THE REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

# PREPARATORY SURVEY FOR METRO MANILA INTERCHANGE CONSTRUCTION PROJECT (VI) IN THE REPUBLIC OF THE PHILIPPINES

# FINAL REPORT

**NOVEMBER 2012**


**JAPAN INTERNATIONAL COOPERATION AGENCY**

**KATAHIRA & ENGINEERS INTERNATIONAL**
**ORIENTAL CONSULTANTS CO., LTD.**
**NIPPON ENGINEERING CONSULTANTS CO., LTD.**


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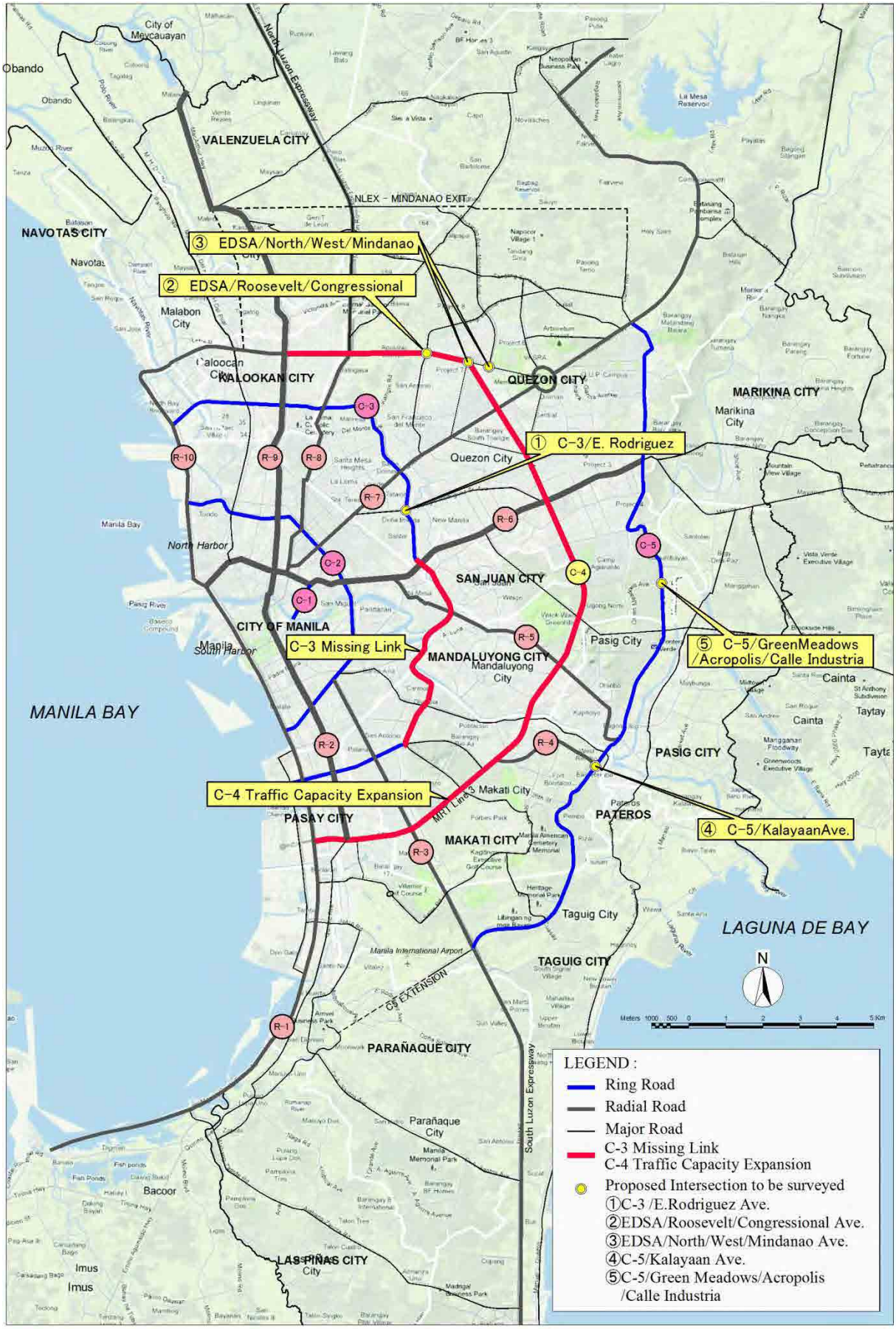


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| | | |
|---|---|---|
| AADT | : | Annual Average Daily Traffic |
| AASHTO | : | American Association of State Highway and Transportation Officials |
| ADB | : | Asian Development Bank |
| AM | : | Ante Meridiem |
| AP | : | Affected Person |
| ASEP | : | Association of Structural Engineers of the Philippines |
| ARAP | : | Abbreviated Resettlement Action Plan |
| BOD | : | Biological Oxygen Demand |
| BOM | : | Bureau of Maintenance |
| BOT | : | Build-Operate-Transfer |
| BRT | : | Build Rapid Transit |
| BTMC | : | Basic Technology and Management Corporation |
| C3 | : | Circumferential Road 3 |
| C4 | : | Circumferential Road 4 (EDSA) |
| C5 | : | Circumferential Road 5 (C.P. Garcia Avenue) |
| C6 | : | Circumferential Road 6 |
| CBD | : | Central Business District |
| CCTV | : | Closed Circuit Television |
| CDO | : | Cease and Desist Order |
| CER | : | Compliance Evaluation Report |
| CMMTC | : | Citra Metro Manila Tollways Corporation |
| CMR | : | Compliance Monitoring Report |
| CMVR | : | Compliance Monitoring and Validation Report |
| CNC | : | Certificate of Non-Coverage |
| CS | : | Construction Supervision |
| DAO | : | Department Administrative Order |
| DD | : | Detailed Design |
| DE | : | Design Engineer |
| DENR | : | Department of Environment and Natural Resources |
| DFR | : | Draft Final Report |
| DO | : | Dissolved Oxygen |
| DOH | : | Department of Health |
| DOTC | : | Department of Transportation and Communications |
| DPWH | : | Department of Public Works and Highways |
| DWT | : | Dead Weight Tonnage |
| ECAs | : | Environmentally Critical Areas |
| ECC | : | Environmental Compliance Certificate |
| ECPs | : | Environmentally Critical Projects |

| | | |
|---|---|---|
| EDSA | : | Epifanio Delos Santos Avenue (C4) |
| EIA | : | Environmental Impact Assessment |
| EIS | : | Environmental Impact Statement |
| EIRR | : | Economic Internal Rate of Return |
| EMA | : | External Monitoring Agent |
| EMB | : | Environmental Management Bureau |
| EMK | : | Equivalent Maintenance Kilometer |
| EMOP | : | Environmental Monitoring Plan |
| EMP | : | Environmental Management Plan |
| ENPV | : | Economic Net Present Value |
| ESSO | : | Environmental and Social Services Office |
| FR | : | Final Report |
| FTI | : | Food Terminal, Inc |
| FY | : | Fiscal Year |
| GAA | : | General Appropriations Act |
| GC | : | General Condition |
| GDP | : | Gross Domestic Product |
| GOP | : | Government of the Philippines |
| GPS | : | Global Positioning System |
| HIV/AIDS | : | Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome |
| ICC | : | Indigenous Cultural Community |
| ICR | : | Inception Report |
| IEC | : | Information, Education and Communication |
| IEE | : | Initial Environmental Examination |
| IEER | : | Initial Environmental Examination Report |
| IEEC | : | Initial Environmental Examination Checklist |
| IMA | : | Internal Monitoring Agent |
| IMP | : | Impacts Management Plan |
| IP | : | Indigenous People |
| IPAP | : | Indigenous People's Action Plan |
| IPRA | : | Indigenous Peoples' Rights Act |
| IRA | : | Independent Land Appraiser |
| IROW | : | Infrastructure Right-of-Way |
| ITR | : | Interim Report |
| IUCN | : | International Union for the Conservation of Nature and Natural Resources |
| JBIC | : | Japanese Bank International for Cooperation |
| JICA | : | Japan International Cooperation Agency |
| JPY | : | Japanese Yen |
| KEDCF | : | Korean Economic Development Cooperation Fund |
| KOICA | : | Korea International Cooperation Agency |

| | | |
|---|---|---|
| LAPRAP | : | Land Acquisition Plan and Resettlement Action Plan |
| LARRIPP | : | Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy |
| LGU | : | Local Government Unit |
| LOS | : | Level of Service |
| LRT | : | Light Rail Transit |
| LTFRB | : | Land Transportation Franchising and Regulatory Board |
| MARIPAS | : | Marikina, Rizal, Pasig |
| MBA | : | Maintenance Work by Administration |
| MBC | : | Maintenance Work by Contract |
| MCC | : | Millennium Challenge Corporation |
| METI | : | Ministry of Economy, Trade and Industry (of the Government of Japan) |
| MMDA | : | Metropolitan Manila Development Authority |
| MMICP | : | Metro Manila Interchange Project (VI) |
| MMT | : | Multi-partite Monitoring Team |
| MM-PIBAS | : | Mega Manila Provincial Integrated Bus Axis System |
| MMURTRIP | : | Metro Manila Urban Transport Integration Project |
| MMUTIS | : | Metro Manila Urban Transport Integration Study |
| MMTC | : | Metro Manila Tollways Corporation |
| MOOE | : | Maintenance and Other Operating Expenses |
| MRIC | : | Municipal/City Resettlement Implementation Committee |
| MRT | : | Mass Rail Transit |
| MVUC | : | Motor Vehicle User's Change |
| MWSS | : | Metropolitan Waterworks and Sewerage System |
| NAIA | : | Ninoy Aquino International Airport |
| NBP | : | New Bilibid Prison s |
| NCR | : | National Capital Region |
| NCIP | : | National Commission on Indigenous Peoples |
| NECA | : | Non-Environmentally Critical Areas |
| NECP | : | Non-Environmentally Critical Project |
| NEDA | : | National Economic Development Authority |
| NEPC | : | National Environmental Protection Council |
| NHA | : | National Housing Authority |
| NIPAS | : | National Integrated Projected Areas System |
| NLEX | : | North Luzon Expressway |
| NPCC | : | National Pollution Control Commission |
| NSO | : | National Statistics Office |
| OBR | : | Organized Bus Route |
| ODA | : | Official Development Assistance |
| OD | : | Origin–Destination |
| OECF | : | Overseas Economic Cooperation Fund |

| | | |
|---|---|---|
| PAF | : | Project Affected Family |
| PAPs | : | Project Affected Persons |
| PCU | : | Passenger Car Units |
| PDR | : | Project Description Report |
| PEISS | : | Philippine Environmental Impact Statement System |
| PERT/CPM | : | Program Evaluation Review Technique/Critical Path Method |
| PHP | : | Philippine Peso |
| PM | : | Post Meridiem |
| PMO | : | Project Management Office |
| PNCC | : | Philippine National Construction Corporation |
| PNR | : | Philippine National Railways |
| PPP | : | Public-Private Partnership |
| PROC | : | People's Republic of China |
| PRRC | : | Pasig River Rehabilitation Commission |
| PRRP | : | Pasig River Rehabilitation Programs |
| PUB(s) | : | Public Utility Bus(es) |
| PUV(s) | : | Public Utility Vehicle |
| QMC | : | Quezon Memorial Circle |
| R1 | : | Radial Road 1 |
| R7 | ; | Radial Road 7 |
| RA | : | Republic Act |
| RAP | : | Resettlement Action Plan |
| RIC | : | Resettlement Implementation Committee |
| ROW | : | Right-of- Way |
| SC | : | Supervising Consultant |
| SLEX | : | South Luzon Expressway |
| SMC | : | San Miguel Corporation |
| SMR | : | Self-Monitoring Report |
| SPM | : | Suspended Particulate Matter |
| STRADA | : | System for Traffic Demand Analysis |
| UK | : | United Kingdom |
| URPO | : | Urban Roads Project Office |
| USD | : | US Dollar |
| UV | : | Utility Vehicle |
| UVVRS | : | Uniform Vehicular Volume Reduction Scheme |
| UWRS | : | Uniform Volume Reduction Scheme |
| VISSIM | : | The Leading Microscopic Simulation Program for Multi-Modal Traffic Flow Modeling |
| WB | : | World Bank |

# EXECUTIVE SUMMARY

## 1. INTRODUCTION

### 1.1 Background of the Project

Metro Manila has a strategic foothold in the socio-economic activities of the Philippines that attracts 13% of the population and generates 37% of the total GDP of the country. Metro Manila has been continuously developing and improving its transport sector infrastructure and traffic network. Manila is currently still faced with the problems of heavy traffic congestion and increased travel times. Such a situation creates a bottleneck for the distribution of goods and hampers the movement of people, resulting in huge economic losses. At the same time, chronic traffic congestion causes increase in air pollution and noise.

In view of the above, the DPWH has requested the JICA to evaluate the possibility of financing the construction of the highly prioritized grade separated interchange projects in Metro Manila. JICA responded favorably to this DPWH request and has selected the consultants to undertake the Preparatory Survey for Metro Manila Interchange Construction Project (VI).

### 1.2 Objectives of the Study

**(1)** The objective of the Study is to conduct screening of the proposed improvements as Japanese ODA Loan Project, focusing on the items such as the purpose of the project, scope of works, project cost, project implementation organization, operation and maintenance organization and social environmental aspects based on previous detailed design and other related studies.

**(2)** Conduct a review and study for the preliminary engineering study on the construction of the Circumferential Road-3 (C-3) missing link includes of impact to the proposed flyover.

**(3)** Conduct preliminary engineering study on traffic capacity expansion of Circumferential Road-4 (C-4) includes of find space for proposed viaduct structures.

### 1.3 Scope of the Study

**(1) Study of construction of interchanges**

- Feasibility Study for four (4) interchanges
  - C-3/E. Rodriguez
  - EDSA/Roosevelt/Congressional
  - EDSA/North/West/Mindanao
  - C-5/Green Meadows/ Calle Industria/Eastwood
- Scheme study and preparation of design options for C-5/Kalayaan

**(2) Study of the C-3 missing link includes of impact to the proposed flyover.**

- Review of six (6) alignments established by DPWH
- Establish evaluation criteria and undertake evaluation of alternative alignments

**(3) Study on C-4 traffic capacity expansion includes of find space for proposed viaduct structures.**

- Review of present and proposed projects in the study area
- Study on traffic capacity expansion for the construction of viaduct and tunnel schemes.

## 2. CONFIRMATION OF VALIDITY AND NECESSITY OF THE PROJECT

### 2.1 Confirmation of Consistency on Traffic Plans by Other Agencies

This Project is consistent with the traffic plans of other agencies such as MMDA and DOTC. There is no conflict with the traffic plans of other agencies; it is supportive of the traffic plans of the LGUs and other agencies. However, the following issues need to be noted:

**MRT Line 7 Construction**

The proposed intersection scheme for EDSA/West/North/Mindanao Avenues has been confirmed and approved by the project proponent of MRT 7 and DOTC. However, a reconfirmation has to be made during the Detailed Design Stage to ensure that there has been no change in the scheme that has been originally approved.

**Skyway Stage 3**

The project is a 14.5km six-lane elevated viaduct that will connect the north and south expressways via C-3, and has been approved as a priority project by the government last August 2012. Correspondingly, implementation of the C-3/E. Rodriguez Interchange has been deferred by DPWH due to a conflict of its alignment with that of the project.

### 2.2 Confirmation of Necessity and Priority of the Proposed Flyover Project

The five interchange under this proposal are included in the list of priority projects for NCR under DPWH's Public Investment Plan 2011-2016. Proposed budget for the Metro Manila Interchange Construction Project is about P7.36 Billion. The construction of five interchanges has a total allocation of P5.17 Billion excluding consultancy services.

### 2.3 Lessons Learned from Previous Similar Projects and Proposed Countermeasures

The ex-post evaluation study for Metro Manila Interchange Construction Project (IV) dated June 2008 was undertaken jointly by JBIC Consultants and the National Economic and Development Authority (NEDA). The Report identified the following three lessons and the recommended actions that need to be taken into account in future project implementation:

Lesson-1: Lack of in-depth investigation during detailed design
Lesson-2: Delay in land acquisition and resettlement
Lesson-3: Absence of pragmatic project scheduling
Recommendation: Sufficient maintenance funds should be secured

The Consolidated Report in January 2011 for the Metro Manila Urban Transport Integration Project (MMURTRIP) financed by World Bank identified that bureaucratic processes, changes in administration, and ensuing changes in development policies are the main causes of delay in project implementation.

### 2.4 Technical Level for Construction and Maintenance of Flyover of the DPWH

The PMO-URPO is in charge of flyover construction and its maintenance is undertaken by NCR Regional Office. Technical level of both agencies is fairly high and capable enough to construct and maintain flyovers, but there is some room for improvement in the following processes:

1. Bureaucratic procurement process
2. Prolonged relocation process
3. Casual maintenance approach rather than preventive

# 3. TRAFFIC FLOW ANALYSIS AND DEMAND FORECAST

## 3.1 Traffic Survey

The traffic surveys shown in **Table 3-1** were conducted to grasp the present traffic flow characteristics of the project sites.

**Table 3-1 Type and Location of Traffic Surveys**

| Type of Survey | Purpose of the Survey | Location |
|---|---|---|
| 1. Intersection Directional Traffic Volume (Dec. 6~Dec. 21 2011) | - Assessment of present service level of the intersections<br>- Formulation of interchange schemes<br>- Benefit calculation | 1. C-3/E. Rodriguez<br>2. EDSA/Roosevelt/Congressional<br>3. EDSA/North/West/Mindanao<br>4. C-5/Kalayaan<br>5. C-5/Green Meadows/Acroplis /Calle Industria<br>Note: C-5/Kalayaan is not included in the Number Plate Survey |
| 2. Number Plate Vehicle Movement Survey (Dec. 6~Dec. 21 2011) | - Formulation of present Origin Destination (OD) matrix for traffic analyses | |
| 3. Intersection Queue Length Survey (Dec. 6~Dec. 21 2011) | - Verification of current service level of the intersections | |
| 4. Travel Speed Survey (Nov. 22~Dec.8 2011) | - Basic information for assessment of effect and impact of interchange construction | 8 major streets passing/crossing project intersections |

*Source: JICA Study Team*

*Note: Survey of above 1, 2 and 3 of C-5/Kalayaan was conducted March 13 and 14 2012*

### 3.1.1 Result of Traffic Demand Forecast by Micro-simulation

Daily vehicle-km, daily-vehicle hour and average travel speed of each interchange are shown in **Tables 3-2** to **3-5**.

**Table 3-2 Daily Vehicle-Km, Vehicle-Hour and Average Travel Speed (C-3/E. Rodriguez Intersection)**

| Indicator | Vehicle Category | 2011 (Daily) | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 90,049 | 174,597 | 175,989 | -1,392 | 111,650 | 112,375 | -724 |
| | Jeepney | 9,346 | 18,453 | 18,432 | 20 | 30,503 | 30,529 | -26 |
| | UtilityVehicle | 9,618 | 18,353 | 18,574 | -222 | 11,950 | 12,071 | -121 |
| | Bus | 449 | 836 | 805 | 32 | 559 | 536 | 23 |
| | Truck | 2,881 | 5,531 | 5,624 | -93 | 3,517 | 3,541 | -23 |
| | Motorcycle | 41,595 | 86,428 | 81,010 | 5,418 | 139,866 | 130,296 | 9,570 |
| | **Total** | **153,938** | **304,197** | **300,433** | **3,764** | **298,046** | **289,347** | **8,699** |
| Vehicle Hour | Car | 3,293 | 5,842 | 7,326 | -1,483 | 3,627 | 4,603 | -977 |
| | Jeepney | 340 | 610 | 767 | -158 | 985 | 1,190 | -205 |
| | UtilityVehicle | 356 | 605 | 778 | -173 | 382 | 511 | -129 |
| | Bus | 16 | 27 | 34 | -6 | 18 | 21 | -3 |
| | Truck | 106 | 164 | 230 | -67 | 101 | 143 | -42 |
| | Motorcycle | 1,518 | 2,541 | 3,270 | -730 | 4,050 | 5,900 | -1,850 |
| | **Total** | **5,629** | **9,788** | **12,405** | **-2,617** | **9,162** | **12,369** | **-3,206** |
| Traffic Volume | Car | 67,712 | 132,486 | 132,376 | 111 | 84,621 | 84,692 | -71 |
| | Jeepney | 7,379 | 14,518 | 14,529 | -11 | 23,964 | 24,062 | -98 |
| | UtilityVehicle | 6,917 | 13,393 | 13,417 | -24 | 8,687 | 8,717 | -30 |
| | Bus | 352 | 632 | 628 | 4 | 421 | 421 | 0 |
| | Truck | 2,001 | 3,890 | 3,903 | -14 | 2,460 | 2,443 | 16 |
| | Motorcycle | 28,668 | 55,779 | 55,808 | -28 | 90,305 | 89,762 | 542 |
| | **Total** | **113,029** | **220,698** | **220,660** | **38** | **210,458** | **210,098** | **360** |
| Average Travel Speed (Km/Hour) | Car | 27.3 | 29.9 | 24.0 | 5.9 | 30.8 | 24.4 | 6.4 |
| | Jeepney | 27.5 | 30.3 | 24.0 | 6.2 | 31.0 | 25.6 | 5.3 |
| | UtilityVehicle | 27.0 | 30.4 | 23.9 | 6.5 | 31.3 | 23.6 | 7.7 |
| | Bus | 27.5 | 30.8 | 24.0 | 6.9 | 31.9 | 25.7 | 6.2 |
| | Truck | 27.2 | 33.8 | 24.4 | 9.4 | 34.8 | 24.7 | 10.1 |
| | Motorcycle | 27.4 | 34.0 | 24.8 | 9.2 | 34.5 | 22.1 | 12.4 |
| | **Average** | **27.3** | **31.1** | **24.2** | **6.9** | **32.5** | **23.4** | **9.1** |

*Source: JICA Study Team*

**Table 3-3 Daily Vehicle-km, Vehicle-Hour and Average Travel Speed (EDSA /Roosevelt/ Congressional Intersection)**

| Indicator | Vehicle Category | 2011 (Daily) | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 118,775 | 144,485 | 150,012 | -5,527 | 134,665 | 139,990 | -5,325 |
| | Jeepney | 20,782 | 22,329 | 26,650 | -4,321 | 29,268 | 35,042 | -5,774 |
| | UtilityVehicle | 18,410 | 22,402 | 23,286 | -884 | 20,734 | 21,591 | -857 |
| | Bus | 15,196 | 18,316 | 19,392 | -1,076 | 16,966 | 17,962 | -996 |
| | Truck | 14,081 | 17,072 | 17,669 | -597 | 15,885 | 16,530 | -646 |
| | Motorcycle | 21,078 | 25,264 | 26,579 | -1,315 | 32,937 | 34,900 | -1,963 |
| | **Total** | **208,323** | **249,869** | **263,588** | **-13,720** | **250,454** | **266,016** | **-15,561** |
| Vehicle Hour | Car | 3,915 | 4,770 | 5,116 | -347 | 4,444 | 4,810 | -366 |
| | Jeepney | 710 | 703 | 945 | -242 | 926 | 1,252 | -326 |
| | UtilityVehicle | 610 | 749 | 799 | -50 | 691 | 743 | -51 |
| | Bus | 510 | 543 | 675 | -132 | 503 | 629 | -127 |
| | Truck | 469 | 569 | 612 | -43 | 527 | 577 | -50 |
| | Motorcycle | 701 | 904 | 916 | -12 | 1,183 | 1,210 | -27 |
| | **Total** | **6,914** | **8,237** | **9,063** | **-826** | **8,274** | **9,221** | **-947** |
| Traffic Volume | Car | 78,477 | 99,454 | 99,193 | 261 | 92,615 | 92,521 | 94 |
| | Jeepney | 9,664 | 12,419 | 12,338 | 82 | 16,302 | 16,266 | 37 |
| | UtilityVehicle | 11,131 | 14,190 | 14,178 | 12 | 13,159 | 13,182 | -24 |
| | Bus | 10,550 | 13,480 | 13,427 | 53 | 12,468 | 12,475 | -7 |
| | Truck | 8,484 | 10,934 | 10,997 | -63 | 10,148 | 10,266 | -118 |
| | Motorcycle | 13,641 | 17,250 | 17,239 | 10 | 22,662 | 22,662 | 0 |
| | **Total** | **131,948** | **167,726** | **167,372** | **355** | **167,353** | **167,372** | **-18** |
| Average Travel Speed (Km/Hour) | Car | 30.3 | 30.3 | 29.3 | 1.0 | 30.3 | 29.1 | 1.2 |
| | Jeepney | 29.3 | 31.8 | 28.2 | 3.6 | 31.6 | 28.0 | 3.6 |
| | UtilityVehicle | 30.2 | 29.9 | 29.2 | 0.8 | 30.0 | 29.1 | 0.9 |
| | Bus | 29.8 | 33.7 | 28.7 | 5.0 | 33.8 | 28.5 | 5.2 |
| | Truck | 30.0 | 30.0 | 28.9 | 1.2 | 30.2 | 28.7 | 1.5 |
| | Motorcycle | 30.1 | 27.9 | 29.0 | -1.1 | 27.8 | 28.8 | -1.0 |
| | **Average** | **30.1** | **30.3** | **29.1** | **1.3** | **30.3** | **28.8** | **1.4** |

*Source: JICA Study Team*

**Table 3-4 Daily Vehicle-km, Vehicle-Hour and Average Travel Speed (EDSA /North/West/Mindanao Intersection)**

| Indicator | Vehicle Category | 2011 Daily | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 257,061 | 308,345 | 317,028 | -8,683 | 289,377 | 297,381 | -8,004 |
| | Jeepney | 22,322 | 23,009 | 26,265 | -3,256 | 27,499 | 31,912 | -4,413 |
| | UtilityVehicle | 26,357 | 30,795 | 32,449 | -1,654 | 28,887 | 30,528 | -1,641 |
| | Bus | 14,382 | 18,139 | 18,292 | -154 | 16,835 | 16,960 | -125 |
| | Truck | 23,232 | 28,545 | 29,065 | -520 | 26,755 | 27,198 | -443 |
| | Motorcycle | 40,702 | 50,013 | 50,930 | -917 | 65,028 | 66,657 | -1,629 |
| | **Total** | **384,056** | **458,845** | **474,029** | **-15,184** | **454,382** | **470,635** | **-16,254** |
| Vehicle Hour | Car | 9,191 | 10,754 | 13,360 | -2,606 | 9,753 | 12,072 | -2,319 |
| | Jeepney | 834 | 939 | 1,079 | -141 | 1,114 | 1,293 | -179 |
| | UtilityVehicle | 972 | 1,135 | 1,377 | -242 | 1,030 | 1,284 | -254 |
| | Bus | 460 | 506 | 636 | -130 | 466 | 567 | -102 |
| | Truck | 895 | 1,015 | 1,349 | -334 | 919 | 1,223 | -303 |
| | Motorcycle | 1,544 | 1,723 | 2,603 | -880 | 2,198 | 3,293 | -1,095 |
| | **Total** | **13,895** | **16,072** | **20,405** | **-4,332** | **15,481** | **19,732** | **-4,252** |
| Traffic Volume | Car | 167,998 | 206,255 | 205,934 | 321 | 193,438 | 193,023 | 415 |
| | Jeepney | 10,459 | 11,455 | 11,489 | -34 | 12,837 | 12,828 | 8 |
| | UtilityVehicle | 16,403 | 19,929 | 19,937 | -9 | 18,690 | 18,755 | -65 |
| | Bus | 10,381 | 13,198 | 13,194 | 4 | 12,242 | 12,246 | -4 |
| | Truck | 16,154 | 20,309 | 20,233 | 77 | 18,959 | 18,945 | 14 |
| | Motorcycle | 26,130 | 32,745 | 32,588 | 156 | 42,425 | 42,358 | 67 |
| | **Total** | **247,526** | **303,890** | **303375.1** | **515.0** | **298,592** | **298,156** | **436** |
| Average Travel Speed (Km/Hour) | Car | 28.0 | 28.7 | 23.7 | 4.9 | 29.7 | 24.6 | 5.0 |
| | Jeepney | 26.8 | 24.5 | 24.3 | 0.2 | 24.7 | 24.7 | 0.0 |
| | UtilityVehicle | 27.1 | 27.1 | 23.6 | 3.6 | 28.1 | 23.8 | 4.3 |
| | Bus | 31.3 | 35.8 | 28.7 | 7.1 | 36.2 | 29.9 | 6.3 |
| | Truck | 26.0 | 28.1 | 21.5 | 6.6 | 29.1 | 22.2 | 6.9 |
| | Motorcycle | 26.4 | 29.0 | 19.6 | 9.5 | 29.6 | 20.2 | 9.3 |
| | **Total** | **27.6** | **28.5** | **23.2** | **5.3** | **29.4** | **23.9** | **5.5** |

*Source: JICA Study Team*

**Table 3-5 Daily Vehicle-m, Vehicle-Hour and Average Travel Speed (C-5 Green Meadows/Acropolis/Calle Industria)**

| Indicator | Vehicle Category | 2011 (Daily) | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 324,251 | 367,398 | 373,519 | -6,121 | 543,481 | 552,795 | -9,314 |
| | Jeepney | 13,173 | 15,185 | 15,213 | -28 | 22,715 | 22,867 | -152 |
| | UtilityVehicle | 54,476 | 62,176 | 62,507 | -331 | 92,139 | 92,672 | -533 |
| | Bus | 772 | 858 | 865 | -8 | 1,302 | 1,299 | 2 |
| | Truck | 34,601 | 39,742 | 39,905 | -163 | 58,850 | 59,115 | -265 |
| | Motorcycle | 90,496 | 103,721 | 104,143 | -423 | 152,917 | 153,418 | -501 |
| | **Total** | **517,769** | **589,078** | **596,153** | **-7,074** | **871,404** | **882,166** | **-10,763** |
| Vehicle Hour | Car | 10,309 | 10,885 | 11,936 | -1,051 | 17,874 | 19,823 | -1,949 |
| | Jeepney | 419 | 419 | 487 | -67 | 702 | 854 | -153 |
| | UtilityVehicle | 1,736 | 1,783 | 2,003 | -220 | 2,971 | 3,531 | -560 |
| | Bus | 25 | 23 | 28 | -4 | 39 | 48 | -8 |
| | Truck | 1,102 | 1,108 | 1,278 | -170 | 1,822 | 2,182 | -360 |
| | Motorcycle | 2,878 | 3,008 | 3,329 | -321 | 4,928 | 5,534 | -606 |
| | **Total** | **16,468** | **17,227** | **19,061** | **-1,834** | **28,336** | **31,972** | **-3,635** |
| Traffic Volume | Car | 114,767 | 132,136 | 132,178 | -42 | 195,412 | 195,166 | 246 |
| | Jeepney | 4,360 | 5,054 | 5,051 | 3 | 7,574 | 7,591 | -17 |
| | UtilityVehicle | 18,281 | 20,971 | 20,974 | -3 | 30,992 | 30,992 | 0 |
| | Bus | 257 | 288 | 288 | 0 | 428 | 428 | 0 |
| | Truck | 11,526 | 13,255 | 13,286 | -31 | 19,582 | 19,606 | -24 |
| | Motorcycle | 30,917 | 35,590 | 35,667 | -77 | 52,532 | 52,401 | 132 |
| | **Total** | **180,108** | **207,294** | **207,444** | **-151** | **306,520** | **306,183** | **337** |
| Average Travel Speed (Km/Hour) | Car | 31.5 | 33.8 | 31.3 | 2.5 | 30.4 | 27.9 | 2.5 |
| | Jeepney | 31.4 | 36.2 | 31.3 | 4.9 | 32.4 | 26.8 | 5.6 |
| | UtilityVehicle | 31.4 | 34.9 | 31.2 | 3.7 | 31.0 | 26.2 | 4.8 |
| | Bus | 31.5 | 36.7 | 31.2 | 5.5 | 33.2 | 27.3 | 5.9 |
| | Truck | 31.4 | 35.9 | 31.2 | 4.7 | 32.3 | 27.1 | 5.2 |
| | Motorcycle | 31.4 | 34.5 | 31.3 | 3.2 | 31.0 | 27.7 | 3.3 |
| | **Total** | **31.4** | **34.2** | **31.3** | **2.9** | **30.8** | **27.6** | **3.2** |

*Source: JICA Study Team*

# 4. STUDY OF EACH INTERCHANGE

## 4.1 Design Standard for Highway and Flyover

Design standards for Highway and Flyovers adopt DPWH design standards except for seismic acceleration coefficient which was increased from 0.4g to 0.5g due to scheduled change in the ASEP design code.

## 4.2 C-3/E. Rodriguez Avenue

### 4.2.1 Review of Previous Detailed Design

Along C-3

The total length of the project section along this road segment is 2,105m, consisting of 275m of 4-lanes flyover, 205m of approach roads and 1,625m of embankment roads. The highest embankment height is 2.50m.

Along E. Rodriguez Avenue

The road has 827m long and four lanes with a total width of 20.0m and highest embankment height of 1.55m.

Identified Problems

There has been no study yet of the possible impacts of flooding on the people living within the vicinity of the project area and also no documents showing public acceptance on the proposed raising of the current road elevation.

Recommendations

The most appropriate countermeasure(s) against flood, i.e. in case to raise present road elevations further, etc. should be thoroughly studied.

### 4.2.2 Preliminary Design of Interchange

#### (1) Study and Countermeasure against Flood

The construction of an elevated highway should

be provided proper counter measure to the fundamental problem of floods and should be properly addressed by a flood control management project.

**(2) Comparative Study**

The following three (3) alternatives are proposed as the most suitable schemes for comparison:

Scheme-1 : 275.0m long flyover and 630m long 6 lanes additional approach road (Original Design).

Scheme-2 : 280.0m long flyover

Scheme-3 : 280.0m long flyover and 598m long 4 lanes additional approach with RCBC.

Among the three (3) schemes, scheme-3 was selected though it was more expensive than scheme-2 by approximately 22%. This is due to the 598m extent of elevated road to alleviate effects of flood and provide 2-lanes per direction of service roads at the at-grade section which will be deemed sufficient to support the activities of people along this road section.

Implementation of the C-3/E. Rodriguez Interchange was cancelled by the DPWH to give priority to the construction of Skyway Stage 3, second level, along C-3 under BOT scheme.

**(3) Cost Estimate and Construction Duration**

Estimated cost and construction duration are PhP 492M and 17 months, respectively.

## 4.3 EDSA-Roosevelt Ave. / Congressional Avenue

### 4.3.1 Review of Previous Detailed Design

Northbound

The total length of the project section and the flyover are 729m and 502m, respectively.

Southbound

Total length of the project section and flyover are 729m and 500m, respectively.

Identified Problems

Total re-planning and redesign will be required due to the constructed MRT-3 and Muñoz Station and the Pedestrian Bridges at the intersection.

Recommendations

A careful study of the vertical and horizontal clearances against the constructed Muñoz Station and MRT-3 viaduct structures should be undertaken.

### 4.3.2 Preliminary Design of Interchange

**(1) Comparative Study**

The following three (3) alternatives are proposed as the most suitable schemes for comparison.

Scheme-1 : Flyover with 422m long and 3 lanes per direction. (Maintain of all pedestrian bridges )

Scheme-2 : Flyover with 366m long and 3 lanes per direction. (No pedestrian bridges near Muñoz Station)

Scheme-3 : Flyover with 719m (NB) and 880m (SB) long. (Maintaining all pedestrian bridges and improving at grade intersection)

Among the three (3) alternatives, scheme-2 was selected having the cheapest construction cost, shorter construction duration and superior vertical grade against the other schemes.

**(2) Cost Estimate and Construction Duration**

Estimated cost and construction duration is PhP 630M and 22 months, respectively.

## 4.4 EDSA/ North Avenue/ West Avenue/ Mindanao Avenue

### 4.4.1 Review of Previous Detailed Design

EDSA Southbound

The total length of the project section and the flyover are 854m and 361m, respectively. The length of the left turn flyover (EDSA–North Avenue) which is located above the EDSA northbound flyover is 286m.

EDSA Northbound

The total length of the project section and the flyover are 569m and 343m, respectively.

EDSA–North Avenue Left Turn Flyover

- ⇨ North Avenue Straight
  Total length of project section = 1,228m; Length of flyover = 1,011m
- ⇨ North Avenue–Mindanao Avenue
  Total length of project section = 306m; Length of flyover = 180m

West Avenue–North Avenue Flyover

The flyover has two lanes and horizontal alignment of 80m radius right curve at the intersection which merges with EDSA–North Avenue Left Turn Flyover after the curve. The lengths of the project section and flyover are 483m and 392m, respectively.

Identified Problems

(a) Requires total re-planning and redesign due to the planned construction of the Common Station along LRT-1 in front of SM North, and MRT-7 which will pass along North Avenue.

(b) The construction of a Left Turn Flyover from EDSA to North Avenue will not be possible with the planned construction of the Common Station.

Recommendations

The necessary data and information on the MRT-3 and LRT Line-1 extension and detailed design of the Common Station and MRT 7 should be obtained for Preliminary Design.

### 4.4.2 Preliminary Design (EDSA/North/ West Interchange)

**(1) Comparative study**

The following two (2) alternatives are proposed as the most suitable for comparison:

Scheme-1 : Flyover with 342m long north bound and 319m long south bound.

Scheme-2 : Cut and cover tunnel with 231m long north bound and 131m long south bound.

Between the two (2) schemes, the flyover scheme was selected due to cheaper construction cost, no ROW acquisition, shorter construction duration and no specific O & M.

### 4.4.3 Preliminary Design (North/Mindanao Interchange)

**(1) Comparative study**

The following two (2) alternatives are proposed as the most suitable for comparison:

Scheme-1 : Left turn flyover from North Ave to Mindanao Ave (3rd level) and left turn flyover from Mindanao Ave to North Ave (2nd level)

Scheme-2 : Left turn cut and cover tunnel from North Ave to Mindanao Ave (under pass) and left turn flyover from Mindanao Ave to North Ave (2nd level).

Between two (2) schemes, scheme-2 was

selected due to cheaper construction cost and better environmental and traffic conditions.

**(2) Cost Estimate and Construction Duration**

Estimated cost and construction duration for the above two interchanges are P1,166 M and 24 months, respectively.

## 4.5 C-5/Kalayaan Avenue

### 4.5.1 Review of Previous Detailed Design

Identified Problems

The U-Turn Flyovers constructed at both sides of the intersection along C-5 are considered to be substandard structures under the design code.

Recommendations

A more comprehensive study of actual traffic flow and volume at the intersection needs to be undertaken to identify the cause of traffic jam and to study proper counter measures.

### 4.5.2 Advice for Technical Issue and Design Option

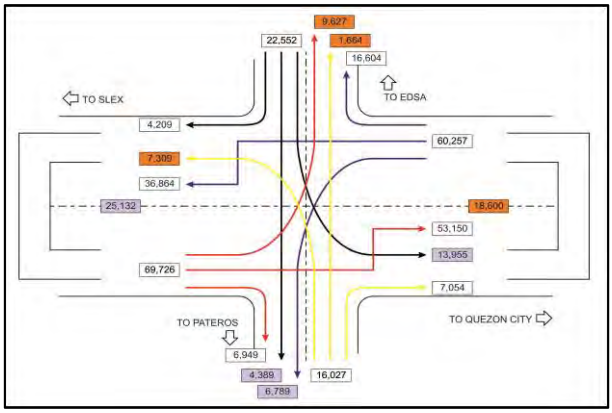
**(1) Site Condition and Traffic survey**

Three (3) issues were identified:

a) Carriageway width of C5 thru traffic is substandard.

b) Subtle curve alignments along C5 for thru traffic in both directions were observed around the U-turn flyover.

c) Traffic survey data shows that passing vehicles along U-turn flyover at south side and north side are 25,132 vehiclesper day and 18,600 vehicles per day, respectively. Summarized actual traffic intersection flow graphic are shown as follows:




*Source: JICA Study Team*

**(2) Technical study maintaining existing U-turn flyover**

Maintaining existing U-turn flyover and from above traffic data, the following five (5) schemes were studied:

| Option | | AADT | Findings | Reduced Conflict No. (Present conflict is 5) |
|---|---|---|---|---|
| Scheme -1 | Construct left turn flyover from Kalayaan Ave. to C5 north bound | 13,955 | Require ROW acquisition but Tibagan elementary is located along C5 north bound. | -2 |
| Scheme -2 | Construct left turn flyover from Pateros to C5 north bound | 7, 309 | Comparatively traffic volume is small and requires ROW acquisition | -1 |
| Scheme -3 | Construct straight flyover along Kalayaan Ave. | 6,053 | Traffic volume is small | -1 |
| Scheme -4 | Construct left turn flyover from C5 south bound to Pateros | 6,789 | Not enough transition length | -1 |
| Scheme -5 | Construct left turn flyover from C5 north bound to EDSA | 9,627 | Not enough transition length | 0 |

*Source: JICA Study Team*

Among the above five (5) schemes, the most effective option is to construct left turn flyover from Kalayaan Ave. to C5 north direction but it should be noted that the Tibagan elementary school is located just beside of road along C5 north direction.

**(3) Technical study with demolition of existing U-turn flyover**

New intersection plans provide for three (3) lanes in each direction with underpass scheme along C5 for thru traffic. Based on the traffic volume and traffic flow at the intersection, four (4) schemes as new intersection plans can be considered as shown in the comparison table hereunder.

| Description | Signal Phase | Traffic Reduction Ratio | Length and Cost of Flyover (m) | Overall Evaluation/Ranking | |
|---|---|---|---|---|---|
| **Scheme-1**<br>No structure for grade separation | 4-Phase | $\frac{0}{43.733} = 0\%$ | 0m<br>MP0 | * Manage 4-phases signalization<br>* No cost, no improvement | 4 |
| **Scheme-2**<br>2-lanes Left turn flyover from Kalayaan Ave. to C5 both direction | 3-Phase | $\frac{21.264}{43.733} = 48.6\%$ | 370m x 2 = 740m<br>MP 444 | * Most effective plan due to almost 50% of traffic is free flow | 1 |
| **Scheme-3**<br>2-lanes Straight flyover along Kalayaan Ave. | 3-Phase | $\frac{6.053}{43.733} = 13.8\%$ | 360m<br>MP 216 | * Requires budget is reasonable but effeteness to the traffic flow is small | 3 |
| **Scheme-4**<br>2-lanes Left turn flyover from C5 both direction to Kalayaan Ave. | 3-Phase | $\frac{16.416}{43.733} = 37.5\%$ | 370m x 2 =740 m<br>MP 444 | * 2nd effective plan due to almost 40% of traffic is free flow | 2 |

Note: 1) Traffic rate : Ratio of number of traffic vehicle pass the flyover against total volume of traffic at intersection except along C5 thru traffic and right turn traffic (total volume of traffic for calculation is 43.733 vehicles)
2) Number of lane for all flyover is 2-lane
3) Cost of flyover : P 300,00/m/lane

*Source: JICA Study Team*

**(4) Overall evaluation**

With existing U-turn flyover

- Existing substandard carriageway widths and subtle curve alignments are the cause of unsmooth traffic around both sides of the U-turn flyover and that becomes the bottlenecks for C5 thru traffic and there are no remedial measures without demolishing the existing u-turn flyover.

  Most optimum option is the construction of a left turn flyover from Kalayaan Ave to C5 in both directions, but ROW problem is existence (Tibagan elementary school is located at just beside of north bound of C5).

Without existing U-turn flyover

- Construct underpass 3-lanes in each direction along C5.
- Construction of left turn flyovers from kalayaan Ave. to C5 in both directions will be the most effective scheme considering that almost 50% of traffic will be free flow
- Estimated cost are as follows:

  Construction of 2-lanes Flyover (total length 740m) = P 444M

  Construction of 6-lanes Underpass structure (490m) = P 520M

  Demolition of existing U-turn flyover = P 64M

  Total = P 1,028M

**(5) Recommendation**

With U-turn flyover

- To find a solution for the ROW problem (Tibagan elementary school) for improvement of intersection with present condition of U-turn flyover.

Without U-turn flyover

- To construct 6-lanes underpass for C5 thru traffic and 2-lanes left turn flyover from Kalayaan Ave. to C5 in both directions.

Total Recommendation

Implementation of the above without a U-turn flyover is recommended because the study shows that there is no ultimate solution that could fully address the expected yealy increase traffic without demolition of the existing U-turn flyover.

## 4.6 C-5-Green Meadows Avenue

### 4.6.1 Review of Previous Detailed Design

**(1) Design Plan**

The 925m long and four (4) lanes cut and cover tunnel was initially designed.

Identified Problems

There is no study on the complicated construction procedure for a tunnel underneath the existing creek.

Recommendations

Based on the problems identified, the proposed improvement should be carefully and thoroughly studied.

### 4.6.2 Preliminary Design of Interchange

**(1) Study of White Plains Creek**

The proposed inverted siphon cannot be adopted for the following reasons:

(a) The calculation result of the loss of head of inverted siphon is 1.3 m. Therefore, at the time of freshet, the water level will rise 1.3m higher than the present condition at the upstream side.

(b) It is expected that much garbage will flow at the time of freshet because the creek is flowing through a residential area.

**(2) Comparative Study**

The following three (3) alternatives are proposed as the most suitable for comparison:

- Scheme-1 : 1098m long flyover
- Scheme-2 : 808m long Cut and cover tunnel
- Scheme-3 : 432m long flyover and 80m long cut and cover tunnel

Among the three (3) schemes, scheme-1 was selected due to: Construction cost is cheapest, no ROW acquisition, and much easier construction, can provide four (4) lanes in each direction at the total stretch of area underneath the viaduct and will not require specific O&M.

**(3) Cost Estimate and Construction Duration**

Estimated cost and construction duration are MP1.098 and 24 months, respectively.

# 5. IMPLEMENTATION SCHEDULE

## 5.1 Study of Contract Package Arrangement

Proposed contract packages were decided considering the size of contract and location of each flyover as follows:

**Package-1:** EDSA/North/West/Mindanao: 1,133million pesos

**Package-2:** C5/Green Meadows: 1,066million pesos

**Package-3:** EDSA/Roosevelt/Congressional 612 million pesos

C-3/E. Rodriguez Interchange was canceled due to conflict with on-going project of Skyway Stage-3.

## 5.2 Study of Consultancy services

Consultancy services are required at Detailed Design Stage (12 months), Tender Assistance Stage (12 months) and Construction Supervision Stage (26 months). Total amount of proposed consultancy cost is 342,9 MP (651.6MY) including 5% contingency.

## 5.3 Project Cost Estimate

Total project cost is 3,266.51 million Pesos and loan amount is 5,336.75 million Yen, equity of Government of the Philippines is 412.64 million Pesos.

Summary of the project cost is shown in **Table 5-1**.

**Table 5-1 Summary of Project Cost**

**Unit:** *Million Pesos*

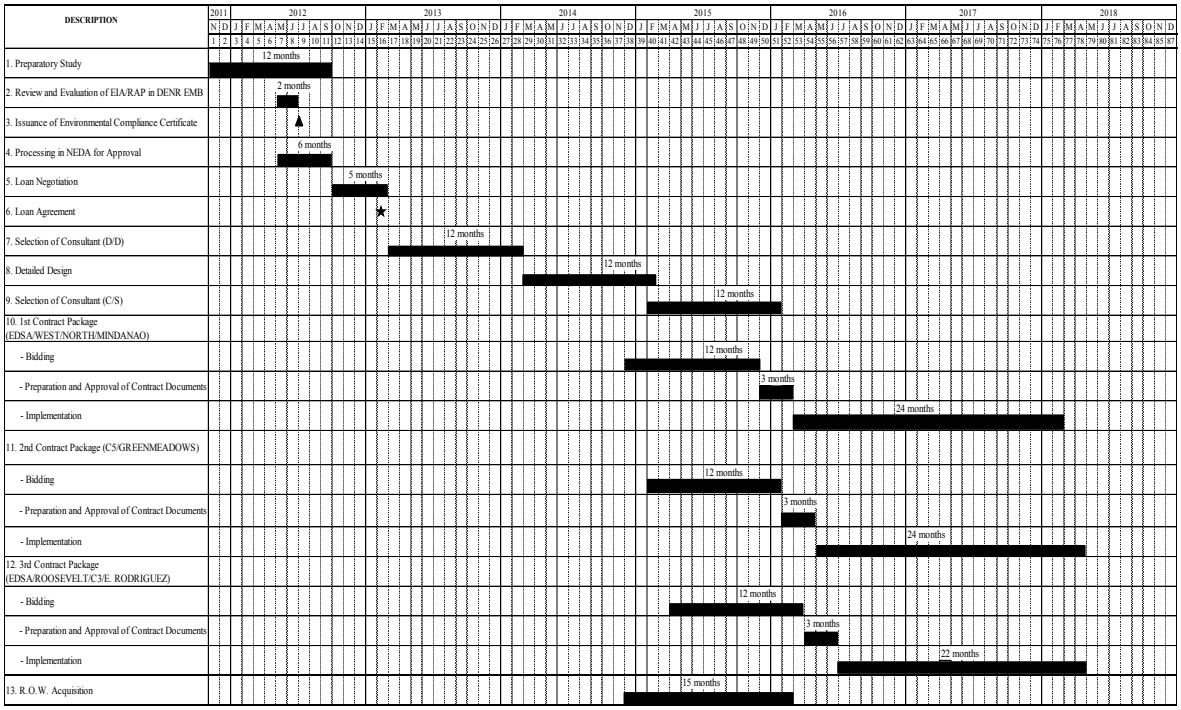
| Item | Total | GOP | ODA | Remarks |
|---|---|---|---|---|
| **1. Total Cvil Work Cost** | **2,811.17** | **301.20** | **2,509.97** | |
| Civil Work Cost | 2,756.05 | | | |
| Physical Contingency (2%) | 55.12 | | | |
| **Package-1 EDSA/North/West and North/Mindanao IC Civil Work Cost** | **1,132.59** | **121.35** | **1,011.24** | |
| Civil Work Cost | 1,110.38 | | | |
| Physical Contingency (2%) | 22.21 | | | |
| **Package-2 C5/Green Meadows IC Civil Work Cost** | **1066.33** | **114.25** | **952.08** | |
| Civil Work Cost | 1045.42 | | | |
| Physical Contingency (2%) | 20.91 | | | |
| **Package-3 EDSA/Roosevelt IC** | **612.25** | **65.60** | **546.65** | |
| Civil Work Cost | 600.24 | | | |
| Physical Contingency (2%) | 12.00 | | | |
| **2. ROW Acquisition Cost** | **4.00** | **4.00** | | |
| | | | | |
| **3. Detailed Engineering Design (DED) Cost Total** | **116.81** | **3.43** | **113.38** | |
| Detailed Engineering Design Cost | 114.52 | | | |
| Physical Contingency (2%) | 2.29 | | | |
| **4. Construction Supervision Cost Total** | **238.07** | **7.55** | **230.52** | |
| Construction Supervision Cost | 233.40 | | | |
| Physical Cor | 4.67 | | | |
| **5. Project Adı** | **96.46** | **96.46** | | |
| Detailed Design Stage, Construction Supervision Stage (3.5%) | 96.46 | | | |
| | | | | |
| **Grand Total in Pesos** | **3,266.51** | **412.64** | **2,853.88** | |
| **Grand Total in Yen** | **6,108.38** | **771.63** | **5,336.75** | |

*Source: JICA Study Team*

*Source: JICA Study Team*

## 5.4 Total proposed implementation schedule is presented as follows:

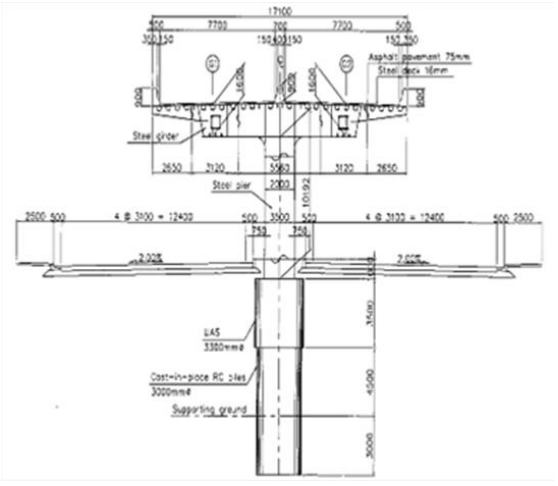
**IMPLEMENTATION SCHEDULE OF MMICP**




*Source: JICA Study Team*

## 5.5 IDEA AND BASIC CONCEPT FOR STEP SCHEME

Proposed use of steel bridge, with steel box girder, steel slab deck and steel piers utilizing Japanese technology, as shown in Figure**,** will remove the risks of the original detailed design plan mentioned above and minimize traffic congestion during the construction of superstructure.




**Procurement Amount from Japan for the Project**

**(Unit: Pesos)**

| No. | Description | Amount | % |
|---|---|---|---|
| 1. | Cement (Material Only) | 82,631,608 | 2.61 |
| 2. | Reinforcing Steel Bar (Material Only) | 414,488,550 | 13.08 |
| 3. | Procurement of structural steel members (Material Only) | 16,017,322 | 0.51 |
| 4. | Structural Steel (Material Only) | 603,502,451 | 19.05 |
| 5. | ERMSE Wall (Material Only) | 36,226,866 | 1.14 |
| 6. | Service of Japanese Contractor | 228,729,600 | 7.22 |
| | **TOTAL** | **1,381,596,397** | **43.61** |

*Source: JICA Study Team*

The total amount of Japanese content, at 2,155 million yen, is 36.39% of the total 5,572 million yen construction cost under STEP scheme. Furthermore, procurement ratio becomes 43.61% once the 7.22% of overhead of the Japanese contractor is added. The Japanese content proposed above therefore is adequate to satisfy the required 30% procurement ratio under STEP scheme condition.

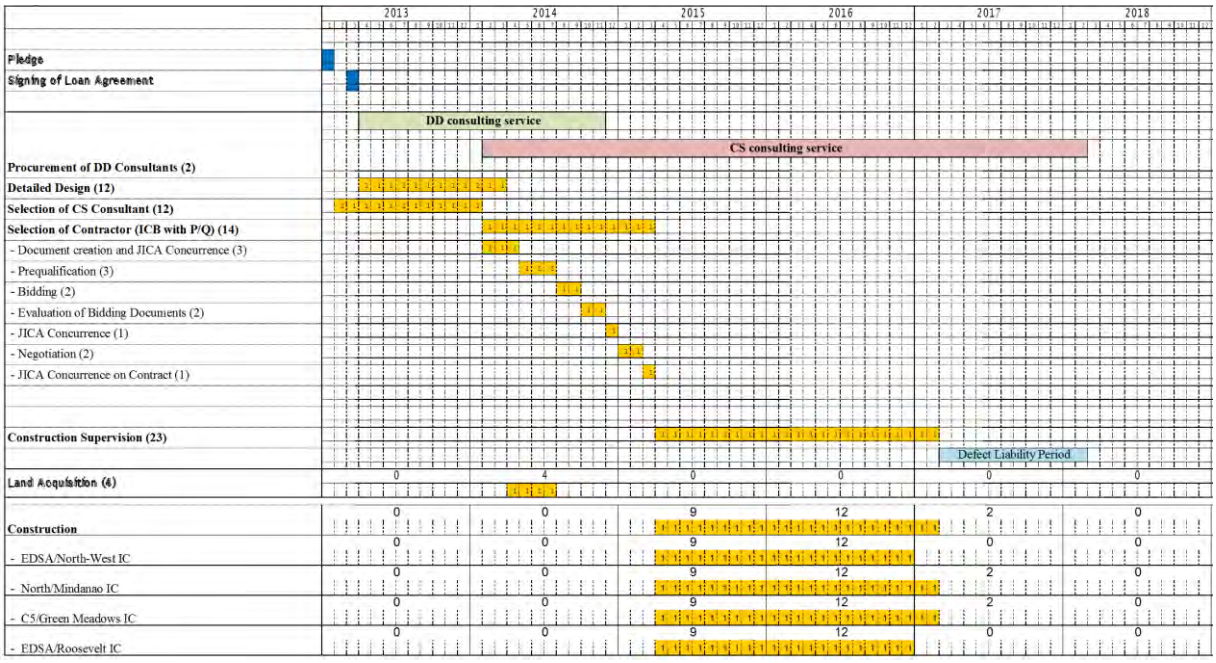
## Summary of Project Cost (STEP Loan)

**Unit:** *Million Pesos*

| Item | | Total | GOP | ODA | Remarks |
|---|---|---|---|---|---|
| **1.** | **Total Cvil Work Cost** | **3,231.36** | **346.22** | **2,885.14** | |
| | Civil Work Cost | 3,168.00 | | | |
| | Physical Contingency (2%) | 63.36 | | | |
| | **1. EDSA/North/West IC Civil Work Cost** | **640.94** | **68.67** | **572.27** | |
| | Civil Work Cost | 628.38 | | | |
| | Physical Contingency (2%) | 12.57 | | | |
| | **2. North/Mindanao IC Civil Work Cost** | **592.77** | **63.51** | **529.26** | |
| | Civil Work Cost | 581.15 | | | |
| | Physical Contingency (2%) | 11.62 | | | |
| | **3. C5/Green Meadows IC Civil Work Cost** | **1296.54** | **138.91** | **1,157.62** | |
| | Civil Work Cost | 1271.11 | | | |
| | Physical Contingency (2%) | 25.42 | | | |
| | **4. EDSA/Roosevelt IC Civil Work Cost** | **701.11** | **75.12** | **625.99** | |
| | Civil Work Cost | 687.36 | | | |
| | Physical Contingency (2%) | 13.75 | | | |
| **2.** | **ROW Acquisition Cost** | **4.00** | **4.00** | | |
| | | | | | |
| **3.** | **Construction Supervision Cost Total** | **245.37** | **8.16** | **237.21** | |
| | Construction Supervision Cost | 240.56 | | | |
| | Physical Contingency (2%) | 4.81 | | | |
| **4.** | **Project Administrative Cost Total** | **110.88** | **110.88** | | |
| | Detailed Design Stage, Construction Supervision Stage (3.5%) | 110.88 | | | |
| | | | | | |
| **Grand Total in Pesos** | | **3,591.61** | **469.26** | **3,122.36** | |
| **Grand Total in Yen** | | **6,716.31** | **877.51** | **5,838.80** | |

*Source: JICA Study Team*

## Implementation Schedule of MMICP (STEP Loan)




*Source: JICA Study Team*

## 5.6 Summary of Comparison between STEP Loan and Regular Yen Loan

The characteristics and advantages of both types of loans are shown in the table below.

| Description | | STEP Loan | Regular Yen Loan | Remarks |
|---|---|---|---|---|
| 1. Bridge Type | | PC Voided Slab Bridge + Steel Box and Steel Deck-Slab Bridge | PC Voided Slab Bridge | |
| 2. Total Construction Cost | | PHP 3,231 M | PHP 2,811 M | Cost is PHP 420 M or 14.9% higher under STEP |
| 3. EIRR (%) | EDSA/North/West | 37.4 | 68.0 | |
| | North/Mindanao | 15.7 | 23.6 | |
| | EDSA/ Roosevelt | 22.5 | 35.9 | |
| | C-5/Greenmeadows | 16.4 | 25.1 | |
| 4. Construction Duration (per Flyover) | | 22~23 months | 23~24 months | Reduce 1 month |
| 5. Period of Traffic Control at Intersection | | 10 days | 270 days | |
| 6. Detailed Design | | Under JICA Grant | Under Loan | Estimated Detailed Design Cost is PHP 92 M |
| 7. Interest Rate of Loan | | 0.2% p.a. | 1.4% p.a. | |
| 8. Grace Period and Repayment Duration | | 10 years and 40 years | 7 years and 30 years | |

Initial investment is high under STEP loan and, correspondingly, low EIRR, but it has the following advantages:

(a) Relatively shorter duration of construction per flyover;

(b) Traffic control at intersection is much shorter;

(c) PHP 92 M estimated cost of detailed design will be undertaken under JICA Grant;

(d) Very low and fixed interest rate (0.2%) and long-term repayment period.

## 6. EVALUATION OF PROJECT EFFECTIVENESS

Economic analysis of the Metro Manila intersections, namely, C-3/E. Rodriguez, EDSA-Roosevelt, EDSA-North/ West, North-Mindanao, C-5/Green Meadows and these aggregate were undertaken with EIRR and ENPV as efficiency measurement indicators, for the Middle Income Countries General Condition (GC) loan and the STEP loan.

Conversion factors to estimate economic costs and unit prices of Vehicle Operation Cost (VOC-Running and Time costs, DPWH 2008) were updated to 2012 price level.

In the STEP loan case, the economic cost for each intersection was PhP 661.12 million, PhP 625.97 million, PhP 597.44 million, PhP 1,225.41 million, and total PhP 3,036.55 million.

Furthermore, the annual investment rate over the six year construction period is assumed to be 1.68%, 42.37%, 39.12%, 6.89%, 9.94% and 0.0%.

Note that the implementation of the C-3/E. Rodriguez was cancelled by the DPWH to give priority to the construction of Skyway Stage 3 along C-3 under BOT scheme.

| | Passenger Car | Jeepney | Utility Vehicle | Bus | Truck | Motorcycle |
|---|---|---|---|---|---|---|
| Running Cost (V-km) | 8.6 | 7.1 | 7.5 | 23.1 | 31.6 | 1.5 |
| Time Cost (V-Hr) | 408.4 | 446.6 | 154.2 | 1,669.2 | 109.7 | 89.9 |

Analytical results and sensitivity analysis for the STEP loan are summarized hereunder, with EIRRs profoundly revealing the worthiness of MMICP to the national economy. As such, the commencement of the project at an early stage of time would be recommendable by securing Japan's ODA financing loan facilities as an option.

STEP loan

| | EDSA/Roosevelt | EDSA/North/West | North/Mindanao | C-5/Green Meadows | Aggregate |
|---|---|---|---|---|---|
| EIRR (%) | 22.5 | 37.4 | 15.7 | 16.4 | 23.2 |
| ENPV (PhP mill) | 303.01 | 1,102.31 | 20.44 | 104.02 | 1,573.71 |
| Cost 15% Up | 20.2 | 34.4 | 15.7 | 14.7 | 20.9 |
| Benefit 15% Down | 19.9 | 33.9 | 13.8 | 14.4 | 20.6 |
| C-B Combination | 17.8 | 31.1 | 13.5 | 12.8 | 18.5 |

Qualitative benefits include, among others, an improved business operations environmental ambiancy with lesser $CO_2$ emission and noise, road safety and reduction of traffic accidents. Improvement in the institutional capability of the DPWH in newer technologies such as tunneling and quick-construction techniques, through the MMICP will help increase efficiency of public service in the future.

**Table 6-1** shows proposed monitoring plan for operation and effect indicators of the project.

**Table 6-1 Monitoring Plan for Operation and Effect Indicators**

| Indicators | | Vehicle Type | Base Year (2011) | Target Year* (2019) | Monitoring Location |
|---|---|---|---|---|---|
| Traffic Volume (veh/day) | EDSA/Roosevelt/ Congressional Intersection | Car | 65,107 | 69,126 | Along EDSA: Cubao Side |
| | | Jeepney | 2,302 | 8,925 | |
| | | Utility Vehicle | 8,064 | 6,524 | |
| | | Bus | 10,134 | 12,415 | |
| | | Truck | 7,035 | 2,968 | |
| | | Bicycle | 7,171 | 18,210 | |
| | | **Total** | **99,813** | **118,167** | |
| | EDSA/West/North Intersection | Car | 129,372 | 130,786 | Along EDSA: Cubao Side |
| | | Jeepney | 2,119 | 0 | |
| | | Utility Vehicle | 5,080 | 6,691 | |
| | | Bus | 10,432 | 13,593 | |
| | | Truck | 8,119 | 4,211 | |
| | | Bicycle | 11,259 | 23,703 | |
| | | **Total** | **166,381** | **178,985** | |
| | North/Mindanao Intersection | Car | 43,406 | 44,645 | Along North Ave.: EDSA Side |
| | | Jeepney | 12,209 | 10,963 | |
| | | Utility Vehicle | 4,240 | 5,733 | |
| | | Bus | 58 | 0 | |
| | | Truck | 2,089 | 1,435 | |
| | | Bicycle | 7,390 | 13,818 | |
| | | **Total** | **69,392** | **76,593** | |
| | C-5/Green Meadows/ Acropolis/Calle Industria Intersection | Car | 77,269 | 112,519 | Along C-5: Pasig City Side |
| | | Jeepney | 3,727 | 5,820 | |
| | | Utility Vehicle | 14,679 | 18,539 | |
| | | Bus | 215 | 524 | |
| | | Truck | 9,765 | 6,244 | |
| | | Bicycle | 24,785 | 34,904 | |
| | | **Total** | **129,440** | **178,551** | |
| Average Travel Speed in PM Peak (km/h) | EDSA/Roosevelt/ Congressional Intersection | | 16.2 | 62.2 | Along EDSA: Northbound Flyover |
| | EDSA/West/North Intersection | | 19.9 | 33.6 | Along EDSA: Northbound Flyover |
| | North/Mindanao Intersection | | 9.8 | 50.3 | Along North Ave.: EDSA Side bound to Quezon Circle |
| | C-5/Green Meadows/ Acropolis/Calle Industria Intersection | | 29.3 | 51.0 | Along C-5: Northbound Flyover |

* Target Year is two years after the completion of the Project, which is defined as the time when the Project is open to traffic.
*Source: JICA Study Team*

## 7. STUDY OF ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

Environmental Impact Assessment Study

- In accordance with the "JICA Guidelines for Environmental and Social Considerations (2002 April)" (hereafter referred to as JICA Guidelines), alternative schemes including a zero option (without-the-project) case were analyzed and scoping was conducted. The results of scoping show that there are no significant adverse impacts on natural environment and socio-economic conditions. According to the criteria of PEISS, DPWH will submit the Initial Environmental Examination (IEE) reports to DENR EMB in

order to apply the Environmental Compliance Certificate (ECC).

- Noise, air pollutants and $CO_2$ emissions emitted from vehicles are predicted based on the projected traffic in 2018. The results of prediction show that the noise levels may exceed the Philippine maximum permissible levels due to the increase of traffic volume. Because of the increase of average travel speeds and the decrease of vehicle hours, emissions of air pollutants and $CO_2$ will be reduced by approximately 10 - 20% compared with the zero option case. Air pollutant concentrations might not exceed the maximum permissible levels of the Philippine Clean Air Act of 1999.
- Technically feasible mitigation measures during the construction and operation phases are drawn up and proposed for the four interchange projects. After opening, the interchange, noise levels should be regularly monitored. Installation of noise barriers shall be considered where the noise levels significantly exceed the permissible levels in residential zones. Trees should be planted in central reserves and sidewalks to improve the local aesthetic views and mitigate the noise and air pollutants emitted from vehicles.
- In order to ensure the effectiveness of mitigation measures and monitor the unexpected impacts, the Environmental Management Plans for the construction and operation phases should be drawn up. After the opening of the interchanges, replanted trees, ambient air quality, and noise and vibration should be regularly monitored.

Land Acquisition and Resettlement Action Plan (RAP)

- The results of the census survey and inventory (assets and land) survey are shown in Table 7.1. No involuntary resettlement is anticipated. The JICA Study Team supported the DPWH in preparing the Abbreviated Resettlement Action Plan in line with DPWH's Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy and JICA Guidelines/World Bank Operational Policies.

| Interchange | Land Acquisition | Resettlement | Affected Structure |
|---|---|---|---|
| C-3/E. Rodriguez | None | None | None |
| EDSA/Roosevelt/Congressional | None | None | 5 stalls (marginal[*1]) |
| EDSA/North/West/Mindanao | Additional ROW for sump pit (100 sq.m) | None | 25 stalls (marginal[*1]) |
| C-5/Green Meadows/Acropolis/ Calle Industria | None | None | None |

**Table 7-1 Land Acquisition, Involuntary Resettlement and Affected Structure for MMICP**

*Source: JICA Study Team*

*Note : the impact is only partial and the remaining portion of the property or asset is still viable for continued use.*

Support DPWH to hold Public Consultation Meetings

- DPWH assisted the JICA Study Team with the Public Consultation Meetings at four interchange project sites. The stakeholders favored the interchange projects to ease the present traffic congestion. There were the comments on the implementation of the Traffic Management Plan during construction, noise mitigation measures and restoration of cut trees. DPWH will draw up the proper countermeasures in the planning stage of the interchange projects against these issues raised by stakeholders.

# 8. C-3 MISSING LINK

## 8.1 Background to the Study on the C-3 Missing Link

The southern segment (hereafter referred to as the C-3 Missing Link) of C-3 has not yet been implemented to date. The circumferential road network serving south-central Metro Manila is therefore not effectively functioning resulting in heavily congested traffic conditions on EDSA. The construction of the C-3 Missing Link is expected to have a substantial impact on improving the circumferential road network in Metro Manila and on decongesting EDSA.

The study involved review of the C-3 missing link construction project report and also study of influence to the proposed flyovers by the captioned project.

## 8.2 River Systems

### (1) Pasig River

The average width of Pasig River is 91m and average depth is 4m with the deepest sections being 6m. Flow volume can be as low as 12cum/sec in the dry season whereas during the rainy season flow can increase to 275 cum/sec.

The Ayala Bridge is the lowest bridge, with a vertical clearance of only 3.5m above high water level.

### (2) San Juan River

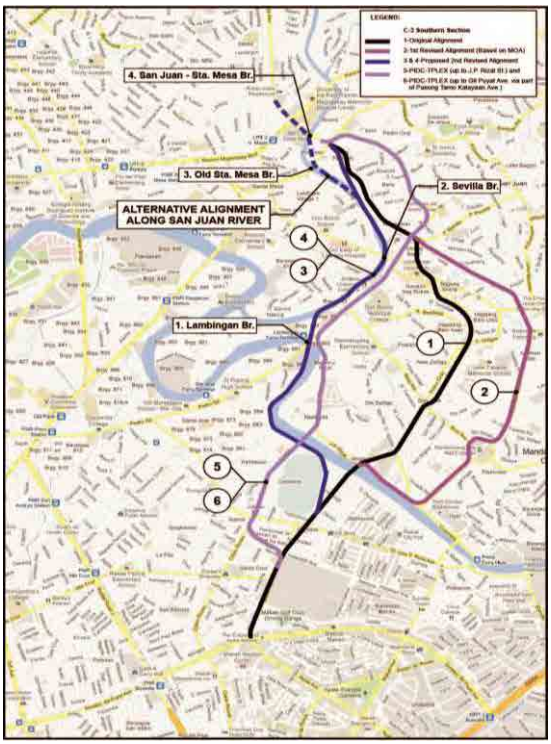
The width of the river in the project area is typically 40m-50m. The river is flood prone over most of its length with wide areas of floodwater breakout, including within the project area.

The San Juan River is not navigable and is outside of the mandate of the Philippine Coast Guard.

## 8.3 Alternative Alignments and DPWH Comparative Study

### 8.3.1 Alternative Alignments

The six (6) alternative alignments for the C-3 Missing Link together with a comparative study was prepared by DPWH URPO. These alignments are presented below.




### 8.3.2 DPWH Comparative Study

The 6 alternatives were presented considering the following items: length of each alternatives, number of lanes, structural type, cost of RROW, construction cost and total cost.

The report also presented advantages and disadvantages for all alternatives but there was no mention of which alternative was superior or even did not make comparative rankings among the alternatives.

### 8.3.3 Review of DPWH Comparative Study

The Study Team conducted a review of the DPWH comparative study and established the

following evaluation criteria: 1) Proposed Scope of Work, 2) Construction Issue, 3) R.O.W. Acquisition, 4) Resettlement Issue, 5) Environmental Issue, 6) Navigation Issue in Pasig River and 7) Construction Cost.

## 8.4 Updated Study

### 8.4.1 Geometric Design Standards

Design conditions of the project adopted the design criteria of the DPWH.

### 8.4.2 Typical Cross Sections

The number of lanes assumed for the alternative alignments is taken to be the same as the existing C-3 Northern Segment, a 6 lane divided road.

A road bridge over inland waterways must have a minimum vertical clearance of 3.75m from the highest water level, while the San Juan River is not navigable.

Based on the above conditions, five (5) types of typical cross sections were prepared, namely: 1) at grade section, 2) viaduct on ground, 3) double deck viaduct on ground, 4) along Pasig River, and 5) along San Juan River.

### 8.4.3 Scope of Work of Each Alignment

The scope of work for each alignment is presented in table below:

| | At Grade | Elevated Single Deck | Elevated Double Deck | Total | R.O.W. Acquisition |
|---|---|---|---|---|---|
| Alternative-1 | 1.05km | 0.80km | 3.95km | 5.8km | 102,000m$^2$ |
| Alternative-2 | 1.05km | 1.60km | 4.65km | 7.3km | 105,000m$^2$ |
| Alternative-3 | 0.0km | 4.55km | 1.75km | 6.3km | 35,000m$^2$ |
| Alternative-4 | 0.0km | 4.55km | 1.75km | 6.3km | 92,000m$^2$ |
| Alternative-5 | 1.55km | 0.15km | 3.40km | 5.1km | 74,000m$^2$ |
| Alternative-6 | 1.15km | 0.15km | 5.10km | 6.4km | 77,000m$^2$ |

**(1) Viaduct Configuration**

Single level viaduct structures are proposed as a preferred configuration. However, where available ROW is limited, double deck viaducts have been proposed. Long span bridges, at a range of 50m to 100m or so, will be necessary to cross the Pasig River, and the San Juan River.

**(2) Interconnectivity with Local Roads**

The interconnectivity of the proposed alternative alignments with local roads is a key aspect in promoting the functionality of each route. 2- ramps are planned for each alternative, namely: Boni. Ave. and New Panaderos in the south side and Shaw Blvd. in the north side.

**(3) Navigation Issues in Pasig River**

The section of Pasig River just upstream of Lambingan Bridge is already posing navigational problems for the larger vessels plying the river. Any obstructions in the river reducing the navigable width will further exacerbate the already difficult situation.

**(4) San Juan River Issues**

San Juan River is not navigable and therefore not subject to consideration of vessel navigation and ship collision forces.

### 8.4.4 Project Affected Buildings and Project Affected People

The numbers of affected buildings and people have been identified from open source satellite images. Informal settlements are located beside SM City Sta. Mesa near C-3 road side.

### 8.4.5 Environmental Issues

The conducted environmental study for all proposed alignments considered road side air pollution and noise impact, sun light easement and water quality deterioration.

All of these items are conditions judged having minor influence.

### 8.4.6 Rough Cost Estimate

The estimate of construction cost and cost of R.R.O.W. acquisition were calculated based on similar completed and on-going projects data. Estimated cost is as follows:

| Alignment | Construction Cost (MP) | ROW Acquisition/ Land Improvement Cost (MP) | Total (MP) |
|---|---|---|---|
| 1 | 12,000 | 5,600 | 17,600 |
| 2 | 14,700 | 5,700 | 20,400 |
| 3 | 16,400 | 2,100 | 18,500 |
| 4 | 14,600 | 4,700 | 19,300 |
| 5 | 9,600 | 4,100 | 13,700 |
| 6 | 13,900 | 4,400 | 18,300 |

### 8.4.7 Updated Comparative Study

The comparative study of the six alignments for the C-3 Missing Link is presented as follows:

| Ref | Description | Construction Aspects and Cost | Environmental Impact &Pasig River Navigation | ROW Acquisition (excluding ramps) | Project Affected People | Comment |
|---|---|---|---|---|---|---|
| 1 | Original Alignment (6 Lane, 5.8 km.) | Adequate traffic management during construction will be crucial. COST: 17,600MP | Since the route is established in the populated residential area, the impacts of emission gases, noise and sunlight shading will be the most significant among the alternatives and must be mitigated. Number of impacts: 8 | Very substantial ROW acquisition (102,000 sqm). Requires wholescale demolition at: Olympia Ville, Mandaluyong Cemetery, Core Oil Gas Station, Barangay Hall Bagong Silang, and residential blocks from Valenzuela to N. Domingo. Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave. | Maximum estimated number of PAPs at 4,430. | Large area of ROW acquisition and largest number of PAPs makes this one of the least favored routes. |
| 2 | 1ST Revised Alignment (6 Lane, 7.3 km.) | Adequate traffic management during construction will be crucial. COST: 20,400MP | Since the route is established in the populated residential area, the impacts of emission gases, noise and sunlight shading will be the most significant among the alternatives and must be abated. Number of impacts: 8 | Greatest ROW acquisition (105,000 sqm). Requires wholescale demolition at: Olympia Ville, residential blocks at corner of Coronado-San Francisco, along Maytunas Creek (partial), and residential blocks from Valenzuela to N. Domingo. Encroaching into Manila South Cemetery is avoided with double deck viaduct along South Ave. | Second largest estimated number of PAPs at 3,925. | Largest area of ROW acquisition and very large number of PAPs makes this one of the least favored routes. |
| 3 | 2ND Revised Alignment a1 (6 Lane, 6.3 km.) | Access along both waterways will be required for construction. Barges could be used both to deliver materials and as a platform for construction equipment along Pasig River. Craneways may be necessary along San Juan River given that the river is not navigable. COST: 18,500MP | Piers will be constructed on the riverbeds in Pasig River and San Juan River. Installation of piers and untreated storm runoff may deteriorate river water quality. Ease of navigation along Pasig River will be severely impacted especially where the river narrows and at the point where the rivers bends 90 degrees on the approach to Lambingan. Number of impacts: 3 | Least ROW acquisition (35,000 sqm) given that most of alignment is in Pasig and San Juan River. There is a requirement to partially demolish Olympia Ville, between Kalayaan Avenue and J.P. Rizal. Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave. | Smallest estimated number of PAPs at 550. | Most favored in terms of limiting area of ROW acquisition and number of PAPs. However construction along sections of Pasig River may not be possible given the existing critical navigation problems. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | 2ND Revised<br>Alignment a2<br>(6 Lane, 6.3 km.) | Construction access along the river banks can be made after the easement has been cleared.<br>No construction activities are required in the river waterways.<br>COST: 19,300MP | Since the route is established in the populated residential area, noise abatement measures will be needed.<br>Number of impacts: 4 | Still substantial ROW acquisition (92,000 sqm) given the need to acquire ROW along the river banks of Pasig and San Juan River. Substantial demolition of industrial and residential properties.<br>There is a requirement to partially demolish Olympia Ville, between Kalayaan Avenue and J.P. Rizal.<br>Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave. | Second smallest estimated number of PAPs at 950. | Reasonably favored in terms of limiting number of PAPs.<br>No adverse impacts on river waterway or navigation.<br>However construction along the banks will still require substantial ROW acquisition. |
| 5 | PIDC-TPLEX<br>Alignment b1<br>(6 Lane, 5.1 km.) | Adequate traffic management during construction will be crucial.<br>COST: 13,700MP | Since the route is established in the commercial and residential area, the impacts of emission gases, noise and sunlight shading should be mitigated.<br>Number of impacts: 6 | Double deck configuration limits ROW acquisition (74,000 sqm).<br>However many properties affected including commercial buildings especially along New Panaderos and F. Bulmentritt.<br>Curved alignment cuts the corner at F. Blumentritt requiring wholescale demolition in one section. | Estimated number of PAPs still substantial at 1,765. | Route not favored since it does not extend to Gil Puyat. |
| 6 | PIDC-TPLEX<br>Alignment b2<br>(6 Lane, 6.4 km.) | Adequate traffic management during construction will be crucial.<br>COST: 18,300MP | Since the route is established in the commercial and residential area, the impacts of emission gases, noise and sunlight shading should be mitigated.<br>Number of impacts: 6 | Double deck configuration limits ROW acquisition (77,000 sqm).<br>Affected properties same as above.<br>In addition ROW acquisition along Kalayaan Avenue will be required.Encroachment into Manila South Cemetery is avoided with double deck viaduct along South Ave. | Estimated number of PAPs still substantial at 2,085. | Route not favored given the need for ROW acquisition along commercial strips, despite double deck construction, and wholescale demolition in Blumentritt to accommodate the curved alignment. |

*Source: JICA Study Team*

### 8.4.8 Effect on the Project Interchanges due to Construction of the C-3 Missing Link

The effect on the Project interchanges due to construction of the Missing Link was analyzed using MMUTIS's data.

Result of the effects on each of the intersections are so follows:

(a) C-3/E. Rodriguez

The south side of this intersection directly connects to the Missing Link; therefore, the effect is substantial. Traffic along C-3 will increase by 26-56%.

(b) EDSA/Roosevelt/Congressional

The traffic on Roosevelt Avenue connecting to the Missing Link will increase by 46%, but the effects on traffic volume for other roads connecting to the interchange are minimal.

(c) EDSA/North/West/Mindanao

Traffic on West Avenue will be reduced by about 30% due to traffic diverting to Roosevelt Avenue. Effects on traffic volume for other roads connecting to the interchange are minimal.

(d) C-5/Kalayaan

C5 is parallel to the Missing Link. Traffic on Kalayaan Ave. will increase by about 10%. And traffic on C5 will decrease by about 10%.

(e) C-5/Green Meadows/Acropolis

C5 is parallel to the Missing Link but far from the Missing Link. The effect on traffic volume is minimal.

### 8.4.9 Recommendations

The most favored alignments are those that follow the Pasig and San Juan Rivers. These alignments are favored since both of the number of affected buildings and PAP's are minimized and also the least environmental impacts are

expected.

However, both alternatives have drawbacks: navigation problems in Pasig River; obstruction of waterway area in San Juan River; and a need for substantial ROW acquisition.

It is recommended that the Study on the C-3 Missing Link should be the subject of a feasibility study in establishing preliminary design, assessing traffic impacts and conforming economic viability.

### 8.4.10 Related Proposed Projects in Metro Manila

In addition to the DPWH proposal for a C-3 Missing Link Project, there are several other proposals, from the private sector and other government agencies, to provide elevated roadways serving a similar function or occupying corridors that may intersect with the C-3 Missing Link Project. The other proposed projects are listed below:

| | Proposed Project | Proponent |
|---|---|---|
| 1 | C-3 Expressway | Ayala Corporation |
| 2 | NLEX-SLEX Connector | Metro North Tollway Corp. (MNTC) |
| 3 | Metro Manila Skyway Stage 3 | CITRA/PNCC |
| 4 | SKYBRIDGE | MMDA |

## 9. THE CONCEPTUAL STUDY FOR THE TRAFFIC CAPACITY EXPANSION ALONG EDSA

### 9.1 Background of the Project

The 24 km length of EDSA is the main circumferential road of Metro Manila and has average traffic of more than 200,000 vehicles per section every day. Notwithstanding the improvements to EDSA brought by the construction of several interchanges, in addition to the MRT-3 and LRT-1 North Extension, the limited capacity of EDSA to handle the large daily volumes of traffic from early morning to late evening has resulted in severe congestion and low traffic speeds. Such situation is severely hampering the socio-economic development of Metro Manila and is an impairment to the environment.

In view of the above critical condition, a ceptual Study on Traffic Capacity Expansion along EDSA has been proposed.

### 9.2 Objectives and Concept of Conceptual Study

The purpose of this conceptual study is to identify the outline of the possibility of constructing high level viaduct or tunnel solutions that will expand the capacity of EDSA and the study includes of find space for proposed viaduct structures.

### 9.3 Confirmation of Consistency between the Proposed Project and Present Traffic Plans in the Metro Manila

Some existing plans of trunk roads, expressways and railways are related to the proposed study with regards to the share of traffic volume but these should not be affected or disturbed much in the implementation of the proposed project.

### 9.4 Confirmation of Open Spaces for Tunnel Plan and Viaduct Plan

The study will confirm in outline the availability of open space to accommodate the support structures of high level viaduct solutions and tunnel solutions at critical locations along EDSA. The basic concept in assessing available space is to develop outline solutions that will minimize occupation of width along EDSA and also minimize ROW acquisition where and if necessary.

### 9.5 Confirmation of Hindrance Structures

The following hindrance structures for both directions on EDSA have been identified:

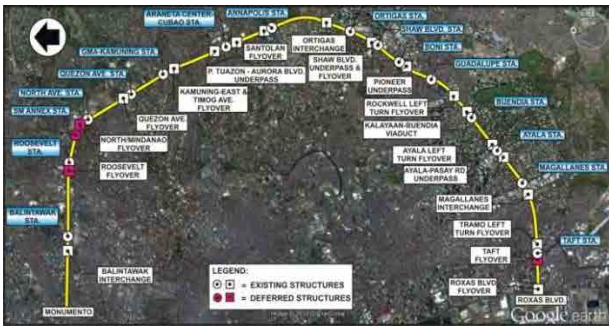
MRT/LRT Station : 15 stations

Flyover along/across EDSA: Southbound =13 locations, Northbound=14 locations

Under pass along/across EDSA :4 locations

Pedestrian Bridge : 30 locations

Those hindrance structures shown in the figure below:




*Source: JICA Study Team*

**Location Map of MRT-3, LRT-1 Stations, Flyover and Underpass**

### 9.6 EDSA General Condition

**(1) Topology**

EDSA generally has ten (10) lanes with five (5) equal lanes per direction. Within the 3.0 m sidewalks, various utilities including overhead cables are located at-grade, underground and in the air. A median separator exists throughout EDSA. Both the MRT-3 and LRT-1 North Extension fully occupies this corridor.

**(2) Traffic Condition**

The traffic volume along EDSA has been steadily increasing every year. To ease traffic flow on EDSA, slow moving cargo trucks have been prohibited running on the major section between Makati and Quezon City. This is imposed except on a specific time window which is from 9:00pm to 6:00am daily except Sundays and Holidays. To further decongest EDSA, a volume reduction scheme has been implemented to reduce daily traffic by twenty percent (20%) theoretically by prohibiting all vehicle types on the basis of its last digit plate number from 7:00am to 7:00pm.

### 9.7 Viaduct Scheme

#### 9.7.1 Proposed Viaduct Plan and Profile

This concept will require columns and foundations over the current roadway. This will diminish the number of at-grade lanes in each direction from five to four. However, after the construction of the elevated viaduct, EDSA will have seven lanes in total in each direction.

For site conditions requiring long spans and high piers, steel box girders supported by rectangular steel columns are recommended.

#### 9.7.2 Proposed Location of Ramps

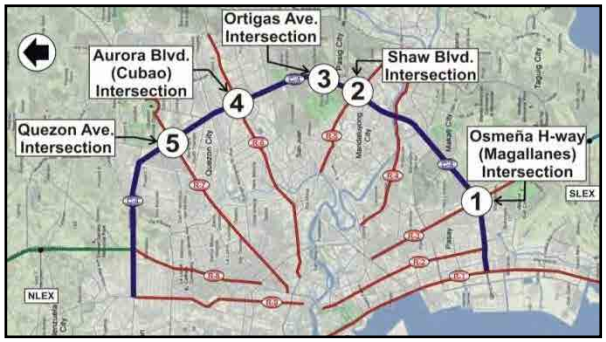
The ramps give access to the major Central Business Districts (CBD) of Makati and Ortigas, and to the hub of government offices in Quezon City and distance between ramps are about 5.3km each.

The estimated additional RROW requirement for an elevated viaduct and the provided ramps on EDSA is roughly about 140,000 sq m.

#### 9.7.3 Description of Five High Critical Hindrance Structures/Sections

The stretch of EDSA was examined to identify the five most difficult locations for viaduct construction. A list of the sites assessed against the major hindrance, the most difficult

construction and their exact locations are shown in the following figure:




*Source: JICA Study Team*

**Location of the Five Most Difficult Construction Sites**

### 9.7.4 Find Space for Proposed Viaduct Structures

There is a spaces for proposed viaduct Structures after construction of proposed flyover.

### 9.7.5 Cost Estimate

Estimate Cost for construction of viaduct at the section, PhP 170 B will be required.

## 9.8 Tunnel Scheme

### 9.8.1 Proposed Plan and Typical Cross Sections of Tunnel

The beginning and endpoint of the tunnel are located Roxas Boulevard, and Monumento Circle and Balintawak, respectively. The main tunnel consists of 2-lane tunnels at both sides of the entrance and exit while 3-lane tunnels shall be used for the entire middle section. 1-lane ramps shall be provided at four (4) locations.

### 9.8.2 Standard Earth Covering of Tunnel

Computation of earth covering underground and under river are as follows:

- Underground :Same diameter of tunnel (1.0 x diameter of tunnel)
  (15m (estimated pile length) + 1.0 x 14.62= 29.6m › 30.0m)
- Under river :Two times of diameter of tunnel (2.0 x diameter of tunnel)
  (2 x 14.62= 29.2m › 30.0m)

### 9.8.3 Ramp (Entrance and Exit)

One-lane ramp tunnel provided at four (4) locations, as follows:

-Between Skyway and Makati
-Before and after Ortigas Ave.
-Before and after Quezon Ave. and
-Between Balintawak and Roosevelt Ave.

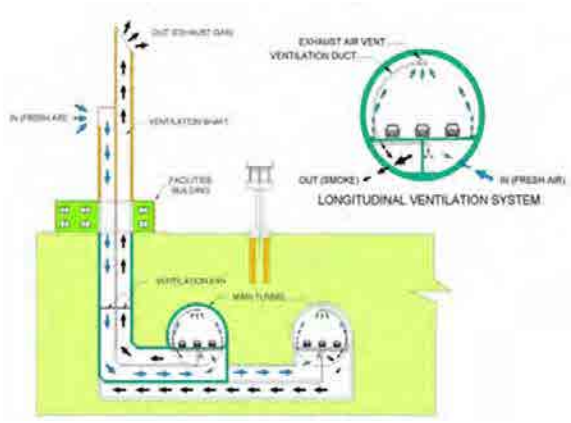
Tunnel layout including ramp locations are shown in the figure below.


*Source: JICA Study Team*

**Tunnel Layout (Plan and Profile)**

### 9.8.4 Ventilation System

The main function of the tunnel ventilation system is to discharge the vehicle exhausted fumes and smoke from fire. Airflow shall be diverted into two (2) sections underneath the deck slab of carriageway: one to discharge smoke and the other to take in fresh air which will also be utilized for people access to evacuation. General concepts of this system are shown in the following figure.




*Source: JICA Study Team*

**General Concept of Ventilation System**

### 9.8.5 Shield Shaft

Tunnel excavation will be done by one shield machine per direction between the departure vertical shaft and arrival vertical shaft. Shield tunnel construction works have routine works of excavation, assembly of precast concrete segments and grouting between concrete segment and soil.

### 9.8.6 Required Tunnel Facilities

Based on " installation standards of Emergency Facilities for Road Tunnel" issued by Japan Road Association, the proposed tunnel can be classified with the highest rank of "AA" which requires the provision of all type of facilities such as: 1) Emergency call and warning devices, 2) Fire extinguisher equipment, 3) Evacuation facilities, 4) Communication system, and 5) Water spray system.

### 9.8.7 Construction Schedule

Based on the experience of past projects in Japan, total implementation of all the sections will take about 20 years if it is done in stage by stage continuous base.

### 9.8.8 Cost Estimate

Rough cost will be estimated based on completed projects and past experiences in Japan considering similar site conditions of EDSA. Estimated cost of 3-lanes and 2-lanes tunnels in the both directions are PhP 441B and PhP 331B, respectively.

## 10. SEMINAR ON LATEST JAPANESE ROAD AND BRIDGE CONSTRUCTION TECHNOLOGY

### 10.1 Objectives

The objective of the seminar was to introduce the latest Japanese technologies of road and bridge construction for understanding technical superior of STEP scheme for the proposed flyover project and also Filipino engineers to apply these to on-going and/or future projects. Said technologies are related to tunnel construction, asphalt pavement, rapid construction methods, bridge rehabilitation and improvement and quality control systems.

### 10.2 Seminar Program

Venue : $H_2O$ Hotel, Manila City

Date : March 6 and 7, 2012

- Day 1 (6th March)
  - Seminar 1 - Introduction of Japanese Road Technologies
  - Seminar 2 - Tunneling Construction Techniques
  - Seminar 3 - Pavement Technology
- DAY2(7th March)
  - Seminar 4 - Rapid Construction Methods (Concrete Bridge)
  - Seminar 5 - Rapid Construction Methods (Steel Bridge)
  - Seminar 6 - Bridge Rehabilitation and Improvement Technology
  - Seminar 7 - Quality Control System Technology

### 10.3 Attendance

(1) PHILIPPINES

Attendance for the seminar on the first day was 84 and 80 on the second day, mainly from DPWH personnel with 73% of share of attendees including the Honorable Secretary. Others are from other Government Agencies, LGU's, Private Sectors and the Academies.

(2) JAPAN

There were Fifteen (15) guest speakers for the seven sessions and eight (8) Japanese officials were attended.

### 10.4 Summary and Analysis of Questionnaire

Thirty nine (39) Questionnaires, summarized as follows were submitted to the attendees :

Q1- In this seminar, which subject interests you the most?

Tunneling Construction Technology ranked as the first by 17 persons, the second Pavement Technology, and the third Rapid construction Method (steel bridge).

Q2- What subjects would you consider for future projects or activities, and why?

Tunneling Construction Techniques, Pavement Technology ranked as the first with 10 persons each, the second was Rapid Construction Method (Steel Bridge), followed by Rapid Construction Method (Concrete Bridge) as the third in rank. This answer was similar to question-1 above.

Q3- Please give your comments about the seminar:

Almost all of the attendees were satisfied with the contents of each topic, imparted knowledge of new technology, excellent handouts and the the way how to manage the seminar. Some useful comments were presented: time of each topic was comparatively short, needed to be explained how the new technology will be applied and effective in the Philippines context, and the venue and the number of comfort rooms were rather narrow/a little.

### 10.5 Conclusion

The following items were opined to be the main reasons why the Seminar was satisfactorily conducted:

a) All of the topics were interesting

b) Presentation materials of speakers were interesting and excellent

c) Proper arrangements of invitation to all relevant offices concerned with road and bridge construction.

d) Almost all of the top officials of the DPWH including the Honorable DPWH Secretary attended.

e) Issuing a Certificates of Attendance was Good arrangements.

f) Invitation letters were issued in the name of the Honorable DPWH Secretary

# CHAPTER 1

# INTRODUCTION

## 1.1 BACKGROUND OF THE PROJECT

Metro Manila is a strategic foothold for the economic activities of the Philippines that attracts 13% of the population and generates 37% of the total GDP of the country[1]. The government has been continuously developing Metro Manila's transport infrastructures and improving traffic situation through the construction of circumferential roads, expressways, light rail transit (LRT) lines, etc., yet traffic congestion and longer travel times continue to be experienced. Such situation creates a bottleneck to the efficient distribution of goods and hampers the movement of people, thereby resulting in huge economic losses, which is one of the reasons for deterioration of the economic competitiveness of the country. Moreover, chronic traffic congestion results in an increase in air pollution and noise.

The Department of Public Works and Highways (DPWH) has put high priority on the construction of grade-separated interchanges along with major interchanges to solve such issues which are identified in the Public Investment Program(2011~2016) of DPWH. The construction of Circumferential Road 3 (C-3) missing link between N. Domingo Street in San Juan City and Sen. Gil Puyat Avenue in Makati City, over about 6 km in length, is expected not only to improve mobility of the residents along the road but also to decongest traffic along EDSA. Furthermore, traffic capacity expansion of C-4 (EDSA) by the construction of either an elevated viaduct or underground tunnel, in addition to grade separation of major intersections and the construction of C-3 Missing Link, is expected to provide fundamental solution to the chronic traffic congestion of EDSA.

In view of the above, DPWH requested Japan International Cooperation Agency (JICA) to evaluate the possibility to finance said high priority grade-separated interchange construction project in Metro Manila. JICA responded favorably to the request and has selected the consultants to undertake the Preparatory Survey for Metro Manila Interchange Construction Project (VI).

## 1.2 OBJECTIVES OF THE STUDY

The objectives of the study are as follows:

**(1)** To conduct a screening that will focus on the following requirements of Japanese ODA Loan Projects: (a) purpose of the project, (b) scope of works, (c) project cost, (d) project implementation organization, (e) operation and maintenance organization and (f) social and

[1] National Census in 2007 by National Statistics Office of the Philippines

environmental aspect based on previous detailed design and other related studies.

**(2)** To conduct initial review and study for the preliminary engineering study on the construction of Circumferential Road 3 (C-3) Missing Link includes of impact to the proposed flyover.

**(3)** To conduct a preliminary engineering study on traffic capacity expansion of Circumferential Road 4 (C-4) includes of find space for proposed viaduct structures.

## 1.3 STUDY AREA

The study covers the entire Metropolitan Manila area of the Republic of the Philippines where the intersections and road sections under study are located.

## 1.4 SCOPE OF THE STUDY

In order to achieve the above objectives, the study covered the following:

**(1) Study of the construction of interchanges**

- Feasibility study of four interchanges
  - C-3/E. Rodriguez
  - EDSA/Roosevelt/Congressional
  - EDSA/North/West/Mindanao
  - C-5/Greenmeadows/Acropolis
- Scheme study and preparation of design options
  - C-5/Kalayaan

**(2) Study of the C-3 Missing Link includes of impact to the proposed flyover.**

- Review of six alignments established by DPWH
- Establishment of evaluation criteria and evaluation of alternative alignments

**(3) Study of C-4 traffic capacity expansion includes of find space for proposed viaduct structures.**

- Review of present and proposed projects in the study area
- Study of traffic capacity expansion for construction of viaduct and tunnel schemes

## 1.5 SCHEDULE OF THE STUDY

The study commenced in November 2011 and will be completed by the end of November 2012, as shown in **Table 1.5-1**.

**Table 1.5-1 Study Schedule**

| Work Item \ Year/Month | 2011 | | 2012 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Preparatory works in Japan | | | | | | | | | | | | | |
| 【ITEM-1】 Confirmation of Necessity and Validity of the Project | | | | | | | | | | | | | |
| 【ITEM-2】 Confirmation of Present Detailed design | | | | | | | | | | | | | |
| 【ITEM-3】 Confirmation of the Scope of Works and Technical Examinations | | | | | | | | | | | | | |
| 【ITEM-4】 Prepare Implementation Plan of the Project | | | | | | | | | | | | | |
| 【ITEM-5】 Evaluation of Effectiveness of the Project | | | | | | | | | | | | | |
| 【ITEM-6】 Investigation for Social Environmental Conditions | | | | | | | | | | | | | |
| 【ITEM-7】 Comparison Study of C-3 Missing Section | | | | | | | | | | | | | |
| 【ITEM-8】 The Conceptual Study for the Traffic Capacity Expansion along EDSA | | | | | | | | | | | | | |
| 【ITEM-9】 Implementation of Seminar and Record and Analysis of Seminar | | | | | | | | | | | | | |
| 【ITEM-10】 Preparation of Reports | IC/R | | IT/R | | | DF/R | | | | | | | F/R |

Preparatory Work  Work in the Philippines  Work in Japan  Report / Explanation

IC/R: Inception Report  IT/R: Interim Report  DF/R: Draft Final Report  F/R: Final Report

*Source: JICA Study Team*

# CHAPTER 2

# CONFIRMATION OF VALIDITY AND NECESSITY FOR THE PROJECT

## 2.1 REVIEW OF THE TRAFFIC PLAN OF METRO MANILA

### 2.1.1 Traffic Improvement Projects in Metro Manila

Metro Manila is known as the National Capital Region (NCR) of the Philippines and designated as a special administrative and development region by virtue of Republic Act (RA) 7924. It is the center of commercial, financial, industrial, educational, social, cultural and political activities of the country and serves as its primary link to Asia and the rest of the world.

Metro Manila is the smallest of the country's administrative regions in terms of land area, but the most populous, with 11,553,427 inhabitants per national census conducted in 2007, accounting for 13% of the national population. Metro Manila is comprised of 16 cities and one municipality occupying a total land area of 636 square kilometers.

Metro Manila's rapid increase in population and economic development has resulted in increased traffic volume that consequently created traffic and transport problems. One of the most pressing transport problems is traffic congestion. Traffic congestion is severe especially during peak hours, with average travel speed as low as 12 km/h and 9 km/h for buses and jeepneys, respectively. It was estimated that the direct and indirect economic losses due to traffic congestion alone was about PHP100 billion annually in 1996, or around 5% of the Gross Domestic Product (GDP)[1].

The Metro Manila Traffic and Transport Declaration 2010 of the Metropolitan Manila Development Authority (MMDA) stated that the causes of traffic problems include limited capacity of the existing roads to cope with increasing volume of private and public vehicles, illegal structures and other obstructions along the carriageways, poor road geometry and engineering, inadequate traffic signal systems, poor public transport system, frequent vehicular accidents, poor enforcement of and compliance with traffic rules and regulations, and instant flooding in selected areas on rainy days.

The MMDA, created by virtue of RA 7924, is the government agency that administers the affairs of Metro Manila. One of MMDA's services is transport and traffic management. This covers the formulation, coordination and monitoring of policies, standards, programs and projects to rationalize the existing transport operations, infrastructure requirements, the use of thoroughfares, and promotion of safe and convenient movement of persons and goods; provision for the mass transport system and the institution of a system to regulate road users; administration and

[1] Mega Manila Public Transport Study (MMPTS), Final Report, 2007

implementation of all the enforcement operations, traffic engineering services and traffic education programs, including the institution of a single ticketing system[2] in Metropolitan Manila.

Consequently, MMDA has implemented various projects to decongest traffic. Among these are the construction of flyovers (elevated roads), interchanges, loading bays for Public Utility Vehicles (PUVs), emergency bays, and designation of U-turn slots over various intersections and thoroughfares. It has also engaged in road widening with the support of the DPWH and installation of footbridges for pedestrians and waiting sheds have likewise been resorted to at various roads in the metropolis.

The agency has also implemented various schemes for motorists such as the Uniform Vehicular Volume Reduction Scheme (UVVRS), more popularly known as "color coding", where vehicles which plate numbers end in specified numbers are banned from traveling on particular days, the Yellow Lane Scheme, where yellow-plated PUBs (Public Utility Buses) are to use only the two outermost lanes along EDSA, and the Organized Bus Route (OBR) for Metro Manila.

However, despite implementation of these projects, traffic and transport problems still persist. The situation will be further exacerbated due to the expected growth in population and income and the subsequent increase in car ownership. The Government recognizes the urgent need to address the everyday traffic and transport problems of Metro Manila and their adverse effects on the safety, mobility, civility and productivity of Metro Manila's daily commuting and pedestrian public. It recognizes that measures must be made to reduce waiting, travel and turn-around time of commuters, vehicles and goods to achieve efficiency and improve productivity.

The Government, through its various agencies, the DPWH, Department of Transportation and Communications (DOTC), Department of Environment and Natural Resources (DENR), and MMDA and the concerned Local Government Units (LGUs) together with other traffic and transport groups, are fully supportive in the implementation of proposed projects and resolutions which contribute to an efficient, cost-effective, convenient transport and traffic system for Metropolitan Manila.

**Tables 2.1-1**, **2.1-2** and **2.1-3** show the list of on-going, under study, and future projects for implementation under the medium- and long-term development plans aimed to reduce traffic congestion and promote safer, faster, and sustainable urban transportation in Metro Manila, while **Figures 2.1-1**, **2.1-2** and **2.1-3** show locations of the respective transport projects.

[2] Currently, different traffic law enforcement agencies issue their own tickets to traffic rule violators; this may give confusion to drivers and residents. Introduction of unified single ticket is proposed now.

**Table 2.1-1 List of On-going Major Transport Projects in the NCR**

| Name of Project/Location | Brief Description | Implementing Agency | Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| **1. Construction of Footbridges**<br>• **Commonwealth Avenue**<br>• **Radial Road 10 (R-10)**<br>• **McArthur Highway**<br>• **Quezon Avenue**<br>• **EDSA**<br>• **Circumferential Road 5 (C-5)** | - Construction of footbridges, improvements of road, drainage and sidewalk and installation of gantries and road signages | MMDA | 2007–2014 | National Government | Not available |
| **2. C-3 (G. Araneta Avenue)/Quezon Avenue Interchange Flyover Construction Project** | - Construction of 4-lanes per direction underpass along Quezon Avenue crossing G. Araneta Avenue | DPWH-URPO | 2011–2014 | To be determined | Not available |
| **3. Construction of flyover at intersection between C-2 and R-7 (España)** | - Construction of 4-lane 674m flyover | DPWH-URPO | 2012–2013 | Local Funds | PHP 835 M |
| **4. Construction of Flyover at intersection between C-5/Lanuza and Julia Vargas Avenue** | - Construction of 2-lane 593m flyover | DPWH-URPO | 2012–2013 | Local Funds | PHP 455 M |
| **5. C-3/(Sgt. Rivera Street)/A. Bonifacio Interchange Flyover Construction Project** | - Construction of 4-lane flyover | DPWH-URPO | 2012–2013 | Local Funds | PHP 355 M |
| **6. MRT 7 Construction Project** | - The project consists of 23 km mostly elevated railway line with 14 stations from San Jose Del Monte City, Bulacan to MRT 3 North Avenue in Quezon City and a 22 km 6-lane asphalt road from Bocaue Interchange at NLEX to the intermodal terminal in Tala, Caloocan City | DOTC | 2012–2015 | Private Sector | USD 1.24 B |
| **7. Skyway Stage-3** | - The project consists of 14.5 km 6 lane elevated expressway to connect North and South Expressway passing thru mostly along existing C-3 and A. Bonifacio Ave. | DPWH | 2012–2015 | Private Sector | PHP 19.5 B |

*Source: Compiled by JICA Study Team based on data collected from DPWH Planning Service, MMDA and DOTC*

**Table 2.1-2 List of Major Transport Projects under Study in the NCR**

| Name of Project/Location | Brief Description | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| **1. JICA Technical Assistance – Metro Manila Interchange, Phase VI**<br>**(a) C-3 (G. Araneta Avenue)/E. Rodriguez Avenue Interchange**<br>**(b) EDSA/Congressional–Roosevelt Interchange**<br>**(c) EDSA/West/Mindanao–North Avenue Interchange**<br>**(d) C-5–Kalayaan Avenue–Bagong Ilog Flyover Interchange**<br>**(e) C-5, Greenmeadows Interchange**<br>**(f) C-3 Southern Segment (Missing Link)** | - Project preparatory survey for Metro Manila Interchange Phase VI is on-going under JICA TA (this Project) | DPWH-URPO | 2011–2018 | ODA | Under Study |
| **2. LRT Line 2 Extension (East/West) Project** | - Extension of the existing LRT Line 2 by 4.14 km eastward from the existing Santolan Station at Marcos Highway, terminating at the intersection of Marcos Highway and Sumulong Highway<br>- Two additional stations are proposed:<br>(1) Emerald Station in front of Robinson's Place Metro East in Cainta, Rizal, and<br>(2) Masinag Station at Masinag Junction in Antipolo City | DOTC-LRTA | First draft final report on the preparatory study by JICA was submitted on 30 June 2011 | Private Sector or ODA | PHP 11.9 B |
| **3. LRT Line 1 Cavite Extension Project** | - Extension of the existing 20.7 km LRT Line 1 by approximately 11.7 km (from Baclaran to Bacoor), including the initial rolling stock (55 train sets)<br>- Eight (8) passenger stations with a provision of 2 additional stations; 1 satellite depot and 3 intermodal facilities<br>- Operation and maintenance concession of the integrated | DOTC-LRTA | 2011–2016 | Private Sector | USD 1.56B |

| Name of Project/Location | Brief Description | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| | line with systems enhancement works throughout the concession period | | | | |
| **4. Daang Hari–SLEX Link** | - New 4 km, 4-lane paved toll road that will pass through the New Bilibid Prisons reservation and connect Bacoor, Cavite to the South Luzon Expressway thru Susana Heights | DPWH-PPP Center | 2011–2013 | Private Sector | PHP 1.96 B |
| **5. NAIA Expressway (Phase II)** | - 4-lane elevated expressway with a total length of 5.2 km starting at Sales Street going through Andrews Avenue, Domestic Road, MIA Road, and ends at Roxas Boulevard; includes construction of toll plaza and 5 on and off ramps<br>- Traverses Pasay City and Parañaque City thru the 5.2 km NAIA Expressway Phase I to Roxas Boulevard | DPWH | 2012–2015 | Private Sector | PHP 13.58 B |
| **6. C-5/FTI/Skyway Connector** | - Provide access to Food Terminal Inc. (FTI) from both Skyway and C-5, total length = 6.8 km (including ramps; 2–4 lanes, L = 3 km) | DPWH | 2013–2015 | To be determined | PHP 5.64 B |
| **7. C-6 Expressway (North Section)** | - Contribute to sound urban development of the provinces of Rizal and Bulacan<br>- Starts at NLEX in the Bocaue/Marilao boundary and traverses Sta. Maria, San Jose del Monte, Rodriguez, San Mateo, Antipolo, Taytay, Taguig and connects with Skyway at Bicutan; the north section is to be built by the MRT 7 Consortium<br>- 4 lanes, L = 16.5 km | DPWH | To be determined | Private Sector | PHP 7.85 B |
| **8. C-6 Expressway (South Section)** | - Starts from NLEX at Bocaue/Marilao boundary and through the town of Sta. Maria and San Jose del Monte City in the Province of Bulacan, to Rodriguez, San Mateo, Antipolo City and Taytay in the Province of Rizal, to Taguig City, and connects with SLEX at Sucat, | DPWH | To be determined | Private Sector | PHP 44.59 B |

| Name of Project/Location | Brief Description | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| | Parañaque City and Muntinlupa City<br>- A Bonifacio Global City link of C-6 Expressway that will serve as a vital access to commercial and business centers<br>- 4–6 lanes, L = 56.5 km | | | | |
| **9. C-6 Extension (Flood Control Dike Expressway)** | - Will ease traffic congestion in the Muntinlupa and Calamba area and also serve as flood control measure in Laguna de Bay coastal area<br>- 4 lanes and a dike (W = 8 m), L = 43.6 km | DPWH | To be determined | Private Sector | PHP 18.59 B |
| **10. NLEX–SLEX Link Expressway** | - A 13.4 km 4-lane elevated expressway that will link the existing SLEX and NLEX passing through Metro Manila and utilizing the existing PNR alignment as its route; it will complete the north–south industrial development beltway transport axis by connecting NLEX with SLEX to decongest Metro Manila traffic and also to provide better access to Manila ports | DPWH | 2014–2016 | Private Sector | PHP 19.98 B |

*Source: Compiled by JICA Study Team based on data collected from DPWH Planning Service, MMDA and DOTC*

## Table 2.1-3 List of Future Transport Projects in the NCR

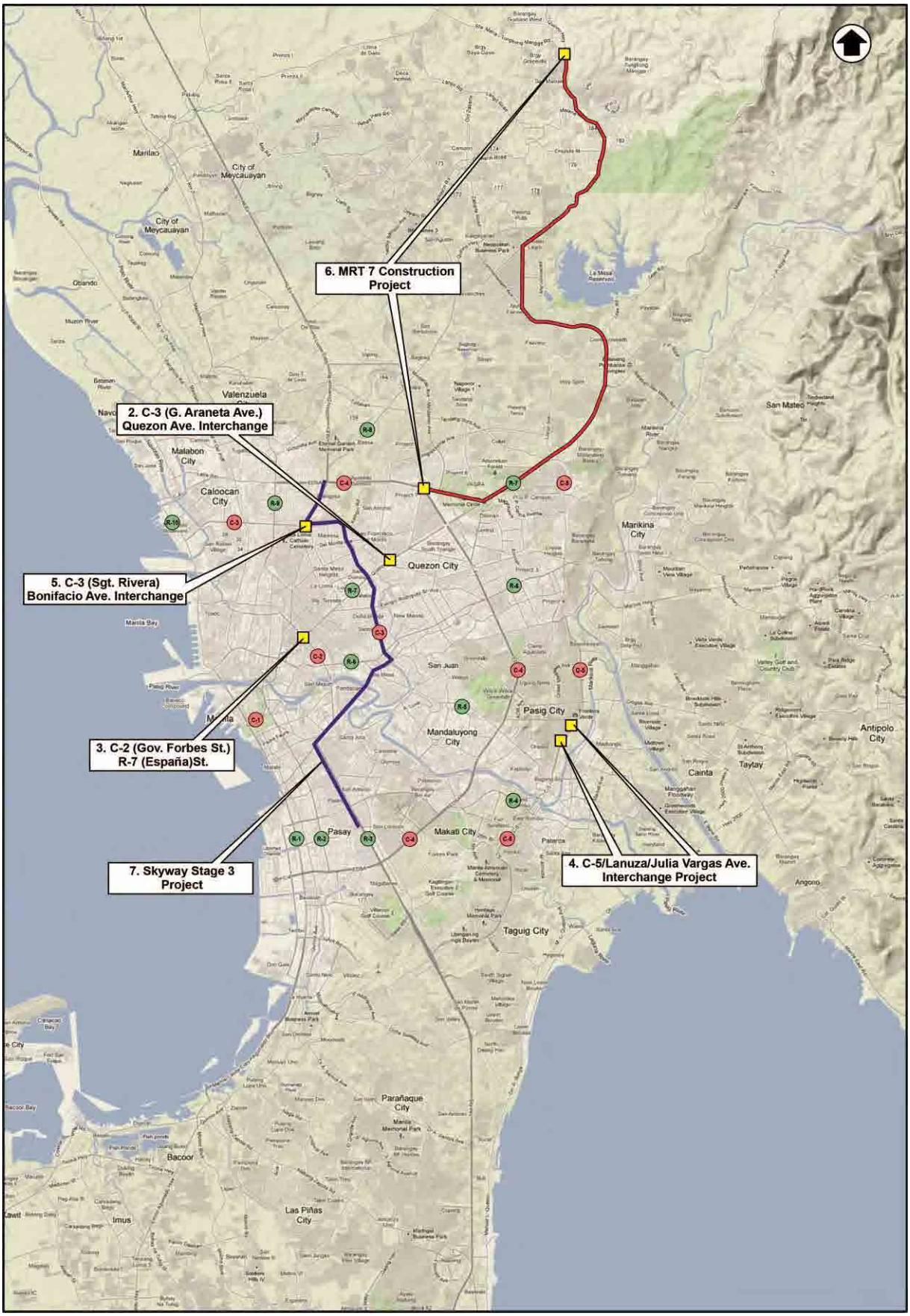
| Name of Project/Location | Brief Description/ Existing Condition/Proposed Improvement | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| 1. Proposed Improvement of Metro Manila Circumferential Road 5 (C-5) and Other Priority Roads/ Interchanges | | DPWH-URPO | 2012–2016 | Local Funds | Not available |
| **Segment A: From C-5/SLEX–R-1 Coastal Expressway and NAIA Connectors** | | | | | |
| • A-1: Construction at Flyover/ Interchange at C-5/SLEX | - No connector across SLEX; proposed flyover crossing SLEX (switch alignment with left turn ramp towards SLEX at-grade northbound or without switch alignment to reduce ROW | | | | |
| • A-2: Completion of SLEX–Sucat Section | - Incomplete portion due to RROW problem | | | | |
| • A-3: Flyover and C-5, Multinational Avenue | - At-grade 4-legged intersection; second level flyover structure to bypass Multinational Avenue | | | | |
| • A-4: C-5, Existing R-1 Coastal Expressway Connector | - Missing link from Quirino Avenue/C-5 to Coastal Road that will connect C-5 from Quirino Avenue to R-1 Coastal Expressway<br>- With flyover structure at Quirino and Interchange ramp at R-1 | | | | |
| • A-5: C-5 Multinational–R-1 Coastal Expressway Connector via San Dionisio or Pacific Avenue | - Alternative alignment to connect with C-5 at R-1 Expressway | | | | |
| • A-6: C-5–NAIA 1 and 2 Connectors | - Upgrading and provision of viaduct connecting C-5–Multinational towards NAIA Terminals 1 and 2 | | | | |
| **Segment B: From SLEX to C.P. Garcia Avenue** | | DPWH-URPO | 2012–2016 | Local Funds | Not available |
| • B-1: Levi Mariano Avenue (Commando Interchange) Improvement Project | - 3 lanes each direction of C-5 and 2 lanes each direction of northbound and southbound service roads | | | | |
| • B-2: C-5/Kalayaan and C-5/Bagong Ilog | - Close northbound down ramp and widen flyover up to Pasig Boulevard Extension and transfer the down ramp; 1-lane widening of the bridge southbound<br>- Direction crossing Pasig River from West Rembo, Makati City to Bagong Ilog in Pasig City | | | | |

| Name of Project/Location | Brief Description/ Existing Condition/Proposed Improvement | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| • B-2A: Fort Bonifacio Global City to Meralco Avenue Link Road Project | - Construct viaduct/bridge with 2 lanes each direction crossing Pasig River up to near Meralco Avenue intersection with Julia Vargas Avenue | | | | |
| • B-3: C-5/Lanuza to connect to Mercedez Avenue | - Construct four lanes to connect Ortigas Center via Lanuza at C-5 towards Mercedes Avenue. | | | | |
| • B-4: Northbound Service Road of C-5/ Boni Serrano Interchange | - 2 lanes north bound service road at E. Rodriguez Avenue approaches. | | | | |
| • B-5: C-5/Katipunan-Ateneo Section | - At-grade intersection with three U-turn provisions at the gates of Ateneo, Miriam College and other subdivision entrances<br>- Construction of additional (1) lane at the Ateneo/ Miriam property with geometric improvement at entrance streets of the subdivision abutting Katipunan Avenue<br>- Construction of a viaduct with 2 lanes each direction near the approach of the existing flyover at Katipunan Avenue to end after C.P. Garcia Avenue | | | | |
| **Segment C: From C.P. Garcia Avenue to Mindanao Avenue** | | DPWH-URPO | 2012–2016 | Local Funds | Not available |
| • C-1: Congressional Avenue and Mindanao Avenue | - To explore further improvement as the intersection is a potential choke point | | | | |
| • C-2: Congressional Avenue and Visayas Avenue | - To explore further improvement as the intersection is a potential choke point | | | | |
| • C-3: Mindanao Avenue to Tandang Sora Avenue Intersection | - To explore further improvement as the intersection is a potential choke point | | | | |
| • C-4: Commonwealth/Luzon Avenue to Republic Avenue | - To explore further improvement as the intersection is a potential choke point; currently with ROW constraints | | | | |
| • C-5: Republic/Luzon Avenue to Mindanao NLEX Connector | - To provide a 6-lane road | | | | |

| Name of Project/Location | Brief Description/ Existing Condition/Proposed Improvement | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| **Segment D: Other Priority Urban Projects** | | DPWH-URPO | 2012–2016 | Local Funds | Not available |
| • D-1: Roxas Boulevard Section | - Indicative improvement is trumpet interchange | | | | |
| • D-1a: Interchange at Roxas Boulevard/Quirino Ave.nue | - At-grade interchange with CCP Road and Vito Cruz at Roxas Boulevard Current proposal: | | | | |
| • D-1b: Interchange at Roxas Boulevard/Vito Cruz | - Depressed Roxas Boulevard | | | | |
| • D-2: Airport Section | | | | | |
| • D-2a: Construction of Interchange at Aurora Boulevard and Andrews Avenue and Elevated Highway to NAIA via Circulo | - Proposed flyover at Andrews Avenue and Aurora Boulevard and elevated highway to NAIA 3 | | | | |
| • D-2b: Construction of Interchange at Airport/Domestic Road (New Caltex Station) | - Proposed 3-level interchange at Airport Road, second level left turn to Domestic Road at 3 road level | | | | |
| • D-3: C-2/R-1 Quirino Avenue/ Osmeña Avenue | - Proposed 3 levels interchange; second level along Quirino Avenue, left turn, third level from Quirino Avenue to SLEX southbound | | | | |
| 2. R-7 Expressway | - The project will be constructed over one of the most heavily congested corridors in Metro Manila, namely Quezon Avenue and Don Mariano Marcos Avenue<br>- 4 lanes, L = 16.1 km | DPWH | Conceptual Stage | To be determined | PHP 23.98 B |
| 3. NLEX East/La Mesa Parkway | - The project will form an important transport axis in the eastern area of Region III and serve the growing areas of the provinces of Bulacan and Nueva Ecija<br>- Starts at Don Mariano Marcos Avenue in Quezon City and traverses almost parallel to Daang Maharlika, serving the areas of San Miguel, Gapan, and Cabanatuan City | DPWH | 2016–2019 | Private Sector | PPH 32.53 B |

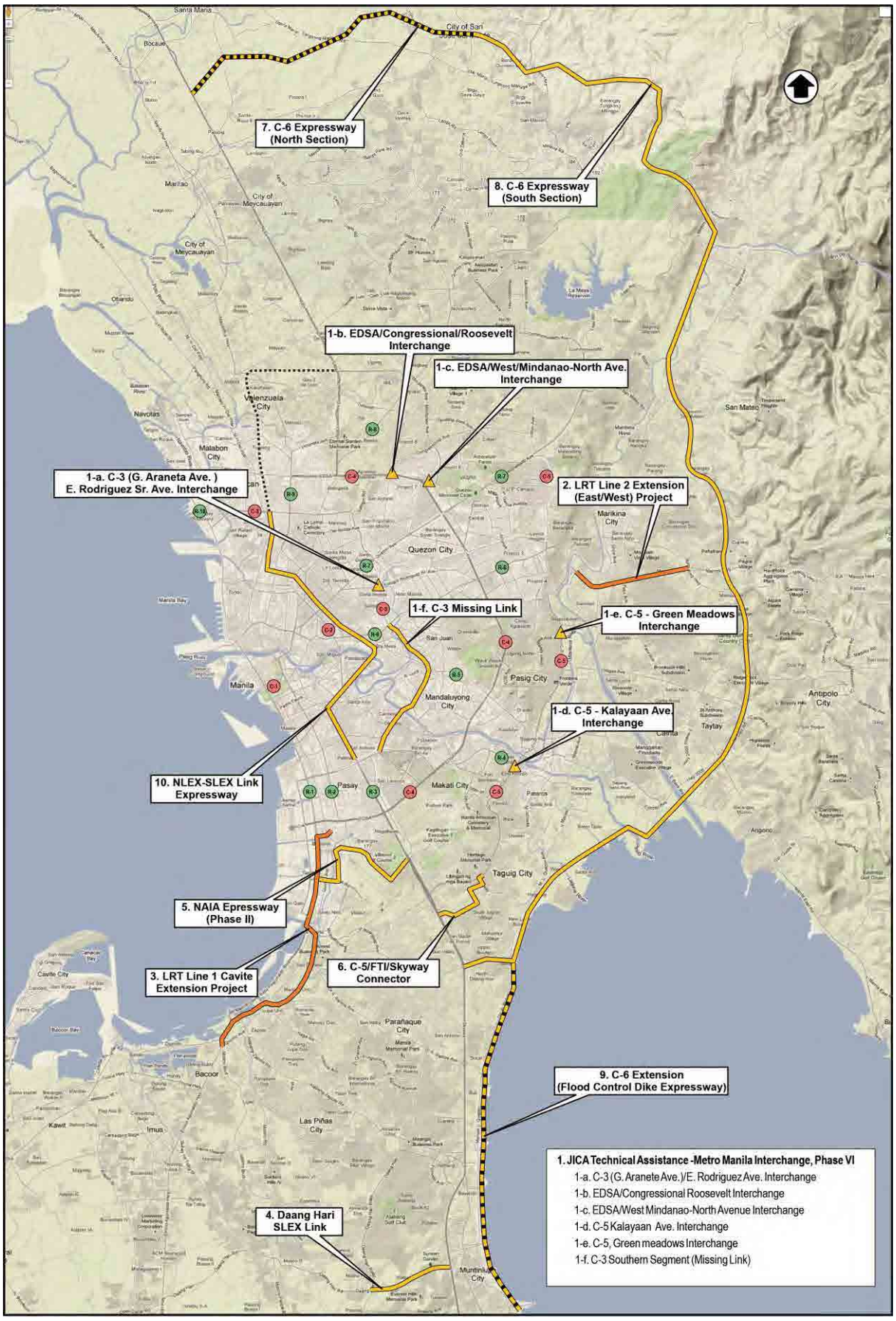
| Name of Project/Location | Brief Description/ Existing Condition/Proposed Improvement | Implementing Agency | Proposed Implementation Period | Proposed Funding Source | Estimated Cost |
|---|---|---|---|---|---|
| | - 4 lanes, L = 10.9 (La Mesa Parkway) and 92.1 (NLEX East) | | | | |
| 4. Establishment of the Mega Manila Provincial Integrated Bus Axis System (MM-PIBAS) | - Construction of 4 terminals : North, East, South, and Southeast Corridors | MMDA | 2012 | Private sector | Not available |
| 5. North PIBAS Terminal | - Establishment of 11.70 km has integrated bus terminal along NLEX | MMDA | 2013 | To be determined | Not available |
| 6. Development of Airport Tram System | - Approximately a 7-km long tram system<br>- Connect South MM-PIBAS to Ninoy Aquino International Airport Terminals | MMD A | - | | Not available |
| 7. Upgrading of Traffic Signal System and Field Facilities<br>• Replacement of 88 traffic signal lanterns into LED type signal light<br>• Signalization of additional 200 warranted intersections<br>• Installation of LED lighting facilities on footbridges, tunnel, etc. | - Replacement of control center facilities which includes software, hardware, loop detectors at 450 intersections and its cables<br>- LED type signal light lanterns<br>-<br>- New 200 signalized intersections | MMDA | 2012 | ODA | Not available |
| 8. Road Safety Surveillance and Wireless Communications System | - Installation of IP cameras and wireless communications equipment | To be determined | To be determined | To be determined | Not Available |
| 9. Road Information and Enforcement System | - Installation of vehicle detectors and video analytics software | To be determined | To be determined | To be determined | Not Available |
| 10. Photo Speed Enforcement System | - Installation of cameras, illuminator, radar system, lane processor, and system for data processing with payment module | MMDA | To be determined | National Government | Not Available |
| 11. Development of Alternative Modes of Transport | - Implementation of bicycle/motorcycle lane, rapid transport system (BRT) | MMDA | 2013 | National Government | Not available |
| 12. San Juan River Elevated Highway | - Construction of about 7 km long highway with 3 lanes on both directions decongesting traffic along EDSA | MMDA | 2013 | National Government | Not available |

*Source: Compiled by JICA Study Team based on data collected from DPWH Planning Service, MMDA and DOTC*



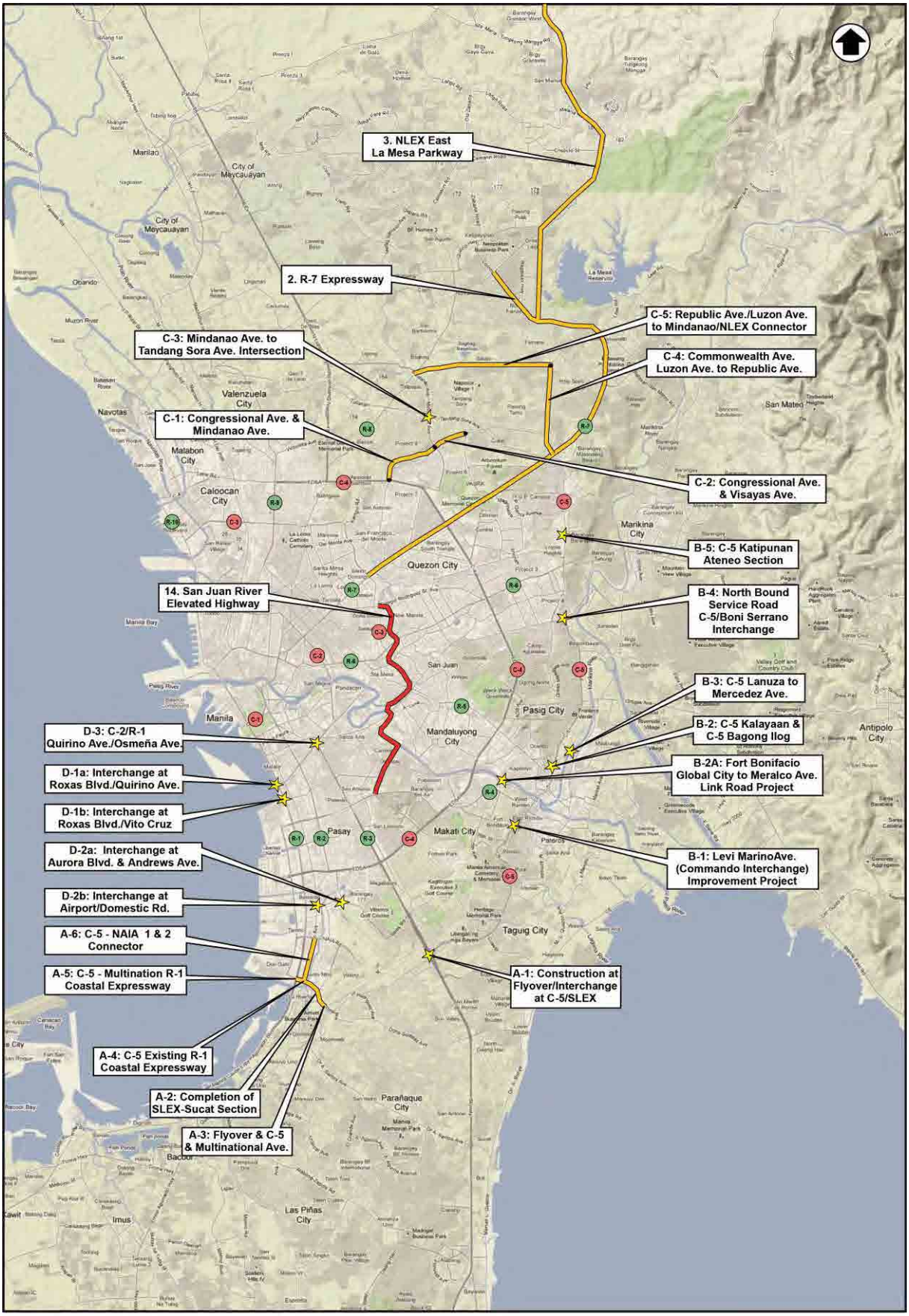

*Source: Compiled by JICA Study Team based on data collected from DPWH Planning Service, MMDA and DOTC*

**Figure 2.1-1 Location of On-going Major Transport Projects in NCR**




*Source: Compiled by JICA Study Team based on data collected from DPWH Planning Service, MMDA and DOTC*

**Figure 2.1-2 Location of Major Transport Projects under Study in the NCR**




*Source: Compiled by JICA Study Team based on data collected from DPWH Planning Service, MMDA and DOTC*

**Figure 2.1-3 Location of Future Transport Projects in the NCR**

### 2.1.2 Consistency with Traffic Plans of Other Agencies

MMDA's proposed and on-going projects aim at improving pedestrian safety, increasing travel speed and reducing overall traffic congestion.

The plan of DOTC to implement additional rail transport systems, such as MRT 7 and LRT 1 and LRT 2 Extension Projects, likewise aim to decongest Metro Manila and provide a more convenient, safer, and faster access to the Central Business Districts (CBDs).

The major on-going, under study, and future projects of DPWH in the NCR such as the proposed expressways are likewise geared towards alleviating the traffic congestion.

The project is consistent with the traffic plans of other agencies, such as MMDA and DOTC, where the primary objective is to improve pedestrian safety, increase travel speed, and overall reduction of traffic congestion. It is not in conflict with but rather supportive of the traffic plans of the said agencies and the concerned LGUs as well.

However, the following issues are to be noted:

MRT Line 7 Construction

As shown in **Table 2.1-1**, MRT Line 7 is to be constructed along Commonwealth Avenue, starting from EDSA/North/West intersection. The proposed intersection scheme for EDSA/West/North/Mindanao Avenues has been confirmed and approved by the project proponent of MRT 7 and DOTC. However, a reconfirmation has to be made during the Detailed Design Stage to ensure that there has been no change in the scheme that has been originally approved.

Skyway Stage 3

The project is a 14.5 km six-lane elevated viaduct that will connect the north and south expressways via C-3, where most of the road will be passing through, and has been approved as a priority project by the government last August 2012.Correspondingly, implementation of the C-3/E. Rodriguez Interchange has been deferred by DPWH due to a conflict of its alignment with that of the project.

### 2.1.3 Necessity for and Priority of the Proposed Flyover Project

Improvement of traffic flow at main corridors through traffic engineering and management, intermodal integration, and selected flyovers and bypasses in major urban centers is one of the road policies and strategies. Thus, the interchange project is necessary to support this policy.

It is further confirmed under the DPWH 2011–2016 Public Investment Program that the four interchanges included in the Metro Manila Interchange Construction Project VI (this Project) are necessary and priority projects proposed for construction/implementation starting 2013. The interchanges are included in the list of priority projects for the NCR under the current public investment program.

The proposed allocation for each interchange is presented in **Table 2.1-4**. Under the plan, the total investment allocated for the NCR is about PHP20.01 billion, of which PHP9.30 billion is for urban transport projects in Metro Manila, while PHP 6.02 billion is allocated for primary road projects.

As listed in the investment program, the proposed budget for the Metro Manila Interchange Construction Project is about PHP7.36 billion. Construction of the five interchanges namely, EDSA/Roosevelt/Congressional Avenue, EDSA/North/West Avenue, C-3/E. Rodriguez, C-5/Greenmeadows/Acropolis and C-5/Kalayaan have a total allocation of PHP5.17 billion, excluding the cost of consultancy services.

**Table 2.1-4 Proposed Fund Allocation for Interchange Projects**

| List of Projects | Fund Source | Total Cost | Proposed Annual Allocation (PHP1,000) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 2013 | 2014 | 2015 | 2016 | 2016 Beyond |
| **Total of NCR** | GOP | 7,783,491 | 163,252 | 431,086 | 1,497,928 | 2,702,823 | 2,988,402 |
| | LP | 12,231,759 | 244,883 | 649,133 | 2,290,292 | 4,235,858 | 4,811,593 |
| | Total | 20,015,250 | 408,135 | 1,080,219 | 3,788,220 | 6,938,681 | 7,799,995 |
| 1. Urban Transport | GOP | 3,722,910 | 67,690 | 187,146 | 745,668 | 1,479,898 | 1,242,508 |
| | LP | 5,584,430 | 101,540 | 280,724 | 1,116,892 | 2,319,920 | 1,765,354 |
| | Total | 9,307,340 | 169,230 | 467,870 | 1,862,560 | 3,799,818 | 3,007,862 |
| 2. Primary Road | GOP | 2,408,890 | 43,800 | 43,800 | 481,778 | 938,728 | 900,784 |
| | LP | 3,613,410 | 65,700 | 65,700 | 722,684 | 1,508,160 | 1,251,166 |
| | Total | 6,022,300 | 109,500 | 109,500 | 1,204,462 | 2,446,888 | 2,151,950 |
| 3. Metro Manila Interchange Construction Project | GOP | 2,914,324 | 95,562 | 243,940 | 752,260 | 1,177,075 | 645,487 |
| | LP | 4,451,486 | 143,343 | 368,409 | 1,173,400 | 1,828,104 | 938,230 |
| | Total | 7,365,810 | 238,905 | 612,349 | 1,925,660 | 3,005,179 | 1,583,717 |
| Total of five Interchanges | GOP | 2,330,108 | 50,719 | 184,097 | 677,417 | 857,432 | 560,643 |
| | LP | 3,535,162 | 76,078 | 276,144 | 1,056,135 | 1,355,839 | 770,966 |
| | Total | 5,865,270 | 126,797 | 460,241 | 1,733,552 | 2,213,271 | 1,331,609 |
| a. C-2 (Gov. Forbes Ave.)/R-7 (España St.) Interchange | GOP | 426,856 | 23,527 | 47,054 | 235,270 | 121,005 | - |
| | LP | 640,284 | 35,291 | 70,581 | 352,910 | 181,502 | - |
| | Total | 1,067,140 | 58,818 | 117,635 | 588,180 | 302,507 | - |
| b. C-3/E. Rodriguez Interchange and other related roads | GOP | 406,212 | 27,192 | 54,383 | 226,830 | 97,807 | - |
| | LP | 609,318 | 40,787 | 81,574 | 340,250 | 146,707 | - |
| | Total | 1,015,530 | 67,979 | 135,957 | 567,080 | 244,514 | - |
| c. C-5/Lanuza St.-Julia Vargas Ave. Interchange | GOP | 173,120 | - | 10,463 | 20,925 | 104,830 | 37,102 |
| | LP | 259,680 | - | 15,694 | 31,387 | 156,940 | 55,659 |
| | Total | 432,800 | - | 26,157 | 52,312 | 261,770 | 92,761 |
| d. EDSA/North Ave.-West Ave. Mindanao Interchange | GOP | 867,590 | - | 43,380 | 86,759 | 433,790 | 303,661 |
| | LP | 1,301,390 | - | 65,070 | 130,139 | 650,690 | 455,491 |
| | Total | 2,168,980 | - | 108,450 | 216,898 | 1,084,480 | 759,152 |
| e. EDSA/Roosevelt Ave. Interchange | GOP | 376,330 | - | 18,817 | 37,633 | 100,000 | 219,880 |
| | LP | 564,490 | - | 28,225 | 56,449 | 220,000 | 259,816 |
| | Total | 940,820 | - | 47,042 | 94,082 | 320,000 | 479,696 |
| f. C-5/Kalayaan Ave. Interchange | GOP | 80,000 | - | 10,000 | 70,000 | - | - |
| | LP | 160,000 | - | 15,000 | 145,000 | - | - |
| | Total | 240,000 | - | 25,000 | 215,000 | - | - |

GOP: Government of the Philippines
LP: Loan Proceedings

*Source: DPWH Public Investment Program 2011–2016*

## 2.2 LESSONS LEARNED FROM PREVIOUS SIMILAR PROJECTS AND PROPOSED COUNTERMEASURES

Two project related reports were reviewed in order to gain insights on the experiences and lessons learned during the previous project implementation. The reports enumerated valuable countermeasures and recommended actions to be taken into account in future project implementation. The countermeasures mentioned in the reports should be considered seriously to avoid repetition of the same shortcomings and problems encountered and enable a more successful project implementation in the future. These are enumerated in following sections.

### 2.2.1 Metro Manila Interchange Construction Project (IV) Ex-Post Evaluation Report

The June 2008 ex-post evaluation report on the Metro Manila Interchange Construction Project (IV) was undertaken jointly by JBIC Consultants and the National Economic and Development Authority (NEDA). The report identified three lessons learned and the recommended actions are taken into account in future project implementation. In addition to the recommendations, the evaluation team also raised concern on the shortage of maintenance funds in the future when major rehabilitation work is needed. The findings mentioned in the report are as follows (refer to **Appendix 2.1** for the full report):

**1) Lack of in-depth investigation during detailed design.** More detailed engineering investigation and designs should be undertaken in order to avoid any variations/change orders and supplemental agreements during the implementation, which quite often result in a delay of implementation and cost overruns.

**2) Delay in land acquisition and resettlement.** In order to minimize the delay of project implementation due to land acquisition and resettlement, the executing agency should organize a project coordination committee which may consist of DPWH, local government units, and other stakeholders (private and public) and establish a coordination body to enhance dialogue and contact with the neighboring residents.

**3) Absence of pragmatic project scheduling.** In planning the implementation schedule, pragmatic scheduling, taking into consideration the time needed for land acquisition, tendering process, and more realistic construction period, should be made. The JICA appraisal team should engage in thorough discussions with the borrower at the appraisal stage so that more realistic and pragmatic scheduling can be achieved.

**4) Insufficient maintenance fund.** Some concern regarding the operation and maintenance of the project. As the need for major rehabilitation works arises in the future, there is a possibility that the financial resources will be insufficient. As such, a financing plan and implementation schedule for major rehabilitation works should be formulated well in advance.

The Study Team's analysis of the said findings is discussed below.

### (1) Lack of In-depth Investigation during Detailed Design

**Table 2.2-1** shows the comparison of changes.

**Table 2.2-1 Comparison of Design Changes**

| Interchange | Planned | Actual |
|---|---|---|
| **EDSA/Quezon Interchange** | - 2 x 545 m 3-lane flyover<br>- 581m four-lane underpass<br>- Service lanes | - 2 x 548 m 3-lane flyover (as planned)<br>- 890 m 4-lane underpass (300 m added)<br>- Service lanes (as planned)<br>- Permanent pumping station (additional) |
| **C-5/Boni Serrano** | - 230 m 6-lane flyover along C-5<br>- 650 m 4-lane underpass along Katipunan Avenue<br>- At-grade 6-lane deck girder bridge | - 475 m four-lane flyover along C-5 (245 m extended)<br>- 203 m 4-lane underpass along Katipunan (447 m shorter)<br>- Service roads along Boni Serrano Avenue (as planned)<br>- Service road along E. Rodriguez and Katipunan Avenue (additional) |
| **C-5/Ortigas Avenue** | - 694 m 4-lane flyover along C-5<br>- 365 m 2-lane left-turn flyover<br>- 427 m 2-lane flyover along Ortigas Avenue<br>- Steel pedestrian overpass along Ortigas Avenue | - 694 m 4-lane flyover along C-5 (as planned)<br>- 232 m 2-lane left-turn flyover (shortened)<br>- 427 m 2-lane flyover along Ortigas Avenue (excluded)<br>- Steel pedestrian overpass along Ortigas Avenue (excluded) |
| **Other four interchanges under MMICP (V)** | - Design completed but implementation deferred/cancelled due to change in development policy of the government | |

*Source: Ex-Post Evaluation for Metro Manila Interchange Project (IV), JBIC & NEDA, June 2008*

Major changes shown in the table are attributed to change (s) in design concept or change (s) in development policy after the planning stage, but not to change (s) in design during the construction stage, although it is a fact that numerous variation orders were made during construction to fit actual site condition, but such were not conceptual changes. Nonetheless, since the DPWH is now imposing strict guidelines to restrict the easy issuance of variation orders, the Study Team proposes the following measures to avoid frequent design changes:

- **In-depth Study during Planning Stage**

A project preparatory study, such as this study, has to be undertaken prior to project appraisal to finalize project cost and scope of work.

- **Thorough Investigation during Detailed Design**

As recommended in the evaluation report, thorough field investigation, particularly of drainage facilities and their condition, presence of illegal structures and informal settlers that were not existent during planning stage, and presence of underground utilities such as water, telephone and sewerage pipes, has to be undertaken.

**(2) Delay in Land Acquisition and Resettlement**

Land acquisition and relocation of affected families requires a lengthy and careful process of amicable relocation even well planned relocation plan will be prepared. Hence, effort to minimize relocation shall be made during planning stage and scheme formation stage. This Study aims to formulate interchange schemes where land acquisition and relocation of affected people should be minimized.

**(3) Absence of Pragmatic Project Scheduling**

The main cause of delay may not be impractical project scheduling but, as mentioned in the evaluation report, lengthy and prolonged procurement process of consultants and contactors. JICA and DPWH shall agree during loan negotiations to prepare a project implementation timetable with milestones to be attained within specified period and both parties must strictly follow the agreed timetable and milestones.

**(4) Insufficient Maintenance Fund**

Basically, no major maintenance works will be required on the interchange structures, other than routine and periodic maintenance works such as cleaning of drainages, reinstallation of lane markings and traffic signs, and repair of railings, except for steel structures that may need periodic repainting and rust proofing. Such routine and periodic maintenance must be carried out in a preventive manner rather than condition responsive; i.e., maintenance work shall be undertaken before deterioration becomes obvious and progressive to the human eye.

### 2.2.2 Metro Manila Urban Transport Integration Project (MMURTRIP), WB Loan No. 7058-PH, Consolidated Report, January 2011

The MMURTRIP aims to assist the government in enhancing the economic productivity and quality of life of Metro Manila residents by improving the operational efficiency and safety of the transport system with better opportunities for access to public transport and non-motorized transport, the dominant transport modes of low-income residents. The project has five components namely, (1) traffic management improvements, (2) MARIPAS (Marikina, Rizal and Pasig) access improvements, (3) secondary road program, (4) non-motorized transport, and (5) institution building.

The project implementing agencies are DPWH, MMDA, and the City Government of Marikina. It was funded by The World Bank under Loan No. 7058-PH at an original project cost of USD60 million and GOP counterpart of PHP1,739,455.00. The project was approved in 28 November 2000 and was completed on 31 March 2010.

The MMURTRIP Consolidated Report enumerated the following lessons learned and recommendations for consideration in future project implementation:

**(1) Delay in project implementation**

The project experienced delays took nine years to implement, from the date the loan was signed (May 2001) up to loan closure (end of March 2010). The delays were attributed to the bureaucratic process of the Department and the political situation brought about by the untimely changes in leadership and, correspondingly, changes in government policies and priorities, resulting in major setbacks in the implementation stage.

**(2) Lack of coordination among concerned agencies**

- Coordination and comprehensive planning is necessary to minimize project delays. It is important to anticipate future setbacks such as presence of underground utilities, removal and/or relocation of obstructions and existing facilities, political interventions and changes in the implementing agency's leadership.
- Proper coordination with concerned LGUs and other government/private agencies should be made so that appropriate actions may be taken.
- NEDA, DPWH, and other agencies that will be involved in any project should be coordinated for the timely resolution of any problem that may arise.
- DPWH must formulate an inter-agency committee consisting of representatives from DPWH, DOTC, MMDA, DENR, concerned LGUs and other related agencies, if any, and call for meetings regularly or as may be necessary to identify potential problems/issues the earliest time possible for timely resolution.

**(3) Lack of initiative from implementing agencies**

Implementing agencies should take an active role during the design stage to ensure that all designs include underground and aboveground utilities, as-built plans, etc.

**(4) Ineffective use of technical assistance.**

Detailing of activities to be undertaken for projects with technical assistance components should be made during the loan negotiation stage to maximize its utilization and benefits that can be derived from this component.

**(5) Inflexible application of basic policies**

Acquisition of right-of-way should be completed before any bidding is conducted. However, if the area to be acquired is only within some portion(s) of the project, construction implementation schedule could be modified to hinge the right-of-way acquisition schedule with optimum forecasting when right-of-way related matters will be resolved.

**(6) Ineffective management of underground facilities**

- The exact location of utilities such as waterlines, drainage lines and telecommunications lines

should be made available particularly if they are installed after the design and before construction. This will assist the implementing agency/entity in case of obstruction, in informing the respective owners so that the proper actions may be taken.

- During the design phase, thorough underground facility survey shall be conducted and location of underground facilities shall be indicated in bid drawings. Such survey works shall be included in the design consultant's scope of works.
- The Project Management Office (PMO) that will be in-charge of construction of the interchanges should inform and instruct the Regional Office (NCR) not to issue permits for installation of underground facilities in the project area whenever project implementation is approved by NEDA.
- The District Offices should regularly inspect the proposed project's site to prevent unauthorized installation of underground facilities.

**(7) Lack of a comprehensive maintenance program**

Sustainability plans for periodic maintenance and budget allocation should be well defined.

**(8) Delay in the procurement process**

Integration of policies should be considered a must. The lending institution (s) and the GOP should have common and well-defined guidelines on project procurement to avoid delays that affect the total program. A flowchart with timeframe for any future programs should be prepared and agreed upon by the parties concerned.

**(9) Lack of natural environmental consideration**

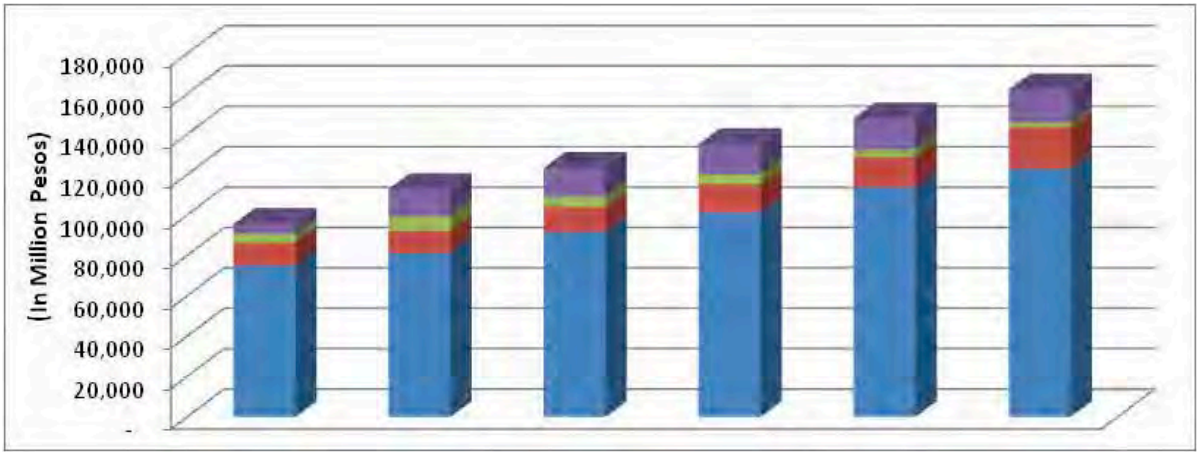
On the environmental aspect, a more detailed program should be added, like noise pollution monitoring, and other factors to mitigate any effect on the worldwide problem on climate change should be considered. It would be necessary to magnify/introduce tree planting and proper landscaping works within the defined projects towards a balanced nature.

## 2.3 PRESENT SITUATION AND FUTURE INVESTMENT PLAN IN THE HIGHWAY SECTOR

The DPWH Public Investment Program (2011–2016) consists of three categories namely, (1) highways, (2) flood control, and (3) other DPWH projects. Of the total annual investment, the highway sector gets the biggest share, which is 84% of the total investment program for the three sectors, as illustrated in **Figure 2.3-1**.

Under the Public Investment Program, DPWH is envisaging a total investment of PHP776 billion, including Motor Vehicle User Charge (MVUC) amounting to PHP78.8 billion. Of the PHP776 billion total investment requirement, PHP585 billion is earmarked for the highways sector, in addition to PHP78.8 billion from MVUC, PHP83 billion for flood control works and PHP28 billion for other projects.

In previous years, annual investment plan in the highway sector totaled to PHP65.86 billion while in 2011 it was PHP75.047 billion. For year 2012, the highway investment program is proposed to be PHP81.24 billion, increasing by an average of 10% annually until 2016.




(PHP Million)

| LEGEND | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total | Share (%) |
|---|---|---|---|---|---|---|---|---|
| Highways | 75,047 | 81,246 | 91,497 | 101,347 | 113,722 | 122,878 | 585,737 | 83.9 |
| Flood Control | 11,166 | 10,817 | 12,523 | 13,854 | 14,961 | 20,628 | 83,949 | 12.0 |
| Other DPWH Projects | 4,474 | 7,428 | 5,219 | 5,181 | 3,739 | 2,357 | 28,398 | 4.1 |
| **Sub-total DPWH** | **90,687** | **99,491** | **109,239** | **120,382** | **132,422** | **145,863** | **698,084** | **100.0** |
| MVUC | 4,897 | 13,386 | 14,055 | 14,758 | 15,496 | 16,270 | 78,862 | |
| **Total DPWH and MVUC** | **95,584** | **112,877** | **123,294** | **135,140** | **147,918** | **162,133** | **776,946** | |

*Source: DPWH Public Investment Program, 2011 –2016*

**Figure 2.3-1 Public Investment Program, 2011–2016**

## 2.4 ORGANIZATION, ANNUAL BUDGET AND TECHNICAL LEVEL OF THE DPWH MANDATE, FUNCTIONS, VISION AND MISSION

Following mottos are stated in the DPWH Public Investment Plan (2011~2016)

### 2.4.1 Mandate

The objective of Philippine Development Plan is to accelerate infrastructure development and ensure equitable access to infrastructure services through the following strategies:

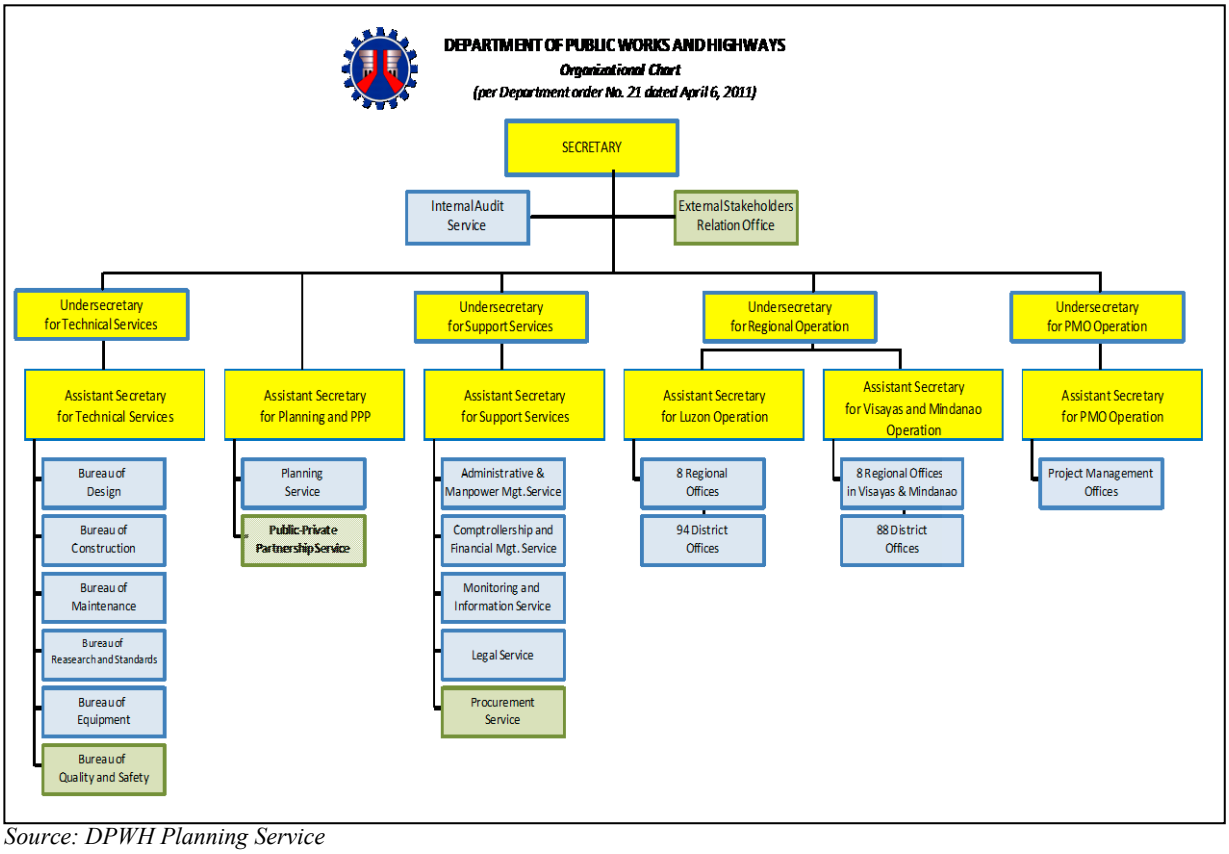
1) To optimize resources and investments
2) To attract investment in infrastructure
3) To foster transparency and accountability
4) To adapt to climate change and mitigate the impact of natural calamities
5) To provide productive employment opportunities

In support of the national development objective envisioned under the Philippine Development Plan, the DPWH is mandated to undertake (a) the planning of infrastructure, such as national roads and bridges, flood control, water resources projects and other public works, and (b) the design, construction, and maintenance of national roads and bridges and major flood control systems.

#### (1) Functions

The DPWH functions as the engineering and construction arm of the Government tasked to continuously develop its technology for the purpose of ensuring the safety of all infrastructure facilities and securing for all public works and highways with the highest efficiency and quality in construction.

DPWH is currently responsible for the planning, design, construction and maintenance of infrastructure, especially the national highways, flood control and water resources development system, and other public works in accordance with national development objectives. The DPWH organizational chart is presented in **Figure 2.4-1**.




*Source: DPWH Planning Service*

**Figure 2.4-1 DPWH Organizational Chart**

### (2) Vision

By 2030, DPWH is an effective and efficient government agency, improving the life of every Filipino through quality infrastructure.

### (3) Mission

To provide and manage quality infrastructure facilities and services responsive to the needs of the Filipino people in the pursuit of national development objectives.

## 2.4.2 Annual Budget

DPWH budget for Fiscal Year (FY) 2012 is PHP109.833 billion based on the General Appropriations Act (GAA). The budget increased by 8.93% from the FY 2011 budget of PHP100.82 billion as presented in **Table 2.4-1**. **Table 2.4-2** shows the breakdown of capital outlay budget in FY 2012. The highway sector shares 79% of the total capital outlay budget.

**Table 2.4-1 DPWH Budget in FY 2011 and 2012**

| Category | FY 2011 (PHP, Million) | FY 2012 (PHP, Million) | Increase / Decrease | |
|---|---|---|---|---|
| | | | Amount (PHP, Million) | % |
| 1. Capital Outlays | | | | |
| 1.1 Infrastructure | | | | |
| 1.1.1 Foreign-assisted Projects | 22,704 | 16,680 | - 6,020 | - 26,530 |
| 1.1.2 Locally-funded Projects | 68,196 | 82,810 | 14,610 | 21,430 |
| Subtotal | 90,900 | 99,490 | 8,590 | 9,450 |
| 2. Current Operating Expenditures | | | | |
| 2.1 Personal Services | 3,829 | 4,122 | 290 | 7,670 |
| 2.2 MOOE[3] | 6,082 | 6,206 | 120 | 2,040 |
| 2.3 Non-infrastructure | 15 | 15 | 0 | 0 |
| Subtotal | 9,926 | 10,343 | 420 | 4,210 |
| **TOTAL BUDGET** | **100,826** | **109,833** | **9,010** | **8,930** |

*Note: MOOE: Maintenance and Other Operating Expenses*
*Source: DPWH Website*

**Table 2.4-2 Capital Outlay Budget by Expenditure Type in FY 2012**

(PHP, Million)

| Category | Locally Funded Projects | Foreign Assisted Projects | Total | Share |
|---|---|---|---|---|
| 1. Highways | 63,718 | 14,380 | 78,098 | 79% |
| 2. Flood Control | 8,517 | 2,300 | 10,817 | 11% |
| 3. Feasibility Study/Preliminary Detailed Engineering | 1,207 | - | 1,207 | 1% |
| 4. ROW, Contractual Obligation | 4,237 | - | 4,237 | 4% |
| 5. Public Private Partnership (PPP) | 3,000 | - | 3,000 | 3% |
| 8. Water Supply/Disaster Related/VILP | 2,131 | - | 2,131 | 2% |
| **Total** | **82,810** | **16,680*** | **99,490** | **100%** |

*Note: Out of PHP16,680 Million of Foreign Assisted Projects, PHP6,221 Million is GOP Counterpart Fund; Pure Foreign Fund is PHP10,459 million*
*Source: DPWH Planning Service*

### 2.4.3 Maintenance System and Budget in DPWH

The Bureau of Maintenance prepared tabulation for the computation of Equivalent Maintenance Kilometer (EMK) showing the factors on road width, Annual Average Daily Traffic (AADT), and surface type. The multiplication of these factors together with the annual proposal of P/EMK determines how much maintenance will be allocated on a certain road section. For bridges, a constant of 0.01 for concrete type is multiplied by the length (abutment to abutment) together with the P/EMK to come up with the annual maintenance cost for a certain bridge. The higher maintenance cost depends on the width and surface type and AADT of any given road. The amount

[3] MOOE: Maintenance and Other Operation Expenditure

per EMK varies annually, adopting the proposed budgetary requirements per GAA.

The total length of national roads and bridges under the management of DPWH is about 30,000 km. In 2008, the total maintenance cost for national roads and bridges in all regions, including the NCR, was PHP12.52 billion. Of this amount, 53% was allocated for the carriageway and roadside (routine) maintenance while 47% was allocated for preventive maintenance. In terms of funding sources, around PHP6.5 billion was funded from the Motor Vehicle User Change (MVUC) while PHP6 billion was funded from the GAA. The NCR got the highest share of the routine maintenance funds among the regions, at PHP617 million or 12% of the total allocation for routine maintenance.

In the NCR, the total length of national roads and bridges is about 1,087 km managed by nine DPWH District Engineering Offices. All other routine maintenance activities in Metro Manila such as maintenance of traffic signals, drainage clearing, and painting of sidewalls are undertaken by MMDA. Likewise, periodic maintenance falls under the jurisdiction of MMDA. DPWH is responsible for maintenance of carriageway of the facilities. The Bureau of Maintenance (BOM) of DPWH provides technical assistance and guidelines for the efficient and economical implementation of maintenance functions. The BOM conducts a semi-annual road condition inventory of national roads and bridges and the information is updated every year.

In terms of maintenance operation, the work is divided into two categories: (i) Maintenance Work by Administration (MBA), and (ii) Maintenance Work by Contract (MBC). The routine maintenance work for the main carriageway of interchange is undertaken by maintenance crews of the District Engineering Office under MBA, while periodic maintenance work is contracted out to private contractors. Contractors are selected through competitive bidding and maintenance work items are scheduled on a tri-monthly basis.

For the maintenance budget of the NCR, the routine/carriageway maintenance program and preventive maintenance are funded from both the Special Road Support Fund (part of revenues from the MVUC) and the GAA. The maintenance allocation from 2005 to 2010 is shown in **Table 2.4-3**.

**Table 2.4-3 Maintenance Budget for National Capital Region**

(PHP, Million)

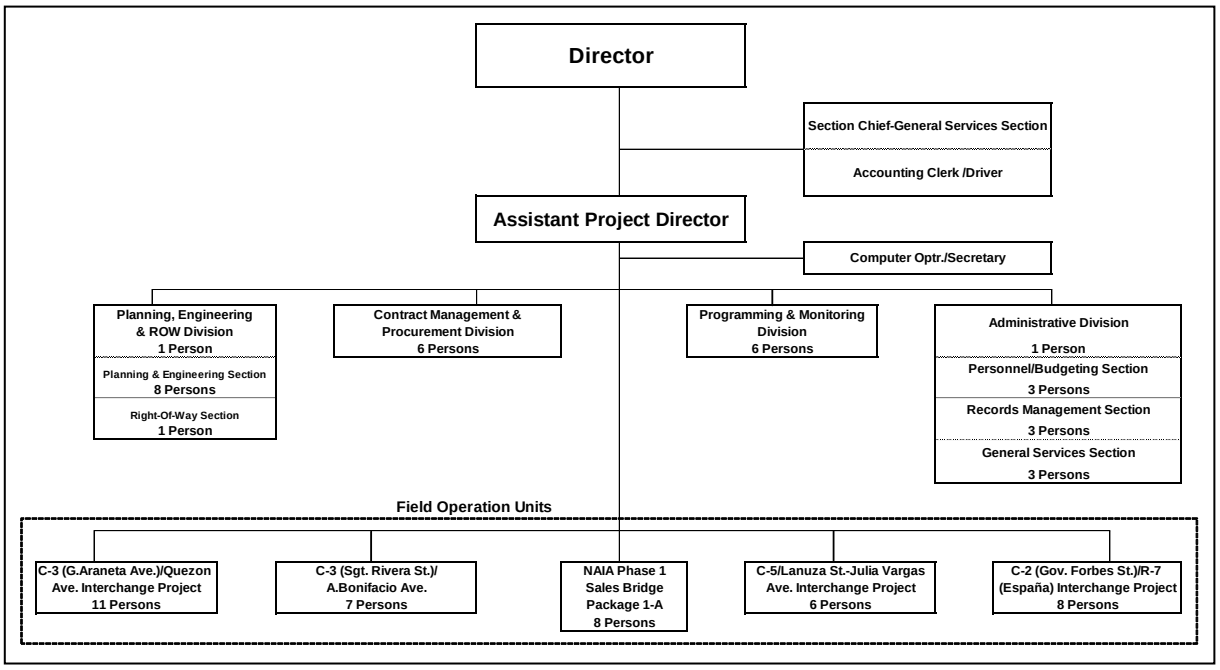
| Year | MVUC Allocation | GAA Fund | Total Maintenance Budget |
|---|---|---|---|
| 2005 | 770.90 | - | 770.89 |
| 2006 | 1,222.45 | - | 1,222.45 |
| 2007 | 1,134.89 | - | 1,134.89 |
| 2008 | 1,075.01 | 115.10 | 1.190.11 |
| 2009 | 1,206.64 | 143.80 | 1,350.44 |
| 2010 | 961.89 | 114.67 | 1,076.56 |

*Source: BOM and Road Board Report*

### 2.4.4 Technical Level for Construction and Maintenance of Flyover of the DPWH

#### (1) Flyover Construction

Foreign assisted highway projects in Metro Manila of the DPWH are mainly implemented by Project Management Office – Urban Road Projects Office (PMO–URPO). PMO–URPO was established with special task to handle major highway projects in Metro Manila particularly foreign-assisted projects. **Figure 2.4-2** shows organizational structure of PMO–URPO.




*Source: DPWH, PMO-URPO, as of February 2012*

**Figure 2.4-2 Organization of PMO–URPO**

PMO–URPO has track record of numerous interchange construction projects of JICA[4], from MMICP (I) to (V) and local fund. In addition to JICA interchange projects, PMO–URPO also handled locally-funded flyover projects and WB-assisted projects, such as MMURTRIP, and most projects were implemented successfully. It can be said that capacity and technical level of PMO–URPO as the implementing agency of MMICP (VI) is high, but the following must be noted:

Bureaucratic Procurement Process

One of major reasons of delay in project implementation in the past projects is delay in procurement of both consultant and contractors. Procurement of consultant and contractors must be fair and transparent but not with bureaucratic way. Tedious and unnecessary paper works shall be eliminated and adoption of electronic procurement system that can secure higher fairness and transparency shall be sought.

Land Acquisition and Resettlement

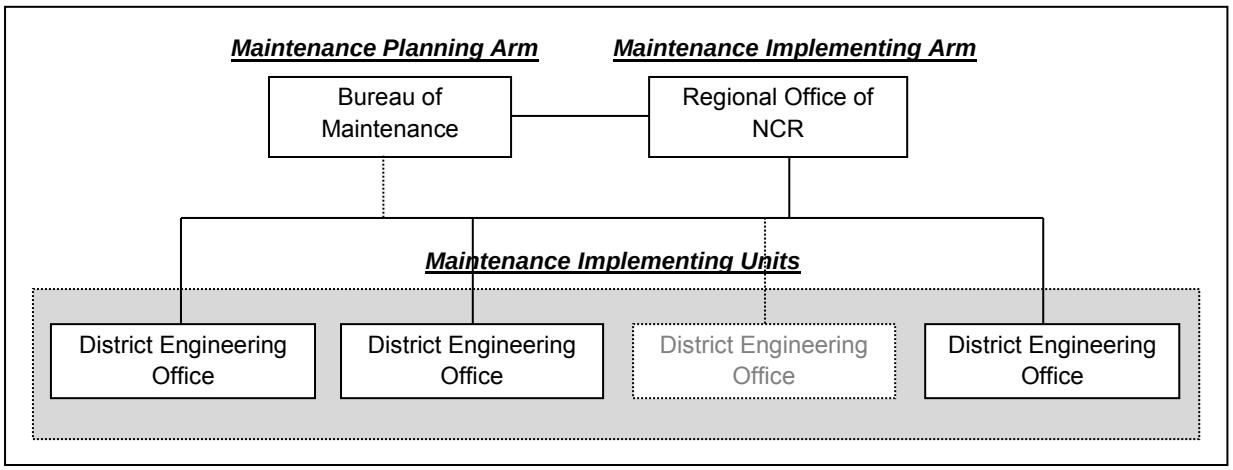
Another cause of delay in project implementation is delay in land acquisition and resettlement.

[4] Including JBIC and OECF financing period

Land acquisition and resettlement of MMICP (VI) is expected to be minimal and is not supposed to be a main issue, but the possibility of encroachment to present RROW in the future cannot be fully eliminated and resettlement issue can still be a sensitive issue for successful implementation of the project. PMO–URPO shall, in close coordination with ESSO, commence validation survey to identify relocation requirements the earliest possible time prior to project implementation.

**(2) Flyover Maintenance**

Once interchanges are completed and open to traffic, the completed facilities are relegated to maintenance units of DPWH from PMO–URPO. DPWH's Maintenance organization in Metro Manila is shown in **Figure 2.4-3**.




*Source: DPWH , BOM*

**Figure 2.4-3 Maintenance Organization in Metro Manila**

The Bureau of Maintenance (BOM) is in-charge of establishing maintenance policy and strategy, budget allocation and audit of maintenance activities. The Regional Office of the NCR is in-charge of the implementation of daily maintenance works with its subordinate units of District Engineering Offices. There are 12 District Engineering Offices under the NCR. Routine and periodic maintenance works are undertaken by District Engineering Offices while major rehabilitation works are directly implemented by Regional Office.

Capacity and technical level of the BOM and the Regional Office in the field of flyover maintenance is assessed high and they can implement without need for any external assistance. But, care must be paid to the following:

Repainting and Anti-corrosion Treatments of Steel Materials

There is a tendency to undertake repainting and anti-corrosion treatment of steel materials, particularly steel girders, only when deterioration becomes remarkably visible. Such maintenance always lags behind timely maintenance and may lead to reduction of residual life of the steel materials. The technical level of DPWH staff on the inspection of steel structures and formulation of maintenance works shall be enhanced through external technical assistance such as the on-going JICA-assisted project for the Improvement of Quality Management for

Highway and Bridge Construction and Maintenance, Phase II.

## 2.5 CIRCUMSTANCES OF SUPPORT TO THE TRANSPORT SECTOR BY OTHER DONORS

The international funding institutions continuously support the Government in the implementation of transport projects in the form of loans, grants and technical assistances. Local funds are not sufficient to meet the funding requirements of transport projects, thus they are funded through ODA.

The most recently completed foreign-assisted project in the NCR is the World Bank-funded Metro Manila Urban Transport Integration Project. It has five components, namely: (1) traffic management improvement, (2) MARIPAS access improvements, (3) secondary road program, (4) non-motorized transport, and (5) institution building. The project was successfully completed on March 2010.

The Korea International Cooperation Agency (KOICA) funded the Feasibility Study of the C-6 Expressway Project. The study was submitted last January 2012.

Projects prepared and prioritized under the Master Plan of High Standard Highways, which is a JICA-assisted project, are proposed to be implemented under Public-Private Partnership (PPP).

It is reported that under FY 2011–2016, DPWH Public Investment Program, 23.83% of the total investment will be financed by international financing institutions. There are 250 foreign-assisted projects nationwide (including projects with financing to be determined) with a total cost of PHP189.172 billion. About 25 of these projects/programs are located in to the NCR with a total cost of PHP41.356 billion.

Among the funding institutions, JICA has the biggest share of financing at 12.44%, followed by French Loan at 2.97%, World Bank at 2.20%, ADB at 1.95%, and UK 1.75%. Other funding institutions with share below one percent of the total investment cost are Saudi Fund, 0.39%; KEDCF, 0.76%; MCC, 0.12%; PROC, 0.17%; Kuwait, 0.49%; Spanish, 0.49%, and Australia, 0.10%.[5]

[5] DPWH Planning Service

# CHAPTER 3

# TRAFFIC FLOW ANALYSIS AND DEMAND FORECAST

## 3.1 TRAFFIC SURVEY

### 3.1.1 Type and Location of Traffic Survey

The traffic surveys shown in **Table 3.1-1** were conducted to grapes present traffic flow characteristics of the project sites.

**Table 3.1-1 Type and Location of Traffic Surveys**

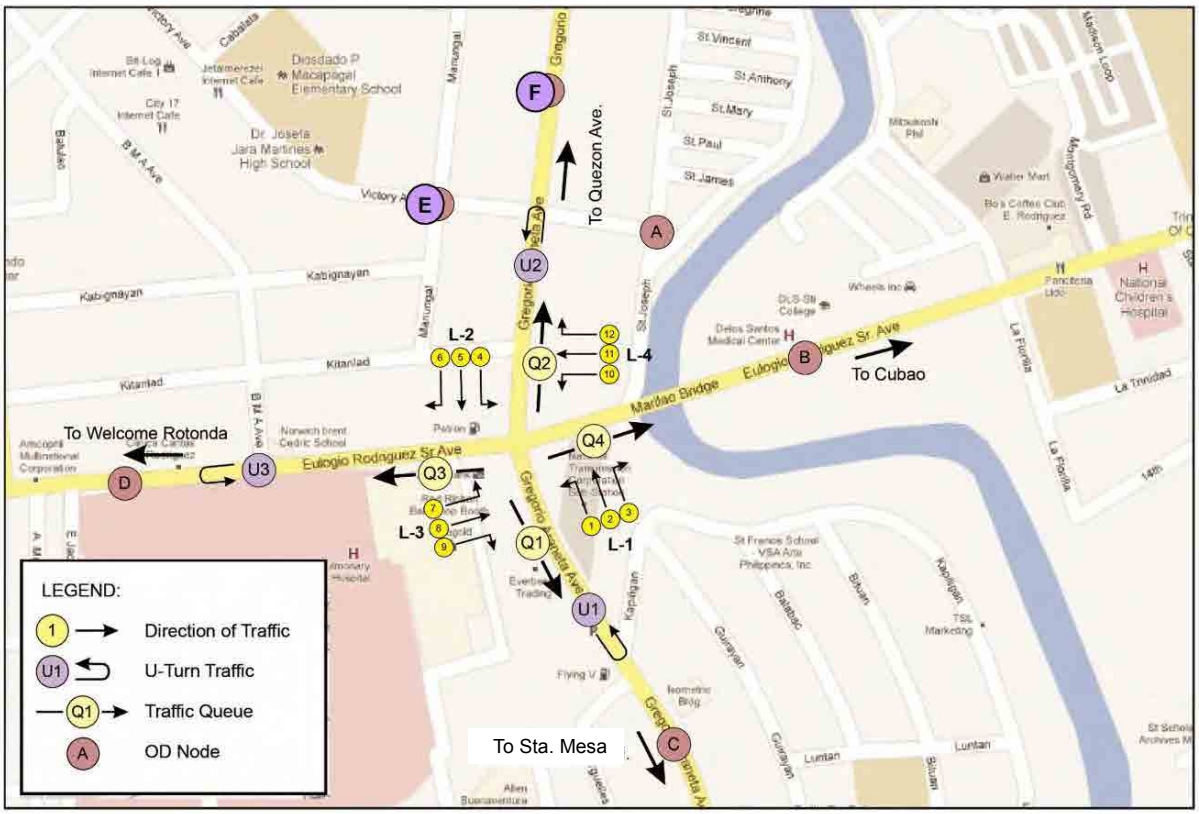
| Type of Survey | Purpose of the Survey | Location |
|---|---|---|
| 1. Intersection Directional Traffic Volume<br>(Dec. 6~Dec. 21 2011) | - Assessment of present service level of the intersections<br>- Formulation of interchange schemes<br>- Benefit calculation | 1. C-3/E. Rodriguez<br>2. EDSA/Roosevelt/ Congressional<br>3. EDSA/North/West/ Mindanao<br>4. C-5/Kalayaan<br>5. C-5/Green Meadows/ Acroplis/Calle Industria<br><br>Note: C-5/Kalayaan is not included in the Number Plate Survey |
| 2 Number Plate Vehicle Movement Survey<br>(Dec. 6~Dec. 21 2011) | - Formulation of present Origin Destination (OD) matrix for traffic analyses | |
| 3 Intersection Queue Length Survey<br>(Dec. 6~Dec. 21 2011) | - Verification of current service level of the intersections | |
| 4. Travel Speed Survey<br>(Nov. 22~Dec.8 2011) | - Basic information for assessment of effect and impact of interchange construction | 8 major streets passing/crossing project intersections |

*Source: JICA Study Team*
*Note: Survey of above 1, 2 and 3 of C-5/Kalayaan was conducted March 13 and 14 2012*

Location of traffic survey site is shown in **Figure 3.1-1**. Traffic flow direction, OD code, location of queue length survey and number plate survey at each intersection are shown in **Figure 3.1-2** to **Figure 3.1-6**.

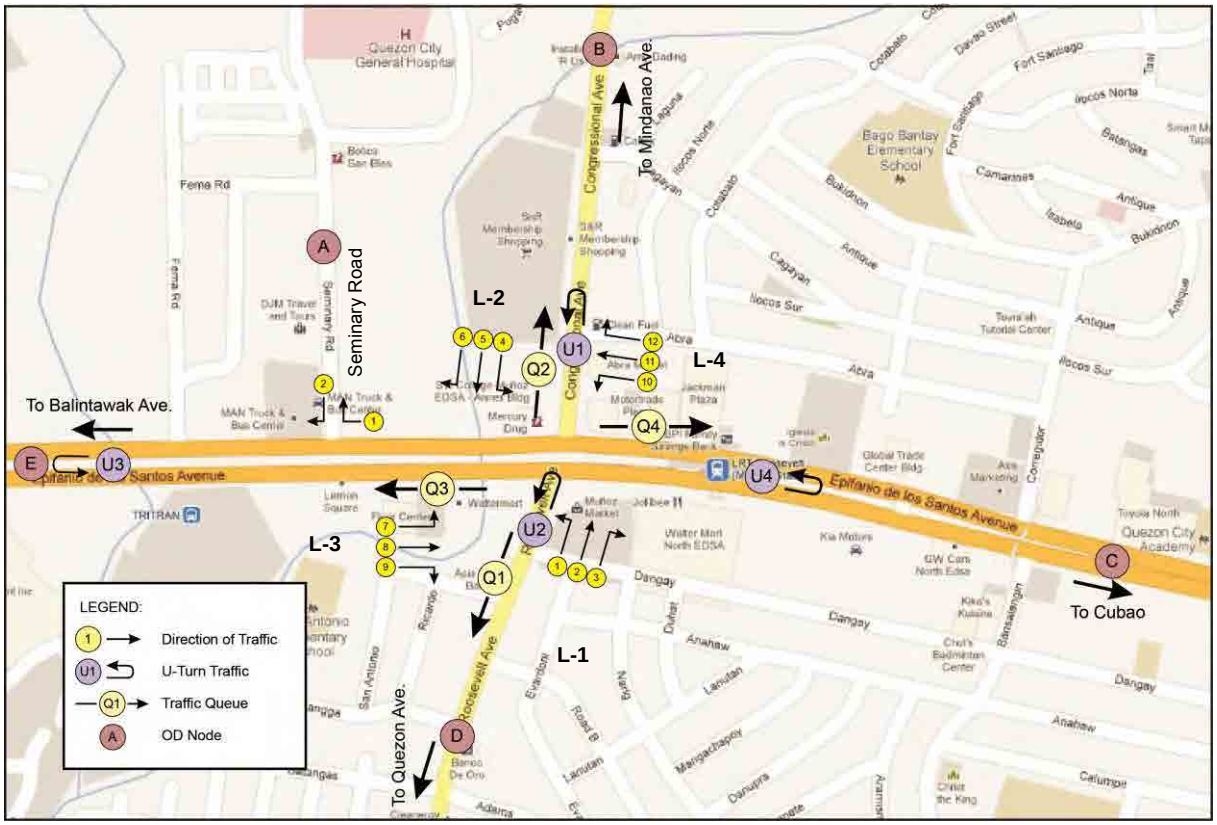

*Source: JICA Study Team*

**Figure 3.1-1 Location of Traffic Surveys**



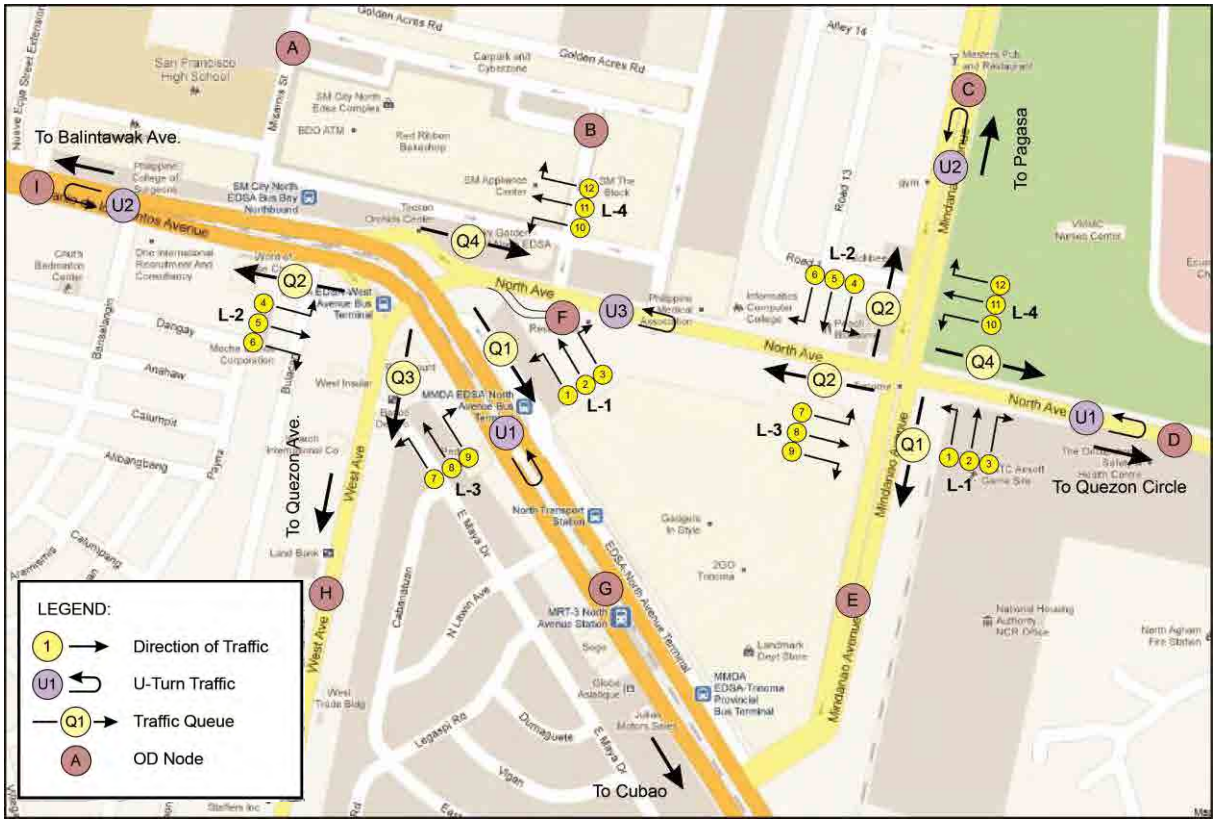

*Source: JICA Study Team*

**Figure 3.1-2 Traffic Survey Location at C-3/E. Rodriguez Intersection**



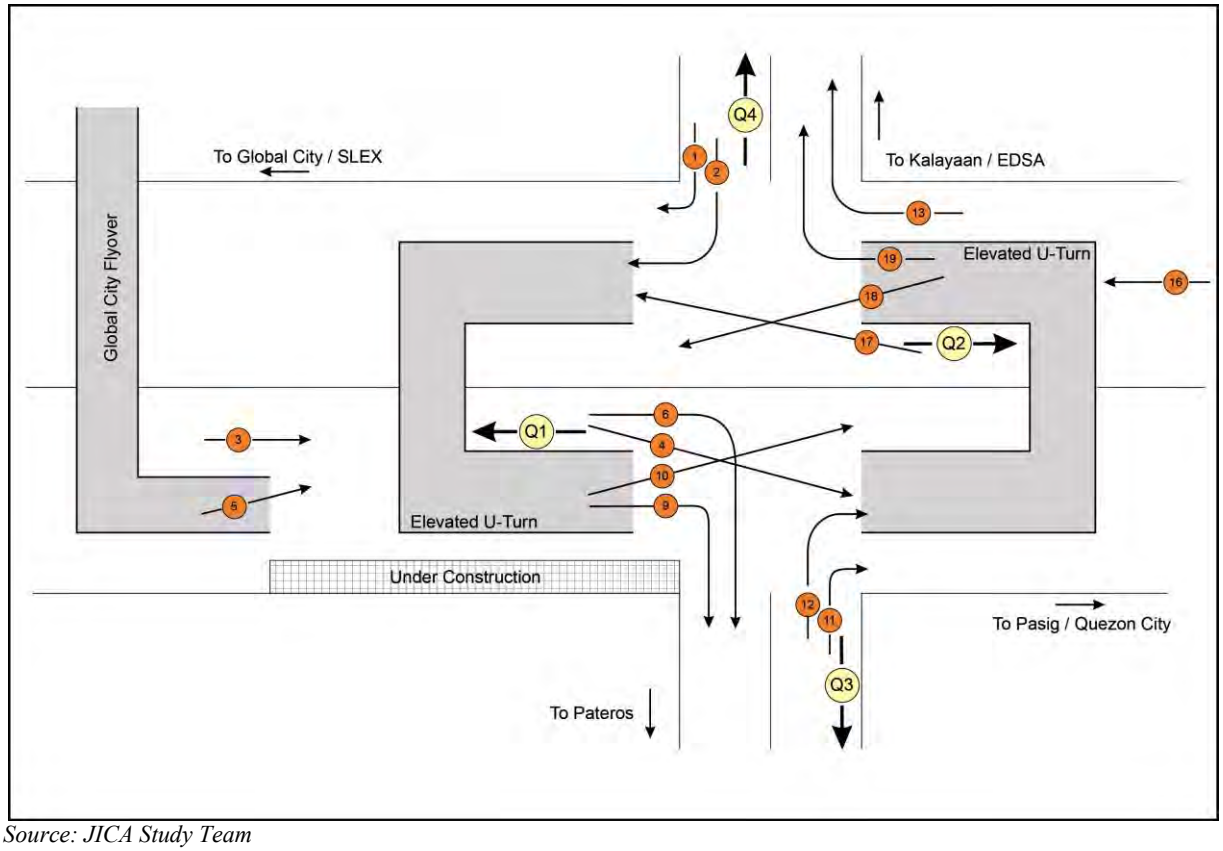

*Source: JICA Study Team*

**Figure 3.1-3 Traffic Survey Location at EDSA/Roosevelt/Congressional Avenue**



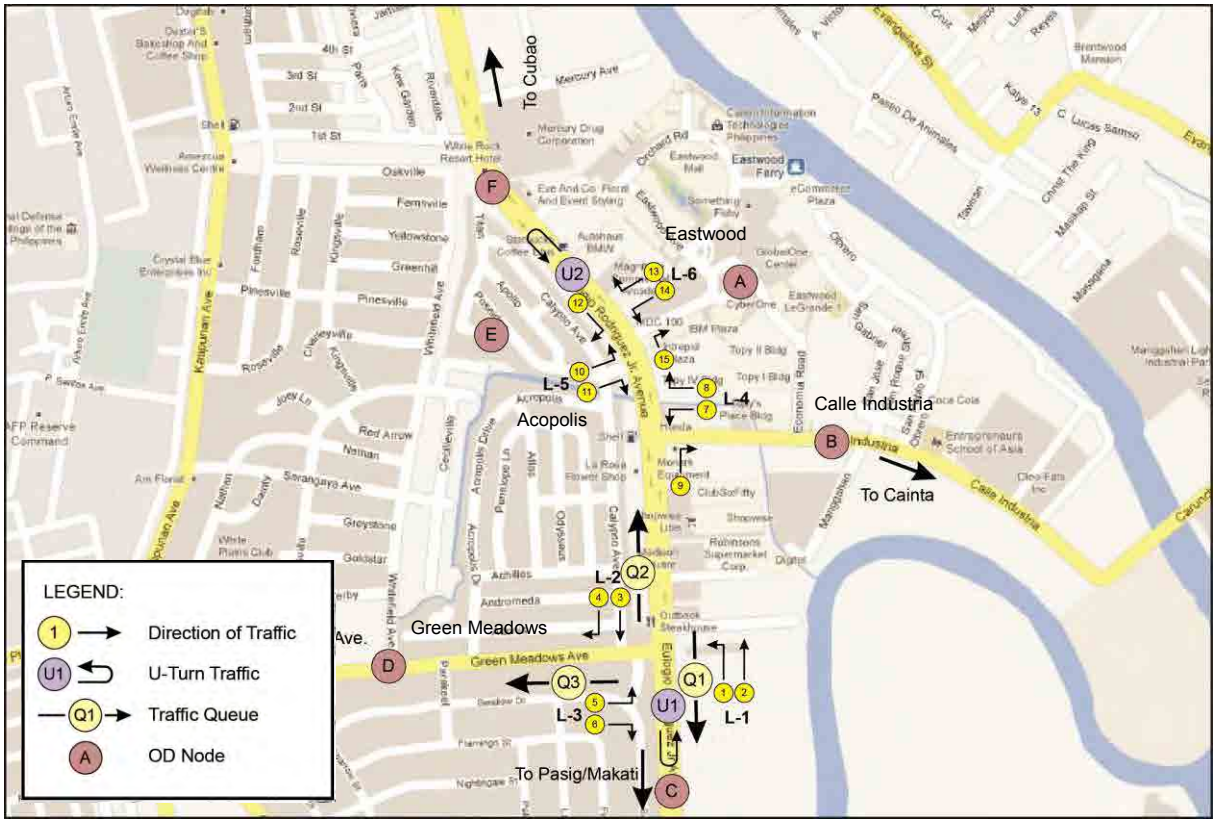

*Source: JICA Study Team*

**Figure 3.1-4 Traffic Survey Location at EDSA/North/West/Mindanao Avenue**




*Source: JICA Study Team*

**Figure 3.1-5 Traffic Survey Location at C-5/Kalayaan Avenue**




*Source: JICA Study Team*

**Figure 3.1-6 Traffic Survey Location at C-5/Green Meadows**

### 3.1.2 Intersection Directional Traffic Volume Survey

#### (1) Method of Survey

The number of vehicles that enter into the interchange were counted on each direction of traffic and classified into ten vehicle categories that widely adopted in the Philippines, namely:

1) Passenger Car (private cars, jeeps, taxis, 4-wheel drive)
2) Passenger Jeepney
3) Goods Utility (vans)
4) Small Bus
5) Large Bus
6) Rigid 2-axle Truck
7) Rigid 3-axle Truck
8) Rigid 4-axle or more Truck
9) Motorcycle
10) Tricycle

The traffic counts were conducted for each intersection and adjoining roads per direction/flow for 16 hours starting from 6:00 AM to 10:00 PM for two consecutive days on weekdays except Mondays and Fridays. Expansion factors to convert 16-hour traffic volume to 24-hour volume are obtained previous traffic count surveys while daily factors and seasonal factors are assumed to be 1.0 since survey date is weekdays in ordinary season and not summer holiday season.

The adjusted 24 hour count was used as the Annual Average Daily Traffic (AADT). The converted traffic counts represent the normal traffic for each intersection. For this study, expansion factors shown in **Table 3.1-2** were applied.

**Table 3.1-2 Expansion Factor Used for Obtaining AADT**

| Interchange Location | Day | Car | Jeepney | Utility. | S. Bus | L.Bus | 2 Axle Trk | 3 Axle Trk | 4 Axle Trk | M'cycle | T'Cycle |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C-3/ E. Rodrigues | Day 1 (Thu) | 1.23 | 1.15 | 1.22 | 1.52 | 1.52 | 1.18 | 1.43 | 1.54 | 1.2 | 1.2 |
| | Day 2 (Fri) | 1.23 | 1.17 | 1.14 | 1.37 | 1.37 | 1.26 | 1.61 | 1.73 | 1.2 | 1.2 |
| | **Average** | **1.23** | **1.16** | **1.18** | **1.45** | **1.45** | **1.22** | **1.52** | **1.64** | **1.2** | **1.2** |
| EDSA/ Rossevelt | Day 1 (Tue) | 1.19 | 1.22 | 1.18 | 1.28 | 1.28 | 1.66 | 3.44 | 4.14 | 1.2 | 1.2 |
| | Day 2 (Wed) | 1.28 | 1.21 | 1.17 | 1.36 | 1.36 | 1.64 | 4.42 | 4.61 | 1.2 | 1.2 |
| | **Average** | **1.24** | **1.22** | **1.18** | **1.32** | **1.32** | **1.65** | **3.93** | **4.38** | **1.2** | **1.2** |
| Edsa/North/ West/ Mindanao | Day 1 (Tue) | 1.19 | 1.22 | 1.18 | 1.28 | 1.28 | 1.66 | 3.44 | 4.14 | 1.2 | 1.2 |
| | Day 2 (Wed) | 1.28 | 1.21 | 1.17 | 1.36 | 1.36 | 1.64 | 4.42 | 4.61 | 1.2 | 1.2 |
| | **Average** | **1.24** | **1.22** | **1.18** | **1.32** | **1.32** | **1.65** | **3.93** | **4.38** | **1.2** | **1.2** |
| C-5/Kalayaan | Day 1 (Tue) | 1.20 | 1.13 | 1.19 | 1.08 | 1.07 | 1.33 | 2.00 | 3.23 | 1.18 | 1.00 |
| | Day 2 (Wed) | 1.22 | 1.18 | 1.21 | 1.00 | 1.02 | 1.46 | 1.84 | 1.84 | 1.16 | 1.00 |
| | **Average** | **1.21** | **1.16** | **1.20** | **1.04** | **1.05** | **1.40** | **1.92** | **2.53** | **1.17** | **1.00** |
| C-5/ Green Meadows | Day 1 (Tue) | 1.12 | 1.16 | 1.12 | 1.12 | 1.12 | 1.21 | 1.56 | 1.86 | 1.13 | 1.13 |
| | Day 2 (Wed) | 1.12 | 1.16 | 1.12 | 1.12 | 1.12 | 1.21 | 1.56 | 1.86 | 1.13 | 1.13 |
| | **Average** | **1.12** | **1.16** | **1.12** | **1.12** | **1.12** | **1.21** | **1.56** | **1.86** | **1.13** | **1.13** |

*Source:* ***E. Rodriguez****: 2007,C-6 traffic Count Feasibility Study on Metro manila C-6 Expressway METI/Katahira*
***Roosevelt/Congressional****: 2007,C6 Traffic Count Feasibility Study on Metro manila C-6 Expressway METI/Katahira*
***North Avenue/EDSA/Mindanao****: 2007,C-6 traffic Count Feasibility Study on Metro manila C-6 Expressway METI/Katahira*
***C-5/Kalayaan:*** *Survey Result of JICA Study Team*
***Green Meadows*** *; 2011 C-6 Feasibility Study KOICA*

### (2) Result of Survey

Result of survey is summarized in **Table 3.1-3** to **3.1-5** while more detailed survey data and graphical traffic volume of each interchange are presented in **Appendix 3-1**.

## Table 3.1-3 Intersection Traffic Volume (AADT) (1/3)

| Staion Code | Flow No | Directional Flow | | Vehicle Types | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | Passenger Car | Passenger Jeepney | Goods Utility (Van) | Small Bus | Large Bus | Rigid 2-axle Truck | Rigid 3-axle or more Truck | Semi-Trailer Truck (3 or more axles) | Motorcycle | Tricycle | TOTAL |
| **No.1 C-3/E. Rodriguez Itersection** | | | | | | | | | | | | | | |
| **Leg-1: from Sta. Mesa along C-3** | | | | | | | | | | | | | | |
| ITC-ER1 | 1 | Sta. Mesa | Welcome | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ER1 | 2 | Sta. Mesa | Sgt. Rivera | 22,340 | 1,092 | 1,620 | 10 | 52 | 853 | 492 | 361 | 4,881 | 572 | **32,272** |
| ITC-ER1 | 3 | Sta. Mesa | Cubao | 5,013 | 23 | 281 | 4 | 9 | 99 | 10 | 42 | 958 | 63 | **6,501** |
| | | **Sub-total** | | **27,353** | **1,115** | **1,901** | **13** | **60** | **951** | **502** | **403** | **5,839** | **635** | **38,773** |
| **Leg-2: from Quezon Ave. along C-3** | | | | | | | | | | | | | | |
| ITC-ER1 | 4 | Quzon Ave. | Cubao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ER1 | 5 | Quzon Ave. | Sta. Mesa | 12,239 | 1,105 | 2,310 | 2 | 15 | 966 | 253 | 166 | 6,991 | 780 | **24,826** |
| ITC-ER1 | 6 | Quzon Ave. | Welcome | 2,290 | 60 | 231 | 0 | 4 | 48 | 8 | 3 | 547 | 40 | **3,233** |
| | | **Sub-total** | | **14,529** | **1,165** | **2,541** | **2** | **19** | **1,013** | **261** | **169** | **7,538** | **820** | **28,059** |
| **Leg-3: from Welcom along E. Rodriguez** | | | | | | | | | | | | | | |
| ITC-ER1 | 7 | Welcome | Sgt. Rivera | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ER1 | 8 | Welcome | Cubao | 13,424 | 2,837 | 1,014 | 1 | 80 | 151 | 4 | 4 | 3,393 | 0 | **20,908** |
| ITC-ER1 | 9 | Welcome | Sta. Mesa | 5,243 | 26 | 748 | 2 | 9 | 163 | 42 | 23 | 613 | 40 | **6,907** |
| | | **Sub-total** | | **18,667** | **2,863** | **1,762** | **2** | **90** | **314** | **46** | **26** | **4,006** | **40** | **27,815** |
| **Leg-4: from Cubao along E. Rodriguez** | | | | | | | | | | | | | | |
| ITC-ER1 | 10 | Cubao | Sta. Mesa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ER1 | 11 | Cubao | Welcome | 17,598 | 2,760 | 1,445 | 0 | 117 | 347 | 14 | 6 | 3,306 | 74 | **25,667** |
| ITC-ER1 | 12 | Cubao | Sgt. Rivera | 3,318 | 30 | 546 | 4 | 5 | 172 | 48 | 20 | 1,055 | 79 | **5,276** |
| | | **Sub-total** | | **20,916** | **2,790** | **1,991** | **4** | **122** | **519** | **62** | **25** | **4,361** | **153** | **30,943** |
| **U-Trun Traffic** | | Name of Street | Location | | | | | | | | | | | |
| UTC-ER1 | 1 | C-3 | Sta. Mesa U-Turn | 2,483 | 66 | 414 | 3 | 8 | 134 | 23 | 6 | 633 | 157 | **3,926** |
| UTC-ER1 | 2 | C-3 | Sgt. Rivera U-Turn | 4,712 | 91 | 750 | 1 | 7 | 166 | 38 | 11 | 551 | 79 | **6,405** |
| UTC-ER1 | 3 | E. Rodriguez | Q.I. U-Turn | 2,089 | 86 | 196 | 2 | 1 | 48 | 1 | 1 | 192 | 23 | **2,636** |
| **No.2 EDSA/Roosevelt/Congrssional Intersection** | | | | | | | | | | | | | | |
| **Leg-1: from Quezon Ave. along Roosvelt Ave.** | | | | | | | | | | | | | | |
| ITC-ERC1 | 1 | Quezon Ave. | Balintawak | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ERC1 | 2 | Quezon Ave. | Mindanao Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ERC1 | 3 | Quezon Ave. | Cubao | 5,278 | 2,068 | 1,062 | 0 | 4 | 340 | 54 | 0 | 2,771 | 18 | **11,597** |
| | | **Sub-total** | | **5,278** | **2,068** | **1,062** | **0** | **4** | **340** | **54** | **0** | **2,771** | **18** | **11,597** |
| **Leg-2: from Mindanao Ave. along Congressional Ave.** | | | | | | | | | | | | | | |
| ITC-ERC1 | 4 | Mindanao Ave. | Cubao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ERC1 | 5 | Mindanao Ave. | Quezon Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ERC1 | 6 | Mindanao Ave. | Balintawak | 14,280 | 2,360 | 1,376 | 1 | 842 | 984 | 313 | 74 | 3,753 | 7 | **23,990** |
| | | **Sub-total** | | **14,280** | **2,360** | **1,376** | **1** | **842** | **984** | **313** | **74** | **3,753** | **7** | **23,990** |
| **Leg-3: from Baintawak along EDSA** | | | | | | | | | | | | | | |
| ITC-ERC1 | 7 | Balintawak | Mindanao Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ERC1 | 8 | Balintawak | Cubao | 33,768 | 2,495 | 5,026 | 1 | 5,086 | 2,694 | 1,235 | 780 | 5,456 | 7 | **56,550** |
| ITC-ERC1 | 9 | Balintawak | Quezon Ave. | 4,045 | 2,136 | 799 | 1 | 3 | 198 | 32 | 27 | 2,462 | 0 | **9,702** |
| | | **Sub-total** | | **37,813** | **4,631** | **5,825** | **2** | **5,089** | **2,892** | **1,267** | **808** | **7,919** | **7** | **66,252** |
| **Leg-4: from Cubao along EDSA** | | | | | | | | | | | | | | |
| ITC-ERC1 | 10 | Cubao | Quezon Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-ERC1 | 11 | Cubao | Balintawak | 33,340 | 2,930 | 3,891 | 22 | 4,310 | 2,352 | 527 | 179 | 4,600 | 0 | **52,149** |
| ITC-ERC1 | 12 | Cubao | Mindanao Ave. | 12,325 | 2,228 | 1,692 | 0 | 750 | 601 | 88 | 13 | 3,152 | 8 | **20,858** |
| | | **Sub-total** | | **45,665** | **5,158** | **5,582** | **22** | **5,060** | **2,953** | **615** | **192** | **7,752** | **8** | **73,007** |
| **Name of Intersection: EDSA/Seminary Road** | | | | | | | | | | | | | | |
| ITC-ERC2 | 1 | EDSA | Seminary Road | 1,425 | 55 | 152 | 0 | 0 | 51 | 4 | 0 | 339 | 33 | **2,059** |
| ITC-ERC2 | 2 | Seminary Road | EDSA | 2,218 | 188 | 385 | 0 | 11 | 163 | 10 | 4 | 685 | 2 | **3,665** |
| | | **Sub-total** | | **3,643** | **243** | **537** | **0** | **11** | **214** | **14** | **4** | **1,024** | **35** | **5,724** |
| **U-Turn Traffic** | | Name of Street | Location | | | | | | | | | | | |
| UTC-ERC1 | 1 | Congressional Ave. | Congressional U-Turn | 16 | 970 | 4 | 1 | 0 | 1 | 0 | 0 | 26 | 10 | **1,027** |
| UTC-ERC1 | 2 | Roosevelt Ave. | at intersection | 177 | 4 | 20 | 2 | 0 | 2 | 0 | 0 | 43 | 1 | **250** |
| UTC-ERC1 | 3 | EDSA | Balintawak U-Turn | 7,042 | 2,591 | 730 | 0 | 955 | 353 | 26 | 0 | 2,727 | 0 | **14,424** |
| UTC-ERC1 | 4 | EDSA | In fromt of Inc U-Turn | 9,802 | 3,709 | 1,803 | 5 | 15 | 838 | 64 | 12 | 4,421 | 0 | **20,670** |

*Source: JICA Study Team*

## Table 3.1-4 Intersection Traffic Volume (AADT) (2/3)

| Staion Code | Flow No | Directional Flow | | Vehicle Types | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | Passenger Car | Passenger Jeepney | Goods Utility (Van) | Small Bus | Large Bus | Rigid 2-axle Truck | Rigid 3-axle or more Truck | Semi-Trailer Truck (3 or more axles) | Motorcycle | Tricycle | TOTAL |
| **No 3A EDSA/North/West Intersection** | | | | | | | | | | | | | | |
| **Leg-1: from Cubao along EDSA** | | | | | | | | | | | | | | |
| ITC-SM1 | 1 | Cubao | Quezon Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-SM1 | 2 | Cubao | Balintawak | 75,753 | 917 | 2,096 | 0 | 5,441 | 2,382 | 212 | 56 | 3,756 | 0 | **90,613** |
| ITC-SM1 | 3 | Cubao | Quezon Circle | 23,994 | 3,443 | 1,897 | 3 | 8 | 615 | 92 | 6 | 3,669 | 0 | **33,727** |
| | | **Sub-total** | | **99,747** | **4,360** | **3,993** | **3** | **5,449** | **2,997** | **304** | **62** | **7,425** | **0** | **124,340** |
| **Leg-2: from Balintawak along EDSA** | | | | | | | | | | | | | | |
| ITC-SM1 | 4 | Balintawak | Quezon Circle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-SM1 | 5 | Balintawak | Cubao | 53,736 | 2,126 | 4,903 | 16 | 4,990 | 2,696 | 1,646 | 1,246 | 7,935 | 0 | **79,294** |
| ITC-SM1 | 6 | Balintawak | Quezon Ave. | 10,368 | 2,174 | 744 | 11 | 9 | 186 | 12 | 0 | 1,360 | 2 | **14,866** |
| | | **Sub-total** | | **64,104** | **4,300** | **5,647** | **27** | **4,999** | **2,882** | **1,658** | **1,246** | **9,295** | **2** | **94,160** |
| **Leg-3: from Quezon Ave. along West Ave.** | | | | | | | | | | | | | | |
| ITC-SM1 | 7 | Quezon Ave. | Balintawak | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-SM1 | 8 | Quezon Ave. | Quezon Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-SM1 | 9 | Quezon Ave. | Cubao | 8,913 | 2,053 | 616 | 0 | 0 | 0 | 2 | 0 | 1,543 | 0 | **13,126** |
| | | **Sub-total** | | **8,913** | **2,053** | **616** | **0** | **0** | **0** | **2** | **0** | **1,543** | **0** | **13,126** |
| **Leg-4: from Quezon Circle along North Ave.** | | | | | | | | | | | | | | |
| ITC-SM1 | 10 | Quezon Circle | Cubao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-SM1 | 11 | Quezon Circle | Quezon Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-SM1 | 12 | Quezon Circle | Balintawak | 16,164 | 2,808 | 987 | 0 | 4 | 467 | 174 | 72 | 2,639 | 1 | **23,316** |
| | | **Sub-total** | | **16,164** | **2,808** | **987** | **0** | **4** | **467** | **174** | **72** | **2,639** | **1** | **23,316** |
| **U-Trun Traffic** | | Name of Street | Location | | | | | | | | | | | |
| UTC-SM1 | 1 | EDSA | Trinoma U-Turn | 16,512 | 3,210 | 2,216 | 1 | 12 | 308 | 85 | 24 | 2,822 | 0 | **25,190** |
| UTC-SM1 | 2 | EDSA | SM Annex U-Turn | 16,382 | 2,100 | 894 | 2 | 14 | 367 | 34 | 5 | 2,158 | 2 | **21,957** |
| UTC-SM1 | 3 | North Avenue | SM U-Turn | 7,408 | 2,910 | 520 | 3 | 0 | 8 | 2 | 0 | 404 | 11 | **11,266** |
| **No. 3B North Ave./Mindanao Ave. Intersection** | | | | | | | | | | | | | | |
| **Leg-1: from Trinoma along Mindanao Ave. Ext.** | | | | | | | | | | | | | | |
| ITC-M1 | 1 | Trinoma | EDSA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ITC-M1 | 2 | Trinoma | Pagasa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ITC-M1 | 3 | Trinoma | Quezon Circle | 6,958 | 0 | 254 | 3 | 1 | 120 | 2 | 0 | 596 | 0 | 7,934 |
| | | **Sub-total** | | **6,958** | **0** | **254** | **3** | **1** | **120** | **2** | **0** | **596** | **0** | **7,934** |
| **Leg-2: from Pagasa along Mindanao Ave.** | | | | | | | | | | | | | | |
| ITC-M1 | 4 | Pagaasa | Quezon Circle | 8,229 | 40 | 1,373 | 1 | 24 | 1,050 | 1,548 | 375 | 4,480 | 226 | 17,344 |
| ITC-M1 | 5 | Pagaasa | Trinoma | 8,682 | 0 | 526 | 0 | 1 | 56 | 3 | 0 | 1,027 | 0 | 10,296 |
| ITC-M1 | 6 | Pagaasa | EDSA | 5,672 | 3,441 | 705 | 1 | 4 | 222 | 6 | 18 | 1,336 | 0 | 11,404 |
| | | **Sub-total** | | **14,354** | **3,441** | **1,232** | **1** | **5** | **278** | **9** | **18** | **2,363** | **0** | **21,700** |
| **Leg-3: from EDSA along North Ave.** | | | | | | | | | | | | | | |
| ITC-M1 | 7 | EDSA | Pagasa | 14,590 | 4,542 | 1,400 | 10 | 5 | 410 | 24 | 0 | 1,948 | 0 | 22,929 |
| ITC-M1 | 8 | EDSA | Quezon Circle | 8,601 | 1,914 | 1,218 | 3 | 13 | 646 | 134 | 28 | 1,596 | 0 | 14,153 |
| ITC-M1 | 9 | EDSA | Trinoma | 6,257 | 0 | 386 | 0 | 1 | 4 | 0 | 0 | 357 | 0 | 7,005 |
| | | **Sub-total** | | **14,858** | **1,914** | **1,603** | **3** | **14** | **650** | **134** | **28** | **1,953** | **0** | **21,158** |
| **Leg-4: from Quezon Circle along North Ave.** | | | | | | | | | | | | | | |
| ITC-M1 | 10 | Quezon Circle | Trinoma | 3,318 | 0 | 79 | 0 | 0 | 12 | 0 | 0 | 229 | 0 | 3,637 |
| ITC-M1 | 11 | Quezon Circle | EDSA | 8,286 | 2,312 | 530 | 1 | 20 | 360 | 171 | 67 | 2,153 | 0 | 13,901 |
| ITC-M1 | 12 | Quezon Circle | Pagasa | 6,685 | 94 | 799 | 16 | 7 | 995 | 1,097 | 627 | 3,256 | 266 | 13,843 |
| | | **Sub-total** | | **14,971** | **2,405** | **1,330** | **17** | **28** | **1,355** | **1,268** | **694** | **5,410** | **266** | **27,744** |
| **U-Turn Traffic** | | Name of Street | Location | | | | | | | | | | | |
| UTC-M1 | U 1 | North Ave. | Mindanao Ave. U-Turn | 748 | 412 | 53 | 1 | 1 | 21 | 2 | 2 | 201 | 211 | 1,651 |
| UTC-M1 | U 2 | North Ave. | VMMC U-Turn | 415 | 62 | 1 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 499 |

*Source: JICA Study Team*

## Table 3.1-5 Intersection Traffic Volume (AADT) (3/3)

| Staion Code | Flow No | Directional Flow | | Vehicle Types | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | Passenger Car | Passenger Jeepney | Goods Utility (Van) | Small Bus | Large Bus | Rigid 2-axle Truck | Rigid 3-axle or more Truck | Semi-Trailer Truck (3 or more axles) | Motorcycle | Tricycle | TOTAL |
| **No. 4 C-5/Kalayaan Intersection** | | | | | | | | | | | | | | |
| **Leg-1: from EDSA along Kalayaan** | | | | | | | | | | | | | | |
| ITC-K | 1 | EDSA | Global/SLEX | 1,116 | 2,161 | 130 | 1 | 11 | 71 | 78 | 6 | 636 | 0 | 4,209 |
| ITC-K | 2 | EDSA | Elevated U-Turn | 11,507 | 870 | 1,042 | 1 | 8 | 707 | 384 | 82 | 3,744 | 0 | 18,344 |
| **Sub-total** | | | | **12,623** | **3,031** | **1,172** | **1** | **19** | **778** | **461** | **88** | **4,379** | **0** | **22,552** |
| **Leg-2: from Global/SLEX along C-5** | | | | | | | | | | | | | | |
| ITC-K | 3 | Global/SLEX | Pasig/Quezon City | 35,418 | 2,813 | 4,800 | 15 | 117 | 3,096 | 2,450 | 902 | 12,762 | 0 | 62,372 |
| ITC-K | 5 | Global/SLEX | Pasig/Quezon City | 5,615 | 243 | 302 | 2 | 1 | 3 | 29 | 3 | 1,157 | 0 | 7,354 |
| **Sub-total** | | | | **44,512** | **3,879** | **5,549** | **17** | **140** | **3,402** | **3,048** | **964** | **15,164** | **0** | **76,674** |
| **Leg-3: from Pateros along Kalayaan Ave.** | | | | | | | | | | | | | | |
| ITC-K | 11 | Pateros | Pasig/Quezon City | 4,232 | 0 | 259 | 1 | 0 | 216 | 237 | 92 | 2,016 | 0 | 7,054 |
| ITC-K | 12 | Pateros | Elevated U-Turn | 4,282 | 820 | 623 | 2 | 10 | 338 | 310 | 166 | 2,424 | 0 | 8,973 |
| **Sub-total** | | | | **8,514** | **820** | **882** | **3** | **10** | **554** | **547** | **258** | **4,440** | **0** | **16,027** |
| **Leg-4: from Pasig/Quezon City along C-5** | | | | | | | | | | | | | | |
| ITC-K | 13 | Pasig/Quezon City | EDSA | 10,171 | 0 | 833 | 3 | 21 | 338 | 223 | 3 | 5,013 | 0 | 16,604 |
| ITC-K | 16 | Pasig/Quezon City | Global/SLEX | 39,255 | 0 | 4,268 | 19 | 62 | 3,164 | 2,257 | 851 | 10,382 | 0 | 60,257 |
| **Sub-total** | | | | **49,426** | **0** | **5,101** | **22** | **83** | **3,502** | **2,480** | **854** | **15,394** | **0** | **76,861** |
| **U-Turn Viaduct - 1 (South)** | | | | | | | | | | | | | | |
| ITC-K | 9 | Elevated U-Turn | Pateros | 6,765 | 628 | 761 | 0 | 0 | 333 | 391 | 84 | 2,225 | 0 | 11,187 |
| ITC-K | 10 | Elevated U-Turn | Pasig/Quezon City | 7,905 | 0 | 1,090 | 0 | 6 | 677 | 221 | 431 | 2,526 | 0 | 12,856 |
| **Sub-total** | | | | **14,670** | **628** | **1,851** | **0** | **6** | **1,011** | **611** | **514** | **4,751** | **0** | **24,043** |
| **U-Turn Viaduct - 2 (North)** | | | | | | | | | | | | | | |
| ITC-K | 18 | Elevated U-Turn | Global/SLEX | 4,582 | 93 | 306 | 1 | 9 | 301 | 240 | 92 | 2,087 | 0 | 7,713 |
| ITC-K | 19 | Elevated U-Turn | EDSA | 5,552 | 3,230 | 363 | 5 | 1 | 216 | 158 | 8 | 1,758 | 0 | 11,291 |
| **Sub-total** | | | | **10,134** | **3,323** | **669** | **6** | **10** | **518** | **398** | **100** | **3,845** | **0** | **19,004** |
| **Under U-Turn Viaduct** | | | | | | | | | | | | | | |
| ITC-K | 6 | Global/SLEX | Pateros | 3,479 | 823 | 447 | 1 | 23 | 302 | 569 | 60 | 1,245 | 0 | 6,949 |
| ITC-K | 4 | Global/SLEX | Elevated U-Turn | 5,893 | 2,053 | 112 | 0 | 1 | 197 | 44 | 1 | 1,327 | 0 | 9,627 |
| ITC-K | 17 | Pasig/Quezon City | Elevated U-Turn | 3,678 | 0 | 812 | 0 | 1 | 311 | 318 | 81 | 1,587 | 0 | 6,789 |
| **No. 5 C-5/Greem Meadows/Acropolis/Calle Industria Intersections** | | | | | | | | | | | | | | |
| **Leg-1: from Pasig along C-5** | | | | | | | | | | | | | | |
| ITC-G1 | 1 | Pasig | Greem Meadows | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-G1 | 2 | Pasig | Eastwood | 36,880 | 2,075 | 9,118 | 19 | 72 | 4,005 | 1,927 | 884 | 13,298 | 0 | **68,279** |
| **Sub-total** | | | | **36,880** | **2,075** | **9,118** | **19** | **72** | **4,005** | **1,927** | **884** | **13,298** | **0** | **68,279** |
| **Leg-2: from Cubao along C-5** | | | | | | | | | | | | | | |
| ITC-G1 | 3 | Calle Industrial | Pasig | 47,509 | 2,216 | 6,020 | 11 | 114 | 3,122 | 1,750 | 597 | 12,696 | 0 | **74,035** |
| ITC-G1 | 4 | C5 | Greem Meadows | 6,903 | 0 | 550 | 0 | 1 | 7 | 12 | 1 | 1,319 | 0 | **8,792** |
| **Sub-total** | | | | **54,411** | **2,216** | **6,570** | **11** | **115** | **3,128** | **1,761** | **598** | **14,015** | **0** | **82,826** |
| **Leg-3: from Ortigas along Green Meadows** | | | | | | | | | | | | | | |
| ITC-G1 | 5 | Greem Meadows | Eastwood | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| ITC-G1 | 6 | Greem Meadows | C5 | 7,355 | 0 | 187 | 6 | 1 | 1 | 4 | 0 | 959 | 0 | **8,513** |
| **Sub-total** | | | | **7,355** | **0** | **187** | **6** | **1** | **1** | **4** | **0** | **959** | **0** | **8,513** |
| **Leg-4: from Cainta along Calle Industria** | | | | | | | | | | | | | | |
| ITC-G2 | 7 | C5 | Calle Industrial | 7,830 | 308 | 1,072 | 5 | 14 | 486 | 168 | 85 | 2,929 | 2 | 12,900 |
| ITC-G2 | 8 | Calle Industrial | C5 | 6,136 | 325 | 1,346 | 0 | 11 | 585 | 406 | 179 | 2,637 | 2 | 11,627 |
| **Sub-total** | | | | **13,966** | **633** | **2,419** | **5** | **25** | **1,071** | **575** | **263** | **5,566** | **5** | **24,527** |
| **Leg-5: from Acropolis along Poseidon** | | | | | | | | | | | | | | |
| ITC-G3 | 9 | C5 | Acropolis | 1,075 | 0 | 81 | 0 | 1 | 11 | 1 | 0 | 186 | 0 | 1,355 |
| ITC-G3 | 10 | Acropolis | C5 | 1,066 | 0 | 124 | 0 | 0 | 4 | 0 | 0 | 205 | 0 | 1,399 |
| **Sub-total** | | | | **2,141** | **0** | **205** | **0** | **1** | **15** | **1** | **0** | **391** | **0** | **2,754** |
| **Leg-6: from Global One along Eastwood Ave.** | | | | | | | | | | | | | | |
| ITC-G4 | 11 | C5 | Eastwood | 7,414 | 0 | 200 | 6 | 16 | 2 | 0 | 0 | 1,045 | 0 | 8,681 |
| ITC-G4 | 12 | Eastwood | C5 | 9,817 | 0 | 266 | 0 | 2 | 0 | 0 | 0 | 1,010 | 0 | 11,096 |
| **Sub-total** | | | | **17,231** | **0** | **466** | **6** | **18** | **2** | **0** | **0** | **2,055** | **0** | **19,777** |
| **U-Trun Traffic** | | Name of Street | Location | | | | | | | | | | | |
| UTC-G1 | 1 | Eastwood | Greem Meadows U-Turn | 8,412 | 282 | 823 | 2 | 2 | 87 | 0 | 1 | 1,082 | 2 | 10,693 |
| UTC-G2 | 2 | Pasig | Eastwood U-Turn | 16,424 | 25 | 930 | 0 | 0 | 1 | 0 | 0 | 2,105 | 0 | 19,486 |

*Source: JICA Study Team*

### 3.1.3 Number Plate Vehicle Movement Survey

#### (1) Method of Survey

Since most of left turn and straight movements that cross main road are prohibited at the project intersections, these traffics are obliged to make right turn and pass U-turn slots provided at median along main road. Volumes of straight traffic along main road and right turn traffic observed by the intersection traffic survey include straight traffics and left turn traffics and these traffics from crossing road has to be segregated from observed traffic to have actual traffic movements.

The number plate vehicle movement survey that traces movement of vehicles by tracking plate numbers was conducted to capture actual traffic volume of left-turn and straight traffic. Number plate of vehicles that pass strategic locations of the intersections such as right turn corners and U-turn slots are recorded and number matching between survey spots was done to trace movement of each vehicle.

Vehicle categories are simplified into following six vehicle types rather than 10 to avoid extensive number matching works that may lead to accumulation of errors.

1) Car
2) Jeepney
3) Pickup
4) Bus
5) Truck
6) Motorcycle

Public utility vehicles such as jeepneys and buses were not included in the vehicle plate survey because these vehicles pass pre-identified routes designated by the Land Transportation Franchising and Regulatory Board (LTFRB) and these pre-determined routes were confirmed during the reconnaissance survey. The number plate survey was carried out for two consecutive days simultaneously with intersection and U-turn traffic count surveys. The number plate survey was undertaken for two hours each during following time period;

7:00 to 9:00AM,

12:00NN to 2:00PM and

4:00 to 6:00PM.

**(2) Result of Survey**

The identified traffic volumes through number plate survey were segregated from directional traffic volumes observed by intersection traffic volume survey and compiled as a form of Origin and Destination (OD) Matrix that will be used for micro-simulation of the intersections during analysis stage. OD matrices of six hour total for each intersection are shown in **Table 3.1-6** to **Table 3.1-9** while OD matrices of AM peak, Noon Time and PM peak is shown in **Appendix 3-2**.

Number plate survey was not conducted at C-5/Kalayaan Intersection because the interchange is not part of the preliminary engineering design and micro-simulation analysis is not needed.

### 3.1.4 Intersection Queue Length Survey

**(1) Method of Survey**

The queuing length survey was conducted for each intersection interchange during;

7:00 to 9:00AM,

12:00NN to 2:00PM and

4:00 to 6:00PM.

This survey was conducted simultaneously with number plate survey for two consecutive days. Queue length was measured every ten minutes for the longest queue among the identified lane.

**(2) Result of the Survey**

**Figure 3.1-7** to **Figure 3.1-12** show summary of queue length survey of each intersection together with diagrams that graphically show maximum average queue length observed during the two-day survey period.

## Table 3.1-6 Origin and Destination Traffic of C-3/E. Rodriguez Intersection

**Intersection Name: C-3/E. Rodriguez** (6 Hour Total : 7:00-9:00AM + 12:00NN-2:00PM + 4:00-6:00PM)

Vehicle Type: Car

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 6 | 60 | 10 | 24 | 76 | 176 |
| | B | 6 | | 694 | 5,714 | 12 | 740 | 7,166 |
| | C | 40 | 1,288 | | 68 | 50 | 3,912 | 5,358 |
| | D | 6 | 3,904 | 1,674 | | 6 | 372 | 5,962 |
| | E | 52 | 6 | 52 | 10 | | 224 | 344 |
| | F | 18 | 264 | 2,430 | 416 | 58 | | 3,186 |
| | Total | 122 | 5,468 | 4,910 | 6,218 | 150 | 5,324 | 22,192 |

Vehicle Type: Jeepney

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 0 | 968 | 0 | 12 | 980 |
| | C | 0 | 8 | | 0 | 0 | 410 | 418 |
| | D | 0 | 1,038 | 6 | | 0 | 0 | 1,044 |
| | E | 0 | 0 | 0 | 0 | | 0 | 0 |
| | F | 0 | 0 | 360 | 20 | 0 | | 380 |
| | Total | 0 | 1,046 | 366 | 988 | 0 | 422 | 2,822 |

Vehicle Type: Utility Vehicle

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 12 | 0 | 10 | 10 | 32 |
| | B | 6 | | 82 | 448 | 2 | 116 | 654 |
| | C | 6 | 86 | | 34 | 6 | 338 | 470 |
| | D | 2 | 288 | 212 | | 0 | 88 | 590 |
| | E | 10 | 0 | 22 | 0 | | 32 | 64 |
| | F | 2 | 22 | 422 | 28 | 22 | | 496 |
| | Total | 26 | 396 | 750 | 510 | 40 | 584 | 2,306 |

Vehicle Type: Bus

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 0 | 0 | 2 | 0 | 2 |
| | B | 0 | | 0 | 28 | 0 | 0 | 28 |
| | C | 0 | 4 | | 0 | 0 | 18 | 22 |
| | D | 0 | 20 | 2 | | 0 | 0 | 22 |
| | E | 0 | 0 | 0 | 0 | | 0 | 0 |
| | F | 0 | 0 | 4 | 0 | 0 | | 4 |
| | Total | 0 | 24 | 6 | 28 | 2 | 18 | 78 |

Vehicle Type: Trucks

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 0 | 0 | 0 | 4 | 4 |
| | B | 0 | | 16 | 110 | 0 | 32 | 158 |
| | C | 0 | 40 | | 2 | 0 | 194 | 236 |
| | D | 0 | 44 | 52 | | 0 | 14 | 110 |
| | E | 2 | 0 | 6 | 0 | | 4 | 12 |
| | F | 0 | 8 | 198 | 2 | 6 | | 214 |
| | Total | 2 | 92 | 272 | 114 | 6 | 248 | 734 |

Vehicle Type: Motorcycle

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 74 | 6 | 130 | 70 | 280 |
| | B | 16 | | 58 | 1,072 | 46 | 362 | 1,554 |
| | C | 96 | 336 | | 0 | 278 | 2,106 | 2,816 |
| | D | 16 | 940 | 186 | | 38 | 284 | 1,464 |
| | E | 178 | 4 | 258 | 14 | | 312 | 766 |
| | F | 74 | 34 | 3,516 | 176 | 282 | | 4,082 |
| | Total | 380 | 1,314 | 4,092 | 1,268 | 774 | 3,134 | 10,962 |

Vehicle Type: All

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 6 | 146 | 16 | 166 | 160 | 494 |
| | B | 28 | | 850 | 8,340 | 60 | 1,262 | 10,540 |
| | C | 142 | 1,762 | | 104 | 334 | 6,978 | 9,320 |
| | D | 24 | 6,234 | 2,132 | | 44 | 758 | 9,192 |
| | E | 242 | 10 | 338 | 24 | | 572 | 1,186 |
| | F | 94 | 328 | 6,930 | 642 | 368 | | 8,362 |
| | Total | 530 | 8,340 | 10,396 | 9,126 | 972 | 9,730 | 39,094 |

*Source: JICA Study Team*

## Table 3.1-7 Origin and Destination Traffic of EDSA/Roosevelt/ Congressional Intersection

**No.2 EDSA/Roosevelt/Congressional (6 Hour Total: 7:00_9:00AM + 12:00NN_2:00PM + 4:00_6:00PM)**

Vehicle Type: **Car**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 38 | 32 | 468 | 538 |
| | B | 0 | | 226 | 248 | 2,816 | 3,290 |
| | C | 464 | 1,778 | | 218 | 4,532 | 6,992 |
| | D | 0 | 196 | 808 | | 112 | 1,116 |
| | E | 0 | 278 | 5,244 | 692 | | 6,214 |
| | Total | 464 | 2,252 | 6,316 | 1,190 | 7,928 | 18,150 |

Vehicle Type: **Jeepney**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 10 | 4 | 84 | 98 |
| | B | 0 | | 24 | 526 | 322 | 872 |
| | C | 92 | 420 | | 4 | 678 | 1,194 |
| | D | 0 | 526 | 380 | | 28 | 934 |
| | E | 0 | 16 | 748 | 184 | | 948 |
| | Total | 92 | 962 | 1,162 | 718 | 1,112 | 4,046 |

Vehicle Type: **Utility Vehicle**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 60 | 28 | 314 | 402 |
| | B | 0 | | 300 | 378 | 1,680 | 2,358 |
| | C | 340 | 2,238 | | 114 | 3,594 | 6,286 |
| | D | 0 | 418 | 1,126 | | 146 | 1,690 |
| | E | 0 | 268 | 4,370 | 692 | | 5,330 |
| | Total | 340 | 2,924 | 5,856 | 1,212 | 5,734 | 16,066 |

Vehicle Type: **Bus**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 150 | 0 | 0 | 150 |
| | C | 4 | 134 | | 0 | 812 | 950 |
| | D | 0 | 0 | 0 | | 0 | 0 |
| | E | 0 | 0 | 954 | 0 | | 954 |
| | Total | 4 | 134 | 1,104 | 0 | 812 | 2,054 |

Vehicle Type: **Trucks**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 2 | 2 | 18 | 22 |
| | B | 0 | | 8 | 12 | 122 | 142 |
| | C | 12 | 34 | | 12 | 226 | 284 |
| | D | 0 | 10 | 7 | | 0 | 17 |
| | E | 0 | 28 | 61 | 46 | | 135 |
| | Total | 12 | 72 | 78 | 72 | 366 | 600 |

Vehicle Type: **Motorcycle**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 12 | 10 | 148 | 170 |
| | B | 0 | | 82 | 68 | 900 | 1,050 |
| | C | 114 | 492 | | 70 | 208 | 884 |
| | D | 0 | 38 | 398 | | 24 | 460 |
| | E | 0 | 42 | 366 | 626 | | 1,034 |
| | Total | 114 | 572 | 858 | 774 | 1,280 | 3,598 |

Vehicle Type: **All**

| OD Code | | Destination | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| Origin | A | | 0 | 122 | 76 | 1,032 | 1,230 |
| | B | 0 | | 790 | 1,232 | 5,840 | 7,862 |
| | C | 1,026 | 5,096 | | 418 | 10,050 | 16,590 |
| | D | 0 | 1,188 | 2,719 | | 310 | 4,217 |
| | E | 0 | 632 | 11,743 | 2,240 | | 14,615 |
| | Total | 1,026 | 6,916 | 15,374 | 3,966 | 17,232 | 44,514 |

*Source: JICA Study Team*

## Table 3.1-8 Origin and Destination Traffic of EDSA/North/West/Mindanao Intersection

**No.3 EDSA/North/West/Mindanao Avenue (6 Hour Total_7:00_9:00AM + 12:00NN_2:00PM + 4:00_6:00PM)**

Vehicle type: **Car**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 29 | 27 | 18 | 18 | 146 | 106 | 1,610 | 1,954 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 170 | 54 | | 2,832 | 1,722 | 145 | 390 | 33 | 618 | 5,963 |
| | D | 161 | 802 | 1,875 | | 1,067 | 198 | 440 | 324 | 842 | 5,707 |
| | E | 0 | 0 | 42 | 1,895 | | 0 | 0 | 0 | 0 | 1,937 |
| | F | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | G | 3,026 | 316 | 3,160 | 2,203 | 0 | 734 | | 261 | 14,036 | 23,734 |
| | H | 127 | 78 | 65 | 39 | 36 | 36 | 2,592 | | 54 | 3,026 |
| | I | 0 | 0 | 329 | 453 | 0 | 432 | 9,801 | 2,025 | | 13,039 |
| | Total | 3,483 | 1,249 | 5,499 | 7,449 | 2,843 | 1,562 | 13,368 | 2,748 | 17,159 | 55,359 |

Vehicle Type: **Jeepney**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 0 | 0 | | 0 | 0 | 510 | 0 | 707 | 0 | 1,217 |
| | D | 0 | 0 | 0 | | 0 | 510 | 0 | 0 | 0 | 510 |
| | E | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| | F | 0 | 0 | 88 | 676 | 0 | | 0 | 0 | 290 | 1,053 |
| | G | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| | H | 0 | 0 | 620 | 0 | 0 | 0 | 0 | | 0 | 620 |
| | I | 0 | 0 | 0 | 0 | 0 | 402 | 0 | 0 | | 402 |
| | Total | 0 | 0 | 708 | 676 | 0 | 1,422 | 0 | 707 | 290 | 3,801 |

Vehicle Type: **Utility Vehicle**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 10 | 9 | 8 | 8 | 82 | 38 | 684 | 838 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 16 | 13 | | 432 | 360 | 52 | 192 | 16 | 317 | 1,396 |
| | D | 7 | 101 | 224 | | 66 | 16 | 19 | 14 | 35 | 480 |
| | E | 0 | 0 | 19 | 71 | | 0 | 0 | 0 | 0 | 90 |
| | F | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | G | 25 | 32 | 422 | 279 | 0 | 32 | | 58 | 144 | 990 |
| | H | 34 | 12 | 14 | 9 | 2 | 2 | 182 | | 14 | 267 |
| | I | 0 | 0 | 104 | 90 | 0 | 29 | 1,057 | 181 | | 1,461 |
| | Total | 80 | 157 | 792 | 889 | 436 | 138 | 1,531 | 306 | 1,193 | 5,521 |

Vehicle Type: **Bus**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | D | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| | E | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| | F | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | G | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 1,441 | 1,441 |
| | H | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| | I | 0 | 0 | 0 | 0 | 0 | 0 | 1,508 | 0 | | 1,508 |
| | Total | 0 | 0 | 0 | 0 | 0 | 0 | 1,508 | 0 | 1,441 | 2,949 |

Vehicle Type: **Trucks**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 1 | 1 | 9 | 9 | 8 | 2 | 46 | 75 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 3 | 2 | | 385 | 38 | 9 | 8 | 3 | 14 | 460 |
| | D | 11 | −1 | 398 | | 4 | 3 | 28 | 18 | 44 | 504 |
| | E | 0 | 0 | 3 | 23 | | 0 | 0 | 0 | 0 | 25 |
| | F | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | G | 44 | 17 | 143 | 95 | 0 | 5 | | 4 | 223 | 530 |
| | H | 0 | 0 | 0 | 0 | 0 | 0 | 39 | | 0 | 39 |
| | I | 0 | 0 | 31 | 23 | 0 | 1 | 642 | 0 | | 695 |
| | Total | 58 | 18 | 575 | 526 | 51 | 26 | 723 | 25 | 327 | 2,327 |

Vehicle Type: **Motorcycle**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 4 | 3 | 2 | 2 | 19 | 16 | 316 | 361 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 48 | 18 | | 1,978 | 495 | 3 | 137 | 9 | 204 | 2,890 |
| | D | 59 | 138 | 1,005 | | 78 | 4 | 71 | 123 | 339 | 1,814 |
| | E | 0 | 0 | 7 | 204 | | 0 | 0 | 0 | 0 | 211 |
| | F | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | G | 23 | 32 | 732 | 512 | 0 | 43 | | 10 | 177 | 1,528 |
| | H | 6 | 5 | 11 | 6 | 3 | 1 | 501 | | 3 | 535 |
| | I | 0 | 0 | 45 | 58 | 0 | 20 | 2,305 | 378 | | 2,805 |
| | Total | 135 | 192 | 1,802 | 2,760 | 577 | 72 | 3,033 | 536 | 1,038 | 10,143 |

Vehicle Type: **All**

| OD Code | | Destination | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | |
| Origin | A | | 0 | 43 | 40 | 37 | 37 | 255 | 162 | 2,655 | 3,228 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C | 236 | 86 | | 5,626 | 2,614 | 718 | 727 | 767 | 1,153 | 11,925 |
| | D | 237 | 1,040 | 3,500 | | 1,214 | 730 | 557 | 478 | 1,259 | 9,015 |
| | E | 0 | 0 | 70 | 2,192 | | 0 | 0 | 0 | 0 | 2,262 |
| | F | 0 | 0 | 88 | 676 | 0 | | 0 | 0 | 290 | 1,053 |
| | G | 3,116 | 396 | 4,457 | 3,089 | 0 | 814 | | 331 | 16,020 | 28,222 |
| | H | 167 | 94 | 709 | 54 | 41 | 39 | 3,313 | | 71 | 4,486 |
| | I | 0 | 0 | 508 | 623 | 0 | 883 | 15,312 | 2,584 | | 19,909 |
| | Total | 3,756 | 1,615 | 9,375 | 12,299 | 3,906 | 3,220 | 20,163 | 4,321 | 21,446 | 80,099 |

*Source: JICA Study Team*

## Table 3.1-9 Origin and Destination Traffic of C-5/Green Meadows Intersection

**No.4 C-5/Greenmeadows** (6 Hour Total : 7:00-9:00AM + 12:00NN-2:00PM + 4:00-6:00PM)

Vehicle Type: Car

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 238 | 88 | 0 | 2,648 | 2,974 |
| | B | 0 | | 288 | 134 | 18 | 1,768 | 2,208 |
| | C | 2,324 | 1,972 | | 510 | 104 | 8,094 | 13,004 |
| | D | 64 | 108 | 1,888 | | 0 | 216 | 2,276 |
| | E | 0 | 0 | 320 | 0 | | 0 | 320 |
| | F | 0 | 138 | 14,982 | 1,982 | 374 | | 17,476 |
| | Total | 2,388 | 2,218 | 17,716 | 2,714 | 496 | 12,726 | 38,258 |
| | | | | | | | | 38,258 |

Vehicle Type: Jeepney

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 0 | 0 | 0 | 122 | 122 |
| | C | 0 | 106 | | 0 | 0 | 620 | 726 |
| | D | 0 | 0 | 0 | | 0 | 0 | 0 |
| | E | 0 | 0 | 0 | 0 | | 0 | 0 |
| | F | 0 | 0 | 800 | 0 | 0 | | 800 |
| | Total | 0 | 106 | 800 | 0 | 0 | 742 | 1,648 |
| | | | | | | | | 1,648 |

Vehicle Type: Utility Vehicle

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 8 | 2 | 0 | 80 | 90 |
| | B | 0 | | 38 | 12 | 6 | 444 | 500 |
| | C | 60 | 472 | | 2 | 24 | 2,322 | 2,880 |
| | D | 0 | 0 | 48 | | 0 | 6 | 54 |
| | E | 0 | 0 | 50 | 0 | | 0 | 50 |
| | F | 0 | 18 | 1,964 | 192 | 28 | | 2,202 |
| | Total | 60 | 490 | 2,108 | 208 | 58 | 2,852 | 5,776 |
| | | | | | | | | 5,776 |

Vehicle Type: Bus

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 0 | 0 | 0 | 0 | 0 |
| | C | 0 | 0 | | 0 | 0 | 28 | 28 |
| | D | 0 | 0 | 0 | | 0 | 0 | 0 |
| | E | 0 | 0 | 0 | 0 | | 0 | 0 |
| | F | 0 | 0 | 54 | 0 | 0 | | 54 |
| | Total | 0 | 0 | 54 | 0 | 0 | 28 | 82 |
| | | | | | | | | 82 |

Vehicle Type: Trucks

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | 0 | | 6 | 2 | 2 | 286 | 296 |
| | C | 0 | 286 | | 2 | 14 | 1,434 | 1,736 |
| | D | 0 | 0 | 2 | | 0 | 0 | 2 |
| | E | 0 | 0 | 2 | 0 | | 0 | 2 |
| | F | 0 | 14 | 1,256 | 6 | 6 | | 1,282 |
| | Total | 0 | 300 | 1,266 | 10 | 22 | 1,720 | 3,318 |
| | | | | | | | | 3,318 |

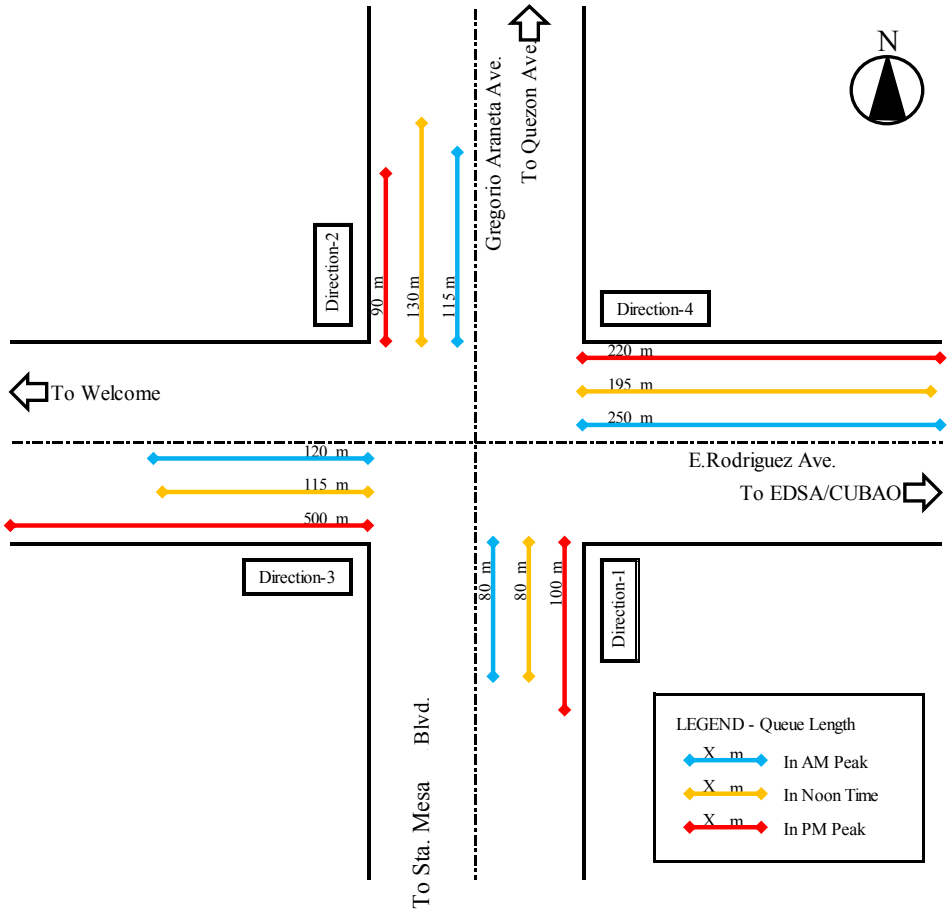
Vehicle Type: Motorcycle

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 26 | 10 | 0 | 292 | 328 |
| | B | 0 | | 34 | 6 | 10 | 924 | 974 |
| | C | 326 | 948 | | 12 | 32 | 2,756 | 4,074 |
| | D | 8 | 26 | 216 | | 0 | 26 | 276 |
| | E | 0 | 0 | 72 | 0 | | 0 | 72 |
| | F | 0 | 16 | 4,390 | 498 | 72 | | 4,976 |
| | Total | 334 | 990 | 4,738 | 526 | 114 | 3,998 | 10,700 |

Vehicle Type: All

| OD Code | | Destination | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | |
| Origin | A | | 0 | 272 | 100 | 0 | 3,020 | 3,392 |
| | B | 0 | | 366 | 154 | 36 | 3,544 | 4,100 |
| | C | 2,710 | 3,784 | | 526 | 174 | 15,254 | 22,448 |
| | D | 72 | 134 | 2,154 | | 0 | 248 | 2,608 |
| | E | 0 | 0 | 444 | 0 | | 0 | 444 |
| | F | 0 | 186 | 23,446 | 2,678 | 480 | | 26,790 |
| | Total | 2,782 | 4,104 | 26,682 | 3,458 | 690 | 22,066 | 59,782 |

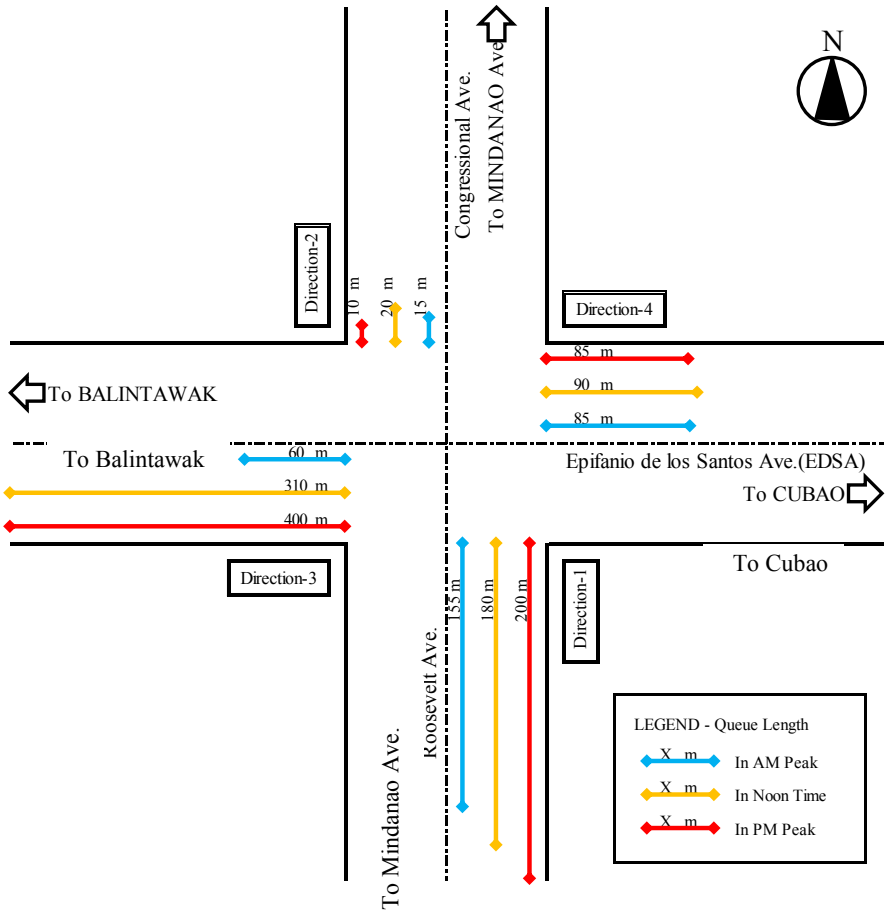
*Source: JICA Study Team*




| | | | Direction-1 | | | | | | | | | | | | Direction-2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 8 Dec. | 40 | 50 | 30 | 80 | 70 | 80 | 50 | 70 | 40 | 40 | 40 | 100 | 60 | 70 | 120 | 140 | 70 | 90 | 70 | 100 | 80 | 50 | 110 | 140 |
| | | 9 Dec. | 50 | 50 | 40 | 60 | 70 | 70 | 50 | 50 | 50 | 80 | 40 | 60 | 90 | 60 | 70 | 90 | 80 | 80 | 80 | 70 | 80 | 60 | 60 | 70 |
| | | Avg. | 45 | 50 | 35 | 70 | 70 | 75 | 50 | 60 | 45 | 60 | 40 | 80 | 75 | 65 | 95 | 115 | 75 | 85 | 75 | 85 | 80 | 55 | 85 | 105 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 8 Dec. | 40 | 70 | 100 | 40 | 40 | 50 | 70 | 50 | 110 | 40 | 100 | 30 | 70 | 70 | 70 | 80 | 70 | 60 | 100 | 70 | 130 | 80 | 90 | 100 |
| | | 9 Dec. | 50 | 40 | 50 | 50 | 40 | 80 | 50 | 70 | 50 | 70 | 60 | 60 | 70 | 70 | 70 | 80 | 70 | 60 | 100 | 70 | 130 | 80 | 90 | 100 |
| | | Avg. | 45 | 55 | 75 | 45 | 40 | 65 | 60 | 60 | 80 | 55 | 80 | 45 | 70 | 70 | 70 | 80 | 70 | 48 | 100 | 70 | 130 | 80 | 90 | 100 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 8 Dec. | 40 | 60 | 50 | 50 | 60 | 150 | 80 | 40 | 50 | 70 | 120 | 80 | 70 | 80 | 50 | 70 | 50 | 90 | 60 | 90 | 110 | 80 | 70 | 50 |
| | | 9 Dec. | 50 | 100 | 80 | 90 | 70 | 50 | 40 | 50 | 40 | 50 | 70 | 80 | 60 | 80 | 120 | 80 | 60 | 50 | 70 | 80 | 70 | 50 | 60 | 70 |
| | | Avg. | 45 | 80 | 65 | 70 | 65 | 100 | 60 | 45 | 45 | 60 | 95 | 80 | 65 | 80 | 85 | 75 | 55 | 70 | 65 | 85 | 90 | 65 | 65 | 60 |
| | | | Direction-3 | | | | | | | | | | | | Direction-4 | | | | | | | | | | | |
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 8 Dec. | 70 | 110 | 120 | 110 | 130 | 100 | 130 | 130 | 110 | 100 | 100 | 100 | 60 | 120 | 140 | 150 | 200 | 200 | 200 | 300 | 200 | 200 | 300 | 300 |
| | | 9 Dec. | 110 | 110 | 120 | 120 | 110 | 90 | 110 | 100 | 130 | 90 | 110 | 100 | 170 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | Avg. | 90 | 110 | 120 | 115 | 120 | 95 | 120 | 115 | 120 | 95 | 105 | 100 | 115 | 160 | 170 | 175 | 200 | 200 | 200 | 250 | 200 | 200 | 250 | 250 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 8 Dec. | 70 | 110 | 110 | 120 | 100 | 110 | 120 | 110 | 100 | 100 | 90 | 80 | 90 | 140 | 200 | 300 | 100 | 200 | 100 | 150 | 100 | 150 | 100 | 100 |
| | | 9 Dec. | 110 | 90 | 100 | 100 | 80 | 110 | 110 | 100 | 120 | 100 | 100 | 120 | 150 | 100 | 120 | 90 | 80 | 110 | 60 | 100 | 90 | 50 | 90 | 70 |
| | | Avg. | 90 | 100 | 105 | 110 | 90 | 110 | 115 | 105 | 110 | 100 | 95 | 100 | 120 | 120 | 160 | 195 | 90 | 155 | 80 | 125 | 95 | 100 | 95 | 85 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 8 Dec. | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 120 | 150 | 100 | 70 | 90 | 130 | 150 | 200 | 200 | 300 | 300 | 300 |
| | | 9 Dec. | 130 | 90 | 90 | 100 | 130 | 90 | 100 | 100 | 300 | 500 | 200 | 300 | 90 | 200 | 150 | 90 | 100 | 90 | 90 | 100 | 200 | 100 | 140 | 130 |
| | | Avg. | 315 | 295 | 295 | 300 | 315 | 295 | 300 | 300 | 400 | 500 | 350 | 400 | 105 | 175 | 125 | 80 | 95 | 110 | 120 | 150 | 200 | 200 | 220 | 215 |

*Source: JICA Study Team*

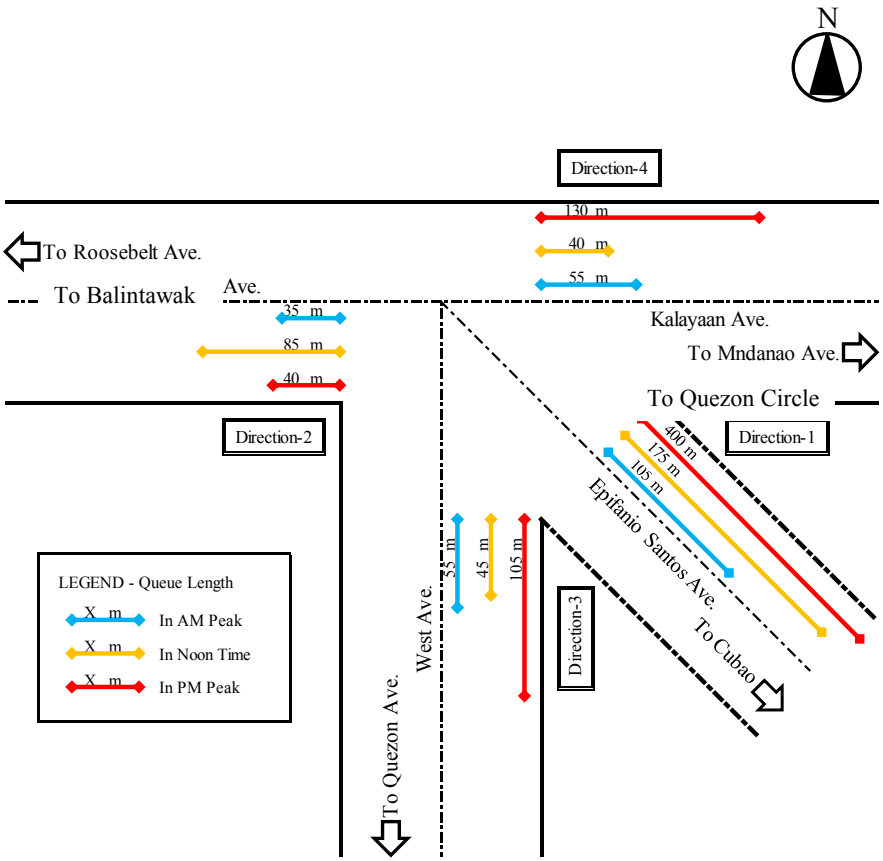
**Figure 3.1-7 Result of Queue Length Survey at C-3/E. Rodriguez Intersection**




| | | | Direction-1 | | | | | | | | | | | | Direction-2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | Day-1 | 40 | 50 | 160 | 140 | 140 | 170 | 160 | 160 | 160 | 190 | 150 | 120 | 0 | 10 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 20 | 0 | 10 |
| | | Day-2 | 130 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 120 | 120 | 100 | 100 | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 0 |
| | | Avg. | 85 | 75 | 130 | 120 | 120 | 135 | 130 | 130 | 140 | 155 | 125 | 110 | 0 | 5 | 5 | 5 | 5 | 0 | 5 | 0 | 0 | 15 | 5 | 5 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | Day-1 | 160 | 160 | 140 | 190 | 180 | 230 | 210 | 150 | 130 | 160 | 170 | 160 | 0 | 10 | 0 | 0 | 20 | 10 | 0 | 10 | 10 | 10 | 0 | 10 |
| | | Day-2 | 80 | 100 | 150 | 150 | 150 | 100 | 150 | 150 | 70 | 100 | 100 | 100 | 0 | 30 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 10 | 0 |
| | | Avg. | 120 | 130 | 145 | 170 | 165 | 165 | 180 | 150 | 100 | 130 | 135 | 130 | 0 | 20 | 0 | 0 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | Day-1 | 180 | 150 | 160 | 160 | 200 | 190 | 230 | 190 | 230 | 230 | 250 | 300 | 10 | 10 | 0 | 10 | 20 | 0 | 0 | 10 | 0 | 10 | 20 | 10 |
| | | Day-2 | 100 | 70 | 70 | 70 | 70 | 70 | 50 | 70 | 70 | 100 | 100 | 100 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Avg. | 140 | 110 | 115 | 115 | 135 | 130 | 140 | 130 | 150 | 165 | 175 | 200 | 5 | 5 | 0 | 10 | 10 | 0 | 0 | 5 | 0 | 5 | 10 | 5 |
| | | | Direction-3 | | | | | | | | | | | | Direction-4 | | | | | | | | | | | |
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | Day-1 | 20 | 50 | 50 | 60 | 50 | 100 | 100 | 60 | 30 | 30 | 20 | 40 | 90 | 80 | 90 | 70 | 70 | 90 | 100 | 100 | 90 | 100 | 80 | 90 |
| | | Day-2 | 40 | 30 | 20 | 20 | 30 | 20 | 0 | 0 | 30 | 0 | 20 | 0 | 50 | 60 | 50 | 40 | 60 | 80 | 50 | 60 | 50 | 60 | 70 | 70 |
| | | Avg. | 30 | 40 | 35 | 40 | 40 | 60 | 50 | 30 | 30 | 15 | 20 | 20 | 70 | 70 | 70 | 55 | 65 | 85 | 75 | 80 | 70 | 80 | 75 | 80 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | Day-1 | 20 | 50 | 20 | 20 | 30 | 20 | 40 | 0 | 120 | 50 | 40 | 50 | 90 | 70 | 70 | 80 | 100 | 80 | 70 | 70 | 60 | 50 | 60 | 50 |
| | | Day-2 | 30 | 120 | 500 | 110 | 0 | 140 | 0 | 200 | 500 | 300 | 500 | 500 | 90 | 70 | 60 | 70 | 60 | 80 | 60 | 70 | 60 | 50 | 50 | 60 |
| | | Avg. | 25 | 85 | 260 | 65 | 15 | 80 | 20 | 100 | 310 | 175 | 270 | 275 | 90 | 70 | 65 | 75 | 80 | 80 | 65 | 70 | 60 | 50 | 55 | 55 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | Day-1 | 50 | 40 | 30 | 60 | 30 | 40 | 30 | 120 | 0 | 40 | 80 | 300 | 50 | 50 | 70 | 90 | 100 | 80 | 80 | 90 | 70 | 90 | 100 | 90 |
| | | Day-2 | 500 | 500 | 500 | 500 | 200 | 0 | 0 | 30 | 30 | 200 | 0 | 500 | 90 | 80 | 60 | 60 | 70 | 60 | 80 | 70 | 60 | 80 | 50 | 60 |
| | | Avg. | 275 | 270 | 265 | 280 | 115 | 20 | 15 | 75 | 15 | 120 | 40 | 400 | 70 | 65 | 65 | 75 | 85 | 70 | 80 | 80 | 65 | 85 | 75 | 75 |

*Source: JICA Study Team*

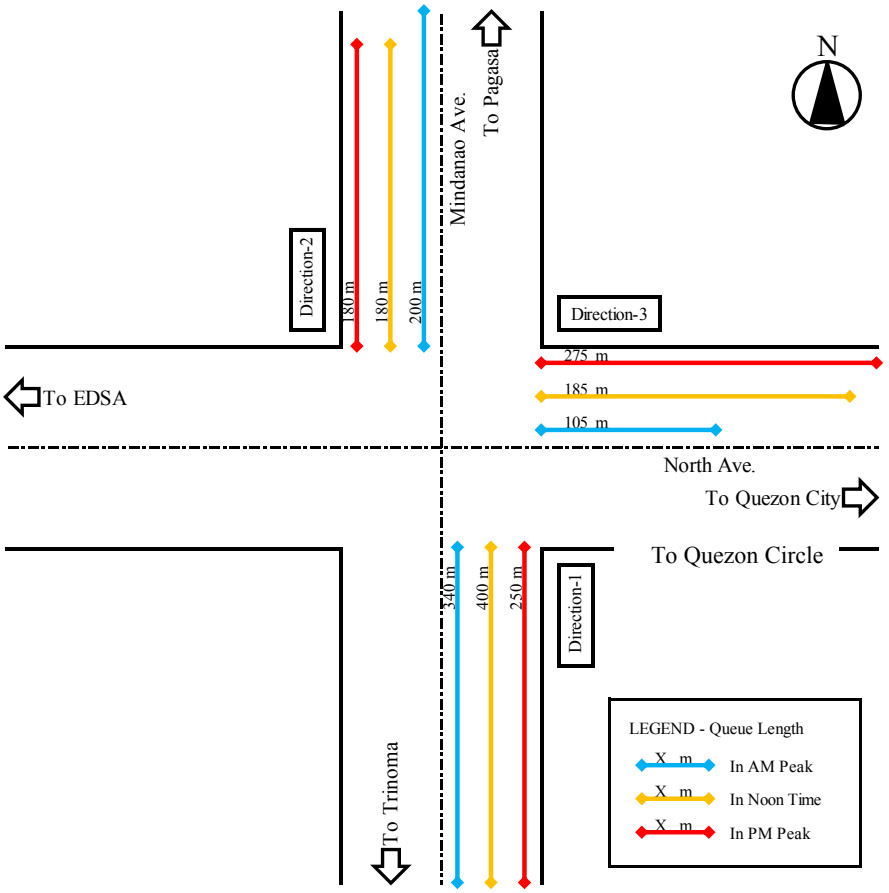
**Figure 3.1-8 Result of Queue Length Survey at EDSA/Roosevelt Intersection**




| | | | Direction-1 | | | | | | | | | | | | Direction-2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 20 | 20 | 0 | 30 | 20 | 20 | 30 | 20 | 0 | 0 | 20 | 20 | 20 | 0 | 40 | 30 | 0 | 0 | 20 | 0 | 20 | 0 | 0 | 0 |
| | | 7 Dec. | 30 | 20 | 80 | 180 | 30 | 20 | 20 | 0 | 0 | 20 | 20 | 30 | 50 | 20 | 20 | 30 | 20 | 20 | 20 | 30 | 20 | 20 | 50 | 20 |
| | | Avg. | 25 | 20 | 40 | 105 | 25 | 20 | 25 | 10 | 0 | 10 | 20 | 25 | 35 | 10 | 30 | 30 | 10 | 10 | 20 | 15 | 20 | 10 | 25 | 10 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 30 | 0 | 80 | 40 | 0 | 40 | 100 | 150 | 60 | 0 | 60 | 0 | 30 | 20 | 30 | 0 | 20 | 20 | 150 | 90 | 150 | 140 | 150 | 50 |
| | | 7 Dec. | 0 | 50 | 100 | 100 | 100 | 150 | 100 | 200 | 100 | 100 | 50 | 50 | 20 | 50 | 20 | 30 | 30 | 20 | 20 | 20 | 20 | 20 | 20 | 40 |
| | | Avg. | 15 | 25 | 90 | 70 | 50 | 95 | 100 | 175 | 80 | 50 | 55 | 25 | 25 | 35 | 25 | 15 | 25 | 20 | 85 | 55 | 85 | 80 | 85 | 45 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 50 | 100 | 100 | 100 | 200 | 200 | 100 | 200 | 400 | 400 | 400 | 400 | 20 | 40 | 30 | 30 | 20 | 60 | 50 | 40 | 20 | 20 | 20 | 0 |
| | | 7 Dec. | 150 | 150 | 200 | 150 | 150 | 150 | 200 | 400 | 400 | 400 | 400 | 400 | 20 | 20 | 20 | 10 | 30 | 20 | 0 | 20 | 30 | 40 | 30 | 20 |
| | | Avg. | 100 | 125 | 150 | 125 | 175 | 175 | 150 | 300 | 400 | 400 | 400 | 400 | 20 | 30 | 25 | 20 | 25 | 40 | 25 | 30 | 25 | 30 | 25 | 10 |
| | | | Direction-3 | | | | | | | | | | | | Direction-4 | | | | | | | | | | | |
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 10 | 10 | 20 | 20 | 60 | 20 | 40 | 10 | 40 | 70 | 30 | 20 | 30 | 20 | 30 | 10 | 30 | 20 | 20 | 30 | 0 | 20 | 0 | 20 |
| | | 7 Dec. | 10 | 20 | 20 | 20 | 20 | 10 | 10 | 20 | 10 | 40 | 20 | 10 | 40 | 10 | 30 | 100 | 20 | 20 | 0 | 0 | 0 | 40 | 10 | 20 |
| | | Avg. | 10 | 15 | 20 | 20 | 40 | 15 | 25 | 15 | 25 | 55 | 25 | 15 | 35 | 15 | 30 | 55 | 25 | 20 | 10 | 15 | 0 | 30 | 5 | 20 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 20 | 10 | 10 | 20 | 10 | 10 | 10 | 10 | 20 | 80 | 30 | 50 | 0 | 10 | 20 | 10 | 0 | 30 | 10 | 10 | 40 | 40 | 20 | 20 |
| | | 7 Dec. | 10 | 20 | 40 | 30 | 20 | 10 | 20 | 40 | 10 | 10 | 20 | 20 | 10 | 20 | 10 | 20 | 10 | 20 | 30 | 20 | 30 | 30 | 30 | 60 |
| | | Avg. | 15 | 15 | 25 | 25 | 15 | 10 | 15 | 25 | 15 | 45 | 25 | 35 | 5 | 15 | 15 | 15 | 5 | 25 | 20 | 15 | 35 | 35 | 25 | 40 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 20 | 20 | 90 | 100 | 140 | 120 | 180 | 150 | 160 | 110 | 80 | 20 | 30 | 20 | 20 | 40 | 40 | 30 | 40 | 40 | 20 | 40 | 60 | 60 |
| | | 7 Dec. | 10 | 10 | 20 | 20 | 20 | 10 | 10 | 10 | 30 | 100 | 20 | 20 | 10 | 20 | 20 | 110 | 40 | 20 | 40 | 80 | 150 | 130 | 200 | 200 |
| | | Avg. | 15 | 15 | 55 | 60 | 80 | 65 | 95 | 80 | 95 | 105 | 50 | 20 | 20 | 20 | 20 | 75 | 40 | 25 | 40 | 60 | 85 | 85 | 130 | 130 |

*Source: JICA Study Team*

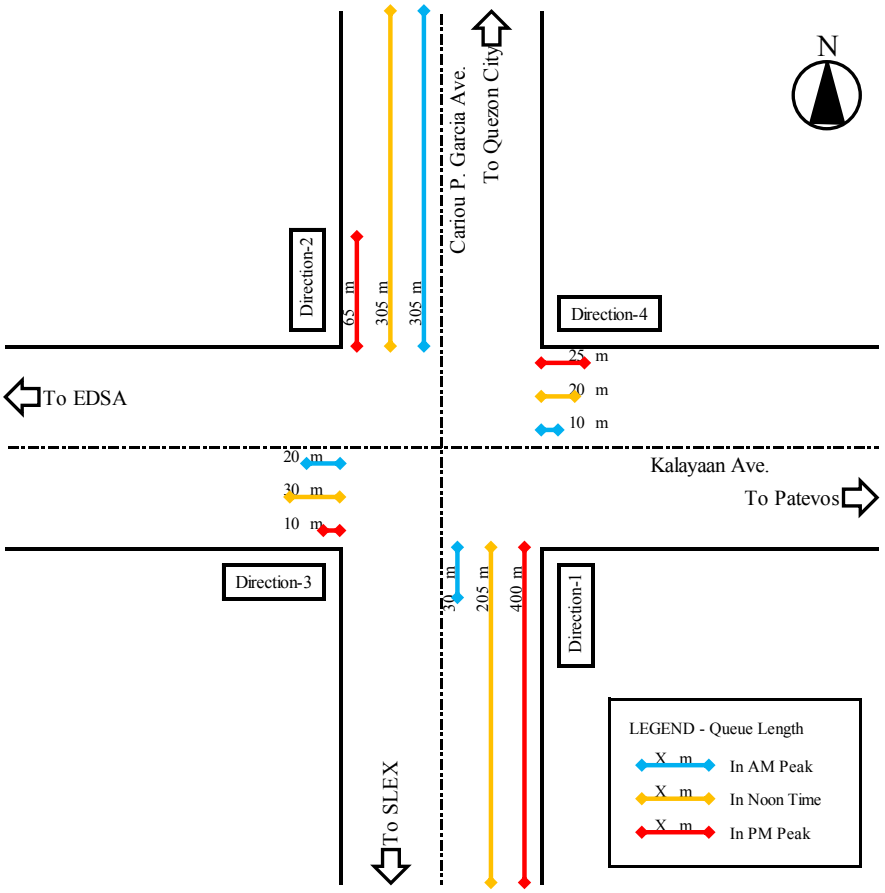
**Figure 3.1-9 Result of Queue Length Survey at EDSA/North/West Intersection**




| | | | Direction-1 | | | | | | | | | | | | Direction-2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 350 | 350 | 330 | 330 | 270 | 170 | 130 | 160 | 160 | 180 | 190 | 200 | 100 | 110 | 200 | 100 | 160 | 110 | 120 | 110 | 140 | 50 | 110 | 150 |
| | | 14 Dec. | 210 | 180 | 350 | 220 | 150 | 160 | 330 | 320 | 270 | 290 | 170 | 190 | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 0 |
| | | Avg. | 280 | 265 | 340 | 275 | 210 | 165 | 230 | 240 | 215 | 235 | 180 | 195 | 50 | 55 | 105 | 55 | 80 | 55 | 60 | 55 | 70 | 30 | 60 | 75 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 250 | 350 | 370 | 500 | 400 | 430 | 470 | 370 | 350 | 290 | 370 | 310 | 110 | 100 | 180 | 80 | 80 | 50 | 90 | 90 | 100 | 120 | 100 | 120 |
| | | 14 Dec. | 290 | 360 | 350 | 400 | 320 | 340 | 330 | 350 | 350 | 290 | 180 | 270 | 50 | 80 | 120 | 100 | 60 | 120 | 90 | 70 | 120 | 60 | 100 | 110 |
| | | Avg. | 270 | 355 | 360 | 450 | 360 | 385 | 400 | 360 | 350 | 290 | 275 | 290 | 80 | 90 | 150 | 90 | 70 | 85 | 90 | 80 | 110 | 90 | 100 | 115 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 100 | 110 | 130 | 140 | 150 | 90 | 110 | 130 | 90 | 50 | 90 | 350 | 110 | 100 | 180 | 80 | 80 | 50 | 90 | 90 | 100 | 120 | 100 | 120 |
| | | 14 Dec. | 400 | 100 | 100 | 170 | 290 | 300 | 210 | 160 | 170 | 240 | 110 | 150 | 50 | 100 | 100 | 120 | 150 | 120 | 140 | 140 | 160 | 100 | 120 | 120 |
| | | Avg. | 250 | 105 | 115 | 155 | 220 | 195 | 160 | 145 | 130 | 145 | 100 | 250 | 80 | 100 | 140 | 100 | 115 | 85 | 115 | 115 | 130 | 110 | 110 | 120 |
| | | | Direction-3 | | | | | | | | | | | | | | | | | | | | | | | |
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | | | | | | | | | | | | |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | | | | | | | | | | | | |
| | Length (m) | 13 Dec. | 20 | 50 | 50 | 60 | 50 | 100 | 100 | 60 | 30 | 30 | 20 | 40 | | | | | | | | | | | | |
| | | 14 Dec. | 120 | 120 | 140 | 110 | 160 | 110 | 160 | 130 | 110 | 170 | 150 | 130 | | | | | | | | | | | | |
| | | Avg. | 70 | 85 | 95 | 85 | 105 | 105 | 130 | 95 | 70 | 100 | 85 | 85 | | | | | | | | | | | | |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | | | | | | | | | | | | |
| | Length (m) | 13 Dec. | 20 | 50 | 20 | 20 | 30 | 20 | 40 | 10 | 120 | 50 | 40 | 50 | | | | | | | | | | | | |
| | | 14 Dec. | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | | | | | | | | | | | | |
| | | Avg. | 135 | 150 | 135 | 135 | 140 | 135 | 145 | 130 | 185 | 150 | 145 | 150 | | | | | | | | | | | | |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | | | | | | | | | | | | |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | | | | | | | | | | | | |
| | Length (m) | 13 Dec. | 50 | 40 | 30 | 60 | 30 | 40 | 30 | 120 | 0 | 40 | 80 | 300 | | | | | | | | | | | | |
| | | 14 Dec. | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | | | | | | | | | | | | |
| | | Avg. | 150 | 145 | 140 | 155 | 140 | 145 | 140 | 185 | 125 | 145 | 165 | 275 | | | | | | | | | | | | |

*Source: JICA Study Team*

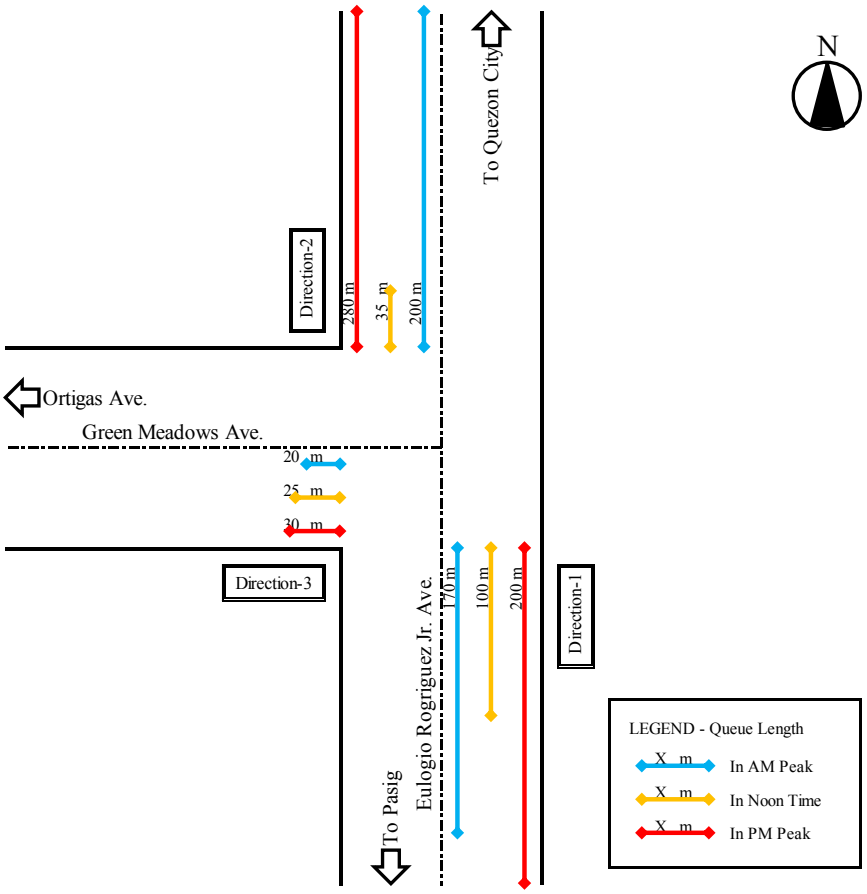
**Figure 3.1-10 Result of Queue Length Survey at EDSA/North/ Mindanao Intersection**




| | | | Direction-1 | | | | | | | | | | | | Direction-2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 0 | 0 | 20 | 10 | 10 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 10 | 150 | 600 | 400 | 50 | 70 | 400 | 300 | 30 | 20 | 30 | 10 |
| | | 14 Dec. | 0 | 20 | 10 | 20 | 30 | 50 | 60 | 30 | 30 | 20 | 50 | 30 | 10 | 10 | 10 | 20 | 10 | 10 | 0 | 10 | 20 | 30 | 10 | 110 |
| | | Avg. | 0 | 10 | 15 | 15 | 20 | 25 | 30 | 20 | 15 | 15 | 25 | 15 | 10 | 80 | 305 | 210 | 30 | 40 | 200 | 155 | 25 | 25 | 20 | 60 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 100 | 0 | 0 | 0 | 600 | 300 | 200 | 0 | 20 | 0 | 10 | 0 | 70 | 20 | 400 | 0 |
| | | 14 Dec. | 400 | 400 | 400 | 400 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 | 10 | 20 | 0 | 10 | 0 | 0 |
| | | Avg. | 200 | 205 | 200 | 200 | 0 | 0 | 0 | 15 | 50 | 0 | 0 | 0 | 305 | 150 | 105 | 0 | 10 | 0 | 10 | 10 | 35 | 15 | 200 | 0 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 10 | 0 | 10 | 10 | 0 | 10 | 0 | 0 | 10 | 0 | 0 | 0 |
| | | 14 Dec. | 200 | 0 | 30 | 200 | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 20 | 0 | 10 | 20 | 20 | 10 | 110 | 130 | 10 | 0 | 0 | 10 |
| | | Avg. | 300 | 200 | 215 | 300 | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 400+ | 15 | 0 | 10 | 15 | 10 | 10 | 55 | 65 | 10 | 0 | 0 | 5 |
| | | | Direction-3 | | | | | | | | | | | | Direction-4 | | | | | | | | | | | |
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 20 | 10 | 10 | 30 | 10 | 10 | 10 | 10 | 10 | 10 | 20 | 10 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 10 |
| | | 14 Dec. | 10 | 10 | 0 | 0 | 10 | 10 | 0 | 10 | 0 | 0 | 0 | 30 | 0 | 20 | 10 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0 |
| | | Avg. | 15 | 10 | 5 | 15 | 10 | 10 | 5 | 10 | 5 | 5 | 10 | 20 | 0 | 10 | 10 | 10 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 30 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0 | 0 | 10 | 10 | 0 | 10 | 10 |
| | | 14 Dec. | 50 | 40 | 10 | 20 | 20 | 0 | 0 | 0 | 10 | 0 | 0 | 10 | 30 | 20 | 30 | 10 | 30 | 20 | 10 | 0 | 30 | 0 | 20 | 10 |
| | | Avg. | 30 | 25 | 10 | 15 | 15 | 5 | 5 | 15 | 15 | 5 | 5 | 10 | 20 | 15 | 20 | 10 | 20 | 10 | 5 | 5 | 20 | 0 | 15 | 10 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 13 Dec. | 10 | 0 | 0 | 20 | 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0 | 10 | 10 | 20 | 40 |
| | | 14 Dec. | 10 | 10 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 10 | 10 | 0 | 10 | 10 | 0 | 10 | 40 | 10 | 10 | 10 | 30 | 20 | 30 | 10 |
| | | Avg. | 10 | 5 | 0 | 10 | 5 | 10 | 5 | 0 | 0 | 5 | 5 | 0 | 10 | 10 | 5 | 10 | 25 | 10 | 10 | 5 | 20 | 15 | 25 | 25 |

*Source: JICA Study Team*

**Figure 3.1-11 Result of Queue Length Survey at C-5/Kalayaan Intersection**




| | | | Direction-1 | | | | | | | | | | | | Direction-2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 40 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 70 | 0 |
| | | 7 Dec. | 10 | 10 | 10 | 10 | 10 | 200 | 200 | 200 | 300 | 200 | 300 | 300 | 40 | 50 | 0 | 20 | 50 | 60 | 0 | 30 | 0 | 30 | 300 | 400 |
| | | Avg. | 5 | 5 | 5 | 5 | 5 | 100 | 100 | 100 | 150 | 105 | 170 | 170 | 20 | 25 | 0 | 10 | 25 | 30 | 0 | 15 | 0 | 55 | 185 | 200 |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 0 | 10 | 20 | 20 | 0 | 30 | 40 | 0 | 100 | 100 | 100 | 100 | 0 | 50 | 30 | 0 | 40 | 30 | 0 | 70 | 0 | 0 | 0 | 10 |
| | | 7 Dec. | 30 | 60 | 20 | 150 | 200 | 150 | 40 | 10 | 70 | 0 | 0 | 10 | 60 | 0 | 0 | 20 | 0 | 0 | 30 | 0 | 60 | 0 | 50 | 50 |
| | | Avg. | 15 | 35 | 20 | 85 | 100 | 90 | 40 | 5 | 85 | 50 | 50 | 55 | 30 | 25 | 15 | 10 | 20 | 15 | 15 | 35 | 30 | 0 | 25 | 30 |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 |
| | Length (m) | 6 Dec. | 100 | 100 | 100 | 100 | 60 | 80 | 40 | 10 | 100 | 100 | 100 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 30 | 50 | 40 | 60 | 0 |
| | | 7 Dec. | 20 | 20 | 10 | 20 | 0 | 100 | 150 | 250 | 200 | 250 | 300 | 300 | 0 | 0 | 0 | 0 | 20 | 80 | 500 | 500 | 500 | 500 | 500 | 500 |
| | | Avg. | 60 | 60 | 55 | 60 | 30 | 90 | 95 | 130 | 150 | 175 | 200 | 200 | 0 | 0 | 0 | 0 | 10 | 40 | 260 | 265 | 275 | 270 | 280 | 250 |
| | | | Direction-3 | | | | | | | | | | | | | | | | | | | | | | | |
| AM Peak | Time | H | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | | | | | | | | | | | | |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | | | | | | | | | | | | |
| | Length (m) | 6 Dec. | 10 | 10 | 10 | 10 | 10 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | | | | | | | | | | | | |
| | | 7 Dec. | 0 | 10 | 0 | 20 | 30 | 0 | 0 | 10 | 0 | 0 | 10 | 20 | | | | | | | | | | | | |
| | | Avg. | 5 | 10 | 5 | 15 | 20 | 0 | 0 | 5 | 5 | 0 | 10 | 10 | | | | | | | | | | | | |
| Noon Time | Time | H | 12 | 12 | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | | | | | | | | | | | | |
| | Length (m) | 6 Dec. | 20 | 0 | 10 | 0 | 0 | 0 | 10 | 20 | 30 | 20 | 0 | 0 | | | | | | | | | | | | |
| | | 7 Dec. | 10 | 10 | 30 | 0 | 0 | 0 | 10 | 10 | 20 | 10 | 0 | 0 | | | | | | | | | | | | |
| | | Avg. | 15 | 5 | 20 | 0 | 0 | 0 | 10 | 15 | 25 | 15 | 0 | 0 | | | | | | | | | | | | |
| PM Peak | Time | H | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | | | | | | | | | | | | |
| | | M | 10 | 20 | 30 | 40 | 50 | 60 | 10 | 20 | 30 | 40 | 50 | 60 | | | | | | | | | | | | |
| | Length (m) | 6 Dec. | 10 | 0 | 10 | 0 | 10 | 50 | 30 | 20 | 40 | 30 | 60 | 30 | | | | | | | | | | | | |
| | | 7 Dec. | 10 | 10 | 30 | 0 | 0 | 0 | 10 | 10 | 20 | 10 | 0 | 0 | | | | | | | | | | | | |
| | | Avg. | 10 | 5 | 20 | 0 | 5 | 25 | 20 | 15 | 30 | 20 | 30 | 15 | | | | | | | | | | | | |

*Source: JICA Study Team*

**Figure 3.1-12 Result of Queue Length Survey at C-5/Green Meadows/Acropolis/ Calle Industria Intersection**

### 3.1.5 Travel Speed Survey

#### (1) Surveyed Road

**Table 3.1-10** shows road sections where travel speed survey was conducted while **Figure 3.1-13** shows location of surveyed road sections.

**Table 3.1-10 Road Sections Travel Speed Survey Conducted**

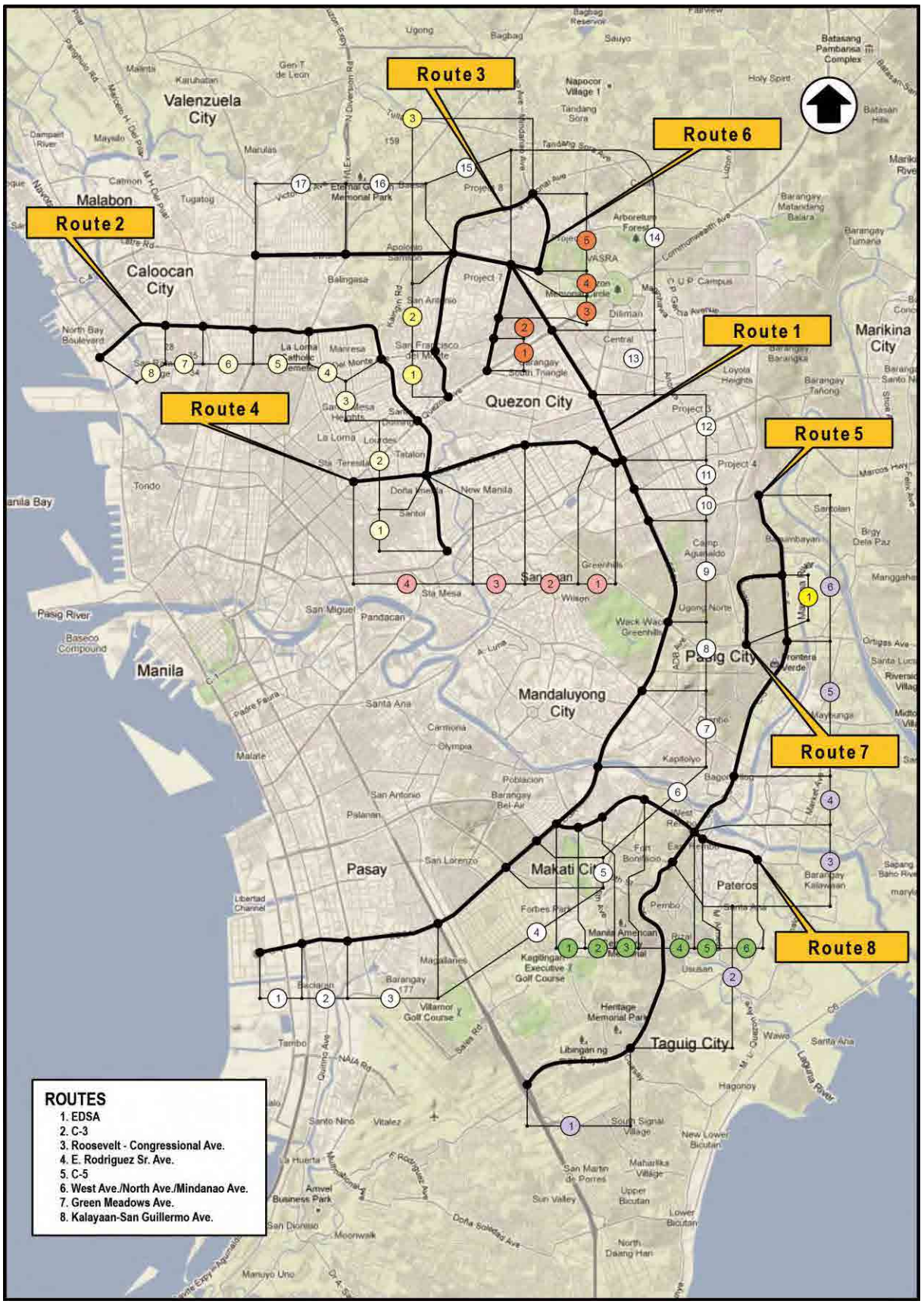
| Route No. | Road Section | No. of Subsections | Length (km) | Date of Survey |
|---|---|---|---|---|
| 1 | EDSA (Mall of Asia–Monumento) | 17 | 23.81 | Nov. 29,2011 |
| 2 | C-3 (Aurora Boulevard–R-10) | 8 | 10.70 | Dec. 6, 2011 |
| 3 | Roosevelt/Congressional Avenue (Quezon Avenue– Mindanao Avenue) | 3 | 5.61 | Dec. 8, 2011 |
| 4 | E. Rodriguez (Aurora Boulevard–Quezon Avenue) | 4 | 5.23 | Dec. 7, 2011 |
| 5 | C-5 (East Service Road–Boni Serrano Avenue) | 6 | 14.30 | Nov. 24, 2011 |
| 6 | West/North/Mindanao Avenue (Quezon Avenue–Congressional Avenue) | 5 | 4.55 | Dec. 1, 2011 |
| 7 | Green Meadows (Ortigas Avenue–C-5 Southbound) | 1 | 2.14 | Nov. 23, 2011 |
| 8 | Kalayaan/San Guillermo Avenue (EDSA–San Joaquin) | 6 | 5.0 | Nov. 22, 2011 |

#### (2) Method of Survey

The travel speed survey was conducted by traveling with passenger car along surveyed roads during morning peak hours (7:00–9:00 AM) , noon time (12:00–2:00 PM) and afternoon peak hours (5:00 – 7:00 PM) on weekdays using GPS that can record travel time, travel distance, travel speed and coordinates every speed change during travel. Average travel speed was calculated dividing travel distance by travel time for each subsection shown in **Figure 3.1-13**. The travel speed of the surveyed roads was recorded for each direction.

#### (3) Result of Survey

Result of travel speed survey along eight surveyed roads is summarized in **Table 3.1-11** through **Table 3.1-18** and graphically shown in **Figure 3.1-14**, **Figure 3.1-15** and **Figure 3.1-16** for morning peak, noon time and afternoon peak respectively while detailed survey result is presented in **Appendix 3-2**.




*Source: JICA Study Team*

**Figure 3.1-13 Location of Road Sections Where Travel Speed Survey was Conducted**

## Table 3.1-11 Travel Speed along Route 1 (EDSA)

| Section No | Location | North Bound Section 1→17 | | | South Bound Section 17→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 9:00 AM)** | | | | | | | |
| 1 | Mall of Asia Circle - Roxas Blvd. | 0.819 | 0:04:28 | 11.00 | 0.819 | 0:05:21 | 9.19 |
| 2 | Roxas Blvd. - Pasay Taft Ave. | 0.903 | 0:04:40 | 11.61 | 0.903 | 0:02:04 | 26.22 |
| 3 | Pasay Taft Ave. - Magallanes Interchange | 1.686 | 0:04:15 | 23.80 | 1.686 | 0:10:08 | 9.98 |
| 4 | Magallanes Interchange - Ayala Ave. | 2.008 | 0:03:58 | 30.37 | 2.008 | 0:15:09 | 7.95 |
| 5 | Ayala Ave. - Buendia | 0.597 | 0:00:51 | 42.14 | 0.597 | 0:00:54 | 39.80 |
| 6 | Buendia-Guadalupe | 1.869 | 0:03:08 | 35.79 | 1.869 | 0:08:51 | 12.67 |
| 7 | Guadalupe-Shaw Blvd. | 1.836 | 0:01:57 | 56.49 | 1.836 | 0:09:42 | 11.36 |
| 8 | Shaw Blvd. - Ortigas Ave. | 1.228 | 0:01:59 | 37.15 | 1.228 | 0:08:56 | 8.25 |
| 9 | Ortigas Ave. - Santolan | 2.326 | 0:03:00 | 46.52 | 2.326 | 0:09:15 | 15.09 |
| 10 | Santolan - P. Tuazon | 0.575 | 0:00:47 | 44.04 | 0.575 | 0:03:06 | 11.13 |
| 11 | P. Tuazon - Aurora Blvd. | 0.632 | 0:00:47 | 48.41 | 0.632 | 0:02:57 | 12.85 |
| 12 | Aurora Blvd. - East Ave. | 1.266 | 0:02:15 | 33.76 | 1.266 | 0:10:26 | 7.28 |
| 13 | East Ave. - Quezon Ave. | 1.602 | 0:01:40 | 57.67 | 1.602 | 0:07:18 | 13.17 |
| 14 | Quezon Ave. - North Ave. | 1.433 | 0:02:31 | 34.16 | 1.433 | 0:02:04 | 41.60 |
| 15 | North Ave - Congressional | 1.151 | 0:01:48 | 38.37 | 1.151 | 0:02:21 | 29.39 |
| 16 | Congressional - Balintawak | 2.004 | 0:03:08 | 38.37 | 2.004 | 0:02:57 | 40.76 |
| 17 | Balintawak - Monument | 1.875 | 0:03:46 | 29.87 | 1.875 | 0:03:10 | 35.53 |
| | **Total** | **23.810** | **0:44:58** | **31.77** | **23.810** | **1:44:39** | **13.65** |
| **Noon Time (12:00 NN - 2:00 PM)** | | | | | | | |
| 1 | Mall of Asia Circle - Roxas Blvd. | 0.819 | 0:04:05 | 12.08 | 0.819 | 0:03:07 | 15.77 |
| 2 | Roxas Blvd. - Pasay Taft Ave. | 0.903 | 0:01:24 | 38.70 | 0.903 | 0:01:25 | 38.24 |
| 3 | Pasay Taft Ave. - Magallanes Interchange | 1.686 | 0:03:05 | 32.81 | 1.686 | 0:09:15 | 10.94 |
| 4 | Magallanes Interchange - Ayala Ave. | 2.008 | 0:04:22 | 27.59 | 2.008 | 0:07:19 | 16.47 |
| 5 | Ayala Ave. - Buendia | 0.597 | 0:01:13 | 29.44 | 0.597 | 0:00:59 | 36.43 |
| 6 | Buendia-Guadalupe | 1.869 | 0:02:54 | 38.67 | 1.869 | 0:07:14 | 15.50 |
| 7 | Guadalupe-Shaw Blvd. | 1.836 | 0:02:40 | 41.31 | 1.836 | 0:05:03 | 21.81 |
| 8 | Shaw Blvd. - Ortigas Ave. | 1.228 | 0:04:47 | 15.40 | 1.228 | 0:05:33 | 13.28 |
| 9 | Ortigas Ave. - Santolan | 2.326 | 0:03:59 | 35.04 | 2.326 | 0:06:27 | 21.64 |
| 10 | Santolan - P. Tuazon | 0.575 | 0:01:07 | 30.90 | 0.575 | 0:03:04 | 11.25 |
| 11 | P. Tuazon - Aurora Blvd. | 0.632 | 0:01:36 | 23.70 | 0.632 | 0:02:39 | 14.31 |
| 12 | Aurora Blvd. - East Ave. | 1.266 | 0:03:26 | 22.12 | 1.266 | 0:04:22 | 17.40 |
| 13 | East Ave. - Quezon Ave. | 1.602 | 0:01:32 | 62.69 | 1.602 | 0:02:35 | 37.21 |
| 14 | Quezon Ave. - North Ave. | 1.433 | 0:01:45 | 49.13 | 1.433 | 0:01:48 | 47.77 |
| 15 | North Ave - Congressional | 1.151 | 0:01:47 | 38.73 | 1.151 | 0:02:09 | 32.12 |
| 16 | Congressional - Balintawak | 2.004 | 0:02:31 | 47.78 | 2.004 | 0:02:36 | 46.25 |
| 17 | Balintawak - Monumento | 1.875 | 0:03:16 | 34.44 | 1.875 | 0:02:54 | 38.79 |
| | **Total** | **23.810** | **0:45:29** | **31.41** | **23.810** | **1:08:29** | **20.86** |
| **Afternoon Peak (5:00 - 8:00 PM)** | | | | | | | |
| 1 | Mall of Asia Circle - Roxas Blvd. | 0.819 | 0:04:55 | 9.99 | 0.819 | 0:03:15 | 15.12 |
| 2 | Roxas Blvd. - Pasay Taft Ave. | 0.903 | 0:09:01 | 6.01 | 0.903 | 0:06:35 | 8.23 |
| 3 | Pasay Taft Ave. - Magallanes Interchange | 1.686 | 0:02:58 | 34.10 | 1.686 | 0:05:23 | 18.79 |
| 4 | Magallanes Interchange - Ayala Ave. | 2.008 | 0:10:23 | 11.60 | 2.008 | 0:05:07 | 23.55 |
| 5 | Ayala Ave. - Buendia | 0.597 | 0:01:06 | 32.56 | 0.597 | 0:01:03 | 34.11 |
| 6 | Buendia-Guadalupe | 1.869 | 0:04:57 | 22.65 | 1.869 | 0:09:30 | 11.80 |
| 7 | Guadalupe-Shaw Blvd. | 1.836 | 0:24:07 | 4.57 | 1.836 | 0:03:00 | 36.72 |
| 8 | Shaw Blvd. - Ortigas Ave. | 1.228 | 0:06:11 | 11.92 | 1.228 | 0:01:29 | 49.67 |
| 9 | Ortigas Ave. - Santolan | 2.326 | 0:07:12 | 19.38 | 2.326 | 0:03:20 | 41.87 |
| 10 | Santolan - P. Tuazon | 0.575 | 0:01:49 | 18.99 | 0.575 | 0:00:52 | 39.81 |
| 11 | P. Tuazon - Aurora Blvd. | 0.632 | 0:02:14 | 16.98 | 0.632 | 0:00:49 | 46.43 |
| 12 | Aurora Blvd. - East Ave. | 1.266 | 0:03:14 | 23.49 | 1.266 | 0:01:44 | 43.82 |
| 13 | East Ave. - Quezon Ave. | 1.602 | 0:03:07 | 30.84 | 1.602 | 0:01:56 | 49.72 |
| 14 | Quezon Ave. - North Ave. | 1.433 | 0:05:18 | 16.22 | 1.433 | 0:02:31 | 34.16 |
| 15 | North Ave - Congressional | 1.151 | 0:03:28 | 19.92 | 1.151 | 0:05:48 | 11.91 |
| 16 | Congressional - Balintawak | 2.004 | 0:04:01 | 29.94 | 2.004 | 0:09:22 | 12.84 |
| 17 | Balintawak - Monumento | 1.875 | 0:07:12 | 15.63 | 1.875 | 0:05:26 | 20.71 |
| | **Total** | **23.810** | **1:41:13** | **14.11** | **23.810** | **1:07:10** | **21.27** |

*Source: JICA Study Team*

## Table 3.1-12 Travel Speed along Route 2 (C-3)

| Section No | Location | North Bound Section 1→8 | | | South Bound Section 8→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 8:30 AM)** | | | | | | | |
| 1 | Aurora Blvd. - E. Rodriguez | 1.570 | 0:04:45 | 19.83 | 1.570 | 0:05:03 | 18.65 |
| 2 | E. Rodriguez - Quezon Ave. | 1.136 | 0:02:38 | 25.88 | 1.136 | 0:03:37 | 18.85 |
| 3 | Quezon Ave. - Del Monte Ave. | 1.446 | 0:02:26 | 35.65 | 1.446 | 0:06:04 | 14.30 |
| 4 | Del Monte Ave. - A. Bonifacio | 1.899 | 0:04:27 | 25.60 | 1.899 | 0:06:33 | 17.40 |
| 5 | A. Bonifacio - Rizal Ave. | 1.101 | 0:02:38 | 25.09 | 1.101 | 0:02:00 | 33.03 |
| 6 | Rizal Ave. - A. Mabini | 1.332 | 0:10:31 | 7.60 | 0.972 | 0:06:30 | 8.97 |
| 7 | A. Mabini - Dagat-Dagatan | 0.717 | 0:02:47 | 15.46 | 0.717 | 0:03:16 | 13.17 |
| 8 | Dagat-Dagatan - R10 | 1.499 | 0:05:14 | 17.19 | 1.499 | 0:03:21 | 26.85 |
| | **Total** | **10.700** | **0:35:26** | **18.12** | **10.340** | **0:36:24** | **17.04** |
| **Noon Time (12:00 NN - 1:30 PM)** | | | | | | | |
| 1 | Aurora Blvd. - E. Rodriguez | 1.570 | 0:04:47 | 19.69 | 1.570 | 0:06:00 | 15.70 |
| 2 | E. Rodriguez - Quezon Ave. | 1.136 | 0:07:02 | 9.69 | 1.136 | 0:03:44 | 18.26 |
| 3 | Quezon Ave. - Del Monte Ave. | 1.446 | 0:03:44 | 23.24 | 1.446 | 0:03:59 | 21.78 |
| 4 | Del Monte Ave. - A. Bonifacio | 1.899 | 0:11:44 | 9.71 | 1.899 | 0:05:23 | 21.17 |
| 5 | A. Bonifacio - Rizal Ave. | 1.101 | 0:05:02 | 13.12 | 1.101 | 0:04:35 | 14.41 |
| 6 | Rizal Ave. - A. Mabini | 1.332 | 0:06:12 | 12.89 | 0.972 | 0:04:42 | 12.41 |
| 7 | A. Mabini - Dagat-Dagatan | 0.717 | 0:02:30 | 17.21 | 0.717 | 0:01:06 | 39.11 |
| 8 | Dagat-Dagatan - R10 | 1.499 | 0:02:09 | 41.83 | 1.499 | 0:04:30 | 19.99 |
| | **Total** | **10.700** | **0:43:10** | **14.87** | **10.340** | **0:33:59** | **18.26** |
| **Afternoon Peak (5:00 - 6:30 PM)** | | | | | | | |
| 1 | Aurora Blvd. - E. Rodriguez | 1.570 | 0:04:24 | 21.41 | 1.570 | 0:03:55 | 24.05 |
| 2 | E. Rodriguez - Quezon Ave. | 1.136 | 0:12:22 | 5.51 | 1.136 | 0:05:47 | 11.79 |
| 3 | Quezon Ave. - Del Monte Ave. | 1.446 | 0:03:45 | 23.14 | 1.446 | 0:14:10 | 6.12 |
| 4 | Del Monte Ave. - A. Bonifacio | 1.899 | 0:06:46 | 16.84 | 1.899 | 0:05:55 | 19.26 |
| 5 | A. Bonifacio - Rizal Ave. | 1.101 | 0:02:03 | 32.22 | 1.101 | 0:07:19 | 9.03 |
| 6 | Rizal Ave. - A. Mabini | 1.332 | 0:04:08 | 19.34 | 0.972 | 0:04:31 | 12.91 |
| 7 | A. Mabini - Dagat-Dagatan | 0.717 | 0:01:32 | 28.06 | 0.717 | 0:02:51 | 15.09 |
| 8 | Dagat-Dagatan - R10 | 1.499 | 0:03:24 | 26.45 | 1.499 | 0:03:44 | 24.09 |
| | **Total** | **10.700** | **0:38:24** | **16.72** | **10.340** | **0:48:12** | **12.87** |

*Source: JICA Study Team*

## Table 3.1-13 Travel Speed along Route 3 (Roosevelt/Congressional Avenue)

| Section No | Location | North Bound Section 1→3 | | | South Bound Section 3→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 8:00 AM)** | | | | | | | |
| 1 | Quezon Ave. - Del Monte Ave. | 1.012 | 0:05:39 | 10.75 | 1.012 | 0:05:30 | 11.04 |
| 2 | DEL Monte Ave. - EDSA (Congressional) | 2.468 | 0:06:18 | 23.50 | 2.960 | 0:10:26 | 17.02 |
| 3 | EDSA - Mindanao Ave. | 2.130 | 0:05:56 | 21.54 | 2.128 | 0:05:50 | 21.89 |
| | **Total** | **5.610** | **0:17:53** | **18.82** | **6.100** | **0:21:46** | **16.81** |
| **Noon Time (12:00 NN - 1:00 PM)** | | | | | | | |
| 1 | Quezon Ave. - Del Monte Ave. | 1.012 | 0:07:48 | 7.78 | 1.012 | 0:05:58 | 10.18 |
| 2 | DEL Monte Ave. - EDSA (Congressional) | 2.468 | 0:06:08 | 24.14 | 2.960 | 0:08:42 | 20.41 |
| 3 | EDSA - Mindanao Ave. | 2.130 | 0:05:24 | 23.67 | 2.128 | 0:04:05 | 31.27 |
| | **Total** | **5.610** | **0:19:20** | **17.41** | **6.100** | **0:18:45** | **19.52** |
| **Afternoon Peak (5:00 - 6:00 PM)** | | | | | | | |
| 1 | Quezon Ave. - Del Monte Ave. | 1.012 | 0:09:54 | 6.13 | 1.012 | 0:05:38 | 10.78 |
| 2 | DEL Monte Ave. - EDSA (Congressional) | 2.468 | 0:11:26 | 12.95 | 2.960 | 0:18:25 | 9.64 |
| 3 | EDSA - Mindanao Ave. | 2.130 | 0:11:21 | 11.26 | 2.128 | 0:08:04 | 15.83 |
| | **Total** | **5.610** | **0:32:41** | **10.30** | **6.100** | **0:32:07** | **11.40** |

*Source: JICA Study Team*

## Table 3.1-14 Travel Speed along Route 4 (E. Rodriguez)

| Section No | Location | West Bound Section 1→4 | | | East Bound Section 4→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 8:00 AM)** | | | | | | | |
| 1 | Aurora Blvd. - New York Ave. | 0.455 | 0:01:20 | 20.48 | 0.455 | 0:00:47 | 34.85 |
| 2 | New York Ave. - Tomas Morato Ave. | 1.356 | 0:05:30 | 14.79 | 1.356 | 0:02:41 | 30.32 |
| 3 | Tomas Morato Ave. - G. Araneta Ave. | 2.031 | 0:09:29 | 12.85 | 2.031 | 0:07:28 | 16.32 |
| 4 | G. Araneta Ave. - Quezon Ave. (Welcome Rotonda) | 1.385 | 0:06:10 | 13.48 | 1.385 | 0:04:16 | 19.48 |
| | **Total** | **5.227** | **0:22:29** | **13.95** | **5.227** | **0:15:12** | **20.63** |
| **Noon Time (12:00 NN - 1:00 PM)** | | | | | | | |
| 1 | Aurora Blvd. - New York Ave. | 0.455 | 0:01:26 | 19.05 | 0.455 | 0:07:27 | 3.66 |
| 2 | New York Ave. - Tomas Morato Ave. | 1.356 | 0:03:56 | 20.68 | 1.356 | 0:04:38 | 17.56 |
| 3 | Tomas Morato Ave. - G. Araneta Ave. | 2.031 | 0:16:35 | 7.35 | 2.031 | 0:13:32 | 9.00 |
| 4 | G. Araneta Ave. - Quezon Ave. (Welcome Rotonda) | 1.385 | 0:05:08 | 16.19 | 1.385 | 0:03:42 | 22.46 |
| | **Total** | **5.227** | **0:27:05** | **11.58** | **5.227** | **0:29:19** | **10.70** |
| **Afternoon Peak (5:00 - 6:00 PM)** | | | | | | | |
| 1 | Aurora Blvd. - New York Ave. | 0.455 | 0:01:20 | 20.48 | 0.455 | 0:01:07 | 24.45 |
| 2 | New York Ave. - Tomas Morato Ave. | 1.356 | 0:05:08 | 15.85 | 1.356 | 0:04:34 | 17.82 |
| 3 | Tomas Morato Ave. - G. Araneta Ave. | 2.031 | 0:12:48 | 9.52 | 2.031 | 0:15:39 | 7.79 |
| 4 | G. Araneta Ave. - Quezon Ave. (Welcome Rotonda) | 1.385 | 0:06:05 | 13.66 | 1.385 | 0:18:20 | 4.53 |
| | **Total** | **5.227** | **0:25:21** | **12.37** | **5.227** | **0:39:40** | **7.91** |

*Source: JICA Study Team*

## Table 3.1-15 Travel Speed along Route 5 (C-5)

| Section No | Location | North Bound Section 1→6 | | | South Bound Section 6→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Mornig Peak (7:00 - 8:00 AM)** | | | | | | | |
| 1 | East Service Road - Bayani Road | 2.967 | 0:03:27 | 51.60 | 2.967 | 0:06:05 | 29.26 |
| 2 | Bayani Road - Market Market | 2.778 | 0:03:15 | 51.29 | 2.778 | 0:02:54 | 57.48 |
| 3 | Market Market - Kalayaan Ave. | 1.375 | 0:01:48 | 45.83 | 1.375 | 0:02:30 | 33.00 |
| 4 | Kalayaan Ave. - Pasig Blvd. | 1.373 | 0:01:30 | 54.92 | 1.373 | 0:03:39 | 22.57 |
| 5 | Pasig Blvd. - Ortigas Ave. | 2.873 | 0:03:02 | 56.83 | 2.873 | 0:14:17 | 12.07 |
| 6 | Ortigas Ave. - Boni Serrano Ave. | 2.930 | 0:04:09 | 42.36 | 2.930 | 0:08:25 | 20.89 |
| | **Total** | **14.296** | **0:17:11** | **49.92** | **14.296** | **0:37:50** | **22.67** |
| **Noon Time (12:00 NN - 1:00 PM)** | | | | | | | |
| 1 | East Service Road - Bayani Road | 2.967 | 0:02:57 | 60.35 | 2.967 | 0:04:21 | 40.92 |
| 2 | Bayani Road - Market Market | 2.778 | 0:03:22 | 49.51 | 2.778 | 0:02:55 | 57.15 |
| 3 | Market Market - Kalayaan Ave. | 1.375 | 0:04:28 | 18.47 | 1.375 | 0:01:53 | 43.81 |
| 4 | Kalayaan Ave. - Pasig Blvd. | 1.373 | 0:09:47 | 8.42 | 1.373 | 0:03:20 | 24.71 |
| 5 | Pasig Blvd. - Ortigas Ave. | 2.873 | 0:02:52 | 60.13 | 2.873 | 0:03:58 | 43.46 |
| 6 | Ortigas Ave. - Boni Serrano Ave. | 2.930 | 0:03:55 | 44.89 | 2.930 | 0:05:56 | 29.63 |
| | **Total** | **14.296** | **0:27:21** | **31.36** | **14.296** | **0:22:23** | **38.32** |
| **Afternoon Peak (5:00 - 6:00 PM)** | | | | | | | |
| 1 | East Service Road - Bayani Road | 2.967 | 0:03:20 | 53.41 | 2.967 | 0:04:33 | 39.13 |
| 2 | Bayani Road - Market Market | 2.778 | 0:03:28 | 48.08 | 2.778 | 0:03:39 | 45.67 |
| 3 | Market Market - Kalayaan Ave. | 1.375 | 0:05:00 | 16.50 | 1.375 | 0:01:52 | 44.20 |
| 4 | Kalayaan Ave. - Pasig Blvd. | 1.373 | 0:03:30 | 23.54 | 1.373 | 0:03:33 | 23.21 |
| 5 | Pasig Blvd. - Ortigas Ave. | 2.873 | 0:04:46 | 36.16 | 2.873 | 0:06:59 | 24.68 |
| 6 | Ortigas Ave. - Boni Serrano Ave. | 2.930 | 0:06:00 | 29.30 | 2.930 | 0:04:39 | 37.81 |
| | **Total** | **14.296** | **0:26:04** | **32.91** | **14.296** | **0:25:15** | **33.97** |

*Source: JICA Study Team*

## Table 3.1-16 Travel Speed along Route 6 (West/North/Mindanao Avenue)

| Section No | Location | North Bound Section 1→5 | | | South Bound Section 5→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 8:00 AM)** | | | | | | | |
| 1 | Quezon Ave. - Del Monte Ave. | 0.628 | 0:01:37 | 23.31 | 0.628 | 0:01:20 | 28.26 |
| 2 | Del Monte Ave. - Baler St. | 0.582 | 0:00:50 | 41.90 | 0.582 | 0:01:40 | 20.95 |
| 3 | Baler St. - North Ave. (EDSA) | 0.822 | 0:01:19 | 37.46 | 0.822 | 0:01:58 | 25.08 |
| 4 | North Ave. (EDSA) - Mindanao Ave. | 0.944 | 0:04:53 | 11.60 | 0.944 | 0:02:19 | 24.45 |
| 5 | Mindanao Ave. - Congressional Ave. | 1.574 | 0:03:02 | 23.41 | 1.574 | 0:04:51 | 19.47 |
| | **Total** | **4.550** | **0:11:41** | **23.37** | **4.550** | **0:12:08** | **22.50** |
| **Noon Time (12:00 NN - 1:00 PM)** | | | | | | | |
| 1 | Quezon Ave. - Del Monte Ave. | 0.628 | 0:02:55 | 12.92 | 0.628 | 0:01:52 | 20.19 |
| 2 | Del Monte Ave. - Baler St. | 0.582 | 0:01:48 | 19.40 | 0.582 | 0:01:14 | 28.31 |
| 3 | Baler St. - North Ave. (EDSA) | 0.822 | 0:01:26 | 34.41 | 0.822 | 0:01:52 | 26.42 |
| 4 | North Ave. (EDSA) - Mindanao Ave. | 0.944 | 0:03:27 | 16.42 | 0.944 | 0:02:56 | 19.31 |
| 5 | Mindanao Ave. - Congressional Ave. | 1.574 | 0:04:09 | 22.76 | 1.574 | 0:08:51 | 10.67 |
| | **Total** | **4.550** | **0:13:45** | **19.85** | **4.550** | **0:16:45** | **16.30** |
| **Afternoon Peak (5:00 - 6:00 PM)** | | | | | | | |
| 1 | Quezon Ave. - Del Monte Ave. | 0.628 | 0:02:52 | 13.14 | 0.628 | 0:02:16 | 16.62 |
| 2 | Del Monte Ave. - Baler St. | 0.582 | 0:01:29 | 23.54 | 0.582 | 0:01:56 | 18.06 |
| 3 | Baler St. - North Ave. (EDSA) | 0.822 | 0:01:35 | 31.15 | 0.822 | 0:02:27 | 20.13 |
| 4 | North Ave. (EDSA) - Mindanao Ave. | 0.944 | 0:05:48 | 9.77 | 0.944 | 0:02:45 | 20.60 |
| 5 | Mindanao Ave. - Congressional Ave. | 1.574 | 0:04:11 | 22.58 | 1.574 | 0:03:38 | 25.99 |
| | **Total** | **4.550** | **0:15:55** | **17.15** | **4.550** | **0:13:02** | **20.95** |

*Source: JICA Study Team*

## Table 3.1-17 Travel Speed along Route 7 (Greenmeadows)

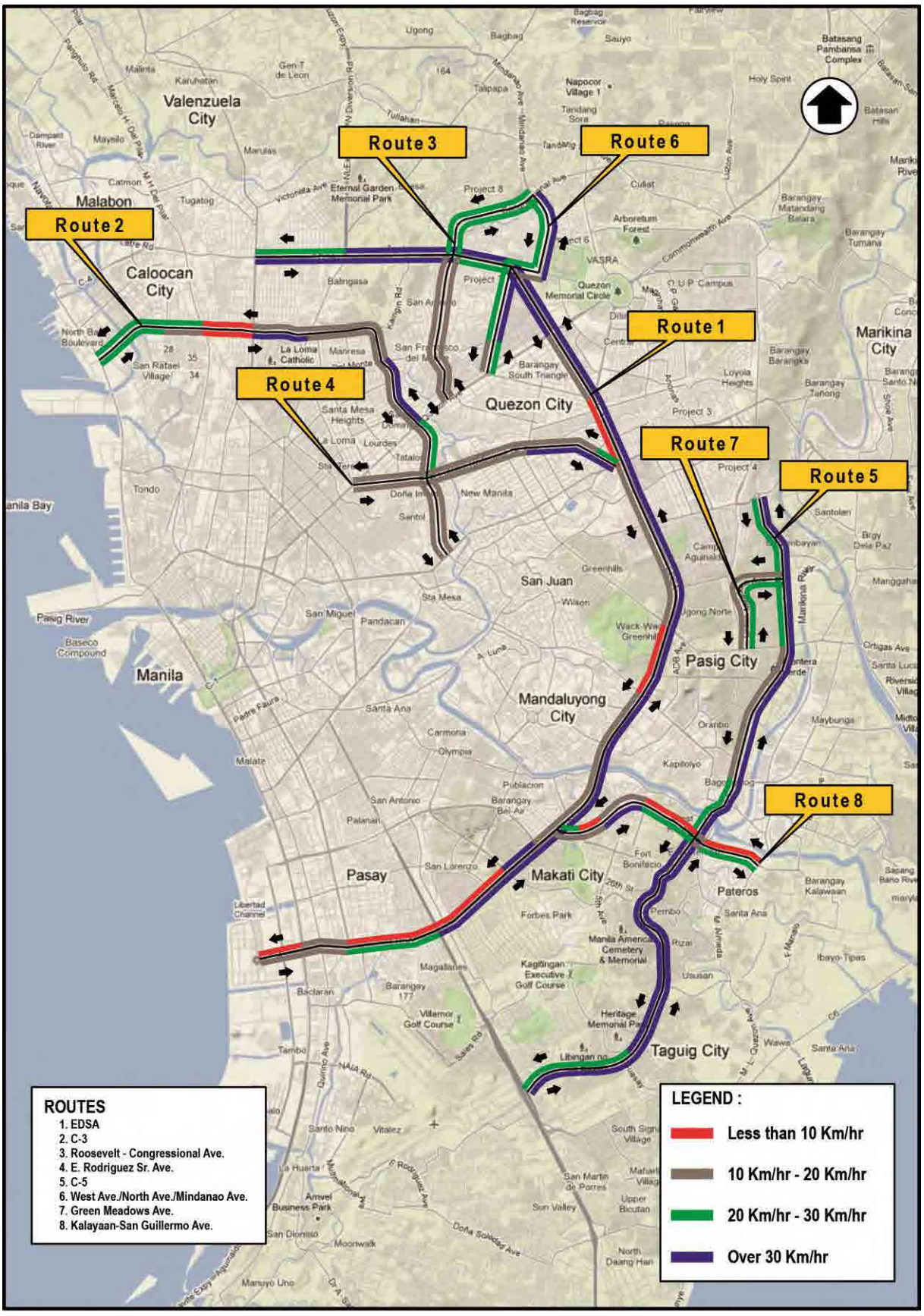
| Section No | Location | North Bound | | | South Bound | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 7:30 AM)** | | | | | | | |
| 1 | Ortigas Ave. - C5 South Bound | 2.145 | 0:04:36 | 27.98 | 2.145 | 0:11:16 | 11.42 |
| **Noon Time (12:00 - 12:30 NN)** | | | | | | | |
| 1 | Ortigas Ave. - C5 South Bound | 2.145 | 0:04:13 | 30.52 | 2.145 | 0:05:49 | 22.13 |
| **Afternoon Peak (5:00 - 5:30 PM)** | | | | | | | |
| 1 | Ortigas Ave. - C5 South Bound | 2.145 | 0:04:21 | 29.59 | 2.145 | 0:05:37 | 22.91 |

*Source: JICA Study Team*

## Table 3.1-18 Travel Speed along Route 8 (Kalayaan/San Guillermo Avenue)

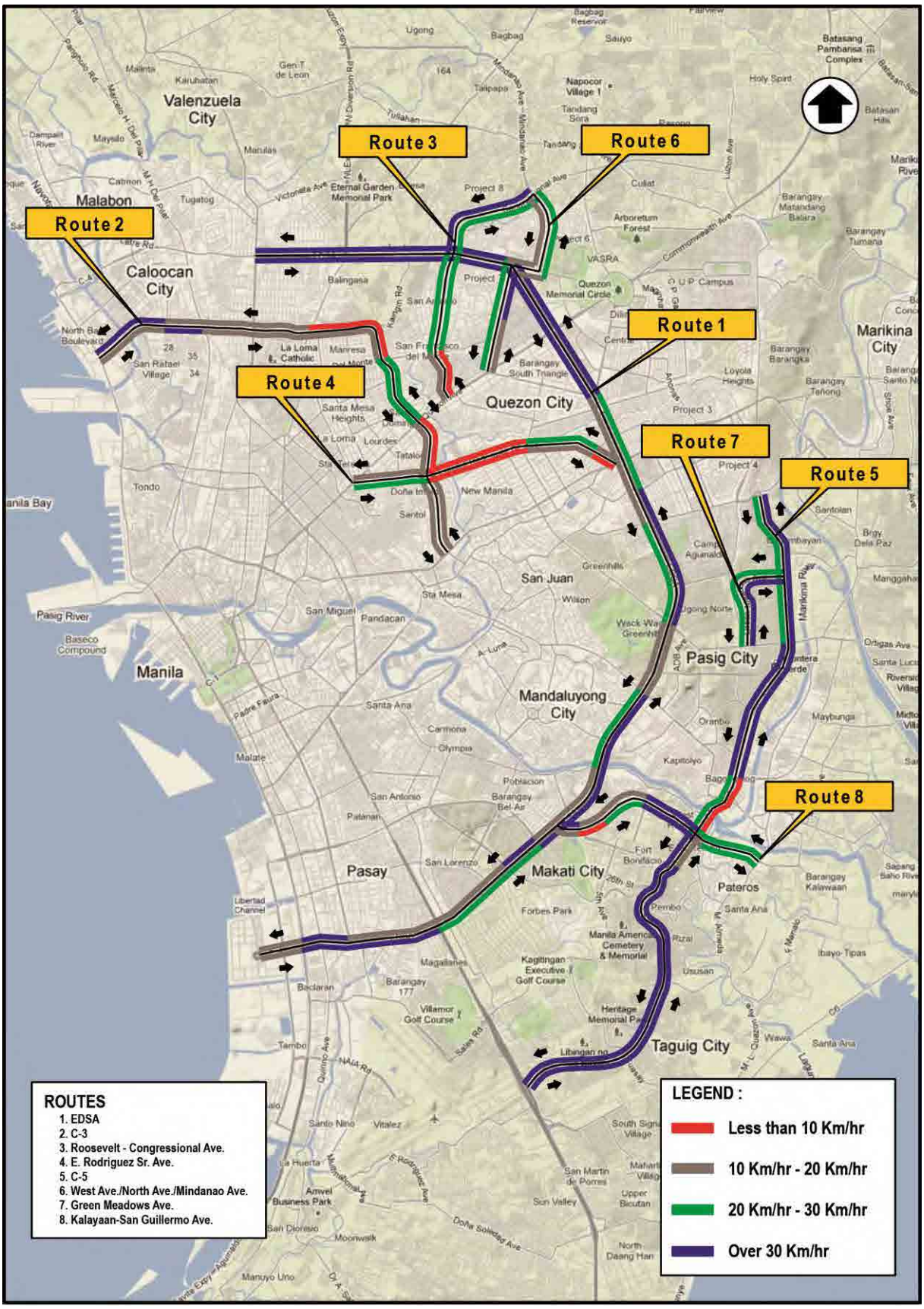
| Setion No | Location | East Bound Section 1→6 | | | West Bound Section 6→1 | | |
|---|---|---|---|---|---|---|---|
| | | Travel Distance (km) | Travel Time | Travel Speed (km/h) | Travel Distance (km) | Travel Time | Travel Speed (km/h) |
| **Morning Peak (7:00 - 8:00 AM)** | | | | | | | |
| 1 | EDSA - 32nd St. | 0.395 | 0:01:29 | 15.98 | 0.395 | 0:00:50 | 28.44 |
| 2 | 32nd St. -Anastacio St. | 0.515 | 0:02:22 | 13.06 | 0.515 | 0:04:54 | 6.31 |
| 3 | Anastacio St. - Lawton Ave. | 0.982 | 0:01:56 | 30.48 | 0.990 | 0:05:08 | 11.57 |
| 4 | Lawton Ave. - C-5 | 1.171 | 0:02:25 | 29.07 | 1.163 | 0:08:19 | 8.39 |
| 5 | C5 - J.P. Rizal | 0.764 | 0:03:09 | 14.55 | 0.764 | 0:04:09 | 11.05 |
| 6 | J.P. Rizal - San Joaquin (A. Luna) | 1.173 | 0:03:12 | 21.99 | 1.173 | 0:07:38 | 9.22 |
| | **Total** | **5.000** | **0:14:33** | **20.62** | **5.000** | **0:30:58** | **9.69** |
| **Noon Peak (12:00 NN - 1:00 PM)** | | | | | | | |
| 1 | EDSA - 32nd St. | 0.395 | 0:01:12 | 19.75 | 0.395 | 0:00:40 | 35.55 |
| 2 | 32nd St. -Anastacio St. | 0.515 | 0:06:16 | 4.93 | 0.515 | 0:01:39 | 18.73 |
| 3 | Anastacio St. - Lawton Ave. | 0.982 | 0:02:06 | 28.06 | 0.990 | 0:04:01 | 14.79 |
| 4 | Lawton Ave. - C-5 | 1.171 | 0:01:55 | 36.66 | 1.163 | 0:02:19 | 30.12 |
| 5 | C5 - J.P. Rizal | 0.764 | 0:02:25 | 18.97 | 0.764 | 0:01:51 | 24.78 |
| 6 | J.P. Rizal - San Joaquin (A. Luna) | 1.173 | 0:03:17 | 21.44 | 1.173 | 0:03:01 | 23.33 |
| | **Total** | **5.000** | **0:17:11** | **17.46** | **5.000** | **0:13:31** | **22.19** |
| **Afternoon Peak (5:00 - 6:00 PM)** | | | | | | | |
| 1 | EDSA - 32nd St. | 0.395 | 0:01:22 | 17.34 | 0.395 | 0:00:39 | 36.46 |
| 2 | 32nd St. -Anastacio St. | 0.515 | 0:03:30 | 8.83 | 0.515 | 0:01:07 | 27.67 |
| 3 | Anastacio St. - Lawton Ave. | 0.982 | 0:02:26 | 24.21 | 0.990 | 0:03:42 | 16.05 |
| 4 | Lawton Ave. - C-5 | 1.171 | 0:02:32 | 27.73 | 1.163 | 0:03:06 | 22.51 |
| 5 | C5 - J.P. Rizal | 0.764 | 0:02:01 | 22.73 | 0.764 | 0:01:40 | 27.50 |
| 6 | J.P. Rizal - San Joaquin (A. Luna) | 1.173 | 0:04:58 | 14.17 | 1.173 | 0:04:11 | 16.82 |
| | **Total** | **5.000** | **0:16:49** | **17.84** | **5.000** | **0:14:25** | **20.81** |

*Source: JICA Study Team*



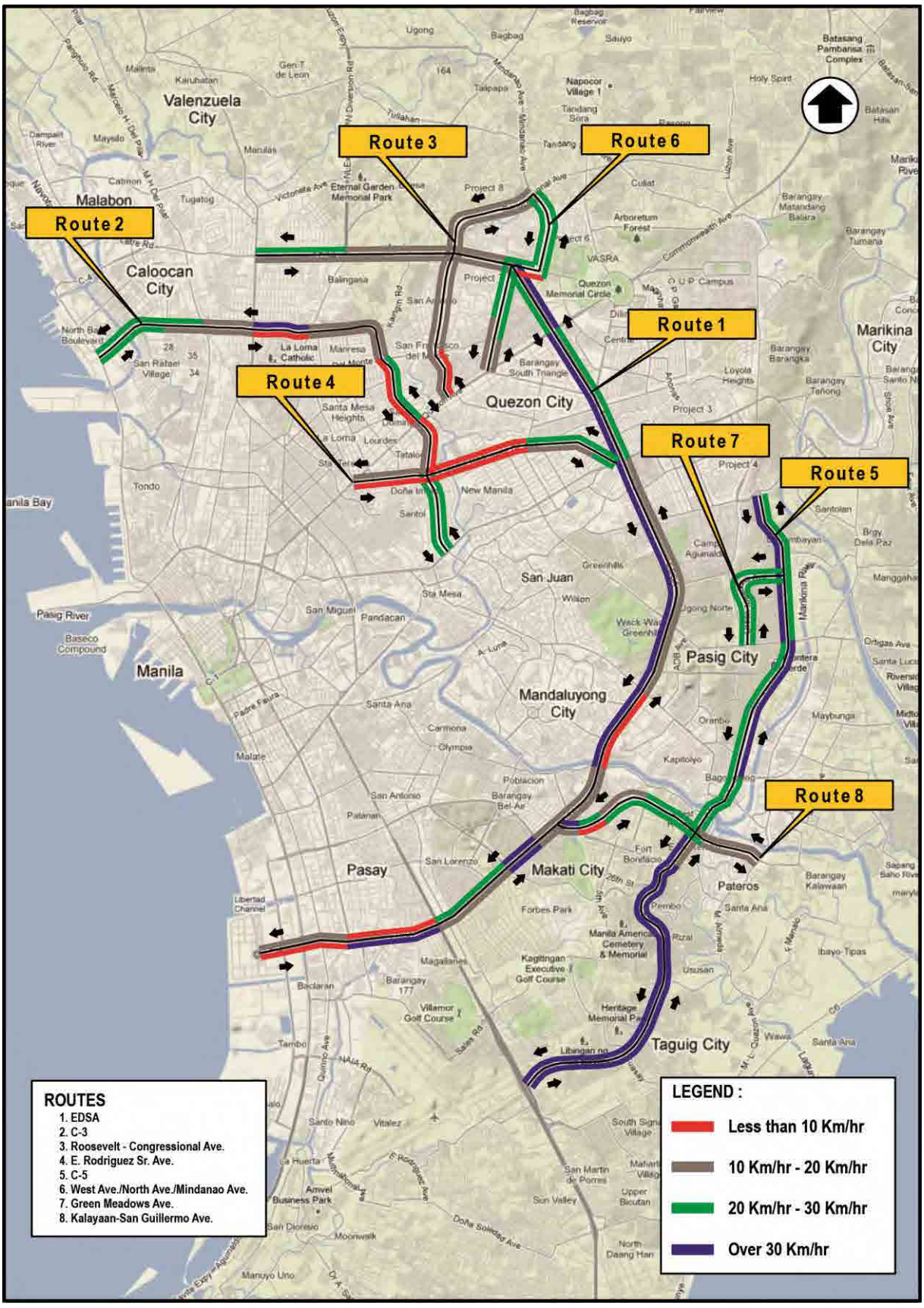

*Source: JICA Study Team*

**Figure 3.1-14 Result of Travel Speed Survey (Morning Peak)**




*Source: JICA Study Team*

**Figure 3.1-15 Result of Travel Speed Survey (Noon Time)**




*Source: JICA Study Team*

**Figure 3.1-16 Result of Travel Speed Survey (Afternoon Peak)**

## 3.2 CURRENT TRAFFIC CONDITION AT EACH INTERSECTION

### 3.2.1 C-3/E. Rodriguez Intersection

**Figure 3.2-1** shows current condition of the intersection with pictures.

#### (1) Traffic Control

Traffic flow of the intersection is currently controlled by traffic signal with prohibited left-turn movements from all directions. Three U-turn slots are installed at the intersection; two slots along C-3 and one slot along E. Rodriguez in front of Quezon Institute. There is no U-turn slot along E. Rodriguez at Cubao side because of no available space. Left-turn traffic from Welcome and Sta. Mesa shall use U-turn slots along C-3 by going straight or making right-turn. No other movement bans are imposed at the intersection.

#### (2) Traffic Volume

**Table 3.2-1** shows summary of traffic volume obtained from traffic count survey.

**Table 3.2-1 Summary of Traffic Volume (C-3/E. Rodriguez)**

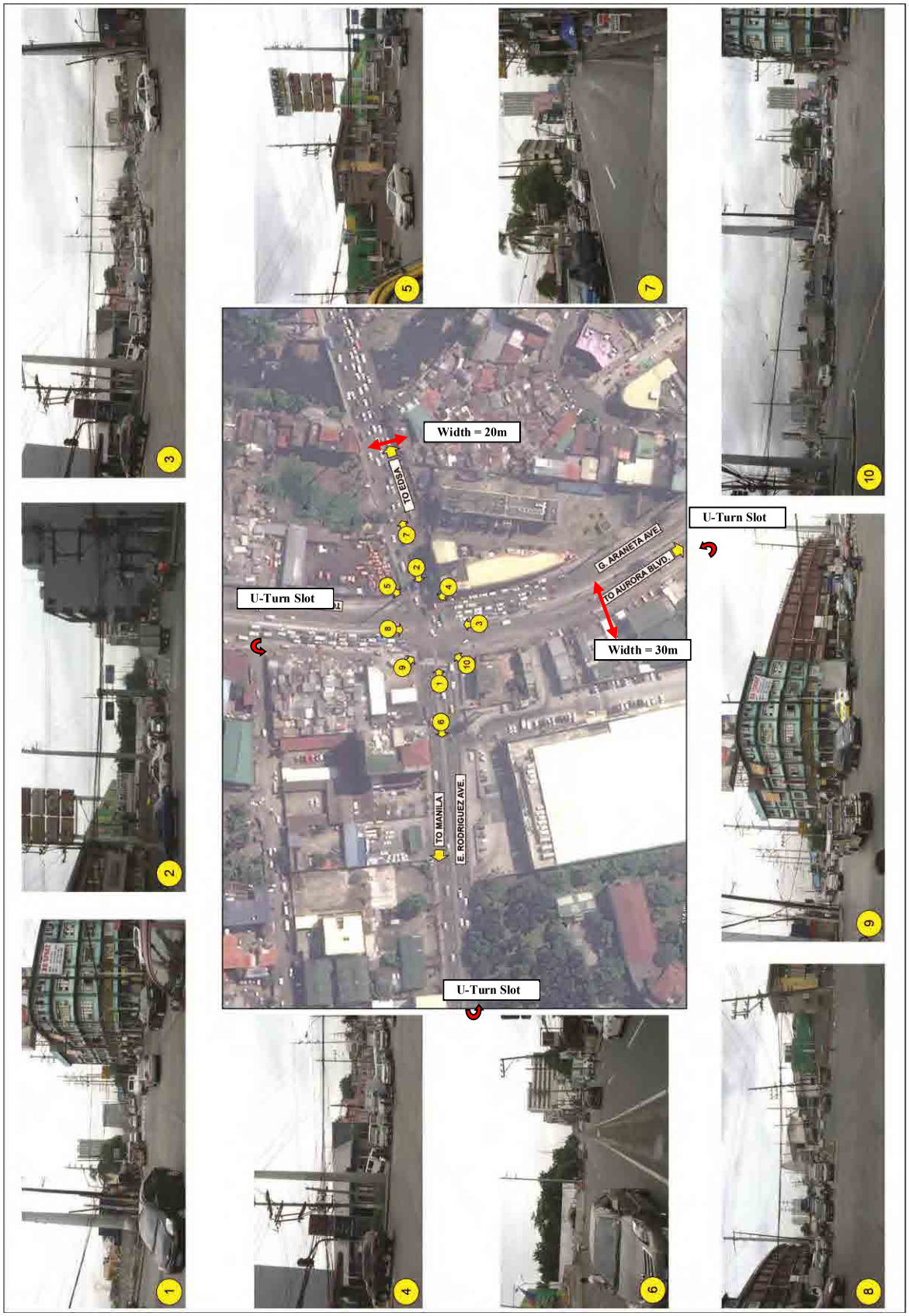
| Direction of Flow | AADT | AM Peak (7-9 AM) (Vehicle/Hour) | Noon Time (12-14) (Vehicle/Hour) | PM Peak(4-6 PM) (Vehicle/Hour) |
|---|---|---|---|---|
| **Leg-1 (from/to Aurora Blvd.)** | | | | |
| - From Sta. Mesa | 34,847 | 1,708 | 1,820 | 1,945 |
| - To Sta. Mesa | 27,807 | 2,354 | 1,424 | 1,264 |
| **Total** | **62,654** | **4,062** | **3,244** | **3,209** |
| - U-Turn | 3,926 | 202 | 219 | 245 |
| **Leg-2 (from /to Quezon Ave.)** | | | | |
| - From Quezon Ave. | 21,654 | 1,985 | 1,274 | 1,246 |
| - To Quezon Ave. | 31,143 | 1,850 | 1,825 | 1,996 |
| **Total** | **52,797** | **3,835** | **3,099** | **3,242** |
| - U-Turn | 6,405 | 143 | 162 | 186 |
| **Leg-3 (from/to Welcome)** | | | | |
| - From Welcome | 25,179 | 1,591 | 1,431 | 1,291 |
| - To Welcome | 26,263 | 1,789 | 1,445 | 1,390 |
| **Total** | **51,442** | **3,380** | **2,876** | **2,681** |
| - U-Turn | 2,636 | 195 | 167 | 113 |
| **Leg-4 (from/to Cubao)** | | | | |
| - From Cubao | 30,943 | 2,126 | 1,688 | 1,633 |
| - To Cubao | 27,409 | 1,489 | 1,519 | 1,465 |
| **Total** | **58,352** | **3,615** | **3,207** | **3,098** |
| - U-Turn | - | - | - | - |
| **Total Inflow Traffic** | **112,623** | **7,410** | **6,213** | **6,115** |

*Source: JICA Study Team*

Major traffic movements are:

OD (B⇔D) Cubao ⇔ Welcome with 8,340/6,234 vehicles/6 hours along E. Rodriguez.[1]

[1] Refer to **Table 3.2-1** OD Traffic at C-3/E. Rodriguez




*Source: JICA Study Team*

**Figure 3.2-1 Current Condition of Intersection (C3/E. Rodriguez)**

- OD (F⇔C) Sta. Mesa ⇔Quezon Avenue with 6,978/6,930 vehicles/6 hours along C-3.

Above OD movement implies that construction of flyover for through traffic along either C-3 or E. Rodriguez is needed. Difference in traffic volume between C-3 and E. Rodriguez is marginal, therefore, flyover should to be constructed along street that have enough space to accommodate it. It is obviously adequate to construct flyover along C-3 because it has 24 m of carriageway width while E. Rodriguez has only 18 m.

**(3) Traffic Congestion**

Queue length along E. Rodriguez is longer than C-3 during morning and evening peak hours and even during noon time off-peak hours. This longer queue length along E. Rodriguez is attributed to narrow carriageway width compared with C-3, while traffic volume is almost same as C-3. Average travel speed along C-3 and E. Rodriguez that passes through the intersection is more or less 15 km/hour during morning, noon time and afternoon peak hours. This implies that the roads crossing the intersection is severely congested and mitigation measures including construction of flyover must be taken as early as possible.

### 3.2.2 EDSA/Roosevelt/Congressional Intersection

**Figure 3.2-2** shows current condition of the intersection with pictures.

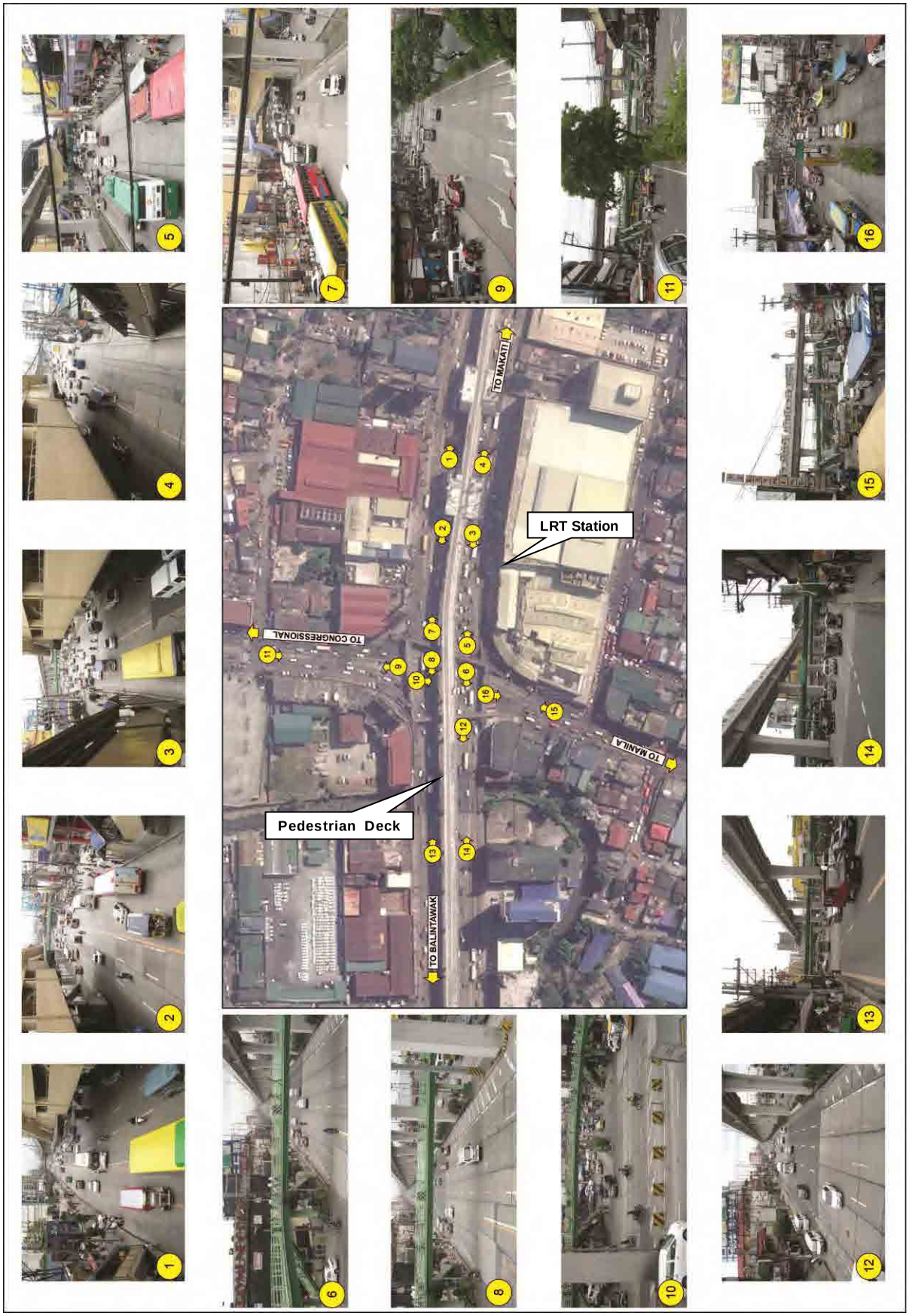
**(1) Traffic Control**

There is no traffic signal control at the intersection. Straight and left-turn movements along Roosevelt and Congressional Avenue are prohibited. Left-turn movement along EDSA is also prohibited. Three U-turn slots are installed at the intersection; two slots along EDSA and one slot along Congressional Avenue. There is no U-turn slot along Roosevelt Avenue because there is no available space. Left-turn traffic from Balintawak along EDSA shall use U-turn slot along C-3 at Cubao side by going straight the intersection. Straight and left-turn movements at the intersection will be hampered by the pier of the LRT viaduct that was constructed at center of the intersection if the intersection will be open to all traffic movements after construction of flyover. Appropriate guideway shall be installed around the pier to safely lead crossing traffic.

Pedestrian deck is installed around the intersection that to be temporarily removed during construction of the flyover. Elevated LRT station is located at 150 m away toward Cubao from the intersection.

**(2) Traffic Volume**

**Table 3.2-2** shows the summary of traffic volume obtained from the traffic count survey.




*Source: JICA Study Team*

**Figure 3.2-2 Current Condition of Intersection (EDSA/Roosevelt/Congressional)**

**Table 3.2-2 Summary of Traffic Volume (EDSA/Roosevelt/Congressional)**

| Direction of Flow | AADT | AM Peak (7-9 AM) (Vehicle/Hour) | Noon Time (12-14) (Vehicle/Hour) | PM Peak(4-6 PM) (Vehicle/Hour) |
|---|---|---|---|---|
| **Leg-1 (from/to Quezon Ave.)** | | | | |
| - From Quezon Ave.. | 11,597 | 467 | 612 | 629 |
| - To Quezon Ave. | 9,702 | 704 | 510 | 405 |
| **Total** | **21,299** | **1,171** | **1,122** | **1,034** |
| - U-Turn | 1,027 | 90 | 47 | 53 |
| **Leg-2 (from /to Mindanao Ave.)** | | | | |
| - From Mindanao Ave. | 23,740 | 1,499 | 1,177 | 981 |
| - To Mindanao Ave. | 20,608 | 815 | 1,030 | 1,277 |
| **Total** | **44,348** | **2,313** | **2,207** | **2,258** |
| - U-Turn | 250 | 14 | 15 | 15 |
| **Leg-3 (from/to Balintawak)** | | | | |
| - From Balintawak | 51,828 | 2,860 | 2,609 | 2,658 |
| - To Balintawak | 63,322 | 3,247 | 2,984 | 2,935 |
| **Total** | **115,150** | **6,107** | **5,593** | **5,593** |
| - U-Turn | 14,424 | 832 | 755 | 709 |
| **Leg-4 (from/to Cubao)** | | | | |
| - From Cubao | 52,337 | 2,449 | 2,501 | 2,745 |
| - To Cubao | 47,476 | 2,573 | 2,388 | 2,419 |
| **Total** | **99,813** | **5,022** | **4,889** | **5,164** |
| - U-Turn | 20,670 | 982 | 1,077 | 1,172 |
| **Leg-5 (from/to Seminary Road)** | | | | |
| - From Seminary Road | 3,665 | 281 | 135 | 162 |
| - To Seminary Road | 2,059 | 217 | 121 | 139 |
| **Total** | **5,724** | **498** | **256** | **301** |
| - U-Turn | - | - | - | - |
| **Total Inflow Traffic** | **143,167** | **7,556** | **7,034** | **7,175** |

*Source: JICA Study Team*

Major traffic movements are

- OD (C⇔E) Cubao ⇔ Balintawak with 10,050/11,743 vehicles/6 hours along EDSA,[2]
- OD (B→E) Mindanao Avenue → Balintawak with 5,840 vehicles/6 hours, and
- OD (C→B) Cubao → Mindanao Avenue with 5,096 vehicles/6 hours.

Construction of flyover along EDSA for through traffic may be enough for this intersection. Traffic movements from/to Congressional Avenue are relatively high compare with other traffic movement due to connection to Mindanao Avenue that leads to North Luzon Expressway.

### (3) Traffic Congestion

Severe congestion is observed during afternoon peak hours. Queue length along southbound EDSA has reached 400 m. Queue length along northbound EDSA was fairly short than southbound because traffic flow has already been choked at EDSA/North Intersection. Average

[2] Refer to **Table 3.2-2** OD Traffic at EDSA/Roosevelt/Congressional

travel speed between EDSA/Roosevelt and EDSA/North Avenue is remarkably reduced during afternoon peak hours both northbound (19.92km/hour) and southbound (11.91km/hour).

### 3.2.3 EDSA/North/West/Mindanao Intersection

**Figure 3.2-3** shows current condition of the intersection with pictures.

#### (1) Traffic Control

**EDSA/North/West Avenue Intersection**

Traffic of the intersection is not controlled by traffic signal now. Straight and left-turn movements along North Avenue and West Avenue are prohibited. Left-turn movement along EDSA is also prohibited. Two U-turn slots are installed at the intersection; one slot each along EDSA north and south of the intersection. Jeepney and bus bays are available inside shopping malls and loading and unloading lanes along EDSA are also available. Loading and unloading passengers along the roads outside designated lanes are prohibited.

Several pedestrian decks are installed around the intersection that to be temporarily removed during construction of flyover. Columns of viaduct for LRT Line 1 and Line 2 occupy median of EDSA.

**North/Mindanao Avenue Intersection**

The intersection is controlled by traffic signal and all movements along North Avenue and Mindanao Avenue are allowed except straight and left turn movements from Trinoma. There is one U-turn slot at the northern side of Mindanao Avenue mostly used by left-turn traffic from Trinoma to North Avenue.

#### (2) Traffic Volume

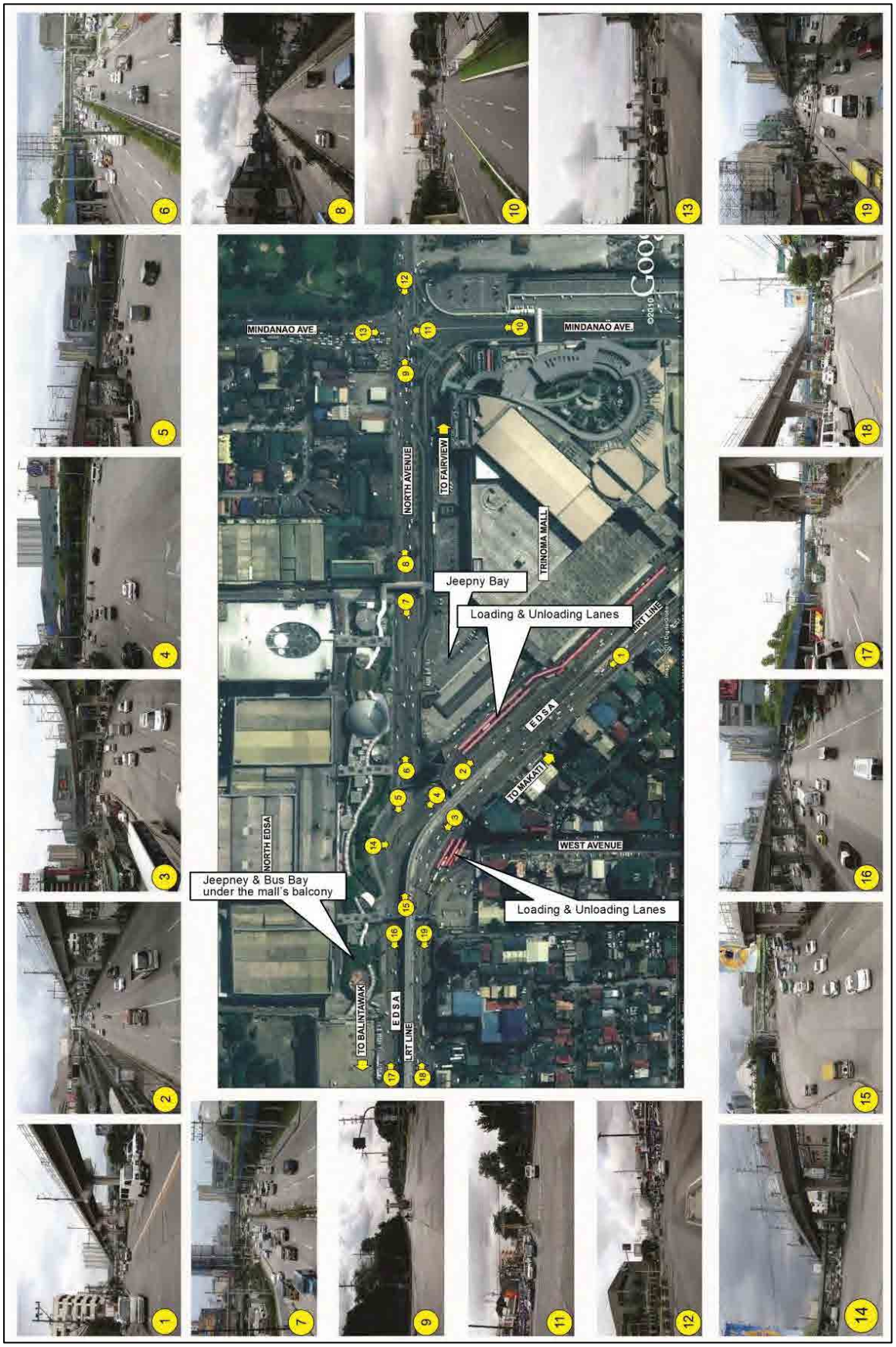
**Table 3.2-3** shows summary of traffic volume obtained from traffic count survey.

**EDSA/North/West Avenue Intersection**

In addition to EDSA, traffic volume along North Avenue is also large and construction of additional viaduct along North Avenue was proposed in the previous detailed design. However, there might not be enough space around the intersection due to construction of LRT viaduct and station after the detailed design. Construction of a simple flyover along EDSA may be the most suitable scheme for the intersection.

**North/Mindanao Avenue Intersection**

Left-turn traffic between North Avenue and Mindanao Avenue is major traffic flow rather than straight traffic at this intersection. If flyover is constructed at this intersection, left-turn flyover will be introduced rather than flyover for straight traffic.




*Source: JICA Study Team*

**Figure 3.2-3 Current Condition of Intersection (EDSA/North/West/Mindanao)**

**Table 3.2-3 Summary of Traffic Volume (EDSA/North/West/Mindanao)**

| Direction of Flow | AADT | AM Peak (7-9 AM) (Vehicle/Hour) | Noon Time (12-14) (Vehicle/Hour) | PM Peak(4-6 PM) (Vehicle/Hour) |
|---|---|---|---|---|
| **EDSA/North/West Intersection** | | | | |
| **Leg-1 (from/to Cubao)** | | | | |
| - From Cubao. | 99,149 | 3,934 | 4,064 | 5,659 |
| - To Cubao | 67,232 | 3,408 | 3,360 | 2,937 |
| **Total** | **166,381** | **7,342** | **7,424** | **8,596** |
| U-turn | 25,190 | 1,309 | 1,249 | 1,359 |
| **Leg-2 (from /to Balintawak)** | | | | |
| - From Balintawak | 67,514 | 3,944 | 3,645 | 3,333 |
| - To Balintawak | 119,930 | 3,701 | 3,912 | 5,766 |
| **Total** | **187,444** | **7,645** | **7,557** | **9,099** |
| U-turn | 21,957 | 1,095 | 1,007 | 1,022 |
| **Leg-3 (from/to Quezon Avenue)** | | | | |
| - From Quezon Avenue | 13,126 | 497 | 677 | 695 |
| - To Quezon Avenue | 14,864 | 819 | 721 | 755 |
| **Total** | **27,990** | **1,316** | **1,398** | **1,450** |
| U-turn | - | - | - | - |
| **Leg-4 (from/to Quezon Circle)** | | | | |
| - From Quezon City Circle | 23,316 | 1,133 | 1,039 | 1,281 |
| - To Quezon City Circle | 33,727 | 1,580 | 1,433 | 1,511 |
| **Total** | **57,043** | **2,713** | **2,472** | **2,792** |
| - U-turn | - | - | - | - |
| **Total Inflow Traffic** | **231,063** | **9,508** | **9,425** | **10,968** |
| **North Avenue/Mindanao Avenue** | | | | |
| **Leg-1 (from/to Trinoma)** | | | | |
| - From Trinoma | 7,934 | 535 | 177 | 385 |
| - To Trinoma | 20,938 | 1,117 | 1,066 | 1,154 |
| **Total** | **28,872** | **1,652** | **1,243** | **1,539** |
| U-turn | - | - | - | - |
| **Leg-2 (from /to Mindanao Avenue)** | | | | |
| - From Mindanao Avenue | 37,393 | 1,702 | 2,655 | 1,721 |
| - To Mindanao Avenue | 35,120 | 1,911 | 1,556 | 1,487 |
| **Total** | **72,513** | **3,613** | **4,211** | **3,199** |
| - U-Turn | 1,651 | 105 | 84 | 89 |
| **Leg-3 (from/to Balintawak)** | | | | |
| - From Balintawak | 44,086 | 2,494 | 2,197 | 2,186 |
| - To Balintawak. | 25,305 | 1,188 | 1,709 | 1,301 |
| **Total** | **69,391** | **3,682** | **3,906** | **3,487** |
| U-Turn | - | - | - | - |
| **Leg-4 (from/to Quezon Circle)** | | | | |
| - From Quezon City Circle | 30,882 | 1,487 | 1,691 | 1,463 |
| - To Quezon City Circle | 38,933 | 2,002 | 2,389 | 1,822 |
| **Total** | **69,815** | **3,489** | **4,080** | **3,285** |
| - U-Turn | 499 | 24 | 23 | 19 |
| **Total Inflow Traffic** | **120,295** | **6,218** | **6,720** | **5,755** |

*Source: JICA Study Team*

### (3) Traffic Congestion

Severe traffic congestion along EDSA northbound during afternoon peak hours is observed. Queue length along northbound EDSA reaches 400 m during afternoon peak hours. Queue length of southbound EDSA is relatively shorter than northbound, probably due to traffic flow

blockage at EDSA/Roosevelt Intersection. Queue length along North Avenue at North/Mindanao Intersection could not be properly recorded due to frequent disturbances by inflow and outflow from/to shopping malls.

Travel speed along West/North Avenue between two intersections sharply decreases compared to adjacent sections, from 31.15 km/h to 9.77 km/h along northbound lanes in afternoon peak hours.

### 3.2.4 C-5/Kalayaan Intersection

**Figure 3.2-4** shows current condition of the intersection with pictures.

#### (1) Traffic Control

There is no traffic signal control at the intersection. Straight and left-turn movements along Kalayaan Avenue are prohibited. Left-turn movement from C-5 is also prohibited. These are two U-turn viaducts along C-5 and straight and left-turn traffic from Kalayaan Avenue and left-turn traffic from C-5 have to pass the U-turn viaducts.

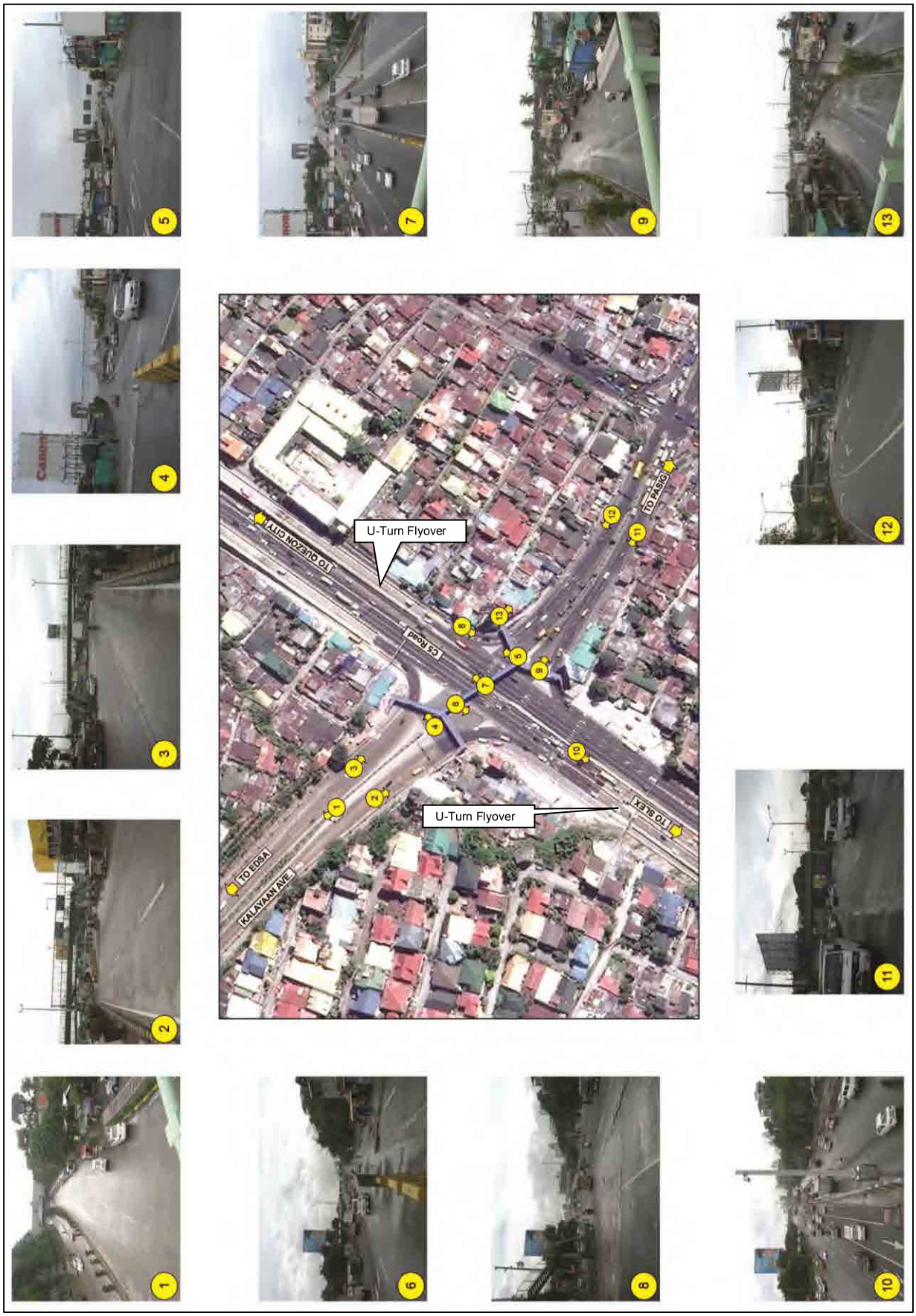
#### (2) Traffic Volume

**Table 3.2-4** shows summary of traffic volume obtained from traffic count survey.

**Table 3.2-4 Summary of Traffic Volume (C-5/Kalayaan)**

| Direction of Flow | AADT | AM Peak (7-9 AM) (Vehicle/Hour) | Noon Time (12-14) (Vehicle/Hour) | PM Peak(4-6 PM) (Vehicle/Hour) |
|---|---|---|---|---|
| **Leg-1 (from/to Global/SLEX)** | | | | |
| - From Global/SLEX. | 69,726 | 4,203 | 2,943 | 2,909 |
| - To Global/SLEX | 48,788 | 2,653 | 1,975 | 2,608 |
| **Total** | **118,514** | **6,856** | **4,918** | **5,517** |
| - U-turn | 25,132 | 1,008 | 970 | 1,290 |
| **Leg-2 (from /to Pasig/Quezon City)** | | | | |
| - From Pasig/Quezon City | 60,257 | 3,788 | 2,453 | 3,277 |
| - To Pasig/Quezon City | 73,060 | 4,453 | 3,041 | 3,362 |
| **Total** | **133,317** | **8,241** | **5,494** | **6,639** |
| - U-turn | 18,600 | 1,094 | 789 | 693 |
| **Leg-3 (from/to Pateros)** | | | | |
| - From Pateros | 16,027 | 1,038 | 741 | 701 |
| - To Pateros | 18,136 | 839 | 843 | 898 |
| **Total** | **34,163** | **1,877** | **1,584** | **1,599** |
| - U-turn | - | - | - | - |
| **Leg-4 (from/to Kalayaan/EDSA)** | | | | |
| - From Kalayaan/EDSA | 22,552 | 1,021 | 806 | 1,207 |
| - To Kalayaan/EDSA | 27,895 | 2,178 | 1,178 | 1,197 |
| **Total** | **50,447** | **3,199** | **1,984** | **2,404** |
| - U-turn | - | - | - | - |
| **Total Inflow Traffic** | **168,562** | **10,050** | **6,943** | **8,094** |

*Source: JICA Study Team*




*Source: JICA Study Team*

**Figure 3.2-4 Current Condition of Intersection (C-5/Kalayaan)**

Major traffic movements are straight flow along C-5 (AADT 118,514 from Global City/SLEX and AADT 133,317 from/to Pasig City/Quezon City). Traffic from/to EDSA through Kalayaan Avenue is also fairly large (AADT 50,447). The Number plate survey for this intersection was not conducted and OD matrix was not constructed. With absence of the OD matrix, demand for left-turn movement was not precisely grasped but roughly perceived that left-turn movement from EDSA/Kalayaan to Pasig/Quezon City is relatively large with AADT 12,900.

**(3) Traffic Congestion**

Queue length along C-5 reaches 400 m along northbound lane in the afternoon peak and 305 m along southbound lane in the morning peak. Three lanes are available for through traffic along C-5 due to the presence of left-turn viaducts. Approximate hourly capacity of the 3-lane road is estimated at:

1,200 vehicles/lane/hour[3] x 3 lanes = 3,600 vehicles/hour.

Maximum hourly through traffic along C-5 is recorded at 3,427 vehicles in morning peak hours from Pasig City/Quezon City. This implies that the intersection will be saturated in the near future. Increase of the number of through traffic lanes by widening the road or removal of the U-turn viaduct and construction of a flyover for through traffic may be needed to increase capacity of the intersection.

### 3.2.5 C-5/Green Meadows/Acropolis/Calle Industria Intersection

**Figure 3.2-5** shows current condition of the intersection with pictures.

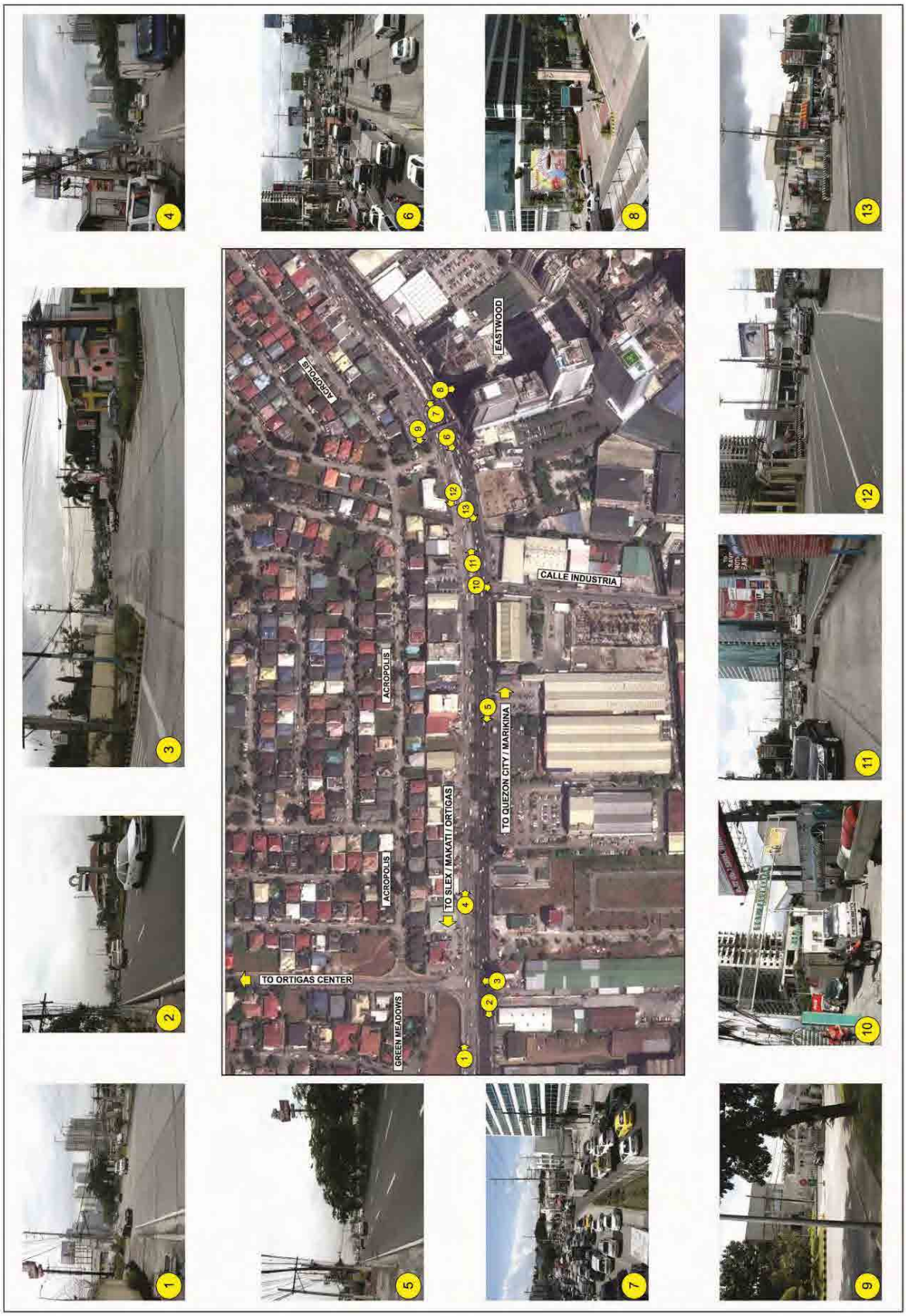
**(1) Traffic Control**

There are four streets that connect to C-5, namely Eastwood Street, Acropolis Street, Calle Industria Street and Green Meadows Street. Intersections with these streets are not controlled by traffic signals but restriction movements. All left-turn movements are prohibited at each intersection. There are three U-turn slots are available at the site but one U-turn slot at the middle of the intersections is currently closed and the slots at Cubao side and Pasig side are open to traffic and currently used.

**(2) Traffic Volume**

**Table 3.2-5** shows summary of traffic volume obtained from traffic count survey. Major traffic movements are through traffic along C-5 and other traffic movements from/to other streets are marginal. This implies that substantial number of traffic will be eliminated from at-grade intersection if through traffic flyover will be constructed.

[3] DPWH Highway Planning Manual




*Source: JICA Study Team*

**Figure 3.2-5 Current Condition of Intersection (C-5/Green Meadows/Acroplis/Calle Industria)**

**Table 3.2-5 Summary of Traffic Volume (C-5/Green Meadows/Acropolis/Calle Industria)**

| Direction of Flow | AADT | AM Peak (7-9 AM) (Vehicle/Hour) | Noon Time (12-14) (Vehicle/Hour) | PM Peak(4-6 PM) (Vehicle/Hour) |
|---|---|---|---|---|
| **Leg-1 (from/to Pasig)** | | | | |
| - From Pasig | 57,586 | 3,668 | 2,314 | 3,402 |
| - To Pasig | 71,854 | 4,839 | 3,838 | 3,929 |
| **Total** | **129,440** | **8,507** | **6,152** | **7,331** |
| - U-turn | 10,693 | 450 | 599 | 684 |
| **Leg-2 (from /to Cubao)** | | | | |
| - From Cubao | 82,826 | 5,522 | 4,496 | 4,582 |
| - To Cubao | 68,279 | 4,118 | 2,913 | 4.086 |
| **Total** | **151,105** | **9,640** | **7,409** | **8,668** |
| - U-turn | - | - | - | - |
| **Leg-3 (from/to Greenmeadows)** | | | | |
| - From Greenmeadows | 8,513 | 449 | 397 | 565 |
| - To Greenmeadows | 8,792 | 682 | 457 | 535 |
| **Total** | **17,305** | **1,131** | **854** | **1,100** |
| - U-turn | - | - | - | - |
| **Leg-4 (from/to Calle Industria)** | | | | |
| - From Calle Idustria | 11,627 | 884 | 567 | 596 |
| - To Calle Industria | 12,900 | 656 | 673 | 901 |
| **Total** | **24,527** | **1,540** | **1,240** | **1,497** |
| - U-turn | - | - | - | - |
| **Leg-5 (from/to Acropolis)** | | | | |
| - From Acropolis | 1,399 | 50 | 77 | 92 |
| - To Poseidon | 1,355 | 67 | 76 | 96 |
| **Total** | **2,754** | **117** | **153** | **188** |
| - U-turn | - | - | - | - |
| **Leg-6 (from/to Eastwood)** | | | | |
| - From Eastwood | 11,096 | 527 | 469 | 701 |
| - To Eastwood | 8,681 | 428 | 357 | 575 |
| **Total** | **19,777** | **955** | **826** | **1,276** |
| - U-turn | - | - | - | - |
| **Leg-7 (from/to Cubao)** | | | | |
| - From Cubao | 63,297 | 4,138 | 3,121 | 3,593 |
| - To Cubao | 49,935 | 3,045 | 1,545 | 2,912 |
| **Total** | **113,232** | **7,183** | **4,666** | **6,505** |
| - U-turn | 19,486 | 1,401 | 1,374 | 993 |
| **Total Inflow Traffic** | **153,518** | **9,716** | **6,945** | **8,949** |

*Source: JICA Study Team*

### (3) Traffic Congestion

Severe traffic congestion is experienced along C-5 due to merging traffic from side streets. Queue length at C-5/Greenmeadows reaches more than 200 m during morning and afternoon peak hours.

## 3.3 TRAFFIC DEMAND FORECAST

The traffic demand forecast for four intersections, namely C-3/E. Rodriguez, EDSA/Roosevelt/ Congressional Avenue, EDSA/North/West/Mindanao and C-5/Green Meadows/Acropolis/Calle Industria have been carried out for 2018, expected opening year of the interchanges, and for 2028, 10 years after the opening of the interchanges.

### 3.3.1 Methodology of the Demand Forecast

The traffic demand forecast was undertaken by the following two steps;

Step 1: Estimation of traffic volume growth rate considering future road network in Metro Manila. Traffic growth rate at each intersection was estimated through analysis on overall traffic flow in Metro Manila considering future road network development plan proposed by MMUTIS. The result of the analysis was used to forecast future traffic volume at each intersection.

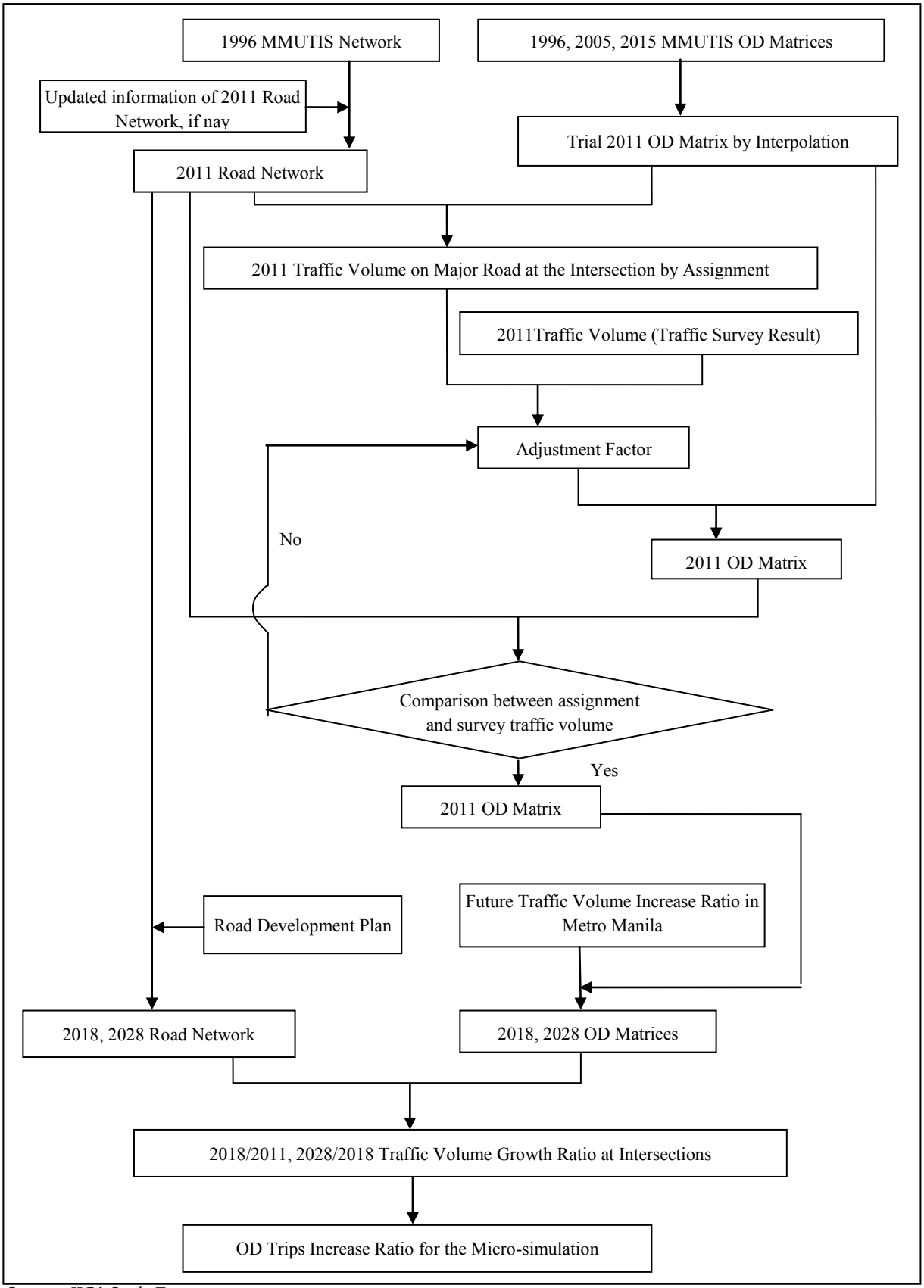
Step 2: Traffic analysis at the intersections by micro-simulation. Micro-simulation at each intersection was carried out using present traffic count data and the growth rates derived in the Step 1. Traffic volume by direction in morning peak, noon time and afternoon peak was forecasted and subsequently AADT was estimated. The total vehicle-km, total vehicle-hour and average travel speed were calculated for the purpose of project assessment. More detailed procedures of each step are discussed below.

#### (1) Estimation of Traffic Growth Rate

MMUTIS conducted in 1998 is the latest and most reliable traffic study that covers most major roads in Metro Manila. The traffic demand forecast model of MMUTIS is the only available model for analysis of the transport network that covers the entire Metro Manila.

The MMUTIS used "System for Traffic Demand Analysis (STRADA)", a traffic analysis software developed by JICA, using the "four-step method" for traffic demand forecast. The MMUTIS analysis includes analysis of public transportation; the road network covers the entire Metro Manila, which encompasses the project intersections.

MMUTIS has conducted traffic analysis for 1996 and 2015. OD matrix for 2005 was also established. The flow of derivation of traffic growth rate for micro-simulation is shown in **Figure 3.3-1**.




*Source: JICA Study Team*

**Figure 3.3-1 Flowchart of Traffic Analysis of the Project**

The road network of MMUTIS in 1996 was updated by adding current road network data to formulate 2011 road network. Trial 2011 OD matrix was calculated by interpolating between 1996, 2005 and 2015 OD matrices. The final 2011 OD matrix was derived by comparing traffic count data undertaken by JICA study team and result of traffic assignment using trial 2011 OD matrix. 2018 and 2028 OD matrices were calculated using final 2011 OD matrix and traffic growth rate estimated by MMUTIS. Then future traffic volume of 2018 and 2028 was estimated using 2018 and 2028 OD matrices and road network proposed by MMUTIS. Traffic growth rates between 2011–2018 and 2018–2028 were then computed by comparing current 2011 traffic volume. The parameters used for traffic assignment were taken from MMUTIS.

Since MMUTIS OD matrices use unit of PCU (Passenger Car Unit), present traffic data in terms of number of vehicles was converted into PCU unit using conversion factors shown in **Table 3.3-1**. Since MMUTIS OD matrices do not include motorcycle, motorcycle was excluded from PCU conversion.

**Table 3.3-1 PCU Conversion Factors**

| | Car | Jeepney | Utility Vehicle | Bus | Truck | Motorcycle |
|---|---|---|---|---|---|---|
| Factor | 1.0 | 1.5 | 1.5 | 2.0 | 2.5 | 1.0 |

*Source: DPWH Highway Planning Manual 2003*

The MMUTIS annual average traffic growth rate between 2005 and 2015 is 6.4%. According to DPWH data on the number of registered vehicles in the NCR, the annual average growth rate between 2008 and 2010 is 6.1% that is almost same as MMUTIS growth rate, therefore, MMUTIS traffic growth rate was used for the traffic analysis of the Project.

The MMUTIS traffic growth rate is used until 2015. Beyond 2015, traffic growth rate is expected to decrease considering the decreasing trend in growth rate estimated by DPWH. **Table 3.3-2** shows annual traffic growth rates in the NCR estimated by DPWH. The estimated traffic growth rates used for traffic analysis of the project were obtained by deducting rates of 1.9% and 0.8% and shown in **Table 3.3-3**.

**Table 3.3-2 DPWH Annual Traffic Growth Rates in NCR**

| Time Period | Traffic Growth Rate |
|---|---|
| A: 2009–2014 | 7.5% |
| B: 2015–2020 | 5.6% |
| C: 2021–2026+ | 4.8% |
| Decrease Rate, B – A | -1.9% |
| Decrease Rate, C – B | -0.8% |

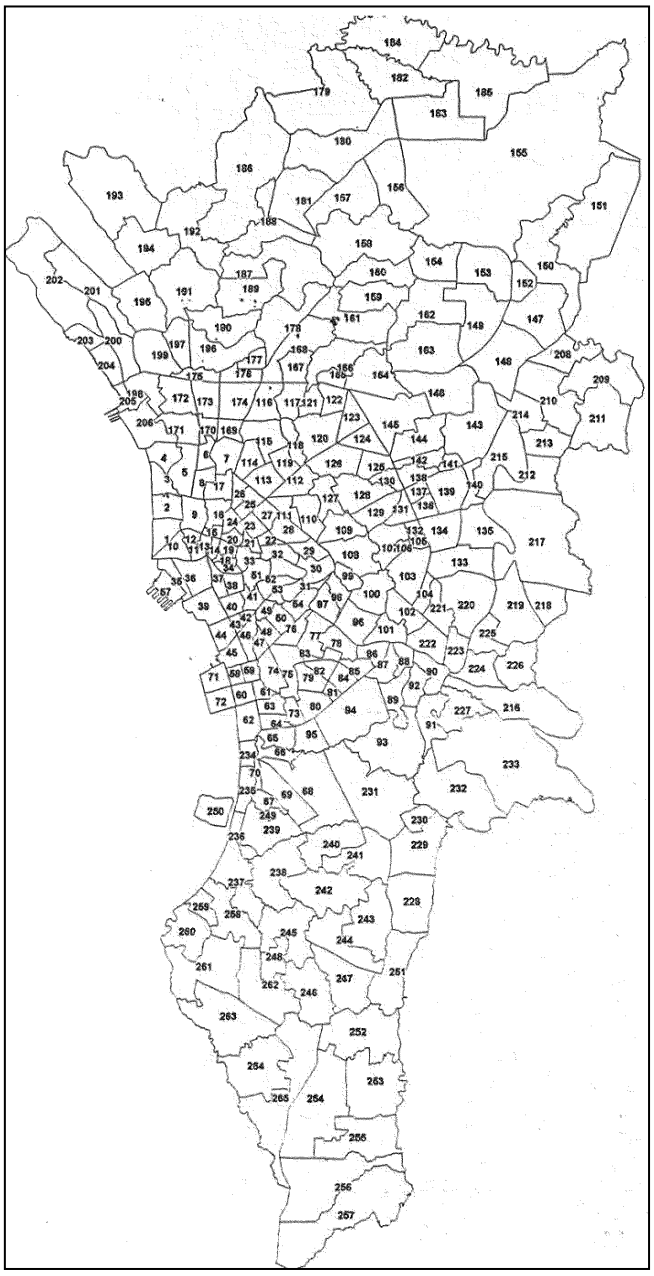
*Source: DPWH*

**Table 3.3-3 Average Traffic Growth Rate for the Project**

| Period | Annual Growth Rate |
|---|---|
| 2011-2015 | 6.4% |
| 2015-2020 | 4.5% (-1.9%) |
| 2020-2028 | 3.7% (-0.8%) |

*Source: JICA Study Team*

The zone system of OD matrices is shown in **Figure 3.3-2** for Metro Manila and **Figure 3.3-3** for adjacent areas.



*Source: Metro Manila Urban Transportation Integration Study, JICA, March 1999*

**Figure 3.3-2 OD Zone System in Metro Manila**

*Source: Metro Manila Urban Transportation Integration Study, JICA, March 1999*

**Figure 3.3-3 OD Zone System in Adjacent Area of Metro Manila**

### (2) Road Network Data

**2011 Road Network.** According to the information from DPWH, there are no new major road and railway construction in Metro Manila between 1996 and 2011, except Skyway and MRT whose traffic impacts on the project intersections are considered to be marginal. Therefore, this Study used the 1996 MMUTIS road network for analysis of 2011traffic.

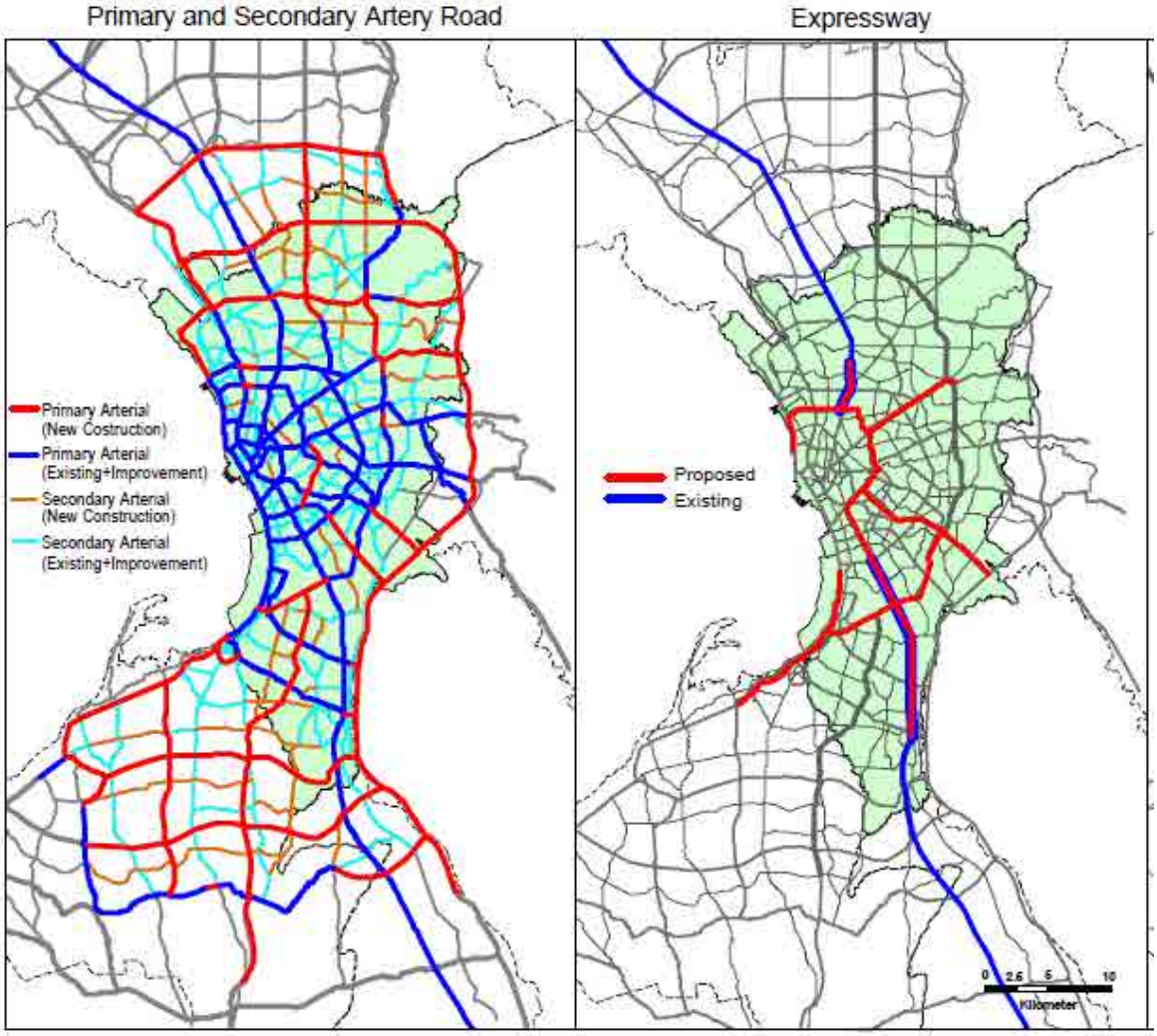
**2018 Road Network.** The "C-3 Missing Link" is to be added to the 2011 road network for the 2018 road network. The C-3 aliment recommended by the Project Team was incorporated into the 2018 road network. The main feature of the proposed C-3 Missing Link is shown **Table 3.3-4.**

**Table 3.3-4 Condition of C-3 Missing Link**

| Total Length | No. of Lanes | Start | Connections | | End |
|---|---|---|---|---|---|
| 6.3 km | 6 | Junction Sen. Gil Puyat (Buendia) Avenue /Ayala Avenue | New Panaderos (Lambingan) (Sta. 3.3 km) | Shaw Boulevard (Sta. 4.4 km) | C-3 Araneta Avenue after crossing LRT Line 2 (Sta. 6.3 km) |

*Source: JICA Study Team*

**2028 Road Network**. The MMUTIS road network master plan is used as the 2028 road network. The original schedule of the master plan expected that the master plan network would be completed by 2015, but it has not fully realized as planned. However, according to a meeting with DPWH officials, the master plan is still to be pursued for implementation. Therefore, MMUTIS master plan road network was used as the 2028 road network in this study. The MMUTIS master plan road network is shown in **Figure 3.3-4**.




*Source: Metro Manila Urban Transportation Integration Study, JICA, March 1999*

**Figure 3.3-4 MMUTIS Network Master Plan**

### (3) Traffic Volume Growth Rate at Each Intersection

The traffic volume growth rates along major road that passes through the project intersections are calculated based on result of traffic assignments using OD matrices and road networks mentioned above. The formula to derive traffic growth rate is shown below. 2011 OD matrices are adjusted using an adjustment factor calculated based on the results of the assignment model and traffic survey.

Growth rate from 2011 to 2018 = 2018 assigned traffic volume / 2011 assigned traffic volume

Growth rate from 2018 to 2028 = 2028 assigned traffic volume / 2018 assigned traffic volume

1) At C-3/E. Rodriguez Intersection

The comparison of 2011 traffic volume along C-3 between assigned traffic volume using OD matrix constructed from number plate survey and actual survey result is shown in **Table 3.3-5**. The difference is merely 1%, thus, the 2011 OD matrix can be used for further analysis. The 2018 and 2028 OD matrices are then established using the growth rate derived from procedures discussed above.

**Table 3.3-5 Traffic Volume Comparison (C-3/E. Rodriguez Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A. Assignment Result | 62,600 |
| B. Traffic Survey Result | 63,400 |
| Difference (B/A) | 1.01 |

*Note: Excluding motorcycles*
*Source: JICA Study Team*

Traffic assignments for 2018 and 2028 were carried out using 2018 and 2028 OD matrices and road network, and the traffic volume growth rate of main road that passes through intersection are calculated. The results are shown in **Table 3.3-6**.

**Table 3.3-6 Traffic Growth Rate (C-3/E. Rodriguez Intersection)**

| Period | Growth Rate | Vehicle Type |
|---|---|---|
| 2018/2011 | 1.96 | All Types |
| 2028/2018 | 1.62 | Motorcycles, Jeepneys (do not use expressway) |
| 2028/2018 | 0.64 | Cars, Utility Vehicles, Buses, Trucks |

*Note: Excluding motorcycles*
*Source: JICA Study Team*

Because the existing C-3 will be connected to the C-3 Missing Link in 2018, traffic will drastically increase. It is assumed that the C-3 Urban Expressway will be operational by 2028, therefore, traffic volume of C-3 at the intersection will decrease due to the diversion of traffic to the said expressway. Hence, growth ratio becomes 0.64. On the other hand, in the case of no C-3 Urban Expressway, traffic volume will increase 1.62 times by 2028. It is assumed that motorcycles and jeepneys will not use the expressway, so the growth ratio of 1.62 is used for these vehicle categories.

2) At EDSA/Roosevelt/Congressional Intersection

The comparison of the 2011 traffic volume of EDSA (between Congressional Avenue and North Avenue) is shown in **Table 3.3-7**. The difference is 11%, which is fairly large and is not suitable for direct use to the traffic demand forecast. Therefore, the OD matrix was adjusted.

**Table 3.3-7 Traffic Volume Comparison, 2011**
**(EDSA/Roosevelt/Congressional Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A. Assignment Result | 231,800 |
| B. Traffic Survey Result | 206,400 |
| Difference (B/A) | 0.89 |

*Note: Excluding motorcycles*
*Source: JICA Study Team*

The result of re-assignment is shown in **Table 3.3-8**. The difference is 1% that is small enough to proceed further analysis. Then 2018 and 2028 OD matrices are established using the growth ratio derived from procedures discussed above.

**Table 3.3-8 Traffic Volume Comparison, Adjusted**
**(EDSA/Roosevelt/Congressional Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A: Assignment Result | 208,900 |
| B: Traffic Survey Result | 206,400 |
| Difference(B/A) | 0.99 |

*Note: excluding motorcycles*
*Source: JICA Study Team*

The traffic volume growth rate of major road that passes through the intersection is calculated using the result of assignments for EDSA/Roosevelt/Congressional. The result of the calculation is shown **Table 3.3-9**.

**Table 3.3-9 Traffic Growth Rate (EDSA/Roosevelt/Congressional Intersection)**

| Period | Growth Ratio | Vehicle Type |
|---|---|---|
| 2018/2011 | 1.27 | All Types |
| 2028/2018 | 1.31 | Motorcycles, Jeepneys (do not use expressway) |
| 2028/2018 | 0.93 | Cars, Utility Vehicles, Buses, Trucks |

*Source: JICA Study Team*

It is assumed that the C-3 Urban Expressway will be operational by 2028, therefore, traffic volume at EDSA/Roosevelt/Congressional Intersection also shows trend of decrease due to the influence of traffic diversion to the said expressway. However, in the case of no C-3 Urban Expressway, traffic volume will increase 1.31 times by 2028. It is further assumed that motorcycles and jeepneys will not use the expressway, so the growth ratio of 1.31 is used for these vehicle types.

3) At EDSA/North/West/Mindanao Intersection

The comparison of 2011 traffic volume of EDSA (between Congressional Avenue and North Avenue) that passes through EDSA/North/West/Mindanao is shown in **Table 3.3-10**. The same location of EDSA/Roosevelt/Mindanao Intersection was selected for traffic volume comparison, because EDSA/North/West/Mindanao is located next to EDSA/Roosevelt/Congressional

Intersection. The difference is 11% which is too large to use traffic analysis. Therefore, the OD matrix was adjusted.

**Table 3.3-10 Traffic Volume Comparison, 2011**
**(EDSA/North/West/Mindanao Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A: Assignment Result | 231,800 |
| B: Traffic Survey Result | 206,400 |
| Difference(B/A) | 0.89 |

*Note: excluding motorcycles*
*Source: JICA Study Team*

The results of re-assignment are shown below. The difference is 1% and small enough for the demand forecast. 2018 and 2028 OD matrices are established using the growth rate derived from procedures discussed above.

**Table 3.3-11 Traffic Volume Comparison, Adjusted**
**(EDSA/North/West/Mindanao Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A: Assignment Result | 208,900 |
| B: Traffic Survey Result | 206,400 |
| Difference(B/A) | 0.99 |

*Note: excluding motorcycles*
*Source: JICA Study Team*

The traffic volume growth rate of major road that passes through the intersection is calculated using the result of traffic assignment. The result of the calculation is shown in **Table 3.3-12**.

**Table 3.3-12 Traffic Growth Rate (EDSA/North/West/Mindanao Intersection)**

| Period | Growth Ratio | Vehicle Type |
|---|---|---|
| 2018/2011 | 1.27 | All Types |
| 2028/2018 | 1.31 | Motorcycles, Jeepneys (not allowed on Expressway) |
| 2028/2018 | 0.93 | Cars, Utility Vehicles, Buses, Trucks |

*Source: JICA Study Team*

The traffic flow of the intersection will be affected by the opening of the C-3 Urban Expressway after 2028 and traffic growth rate of 0.93 was obtained. It is assumed that motorcycles and jeepneys will not use the expressway, so a growth rate of 1.31 was used.

The zoning system of the micro-simulation for EDSA/North/West/Mindanao includes commercial zones. The commercial areas are currently active. Therefore, it seems that the decreasing trend of traffic growth rate as expected at the other intersections may not happen at this particular intersection. Therefore it is assumed that the commercial zone generation and attraction trips will maintain the same growth rate trend in the future.

4) At C-5/Green Meadows/Acropolis/Calle Industria Intersection

The comparison of the 2011 traffic volume for C-5 (between Eastwood Avenue and Mercury Avenue) through the project intersections is shown in **Table 3.3-13**. The difference is 17% which is too large for the demand forecast. Therefore, the OD matrix was adjusted.

**Table 3.3-13 Traffic Volume Comparison, 2011**
**(C-5/Green Meadows/Acropolis/Calle Industria Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A: Assignment Result | 96,500 |
| B: Traffic Survey Result | 113,100 |
| Difference(B/A) | 1.17 |

*Note: excluding motorcycles*
*Source: JICA Study Team*

The result of re-assignment is shown in **Table 3.3-14**. The difference is 5%, which may be acceptable for the demand forecast.

**Table 3.3-14 Traffic Volume Comparison, Adjusted**
**(C-5/Green Meadows/Acropolis/Calle Industria Intersection)**

Unit：PCU/Day

| | |
|---|---|
| A: Assignment Result | 107,700 |
| B: Traffic Survey Result | 113,100 |
| Difference(B/A) | 1.05 |

*Note: excluding motorcycles*
*Source: JICA Study Team*

The traffic volume growth ratio of major road that passes through the intersection is calculated based on the results of assignment for the intersection. The result of the calculation is shown in **Table 3.3-15**.

**Table 3.3-15 Traffic Growth Rate (C-5/Green Meadows/Acropolis/Calle Industria Intersection)**

| Period | Growth Ratio | Vehicle Type |
|---|---|---|
| 2018/2011 | 1.15 | All Type |
| 2028/2018 | 1.48 | All Type |

*Source: JICA Study Team*

### (4) Traffic Analysis at Intersections with Micro-simulation

Analysis of intersection improvement is carried out by micro-simulation

1) Establishment of OD matrices for the micro-simulation

Current OD matrices for micro-simulation of intersections are established considering the results of traffic surveys. OD matrices of AM peak hour, mid noon off peak and PM peak hour are established. The three-hour traffic volume was expanded to 24 hours by multiplying expansion factors.

2) Present Network

Present intersection network is formulated based on the result of site survey, topographic survey and existing road inventory data.

3) Future OD Matrices

Future OD matrices are established using the growth ratio that was calculated using a model based on MMUTIS.

4) Future Network

Two future networks were established; one is "without project network" that is basically same as the current network and "with project network" that incorporates proposed flyovers.

5) Micro-simulation

Micro-simulation was carried out with the future OD matrices and networks. The software package for micro-simulation is VISSIM. It is one of the authorized software package by Traffic Simulation clearing house that is managed by Japan Society of Traffic Engineers.

Vehicle types of the OD matrices for the micro-simulation are the six types by combining 10 vehicle categories from intersection directional traffic volume survey as shown in **Table 3.3-16**.

**Table 3.3-16 Vehicle Types of OD Matrices for Micro-simulation**

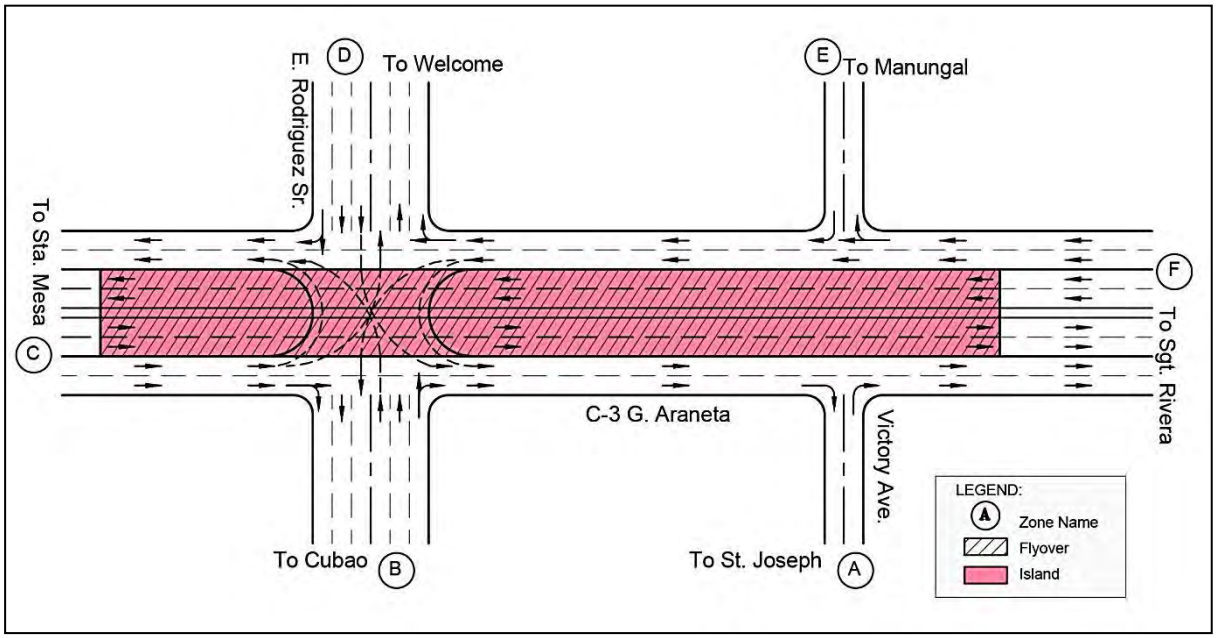
| Vehicle Type of Traffic Count Survey | | Vehicle Type of Micro-simulation | |
|---|---|---|---|
| 1 | Car | 1 | Car |
| 2 | Jeepney | 2 | Jeepney |
| 3 | Utility Vehicle | 3 | Utility Vehicle |
| 4 | Small Bus | 4 | Bus |
| 5 | Large Bus | | |
| 6 | Rigid 2-axle Truck | 5 | Truck |
| 7 | Rigid 3-axle Truck | | |
| 8 | Rigid 4-axle or more Truck | | |
| 9 | Motorcycle | 6 | Motorcycle |
| 10 | Tricycle | | |

*Source: JICA Study Team*

Result of the traffic analysis is discussed in the following sections.

a) C-3/E. Rodriguez Intersection

The location of zones and the intersection network is shown in **Figure 3.3-5**.




*Source: JICA Study Team*

**Figure 3.3-5 Location of Zones and Intersection Network (C-3/E. Rodriguez)**

The following formula was used to expand three-hour (AM peak hour, mid noon off peak hour and PM peak hour) traffic volume to 24-hour traffic volume.

24-hour traffic volume = (AM peak hour traffic volume + mid-noon off-peak hour traffic volume + PM peak hour traffic volume) x Expansion Factor

The expansion factors used in the above formula was obtained from result of traffic survey and shown in **Table 3.3-17**.

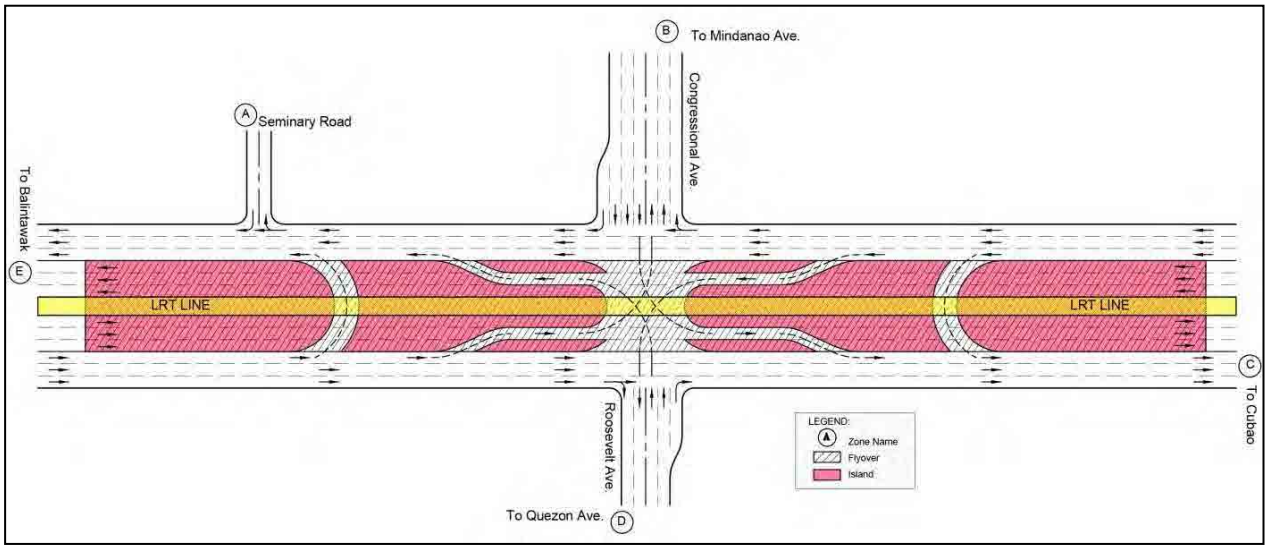
**Table 3.3-17 Traffic Volume Expansion Factors (C-3/E. Rodriguez)**

| Car | Jeepney | Utility Vehicle | Bus | Truck | Motorcycle |
|---|---|---|---|---|---|
| 6.15 | 5.32 | 5.93 | 8.10 | 5.49 | 5.14 |

*Note: 3 hours: AM Peak Hour, Mid noon Off-peak Hour and PM Peak Hour*
*Source: JICA Study Team*

b) EDSA/Roosevelt/Congressional Intersection

The location of zones and the intersection network is shown in **Figure 3.3-6**.




*Source: JICA Study Team*

**Figure 3.3-6 Location of Zones and Intersection Network (EDSA/Roosevelt/Congressional)**

The expansion factors to have 24-hour traffic volume obtained from traffic survey are shown in **Table 3.3-18**.

**Table 3.3-18 Traffic Volume Expansion Factors (EDSA/Roosevelt/Congressional)**

| Car | Jeepney | Utility Vehicle | Bus | Truck | Motorcycle |
|---|---|---|---|---|---|
| 6.06 | 5.64 | 5.91 | 7.05 | 13.92 | 5.13 |

*Note: 3 hours: AM Peak Hour, Mid-noon Off-peak Hour and PM Peak Hour*
*Source: JICA Study Team*

The expansion factor of truck is quite large due to effect of "truck ban" imposed on major thoroughfares in Metro Manila.

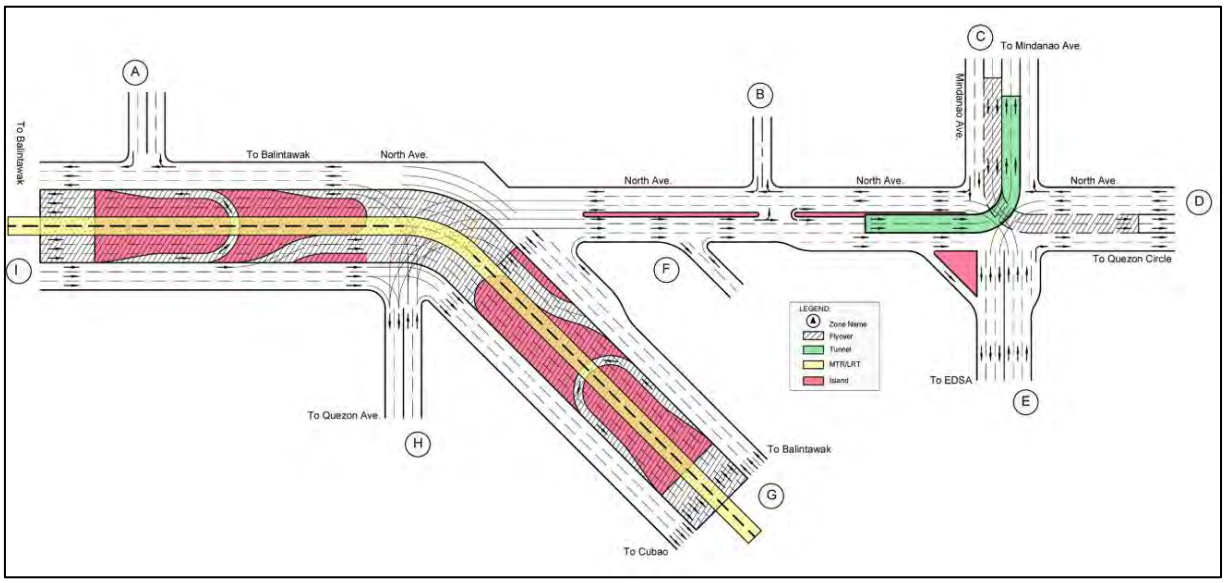
c) EDSA /North/West/Mindanao Intersection

The location of zones and the intersection network is shown in **Figure 3.3-7** while **Table 3.3-19** shows expansion factors.

**Table 3.3-19 Traffic Volume Expansion Factors (EDSA/North/West/Mindanao)**

| Car | Jeepney | Utility Vehicle | Bus | Truck | Motorcycle |
|---|---|---|---|---|---|
| 6.06 | 5.64 | 5.91 | 7.05 | 13.92 | 5.13 |

*Note: 3 hours: AM Peak Hour, Mid-noon Off-peak Hour and PM Peak Hour*
*Source: JICA Study Team*




*Source: JICA Study Team*

**Figure 3.3-7 Location of Zones and Intersection Network (EDSA/North/West/Mindanao)**

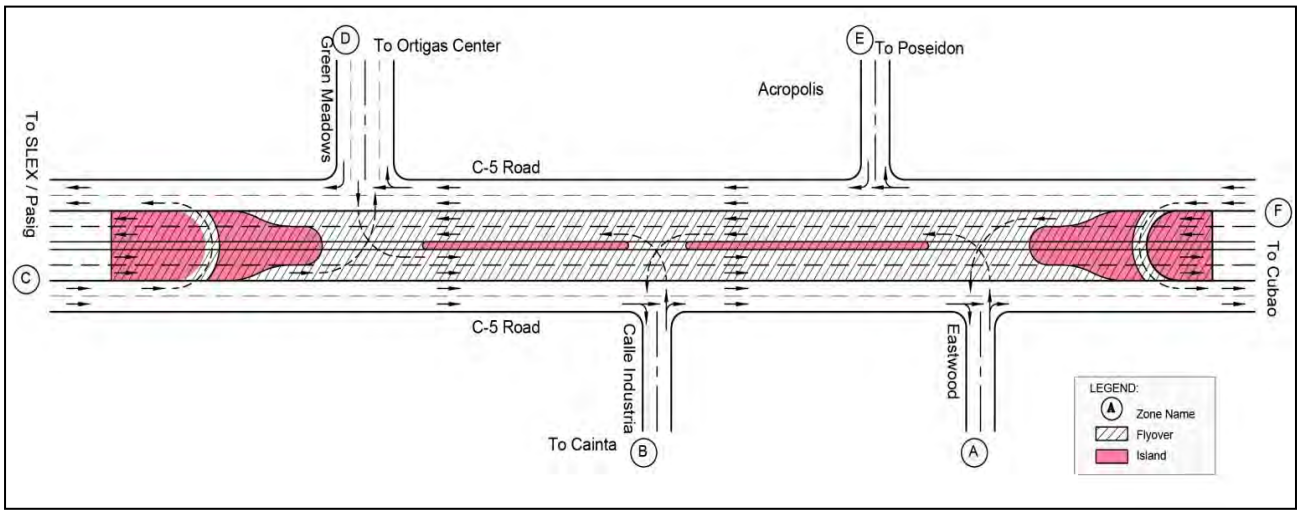
d) C-5/Green Meadows/Acropolis/Calle Industria Intersection

The location of zones and the intersection network is shown in **Figure 3.3-8** and **Table 3.3-20** shows expansion factors for the intersection.

**Table 3.3-20 Traffic Volume Expansion Factor**
**(C-5/Green Meadows/Acropolis/Calle Industria)**

| Car | Jeepney | Utility Vehicle | Bus | Truck | Motorcycle |
|---|---|---|---|---|---|
| 6.01 | 5.60 | 6.33 | 5.59 | 6.90 | 5.72 |

*Note: 3 hours: AM Peak Hour, Mid-noon Off-peak Hour and PM Peak Hour)*
*Source: JICA Study Team*



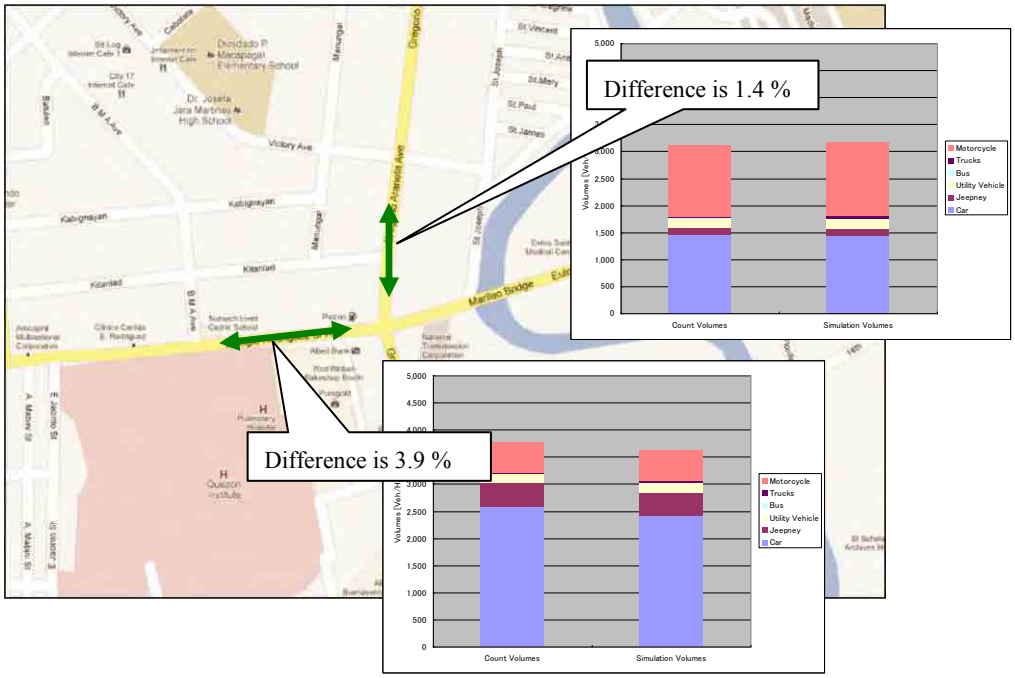

*Source: JICA Study Team*

**Figure 3.3-8 Location of Zones and Intersection Network (C-5/Kalayaan)**

### (5) Verification of Simulation Results

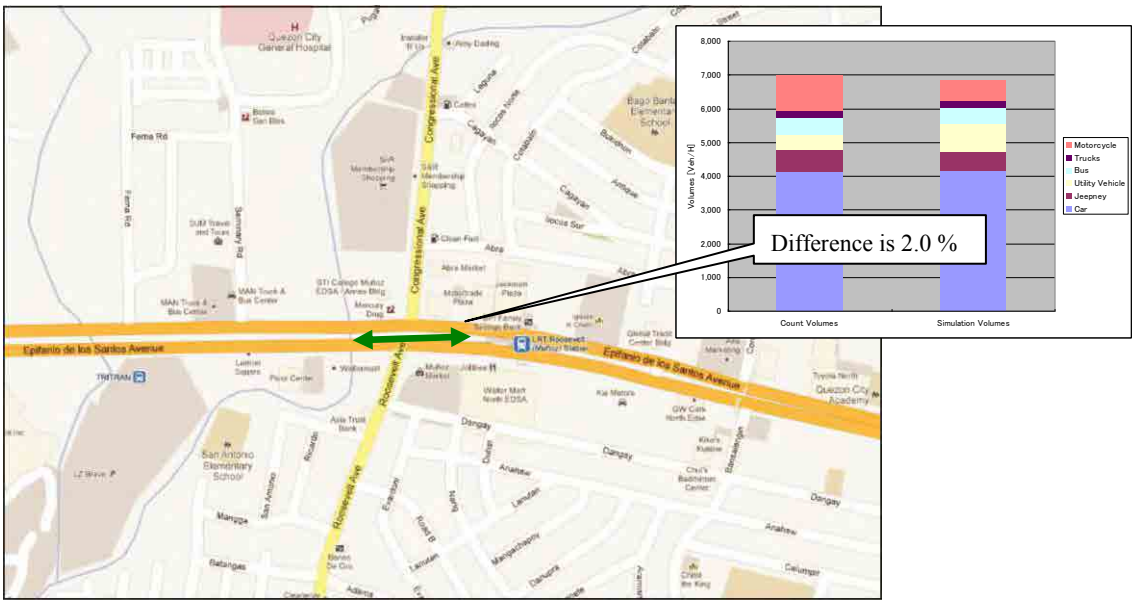
Viability of the simulation models were verified using comparison between result of traffic survey and traffic volume derived from the simulation along major road passes through the intersections at AM peak hour.

**Figure 3.3-9** through **Figure 3.3-12** show differences of simulations result for each intersection. Differences are less than 5% and considered that simulation results fairly reflect actual traffic flow condition.



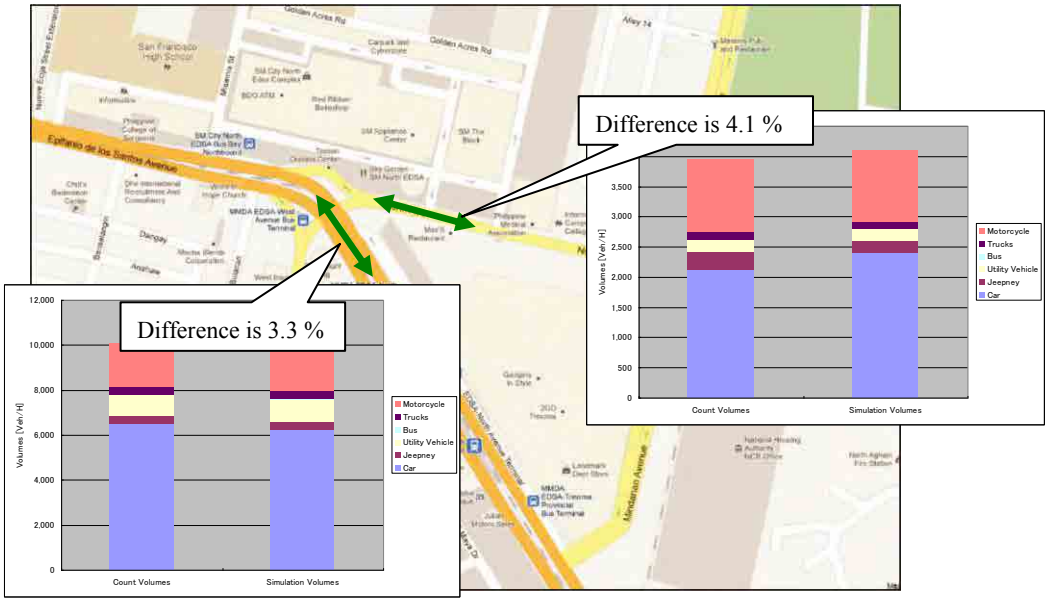

*Source: JICA Study Team*

**Figure 3.3-9 Difference between Traffic Survey Results and Simulation Results (C-3/E. Rodriguez Intersection)**



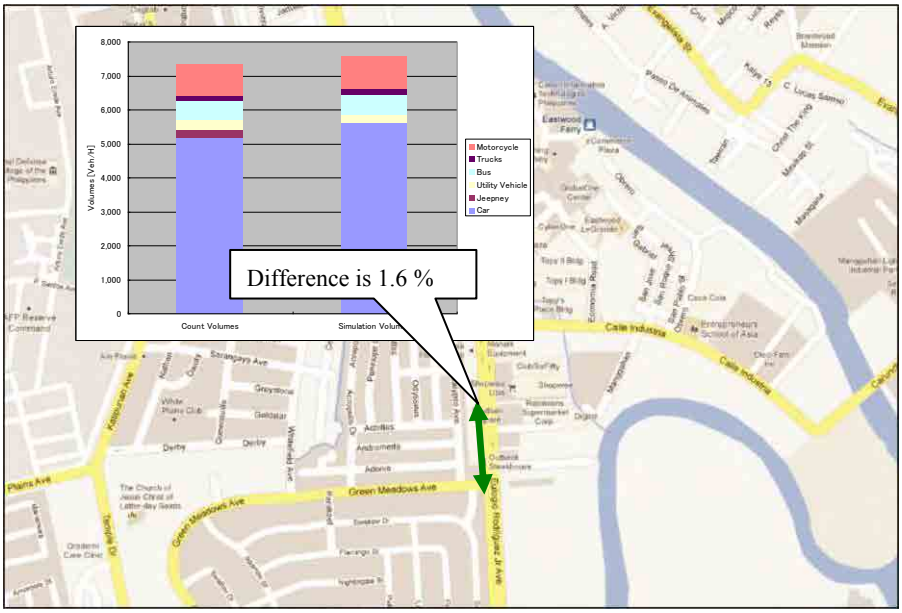

*Source: JICA Study Team*

**Figure 3.3-10 Difference between Traffic Survey Results and Simulation Results (EDSA/Roosevelt/Congressional Intersection)**




*Source: JICA Study Team*

**Figure 3.3-11 Difference between Traffic Survey Results and Simulation Results (EDSA/North/West/Mindanao Intersection)**




*Source: JICA Study Team*

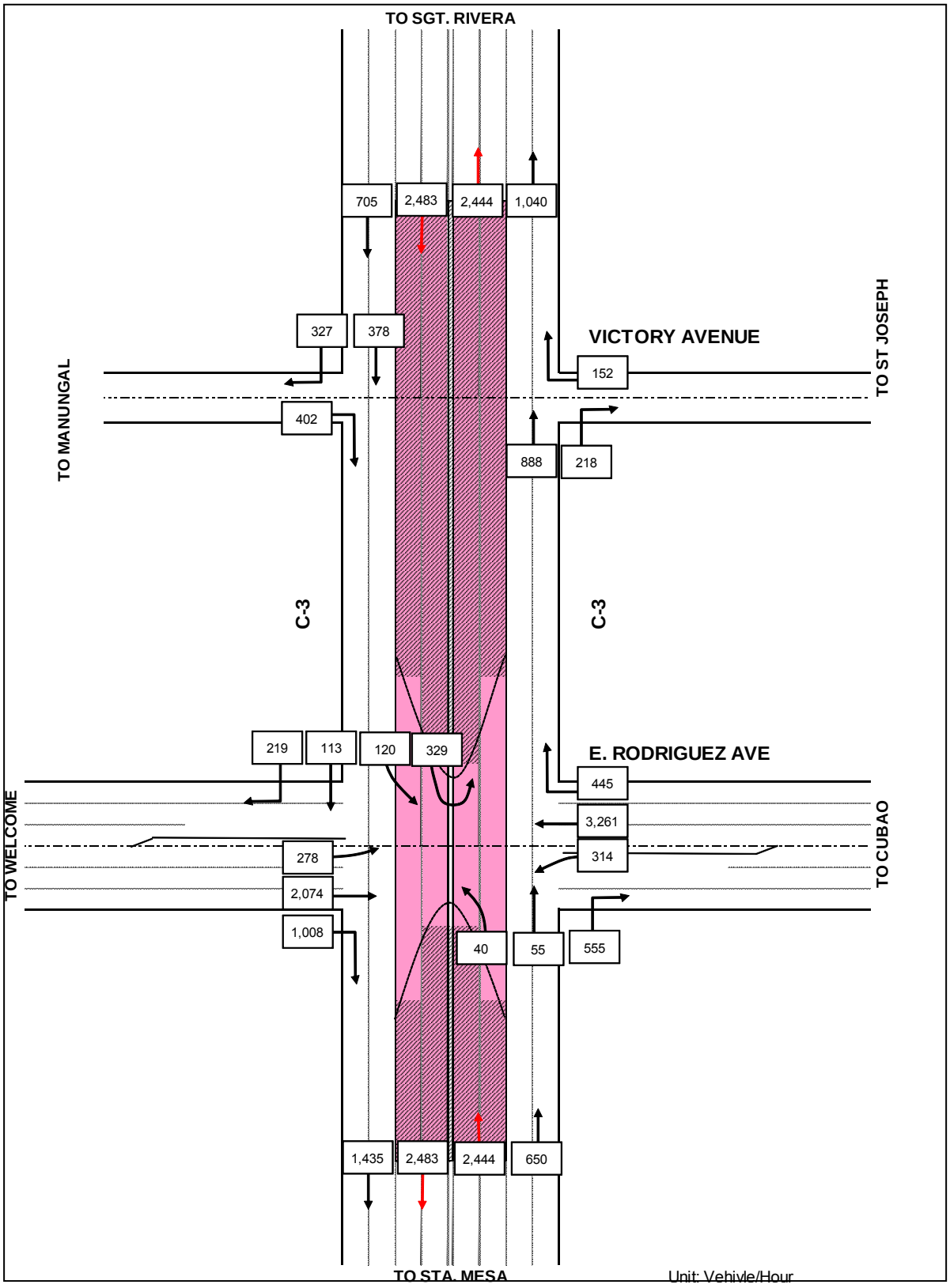
**Figure 3.3-12 Difference between Traffic Survey Results and Simulation Results (C-5/Green Meadows/Acropolis/Calle Industria Intersection)**

### 3.3.2 Results of Traffic Demand Forecast by Micro-simulation

#### (1) C-3/E. Rodriguez Intersection

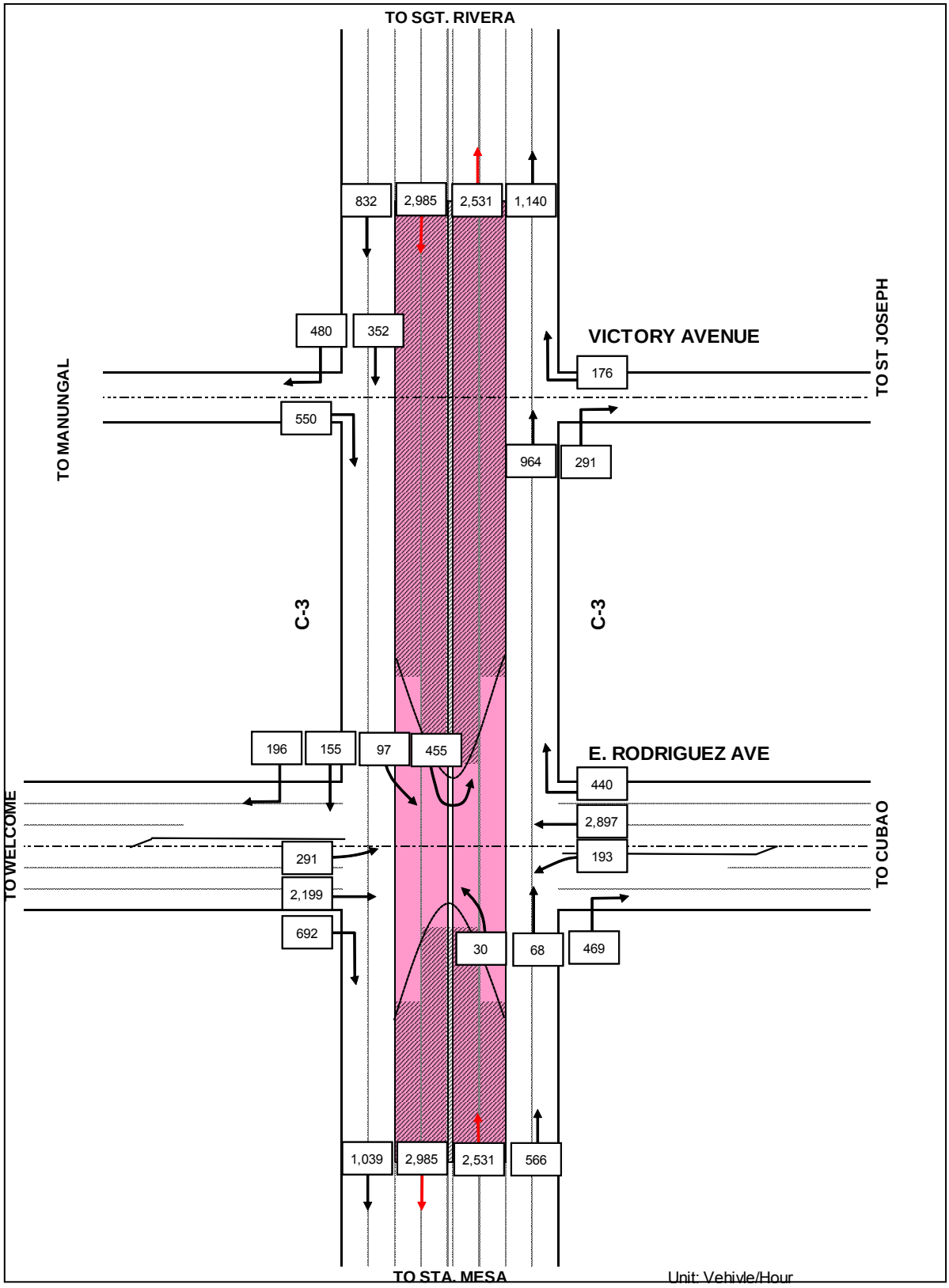
1) Traffic Volume by Direction

The hourly total traffic volumes by direction in AM peak hour on 2018 and 2028 are shown in **Figure 3.3-13** and **Figure 3.2-14** respectively. The traffic volumes of each vehicle category in AM peak, noon time and PM peak are presented in **Appendix 3.3**.




*Source: JICA Study Team*

**Figure 3.3-13 Hourly Traffic Volume at C-3/E. Rodriguez Intersection (All Vehicles : AM Peak Hour in 2018)**

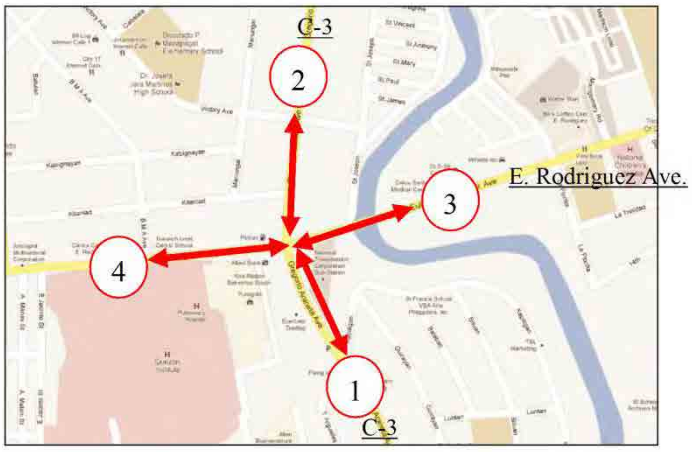


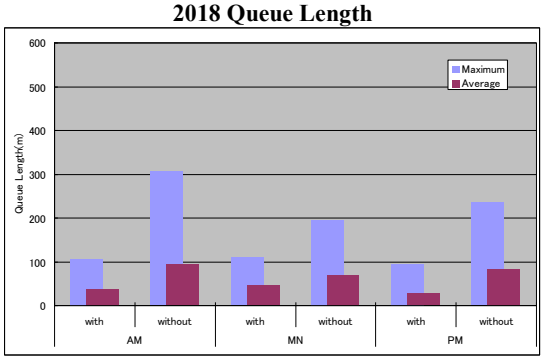
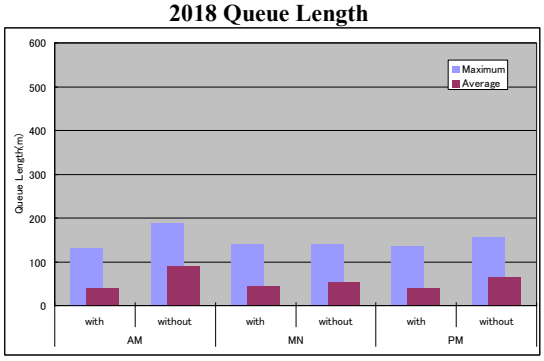
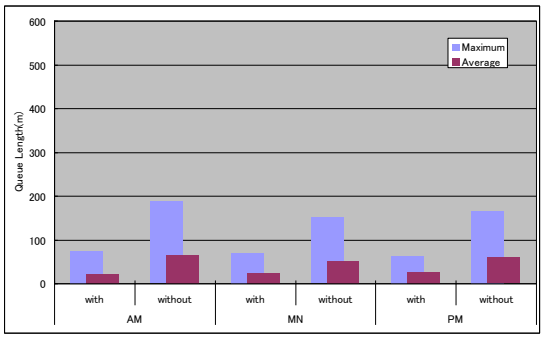
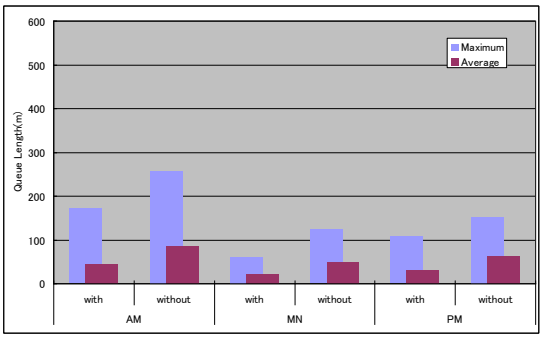

*Source: JICA Study Team*

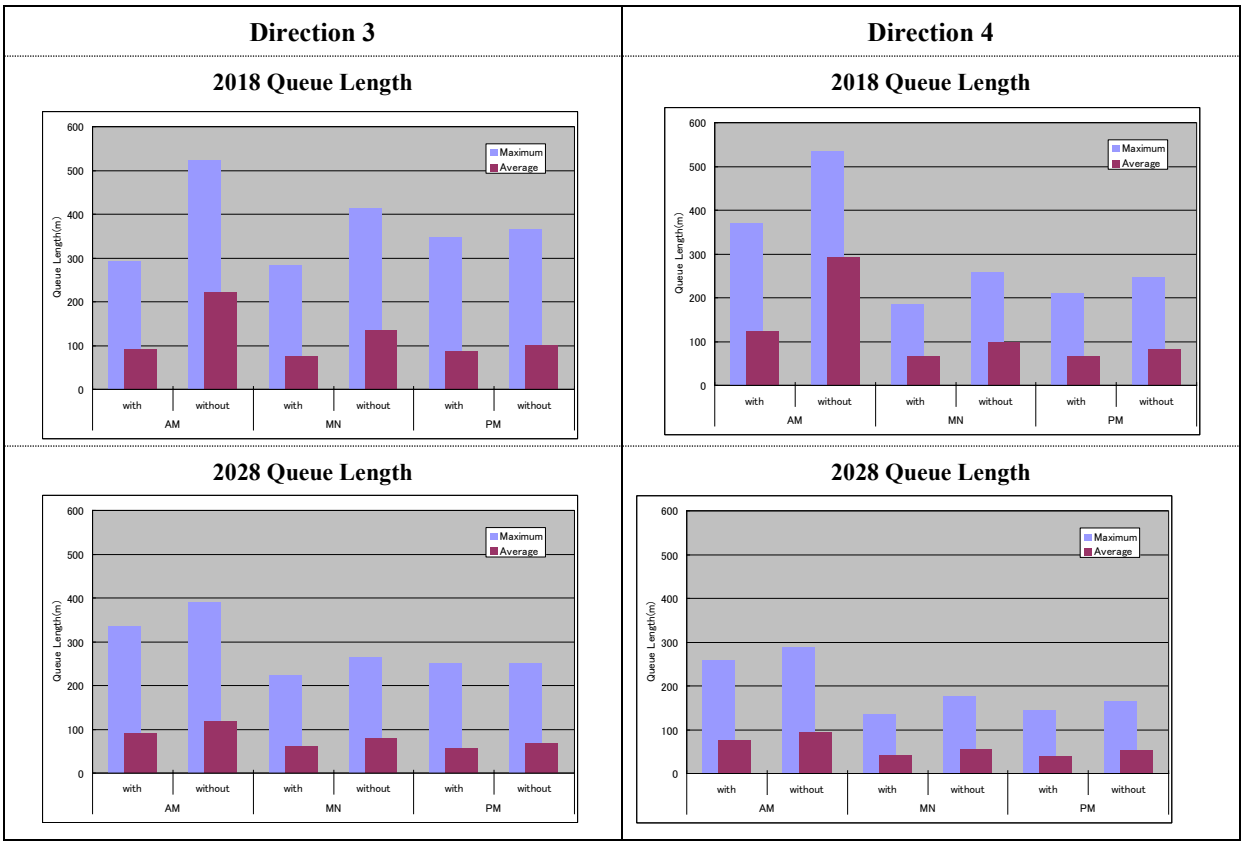
**Figure 3.3-14 Hourly Traffic Volume at C-3/E. Rodriguez Intersection (All Vehicles : AM Peak Hour in 2028)**

2) Estimated Queue Length

The queue length (speed is less than 5 km/h) in AM peak hour are shown in **Figure 3.3-15**. The with case queue lengths are shorter than the without case




| Direction 1 | Direction 2 |
|---|---|
| **2018 Queue Length** | **2018 Queue Length** |
|  |  |
| **2028 Queue Length** | **2028 Queue Length** |
|  |  |




*Source: JICA Study Team*

**Figure 3.3-15 Queue Length at C-3/E. Rodriguez Intersection**

3) Vehicle-Km, Vehicle-Hour and Average Travel Speed

Daily vehicle-km, daily vehicle-hour and average travel speed are shown in **Table 3.3-21**.

**Table 3.3-21 Daily Vehicle-Km, Vehicle-Hour and Average Travel Speed (C-3/E. Rodriguez Intersection)**

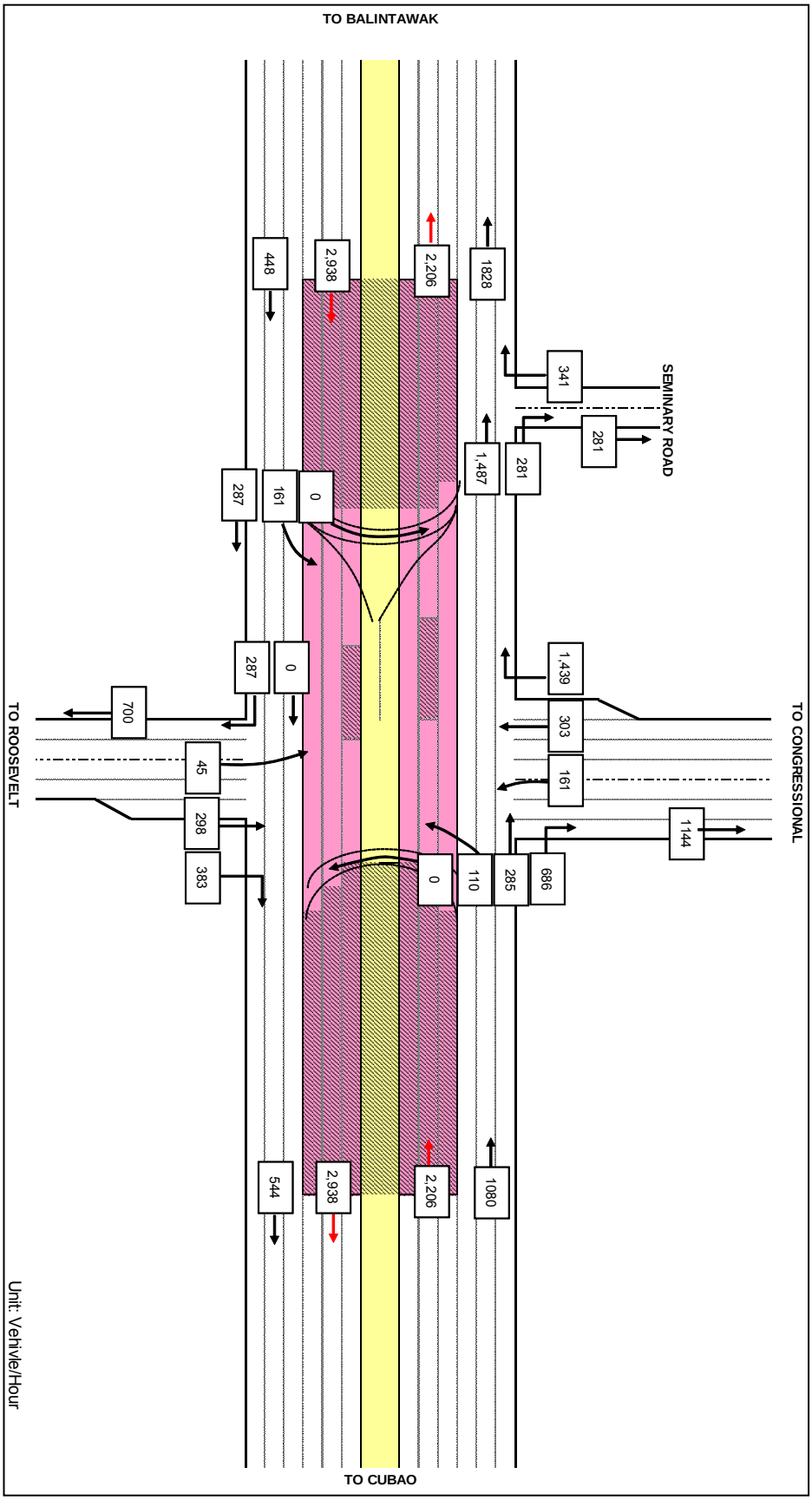
| Indicator | Vehicle Category | 2011 (Daily) | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 90,049 | 174,597 | 175,989 | -1,392 | 111,650 | 112,375 | -724 |
| | Jeepney | 9,346 | 18,453 | 18,432 | 20 | 30,503 | 30,529 | -26 |
| | UtilityVehicle | 9,618 | 18,353 | 18,574 | -222 | 11,950 | 12,071 | -121 |
| | Bus | 449 | 836 | 805 | 32 | 559 | 536 | 23 |
| | Truck | 2,881 | 5,531 | 5,624 | -93 | 3,517 | 3,541 | -23 |
| | Motorcycle | 41,595 | 86,428 | 81,010 | 5,418 | 139,866 | 130,296 | 9,570 |
| | **Total** | **153,938** | **304,197** | **300,433** | **3,764** | **298,046** | **289,347** | **8,699** |
| Vehicle Hour | Car | 3,293 | 5,842 | 7,326 | -1,483 | 3,627 | 4,603 | -977 |
| | Jeepney | 340 | 610 | 767 | -158 | 985 | 1,190 | -205 |
| | UtilityVehicle | 356 | 605 | 778 | -173 | 382 | 511 | -129 |
| | Bus | 16 | 27 | 34 | -6 | 18 | 21 | -3 |
| | Truck | 106 | 164 | 230 | -67 | 101 | 143 | -42 |
| | Motorcycle | 1,518 | 2,541 | 3,270 | -730 | 4,050 | 5,900 | -1,850 |
| | **Total** | **5,629** | **9,788** | **12,405** | **-2,617** | **9,162** | **12,369** | **-3,206** |
| Traffic Volume | Car | 67,712 | 132,486 | 132,376 | 111 | 84,621 | 84,692 | -71 |
| | Jeepney | 7,379 | 14,518 | 14,529 | -11 | 23,964 | 24,062 | -98 |
| | UtilityVehicle | 6,917 | 13,393 | 13,417 | -24 | 8,687 | 8,717 | -30 |
| | Bus | 352 | 632 | 628 | 4 | 421 | 421 | 0 |
| | Truck | 2,001 | 3,890 | 3,903 | -14 | 2,460 | 2,443 | 16 |
| | Motorcycle | 28,668 | 55,779 | 55,808 | -28 | 90,305 | 89,762 | 542 |
| | **Total** | **113,029** | **220,698** | **220,660** | **38** | **210,458** | **210,098** | **360** |
| Average Travel Speed (Km/Hour) | Car | 27.3 | 29.9 | 24.0 | 5.9 | 30.8 | 24.4 | 6.4 |
| | Jeepney | 27.5 | 30.3 | 24.0 | 6.2 | 31.0 | 25.6 | 5.3 |
| | UtilityVehicle | 27.0 | 30.4 | 23.9 | 6.5 | 31.3 | 23.6 | 7.7 |
| | Bus | 27.5 | 30.8 | 24.0 | 6.9 | 31.9 | 25.7 | 6.2 |
| | Truck | 27.2 | 33.8 | 24.4 | 9.4 | 34.8 | 24.7 | 10.1 |
| | Motorcycle | 27.4 | 34.0 | 24.8 | 9.2 | 34.5 | 22.1 | 12.4 |
| | **Average** | **27.3** | **31.1** | **24.2** | **6.9** | **32.5** | **23.4** | **9.1** |

*Source: JICA Study Team*

### (2) EDSA/Roosevelt/Congressional Intersection

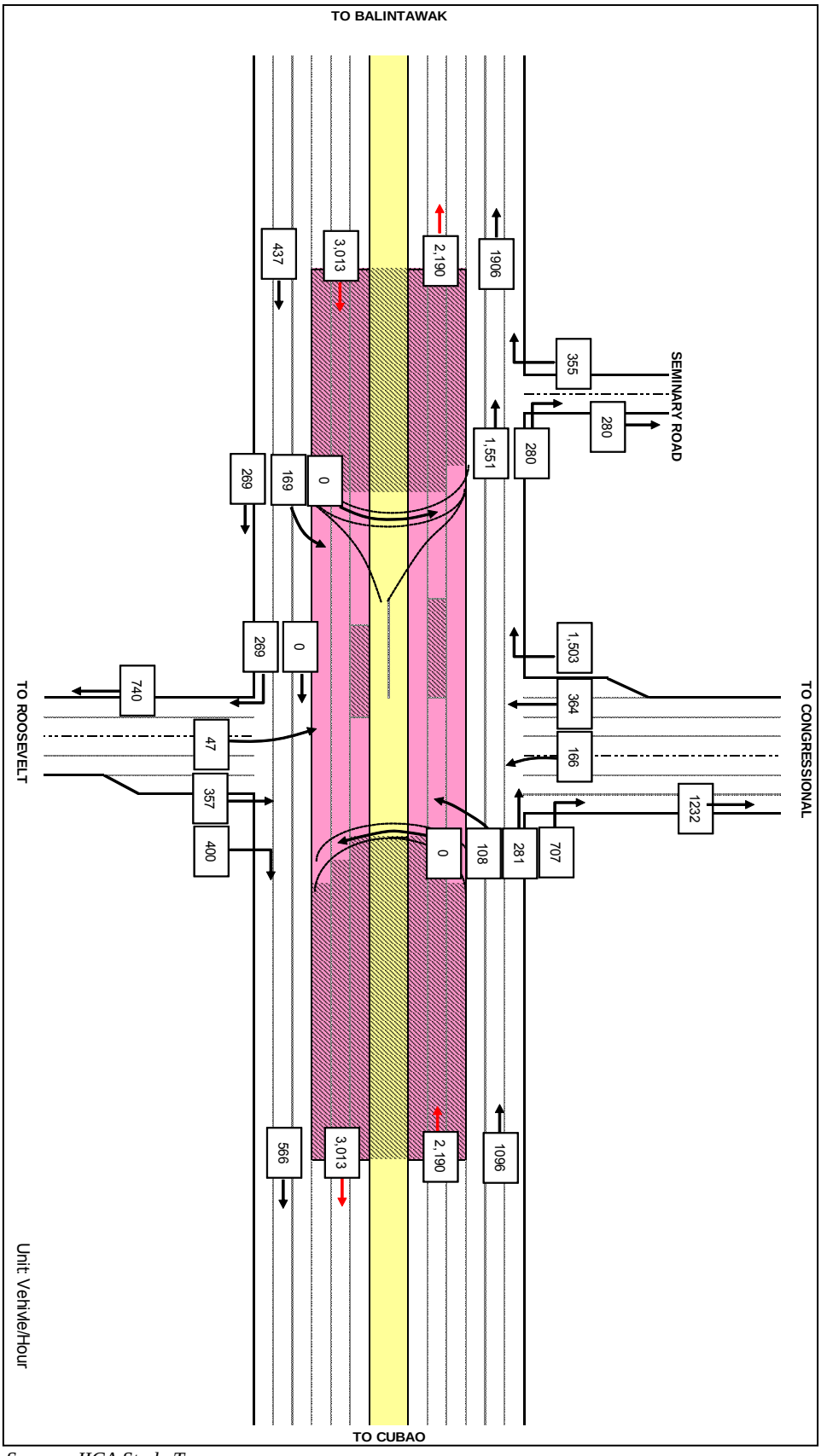
1) Traffic Volume by Direction

The hourly total traffic volumes by direction in AM peak hour on 2018 and 2018 are shown in **Figure 3.3-16** and **Figure 3.3-17** respectively. The traffic volumes of each vehicle category in AM peak, noon time and PM peak are presented in **Appendix 3.3**.




*Source: JICA Study Team*

**Figure 3.3-16 Hourly Traffic Volume at EDSA/Roosevelt/Congressional Intersection (All Vehicles : AM Peak Hour in 2018)**

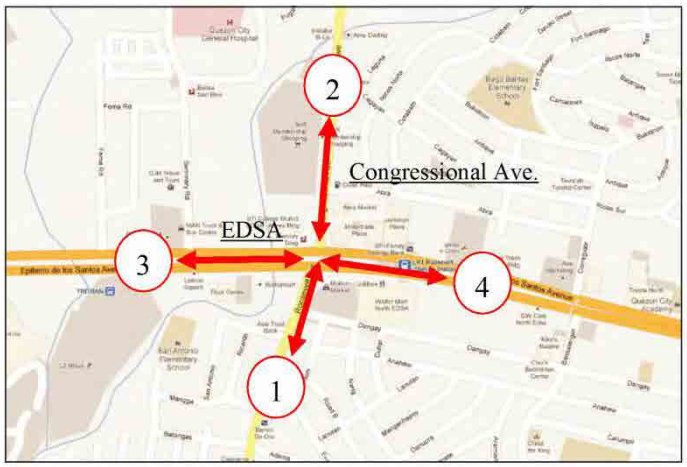


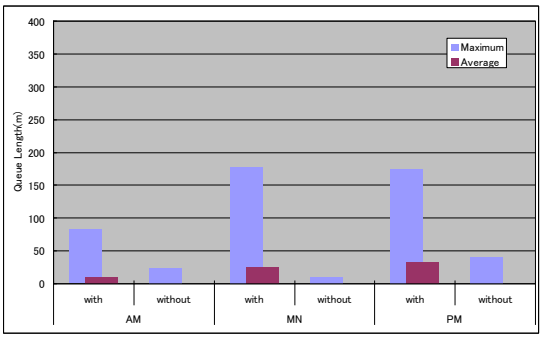
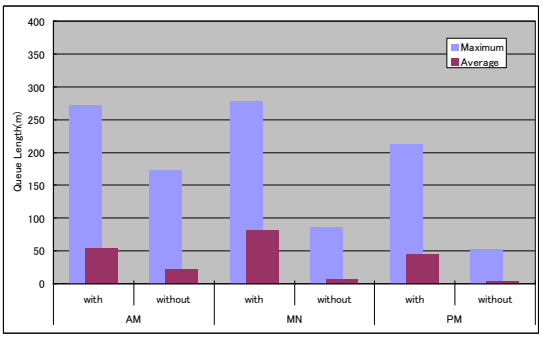
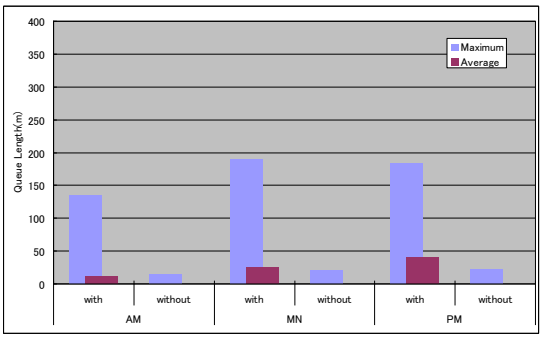
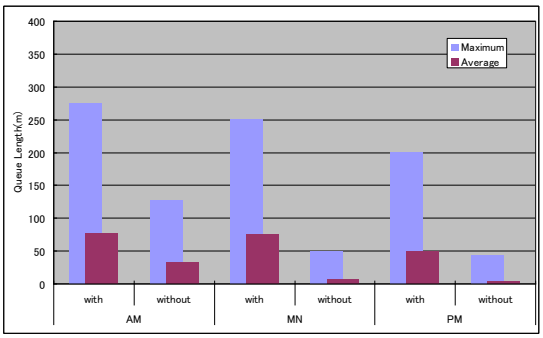

*Source: JICA Study Team*

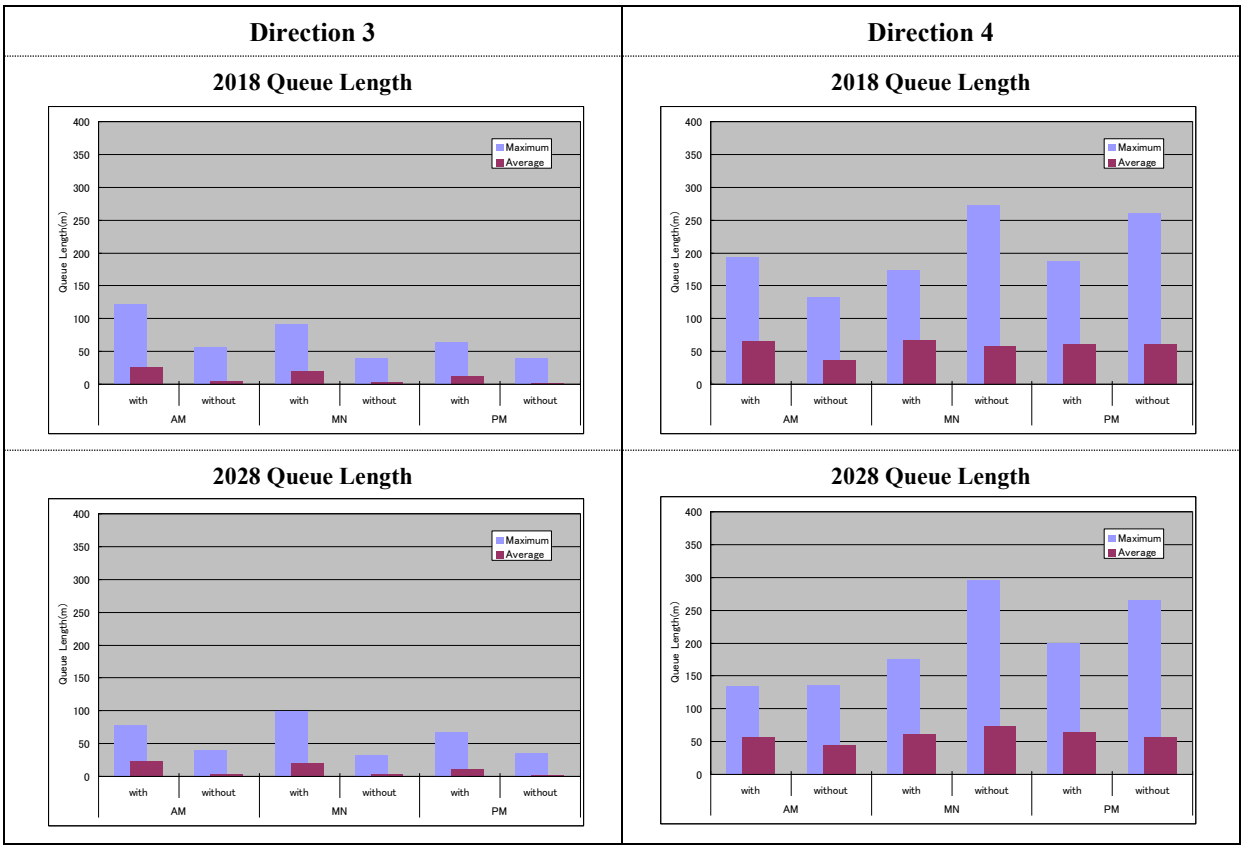
**Figure 3.3-17 Hourly Traffic Volume at EDSA/Roosevelt/Congressional Intersection (All Vehicles : AM Peak Hour in 2028)**

2) Queue Length

The queue length in AM peak hour is shown in **Figure 3.3-18**. This interchange will be signalized in the case of with project, so queue length of some direction will be longer than without project case.




| Direction 1 | Direction 2 |
|---|---|
| **2018 Queue Length** | **2018 Queue Length** |
|  |  |
| **2028 Queue Length** | **2028 Queue Length** |
|  |  |




*Source: JICA Study Team*

**Figure 3.3-18 Queue Length at EDSA/Roosevelt/Congressional Intersection**

3) Vehicle-Km, Vehicle-Hour and Average Travel Speed

Daily vehicle-km, vehicle-hour and average travel speed are shown in **Table 3.3-22**.

**Table 3.3-22 Daily Vehicle-Km, Vehicle-Hour and Average Travel Speed (EDSA/Roosevelt/Congressional Intersection)**

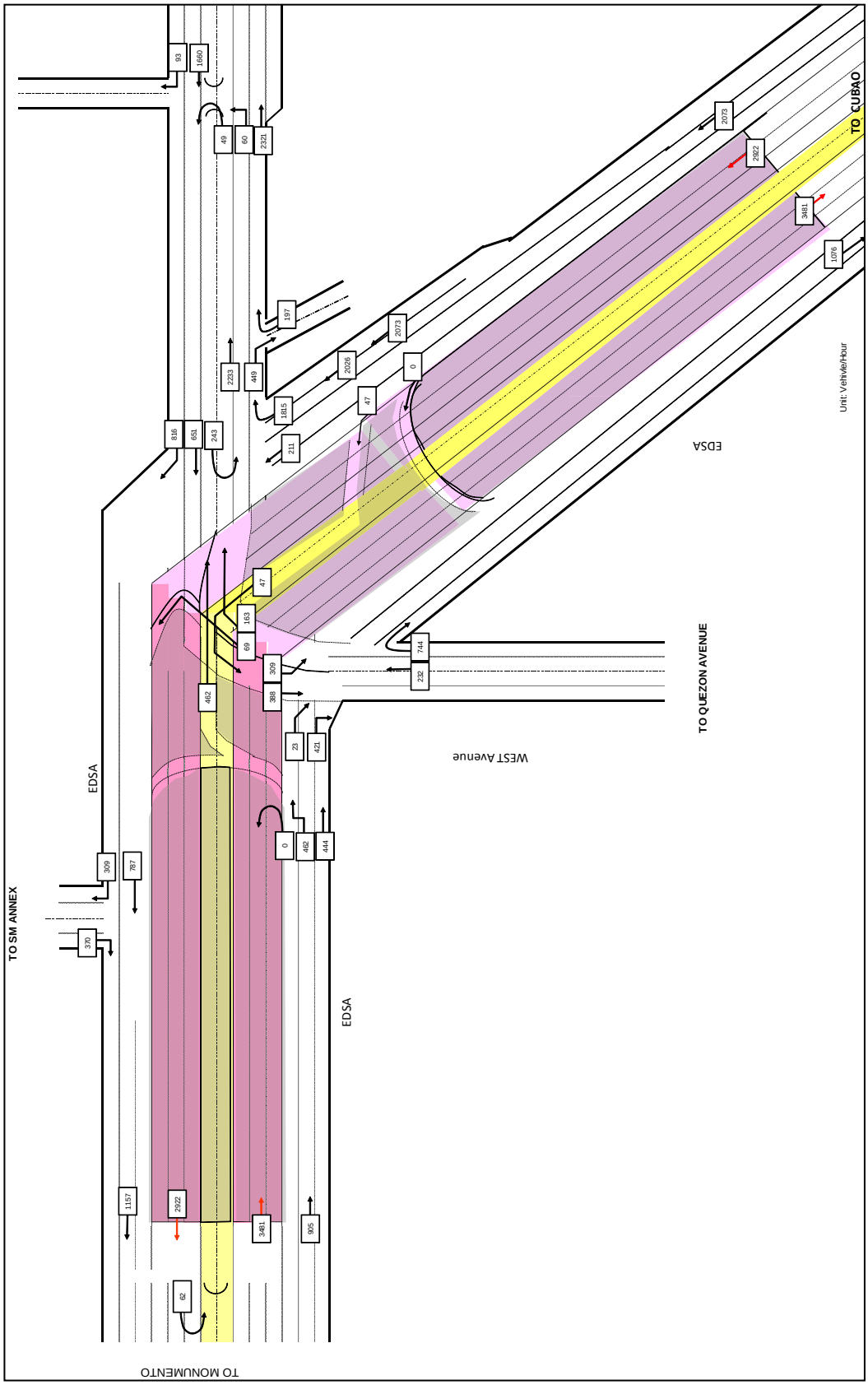
| Indicator | Vehicle Category | 2011 (Daily) | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 118,775 | 144,485 | 150,012 | -5,527 | 134,665 | 139,990 | -5,325 |
| | Jeepney | 20,782 | 22,329 | 26,650 | -4,321 | 29,268 | 35,042 | -5,774 |
| | UtilityVehicle | 18,410 | 22,402 | 23,286 | -884 | 20,734 | 21,591 | -857 |
| | Bus | 15,196 | 18,316 | 19,392 | -1,076 | 16,966 | 17,962 | -996 |
| | Truck | 14,081 | 17,072 | 17,669 | -597 | 15,885 | 16,530 | -646 |
| | Motorcycle | 21,078 | 25,264 | 26,579 | -1,315 | 32,937 | 34,900 | -1,963 |
| | **Total** | **208,323** | **249,869** | **263,588** | **-13,720** | **250,454** | **266,016** | **-15,561** |
| Vehicle Hour | Car | 3,915 | 4,770 | 5,116 | -347 | 4,444 | 4,810 | -366 |
| | Jeepney | 710 | 703 | 945 | -242 | 926 | 1,252 | -326 |
| | UtilityVehicle | 610 | 749 | 799 | -50 | 691 | 743 | -51 |
| | Bus | 510 | 543 | 675 | -132 | 503 | 629 | -127 |
| | Truck | 469 | 569 | 612 | -43 | 527 | 577 | -50 |
| | Motorcycle | 701 | 904 | 916 | -12 | 1,183 | 1,210 | -27 |
| | **Total** | **6,914** | **8,237** | **9,063** | **-826** | **8,274** | **9,221** | **-947** |
| Traffic Volume | Car | 78,477 | 99,454 | 99,193 | 261 | 92,615 | 92,521 | 94 |
| | Jeepney | 9,664 | 12,419 | 12,338 | 82 | 16,302 | 16,266 | 37 |
| | UtilityVehicle | 11,131 | 14,190 | 14,178 | 12 | 13,159 | 13,182 | -24 |
| | Bus | 10,550 | 13,480 | 13,427 | 53 | 12,468 | 12,475 | -7 |
| | Truck | 8,484 | 10,934 | 10,997 | -63 | 10,148 | 10,266 | -118 |
| | Motorcycle | 13,641 | 17,250 | 17,239 | 10 | 22,662 | 22,662 | 0 |
| | **Total** | **131,948** | **167,726** | **167,372** | **355** | **167,353** | **167,372** | **-18** |
| Average Travel Speed (Km/Hour) | Car | 30.3 | 30.3 | 29.3 | 1.0 | 30.3 | 29.1 | 1.2 |
| | Jeepney | 29.3 | 31.8 | 28.2 | 3.6 | 31.6 | 28.0 | 3.6 |
| | UtilityVehicle | 30.2 | 29.9 | 29.2 | 0.8 | 30.0 | 29.1 | 0.9 |
| | Bus | 29.8 | 33.7 | 28.7 | 5.0 | 33.8 | 28.5 | 5.2 |
| | Truck | 30.0 | 30.0 | 28.9 | 1.2 | 30.2 | 28.7 | 1.5 |
| | Motorcycle | 30.1 | 27.9 | 29.0 | -1.1 | 27.8 | 28.8 | -1.0 |
| | **Average** | **30.1** | **30.3** | **29.1** | **1.3** | **30.3** | **28.8** | **1.4** |

*Source: JICA Study Team*

### (3) EDSA /North/West/Mindanao Intersection

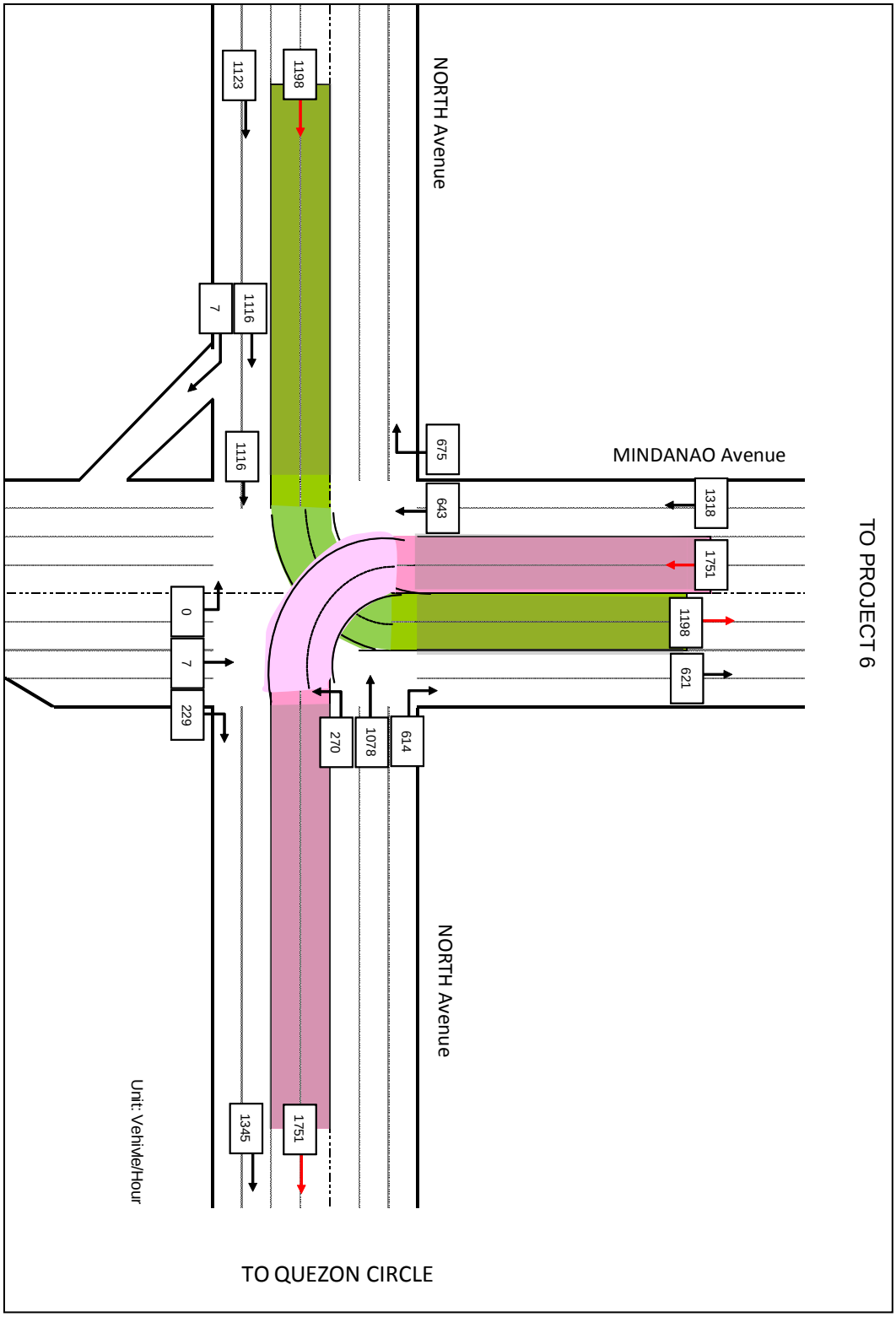
1) Traffic Volume by Direction

The hourly total traffic volumes by direction in AM peak hour on 2018 and 2018 are shown in **Figure 3.3-19** through **Figure 3.3-23** respectively. The traffic volumes of each vehicle category in AM peak, noon time and PM peak are presented in **Appendix 3.3**.



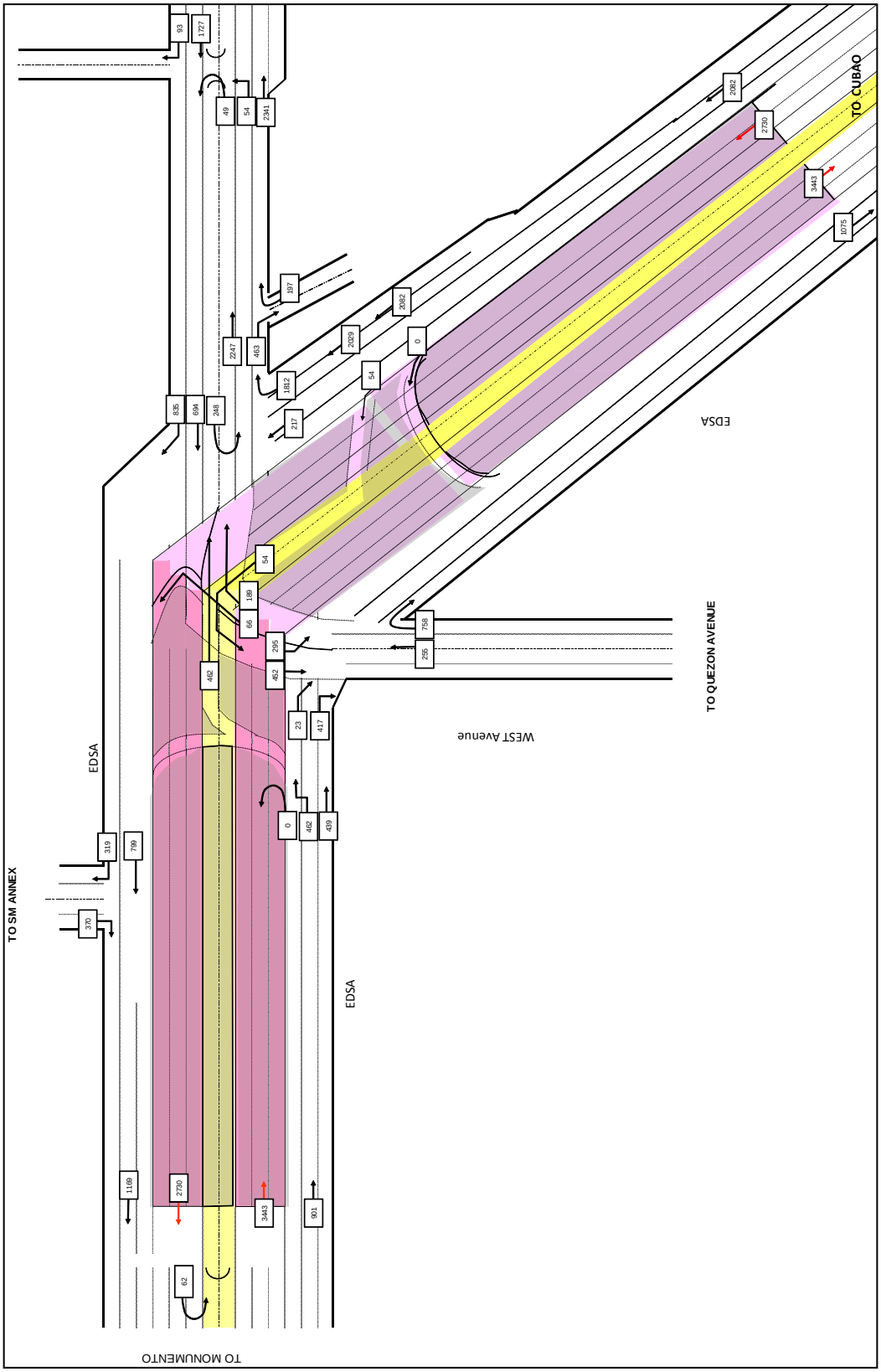

*Source: JICA Study Team*

**Figure 3.3-19 Hourly Traffic Volume at EDSA/North/West Intersection (All Vehicles : AM Peak Hour in 2018)**



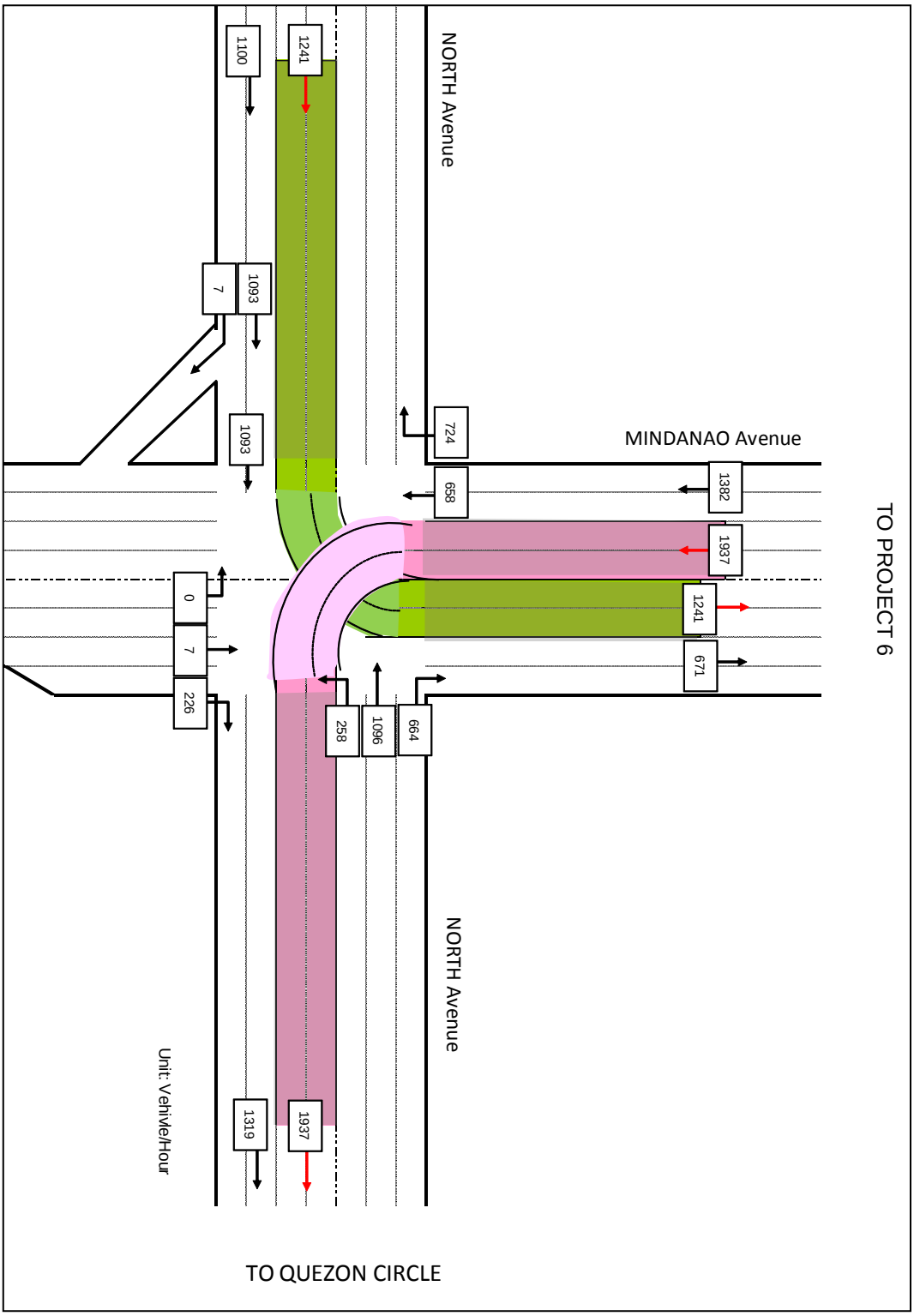

*Source: JICA Study Team*

**Figure 3.3-20 Hourly Traffic Volume at North/Mindanao Intersection (All Vehicles : AM Peak Hour in 2018)**




*Source: JICA Study Team*

**Figure 3.3-21 Hourly Traffic Volume at EDSA/North/West Intersection (All Vehicles : AM Peak Hour in 2028)**

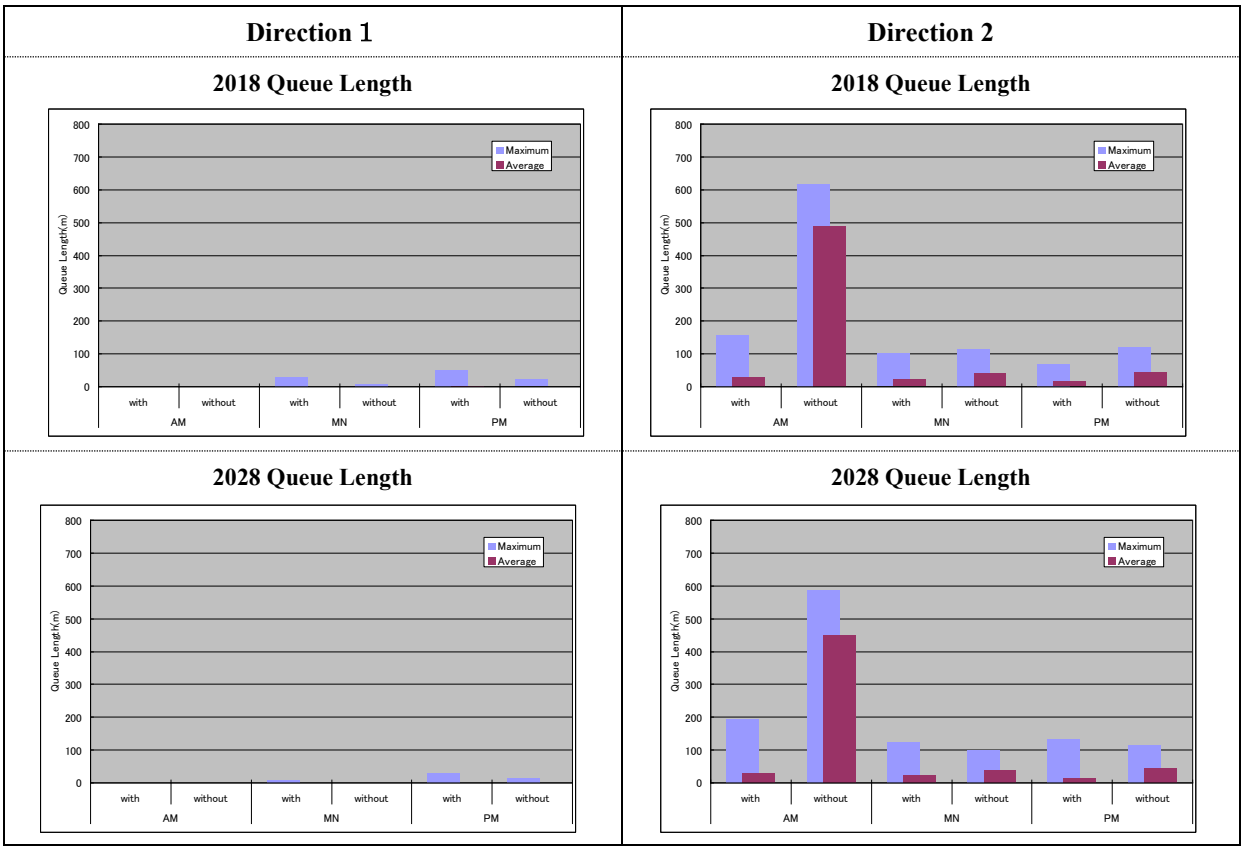



*Source: JICA Study Team*

**Figure 3.3-22 Hourly Traffic Volume at North/Mindanao Intersection (All Vehicles : AM Peak Hour in 2028)**

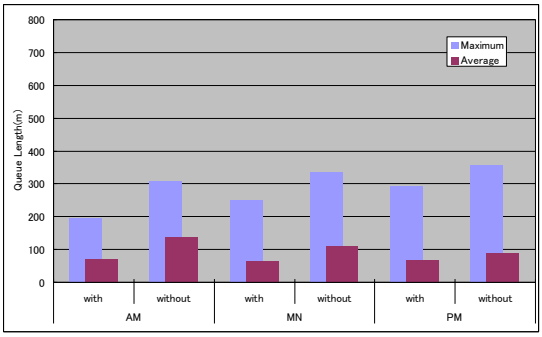
2) Queue Length

The queue length (speed is less than 5 km/h) in AM peak hour are shown in **Figure 3.3-23**. Most of the queue lengths in the case of with project will be shorter than without project case.

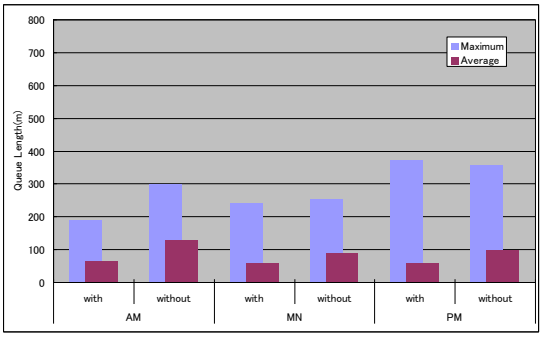



**Direction 3**

**2018 Queue Length**

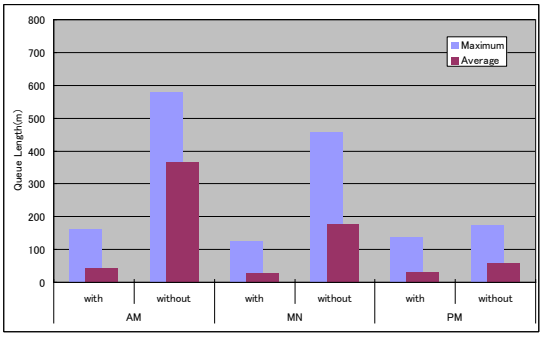



**2028 Queue Length**

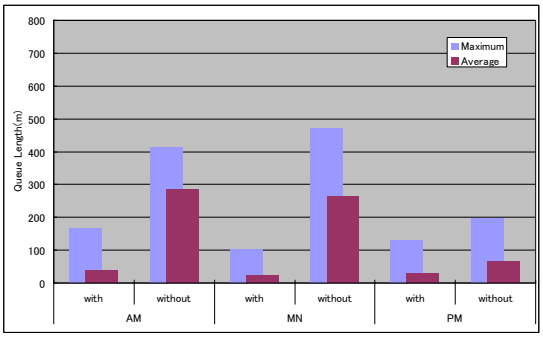



**Direction 4**

**2018 Queue Length**

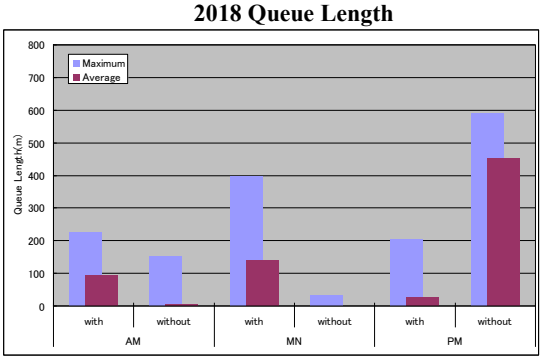



**2028 Queue Length**

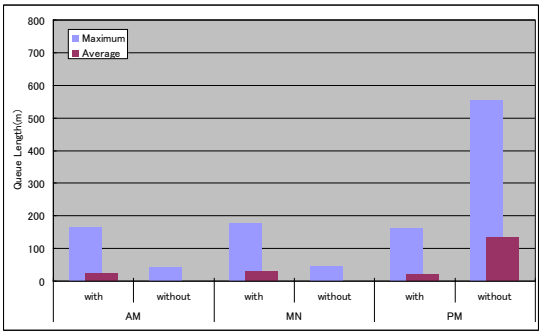



**Direction 5**

**2018 Queue Length**

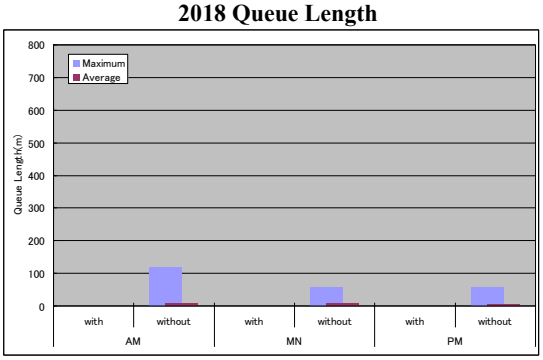



**2028 Queue Length**

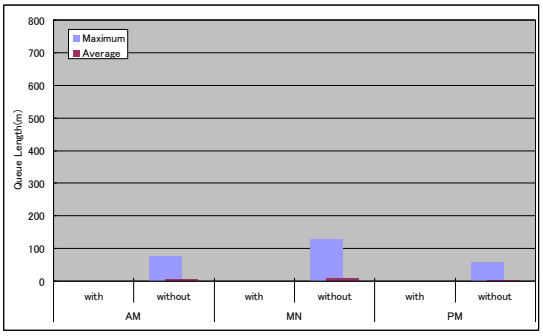


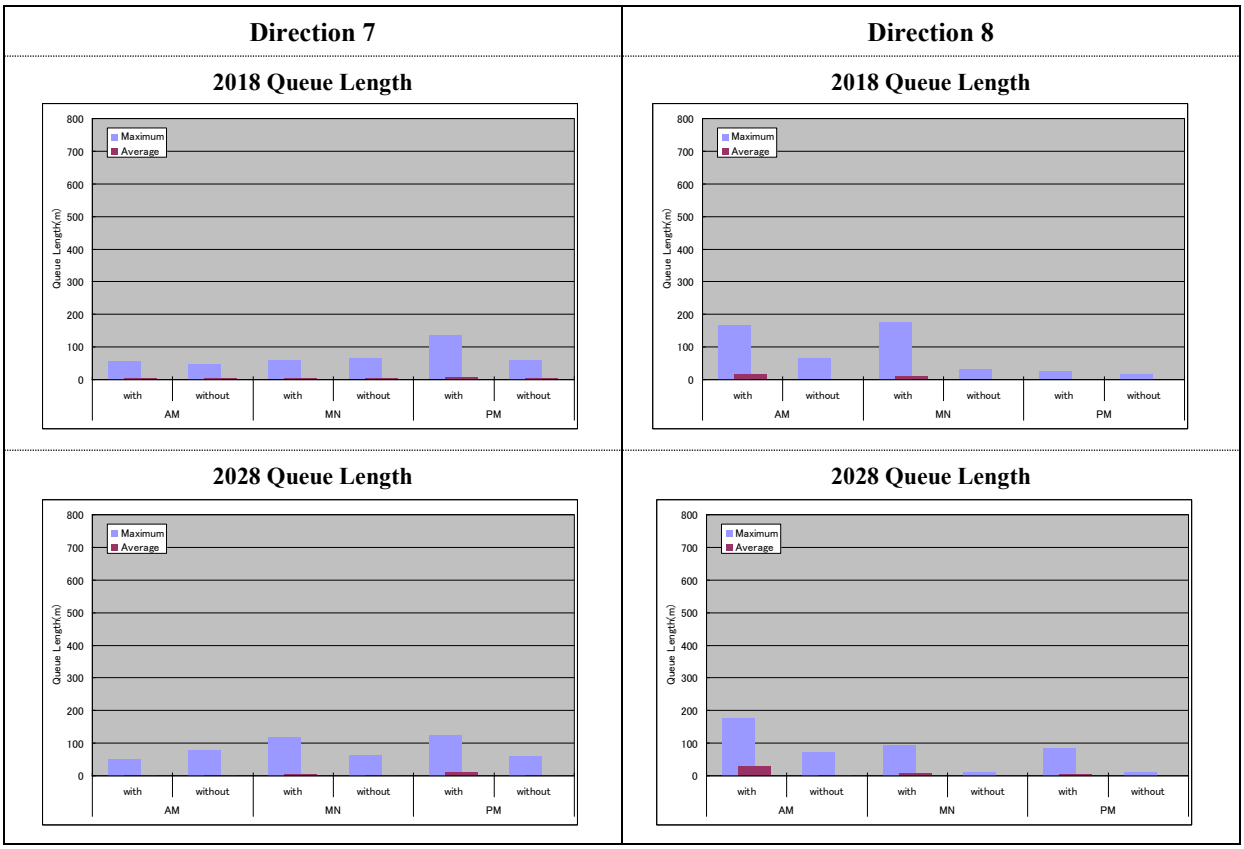

**Direction 6**

**2018 Queue Length**




**2028 Queue Length**






*Source: JICA Study Team*

**Figure 3.3-23 Queue Length at EDSA/North/West/Mindanao Intersection**

3) Vehicle-Km, Vehicle-Hour and Average Travel Speed

Daily vehicle-km, vehicle-hour and average travel speed are shown in **Table 3.3-23**.

**Table 3.3-23 Daily Vehicle-Km, Vehicle-Hour and Average Travel Speed (EDSA/North/West/Mindanao Intersection)**

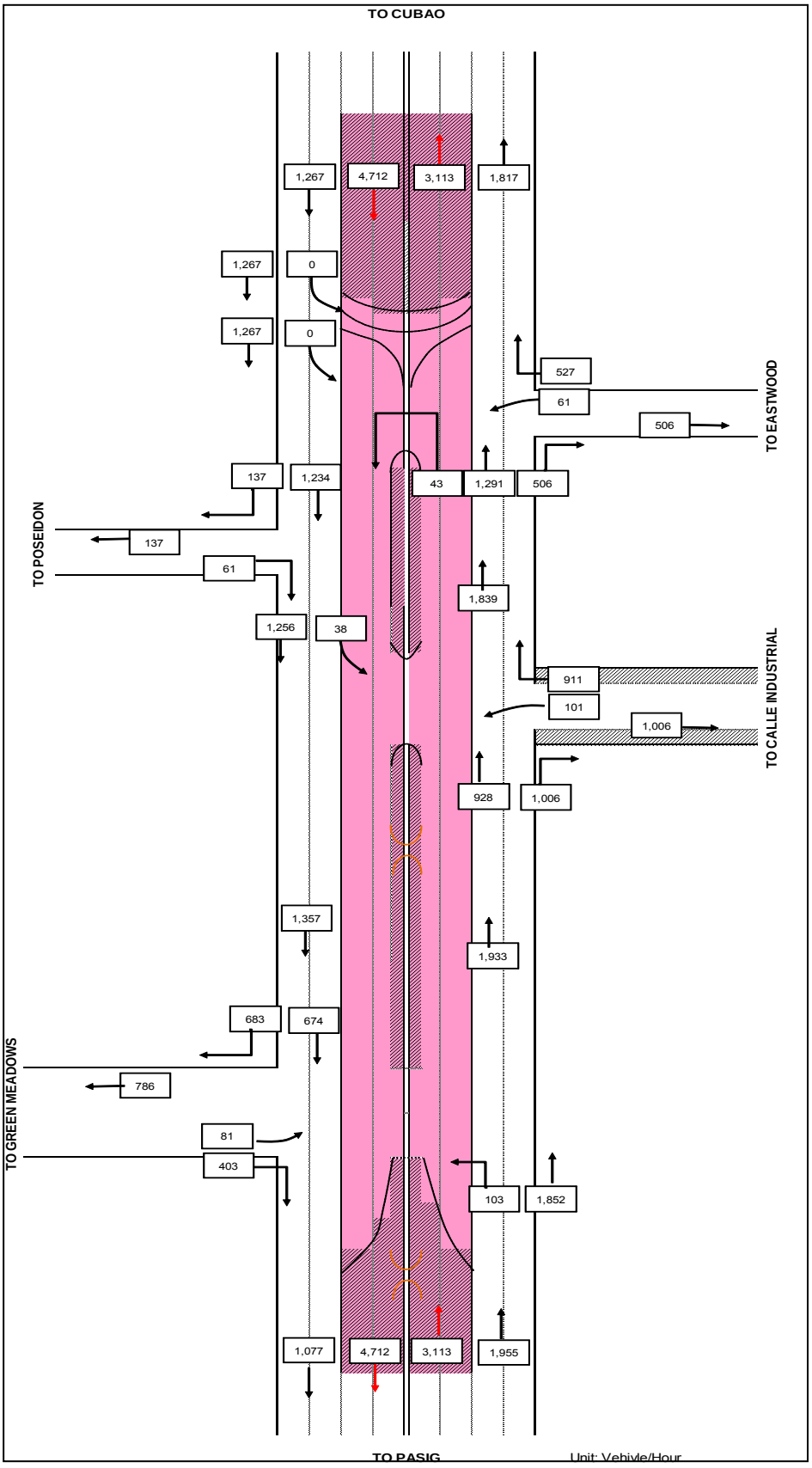
| Indicator | Vehicle Category | 2011 Daily | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 257,061 | 308,345 | 317,028 | -8,683 | 289,377 | 297,381 | -8,004 |
| | Jeepney | 22,322 | 23,009 | 26,265 | -3,256 | 27,499 | 31,912 | -4,413 |
| | UtilityVehicle | 26,357 | 30,795 | 32,449 | -1,654 | 28,887 | 30,528 | -1,641 |
| | Bus | 14,382 | 18,139 | 18,292 | -154 | 16,835 | 16,960 | -125 |
| | Truck | 23,232 | 28,545 | 29,065 | -520 | 26,755 | 27,198 | -443 |
| | Motorcycle | 40,702 | 50,013 | 50,930 | -917 | 65,028 | 66,657 | -1,629 |
| | **Total** | **384,056** | **458,845** | **474,029** | **-15,184** | **454,382** | **470,635** | **-16,254** |
| Vehicle Hour | Car | 9,191 | 10,754 | 13,360 | -2,606 | 9,753 | 12,072 | -2,319 |
| | Jeepney | 834 | 939 | 1,079 | -141 | 1,114 | 1,293 | -179 |
| | UtilityVehicle | 972 | 1,135 | 1,377 | -242 | 1,030 | 1,284 | -254 |
| | Bus | 460 | 506 | 636 | -130 | 466 | 567 | -102 |
| | Truck | 895 | 1,015 | 1,349 | -334 | 919 | 1,223 | -303 |
| | Motorcycle | 1,544 | 1,723 | 2,603 | -880 | 2,198 | 3,293 | -1,095 |
| | **Total** | **13,895** | **16,072** | **20,405** | **-4,332** | **15,481** | **19,732** | **-4,252** |
| Traffic Volume | Car | 167,998 | 206,255 | 205,934 | 321 | 193,438 | 193,023 | 415 |
| | Jeepney | 10,459 | 11,455 | 11,489 | -34 | 12,837 | 12,828 | 8 |
| | UtilityVehicle | 16,403 | 19,929 | 19,937 | -9 | 18,690 | 18,755 | -65 |
| | Bus | 10,381 | 13,198 | 13,194 | 4 | 12,242 | 12,246 | -4 |
| | Truck | 16,154 | 20,309 | 20,233 | 77 | 18,959 | 18,945 | 14 |
| | Motorcycle | 26,130 | 32,745 | 32,588 | 156 | 42,425 | 42,358 | 67 |
| | **Total** | **247,526** | **303,890** | **303375.1** | **515.0** | **298,592** | **298,156** | **436** |
| Average Travel Speed (Km/Hour) | Car | 28.0 | 28.7 | 23.7 | 4.9 | 29.7 | 24.6 | 5.0 |
| | Jeepney | 26.8 | 24.5 | 24.3 | 0.2 | 24.7 | 24.7 | 0.0 |
| | UtilityVehicle | 27.1 | 27.1 | 23.6 | 3.6 | 28.1 | 23.8 | 4.3 |
| | Bus | 31.3 | 35.8 | 28.7 | 7.1 | 36.2 | 29.9 | 6.3 |
| | Truck | 26.0 | 28.1 | 21.5 | 6.6 | 29.1 | 22.2 | 6.9 |
| | Motorcycle | 26.4 | 29.0 | 19.6 | 9.5 | 29.6 | 20.2 | 9.3 |
| | **Total** | **27.6** | **28.5** | **23.2** | **5.3** | **29.4** | **23.9** | **5.5** |

*Source: JICA Study Team*

### (4) C-5/Green Meadows/Acropolis/Calle Industria

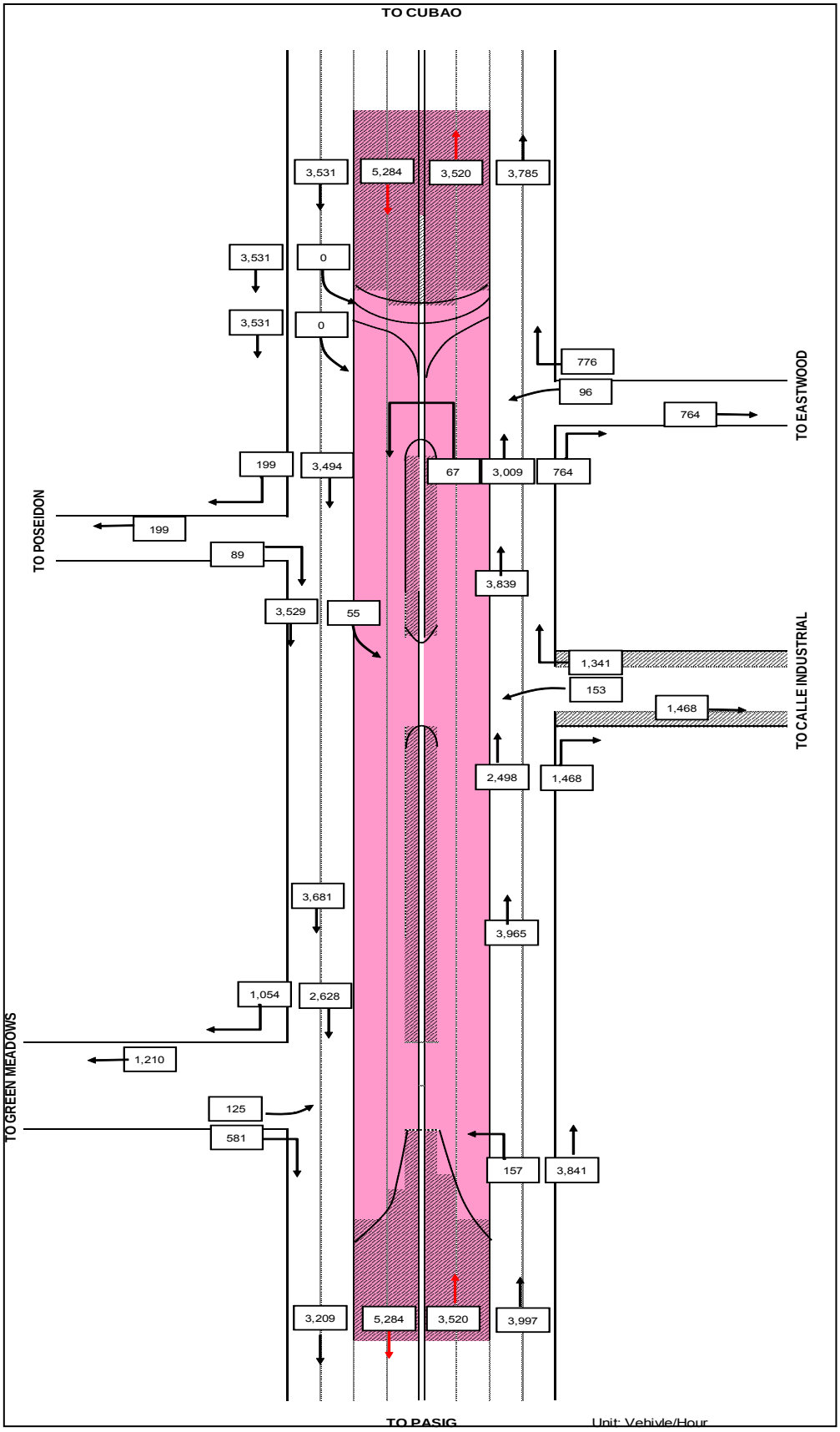
1) Traffic Volume by Direction

The hourly total traffic volumes by direction in AM peak hour on 2018 and 2018 are shown in **Figure 3.3-24** and **Figure 3.3–25**, respectively. The traffic volumes of each vehicle category in AM peak, noon time and PM peak are presented in **Appendix 3.3**.




*Source: JICA Study Team*

**Figure 3.3-24 Hourly Traffic Volume at C-5/Green Meadows/Acropolis/Calle Industria (All Vehicles : AM Peak Hour in 2018)**

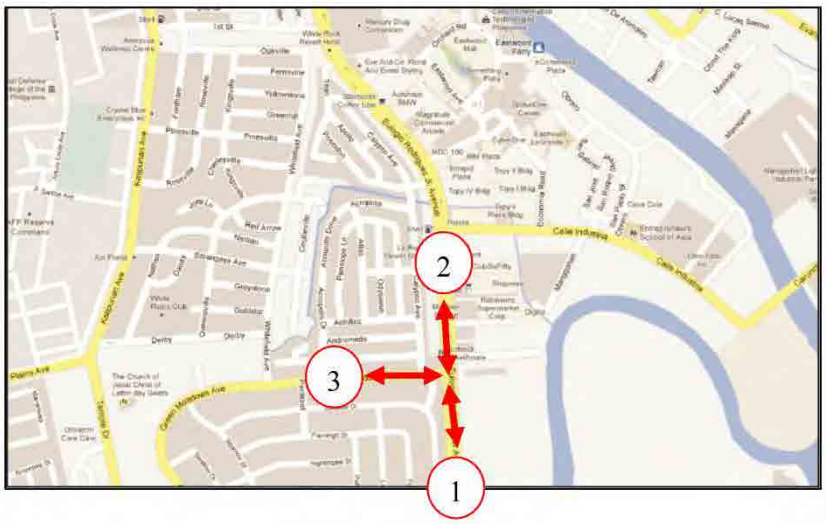


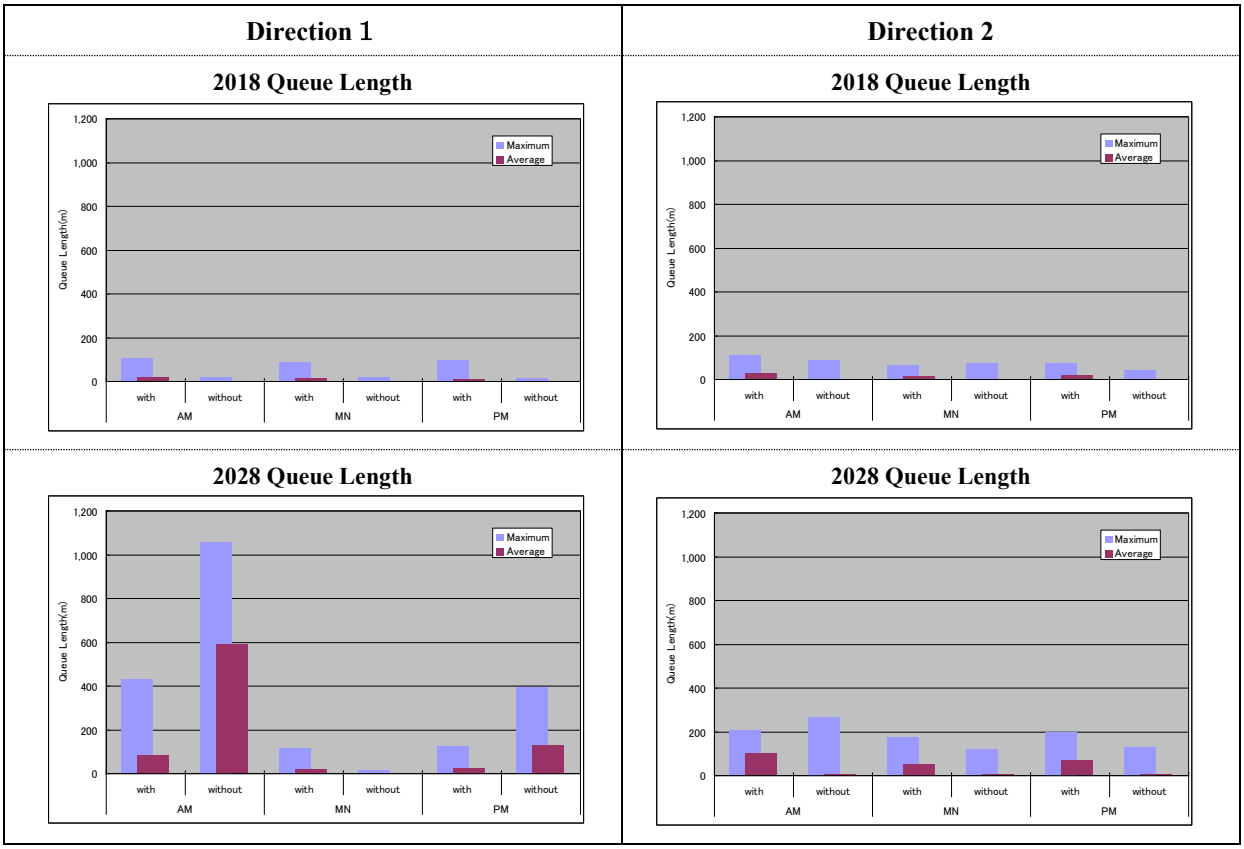

*Source: JICA Study Team*

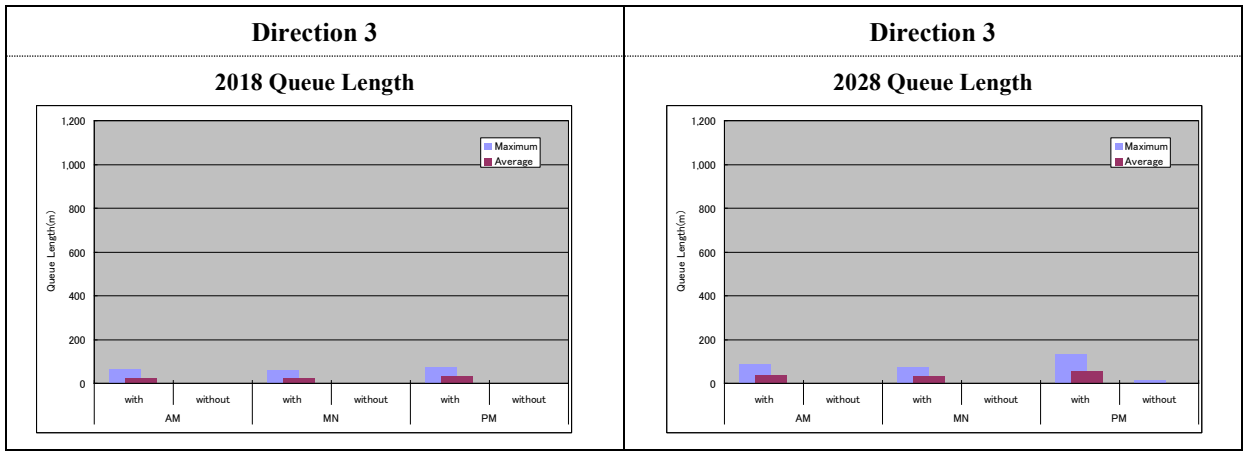
**Figure 3.3-25 Hourly Traffic Volume at C-5/Green Meadows/Acropolis/Calle Industria Intersection(All Vehicles : AM Peak Hour in 2028)**

2) Queue Length

The queue length (speed is less than 5 km/h) in AM peak hour is shown in **Figure 3.3-26**.






*Source: JICA Study Team*

**Figure 3.3-26 Queue Length at C-5/Green Meadows/Acropolis/Calle Industria Intersection**

3) Vehicle-Km, Vehicle-Hour and Average Travel Speed

Daily vehicle-km, vehicle-hour and average travel speed are shown in **Table 3.3-24**

**Table 3.3-24 Daily Vehicle-Km, Vehicle-Hour and Average Travel Speed (C-5/Green Meadows/Acropolis/Calle Industria Intersection)**

| Indicator | Vehicle Category | 2011 (Daily) | 2018 (Daily) | | | 2028 (Daily) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 (With) | 2018 (Without) | With - Without | 2028 (With) | 2028 (Without) | With - Without |
| Vehicle Km | Car | 324,251 | 367,398 | 373,519 | -6,121 | 543,481 | 552,795 | -9,314 |
| | Jeepney | 13,173 | 15,185 | 15,213 | -28 | 22,715 | 22,867 | -152 |
| | UtilityVehicle | 54,476 | 62,176 | 62,507 | -331 | 92,139 | 92,672 | -533 |
| | Bus | 772 | 858 | 865 | -8 | 1,302 | 1,299 | 2 |
| | Truck | 34,601 | 39,742 | 39,905 | -163 | 58,850 | 59,115 | -265 |
| | Motorcycle | 90,496 | 103,721 | 104,143 | -423 | 152,917 | 153,418 | -501 |
| | **Total** | **517,769** | **589,078** | **596,153** | **-7,074** | **871,404** | **882,166** | **-10,763** |
| Vehicle Hour | Car | 10,309 | 10,885 | 11,936 | -1,051 | 17,874 | 19,823 | -1,949 |
| | Jeepney | 419 | 419 | 487 | -67 | 702 | 854 | -153 |
| | UtilityVehicle | 1,736 | 1,783 | 2,003 | -220 | 2,971 | 3,531 | -560 |
| | Bus | 25 | 23 | 28 | -4 | 39 | 48 | -8 |
| | Truck | 1,102 | 1,108 | 1,278 | -170 | 1,822 | 2,182 | -360 |
| | Motorcycle | 2,878 | 3,008 | 3,329 | -321 | 4,928 | 5,534 | -606 |
| | **Total** | **16,468** | **17,227** | **19,061** | **-1,834** | **28,336** | **31,972** | **-3,635** |
| Traffic Volume | Car | 114,767 | 132,136 | 132,178 | -42 | 195,412 | 195,166 | 246 |
| | Jeepney | 4,360 | 5,054 | 5,051 | 3 | 7,574 | 7,591 | -17 |
| | UtilityVehicle | 18,281 | 20,971 | 20,974 | -3 | 30,992 | 30,992 | 0 |
| | Bus | 257 | 288 | 288 | 0 | 428 | 428 | 0 |
| | Truck | 11,526 | 13,255 | 13,286 | -31 | 19,582 | 19,606 | -24 |
| | Motorcycle | 30,917 | 35,590 | 35,667 | -77 | 52,532 | 52,401 | 132 |
| | **Total** | **180,108** | **207,294** | **207,444** | **-151** | **306,520** | **306,183** | **337** |
| Average Travel Speed (Km/Hour) | Car | 31.5 | 33.8 | 31.3 | 2.5 | 30.4 | 27.9 | 2.5 |
| | Jeepney | 31.4 | 36.2 | 31.3 | 4.9 | 32.4 | 26.8 | 5.6 |
| | UtilityVehicle | 31.4 | 34.9 | 31.2 | 3.7 | 31.0 | 26.2 | 4.8 |
| | Bus | 31.5 | 36.7 | 31.2 | 5.5 | 33.2 | 27.3 | 5.9 |
| | Truck | 31.4 | 35.9 | 31.2 | 4.7 | 32.3 | 27.1 | 5.2 |
| | Motorcycle | 31.4 | 34.5 | 31.3 | 3.2 | 31.0 | 27.7 | 3.3 |
| | **Total** | **31.4** | **34.2** | **31.3** | **2.9** | **30.8** | **27.6** | **3.2** |

*Source: JICA Study Team*