575	58,525	59,110	59,157	58,288	60,207	60,540
	Governor's Drive (Dasma-GMA)	49,837	48,135	47,854	47,876	47,926	47,912	47,806	47,841	47,839
	year 2015 (2010 net)									
	Service Road (Bacoor-Imus)	49,251	12,913	53,396	19,085	11,646	11,427	51,866	51,310	48,415
	Service Road (Imus-Dasma)	-	18,790	21,806	19,633	16,727	14,277	17,787	24,724	24,407
	Aguinaldo Highway (Bacoor-Imus)	109,116	108,468	100,154	126,165	115,323	115,280	111,599	100,301	105,085
	Aguinaldo Highway (Imus-Dasma.)	105,297	79,520	79,966	80,240	87,142	81,327	76,621	71,339	79,565
	Aguinaldo Highway (Dasma-Silang)	41,814	41,988	42,311	47,352	44,149	44,893	47,632	45,012	43,158
	Molino Road (Bacoor)	33,424	33,557	23,916	31,080	29,342	34,120	24,771	25,193	23,898
	Molino Road (Imus-Dasma)	83,905	55,681	54,043	53,351	52,441	55,441	53,298	50,584	53,080
	Governor's Drive (Dasma-Gen. Trias)	149,446	152,934	153,211	153,587	153,684	153,666	152,819	154,998	153,895
	Governor's Drive (Dasma-GMA)	68,158	67,563	67,920	67,323	67,073	67,181	67,596	67,339	67,446

Table 4.10 Results of Demand Forecast (sensitivity of existence of LRT1 extension) (*Continued*)

	Busway	without			with					
	Service road	without	2lanes	4lanes	2lanes			4lanes		
	Bacoor - Baclaran Operation	without	without	without	LRT-1 ext.	Bus	Nothing	LRT-1ext.	Bus	Nothing
Average Speed (km/h)	**year 2002**									
	Service Road	-								
	Aguinaldo Highway	14.53								
	Molino Road	20.52								
	Govenor's Drive	6.03								
	All roads in Study Area	14.69								
	year 2005									
	Service Road	10.82	9.45	15.00	10.91	12.37	10.99	14.35	14.89	13.58
	Aguinaldo Highway	9.15	11.61	11.69	11.41	10.95	11.89	12.07	12.32	12.16
	Molino Road	9.72	11.98	11.41	12.72	12.86	12.70	11.75	12.79	12.72
	Govenor's Drive	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	All roads in Study Area	12.17	15.86	16.50	16.27	16.44	16.25	16.80	17.03	16.88
	year 2010									
	Service Road	11.34	6.96	11.73	8.45	8.00	8.11	9.60	12.01	12.68
	Aguinaldo Highway	9.08	10.11	9.69	9.85	9.99	9.90	11.04	10.47	10.33
	Molino Road	9.69	9.04	8.59	8.69	9.33	9.68	8.88	9.33	9.12
	Govenor's Drive	5.45	5.47	5.48	5.61	5.60	5.58	5.58	5.59	5.59
	All roads in Study Area	9.33	13.48	14.17	13.65	13.83	13.70	13.91	14.33	14.27
	year 2015 (full net)									
	Service Road	25.31	19.91	22.66	21.38	23.15	23.15	20.16	23.53	23.39
	Aguinaldo Highway	19.57	19.90	20.78	21.21	21.43	21.59	22.05	22.88	21.87
	Molino Road	18.07	19.33	19.31	16.79	18.48	18.75	16.18	19.54	19.45
	Govenor's Drive	18.01	17.65	17.46	17.78	17.65	17.62	17.45	17.63	17.62
	All roads in Study Area	19.18	21.15	21.75	22.37	21.62	21.40	22.30	21.99	22.07
	year 2015 (2010 net)									
	Service Road	5.23	5.13	7.85	4.08	3.48	4.10	6.80	6.75	6.67
	Aguinaldo Highway	6.84	6.93	7.42	7.01	7.49	6.85	7.67	8.27	7.04
	Molino Road	6.37	6.01	6.49	7.13	7.24	7.46	6.79	6.98	6.88
	Govenor's Drive	4.80	4.99	5.09	5.33	5.35	5.40	5.57	5.36	5.43
	All roads in Study Area	7.32	10.89	11.40	10.93	11.16	11.17	11.58	11.83	11.75
Average VCR	**year 2002**									
	Service Road	0.33								
	Aguinaldo Highway	1.04								
	Molino Road	0.86								
	Govenor's Drive	1.57								
	All roads in Study Area	1.02								
	year 2005									
	Service Road	0.63	0.92	0.85	0.91	0.90	0.88	0.86	0.79	0.83
	Aguinaldo Highway	1.30	1.20	1.12	1.20	1.14	1.18	1.09	1.08	1.09
	Molino Road	1.23	1.03	1.06	1.02	1.03	1.01	1.06	1.04	1.04
	Govenor's Drive	4.59	4.56	4.67	4.47	4.48	4.51	4.65	4.63	4.65
	All roads in Study Area	1.35	1.15	1.11	1.15	1.14	1.14	1.12	1.09	1.10
	year 2010									
	Service Road	0.88	1.12	1.06	1.16	1.17	1.12	1.02	1.09	1.13
	Aguinaldo Highway	1.24	1.18	1.14	1.22	1.16	1.17	1.15	1.09	1.09
	Molino Road	1.35	1.27	1.16	1.23	1.22	1.22	1.14	1.14	1.14
	Govenor's Drive	2.95	2.98	3.01	2.98	2.93	2.95	2.96	3.01	3.02
	All roads in Study Area	1.36	1.15	1.12	1.19	1.15	1.16	1.15	1.13	1.12
	year 2015 (full net)									
	Service Road	0.27	0.61	0.60	0.60	0.57	0.61	0.65	0.59	0.60
	Aguinaldo Highway	0.84	0.84	0.81	0.81	0.80	0.82	0.81	0.78	0.78
	Molino Road	0.84	0.81	0.83	0.85	0.81	0.80	0.85	0.82	0.83
	Govenor's Drive	0.82	0.82	0.83	0.81	0.81	0.81	0.81	0.82	0.82
	All roads in Study Area	0.82	0.72	0.70	0.70	0.71	0.73	0.70	0.70	0.70
	year 2015 (2010 net)									
	Service Road	1.10	1.37	1.19	1.43	1.36	1.26	1.12	1.16	1.21
	Aguinaldo Highway	1.71	1.55	1.50	1.62	1.58	1.58	1.50	1.47	1.50
	Molino Road	1.79	1.62	1.39	1.50	1.54	1.58	1.31	1.34	1.34
	Govenor's Drive	3.59	3.69	3.70	3.63	3.63	3.63	3.62	3.63	3.66
	All roads in Study Area	1.69	1.46	1.36	1.48	1.44	1.44	1.38	1.37	1.35

5 ANALYSIS OF THE ALTERNATIVE PLANS AND CORRIDOR DEVELOPMENT CONCEPT

5.1 Major Planning Issues of the Cavite Busway System

The CALA World Bank Study has examined the basic planning issues such as selection of the conceptual alignment for the proposed public transport system, as described in Chapter 2. This Study has identified and analyzed the detailed issues specifically on the design components of the proposed busway system. These details and remaining major issues on the busway physical planning are as follows:

(1) Confirmation of the cross-section

The following design issues were addressed by the study: 1) number of lanes required for bus operation as well as for ordinary traffic, based on future traffic demand; 2) necessity of lane segregation bus lanes from the ordinary traffic lanes and 3) other cross-sectional components required (e.g. sidewalk, bicycle lane, landscape, etc.). The cross-section requirements may differ by segment depending on their respective land use and traffic demand.

(2) Finalization of the proposed busway alignment

Basically, the CALA Study proposed that the busway corridor would originate at Niog, Bacoor and terminate at Governor’s Drive in Dasmariñas. This Study tried to finalize an exact alignment of the proposed busway based on land availability as well as economic variability of the construction cost. The social component, which determines the magnitude of displacement of both formal and informal settlers, was a major evaluation criterion.

(3) Preparation of the terminal and bus stop development

Terminals and bus stops are indispensable facilities of the busway system, with ridership on the busway depending much on accessibility to the terminals or bus stops. In addition, from the urban development perspective, the terminal and bus stop areas have a higher development potential. Location of facilities for terminals and bus stops, therefore, was carefully determined and designed.

(4) Coordination with other regional road network

The proposed busway will provide several lanes for ordinary traffic in order to supplement the regional road network system and also to encourage urban developments in the proposed busway corridor. An effective linkage with other regional road network will be useful to develop preferable feeder system to/from terminals or bus stops. Thus, the provision of an effective linkage with the existing and future regional road network configuration was studied and the intersection/ interchange configuration was carefully designed.

(5) Coordination with urban development in the corridor

The adoption of the so-called "public transport oriented urban corridor development" is vital in order to encourage the utilization of the public transport system. This will enhance the development not only of the transport system itself but as well as the urban development. In addition, the public transport oriented urban development needs promotion with property market force and will also require a strong and strategic institutional leadership by the concerned local government units, both at the provincial and municipal levels.

These are global issues and were taken into consideration on the physical planning of the proposed busway. The succeeding discussion identifies the constraints in the detailed alignment study.

Based on the data and information collected and site reconnaissance surveys, several planning issues for the selection of the preferred busway alignment are identified as shown in Figure 5.1. Basically, there are less physical constraints in terms of topography and geology; however, major constraints are the existing structures such as subdivision developments and the electric sub-station. The following are the major planning issues from the north in Bacoor:

(1) Connection with the Coastal Expressway. At present, the Coastal Expressway ends just at the intersection point of Talaba - Las Piñas Diversion Road. In the future, the expressway will be extended up to Cavite City running along the coastal area. Trumpet type interchange is planned for the Talaba - Las Piñas Diversion Road. Thus, the connection of the busway with the Coastal Expressway is a planning issue.

(2) Coordination with LRT Line 1 extension project at Niog, particularly LRT alignment and location of the planned LRT terminals.

(3) Crossing the existing built-up area in Bacoor. Options are either to widen the existing main road (Talaba - Las Piñas Diversion Road) or cross the residential area where some informal settlers are found.

(4) Coordination with the ongoing highway project, Molino Boulevard, which has a ROW of 30m or less. Earthwork and pavement work of some sections are completed, however, still some sections have not even started with the construction.

(5) How to minimize the impact on many existing and ongoing subdivision developments providing a sufficient design for the proposed busway. A new subdivision project, Citta Italia, has been completed and poses difficulty in cutting through this subdivision area. There is no alternative alignment available that will not cut through the existing subdivision development areas. Some areas in these residential developments, however, have no built structure or houses yet, except for local roads.

(6) Coordination with One Asia Development Corp., a large-scale landowner in the municipality of Imus. The developer intends to build an urban center for Cavite Province with approximately 200,000 daytime population. The planned land use is for mixed-use development consisted of commercial, light-industry and residential areas Given this scenario, it is essential to encourage a public transport oriented urban development in the area.

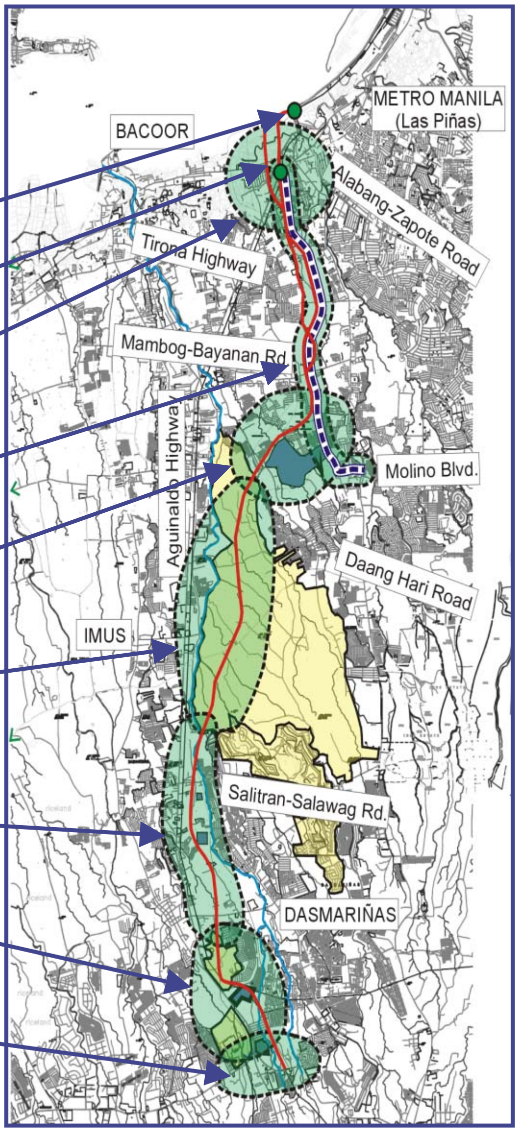
(7) Avoiding the existing subdivision developments in the narrow area between Aguinaldo Highway and the river running parallel. At present, the area is not fully developed and there are still plenty of vacant lands that can be seen.

(8) There is limited space for the busway because of the existing subdivision developments and electric substation, transmission lines and pylons. In addition, a new subdivision development project is ongoing behind the substation. The property on the opposite side of Aguinaldo Highway belongs to another large-scale landowner, SOLAR Resources. There also exists a government land which used to be the old Aguinaldo road in the area. However, informal settlers presently occupy a portion of these properties.

(9) Selection of the best location for the busway terminus from both traffic and urban development perspectives.

Figure 5.1 Major Planning Issues on the Alignment Study

- Connection with the Coastal Expressway
- Coordination with LRT Line 1 extension project at Niog.
- Crossing the existing built-up area in Bacoor. Options are to either widen the existing main road or cross the residential area.
- Coordination with the ongoing highway project, Molino Blvd. ROW will be 30m or less.
- How to minimize the impact on many existing and ongoing subdivision developments providing a sufficient design for the proposed Busway.
- Coordination with a large-scale landowner and to encourage public transport oriented urban development.
- Avoiding the existing subdivision developments in the narrow area between Aguinaldo Highway and the river running parallel to the highway.
- Limited space for busway because of the existing subdivision developments and electric substation, transmission lines and tower.
- Selection of the best location for the busway terminus from both traffic and urban center development perspectives.



5.2 Examination of the Busway Cross-sections

5.2.1 Typical Cross-section

The cross-section is consisted of two components: one is for exclusive bus operation and the other is for secondary road function serving the proposed corridor. During the earlier stages of the Study, there was an option for the busway to be designed as a normal 4-lane or 6-lane roadway, with one lane per direction exclusively for bus operation. If the option on shared road space with lane separation through the provision of lane markings is adopted, it will be difficult to avoid other vehicles from encroaching the bus exclusive lanes which may eventually cause bus operation to be stuck with the congested normal traffic. Therefore, it is proposed that the busway should be physically separated from the normal traffic.

Different aspects of the cross-section such as number of lanes and lane width were examined based on the traffic demand and expected function on the roadway, as well as land use along the corridor. Firstly, several alternative cross-sections were designed for the traffic demand forecasting. The alternative plans are as shown in Figure 5.2, including the following lane distributions:

- 4-lane busway with 2-lane service road
- 4-lane busway with 4-lane service road
- 3-lane busway with 4-lane service road
- 3-lane busway with 2-lane service road
- 2-lane busway with 4-lane service road

Total width of ROW ranges from 30m to 40m.

The result of the traffic demand forecasting was examined in the previous chapter. The major finding from this demand forecasting exercise was that a large volume of traffic demand was forecasted from the intensive housing and industrial developments in Cavite Province. Therefore, traffic demand on the proposed corridor is projected to increase depending on how much capacity can be provided by the busway corridor. However, judging from the expected function or role of the busway corridor, the traffic demand should be moderated as that of secondary roads. Thus, the number of lanes for secondary roads will be 4 lanes for both directions.

With regard to the bus exclusive space, the passenger demand on the corridor indicates more than 2-lane single carriageway. One of the options considered was a three-lane corridor, with one lane for tidal flow. The three-lane operation will increase the capacity, but might pose a problem on securing the safety. Thus, despite the lesser capacity of a two-lane operation, this was considered to be a better option.

Figure 5.3 shows a proposed typical cross-section for the busway. The ordinary section will be a 2-lane busway with 4-lane service road. Exclusive busway will be 13m wide, providing sufficient lateral clearance for emergency parking and vehicle breakdown. In the bus stop section, 3 lanes will be provided including stopping lane and two passing lanes for both directions. In addition, based on the DPWH guideline, a bicycle lane (for non-motorized vehicle) will be provided. The total required ROW would be 40m.

Figure 5.2 Busway Cross-section Alternatives

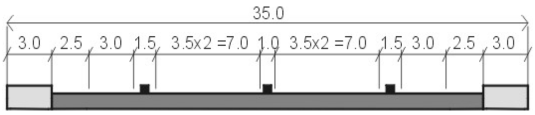
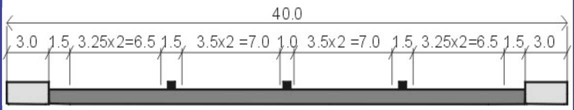
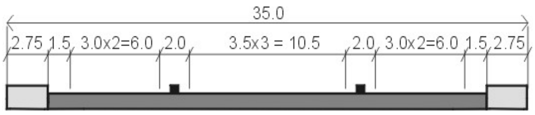
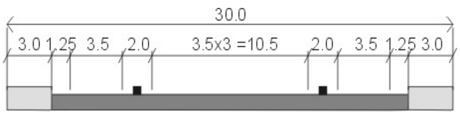
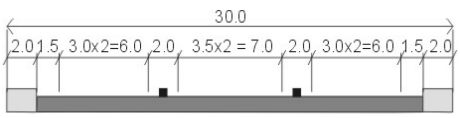
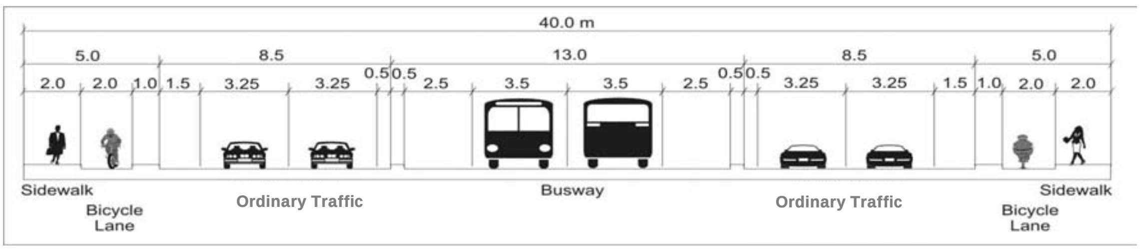
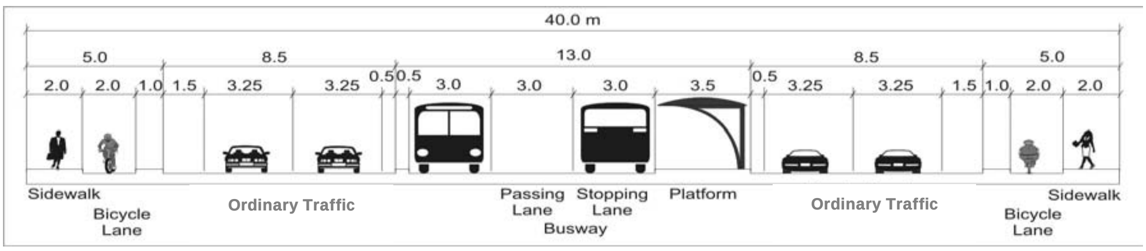
No. of Lanes Busway + Service Road	Section	Total Road Width	Note
4+2		35.0	This is public transport oriented with 4 lanes allotted to busway. One-lane service road may be too narrow.
4+4		40.0	It will satisfy both public transport and general traffic. But ROW limitation and financial aspects have to be seriously considered.
3+4		35.0	It may not accommodate large volume of bus traffic demand, but smooth operation can be managed with a tidal lane. Sufficient capacity on the service road will be provided.
3+2		30.0	In order to use the limited ROW effectively, a tidal lane is placed on busway to ensure smooth bus operation. It's direction is reversible depending on the demand. However, capacity of the service road will be controlled.
2+4		30.0	More private transport oriented road section with 4 lanes reserved for service road. Busway will not be able to meet the public transport demand.

Figure 5.3 Proposed Typical Cross-section for the Busway

Normal Section



Bus Stop Section



5.2.2 Cross-section by Segment (Road Function)

Typical cross-section with 40 meter ROW has been developed as shown in the previous section. Cross-sectional arrangement for the bus exclusive lanes in the center of the ROW will be maintained on the whole stretch of the proposed busway. But for the terminal and bus stop areas, as well as long structure sections (bridges and underpass structure), modifications may be applied. However, the cross-section for ordinary traffic road space will differ accordingly depending on the determined road functions and based on the existing and future regional or local road network.

The present road network in the study area is basically consisted of two north-south axes (Aguinaldo Highway and Molino Road) and five east-west axes (Mambog-Bayanan Road, Daang Hari Road, Salawag-Salitran Road, Congressional Road and Governor's Drive). In terms of the functional classification, the two north-south axes and the two east-west roads (Daang Hari and Governor's Drive) will be classified into major inter-urban trunk roads and the others will be classified into secondary road network, as shown in Figure 5.4. Based on the present road network and existing landuse pattern, the function of the proposed busway (as an ordinary road function) will be divided into the following three sections:

Section 1: Molino Boulevard Segment in Bacoor

Section 2: New Township Development (One Asia) Segment in Imus

Section 3: Dasmariñas Segment

The modification of the typical cross-section for each segment was examined based on the road network configuration as well as land use pattern in the corridor as mentioned above, so that the cross-section for each segment will be proposed as follows:

Section 1: Molino Boulevard Segment in Bacoor

In the case of sharing the ROW with the Molino Boulevard, the function of the ordinary traffic space on the busway corridor will require the same function as that of the Molino Boulevard, which is that of an Inter-urban Major Road.

Section 2: New Township Development (One Asia) Segment in Imus

This segment will be expected to play a major role as a part of the road network system in the new township development and in providing access from the development area to the inter-urban road network system. The road function of this segment is categorized as a Secondary Road.

Section 3: Dasmariñas Segment

This segment is passing through the narrow areas between Aguinaldo Highway and Imus River, running north to south. The Aguinaldo Highway shall still cater to the major traffic, therefore the traffic function of the busway will be to serve the local traffic coming in and out of the adjacent areas.

Figure 5.4 Proposed Road Function on the Busway Corridor

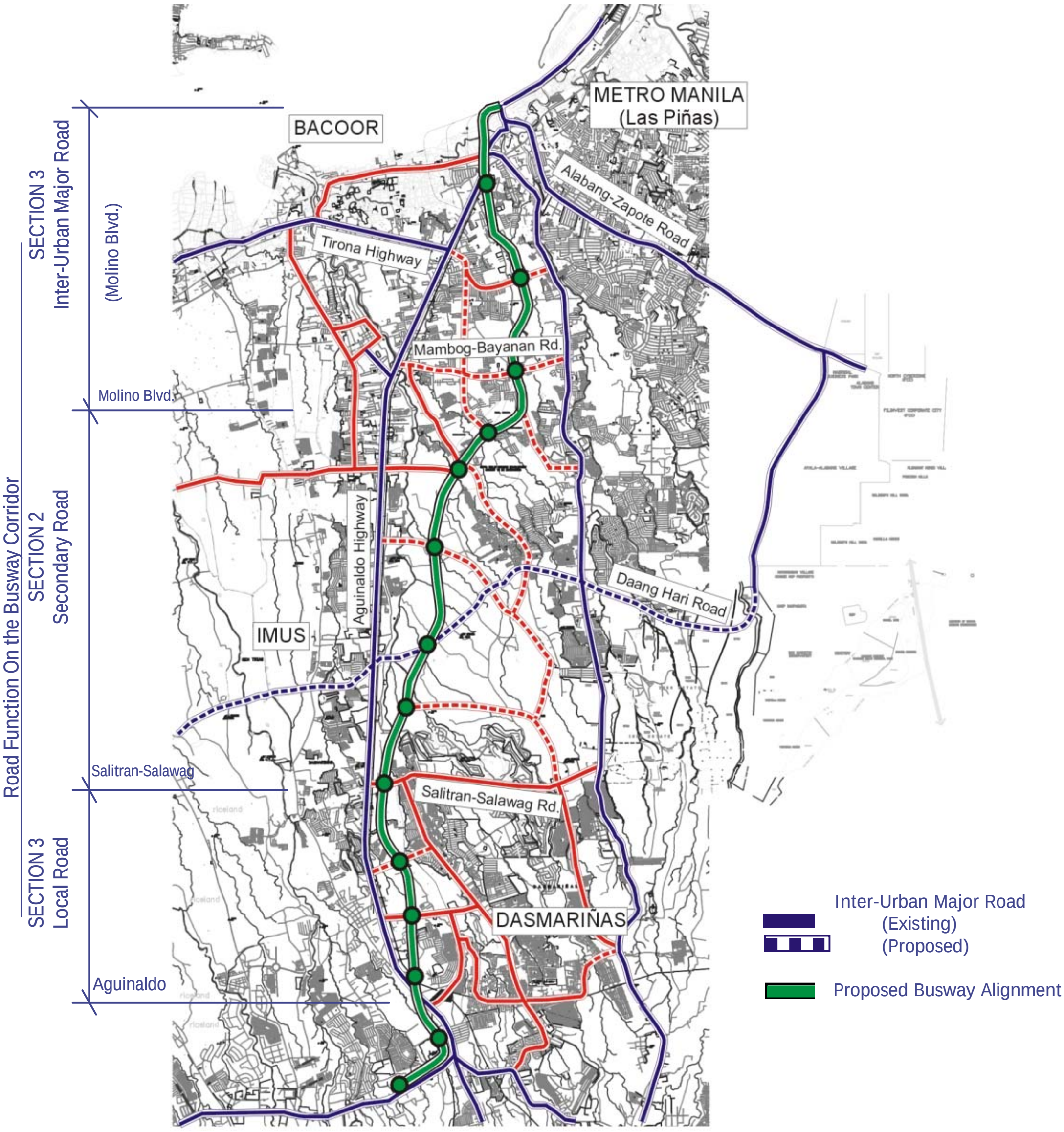
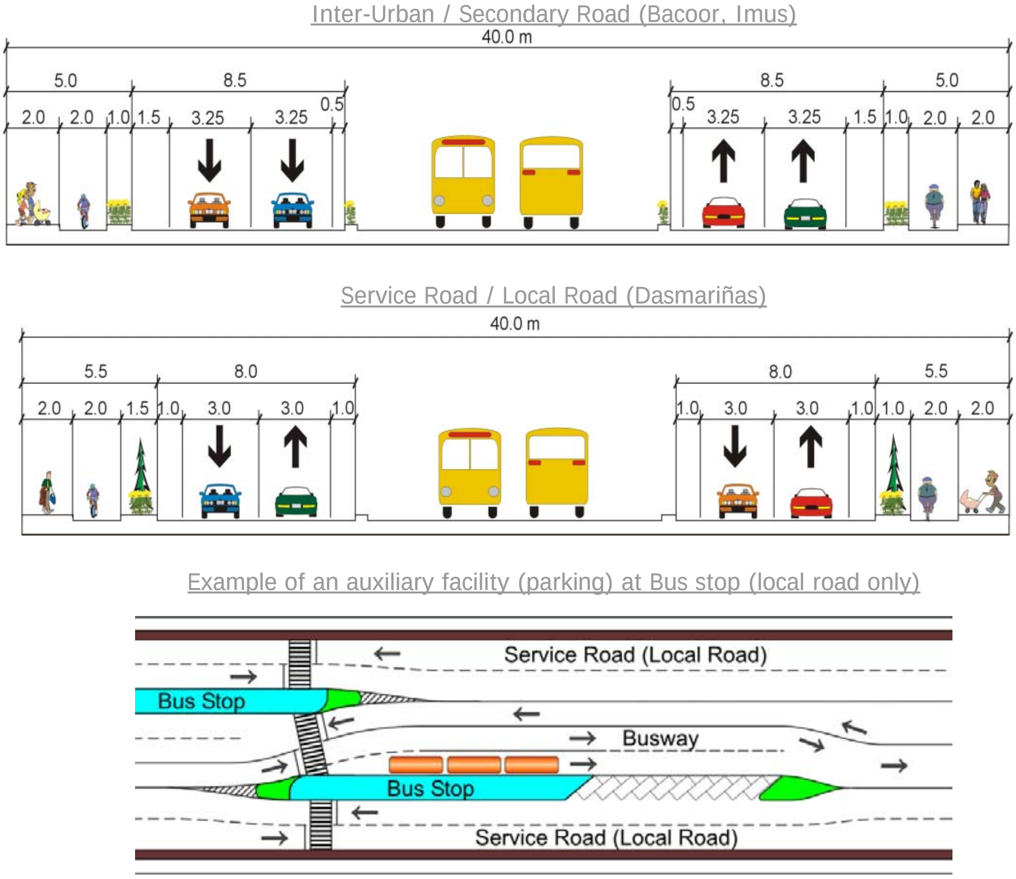


Figure 5.5 shows the cross-section for the ordinary traffic function in the busway corridor. Sections 1 and 2 will adopt this typical cross-section while Section 3 will apply a two-directional operation for ordinary traffic lanes. Despite this difference in cross-section arrangements among the segments, total ROW will be maintained at 40m. Further modifications were examined accordingly during the analysis of the alternative alignments.

Figure 5.5 Proposed Cross-section for Ordinary Traffic Function



5.3 Examination of Alternative Alignments and Terminal Locations

5.3.1 Preparation of the Alternative Plans

In order to determine an optimum alignment for the proposed busway, several alternative plans are prepared and evaluated taking into account the major issues discussed in the previous sections. Preparation of the alternative alignments was made based on the landuse and administrative boundary of Bacoor, Imus and Dasmariñas, while and Coastal Road Access and location of the Southern Terminal are examined separately. The segments or location for the alternative analysis are:

a) Bacoor	Segment 1:	Brgy Niog to Mambog-Bayanan Road
b) Imus	Segment 1:	Mambog-Bayanan Road to Anabu I (There was no alternative alignment prepared for Segment 2, Anabu I to Salawag-Salitran Road, because of the large new township development)
c) Dasmariñas	Segment 1: Segment 2:	Salawag-Salitran Road to Congressional Road Congressional Road to Governor's Drive
d) Coastal Road Access in Bacoor		
e) Southern Terminal in Dasmariñas		

The location of the proposed alternative alignments is shown in Figures 5.6 to 5.8 and the outline of each alternative plan is described in Tables 5.1 to 5.3. The following discussion is a summary of said alternative alignments and plans.

Figure 5.6 Alternative Alignments in Bacoor

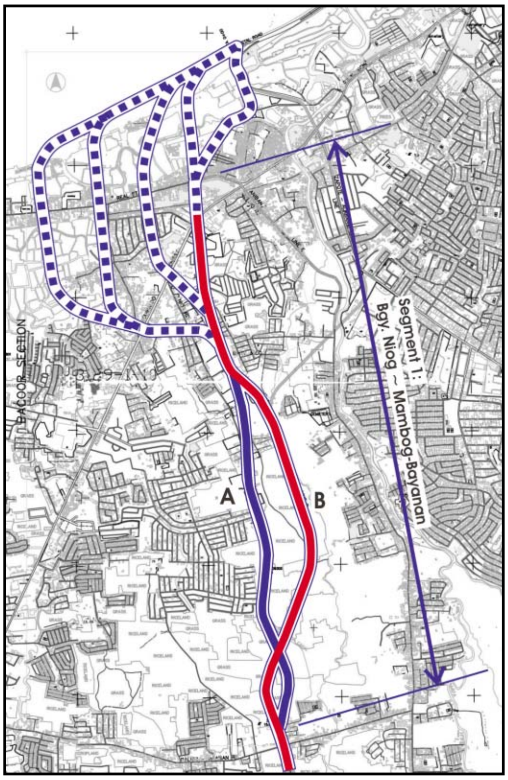


Figure 5.7 Alternative Alignments in Imus

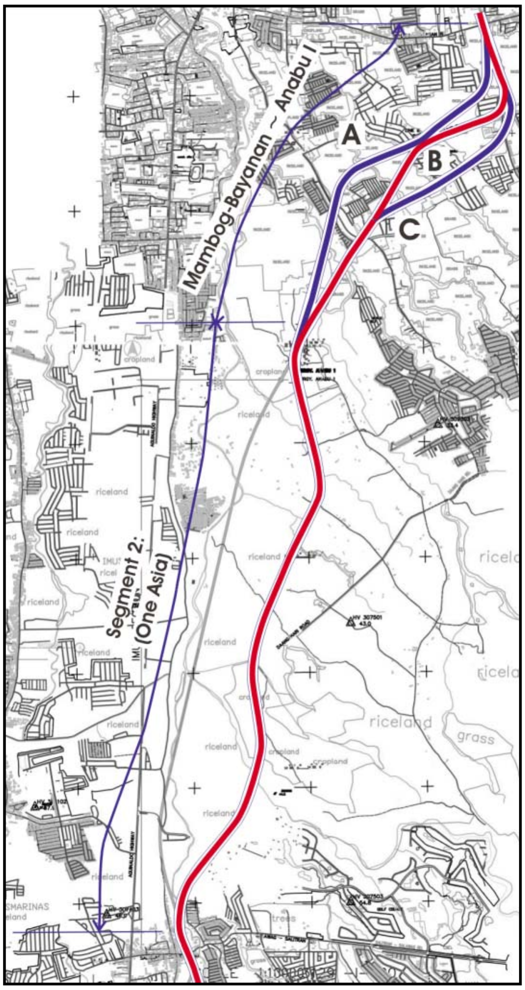
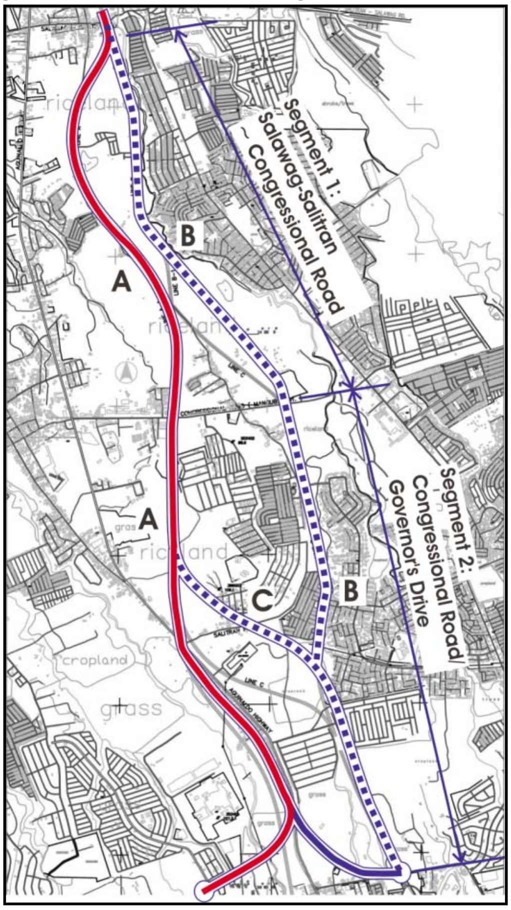


Figure 5.8 Alternative Alignments in Dasmariñas



The major planning issue in the Bacoor section is whether the busway is going to share the ROW with Molino Boulevard or not. The Molino Boulevard project has been launched, with some sections already completed. At present, however, the project has stopped its construction and is still close to traffic.

On the Imus section, the planning issue confronted in Segment 1 is how to find a way to minimize the impact to the scattered subdivision developments in the area. Segment 2, on the other hand, will be determined based on the large-scale new township development.

For Dasmariñas section, alternative alignments were prepared to avoid the existing structures which are sparsely developed in the area. A major control point in this section is the electric power substation which blocks the busway alternative alignment on the eastern part of Aguinaldo Highway. The negotiation on possible relocation of the power substation was a major concern during the preparation of the alternative alignments. Another possible alternative considered for this segment in Dasmariñas is for the busway corridor to share the ROW of Aguinaldo Highway.

The cross-sections applied for the alternatives are discussed in Section 5.2.2. However, the two cross-sections for the alternative alignment along Aguinaldo Highway in Dasmariñas (Dasmariñas Segment 2) are prepared as shown in Figure 5.9. The basic planning concept adopted for the proposed cross-section is that the bus lanes should be segregated to avoid any adverse impact on the existing traffic function of Aguinaldo Highway and to also promote the bus transport system in the new urban development along the Highway.

Table 5.1 Description of Alternative Alignments in Bacoor

Alternative	Outline
Segment 1: Brgy Niog to Mambog-Bayanan Road	
A	The alternative line shares with the right-of-way of the existing Niog Road after taking off from the terminus of Segment 1 by-passing heavily built-up area along the first 1 km of the same road. It follows the same alignment as that of the existing road until it terminates at Mambog Road.
B	The second alternative line also shares with the right-of-way of Molino Blvd. Acquisition of the entire right-of-way for the roadway seems underway, as the construction of the road is being done by phases.

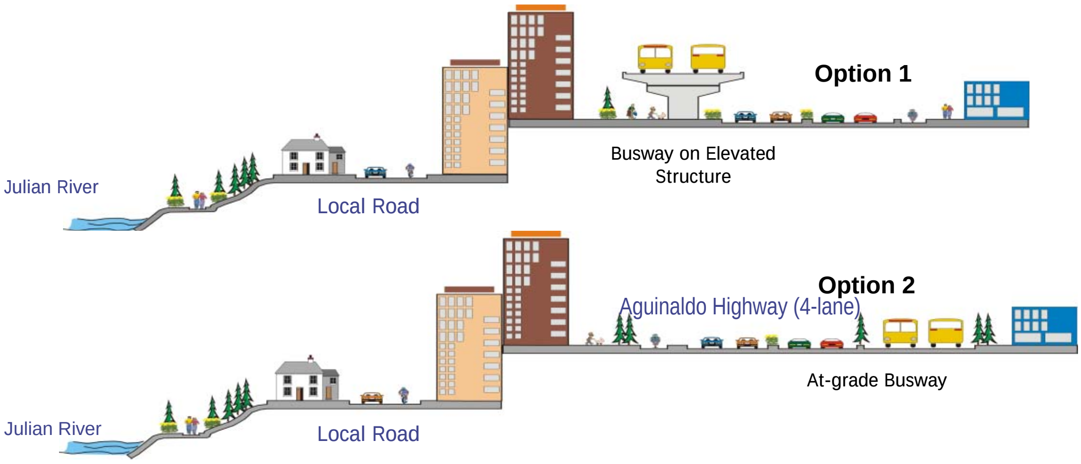
Table 5.2 Description of Alternative Alignments in Imus

Alternative	Outline
Segment 1 :	
A	From the intersection of Paliko Daanan Road, the line runs parallel to Niog Road southward for 500 meters. It turns east and cuts through the middle of Vista Verde (East) Subdivision, after which it goes through an open area with a span of about 550 meters. As it continues its route westward, the line passes two more residential subdivisions with about 400 meters open area in between before crossing a local road hitting a line of two-storey residential structures along Camella Subdivision. The total length generated by Line A is 3.80 km
B	The line runs at the northern boundary of Vista Verde (East) Subdivision, a little farther from Line A. Halfway, it meets Line A at the middle of Vista Verde (South) Subdivision as the busway section proceeds and terminates at Anabu I. Line B has a length of 4.05 km.
C	The Line runs farther but also parallel to Niog Road, 1.0 km from the intersection of Paliko Daanan Road. It turns westward and passes the open area between Vista Verde (East) and Addas Subdivisions. It also enters Vista Verde (South) Subdivision at the southern area and traverses another open area north of the boundary of Citta Italia Subdivision. It runs toward its terminus after crossing the local road with a total length of 3.92 km.

Table 5.3 Description of Alternative Alignments in Dasmariñas

Alternative	Outline
Segment 1: Salawag-Salitran Road to Congressional Road	
A	From Salawag-Salitran Road, the alignment veers westward and meets Salitran Road. It then follows the easterly alignment of the existing road for 1.50 km, after which it turns westward veering away from the existing road toward the intersection of Congressional Road where the alignment ends with a total length of 2.85 km. On the other hand, another line variation (Line A-1) could be developed, by following continuously the alignment of Salitran Road eastward along its undeveloped areas. The alignment changes direction as it approaches the built-up section of Salitran Road to meet Congressional Road 300 meters east of the Salitran Road intersection. The length generated by this alignment is 3.10 km.
B	The alternative line runs eastward along an open area following the alignment of the existing waterway for about 1.70 km. It then goes farther east and changes direction only as it approaches its proposed terminus along Congressional Road where it meets the same end point of Line A-1. The total length generated by this line is 2.90 km. Another alternative line (Line B-1) could still be developed by connecting the alignment with that of the first alternative alignment, Line A at a location where the latter separates from Salitran Road. This line measures 2.70 km in length.
Segment 2: Congressional Road to Governor’s Drive	
A	The alternative alignment runs westward from Salawag-Salitran Road toward Aguinaldo Highway and near the latter’s intersection with the extension of Salitran Road at this section. Then it crosses the Highway and run alongside the existing highway alignment inside Solar Properties . It runs parallel to Aguinlado Highway and turns further east following the Governor’s Drive towards Trece Martirez direction. The line terminates about one kilometer from the intersection of Aguinaldo Highway and Governor’s Drive.
B	The alternative line traverses the open area after Congressional Road following closely the existing waterway alignment. It uses the narrow space between the waterway and the existing subdivisions. After 2.10 km., it enters and cuts through the center of Robinson’s Subdivision and runs alongside the NPC right-of-way for some distance. The next segment then lies along relatively wide and open area until it meets Governor’ Drive about 2 km east of latter road’s intersection with Aguinaldo Highway. The line option spans 3.4 km.
C	The alternative line has the same route but it passes between NPC Property and Salitran Road. It traverses open areas including a portion of the NPC Property hitting the existing public school compound beside the NPC area. The line option has a length of 3.85 km.

Figure 5.9 Development Concept of Alternative Alignment along Aguinaldo Highway



For the Coastal Road Access, several alternatives were prepared, with the first alternative passing through the existing Talaba Diversion Road while the second alternative passes through the built-up area in Bacoor. Several options for the second alternative are shown in Figure 5.6.

The alignment had to take a detour route in the west side of Bacoor in order to avoid the existing structures. However, it will be difficult for the detour route to play its expected road function and shall require an expensive construction cost. A more possible alignment for this alternative is further examined carefully near the Niog road as shown in Figure 5.10. In terms of the advantages on the number of structures affected, line A-3 is the most preferred option. Three alternative alignments are thus prepared, as described in Table 5.4 and shown in Figure 5.11.

The cross-section for the busway access in the coastal road differs from the typical cross-section of the busway main line. There are two road functions expected from this access road before and after the completion of the LRT Line 1 extension project up to Niog. Before the completion of the LRT Line 1 extension project, bus operation on the proposed busway will extend up to the existing LRT Line 1 Southern terminal in Baclaran. Therefore, the access road will be exclusively for bus operation. However, after the completion of the LRT Line 1 extension project, bus operation will terminate at Niog, and the access road will be opened to ordinary traffic.

The alternative on the existing Talaba Diversion road will require 40m ROW to accommodate the LRT Line 1 and the busway corridor, as well as for ordinary traffic. To minimize the magnitude of disturbance on the existing commercial establishments, an integrated viaduct structure may be constructed. Three alternative cross-sections are examined as shown in Figure 5.12.

Figure 5.10 Alternative Alignments for Coastal Road Access

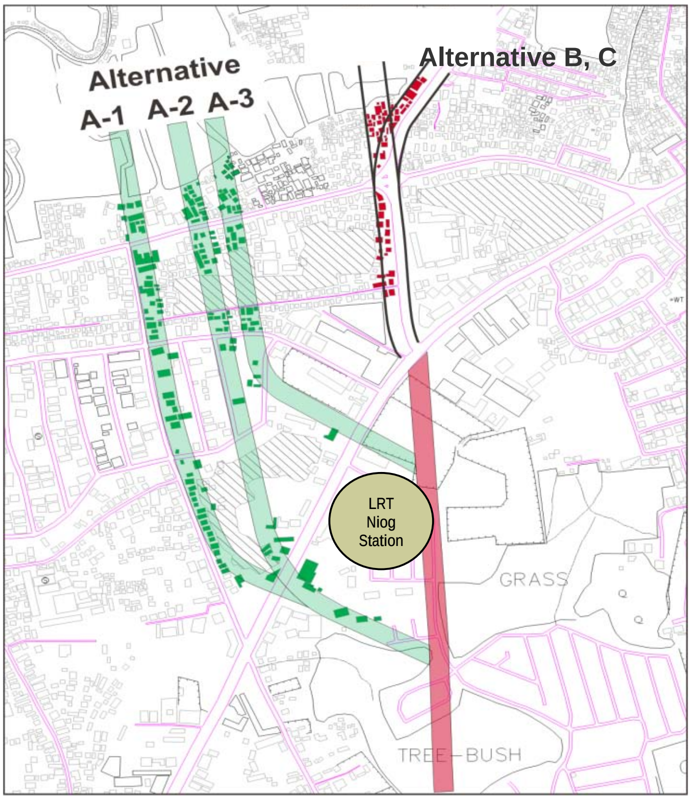
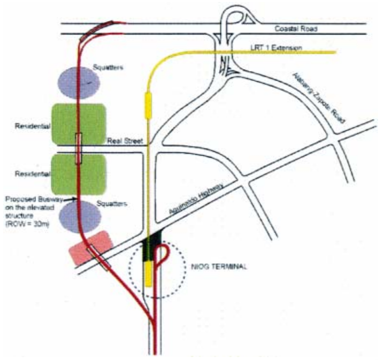


Table 5.4 Alternative Locations for the Coastal Road Access

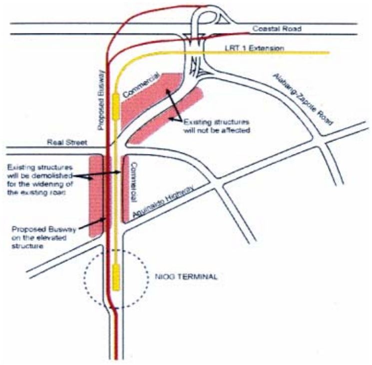
Alternative	Outline
Coastal Road Access	
A	This line is laid at about 400 m west of the Talaba-Las Piñas Diversion Road. Likewise, after turning from the Coastal Road, it runs toward the coastline for about 1.30 km until it crosses Real St. It then cuts across the residential area in Brgy. Niog I, running parallel and alongside Niog St.
B	The line has an approximate length of 2.45 km starting from its interface with the Coastal Road until it terminates at an area in Brgy Niog. After turning from the Coastal Road, the alignment runs toward the coastline for about 1.0 km crossing the existing waterway along the same area until it reaches the intersection of Real St. and Talaba - Las Pinas Diversion Road. Then, it follows the alignment of the diversion road toward Brgy Niog after crossing Aguinaldo Highway.
C	The alternative line considers the existing roadway from the Coastal Road Spur connection and Talaba-Las Piñas Diversion Road and meets with Line D. Both lines use the proposed alignment of Molino Blvd. This line option has a length of 2.525 km.

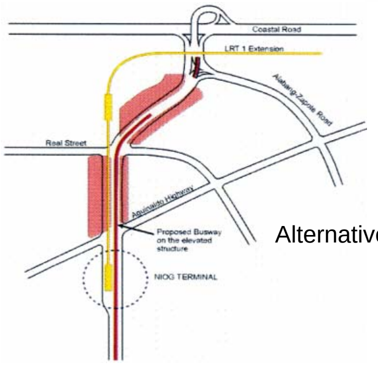
Figure 5.11 Alternative Alignments for Coastal Road Access

Alternative A



Alternative B

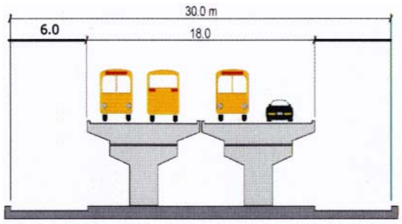




Alternative C

Figure 5.12 Proposed Cross-section Alternatives for Coastal Road Access

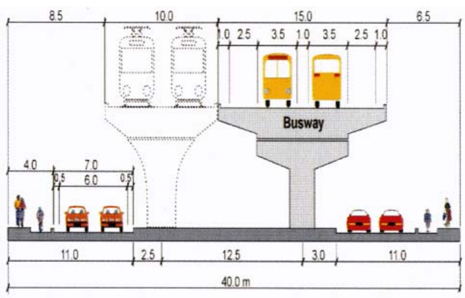
Alternative A



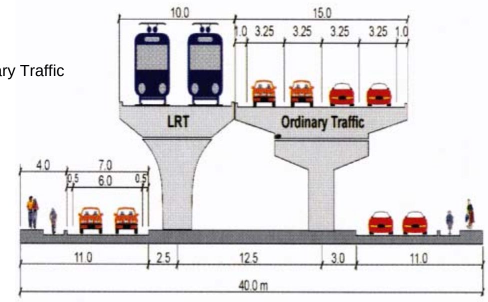
Alternative B and C

Option (1) Separate Structure for LRT and Busway

Busway without LRT (before LRT construction)

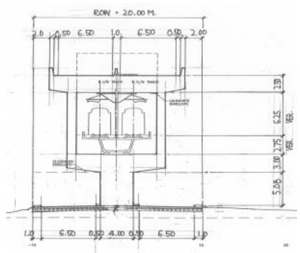


LRT and Ordinary Traffic



Option (2) Double Deck Structure

Alt. 2 Integrated Structure

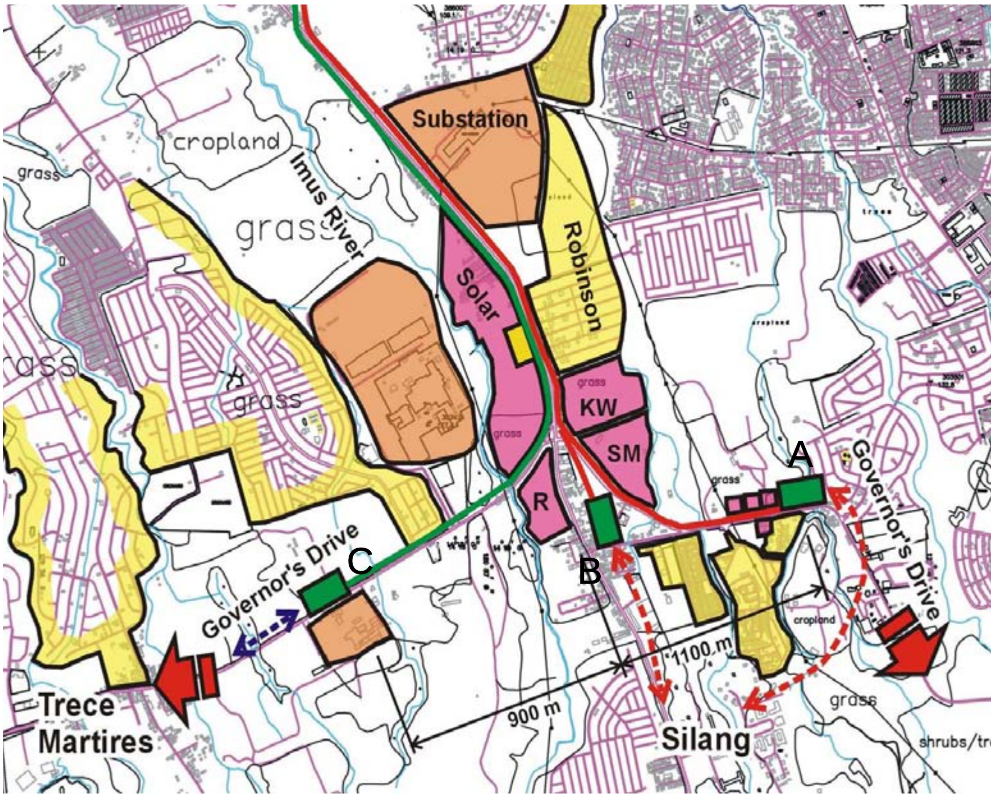


For the location of the Southern Terminal, three alternative locations were analyzed based on the directions of the future extension of the project, whether it will be extended to the south, to the east or to the west.

Table 5.5 Alternative Locations for the Southern Terminal

Alternative	Outline
A	This alternative location places the terminal somewhere in the eastern side (GMA bound) of Governor's Drive. It is approximately one kilometer from the intersection between Aguinaldo and Governor's Drive (Pala-pala intersection). Along the Governor's Drive, some commercial establishments exist such as restaurants and gas stations.
B	This alternative location is a triangle area enclosed by Aguinaldo Highway and Governor's Drive, heading southbound, directly towards Silang. The location will be in between the two intersections in Pala-pala.
C	The location will be somewhere westbound of Governor's Drive, heading for the provincial capital of Cavite, Trece Martires City. It is approximately one kilometer from the Pala-pala intersection. The busway alternative alignment crossing Aguinaldo Highway will use this terminal location. Although there is no structure along Governor's Drive, the busway alignment has to cross the Julian River to reach this terminal location.

Figure 5.13 Alternative Locations for the Southern Terminal



5.3.2 Evaluation of the Alternative Alignments for the Busway

A comparative analysis was undertaken to aid in the selection of the optimum alignment for the proposed busway. Evaluation criteria employed for the analysis are as follows:

- Magnitude of disturbance on existing development
- Difficulty in ROW acquisition
- Construction difficulty
- Adequacy of the alignment for the project
- Magnitude of project capital requirements

With these criteria, advantages and disadvantages on the each alternative alignment by each analytical segment are examined and comprehensive evaluation is made to select an optimum alignment for the each segment. The results of the evaluations are shown in Table 5.6 to 5.9.

The segment in Bacoor, the alternative alignment which is sharing the ROW with Molino Boulevard is perturbed in spite of the counter proposal. For Imus Segment 1, although a clear predominance is not observed among the three alternatives, line B may be selected from the viewpoint of the magnitude of disturbance on the existing subdivision development and adequacy of the alignment.

For Dasmariñas section, Segment 1, Line A, which is passing through the center of the narrow area is a favorable alignment judging from the magnitude of project capital requirement as well as efficiency of the land use along both sides of the corridor. For Segment 2, land survey, negotiation with the electric power substation and preparation of Line B and C were undertaken to determine the most feasible line. However, the alternative alignments will be difficult to justify due to the new subdivision development beside the substation which limits the available space to a very small curvature to avoid the power station. Eventually, Line A along Aguinaldo Highway was selected.

Table 5.6 Summary of Evaluation and Selection Process in Bacoor

ALIGNMENT OPTIONS / EVALUATION FACTORS	BACOOR SECTION: (Barangay Niog to Mambog-Bayanan Road)	
	Line A	Line B
Magnitude of Disturbance on Existing Development (estimated)	• Using the Niog Road would affect about 13 to 26 residential and warehouse or factory type buildings. • The rest of the alignment is still open and undeveloped. b	• Basically, there are no social as well as environmental issues involve in this alignment option. As a matter of fact, construction of a major portion of the alignment is partly completed. a
Difficulty in ROW Acquisition	• Niog Road has 10 meters ROW, accounting for 25 to 30% of the busway ROW requirement. • However, it shall involve negotiations with several individual landowners and compensation for affected buildings (one to three storeys). b	• The acquisition of the remaining areas for the road's ROW is being undertaken by the DPWH. a
Construction Difficulty	• Roadside development along Niog Road is not too heavy and that a longer section of the alignment up to its intersection with Mambog Road or Palico-Daanan Road remains undeveloped. • The line intersects with Molino Blvd near its terminus thus requiring grade separation. • Both are proposed as major roadways. a	• Major portion of the segment is partly completed. Remaining work would be to modify the cross-sectional features of the existing roadway based on the busway requirements and as required by traffic demand. • The busway alignment will not require major or complicated structures along this segment. • Its intersection with Niog Road could be modified to preclude provision of grade separation structure. a
Adequacy of the Alignment for the Project	• The alignment of Niog Road along this segment is 3.00 km and its geometric characteristics and low speed classification fit that of a local road. • Improvement and modification of its horizontal alignment would be required in accordance with the busway standards. a	• The constructed section of the alignment indicates that the roadway could accommodate high-speed operation. • Though longer by 375 meters than that of Niog Road, its horizontal alignment features fit well with the proposed busway alignment requirement. • The line has no sharp curves/bends. The vertical alignment follows the flat topography of the area. a
Magnitude of Project Capital Requirements	Major pay items include: • ROW acquisition and compensation cost • Grade separation structure • Reconstruction of the existing pavement structure • Other miscellaneous items b	• The investment requirement for this alternative line is significantly less than that of the first line option. • Additional ROW costs may be required for access facilities to serve off-site developed areas. a
Overall Evaluation	B	A

Note: Aa: Advantage Bb: Moderate Cc: Disadvantage

Table 5.7 Summary of Evaluation and Selection Process in Imus

ALIGNMENT OPTIONS / EVALUATION FACTORS	IMUS SECTION: Segment 1 (Mambog-Bayanan))		
	Line A	Line B	Line C
Magnitude of Disturbance on Existing Development (estimated)	• The line passes through middle- to high-end subdivision areas, Vista Verde East and South. • Although these areas are partially developed, very few structures were erected. • Inside these subdivisions, the line could avoid hitting the existing structures since they are confined in isolated areas. • However, as the line approaches the intersection of the existing barangay road, it will hit several residential structures inside the newly developed Primarosa subdivision as well as some two-storey residential structures and a playground at Camella Homes, as the line traverses the opposite side of the existing road. b	• The first stretch of the line avoided the developed area of Vista Verde East; hence, no structures will be affected. • After passing through East and South Vista Verde initially using Line A alignment, the line variation veers southwest toward the northern boundary of Citta Italia. • It will hit only a few structures to include an existing barangay hall. • After intersecting the barangay road, it runs parallel to another side road and traverses the open area in Anabu I. a	• Like with the other options, this line tries to avoid hitting existing structures. a
Difficulty in ROW Acquisition	• The line will pass through an expensive subdivision area but the area affected would not be too large. • Since the area is not yet fully developed, it is expected that no structures will be demolished and payment for compensation will be minimal. • On the other hand, the owner(s) of the undeveloped land adjacent to this subdivision would probably attempt to command a high price for his/their property(ies) being near to the said high end developed properties. c	• For the first half of the line, ROW acquisition should be less difficult. b	• Line will traverse less developed areas, thus reducing the number of individual landowners to deal with. • ROW acquisition should be less difficult, but distance passing through the subdivision area will be longer than Line B.. b
Construction Difficulty	• Alternative line does not need complex or complicated structures as they run along the said section. a	• Except for the demolition of affected structures, the alternative lines have no requirement for complex and complicated structures. a	• There are no complex or complicated structures required along this line. a
Adequacy of the Alignment for the Project	• The line option could be laid to satisfactorily meet standards and even exceed minimum requirements; however, the first option will require a tighter bend as it turns toward Camella Homes Subdivision. • The intersection with Molino Boulevard will require large land area. Distance to the intersection with Mambog-Bayanan will be too close. • Intersection area will be minimized. • Condition of the intersection development will be the same as Line B. c	• The line will require tighter bends as the lines meet the Line A at the middle of Vista Verde South but smoother curves could be adapted as the lines proceed toward their termini. a	• Bends would exceed minimum requirements and could even adapt the desirable values should the economic aspect permits. • There are no undulating curves along the route although the alternative line has the longest route. b
Magnitude of Project Capital Requirements	• Major pay items include: ROW acquisition and compensation costs, with costs higher for line option 1 since demolition of expensive structures is inevitable as the line cuts through Primarosa Village and Camella Homes. c	• The line option would have lesser ROW acquisition and compensation costs having avoided hitting the developed areas at Vista Verde East. a	• Expensive ROW acquisition cost should be lesser as the line avoided large developed areas inside the existing subdivisions. a
Overall Evaluation	C	A	B

Note: Aa: Advantage Bb: Moderate Cc: Disadvantage

Table 5.8 Summary of Evaluation and Selection Process in Dasmariñas Segment 1

ALIGNMENT OPTIONS / EVALUATION FACTORS	DASMARIÑAS SECTION: Segment 1 (Salawag-Salitran Rd. to Mangubat)		
	Line A: West Line + Line Variation A-1		Line B: East Line + Line Variation B-1
	Line A	Line Variation A-1	
Magnitude of Disturbance on Existing Development (estimated)	• Line A, West Line shares partly with the right of way of the existing Salitran Road. • The alternative line will affect several houses at the intersection of Congressional Road. • However, from Salawag-Salitran Road and while following the alignment of Salitran Road, no structures will be affected. a	• This line runs continuously along the existing road for another 1 km before it changes direction toward the east where it meets the terminus of alternative line B at the intersection of Congressional Road. As observed, the line option will not hit any structure a	• Both alternative lines will hit several one-storey and two-storey houses as they cut through the Sunny Crest and Ivory Crest Subdivisions. After this section, Line B runs on relatively open area. • Line variation B-1 will affect some structures as it meets the alignment of Line A near its terminus. a
Difficulty in ROW Acquisition	• About 40% of the length of the line will share with the ROW of Salitran Road. • Its remaining length will rest on relatively open area after hitting a small portion at the boundary of the existing Rosario Subd. • Some houses will also be affected at the intersection of Congressional Road. b	• More ROW area could be shared with the existing Salitran Road and more open undeveloped land could be utilized at this alignment. b	• As the both lines cuts through newly developed property, more ROW problems will be encountered during negotiations with individual landowners. • The waterway easement, which should lessen the ROW requirement of the busway could not be maximized due to the winding alignment of the waterway. This could end up in acquisition of unusable land areas adjacent to the existing waterway cut off by busway alignment. a
Construction Difficulty	• There is no requirement for complicated or complex structure along the two alternative lines since their alignment will be laid at at-grade. a	a	• Since both lines run alongside the bank of the existing waterway, additional slope protection measures will have to be considered to prevent road slip and erosion of the down hill slopes. b
Adequacy of the Alignment for the Project	• A slightly tight bend is encountered as the line departs from the intersection of Salawag-Salitran Road toward Salitran Road. • Two more curves are provided; one following the alignment of Salitran Road and the other as it veers away from the existing road toward the intersection at Congressional Road. b	• The same number of horizontal curves will be generated in this alignment. • However, the route is longer than the first line option. b	• A generally good alignment with smooth curves could be established along this route while maintaining almost the same length as those of the other alternative lines. a
Magnitude of Project Capital Requirements	• For both alternatives, aside from the construction costs, the major pay items requiring significantly large capital requirements would be ROW acquisition and compensation costs. • Line variation A-1 has lesser ROW requirement and will entail less compensation cost. a	a	This line shall require bigger capital requirement due to the following cost items: • The cost consideration of slope protection and retaining structures • ROW acquisition and compensation costs • Basic construction costs b
Overall Framework	A	B	B

Note: Aa: Advantage Bb: Moderate Cc: Disadvantage

Table 5.9 Summary of Evaluation and Selection Process in Dasmariñas Segment 2

ALIGNMENT OPTIONS	DASMARIÑAS SECTION: Segment 2 (Congressional Road to Governor's Drive)		
EVALUATION FACTORS	Line A (Western Alignment)	Line B (Eastern Alignment)	Line C
Magnitude of Disturbance on Existing Development (estimated)	• As observed, the line will affect few houses only at the intersection of Congressional Road where the line starts. • After this short section, the line traverses relatively open areas. a	• It is inevitable that several two-storey structures will be affected as the line runs alongside the eastern boundary of South Crest Village. b	• Less number of structures will be affected but the line will require demolition of the existing public school complex beside NPC. c
Difficulty in ROW Acquisition	• ROW acquisition is less difficult due to large open areas available along its route and the consideration given to the busway alignment to pass through a large property alongside Aguinaldo Highway. a	• ROW acquisition will be more difficult at this line option since the alignment will require land area alongside South Crest Village and the newly developed Robinson's Subdivision. c	• ROW acquisition along South Crest village is not avoided although the area is relatively small. b
Construction Difficulty	• As it ends at the intersection of Governor's Drive, the future line extension will require relocation of high voltage electrical lines erected along the roadsides of Governor's Drive. • Considering further the line extension toward south, the alternative line has to cross Aguinaldo Highway again to find its way east of the said highway where large open areas are still available. b	• The area between South Crest Village and the existing waterway is too tight and narrow because the alignment will be laid along the downhill slopes of the existing waterway. • Slope protection and retaining structures will be required along the stretch of the existing waterway. c	• The line runs between the NPC Property and Salitran Road. • Risk of running alongside high voltage electrical line is still not avoided. c
Adequacy of the Alignment for the Project	• The geometric alignments for the busway could be developed to even exceed minimum requirements as the line traverses flat to gently rolling terrain. • Few horizontal curves will be generated along this line. • The line runs shorter by about 200 meters than Line option B. a	• The route alignment is longer by about 200 meters. • The alignment will have tight horizontal curves as the alignment runs between South Crest Village and the existing waterway. • As the line cuts through the center area of Robinson's subdivision, its alignment has to squeeze in between the existing transmission towers of NPC. b	• The line require sharp turns as it crosses between electrical towers after Salitran Road and as it turns between South Crest and an NPC tower. c
Magnitude of Project Capital Requirements	Major cost items include: • Construction cost with consideration to the development of the alignment along the slopes beside Aguinaldo Highway. • ROW and compensation costs should also be considered. b	• ROW acquisition and compensation costs form part of the major investment requirement for this line option. • However, the cost is cheaper than alternative Line A. b	• ROW acquisition and compensation costs form part of the major investment requirement for this line option. a
Overall Framework	A	C	B

5.3.3 Evaluation of the Coastal Road Access

Preliminary engineering study including land survey was carried out to obtain more accurate figures for the number of structures affected, ROW acquisition and viaduct structures, etc. Results of this engineering study are shown in Table 5.10. The number of structures affected for Line A is 113, the biggest among the alternatives. Line B and C(a) indicate almost the same number of structures affected, with Line B affecting more houses of informal settlers.

Land use of the required ROW is mainly residential for Line A and commercial use for Line C(a), while half of the section of Line B goes through the reclamation land in the coastal area. Project cost of Line C(a) is the highest due to the ROW acquisition of the commercial land, while Line B is most economical judging from ROW cost as well as total cost. The construction cost of Line B will be a bit higher than Line C(a) because of the structure for the interchange with the Coastal Expressway.

Table 5.10 Comparison of the Alternative Alignment for Coastal Road Access

Alternative Plan		Line A	Line B (alongside LRT)	Line C(a) (Talaba Diversion)	Line C(b) (Double-decker)
Length (m)		2,285	2,005	1,480	1,480
Right of Way (m)		30	40	40	20
No. of affected structures	Concrete	58	34	38	-
	Semi-Concrete	34	12	20	10
	Wooden/Bamboo	21	19	7	-
	Total	113	65	65	10
ROW Acquisition (m^2)	Built-up Area	7,500	8,000	22,100	5,050
	Others	46,800	30,000	7,500	-
	Total	54,300	38,000	29,600	5,050
Construction	Elevated Structure (m)	1,400	1,060	760	860
	Interchanges (no.)	1	1	-	-
	Reclamation (m^2)	745	545	-	-
Cost (Million Pesos)	Construction Cost	882.4	474.4	452.8	1,025.9
	ROW Cost	525.6	432.4	1,180.0	227.3
	Total	1,408.0	906.8	1,631.8	1,253.2

Comparative evaluation of the alternatives is shown in Table 5.11. Integrated Structure Line C(b) indicates advantages both on the social impact and on the difficulty in ROW acquisition. However, the other criteria items do not rate this line positively. Thus, eventually, based on the comprehensive evaluation, Line B is selected as the preferred plan.

Table 5.11 Comparative Evaluation of the Alternatives for Coastal Road Access

Evaluation Items/Alternative Plan	Line A	Line B (alongside LRT)	Line C(a) (Talaba Diversion)	Line C(b) (Double-decker)
Social Impact	C	B	B	A
Number of structures	c	b	b	a
Division of community	c	a	a	a
Living environment	c	a	a	a
Commercial activities	a	c	c	b
Difficulty in ROW Acquisition	C	B	B	A
Built-up area	b	b	c	a
Marine pond	c	b	a	a
Informal occupation	c	b	a	a
Construction Difficulties	A	B	B	C
Magnitude of structures construction	b	b	c	c
Reclamation	c	b	a	a
Coordination with existing traffic	a	c	c	c
Coordination with LRT Extension Project	a	c	c	c
Project Capital Requirements	B	A	C	C
Construction cost	b	b	a	c
Right-of-way cost	b	a	c	a
Total	b	a	c	c
Overall Evaluation	C	A	B	C

Note: A.a – Advantage B.b – Moderate C.c - Disadvantage

Although Line B is the preferred plan, there still exist many issues to be addressed during project implementation, as follows:

- Disturbance on the existing commercial activities along Talaba Diversion Road
- Traffic congestion particularly during the construction stage
- Coordination with the LRT Line 1 Extension Project.

The following are possible countermeasures in addressing these issues:

- Commercial activities

  It is important to provide alternative areas for their continuing commercial and business activities. If the relocation places can be found along the proposed busway, the activities will also encourage the usage of the public transport.

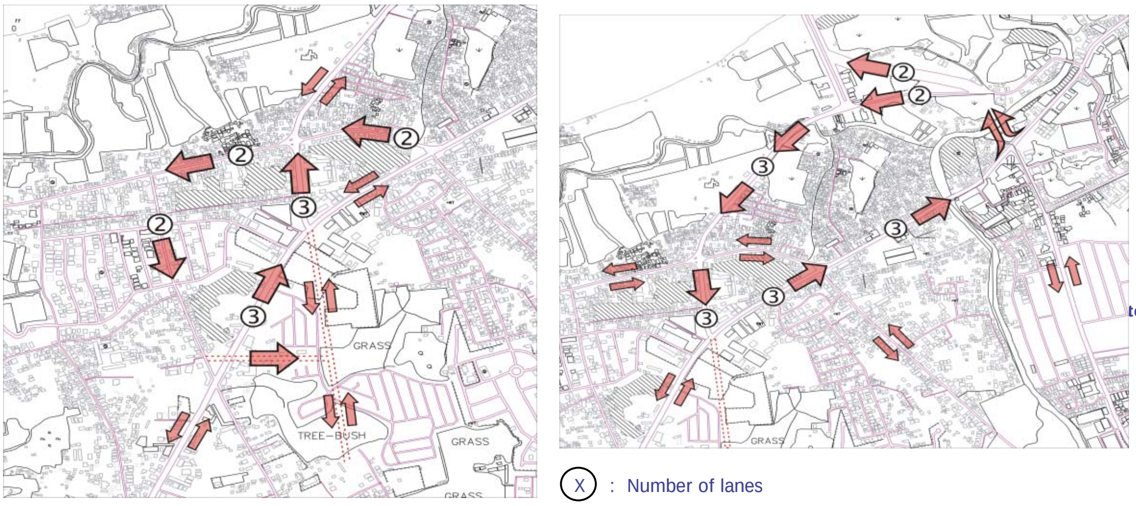
- Traffic congestion and coordination with the LRT Line 1 Extension Project

  Coordination with the LRT Line 1 extension project will be the most significant issue on the proposed Line B option, not only from the perspective of traffic congestion on the ordinary traffic flow but as well as for the optimization of the infrastructure investment. In particular, ROW acquisition and construction of the structures on the existing road should be coordinated in terms of schedule as well as cost-sharing. If the two projects would be implemented separately, disruptions on the traffic flows and the living environment in the area will be immeasurable.

Coordination with LRT Line 1 Extension Project is very important as described above. In case the busway project would be implemented earlier than the LRT project, introduction of an alternative traffic management system (one-way road network) will be effective mitigating measure.

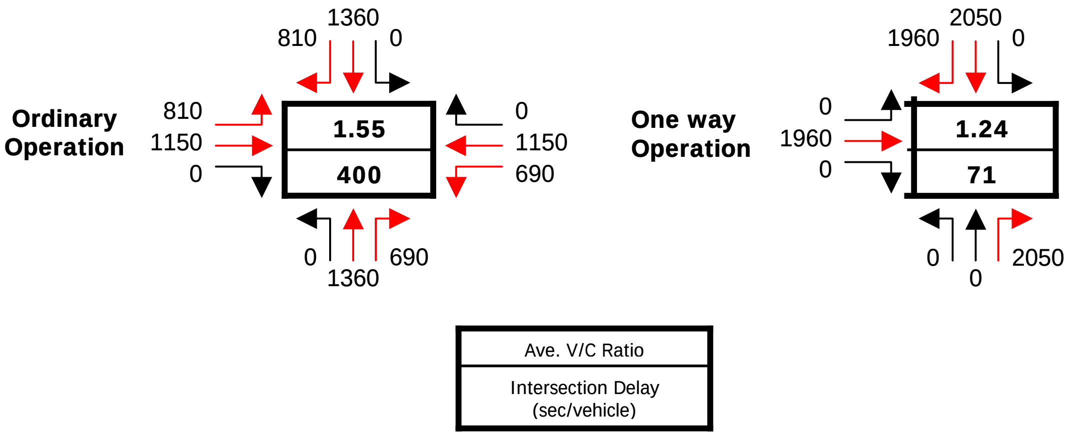
Two options can be prepared for the one-way road system in Niog, Baccor, as shown in Figure 5.14. The first will make use of Real Street and Niog Road for southbound traffic and the second option will use Alabang-Zapote road for northbound direction, with Talaba Diversion Road used for opposite direction on the each option. On the comparison of the two options, the first option will be difficult to implement due to the insufficient road width on Real street and Niog road, in addition to the very high density of the residential houses along the existing roads.

Figure 5.14 Alternative One-Way System to Alleviate Traffic Congestion in Bacoor



In order to verify the effectiveness of the one-way option, traffic capacity and degree of the congestion are calculated both for ordinary operation and one-way operation. The result of the calculation is shown in Figure 5.15. The congestion level for the ordinary operation will exceed 1.5 and intersection delay will be 400 sec/veh in 2005, which is a seriously congested situation. On the other hand, one-way operation can reduce the congestion level up to an acceptable level of 1.2 and intersection delay of 71 sec/veh.

Figure 5.15 Alternative One-Way System to Alleviate Traffic Congestion in Bacoor (2005)



5.3.4 Evaluation of the Southern Terminal Location

The proposed alignment in the CALA WB study is terminated at the east side of the Governor's Drive from the intersection with Aguinaldo Highway (Refer to Figure 2.2). Based on a series of discussions with LGUs, this Study re-examined the location of the Southern Terminal. For the comparative analysis, three alternative locations were prepared as described in the previous section.

In order to clarify the features of each alternative, relations between each alternative location and land use as well as accessibility of the feeder system for the proposed busway are examined carefully. Figure 5.16 shows the relations with major urban developments in the area and Figure 5.17 shows the possible circulation system for the ordinary bus route accessing to the Southern Terminal.

Table 5.12 shows the result of the comparison of the Southern Terminal location alternatives. Alternative terminal locations are found at the distance of 1100m, 100m and 900m from Pala-pala intersection, respectively. From accessibility to feeder system perspective, Plan B will be a strategic location for all directions. However, existing land use and traffic circulation at the Pala-pala intersection will not able to justify Plan B.

Plan A is on the east side of Pala-pala intersection where new commercial developments are present along Governor's Drive, thus indicating disadvantages on the ROW acquisition. Plan C is being recommended for the Southern Terminal. It is also recommended that the future public transport corridor will be extended towards Trece Martires instead of Silang.

Figure 5.16 Alternative Locations of Southern Terminal and Future Land Use

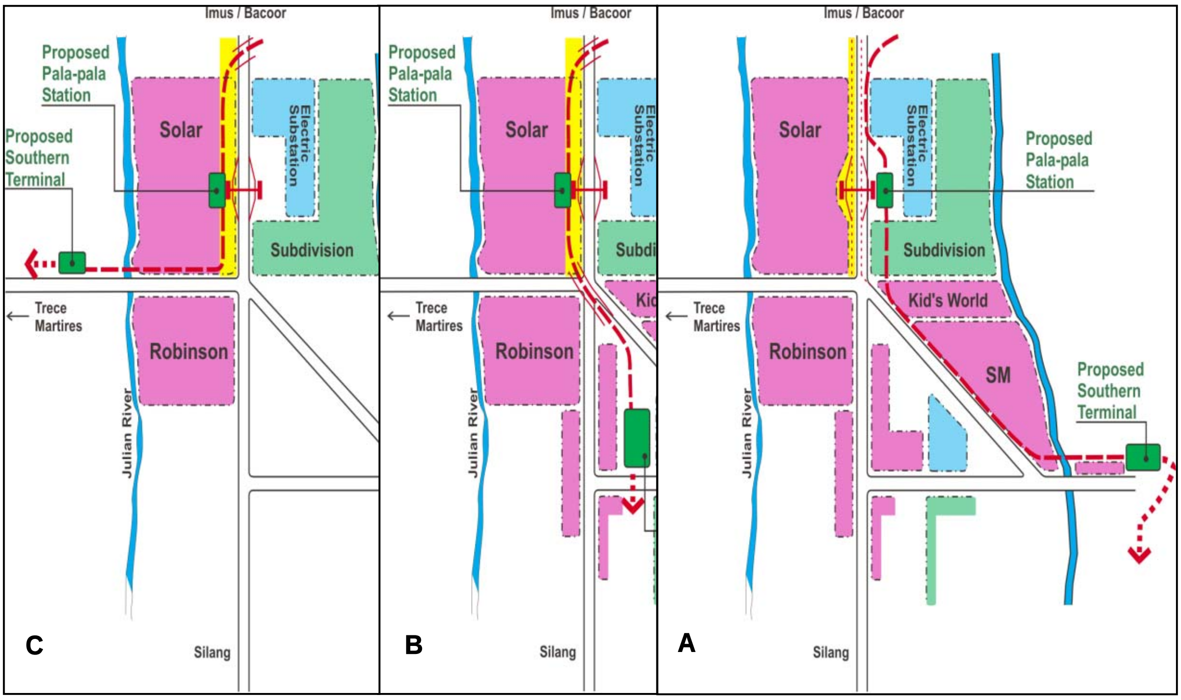
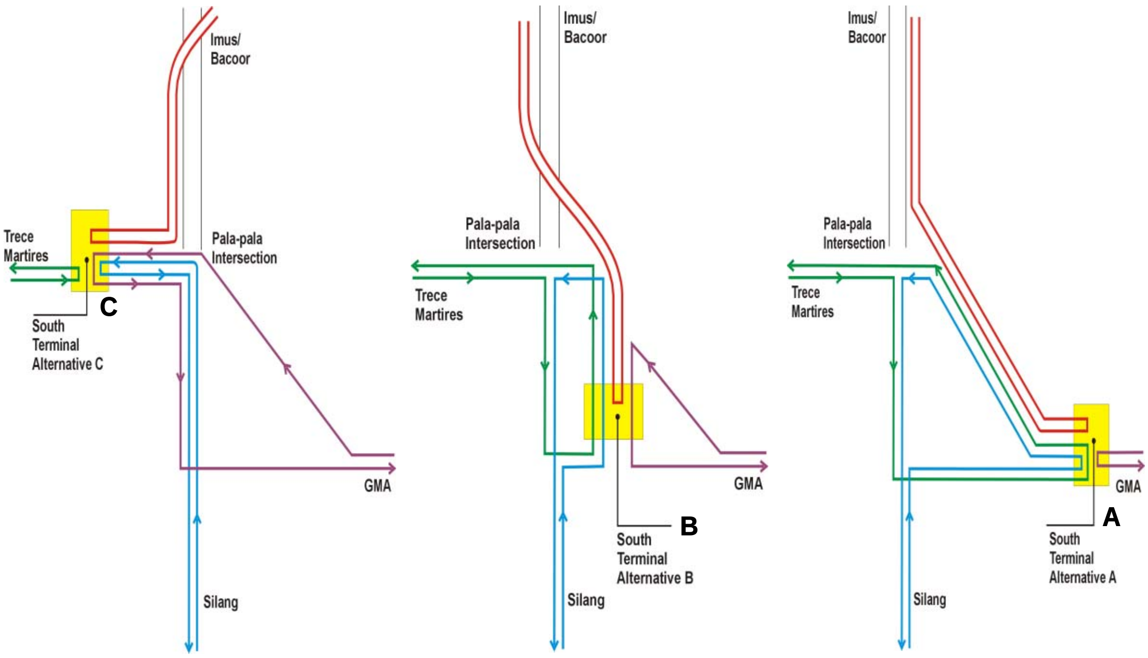


Figure 5.17 Proposed Feeder Access at Southern Terminal by Alternative Terminal Location



The proposed Southern Terminal will be located westbound of Governor's Drive, with providing for a preferred accessibility on the feeder system heading towards Trece Martires. However, accessibility toward south, Silang-bound, will also be indispensable to generate a sufficient ridership on the proposed busway system so that sufficient facilities for southbound should be provided either at the Pala-pala station or San Agustin station located along Aguinaldo Highway.

Table 5.12 Comparative Evaluation of the Southern Terminal Alternatives

Alternative Plan		A	B	C
Location		East side of Pala-pala intersection (Governor's Drive)	Pala-pala intersection	West side of Pala-pala intersection
Distance from Pala-pala intersection		1,100 m	100 m	900 m
Accessibility for the Feeder	Silang	b	a	b
	GMA	a	a	c
	Trece Martires	c	b	a
Impact to the traffic congestion at Pala-pala intersection		b	c	a
Land availability at proposed terminal location		b	c	a
Land availability on approach section		c (coordination will be required with respective developers)	b	a (in cooperation with solar resources)
Future extension		Silang Diversion from Governor's Drive to Aguinaldo Highway will be required	Silang (Aguinaldo)	Trece Martires (Governor's Drive)

Note: a – advantage b – moderate c- disadvantage

5.4 Terminals and Bus Stops Development

5.4.1 Location of Terminals and Bus Stops

Designing convenient public transport modes aims to minimize urban traffic congestion and largely contribute to improvement of the urban environment.

Measures to provide more convenient public transport are the introduction of suitable modes of transport and the smooth transfer between modes. One of the more critical aspects of public transport, especially mass public transport, is the need for passengers to transfer from one mode to another. Therefore, smooth transfer between modes is the key factor to ensure success of a public transport system.

Generally, there are some discussions concerning the definition of a bus terminal. Terminal in this study, however, indicates both ends of the busway only, which are the Talaba (Northern Terminal) and the Southern Terminal. Intermediate stops are referred to as bus stops, which can be classified into several types based on the number of boarding/alighting passengers, access mode pattern, and roadside land use, etc. Basic considerations for planning the two terminals are as follows:

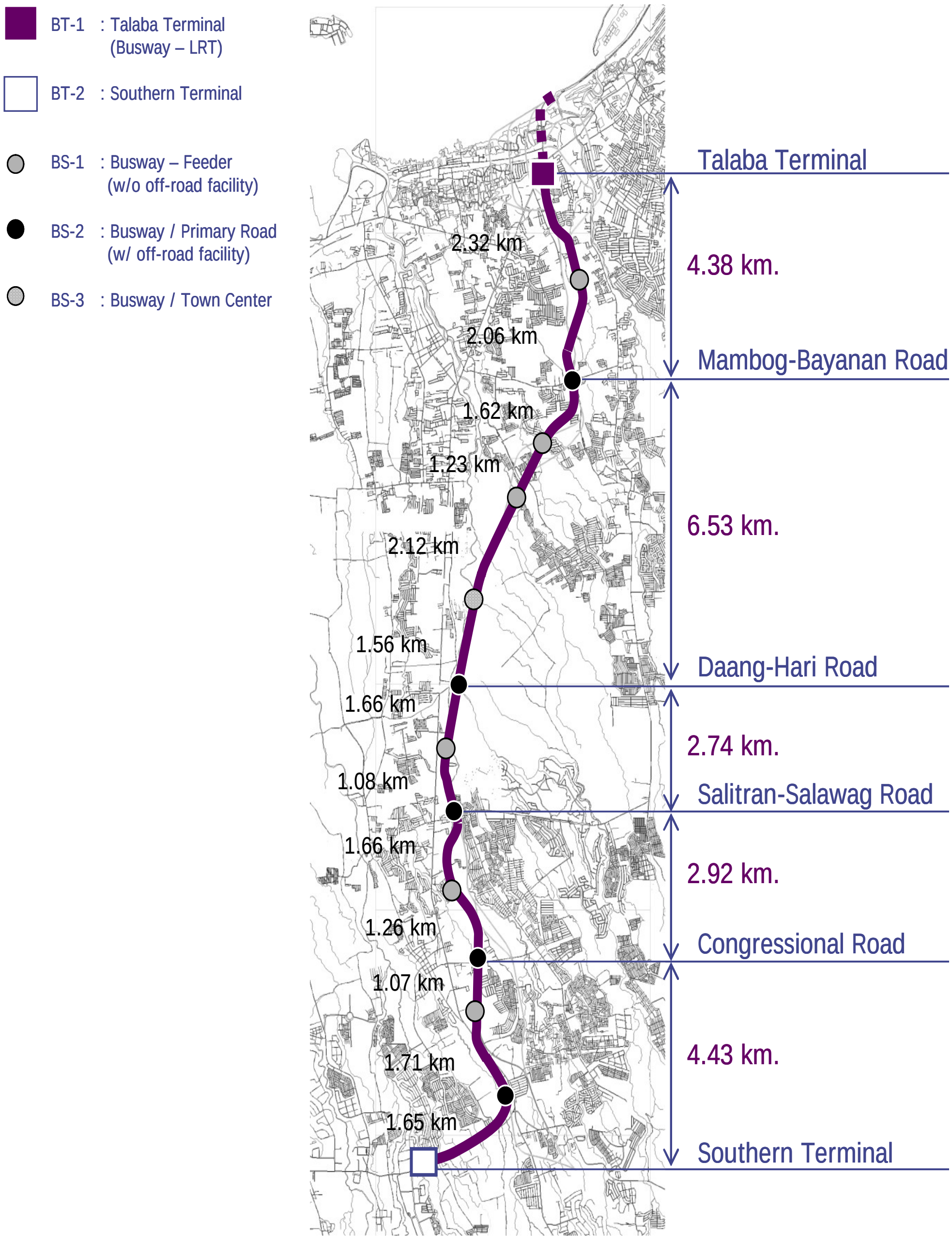
a. Talaba (Northern Terminal): Smooth transfer facilities should be prepared not only between this terminal and LRT 1 Extension but also between this terminal and intercity buses.

b. Southern Terminal: Many transfer passengers can be expected not only from the public transport modes but also from private cars at this terminal. Therefore, convenient car parking facilities could help to further increase patronage of the busway

Typical bus stop spacing based on prevailing practices range from approximately 300m (CBD) to 500m (suburban and rural area). While the proposed busway project will have to provide a high level of service in terms of travel speed of buses, a distance longer than the above-mentioned range should be considered in deciding the proper bus stop spacing. Based on the above discussion, the intersected roads and the land use, a 1 to 2-km bus stop spacing can be adopted in this study. Incidentally, average station spacing of existing LRTs is approximately 0.8km (LRT 1) to 1.5km (MRT/LRT 3).

Actual location of the proposed terminals and bus stops will be identified based upon the existing and future road network, as well as expected land use along the busway corridor. Figure 5.18 shows the proposed terminals and bus stops.

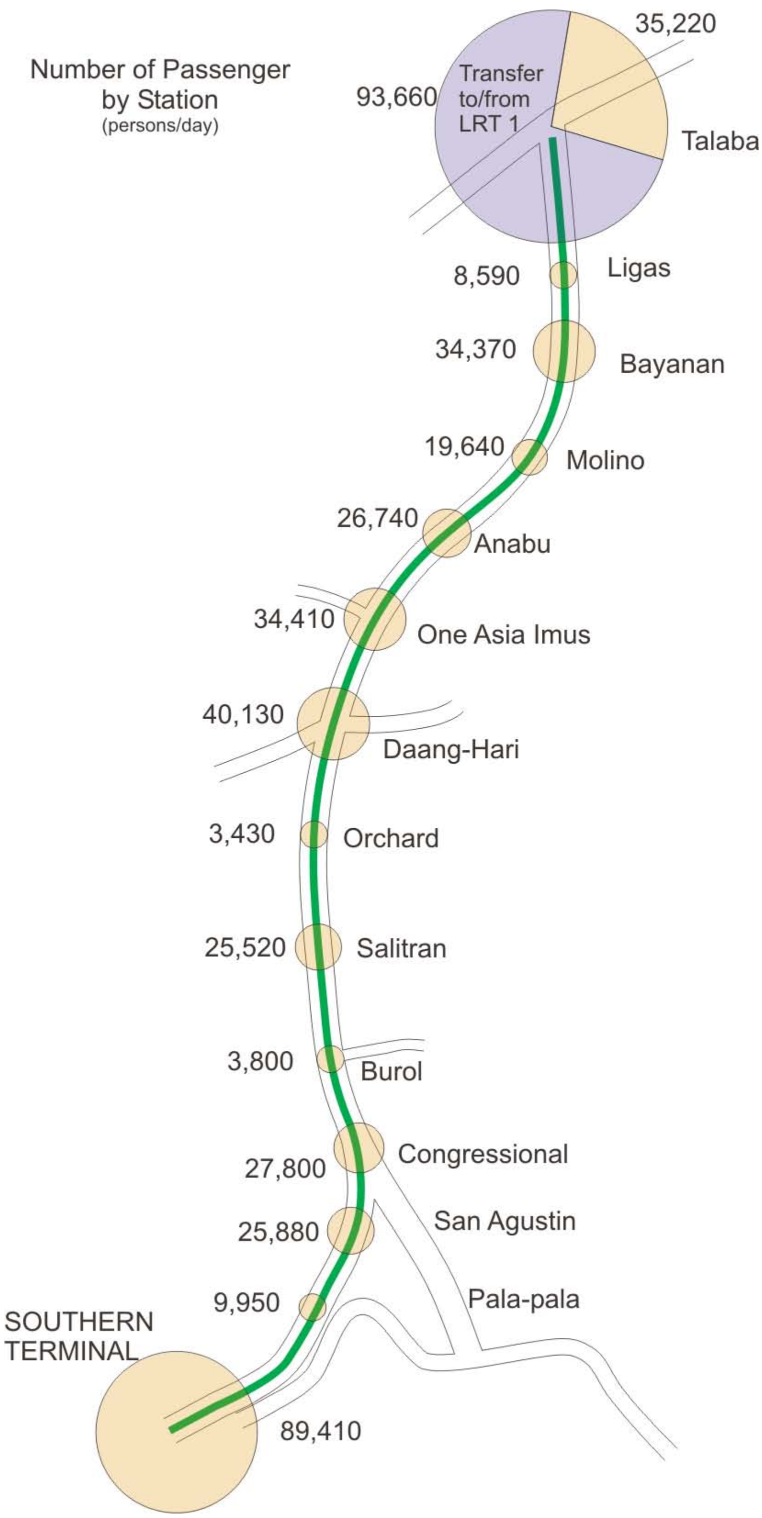
Figure 5.18 Bus Stop Spacing along the Busway



5.4.2 Passenger Demand

Number of daily boarding/alighting passengers in 2015 on the 2010 network by terminal/stop and modal share are summarized in Figure 5.15.

Figure 5.19 Busway Passenger Demand by Bus Terminal and by Bus Stop in Year 2015



5.4.3 Type of Bus Terminal and Bus Stops

Two (2) types of bus terminals and three (3) types of bus stops are identified as shown in Figures 5.18, with the conceptual designs illustrated in Figures 5.20 to 5.22 based on the following description:

a. Bus Terminal

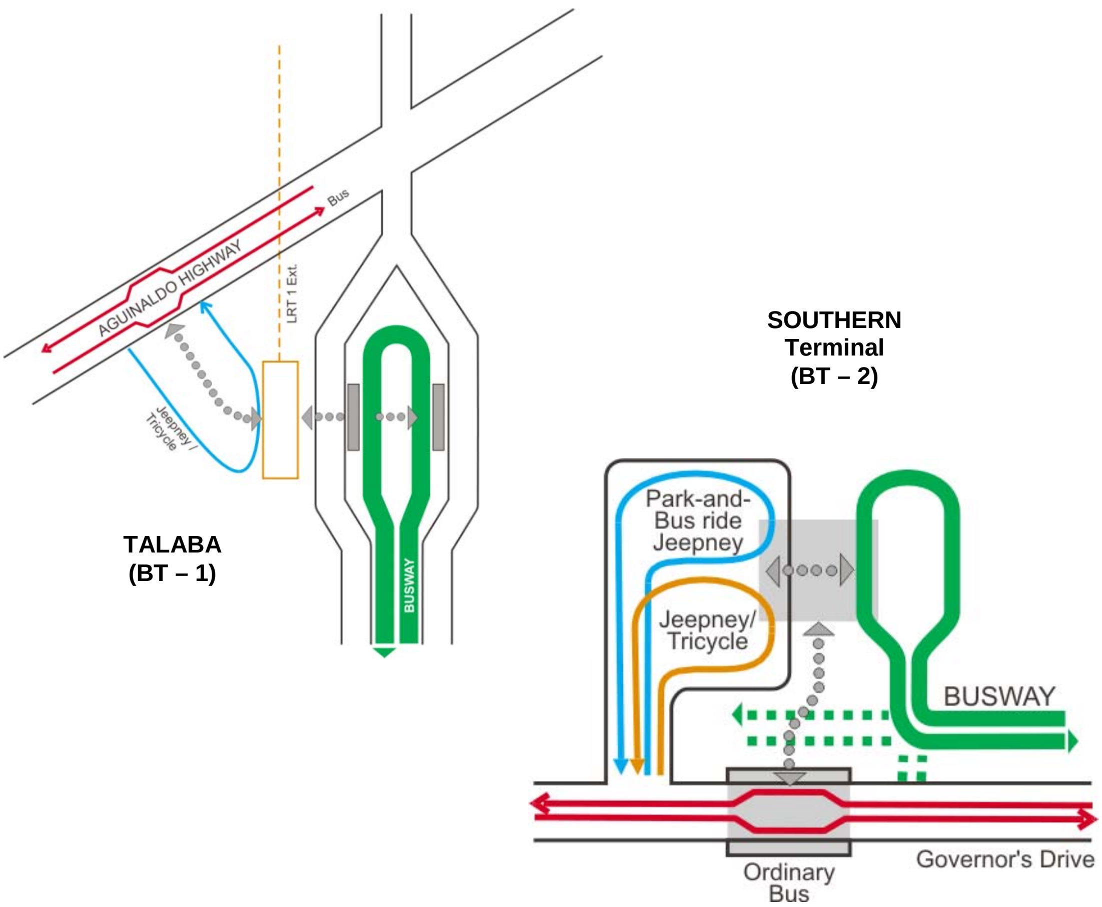
1. BT-1

This terminal is located at the northern end of the busway corridor, which will connect to the LRT Line 1 in the near future. It is expected that there will be many transfer passengers between the busway and LRT; therefore, smooth transfer between the two modes is necessary. This need also applies to one of the bus terminals in the suburban area in Metro Manila.

2. BT-2

This terminal is located at the southern end of the busway corridor and is b. expected to generate transfer passengers not only between busway and public transport modes, such as the bus and jeepney, but also those of private cars. Therefore, it is necessary to develop this terminal as a multi-modal interchange.

Figure 5.20 Conceptual Design of Bus Terminals

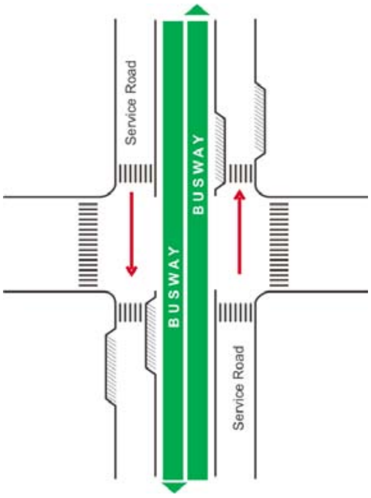


b. Bus Stop

1. BS-1

This type of bus stop connects a small feeder road such as a barangay road and subdivision road. Users' main access therefore to the busway is by walking or by tricycle. This type of bus stop satisfies the minimum modal interchange facility. Therefore, an off-road bus stop plaza is not developed for this type of bus stop.

Figure 5.21 Conceptual Design of Bus Stops (BS-1)



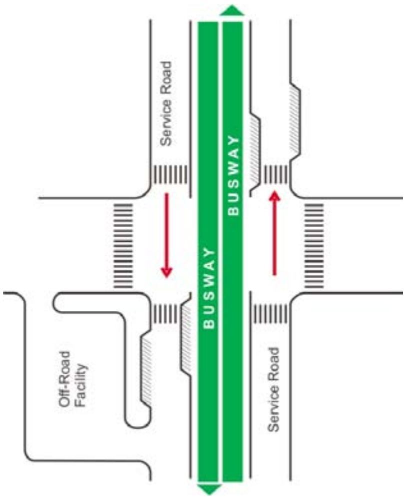
2. BS-2

This type of bus stop is located mainly at an intersection with primary/secondary road. Based on the feeder public transport system along the busway, the jeepney, which is allowed to operate not only on primary roads but also on secondary roads, is the most convenient feeder mode to the busway. Therefore, jeepney loading/unloading facilities are most important in this type of bus stop. Ordinary bus stop provides only along primary roads.

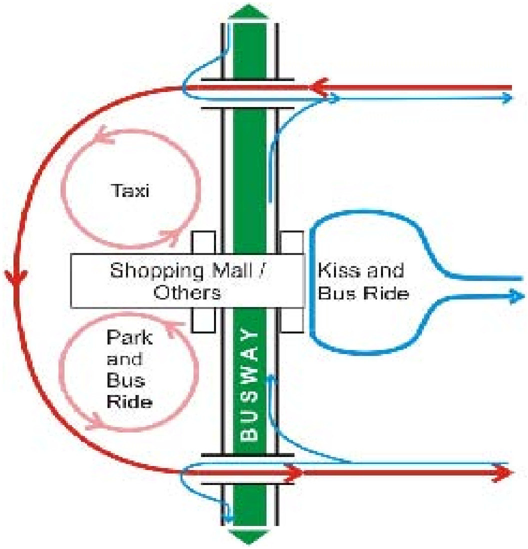
3. BS-3

This is a new type of bus stop located in a large-scale mixed-use property development. Therefore, it is necessary to develop the bus stop in conformity with the property development concept. It is possible to develop not only modal interchange facilities, such as bus loading/unloading bay, taxi stand and car park for park-and-bus ride, but also a town center and/or a shopping mall.

Figure 5.22 Conceptual Design of Bus Stops (BS-2 and 3)



BS-2



BS-3

5.4.4 Facility Requirement

(1) Basic Considerations

a. The number of daily passengers in Talaba, the Northern Terminal, is the largest (128,880 passengers/day, including 93,660 transfer passengers between LRT) among busway terminals and bus stops. However, this terminal is located in a built-up area in Cavite. Therefore, only transport functions are developed in this terminal due to the limited area. Coordination should be carefully considered with LRT authorities (BT-1).

b. Many large-scale developments such as Solar, SM, Robinson and others are ongoing in the surrounded area at Aguinaldo Highway/Governor's Drive intersection. Therefore, it is expected to grow as the regional center in Dasmarinas in the future. Meanwhile, nearby is the Southern Terminal whose transport functions are developed but not the urban functions, even though this terminal has the second largest number of daily passengers, which is 89,410 among terminals/stops (BT-2).

c. An off-road bus stop plaza is not developed for bus stops with less than 20,000 passengers per day (BS-1).

d. OneAsia Imus bus stop should be developed as a unique multi-functional mode interchange area because this bus stop is located in the large-scale suburban development. A shopping mall, a park-and-bus-ride parking area, a taxi pool and jeepney/tricycle pool in the town center can be considered as the development facilities (BS-3).

e. Other bus stops are developed with not only transport functions but also with kiosks attached to the administrative office (BS-2).

f. Most of the busway passengers are public transport users. However, the taxi loading/unloading, taxi pool and park-and-bus-ride parking area are developed in the terminal/bus stop for the convenience of private car users, considering the land use and road network around the terminal/bus stop. Taking this in consideration, a 50-slot, park-and-bus-ride parking areas are provided for One Asia Imus bus stop (BS-3) and the Southern Terminal (BT-2).

(2) Formula for Facility Requirement

Based on the "Konami Formula," the formula used to calculate the facility requirement in the station plazas of rail transit in Japan, the "Cavite Busway System Formula" for estimation of the facility requirement of bus stop plaza of feeder modes to/from busway is developed as follows:

BS=BSP+BSB+BSJ+BST+BSR+BSC+BSA+BSL

Where: BS: Space requirement of bus stop plaza (sq. m.)

BSP: Space requirement for pedestrian (sq. m.)
BSP=(P/(S*V))*LP
Where: P: Number of pedestrians (persons/sec.)
S: Average pedestrian density (persons/sq. m.), usually, S=1.2 persons/sq. m.
V: Average walking speed (m./sec.), usually, V=1.1 m./sec.
LP: Average walking distance (m.)

Assuming that S=1.2 persons/sq. m. and V=1.1 m./sec., BSP is presented as follows:

BSP=0.76P*LP
BSB: Space requirement for bus (sq. m.) *This is feeder bus.
BSB=(NB/40+NB/20)*45+(0.76*(40NB/3,600)*LP)+((NB/20)*13) +600
Where: NB: Peak hour number of arriving/departing buses

First item shows the required space of bus berths. Unloading time at unloading berth is 1.5 min. and loading time is 3 min. Required unit bus berth is 45 sq. m./bus.

Second item shows the walking space for unloading passengers. Number of passengers/bus is assumed to be 40.

Third item shows the waiting space for loading passengers. Required unit space is 0.33 sq. m./person*40passengers/bus=13 sq. m./bus

Fourth item shows the access carriageway of bus, 600 sq. m. (=width 6m*length 100 m.)

BSJ: Space requirement for jeepney (sq. m.)

BSJ=(NJ/60+NJ/30)*30+(0.76*(10NJ/3,600)*LP)+((NJ/30)*3.3)+NJ/6*30+600

Where: NJ: Peak hour number of arriving/departing jeepneys

First item shows the required space of jeepney berths. Unloading time at unloading berth is 1 min. and loading time is 2 min. Required unit jeepney berth is 30 sq. m./jeepney.

Second item shows the walking space for unloading passengers. Number of passengers/jeepney is assumed to be 10.

Third item shows the waiting space for loading passengers. Required unit space is 0.33 sq. m./person*10passengers/jeepney=3.3 sq. m./jeepney

Fourth item shows the required space of jeepney pool.

Fifth item shows the access/egress carriageway of jeepney, 600 sq. m. (=width 6m*length 100 m.), if there is no bus facility that the jeepney can use as well.

BST: Space requirement for taxi (sq. m.)

BST=(T/600/20)*20*2+20*T+600

Where: T: Peak 10-min. incoming taxi traffic (= number of parking taxis)

First item shows the required space for taxi loading/unloading. Unit space assumes 20 sq. m./taxi and loading/unloading time is 20 seconds.

Second item shows the required space of taxi pool. It is assumed that the parking taxi in the taxi pool is equal to the peak 10-min. incoming taxi traffic.

Third item shows the access/egress carriageway of taxi, 600 sq. m. (=width 6m*length 100 m.)

BSR: Space requirement for tricycle (sq. m.)

BSR=5*R

Where: R: Peak 10-min. incoming tricycle traffic (= number of parking tricycles)

Unit space assumes 5 sq. m./tricycle

BSC: Space requirement for private car (sq. m.)

BSC=(NC/(600/10))*20+(NC/2)*0.5*35

Where: NC: Peak 10-min. incoming busway passenger traffic by private car (person/10 min.)
First item shows the required space for private car loading/unloading. Unit space assumes 20 sq. m./private car and loading/unloading time is 10 seconds.

Second item shows the required space of park-and-bus ride parking. It is assumed that the 50% of incoming private cars use parking space.

BSA: Space requirement for public use (sq. m.)
BSA=0.2-1.0*(BSP+BSB+BSJ+BST+BSR+BSC)
This depends upon the bus stop type.

BSL: Space requirement for landscaping (sq. m.)
BSL=0.5*(BSP+BSB+BSJ+BST+BSR+BSC+BSA)

(3) Facility Requirement

Following the “Cavite Busway System Formula” presented above, the calculation is made by bus stop. Assessment is then made from the viewpoint of geometric design. A summary of results by bus terminal and by bus stop is given in Table 5.13.

Table 5.13 Summary of Proposed Bus Terminals and Bus Stops by Type

Station Number	Name of Station *1	Location of Bus Terminal/ Bus Stop	Distance between Bus Terminals/ Bus Stops	Type of Bus Terminal/ Bus Stop *2	Number of Platforms *3	Type of Service		Future Land Use	Function of busway service road	Connected Road with road width (m)	No. of Passengers in 2015 (2010 net) (persons/day)	Area (sq. m.)	Related Facilities	Mode Interchange Pattern						Development Concept of Bus Terminal/Stop Area
						Ordinary	Express							LRT	Bus	Jeepney	Tricycle	Taxi	Private Car	
1	Talaba	0		BT-1	4	○	○	Commercial/ Residential		LRT/ Aguinaldo Highway (25.0)	*4 128,880	3,500	Kiosk	○	○	○	○	○	○	Minimize the terminal area because the terminal is located in the built-up area
2	Ligas	2,315	2,315	BS-1	2	○		Residential	Inter-urban trunk road	Subdivision Road Ext. (20.0)	8,590	0				○	○	○	○	
3	Bayanan	4,376	2,061	BS-2	2	○		Residential		Manbog-Bayanan Road (15.0)	34,370	3,480	Kiosk			○	○	○	○	Medium-scale bus stop intersected with secondary roads
4	Molino	5,994	1,618	BS-1	2	○		Residential		Subdivision Road (10.0)	19,640	0				○	○	○	○	
5	Anabu	7,230	1,236	BS-2	2	○		Residential		Subdivision Road (15.0)	26,740	3,000	Kiosk			○	○	○	○	
6	OneAsia Imus	9,350	2,120	BS-3	4	○	○	Residential	Secondary road	Subdivision Road (25.0)	34,410	5,800	Shopping Mall/ Branch of LGU/ Public Open Space/ Others			○	*5 (○)	○	*6 ◎	New type of modal interchange with urban center
7	Daang-Hari	10,911	1,561	BS-2	2	○		Residential		Daang-Hari Rd. Extension (40.0)	40,130	3,280	Kiosk		○	○	○	○	○	Busway stop intersected with ordinary bus routes along primary road
8	Orchard	12,570	1,659	BS-1	2	○		Residential		Subdivision Road (15.0)	3,430	0				○	○	○	○	
9	Salitran	13,653	1,083	BS-2	2	○		Residential		Salitran-Salawag Road (25.0)	25,520	2,990	Kiosk			○	○	○	○	
10	Burol	15,310	1,657	BS-1	2	○		Residential		Subdivision Road (15.0)	3,800	0				○	○	○	○	
11	Congressional	16,573	1,263	BS-2	2	○	○	Residential	Service road of busway	Congressional Road (20.0)	27,800	3,090	Kiosk			○	○	○	○	New type of bus stop to cater to the subdivisions
12	San Augstin	17,640	1,067	BS-2	2	○		Commercial/ Residential		Subdivision Road/ Aguinaldo HWY (25.0)	25,880	3,140	Kiosk			○	○	○	○	
13	Pala-pala	19,350	1,710	BS-1	2	○		Commercial/ Residential	Busway only	Aguinaldo HWY (25.0)	9,950	0			○	○	○	○	○	
14	Southern Terminal	21,000	1,650	BT-2	4	○	○	Commercial/ Residential		Governor's Drive (25.0)	89,410	22,100	Kiosk		○	○	○	○	*6 ◎	Multi-modal interchange in the newly developed subcenter in Dasmarinas

Note: Average distance between stops is approximately 1,615 m.
*1: Based on the barangay name
*2: Legend of Bus Terminal/Stop Type

BT-1 Bus Terminal Type 1	LRT - Busway (Talaba: Northern Terminal)	BS-1 Bus Stop Type 1	Busway bus stop only
BT-2 Bus Terminal Type 2	Busway Terminal (Southern Terminal)	BS-2 Bus Stop Type 2	Busway bus stop with off-road plaza
		BS-3 Bus Stop Type 4	Busway in the town center

*3: Number of platforms include both directions. Platform length is 60 m and width is 3.0m
*4: Including 93,660 transfer passengers to/from LRT 1
*5: Depend on the discussion with developer/land owner
*6: Park-and-bus ride (others are kiss-and-bus ride)

5.4.5 Layout Plans

Based on the above-mentioned preconditions, basic considerations, and the summary of facility requirement by busway terminals/bus stops, the layout plan for the busway terminals/bus stops are designed and each detailed layout plan are attached in the Drawing Volume of this Report. The conceptual terminal layout plans are shown in the Preface as well as in Section 5.6. Here, typical layout and sketches for the typical bus stops are presented.

Figure 5.23 Typical Lay-out Plan for Bus Stops

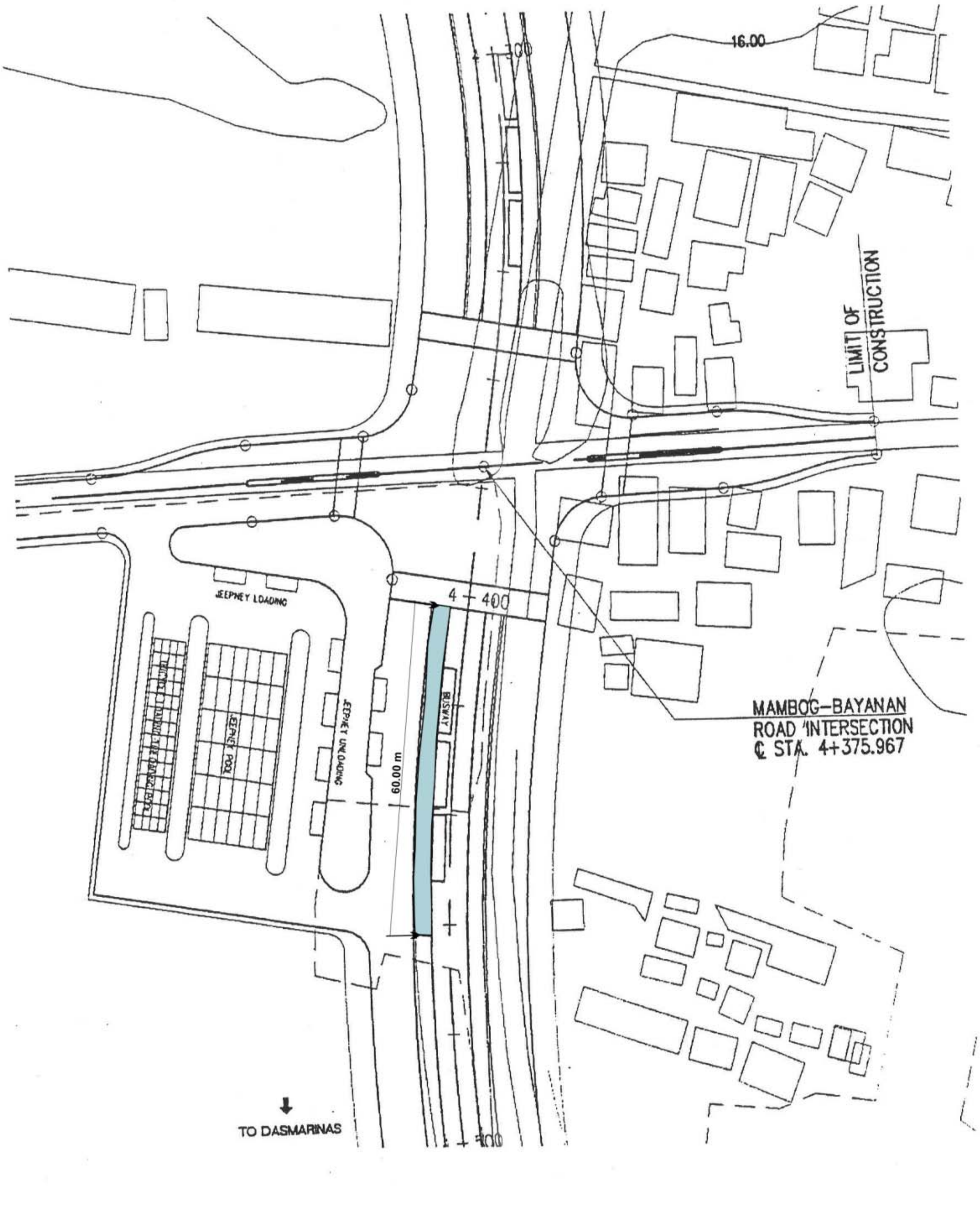


Figure 5.24 Sketch Layout for Typical Bus Stops

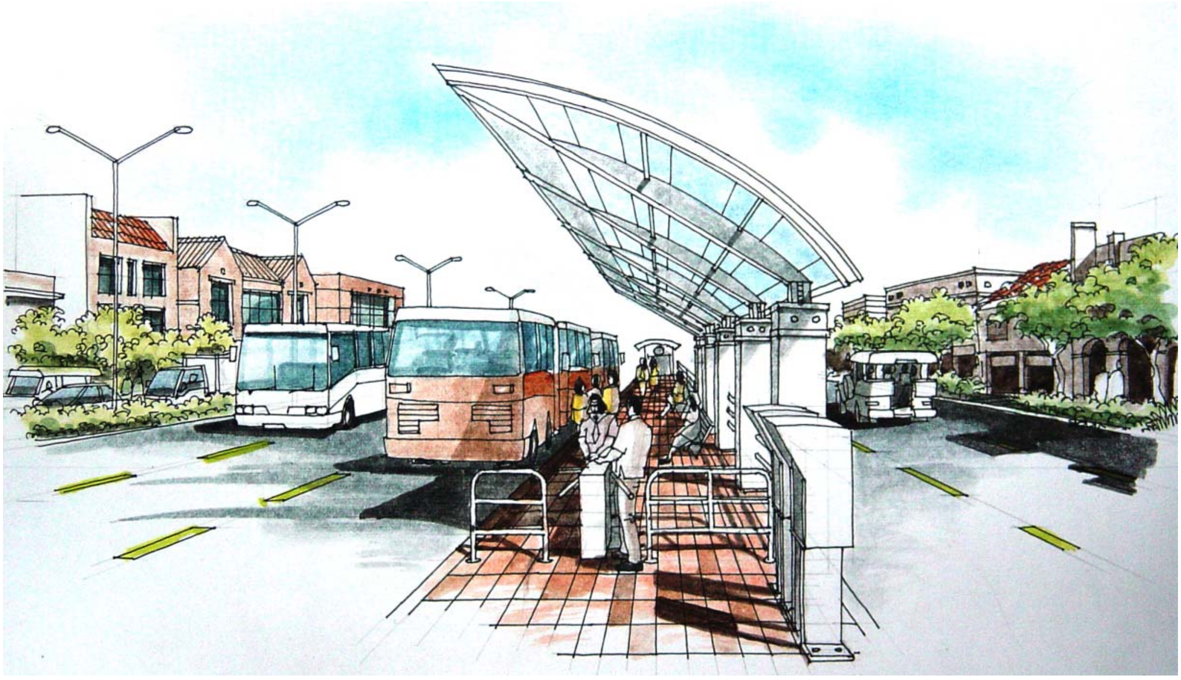
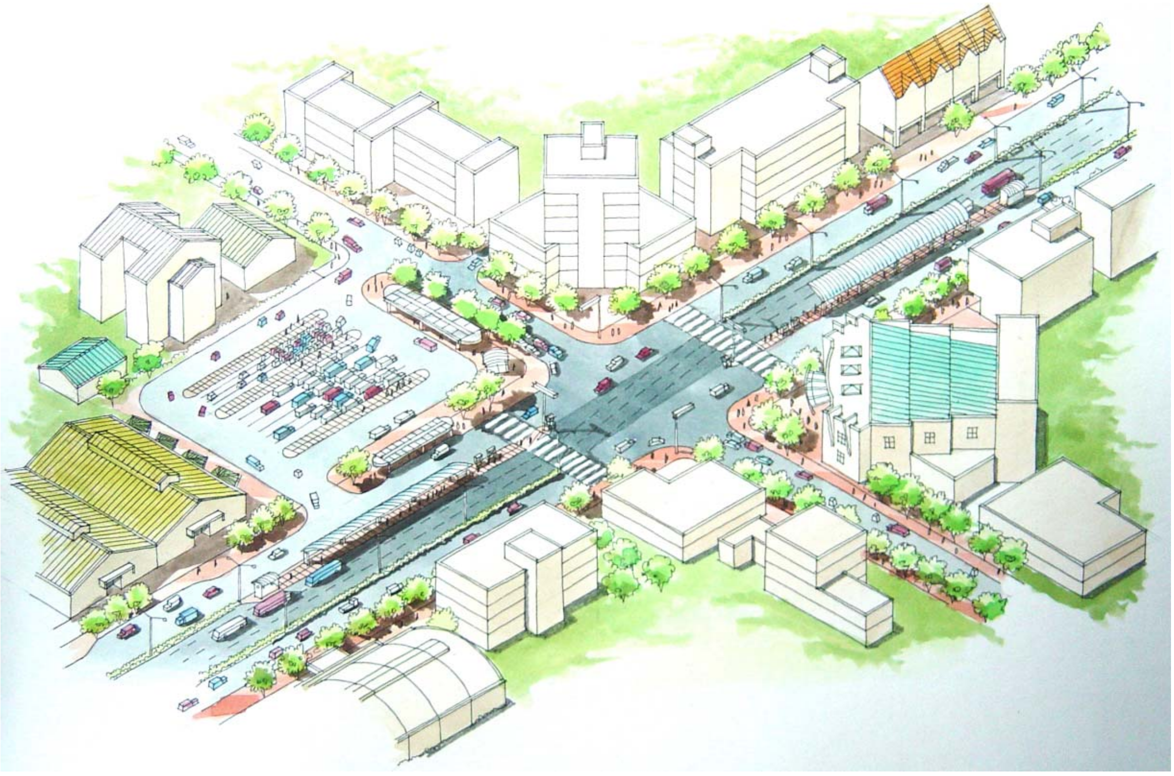


Figure 5.25 Sketch Layout of Typical Bus Stop Area



5.5 Secondary Road Network and Busway Feeder System

5.5.1 Secondary Road Network

As presented in Chapter 3, the road system in the Study area has not been developed sufficiently, particularly from the network configuration viewpoint. Lack of the proper road network system has been causing a sprawl type of urbanization in the areas. Most of the existing subdivision developments have provided a limited ingress/egress from/to the existing road, regardless of the function and physical condition of the existing roads, which subsequently have not only deteriorated accessibility but also induced traffic congestion on the existing roads.

Urban road network system based on the functional classification is sometimes referred to the AASHTO, as shown in Figure 5.26. The spacing of minor arterial streets, a system which forms a residential neighborhood, commercial, and industrial areas, may vary from 0.2 to 0.8 km in the central business district to 3 to 5 km in the suburban fringes. It is normally not more than 1 km in fully developed areas. A proposed typical cross-section for secondary road network is shown in Figure 5.27.

Figure 5.26 Schematic Road Network in Urban Areas

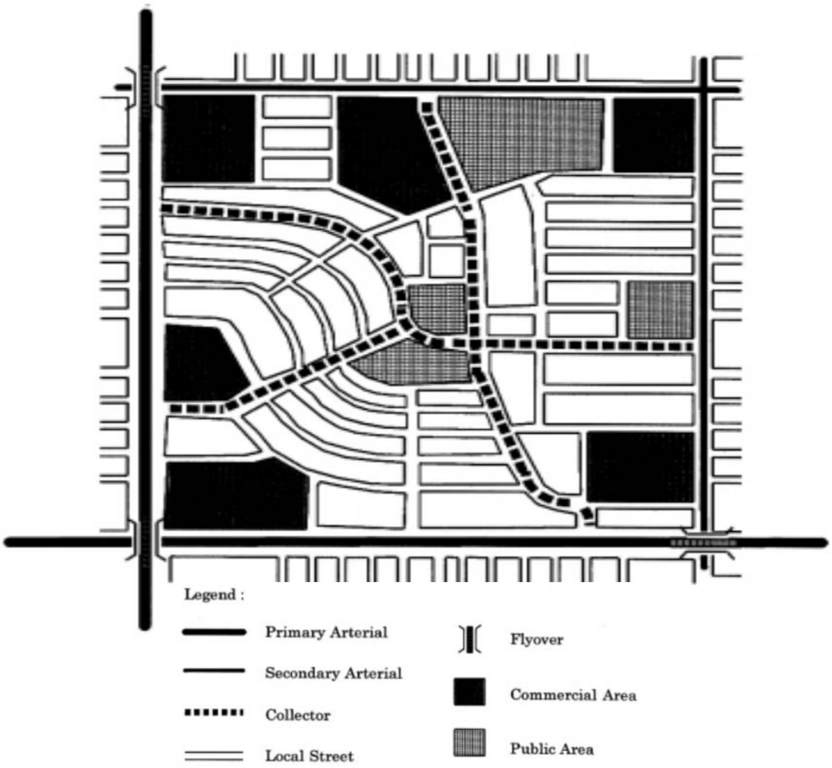
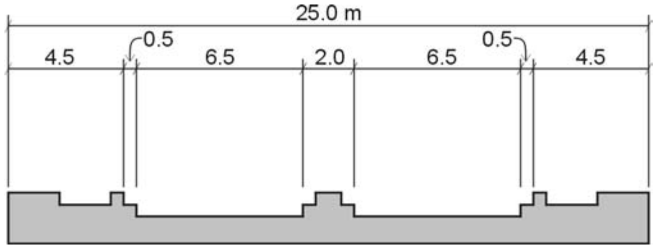
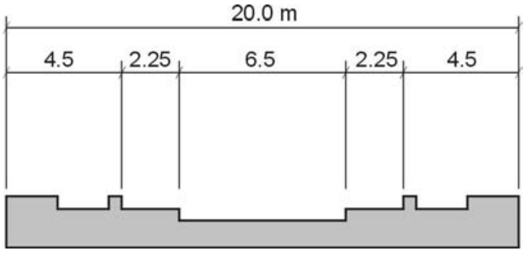


Figure 5.27 Typical Cross-section for Secondary Road



4 lanes



2 lanes

Secondary road network system for the Study area is examined based on the concept of the urban road systems and existing road conditions. The proposed secondary road network in the Study area is shown in Figure 5.28. Outline of the network system for each municipality is discussed below.

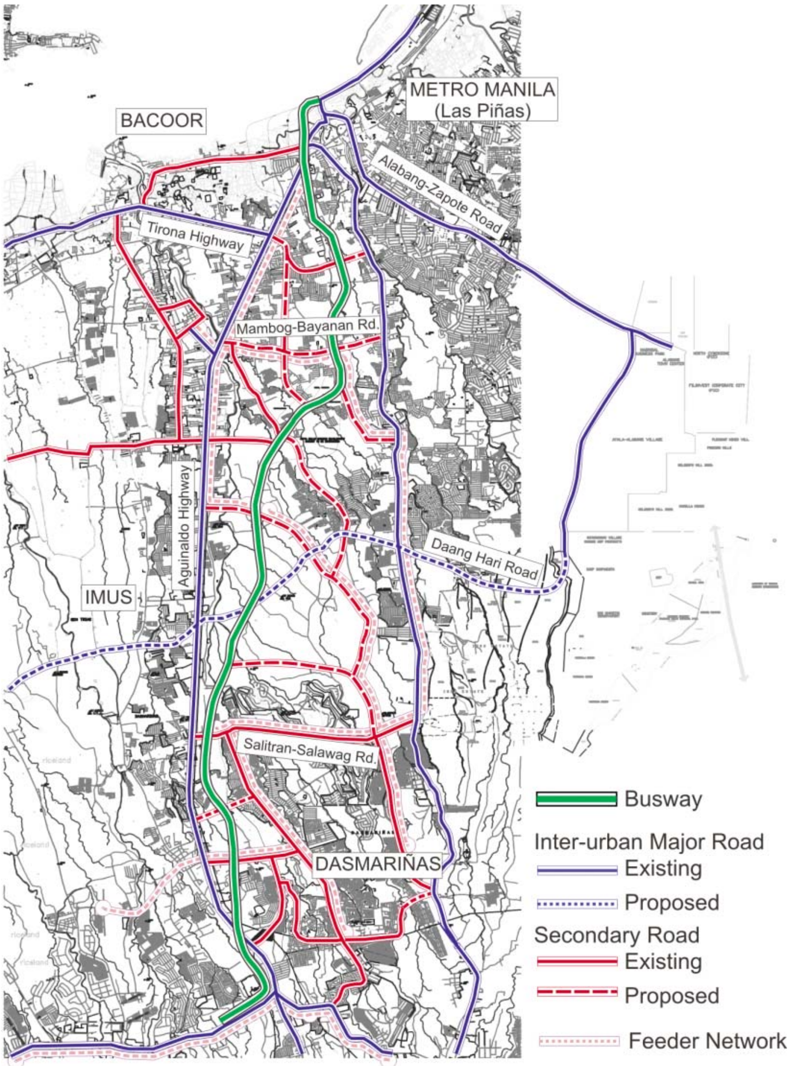
(1) Bacoor

There is at present one east-west road, Mambog-Bayanan Road, which connects Aguinaldo Highway and Molino Road, with no secondary road running north to south. The proposed busway will be running north to south between the two inter-provincial roads. Based on the existing conditions and desirable spacing, two east-west secondary roads are proposed. One is an extension from Tirona Highway to Molino Road, the other is a new road running parallel to Mambog-Bayanan Road. Existing Mambog-Bayanan Road will be constrained to widen to sufficient ROW due to the existing houses in line facing the narrow existing road. In addition, linkages connecting the two proposed east-west secondary roads, which will be running parallel to the busway on both sides, will help to form a more desirable grid pattern network configuration.

(2) Imus

Most of the alignment of the busway corridor in Imus will be traversing the One-Asia property. There is at present no network configuration with any secondary road. One barangay road, namely Anabu Road, is running diagonally from NNW to SSE. There is also one access road from Aguinaldo Highway to Citta Italia which is under construction as of February 2002. A new inter-provincial road development project, which is one of the major east-west corridor development projects in Cavite Province, is planned passing through east to west in the center of this area.

Figure 5.28 Proposed Secondary and Feeder Road Network in the Study Area



Road network system will be formed taking into account the One-Asia development plan. However, it is significant that the road network in the development area should coordinate other primary and secondary road network, including proper access to the proposed bus stops.

(3) Dasmariñas

There are dense subdivision developments in the Salitran-Salawag Road to Governor's Drive area that also includes a huge resettlement area particularly along Congressional Avenue. Due to the topographic condition, the development distribution are divided by valleys flowing from south to north, so that access roads to those areas are very limited from major roads such as Aguinaldo Highway and Molino Boulevard. However, some main roads inside of the subdivision developments have a sufficient ROW, so that a secondary road network for this area may be developed to provide effective connections between the existing facilities.

The proposed busway will pass through the narrow area between Aguinaldo Highway and river valley. To enhance the accessibility to the busway from the existing large residential area, some access roads to the bus stops should be provided crossing the valleys.

5.5.2 Busway Feeder System

In order to encourage the usage of the proposed busway system, it is important to provide a better access for each respective bus terminal or bus stop from the residential areas or from the workplace. Access modes from bus terminals/stops to residential/workplace vary depending on the distance. Such access modes are feeder bus, jeepney and tricycle. For shorter distances, people usually walk but for longer distances, people may ride a tricycle, jeepney or other mode of transport. Some users may have a private arrangement from the stations. Therefore, the feeder system can be determined from the following two systems:

(1) Public Transport System

Considering the proposed busway system, future road network and existing public transport route structure, the following ideas of public transport system along busway corridor can be adopted:

a. Provincial bus

Route structure of provincial bus remains as it is. Because the provincial bus has routes along intercity primary roads, such as Aguinaldo Highway and Governor’s Drive, and the future intercity primary road network is the same structure as existing network. This means that the provincial bus can access two terminals located along Aguinaldo Highway and Governor’s Drive.

b. City bus

Basically, functional bus service is on the multi-lane road (4-lane and more). Based on the future road network along busway corridor, primary roads consist of Aguinaldo Highway, Governor’s Drive and Daang – Hari Road. Therefore, these are the candidates of city bus routes.

c. Jeepney

This is most convenient feeder public transport system in the Philippines. Therefore, convenient rerouting of jeepney is necessary even on the busway corridor. Jeepney routes may be allowed along primary and secondary roads, such as Aguinaldo Highway, Niog Road, Manbog - Bayanan Road, Daang - Hari Road, Salitran - Salawag Road, Congressional Road and Governor’s Drive. And jeepney operation can be permitted on part of service road along busway.

d. Tricycle

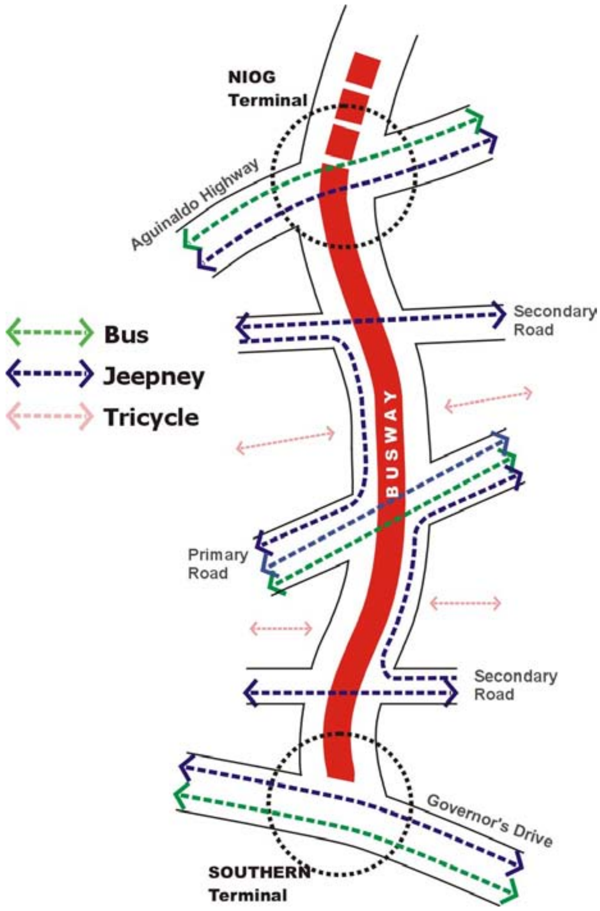
Tricycle operation may be allowed only on small roads such as barangay roads.

e. Taxi

Taxis can serve any bus terminals and bus stops located on roads of more than 2 lanes and it is necessary to provide a taxi pool for the bus terminals and major bus stops.

Conceptual public transport feeder system along busway corridor is shown in Figure 5. 29.

Figure 5.29 Public Transport Feeder System along the Busway Corridor



(2) Private car

Considering the busway passenger demand and its characteristics, and improvement for smooth transfer from the private car users, it is necessary to provide convenient car parking facilities at each bus terminal and bus stop, such as park-and-bus ride and kiss-and-bus ride facilities. These systems could also greatly contribute to reducing traffic congestion in and around the CBD in Manila, because if these systems function properly, private cars entering the CBD can be reduced.

a. Park-and-bus ride

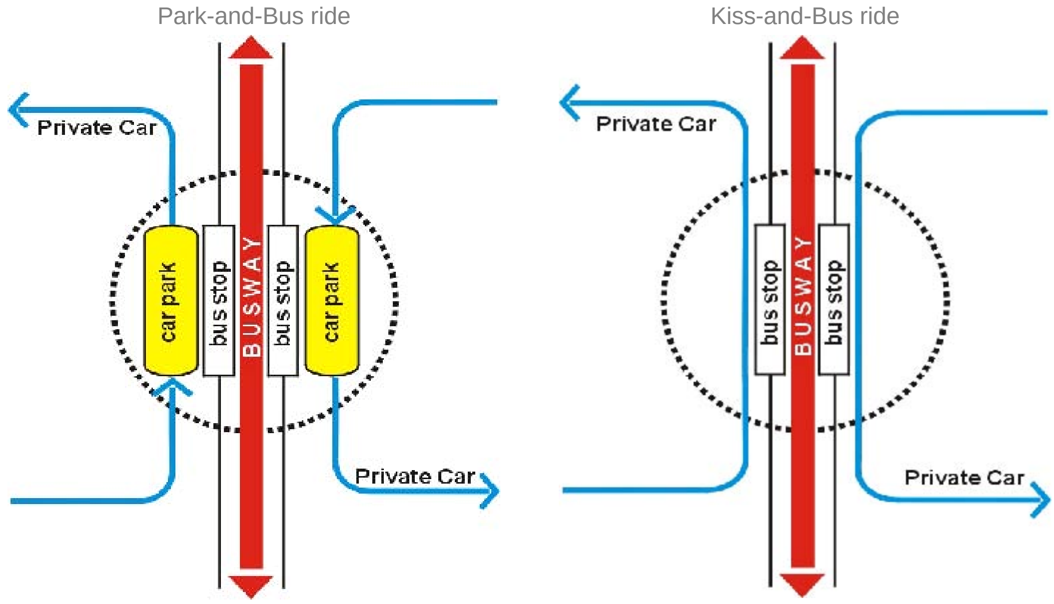
Busway passenger and private car driver are the same person. So, the driver has to find a parking space, park, get off, and walk to the busway stop. Therefore, facilities of park-and-bus ride, such as off-road parking space could be prepared at the Southern Terminal and near the major bus stop at the intersected primary road or at the town center in the large-scale newly developed subdivision.

b. Kiss-and-bus ride

This system involves passengers driven to busway stops by private cars. Minor facilities such as a private car loading/unloading bay are required. Off-road parking space is not necessary for this concept.

Concept of park-and-bus ride and kiss-and-bus ride is shown in Figure 5.30.

Figure 5.30 Park-and-Bus Ride and Kiss-and-Bus Ride



5.5.3 Intersection and Interchange Plan

The proposed busway will cross several primary, secondary and even local roads from the Coastal Expressway in Bacoor to Governor's Drive in Dasmariñas. Whether these intersections will be at-grade or grade-separated will be dependent on not only traffic demand but also function of the roads being intersected. Table 5.14 shows a guideline for the selection of the type of intersection based on the functional classification of the road network. This guideline referred to the Japanese Road Design Standard as well as AASHTO and was prepared during the MMUTIS.

Table 5.14 Guideline for the Selection of Intersection Type

	Primary	Secondary	Collector	Local
Primary	GS-N	GS-D	RT-D	RT-N
Secondary		AI-N	AI-N	RT-D
Collector			AI-N	AI-D
Local				AI-N

Note:
GS: Grade Separation
AI: At-Grade Intersection
RT: Right Turn Only
N: Necessary
D: Desirable
Source : MMUTIS

Intersection planning on the proposed busway will basically refer to the Guideline. However, two aspects of the busway, the bus exclusive lane and the secondary road, should be examined carefully on each crossing point. The Guideline may be used for planning of the secondary road, while planning for the bus exclusive lane may require higher standard of intersection facilities to provide a better bus transport services such as travel speed, comfort and such other factors. In addition, design of the busway at intersections should be coordinated with the design of the proposed bus terminal/bus stop and future extension of the LRT system on the proposed busway.

Based on the features of the proposed project, the following planning policies are prepared for the selection of the intersection type.

(1) Strategically, the proposed bus transport system shall be the first stage for an efficient public transport corridor in the study area. In the long-term, this corridor can be transformed into an LRT system with higher capacity and service level to serve the projected increase in transport demand. The busway has advantages over the LRT system such as its less complicated system and structures and less investment cost, among others. Given these advantages and the busway development policies, the investment cost for busway should be as economical as possible for faster implementation. Taking these factors into consideration in the design of intersections, therefore, at-grade intersections with signal control will be used as the basic type of intersection for the proposed project.

(2) However, under the following conditions, grade separation structures will be advantageous:

- At intersections where serious traffic congestions due to the large traffic demand is estimated in the initial stage of the bus operation.
- At intersections with regional primary road system. In this case, the requirement of the grade-separation will be for the primary road

function. Therefore it is proposed that the cost will be borne by a primary road project.

(3) A signal system that will prioritize bus traffic shall be installed at at-grade intersections.

(4) Crossing of bus exclusive lanes shall not be allowed at some local and subdivision roads. Instead, only right turns to the service road shall be allowed.

(5) Crossing of the busway will be controlled due to the bus exclusive lane in the center of the busway. U-turn facilities will be provided within an appropriate interval (1km to 2km) for the roadside landuse, unless alternative routes are available.

(6) For sections passing through planned large-scale development areas, roads connecting to the busway and their type of intersections will be coordinated with the respective developers. Grade-separation will be advantageous for intersections with their main roads, with cost of the construction proposed to be borne by the developers.

(7) Design of the intersections, for both at-grade and grade-separated intersections, particularly for structures and alignments, should consider the future LRT extension using the busway facility.

(8) In addition, GOP/busway LGUs should provide traffic enforcers at intersections to manage traffic flow and to avoid the ordinary traffic from entering into the bus lane.

The proposed type of intersection and the typical at-grade intersection are shown in Figures 5.31 and 5.32. The traffic circulation system on related road network is prepared as shown in Figure 5.33.

Figure 5.31 Location of the Proposed Intersections

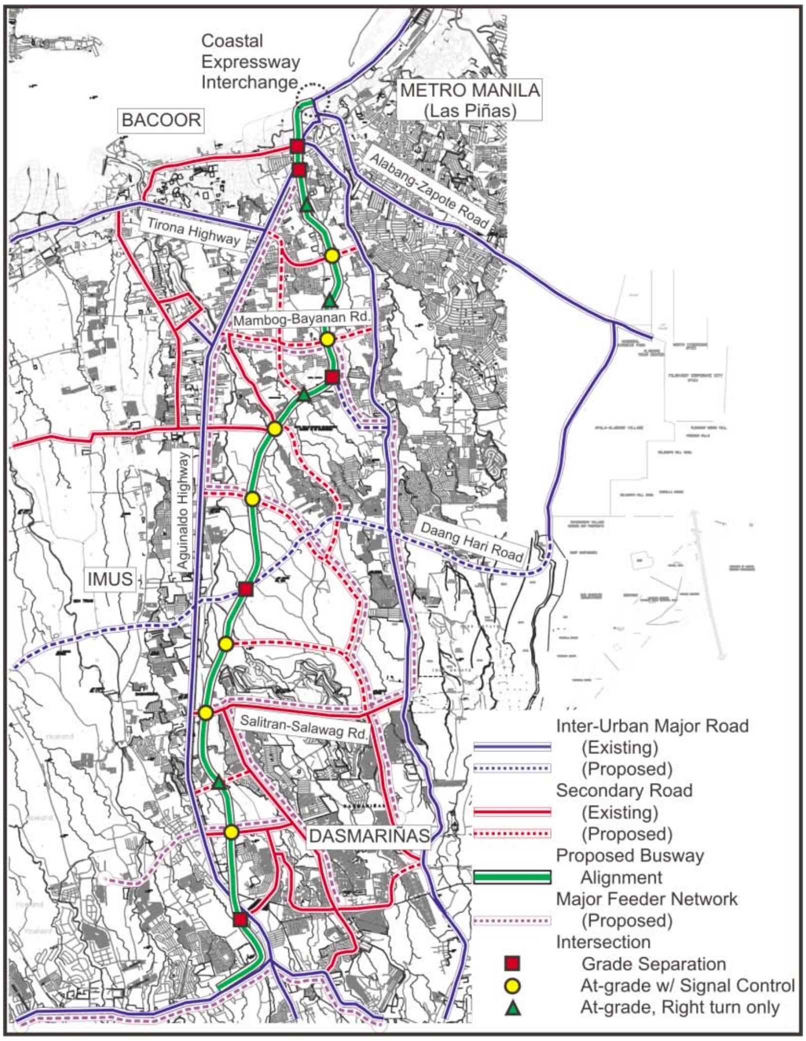


Figure 5.32 Typical At-Grade Intersection Design

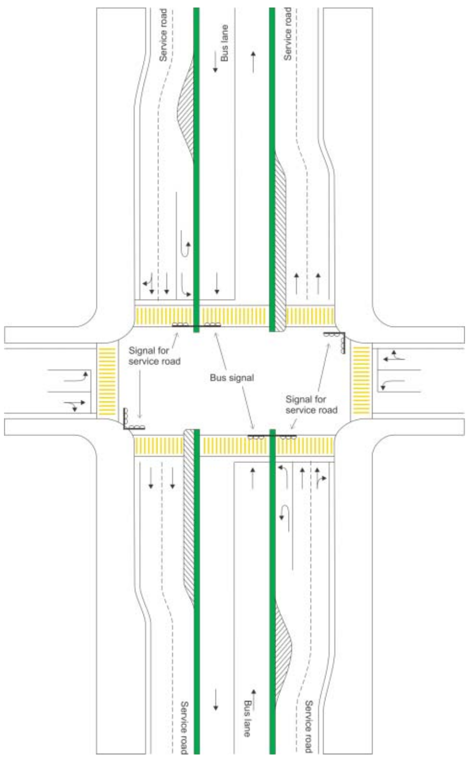
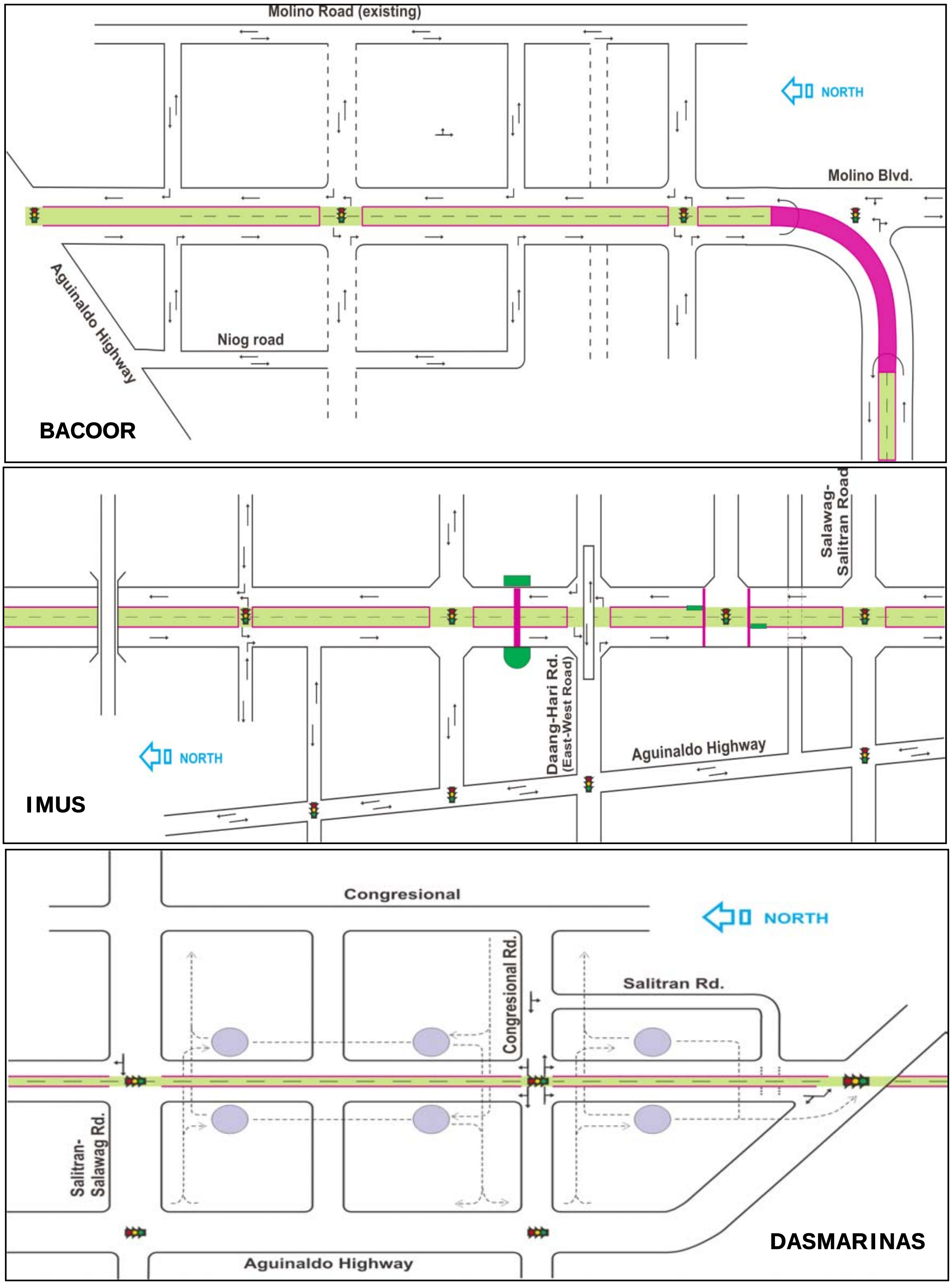


Figure 5.33 Proposed Traffic Circulation System for Busway Related Roads in Bacoor, Imus and Dasmariñas



5.6 Busway Corridor Development Strategies

5.6.1 Corridor Land Use Plan

Land uses along the corridor can accommodate higher development densities than can be currently achieved with the present transport infrastructure network with the provision of a higher capacity busway along the new proposed alignment. The realization of higher development densities, however, would also be contingent upon the provision of additional lateral access corridors. Figures 5.34 and 5.35 show some examples of the land use features along the busway in Curitiba, Brazil.

Figure 5.34 Busway Corridor, Curitiba, Brazil

Figure 5.35 Busway Terminal, Curitiba, Brazil

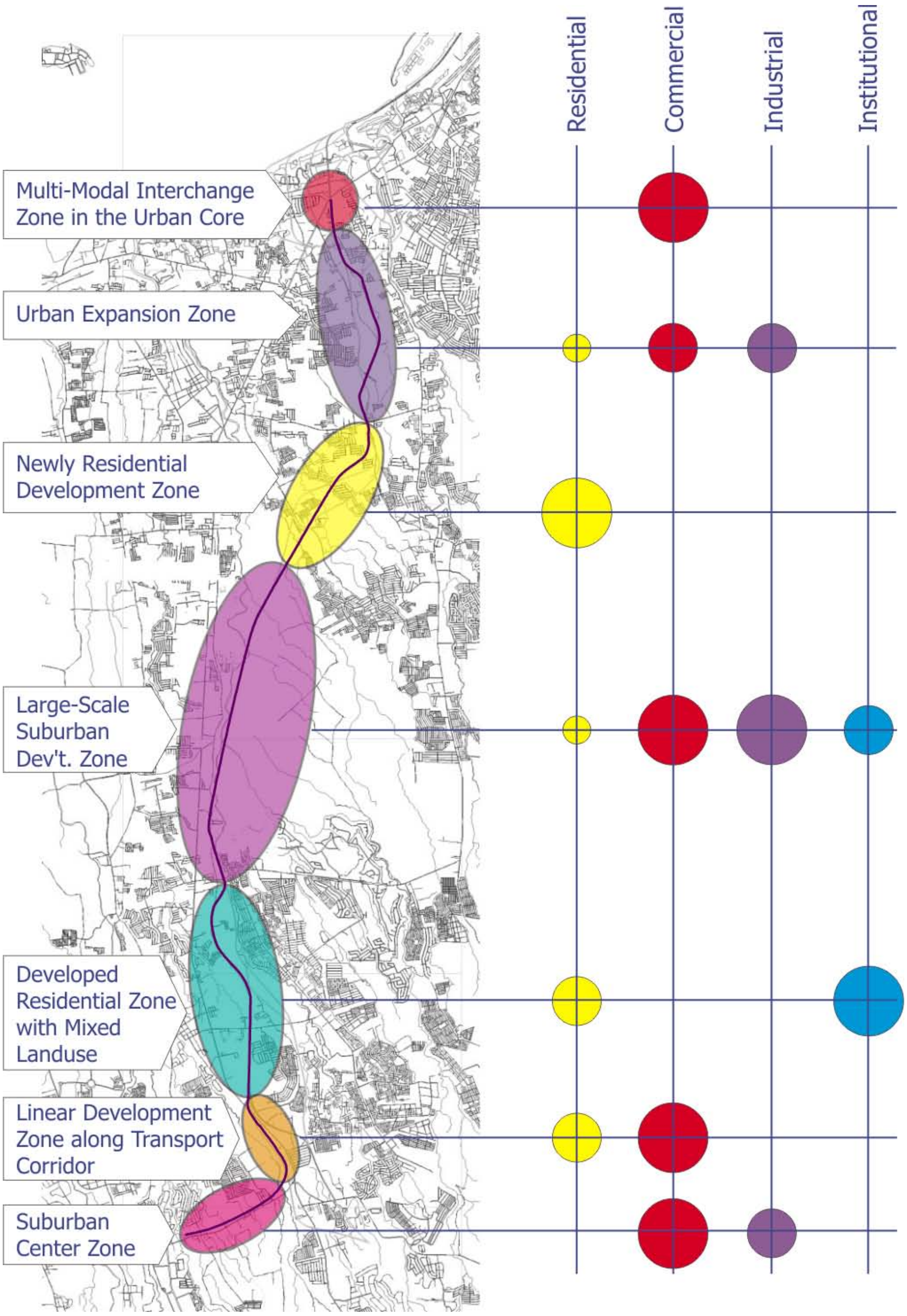
In terms of specific land uses along the corridor, the critical parameters pertain to access control and management, and how they affect operational viability of the busway. These land uses will evolve over a period of time commensurate to the build-up phase of the busway patronage. The physical interfaces of the busway corridor with the lateral access roads should also be undertaken in a phased-in manner, with initial at-grade configurations for busway-access road intersections, eventually providing for grade-separation facilities where volumes merit.

As the busway corridor itself will act as a barrier between opposite sides of the alignment, there needs to be regular intervals where land uses on opposite sides can be interrelated through grade separation, or at-grade intersection control.

The land uses along the corridor vary throughout the alignment, with the areas surrounding the major terminals generally having a commercial use, and residential uses predominant in the areas between the two end terminals. Some industrial uses will also be located in the suburban development zone in Imus, as well as an urban expansion zone in Bacoor. Institutional uses will be located in the Imus suburban development, as well as retention of educational uses for the mixed use zone in Dasmariñas.

Figure 5.36 shows the development concept of land use along the busway corridor, described by general zones and major land uses.

Figure 5.36 Land Use Development Concept



The northern portion in the Niog/Talaba areas in Bacoor is characterized by the multi-modal interchange within an urban core. The planned Northern busway terminal will interface with the Southern Terminal of the proposed LRT Line 1 Extension at Niog. This zone will be characterized by a predominantly commercial land use due to the confluence of passengers transferring from one mode to another.

Proceeding southwards, the alignment would traverse through an area which can be characterized as an urban expansion zone, where there will be a number of residential subdivisions. Some industrial land uses will also be located in this urban expansion zone.

Further south along the Bacoor-Imus boundary, new residential subdivisions will predominate.

As the alignment proceeds south towards Daang Hari, a new large-scale suburban development is planned in an area of more than 1000 hectares. This whole area is under the direct influence of one developer, and as such, land uses can be planned in an optimal manner. This suburban development zone is located around the junction of the busway corridor and Daang Hari, a major east-west road corridor for the northern portion of Cavite Province.

Further south towards Dasmariñas, the busway alignment is located closer to Aguinaldo Highway, and land uses along the corridor will follow predominant land uses along this portion of Aguinaldo Highway. This zone can be characterized mainly by residential and institutional uses. Educational facilities are already present in this zone, and this is foreseen to continue into the future.

Further south, the busway alignment merges with Aguinaldo Highway, and land uses along the corridor and along this portion of Aguinaldo Highway (just north of Pala-pala) will be one and the same. The land use will be characterized by linear/ strip development of commercial activities, interspersed with residential uses.

Approaching the busway's Southern Terminal along Governor's Drive, a suburban center zone characterized by commercial activities (at least two shopping malls are planned for the Pala-pala area), with some institutional (educational) facilities in the area.

5.6.2 Terminal Area Development Concept

The busway project would require additional facilities at terminals and stations in addition to the requirements for busway operations. Intermodal exchange terminals, park-and-ride facilities, bus, jeepney, tricycle and private car drop-off and pick-up stations all need to be provided. In addition, facilities for passenger amenities such as toilets, eateries, newsstands, etc. will be housed in the terminal/station areas.

Government offices may also be located at some of the terminals or stations in order to bring public service closer to Cavite’s population.

Typical Bus Stop

Figure 5.37, shows the proposed development concept for a typical bus stop along the busway corridor. This typical bus stop would be located adjacent to the busway corridor. It would accommodate facilities for jeepney/tricycle loading and unloading, as well as passenger amenities such as kiosks, news stands, etc.

Talaba Terminal

Figure 5.38, shows the proposed development concept for the Talaba Terminal. This concept makes use of the interchange between the busway and the LRT Line 1 Extension. Facilities for busway turnaround and interface with other modes such as regular buses, jeepneys, and shared taxis are provided. Passenger amenities such as kiosks with eateries, toilet facilities, and information centers will also be housed within the terminal area.

Imus Suburban Development Terminal (One Asia)

Figure 5.39, shows a sketch of the development concept for the busway terminal within the large-scale suburban development zone in Imus, near the junction with Daang Hari. Being proposed for development by One Asia Development Corporation, the terminal area will also house a major transfer facility serving the suburban development. In this terminal, mode interchange facilities with the local public transport network serving the development will be located. The attendant facilities for passenger amenities will also be provided. The terminal will be part of a major commercial node.

Southern Terminal

The southern terminal at Governor Drive west of the Pala-pala junction in Dasmariñas will house the depot of the busway system. This southern terminal will be a major interchange point between the busway and Governor Drive, particularly the section west of Pala-pala. The public transport units operating routes along Governor Drive will need transfer facilities at the southern terminal of the busway system. This southern terminal will also be located in a commercial node, with the volume of transferring passengers providing the economic base for commercial land uses. Figure 5.42, shows a sketch of the proposed development in the southern terminal.

Figure 5.37 Terminal Area Development/ Redevelopment Concept

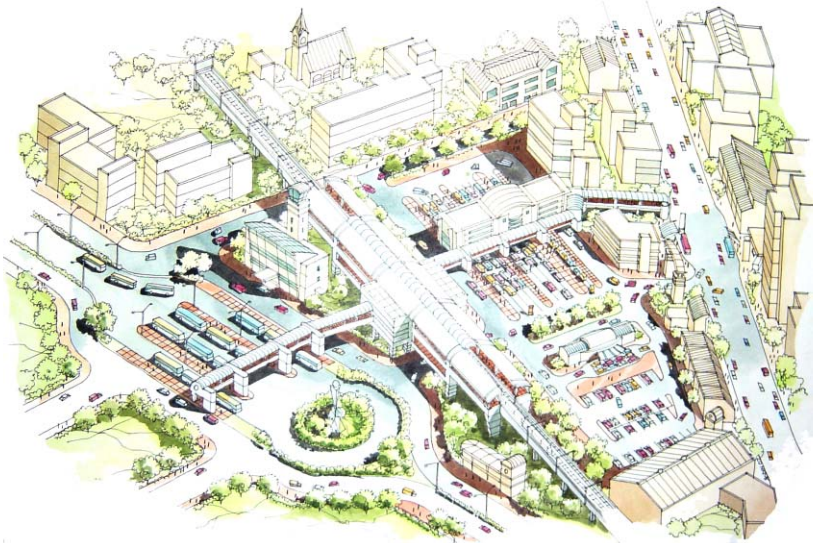


Figure 5.38 New Type of Mode Interchange with Town Center

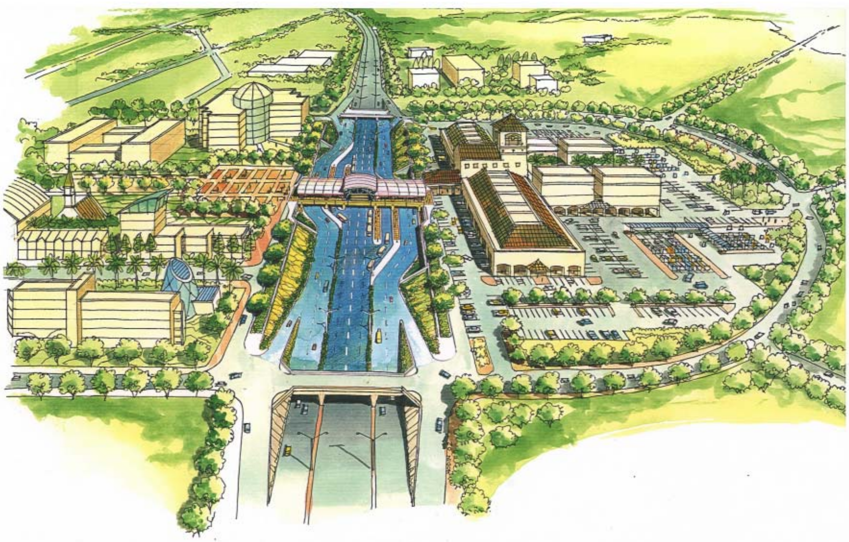


Figure 5.39 Multi-Modal Interchage in the Newly Developed Urban Subcenter

5.6.3 Institutional Development Concept

In order to promote public transport oriented urban development, not only will the preparation of strategic land use and urban development plans be necessary but also a strong institutional setup will be indispensable. Such institution should be able to take the lead backed with strong financial resource for the corridor urban development. It will be difficult for the government sector to directly commit to urban development as it is constrained with budget shortages and administrative bureaucracy. Therefore, a new organization should be established solely for the public transport corridor urban development. The functions of the proposed organization, herein referred to as the Cavite Busway Public Corporation/Company (CBPC), could be, but not necessarily limited to, as follows:

- To manage busway operation, particularly the selection of bus operators, collection of rental fees for busway facilities and day-to-day monitoring of bus operation.
- To develop the land use plan and development program for the corridor (the plans should be enacted);
- To reconfigure the shape of lands in the designated corridor through land swapping and land readjustment method in order to develop the necessary infrastructure outside of the proposed busway (the busway will be constructed by DPWH); and
- To prepare fund resources for the corridor urban development.

It is desirable for the CBPC to be formed by the stakeholders, including the members of the Trust proposed in Chapter 9.5 such as the Provincial Government of Cavite, the Municipal Governments of Bacoor, Imus and Dasmarinas, and the private sector.

The strategy for urban development and the financial mechanism for the operation of CBPC is conceptually summarized as follows:

(1) Planning Safeguard

At first, the busway corridor must be secured by legal planning arrangement in order to avoid further development and possible encroachment into the corridor of the alignment. This will minimize the cost of actual land acquisition and interactions with the landowners and residents who are affected by the busway project.

(2) Land Management Policy

Beside the planning safeguard, it should have three zones for land acquisition policies as illustrated in Figure 5.41.

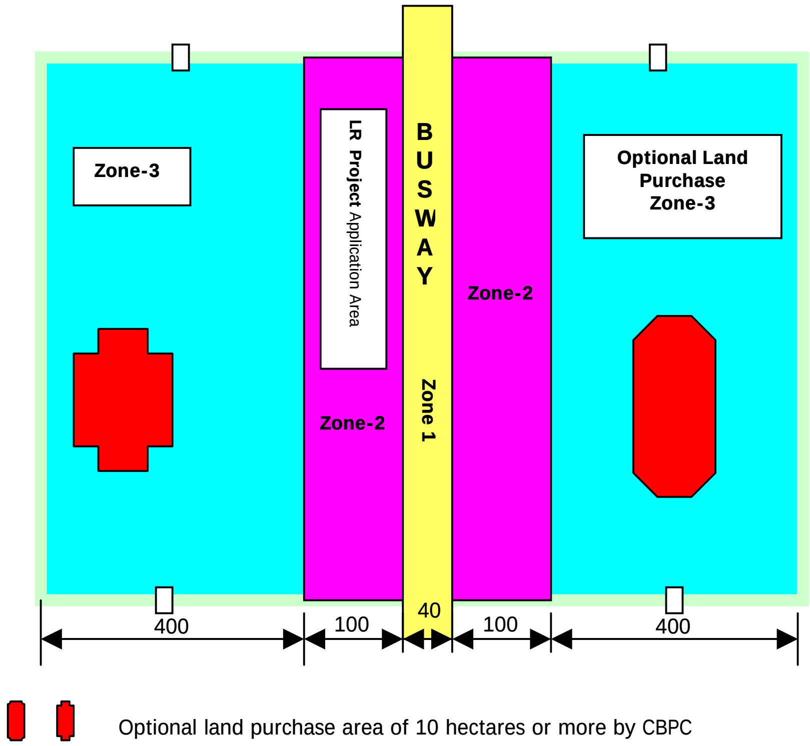
Zone-1: This zone is the designated ROW on the Busway site (40 meters) and land purchase should be promoted by the Trust, LGUs and DPWH with available budget.

Zone-2: This zone might be designated within approximately 100 meters from the boundary of the busway ROW and optional land purchase is made if the landowner agrees. In the future, these areas could be developed by land readjustment projects.

Zone-3: This zone might be approximately one kilometer from the busway, and if a large scale vacant land (10ha. or more) is available, it should be acquired for use in exchange/swapping or resettlement area of residents affected by the busway project.

Zones 2 and 3:The land acquisition shall be guaranteed for the CBPC by the Presidential Decree No. 399 for the area along National Highway or others.

Figure 5.40 Land Acquisition Phasing and Development Pattern



(3) City Planning Designation

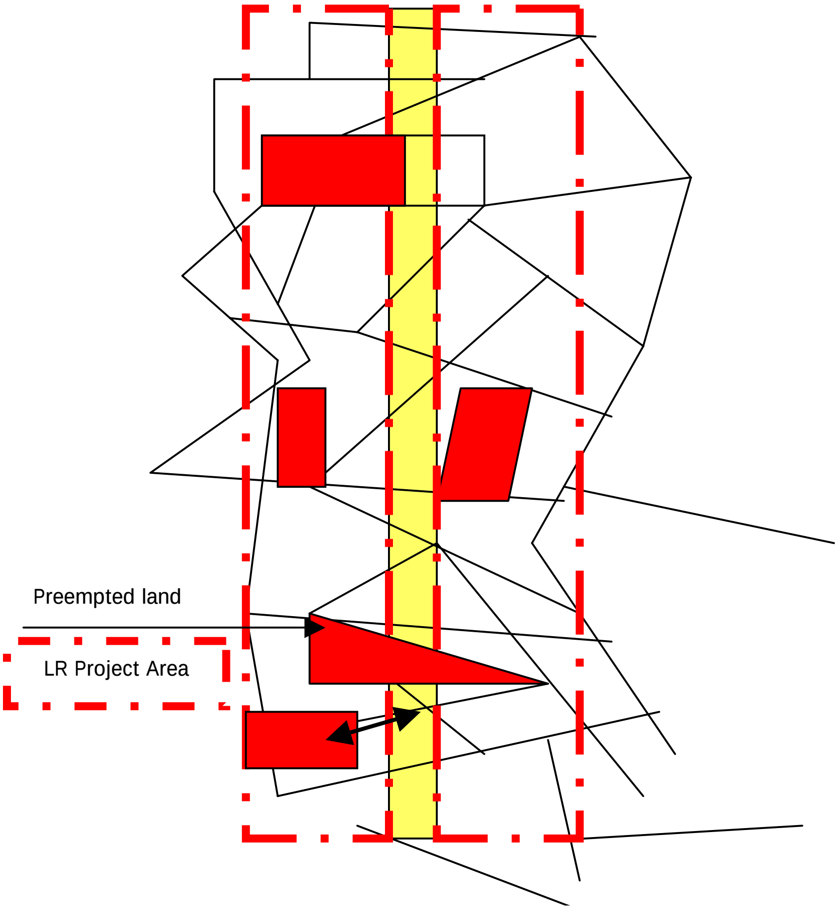
The adjacent area of the busway project should be designated for urban development and must be guided by city planning procedures to avoid uncontrolled development. Respective local plans in the three busway municipalities should be prepared for the designated area, which should include zoning, infrastructure improvement and other necessary components.

(4) Application of Land Readjustment (LR)

It would be ideal for the CBS to be developed to include the urban development of the adjacent area along the corridor. However, such cohesive development will prolong the completion of the busway system due to huge resource requirement. As such, based on the three-zone classification for land acquisition, the priority for acquisition would vary. Highest priority is the busway corridor, which needs immediate acquisition by direct purchase, swapping or other measures. The proposed Trust will play an important role in this aspect. The second zone adjacent to the busway is not so urgent. Hence, the application of a land readjustment project will be ideal to minimize the cost of land acquisition for needed urban infrastructure and for better linkage with the busway.

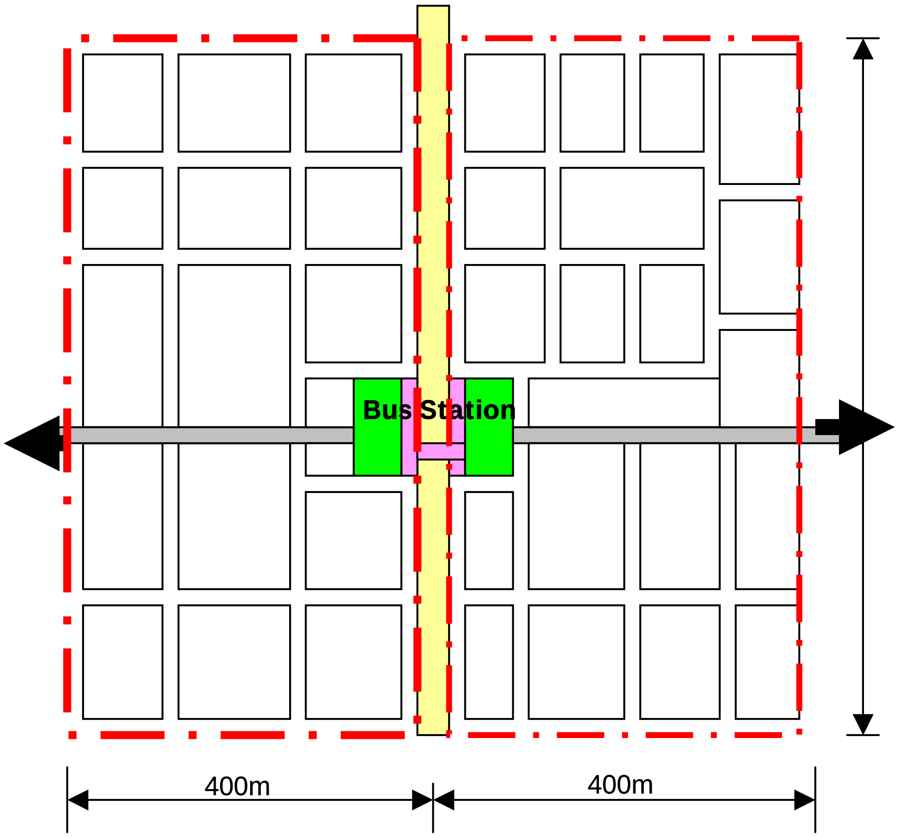
The LR project requires some legal arrangements to bring together the landowners and residents of the area and also to enforce the controls and procedures needed for the implementation of the project.

Figure 5.41 Pre-emption Area in LR Project Area



Note: This is a combination of land purchase and LR project including the busway alignment. The land on the alignment which is difficult to purchase can be exchanged with pre-empted land outside of the alignment (land swapping). Pre-emption of land should be done in coordination with the Trust.

Figure 5.42 Land Readjustment Layout Plan



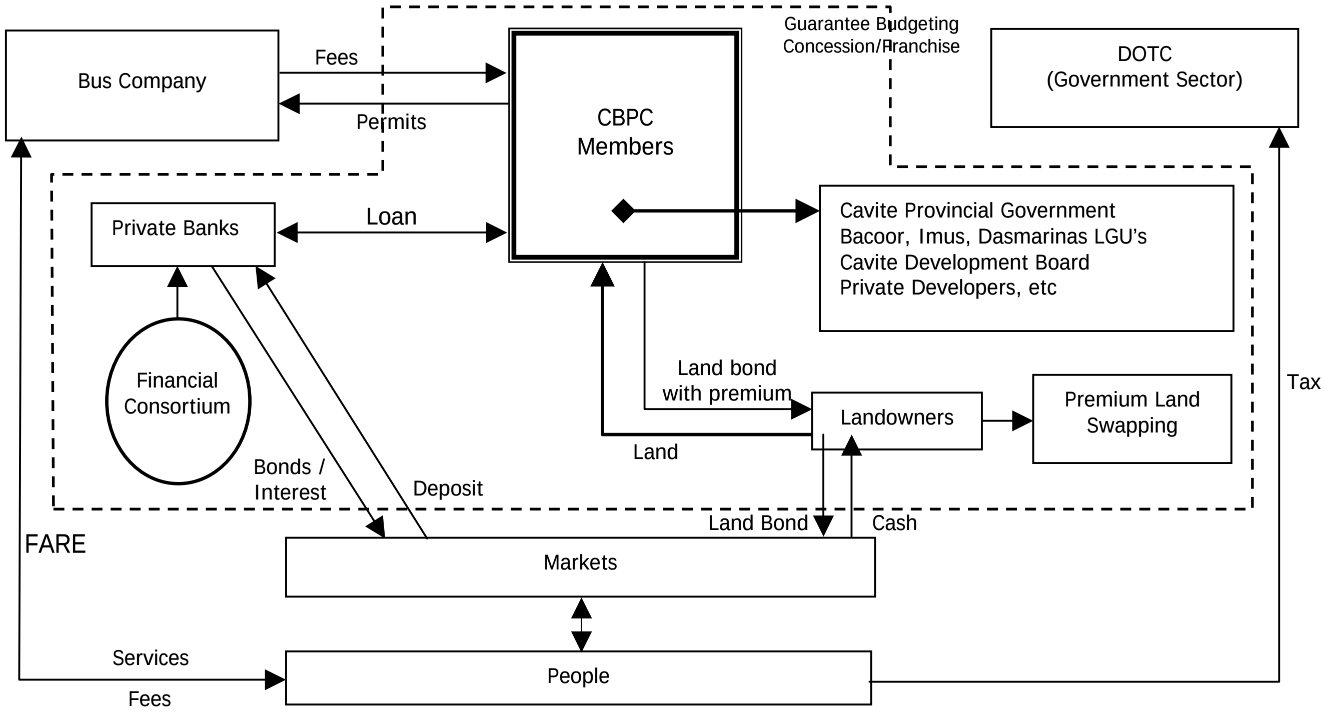
In case of entire application of Land Readjustment project in the corridor, the area might be developed in an orderly way but the realization of the busway alignment site will take more time compared to the direct land purchase system.

(5) Financial Strategy for the CBPC

Financial stability of the CBPC is the most significant and yet the most difficult issue for the organization. The conceptual financial flow for the organization is shown in Figure 5.44. The following are some of the features of the financial scheme for the operation of the CBPC in land acquisition:

- In the event that the proposed affiliated bodies of the project will not be able to provide sufficient funds for the operation of the CBPC, the latter should be able to draw out loans from financial agencies or acquire the land by the issuance of land bonds to the landowners.
- The government authority and CBPC should enter into an agreement that the former should guarantee the loan or issued land bond of the latter. As such, the CBPC would have to be established as a non-profit oriented public organization.
- Main revenue source of the CBPC will be obtained from the added value of the land developed in the designated the busway corridor.

Figure 5.43 Financial Scheme for the CBPC



CBPC: Cavite Busway Public Corporation
Premium Land Swapping: Special premium and priority purchase rights given to land bond hodlers for the land developed in the busway corridor.

6 ENGINEERING STUDY

6.1 Design Standard

The Design Standard and Guidelines adapted for this project were based on the "Guide for the Design of High Operational Vehicles (HOV) Facilities", AASHTO 1998, for the Busway component. Some dimensions of the relevant LRT System have been referred from the standards of LRTA and these were considered in planning the cross section and vertical alignment of the Busway facility. Other manuals have been referred to, such as AASHTO's "A Policy on Geometric Design of Highways and Streets", 2001 Ed. and the DPWH Design Guidelines, Criteria and Standards, 1988 Edition, for the service road component and in consideration of local conditions.

6.2 Design Criteria

6.2.1 Geometric Design

(1) Horizontal Alignment

The Busway has been planned initially as a Highway facility. However, provisions have been made for future conversion of the proposed facility to accommodate the LRT System, in anticipation of the proposed extension of LRT 1 from Baclaran to Zapote and eventually to Imus in Cavite.

Accordingly, the proposed design of the Busway facility took into consideration the standards of the LRT System. The Design Criteria considered were secured after coordinating with the LRTA. This provision includes conformity of the horizontal alignment to the minimum radius requirement for LRT System. Whenever feasible, larger radius of curvature should be adapted within economic limits.

(2) Vertical Alignment

Likewise, the gradient or vertical grade of the Busway facility should not exceed the maximum gradient required for LRT System. Where feasible, maximum of 3% should be considered. In exceptional cases, absolute maximum grade of 4% could be adapted if only to consider the economic aspect of the project.

Inasmuch as the Busway cross section is confined by sidewalks and curbs, a minimum of 0.30% vertical gradient should be provided for drainage purposes.

(3) Cross-Sectional Requirements

Widths of carriageway for both the Busway facility and service roads are based on the abovementioned guidelines with due consideration to projected traffic volumes and composition. Shoulders for Busway and service roads with sufficient widths were also provided to allow horizontal clearance, to provide traffic safety and convenience, and to protect the structural component of the roadways. One Bike lane in each direction, has been included in the cross sectional features of the Busway facility.

The proposed design guidelines, criteria and standards adapted for the project are shown in Tables 6.1 and 6.2.

Table 6.1 Design Standards for the Busway

Item		Busway	Reference: LRT-1	Remarks
A	Design Speed	80 km/h	60km/h	
B	Cross Section			
	1) Pavement Cross fall	2.5% (2 Lane)	Limit 5%	
	2) Embankment Slope	1V:2H		For sections on fill
C	Horizontal Alignment			
	1) Curve Radius	・Desirable 280 m (Min. 230m)	・ Desirable 250m ・ Main Line 170m ・ Station, Depot.100m	
	2) Curve Length	Min. 140m		
D	Vertical Alignment			
	1) Grade	Max 4%	Limit 4%	
	2) Minimum Grade	Not less than 0.3%		For drainage req'ts
	3)Radius (Crest)	Min. 3000m	Min. 1000m	
	4)Radius (Sag)	Min. 2000m	Min. 1000m	
E	Vertical Clearance		Slab~Rail level=500mm Rail level~Top=4900mm Total =5400mm	
	1) Road	5.08m(AASHTO)		
	2) Railway	5.5m		
	3) River	1.0m 1.5m		W/out Debris W/debris

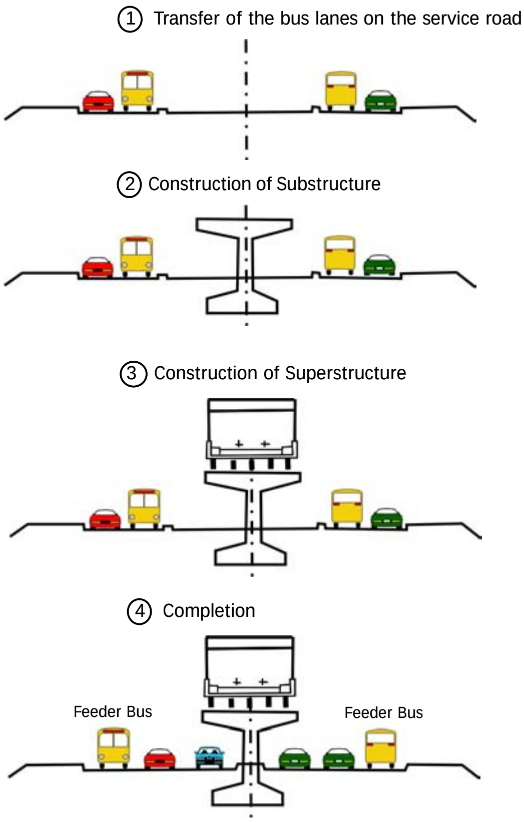
Table 6.2 Geometric Design for Crossing Road

Item		・Aguinaldo Highway ・Molino Boulevard ・East-West Highway	・Tirona Highway ・Monbok Bayanan Road ・Super Division Road ・One Asia ・Salawag Salitran ・Congresional Road ・Service Road Section Ⅱ	・Niog Road ・Anabu Road ・Orchard Road ・Service Road SectionⅢ
A	Design Speed	80 km/h	60km/hr	40km/hr
B	Cross Section			
	1) Pavement Cross fall	2.5% (2 Lane)	1.5% (2 Lane)	1.5% (2 Lane)
	2) Embankment Slope	1V:2H	1V:2H	1V:2H
C	Horizontal Alignment			
	1) Curve Radius	Min.280 m	Min. 150m	Min. 60m
	2) Curve Length	Min. 140m	Min. 100m	Min. 79m
D	Vertical Alignment			
	1) Grade	Max 4%	Max. 5%	Max. 10%
	2) Minimum Grade	Min. 0.3%	Min. 0.3%	Min. 0.3%
	3)Radius (Crest)	Mini. 3000m	Mini. 1400m	Mini. 450m
	4)Radius (Sag)	Mini. 2000m	Mini. 1000m	Mini. 450m
E	Vertical Clearance			
	1) Road	5.08m(ref. AASHTO)		
	2) Railway (LRT)	5.5m		
	3) River	1.0m (without debris) : 1.5m (with debris)		

(4) Future Conversion to Rail

As mentioned in the previous sections, on the long-term planning perspective, the proposed busway corridor may be converted to a rail-based public transport system to meet the projected increase in traffic demand in the future. Thus, it is very important to consider the future system changes on the Busway design standards so as to provide uninterrupted bus services even during the transition period from the busway to rail system. Figure 6.1 shows an example of the construction method that can be adopted. The busway operation will be provided on the ordinary traffic space/service roads while construction is ongoing on the busway lanes. However, efficient modern construction technologies should be applied so that the impact in the construction stage can be minimized.

Figure 6.1 Construction Methods during Transition from Busway to Rail-Based System



6.2.2 Structural Design Criteria

(1) General

The choice of structure for the flyover and bridges was based on the following criteria:

a. Economy

b. Characteristics of Structure

c. Construction Method (Construction Period and Traffic Obstruction)

d. Maintenance Cost

e. Aesthetics

Structures shall be design based on the following loads:

a. Dead Load, weight of materials such as concrete, reinforcing bars, structural steel elements and all immovable components of the structure.

b. Live Load, load imposed by moving vehicles.

c. Impact or dynamic effect of the live load.

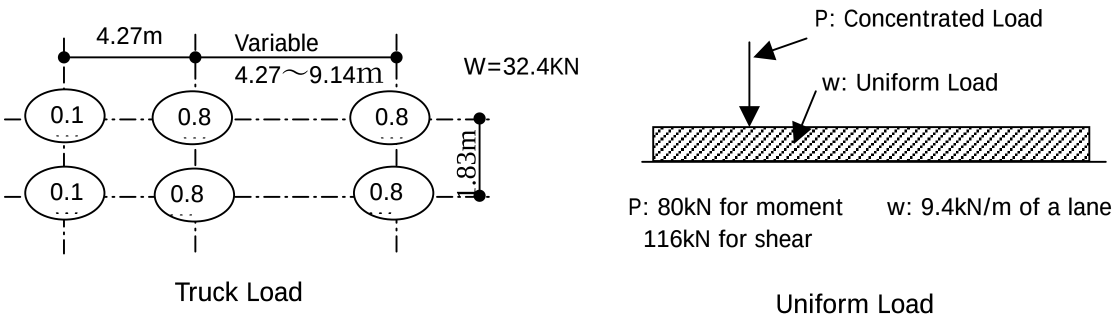
d. Wind Load

e. Other forces such as longitudinal forces, centrifugal forces, thermal forces, earth pressure, buoyancy, shrinkage stresses, erection stresses, and earthquake stresses.

(2) Live Load

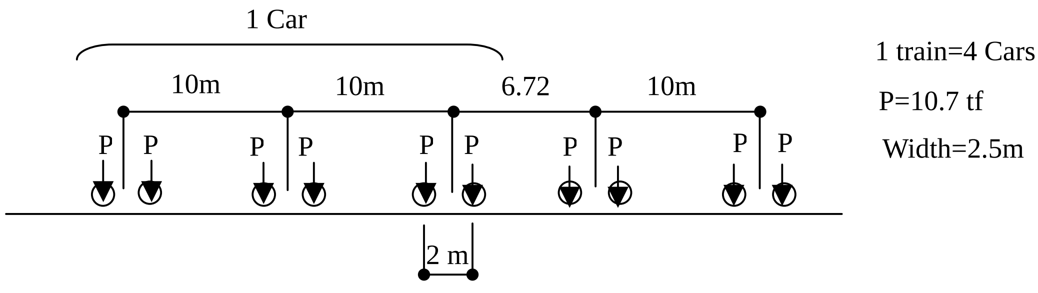
The Live Load is determined based on HS20-44 loading as specified by AASHTO and as presented hereafter.

Figure 6.2 Live Load by AASHTO



Since the Busway facility is proposed for future conversion to accommodate the LRT System, it is necessary to verify applicable loads that will be imposed by the LRT trains on the proposed Busway structures. Therefore, the following Live Load for LRT-1 train has to be considered:

Figure 6.3 Train Loading by LRT-1



The said live loads were analyzed, and it was observed that LRT trains impose heavier loads during operation than those of the passenger vehicles and commercial trucks. The comparison of shear and moments of AASHTO and LRT loadings are presented in Table 6.3.

Table 6.3 Comparative Table of Shear and Moment between AASHTO and LRT Loading

SPAN (meters)	AASHTO Loading					LRT Loading				
	Impact	Shear		Moment		Impact	Shear		Moment	
		V Max (kN)	V(1+I) (kN)	M Max (kN-m)	M(1+I) (kN-m)		V (kN)	V(1+I) (kN)	M (kN-m)	M(1+I) (kN-m)
20.0	0.263	276.26	348.92	1234.44	1559.10	0.333	352.38	469.72	1409.52	1878.89
30.0	0.224	293.26	358.95	2044.44	2502.39	0.265	458.64	580.18	2879.10	3642.06
40.0	0.195	300.94	359.62	2854.44	3411.06	0.242	553.98	688.04	4888.80	6071.89

The results of the evaluation of the loadings by HS20-44 and LRT System indicate the necessity to design the structures for the Busway in accordance with the said requirements.

(3) Impact (I)

The amount of this allowance or increment of load is expressed as a fraction of live load stress, and shall be determined by the formula:

a. For HS20-44 Loading, the impact requirement is as follows:

$$I = \frac{15.24}{L+38} \text{ (maximum 30 percent)}$$

where: I = impact fraction
L = length in m of the portion of the span which is loaded to produce the maximum stress in the member.

b. For LRT System, the impact requirement is expressed as:

$$I = 100L/(L+D)$$

where: L = total live load on the member for which the computations are being made
D = dead load applicable for the member for which computations are being made.

(4) Seismic Force

The report on “Earthquake Engineering for the Manila North Expressway Structures in Luzon, Philippines” has been adopted as a guide for establishing the earthquake design criteria for the structural component of the project, provided that the result is greater than the force produced by 10%(DL+1/2LL);

where: DL = Dead Load
LL = Live Load

(5) Strength of Materials

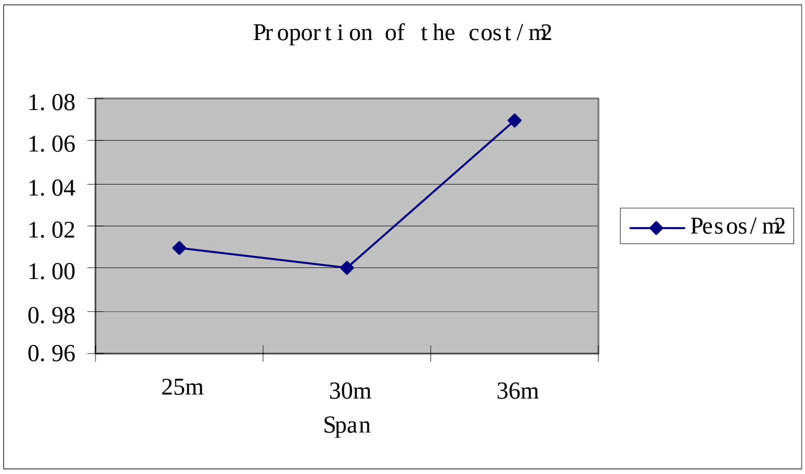
Strength of concrete, reinforcing bar and pre-stressing strands will be based on their specifications as required by the AASHTO Standard Specifications for Highway Bridges, latest Edition and the latest edition of the DPWH Standard Specifications for Highways and Bridges.

(6) Span Length

The selection of the simple span length should be designed taking into consideration the cost of structure.

Figure 6.3 provides a basic guide in the selection of span length of the structures.

Figure 6.4 Guide in Span Length Selection for Structures



6.2.3 Highway Drainage Design Criteria

The basic criteria are taken from the Highway Drainage Guidelines 1992 Edition of the American Association of State Highway and Transport Officials (AASHTO). Reference has also been made to the DPWH Design Guidelines, Criteria and Standards.

(1) Flood Frequencies

The recommended design storm frequency period was based on the guidelines set by the DPWH as follows:

Structure	Design Flood Frequency
Bridge	1 in 50 years
Box Culvert	1 in 25 years
Road Embankment	1 in 25 years
Channels	1 in 50 years
Pipe Culverts	1 in 10 years

(2) Runoff Predictions

Two methods were employed such as the Rational Method for catchment area less than 25 sq. km. and Unit Hydrograph for catchment area greater than 2.5 sq. km.

(3) Hydraulic Design

The hydraulic design basically adapted the Mannings Equations and other formula used in calculating backwater along waterways.

Waterway clearance adapted follows the recommendations of the DPWH Design guidelines such as:

a. 1.0 meter for waterway without debris in its discharge; and
b. 1.5 meter for waterway with debris in its discharge.

6.3 Description of the Proposed Busway Alignment

6.3.1 Physical Control Points

(1) Embankment Height

There are some small rivers traversed by the proposed Busway corridor. Since the river water is mainly used for agricultural purposes and for discharge of residual water from both agriculture and human activities, the proposed Busway corridor should be designed so as not to disturb or alter their functions. Therefore, the embankment height should be planned at sufficiently higher than ground level considering the functions of the existing waterways and other factors such as maximum flood level and construction clearance. To provide continuity of flow or discharge along the waterways, drainage structures such as pipe and reinforced box culvert will be provided.

(2) Flyover and Bridge Structures

The proposed Busway alignment will intersect existing and planned roadways and waterways. It is necessary to consider these restrictions to provide continuity of traffic flow through the provision of grade-separated structures such as flyover and bridges where these are required. Common locations are major highway intersections.

These flyover and bridges were designed using standard AASHTO PC girders, for the superstructures. The length are standardized from 20m to 40m long span for economic purposes and the fact that said type of superstructure is commonly used in other similar and related infrastructure projects of the government, due to economy and ease in construction.

In case of long spanned structures as a result of geometric alignment, the superstructure was designed with PC Box girder in order to clear the 40-meter width of proposed bus-way corridor. This type of super-structure has been adapted in various highway projects of the Government with similar local site conditions.

(3) Foundation

According to the previous report, the geology of the Metro Manila area consists of the Guadalupe and Alluvial formations. The Guadalupe formation is known locally as “adobe” and provides firm foundations in the Metro Manila area. The SPT blow count of the Guadalupe tuff is over 50 and its unconfined compressive strength generally exceeds 2 Mpa. Therefore mechanical excavation such as ripping is required for this formation. However in the surface weathered portion, which varies from 5 to 15m in thickness, the SPT blow count is N=20 to 40.

The sub-structure for fly-over and bridges has been designed with Pile-foundation, basically with bore piles to facilitate the construction.

(4) Molino Boulevard

Molino Boulevard is presently under-construction. Since the Busway facility will utilize partly its alignment, it is proposed that the existing pavement be improved and to provide widening, when necessary to accommodate the requirements of the Busway cross section.

At the location of Molino Blvd. flyover, the existing pavement has to be removed and replaced.

(5) Aguinaldo Fly-over

The simple span length for the Aguinaldo Flyover has been designed similar to Molino Flyover.

The horizontal alignment is designed with a curve radius of 200m. The alignment crosses over the Aguinaldo Highway. It is proposed to extend the alignment parallel to the existing Aguinaldo Highway and Governor’s Drive Road until the Busway reaches the south terminal.

(6) Construction Clearance

There are two (2) types of Construction clearance proposed for the Busway facility. One type is for the road vertical clearance and another type is for the proposed LRT tracks, inasmuch as the proposed Busway would be converted into LRT system in the future. Roadway clearance is specified at 4.88 meters plus provision for pavement overlay; whereas, clearance for railway tracks is 5.5 meters.

(7) Bridges

There are three (3) bridges, which are located at Station 11+660,12+530 and19+850. These are Baluctot Bridge with one span, Imus Bridge with two spans and Pala-pala Bridge with 8 spans. The super-structure is designed with standard AASHTO PC girder.

6.3.2 Pavement Structure

The process in the design of pavement structure using the AASHTO Guide for the Design of Pavement Structures requires the preparation and the selection of the necessary inputs for the different design variables as presented hereafter.

a. Analysis Period or Pavement Design Life, normally 20 years for rigid pavement and 5 to 10 years for staged construction.
b. Traffic, refers to the cumulative expected 18-kip equivalent single axle loads (ESAL) during the analysis period in the design lane.
c. Reliability factor. Reliability concept is a means of incorporating some degree of certainty into the design process to ensure that the various design alternatives will last the analysis period.
d. Serviceability. The serviceability of the pavement is defined as its ability to serve the type of traffic, which use the facility and the primary measure is expressed as Present Serviceability Index.
e. Effective Roadbed Soil Resilient Modulus, MR a factor in determining the strength of the underlying soil materials.
f. Effective modulus of sub-grade reaction, k
g. Elastic Modulus of Concrete, E’c
h. Drainage Coefficient, Cd is used to treat the expected level of drainage for a rigid pavement.
i. The load transfer coefficient, J, is a factor used in rigid pavement design to account for the ability of the concrete pavement structure to transfer (distribute) load across discontinuities, such as joints or cracks.
j. Loss of Support, LS, is included in the design of rigid pavements to account for the potential loss of support arising from sub-base erosion and/or differential vertical soil movements.
k. Structural Number, SN of flexible pavement.

Basically, the results of the traffic study for the Busway project and the selected design variables considering soils conditions and specifications of materials to be used, served as the basis in determining the different thickness of the pavement structure components.

The results of the pavement structure evaluation indicate the following thickness:

a. For Busway facility

i. Surfacing:	100 mm Asphalt Concrete
ii. Base Course:	100 mm Asphalt Treated Base
	150 mm Crushed Aggregate Base Course
iii. Subbase:	200 mm Aggregate Subbase Course

b. For the Service Road (In all segments/sections)

i. Surfacing: 230 mm Portland Cement Concrete Pavement
ii. Subbase: 200-mm Aggregate Subbase Course

The evaluation considers using improved sub-grade having CBR of 10% minimum, since the alignment passes through lands, which were utilized previously for agricultural purposes.

6.3.3 Highway Drainage System

The proposed drainage system of the Busway facility consists of collector pipes and curb inlet manholes to drain surface runoff from the pavement. On the other hand, pipe and box culverts were provided for existing and minor waterways. Rivers were provided with bridge structures as discussed above.

The sizes of drainage structures were established based on the hydrologic and hydraulic analysis conducted along the busway corridor. The process involve determining various factors such as flood frequencies, intensities and rainfall duration, topographical features of the project area and tributary areas or water catchment areas.

6.3.4 Street Lighting System

Considering traffic safety and convenience especially at night, street lighting system shall be provided. The street poles will be installed every 35m interval or as required along the alignment. Design and specifications shall conform to those provided in the Memorandum of Agreement executed between the DPWH and MERALCO.

6.4 Construction and Maintenance Planning

6.4.1 Construction Planning

Considering the magnitude of the project in terms of complicated construction activities and high level of investment involved, it is necessary to prepare execution plan based on experiences in similar and related projects. Factors include capability (periodic accomplishments) of both local and foreign contractors executing similar and related projects, capability of the implementing agency to disburse funds on time to fulfill its financial obligations, and availability of all the required resources for the project.

The project consists of the following significant components:

a. Long viaducts and/or flyover structures;
b. Massive earthwork activities;
c. Requirement for imported materials;
d. Demolition of existing structures and obstructions;
e. Right of way acquisition; and
f. Complicated work areas such as on heavily congested roads, and residential and commercial areas.

There are other equally important components, all of which would require significant and same magnitude of efforts, funds and time for preparation and execution.

Therefore, it is proposed that the project be executed ideally in four (4) packages, each construction package costs an average of P840M:

a. Bacoor – Imus Segment 1 and 2, (P863M);
b. Imus – Dasmariñas Segment 1, (P778M);
c. Imus – Dasmariñas Segment 2, (P909M); and
d. Dasmariñas – Pala-pala Section, (P809M).

Aside from the contract packaging, it is proposed that the implementation would be undertaken with two (2) construction teams for each package, such that minimum requirements for manpower, equipment and resources should be considered based on this scheme. This is to preclude delays, which would tend to cause adverse effects to the people, environment and economy of the project areas.

6.4.2 Maintenance Planning

In general principle, to ensure traffic safety and convenience along the facility, an integrated effort of maintenance to consider the Busway as well as the service roads should be planned. If possible, a routine and periodic maintenance manual should be organized to systematize the required maintenance works for the facility. This manual shall describe in detailed manner all of the procedures and related inspection forms, necessary to all preventive and curative maintenance along both components of the facility. These would include the following tasks:

(1) Ground Maintenance

Tasks included in this item are:

- (i) The mowing turf area;
- (ii) The hand trimming and edging of vegetation around trees, ground structures such as benches, walkways and other facilities to present a neat, clean and pleasing appearance;
- (iii) The maintenance of planter beds including site preparation, fertilizing, mulching, weeding and watering;
- (iv) The pick up, collection and removal of litter and other debris from the building ground;
- (v) The routine maintenance and repair of outside lighting for buildings, walkways, parking lots and ground to provide safety and security;
- (vi) The cleaning and maintenance of drain, inlets, manholes and other ground drainage structures; and
- (vii) The maintenance and repair of fence and other boundary markers.

(2) Road Travel Way and Adjacent Areas

Certain maintenance activities will be performed on all types of road pavements as follows:

- (i) Litter pick up means the collection and disposal of litter from road/street rights-of-way and parking areas to remove unsightly or hazardous objects that may cause accidents or obstruct drainage;
- (ii) Right-of-way maintenance including the maintenance of crossings, entrances and intersections, as well as the repair and maintenance of fence and other boundary markers;
- (iii)Clean drainage structures includes the removal of debris and silt, as required, from box culverts, pipe culverts, inlet and storm sewers to maintain adequate drainage and prevent flooding;
- (iv)Vegetation control includes the cutting of tall grass brush, trees and limbs, within the right of way o restore sight distance, eliminate traffic hazards and encroaching vegetation that may damage the road and streets;
- (v) General Traffic Maintenance includes, as applicable to the type of road:
  - Stripping the centerline, edge and lane markings and pedestrian crossings;
  - Repair and replacement of signs and other traffic control devices;
  - Repair and replacement of deteriorated guardrail; and,
  - Maintenance of lighting in urban areas of high enmity vehicular use.

(3) Bridge and Similar Structures

Maintenance includes painting of exposed surfaces of the structures, minor repair of damaged areas, periodic inspection to determine presence of cracks and other defective elements of the structures.

(4) Building Maintenance

(i) Exterior envelope maintenance including:

- The repair of exterior walls, columns and trim to provide a satisfactory appearance and to maintain structural integrity;
- The repair or partial replacement of exterior porches decks steps, rails, posts and other elements for safety reasons; and
- The repair and replacement of windows and doors associated frames, hardware, glass, screens and weather stripping.

(ii) Interior envelope maintenance including:

- The repair and replacement of interior wall, columns and ceiling coverings to present a clean appearance and protect the structure; and
- The repair and partial replacement of damaged and worn out floor coverings to provide a safe surface.

(iii) Roof maintenance including:

- The repair and replacement of roof coverings to prevent water or moisture from entering the structure and causing interior damage;
- The repair of roof flashing to seal roof joints and prevent the entry of water into the structure; and
- The repair of roof gutters and downspouts and periodic cleaning of drains to direct water runoff away from the building and building foundation.

(iv) Building utilities maintenance including:

- The maintenance and repair of interior plumbing systems, pipe, valves, vents, wastewater lines, fixtures and related plumbing hardware such as faucets, sinks, showers;
- The maintenance and repair of septic vaults, and associated drainage lines;
- The repair of electrical systems including wiring, electrical switches, outlets, lighting fixtures, fuses circuit breakers and other electrical system components;
- Cleaning and repair of air conditioning system;
- Maintenance and repair of protective systems such as security alarms, fire alarms; and

- Cleaning of water tanks and reservoirs to remove sludge and to prevent wear loss by seepage through structural failures.

(v) Custodial maintenance including:

- The cleaning, sweeping, dusting, mopping, waxing, washing of interior and exterior building components, furnishings, surfaces; and
- Maintenance and operation of alternative energy systems such as generators.

6.4.3 Traffic Management During Construction

(1) General

The most critical task in the implementation of the project is to ensure that traffic will flow smoothly, while the different components of the project are being implemented. At present, some of the areas that will be traversed by the project alignment experience traffic congestion even during off peak periods. The closure of at least one lane would surely aggravate the existing situation.

Therefore, to preclude such situation, the plan for traffic management during construction should be closely coordinated with the traffic bureau of each concerned LGU.

Some of the initial measures to ensure that traffic flow will have manageable level of congestion if not totally eliminate said effect are as follows:

(i) Provision of sufficient number of flagmen, who will direct traffic during construction;

(ii) Provision of adequate warning signs, construction lights during evening and barriers;

(iii) Longer construction periods or adaptation of two shifts work period to expedite completion;

(iv) Use of latest construction technology and construction alternatives to minimize disturbance; and

(v) Provision of alternative routes to minimize impact of lane closure or road closure.

(2) Traffic Control

Warning and traffic signs shall be adequately posted on all works especially when restrictions on the width of the highway are imposed due to construction works. The effectiveness of these signing and lighting devices shall be constantly monitored.

All full, partial and temporary road closures shall be manned day and night. All operatives shall be trained and fully briefed on their responsibilities. These shall include achieving minimum disruption to traffic consistent with the safety of pedestrians, construction operatives and supervisory staff and vehicular traffic.

Utilization of flagmen is necessary to direct the flow of traffic for any restriction to traffic (reduction to one lane – whatever is the duration of time).

When appropriate, the traffic controllers or flagmen shall be provided with communication equipment.

Table 6.4 Traffic Control Signs, Delineators and Warning Lights

Item	Minimum Requirements
1. General	One-way traffic control signs and devices shall be provided along sections with on-going construction for a length of 200 meter or less. Signs, delineators, warning lights and flagmen shall be posted and maintained.
2. Delineator	Reflective red or orange plastic or rubber shall be placed at 30-meter intervals along the traffic side of the restricted area.
3. Warning Lights	Amber flashing lights shall be provided at all sign locations. The intensity of the lights shall be at least 4 candlepower and have a flash rate between 50-75 flashes directly traffic movements.

(3) Traffic Safety

All traffic control arrangements shall be carefully planned and should be coordinated with all concerned parties to advertise and seek agreement on the most universally acceptable traffic management practices. Diversions shall be advertised in advance and fully signed and lighted when implemented. Safety of all parties using and working on the road shall be paramount. It will be required to provide and maintain effective protective fences, bunding, etc. below slope works and to define the edges of steep excavations or existing down slopes, and in association provide signing and lighting as necessary.

All barricades fences such other aids as are required shall be provided with reflectors and shall conform to the regulations of the DPWH and shall be illuminated at night by lanterns.

A responsible member of the project staff should be assigned to inspect daily all traffic aids within the site. He shall arrange the cleaning and repairing; to maintain the proper effectiveness of these traffic aids at all times.