CHAPTER 12

HSH DEVELOPMENT STRATEGY

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12.1 PROCEDURE TO FORMULATE HSH NETWORK

Procedure to formulate HSH development Master Plan is shown in **Figure 12.1-1**. This Chapter discusses the formulation of HSH network and formulation of Master Plan is discussed in Chapter 16.

12.2 IDENTIFIED ISSUES

12.2.1 Metro Manila

Identified issues are as follows;

METRO MANILA

ARTERIAL ROAD NETWORK

- Arterial road network comprising of 6 circumferential and 10 radial roads was proposed in the late 1960's.
- All radial roads were already completed, however, development of circumferential roads is still incomplete.
  - C-3 is incomplete and is almost given up to complete due to ROW acquisition problems.
  - C-5 is incomplete in the northern section and the south-west section. The northern section is proposed to be built by BOT, however, ROW acquisition problem is being encountered.
  - The franchise to development C-6 was given to the private firm over 30 years ago, however, the BOT company failed to develop it. The franchise was cancelled in April, 2007. Now, DPWH is seriously considering to develop C-6. Original C-6 alignment was planned at the radius of about 15 km. from Manila City, however, it needs to be placed at the radius of about 20 km. from Manila City due to expansion of urbanization.
- Road network development has been focused on 1) widening of a road within an available road ROW, and 2) construction of grade separation of at-grade intersection.
- Due to ROW acquisition problems, new road construction was rarely implemented since the completion of C-5 from SLEx to Pasig River which was built about 15 years ago.

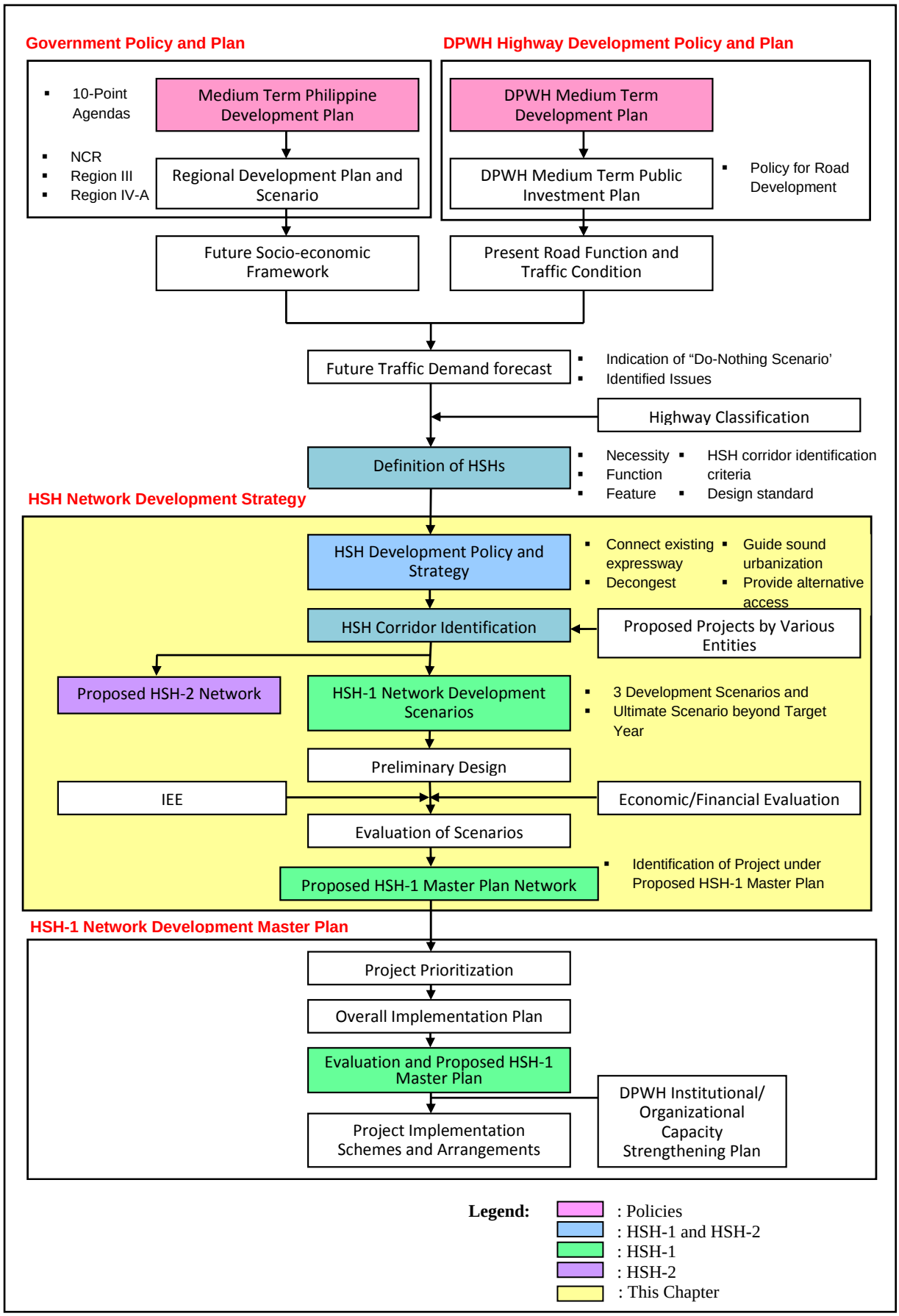


FIGURE 12.1-1 PROCEDURE OF HSH-1 NETWORK DEVELOPMENT MASTER PLAN

EXPRESSWAY NETWORK

- Three expressways, namely NLEx, SLEx with Skyway over it and the Manila-Cavite Toll Expressway, are presently functioning individually and expressways are not formed as a network yet.

- There are many proposals to construct expressways, however, there is no indication of their priority due to lack of the Master Plan.

- Due to difficulty of ROW acquisition and related relocation of project affected persons (PAPs), expressways need to be planned along the existing ROW such as a road ROW, a rail ROW, a river ROW, etc., most proposals are to utilize such ROW, however, additional ROW are usually required at interchange location, on-off ramps and toll gates. Therefore, how to minimize additional ROW acquisition is one of the key factors for smooth implementation of expressway projects.

TRAFFIC CONDITIONS

- Traffic congestion is one of most serious problems of Metro Manila.

- Traffic congestion is being experienced a whole day long from 6:00 AM to 10:00 PM.

- Travel speed of most arterial roads in Metro Manila is quite low at less than 20 km./hr. Travel speed of some arterial roads is less than 10 km./hr.

- Traffic congestion is causing various problems as follows;

  - Increase of travel time
  - Failure of timely delivery of goods and people
  - Loss of valuable time of people
  - High transportation cost
  - High emission of CO and NOx, adversely contributing to global warming
  - Aggravating roadside environment including air pollution, noise, vibration, and amenity
  - High risk of traffic accidents

- Traffic congestion is also affecting sound socio-economic activities. Industries are losing international competitiveness, resulting in loss of international/domestic investment.

CURRENT MEASURES TO COPE WITH TRAFFIC CONGESTION

The following are being implemented:

- Traffic demand managements (TDM)
  - Truck ban on selected roads
  - Unified vehicular volume reduction program (commonly known as "color coding")
- Construction of Mass Rapid Transit
  - LRT Line-1 extension towards EDSA North from Monumento is under construction
  - LRT Line-7 is being planned by BOT and is about to start its construction.
- Traffic Management
  - Bus priority lanes
  - U-turn to remove an intersection along selected arterial roads.

12.2.2 Outside Metro Manila

Identified issues are as follows;

NORTH OF METRO MANILA

ARTERIAL ROAD NETWORK AND EXPRESSWAY NETWORK

- All mega urban, primary urban and secondary urban centers are connected by arterial roads (North-South Backbone, East-West Lateral and Other Road of Strategic Importance). Thus, the arterial road network is well formed.
- There are three (3) expressways, namely North Luzon Expressway (NLEx), Subic-Clark-Tarlac Expressway (SCTEx), and Tipo Expressway. NLEx and SCTEx is connected by a connector road. SCTEx and Tipo Expressway is also connected by a connector road.
- Construction of extension of SCTEx, which is called as the Tarlac-Pangasinan-La Union Expressway (TPLEx) which runs almost parallel to Manila North Road has started.
- There are four (4) important transport corridors as follows;
  - First Corridor : Metro Manila-Clark-Tarlac-Region I/CAR
  - Second Corridor : Metro Manila-Plaridel-Gapan-Cabanatuan-Region II
  - Third Corridor : Metro Manila-San Fernando-Subic
  - Fourth Corridor : Subic-Clark

First Corridor is currently served by NLEx, part of SCTEx and Manila North, eventually by TPLEx when it is completed. Thus, facility wise, the corridor is well served.

Second Corridor is currently served by Pan Philippine Highway (or Maharlika Highway). Plaridel Bypass is going to built soon. This corridor suffers traffic congestion problem at urban sections.

Third Corridor is currently served by NLEx and Olongapo-San Fernando Road. An alternative is SCTEx in lieu of Olongapo-San Fernando Road.

Fourth Corridor is currently served by SCTEx.

Although lateral (or east-west) movement of traffic is not significant yet, several lateral roads are already provided.

TRAFFIC CONDITIONS

- Typical traffic problems common to inter-city arterial roads such as Pan Philippine Highway and Manila North Road are as follows;

  - The inter-city arterial road connects small, medium and large size urban centers at an interval of about 10 km.

  - At such urban sections, local traffic like jeepneys and tricycles drastically increase which greatly affect smooth flow of traffic. Urban section of the Pan Philippine Highway at Cabanatuan City is a good example. Through traffic can pass through the city in 20 minutes if there is no local traffic, but it sometimes takes 60 minutes to pass through due to heavy slow moving local traffic.

  - On the other hand, the inter-city section (on rural section) can be still traveled at the travel speed of about 30 km./hr.

  - Thus, traffic bottlenecks are created only at urban sections of the inter-city roads.

  - Widening of such urban sections is difficult due to roadside development.

  - There are two solutions, one is to construct a bypass at medium and large urban centers, then bypass will be connected by new roads when the inter-city section reaches to its traffic capacity. This model is adopted for the Pan Philippine Highway. The other is to construct an expressway parallel to the inter-city road. This model is adopted for Manila North Road.

SOUTH OF METRO MANILA

ARTERIAL ROAD NETWORK AND EXPRESSWAY NETWORK

- All mega urban, primary urban and secondary urban centers are connected by arterial roads. The arterial road network is well formed.

- There are two (2) expressways, namely South Luzon Expressway (SLEx and Southern Tagalog Arterial Road (STAR). SLEx and STAR is about to be connected when the on-going construction of SLEx Extension is completed.

- There are many Eco-zones/parks in the area. Many of them are served by SLEx and STAR, however, still many of them located in northern and middle of Cavite Province are not served by an Expressway.

- There are six (6) important transport corridors as follows;

  - First Corridor : Metro Manila-Calamba-Sto. Tomas-Lucena-Region V
  - Second Corridor : Metro Manila-Calamba-Batangas Port
  - Third Corridor : Metro Manila-Rosario-Dasmariñas-Carmona- in Cavite Province
  - Fourth Corridor : Metro Manila-Tagaytay-Calatagan in Batangas Province
  - Fifth Corridor : Metro Manila-Ternate in Cavite Province
  - Sixth Corridor : Metro Manila-Calamba-Los Banos-Pagsanjan in Laguna Province

- First Corridor is served by SLEx up to Calamba, then by Pan Philippine Highway.

- Second Corridor is served by SLEx and STAR, and Calamba-Sto. Tomas-Lipa-Batangas Road.

- Third Corridor is served by Manila-Cavite Coastal Expressway, Bacoor-Rosario Road, Aguinaldo Highway and Governor's Drive.

- Fourth Corridor is served by SLEx-Sta. Rosa-Tagaytay Road or Aguinaldo Highway up to Tagaytay, then Tagaytay-Lian-Calatagan Road.

- Fifth Corridor is served by Manila-Cavite Coastal Expressway and Bacoor-Rosario-Ternate Road.

- Sixth Corridor is served by SLEx, Calamba-Los Baños-Pagsanjan Road.

TRAFFIC CONDITIONS

- Arterial roads in Cavite and Laguna Provinces have the similar traffic congestion problems as arterial roads in Metro Manila.

- Arterial roads in Batangas Province have the similar traffic congestion problems as arterial roads in north of Metro Manila.

12.3 POLICY AND STRATEGY FOR DEVELOPMENT OF HSH

12.3.1 HSH Development Policy

Based on National and Regional development policies and current issues, HSH development policies were established as follows;

HSH DEVELOPMENT POLICIES

- To achieve national integration of socio-economic activities.
- To decongest traffic on Metro Manila arterial roads.
- To actively support development of international logistic bases.
- To promote sound urban expansion.
- To improve accessibility to main tourist spots.

12.3.2 HSH Development Strategy

To achieve development policies, HSH development strategies were established as follows;

DEVELOPMENT POLICIES	DEVELOPMENT STRATEGY
● To achieve national integration of socio-economic activities	● To form a backbone transport axes.
● To decongest traffic on arterial roads	● To decongest traffic in Metro Manila and its suburbs.
● To actively support development of international logistic bases.	● To provide efficient transport facilities for logistic corridors.
● To promote sound urban expansion	● To provide transport facilities for sound urban expansion
● To improve accessibility to main tourist spots.	

Strategies for development HSH for each region are as follows;

METRO MANILA

- HSH-1 shall be planned to form a network, since current HSH-1 are individually functioning.
- HSH-1 shall be so placed to reduce traffic congestion of urban arterial roads.
- HSH-1 shall connect all international ports and airports.
- ROW acquisition is extremely difficult, so that existing road, rail and other ROW shall be utilized as much as possible.
- Existing NLEx and SLEx will be congested within Metro Manila section in future, traffic distribution road (C-6 Expressway) shall be planned.
- Development of HSH-1 requires huge investment. PPP schemes suitable for the country shall be selected.
- Strong government or semi-government organization to plan and manage all HSH-1 development should be studied.
- HSH-2 shall be designated from the existing urban arterial roads, since new road construction is practically impossible due to ROW acquisition.
- HSH-2 shall be well connected with HSH-1.
- HSH-2 shall supplement the function of HSH-1.
- For designated HSH-2, grade separation of at-grade intersections shall be promoted to achieve smooth traffic flow.

NORTH OF METRO MANILA

- All regional urban centers shall be connected by HSH-1 to achieve integration of socio-economic activities.
- Two (2) north-south development corridors (North-West Development axis and North-East Development axis) and Metro Manila-Subic corridor shall be provided with HSH-1 facilities.
- All international ports and airports shall be connected by HSH-1.
- Alternate access to Metro Manila other than existing NLEx shall be made by HSH-1.
- East-West connection by HSH-1 shall be achieved.
- HSH-2 in this area shall be initially a bypass solution, then these shall be connected to form HSH-1.

SOUTH OF METRO MANILA

- All regional urban centers shall be connected by HSH-1.
- North-South industrial development beltway shall be provided with HSH-1.
- South-Luzon development axis shall be provided with HSH-1.
- Numerous eco-zones shall be connected by HSH-1.
- International ports shall be connected by HSH-1.
- Tourism attraction zones shall be provided with HSH-1 or HSH-2.
- HSH-2 shall be achieved by constructing a bypass and/or grade separation facility at at-grade intersection.

12.4 OVERALL ROAD NETWORK DEVELOPMENT PLAN

12.4.1 Appropriateness of National Road Network

National road network is shown in **Figure 12.4.1-1** with functional road classification. In order to review the appropriateness of national road network, cities were classified as follows;

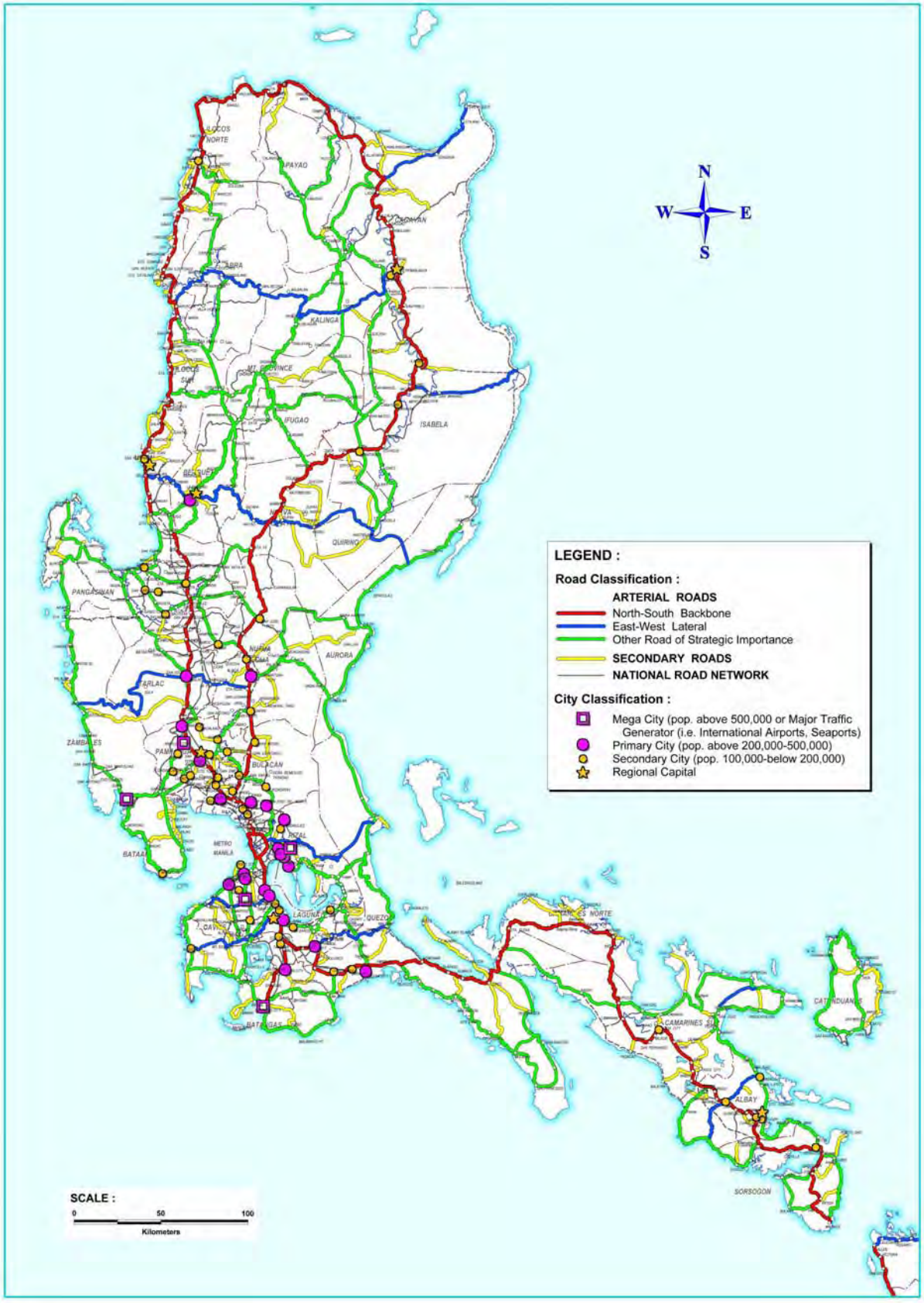
CITY CLASSIFICATION

Mega City	:	City with population over 500,000 or city with major traffic generator (such as international port or international airport)
Primary City	:	City with population between 200,000 and 500,000
Secondary City	:	City with population between 100,000 and 200,000
Regional Capital City	:	Regional Capital City is classified as a Primary City, even though population is less than 200,000

Distribution of cities classified by above criteria is shown in **Figure 12.4.1-1** together with functional road classification. All Mega Cities, Primary Cities, and Secondary Cities are connected by primary national roads (North-South Backbone, East-West Lateral and other Road of Strategic Importance). It can be concluded that national road network is well formed.

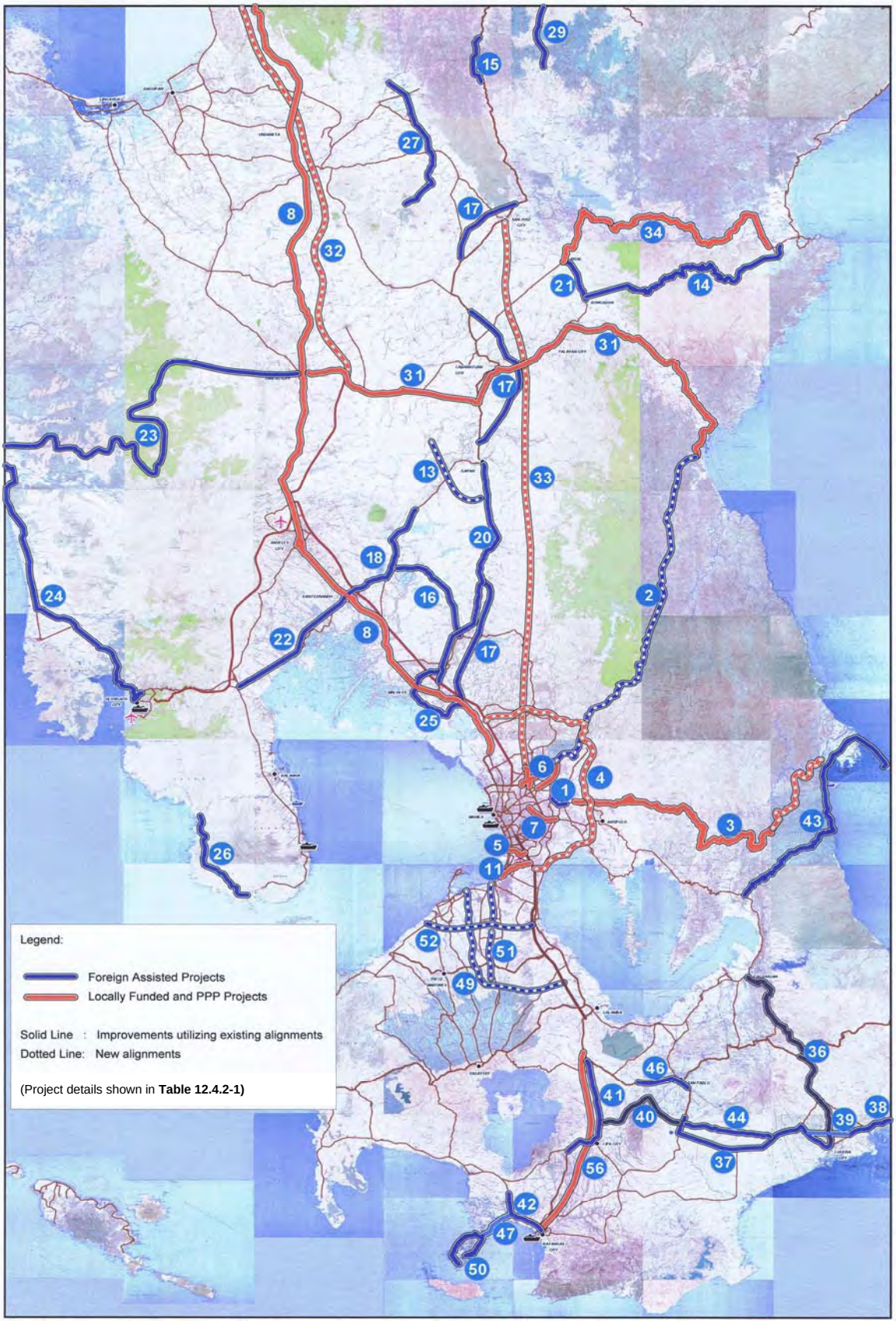
12.4.2 DPWH's Road Network Development Plan

Based on the national road network, DPWH prepared the Medium-Term Public Investment plan (2005-2010) which shows on-going road projects and proposed road projects, some of which are proposed to be implemented after 2010. Proposed road development projects are shown in **Figure 12.4.2-1** and **Table 12.4.2-1**.



Source: Prepared by the Study Team based on DPWH data and NSCB data.

FIGURE 12.4.1-1 URBAN DISTRIBUTION AND DPWH FUNCTIONAL ROAD CLASSIFICATION



Source: Medium Term Public Investment Program 2005-2010 (MTPIP)

FIGURE 12.4.2-1 DPWH'S ROAD DEVELOPMENT PLAN FOR REGION III, NCR AND REGION IV-A

TABLE 12.4.2-1 (1/2) ON-GOING AND PROPOSED ROAD PROJECTS

REF. NO.	REGION / PROJECTS	GOP	LP	TPC
		(in Thousand Pesos)		
NATIONAL CAPITAL REGION				
A. FOREIGN ASSISTED PROJECTS				
A-1 ONGOING				
1	Marcos Highway, Marikina	489,230.00	489,230.00	978,460.00
A-2 PROPOSED				
2	Batasan,QC-Dingalan Aurora Rd.	433,000.00	649,500.00	1,082,500.00
B. LOCALLY FUNDED PROJECTS				
3	Marikina-Infanta-Real Rd.	1,423,695.00		1,423,695.00
4	Circumferential Road - 6	48,349,000.00		48,349,000.00
5	NAIA Exp. & other major roads in MM	1,469,020.00		1,469,020.00
6	Widening/concreting of Commonwealth / Congressional Ave., Q.C	315,000.00		315,000.00
7	Widening/concreting of Ortigas Ave. Ext (b/w Roasrio & Mangahan Bridge)	155,500.00		155,500.00
8	Widening/concreting of Mc Arthur Hway (Manila North Road)	2,609,000.00		2,609,000.00
9	Construction / Opening of C-6 including ROW [see 4]	350,000.00		350,000.00
10	Opening/concreting of Mindanao Ave., Q.C [not shown]	333,666.00		333,666.00
11	C-5 Extension Road Project from SLEx to Sucat including ROW	1,205,000.00		1,205,000.00
REGION III (CENTRAL LUZON)				
A. FOREIGN ASSISTED PROJECTS				
A-1 ONGOING				
12	Nueva Ecija Package IV (improvement) [not shown]	185,779.00	735,912.00	921,691.00
13	San Isidro-Jaen Jct. Maharlika Rd.	33,559.00	31,048.00	64,607.00
14	Bongabong-Baler Rd. (San Luis-Ma. Aurora-Basal Section) (improvement)	165,176.00	479,419.00	644,595.00
15	Dalton Pass Rehabilitation Project (rehab./improvement)	89,844.00	530,735.00	620,579.00
16	Baliuag Bdry-Candaba Road Project (improvement)	21,435.00	6,110.00	27,545.00
17	Arterial Rd Bypass Project Phase I (Plaridel, Cabanatuan, & San Jose Bypass)	869,448.00	2,480,385.00	3,349,833.00
18	Widenning Gapan-Sn Fernando-Olongapo Rd. & Brdgs (Dolores Flyover-Sta Cruz Section)	590,344.00	976,516.00	1,566,860.00
19	North Luzon Package Manila North Road (Mon.-Agoo/Aringay Bdry) Launion,. Bul., Pang. [not shown]	180,460.00	180,460.00	360,920.00
A-2 PROPOSED				
20	Sta Rita (Bul) - Nueva Ecija	1,027,900.00	1,348,500.00	2,376,400.00
21	Bongabon-Pantabangan-Baler Rd	1,157,400.00	1,583,600.00	2,741,000.00
22	Gapan-SnFernando-Olongapo Rd (Sta .Cruz, Lubao-Dinalupihan Section)	745,500.00	1,312,460.00	2,057,960.00
23	Iba-Tarlac Road, 87.25km	951,040.00	1,426,560.00	2,377,600.00
24	Olongapo-Bugallon Rd,(asset reservation)	240,954.00	512,026.00	752,980.00
25	Bigaa-Plaridel-Bulacan-Malolos Rd, (asset preservation)	57,958.00	123,162.00	181,120.00

TABLE 12.4.2-1(2/2) ON-GOING AND PROPOSED ROAD PROJECTS

REF. NO.	REGION / PROJECTS	GOP	LP	TPC
		(in Thousand Pesos)		
26	Bagac-Mariveles Rd Bataan (imp.)	196,768.00	418,132.00	614,900.00
27	San-Nicolas-Natividad-San Quintin-Umingan-Guimba Rd (imp.)	27,037.00	57,453.00	84,490.00
28	Arterial Rd Bypass Project Phase II (Cabanatuan, Plaridel & San Jose Bypass)* [see 17]	5,604,900.00		5,604,900.00
29	Dalton Pass East Alignment, (Digdig-Carranglan-Aritao Rd N.Ecija)	707,937.00	1,061,905.00	1,769,842.00
30	Batasan, Q.C-Dingalan Aurora [see 2]	433,000.00	649,500.00	1,082,500.00
B. LOCALLY FUNDED PROJECTS				
31	Tarlac-N.Ecija-Aurora-Dingalan Port (TarlacCity-StaRosa,N.Ecija-PalayanCity-Gabaldon-DingalanPort)	2,049,925.00		2,049,925.00
32	Tarlac-Pangasinan-LaUnion Exp (TPLEx)	11,594,000.00		11,594,000.00
33	North Luzon Expressway East (NLEE)	8,787,000.00		8,787,000.00
34	Pantabangan-Canili Section (Along Bongabon-Baler Rd)	1,992,900.00		1,992,900.00
REGION IV-A (SOUTHERN TAGALOG)				
A. FOREIGN ASSISTED PROJECTS				
A-1 ONGOING				
35	Marcos Highway, Marikina [see 1]	489,230.00	489,230.00	978,460.00
	Asset Preservation/South Luzon Package	301,920.00	301,920.00	603,840.00
36	Pagsanjan-Lucena City			
37	Tiaong-Lucena Jct Rd			
38	Pagbilao-Cam. Norte			
39	Lucena Diversion Rd.			
A-2 PROPOSED				
40	Lipa-Alaminos-San Pablo-Tiaong Rd (Road Enhancement)	264,900.00	368,800.00	633,700.00
41	Manila South Road (Malvar-Lipa Rd)	114,275.00	242,835.00	357,110.00
42	Palico-Balayan-Batangas Rd.	93,322.00	198,208.00	291,530.00
43	Famy-Infanta-Dinahican Port.	29,968.00	63,682.00	93,650.00
44	Candelaria Bypass Rd.*	234,504.00		234,504.00
45	Calamba-Los Baños Bypass Rd.* [not shown]	2,407,851.00		2,407,851.00
46	Alaminos-San Pablo City Bypass Rd (along Maharlika Hway).*	605,130.00		605,130.00
47	Batangas-Bauan Ring Rd.*	1,358,090.00		1,358,090.00
48	Tiaong Bypass.* [not shown]	102,900.00		102,900.00
49	CALA Expressway*	8,749,600.00		8,749,600.00
50	Mabini Circumferential Rd.	126,512.00	189,768.00	316,280.00
51	CALA Roads, North-South	2,079,240.00	3,118,860.00	5,198,100.00
52	CALA Roads, Daang Hari	501,640.00	752,460.00	1,254,100.00
53	Malunay-San Francisco Rd. [not shown]	208,000.00	312,000.00	520,000.00
B. LOCALLY FUNDED PROJECTS				
54	Marikina-Infanta-Real Rd. [see 3]	1,423,695.00		1,423,695.00
55	Circumferrential Rd - 6 [see 4]	48,349,000.00		48,349,000.00
56	Southern Luzon Tagalog Arterial Rd.	2,511,000.00		2,511,000.00

Notes:
* Designated as PPP Projects, GOP - Government of the Philippines,
LP - Loan Package, TPC - Total Project Cost

12.5 IDENTIFICATION OF HSH CORRIDORS

HSH corridors were identified based on criteria shown in Section 2.2 of Chapter 2 and HSH development strategy.

(1) Distribution of Regional Urban Centers

Distribution of regional urban centers were presented in **Figure 12.4.1-1**.

(2) Strategic Regional/Urban Development Corridor and Strategically Important Area for Economic Development

Development strategy of Regions III, NCR and Region IV-A is shown in **Figure 10.2.2-1** in Chapter 10.

(3) Existing Road Network and Its Functional Road Classification

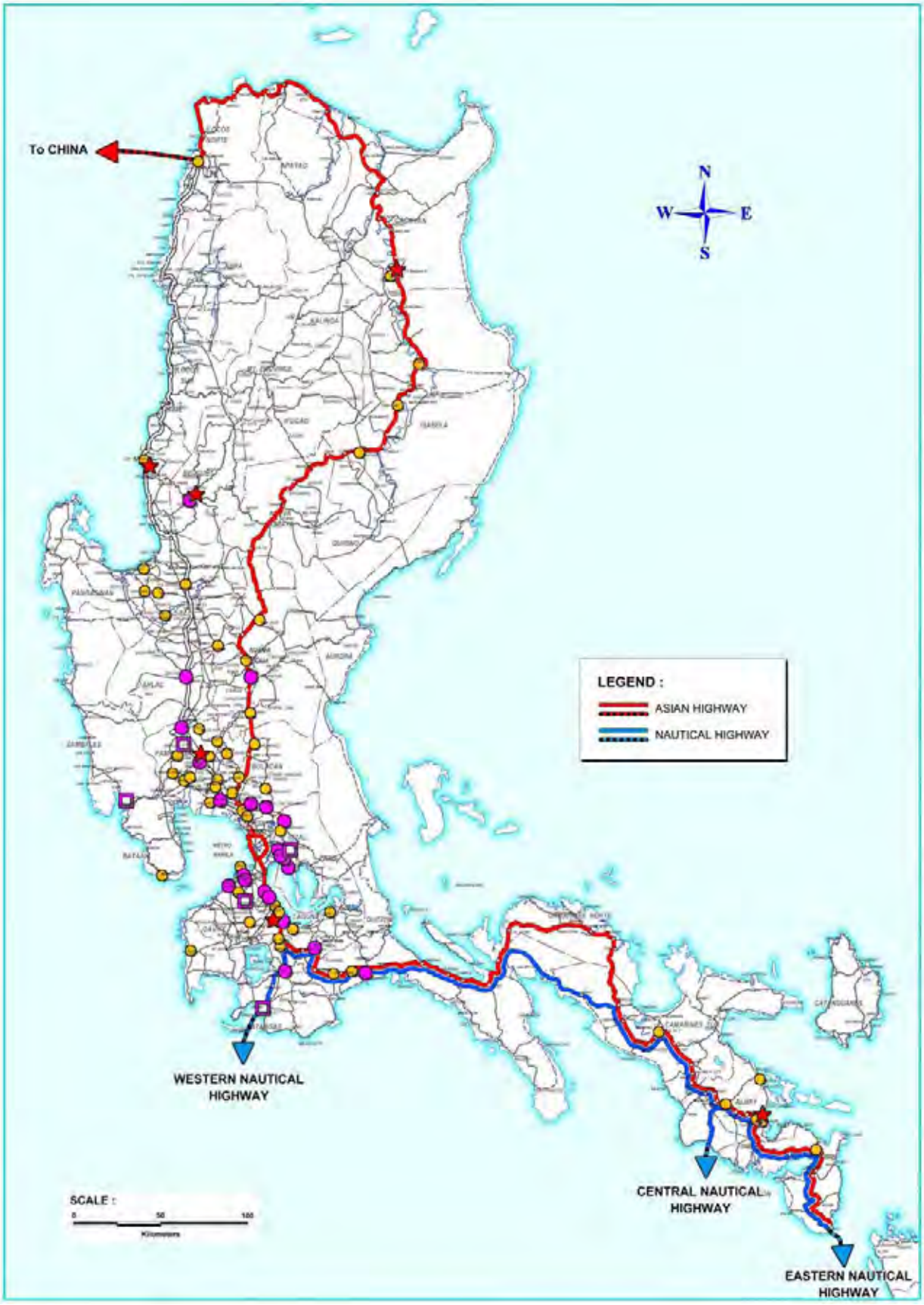
Existing road network and its functional road classification was presented in **Figure 12.4.1-1**.

(4) Specifically Designated Road

There are two (2) specifically designated roads;

- ASIAN Highway
- Nautical Highway

They are shown in **Figure 12.5-1**.



Source: Prepared by the Study Team based on DPWH data and NSCB data.

FIGURE 12.5-1 SPECIFICALLY DESIGNATED ROADS

(5) Corridor Location

Corridors located within Metro Manila and its suburbs are classified as "Intra-Urban Corridor", and all others are classified as "Inter-Urban Corridor".

(6) Indication of "Do Nothing" Case Traffic Assignment

"Do Nothing" Case traffic assignment results indicate the following:

Metro Manila

- Traffic condition of all Metro Manila roads will be further aggravated. Some drastic measures need to be employed; however, ROW acquisition is a serious problem.
- Outskirts of Metro Manila are rapidly developing in disorderly manner. Road network to guide orderly urban development is needed.
- An expressway, which functions as a traffic distributor of expressways, from the North and the South is needed.

North of Metro Manila

- NLEx will soon be congested. Another expressway is needed. North of Manila is served by NLEx (8 lanes) and South of Manila is served by SLEx, Skyway, and Manila-Cavite (20 lanes in total)
- Pan-Philippine Highway (Daang Maharlika) will be further congested. Alternative highway is needed.
- Connector expressway(s) to link expressways in the direction of E-W will be needed to improve flexibility of expressway network.

South of Metro Manila

- Roads in Cavite and Laguna Provinces will be seriously congested like the present condition of Metro Manila's road.
- Existing expressways, SLEx, Skyway, Manila-Cavite Coastal Expressway will also be congested. More expressways and a distributor of traffic on these expressways will be needed.

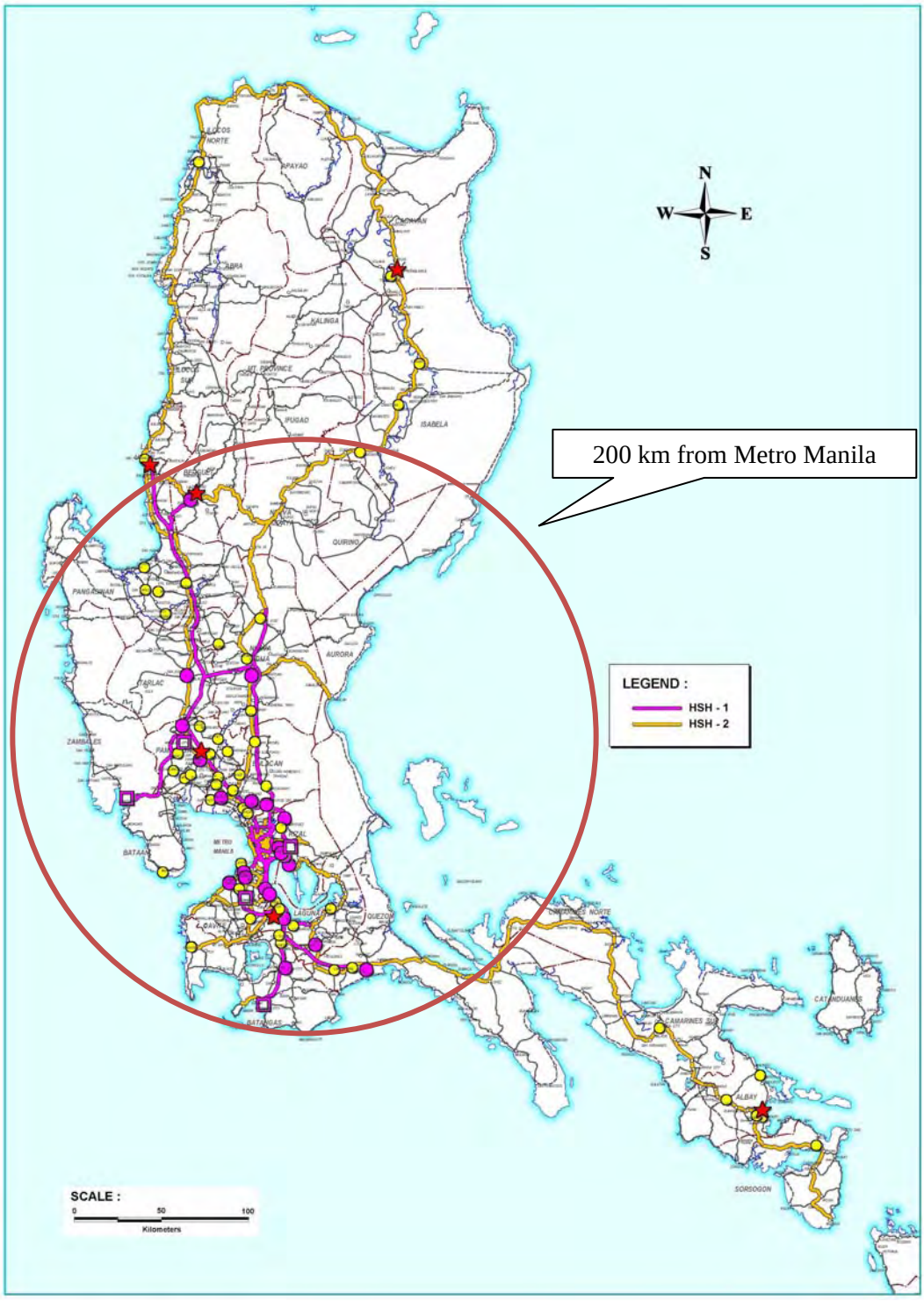
12.6 PROPOSED HSH NETWORK FOR LUZON ISLAND

In order to examine connectivity of HSH network between the Study Area and the rest of Luzon Island, HSH network in Luzon Island was planned.

- Urban centers (secondary cities) are located along the north-south backbone roads (see **Figure 12.4.1-1**).
- According to DPWH, major traffic bottlenecks are observed at the urban sections of the north-south backbone roads. Inter-urban sections are not experiencing traffic problems.

- There are two (2) specifically designated roads, one is ASIAN Highway and the other is Nautical Highway (see **Figure 12.5-1**). Both are the same routes of the north-south backbone roads.

On the basis of above, the north-south backbone roads outside the Study Area were identified as HSH-2. To develop HSH-1 in outside the Study Area was judged to be premature. Proposed HSH network for Luzon Island is shown in **Figure 12.6-1**.



Source: Study Team

FIGURE 12.6-1 PROPOSED HSH NETWORK FOR LUZON ISLAND

12.7 PROPOSED HSH-1 NETWORK

12.7.1 HSH-1 Development Policy and Strategy

HSH-1 development policies and strategies are summarized in **Table 12.7.1-1.**

12.7.2 HSH-1 Development Scenarios

In due consideration of existing issues, policies for road development, regional development scenario and HSH-1 strategies, four (4) HSH-1 development scenarios were developed.

Development Scenario-1: Decentralization Scenario to mitigate over-concentration in Metro Manila

Development Scenario-2: Metro Manila Traffic Decongestion Scenario

Development Scenario-3: Balanced Development Scenario (Scenario-1 + Scenario-2)

Development Scenario-4: Do Max. Scenario

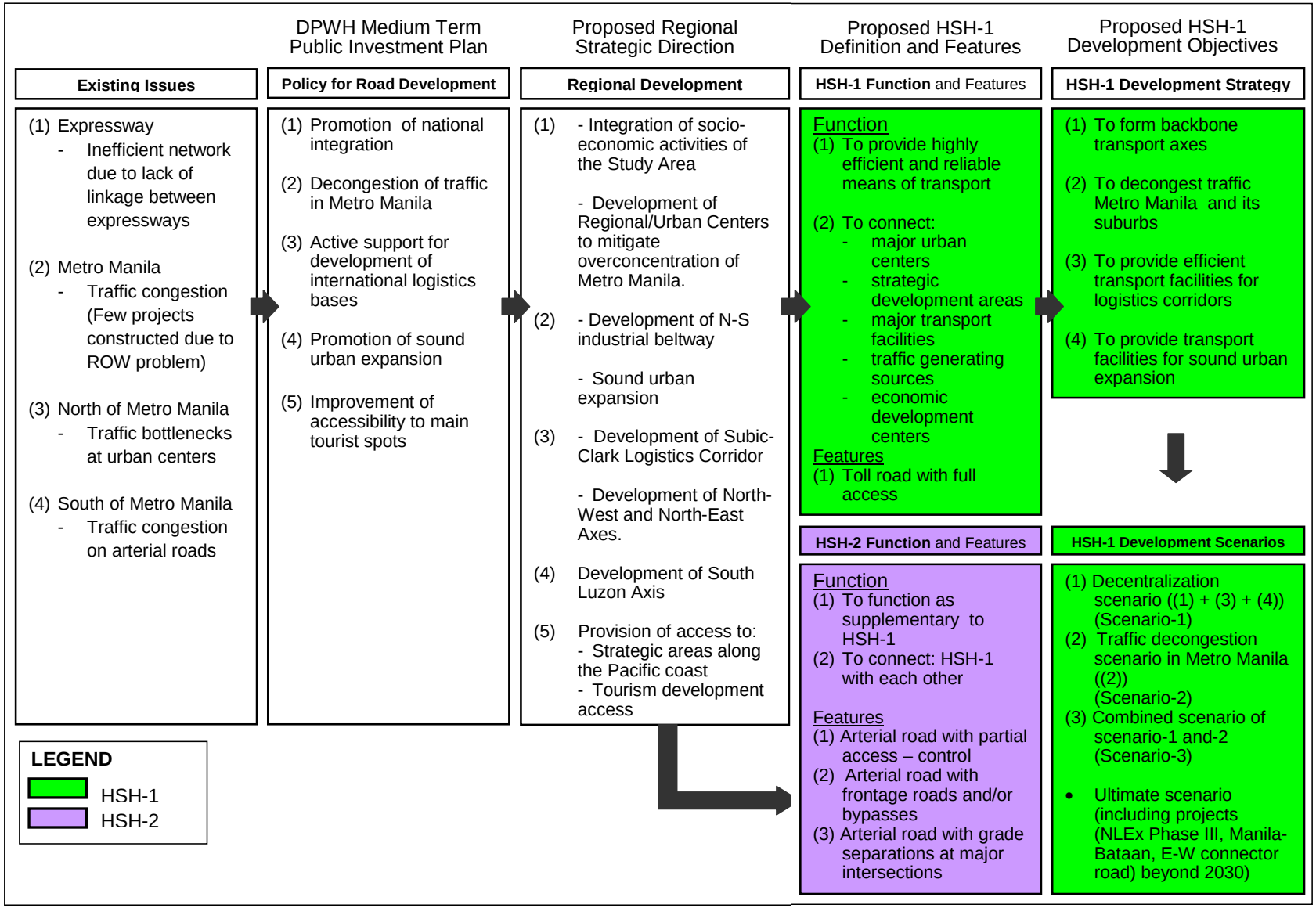
Concept of each development scenario is presented in **Table 12.7.2-1.**

TABLE 12.7.2-1 HSH-1 DEVELOPMENT SCENARIOS

Basic Network	• Existing and on-going expressways • NLEx-SLEx Link Expressway ▪ Missing link of N-S Backbone ▪ Basic Link to form expressway network • C-6 Expressway ▪ Basic Link to form expressway network ▪ Distribute traffic from various expressways to destinations in Metro Manila ▪ Guide sound urban expansion				
Development Scenario	**HSH Development Policies**				
	(1) Promotion of National Integration and De-centralization	(2) Decongestion of Metro Manila Traffic	(3) Active Support for Development of International Logistics Bases	(4) Promotion of Sound Urban Expansion	(5) Improvement of Accessibility to Main Tourist Spots
Scenario-1: Decentralization Scenario to mitigate overconcentration in Metro Manila	◎	-	◎	◎	◎
Scenario-2: Metro Manila Traffic Decongestion Scenario	-	◎	◎	◎	-
Scenario-3: Balanced Development Scenario (Scenarios 1+2)	◎	◎	◎	◎	◎
Scenario-4: Do Max Plan	◎	◎	◎	◎	◎

Note: ◎ Main Focus

TABLE 12.7.1-1 HSH-1 DEVELOPMENT POLICY AND STRATEGY



(1) Development Scenario-1: Decentralization Scenario

Decentralization to mitigate overconcentration of socio-economic activities in Metro Manila is one of the Government's major policies. In order to achieve this policy, regional urban centers need to be developed, for which socio-economic activities of these centers and Metro Manila shall be integrated. HSH-1 network under this scenario was planned focusing on the following:

- All regional urban centers shall be connected each other and with Metro Manila by HSH-1 (see **Figure 12.7.2-1).**

- All international logistic bases such as international ports and airports shall be connected by HSH-1. All economic zones shall have access to international logistics bases (see **Figure 12.7.2-1).**

- To guide sound urban expansion in Provinces of Cavite, Laguna, Rizal and Bulacan, HSH-1 shall be in-place.

Cavite Province	:	CALA Expressway
Laguna Province	:	Calamba-Los Baños Expressway
Rizal Province	:	C-6 Expressway
Bulacan Province	:	La Mesa Parkway/NLEx-East

- To improve accessibility to main tourist spots, HSH-1 shall be placed.
  - Los Baños Area (Hot Springs) by Calamba-Los Baños Expressway
  - Subic (Beach Resorts) by SCTEX.

  Other tourism spots such as Tagaytay, Batangas areas, etc. shall be accessed by HSH-2.

The proposed HSH-1 Network under this scenario is shown in **Figure 12.7.2-2.**

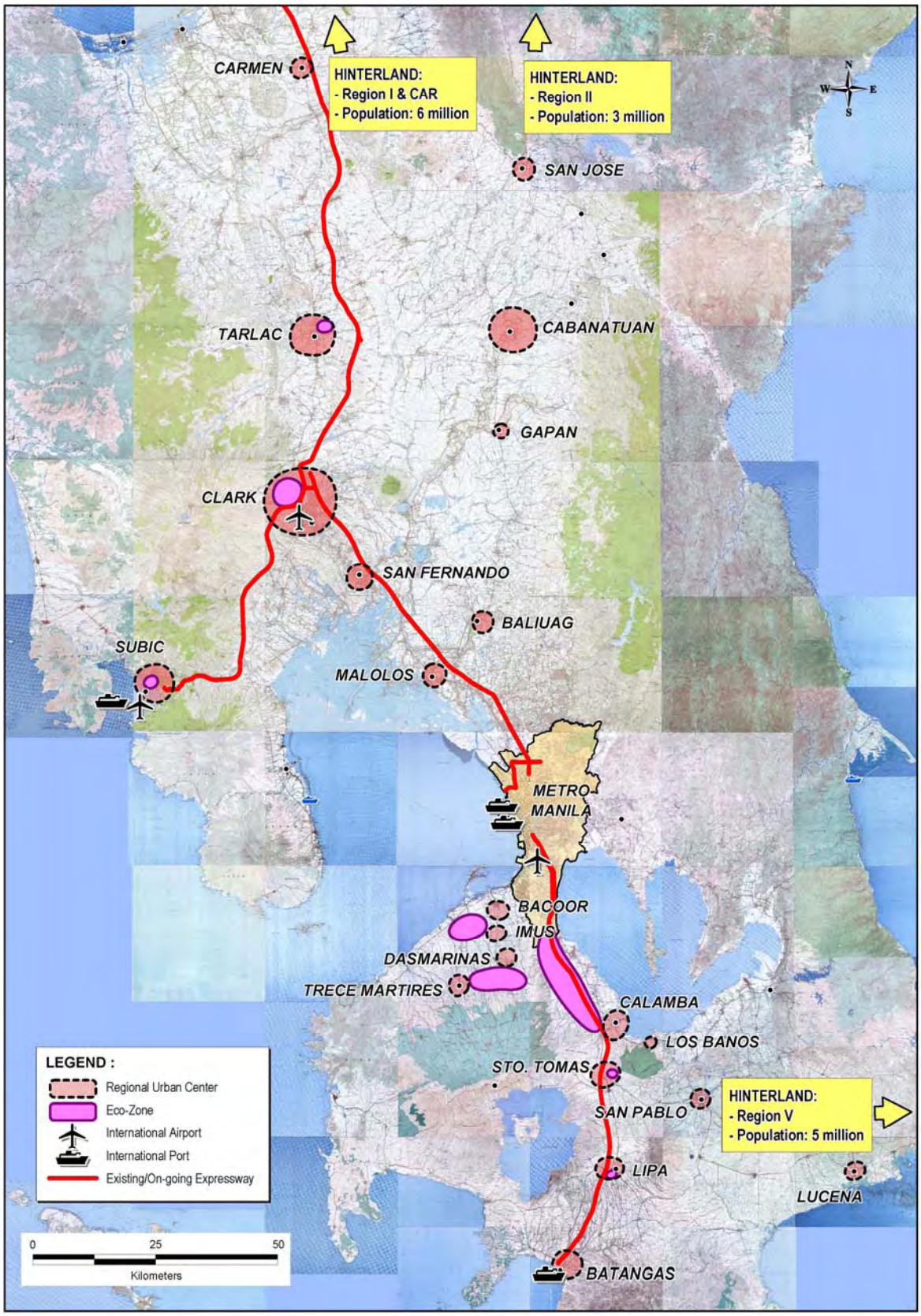


FIGURE 12.7.2-1 DISTRIBUTION OF REGIONAL URBAN CENTERS, ECO-ZONES AND INTERNATIONAL PORTS AND AIRPORTS

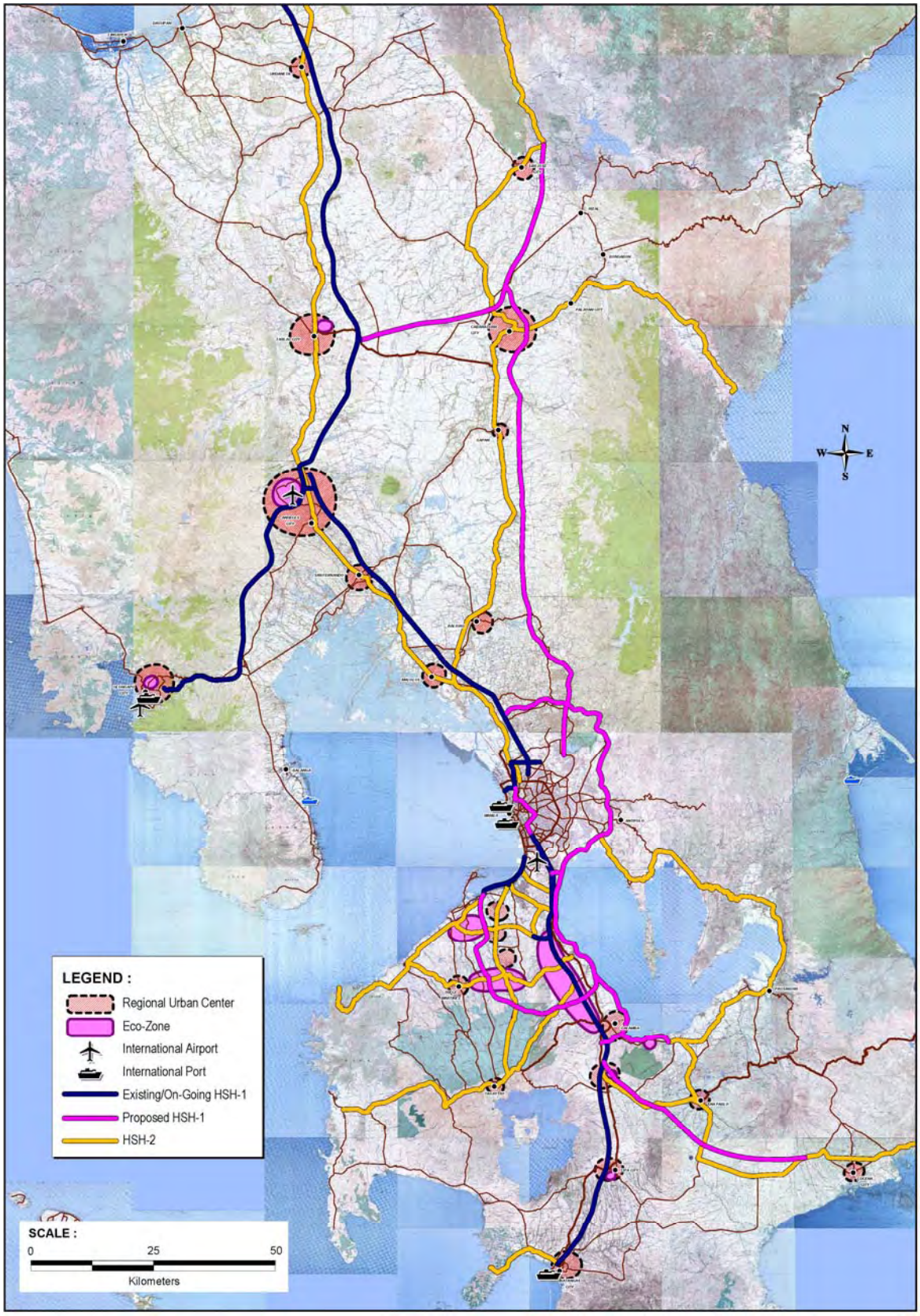


FIGURE 12.7.2-2 HSH-1 DEVELOPMENT SCENARIO-1: DECENTRALIZATION SCENARIO

(2) Development Scenario-2: Metro Manila Traffic Decongestion Scenario

Decongestion of Metro Manila traffic is another important policy of the Government. Metro Manila needs more roads, however, new road construction has been rarely undertaken due to ROW acquisition problem, which often delayed implementation for years and some cases such as C-3 and C-5, the DPWH gave up implementation.

To mitigate ROW acquisition problem, key measures is to construct elevated or underground roads utilizing existing road, rail and/or river ROW.

Figure 12.7.2-3 shows road ROW of more than 35m which can accommodate a 4-lane elevated road and on-off ramps without acquiring new road ROW.

C-2	:	Can partially accommodate an expressway except existing Nagtahan Interchange section. (see Chapter 14 for alternative alignment study of NLEx-SLEx Link Expressway)
C-3	:	Can partially accommodate an expressway (see Chapter 14 for alternative alignment study of NLEx-SLEx Link Expressway)
C-4	:	MRT Line-3 at center of road. Most intersections have already grade separation structure, thus practically impossible to accommodate an expressway.
C-5	:	Most intersections have grade separation structures, thus practically impossible to accommodate an expressway.
R-1	:	Has wide ROW, however, an elevated expressway is not accepted due to aesthetic restriction.
R-10	:	Though ROW is wide, but about 1/3 of ROW was occupied by Thousands of squatters, thus difficult to accommodate an expressway.
Mindanao Ave	:	Currently connected with NLEx. Segment 8.1.
Visayas Ave	:	Not located along an expressway corridor.
Marcos Highway:		There is a plan to extend MRT Line-2, thus difficult to accommodate another structure for an expressway.

In view of above, expressways within Metro Manila were planned as follows;

NLEx-SLEx Link Expressway	:	Utilizing ROW of PNR, C-2 and R-3.
NAIA Expressway	:	Utilizing ROW of Airport Road and Paranaque River.
Manila Bay Expressway	:	Utilizing ROW of reclamation area and under-sea.

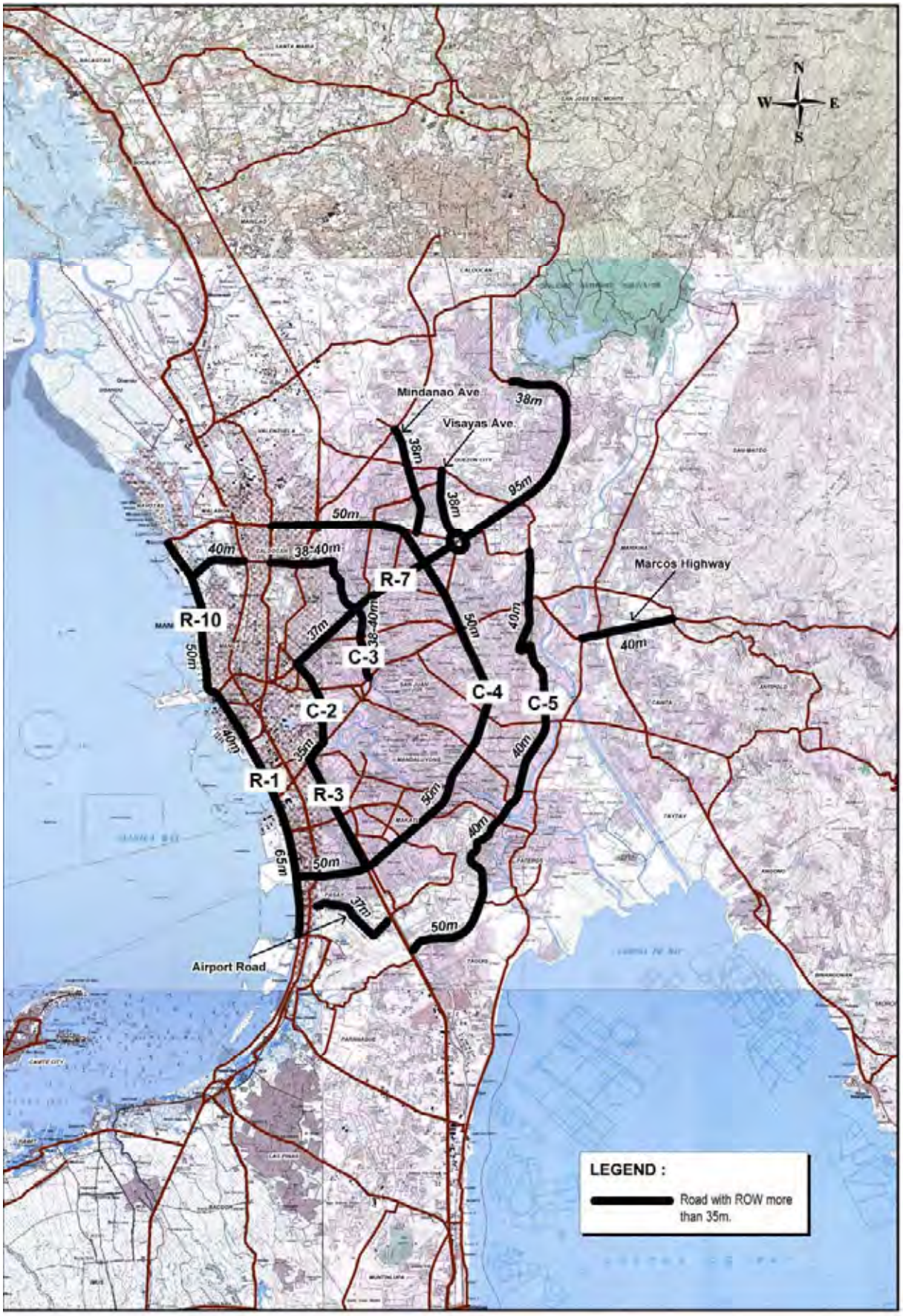


FIGURE 12.7.2-3 ROADS WITH ROW MORE THAN 35m.

La Mesa Parkway	:	Utilizing MWSS ROW (for water pipes)
R-7 Expressway	:	Utilizing ROW of R-7.
Pasig-Marikina Expressway	:	Utilizing river ROW of Pasig and Marikina Rivers.
C-5/FTI/Skyway Connector Road	:	Utilizing Manila Food Terminal land.

Proposed HSH-1 Network under this scenario is shown in **Figure 12.7.2-4.** All expressways which attract more than 50,000 pcu/day were included in this scenario. As shown in the figure, C-6 is not connected with radial expressways due to no available space for expressways, thus, C-6 Expressway connection with radial direction was planned to be done by HSH-2.

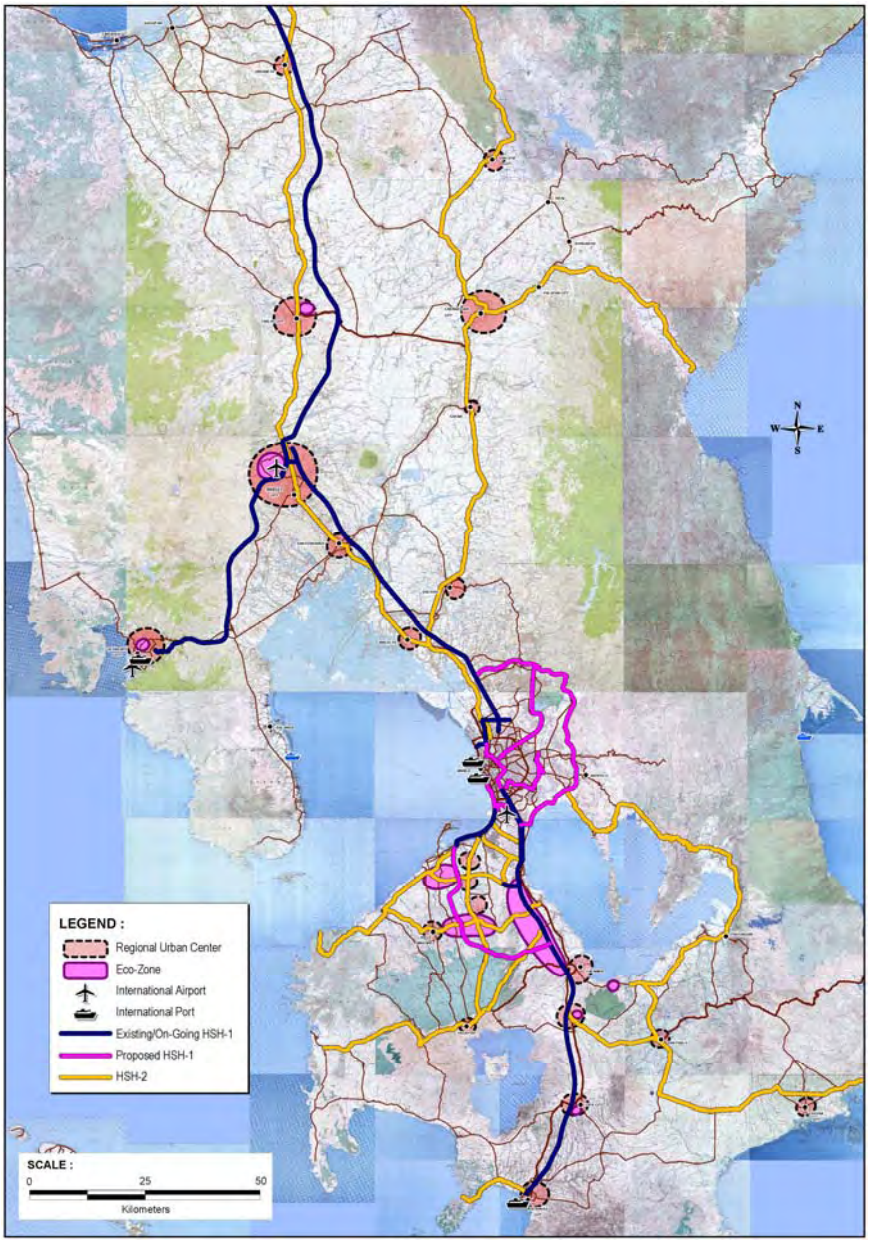


FIGURE 12.7.2-4 HSH-1 DEVELOPMENT SCENARIO-2: METRO MANILA TRAFFIC DECONGESTION SCENARIO

(3) Development Scenario-3: Balanced Development Scenario

In order to achieve development policies of 1) promotion of national integration and 2) decongestion of Metro Manila traffic, this development scenario was prepared by combining HSH-1 network of Scenarios-1 and 2. Proposed HSH-1 network is shown in **Figure 12.7.2-5.**

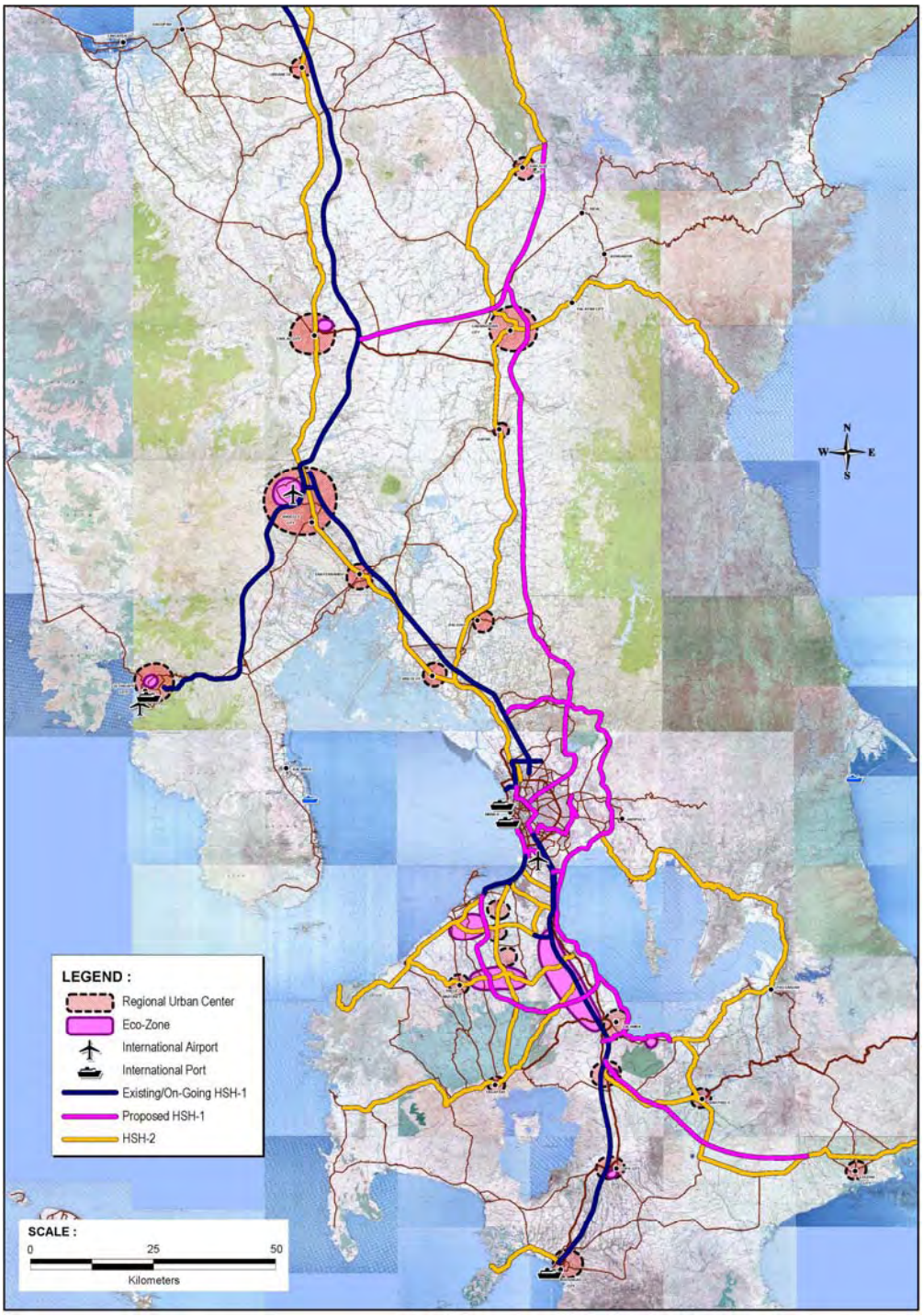


FIGURE 12.7.2-5 HSH-1 DEVELOPMENT SCENARIO-3: BALANCED DEVELOPMENT SCENARIO (SCENARIO-1 + SCENARIO-2)

(4) Development Scenario-4: Do Max Scenario

In addition to HSH-1 network under Scenario-3, the following three (3) roads were added;

- Manila-Bataan Coastal Road: concerned local governments are strongly requesting realization of this road.
- NLEx-Phase 3: a private sector has a franchise for this route.
- East-West Connection Expressway: To improve flexibility of selecting routes by road users (NLEx and NLEx-East), this road was proposed.

HSH-1 network under this scenario is shown in **Figure 12.7.2-6.**

Table 12.7.2-2 shows HSH projects under each scenario.

TABLE 12.7.2-2 HSH-1 PROJECTS FORMING EACH DEVELOPMENT SCENARIO

HSH-1 Project	Scenario-1 (Decentralization Scenario)	Scenario-2 (Metro Manila Traffic Decongestion Scenario)	Scenario-3 (1+2)	Scenario-4 Do Max Scenario
NLEx – SLEx Link Expressway	○	○	○	○
NAIA Expressway (Phase 2)	-	○	○	○
C-6 Expressway/Global City Link	○	○	○	○
C-6 Extension (along Laguna de Bay)	○	-	○	○
Manila Bay Expressway	-	○	○	○
CALA Expressway	○	○	○	○
Central Luzon Expressway	○	-	○	○
Calamba – Los Baños Expressway	○	-	○	○
SLEx Extension (to Lucena City)	○	-	○	○
NLEx East/La Mesa Parkway	○	- (La Mesa Parkway included)	○	○
C-5/FTI/Skyway Connector Road	-	○	○	○
Pasig-Marikina Expressway	-	○	○	○
R-7 Expressway	-	○	○	○
Manila-Bataan Coastal Road	-	-	-	○
NLEx-Phase 3	-	-	-	○
East-West Connection Expressway	-	-	-	○

Note: ○ Project included in a scenario
- Project not included in a scenario

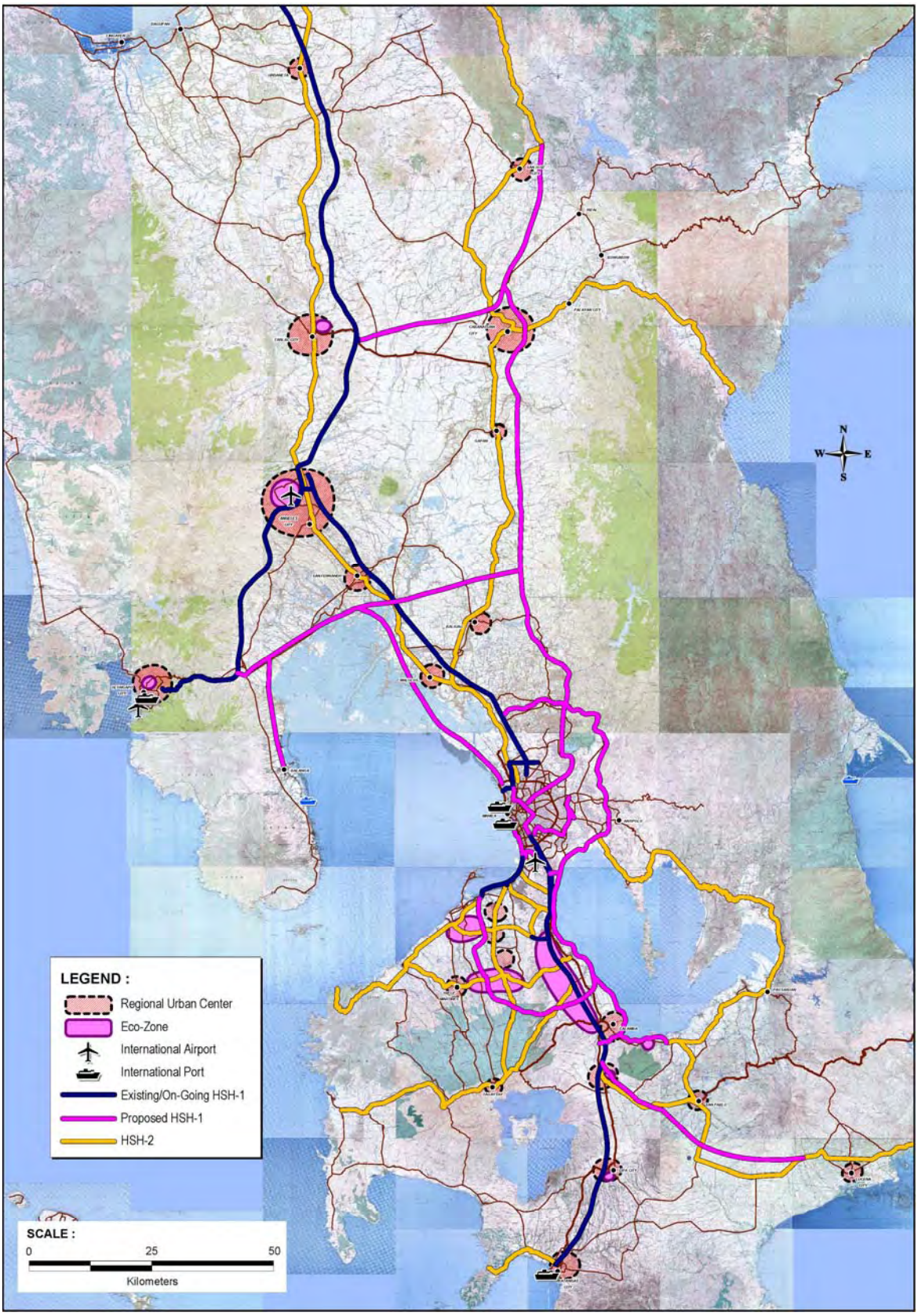


FIGURE 12.7.2-6 HSH-1 DEVELOPMENT SCENARIO-4: DO MAX. SCENARIO

12.7.3 Evaluation of Development Scenarios

Four (4) HSH-1 development scenarios were evaluated based on the following items;

DEVELOPMENT SCENARIOS EVALUATION ITEMS

Evaluation Items	Evaluation Sub-Items
1. Conformity with National Development Policies	1.1 Conformity with "Decentralization Policy"
	1.2 Conformity with "Decongestion of Metro Manila Traffic" policy
2. Transport Efficiency	2.1 Travel time performance
	2.2 Volume Capacity Ratio (V/C ratio) performance
	2.3 Travel Speed Performance
3. Required Investment (total construction cost)	
4. Economic Return	Single Year B/C Ratio
5. Overall Evaluation	

Since item 1 cannot be quantitatively evaluated, therefore, qualitative evaluation of each item was made as follows;

EVALUATION OF EACH ITEM

◎	Best Achievement or Improvement
△	Medium Achievement or Improvement
X	Low Achievement or Improvement

Evaluation results are shown in **Table 12.7.3-1,** and summarized as follows;

Scenario-1

- Does not achieve "Decongestion of Metro Manila Traffic" policy.
- Does not reduce traffic problems in Metro Manila.
- Not recommended.

Scenario-2

- Does not achieve "Decentralization to mitigate overconcentration in Metro Manila" policy.
- Does not reduce traffic problems in outside Metro Manila Area.
- Not recommended.

Scenario-3

- Achieve both national policies.
- Mitigate traffic problems of both inside and outside Metro Manila areas.
- Can be expected relatively high economic return.
- Though huge investment is required, investment level is still within DPWH's financial capacity (refer to section 16.6.4 of Chapter 16).
- Recommended.

Scenario-4

- Almost same performance as Scenario-3, except this scenario requires the highest investment, thus economic return is lower than Scenario-3.
- This scenario includes the following additional three (3) projects to Scenario-3, but these projects can be deferred due to the following reasons;

Manila-Bataan Coastal Road

- There is no major regional urban centers along the corridor, thus it will function as an alternative route of NLEx.
- When NLEx-East which is more important than this road is formed, some of NLEx traffic will be diverted to NLEx-East, therefore above function of this road will not be so significant, thus this road can be deferred.
- This road passes through wide flood-prone areas, thus quite costly and roadside development of the areas near interchanges will not be expected.

NLEx (Phase III)

- Major function of this road is to serve traffic between Subic and Metro Manila, of which traffic demand is not so high yet.
- Above function is being served by the existing SCTEX, thus this road can be deferred.

East-West Connection Expressway

- The function of the expressway is to distribute traffic on NLEx and NLEx-East at a balanced manner.
- Development of NLEx-East will take a lengthy time, therefore, this expressway can be deferred until such time that NLEx-East is formed.

In view of the above evaluation, Scenario-3 was recommended.

Characteristics of Development Scenario-3 are as follows;

CHARACTERISTICS OF DEVELOPMENT SCENARIOS

- To conform with national policies of (1) decentralization to mitigate overconcentration in Metro Manila and (2) decongest Metro Manila traffic.
- All regional urban centers are connected by HSH-1.
- All international ports and airports are connected by HSH-1 to actively support development of international logistics bases.
- Sound urban expansion is supported.
- Accessibility to main tourist spots is improved.
- Overall travel hours in pcu-hour/day will be reduced to 81% or 1,229 thousand pcu-hours will be saved.
- Volume capacity Ratio will be improved.
- Average travel speed will be improved from present 21 km/hr to 27 km/hr.
- The scenario can be financially affordable by the Government under the assumption of 5% of DPWH budget increase and about 40% private sector financing.
- High economic return can be expected.

TABLE 12.7.3-1 EVALUATION OF DEVELOPMENT SCENARIO

			DEVELOPMENT SCENARIO			
			(1)Decentralization	(2) Decongestion of M.M. Traffic	(3) Balanced Development	(4) Do Max
Expressway Length			394 km	179 km	443 km	576 km
EVALUATION ITEMS	Conformity with National Dev't Policy	Decentralization	◎	X	◎	◎
		Decongest Metro Manila Traffic	X	◎	◎	◎
	Transport Efficiency	Travel Time (1,000 pcu.hour per day)	△	△	◎	◎
		V/C Ratio inside Metro Manila	△	◎	◎	◎
		V/C Ratio outside Metro Manila	◎	X	◎	◎
		Average Travel Speed (km/hr)	△	△	◎	◎
	Required Investment (Billion Pesos)		213.2 (1.00) ◎	238.1 (1.12) ◎	343.1 (1.61) △	467.8 (2.19) X
	Economic Return (Single Year B/C Ratio in 2030)		◎ 3.14	△ 2.52	△ 2.65	X 2.20
Overall Evaluation			• Does not achieve "Decongestion of Metro Manila Traffic" policy. • Travel time reduced, but not so much. • V/C ration in Metro Manila not improved • Travel Speed outside Metro Manila improved • Requires minimum investment. • Highest economic return due mainly to less investment cost than others	• Does not achieve "Decentralizatio n policy. • Travel time reduced, but not so much • V/C ratio in Metro Manila improved. • V/C ratio outside Metro Manila not improved. • Travel speed inside Metro Manila improved, but same level as Scenario-1 • Requires almost same investment as Scenario1 but less than ½ of expressways constructed due to high cost of construction. • Medium economic return	• Conforms to National Policy. • Travel time reduced about 20% • V/C ratio both inside and outside Metro Manila improved. • Travel speed both inside and outside Metro Manila improved. • Medium investment among 4 scenarios • Medium economic return	• Conforms to National Policy. • Travel time is reduced about 20% • V/C ratio both inside and outside Metro Manila improved. • Travel speed both inside and outside Metro Manila improved. • Requires highest investment. • Lowest economic return due mainly to high investment required.
			X	X	◎	X
Recommendation			-	-	Recommended	-

Note: Metro Manila includes its suburbs of Cavite, Laguna, Bulacan and Rizal
(1) V/C ratio = Volume/Capacity Ratio
(2) Evaluation

◎ Best achievement, or improvement

△ Medium achievement, or improvement

X Low achievement, or improvement

TABLE 12.7.3-2 EVALUATION OF TRANSPORT EFFECIENCY OF DEVELOPMENT SCENARIO

			Present Status (Do Nothing Case)	DEVELOPMENT SCENARIO							
				(1) Decentralization Scenario to mitigate overconcentration in Metro Manila		(2) Decongestion Metro Manila Traffic Scenario		(3) Balanced Development Scenario (Scenario 1+2)		(4) Do Max Scenario	
Transport Efficiency	Travel Time (1,000 pcu.hour per day)		6,475 (1.00)	△ 5,547 (0.86)		△ 5,618 (0.87)		◎ 5,246 (0.81)		◎ 5,098 (0.79)	
	V/C Ratio inside Metro Manila	Over 1.5	774 km (42%)	595 km (30%)		565 km (28%)		542 km (26%)		514 km (25%)	
		1.0 - 1.5	661 km (35%)	671 km (34%)	△	742 km (37%)	◎	690 km (33%)	◎	674 km (33%)	◎
		Less 1.0	434 km (23%)	703 km (36%)		713 km (35%)		837 km (41%)		881 km (42%)	
	V/C Ratio outside Metro Manila	Over 1.5	15 km (0.4%)	13 km (-)		15 km (-)		12 km (-)		10 km (-)	
		1.0 - 1.5	49 km (1.3%)	37 km (1%)	◎	49 km (1.3%)	X	35 km (1%)	◎	30 km (1%)	◎
		Less 1.0	3,623 km (98.3%)	3,767 km (99%)		3,623 km (98.3%)		3,769 km (99%)		3,876 km (99%)	
	Average Travel Speed (km/hr)	Inside Metro Manila	18.6 (1.00)	22.2 (1.19)		22.8 (1.23)		23.7 (1.27)		24.8 (1.33)	
		Outside Metro Manila	35.2 (1.00)	42.9 (1.22)	△	34.8 (0.99)	△	43.0 (1.22)	◎	43.2 (1.22)	◎
		Study Area	21.0 (1.00)	25.0 (1.19)		24.7 (1.18)		26.5 (1.26)		27.2 (1.30)	

Note: Metro Manila includes its suburbs of Cavite, Laguna, Bulacan and Rizal
(1) V/C ratio = Volume/Capacity Ratio
(2) Evaluation

◎ Best achievement, or improvement

△ Medium achievement, or improvement

X Low achievement, or improvement

12.7.4 Proposed HSH Network

Proposed HSH-1 Network is shown in **Figure 12.7.4-1.** Among the proposed HSH-1 networks, new projects are listed below:

HSH-1 PROJECTS

- NLEx-SLEx Link Expressway
- NAIA Expressway (Phase-2)
- C-6 Expressway / Global City Link
- C-6 Extension (along Laguna de Bay)
- Manila Bay Expressway
- CALA Expressway
- Central Luzon Expressway (CLEx)
- Calamba-Los Baños Expressway
- SLEx Extension (to Lucena City)
- NLEx East
- La Mesa Parkway
- C-5 / FTI / Skyway Connector Road
- Pasig-Marikina Expressway
- R-7 Expressway

[Beyond 2030]

- Manila-Bataan Coastal Road
- NLEx-Phase 3
- East-West Connection Expressway

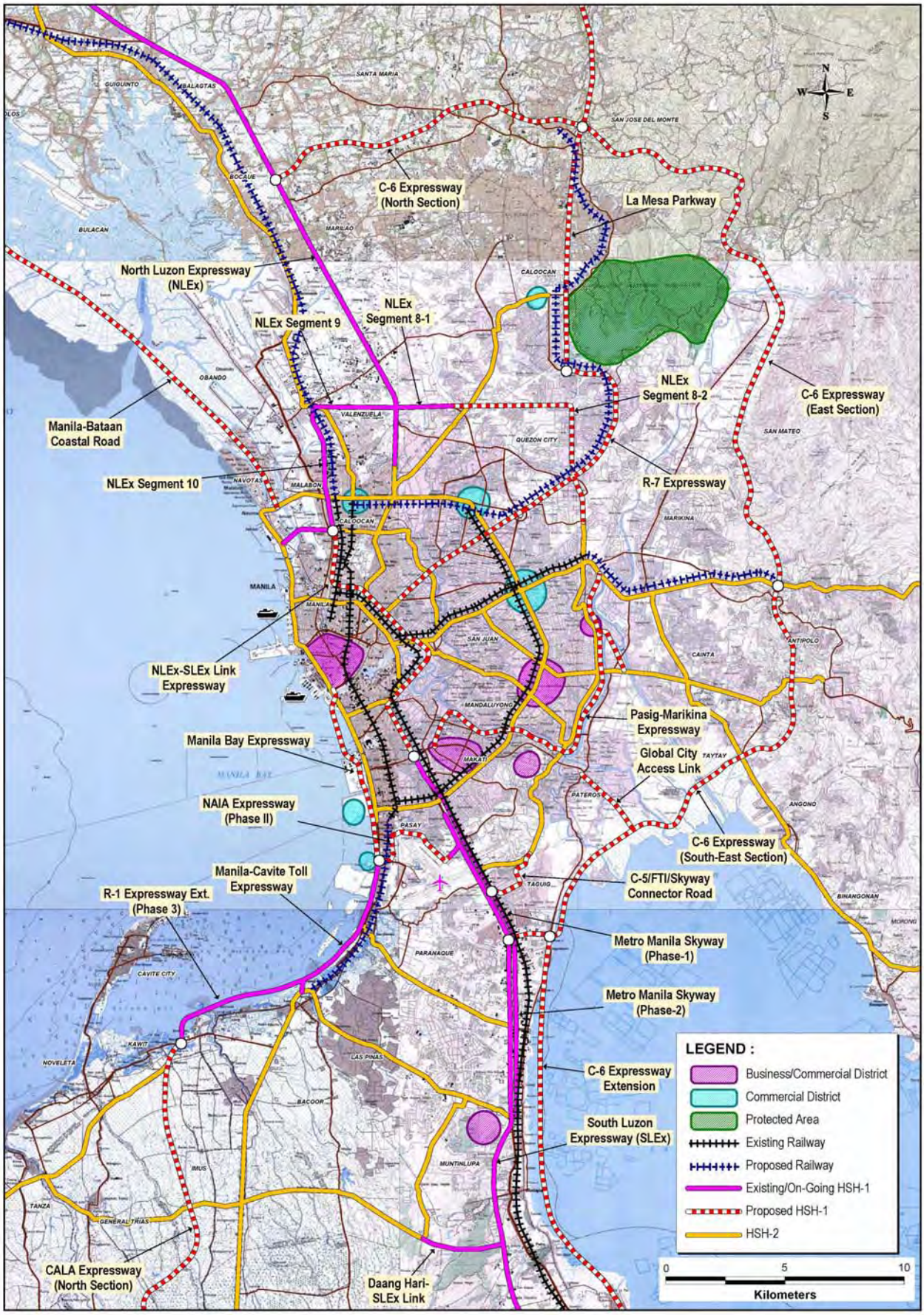


FIGURE 12.7.4-1 (1/3) PROPOSED HSH-1 AND HSH-2 NETWORK: METRO MANILA

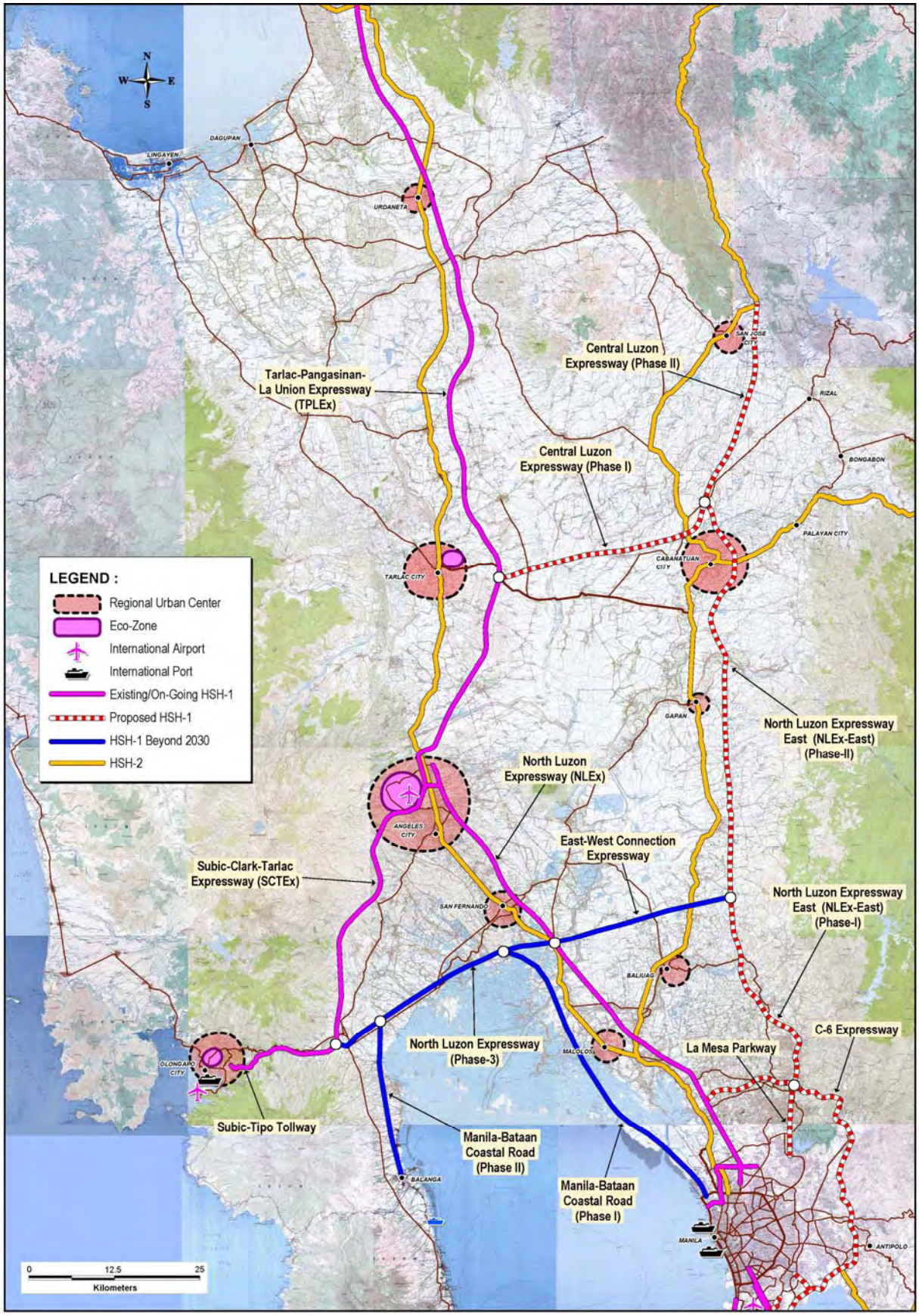


FIGURE 12.7.4-1 (2/3) PROPOSED HSH-1 AND HSH-2 NETWORK: NORTH OF METRO MANILA

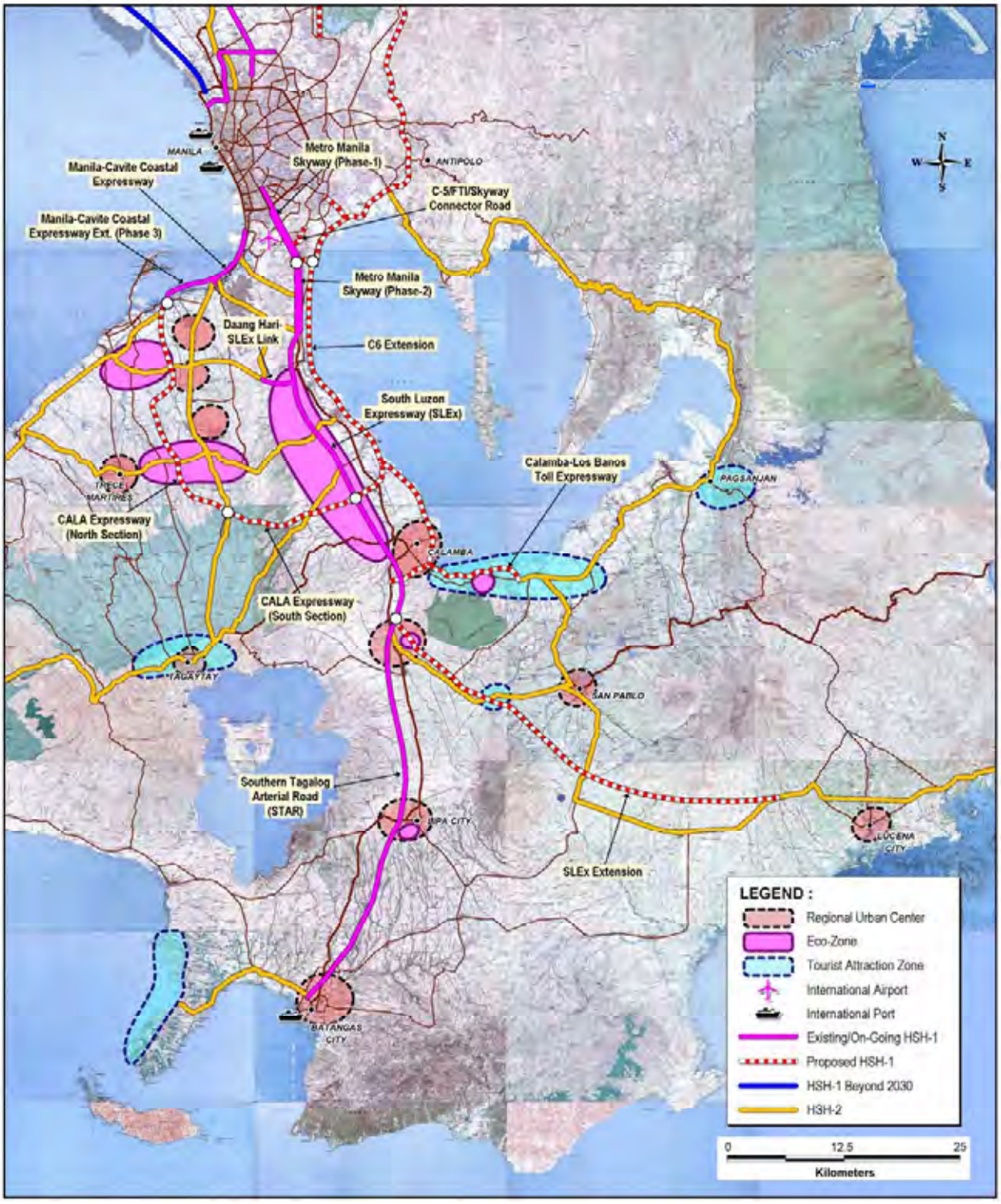


FIGURE 12.7.4-1 (3/3) PROPOSED HSH-1 AND HSH-2 NETWORK: SOUTH OF METRO MANILA

12.7.5 Measures to be Taken for HSH-2

Following measures should be taken for HSH-2 roads;

North of Metro Manila

(1) Manila North Road

- Along this corridor, TPLEx is under construction and is planned to be extended up to San Fernando, La Union.

- Improvement of existing sections from Metro Manila to San Fernando, La Union of Manila North Road should be carefully planned to avoid double investment in consideration of TPLEx development, this measures will be limited to the following:

  - Widening to a 4-lane road within the existing road ROW
  - Pavement of shoulders for tricycles
  - Efficient traffic management at intersections

(2) Pan Philippine Highway (or Daang Maharlika)

- Along this corridor, NLEx-East is proposed, however, its development will require lengthy time (maybe about 15 years from today).

- Before NLEx-East is developed, traffic condition of Pan Philippine Highway will be further aggravated.

- Cabanatuan Bypass and Gapan Bypass may be required ahead of NLEx-East. These bypasses should be so planned that these can be converted to a part of NLEx-East.

- Other sections of Pan Philippine Highway are improved in a similar manner adopted for Manila North Road.

Metro Manila

(1) C-4 (EDSA)

- MRT-3 and North Extension of LRT-1 was built at the center of C-4, and most major intersections were grade separated, therefore, a little can be done in terms of facility improvement of this road.

- Possible facility improvement will be as follows:

  - Grade separation at EDSA/North Avenue/West Avenue Intersection
  - Grade separation at EDSA/Congressional Avenue
  - Widening from MacArthur Highway to R-10

(2) C-5

- Major intersections were already grade separated, so a little can be done in terms of facility improvement.

- Along this corridor, Pasig-Marikina Expressway is proposed under this Study.

- Until the time the proposed expressway is realized, traffic management should be strengthened.

(3) C-3

- Northern section from Rizal Avenue to Baltazar St. still remains at a 2-lane road due to ROW acquisition problem. DPWH should continue to dialogue and negotiate with land owners to acquire ROW.

- Southern section (south of Aurora Blvd.) is still missing, however, its realization is quite difficult due to ROW acquisition problems. Therefore, improvement of existing section should be focused.

- Grade separation of the following intersections should be studied;

  - C-3/E. Rodriquez Avenue Intersection
  - C-3/Quezon Avenue Intersection (R-7 Expressway is proposed along Quezon Avenue as an elevated structure, therefore, flyover should be planned along C-3)
  - C-3/A. Bonifacio Avenue Intersection

(4) Ortigas Avenue

- East section (from C-5 towards to the east) is mostly undivided 4 to 6 lanes and too narrow to plan an elevated expressway along this road.

- Grade separation of an intersection between Ortigas Avenue and Imelda Avenue should be studied.

- Traffic management measures at a section near a large shopping mall should be studied.

(5) Marcos Highway

- MRT Line-2 Extension is being studied on this road.

- Road ROW is quite wide, therefore, effective way to utilize wide ROW should be studied.

(6) R-10

- Many sections are occupied by squatters. Efforts to relocate them should be made and originally planned 6-lane divided road should be realized.

(7) Sucat Road

- Grade separation of the following intersections should be studied;

  - Sucat Road/President's Avenue
  - Sucat Road/San Antonio Avenue/Pilipinas Avenue
  - Sucat Road/Angelina Canaynay Avenue

(8) Alabang-Zapote Road (AZ Road)

- Grade separation of the following intersections should be studied;

  - AZ Road/Don Manolo Avenue/Concha Cruz Drive
  - AZ Road/Marcos Alvarez Avenue
  - AZ Road/B.F. Resort Avenue
  - AZ Road/C.V. Starr Avenue

(9) Other HSH-2 Roads

- Facility improvement of other HSH-2 roads in Metro Manila is difficult due to roadside development, therefore, traffic management at intersection, large scale shopping malls, etc., should be intensified.

South of Metro Manila

(1) Aguinaldo Highway (Cavite Province)

- CALA Expressway is planned along this corridor, therefore, facility improvement of this road should be carefully planned to avoid double investment.

- Grade separation of intersection with Coastal Road should be studied.

(2) Daang Hari (Cavite Province)

- This road should be extended from Aguinaldo Highway up to Naic-Tanza Road.

(3) Governors Drive (Cavite Province)

- Some bridges still remain as a 2-lane bridge. These bridges should be widened to 4-lane.

(4) Sta. Rosa-Tagaytay Road (Cavite Province)

- Short sections were developed as a 4-lane road.

- Widening to a 4-lane road should be continued, where possible within the existing road ROW.

(5) Pan Philippine Highway (Daang Maharlika)

- Along this corridor, SLEx Extension is planned.

- Improvement of this road should be carefully planned as mentioned for Manila North Road.

(6) Laguna de Bay East Flood Control Dike Road

- Laguna de Bay Lake shore areas were heavily damaged by floods caused by typhoons Ondoy (September 24-25) and Pepeng (October 1-3) in 2009. There is a strong need to construct lake shore road to develop the subject areas. Two (2) objectives, i.e. to control flood and to construct a road to serve for traffic along the lake shore and to support land development, are combined and proposed to construct a flood control dike road. The plan is shown in **Figure 12.7.4-2.** East section should be developed as HSH-2. Various HSH-1 projects are proposed along the west lake shore. It takes time to develop C-6 Extension and Calamba-Los Baños Expressway along the west shore line, therefore, if a dike construction project is urgently

implemented; these expressways can be firstly developed as HSH-2 and then converted to HSH-1 later.

(7) Other HSH-2 Roads

- Necessary improvement should be planned within the existing road ROW, such as widening to a 4-lane road or paving of shoulders.

- There are several HSH-2 roads accessing to tourism attraction areas. For such road, the following should be implemented;

  - Beautification of roadsides by planting trees and flowers
  - Rest areas and view decks should be built at selected spots

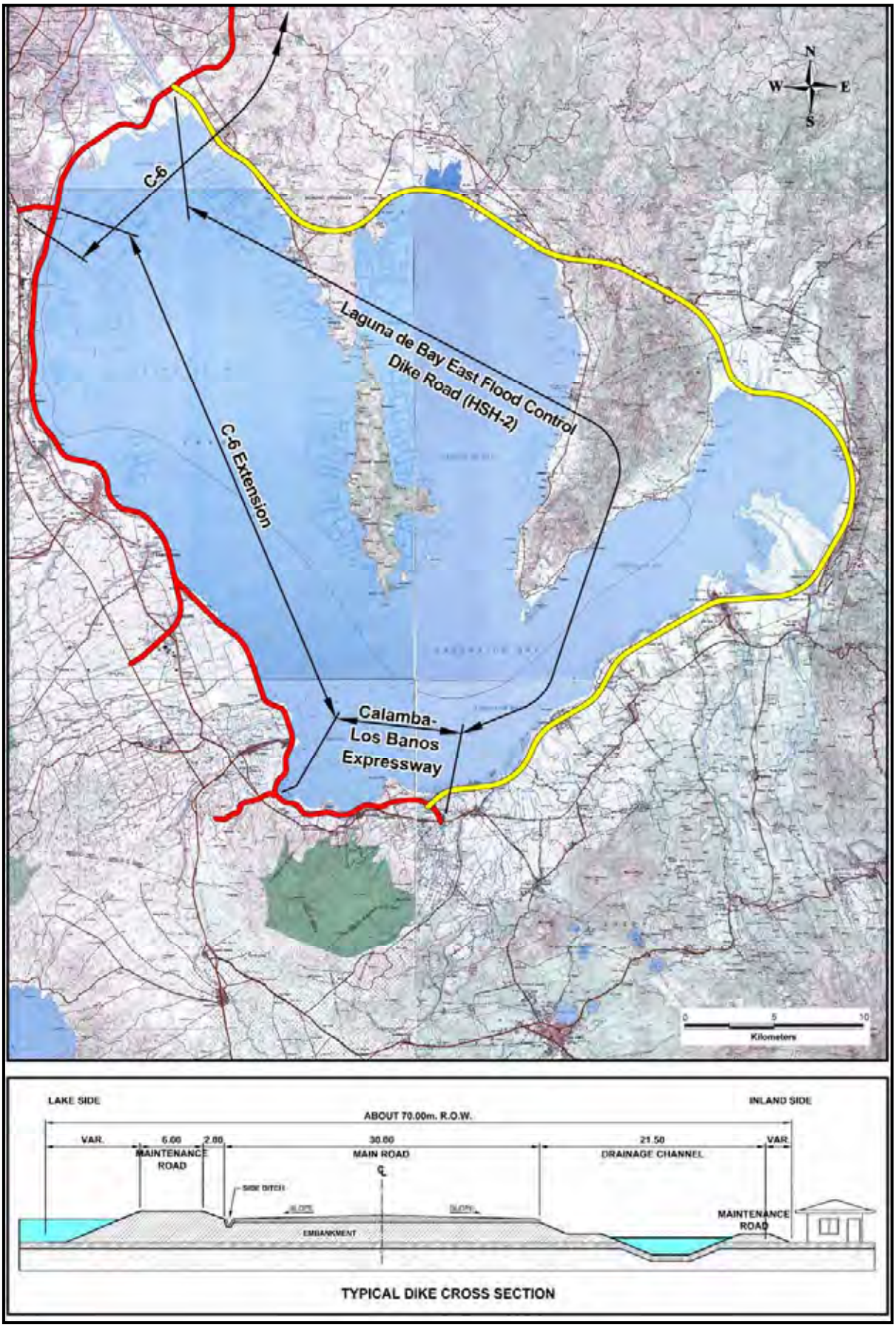


FIGURE 12.7.4-2 LAGUNA DE BAY EAST FLOOD CONTROL DIKE ROAD

CHAPTER 13

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

CHAPTER 13
INITIAL ENVIRONMENTAL EXAMINATION (IEE)

13.1 ENVIRONMENTAL CONDITIONS

13.1.1 Protected Areas

From 1992 to the present, **203** Protected Areas (PAs) have been included as initial components of the NIPAS. Of these, **107** have been proclaimed by the President. To date, only **10** have been enacted by Congress and therefore are established under the **National Integrated Protected Areas System** (NIPAS). None of these are located within the 200 km radius study sphere.

The (NIPAS) was enacted into law as Republic Act (R.A.) 7586 in June 1992. All areas or islands in the country that has been proclaimed pursuant to a law, presidential decree, presidential proclamation, or executive order as national park, strict nature reserve, watershed, mangrove reserve, fish sanctuary, natural and historical landmark, protected and managed landscape/seascape, as well as identified virgin forests before the effectivity of the Act were designated as ***initial components*** of the System

A list of Protected Areas found within the 200 km-radius study sphere is presented in **Table 13.1.1-1**. The location of these are shown in **Figs. 13.1.1-1**, **13.1.1-2**, and **13.1.1-3** for Region III, IV-A, and NCR, respectively.

TABLE 13.1.1-1 LIST OF PROTECTED AREAS FOUND IN THE 200 KM-RADIUS METRO MANILA STUDY SPHERE

Name of Protected Area	Location	Area (Ha)	Status Under NIPAS
Region III (Central Luzon)			
1. Minalungao National Park	Gapan and Gen. Tinio, Nueva Ecija	2,018.00	Initial Component
2. Biak-na-Bato National Park	San Miguel and Doña Remedios Trinidad, Bulacan	658.85	Initial Component
3. Capas Death March Monument	Capas, Tarlac	1.54	Initial Component
4. Mt. Arayat National Park	Arayat and Magalang, Pampanga	3,715.23	Initial Component
5. Bataan National Park	Hermosa, Orani, Samal, Abucay, Pila, Balanga, and Morong, Bataan	23,688.00	Initial Component
6. Roosevelt National Park	Hermosa and Dinalupihan, Bataan	1,334.59	Initial Component
7. Olongapo Naval Base Perimeter	Olongapo City, Zambales	9.04	For disestablishment
8. Aurora Memorial Park (Bongabon-Baler National Park)	Bongabon, Nueva Ecija and Baler, Quezon	5,676.00	Initial Component
9. Lake Malimanga Bird & Fish Sanctuary	Candelaria, Zambales	12.35	Initial Component
10. Mariveles Watershed Forest Reserve	Mariveles, Bataan	325.00	Initial Component
11. Olongapo Watershed Forest Reserve	Olongapo, Zambales	6,335.00	Initial Component
12. Angat Watershed and Forest Range	Norzagaray, San Jose, Bulacan and Montalban, Nueva Viscaya	6,600.00	Initial Component
13. Talavera Watershed Reservation	Sta. Fe, Nueva Viscaya, Carranglan, Lupao, San Jose, Pantabangan, Nueva Ecija	37,156.00	Initial Component

14. Pantabangan-Carranglan Watershed Reservation	Pantabangan, Carranglan, Nueva Ecija	84,500.00	Initial Component
15. Doña Remedios/General Tinio Watershed	Doña Remedios, Bulacan, Gen. Tinio Nueva Ecija	20,760.00	Initial Component
16. Calabgan Watershed Forest Reserve	Casiguran, Aurora	4,803.00	Initial Component
17. Dipaculao Watershed Forest Reserve	Dipaculao, Aurora	1,786.00	Initial Component
18. Dinadiawan River Protected Landscape	Dipaculao, Aurora	3,387.00	Initial Component
19. Amro River Protected Landscape	Casiguran and Dilasag, Aurora	6,470.00	Initial Component
20. Talaytay Protected Landscape	Dinalungan, Aurora	3,527.87	Initial Component
21. imbahan-Talagas Protected Landscape	Dinalungan, Aurora	2,266.49	Initial Component
22. Dibalo-Pingit-Zabali-Malayat Watershed Forest Reserve	Baler, San Luis, Aurora	4,528.00	Initial Component
23. Aurora Watershed Forest Reserve	Baler, Quezon	430.00	Initial Component
Region IV-A (CALABARZON)			
24. Taal Volcano Protected Landscape	Provinces of Batangas	4,537.00	Initial Component
25. Mts. Palay-Palay-Mataas na Gulod National Park	Ternate and Maragondon, Cavite and Nasugbu, Batangas	4,000.00	Initial Component
26. Hinulugang Taktak Protected Landscape	Antipolo, Rizal	0.89	Initial Component
27. Mts. Banahaw-San Cristobal Protected Landscape	Majayjay, Laguna, and Lucban, and Tayabas, Quezon	3,539.25	Initial Component
28. Quezon Protected Landscape	Atimonan, Padre Burgos and Pagbilao, Quezon	983.00	Initial Component
29. Unnamed National Park, Wildlife Sanctuary and Game Preserve	Provinces of Laguna, Quezon, Rizal, and Bulacan	34,681.00	Initial Component
30. Island of Alibijaban	Ragay Gulf, Bondoc Peninsula in Quezon	430.00	Initial Component
31. Pamitinan Protected Landscape	Antipolo, Montalban, Rizal	18,965.86	Initial Component
32. Mulanay Watershed Forest Reserve	Mulanay, Quezon	26.00	Initial Component
33. Infanta Watershed Forest Reserve	Infanta, Quezon	384.00	Initial Component
34. Polilio Watershed Forest Reserve	Polilio, Quezon	130.00	Initial Component
35. Maulawin Spring Protected Landscape	Guinayangan, Quezon	204.00	Initial Component
36. Buenavista Protected Landscape	Mulanay, Quezon	356.00	Initial Component
37. Lopez Watershed Forest Reserve	Lopez, Quezon	418.00	Initial Component
38. Calauag Watershed Forest Reserve	Calauag, Quezon	328.00	Initial Component
39. Alabat Watershed Forest Reserve	Alabat, Quezon	688.00	Initial Component
40. Tibiang-Damagandong Watershed	Quezon, Quezon	280.00	Initial Component
41. Binahaan River Watershed Forest Reserve	Pagbilao, Mauban, Quezon	465.00	Initial Component
42. Island of Polilio, Alabat, Cabalete, Jomalig, Patnanongan, Kalotkot, Kalongkooan, Palasan, Calabao, Icol, and San Rafael Mangrove Swamp Forest Reserve	Lamon Bay, Quezon	Undetermined	Initial Component
National Capital Region (NCR)			
43. Quezon Memorial National Park (Ninoy Aquino Parks and Wildlife)	Diliman, Quezon City	No data	Initial Component

Source: Planning Section, DENR Protected Areas and Wildlife Bureau

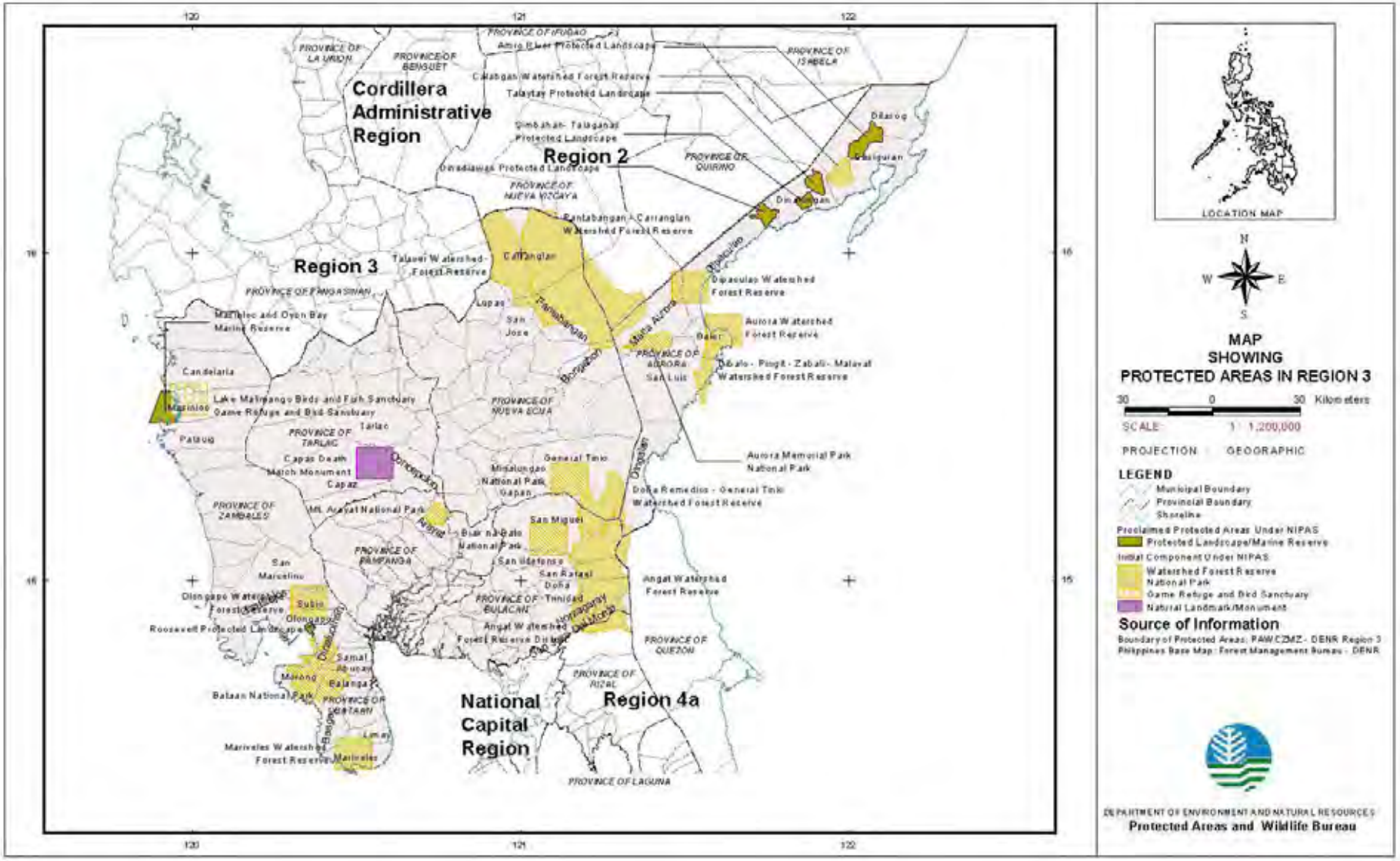


FIGURE 13.1.1-1 PROTECTED AREAS IN REGION III (CENTRAL LUZON)

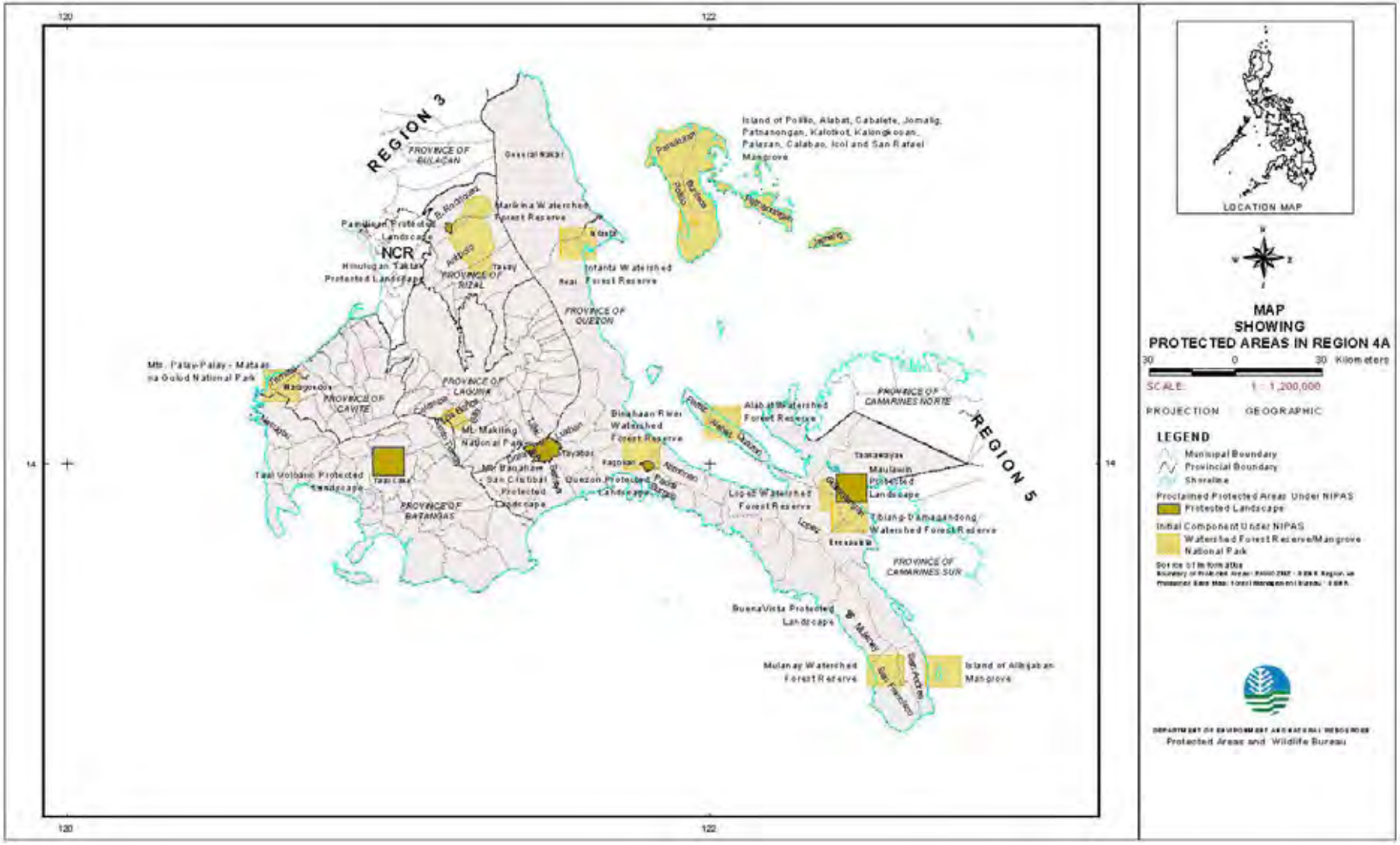


FIGURE 13.1.1-2 PROTECTED AREAS IN REGION IV-A (CALABARZON)

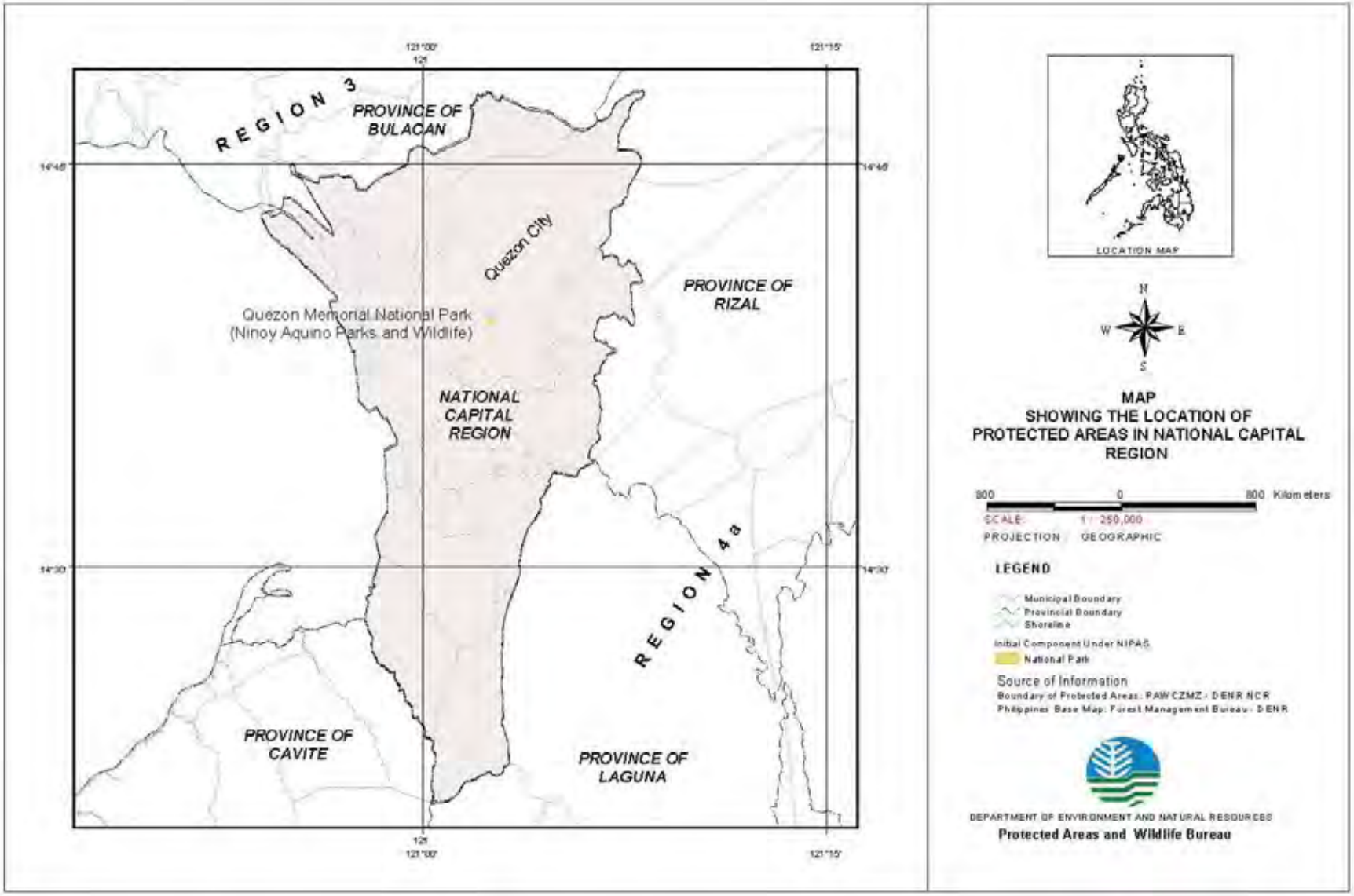


FIGURE 13.1.1-3 PROTECTED AREAS IN THE NATIONAL CAPITAL REGION (NCR)

13.1.2 Flood Potential Areas

Flood potential areas were shown in **Figure 7.1.5-1** of Chapter 7.

13.1.3 Geohazards

As mentioned in **Section 7.1** of Chapter 7, existing geological, geomorphic and tectonic conditions of the 200 km radius Metro Manila study sphere pose certain **geological hazards** that will affect future infrastructure projects. These include *(i) ground shaking*, *(ii) ground rupture*, and *(iii) liquefaction*. These hazards are due to the presence of earthquake generators near the area. A brief description of these geohazards is presented below.

Ground shaking are strong ground vibrations caused by the passage of seismic waves from the earthquake source (foci) to the ground surface. The intensity of ground shaking in a given area is influenced by the magnitude of the earthquake, distance of the site from earthquake generator, and the modifying effects of subsoil conditions. Normally the shallower the earthquake source and the closer the area from the epicenter, the stronger is the intensity felt within the particular site.

Previous works showed probable level of ground shaking on a regional context, where the intensity of the ground shaking is usually translated into percentage of the ground acceleration (g). Hazard maps are prepared to take into consideration the contribution of all possible earthquake generators within a broad area for certain span of time (e.g. 100-year return period) and the result expressed in probabilities (e.g. 90% of non-exceedence).

Ground rupture is the surface rupturing or the breaking and movements of the ground along an active fault trace, which could result to horizontal/vertical shifting of the ground or a *combination* of both. For structures directly straddling and located within a narrow zone of the active fault traces, damages can be severe. For example during the July 16, 1990 earthquake, deformation zones ranged from 5-10 meters from the surface rupture. Accurate delineation of these traces is very important in mitigating the damages due to surface rupturing since the location, pattern, and style of surface faulting generally appear to occur along pre-existing active fault traces.

Liquefaction is a phenomenon in which a soil deposit below the groundwater table becomes fluid-like and loses a substantial amount of strength due to strong earthquake ground shaking. Some soil types tend to compact during earthquake shaking. When this occurs, compaction will induce excess pore water pressures in the soil and as a result reduces the strength of the soil. The fluid-like condition of liquefied soil may continue for some period of time following the earthquake, until the excess pore water pressure dissipates, depending on soil permeability and drainage conditions.

Potential consequence of liquefaction includes (Dayanghirang, 1999):

(i) Reduction or loss of foundation-bearing strength that can lead to large settlements due to shear failure in the weakened soil;
(ii) Flotation of the lightweight structures embedded in the liquefied soils;
(iii) Differential compaction due to soil densification as excess pore water pressures dissipate, which can lead to differential settlements in the structure foundation
(iv) Lateral movements due to lateral spreading or flow sliding of liquefied soils that can lead to total and differential movements of the structure;
(v) Increase lateral pressure on the retaining walls;
(vi) Settlement hazards due to sand boils which involves ejection of liquefied soils to ground surface through vents; and

(vii) Ground oscillation where ground overlying liquefied soil experiences large displacement transient oscillations resulting to fissures, buckling and thrusting of structures.

Manifestations of the active geologic and tectonic settings in the study sphere can be described in terms of events that took place in the past. In the CALABARZON area, there are two large earthquakes reported which identified Quezon as the epicenter. The first is the Alabat Earthquake in 1937 and the Ragay Gulf Earthquake in 1973. The Ragay Gulf Earthquake damaged properties, transportation and communication lines in Calauag and Lopez in Quezon while the Alabat Earthquake destroyed buildings in greater Manila area, Laguna and Batangas. Add to these the two active volcanoes, Taal and Mount Banahaw which may also pose threat especially in their immediate vicinities.

In July 16, 1990 a great Ms 7.8 earthquake hit Luzon. This earthquake was caused by movement of the Digdig Fault in the vicinity of Cabanatuan. It killed 1,700 people, injured 3,000 individuals and displaced 148,000 more in Luzon. Among the cities that sustained the worst damages were Baguio, Dagupan and Cabanatuan. In the following year, Mt. Pinatubo, located at the intersection of the borders of the provinces of Zambales, Tarlac, and Pampanga, erupted and produced the second largest terrestrial eruption of the 20th century. As a consequence, surrounding areas were severely damaged by pyroclastic flows, ash deposits, and later by lahars caused by rainwater remobilizing earlier volcanic deposits. Thousands of houses and other important infrastructures such as roads and bridges were also destroyed.

In August 2002, the JICA-Assisted "Study for Earthquake Impact Reduction for Metropolitan Manila in the Republic of the Philippines (MMEIRS)" was commenced. The main objective of the study is to prepare an earthquake disaster mitigation plan that will enable concerned government agencies, such as the Metropolitan Manila Development Authority (MMDA) and the Philippine Institute of Volcanology and Seismology (PHIVOLCS) to manage potential earthquake disasters in Metropolitan Manila.

According to the Study, the possible seismic sources that may cause much damage to Metro Manila in the future are the: (i) Valley Fault System (VFS) and (ii) Laguna-Banahaw Fault and Digdig and Infanta Segments of the Philippine Fault Zone (PFZ). However the Valley Fault System, is considered to potentially cause the largest impact should it generate a large maximum earthquake. As indicated in recent studies, the West Valley Fault has moved four (4) times and generated strong earthquakes within the last 1400 years. Since the approximate return period of these earthquakes is less than 500 years and no event along the West Valley Fault is known after the 17th century, this indicates that the active phases of the Valley Faults may be approaching.

Liquefaction Potential

As previously described, Metropolitan Manila is divided morphologically into three major parts, namely the: (i) Central Plateau, (ii) Coastal Lowland and (iii) Marikina Valley. In Coastal Lowland and Marikina Plain, Quaternary deposits with loose sands are distributed near ground surface. For large earthquake motions, liquefaction potential of loose sands is **high**. Structures are expected to be damaged since liquefaction will cause ground deformation such as subsidence and lateral flow.

As shown in **Table 13.1.3-1**, the area ratio of Coastal Lowland and Marikina Plain relative to the entire Metro Manila area is 34%. In the Cities of Manila, and Pasig lowland area ratio is more than 80%. Pateros, being almost 100% quaternary is substantially vulnerable to liquefaction.

Based on the liquefaction analysis done in the MMEIRS Study, strong movements along the West Valley Fault system, show the highest potential of liquefaction among the following areas: (i) in the City of Manila, around the mouth of Pasig River; (ii) area from center of Pasig City to Pateros and Taguig, and (iii) parts of Malabon City, Parañaque City, and Marikina City.

It is important to note however, that high potentials for liquefaction for certain areas do not mean that the entire area will be liquefied during a strong earthquake; it's just a strong indication that liquefaction can be observed in many places compared to those with low potential. In the same manner, areas with low potential does not mean that the entire area will be safe. The important thing is to ensure that a thorough evaluation of areas with liquefaction potential must be made, particularly for the stability of foundations of important structures.

TABLE 13.1.3-1 DISTRIBUTION OF QUATERNARY DEPOSITS IN METRO MANILA

City/Municipality	Area (Ha)	Quaternary Deposits Area (Ha)	Area Ratio (%)
Quezon	165,330	10,669	6
Las Piñas	32,265	2,487	8
San Juan	5,880	684	12
Kalookan	53,116	8,526	16
Mandaluyong	11,069	2,657	24
Makati	31,961	8,242	26
Parañaque	45,606	11,829	26
Navotas	10,948	3,041	28
Muntinlupa	38,129	10,896	29
Valenzuela	44,518	17,812	40
Marikina	22,646	13,569	60
Taguig	27,521	17,863	65
Pasay	17,779	12,351	69
Malabon	15,962	12,292	77
Pasig	31,883	26,090	82
Manila	41,284	40,441	98
Pateros	1,951	1,927	99
TOTAL	**597,847**	**201,375**	**34**

Source: PHIVOLCS, MMDA. "Study for Earthquake Impact Reduction for Metropolitan Manila in the Republic of the Philippines"

13.2 SCOPING OF PROPOSED PROJECTS

According to DENR Guideline, categorization of project based on the overall rating is as follows;

Category A: Environmentally Critical Projects (ECP) – Major roads with length greater than or equal to 20 km for flat terrain and greater than or equal to 10 km for areas with critical slopes. Will require preparation of EIS to merit ECC

Category B: Non-Environmentally Critical Project (NECP) in Environmentally Critical Area (ECA) – Minor roads greater than 2 km but less than 20 km for flat terrain or greater than 2 km but less than 10 km for areas with critical slopes. Will require preparation of IEER to merit issuance of ECC

Category C: Same as Category B but will prepare IEEC if road is greater than 2 km but less than 10 km for flat terrain or greater than 2 km but less than 5 km for areas with critical slopes

Category D: Project does not fall within Phil. IES System and will require preparation of Project Description (now in form of a checklist) to merit CNC

For projects with >200 affected persons: WB, ADB, and JICA classify it as Category A. DENR still follows their project grouping but after scoping, they can reclassify from B to A. Under this Study, when 200 or more persons are expected to be affected, the project was classified as Category A.

The EIA category, report type, decision document, and deciding authority for each proposed project are provided in **Table 13.2-1**. Scoping matrices for the 18 priority projects are presented in Annex 13.1.

TABLE 13.2-1 EIA CATEGORY, REPORT TYPE, DECISION DOCUMENT, AND APPROVING AUTHORITY FOR PRIORITY PROJECTS UNDER THE HSH

Priority Project	Category	Report Type	Decision Document	Approving Authority
1. NLEx-SLEx Link Expressway	A	EIS	ECC	DENR Secretary
2. NAIA Expressway-2	A	EIS	ECC	DENR Secretary
3. C6 Expressway	A	EIS	ECC	DENR Secretary
4. C6 Extension	A	EIS	ECC	DENR Secretary
5. Manila Bay Expressway	A	EIS	ECC	DENR Secretary
6. CALA Expressway	A	EIS	ECC	DENR Secretary
7. Central Luzon Expressway	A	EIS	ECC	DENR Secretary
8. Calamba-Los Baños Expressway	A	EIS	ECC	DENR Secretary
9. SLEx Extension (To Lucena)	A	EIS	ECC	DENR Secretary
10. NLEx East	A	EIS	ECC	DENR Secretary
11. La Mesa Parkway	A	EIS	ECC	DENR Secretary
12. C5/FTI/Skyway Connector Road	A	EIS	ECC	DENR Secretary
13. Pasig-Marikina Expressway	A	EIS	ECC	DENR Secretary
14. R-7 Expressway	A	EIS	ECC	DENR Secretary
15. Manila-Bataan Coastal Road	A	EIS	ECC	DENR Secretary
16. NLEx Phase 3	A	EIS	ECC	DENR Secretary
17. East-West Connection Expressway	A	EIS	ECC	DENR Secretary

As shown above, all projects were evaluated to be Category A. From the stage of project planning to the detailed design and construction stage, all possible ways to mitigate adverse environmental and social impacts must be planned and incorporated in the project cost.

During the feasibility study stage, detailed Environmental Impact Assessment (EIA) Study must be undertaken. Suggested TOR for EIA Study is presented in Annex 13.2.

CHAPTER 14

PRELIMINARY DESIGN AND PROJECT COST ESTIMATE

CHAPTER 14
PRELIMINARY DESIGN AND PROJECT COST ESTIMATE

14.1 OUTLINE OF PROPOSED HSH-1 PROJECTS

Outline of proposed 18 projects is described hereunder.

14.1.1 NLEx-SLEx Link Expressway

(1) Objectives of the Project

- To complete the north-south industrial development beltway transport axis by connecting NLEx with SLEx.
- To decongest Metro Manila traffic.
- To provide better access to Manila ports.

(2) Proposed Alignment

In close relation to this project, the following projects are committed by a private sector;

- NLEx Segment 9 which is from NLEx to McArthur Highway along C-5 alignment.
- NLEx Segment 10 (1) which is from McArthur Highway to C-3 along PNR Line (PNR ROW is utilized.)
- NLEx Segment 10 (2) which is C-3 section from PNR to R-10.

According to the plan of a private sector, NLEx Segment 10 (2) is just an improvement of C-3 section. NLEx Segment 10 (2) is an important section to provide better and direct access to Manila North Harbor from the NLEx-SLEx link, therefore, it is proposed that new road facility for this section should be provided together with NLEx-SLEx link.

(a) Alternative Alignments

There are 4 alternative alignments for this project as follows:

Alternative Alignments

Alternative-1	:	PNR Alignment
Alternative-2	:	Skyway III Alignment
Alternative-3	:	C-2 Alignment
Alternative-4	:	Combination of Alternatives 1 & 3

There are two cases to consider alignments, as follows;

Case-1 : All alternative alignments are connected to NLEx Segment 10.1 and start at C-3/PNR intersecting point and end at Skyway Phase I (see **Figure 14.1.1-1**).

Case-2 : Alternative-1 starts at the same point as Case-1. All other alternatives start at the section between NLEx Toll Plaza and EDSA (see **Figure 14.1.1-2**).

All alternatives have structurally difficult sections due to existing 2nd or 3rd level structures such as existing viaduct, MRT/LRT structure, etc., as shown in Annex 14.1.

All alternatives need ROW acquisition and resettlement of PAPs as shown in **Figure 14.1.1-3**.

Preliminary design, traffic assignments, cost estimates were undertaken for all alternatives, and they were evaluated their superiority over to the other to select optimum alignment.

FIGURE 14.1.1-1 NLEx-SLEx LINK EXPRESSWAY ALTERNATIVES: CASE-1

FIGURE 14.1.1-2 NLEx-SLEx LINK EXPRESSWAY ALTERNATIVES: CASE-2

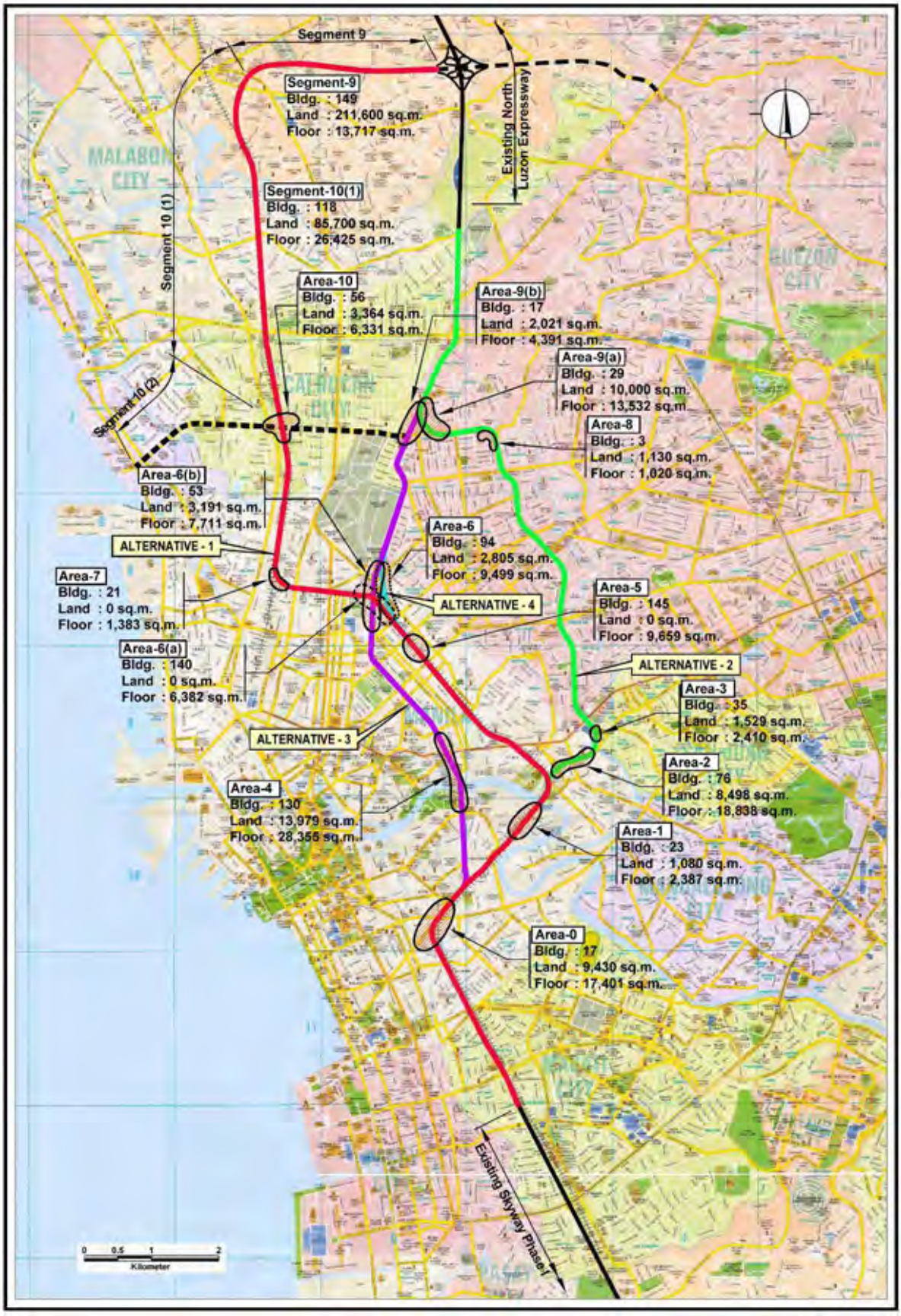


FIGURE 14.1.1-3 AFFECTED BUILDINGS AND REQUIRED LAND ACQUISITION

(b) Evaluation Criteria of Alternative Alignments

With due discussion with TWG, evaluation criteria of alternative alignments was established as shown in **Table 14.1.1-1**.

TABLE 14.1.1-1 EVALUATION CRITERIA OF ALTERNATIVE ALIGNMENTS

Evaluation Item	Weight	Evaluation Sub-item	Sub-weight
(A) Transport Efficiency: Year 2015	25	Expressway Traffic: No. of vehicles attracted by Expressway (pcu/day)	5.0
		• Over 1000,000	(5.0)
		• 90,000 – 100,000	(4.0)
		• 60,000 – 90,000	(3.0)
		• Less 60,000	(2.0)
		Reduction of Travel Time: All network	15
		• Over 50,000	(15.0)
		• 25,000 – 50,000	(12.5)
		• 10,000 – 25,000	(10.0)
		• Less 10,000	(5.0)
		Reduction of At-grade Road Traffic Volume at Screen Line (veh/day)	5
		• Over 20,000	(5.0)
		• 10,000 – 20,000	(4.0)
		• 5,000 – 10,000	(3.0)
		• Less 5,000	(2.0)
(B) Initial Investment Requirement	30	Construction Cost	20
		• Least Cost	(20.0)
		• 1.0 – 1.1 times of least cost	(15.0)
		• 1.1 – 1.2 times of least cost	(10.0)
		• 1.2 – 1.3 times of least cost	(5.0)
		• Over 1.3 times of least cost	(1.0)
		ROW Acquisition/Compensation Cost	10
		• Least Cost	(10.0)
		• 1.0 – 1.1 times of least cost	(8.0)
		• 1.1 – 1.2 times of least cost	(5.0)
		• Over 1.2 times of least cost	(1.0)
(C) Social/Environmental Impact	15	Land Area to be Acquired	5
		• Least area	(5.0)
		• 1.0 – 1.2 times of least area	(4.0)
		• 1.2 – 1.5 times of least area	(3.0)
		• Over 1.5 times of least area	(1.0)
		No. of Structure Affected	5
		• Least No.	(5.0)
		• 1.0 – 1.2 times of least no.	(4.0)
		• 1.2 – 1.5 times of least no.	(3.0)
		• Over 1.5 times of least no.	(1.0)
		No. of Floor Area Affected	5
		• Least area	(5.0)
		• 1.0 – 1.2 times of least area	(4.0)
		• 1.2 – 1.5 times of least area	(3.0)
		• Over 1.5 times of least area	(1.0)
(D) Construction Difficulty	5	Construction Difficulty	2.5
		• Relatively easy	(2.5)
		• Difficult	(0.5)
		Traffic Management During Construction	2.5
		• Relatively easy	(2.5)
		• Difficult	(0.5)
(E) Economic & Financial Viability	25	EIRR (%)	15
		• Over 25%	(15.0)
		• 20 – 25%	(12.5)
		• 15 – 20%	(10.0)
		• Less 15%	(5.0)
		FIRR (%)	10
		• Over 15%	(10.0)
		• 10 – 15%	(8.0)
		• 5 – 10%	(6.0)
		• Less 5%	(4.0)
Total	100		100

(c) Evaluation of Alternative Alignment

Alternative alignments were evaluated based on the evaluation criteria, as shown in **Table 14.1.1-2**. Alternative-1 (PNR Alignment) was evaluated as the most optimum alignment for both cases. It is recommended to adopt PNR Alignment for this project.

(3) <u>Outline of the Project</u>

- Expressway Length : 13.35 km.
- Beginning : Intersecting point of PNR and C-3 (end of NLEx Segment 10)
- End : Skyway III
- Type of Structure : All elevated structure
- No. of lanes : 2 x 2 = 4-lane
- Proposed Alignment : Utilizes PNR ROW, Quirino Avenue ROW and Pres. Sergio Osmeña Highway

FIGURE 14.1.1-4 NLEx-SLEx LINK EXPRESSWAY

TABLE 14.1.1-2 (1/2) EVALUATION OF ALTERNATIVE ALIGNMENTS: CASE-1

			Alternative - 1	Alternative - 2	Alternative - 3	Alternative – 4
Outline of Alternative	Concept		PNR Route	C-3 Route (Skyway-Phase 3)	C-2 Route	Combination of Alternative 1 & 3
	Route Length (km)		N-S Link : 13.35 Port Access: 2.40 Total : 15.75	N-S Link : 15.10 Port Access : 2.40 Total : 17.50 (+1.75 km)	N-S Link : 13.00 Port Access : 2.40 Total : 15.40 (-0.35 km)	N-S Link : 14.10 Port Access : 2.40 Total : 16.50 (+0.75 km)
	ROW to be used.		PNR 65% Road 35%	PNR 14% Road 86%	PNR 4% Road 96%	PNR 35% Road 65%
(A) Transport Efficiency (Year 2015)	Expressway	No. of Vehicles attracted per day	90,400 (1.00) 4.0	94,200 (1.04) 4.0	103,900 (1.15) 5.0	84,700 (0.94) 3.0
	All Road Network	Reduction of Travel Time (pcu-hour/day)	-68,000 (1.00) 15.0	-66,000 (0.97) 15.0	-68,000 (1.00) 15.0	-64,000 (0.94) 15.0
		Average Travel Speed (km/hour)	25.2 (w/o 24.7) -	25.2 -	25.2 -	25.2 -
	Reduction of At-grade Road Traffic Volume at Screen Line (veh/day)		-21,600 (1.00) 5.0	-21,200 (0.98) 5.0	-13,300 (0.62) 4.0	-20,300 (0.94) 5.0
(B) Initial Investment Requirement	(1) Construction Cost (Billion Pesos)		N-S Link : 29.12 Port Access: 2.96 Total : 32.08 (1.00) 20.0	N-S Link : 32.80 Port Access : 2.96 Total : 35.76 (1.11) (+3.68 BP) 10.0	N-S Link : 31.32 Port Access : 2.96 Total : 34.28 (1.07) (+2.20 BP) 15.0	N-S Link : 32.97 Port Access : 2.96 Total : 35.93 (1.12) (+3.85 BP) 10.0
	(2) ROW Acquisition and Compensation Cost (Billion Pesos)		N-S Link : 1.00 Port Access: - Total : 1.00 (1.00) 10.0	N-S Link : 1.15 Port Access : - Total : 1.15 (1.15) (+0.15 BP) 5.0	N-S Link : 1.48 Port Access : - Total : 1.48 (1.48) (+0.48 BP) 1.0	N-S Link : 1.06 Port Access : - Total : 1.06 (1.06) (+0.06 BP) 8.0
	(1) + (2)		33.08 (1.00) -	36.91 (1.12) (+3.83 BP) -	35.76 (1.08) (+2.68 BP) -	36.99 (1.12) (+3.91 BP) -
(C) Social/ Environmental Impacts	Land Area to be Acquired (sq.m.)		15,300 (1.00) 5.0	25,000 (1.63) 1.0	32,000 (2.09) 1.0	18,700 (1.22) 1.22
	No. of Structure Affected (Note – 1)		403 ((263)) (1.92) 1.0	210 (1.00) 5.0	273 (1.30) 3.0	353 ((287)) 1.68) 1.0
	No. of Floor Area Affected (sq. m.)		44,400 (1.00) 5.0	48,400 (1.09) 4.0	64,200 (1.45) 3.0	49,700 (1.12) 4.0
(D) Construction Difficulty	Constructability		• Construction space limited along rail. One side construction, then shift to other side. • Equipment and material transportation along the rail. 0.5	• Construction along heavy traffic road. • Night work. 0.5	• Construction along heavy traffic road. • Night work. 0.5	• Construction along heavy traffic road. • Night work. 0.5
	Traffic Management during Construction		• One-track operation along rail. 0.5	• Careful traffic management needed 0.5	• Careful traffic management needed 0.5	• Careful traffic management needed 0.5
(E) Economic and Financial Aspects	Economic Features	EIRR (%)	17.2% 10.0	16.1% 10.0	16.4% 10.0	15.0% 10.0
	Financial Aspects	Revenue per Day (Million Php)	9.92 (1.00) -	10.53 (1.06) -	10.66 (1.07) -	9.02 (0.91) -
		FIRR (%)	9.7% 6.0	8.7% 6.0	9.2% 6.0	7.8% 6.0
(F) Other Features			• Possibility of future PNR grade separation needs to be considered.	• Possibility of future PNR grade separation needs to be considered. • Affects viability of Segments 9&10.	• Possibility of future PNR grade separation needs to be considered. • Affects viability of Segments 9&10.	• Possibility of future PNR grade separation needs to be considered. • Affects viability of Segments 9&10.
Total Score			82.0	66.0	64.0	64.0
Ranking			1	2	3	3

Note-1: (( )) No. of structures when PNR continues to relocate those within PNR ROW.

TABLE 14.1.1-2 (2/2) EVALUATION OF ALTERNATIVE ALIGNMENTS: CASE-2

			Alternative - 1	Alternative - 2	Alternative - 3	Alternative – 4
Outline of Alternative	Concept		PNR Route	C-3 Route (Skyway-Phase 3)	C-2 Route	Combination of Alternative 1 & 3
	Route Length (km)		N-S Link : 13.35 Port Access: 2.40 Total : 15.75	N-S Link : 16.10 Port Access : 4.30 Total : 20.40 (+4.65 km)	N-S Link : 14.35 Port Access : 4.30 Total : 18.65 (+2.90 km)	N-S Link : 15.50 Port Access : 4.30 Total : 19.80 (+4.05 km)
	ROW to be used.		PNR 65% Road 35%	PNR 12% Road 88%	PNR 3% Road 97%	PNR 29% Road 71%
(G) Transport Efficiency (Year 2015)	Expressway	No. of Vehicles attracted per day	90,400 (1.00) 4.0	105,900 (1.17) 5.0	108,500 (1.20) 5.0	104,000 (1.15) 5.0
	All Road Network	Reduction of Travel Time (pcu-hour/day)	-68,000 (1.00) 15.0	-90,000 (1.32) 15.0	-93,000 (1.37) 15.0	-88,000 (1.29) 15.0
		Average Travel Speed (km/hour)	25.2 (w/o 24.7) -	25.3 -	25.3 -	25.3 -
	Reduction of At-grade Road Traffic Volume at Screen Line (veh/day)		-21,600 (1.00) 5.0	-22,900 (1.06) 5.0	-21,100 (0.98) 5.0	-23,800 (1.10) 5.0
(H) Initial Investment Requirement	(1) Construction Cost (Billion Pesos)		N-S Link : 29.12 Port Access: 2.96 Total : 32.08 (1.00) 20.0	N-S Link : 33.07 Port Access : 7.72 Total : 40.79 (1.27) (+8.71 BP) 5.0	N-S Link : 32.35 Port Access : 7.72 Total : 40.07 (1.25) (+7.99 BP) 5.0	N-S Link : 33.93 Port Access : 7.72 Total : 41.65 (1.30) (+9.57 BP) 1.0
	(2) ROW Acquisition and Compensation Cost (Billion Pesos)		N-S Link : 1.00 Port Access: - Total : 1.00 (1.08) 8.0	N-S Link : 1.35 Port Access : - Total : 1.35 (1.45) (+0.35 BP) 1.0	N-S Link : 1.35 Port Access : - Total : 1.35 (1.45) (+0.35 BP) 1.0	N-S Link : 0.93 Port Access : - Total : 0.93 (1.0) (-0.07 BP) 10.0
	(1) + (2)		33.08 (1.00) -	42.14 (1.27) (+9.06 BP) -	41.42 (1.25) (+8.34 BP) -	42.58 (1.29) (+9.50 BP) -
(I) Social/ Environmental Impacts	Land Area to be Acquired (sq.m.)		15,300 (1.00) 5.0	31,700 (2.07) 1.0	28,600 (1.87) 1.0	15,300 (1.00) 5.0
	No. of Structure Affected (Note-1)		403 ((263)) (2.20) 1.0	183 (1.0) 5.0	217 (1.09) 4.0	297 ((231)) (1.62) 1.0
	No. of Floor Area Affected (sq. m.)		44,400 (1.02) 4.0	55,600 (1.28) 3.0	57,900 (1.33) 3.0	43,400 (1.0) 5.0
(J) Construction Difficulty	Constructability		• Construction space limited along rail. One side construction, then shift to other side. • Equipment and material transportation along the rail. 0.5	• Construction along heavy traffic road. • Night work. 0.5	• Construction along heavy traffic road. • Night work. 0.5	• Construction along heavy traffic road. • Night work. 0.5
	Traffic Management during Construction		One-track operation along rail. 0.5	Careful traffic management needed 0.5	Careful traffic management needed 0.5	Careful traffic management needed 0.5
(K) Economic and Financial Aspects	Economic Features	EIRR (%)	17.2% 10.0	24.0% 12.5	25.0% 15.0	23.6% 12.5
	Financial Aspects	Revenue per Day (Million Php)	9.92 (1.00) -	12.21 (1.23) -	12.05 (1.21) -	11.53 (1.16) -
		FIRR (%)	9.7% 6.0	10.7% 8.0	10.2% 8.0	9.6% 6.0
(L) Other Features			• Possibility of future PNR grade separation needs to be considered.	• Possibility of future PNR grade separation needs to be considered. • Affects viability of Segments 9&10.	• Possibility of future PNR grade separation needs to be considered. • Affects viability of Segments 9&10.	• Possibility of future PNR grade separation needs to be considered. • Affects viability of Segments 9&10.
Total Score			79.0	61.5	63.0	66.5
Ranking			1	4	3	2

Note-1: (( )) No. of structures when PNR continues to relocate those within PNR ROW.

14.1.2 NAIA Expressway: Phase 2

(1) Objectives of the Project

- To provide access to three (3) NAIA terminals.
- To connect Skyway with Manila-Cavite Coastal Expressway so as to improve route selection flexibility of road users.

(2) Proposed Alignment

Proposed alignment is shown in **Figure 14.1.2-1**.

(3) Outline of the Project

- Expressway Length : 4.9 km.
- Beginning : End of Phase I
- End : Roxas Boulevard
- Type of Structure : All elevated structure
- No. of lanes : 2 x 2 = 4-lane
- Proposed Alignment : Utilize ROW of Andrews Avenue, Parañaque River, and NAIA Road

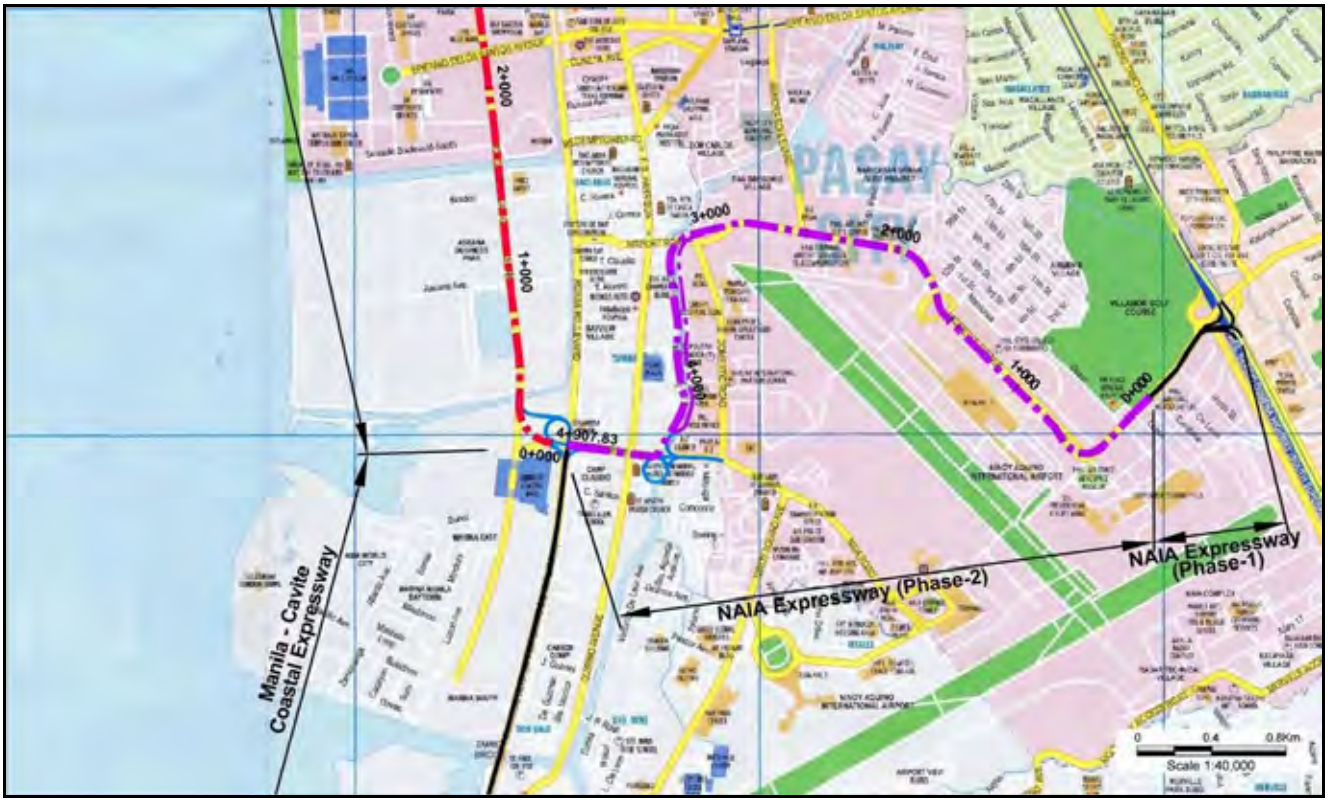


FIGURE 14.1.2-1 PROPOSED NAIA EXPRESSWAY PHASE-2 ALIGNMENT

14.1.3 C-6 Expressway

(1) Objectives of the Project

- To form a backbone urban transport axis.
- To distribute traffic from expressways in the radial directions.
- To guide sound urbanization and support land development of the eastern Metro Manila area and Rizal Province.

(2) Proposed Alignment

Proposed alignment is shown in **Figure 14.1.3-1**.

(3) Outline of the Project

- Expressway Length : 64.8 km.
- Beginning : NLEx between Marilao and Bocaue
- End : Skyway at Bicutan
- Type of Structure : Cut/Embankment - 91% (59.0 km.)
  Viaduct/Bridges - 9% (5.8 km.)
- No. of lanes : 2 x 2 = 4-lane (to be expanded to 2 x 3 = 6-lane)

FIGURE 14.1.3-1 PROPOSED ALIGNMENT OF C-6 EXPRESSWAY

14.1.4 C-6 Extension (Laguna de Bay Flood Control Dike Expressway)

(1) Objectives

- To decongest traffic on Manila South Road and SLEx.
- To contribute to flood control along Laguna de Bay Coastal area and land development.

(2) Proposed Alignment

Proposed alignment is shown in **Figure 14.1.4-1**. Typical cross section is shown in **Figure 14.1.4-2**.

(3) Outline of the Project

- Expressway Length : 43.6 km.
- Beginning : Divert from C-6 at Taguig City
- End : To be connected with CALA Expressway and Calamba-Los Baños Expressway
- Type of Structure : Embankment
- No. of lanes : 2 x 2 = 4-lane

FIGURE 14.1.4-1 PROPOSED ALIGNMENT OF C-6 EXTENSION/ LDB FLOOD CONTROL DIKE EXPRESSWAY

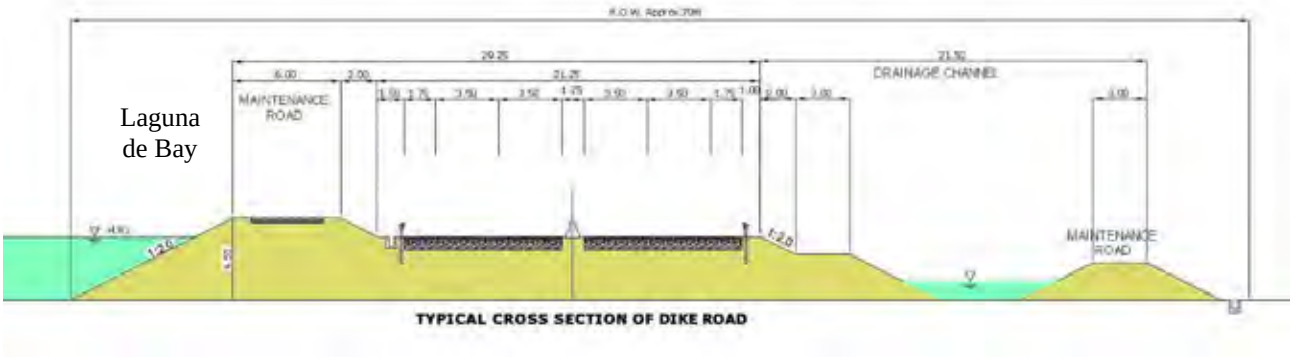


FIGURE 14.1.4-2 TYPICAL CROSS SECTION

14.1.5 Manila Bay Expressway

(1) Objectives of the Project

- To decongest Metro Manila traffic, particularly Roxas Boulevard.
- To provide access to Manila ports.

(2) Proposed Alignment

Proposed alignment is shown in **Figure 14.1.5-1**.

Immersed tunnel is proposed for the section under the sea. Other section is proposed to be U-type tunnel.

(3) Outline of the Project

- Expressway Length : 8.0 km.
- Beginning : Manila-Cavite Coastal Expressway
- End : Bonifacio Drive
- Type of Structure : - U-type tunnel
  - Immersed tunnel
- No. of lanes : 2 x 2 = 4-lane

URE 14.1.5-1 PROPOSED ALIGNMENT OF MANILA BAY EXPRESSWAY

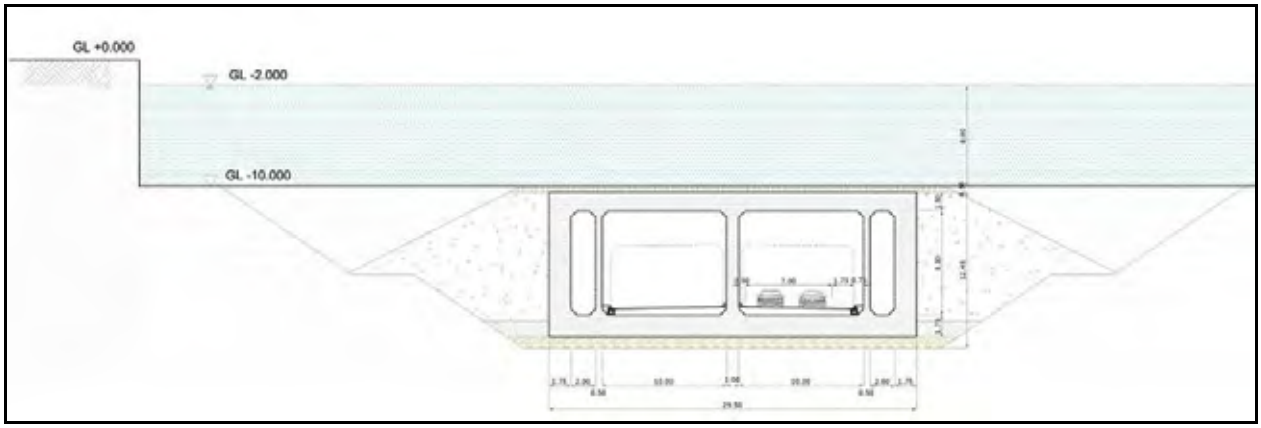


FIGURE 14.1.5-2 TYPICAL CROSS SECTION OF IMMERSED TUNNEL

14.1.6 CALA Expressway

(1) Objectives of the Project

- To decongest Cavite roads traffic, particularly Aguinaldo Highway and Governor's Drive.
- To provide access to economic zones to support economic development.

(2) Proposed Alignment

Proposed alignment is shown in **Figure 14.1.6-1**.

(3) Outline of the Project

- Expressway Length : 63.9 km.
- Beginning : End of Manila-Cavite Coastal Road Extension
- End : Near Greenfield I/C of SLEx
- Type of Structure : Cut/fill
- No. of lanes : 2 x 3 = 6-lane

FIGURE 14.1.6-1 PROPOSED ALIGNMENT OF CALA EXPRESSWAY

14.1.7 Central Luzon Expressway

(1) Objectives of the Project

- To connect SCTEx and NLEx-East to efficiently distribute traffic to both expressways.
- To decongest traffic on the Pan Philippine Highway until such time that NLEx-East becomes operational.

(2) Proposed Alignment

Proposed alignment is shown in **Figure 14.1.7-1**.

(3) Outline of the Project

- Expressway Length : 63.9 km.
- Beginning : Tarlac Interchage of SCTEx
- End : North of San Jose City, Pan Philippine Highway
- Type of Structure : Cut/Fill
- No. of lanes : 2 x 2 = 4-lane

FIGURE 14.1.7-1 PROPOSED ALIGNMENT OF CENTRAL LUZON EXPRESSWAY

14.1.8 Calamba-Los Baños Expressway

(1) Objectives of the Project

- To decongest traffic of national roads.
- To support tourism industry along the corridor.
- To contribute to flood control when Laguna de Bay side alignment is selected.

(2) Proposed Alignment

There are two alternative alignments as shown in **Figure 14.1.8-1**. Laguna de Bay side alignment is preferably selected to contribute to flood control.

(3) Outline of the Project

- Expressway Length : 15.5 km.
- Beginning : SLEx between Calamba and San Rafael
- End : Between Los Baños and Bay
- Type of Structure : Cut/Fill and/or combined structure of flood control dike and road
- No. of lanes : 2 x 2 = 4-lane

FIGURE 14.1.8-1 CALAMBA-LOS BAÑOS TOLL EXPRESSWAY