付属資料

A. 既存鉄道施設およびシステムスペックのレビュ
   1. 路線と土木施設
   2. E&M システム
   3. 車両

B. その他
   1. 土木
   2. 車両

C. Line1 キャビテ延伸の需要予測

D. 交通量調査

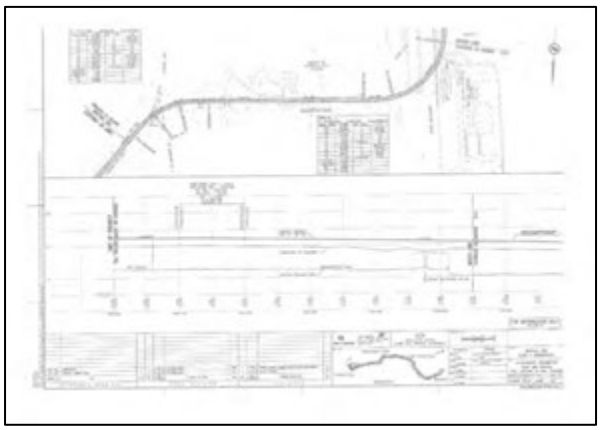
E. 環境マネジメント計画

付属資料 A:　既存鉄道施設およびシステムスペックのレビュ

1　路線と土木施設

路線計画と土木施設計画と施工方法についてLAVALIN図面を基にレビューを行った。その結果、路線計画の一部を除き大きな問題は見当たらないと判断できる。狭隘な Baclaran 駅南端部や交通量の多い ROXAS BOULEVARD 通り交差部は注意が必要な場所であるが、それらについても検討及び計画が行われており、施工可能と判断できる。なお、路線図のうち 2 番、7 番、8 番、17 番、21 番については 3.1 章で注意点を説明済みである。

以下に、路線、土木施設、特殊工事部の計画図を示す。



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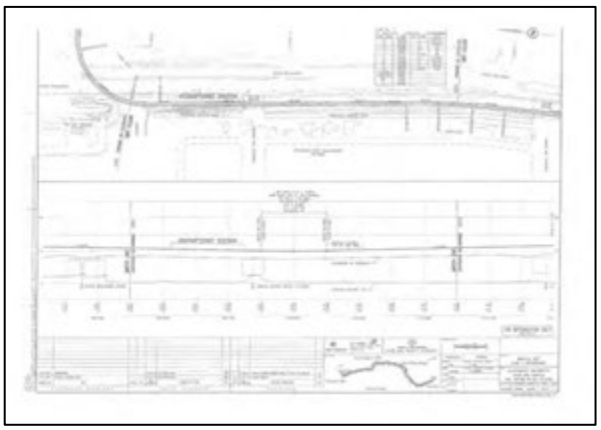

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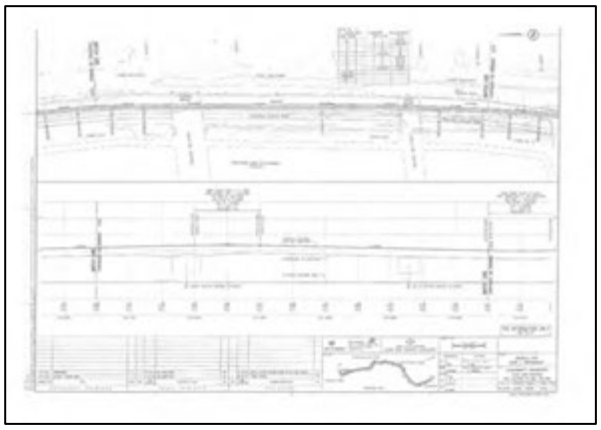

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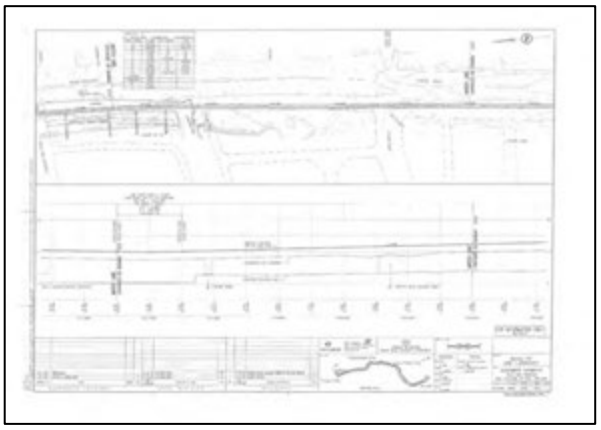

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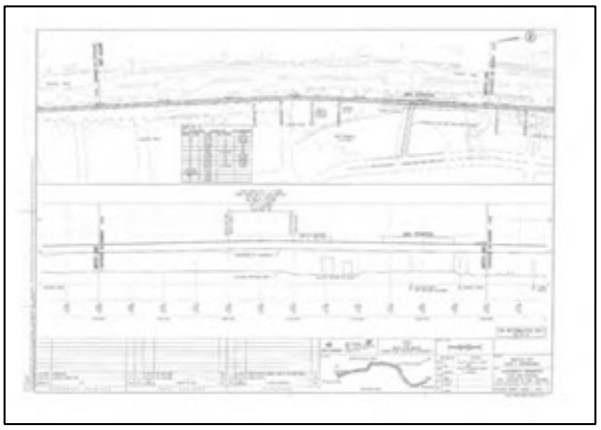

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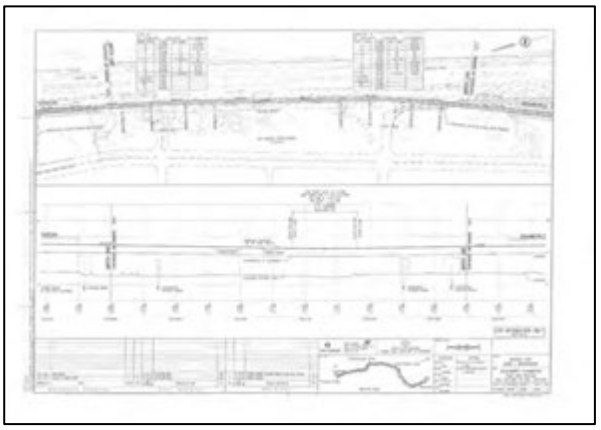

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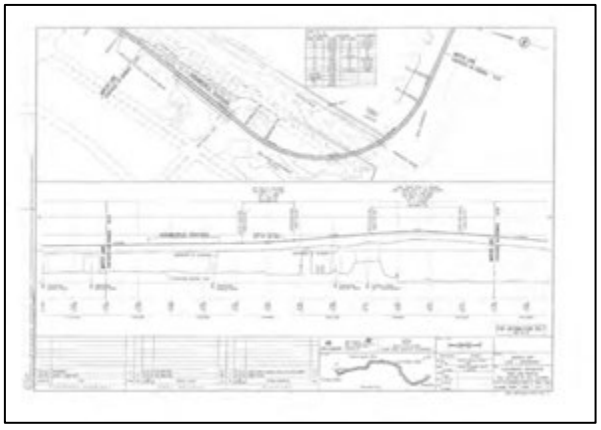

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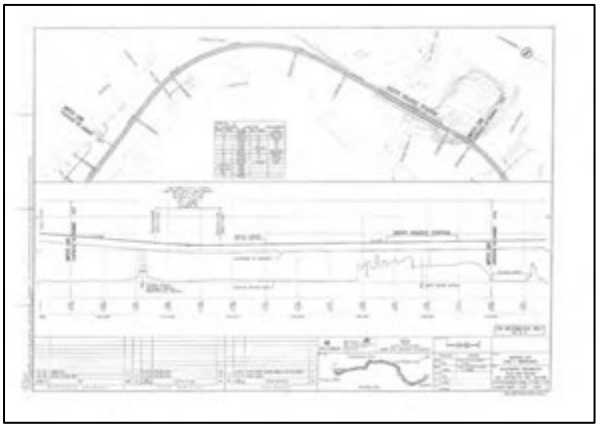

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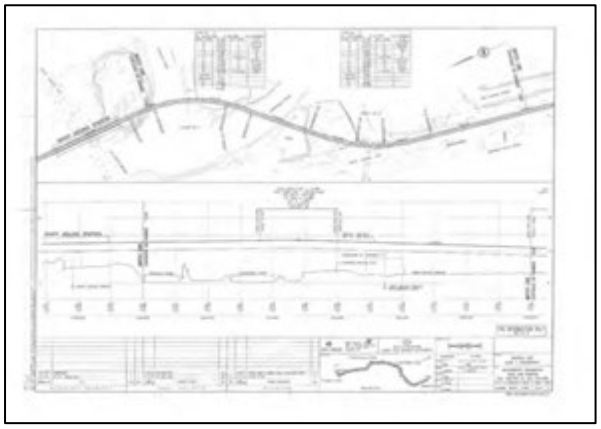

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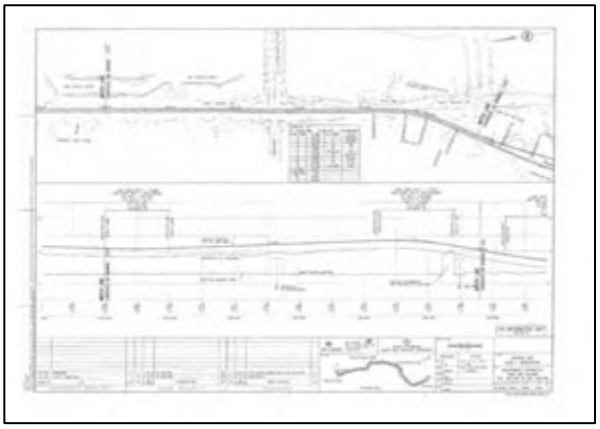

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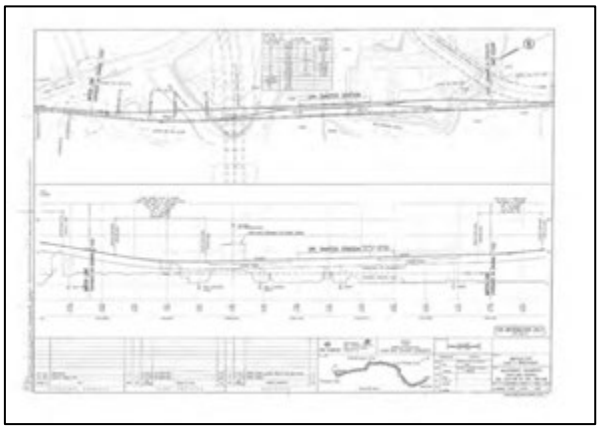

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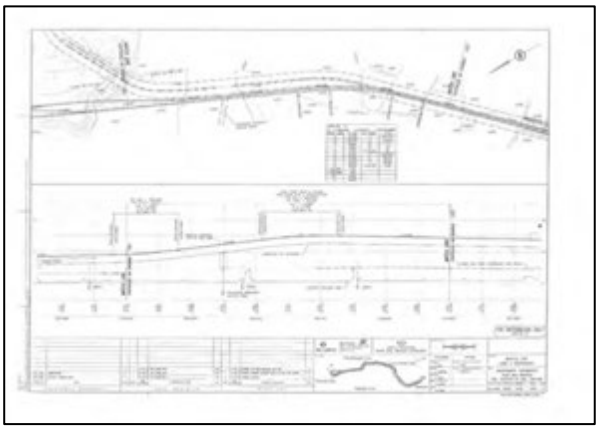

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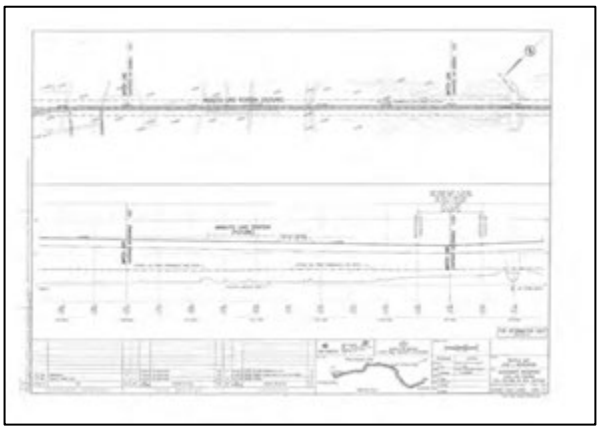

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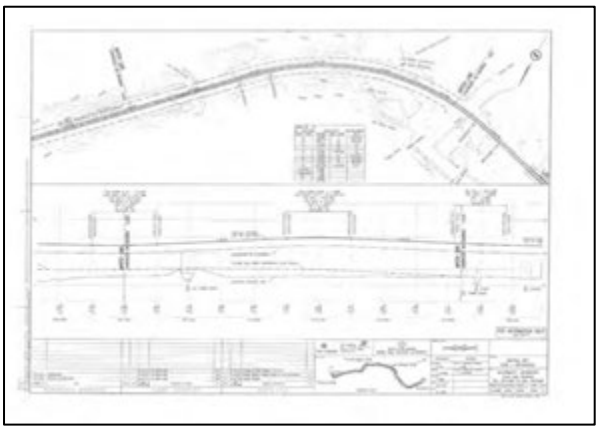

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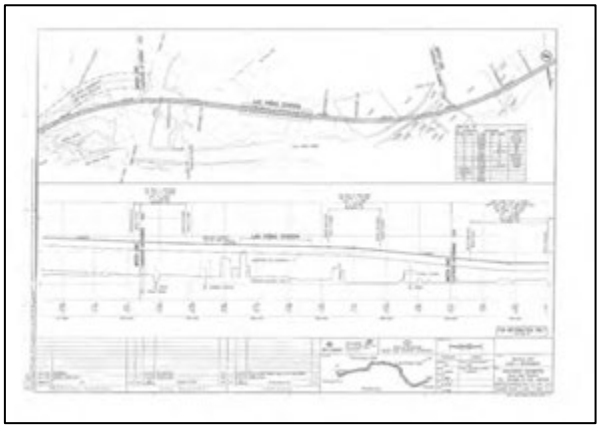

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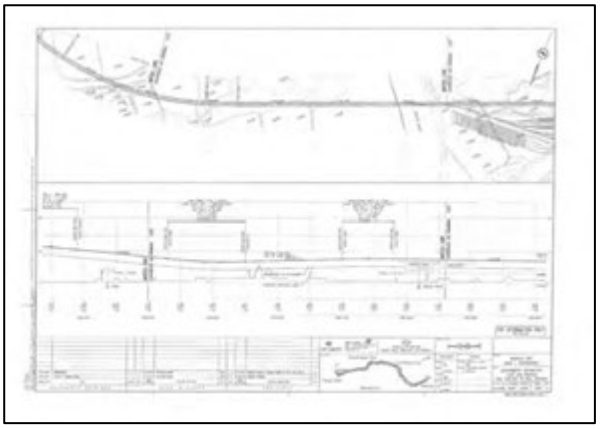

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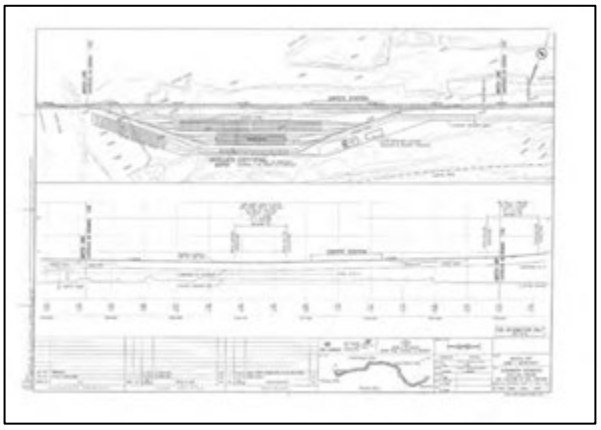

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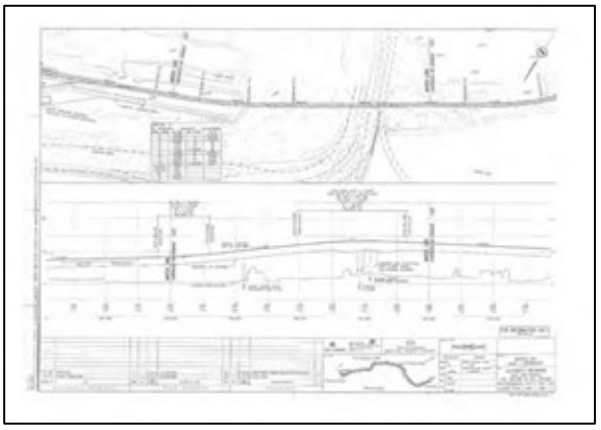

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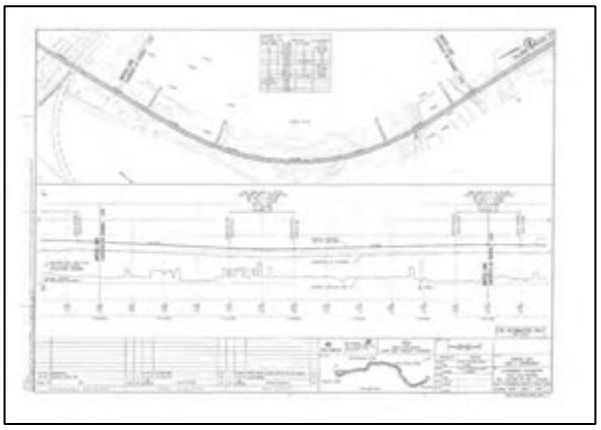

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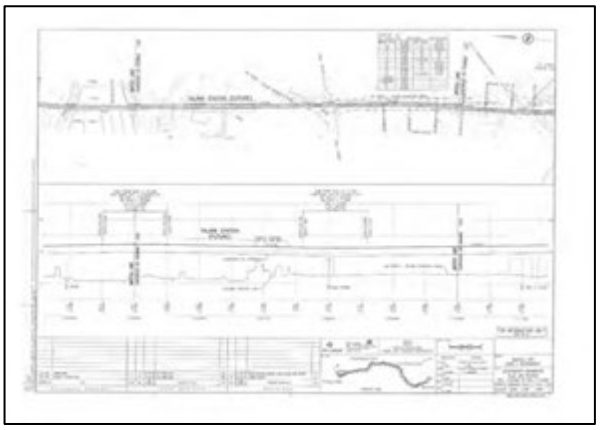

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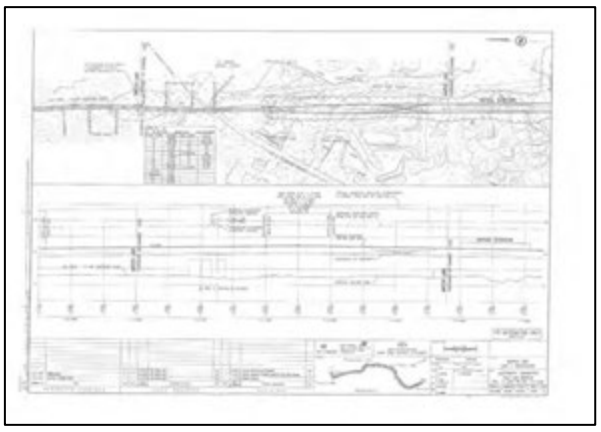

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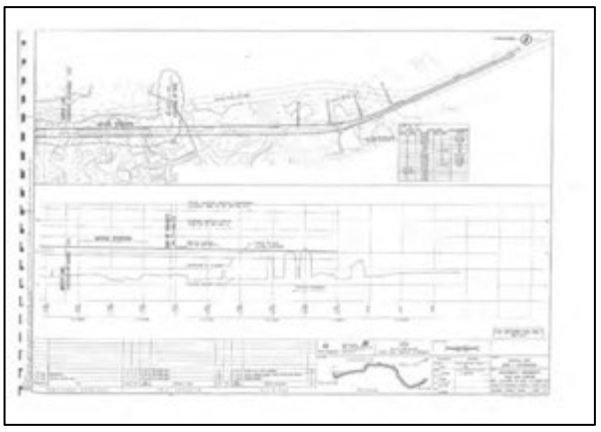

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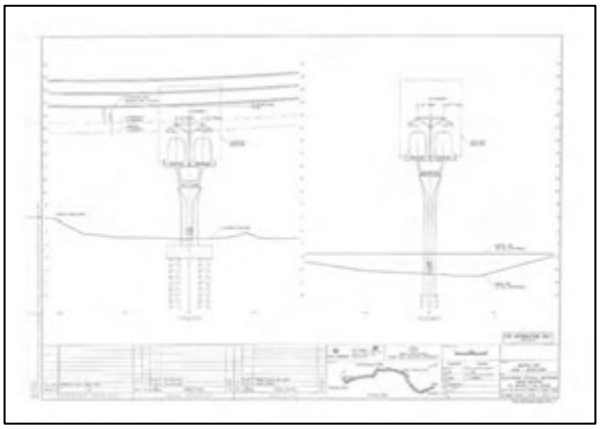
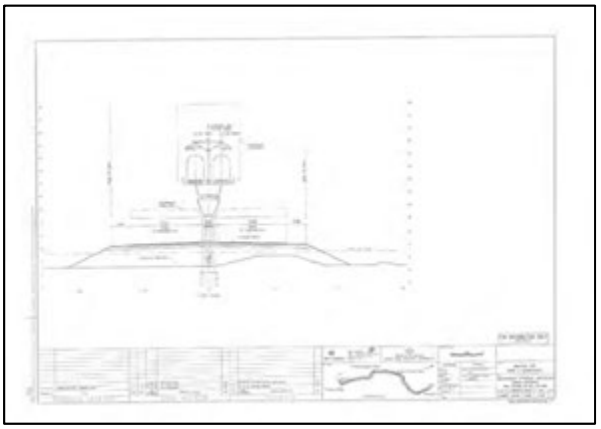
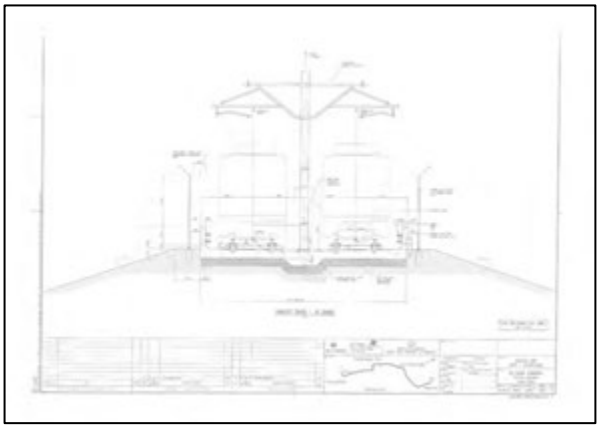


Elevated section

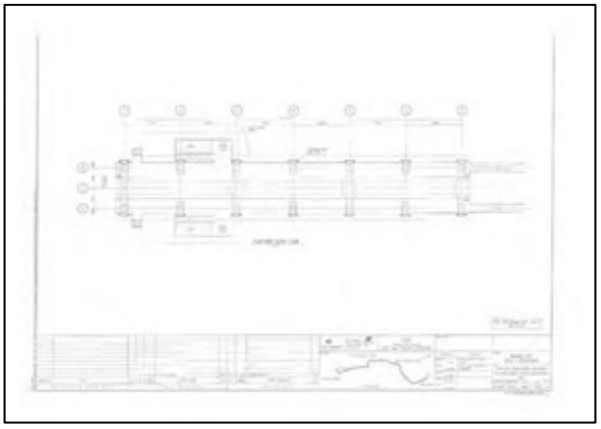


On the road

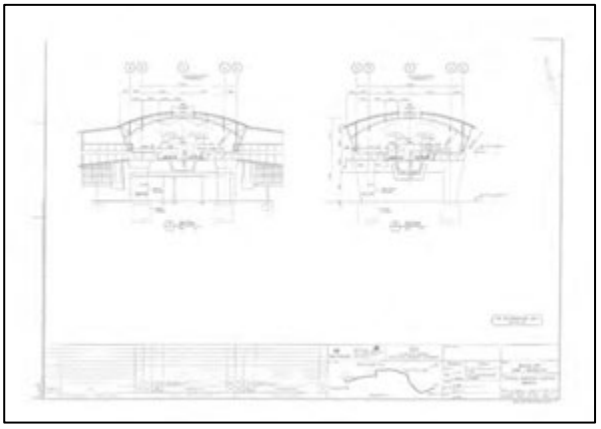


At grade

図 1-5 軌道構造物標準図

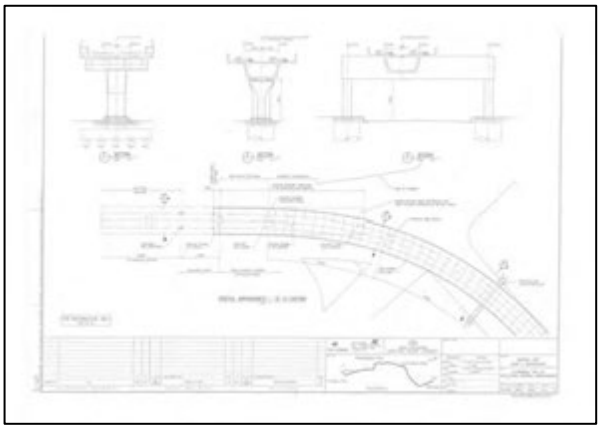


Floor drawing of station

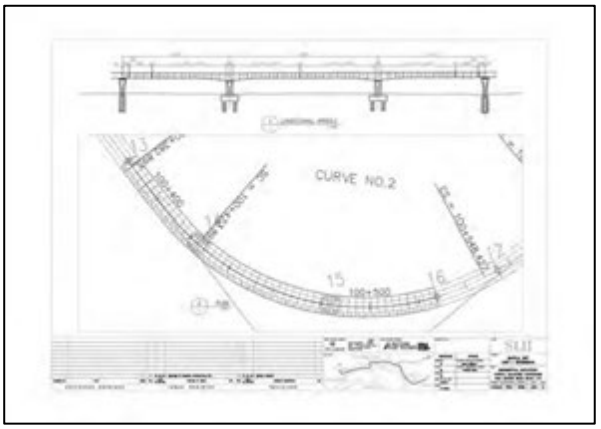


Cross section of station

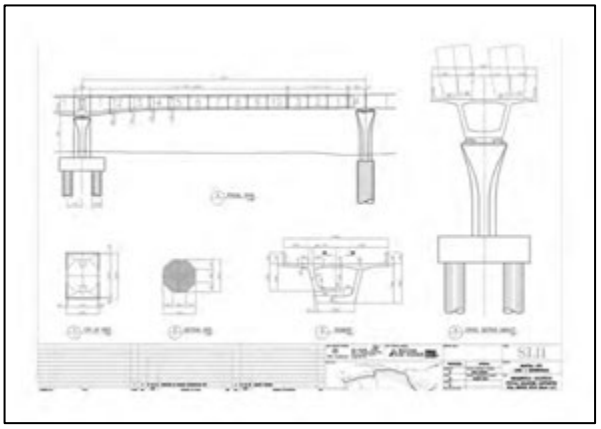
図 1-6 駅舎標準図



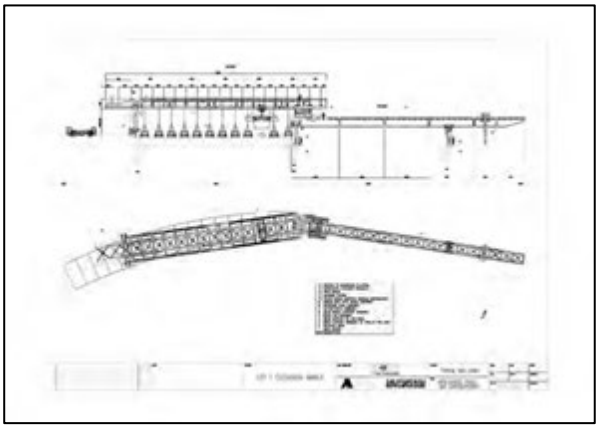
Southernmost end of Baclaran station



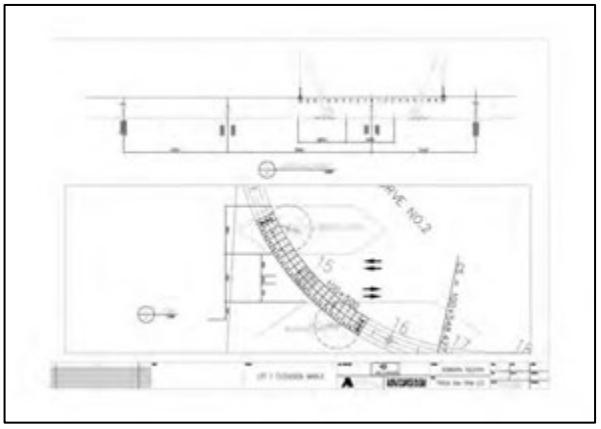
Intersection part with Roxas Blvd.-1



Intersection part with Roxas Blvd.-2



Intersection part with Roxas Blvd.-3



Intersection part with Roxas Blvd.-4

図 1-7 特殊部施工図

2 E&M システム

この章では、これまでの F/S 報告書および北延伸プロジェクト（NEP）契約書類を見直し、LRT1 号線の Cavite 延伸プロジェクト（L1CEP）に対して E&M システムの適切な仕様を提案する。見直しは、信号システム、通信システム、電力供給システム、電車線システムおよび軌道について実施する。

2.1 LRT1 号線の E&M システムの設計基準概要

この章は、L1CEP の E&M システムの設計基準の要約が記述されている。これらは、次の書類から原文のまま抜粋したものである。

- NEP Tender Document
- LAVALIN F/S Report
- Draft Feasibility Study Report (v0.10) August 2006

2.1.1 信号システム

2.2 NEP 入札図書

1) LRT1 号線のシステム容量

The operating capacity of LRTA Line 1 was enhanced to sustain 40,000 pphpd during peak travel times. Consequently, the signaling system is now capable of supporting an operating headway of 112 sec.

2) LRT1 号線の信号システム

The LRT Line 1 signal system comprises of a fixed block system. It operates as a train control system that provides safety functions for train detection, train separation and control and protection for train movements using a microprocessor-based interlocking. The system is designed as fail-safe; thus any malfunctions will ensure the system reverts to a safe condition. Consecutive blocks are governed by signals positioned at fixed locations throughout the system along the wayside. The peak hour operational headway is 112 seconds. Train movement is controlled by operators from a centralized control center (OCC), which is located within the LRTA Depot in Pasay City. Operation control of the signaling system is confined to the mainline including the Depot connecting line. No signaling is provided within the Depot area, where train speed is restricted to only 5km/h. The signaling system entails the following sub-systems:

- Microprocessor-based interlocking,
- Automatic Train Protection System (ATP),
- Automatic Train Supervision System (ATS)
- Axle Counting System (Train Detection).

a) 列車隔離

The line is divided into sections wherein; every entrance of these sections has a fixed wayside signal. A buffer section (overlap) is provided as a safety margin beyond the wayside signals. If a train operator bypasses a red signal (without proper authorization), the train’s emergency brakes are applied by the Automatic Train Protection (ATP) system.

b) 速度制御

The control of train speed is provided through the use of an Automatic Train Protection system, which comprises of wayside and train-borne equipment. Fixed balises located at the wayside signals provide information to the train-borne equipment with respect to the status of the line ahead. This information contains allowable speed, distance-to-go to the next signal and other pertinent data for safe speed control. Similar to the bypassing of a red signal, over speeding, will invoke the train's emergency brakes to bring the train to complete stop.

c) ATP システム (ATP) - 車上装置と地上装置

Currently, eighty (80) train cabs are fitted with ATP train-borne equipment. The sub-system encompasses two sections namely: the train-borne and wayside equipment. The train-borne equipment consists of an on-board computer, which receives data from peripheral equipment for speed and distance traveled, monitoring of the actual speed, and if necessary to apply the service brake or the emergency brake of the vehicle. The system also receives information from the wayside equipment with respect to the status of the line ahead, thereby controlling speed as required. The wayside equipment interfaces with the line-side signals, which in turn receives information from the interlocking and dependent upon the status of the line ahead will transmit the appropriate data for processing by the train-borne system. The information from the wayside system to the train-borne system is transmitted using fail-safe telegrams.

d) 列車検知

The methodology for train detection adopts the use of axle counters. Each fixed block section is composed of either a single or several axle counter sections depending on the distance between two consecutive signals. Train detection is achieved through these axle counters by the effect of train wheels passing through an electro-magnetic field. The wheels/axles are subsequently counted, and for a track section to be declared clear, the number of axle counted into a section must equal the number of wheels/axles counted out. Should the wheels/axles counted not be equal, the track section is declared occupied, i.e. fail-safe principles.

e) インターロッキング

The signaling interlocking is a microprocessor-based system adopting a modular structure. The electronic interlocking provides fail-safe connection to outdoor elements, operation control systems and automatic train control systems. The main interlocking computer is located at Baclaran, with control computers located at Baclaran, Central and Monumento. The facility for loading new interlocking software is also located at Baclaran.

f) 緊急時の折り返し設備 (TBF)

The original turnback facility required that the emergency switches were controlled locally at the site. However, these facilities now have the capability of being controlled and monitored remotely from the Operations Control Center (OCC) and LOWs. The emergency turnback facilities are located at Gil Puyat and Blumentritt.

g) ATS システム (ATS)

The ATS system controls and monitors the signaling system for the entire rail network. This system is located within the OCC facility. Should a complete failure of the OCC occur, operations may be continued from Local Control Workstations (LOW). These are located at Baclaran, Central and Monumento. Operation of the ATS subsystem uses local area network (LAN) architecture. Workstations generate a geographical representation of the transit system network using single line display pages incorporating user-friendly human/machine interfaces.

The ATS sub-system can display:

- An overview of the system and of individual stations
- Train identification numbers.

The overview mimic panel (overhead projector system) displays the status of the following signaling and train control functions:

- Track section occupation/clear
- Route set
- Turnout position
- Signal aspects
- Train describer
- Alarm handling
- Automatic route-setting with possibility of manual override and manual setting of routes and signals
- Speed limits.

In addition, the following functions are available and parameters adjustable both automatically and manually:

- Automatic train regulation
- Dwell times
- Scheduling
- Train describer and train I.D.
- Headway clock
- Simulation
- Record and Playback

3) 既存の 1 号線の運行

- LRTA Line 1 is signaled for uni-directional operation only on all tracks, the exceptions being the reversing areas in the terminal stations, depot departure tracks and turn-back facilities. During normal operation, trains run on the right hand track as viewed from the train driver's cab. Trains normally comprise of 4 cars with an overall length of 106 m.
- The traction supply is distributed by an Overhead Catenary System (OCS). The nominal traction voltage is 750V DC. Both running rails are used for return of traction current. Where insulated rail joints are used, continuity of the traction return current is accomplished by the use of cable traction return bonds.
- The design headway on all tracks used by passenger trains is 90 sec.
- The existing end-to-end run times exclusive of turnaround times is approximately a total of thirty-four (34) minutes.
- Coupling and uncoupling of revenue service trains, except in an emergency, takes place within the depot or in stabling sidings, which are also located in the depot. Revenue service trains of variable length, up to a maximum of 106 m, are equipped with Automatic Train Protection (ATP). In case of a total rolling stock failure, a second train may be used to assist the failed train from the rear.
- Headway is defined as the time interval between successive trains on through track with a specified station stop-time of 40 seconds at each platform. The headway time shall be maintained without any speed limitation to the train, except where unavoidable to meet headway and station stop times at specific stations. Any such limitation in speed shall be justified to and approved by LRTA
- The headway for reversing trains at terminal stations or at stations with turn-back facilities requires special study in relation to the present track layouts. It shall be possible to reverse trains

at all terminal stations at the schedule service using the design headways, and the following additional requirements:

Single Driver reversing.
Shall be allowed a maximum layover of 150 seconds in reversing sidings. This procedure only applies to non-peak hour periods.

Two Drivers reversing.
At stations with reversing tracks, during periods of minimum headway, a second driver will enter the rear cab and drive the train from the reversing track with a maximum layover of 30 seconds. As the reversing takes place in sidings beyond the station, a maximum of 40 seconds shall be allowed for alighting passengers at the arrival platform. A further 40 seconds shall be allowed for passengers to board the train at the departure platform.

4) 北延伸区間の運行

- The signaling system shall be capable of supporting an operational headway of 112 seconds for the Line 1 North Extension Project. The configuration of trains shall remain as 3 and 4-car sets with an expected one way journey time of approximately 43 minutes.
- The additional stations of Balintawak and Roosevelt are designed with “side platforms” while North Avenue Terminal shall be designed with an “island” platform. The expected dwell time at Balintawak and Roosevelt stations shall be 30 seconds.
- In order for the North Extension operations be congruent with the existing Line 1 operations, to support the 112 seconds headway during peak hour time, the Contractor shall consider all aspects in the signaling design and installation to meet the 112 seconds headway requirement especially the configuration of the turnback and platform at North Avenue is different from the existing line.

5) 電力供給と無停電電源装置 (UPS)

- The power supply for the signaling should be derived from a highly reliable source. For this purpose, a main supply for signaling of three-phase 480 VAC, 60 Hz shall be made available at all stations which are to be provided by electrical interface. The Contractor shall additionally furnish an Uninterruptible Power Supply (UPS) at station to complement the main power source.
- The UPS shall be suitably rated to ensure the signaling system’s continuous operation for a period of not less than four (4) hours in the event of failure of the main supply.
- The input of the UPS shall be protected from over voltages and surges of current. Additionally, it shall be protected from the effects of lightning. The UPS shall also function as a filter in order to remove transients and other noise, which may affect the operation of electronic equipment.
- A static bypass switch shall be provided to circumvent the UPS unit should a malfunction occur. Also a manual bypass switch shall be supplied to enable maintenance to be undertaken to the UPS.
- The batteries shall be installed in a dedicated room with the UPS unit. Cabling between the batteries and UPS shall be sufficient to carry the full load.

2.2.1 通信システム

2.3 NEP 入札資料

1) NEP の業務範囲

- Master Clock for synchronization of all electronic systems in the new stations
- SCADA for the remote control and monitoring of electrical and traction power
- CCTV for the monitoring of passenger safety and security at stations

- SDH / Fiber Optic cable for the transmission of voice, data and video
- Public Address for passenger information, safety, and security at the stations
- PABX existing system to be upgraded with new phones and lines to be added
- Digital Trunked Radio System for enhanced communications
- AFC Local Area Network for efficient collation of revenue data
- Upgrading of the Telecommunication facilities at the Operations Control Center (OCC) for centralized supervision of the additional equipment for the new stations
- Uninterruptible Power Supply (UPS).

2) CAPEX プロジェクト

- The present Manila LRTA Line 1 system was installed and commissioned in 1984 by the Belgian based company ACEC Transport (now part of the Alstom group).
- The original system allowed an operating capacity of 18,000 pphpd during peak travel times.
- Modifications to improve the operating capacity of Line 1 to 27,000 pphpd under the CAPEX Project Phase 1 were commenced and completed in 1998.
- The operating capacity of LRTA Line 1 under the recently completed CAPEX Project Phase 2 was further enhanced to sustain 40,000 pphpd during peak travel times.

3) 既存システムと機器

- The existing communications systems being upgraded under CAPEX II Project are based upon digital data, compressed video, digitized audio, UHF radio and telephony currently and automatically exchanged between the depot's Operational Control Center, administration buildings and stations or other LRTA related buildings. IP based CCTV, Public Address systems and SCADA equipment are now installed and operational in all stations and RSS stations using the new SDH Fiber Optic Transmission backbone. For continuous operation and safety of these equipments, UPS and Lightning Protection and Grounding Systems were provided in all 18 stations.
- The existing Trunked radio system used for maintenance purposes operates at 470 MHz in the Ultra-High Frequency band consisting of four (4) base-stations installed in strategic locations along LRT Line 1.
- Additionally, operational personnel used 800 MHz radio sets, which are supplied under a leasing agreement with the DOTC and Nextel.
- The current Private Automatic Branch Exchange (PABX), which was installed as part of the Capacity Expansion Project Phase I was expanded and integrated to the new Synchronous Digital Hierarchy / Fiber Optic Transmission System (SDH/FOTS). New digital and analog telephone sets were also provided.
- A multiport Network Switch for the Ethernet LAN is employed in the SDH equipment in every station as part of the Automatic Fare Collection System. This operates in conjunction with the ticket issuing equipment and data is continually transferred for operational and revenue purposes. The revenue operational parameters, which are used by the station processor system, are currently transferred via the LAN and SDH/FOTS.

4) サブシステム

a) マスタークロックシステム

The primary purpose is to provide precision timing to the new display clocks and to synchronize all telecommunications devices and other electronic systems in the new stations, requiring an accurate time reference source. These systems shall include the following:

- SCADA
- SDH/ FOTS
- PABX
- CCTV
- AFC LAN enabled station equipment
- Trunked Radio
- PA system

b) 旅客放送システム (PAS)

- A digital public address system was installed in every LRTA Line 1 stations for public announcement of live, prerecorded, Background Music and emergency messages for passenger safety and information. The new public address and emergency system used web based (IP) technology, digital transportation and processing of all audio signals from OCC and Platform Supervisor's Booths at the stations.
- Control of the PAS in the station is done locally at each station Platform Supervisors Booth and remotely from the OCC through the use of Call stations, Network Controllers and Workstation PCs loaded with licensed configuration and maintenance software.

c) CCTV システム

- All eighteen (18) passenger stations along LRTA Line 1 service route are currently provided with CCTV systems which can be operated independently from the station's Ticket Booth and can be controlled simultaneously from Workstations in the OCC/Depot via the existing Gigabit Network Switches and Fiber Optic backbone.
- Digital recording from the system's 137 cameras on motion activated mode is accomplished at the OCC via redundant Disk Array of Network Video Recorder (NVR) servers.
- Security cameras are also installed at entrance of the OCC building and gates of the Depot in Baclaran.

d) SCADA システム

A newly commissioned SCADA System for the 9 Rectifier Substations enables remote monitoring, telemetering and control of Substation facilities. Smaller SCADA systems were likewise provided in 18 line stations for monitoring of electrical devices, fire alarm systems, UPS and for monitoring the condition of Escalators and Lifts in the stations.

The primary objectives of the SCADA Monitoring system for the new stations shall be as follows:

- Monitor and control of Electrical Distribution and Traction Power systems within each RSS.
- Monitor condition of water sprinkler systems located within certain nominated station rooms, i.e., Electrical, Signaling and Telecommunications.
- Monitor the conditions of the UPS equipment installed in the three (3) new LRT stations and three (3) RSS.
- Monitor position of Circuit breakers supplying AC power for the TER and Ticket Booth in the stations.
- Monitor the condition of Escalators and elevators in designated stations.

e) SDH 光通信システム

- At present, a 12 core Fiber Optic Cable was recently installed along both sides of the 15 kilometer viaduct from Baclaran Depot and to the 18 stations from Baclaran to Monumento station. The existing optical fiber network is based on Synchronous Digital Hierarchy (STM-1) and Plesiochronous Digital Hierarchy (PDH) systems primarily on G.652 fibers. The fibers installed

conform to ITU-T recommendations.

- The SDH / FOTS serves as the Telecommunication medium for the transmission and reception of Voice, Data and Video information between all 18 line stations, 9 RSS and OCC of the LRTA Line 1 System.

f) AFC-ローカルネットワーク

All 18 Line stations of LRT Line 1 are equipped with multiport Network switches used for interconnecting AFC equipment of the stations with the Central Processing System at the Depot via the SDH transport system.

g) 自動式構内交換機 (PABX)

Overview and Upgrading of the Existing System

- The existing PABX (Ericsson MD110) currently installed within the LRTA system was commissioned in 1994 with an initial load of 306 lines (trunked and locals).
- The PABX has two (2) Line Interface Modules each with 240 lines capacity and presently capable of supporting a total line capacity of 480 lines.
- After the completion of the CAPEX II Project, the total connected lines (locals, tie lines and trunked) as of to date is 435.
- Due to its limited line capacity to handle the telephone requirements of the Line 1 North Extension Project, additional telephone lines in the future for the existing stations and Depot offices, hardware obsolescence, current and future demand for VOIP, packet switching and high speed data for IP based applications, the current MD110 PABX shall be upgraded and migrated to a fully IP enabled Telephone System to support these services.

Upgrading Requirements

- Ericsson MD110 PABX shall be upgraded to MX-ONE TS PABX which is the current upgrading platform for the smooth migration of MD110 PABX.
- The MX-ONE PABX system shall be a completely integrated package consisting of a Line Interface Module having the capabilities and functionalities required to operate with an initial load of 100 telephones for the Line 1 North Extension and Trunk lines at Depot.
- The new switch shall have full compatibility and interoperability with the existing MD110 PABX hardware, user equipment and newly supplied BC13 programming software.

h) 無線システム

Current UHF Trunked Radio Network

- The recently installed UHF Trunked Radio System of LRT line 1 comprises of four (4) base stations in strategic locations with twenty (20) repeaters, 89 Train radios, service vehicles and 185 portables operating in the 470-476 MHz Frequency Band.
- The radio system is sharing the usage of all sets frequencies with LRT Line 2 on a first come, first serve basis.
- The current system is presently experiencing difficulty in communication due to radio interference from unknown sources and radio traffic congestion resulting from frequency sharing with Line 2 Radio System. Moreover, the National Telecommunication Commission recently issued a circular which intend to reallocate the UHF frequency band being used by Line 1 and Line 2 to Digital Television Broadcast.
- In view of this development and the technical problems being encountered it was decided to replace the existing UHF Trunked radio with a new TETRA digital Trunked Radio System for the existing Line 1 and Line 1 North Extension.

i) 感電防護と接地システム

Presently, there are Lightning Protection, Grounding systems, power and telephone line protection in all revenue stations and OCC to protect human lives in these stations and Telecommunications devices installed in these locations. Similarly, the new stations of the LRTA Line 1 North Extension shall be provided with total facility protection systems.

j) 無停電電源装置 (UPS)

Currently, UPSs are provided for all existing Telecommunication Systems in all 18 stations and in the OCC and Depot in Baclaran.

UPS shall be installed at the following locations:

- 3 LRTA stations (Telecommunications and SCADA equipment),
- 3 Traction Power substations (SCADA equipment), and
- 5 base stations sites.

Preliminary rating of telecommunications loads are given below:

- 5 KVA each for the 3 repeater sites/base stations,
- 5 KVA each for 3 LRTA stations, and
- 3 KVA each for 3 SCADA RTUS for Traction Power substations.

UPS Performance Specifications

- The system shall use microprocessor circuitry in the main inverter or battery charger circuitry.
- The UPS shall be rack mounted and installed inside a NEMA rated cabinet together with the Service Bypass Switch and sealed battery banks.
- The UPS unit shall be capable of single phase, 60 Hertz operation.
- The UPS shall accept the standard voltage of 220vac.
- The UPS System's battery charger shall be completely automatic with a programmed reference, and capable of restoring the battery to capacity within 3 hours after restoration of utility power.
- The UPS back up batteries shall be of the maintenance free type and shall be fully sealed types with no gas leaks. The battery shall operate entirely unattended and shall have a minimum life span of not less than 3 years. Periodic inspection of batteries shall be required but kept to a minimum.

UPS Functional Requirements

- All connected loads shall be continuously supplied by the UPS equipment, which shall be fed from the normal utility power source.
- Upon failure of the utility power input, the load shall automatically continue to be powered via the system's battery and inverter for a minimum of 4 hours.

2.3.1 電力システム

2.4 NEP 入札資料

1) オリジナルの電力システム

- Existing 9 substations are being supplied by Meralco wherein even numbered substation (RSS 2,4,6,8) have 2 incoming 34.5KV feeds while odd substations (RSS 3,5,7,9) have a single incoming 34.5KV feed.
- RSS 1, being a Depot substation has 2 incoming feeds.
- These on-line substations are not incorporated into the existing LRT stations.
- The substations are located either near or between Stations.

- The current catenary system utilizes double catenary contact/messenger system powered by 750V DC substations that are spaced, on the average approximately every 1.5 km to 2.0 km along the LRT corridor.
- The Low Voltage 480V AC system from each substation was designed to supply its neighboring stations and is capable of supplying the remaining adjacent stations if the neighboring substation fails.

2) NEP 電力システム

- The 5.7 km LRT Line 1 North Extension from Monumento Station to North Avenue Stations is the next priority segment to be implemented. This would link LRT Line 1 to MRT Line 3.
- The Power System capacity should allow for four car trains at 112 seconds headway.
- Operational and architectural requirements in primarily a suburban residential setting. This includes factors such as noise, speed, overall appearance of the system and code clearances that shall be considered.

3) NEP への電力供給における必要事項

- Three (3) additional substations to supply DC traction power requirement for the Trains and AC power requirement for the stations. One substation is located at Balintawak Station (RSS 10) and two (2) substations located at Roosevelt Station (RSS 11 and 12).
- All arrangement and Works related to power utility provider high reliability primary power supply incoming for the substations.
- A High Voltage Supply loop to ensure the redundancy of power supply on the High Voltage AC System of the substations. This requires coordination and approval from the Power Utility Provider.
- A medium voltage loop at 6.5 KV will be installed for the supply of the Low Voltage, in the case that the high voltage loop cannot be installed.
- A Low Voltage Supply (480/220V) to the main AC power supply requirement for the loads in the 3 new passenger stations.
- Earthling, Bonding and Corrosion Protection.

4) き電変電所 (TPS)

- 34.5 kV power feeds from the power utility provider
- 34.5 kV High Voltage loop system
- 34.5 kV High Voltage AC Switchgear assemblies
- Step down Rectifier Transformers and Rectifier Units (DC System)
- 750 VDC Switchgears
- Negative panels
- Traction return bond
- Auxiliary Step down Transformers (AC System)
- Low Voltage AC Switchgears Assemblies
- 110V Batteries and Chargers for Control Power Supply
- 110V dc distribution panel boards
- Local annunciator panel
- SCADA interface provisions (including Interfacing Panel)
- 34.5 KV ac insulated power cable and accessories
- Low Voltage ac insulated power cable and accessories
- 750V dc insulated power cable and accessories
- Outgoing DC disconnect switches as maybe required for isolation purposes
- Control cables and accessories
- Installation materials

- Earthling/Bonding/Corrosion control
- Ventilation

System Loads and Parameters

The following requirements must be taken into consideration in the design of the TPS.

- System voltage: System rated voltage 750V DC
- Design voltage drop limits: Minimum operating voltage - 600V DC (80% of rated voltage)
- Absolute voltage drop limits: Absolute minimum operating voltage - 525V DC (70% of rated voltage)
- In addition, the System must be designed to:
  Accommodate trains accelerating from rest to a speed of 60 km/hr.
  Accommodate trains operating on a 112 sec. headway

5) き電方式 (TPFS)

The TPFS consists of all feeder (positive and negative) conductors, switches, duct banks, wayside cable trench, cable trays/ladders, and associated hardware that feeds the DC power from the substation to the overhead catenary system via Catenary feeder switch and return from the rails via Traction return bond to the Negative Panel.

Positive Feeder Cables

The DC supply feeder cables must meet the following existing minimum criteria:
All Conductor size shall be 300mm 2 stranded copper

Negative Return Cables

The DC negative return cables must meet the following existing minimum criteria:
All Conductor size shall be 300mm 2 stranded copper

High Voltage AC Power

The high voltage AC power cables should be rated 35kV minimum or as may be specified by the power utility which is ever better, TR-XLPE, shielded armored cable. The minimum allowable cable size is 95mm2 or as may be approved by the power utility company

2.4.1 F/S ドラフト報告書 (v0.10) 2006 年 8 月

The E&M system includes the provision of a traction power supply and distribution (PSD) system for the line 1 extension. The PSD system will include all die electrical equipment for receiving ac power from MERALCO, converting it into dc traction power for the vehicles, and distributing that power to vehicles on the guide way and in the Satellite Depot. The principal components of the PSD system are:

- Traction power substation (TPS) equipment;
- Overhead contact system (OCS);
- Power and control cables and wires; and
- Earthling systems.

The power source will be provided by MERALCO at medium voltage along the route of the Line 1 extension. The supply characteristic, are expected to be 34.5kV ac, 3 phase, 60Hz and the power will be carried from the MERALCO substations to each TPS buildings via underground power cables and ducts that will be provided and installed by MERALCO.

1) き電変電所

There shall be eight TPSs, comprising seven on the extension mainline, and one at the Satellite Depot. The mainline TPSs will be located under the guide way and next to passenger stations wherever possible. The required rating and location for each TPS is shown in the following table.

表 2-1 The required rating and location for each TPS

TPS Designation[1]	Location	Rectifier Rating	Station	
TPS # 10	100+650	2 x 2000kW	Redemptorist	100+650
TPS #11	102+850	2 x 2000kW	Mia	102+650
TPS # 12	104+430	2 x 2000kW	Ninoy Aquino	104+490
TPS # 13	106+230	2 x 2000kW	Dr. Santos	106+150
TPS # 14	108+080	2x2000kW	Las Piñas	108+000
TPS #15	109+580	2 x 2000kW	Zapote	109+260
TPS #16	111+600	2 x 2000kW	Niyog	111+350
TPS # 17	at Satellite Depot	1 x 2000kW		

Source: LRTA

[1] Last TPS designation for the Existing Line is TPS # 9.

Each TPS will incorporate 34.5kV ac switchgear with the required incoming and metering cells, rectifier-transformer feeder cells and an auxiliary power cell, A station power transformer cell will be provided at each of TPS #10 and TPS #16 to feed the passenger stations power transformer assembly.

Each mainline TPS will be configured with two 12-pulse transformer/rectifier units to convert the 34.5W 3-phase incoming power to 750Vdc traction power. The Satellite Depot TPS shall be configured with one such unit.

Each TPS will be configured with 750-volt dc switchgear comprising two line-ups, positive dc switchboard and negative dc switchboard. The positive dc switchboard will consist of high-speed dc circuit breakers for isolating the transformer-rectifier units, controlling power flow to the OCS and protecting feeders and OCS equipment. The negative dc switchboard will consist of rectifier switches for isolating transformer-rectifier units and an earthling panel for detection and protection of dc equipment from earth fault and limiting rail-to-earth potential. The negative bus in the negative dc switchboard will collect the return current from the running rails.

A station power transformer assembly will be provided at each of TPS #10 and TPS #16, which will comprise a step-down transformer and 6.6kV-ac breaker for supplying power to and protecting the 6.6W ring network.

2) 旅客駅の電力

The E&M Systems include a power supply system for the new passenger stations, Including:

- Passenger station substation equipment;
- A 6.6kVac cable ring network; and
- Inter-connecting power and control cables and wires for the passenger substation equipment.

Each substation will be configured with 6.6kVac ring-main unit (RMU) switchgear and two step-down 6.6kVac-480V/277V transformers to supply station loads. In normal operation, the transformers shall share the station loads. When one transformer fails essential loads will be automatically transferred to the other transformer.

A 6.6kVac cable ring network will supply power to the station substations equipment from the station power transformer assemblies located at each end of the ring-main network al TPS #10 and TPS #16. The assembly at each of die two TPSs will consist of a 6.6kV ring-main feeder breaker and a 1500Kva, 34.5kV-6.6kV transformer.

2.4.2 カテナリー式架線システム

A. NEP 入札図書

1) 設計条件

- Speed
  - Maximum 60 km/hr
- System Voltage
  - Minimal 525 VDC
  - Nominal 750 VDC
  - Maximum 1000 VDC
- Wind Velocities
  - Operating condition 160 km/hr.
  - Under typhoon condition 220 km/hr.
- Temperature Range (ambient) 15 – 40 degrees C
- Trains headway requirements 112 seconds

2) 既存の架線システムと NEP 架線システム

- Both tracks consist of double contact wire (120 mm2 CuCd), one messenger cable (140 mm2 CuCd, 37 strands), connected to two (2) reinforcing wayside cables (500 mm2) laid inside the concrete ducts.
- However for the new OCS, instead of reinforcing cables, equivalent non insulated auxiliary cables shall be installed aerial along with the messenger cables.
- Portal beam system are used to hold and support the following:
  contact wires, messenger wires, lightning arresters, isolator switches, hangers, supports, insulators, anchoring assemblies, suspension assemblies, feeding facilities, insulated cables, electrical conduit, etc.
- However for the new OCS installation, H-beam poles shall be used on both side of the viaduct in any tangent track while portal beam system shall be installed on curve track and on all anchoring/dead end portions when necessary.

a) スパン長

- On Tangent Track 44 m – 56m
- On Curve Track 23 m - 27m

b) 架線高さ

- Nominal 4600 mm
- Minimum 4300 mm
- Nominal at Support 4750 mm
- Maximum 6000 mm

c) テンショニング

Weight tensioning method shall be used for each end of contact wire tension length, but on cross-over and messenger wire, tensioning spring shall be used.

B. LAVALIN F/S Report

1) 南延伸区間の車両基地内の架線システム

The depot system will be of trolley type. The catenary system of depot will be of single contact wire, fixed termination design. The depot simple trolley wire construction will use direct suspension.

C. F/S ドラフト報告書 (v0.10) August 2006

1) 南延伸区間の架線システム

- The OCS will include the overhead conductors, support structures and related items forming die distribution system that will provide 750Vdc power to the trains via the vehicle pantographs. The track running rails will be used as the return current conductors,
- Two types of OCS construction will be used: weight-tensioned catenary, and simple trolley wire. The catenary construction method will be utilized throughout the mainline, and on the transition tracks between the mainline and the Satellite Depot yard storage tracks. Trolley wire construction will be supplied throughout the Satellite Depot storage track area. Both types of OCS shall deliver power to the vehicles at 750 volts dc.
- The physical support system for the OCS will be designed in accordance with the allowable loading, deflection and clearance requirements.
- The E&M systems include provision of the cabling to feed the 750Vdc power from the TPS equipment to the OCS. Feed points will be located in close proximity to each substation with the exact location chosen to minimize section gap arcing during train acceleration.

Source: Study Team

写真 2-1 既存 OCS の門型架線柱

Source: Study Team

写真 2-2 NEP OCS の H 型架線柱

Source: Study Team

写真 2-3 既存の車両基地のトロリータイプ

2.4.3 軌道

A. NEP 入札図書

1) NEP の軌道

- The slab track system will be installed on a flat concrete slab. For stray current protection of the structure a suitable grid is installed underneath the track.
- On both sides of the viaduct cast in-situ cable containments will be erected. The upper surface of the cable containments is made available as an emergency detrainment walkway along the line. This concrete structure serves as well as a lateral bearer for the slab track system.
- The track system shall be a slab track with bi-block reinforced sleepers, rubber boots and pads, embedded in track bed concrete. The standard gauge is 1435 mm with rail type EB 50T. The slab track system shall respect the Noise and Vibration criteria.

- The nominal track center distance on the viaduct is 3.20 m. Buffer Stops are installed at the extremity of terminal Station to protect any structure from overshooting full loaded trains entering the station.
- The design speed of the line is 60 kph.
- The turnouts and crossovers shall be installed using the direct fixation method. To ensure compatibility with the Noise and Vibration criteria, they shall be installed on floating slabs.

2) NEP の軌道の仕様

a) 軌条と勾配

- For main line tracks the running rail profile shall be to the EB 50T profile, specified to UIC Code 860 and EN 13674-1.
- Where check or guard rails are to be installed, the rail profile shall be to the CEN 33 C1 (previously U 69 or UIC 33 profile).
- For turnout switch blades, a matching asymmetrical rail profile to the EB 50Tspecified to EN 13674-2, shall be used. Switch blades are also referred to as switch rails.
- In straight and curved tracks with a radius greater than 600 m, the EB 50T profile running rails shall be of steel quality Grade 900A. In curved track with a radius less than or equal to 600 m, the EB 50T profile running rails shall have a minimum tensile strength of 1100 N/mm².
- The CEN 33 C1 profile for check and guard rails shall be of steel quality Grade 900A.

b) ツインブロック・コンクリートまくら木

Sleepers are installed on a concrete track bed.

Source: Study Team

写真 2-4 ツインブロック・コンクリートまくら木

表 2-2 ツインブロック・コンクリートまくら木の寸法

Dimension	Required
Height of block measured in the axis of seat	189 mm
Distance between rail seat areas	1435 mm
Length of blocks	720 mm
Width of block to receive rubber boot)	290 mm
Height of tie bar with regard to base of sleeper	85 mm
Inclination of the rail seat	1:20

Source: LRTA

c) まくら木間隔

The following maximum sleeper spacing shall be respected in ballast less tracks:

- 1428 sleepers per km for radius greater than 1000m,
- 1666 sleepers per km for radius less than or equal to 1000m and greater than 250m, and
- 1818 sleepers per km for radius less than or equal to 250m.

d) レール締結装置

- The rail fastening system shall be of an approved resilient type, appropriate for the operation conditions of the Light Rail system with continuously welded rails.
- The rail fastening shall be of a self-tensioning type, which will give a constant clamping force and rail creep resistance and will maintain the clamping force and rail creep resistance during operation, without any maintenance.

e) ゴムブーツとマイクロセルラーパッド

Rubber boots and the incorporated 12 mm microcellular pads place around and underneath the bi-block concrete sleepers.

f) レール溶接

Alumino-thermic (thermit) welds of the Continuously Welded Rails (CWR)

g) 車止め

- Fixed or Friction-Hydraulic buffer stops shall be installed at all dead-end tracks of the system.
- For self-propelled trains moving: 25 km/h.

h) 伸縮継目

- The rail expansion joints shall be designed to accommodate full movement in rails to which they are to connect.
- Rail expansion switches (joints) shall be provided at the points where continuously welded tracks meet jointed tracks or where it is considered necessary to ensure track will not be subject to misalignment under extremes of temperature.

i) 騒音防止装置

In order to avoid annoyance for the people around the small curve, a noise barrier of 2 m height has to be installed at both sides of the elevated structure. This noise barrier is a light weight metal barrier with noise absorption potential. In order to obtain a transmission loss of at least 20 dB(A) in the frequency range above 500 Hz, the noise barriers should have at least following characteristics:

- Absorption by rockwood panel inside the barrier of at least 50 mm thick and density of 60 kg/m3,
- Metal back panel at least 1.5 mm thick, and
- Perforation rate of front panel: at least 40%.

j) コンクリート軌道

Rails are fastened to the blocks of twin-block sleepers by means of an elastic fastening system. The required track resilience is obtained in the following track components:

- Elastic fastening system,
- Micro cellular pad, and
- Rubber boot.

k) フローティングスラブ

- Floating-slab track beds shall be used under the turnouts, designed to control ground borne noise and vibrations.
- The floating slab is constituted of a continuous reinforced concrete slab supported by individual resilient bearings. It covers the complete width of the turnout. The thickness of the floating slab is 330mm.

l) コンクリートダクトとカバー – 通路

- Cast-in-situ concrete ducts on the viaduct shall be made up of reinforced concrete using steel rebars or steel wire mesh.
- Prefabricated covers shall be made from fiberglass using approved materials and curing procedures.

m) 迷走電流用コンクリート

- The stray current grid layer concrete r is situated underneath the track bed and above the viaduct finished slab.
- This layer includes the placing of stray current grid.

2.5 L1CEP E&M システムの考察と提言

The E&M system of the main line in L1CEP section is the government's PPP portion. The theme in this E&M system which should be solved became clear through the technical review. This section points out technical consideration and recommendation for the government's PPP portion.

Now writing the following items.

2.5.1 信号システム

1) Integration of Signaling System
2) Operations Control Center

2.5.2 通信システム

1) PABX
2) Trunk Radio System
3) Fiber Optic Transmission System

2.5.3 電力システム

1) Traction Power Substation
2) Passenger Station Power Supply
3) Traction Power Feeder System
4) UPS System

2.5.4 カテナリー式架線システム

1) OCS Pole on both side of the Viaduct
2) Existing Depot Catenary System
3) Satellite Depot Catenary System

2.5.5 軌道

1) Minimum Radius
2) Noise Barriers
3) Walkway
4) Concreted Track with Elastic Fastening System

3　車両

3.1　全般

1 号線には第一世代、第二世代、第三世代と３形式の車両が運行されている。第一世代の車両は 1984 年に 1 号線が開業したときに導入された。第二世代の車両は 1999 年の輸送力増強プロジェクトフェーズ１で導入された。第三世代の車両は 2007 年に輸送力増強プロジェクトフェーズ２により導入された。各世代の車両の特徴を以下に記す。

3.1.1　第一世代車両

第一世代車両はベルギーの BN 社 (La Brugeoise et Nivelles SA.) により製造された。車両は路面電車をＬＲＴ用にアレンジしたもので連接部を 2 ヶ所持つ 3 車体で構成されている。路面電車の場合、通常 1 両で運転されるが 1 号線では 2 両を 1 編成として構成されている。車両間には貫通路は設けられていない。連結される部位の車体には運転室機器は設置されず、代わりに旅客用腰掛けが設けられている。路面電車とは異なり旅客はプラットホームから乗り降りする。したがってドアにはステップはついていない。1 車両の片側には 5 箇所の扉がついている。扉はプラグドアとなっており、閉じたときには車両側面はフラットになる。扉が開くときは側方にスイングするため扉があたらないようにプラットホームの高さは 700mm におさえられており車両の床より 200mm 程度低いものとなっている。1 両に 4 台車取付けられており、外寄りの２台車は電動台車、連接部の 2 台車は付随台車となっている。電動機はチョッパ制御による直流電動機であり 1 台車に 1 個の電動機が取付けられている。弾性車輪を使用し路面電車でよく使用されるレールブレーキが取り付けられている。空調は当初取付けられておらず、12 個の強制換気装置がとりつけられていた。

図 3-1 第一次世代車両 (開業時)

輸送力増強計画フェーズ１により第一世代車両は編成あたりの輸送力を増加させるために 1 編成 2 両から 1 編成 3 両に組みかえられた。

また、輸送力増強計画フェーズ２パッケージ B により強制換気装置は取り外され空調装置が取り付けられた。

図 3-2 第一世代車両　(空調取付け後)

3.1.2　第二世代車両

第二世代車両はスェーデンのアドトランツ及び韓国のヒュンダイにより勢作された。 アドトランツは電気部分を担当しヒュンダイは車体を担当した。 列車は 4 両編成で 1 両は 2 車体 1 連接で構成されている。車体はステンレス製で空調装置が取り付けられた。扉は片側 4 ヶ所となっている。

2 台車が電動台車､連接部の台車は付随台車となっている｡電動台車には 2 台の交流誘導電動機が取付けられ、VVVVF インバータにより制御される。台車は第一世代が車輪の内側に台車枠を持っていたのに対し、車輪の外側に台車枠がある構造となっている｡台車の固定軸距は 2,310mm となっているが、LRV としてはかなり長いため基地内のいくつかの線は入線できなくなっている。

車体幅は第一世代に比べて 95mm 大きくなり台車中心間距離も第一世代のものより 2.5m 長くなって 10m となった。このためプラットホームと支障する箇所があり一部のプラットホームは削られることとなった。

図 3-3 第二世代車両

3.1.3　第三世代車両

第三世代車両は近畿車輛及び日本車輛により製造された。編成構成は第二世代と同様になっている。

トラックブレーキは通常路面電車が自動車との衝突をさけるために取り付けられたものであるため、この車両には取付けられなかった。

台車枠は保守の容易にするため車輪の内側となっている。固定軸距は 1,900mm としており基地内での制限箇所は無い。

TMS’(Train Management System)が取り付けられ主な機器の状態を監視し運転士や保守作業者に知らせるようになっている。

図 3-4 第三世代車両

3.2　　現在の車両の諸元

表 3.1 に現在の車両の諸元を示す。

表 3-1 現在の車両の諸元

			第一世代	第二世代	第三世代
軌間			1435mm	1435mm	1435mm
公称電圧			750V	750V	750V
列車構成			3 car	4 car	4 car
車両方式			3 車体 4 台車 2 連接	2 車体 3 台車 1 連接	2 車体 3 台車 1 連接
車体長			29,280mm	26,500mm	26,500mm
レール面からの高さ			3,525mm	3,740mm	3,910mm
パンタグラフ折りたたみ高さ			3,950mm	3,950mm	3,843mm
パンタグラフ作用高さ		最低	4,300mm	4,300mm	4,050mm
		最高	6,000mm	6,000mm	6,500mm
列車長			90m	106m	106m
車体幅			2,485mm	2,590mm	2,590mm
車両重量	Mc		41.5t	37.4t	37.4t
	M		-	36.5t	36.5t
旅客定員 y	Mc	座席	81	78	66
		立席	293	252	272
		合計	374	330	338
	M	座席	-	82	70
		立席	-	267	286
		合計	-	349	356
	列車合計	座席	243	320	272
		立席	879	1038	1116
		合計	1122	1358	1388
車輪径			660mm	660mm	660mm
レールからの床面高さ			900mm	920mm	920mm
旅客用扉	方式		プラグドア	両開き引戸	両開き引戸
	扉数/片側		5	4	4
	開口幅		1400mm	1500mm	1500mm
	開口高さ			1900mm	1900mm
台車	方式		内側台車枠	外側台車枠	内側台車枠
	軸バネ		円錐ゴム	シェブロンゴム	シェブロンゴム
	枕バネ		コイルバネ	空バネ	空気バネ
	固定軸距		1,900mm/1,800mm	2,310mm	1,900mm
主電動機	方式		DC motor	AC induction motor	AC induction motor
	出力		218kW	125kW	105kW
	個数/台車		1	2	2
電動機制御			チョッパ制御	VVVF インバータ制御	VVVF インバータ制御
最高運転速度			60km/h	60km/h	60km/h
最大加速度			1m/s^2	1.1m/s^2	1.1m/s^2
常用最大ブレーキ減速度			1.3m/s^2	1.3m/s^2	1.3m/s^2
非常ブレーキ減速度			2.08m/s^2	2.08m/s^2	1.3m/s^2

付属資料 B:　その他

1　　土木

耐震・軟弱地盤対策にかかる performance indicator および具体的な設計標準等の提示

LRT1 号線の南延伸区間は、マニラ湾の海岸線に沿って計画されている。マニラ首都圏内にはウェスト・バレー活断層があり、多くの研究調査ではマグニチュード 7 またはそれ以上の地震が発生する可能性があると予測されている。この地震による被害想定マップでは、南延伸区間は第四紀沖積層上にありハイリスクの地域に該当する。このため鉄道構造物の建設に当たっては、巨大地震を想定し、従来の設計手法に加え日本で耐震実績のある以下の設計基準を導入し、設計することが必要不可欠である。

耐震設計

「鉄道構造物等設計標準・耐震設計（英語ダイジェスト版）（国土交通省鉄道局、鉄道総合技術研究所）」

本耐震設計標準は、1995 年に発生した兵庫県阪神・淡路大震災を受け、内陸直下型地震、海洋プレート境界型大規模地震の強い地震動を考慮し、動的解析を中心とした方法で構造物の安全性を照査する内容であり、従来の震度法による設計標準よりも大きな地震に対応している。

Type of seismic wave	Assumed earthquake	Assumed maximum acceleration of seismic wave
I	Ocean type grade M8 & Inland type under M6.5	max : 458gal
Ⅱ	Hanshin-Awaji earthquake etc.	max : 975gal

この設計方法で建設された鉄道構造物は、2011 年の東日本大震災において復旧不可能な大変形や破壊は発生せず、局部的な修復工事のみで安全な列車運行が再開されている。この実績からも南延伸区間の耐震設計においては本標準を用いた照査が行なわれるべきである。

また、桁を受ける支承部の耐震対策として、桁の移動制限装置、落橋防止装置等に関する設置基準が整備されており、桁の移動や落下を防ぐことにより列車の転覆防止を図っている。

軟弱地盤、液状化の可能性のある地盤の杭基礎

「鉄道構造物等設計標準・基礎構造物（英語版将来刊行予定）（国土交通省鉄道局、鉄道総合技術研究所）」

マニラ湾沿岸の低地は第四紀沖積層から成り、1 号線オリジナル区間で杭長 40m 程度の杭基礎を用いていることからも、南延伸区間ではそれと同様の基礎を選定する必要があると想定される。本設計標準は杭基礎のほか、この路線の内陸側で採用を予定しているケーソン基礎も含まれており、軟弱地盤、液状化の可能性のある地盤、不完全支持地盤など、特殊な条件下での設計標準が記述されている。

2011 年に発生した東日本大震災では液状化現象により道路や一般家屋は甚大な被害を受けたが、本設計標準で建設された鉄道構造物については液状化の被害は皆無であった。この実績からも南延伸区間の基礎設計においては本標準を用いた照査が行なわれるべきである。

コンクリートひび割れに関する耐久性

「鉄道構造物等設計標準・コンクリート構造物（英語ダイジェスト版）（国土交通省鉄道局、鉄道総合技術研究所）」

1 号線オリジナル区間の高架構造物では、経年変化によってコンクリートにひび割れが多数発生している。海岸線から近い距離にあるためコンクリート表面の塩化物イオン濃度が高く、ひび割れの発生原因のひとつになっている可能性がある。このひび割れを放置するとコンクリート内部の鋼材の腐食が促進され、最終的には構造物の耐力の低下を招くこととなる。

今回計画する南延伸区間はさらに海岸線に近接するため、コンクリート構造物に対する塩害の影響はさらに大きくなる。本設計標準では海岸線からの距離に応じた鋼材腐食の検討が記述されており、この設計標準に従って鉄筋のかぶり等を決定することが望ましい。

2　車両

2.1　設計基準

マニラ LRT 1 号線における車両は現在のシステムとの整合性を維持する為以下の諸元とする。これらの諸元は大きなシステムの変更がない限り将来にわたって変えるべきではない。

表 2.1　車両の設計基準

No.	項目	基準
1.	軌間	1,435mm
2.	寸法	
(1)	列車長	106m 以下
(2)	車体幅	2,600mm 以下
(3)	全高	3,900mm 以下
(4)	パンタグラフ作用高さ	4,300mm 以下– 6,000mm 以上
(5)	パンタグラフ折りたたみ高さ	3,950mm 以下
(6)	床面高さ	920mm
(7)	アンチクライマの高さ	750mm
(8)	車輪径	660mm（新品） – 600mm（摩耗時）
(9)	固定軸距	2,100mm 以下
(10)	台車中心間距離	10,000mm 以下
(11)	扉高さ	1,900mm
3.	電気	
(1)	公称電圧	750V
(2)	電圧変動範囲	525V – 900V
4.	列車性能	
(1)	最高運転速度	60km/h
(2)	最大加速度	1.0m/s^2
(3)	常用最大減速度	1.3m/s^2
(4)	非常減速度	1.3m/s^2
5.	走行性能	
(1)	最小曲線半径	25m
(2)	最急勾配	4%
6.	最大軸重	11t
7.	ブレーキシステム	列車分離があった場合非常制動が作用すること
8.	ドアシステム	列車が走行中はドアは開かないこと
		開扉中は力行できないこと
		非常時に手動での開扉が可能であること

2.2 塩害対策

カビテ延伸における路線は海に近くサテライト基地は海岸から遠くない場所に計画されている。車両は常に塩分を含んだ風に晒されそのために車体や機器の損傷、故障の発生、寿命の短縮などが予想される。潮風による影響を少なくするために新しく作る車両に関して以下のような対策を推奨する。

1.	車体	車体材料は床下を含めてステンレスとする。
2.	機器箱	外部に取り付けられる機器箱はステンレス製とする。
3.	締結部品	車外に露出する全てのボルト、ナットはステンレス製とする。
4.	空気取り入れ口 e	機器の空気取り入れ口は海側を向かないこと。*
5.	機器	機器で外部から冷却のために空気を取り込む構造のものは、塩分を含んだ空気に対し十分配慮した物であること。

* 新しく購入する車両については基地で方向を変えないこととし、常に同じ側が海に面するようにする。

2.3 3 号線への乗入れ

表 2.1 に関わらず 3 号線に乗入れることができる車両とする場合が以下のような仕様とする。

Table 2.2 3 号線乗入れのための車両の基準

1.	**寸法**	
(1)	列車長	95m
(2)	全高	3,730mm
(3)	パンタグラフ作用高さ	3,900mm – 6,000mm
(4)	パンタグラフ折りたたみ高さ	3,660mm
(5)	台車中心間距離	7,500mm
(6)	扉高さ	1,900mm
2.	**車両性能**	
(1)	最高運転速度	65km/h
(2)	最大加速度	1.03m/s^2
(3)	非常減速度	1.58m/s^2
3.	**走行性能**	
(1)	最小通過半径	25m 以下
(2)	最急勾配	5%
4.	**最大軸重**	**9t**

これらは表 2.1 と異なる値となっているが、最高速度以外は表 2.1 に示す、以上、以下の範囲内にあるので矛盾しない。1 号線で速度が 60km/h を越えた場合に信号システムが指定距離内で車両を停止させることを保証できないため、この速度を超えて走ることはできない。しかし、3 号線の最高速度は 65km/h が求められるため、1 号線、3 号線を直通する車両については 1 号線、3 号線のふたつのモードを持ち手動あるいは自動で切替えることができる装置が必要となる。切替えるモードには最高速度の他、加速度、減速度、信号システム、通信システムなどが含まれる。

付属資料 C:　Line1 キャビテ延伸の需要予測

マニラ LRT 需要予測
（LINE 1 CAVITE EXTENSION PROJECT）

付属資料 C

目次

表 C.1 2015 年 LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	32,497	22,755
Balintawak	20,488	8,767
Monumento	72,174	59,904
5th Avenue	21,544	18,018
R Papa	7,997	11,481
A Santos	8,856	19,652
Blumentritt	15,979	16,061
Tayuman	22,493	18,347
Bambang	7,734	9,143
D Jose	33,348	32,824
Carriedo	36,090	35,037
Central	20,451	26,198
UN Avenue	36,841	41,052
Pedro Gil	31,990	32,058
Quirino	17,503	23,704
Vito Cruz	18,210	23,655
Gil Puyat	46,858	50,642
Libertad	16,673	19,204
EDSA	75,303	74,829
Baclaran	38,284	36,835
Redemptorist	6,280	6,468
MIA	6,364	6,511
Asia World	1,721	1,807
Ninoy Aquino	6,992	7,572
Dr. Santos	8,572	8,884
Manuyo Uno	549	558
Las Pinas	2,941	3,080
Zapote	10,219	10,770
Talaba	166	176
Niyog	25,583	24,708
Total	**650,700**	**650,700**
Maximum	**75,303**	**74,829**
Average Trip Length (km)		**9.64**

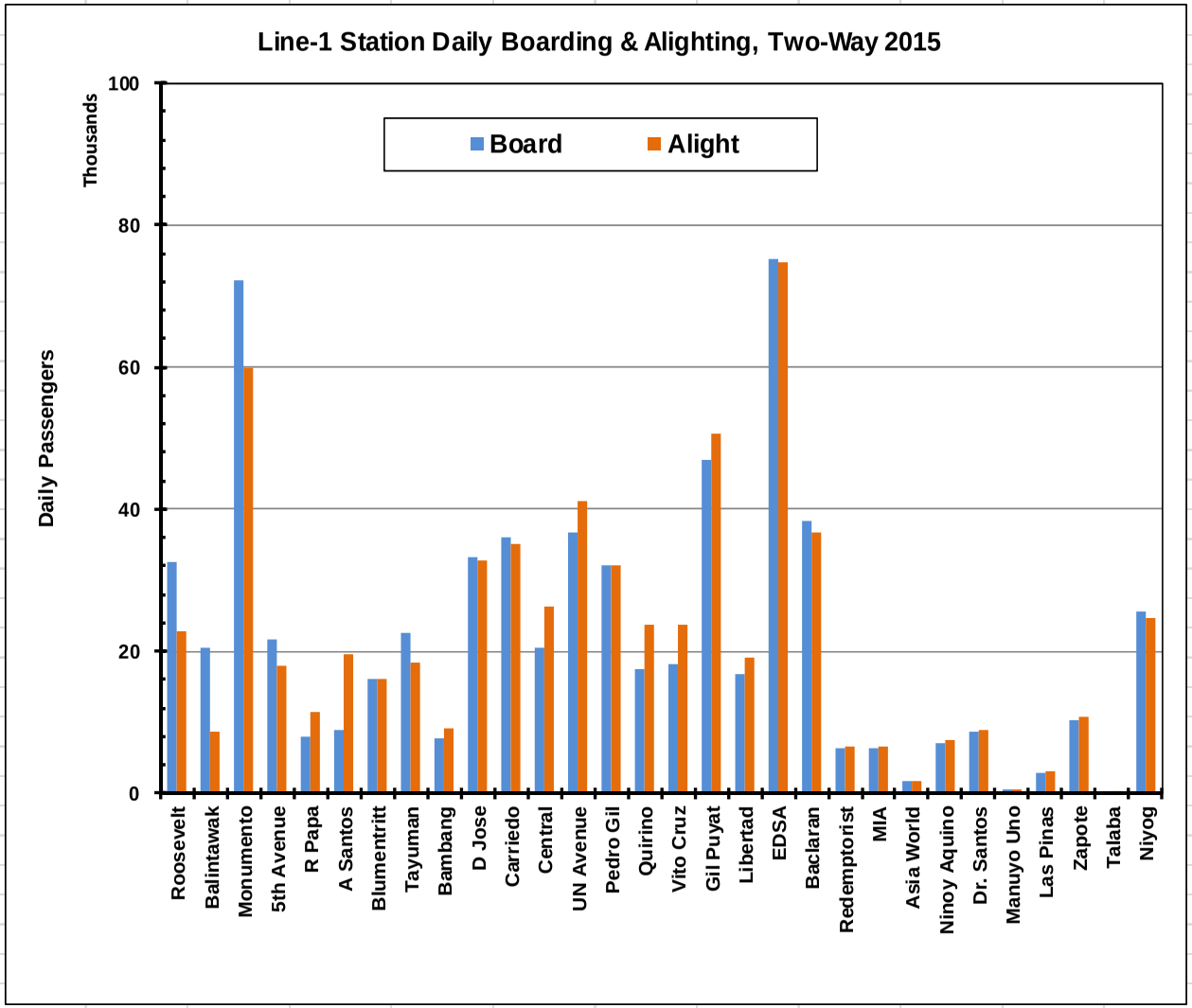
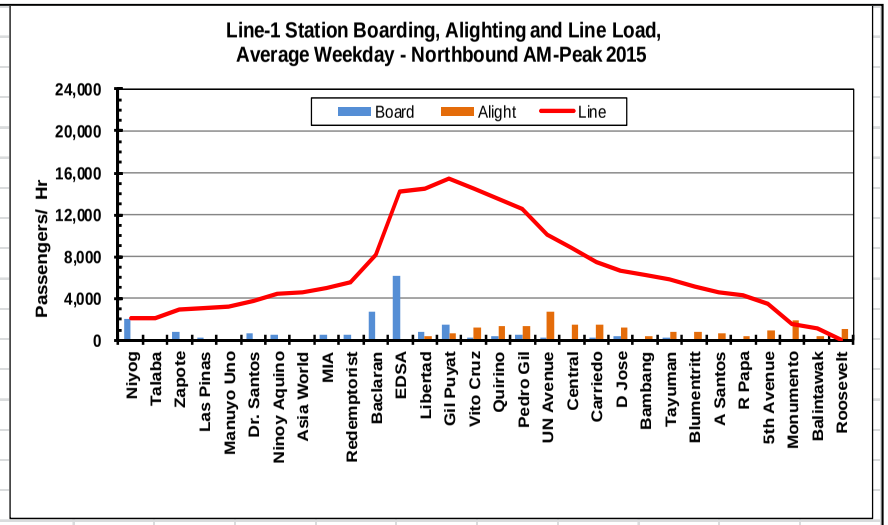


表 C.2 2015 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	**Board**	**Alight**	**Line**
Niyog	2,040	-	2,040
Talaba	13	0	2,053
Zapote	814	0	2,867
Las Pinas	234	0	3,101
Manuyo Uno	44	0	3,144
Dr. Santos	683	1	3,827
Ninoy Aquino	555	1	4,381
Asia World	137	0	4,518
MIA	502	2	5,018
Redemptorist	490	1	5,507
Baclaran	2,733	86	8,154
EDSA	6,155	127	14,182
Libertad	776	408	14,550
Gil Puyat	1,502	636	15,417
Vito Cruz	304	1,218	14,502
Quirino	377	1,391	13,488
Pedro Gil	475	1,376	12,587
UN Avenue	276	2,716	10,147
Central	85	1,447	8,785
Carriedo	251	1,530	7,506
D Jose	324	1,227	6,602
Bambang	85	401	6,286
Tayuman	275	780	5,781
Blumentritt	159	763	5,177
A Santos	118	672	4,623
R Papa	89	431	4,282
5th Avenue	114	970	3,426
Monumento	65	1,951	1,540
Balintawak	2	418	1,124
Roosevelt	-	1,124	- 0
Total	19,677	19,677	
Maximum	6,155	2,716	15,417
Average Trip Length (km)			9.09
Two-Way	49,374	49,374	10.18

Southbound Roosevelt - Niyog			
Station	**Board**	**Alight**	**Line**
Roosevelt	3,957	-	3,957
Balintawak	2,877	1	6,834
Monumento	9,105	21	15,917
5th Avenue	2,705	45	18,576
R Papa	780	21	19,335
A Santos	912	43	20,204
Blumentritt	1,277	101	21,380
Tayuman	1,332	294	22,418
Bambang	447	122	22,742
D Jose	1,784	772	23,754
Carriedo	969	1,204	23,518
Central	328	1,077	22,769
UN Avenue	789	2,417	21,141
Pedro Gil	594	1,342	20,392
Quirino	494	1,451	19,435
Vito Cruz	459	1,565	18,330
Gil Puyat	496	5,099	13,727
Libertad	274	1,669	12,332
EDSA	70	5,584	6,818
Baclaran	30	2,159	4,690
Redemptorist	7	431	4,265
MIA	7	433	3,840
Asia World	0	121	3,719
Ninoy Aquino	2	505	3,216
Dr. Santos	0	593	2,623
Manuyo Uno	0	37	2,586
Las Pinas	0	206	2,381
Zapote	0	719	1,662
Talaba	0	12	1,651
Niyog	-	1,651	0
Total	29,696	29,696	
Maximum	9,105	5,584	23,754
Average Trip Length (km)			10.90
AM-PK Hour to Daily			7.59%



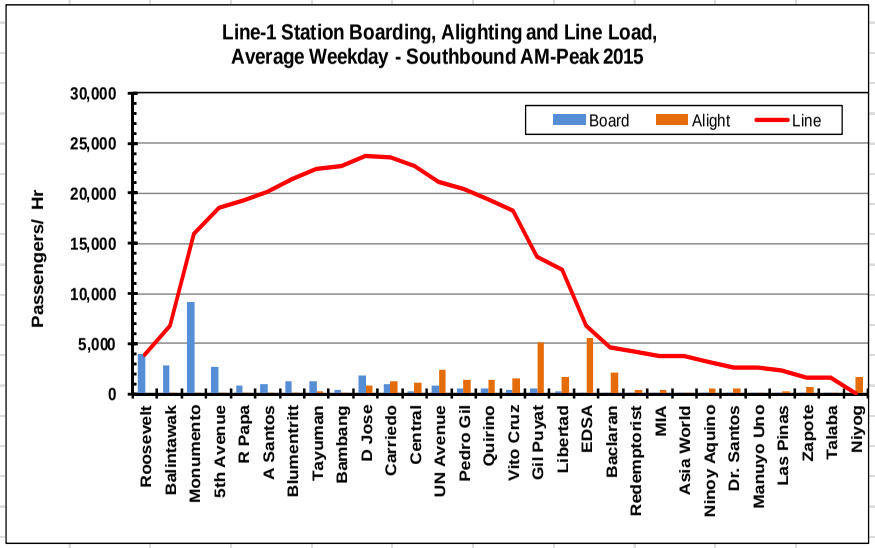


表 C.3 2016 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	34,899	24,415
Balintawak	22,002	9,408
Monumento	77,508	64,277
5th Avenue	23,137	19,333
R Papa	8,588	12,319
A Santos	9,511	21,086
Blumentritt	17,160	17,233
Tayuman	24,155	19,686
Bambang	8,305	9,811
D Jose	35,813	35,221
Carriedo	38,758	37,594
Central	21,963	28,111
UN Avenue	39,563	44,049
Pedro Gil	34,354	34,399
Quirino	18,797	25,436
Vito Cruz	19,556	25,381
Gil Puyat	50,321	54,339
Libertad	17,906	20,606
EDSA	80,868	80,292
Baclaran	41,114	39,524
Redemptorist	11,434	11,747
MIA	11,587	11,824
Asia World	3,134	3,280
Ninoy Aquino	12,729	13,750
Dr. Santos	15,607	16,131
Manuyo Uno	1,002	1,012
Las Pinas	5,354	5,593
Zapote	18,603	19,554
Talaba	297	323
Niyog	46,575	44,866
Total	**750,600**	**750,600**
Maximum	**80,868**	**80,292**
Average Trip Length (km)		**10.72**

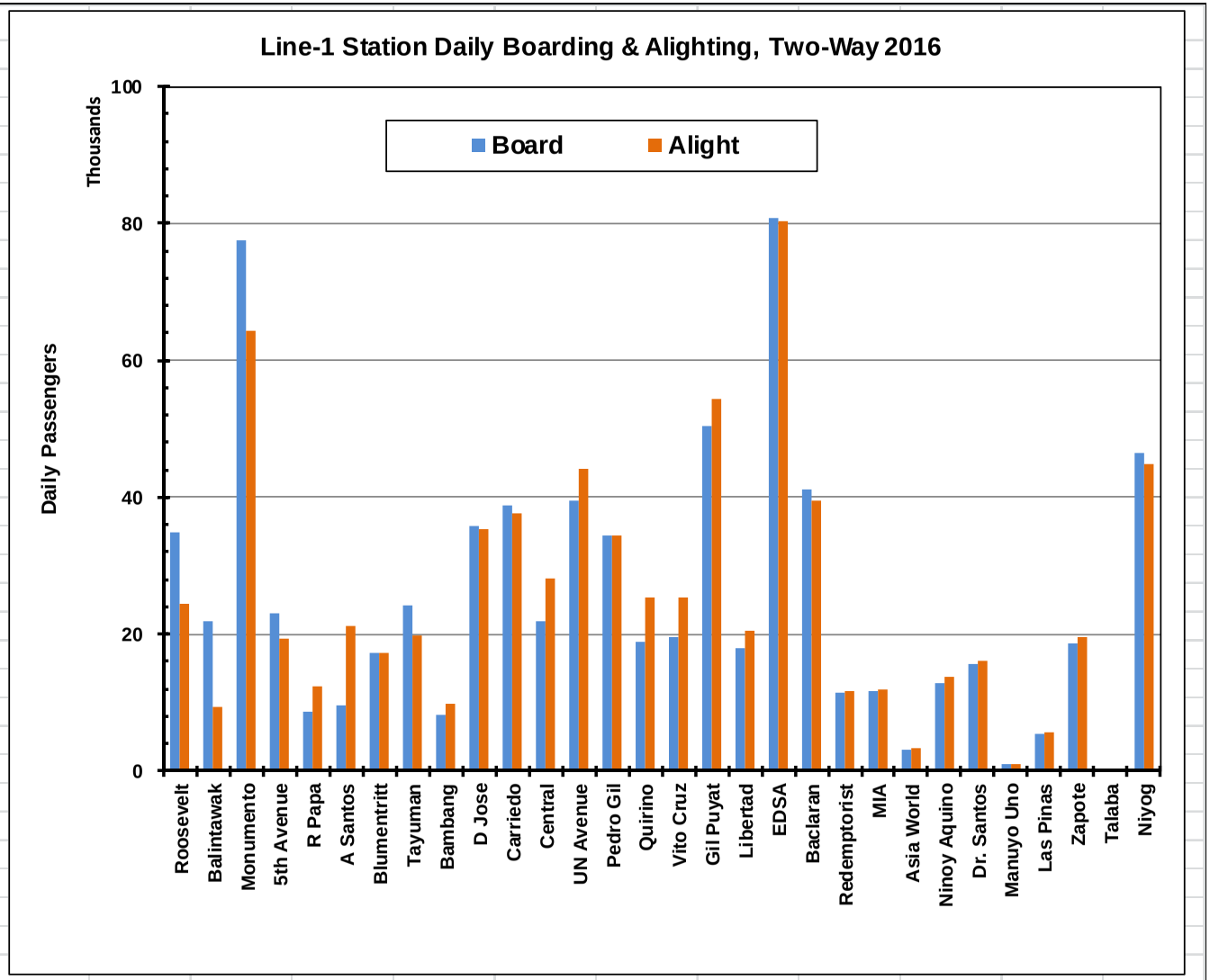
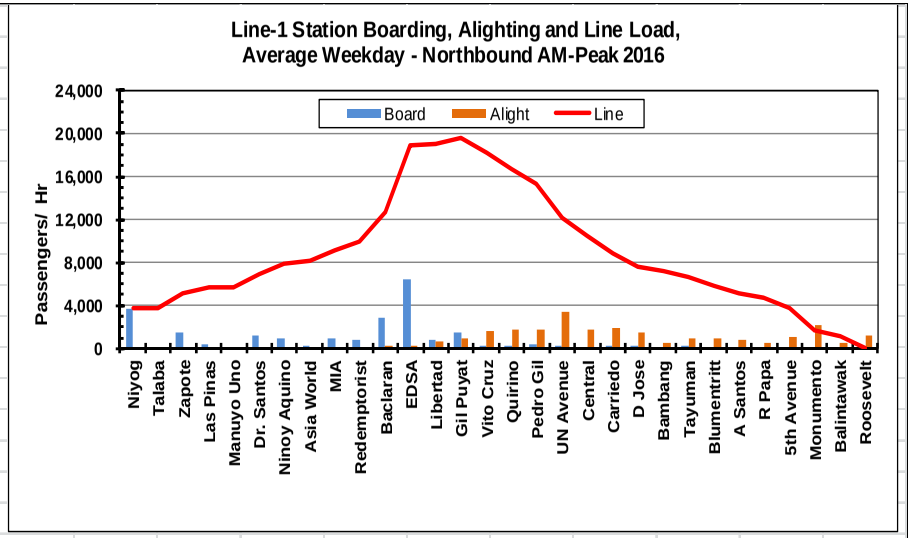


表 C.4 2016 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	Board	Alight	Line
Niyog	3,701	-	3,701
Talaba	24	0	3,724
Zapote	1,475	2	5,197
Las Pinas	424	0	5,622
Manuyo Uno	79	0	5,701
Dr. Santos	1,240	4	6,937
Ninoy Aquino	1,002	2	7,937
Asia World	248	0	8,184
MIA	900	7	9,077
Redemptorist	868	3	9,942
Baclaran	2,884	186	12,640
EDSA	6,499	190	18,949
Libertad	744	619	19,074
Gil Puyat	1,449	970	19,554
Vito Cruz	253	1,595	18,213
Quirino	317	1,803	16,726
Pedro Gil	401	1,752	15,376
UN Avenue	233	3,407	12,202
Central	74	1,802	10,474
Carriedo	213	1,852	8,835
D Jose	288	1,465	7,658
Bambang	75	471	7,262
Tayuman	244	915	6,590
Blumentritt	142	877	5,856
A Santos	110	775	5,190
R Papa	84	492	4,782
5th Avenue	108	1,100	3,790
Monumento	63	2,187	1,666
Balintawak	2	459	1,209
Roosevelt	-	1,209	-
Total	24,145	24,145	
Maximum	6,499	3,407	19,554
Average Trip Length (km)			10.18
Two-Way	57,075	57,075	11.21

Southbound Roosevelt - Niyog			
Station	Board	Alight	Line
Roosevelt	4,318	-	4,318
Balintawak	3,103	1	7,420
Monumento	9,777	21	17,176
5th Avenue	2,897	43	20,030
R Papa	840	20	20,850
A Santos	985	40	21,795
Blumentritt	1,379	90	23,084
Tayuman	1,456	261	24,278
Bambang	490	108	24,661
D Jose	1,976	700	25,937
Carriedo	1,106	1,043	26,000
Central	382	944	25,438
UN Avenue	923	2,107	24,254
Pedro Gil	721	1,170	23,805
Quirino	611	1,270	23,146
Vito Cruz	574	1,374	22,346
Gil Puyat	742	5,124	17,963
Libertad	416	1,663	16,716
EDSA	106	6,005	10,816
Baclaran	65	2,300	8,582
Redemptorist	25	792	7,814
MIA	27	792	7,049
Asia World	1	222	6,829
Ninoy Aquino	8	929	5,908
Dr. Santos	1	1,089	4,820
Manuyo Uno	0	68	4,752
Las Pinas	0	378	4,375
Zapote	1	1,320	3,057
Talaba	0	22	3,035
Niyog	-	3,035	0
Total	32,930	32,930	
Maximum	9,777	6,005	26,000
Average Trip Length (km)			11.96
AM-PK Hour to Daily			7.60%



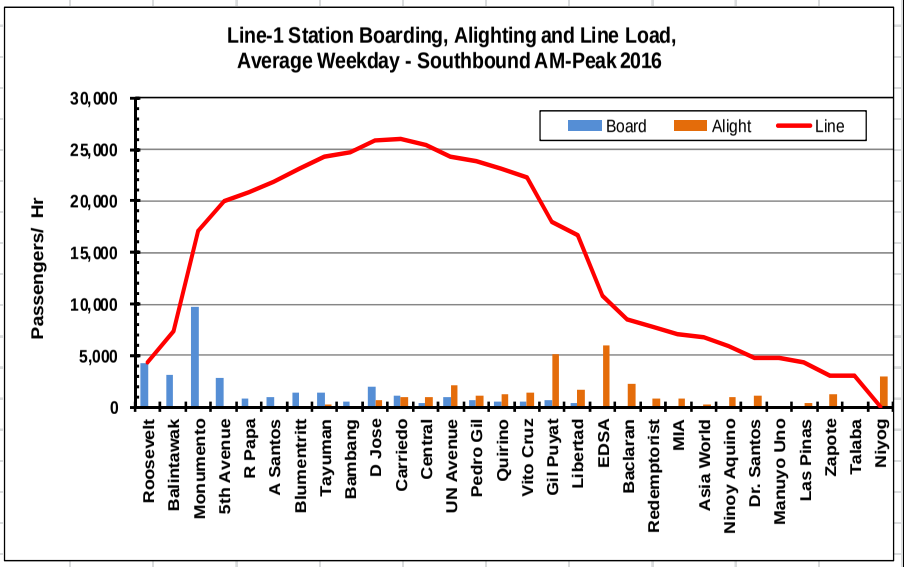


表 C.5 2020 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	37,872	26,489
Balintawak	23,882	10,205
Monumento	84,115	69,737
5th Avenue	25,110	20,977
R Papa	9,319	13,368
A Santos	10,320	22,878
Blumentritt	18,621	18,698
Tayuman	26,213	21,357
Bambang	9,015	10,641
D Jose	38,861	38,214
Carriedo	42,057	40,790
Central	23,831	30,501
UN Avenue	42,930	47,795
Pedro Gil	37,281	37,326
Quirino	20,399	27,592
Vito Cruz	21,226	27,538
Gil Puyat	54,607	58,961
Libertad	19,428	22,356
EDSA	87,755	87,117
Baclaran	44,613	42,886
Redemptorist	13,915	14,286
MIA	14,102	14,380
Asia World	3,814	3,988
Ninoy Aquino	15,492	16,722
Dr. Santos	18,995	19,619
Manuyo Uno	1,218	1,231
Las Pinas	6,516	6,801
Zapote	22,642	23,783
Talaba	364	396
Niyog	56,687	54,568
Total	**831,200**	**831,200**
Maximum	**87,755**	**87,117**
Average Trip Length (km)		**11.00**

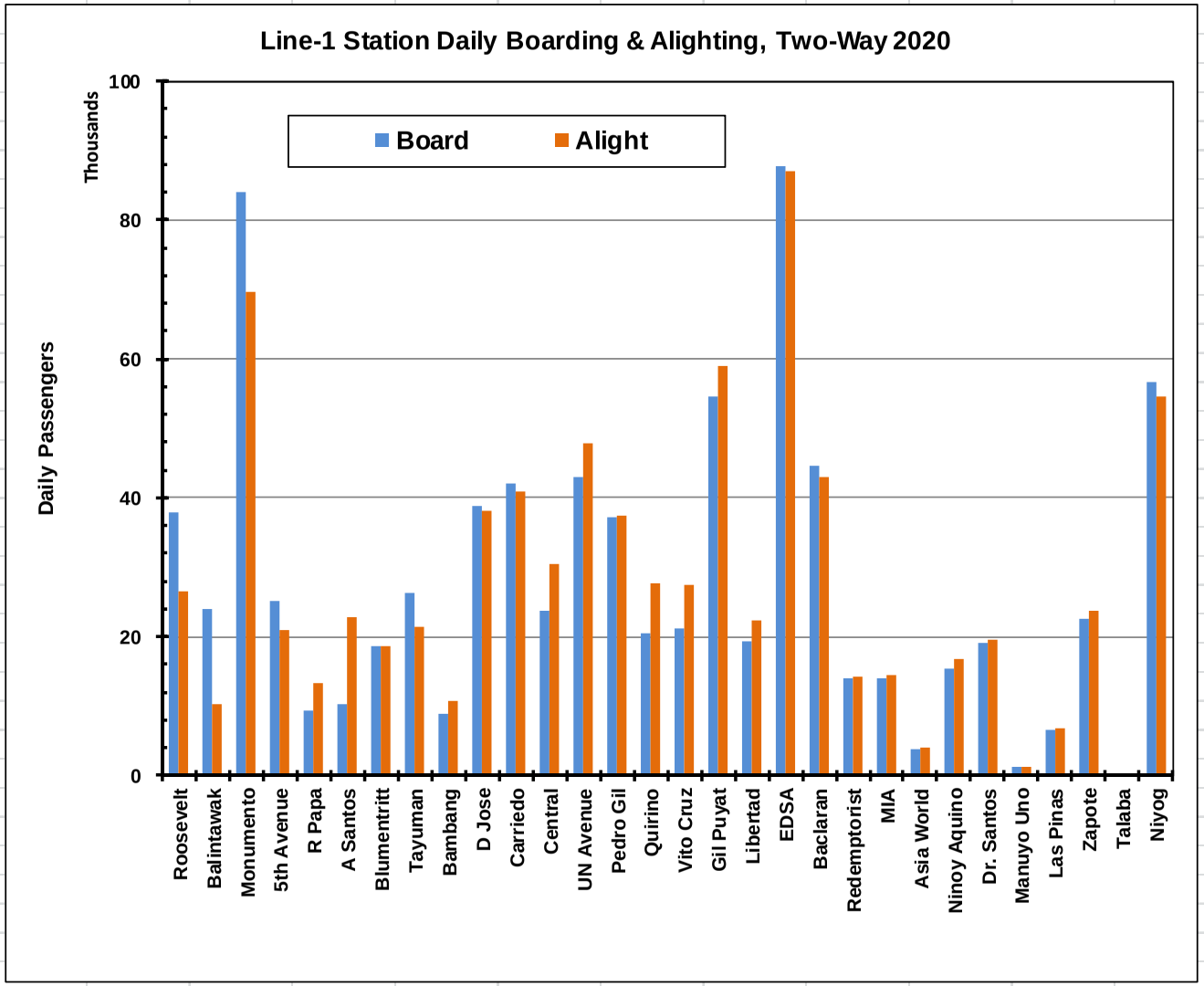
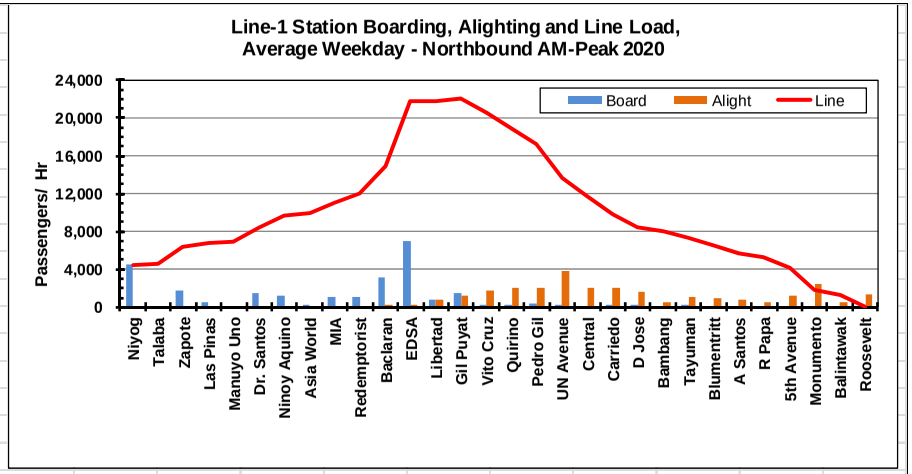


表 C.6 2020 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	**Board**	**Alight**	**Line**
Niyog	4,500	-	4,500
Talaba	29	0	4,529
Zapote	1,793	2	6,319
Las Pinas	516	0	6,834
Manuyo Uno	97	0	6,931
Dr. Santos	1,507	5	8,433
Ninoy Aquino	1,217	3	9,646
Asia World	301	1	9,946
MIA	1,090	10	11,025
Redemptorist	1,046	5	12,067
Baclaran	3,111	238	14,939
EDSA	**7,011**	227	21,723
Libertad	776	736	21,764
Gil Puyat	1,516	1,156	**22,123**
Vito Cruz	254	1,817	20,561
Quirino	318	2,049	18,830
Pedro Gil	404	1,983	17,251
UN Avenue	234	**3,844**	13,641
Central	75	2,031	11,685
Carriedo	215	2,072	9,828
D Jose	294	1,636	8,486
Bambang	76	523	8,039
Tayuman	249	1,016	7,271
Blumentritt	145	969	6,448
A Santos	113	858	5,703
R Papa	87	544	5,247
5th Avenue	112	1,211	4,148
Monumento	66	2,402	1,812
Balintawak	2	502	1,312
Roosevelt	-	1,312	- 0
Total	27,154	27,154	
Maximum	**7,011**	**3,844**	**22,123**
Average Trip Length (km)			**10.44**
Two-Way	**63,226**	**63,226**	**11.47**

Southbound Roosevelt - Niyog			
Station	**Board**	**Alight**	**Line**
Roosevelt	4,707	-	4,707
Balintawak	3,372	1	8,077
Monumento	**10,606**	22	18,662
5th Avenue	3,140	44	21,758
R Papa	912	21	22,649
A Santos	1,070	41	23,679
Blumentritt	1,499	92	25,085
Tayuman	1,588	267	26,406
Bambang	535	110	26,832
D Jose	2,162	718	28,276
Carriedo	1,219	1,057	**28,439**
Central	424	961	27,902
UN Avenue	1,023	2,140	26,785
Pedro Gil	807	1,187	26,405
Quirino	687	1,290	25,801
Vito Cruz	646	1,398	25,049
Gil Puyat	879	5,427	20,501
Libertad	493	1,756	19,238
EDSA	127	**6,511**	12,853
Baclaran	83	2,485	10,451
Redemptorist	36	966	9,521
MIA	40	965	8,596
Asia World	2	270	8,327
Ninoy Aquino	11	1,133	7,206
Dr. Santos	2	1,328	5,880
Manuyo Uno	0	83	5,797
Las Pinas	1	460	5,337
Zapote	2	1,610	3,729
Talaba	0	27	3,702
Niyog	-	3,702	0
Total	36,072	36,072	
Maximum	**10,606**	**6,511**	**28,439**
Average Trip Length (km)			**12.25**
AM-PK Hour to Daily			**7.61%**



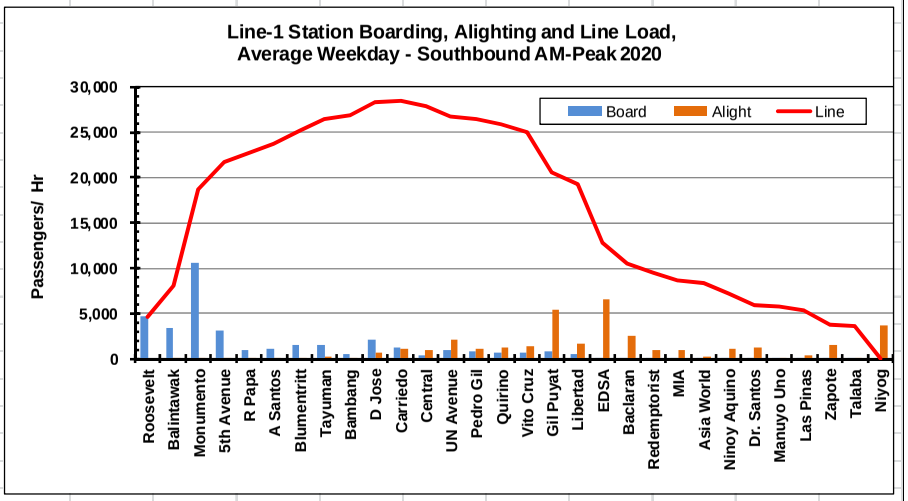


表 C.7 2025 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	40,341	28,211
Balintawak	25,435	10,868
Monumento	89,597	74,276
5th Avenue	26,743	22,343
R Papa	9,925	14,237
A Santos	10,995	24,364
Blumentritt	19,838	19,915
Tayuman	27,924	22,747
Bambang	9,602	11,336
D Jose	41,398	40,703
Carriedo	44,799	43,445
Central	25,384	32,485
UN Avenue	45,734	50,904
Pedro Gil	39,712	39,751
Quirino	21,729	29,391
Vito Cruz	22,608	29,332
Gil Puyat	58,167	62,794
Libertad	20,697	23,808
EDSA	93,477	92,784
Baclaran	47,525	45,677
Redemptorist	16,136	16,557
MIA	16,351	16,664
Asia World	4,422	4,623
Ninoy Aquino	17,963	19,380
Dr. Santos	22,025	22,737
Manuyo Uno	1,412	1,427
Las Pinas	7,556	7,883
Zapote	26,254	27,563
Talaba	422	458
Niyog	65,729	63,237
Total	**899,900**	**899,900**
Maximum	**93,477**	**92,784**
Average Trip Length (km)		**11.22**

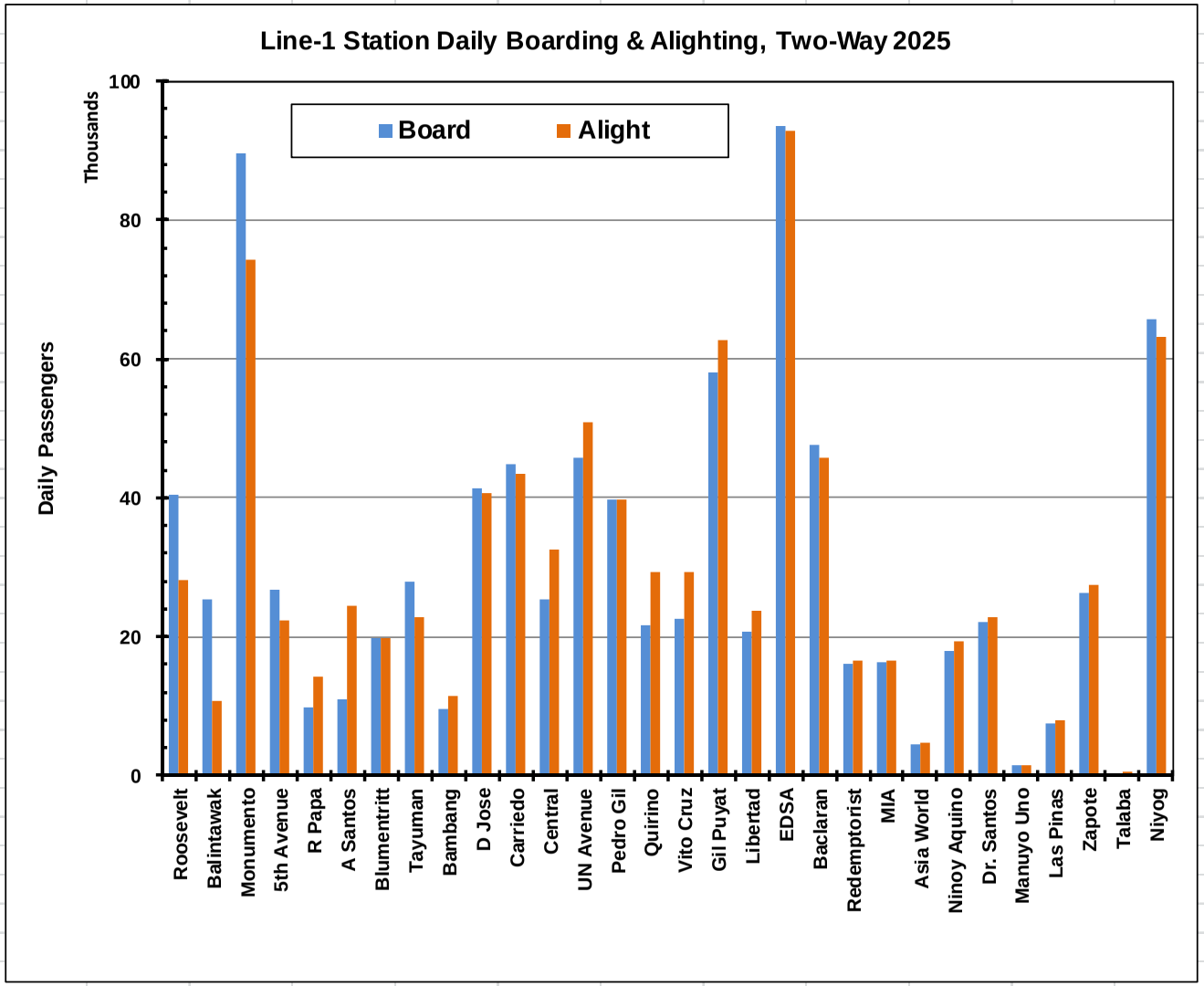
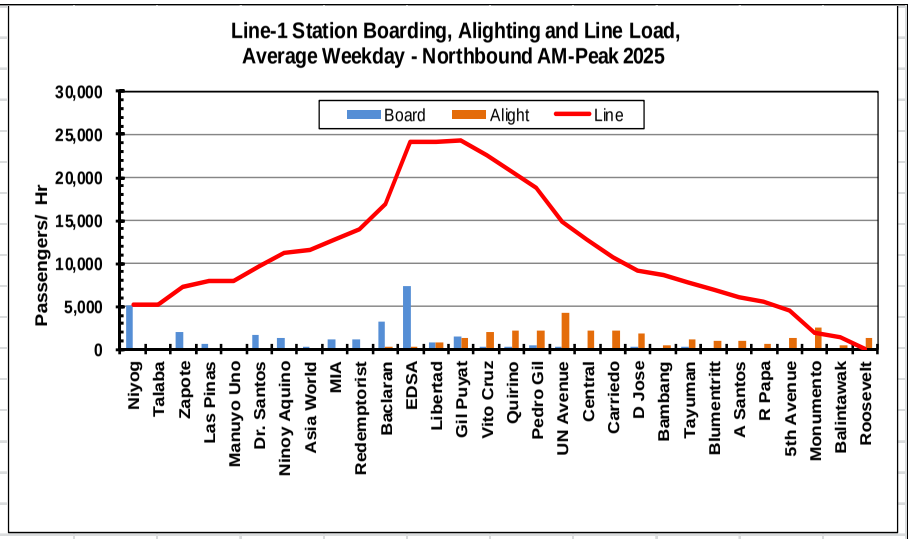


表 C.8 2025 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	Board	Alight	Line
Niyog	5,214	-	5,214
Talaba	33	0	5,247
Zapote	2,076	3	7,320
Las Pinas	597	0	7,917
Manuyo Uno	112	0	8,029
Dr. Santos	1,746	7	9,768
Ninoy Aquino	1,407	5	11,171
Asia World	348	1	11,518
MIA	1,258	14	12,762
Redemptorist	1,203	6	13,959
Baclaran	3,296	288	16,966
EDSA	7,430	262	24,134
Libertad	799	842	24,092
Gil Puyat	1,564	1,326	24,330
Vito Cruz	253	2,008	22,575
Quirino	318	2,261	20,631
Pedro Gil	404	2,181	18,855
UN Avenue	234	4,219	14,870
Central	75	2,226	12,719
Carriedo	216	2,259	10,675
D Jose	297	1,783	9,189
Bambang	77	567	8,699
Tayuman	252	1,102	7,848
Blumentritt	147	1,047	6,948
A Santos	116	928	6,136
R Papa	89	587	5,639
5th Avenue	115	1,306	4,448
Monumento	68	2,584	1,933
Balintawak	2	537	1,398
Roosevelt	-	1,398	0
Total	29,748	29,748	
Maximum	7,430	4,219	24,330
Average Trip Length (km)			10.64
Two-Way	68,464	68,464	11.68

Southbound Roosevelt - Niyog			
Station	Board	Alight	Line
Roosevelt	5,032	-	5,032
Balintawak	3,593	1	8,624
Monumento	11,293	22	19,895
5th Avenue	3,341	45	23,191
R Papa	972	21	24,141
A Santos	1,142	42	25,241
Blumentritt	1,598	93	26,746
Tayuman	1,698	270	28,175
Bambang	573	111	28,637
D Jose	2,319	729	30,227
Carriedo	1,314	1,063	30,478
Central	459	969	29,968
UN Avenue	1,108	2,155	28,921
Pedro Gil	879	1,195	28,605
Quirino	751	1,300	28,056
Vito Cruz	707	1,409	27,354
Gil Puyat	1,002	5,657	22,699
Libertad	564	1,826	21,437
EDSA	146	6,927	14,656
Baclaran	101	2,636	12,120
Redemptorist	47	1,121	11,046
MIA	53	1,119	9,980
Asia World	3	314	9,668
Ninoy Aquino	15	1,315	8,368
Dr. Santos	2	1,542	6,828
Manuyo Uno	0	97	6,732
Las Pinas	1	535	6,198
Zapote	3	1,869	4,331
Talaba	0	31	4,300
Niyog	-	4,300	-
Total	38,716	38,716	
Maximum	11,293	6,927	30,478
Average Trip Length (km)			12.49
AM-PK Hour to Daily			7.61%



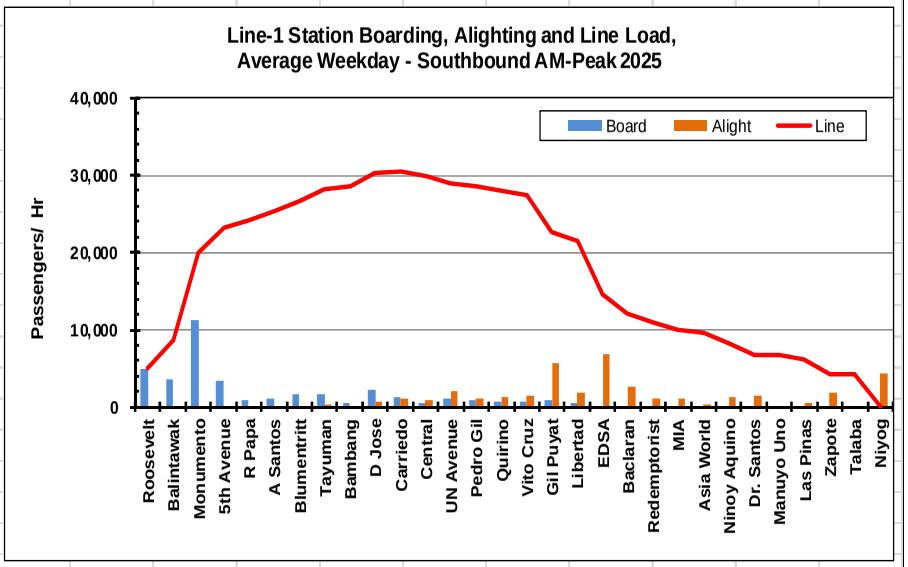


表 C.9 2030 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	42,120	29,452
Balintawak	26,556	11,344
Monumento	93,549	77,545
5th Avenue	27,920	23,326
R Papa	10,364	14,866
A Santos	11,478	25,438
Blumentritt	20,709	20,789
Tayuman	29,155	23,746
Bambang	10,027	11,830
D Jose	43,219	42,491
Carriedo	46,773	45,356
Central	26,504	33,914
UN Avenue	47,749	53,140
Pedro Gil	41,460	41,503
Quirino	22,686	30,681
Vito Cruz	23,600	30,622
Gil Puyat	60,734	65,557
Libertad	21,609	24,855
EDSA	97,598	96,867
Baclaran	49,618	47,686
Redemptorist	17,819	18,277
MIA	18,057	18,397
Asia World	4,883	5,104
Ninoy Aquino	19,838	21,394
Dr. Santos	24,324	25,100
Manuyo Uno	1,560	1,575
Las Pinas	8,345	8,703
Zapote	28,994	30,427
Talaba	465	505
Niyog	72,587	69,810
Total	**950,300**	**950,300**
Maximum	**97,598**	**96,867**
Average Trip Length (km)		**11.37**

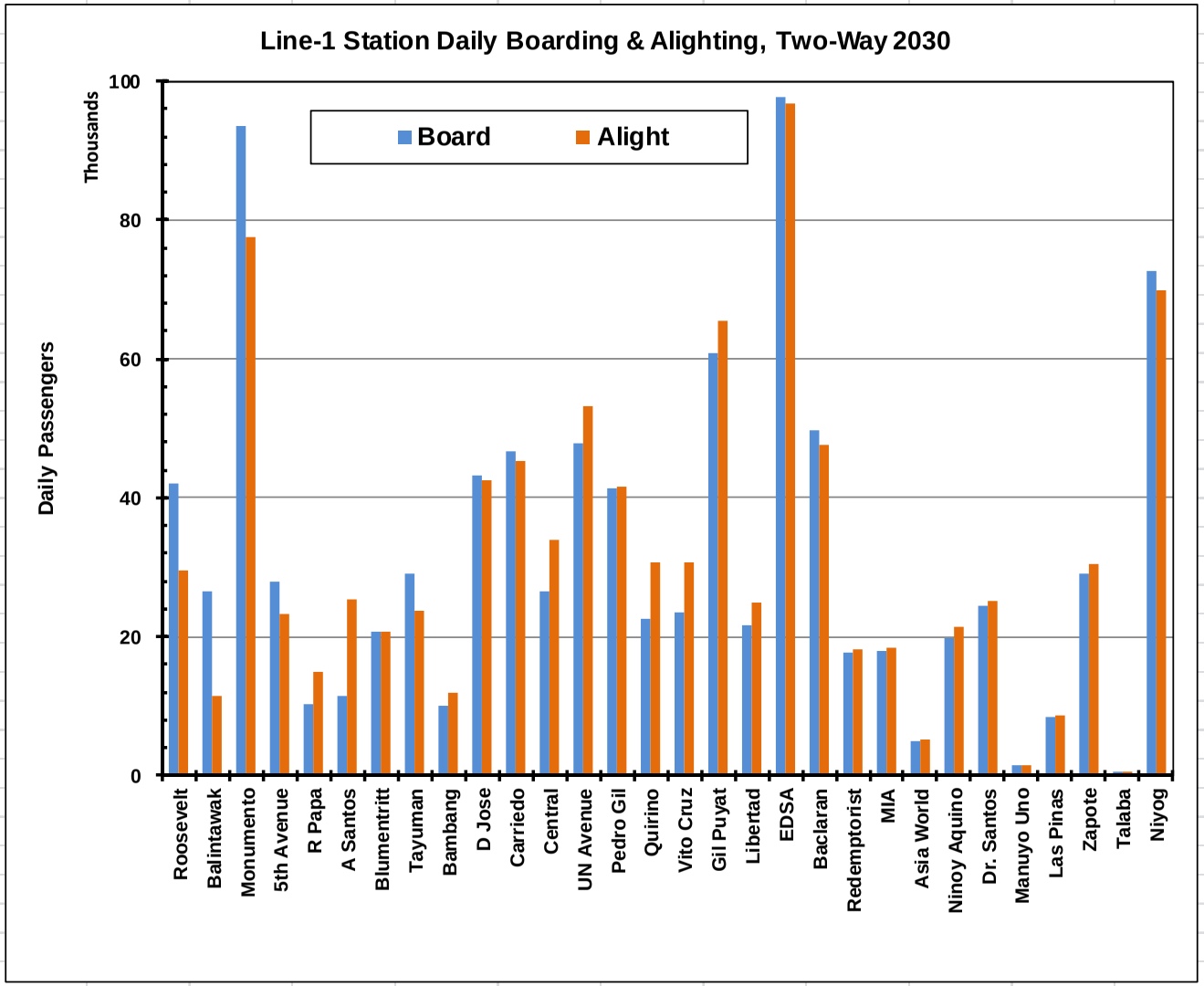
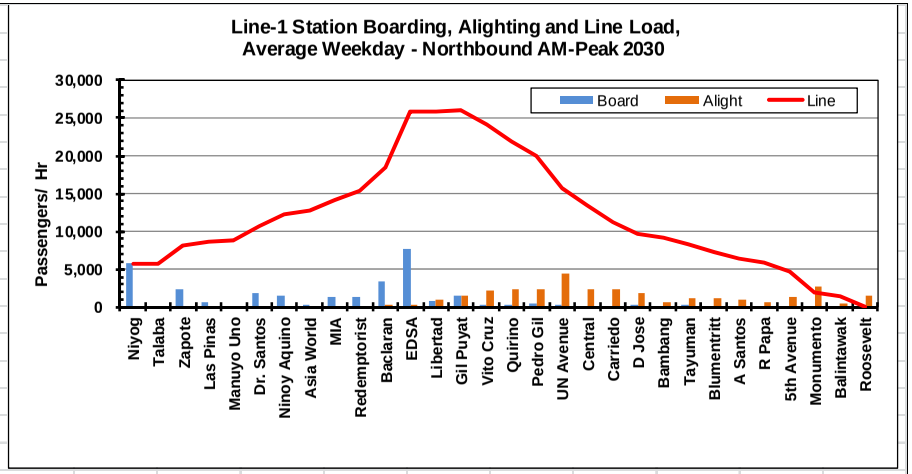


表 C.10 2030 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	**Board**	**Alight**	**Line**
Niyog	5,755	-	5,755
Talaba	37	0	5,791
Zapote	2,291	4	8,079
Las Pinas	659	1	8,737
Manuyo Uno	123	0	8,861
Dr. Santos	1,928	9	10,779
Ninoy Aquino	1,552	6	12,325
Asia World	384	1	12,709
MIA	1,384	17	14,076
Redemptorist	1,320	8	15,388
Baclaran	3,427	328	18,487
EDSA	7,728	290	25,925
Libertad	814	923	25,816
Gil Puyat	1,594	1,457	25,953
Vito Cruz	252	2,149	24,056
Quirino	316	2,417	21,956
Pedro Gil	403	2,327	20,032
UN Avenue	234	4,494	15,771
Central	75	2,370	13,476
Carriedo	215	2,397	11,295
D Jose	299	1,890	9,704
Bambang	77	599	9,181
Tayuman	253	1,165	8,269
Blumentritt	148	1,103	7,314
A Santos	117	979	6,452
R Papa	91	619	5,924
5th Avenue	117	1,375	4,666
Monumento	69	2,716	2,020
Balintawak	3	563	1,460
Roosevelt	-	1,460	-
Total	31,664	31,664	
Maximum	7,728	4,494	25,953
Average Trip Length (km)			10.77
Two-Way	72,304	72,304	11.82

Southbound Roosevelt - Niyog			
Station	**Board**	**Alight**	**Line**
Roosevelt	5,268	-	5,268
Balintawak	3,753	1	9,020
Monumento	11,787	23	20,784
5th Avenue	3,486	46	24,224
R Papa	1,015	22	25,217
A Santos	1,193	43	26,367
Blumentritt	1,670	94	27,944
Tayuman	1,778	272	29,450
Bambang	600	111	29,939
D Jose	2,433	735	31,636
Carriedo	1,384	1,065	31,955
Central	484	972	31,467
UN Avenue	1,169	2,160	30,477
Pedro Gil	933	1,198	30,211
Quirino	798	1,303	29,705
Vito Cruz	752	1,414	29,043
Gil Puyat	1,097	5,810	24,330
Libertad	618	1,872	23,076
EDSA	161	7,225	16,012
Baclaran	115	2,743	13,384
Redemptorist	57	1,239	12,202
MIA	64	1,236	11,030
Asia World	3	347	10,686
Ninoy Aquino	18	1,454	9,250
Dr. Santos	3	1,704	7,548
Manuyo Uno	0	107	7,442
Las Pinas	1	591	6,852
Zapote	3	2,066	4,789
Talaba	0	34	4,755
Niyog	-	4,755	- 0
Total	40,640	40,640	
Maximum	11,787	7,225	31,955
Average Trip Length (km)			12.65
AM-PK Hour to Daily			7.61%



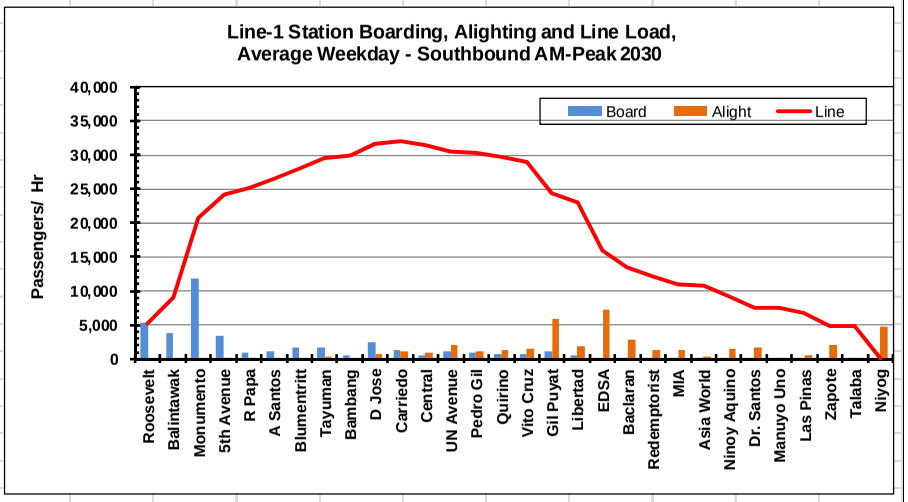


表 C.11 2035 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	43,527	30,436
Balintawak	27,443	11,722
Monumento	96,674	80,128
5th Avenue	28,856	24,106
R Papa	10,710	15,361
A Santos	11,860	26,287
Blumentritt	21,404	21,485
Tayuman	30,124	24,539
Bambang	10,360	12,226
D Jose	44,665	43,908
Carriedo	48,334	46,871
Central	27,387	35,042
UN Avenue	49,340	54,912
Pedro Gil	42,846	42,883
Quirino	23,444	31,706
Vito Cruz	24,393	31,641
Gil Puyat	62,758	67,739
Libertad	22,332	25,686
EDSA	100,855	100,097
Baclaran	51,277	49,272
Redemptorist	19,200	19,686
MIA	19,456	19,815
Asia World	5,263	5,497
Ninoy Aquino	21,373	23,042
Dr. Santos	26,204	27,034
Manuyo Uno	1,681	1,696
Las Pinas	8,991	9,374
Zapote	31,238	32,773
Talaba	500	545
Niyog	78,205	75,191
Total	**990,700**	**990,700**
Maximum	**100,855**	**100,097**
Average Trip Length (km)		**11.48**

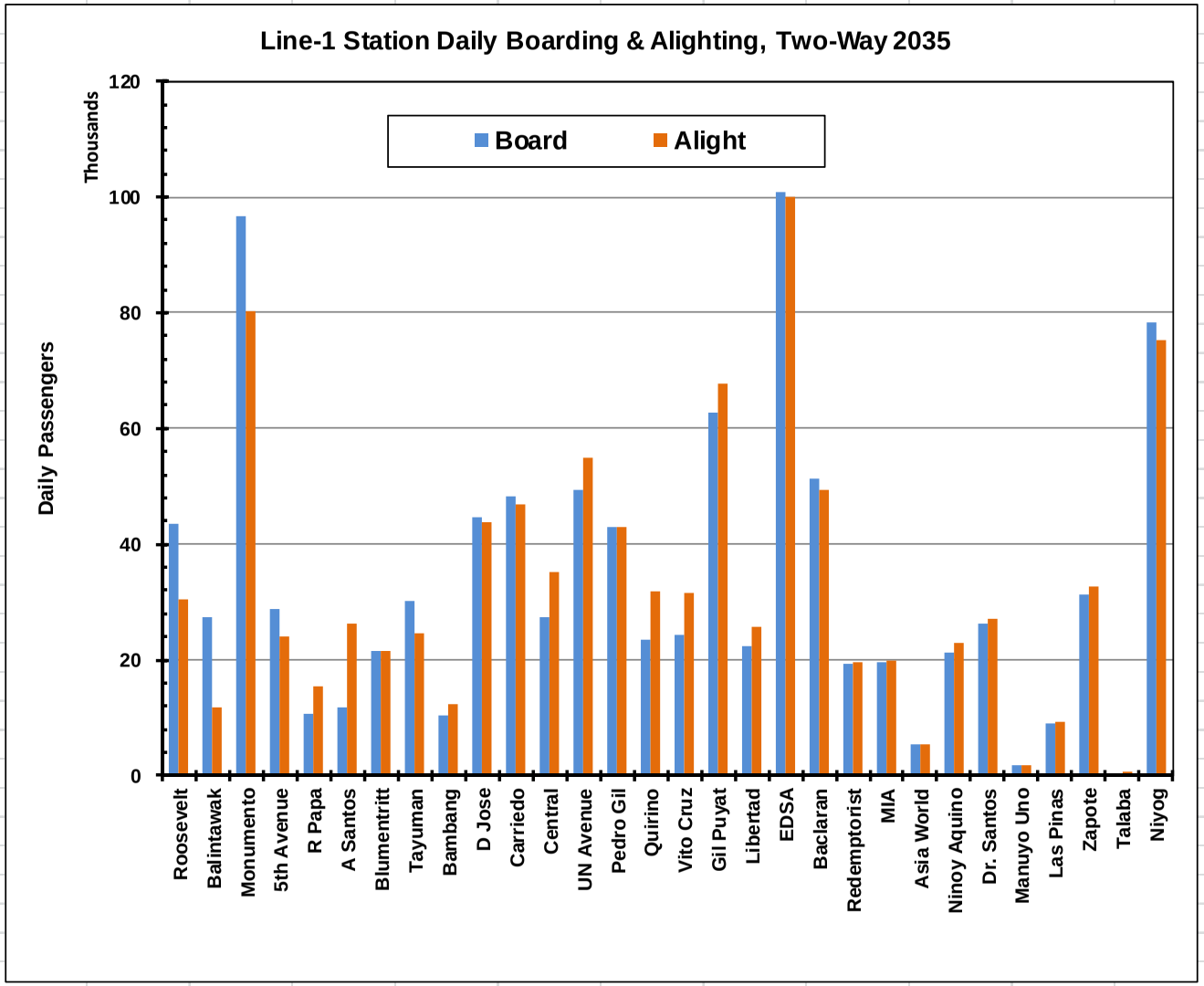
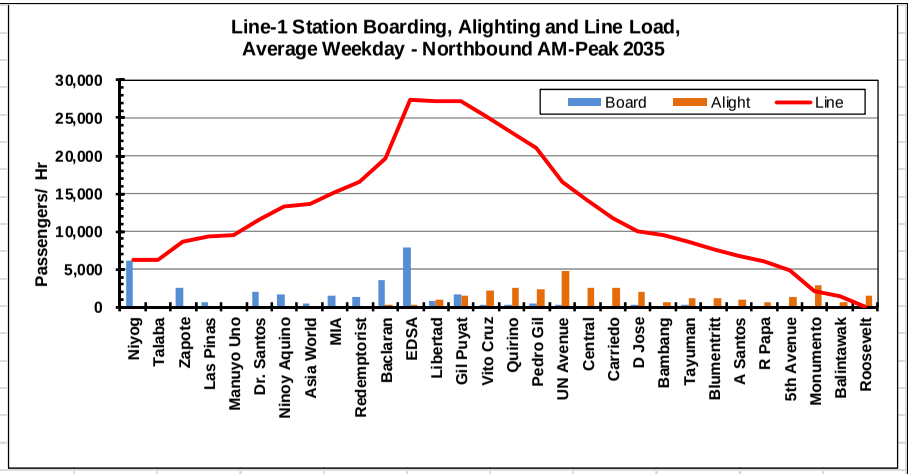


表 C.12 2035 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	**Board**	**Alight**	**Line**
Niyog	6,197	-	6,197
Talaba	39	0	6,237
Zapote	2,467	4	8,700
Las Pinas	710	1	9,409
Manuyo Uno	133	0	9,541
Dr. Santos	2,076	10	11,607
Ninoy Aquino	1,669	7	13,270
Asia World	414	1	13,682
MIA	1,487	19	15,150
Redemptorist	1,414	9	16,556
Baclaran	3,530	362	19,724
EDSA	**7,961**	313	**27,371**
Libertad	824	990	27,205
Gil Puyat	1,616	1,565	27,256
Vito Cruz	251	2,262	25,245
Quirino	315	2,542	23,018
Pedro Gil	402	2,444	20,976
UN Avenue	233	**4,715**	16,494
Central	75	2,486	14,083
Carriedo	215	2,507	11,792
D Jose	300	1,977	10,115
Bambang	77	625	9,567
Tayuman	254	1,216	8,605
Blumentritt	149	1,149	7,605
A Santos	118	1,020	6,703
R Papa	92	644	6,151
5th Avenue	118	1,430	4,839
Monumento	70	2,821	2,089
Balintawak	3	583	1,508
Roosevelt	-	1,508	-
Total	**33,208**	**33,208**	
Maximum	**7,961**	**4,715**	**27,371**
Average Trip Length (km)			**10.87**
Two-Way	**75,381**	**75,381**	**11.93**

Southbound Roosevelt - Niyog			
Station	**Board**	**Alight**	**Line**
Roosevelt	5,455	-	5,455
Balintawak	3,879	1	9,333
Monumento	**12,177**	23	21,486
5th Avenue	3,601	46	25,041
R Papa	1,049	22	26,068
A Santos	1,234	43	27,258
Blumentritt	1,727	94	28,891
Tayuman	1,841	272	30,460
Bambang	621	111	30,969
D Jose	2,523	739	32,753
Carriedo	1,439	1,065	**33,127**
Central	505	973	32,659
UN Avenue	1,218	2,162	31,715
Pedro Gil	975	1,198	31,492
Quirino	835	1,304	31,022
Vito Cruz	788	1,415	30,395
Gil Puyat	1,174	5,924	25,645
Libertad	662	1,906	24,401
EDSA	174	**7,458**	17,117
Baclaran	127	2,826	14,418
Redemptorist	66	1,336	13,148
MIA	73	1,331	11,890
Asia World	4	374	11,519
Ninoy Aquino	21	1,567	9,972
Dr. Santos	3	1,837	8,138
Manuyo Uno	0	115	8,023
Las Pinas	1	637	7,387
Zapote	4	2,227	5,164
Talaba	0	37	5,127
Niyog	-	5,127	-
Total	**42,173**	**42,173**	
Maximum	**12,177**	**7,458**	**33,127**
Average Trip Length (km)			**12.77**
AM-PK Hour to Daily			**7.61%**



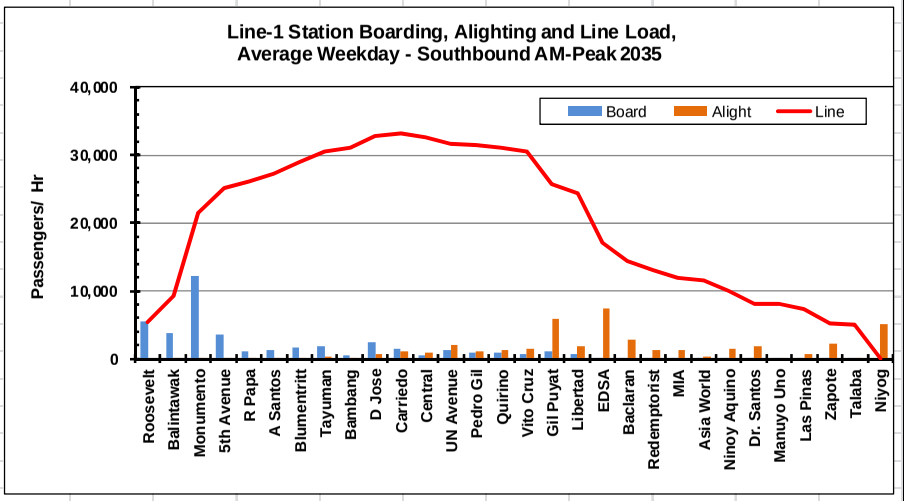


表 C.13 2040 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	44,502	31,116
Balintawak	28,059	11,988
Monumento	98,837	81,923
5th Avenue	29,503	24,643
R Papa	10,953	15,703
A Santos	12,124	26,875
Blumentritt	21,880	21,963
Tayuman	30,802	25,087
Bambang	10,595	12,500
D Jose	45,667	44,892
Carriedo	49,421	47,917
Central	28,002	35,827
UN Avenue	50,449	56,143
Pedro Gil	43,807	43,846
Quirino	23,970	32,419
Vito Cruz	24,937	32,349
Gil Puyat	64,169	69,258
Libertad	22,832	26,258
EDSA	103,119	102,334
Baclaran	52,422	50,377
Redemptorist	20,180	20,689
MIA	20,450	20,824
Asia World	5,531	5,777
Ninoy Aquino	22,466	24,216
Dr. Santos	27,546	28,411
Manuyo Uno	1,767	1,783
Las Pinas	9,451	9,852
Zapote	32,832	34,439
Talaba	524	572
Niyog	82,203	79,019
Total	**1,019,000**	**1,019,000**
Maximum	**103,119**	**102,334**
Average Trip Length (km)		**11.56**

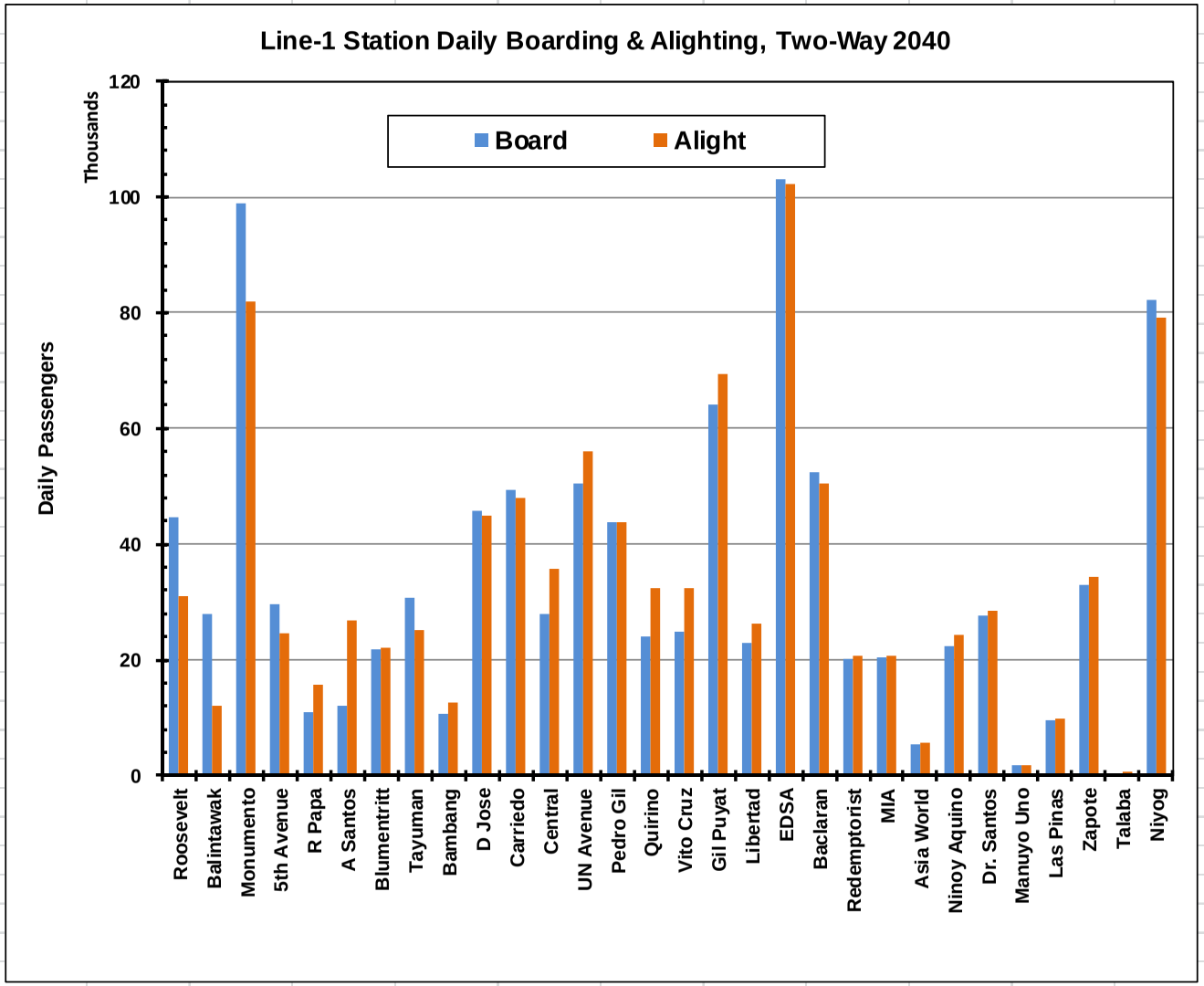
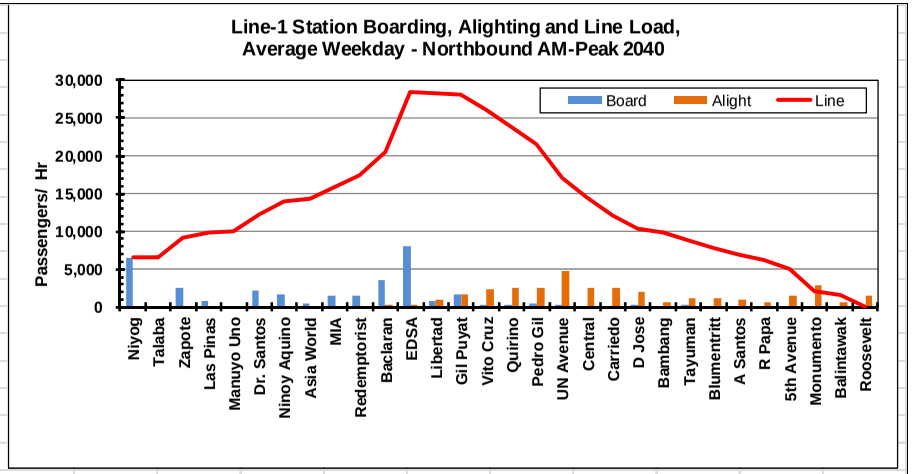


表 C.14 2040 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	**Board**	**Alight**	**Line**
Niyog	6,512	-	6,512
Talaba	41	0	6,554
Zapote	2,592	5	9,141
Las Pinas	746	1	9,886
Manuyo Uno	140	0	10,025
Dr. Santos	2,181	11	12,195
Ninoy Aquino	1,753	7	13,941
Asia World	435	1	14,374
MIA	1,560	21	15,913
Redemptorist	1,481	10	17,385
Baclaran	3,600	386	20,598
EDSA	**8,121**	330	**28,389**
Libertad	831	1,038	28,182
Gil Puyat	1,630	1,643	28,169
Vito Cruz	250	2,341	26,078
Quirino	314	2,630	23,761
Pedro Gil	401	2,526	21,636
UN Avenue	232	**4,870**	16,999
Central	75	2,567	14,507
Carriedo	214	2,583	12,139
D Jose	300	2,037	10,402
Bambang	77	643	9,836
Tayuman	254	1,251	8,839
Blumentritt	149	1,180	7,808
A Santos	118	1,049	6,878
R Papa	92	661	6,309
5th Avenue	119	1,468	4,960
Monumento	71	2,894	2,137
Balintawak	3	597	1,542
Roosevelt	-	1,542	- 0
Total	**34,292**	**34,292**	
Maximum	**8,121**	**4,870**	**28,389**
Average Trip Length (km)			**10.94**
Two-Way	**77,534**	**77,534**	**12.01**

Southbound Roosevelt - Niyog			
Station	**Board**	**Alight**	**Line**
Roosevelt	5,584	-	5,584
Balintawak	3,967	1	9,550
Monumento	**12,446**	23	21,973
5th Avenue	3,680	47	25,606
R Papa	1,073	22	26,657
A Santos	1,262	43	27,876
Blumentritt	1,766	94	29,547
Tayuman	1,885	273	31,159
Bambang	636	112	31,684
D Jose	2,586	741	33,529
Carriedo	1,477	1,064	**33,942**
Central	519	973	33,488
UN Avenue	1,252	2,161	32,579
Pedro Gil	1,005	1,198	32,385
Quirino	861	1,304	31,942
Vito Cruz	813	1,415	31,339
Gil Puyat	1,230	5,999	26,570
Libertad	693	1,928	25,336
EDSA	183	**7,619**	17,900
Baclaran	135	2,884	15,152
Redemptorist	72	1,405	13,820
MIA	81	1,399	12,501
Asia World	4	394	12,112
Ninoy Aquino	23	1,648	10,486
Dr. Santos	3	1,932	8,558
Manuyo Uno	0	121	8,437
Las Pinas	1	670	7,768
Zapote	4	2,342	5,430
Talaba	0	39	5,392
Niyog	-	5,392	-
Total	**43,242**	**43,242**	
Maximum	**12,446**	**7,619**	**33,942**
Average Trip Length (km)			**12.85**
AM-PK Hour to Daily			**7.61%**



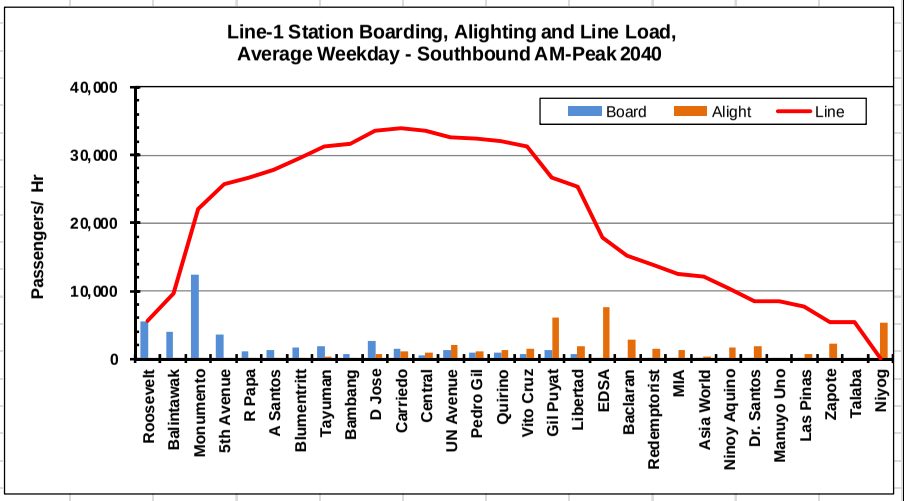


表 C.15 2045 年　LRT1 号線駅別週日平均乗降客数

2-Way Boarding & Alighting		
Station	**Board**	**Alight**
Roosevelt	45,189	31,594
Balintawak	28,495	12,169
Monumento	100,362	83,186
5th Avenue	29,957	25,023
R Papa	11,121	15,944
A Santos	12,315	27,289
Blumentritt	22,216	22,306
Tayuman	31,278	25,473
Bambang	10,757	12,692
D Jose	46,369	45,580
Carriedo	50,182	48,657
Central	28,436	36,382
UN Avenue	51,227	57,011
Pedro Gil	44,485	44,522
Quirino	24,339	32,916
Vito Cruz	25,322	32,848
Gil Puyat	65,158	70,325
Libertad	23,186	26,663
EDSA	104,713	103,916
Baclaran	53,235	51,153
Redemptorist	20,951	21,474
MIA	21,230	21,615
Asia World	5,741	5,997
Ninoy Aquino	23,322	25,136
Dr. Santos	28,596	29,491
Manuyo Uno	1,835	1,851
Las Pinas	9,811	10,224
Zapote	34,087	35,750
Talaba	546	593
Niyog	85,339	82,020
Total	**1,039,800**	**1,039,800**
Maximum	**104,713**	**103,916**
Average Trip Length (km)		**11.62**

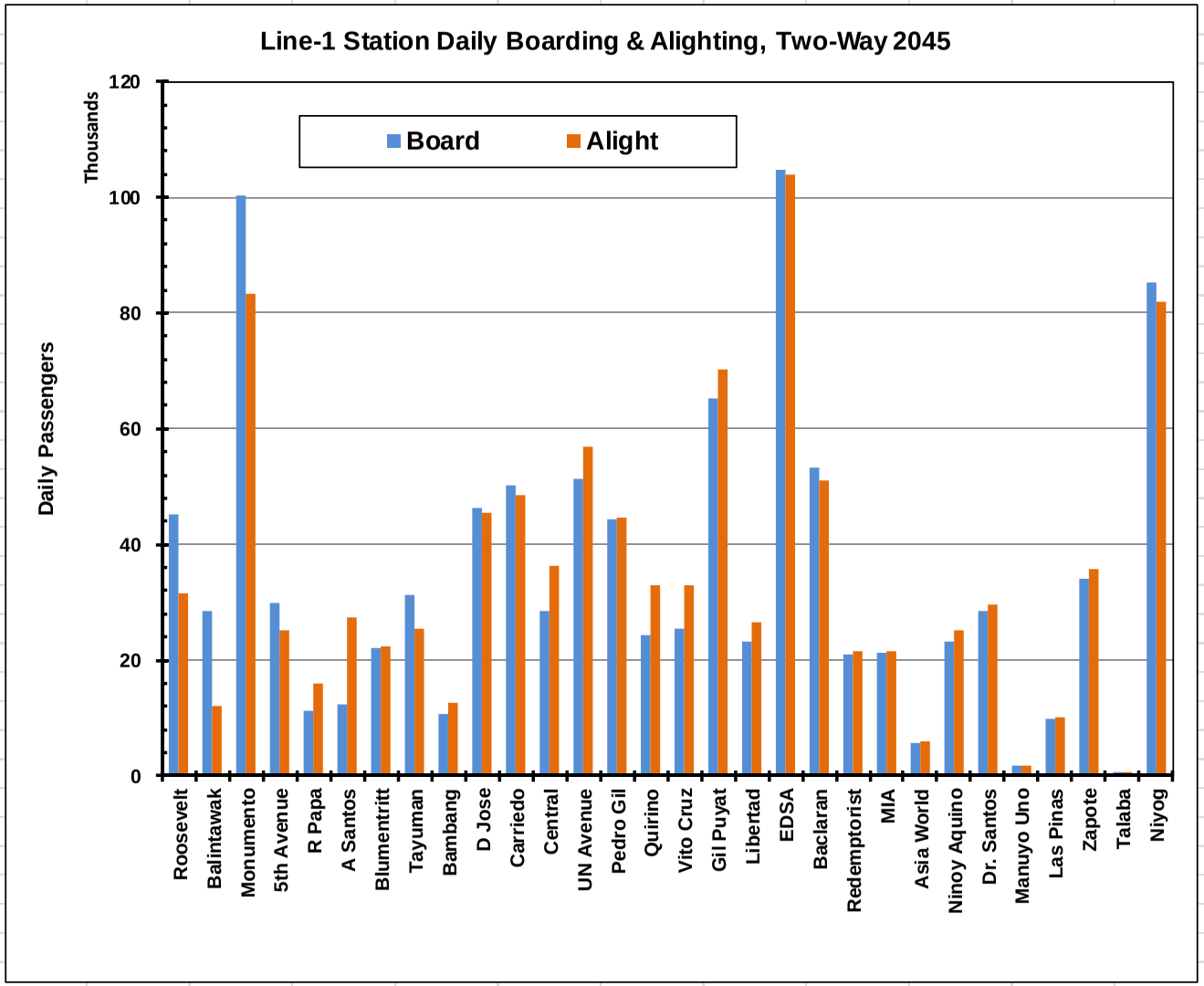
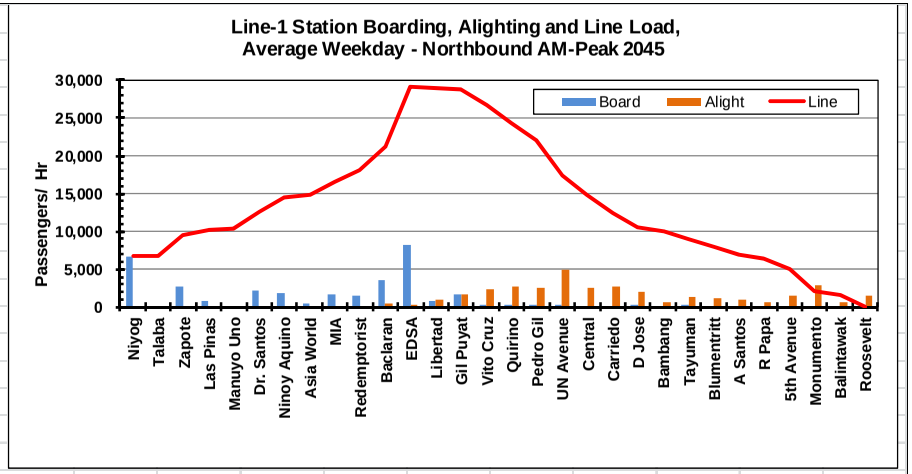
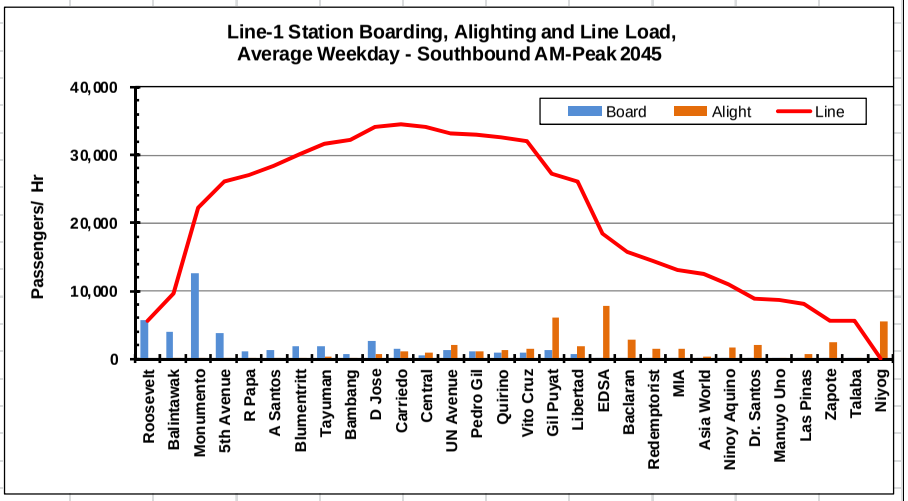


表 C.16 2045 年　AM ピーク(07:00-08:00)の駅・区間における乗降客数

Northbound Niyog - Roosevelt			
Station	**Board**	**Alight**	**Line**
Niyog	6,759	-	6,759
Talaba	43	0	6,802
Zapote	2,690	5	9,487
Las Pinas	774	1	10,260
Manuyo Uno	145	1	10,405
Dr. Santos	2,264	12	12,657
Ninoy Aquino	1,818	8	14,467
Asia World	451	1	14,917
MIA	1,616	23	16,510
Redemptorist	1,533	10	18,033
Baclaran	3,648	407	21,275
EDSA	**8,231**	343	**29,163**
Libertad	834	1,076	28,920
Gil Puyat	1,637	1,704	28,853
Vito Cruz	248	2,401	26,700
Quirino	312	2,696	24,316
Pedro Gil	399	2,587	22,127
UN Avenue	231	**4,985**	17,373
Central	75	2,627	14,821
Carriedo	213	2,640	12,395
D Jose	300	2,082	10,613
Bambang	77	657	10,033
Tayuman	253	1,277	9,010
Blumentritt	149	1,203	7,956
A Santos	119	1,069	7,005
R Papa	92	674	6,423
5th Avenue	119	1,496	5,047
Monumento	71	2,947	2,171
Balintawak	3	607	1,566
Roosevelt	-	1,566	- 0
Total	**35,104**	**35,104**	
Maximum	**8,231**	**4,985**	**29,163**
Average Trip Length (km)			**10.99**
Two-Way	**79,116**	**79,116**	**12.06**

Southbound Roosevelt - Niyog			
Station	**Board**	**Alight**	**Line**
Roosevelt	5,677	-	5,677
Balintawak	4,029	1	9,704
Monumento	**12,636**	23	22,317
5th Avenue	3,735	47	26,005
R Papa	1,090	22	27,073
A Santos	1,282	43	28,312
Blumentritt	1,793	94	30,011
Tayuman	1,916	272	31,655
Bambang	647	111	32,191
D Jose	2,630	740	34,081
Carriedo	1,505	1,060	**34,525**
Central	529	971	34,084
UN Avenue	1,277	2,154	33,207
Pedro Gil	1,026	1,194	33,039
Quirino	880	1,300	32,620
Vito Cruz	831	1,411	32,040
Gil Puyat	1,273	6,043	27,270
Libertad	718	1,940	26,048
EDSA	191	**7,732**	18,507
Baclaran	143	2,923	15,727
Redemptorist	78	1,458	14,346
MIA	87	1,452	12,981
Asia World	4	409	12,577
Ninoy Aquino	24	1,711	10,890
Dr. Santos	4	2,006	8,887
Manuyo Uno	0	126	8,762
Las Pinas	1	696	8,068
Zapote	5	2,432	5,640
Talaba	0	40	5,600
Niyog	-	5,600	-
Total	**44,012**	**44,012**	
Maximum	**12,636**	**7,732**	**34,525**
Average Trip Length (km)			**12.92**
AM-PK Hour to Daily			**7.61%**





付属資料 D:　交通量調査

付属資料 D – 交通量調査

1 はじめに

鉄道案件等の巨額投資が必要な案件では、実行可能性を検証するための計画準備調査が必要である。この調査では、当該サービスを利用すると想定される旅客需要の予測が重要である。旅客需要を予測するに当たって、現況の旅客需要の傾向と、計画路線沿線における交通量の情報が必要である。

本章では、本調査において実施した交通調査の調査の手法、データ処理方法、調査結果の概要について説明する。

2 調査のアプローチと手順

2.1 調査対象エリア

調査対象地は、メトロ・マニラの大部分、既存の LRT 沿線および LRT1 号線と LRT2 号線沿線が含まれている。

a. 調査目的

主な調査目的は以下のとおりである:

- LRT1 号線と LRT2 号線の運転区間及び計画延長区間沿線のの現況交通量と乗客数の観測
- 現況の OD 交通量、対象道路沿いの自動車利用者および LRT 利用者の乗客の社会経済特性の特定

b. 調査手順

以下の 3 種類の調査を行う：

- 交通量調査
- 車両一台当たりの乗車人員調査
- OD 調査: 自動車利用者に対する路肩インタビュー調査及び LRT 利用者に対する対象駅におけるインタビュー調査

1) 交通量調査

路上調査は表 1 に示される 12 か所で行われた。

表 1 交通量調査・車両一台当たりの乗車人数調査の調査地点

No.	Location Description
1	Marcos Highway (West of Sumulong Highway Junction) – Also O/D Site H-1
2	Marcos Highway (Between F. Mariano Av. & A. Rodriguez)
3	Marcos Highway (West of Santalon LRT Station on Footbridge)
4	Rizal Avenue (Between Tayuman Rd and Francis P Yuseco Rd)
5	Taft Ave (Between Vito Cruz and Sen. Gil Puyat Avenue)
6	Roxas Blvd (Between Airport Rd and NAIA Rd – Opposite Aseana Av.)
7	Cavite Expressway South of South Toll Plaza or River Crossing
8	Quririno Avenue Bridge
9	Ninoy Aquino at Imelda Bridge
10	Evangelista St. Just west of Niog Rd Junction
11	Aguinaldo Highway (Between Niog St and Molino Blvd) – Also O/D Site H-2
12	Molino Blvd – North of Ilang-Ilang

交通量調査は 16 時間 (6:00am - 10:00pm)に渡り、車種別に行われた。車種の分類は表 2 の通りである。

表 2 車種分類

No.	Vehicle Type Description	Vehicle Occupancy
1	Cyclo/Motorcycle/Tricycle	All Occupants including driver
2	Private Car/Sedan	All Occupants including driver
3	Public Taxi	All Occupants including driver
4	SUV/Van	All Occupants including driver
5	AUV . Public FX	All Occupants including driver
6	Jeepney	All Occupants including driver
7	Mini Bus	All Occupants including driver
8	Local Public Bus (Aircon, Ordinary)	All Occupants including driver
9	Long Distance (Provincial) Bus	All Occupants including driver
10	Delivery vehicles, 2 axle trucks, other 2 axle vehicle (no occupancy)	
11	Trucks or other goods vehicles with 3 or more axles No Occupancy	

調査日程は表 3 に示すとおりである。

表 3 調査日程: 交通量調査

Dates	Survey Stations
26 June 2012 (Tuesday)	Station 5: Taft Ave (Between Vito Cruz and Sen Gil Puyat Ave)
	Station 6: Roxas Blvd (Between Airport Rd & NAIA Rd . Opposite Aseana Av)
	Station 8: Quirino Avenue Bridge
	Station 9: Ninoy Aquino at Imelda Bridge
27 June 2012 (Wednesday)	Station 1: Marcos Highway (West of Sumulong Highway Junction)
	Station 2: Marcos Highway (Between F. Mariano Ave & A Rodriguez)
	Station 3: Marcos Highway (West of Santolan LRT Station on Footbridge)
	Station 4: Rizal Avenue (Between Tayuman Rd and Francis P Yuseco Rd)
28 June 2012 (Thursday)	Station 7: Cavite Expressway South of South Toll Plaza or River Crossing
	Station 10: Evangelista St (West of Niog Rd Junction)
	Station 11: Aguinaldo Highway (Between Niog St & Molino Blvd)
	Station 12: Molino Blvd (North of Ilang-Ilang)

収集されたデータの信頼性を確保するため、以下の方法に基づいて調査が行われた：

- 図 1 の調査票を用いて、手作業による交通量調査を実施した。調査地点を通った自動車台数は、記入用紙上の数字をマークすることで記録される。最後にマークされた数字は、単位時間（30 分）内の総交通量を意味する。
- 調査地点を通過する全自動車を計測する
- 調査員は多くとも 2 車種までしか担当しない
- 調査員が席を外す必要がある場合に備え、交代要員を配置する
- 調査員は 1 調査日あたり最長でも 1 シフト（8 時間）までしか調査を行わない

Field Survey Form	TRAFFIC COUNT SURVEY	TTPI

Station Code:	Direction	Recorder: .....
Station Name:	From:	Supervisor: .....
Date:	To:	Checker: .....
Weather:		Encoder:

Time Period: From: _____ To: _____

Vehicle Type: ( ) _____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284	285
286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315
316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340	341	342	343	344	345
346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
376	377	378	379	380	381	382	383	384	385	386	387	388	389	390
391	392	393	394	395	396	397	398	399	400	401	402	403	404	405
406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435
436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
451	452	453	454	455	456	457	458	459	460	461	462	463	464	465
466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495
496	497	498	499	500	501	502	503	504	505	506	507	508	509	510
511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
526	527	528	529	530	531	532	533	534	535	536	537	538	539	540

30 mins. Total: _____

Vehicle Type: ( ) _____

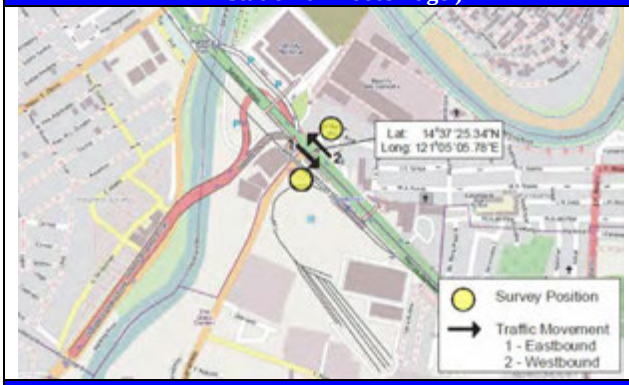
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284	285
286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315
316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340	341	342	343	344	345
346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
376	377	378	379	380	381	382	383	384	385	386	387	388	389	390
391	392	393	394	395	396	397	398	399	400	401	402	403	404	405
406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435
436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
451	452	453	454	455	456	457	458	459	460	461	462	463	464	465
466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495
496	497	498	499	500	501	502	503	504	505	506	507	508	509	510
511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
526	527	528	529	530	531	532	533	534	535	536	537	538	539	540

30 mins. Total: _____

図 1 交通量調査記入用紙

調査地点図を表 4 に示す。

表 4 調査対象地点

Survey Location 1, Marcos Highway (West of Sumulong Highway Junction)	Survey Location 2, Marcos Highway (Between F. Mariano Av. & A. Rodriguez)
	
Survey Location 3, Marcos Highway (West of Santalon LRT Station on Footbridge)	**Survey Location 4, Rizal Avenue (Between Tayuman Rd and Francis P Yuseco Rd)**
	
Survey Location 5, Taft Ave (Between Vito Cruz and Sen. Gil Puyat Avenue)	**Survey Location 6, Roxas Blvd (Between Airport Rd and NAIA Rd – Opposite Aseana Av.)**
	

Survey Location 7, Cavite Expressway (South of South Toll Plaza or River Crossing)	Survey Location 8, Quririno Avenue Bridge
	
Survey Location 9, Ninoy Aquino at Imelda Bridge	**Survey Location 10, Evangelista St. Just west of Niog Rd Junction**
	
Survey Location 11, Aguinaldo Highway (Between Niog St and Molino Blvd)	**Survey Location 12, Molino Blvd: North of Ilang-Ilang**
	

2) 乗車人員数調査

この調査は車種別交通量調査と同時に行われ、調査対象地点は表 3 と同様である。調査では、調査地点を通過した自動車内の乗車人数を計測した。観測される自動車が移動しているため、観測された各自動車の乗車人員数の最良推定値の特定が最も有効と考えられる方法である。

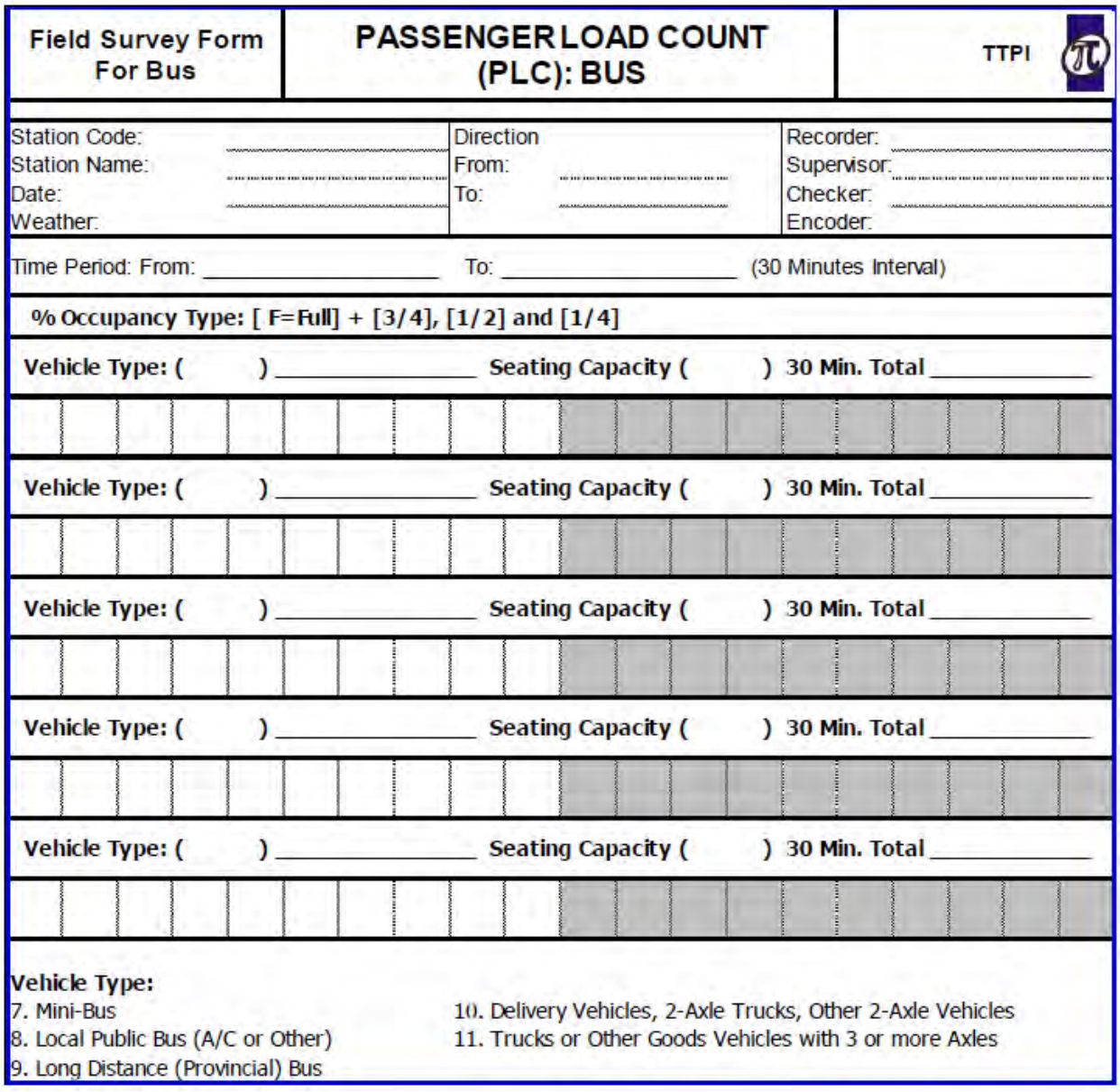
バスの場合は、座席容量に対する乗車率（%）の推定値を記録した（全ての座席が埋まっている場合に 100%、座席数の半数が埋まっている場合に 50%。立って利用する乗客がいる場合、乗車率は 100%を超える）

乗客数は乗車率と座席数を掛け合わせて算出される。自動車の窓ガラスが暗色で車内が観測できない場合、調査担当者は透明なガラスの自動車の乗客数と同様の数値を適用して記録を行った。

この調査は全通過車両の中からランダムに選出した車両に対して行い、表 2 に示した車種それぞれについて行った。車両一台当たりの乗車人数の特定には全車両の少なくとも 20%の車両を利用し、走行方向ごと、車種ごとに数値を算出した。データ収集は 16 時間 (6:00am to 10:00pm)に渡って 30 分単位で行われた。調査担当者一人の担当は一車種とした。

データの信頼性を確保するため、調査担当者が重要な用事等で席を外す場合に備えて交代要員を配置した。さらに、一人の調査時間は 1 シフトである 8 時間を上限とした。調査地点は交通量調査と同じ地点である。

調査には図 2 に示す車両一台当たりの乗車人数調査の記録用紙（バス）が用いられた。



Field Survey Form For Bus	PASSENGER LOAD COUNT (PLC): BUS	TTPI

Station Code: _____ Direction Recorder: _____
Station Name: _____ From: _____ Supervisor: _____
Date: _____ To: _____ Checker: _____
Weather: Encoder:

Time Period: From: _____ To: _____ (30 Minutes Interval)

% Occupancy Type: [F=Full] + [3/4], [1/2] and [1/4]

Vehicle Type: ( ) _____ Seating Capacity ( ) 30 Min. Total _____

Vehicle Type: ( ) _____ Seating Capacity ( ) 30 Min. Total _____

Vehicle Type: ( ) _____ Seating Capacity ( ) 30 Min. Total _____

Vehicle Type: ( ) _____ Seating Capacity ( ) 30 Min. Total _____

Vehicle Type: ( ) _____ Seating Capacity ( ) 30 Min. Total _____

Vehicle Type:
7. Mini-Bus
8. Local Public Bus (A/C or Other)
9. Long Distance (Provincial) Bus
10. Delivery Vehicles, 2-Axle Trucks, Other 2-Axle Vehicles
11. Trucks or Other Goods Vehicles with 3 or more Axles

図 2 車両一台当たりの乗車人数調査の記録用紙（バス）

3) OD 調査

この調査は公共交通利用者を対象としたアンケート形式の調査である。調査地点は表 5 の通りである。

表 5 OD 調査地点

No.	Location Description
H-1	Marcos Highway (West of Sumulong Highway Junction)
H-2	Aguinaldo Highway (Between Niog St and Molino Blvd)
S-1	Roosevelt Station (Entry & Exit 100 Sample Each of Entering and Existing Passengers) Total of 200 samples
S-2	EDSA Station (Entry & Exit 100 Sample Each of Entering and Existing Passengers) Total of 200 samples
S-3	Baclaran Station (Entry & Exit 200 Sample Each of Entering and Existing Passengers) Total of 400 samples
S-4	Santolan Station (Entry & Exit 200 Sample Each of Entering and Existing Passengers) Total of 400 samples
S-5	Taft Station (Entry & Exit 100 Sample Each of Entering and Existing Passengers) Total of 200 samples

a. 路肩調査

調査地点のうち 2 箇所は道路部において行われた（Marcos Highway (Sumulong ジャンクション西部) および Aguinaldo Highway (Niyog St.~Molino Blvd 間)）。調査方法としては、路肩インタビュー調査を適用した。この方法では、ランダムに選出した車両を走行方向ごろに路肩に停車させ、その車両からランダムに選出した乗客に対してインタビューを行う。調査時間はそれぞれの調査地点において 16 時間(6:00am~10:00pm)であった。路肩調査は、前述の交通量調査及び車両一台当たりの乗車人数調査と同時に行った。

サンプル数の目標は、各調査地点のそれぞれの走行方向について通過する全車両の 5%以上であった。調査では自動車を路肩に停車させる必要があるため、地元警察の協力を得て調査を実施した。調査対象とした自動車は、自家用車、ジープニー（小型乗合自動車）、AUVs（実用車）、FX、バスであった。

調査対象車種別のインタビュー人数はそれぞれ、自家用車では 1 名（主に運転手）、FX 及びジープニーでは乗客の中から最低 2 名、バスでは乗客の中から 2~3 名であった。自家用車、ジープニー、FX の場合においては、インタビューは車外から行われた。一方で、バスの乗客に対するインタビューは車内で行われた。調査データは 30 分単位で記録された。調査で使用された質問票は図 3 から図 5 に示す通りである。

調査の信頼性を確保するために、調査担当者一人につき一車種のみ担当させ、調査担当者がその場から離れる場合に備えて交代要員を配置した。さらに、一人の調査時間は 1 シフトである 8 時間を上限とした。図 6 に調査地点 2 地点を示す。

Roadside Interview Survey **Passenger Interview** Form 1 - Private Mode	JICA Study for Enhancement of Railway Network System in Metro Manila	

Control No:

Station Name : _____ Date : _____

Interviewer : _____ Direction : _____

Weather : _____

Survey Data (For Office Use)			
Time:	____ : ____	____ : ____	____ : ____
1.Mode of Travel 1. Cyclo/Motorcycle 2. Private Car/ Sedan/ SUV/ Open Back			
2.Origin Barangay/City - Municipality / Province	_____ _____ (H/A)	_____ _____ (H/A)	_____ _____ (H/A)
3. Destination Street / Barangay City / Municipality / Province	_____ _____ (H/A)	_____ _____ (H/A)	_____ _____ (H/A)
4. Trip Purpose 1. To Home 2. To Work 3. Education 4. Business 5. Others			
5. No. of Passengers (Including Driver)			
6. Seating Capacity			
7. Home Address: _____ Street/Barangay _____ City/Municipality _____ Province			

図 3 OD 調査票 1 (自家用車 –乗客)

Roadside Interview Survey **Passenger's Interview** Form 2 - Public Mode	JICA Study for Enhancement of Railway Network System in Metro Manila	

Control No:

Station Name : _____ Date : _____

Interviewer : _____ Direction : _____

Weather : _____

Survey Data: (For Office Use)			
Time:	____ : ____	____ : ____	____ : ____
1. Vehicle Type 1. Tricycle 2. Public Taxi 3. AUV/Public FX 4. Jeepney 5. Mini-Bus 6. Local Public Bus (Air Con or Other) 7. Long Distance Bus (Provincial Bus)	☐	☐	☐
2.Origin Barangay/City - Municipality / Province	_____ _____ (H/A) ☐ ☐☐☐	_____ _____ (H/A) ☐ ☐☐☐	_____ _____ (H/A) ☐ ☐☐☐
3. Destination Barangay/City - Municipality / Province	_____ _____ (H/A) ☐ ☐☐☐	_____ _____ (H/A) ☐ ☐☐☐	_____ _____ (H/A) ☐ ☐☐☐
4. Trip Purpose 1. To Home 2. To Work 8. Education 4. Business 5. Others	☐	☐	☐

7. Home Address:

_____ _____ _____ ☐☐☐

Street/Barangay City/Municipality Province

図 4 OD 調査票 2 (公共交通 –乗客)

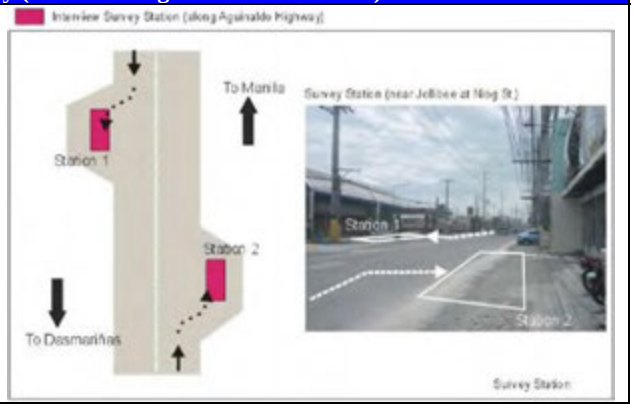
Roadside Interview Survey **Driver's Interview** Form 3 - Public Mode	JICA Study for Enhancement of Railway Network System in Metro Manila	

Control No:	
Station Name : _____	Date : _____
Interviewer : _____	Direction : _____
Weather : _____	

Survey Data: (For Office Use)	☐☐☐☐☐
1. PT Routes Details: From: To:	_____ ☐☐☐ _____ ☐☐☐
2. No. of Passengers (Including Driver)	☐☐
3. Seating Capacity	☐☐

図 5 OD 調査票 3 (公共交通 –運転手)

表 6 OD インタビュー調査の調査地点

Survey Location 1, Marcos Highway (West of Sumulong Highway Junction)	
	
Survey Location 2, Aguinaldo Highway (Between Niog St and Molino Blvd)	
	

b. LRT/MRT 駅における OD インタビュー調査

以下の LRT5 駅において利用者インタビュー調査を実施した（表 7）。

- Roosevelt 駅 (LRT1 号線)
- EDSA 駅 (LRT1 号線)
- Baclaran 駅 (LRT1 号線)
- Santolan 駅 (LRT2 号線)
- Taft 駅 (MRT)

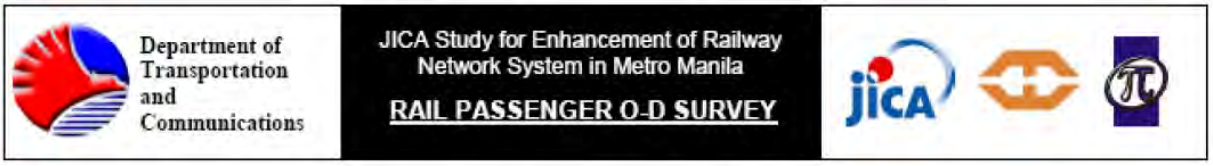
それぞれの駅における調査時間は、朝方のピークを含む 7:00 ~9:00 am と、夕方のピークを含む 5:00~7:00 pm であった。インタビューはランダム抽出によって駅構内の乗降客に対して実施した。サンプル数の目標は表 7 の通りである。

調査の信頼性を確保するため、各駅において乗降客それぞれについて別の調査担当者を割り当て、調査担当者が席を外す場合に備えて交代要員を配置した。

表 7 LRT 駅ごとのサンプル数

Name of Station	No. of Samples 7:00 to 9:00 am (2hrs)			No. of Samples 5:00 to 7:00 pm (2hrs)		
	Entry	Exit	Total	Entry	Exit	Total
LRT1: Roosevelt Station 200 samples)	50	50	100	50	50	100
LRT1: EDSA Station (200 samples)	50	50	100	50	50	100
LRT1: Baclaran Station (400 samples)	100	100	200	100	100	200
LRT2: Santolan Station (400 samples)	100	100	200	100	100	200
MRT: Taft Station (200 samples)	50	50	100	50	50	100
Total (1,400 samples)	350	350	700	350	350	700

調査で使用した質問票は図6の通りである。



Sequential No.: ☐☐☐☐ *(for office use only)*

Surveyor: _____ ☐☐

Questionnaire for LRT users

Date: _____ ☐☐☐☐

Time: _____ : _____ ☐☐ : ☐☐

Direction: LRT 1- 1. Northbound 2. Southbound ☐
Direction: LRT 2- 3. Eastbound 4. Westbound
Direction: MRT3- 5. Northbound 6. Southbound

Mode: 1. LRT 1 2. LRT 2 3. MRT3 ☐

Socio-Economic Profile

Age: _____ ☐☐

Gender: 1. Male 2. Female ☐

Income: (Personal Monthly Income) ☐

1. No Income
2. Below 5,000
3. 5,000 - 9,999
4. 10,000 - 14,999
5. 15,000 - 19,999
6. 20,000 - 24,999
7. 25,000 - 29,999
8. 30,000 - 39,999
9. 40,000 - 49,999
10. 50,000 - 59,999
11. 60,000 - 69,999
12. Above ₱70,000

Occupation: ☐

1. Student
2. Employed/Worker
3. Unemployed
4. Businessman/Self –Employ
5. Professional/Executive

Trip Details

Boarding Location/Sta (B): _____ ☐☐☐

Origin (O): _____ ☐☐☐
Brgy City/Municipality
(H/A) ☐

Main mode to Boarding (O-B): _____ ☐☐

Fare Paid for Main mode: ₱ _____ ☐☐☐

Trip Purpose: ☐

1. To Home
2. To Work
3. Education
4. Business
5. Others

Alighting (A): _____ ☐☐☐

Destination (D): _____ ☐☐☐
Brgy City/Municipality
(H/A) ☐

Other mode to Destination (A-D): _____ ☐☐

Fare Paid for Other Mode ₱ _____ ☐☐☐

Total Travel Time(Estimation):Min _____ ☐☐☐

Mode Type: *(reference for other modes used)*

1. Cyclo/Motorcycle/Tricycle
2. Private Car/ Sedan/ SUV/ Open Back
3. Delivery Vehicles, 2-Axle Truck and Other 2-Axle Veh.
4. Trucks and Other Delivery Vehicles (3 or more Axle)
5. Public Taxi
6. AUV/Public FX
7. Jeepney
8. Mini-Bus
9. Local Public Bus (Air Con or Other)
10. Long Distance Bus (Provincial Bus)
11. LRT/MRT
12. Others _____

7. Home Address:

_____ _____ _____ ☐☐☐
Street/Barangay City/Municipality Province

図 **6** 鉄道利用者に対する **OD** 調査票

3　データ処理

3.1　データ処理機能

データ処理は、以下の三段階によって構成される。

- データ検証 – 検証と論理チェック
- データ・コーディング – データベースシステムに入力するためのデータ項目のコード作成
- データ・エンコーディング – データベースシステムを使用したコンピューターへのコードデータの入力

一般的なデータの処理を図 1 に示す。

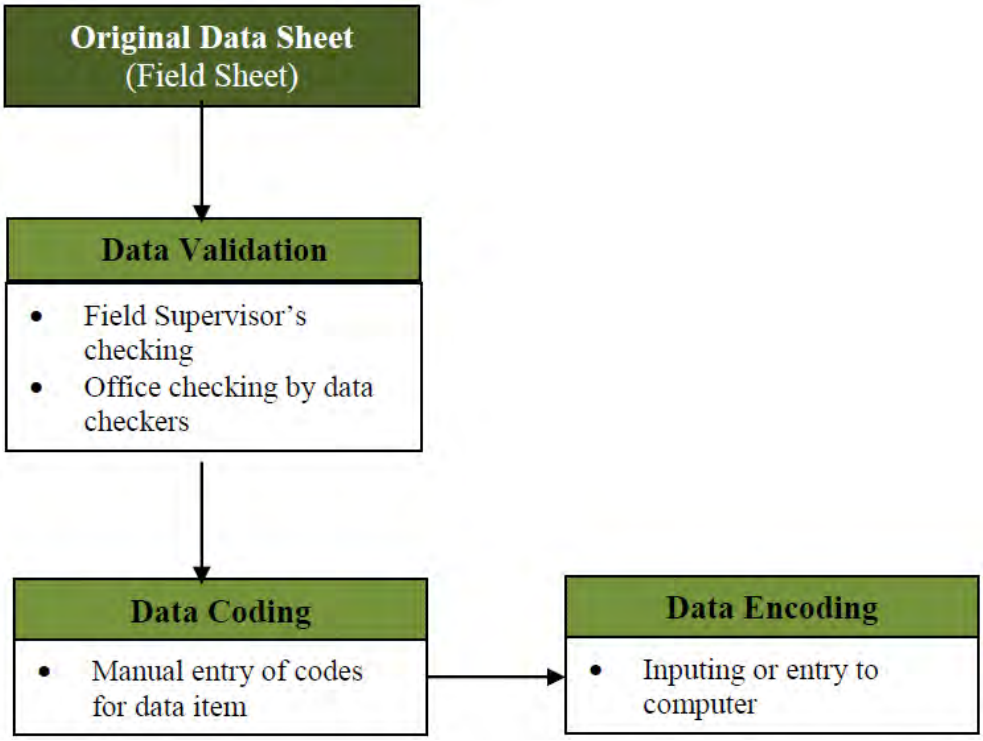


図 1 データ処理

データの妥当性検証に先立ち、データ処理チームではデータベースシステムの設計を行った。

ソフトウェアには Microsoft Office Access を利用した。Microsoft Office Access（旧称 Microsoft Access）は、マイクロソフト社が提供しているリレーショナル・データベース管理システムである。このシステムは Microsoft Jet データベースエンジンと GUI（Graphical User Interface）およびソフトウェア開発ツールを組み合わせて構成されている。Microsoft Office Access は Microsoft Office Professional 以上のエディションで搭載されている。

Microsoft Office Access は、Access Jet データベースエンジンに基づく独自のフォーマットでデータを蓄積する。このソフトはその他の Access データベース、Excel, SharePoint リスト, テキストデータ, XML, Outlook, HTML, dBase, Paradox, Lotus 1-2-3 ソフトウェア等のデータのインポート／リンクが可能である。

「Microsoft Access はシンプルなデータベース構築に用いられる。Microsoft Access テーブルは様々なフィールドタイプ、インデックス、参照整合性をサポートしている。また、Microsoft Access では、クエリインターフェース、データの入力・表示、プリントアウトなどが利用可能である。これらのオブジェクトを含んでいる下層の Jet データベースは、複数ユーザー閲覧、カスケード更新・削除を含むレコードロッキングと参照整合性を持っている。単純な作業はポイントアンドクリックオプションによって自動化出来る。」

3.2 データ検証

現地調査から得られたデータのエラーを最小化するために、調査表は正確性と信頼性の検証をすべきである。これは、二つの工程を経て処理した。

a)調査完了後、例えば、調査員が調査表を完成させたとき、調査員は必要な正確かつすべての情報（場所、調査データ、距離、その他個人情報のパラメータ）を解明したことになる。調査員は管理者に対して完成された調査表を提出した。管理者は、調査員が検査したそれらのデータ表を受け取り、その調査表と対応しているデータの整合性、信憑性、いわゆる論理的なデータとなっているかを検証した。以下の手法を、調査毎にデータ検証の方法として適応した。

<u>交通量調査データ：</u>

- 実際の交通量から極端に逸脱した例：三車線における一時間当たりの全交通量がオフ・ピーク時に一時間当たりの容量が 3,000 台であるのに対し、同じ場所でピーク時に 300 台であるという結果は、信憑性に欠ける。このようなケースに検査を実施した。
- 隣り合う調査時間内の交通量の増減が一般的でない例：同じ区間内で 9 時から 10 時の間は、一時間当たりの交通量が 650 台であったが、10 時から 11 時の間では 2,500 台、11 時から 12 時の間で 400 台まで減少するといった例である。このようなケースに検査を実施した。

<u>乗車データ：</u>

- 一般的でない乗車人数の例：一台のジープニーに対して 35 人や 42 人、バスの場合、300 人や 500 人といった場合。このようなデータは、車両の容量を大幅に超えており、信憑性が担保されていないことが見て取れる。これらのケースの場合に検査を実施した。

<u>**OD 調査データ：**</u>

調査員のインタビュー実施後、調査員は地域、日付等の情報を検証し、同様に OD データを完成させた。完成された調査表のデータは、OD 調査の管理者に提出された。管理者は、一般原則に従って調査表のすべてを細かく確認した。

- 情報の完全性（例：要求されるすべてのデータは調査表に記載される。）
- (ii) 情報の正確性と整合性（例）
  - ✧ 家庭の全所得は、家庭を構成する人員それぞれの所得の総和と同じになる。
  - ✧ 所得に対する職業（例：所得は職業から得られる給料と一致すべきである。）
  - ✧ 出発地や目的地、乗換地点（調査範囲内に含まれている必要がある）
  - ✧ 出発地や目的地、乗換地点の交通モードやルートが関係性のある場所で選択されているか。
  - ✧ 旅行時間や旅行費用に対する OD パターン
  - ✧ 家庭構成員数に対する調査表における個々人の調査表数
  - ✧ その他

b) 調査管理者によって遂行・検証・有効性確保が行われたすべての調査データは、データ検証グループに提出された。それらの有効なデータは、データチェック担当が上記で示した一般原則に従って検証した。実際には、データの妥当性検証は二回行われ、一回目は管理者によって、二回目はデータチェック担当によって実施された。これは「抑制と均衡」原理を基にしている。

3.3 データ・コーディング

二重検証されたデータは、データ・コーディング担当によりコード化される。データベースシステムは、コードシステムやそれぞれのデータ項目に割り当てられた数値コードを含んでいる。検証された調査表は、数値コード毎に指定範囲を持ったコードボックスとなる。以下に事例を示す。

旅行目的	コード
自宅	1
職場	2
学校	3
仕事	4
私用	5
その他	6

したがって、旅行目的のコーディングは、有効な 1 から 6 のコードを持つことになる。データ・コーディング担当者は、数値コードの記入と許容範囲に十分に注意を払った。その他の全データ項目は、それらの一致した数値コードと範囲、上記で説明した同様の方法でコードを持っている。

3.4 データ・エンコーディング

検証・コード化されたデータやコード化されたデータ形式は、データ・エンコーディング担当者に引き渡された。担当者、すべての調査表毎にすべてのデータ項目を手動でコンピューターに入力した。数値データの利用は、データ・エンコーディングを容易にした。

このデータベースシステムは、入力やエンコードにおける間違いの発見を容易にし、、コンピューターによって無効なコードは承認しないように設計された（例:対象地域外のデータ項目など）。

データ処理活動は、調査員や管理者、データチェック担当、データ・コーディング担当、データ・エンコーディング担当などの「問い合わせシステム」を含んでいる。この「問い合わせシステム」フローを以下に示す。

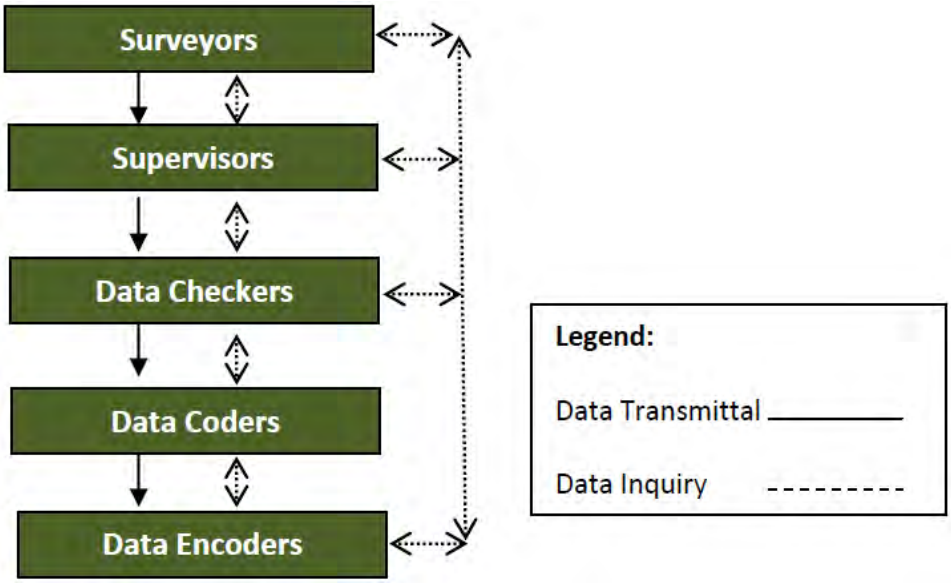


図 2 データ処理問い合わせシステムフロー

3.5 サンプル調査データ

データ検証プロセスは、データ内のエラーを正すものであり、データベース内のエンコード化されたデータは、すべて有効データである。さらには、不完全な回答は自動的に棄却され、データ検証に含まれないため、データベース内に無効なデータは存在しない。

4 調査結果

全調査の集計表を示す。

5 交通量調査

全 16 時間すべての観測地点における区間、車両別の交通量を**表 8** に示す。

表 8 全 16 時間における交通量の集計（全地点）

Station	Direction	Cyclo/Motor-cycle/Tricycle	Pvt. Car	SUV/Van	Public Taxi	AUV/ Public FX	Jeepney	Mini-bus	Local Public Bus	Long Dist. Provincial Bus	Delivery Veh. (2-axle Truck)	Trucks (3 or more axles)	Total
1. Marcos Highway	EB	10,072	15,048	5,578	1,476	1,258	6,097	0	18	8	1,762	2,066	41,317
	WB	11,401	16,187	3,383	1,951	1,139	6,190	0	67	12	2,957	2,856	43,287
	Bothways	**21,473**	**31,235**	**8,961**	**3,427**	**2,397**	**12,287**	**0**	**85**	**20**	**4,719**	**4,922**	**84,604**
2. Marcos Highway	EB	9,085	15,847	5,421	3,496	2,130	5,229	0	28	10	2,802	1,178	44,048
	WB	7,905	18,749	2,956	3,234	2,039	5,537	10	49	5	2,343	1,640	42,827
	Bothways	**16,990**	**34,596**	**8,377**	**6,730**	**4,169**	**10,766**	**10**	**77**	**15**	**5,145**	**2,818**	**86,875**
3. Marcos Highway	EB	8,465	20,472	4,155	4,353	2,401	5,174	0	50	9	2,074	1,830	47,153
	WB	7,291	14,504	3,361	3,819	2,099	5,327	0	31	18	2,528	2,010	38,978
	Bothways	**15,756**	**34,976**	**7,516**	**8,172**	**4,500**	**10,501**	**0**	**81**	**27**	**4,602**	**3,840**	**86,131**
4. Rizal Avenue	NB	3,270	913	333	146	17	5,168	2	0	0	189	0	10,038
	SB	4,536	1,427	411	302	12	4,940	1	0	1	345	10	11,975
	Bothways	**7,806**	**2,340**	**744**	**448**	**29**	**10,108**	**3**	**0**	**1**	**534**	**10**	**22,013**
5. Taft Avenue	NB	959	1,073	644	1,103	342	2,459	3	824	387	291	59	8,085
	SB	1,322	1,346	455	547	927	2,639	0	711	214	134	31	8,295
	Bothways	**2,281**	**2,419**	**1,099**	**1,650**	**1,269**	**5,098**	**3**	**1,535**	**601**	**425**	**90**	**16,380**
6. Roxas Boulevard	NB	6,693	10,944	6,599	3,821	1,710	4,689	0	2,244	1,906	1,745	1,027	40,351
	SB	5,967	7,033	2,032	2,800	2,016	3,010	224	1,018	1,031	599	376	25,730
	Bothways	**12,660**	**17,977**	**8,631**	**6,621**	**3,726**	**7,699**	**224**	**3,262**	**2,937**	**2,344**	**1,403**	**66,081**
7. Cavitex	NB	104	14,921	3,040	692	1,161	1,641	50	788	1,122	1,317	1,111	24,836
	SB	19	13,294	3,308	688	1,134	1,618	53	710	1,089	1,368	411	23,281
	Bothways	**123**	**28,215**	**6,348**	**1,380**	**2,295**	**3,259**	**103**	**1,498**	**2,211**	**2,685**	**1,522**	**48,117**
8. Quirino Avenue	NB	8,682	1,065	631	334	48	2,221	0	5	0	188	72	13,174
	SB	8,829	1,411	406	191	123	3,073	0	7	0	154	39	14,194
	Bothways	**17,511**	**2,476**	**1,037**	**525**	**171**	**5,294**	**0**	**12**	**0**	**342**	**111**	**27,368**
9. Ninoy Aquino Avenue	NB	7,921	6,668	3,775	2,307	1,791	2,726	0	13	20	1,528	927	26,749
	SB	11,633	9,400	2,912	2,411	2,102	3,357	0	26	1	2,364	2,084	34,206
	Bothways	**19,554**	**16,068**	**6,687**	**4,718**	**3,893**	**6,083**	**0**	**39**	**21**	**3,892**	**3,011**	**60,955**
10. Evangelista	EB	3,482	2,735	690	62	51	1,559	0	1	1	363	5	8,944
	WB	3,652	2,487	519	71	31	1,642	0	5	1	417	7	8,825
	Bothways	**7,134**	**5,222**	**1,209**	**133**	**82**	**3,201**	**0**	**6**	**2**	**780**	**12**	**17,769**
11. Aguinaldo Highway	NB	4,985	5,101	1,233	271	473	2,393	841	4	1,280	941	558	17,522
	SB	4,278	6,309	1,973	423	192	2,431	779	74	1,314	941	1,239	18,714
	Bothways	**9,263**	**11,410**	**3,206**	**694**	**665**	**4,824**	**1,620**	**78**	**2,594**	**1,882**	**1,797**	**36,236**
12. Molino Blvd.	NB	3,085	5,696	1,811	168	662	777	0	2	2	600	431	12,803
	SB	3,444	6,197	2,398	171	484	1,038	0	2	0	626	384	14,360
	Bothways	**6,529**	**11,893**	**4,209**	**339**	**1,146**	**1,815**	**0**	**4**	**2**	**1,226**	**815**	**27,163**

表 5 自動車あたりの平均乗車率の集計

Station	Direction	Cyclo/Motor-cycle/Tricycle	Pvt. Car	SUV/Van	Public Taxi	AUV/ Public FX	Jeepney	Mini-bus	Local Public Bus	Long Dist. Provincial Bus	Delivery Veh. (2-axle Truck)	Trucks (3 or more axles)
1. Marcos Highway	EB	1.52	1.83	3.92	2.22	5.31	15.79	2.00	9.45	11.27	2.33	2.49
	WB	1.38	2.13	3.48	2.06	6.64	14.28	4.80	4.92	3.20	2.34	2.35
	Bothways	**1.45**	**1.98**	**3.69**	**2.14**	**5.97**	**15.04**	**4.73**	**5.92**	**7.43**	**2.33**	**2.42**
2. Marcos Highway	EB	1.33	1.99	4.61	2.31	7.66	18.72	4.33	6.32	4.11	2.29	2.13
	WB	1.22	1.76	3.97	2.18	4.84	18.15	10.11	12.12	3.00	2.34	2.39
	Bothways	**1.27**	**1.87**	**4.29**	**2.24**	**6.15**	**18.43**	**8.67**	**10.32**	**3.71**	**2.32**	**2.27**
3. Marcos Highway	EB	1.27	1.53	2.39	1.49	3.40	12.20	0.00	13.90	37.33	2.27	2.16
	WB	1.23	1.53	1.85	1.54	3.86	12.50	0.00	18.21	20.45	2.43	2.19
	Bothways	**1.25**	**1.53**	**2.07**	**1.52**	**3.67**	**12.35**	**0.00**	**15.09**	**28.05**	**2.35**	**2.18**
4. Rizal Avenue	NB	1.48	1.45	1.54	1.71	1.71	11.18	1.00	0.00	0.00	2.02	0.00
	SB	1.76	1.77	2.43	2.10	1.50	11.04	3.00	0.00	0.00	2.37	3.33
	Bothways	**1.62**	**1.65**	**2.25**	**2.03**	**1.62**	**11.11**	**2.00**	**0.00**	**0.00**	**2.27**	**3.33**
5. Taft Avenue	NB	1.34	2.02	2.89	1.95	5.32	12.23	17.00	36.42	28.83	2.17	2.26
	SB	1.44	1.86	1.93	2.07	3.60	10.87	0.00	26.43	6.51	2.47	1.84
	Bothways	**1.38**	**1.94**	**2.49**	**1.99**	**4.45**	**11.54**	**17.00**	**33.30**	**20.76**	**2.21**	**2.14**
6. Roxas Boulevard	NB	1.25	1.85	6.50	2.02	7.68	32.75	36.08	2.39	2.25	0.00	0.00
	SB	1.23	1.47	1.98	2.09	6.85	24.16	33.57	2.35	2.33	0.00	0.00
	Bothways	**1.24**	**1.64**	**4.15**	**2.05**	**7.25**	**28.53**	**34.84**	**2.37**	**2.27**	**0.00**	**0.00**
7. Cavitex	NB	1.09	1.84	6.79	2.27	5.43	14.04	16.24	47.32	48.55	2.27	2.16
	SB	1.29	1.57	4.10	2.31	6.91	13.37	28.78	54.68	56.36	2.36	2.33
	Bothways	**1.27**	**1.70**	**5.40**	**2.29**	**6.34**	**13.70**	**23.80**	**51.33**	**52.46**	**2.32**	**2.27**
8. Quirino Avenue	NB	1.70	1.55	1.86	1.57	1.71	5.85	0.00	30.75	0.00	2.43	2.63
	SB	1.65	1.64	2.02	1.84	2.61	6.82	0.00	12.50	60.00	2.29	3.78
	Bothways	**1.68**	**1.60**	**1.95**	**1.66**	**2.32**	**6.38**	**0.00**	**24.67**	**60.00**	**2.36**	**3.32**
9. Ninoy Aquino Avenue	NB	2.02	1.80	5.93	2.03	4.91	6.27	13.33	2.10	2.20	0.00	0.00
	SB	1.44	1.99	4.16	2.09	6.52	2.64	2.67	2.33	2.28	0.00	0.00
	Bothways	**1.74**	**1.89**	**5.21**	**2.06**	**5.57**	**3.91**	**8.00**	**2.21**	**2.23**	**0.00**	**0.00**
10. Evangelista	EB	1.47	1.66	2.45	1.69	3.11	9.48	0.00	2.00	2.00	2.24	2.75
	WB	1.63	1.98	2.86	1.61	1.33	10.16	0.00	4.67	2.00	2.26	3.40
	Bothways	**1.55**	**1.82**	**2.71**	**1.64**	**2.35**	**9.82**	**0.00**	**4.00**	**2.00**	**2.26**	**3.11**
11. Aguinaldo Highway	SB	1.30	1.72	2.39	1.61	5.22	9.50	12.24	29.35	52.12	2.32	2.13
	NB	1.32	1.53	1.89	2.01	4.92	8.62	10.81	36.36	50.17	2.22	2.15
	Bothways	**1.31**	**1.63**	**2.14**	**1.79**	**5.01**	**9.06**	**11.60**	**34.58**	**51.27**	**2.27**	**2.14**
12. Molino Blvd.	NB	1.29	2.02	3.30	1.70	7.98	15.56	3.22	2.00	4.00	2.39	2.69
	SB	1.40	1.74	7.39	2.25	4.36	15.46	10.00	2.00	2.00	2.13	2.49
	Bothways	**1.34**	**1.88**	**5.22**	**1.98**	**7.39**	**15.51**	**3.90**	**2.00**	**3.33**	**2.28**	**2.53**

6　分布交通量（OD）調査

6.1 路肩インタビュー

路肩インタビューを MB-2: Marcos Highway と MB-11: Aguinaldo Highway の二地点で実施した。

a.　公共交通利用者インタビュー

調査地点による標本分布を**表 10** と **図 5** に示す。

表 10 地点別標本配分：公共交通利用者インタビュー

Station	Location	Direction	Total	Share (%)
MB-2	Marcos Highway	EB	507	24.8%
		WB	488	23.8%
		Both Ways	995	48.6%
MB-11	Aguinaldo Highway	NB	581	28.4%
		SB	471	23.0%
		Both Ways	1,052	51.4%
Total		-	2,047	100.0%
Share (%)		-	100.0%	-

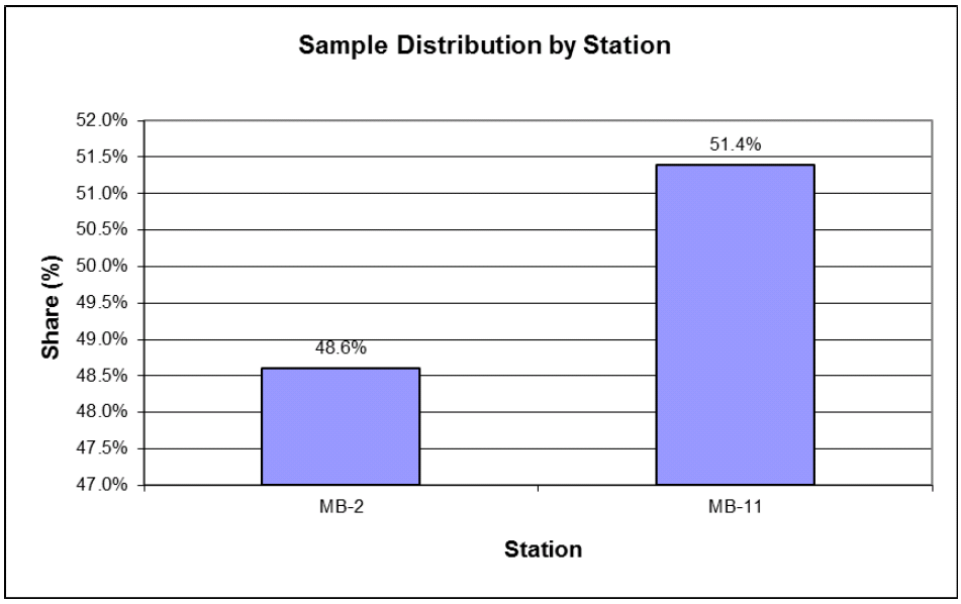


図 5 地点別標本配分：公共交通利用者インタビュー

公共交通による標本分布を**表 11** と**図 10** に示す。

表 11 地点・モード別標本分布：公共交通利用者のインタビュー

Station	Location	AUV/FX	Jeepney	Mini-Bus	Local Public Bus	Provincial Bus	Total	Share (%)
MB-2	Marcos Highway	22	973	0	0	0	995	48.6%
MB-11	Aguinaldo Highway	0	604	151	0	297	1,052	51.4%
Total		22	1,577	151	0	297	2,047	100.0%
Share (%)		1.1%	77.0%	7.4%	0.0%	14.5%	100.0%	-

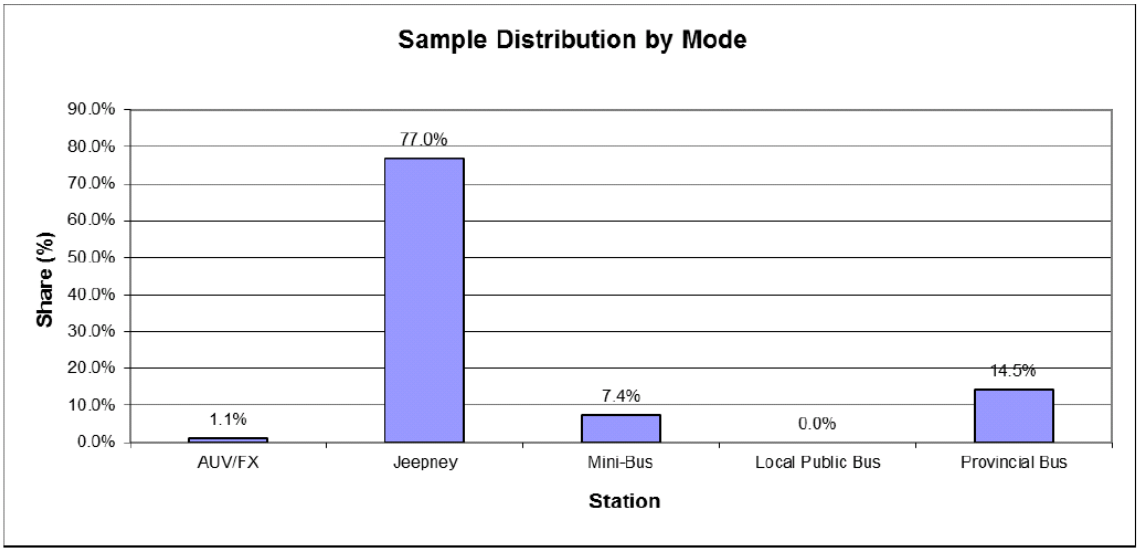


図 10 地点・モード別標本分布：公共交通利用者インタビュー

公共交通モードの旅行目的別配分を**表 12** と**図 11** に示す。公共交通における旅行目的別配分の詳細は、エンコード化された OD データから抽出される。

表 12 全公共交通利用者の旅行目的別分布

Station	Purpose					Total
	1	2	3	4	5	
MB-2	434	235	53	47	224	993
MB-11	488	163	57	41	283	1,032
Total	922	398	110	88	507	2,025
Share (%)	45.5%	19.7%	5.4%	4.3%	25.0%	100.0%

Notes: 22 respondents have no reply.
Purpose 1 – To Home
Purpose 2 – To Work
Purpose 3 – Education
Purpose 4 – Business
Purpose 5 – Others

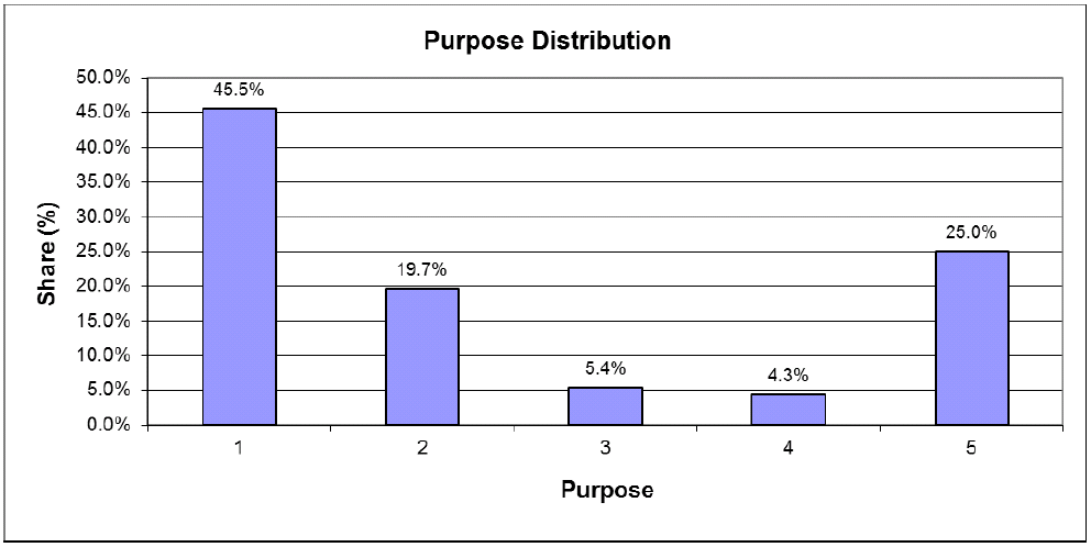


図 11 全公共交通利用者の旅行目的別分布

公共交通利用者の OD パターンは、MB-2 地点でのインタビューを基にしている。都市間・市町村間の総計を**表 13** に示す。

表 13 都市・地域間の乗客の OD 表：地点 MB-2

O/D	Antipolo	Binangonan	Cainta	Caloocan City	Cavite City	Dona Remedios Trinidad	Makati City	Mandaluyong City	Manila	Marikina City	Muntinlupa City	Pasay City	Pasig City	Pateros	Quezon City	Rodriguez	San Mateo	San Pedro	Tanay	Taytay	Valenzuela City	Total	Share (%)
Antipolo	85	1	36	2	0	3	6	8	14	79	1	1	133	1	128	11	2	2	0	5	0	518	52.6%
Bacoor	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Baras	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0.2%
Binangonan	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Cainta	28	0	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	32	3.2%
Caloocan City	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Dasmarinas	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Makati City	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.7%
Mandaluyong City	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	6	0.6%
Manila	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.8%
Marikina City	108	0	5	0	0	0	0	1	1	1	0	0	7	0	3	0	1	0	1	0	0	128	13.0%
Navotas City	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Paranaque City	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0.2%
Pasig City	106	0	3	0	0	0	1	0	0	1	0	0	2	0	1	0	0	0	0	0	0	114	11.6%
Quezon City	148	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	151	15.3%
Rodriguez	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0.4%
San Juan	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2%
Taguig City	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2%
Tanay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.1%
Taytay	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2%
Valenzuela City	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Total	508	1	49	2	1	3	7	9	15	85	1	1	145	1	133	12	3	2	1	5	1	985	100.0%
Share (%)	51.6%	0.1%	5.0%	0.2%	0.1%	0.3%	0.7%	0.9%	1.5%	8.6%	0.1%	0.1%	14.7%	0.1%	13.5%	1.2%	0.3%	0.2%	0.1%	0.5%	0.1%	100.0%	

地点 MB-11 における公共交通利用者の OD パターンの都市間・市町村間の総計を**表 14** に示す。

表 14 都市・地域間の乗客の OD 表：地点 MB-11

O/D	Alfonso	Bacoor	Caloocan City	Cavite City	Dasmarinas	Dona Remedios Trinidad	Gen_ Mariano Alvarez	General Trias	Imus	Kawit	Las Pinas City	Makati City	Malabon City	Manila	Maragondon	Muntinlupa City	Naic	Noveleta	Paranaque City	Pasay City	Quezon City	Rosario	San Pedro	Silang	Tagaytay	Tanza	Ternate	Trece Martires	Total	Share (%)
Bacoor	0	286	0	15	8	0	2	2	39	9	64	1	0	4	1	9	3	3	21	23	2	7	1	1	2	1	0	0	504	48.5%
Cavite City	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	8	0.8%
Dasmarinas	0	13	0	0	0	1	0	0	1	0	9	1	1	3	0	2	0	0	3	13	0	0	0	0	0	0	1	0	48	4.6%
Alvarez	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	3	0.3%
General Trias	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3%
Imus	0	69	0	0	0	0	0	0	6	0	40	1	0	5	0	4	0	0	15	20	1	0	0	0	0	0	0	0	161	15.5%
Indang	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0.2%
Kawit	0	11	0	0	0	0	0	0	0	0	7	0	0	0	0	3	0	1	1	2	0	0	0	0	0	0	0	0	25	2.4%
Las Pinas City	0	53	0	2	7	0	2	0	19	4	3	0	0	0	0	0	2	1	0	0	0	3	0	0	0	2	0	1	99	9.5%
Makati City	0	7	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0.9%
City	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0.2%
Manila	0	8	0	0	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	19	1.8%
Maragondon	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Muntinlupa City	0	10	0	2	2	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	21	2.0%
Naic	0	3	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.7%
Navotas City	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Noveleta	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0.3%
Paranaque City	0	11	0	0	2	0	1	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	26	2.5%
Pasay City	1	16	0	1	5	0	1	0	22	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	1	0	54	5.2%
Quezon City	0	3	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	8	0.8%
Rosario	0	3	0	0	1	0	0	0	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9	0.9%
San Pedro	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Silang	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	0.4%
Tagaytay	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0	4	0.4%
Tanza	0	6	0	0	0	0	0	0	0	0	6	0	0	0	0	1	0	0	0	3	1	0	0	0	0	0	0	0	17	1.6%
Trece Martires	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.1%
Total	1	510	1	20	29	1	7	2	115	17	140	3	1	15	1	23	5	5	44	65	6	11	1	4	5	5	2	1	1040	100.0%
Share (%)	0.1%	49.0%	0.1%	1.9%	2.8%	0.1%	0.7%	0.2%	11.1%	1.6%	13.5%	0.3%	0.1%	1.4%	0.1%	2.2%	0.5%	0.5%	4.2%	6.3%	0.6%	1.1%	0.1%	0.4%	0.5%	0.5%	0.2%	0.1%	100.0%	

b. 公共交通運（PT）転手へのインタビューデータ

PT モードによる標本分布を、**表 15** と**図 12** に示す。

表 15 PT 運転手インタビューによる標本分布

Station	Location	AUV/FX	Jeepney	Mini-Bus	Local Public Bus	Provincial Bus	Total	Share (%)
MB-2	Marcos Highway	142	492	0	0	0	634	50.8%
MB-11	Aguinaldo Highway	10	324	194	11	75	614	49.2%
Total		152	816	194	11	75	1,248	100.0%
Share (%)		12.2%	65.4%	15.5%	0.9%	6.0%	100.0%	-

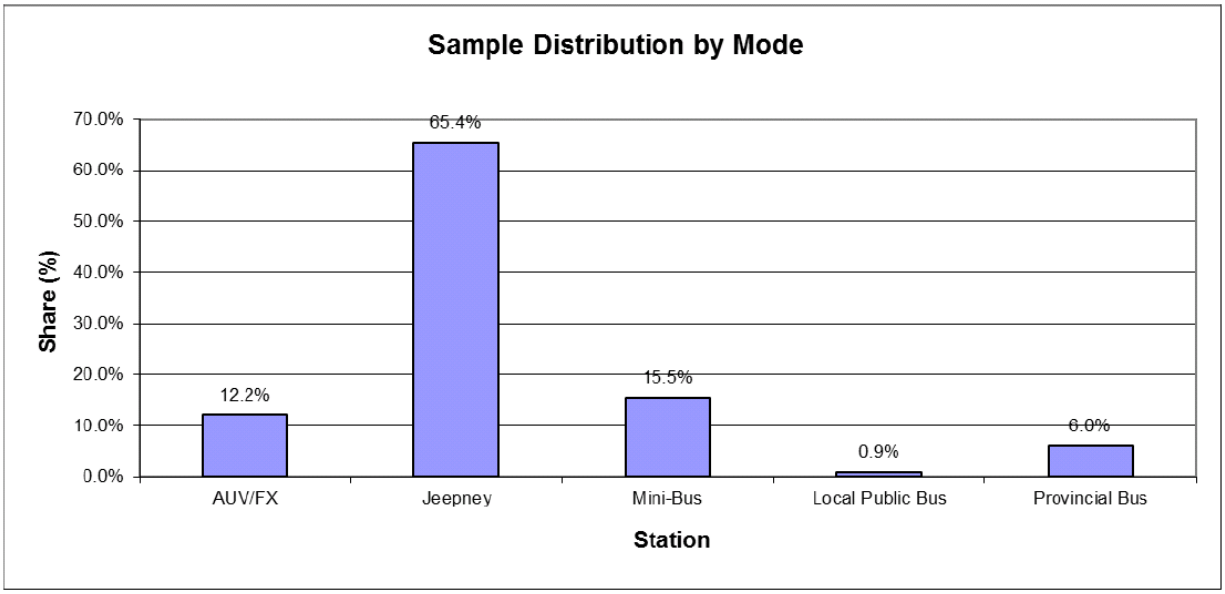


図 12 PT 運転手インタビューによる標本分布

乗車率と乗車容量調査は、**表 5** と**表 5** に示す。

表 5 乗車率：PT 車両調査

Station	Mode	Sample	Sum of Occupancy	Average Occupancy
MB-2	AUV/FX	142	1,011	7.12
	Jeepney	486	7,409	15.24
	Mini-Bus	0	0	0.00
	Local Public Bus	0	0	0.00
	Provincial Bus	0	0	0.00
MB-11	AUV/FX	10	108	10.80
	Jeepney	324	3,177	9.81
	Mini-Bus	194	1,998	10.30
	Local Public Bus	11	405	36.82
	Provincial Bus	75	2,150	28.67

表 5 PT 車両の容量調査

Station	Mode	Sample	Sum of Capacity	Average Capacity
MB-2	AUV/FX	142	1,504	10.59
	Jeepney	487	10,707	21.99
	Mini-Bus	0	0	0.00
	Local Public Bus	0	0	0.00
	Provincial Bus	0	0	0.00
MB-11	AUV/FX	10	159	15.90
	Jeepney	324	6,554	20.23
	Mini-Bus	194	6,415	33.07
	Local Public Bus	11	604	54.91
	Provincial Bus	75	4,154	55.39

PT ルートの配分を**表 5** と**表 15** に示す。

表 5 PT ルート配分：地点 MB-2

O/D	Antipolo	Baras	Cainta	Makati City	Manila	Marikina City	Pasig City	Quezon City	San Mateo	Total	Share (%)
Antipolo	7	0	0	1	0	49	14	172	0	243	38.3%
Baras	0	0	0	0	0	1	0	0	0	1	0.2%
Cainta	1	0	0	0	0	2	0	0	0	3	0.5%
Makati City	3	0	1	0	0	6	0	0	0	10	1.6%
Mandaluyong City	0	0	0	0	0	3	0	0	0	3	0.5%
Marikina City	135	12	0	0	8	1	1	6	1	164	25.9%
Pasig City	53	0	0	0	0	0	1	0	0	54	8.5%
Quezon City	151	0	0	0	0	1	1	3	0	156	24.6%
Total	350	12	1	1	8	63	17	181	1	634	100.0%
Share (%)	55.2%	1.9%	0.2%	0.2%	1.3%	9.9%	2.7%	28.5%	0.2%	100.0%	

表 15 PT ルート配分：地点 MB-11

O/D	Alfonso	Bacoor	Caloocan City	Cavite City	Dasmarinas	Gen_ Mariano Alvarez	General Trias	Imus	Indang	Las Pinas City	Makati City	Manila	Mendez	Naic	Noveleta	Parana que City	Pasay City	Quezon City	Rosario	Silang	Tagaytay	Tanza	Trece Martires	Total	Share (%)
Alfonso	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	7	2.2%
Bacoor	0	26	0	30	21	2	1	6	1	1	0	0	0	13	0	0	6	0	3	14	1	0	0	125	38.7%
Cavite City	0	16	0	1	0	0	0	0	0	17	0	1	0	1	0	0	0	0	0	0	0	0	0	36	11.1%
Dasmarinas	0	31	1	0	0	0	0	0	1	25	1	2	0	0	1	0	33	0	0	0	0	0	0	95	29.4%
Alvarez	0	1	0	0	0	0	0	2	0	10	0	0	0	0	0	0	3	0	0	0	0	0	0	16	5.0%
General Trias	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Imus	0	16	0	0	0	0	0	0	0	13	0	3	0	0	0	2	53	0	0	0	0	0	0	87	26.9%
Indang	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	14	0	0	0	0	0	0	18	5.6%
Kawit	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	5	1.5%
Las Pinas City	0	0	0	3	0	0	0	2	0	2	0	0	0	0	0	1	0	0	0	0	1	0	0	9	2.8%
Makati City	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	3	0.9%
Malabon City	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Manila	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	7	2.2%
Maragondon	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.9%
Mendez	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Naic	0	40	0	3	0	0	0	0	0	26	0	0	0	0	0	0	2	0	0	0	0	0	0	71	22.0%
Noveleta	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	4	1.2%
Paranaque City	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Pasay City	5	7	0	1	13	1	0	22	6	1	0	1	1	0	0	0	3	0	0	0	1	0	2	64	19.8%
Quezon City	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	5	1.5%
Rosario	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.9%
Silang	0	5	0	0	0	0	0	0	0	9	0	0	0	0	0	0	1	0	0	0	0	0	0	15	4.6%
Tagaytay	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0.9%
Tanza	0	12	0	0	0	0	0	0	0	5	0	0	0	0	0	0	1	0	1	0	0	1	0	20	6.2%
Ternate	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Trece Martires	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Valenzuela City	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Total	5	91	0	8	21	1	0	26	7	63	1	5	2	1	0	3	78	1	1	2	4	1	2	323	100.0%
Share (%)	1.5%	28.2%	0.0%	2.5%	6.5%	0.3%	0.0%	8.0%	2.2%	19.5%	0.3%	1.5%	0.6%	0.3%	0.0%	0.9%	24.1%	0.3%	0.3%	0.6%	1.2%	0.3%	0.6%	100.0%	0.3%

c. 自動車保有者・運転者へのインタビュー

調査地点からの標本分布を**表 5** と**図 5** に示す。

表 5 地点における標本分布：自家用車・運転手インタビュー

Station	Location	Direction	Total	Share (%)
MB-2	Marcos Highway	EB	112	22.3%
		WB	191	38.0%
		Both Ways	303	60.4%
MB-11	Aguinaldo Highway	NB	41	8.2%
		SB	158	31.5%
		Both Ways	199	39.6%
Total		-	502	100.0%
Share (%)		-	100.0%	-

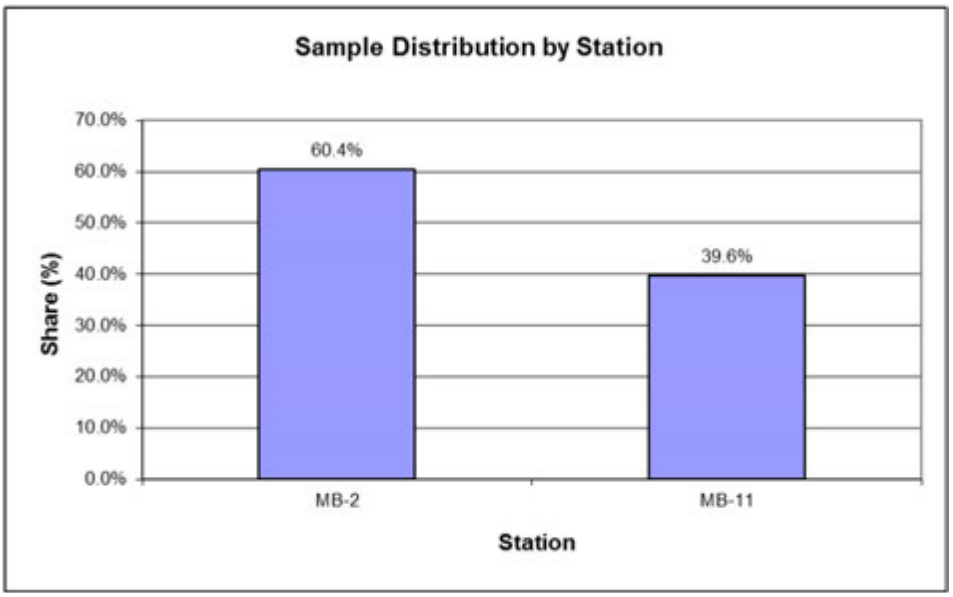


図 5 地点における標本分布：自家用車・運転手インタビュー

自家用車の標本分布を**表 5** と**図 5** に示す。

表 5 地点における標本分布：自家用車両モード：自家用車・運転手インタビュー

Station	Location	Private Car	SUV/Van	Public Taxi	Total	Share (%)
MB-2	Marcos Highway	152	103	48	303	60.4%
MB-11	Aguinaldo Highway	129	67	3	199	39.6%
Total		281	170	51	502	100.0%
Share (%)		56.0%	33.9%	10.2%	100.0%	-

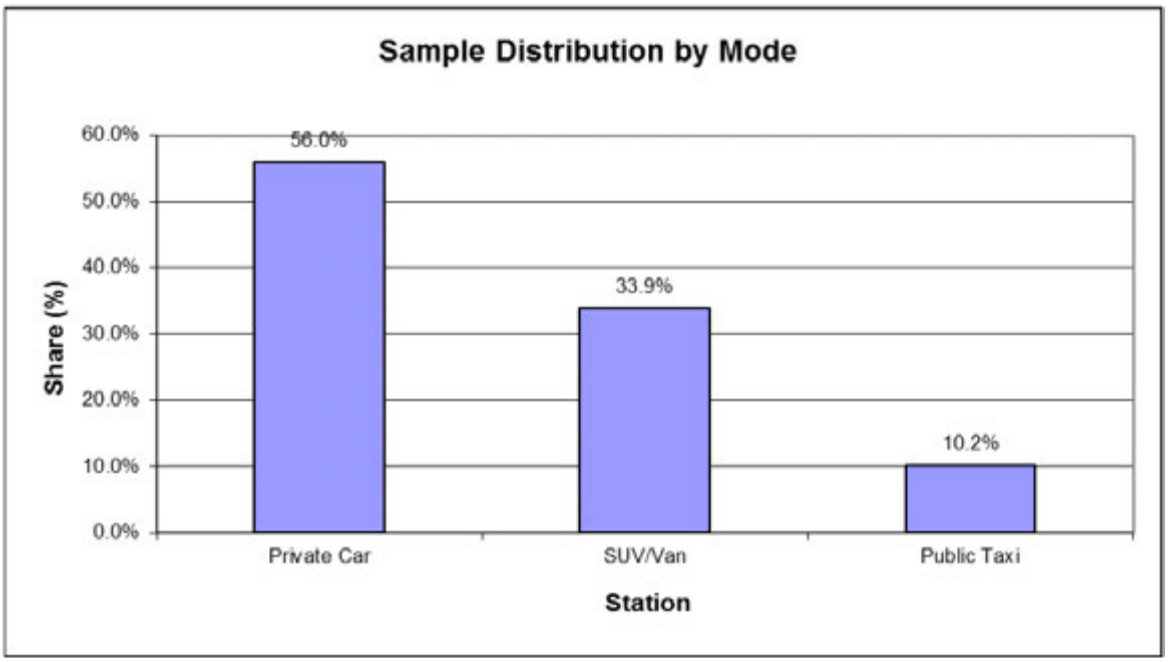


図 5 地点における標本分布：自家用車両モード：自家用車・運転手インタビュー

自家用車運転手の旅行目的別配分を、表 5 と図 5 に示す。

表 5 旅行目的別配分（自家用車運転手）

Station	Purpose					Total
	1	2	3	4	5	
MB-2	115	54	15	17	99	300
MB-11	90	37	4	16	51	198
Total	205	91	19	33	150	498
Share (%)	41.2%	18.3%	3.8%	6.6%	30.1%	100.0%

Legend:
Purpose 1 – To Home
Purpose 2 – To Work
Purpose 3 – Education
Purpose 4 – Business
Purpose 5 – Others

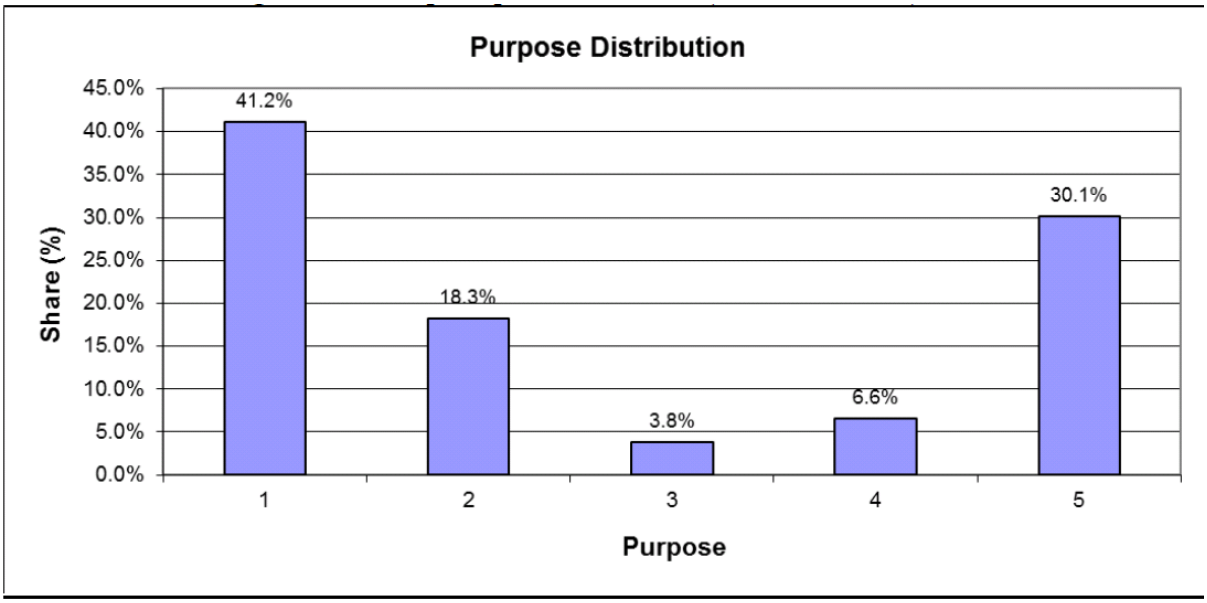


図 5 旅行目的別配分（自家用車運転手）

平均的な乗車率と自家用車容量の調査を、**表 5** と**表 5** に示す。

表 5 自家用車両の乗車率データ

Station	Mode	Sample	Sum of Occupancy	Average Occupancy
MB-2	Private Car	150	326	2.17
	SUV/Van	102	312	3.06
	Public Taxi	45	100	2.22
MB-11	Private Car	127	253	1.99
	SUV/Van	67	191	2.85
	Public Taxi	3	7	2.33

表 5 自家用車の容量

Station	Mode	Sample	Sum of Capacity	Average Capacity
MB-2	Private Car	150	827	5.51
	SUV/Van	103	1213	11.78
	Public Taxi	46	253	5.50
MB-11	Private Car	127	695	5.47
	SUV/Van	67	783	11.69
	Public Taxi	3	21	7.00

地点 MB-2、MB-11 で集められた都市・地域間の自家用車 OD パターン毎の OD データを、**表 5** と**表 5** に示す。

表 5 自家用車運転手の OD パターン：地点 MB-2

O/D	Angono	Antipolo	Baras	Cainta	Makati City	Mandaluyong City	Manila	Marikina City	Morong	Paranaque City	Pasay City	Pasig City	Quezon City	San Juan	San Mateo	Taytay	Teresa	Total	Share (%)
Antipolo	0	37	1	22	1	3	2	23	0	1	1	19	45	1	1	0	0	157	52.5%
Binangonan	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Cainta	0	19	0	4	2	1	1	10	0	0	0	3	9	0	0	0	0	49	16.4%
Dona Remedios Trinidad	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Makati City	0	2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	4	1.3%
Mandaluyong City	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1.0%
Manila	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	1.3%
Marikina City	0	13	0	0	1	0	0	1	0	0	0	3	1	0	0	0	1	20	6.7%
Muntinlupa City	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Paranaque City	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Pasig City	0	12	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	16	5.4%
Quezon City	0	32	0	2	0	0	0	2	0	0	0	1	1	0	0	1	1	40	13.4%
San Pedro	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Tanay	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.3%
Total	1	122	1	31	4	5	3	39	1	1	1	29	56	1	1	1	2	299	100.0%
Share (%)	0.3%	40.8%	0.3%	10.4%	1.3%	1.7%	1.0%	13.0%	0.3%	0.3%	0.3%	9.7%	18.7%	0.3%	0.3%	0.3%	0.7%	100.0%	

表 5 自家用車運転手の OD パターン：地点 MB-11

O/D	Bacoor	Dasmarinas	General Trias	Imus	Kawit	Las Pinas City	Makati City	Manila	Muntinlupa City	Naic	Noveleta	Parañaque City	Pasay City	Quezon City	Rosario	Silang	Tagaytay	Tanza	Ternate	Trece Martires	Total	Share (%)
Bacoor	25	2	1	11	1	3	3	0	2	0	1	1	3	3	0	0	1	1	1	0	59	29.9%
Caloocan City	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1.0%
Cavite City	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.5%
Dasmarinas	1	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	5	2.5%
Imus	3	0	0	2	0	3	2	1	2	0	0	2	3	1	0	0	0	0	0	0	19	9.6%
Las Pinas City	16	3	0	10	2	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	34	17.3%
Makati City	5	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	4.6%
Mandaluyong City	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1.0%
Manila	11	2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	8.6%
Muntinlupa City	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1.5%
Paranaque City	12	1	1	5	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	21	10.7%
Pasay City	5	1	1	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	15	7.6%
Pasig City	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1.0%
Quezon City	2	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	3.0%
San Juan	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.5%
San Pedro	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.5%
Total	87	12	3	45	3	7	5	1	4	1	1	4	9	4	1	2	4	2	1	1	197	100.0%
Share (%)	44.2%	6.1%	1.5%	22.8%	1.5%	3.6%	2.5%	0.5%	2.0%	0.5%	0.5%	2.0%	4.6%	2.0%	0.5%	1.0%	2.0%	1.0%	0.5%	0.5%	100.0%	

d. LRT 乗客へのインタビュー

OD の集計表と LRT の乗客データを記す。調査地点と目的地における標本分布を**表 5** に示す。

表 5 駅と目的地の標本分布

Station Code	Station_Name	Northbound	Southbound	Eastbound	Westbound	Northbound	Southbound	Total	Share (%)
1017	LRT 1 - EDSA/Taft	100	100	0	0	0	0	200	14.1%
1018	LRT 1 - Baclaran	203	203	0	0	0	0	406	28.5%
1020	LRT 1 - Roosevelt	97	103	0	0	0	0	200	14.1%
2001	LRT 2 - Santolan	0	0	200	201	0	0	401	28.2%
3013	MRT 3 - Taft Avenue	0	0	0	0	108	108	216	15.2%
Total	-	400	406	200	201	108	108	1,423	100.0%
Share (%)	-	28.1%	28.5%	14.1%	14.1%	7.6%	7.6%	100.0%	-

駅での回答者の年齢別分布を**表 5** に示す。

表 5 LRT 乗客インタビューの年齢による配分

Age Bracket	LRT1	LRT2	MRT	Total	% Share
12-20	218	147	61	426	30.0
21-29	253	117	104	474	33.3
30-39	138	70	30	238	16.7
40-49	95	34	10	139	9.7
50-59	63	22	10	95	6.7
60 & above	39	11	1	51	3.6
Total	806	401	216	1,423	100.0

駅での回答者の性別による分布を**表 5** に示す。

表 5 回答者の性別による配分

Sex	LRT 1	LRT 2	MRT 3	Total	Share (%)
Male	450	216	148	814	57.2%
Female	356	185	68	609	42.8%
Total	806	401	216	1,423	100.0%
Share (%)	56.6%	28.2%	15.2%	100.0%	-

回答者の職業別分布を**表 5** に示す。

表 5 回答者の職業による配分

Occupation	LRT 1	LRT 2	MRT 3	Total	Share (%)
1. Student	207	154	54	415	29.2%
2. Employed/Worker	390	176	116	682	47.9%
3. Unemployed	123	30	38	191	13.4%
4. Businessman/Self Employ	44	14	1	59	4.1%
5. Professional/Executive	42	27	7	76	5.3%
Total	806	401	216	1,423	100.0%
Share (%)	56.6%	28.2%	15.2%	100.0%	-

回答者の月収分布を**表 5** に示す。

表 5 回答者の月収別配分

Income	LRT 1	LRT 2	MRT 3	Total	Share (%)
No reply	16	19	12	47	3.3%
1. None	331	184	92	607	42.7%
2. Below P5,000	34	19	2	55	3.9%
3. 5,000 - 9,999	93	23	19	135	9.5%
4. 10,000 - 14,999	157	59	37	253	17.8%
5. 15,000 - 19,999	81	53	29	163	11.5%
6. 20,000 - 24,999	41	22	8	71	5.0%
7. 25,000 - 29,999	11	3	7	21	1.5%
8. 30,000 - 39,999	12	8	7	27	1.9%
9. 40,000 - 49,999	9	1	0	10	0.7%
10. 50,000 - 59,999	7	4	1	12	0.8%
11. 60,000 - 69,999	3	2	0	5	0.4%
12. Above P70,000	11	4	2	17	1.2%
Total	806	401	216	1,423	100.0%
Share (%)	56.6%	28.2%	15.2%	100.0%	-

回答者の旅行目的別配分は、**表 5** に示す。

表 5 回答者の旅行目的別配分

Trip Purpose	LRT 1	LRT 2	MRT 3	Total	Share (%)
1. To Home	207	154	54	415	29.2%
2. To Work	390	176	116	682	47.9%
3. Education	123	30	38	191	13.4%
4. Business	44	14	1	59	4.1%
5. Others	42	27	7	76	5.3%
Total	806	401	216	1,423	100.0%
Share (%)	56.6%	28.2%	15.2%	100.0%	-

回答者の駅間における流入を**表 5** に示す。

表 5 回答者の駅間の流入

Boarding Station		Alighting Station		Sample	Share (%)
Code	Station Name	Code	Station Name		
1001	LRT 1 - Monumento	1017	LRT 1 - EDSA/Taft	12	0.8%
1001	LRT 1 - Monumento	1018	LRT 1 - Baclaran	30	2.1%
1001	LRT 1 - Monumento	1020	LRT 1 - Roosevelt	6	0.4%
1002	LRT 1 - 5th Avenue	1017	LRT 1 - EDSA/Taft	3	0.2%
1002	LRT 1 - 5th Avenue	1018	LRT 1 - Baclaran	11	0.8%
1003	LRT 1 - R. Papa	1017	LRT 1 - EDSA/Taft	6	0.4%
1003	LRT 1 - R. Papa	1018	LRT 1 - Baclaran	3	0.2%
1003	LRT 1 - R. Papa	1020	LRT 1 - Roosevelt	2	0.1%
1004	LRT 1 - Abad Santos	1017	LRT 1 - EDSA/Taft	1	0.1%
1004	LRT 1 - Abad Santos	1018	LRT 1 - Baclaran	7	0.5%
1004	LRT 1 - Abad Santos	1020	LRT 1 - Roosevelt	2	0.1%
1005	LRT 1 - Blumentritt	1017	LRT 1 - EDSA/Taft	3	0.2%
1005	LRT 1 - Blumentritt	1018	LRT 1 - Baclaran	7	0.5%
1006	LRT 1 - Tayuman	1017	LRT 1 - EDSA/Taft	6	0.4%
1006	LRT 1 - Tayuman	1018	LRT 1 - Baclaran	3	0.2%
1006	LRT 1 - Tayuman	1020	LRT 1 - Roosevelt	7	0.5%
1007	LRT 1 - Bambang	1017	LRT 1 - EDSA/Taft	1	0.1%
1007	LRT 1 - Bambang	1018	LRT 1 - Baclaran	3	0.2%
1007	LRT 1 - Bambang	1020	LRT 1 - Roosevelt	3	0.2%
1008	LRT 1 - D. Jose	1017	LRT 1 - EDSA/Taft	5	0.4%
1008	LRT 1 - D. Jose	1018	LRT 1 - Baclaran	24	1.7%
1008	LRT 1 - D. Jose	1020	LRT 1 - Roosevelt	6	0.4%
1009	LRT 1 - Carriedo	1017	LRT 1 - EDSA/Taft	9	0.6%
1009	LRT 1 - Carriedo	1018	LRT 1 - Baclaran	23	1.6%
1009	LRT 1 - Carriedo	1020	LRT 1 - Roosevelt	9	0.6%
1010	LRT 1 - Central Station	1017	LRT 1 - EDSA/Taft	7	0.5%
1010	LRT 1 - Central Station	1018	LRT 1 - Baclaran	16	1.1%
1010	LRT 1 - Central Station	1020	LRT 1 - Roosevelt	9	0.6%
1011	LRT 1 - U.N. Avenue	1017	LRT 1 - EDSA/Taft	22	1.5%
1011	LRT 1 - U.N. Avenue	1018	LRT 1 - Baclaran	27	1.9%
1011	LRT 1 - U.N. Avenue	1020	LRT 1 - Roosevelt	7	0.5%
1012	LRT 1 - Pedro Gil	1017	LRT 1 - EDSA/Taft	6	0.4%
1012	LRT 1 - Pedro Gil	1018	LRT 1 - Baclaran	14	1.0%
1012	LRT 1 - Pedro Gil	1020	LRT 1 - Roosevelt	7	0.5%
1013	LRT 1 - Quirino Avenue	1017	LRT 1 - EDSA/Taft	4	0.3%
1013	LRT 1 - Quirino Avenue	1018	LRT 1 - Baclaran	10	0.7%
1013	LRT 1 - Quirino Avenue	1020	LRT 1 - Roosevelt	4	0.3%
1014	LRT 1 - Vito Cruz	1017	LRT 1 - EDSA/Taft	4	0.3%
1014	LRT 1 - Vito Cruz	1018	LRT 1 - Baclaran	4	0.3%
1014	LRT 1 - Vito Cruz	1020	LRT 1 - Roosevelt	10	0.7%
1015	LRT 1 - Gil Puyat	1017	LRT 1 - EDSA/Taft	1	0.1%
1015	LRT 1 - Gil Puyat	1018	LRT 1 - Baclaran	4	0.3%
1015	LRT 1 - Gil Puyat	1020	LRT 1 - Roosevelt	6	0.4%
1016	LRT 1 - Libertad	1018	LRT 1 - Baclaran	2	0.1%
1016	LRT 1 - Libertad	1020	LRT 1 - Roosevelt	4	0.3%

Boarding Station		Alighting Station		Sample	Share (%)
Code	Station Name	Code	Station Name		
1017	LRT 1 - EDSA/Taft	1001	LRT 1 - Monumento	9	0.6%
1017	LRT 1 - EDSA/Taft	1002	LRT 1 - 5th Avenue	9	0.6%
1017	LRT 1 - EDSA/Taft	1003	LRT 1 - R. Papa	1	0.1%
1017	LRT 1 - EDSA/Taft	1005	LRT 1 - Blumentritt	8	0.6%
1017	LRT 1 - EDSA/Taft	1006	LRT 1 - Tayuman	10	0.7%
1017	LRT 1 - EDSA/Taft	1007	LRT 1 - Bambang	1	0.1%
1017	LRT 1 - EDSA/Taft	1008	LRT 1 - D. Jose	9	0.6%
1017	LRT 1 - EDSA/Taft	1009	LRT 1 - Carriedo	5	0.4%
1017	LRT 1 - EDSA/Taft	1010	LRT 1 - Central Station	8	0.6%
1017	LRT 1 - EDSA/Taft	1011	LRT 1 - U.N. Avenue	8	0.6%
1017	LRT 1 - EDSA/Taft	1012	LRT 1 - Pedro Gil	14	1.0%
1017	LRT 1 - EDSA/Taft	1013	LRT 1 - Quirino Avenue	4	0.3%
1017	LRT 1 - EDSA/Taft	1014	LRT 1 - Vito Cruz	9	0.6%
1017	LRT 1 - EDSA/Taft	1015	LRT 1 - Gil Puyat	1	0.1%
1017	LRT 1 - EDSA/Taft	1018	LRT 1 - Baclaran	4	0.3%
1017	LRT 1 - EDSA/Taft	1019	LRT 1 - Balintawak	2	0.1%
1017	LRT 1 - EDSA/Taft	1020	LRT 1 - Roosevelt	13	0.9%
1018	LRT 1 - Baclaran	1001	LRT 1 - Monumento	31	2.2%
1018	LRT 1 - Baclaran	1002	LRT 1 - 5th Avenue	12	0.8%
1018	LRT 1 - Baclaran	1003	LRT 1 - R. Papa	9	0.6%
1018	LRT 1 - Baclaran	1004	LRT 1 - Abad Santos	5	0.4%
1018	LRT 1 - Baclaran	1005	LRT 1 - Blumentritt	10	0.7%
1018	LRT 1 - Baclaran	1006	LRT 1 - Tayuman	13	0.9%
1018	LRT 1 - Baclaran	1007	LRT 1 - Bambang	1	0.1%
1018	LRT 1 - Baclaran	1008	LRT 1 - D. Jose	27	1.9%
1018	LRT 1 - Baclaran	1009	LRT 1 - Carriedo	19	1.3%
1018	LRT 1 - Baclaran	1010	LRT 1 - Central Station	13	0.9%
1018	LRT 1 - Baclaran	1011	LRT 1 - U.N. Avenue	12	0.8%
1018	LRT 1 - Baclaran	1012	LRT 1 - Pedro Gil	11	0.8%
1018	LRT 1 - Baclaran	1013	LRT 1 - Quirino Avenue	9	0.6%
1018	LRT 1 - Baclaran	1014	LRT 1 - Vito Cruz	3	0.2%
1018	LRT 1 - Baclaran	1015	LRT 1 - Gil Puyat	7	0.5%
1018	LRT 1 - Baclaran	1016	LRT 1 - Libertad	5	0.4%
1018	LRT 1 - Baclaran	1017	LRT 1 - EDSA/Taft	4	0.3%
1018	LRT 1 - Baclaran	1018	LRT 1 - Baclaran	3	0.2%
1018	LRT 1 - Baclaran	1019	LRT 1 - Balintawak	5	0.4%
1018	LRT 1 - Baclaran	1020	LRT 1 - Roosevelt	10	0.7%
1019	LRT 1 - Balintawak	1017	LRT 1 - EDSA/Taft	6	0.4%
1019	LRT 1 - Balintawak	1018	LRT 1 - Baclaran	5	0.4%
1020	LRT 1 - Roosevelt	1001	LRT 1 - Monumento	2	0.1%
1020	LRT 1 - Roosevelt	1002	LRT 1 - 5th Avenue	4	0.3%
1020	LRT 1 - Roosevelt	1003	LRT 1 - R. Papa	3	0.2%
1020	LRT 1 - Roosevelt	1004	LRT 1 - Abad Santos	5	0.4%
1020	LRT 1 - Roosevelt	1005	LRT 1 - Blumentritt	6	0.4%
1020	LRT 1 - Roosevelt	1006	LRT 1 - Tayuman	6	0.4%
1020	LRT 1 - Roosevelt	1007	LRT 1 - Bambang	2	0.1%
1020	LRT 1 - Roosevelt	1008	LRT 1 - D. Jose	9	0.6%
1020	LRT 1 - Roosevelt	1009	LRT 1 - Carriedo	6	0.4%
1020	LRT 1 - Roosevelt	1010	LRT 1 - Central Station	6	0.4%
1020	LRT 1 - Roosevelt	1011	LRT 1 - U.N. Avenue	13	0.9%
1020	LRT 1 - Roosevelt	1012	LRT 1 - Pedro Gil	6	0.4%
1020	LRT 1 - Roosevelt	1013	LRT 1 - Quirino Avenue	6	0.4%
1020	LRT 1 - Roosevelt	1014	LRT 1 - Vito Cruz	9	0.6%
1020	LRT 1 - Roosevelt	1015	LRT 1 - Gil Puyat	6	0.4%
1020	LRT 1 - Roosevelt	1016	LRT 1 - Libertad	4	0.3%
1020	LRT 1 - Roosevelt	1017	LRT 1 - EDSA/Taft	9	0.6%
1020	LRT 1 - Roosevelt	1018	LRT 1 - Baclaran	8	0.6%

Boarding Station		Alighting Station		Sample	Share (%)
Code	Station Name	Code	Station Name		
2001	LRT 2 - Santolan	2003	LRT 2 - Anonas	1	0.1%
2001	LRT 2 - Santolan	2004	LRT 2 - Cubao/Araneta	44	3.1%
2001	LRT 2 - Santolan	2005	LRT 2 - Betty Go Belmonte	2	0.1%
2001	LRT 2 - Santolan	2006	LRT 2 - Gilmore	5	0.4%
2001	LRT 2 - Santolan	2007	LRT 2 - J. Ruiz	3	0.2%
2001	LRT 2 - Santolan	2008	LRT 2 - V. Mapa	16	1.1%
2001	LRT 2 - Santolan	2009	LRT 2 - Pureza	25	1.8%
2001	LRT 2 - Santolan	2010	LRT 2 - Legarda	37	2.6%
2001	LRT 2 - Santolan	2011	LRT 2 - Recto	68	4.8%
2002	LRT 2 - Katipunan	2001	LRT 2 - Santolan	4	0.3%
2003	LRT 2 - Anonas	2001	LRT 2 - Santolan	8	0.6%
2004	LRT 2 - Cubao/Araneta	2001	LRT 2 - Santolan	14	1.0%
2005	LRT 2 - Betty Go Belmonte	2001	LRT 2 - Santolan	1	0.1%
2006	LRT 2 - Gilmore	2001	LRT 2 - Santolan	14	1.0%
2007	LRT 2 - J. Ruiz	2001	LRT 2 - Santolan	3	0.2%
2008	LRT 2 - V. Mapa	2001	LRT 2 - Santolan	10	0.7%
2009	LRT 2 - Pureza	2001	LRT 2 - Santolan	18	1.3%
2010	LRT 2 - Legarda	2001	LRT 2 - Santolan	40	2.8%
2011	LRT 2 - Recto	2001	LRT 2 - Santolan	88	6.2%
3001	MRT 3 - North Avenue	3013	MRT 3 - Taft Avenue	13	0.9%
3002	MRT 3 - Quezon Avenue	3013	MRT 3 - Taft Avenue	18	1.3%
3003	MRT 3 - GMA/Kamuning	3013	MRT 3 - Taft Avenue	3	0.2%
3004	MRT 3 - Cubao	3013	MRT 3 - Taft Avenue	18	1.3%
3005	MRT 3 - Santolan/Crame	3013	MRT 3 - Taft Avenue	4	0.3%
3006	MRT 3 - Ortigas	3013	MRT 3 - Taft Avenue	8	0.6%
3007	MRT 3 - Shaw Blvd.	3013	MRT 3 - Taft Avenue	28	2.0%
3008	MRT 3 - Boni	3013	MRT 3 - Taft Avenue	6	0.4%
3009	MRT 3 - Guadalupe	3013	MRT 3 - Taft Avenue	6	0.4%
3010	MRT 3 - Buendia	1020	LRT 1 - Roosevelt	1	0.1%
3010	MRT 3 - Buendia	3013	MRT 3 - Taft Avenue	2	0.1%
3011	MRT 3 - Ayala	3013	MRT 3 - Taft Avenue	1	0.1%
3013	MRT 3 - Taft Avenue	3001	MRT 3 - North Avenue	17	1.2%
3013	MRT 3 - Taft Avenue	3002	MRT 3 - Quezon Avenue	12	0.8%
3013	MRT 3 - Taft Avenue	3003	MRT 3 - GMA/Kamuning	5	0.4%
3013	MRT 3 - Taft Avenue	3004	MRT 3 - Cubao	18	1.3%
3013	MRT 3 - Taft Avenue	3005	MRT 3 - Santolan/Crame	4	0.3%
3013	MRT 3 - Taft Avenue	3006	MRT 3 - Ortigas	14	1.0%
3013	MRT 3 - Taft Avenue	3007	MRT 3 - Shaw Blvd.	13	0.9%
3013	MRT 3 - Taft Avenue	3008	MRT 3 - Boni	7	0.5%
3013	MRT 3 - Taft Avenue	3009	MRT 3 - Guadalupe	9	0.6%
3013	MRT 3 - Taft Avenue	3010	MRT 3 - Buendia	3	0.2%
3013	MRT 3 - Taft Avenue	3011	MRT 3 - Ayala	5	0.4%
3013	MRT 3 - Taft Avenue	3012	MRT 3 - Magallanes	1	0.1%
3013	MRT 3 - Taft Avenue	3013	MRT 3 - Taft Avenue	1	0.1%
Total	-	-	-	1,423	100.0%

回答者の OD パターンを表 34 に示す。これは、都市・地域間流入を示す。

表 5 回答者の OD パターン

O/D	Alfonso	Angono	Antipolo	Bacoor	Binangonan	Cainta	Caloocan City	Dasmarinas	Dona Remedios Trinidad	General Trias	Imus	Indang	Las Pinas City	Makati City	Malabon City	Mandaluyong City	Manila	Marikina City	Morong	Muntinlupa City	Naic	Navotas City	Paranaque City	Pasay City	Pasig City	Pateros	Quezon City	Rodriguez	Rosario	San Juan	San Mateo	San Pedro	Taguig City	Tanza	Taytay	Trece Martires	Valenzuela City	Total	Share (%)
Alfonso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.1%
Angono	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.2%
Antipolo	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	29	0	0	1	0	1	0	0	0	0	13	0	0	3	0	0	0	0	0	0	51	3.8%
Bacoor	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3	8	0	0	0	0	1	0	0	0	0	7	0	0	0	0	0	0	0	0	0	21	1.5%
Binangonan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.2%
Cainta	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	30	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	1	0	37	2.6%
Caloocan City	0	1	2	1	0	3	1	1	0	0	0	0	1	2	0	3	7	0	0	1	0	0	7	7	0	0	6	0	0	1	0	0	1	1	1	1	48	3.4%
Cardona	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Carmona	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Cavite City	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Dasmarinas	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	10	0.7%
Dona Remedios Trinidad	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	1	2	0	0	0	0	0	5	10	0	0	0	0	0	0	0	0	1	0	0	0	23	1.6%
General Trias	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	0.1%
Imus	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	1	8	0.6%
Jalajala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Las Pinas City	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	0	0	1	18	1.3%
Makati City	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	26	0	0	0	0	0	3	3	3	0	5	0	0	0	1	0	0	0	1	0	47	3.3%
Malabon City	0	0	0	1	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	0	0	5	1	3	0	1	0	0	0	0	0	0	0	0	0	15	1.1%
Mandaluyong City	1	0	0	2	0	0	2	3	0	0	3	0	0	0	0	0	12	1	0	0	1	0	1	12	0	0	1	0	0	0	0	0	0	1	0	0	40	2.8%
Manila	0	24	26	7	5	31	6	5	2	0	0	0	9	13	1	13	28	1	1	10	0	0	50	71	28	1	67	2	1	2	6	0	11	0	13	0	3	441	31.2%
Marikina City	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	6	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	14	1.0%
Morong	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Muntinlupa City	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	8	0.6%
Naic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	0.2%
Navotas City	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1%
Noveleta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Pasay City	0	0	2	0	0	0	14	0	3	0	0	0	0	3	5	5	61	0	0	0	0	0	3	17	3	1	33	1	1	0	1	1	1	0	0	0	11	169	12.0%
Pasig City	0	1	1	1	0	0	5	0	0	0	0	0	0	2	0	0	43	3	0	0	0	0	2	2	0	0	16	0	0	2	0	0	0	0	0	0	78	5.5%
Pateros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Pililla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1%
Quezon City	0	3	9	6	5	6	5	3	1	1	5	0	2	5	0	2	73	1	0	1	0	0	16	39	4	0	3	1	0	0	0	0	2	1	7	0	0	202	14.3%
Rodriguez	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0.2%
Rosario	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1%
San Juan	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	0	8	0.6%
San Mateo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1%
San Pedro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1%
Silang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Tagaytay	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Taguig City	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	12	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	19	1.3%
Tanay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0.1%
Tanza	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.3%
Taytay	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	19	1.3%
Teresa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1%
Trece Martires	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	3	0.2%
Valenzuela City	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	4	3	0	0	0	0	1	0	0	0	0	0	0	0	13	0.9%
Total	1	29	43	22	13	42	50	16	14	1	8	1	18	31	8	36	435	10	1	15	1	4	102	181	43	2	192	4	3	9	8	1	17	3	26	1	21	1412	100.0%
Share (%)	0.1%	2.1%	3.0%	1.6%	0.9%	3.0%	3.5%	1.1%	1.0%	0.1%	0.6%	0.1%	1.3%	2.2%	0.6%	2.5%	30.8%	0.7%	0.1%	1.1%	0.1%	0.3%	7.2%	12.8%	3.0%	0.1%	13.6%	0.3%	0.2%	0.6%	0.6%	0.1%	1.2%	0.2%	1.8%	0.1%	1.5%	100.0%	

出発地点から乗車地点までのモードの分布を**表 5** と**表 36** に示す。

表 5 出発地から乗車駅までのモード配分

Mode	LRT 1	LRT 2	MRT 3	Total	Share (%)
1. Cyclo/Motorcycle/Tricycle	58	35	8	101	7.1%
2. Private Car/Sedan/SUV/Open Back	13	17	4	34	2.4%
3. Delivery Vehicles, 2-Axle Truck and Other -Axle Veh.	0	0	0	0	0.0%
4. Trucks and Other Delivery Vehicles (3 or more Axle)	0	0	0	0	0.0%
5. Public Taxi	3	1	1	5	0.4%
6. AUV/Public FX	13	32	3	48	3.4%
7. Jeepney	274	182	91	547	38.4%
8. Mini-Bus	5	1	2	8	0.6%
9. Metro Manila Bus (Regular or Aircon)	44	2	9	55	3.9%
10. Long Distance Bus (Provincial Bus	39	1	12	52	3.7%
11. LRT/MRT	55	24	41	120	8.4%
12. Others	302	106	45	453	31.8%
Total	806	401	216	1,423	100.0%
Share (%)	56.6%	28.2%	15.2%	100.0%	-

表 5 乗車駅までのその他移動手段

Other Mode	LRT 1	LRT 2	MRT 3	Total
SERVICE	1	0	0	1
SIDECAR	1	0	0	1
UNDEFINED	2	4	0	6
WALK	298	102	45	445
Total	302	106	45	453
Share (%)	66.7%	23.4%	9.9%	100.0%

降車駅から目的地までの利用モード分布を**表 5** と**表 5** に示す。

表 5 降車駅から目的地までのモード配分

Mode	LRT 1	LRT 2	MRT 3	Total	Share (%)
1. Cyclo/Motorcycle/Tricycle	48	21	5	74	5.2%
2. Private Car/Sedan/SUV/Open Back	10	7	5	22	1.5%
3. Delivery Vehicles, 2-Axle Truck and Other -Axle Veh.	0	0	0	0	0.0%
4. Trucks and Other Delivery Vehicles (3 or more Axle)	0	0	0	0	0.0%
5. Public Taxi	4	1	1	6	0.4%
6. AUV/Public FX	14	82	7	103	7.2%
7. Jeepney	325	166	72	563	39.6%
8. Mini-Bus	8	0	1	9	0.6%
9. Metro Manila Bus (Regular or Aircon)	44	11	11	66	4.6%
10. Long Distance Bus (Provincial Bus	18	1	20	39	2.7%
11. LRT/MRT	19	26	26	71	5.0%
12. Others	316	86	68	470	33.0%
Total	806	401	216	1,423	100.0%
Share (%)	56.6%	28.2%	15.2%	100.0%	-

表 5 目的地までのその他移動手段

Other Mode	LRT 1	LRT 2	MRT 3	Total
PEDICAB	1	0	0	1
SERVICE	1	0	0	1
UNDEFINED	5	13	0	18
WALK	309	73	68	450
Total	316	86	68	470
Share (%)	67.2%	18.3%	14.5%	100.0%

付属資料 E:　環境マネジメント計画

付属資料 E-1　LRT 1 号線カビテ延伸事業の環境管理計画 JICA モニタリングフォーム

表 1　工事期間

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/ Total, etc)	Philippine Standards/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
Construction of guideway, depots, and stations	Local economy (Employment)	Hire unskilled labor (>50%) and skilled labor (>30%) from the vicinity of the project sites	Employment rate	Barangays in the vicinity	Employment record		RA 6685		LRTA	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Traffic congestion	Traffic Management Plan	Continuous flow of traffic	All construction sites	Daily monitoring for a construction period		-		LRTA/MMDA/ LGUs/	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Community Health and Safety	Public Meetings	Opinions, grievance	Barangays in the vicinity	For a construction period		-		DPWH/ MMDA/LGUs	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Relocation	Entitlement in accordance with Resettlement Action Plan	Progress of RAP Reports of grievance	Affected project sites	Refer to Resettlement Action Plan		Resettlement Action Plan		LRTA/ Interagency Executive and Technical Working Committees	・Submitted annually by RAP monitoring form to DOTC and JICA
Labor Camp	Occupational Health and Safety	Supply the works: -clean water and safe food -toilets/sewage treatment facilities -domestic solid waste management	Camp conditions	All camps	Weekly inspection		The Philippines Occupational Safety and Health Standards (As Amended), 1992		LRTA	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Loss of trees	Tree replanting should be implemented Regular monitoring of replanted trees	Cutting trees and progress of replanting	Replanted sites	Visual inspection of tree growth		-		LRTA/LGUs DENR	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Air pollution	Dust control measures: sprinkling of water; covers of the trucked material during transportation; locate the stockyard away from residential and sensitive areas Pollutant emission control measures: low emission construction vehicles, maintenance and inspection.	Ambient air quality TSP, NO_2, SO_2	Construction sites	Methods specified by the Implementing Rules and Regulations of the Philippine Clean Air Act of 1999 Weekly during construction		The Implementing Rules and Regulations of the Philippine Clean Air Act of 1999 WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005		LRTA/ DENR	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Noise and vibrations	Proper service of equipment; installation of sound barriers for pile driving activity; mufflers and noise suppressors and regular maintenance of heavy equipment, construction machinery; use low-noise construction machines and heavy vehicles; construction activities to be restricted during day time hours only; inform construction schedule to residents in advance.	Noise level: L_{Aeq} (day and night)	Construction sites	Methods specified by the National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78-Ambient Noise Quality and Emission Standards for Noise Weekly during construction		NPCC Memorandum Circular No. 002 Series of 1980, Section 78-Ambient Noise Quality and Emission Standards for Noise General EHS Guidelines; Environmental Noise Management, IFC 2007		LRTA/DENR	・Quarterly Monitoring Report submitted to DOTC and JICA

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/ Total, etc)	Philippine Standards/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
			Vibration acceleration	Construction sites	Methods specified by the 2002/44/EC (EC Vibration Directive) or American Conference of Industrial Hygienists (ACGIH) Weekly during construction		2002/44/EC (EC Vibration Directive) or American Conference of Industrial Hygienists (ACGIH)		LRTA/DENR	・Quarterly Monitoring Report submitted to DOTC and JICA
Dredging, excavation and construction of guideway columns, depots and stations	Surface water quality degradation	Monitoring of TSS to avoid large increase of turbidity in surface water. To use the less turbidity-diffusive dredging method.	Surface water quality (TSS, BOD, Oil/Grease)	Construction sites of bridges and satellite depot	Methods specified by the Revised Effluent Regulations of 1990, Revising and Amending the Effluent Regulations of 1992 Monthly during construction		The Revised Effluent Regulations of 1990, Revising and Amending the Effluent Regulations of 1992		LRTA/ DENR	・Quarterly Monitoring Report submitted to DOTC and JICA
	Groundwater quality degradation due to excavation of the landfill area	Location of aquifer zones will be studied before any excavation activity is started in the landfill areas.	Groundwater quality (Total Coliform)	Excavation site close to the existing deep wells						
Dredging, excavation and construction of guideway columns and satellite depot	Sediment and water quality deterioration	Monitor the present sediment quality before dredging and excavation.	Sediment quality: Organic compound and Nutrients, Heavy metals, Persistent Organic Pollutants (POPs), Polycyclic Aromatic Hydrocarbons (PAHs)	Piling sites and Satellite depot (where waste soil and sand are generated from dredging and excavation)	Before dredging and excavation		Centre for Environment, Fisheries & Aquaculture Science (CEFAS) Guideline Action Levels (2003)		LRTA/ DENR	・Quarterly Monitoring Report submitted to DOTC and JICA
Construction of guideway, depots and stations	Waste generation	Solid Waste Management Plan. Proper implementation of separate collection and disposal	Site conditions and cleanliness	All construction sites and labor camp	Daily site inspection		Ecological Solid Waste Management Act of 2001		LRTA/DENR	・Quarterly Monitoring Report submitted to DOTC and JICA

出典：調査団

表 2　供用後

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/Total, etc)	Philippine Standards/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
Construction of guideway, depots and stations	Loss of trees including mangroves	Monitor the growth of replanting trees	Trees' height and diameter	Replanting sites	Once a year		-		LRTA/DENR/ LGUs	・Annual Monitoring Report submitted to DOTC and JICA
Reclamation	Subsidence	Regular monitoring of ground settlement at reclaimed areas	Settlement	Reclaimed area	Once a year		-		LRTA	・Annual Monitoring Report submitted to DOTC and JICA
Wastewater treatment at stations and depots	Surface water quality degradation	Proper operation and maintenance of wastewater treatment facilities at stations and depots	Effluent water quality (pH, TSS, BOD, COD, Oil/Grease, Phenol, Fiscal Coliforms)	Wastewater treatment facilities at stations and depots	Methods specified by the Revised Effluent Regulations of 1990, Revising and Amending the Effluent Regulations of 1992 2times per year		The Revised Effluent Regulations of 1990, Revising and Amending the Effluent Regulations of 1992		LRTA/ DENR	・Biannual Monitoring Report submitted to DOTC and JICA
Operation at the stations and depots	Waste generation	Proper implementation of separate collection and disposal	Cleanliness	Stations and depots	Site Monitoring		Ecological Solid Waste Management Act of 2001		LRTA/MMDA / LGUs	・Biannual Monitoring Report submitted to DOTC and JICA
Train operation	Noise and vibration	Noise and vibration attenuation measures: installation of noise barriers or shock absorber pads and ballast	Noise level: L_{Aeq} (day and night)	Noise sensitive areas such as residential area, school religious facilities along the extension line	Methods specified by the National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78-Ambient Noise Quality and Emission Standards for Noise 2times per year		NPCC Memorandum Circular No. 002 Series of 1980, Section 78-Ambient Noise Quality and Emission Standards for Noise General EHS Guidelines; Environmental Noise Management, IFC 2007		LRTA/ DENR	・Biannual Monitoring Report submitted to DOTC and JICA
			Vibration acceleration	Sensitive areas such as residential area, school religious facilities along the extension line	Methods specified by the 2002/44/EC (EC Vibration Directive) or American Conference of Industrial Hygienists (ACGIH) 2times per year		2002/44/EC (EC Vibration Directive) or American Conference of Industrial Hygienists (ACGIH)		LRTA/ DENR	・Biannual Monitoring Report submitted to DOTC and JICA
Relocation	Living and livelihood of relocation families	Livelihood restoration program in accordance with Resettlement Action Plan	Living and livelihood conditions	Relocation site at Gen. Trias, Cavite	Refer to Resettlement Action Plan		Resettlement Action Plan		LRTA/Cavite Provincial Government	・Submitted annually by RAP monitoring form to DOTC and JICA
Operation of trains and stations	Congestion and disorder	•Efficient traffic management measures and parking restrictions •Efficient of public and private transit operations	Traffic congestion	All stations with intermodal facilities	Daily site patrol		Traffic Management Plan		LRTA/MMDA /LGUs	・Biannual Monitoring Report submitted to DOTC and JICA

出典：調査団

付属資料 E-2　補足環境アセスメント調査

動植物調査結果

I.　植物

1.　イントロダクション

環境アセス調査対象地は、ラスピニャス市サポテ・バランガイ近辺の Coastal Road 沿いのマニラ湾の東岸から数百メートル内陸に位置する湿地帯である。マニラ湾内に残存するマングローブ植生の数少ない土地の一つである。植民地時代及びそれ以前からマングローブが豊富にあったことより、マニラは「nilad (*Scyphiflora hydrophyllacea*)」と呼ばれるマングローブ種の名前からとったことは有名な話である。

人の居住地の侵入した地区は汚染され悪化した状態にある。人の家屋、掘立小屋がない場所では、植生はどうにか生き残っている。2 つの主な植生タイプがあり、比較的乾いた地帯の草地と沼地帯のマングローブである。

2.　調査方法

6 月 16 日及び 23 日に現地で植物調査を行った。人が居住する場所、していない場所の両方とも調査を行った。現場を歩行調査する間に目視された樹木、低木、草木、ツル植物を同定し記録した。また写真を撮るとともに、証拠標本も同定を助けるために採取された。

3.　調査結果

調査対象地で確認された樹木種を表 1 に、低木、草木及び他の樹木種でない植物種を表 2 の一覧に示す。経済的に価値がある、また生態学的に需要な種が同定された場合も表に示した。

表 1　調査対象地で見られる樹木種

Family	Species	Common name	Endemicity	Economic/ecological importance	IUCN *1	Philippine *2
Acanthaceae	*Avicennia marina*	Api-api	Native	Mangrove species	LC	-
Annonaceae	*Annona squamosa*	Atis	Introduced	Fruit crop	NE	-
Combretaceae	*Terminalia catappa*	Talisay	Native	Fruits edible	NE	-
Fabaceae	*Pithecellobium dulce*	Camachile	Introduced	Fruit crop	NE	-
Fabaceae	*Leucaena leucocephala*	Ipil-ipil	Introduced	Fuel wood	NE	-
Fabaceae	*Albizia* sp.		Not determined	Not determined	NE	-
Fabaceae	*Tamarindus indicus*	Sampaloc	Introduced	Fruit crop	NE	
Fabaceae	*Gliricidia sepium*	Kakawate	Introduced	Fuel wood	NE	-
Malvaceae	*Thespesia populnea*	Portia tree	Introduced	Ornamental	NE	-
Moraceae	*Ficus religiosa*	Bo tree	Introduced	Ornamental	NE	-
Moraceae	*Ficus septica*	Hauili	Native	Fruits provide food for bats and other wildlife; medicinal value	NE	-
Moringaceae	*Moringa oleifera*	Malunggay	Introduced	Food source; medicinal value	NE	-
Muntingiaceae	*Muntingia calabura*	Aratiles	Introduced	Fruits edible	NE	-
Myrtaceae	*Syzygium cumini*	Duhat	Native	Fruit crop	NE	-
Palmae	*Cocos nucifera*	Coconut	Native	Fruit crop, fiber source, lumber	NE	-
Palmae	*Nypa fruticans*	Nipa	Native	Roof material	LC	-

出典：調査団

Note:
1) IUCN 2012. The IUCN Red List of Threatened Species, Version 2012.1.
2) DAO No. 2004-15, Establishing the National List of Threatened Philippine Plants and Their Categories, and the List of Other Wildlife Species.
3) (-): Not fall under any of the categories.

表 2 調査対象地で見られる低木、草木、その他の植物種

Family	Species	Common name	Endemicity	Economic/ecological importance	IUCN[*1]	Philippine[*2]
Araceae	*Colocasia esculenta*	Gabi	Native	Root crop	LC	-[*3]
Asteraceae	*Chromolaena odorata*	Hagonoy	Introduced	Medicinal	NE	-
Asteraceae	*Blumea balsamifera*	Sambong	Native	Medicinal	NE	-
Caricaceae	*Carica papaya*	Papaya	Introduced	Fruit crop	NE	-
Convolvulaceae	*Ipomoea batatas*	Camote	Introduced	Food source	NE	-
Cucurbitaceae	*Coccinia* sp.		Introduced	Fruits provide food for birds	NE	-
Cyperaceae	*Cyperus* spp.	(sedges)	Introduced		NE	-
Euphorbiaceae	*Ricinus communis*	Castor plant	Introduced	Medicinal	NE	-
Euphorbiaceae	*Manihot esculenta*	Cassava	Introduced	Root crop	NE	-
Fabaceae	*Acacia farnesiana*	Aroma	Introduced	Invasive	NE	-
Malvaceae	*Sida rhombifolia*		Introduced	Medicinal	NE	-
Malvaceae	*Hibiscus esculentus*	Okra	Introduced	Fruit crop	NE	-
Musaceae	*Musa paradisiaca*	Banana	Introduced	Fruit crop	NE	-
Poaceae	*Panicum* sp.	(grass)	Native		NE	-
Poaceae	*Eleusine* sp.	(grass)	Native		NE	-
Poaceae	*Saccharum* sp.	Sugarcane	Native	Crop	NE	-
Portulacaceae	*Talinum triangulare*	Purslane	Introduced	Leaves are edible	NE	-
Verbenaceae	*Clerodendrum inerme*	Seaside clerodendrum	Introduced	Ornamental	NE	-

出典：調査団

Note:
1) IUCN 2012. The IUCN Red List of Threatened Species, Version 2012.1.
2) DAO No. 2004-15, Establishing the National List of Threatened Philippine Plants and Their Categories, and the List of Other Wildlife Species.
3) (-): Not fall under any of the categories.

4. 考察

調査対象となった樹木や植物の種のほとんどは、おそらく集落の住民によって植えられたであろうバンレイシ（*Annona squamosa*）、タマリンド（*Tamarindus indicus*）、タリサイ（*Terminalia catappa*） 等の果樹や観賞植物であった。また、住民のかなには自給自足農を営み、キャッサバ（*Manihot esculenta*）、サツマイモ（*Ipomoea batatas*）などを植えていた。他の植物は、高度に攪乱された生息地において典型的な雑草や草原種であった。

調査の結果、最も豊富な樹種はヒルギダマシ（Avicennia marina）と呼ばれるマングローブであった。マニラ湾全体は歴史的に広大なマングローブ生態系で覆われていたことより予想されるところである。残念なことに、豊かで多様な生物群であったものが、ほんの一握りの種まで破壊されてしまった。

絶滅危惧種：

調査結果で報告された種は、表 1 及び 2 に示すように。いずれも絶滅危惧種（絶滅危惧 IA 類、絶滅危惧 IB、絶滅危惧Ⅱ類）に分類される種ではなかった。

1) IUCN レッドリスト

国際自然保護連合（IUCN）によると、生物種は、減少率、集団の大きさ、生息分布域、集団と分布の分断等のクライテリアにより、以下のように 9 グループに分類されている。IUCN レッドリストでは、公式に「節滅危惧種」とは、「絶滅危惧 IA 類」、「絶滅危惧 IB 類」および「絶滅危惧Ⅱ類」の 3 つの分類のグループである。

- EX（絶滅）：すでに絶滅したと考えられる種
- EW（野生絶滅）：飼育・栽培下であるいは過去の分布域外に、個体（個体群）が帰化して生息している状態のみ生存している種
- CR（絶滅危惧 IA 類）：ごく近い将来における野生で絶滅の危険性が極めて高いもの
- EN（絶滅危惧 IB 類）：IA 類ほどではないが、近い将来における野生での絶滅の危険性が高いもの
- VU（絶滅危惧 II 類）：絶滅の危険が増大している種。現在の状態をもたらした圧迫要因が引き続いて作用する場合、近い将来「絶滅危惧 I 類」のランクに移行することが確実と考えられるもの
- NT（準絶滅危惧）：存続基盤が脆弱な種。現時点での絶滅危険度は小さいが、生息条件の変化によっては「絶滅危惧」として上位ランクに移行する要素を有するもの
- LC（軽度懸念）：基準に照らし、上記のいずれにも該当しない種。分布が広いものや、個体数の多い種がこのカテゴリに含まれる。
- DD（情報不足）：評価するだけの情報が不足している種
- NE（未評価）：クライテリアでは未評価

2) DAO No. 2007-01、絶滅の恐れのあるフィリピンの植物種とそのカテゴリ、及び他の野生種に関する国家リスト

「絶滅の恐れのあるフィリピンの植物種とそのカテゴリ、及び他の野生種に関する国家リスト」では、以下の分類が使われている。

- CR（近絶滅種）：野生において極めて高い絶滅のリスクがある種
- EN（絶滅危惧種）：CR ではないがその要因が続くならば野生では生存が難しい種
- VU（危急種）：野生において高いがリスクある種
- その他の危惧種： CR、EN あるいは VU でないが乱獲等の他の悪要因により危惧される種
- その他の野生種：生息地の破壊や他の要因により絶滅の脅威にはさらされていない植物種

5. 植物調査時の写真

Photo 1. Shanties and human settlements typically found in the site

Photo 2. The site is highly polluted with domestic sources of garbage and other effluents

Photo 3. Grassland vegetation type

Photo 4. Mangrove vegetation type

Photo 5. Subsistence farming is practiced by some residents.

Photo 6. *Avicennia marina*, the mangrove species that is most abundant in the site.

II. 動物

1. 調査方法

鳥類の調査は基本的にトランセクト法/目視法を、また、他の野生動物グループに対しては、目視による観察及び可能な限り民族生物学的聞き取り調査を実施した。鳥類以外の他の分類群の情報は、公表された種、フィールドガイドやマニュアル、マニラ湾の沿岸地域における従前の調査からのデータを参照している。鳥類のトランセクト調査、他の脊椎動物に対する目視調査の詳細について以下に考察する。

1) 鳥類調査

2012 年 6 月 16－23 日、JICA 調査で提案されたカビテ州バコール市サポテにおける LRT1 号線延伸事業のサテライトデポにおいて、鳥類は系統的に調査された（昼行性のみで夜行性の鳥類は実施していない）。この調査のような短時間の現場評価法では、鳥類はその地域の全体的な動物構成を評価するための代理として利用される。鳥類は、他の動物、例えば、罠やかすみ網での捕獲が必要な小型哺乳哺乳類や爬虫類と異なり、簡単に観察することができる。トランセクト法による鳥観察は、短時間の現場評価を実施するため、広く用いられている標準的な方法であり、専門家でない人間による継続監視にも適している（Herzog et al. 2002）。現場で集められたデータは、目視法及び鳴き声による観察に基づく種リストと個体数を含む（Bibby et al. 1992）。鳥類名はフィリピンの鳥類に関し公表されている記事（Kennedy et al. 2000）に従った。

2) 他の野生動物インベントリ

両生類、小型哺乳類、または爬虫類等の他の動物グループは、鳥類のラインとランセクト調査中に目視により発見したものを同定した。齧歯類やコウモリ等の種のインベントリは、過去の記録、公表された情報やフィールドガイド、例えば、コウモリ（Ingle and Heaney 1992）、両生類（Alcala and Brown 1998）、爬虫類（Global Reptiles Database）から推察された。

3) 絶滅危惧種及び貴重種

対象地の動物種インベントリは、国際自然保護連合（IUCN 2011）により更新されたリスト、絶滅のおそれのある野生動植物の種の国際取引に関する条約（CITES）、移動性野生動物種の保全に関する条約（CMS）などに基づき、絶滅の恐れのある種、保護種、保護すべき種などに挙げられていないか確認した。さらに、フィリピンの国内法、特に野生生物資源の保全及び保護法（RA No.9147）で危惧種されている種についてレビューした。

2. 調査結果

1) 鳥類

カビテ郡ラスピニャスの事業地予定地全域で計 14 種の鳥が観察された。種の大半は留鳥、または、フィリピンの島々だけでなく、東南アジアの他地域で見つけることができる種であった。このタイプの種は、地理的に広範囲に分布していると考えられる。このうち 3 種は渡り鳥と国内では繁殖していない種であった。渡り鳥は、地域に豊富に存在する種であるコサギで、少なくとも 50 個体観察された。絶滅の恐れのある種やフィリピン固有種はいなかった。

観察された鳥類は、泥地海岸地域に典型的なものであり、シラサギ、アオサギ、ゴイサギ、シギ、チドリ等の渉禽類などである。これらの鳥類は、人間居住地に囲まれ廃棄物に覆い尽くされた未開発の泥沼潮間帯に依然として生息していた。樹木の植生を必要とする鳥、例えば、メグロヒヨドリ、オウギビタキ、また、草地や空地を基本的な住処とする鳥、例えば、キンパラ、チョウショウバトが見られた。これらの陸生の鳥類はメトロマニラの都市化した場所、木々のある公園や庭に順応していることがわかっている（Vallejo, Aloy & Ong 2009）。

表 3　カビテ州バコール市サポテにおける現地調査で観察された鳥類リスト

Species	English Name	Relative Abundance	Residency[*1]	IUCN[*2]	Philippine[*3]
Egretta garzetta	Little egret	50+	M	LC	-[*4]
Passer montanus	Eurasian tree-sparrow	8	R	LC	-
Hirundo tahitica	Pacific swallow	6	R	LC	-
Lonchura malacca	Chestnut munia	6	R	LC	-
Butorides striatus	Little heron	5	M	LC	-
Pycnonotus goiavier	Yellow-vented bulbul	4	R	LC	-
Gerygone sulphurea	Golden-bellied flyeater	3	R	LC	-
Geopelia striata	Zebra dove	3	R	LC	-
Columba livia	Feral pigeon	3	R	LC	-
Amaurornis phoenicurus	White-breasted waterhen	3	R	LC	-
Nycticorax caledonicus	Rufous night-heron	2	R	LC	-
Rhipidura javanica	Pied fantail	2	R	LC	-
Megalurus palustris	Striated grassbird	2	R	LC	-
Nycticorax nycticorax	Black-crowned night-heron	2	M	LC	-

出典：調査団

Note:
1) Residency connotations: R = resident; M = migratory.
2) IUCN 2012. The IUCN Red List of Threatened Species, Version 2012.1.
3) DAO No .2004-15 Establishing the List of Terrestrial Threatened Species And Their Categories, And The List Of Other Wildlife Species Pursuant To Republic Act No. 9147, Otherwise Known As The Wildlife Resources Conservation And Protection Act Of 2001. (-): Not fall under any of the categories.
4) (-): Not fall under any of the categories.

2)　他の野生動物

目視観察では、ジャコウネズミ（*Suncus murinus*）のような小動物の痕が記録された。この小哺乳類はげっ歯類と密接に関連している。文献レビューに基づくと、ゴミの蓄積と密集した人間居住が、家ネズミ（*Rattus tanezumi*）等のネズミの出現に道筋をつけたと考えられる。冷血動物では、観察されはしなかったが、オオヒキガエル（*Rhinella marina*）が出現する可能性がある。この種は世界的に広まり人間社会と関連付けられている。

調査地域は主に沼地生息地であった。干潮時に観察されるトビハゼのような潮間帯に棲息する魚種の多くの生息地でかもしれない。注目すべき魚種はミルクフィッシュの幼魚や成魚（*Chanos chanos*）であり、また、海水耐性のある種々のティラピアも観察された。

3)　絶滅危惧種

表 3 に示すように、フィ国及び世界的なリスト、特に、国際自然保護連合（2012 年）、絶滅のおそれのある野生動植物の種の国際取引に関する条約（附属書 I～III、2011 年）、移動性野生動物種の保全に関する条約（附属書 I と II、2012 年）などに、絶滅の恐れのある種として掲載されている動物種はいなかった。

2001 年野生生物資源の保全及び保護法（RA No.9147）の施行令（DAO No. 2004-15）絶滅の恐れのある陸生動物とそのカテゴリ及び他の野生種に関するリストによると、以下の分類が使われている。

- CR（近絶滅種）：野生において極めて高い絶滅のリスクがある種
- EN（絶滅危惧種）：CR ではないがその要因が続くならば野生では生存が難しい種
- VU（危急種）：CR あるいは EN でないが、いかなる悪要因によっても絶滅が危惧され、近い将来に EN に移行する恐れがある種
- その他の危惧種：CR、EN あるいは VU でないが乱獲等の他の悪要因により危惧される種
- その他の野生種：生息地の破壊や他の要因により絶滅の脅威にはさらされていない植物種

3. 要約及び結論

カビテ州サポテにおいて延伸とデポの計画地は、マングローブの木がかく乱により単独で存在することで特徴づけられる沿岸泥沼生息地であった。かく乱は、泥沼潮間帯に沿った人間居住の侵攻、汚染、燃料用のマングローブ採取による。しかしながら、いくつかの種、特に湿地を渡るコサギや、クイナのような渉禽類などは弾力性があった。これらの種はマニラ湾で汚染された沿岸生息地であっても出現することが知られていた。しかし、ラスピニャス海岸ラグーン保護地区のような同様にかく乱された生息地と比較すると、シギ･チドリ類の多様性はこの地域よりも少ない。最も重要な植生の特徴はまばらに成長しているマングローブであり、これらの鳥の避難所となり、人間の密集居住地域でも出現することを可能にしている。LRT1 号線延伸事業の実施によるマングローブ種の部分的または完全な除去は、将来これらの鳥がいなくなる結果をもたらす恐れがある。

4. 写真

Photo 1. Captured immature Little Heron (Photo by AB Aloy)

Photo 2. An adult Little Heron standing motion-less along the muddy coastal banks awaiting to prey on small fish (Photo by AB Aloy)

Photo 3. A Little Egret foraging over garbage encroached coastal habitats in Zapote, Cavite (Photo by AB Aloy)

Photo 4. Two individuals of Yellow-vented Bulbul were resilient omnivorous birds that occurs in vegetated areas even in parks and gardens of Metro Manila (Photo by AB Aloy)

Photo 5. A White-breasted Waterhen photographed here camouflaged against the lush and thick undergrowths of mangrove outgrowths (Photo by RS Gonzales)

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底質調査結果

1. イントロダクション

バコール市サポテにおける底質調査は、提案された LRT 1 号線カビテ延伸事業の環境影響評価（EIA）のための補足調査の一つである。その目的は事業地における現在の底質について、現場でのパラメータ測定とともに、底質試料の実験室での分析により、評価することである。現場データ及び実験室の分析結果は、補足 EIA 報告書でベースラインの情報として用いられる。

2. 調査地点

カビテ州バコール市はメトロマニラから南西に約 15km にある。東側はラスピニャス市及びメトロマニラ側のモンテルンパ市と接し、南側はダスマリニャス市、西側はカウィットとイムス市、北側はマニラ湾の入り口のバコール湾に面している。

バランガイサポテの LRT サテライトデポ計画地の中に位置している。採取地点はサポテ川に沿った泥沼地に位置する Wawa 1 及び Wawa 2 の 2 地点である（図 1）。

出典：調査団（Google Earth©）

図 1　2 採取地点の位置（黄点）

3. 調査機材と調査方法

調査は、事業地の底質のベースライン情報を収集するために行われた。2 地点の試料採取場所の位置は携帯型全地球測位システム（GPS）を用いて決定した。現地調査中に現場パラメータの測定を行った。底質温度と pH データを測定するため温度計と pH メータが用いられた。計器は測定前後に蒸留水で洗浄した。底質の色と他の物理的性状は肉眼により直接観察した。

実験室分析用の底質はグラブサンプル法により採取した。このような採取法は底泥表面層のかく乱を最小にして底質試料を採取する理想的なものである。プラスティックバケツ水を徐々に水中に沈め、底面に達したら、表面上層約 10 cm を掻きとるように慎重に操作した。温度と pH を測定後、色を同定し、プラスティックシャベルを用いてバケツから底泥を資料ビンに移した。

資料ビンはガラス製で蓋はプラスティックを用い酸で洗浄した。資料は現場における蒸発損失や微生物活動を抑制するためアイスボックスに保存し、後に冷凍した。

試料は 3 つの実験室へ提出された：

1) Mines and Geosciences Bureau (MGB) Petrochemical Laboratory ：8 種の金属、即ちヒ素(As)、カドミウム(Cd)、クロム(Cr)、銅(Cu)、鉛(Pb)、水銀(Hg)、ニッケル (Ni)及び亜鉛(Zn);
2) SGS Philippines, Inc.：粒度分布、含水率、全有機炭素、全窒素及び全リン;
3) SGS Australia Pty Ltd.（SGS Philippines, Inc.からの委託先）：有機塩素系殺虫剤（HCB‐ヘキサクロルベンゼン、DDT‐ジクロロ・ジフェニル・トリクロロ・エタン、クロルデン、アルドリン、ディルドリン、エンドリン、全 PCB（ポリ塩化ビフェニル）及び全 PAHs（多環芳香族炭化水素）。

実験室からの分析結果が出てくるまで 7－21 日営業日であった。

4. 調査結果

表 1 現地調査データ

Parameters	Wawa 1	Wawa 2
Geographical coordinates	14°28.448’ N 120°58.132’E	14°28.332’ N 120°58.162’E
Date of sampling	June 20, 2012	June 20, 2012
Time of sampling	11:44 am	12:30 pm
Sediment temperature	29°C	31°C
Sediment pH	7.40	7.17
Sediment color	Dark gray	Black
Sediment properties	Silt with garbage debris (leaves)	Silt with garbage debris (sanitary napkin)
Water depth where sediments were collected	1.36 meters	1.27 meters
Weather Condition	Sunny	Sunny

出典：調査団

表 2　実験室分析の定量下限値と分析方法

Substance	Quantification Limit	Methodology
Particle size distribution	Not applicable	Sieve test (mesh #200 and mesh #325)
Moisture content	0.002 %	ASTM D2216-10
Organic carbon	0.03 %	Black and Walkley (Lab Manual for the Analysis of Soils, Waters, Fertilizers, Feeds, Plant Tissues, etc. 1st edition)
Nitrogen	0.1 %	Based on AOAC Official Methods, 18th edition, 2005
Phosphorus	5.7 mg/kg	SMEWW 4500-P B and C
Metals		
Arsenic (As)	-	Flame AAS using HVG
Cadmium (Cd)	-	Flame AAS
Chromium (Cr)	-	Flame AAS
Copper (Cu)	-	Flame AAS
Lead (Pb)	-	Flame AAS
Mercury (Hg)	-	Cold Vapor using MA-2000
Nickel (Ni)	-	Flame AAS
Zinc (Zn)	-	Flame AAS
Organic Compounds		
HCB	660 µg/kg	USEPA-8270D
Aldrin	0.1 – 0.2 mg/kg	AN420
Alpha-chlordane	0.1 – 0.2 mg/kg	AN420
Dieldrin	0.1 – 0.2 mg/kg	AN420
Endrin	0.1 – 0.2 mg/kg	AN420
Gamma-chlordane	0.1 – 0.2 mg/kg	AN420
p,p-DDT	0.1 – 0.2 mg/kg	AN420
1-methylnaphthalene	660 µg/kg	USEPA-8270D
2-methylnaphthalene	660 µg/kg	USEPA-8270D
Acenaphthene	660 µg/kg	USEPA-8270D
Acenaphthylene	660 µg/kg	USEPA-8270D
Anthracene	660 µg/kg	USEPA-8270D
Benzo(a)anthracene	660 µg/kg	USEPA-8270D
Benzo(a)pyrene	660 µg/kg	USEPA-8270D
Benzo(b&k)fluoranthe	660 µg/kg	USEPA-8270D
Benzo(ghi)perylene	660 µg/kg	USEPA-8270D
Chrysene	660 µg/kg	USEPA-8270D
Dibenzo(ah)anthracene	660 µg/kg	USEPA-8270D
Fluoranthene	660 µg/kg	USEPA-8270D
Fluorene	660 µg/kg	USEPA-8270D
Indeno(1,2,3-cd)pyrene	660 µg/kg	USEPA-8270D
Naphthalene	660 µg/kg	USEPA-8270D
Phenanthrene	660 µg/kg	USEPA-8270D
Pyrene	660 µg/kg	USEPA-8270D
PCB Congener C101	0.1 – 0.2 mg/kg	AN420
PCB Congener C118	0.1 – 0.2 mg/kg	AN420
PCB Congener C138	0.1 – 0.2 mg/kg	AN420
PCB Congener C153	0.1 – 0.2 mg/kg	AN420
PCB Congener C180	0.1 – 0.2 mg/kg	AN420
PCB Congener C28	0.1 – 0.2 mg/kg	AN420
PCB Congener C52	0.1 – 0.2 mg/kg	AN420

出典：調査団

表 3　分析結果

Substance	Wawa 1	Wawa 2
Mesh #325 Retained (0.044mm)	10.35 %	35.45 %
Mesh #325 Passed Through (0.044mm)	89.65 %	64.55 %
Mesh #200 Retained (0.074mm)	9.20 %	25.49 %
Mesh #200 Passed Through (0.074mm)	90.80 %	74.51 %
Moisture content	72.0 %	64.6 %
Organic carbon	1.17 %	1.23 %
Nitrogen	<0.1 %	<0.1 %
Phosphorus	87.0 mg/kg	113.3 mg/kg
Metals (mg/kg)		
Arsenic (As)	5.93	5.78
Cadmium (Cd)	<1	<1
Chromium (Cr)	17	17
Copper (Cu)	172	136
Lead (Pb)	43	43
Mercury (Hg)	0.28	0.215
Nickel (Ni)	5	39
Zinc (Zn)	389	402
Organic Compounds (mg/kg)		
HCB	<0.2*	<0.1
Aldrin	<0.2*	<0.1
Alpha-chlordane	<0.2*	<0.1
Dieldrin	<0.2	<0.2
Endrin	<0.2	<0.2
Gamma-chlordane	<0.2*	<0.1
p,p-DDT	<0.2*	<0.2*
1-methylnaphthalene	<0.2*	<0.1
2-methylnaphthalene	<0.2*	<0.1
Acenaphthene	<0.2*	<0.1
Acenaphthylene	<0.2*	<0.1
Anthracene	<0.2*	<0.1
Benzo(a)anthracene	<0.2*	<0.2*
Benzo(a)pyrene	<0.2*	<0.1
Benzo(b&k)fluoranthe	<0.2*	<0.2
Benzo(ghi)perylene	<0.2*	<0.1
Chrysene	<0.2*	<0.1
Dibenzo(ah)anthracene	<0.2*	<0.1
Fluoranthene	<0.2*	<0.2*
Fluorene	<0.2*	<0.1
Indeno(1,2,3-cd)pyrene	<0.2*	<0.1
Naphthalene	<0.2*	<0.1
Phenanthrene	<0.2*	<0.1
Pyrene	<0.2*	<0.2*
PCB Congener C101	<0.2*	<0.1
PCB Congener C118	<0.2*	<0.1
PCB Congener C138	<0.2*	<0.1
PCB Congener C153	<0.2*	<0.1
PCB Congener C180	<0.2*	<0.1
PCB Congener C28	<0.2*	<0.1
PCB Congener C52	<0.2*	<0.1

出典：調査団

Notes:
1. "<" less than means the test result is lower than the quantification limit.
2. Samples for organic compound analyses contained large amount of liquid, which was removed from the soil prior to analyses
3. Due to high moisture content and sample matrix, limits of reporting (or practical quantification limits) were raised (with *)
4. Results are in dry-weight basis

5. 考察

2 採取地点からの水底堆積物は濃灰色から黒色だった。粒径は一般的にシルト（0.0039 – 0.0625 mm、ウェントワース分類）でほとんどの粒子はメッシュ番号のスクリーンを通った。木葉、割れたガラスやゴミといった少量の残渣が資料に混じっていた。

Wawa 2 の底質の温度は Wawa 1 の測定温度よりも高かった。これは Wawa 2 で底質採取したときは大気温も上昇した正午過ぎであったためである。2 採取地点の底質 pH は少し塩基性であった。両試料とも含水率は高かった（即ち 50%以上）。

実験室の分析結果から、これらの泥沼地の全有機炭素、窒素及びリン濃度は比較的低いレベルが記録された。従って、底質濃度は、有機物や栄養塩類が豊富である通常の河口域環境の特性を持っていないと推察された。

底質中の重金属、有機塩素系殺虫剤、全 PCB 及び全 PAHs 濃度の評価にあたっては、カナダ暫定底質ガイドライン（The Canadian Interim Sediment Quality Guidelines: ISQG）、及び環境・漁業・養殖科学センター（CEFAS）浚渫土処分ガイドラインアクションレベルに基づいた。

カナダ ISQG は稀有影響レベル（Threshold Effect Levels: TELs）と有害影響レベル（Probable Effect Levels: PELs）を含む（表 4）。このレベルは、生物学的影響に関して化学物質濃度を 3 つの範囲に識別するために使用される。TEL 以下では、有害な影響が希有である影響範囲であり、TEL と PEL 間は、有害な影響が時折起こり得る影響範囲であり、また、PEL を超えるレベルでは、有害な影響が頻繁に起こる可能性のある影響範囲である。

CEFAS ガイドライン（表 5）は、法定の浚渫土汚染物質濃度ではないが、海洋投棄処分に関する意思決定のための根拠の重みづけをする方法として用いられている。アクションレベル 1 以下の場合、汚染による海洋投棄処分の拒絶はなく、アクションレベル 1 と 2 の間は、さらなる評価を必要とし、アクションレベル 2 以上では、浚渫土の海洋投棄処分は承認されない可能性がある。

表 4　カナダ暫定底質ガイドライン（ISQGs）

Substance	Marine water[*1]		Fresh water	
	ISQG/TEL[*2]	PEL[*3]	ISQG/TEL[*2]	PEL[*3]
Metals [mg/kg]	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic (As)	7.24	41.6	5.9	17
Cadmium (Cd)	0.7	4.2	0.6	3.5
Chromium (Cr)	52.3	160	37.3	90
Copper (Cu)	18.7	108	35.7	197
Lead (Pb)	30.2	112	35.0	91.3
Mercury (Hg)	0.13	0.7	0.17	0.486
Zinc (Zn)	124	271	123	315
Organic Compounds [µg/kg]	µg/kg	µg/kg	µg/kg	µg/kg
Chlordane	2.26	4.79	4.5	8.87
DDD	1.22	7.81	3.54	8.51
DDE	2.07	374	1.42	6.75
DDT	1.19	4.77	1.19	4.77
Dieldrin	0.71	4.3	2.85	6.67
Endrin	2.67	62.4	2.67	62.4
Heptachor epoxide	0.6	2.74	0.6	2.74
Lindane (UCH)	0.32	0.99	0.94	1.38
PCBs: Aroclor 1254	63.3	709	60	340
PCBs: Total PCBs	21.5	189	34.1	277
PAH: Acenaphthene	6.71	88.9	6.71	88.9
PAH: Acenaphthylene	5.87	128	5.87	128
PAH: Anthracene	46.9	245	46.9	245
PAH: Benzo(a)anthracene	74.8	693	31.7	385
PAH: Benzo(a)pyrene	88.8	763	31.9	782
PAH: Chrysene	108	846	57.1	862
PAH: Dibenzo(ah)anthracene	6.22	135	6.22	135
PAH: Fluoranthene	113	1494	111	2355
PAH: Fluorene	21.2	144	21.2	144
PAH: 2-methylnaphthalene	20.2	201	20.2	201
PAH: Naphthalene	34.6	391	34.6	391
PAH: Phenanthrene	86.7	544	41.9	515
PAH: Pyrene	153	1398	53	875

出典：水生生物保護のためのカナダ底質ガイドライン（2002）

Note:
(1) Including estuarine.
(2) Interim Sediment Quality Guidelines (ISQG). The lower value, referred to as the threshold effect level (TEL), represents the concentration below which adverse biological effects are expected to occur rarely.
(3) The upper value, referred to as the probable effect level (PEL), defines the level above which adverse effects are expected to occur frequently.
(4) By calculating TELs and PELs according to a standard formula, three ranges of chemical concentrations are consistently defined:
  1) the minimal effect range within which adverse effects rarely occur (i.e., fewer than 25% adverse effects occur below the TEL),
  2) the possible effect range within which adverse effect occasionally occur (i.e., the range between the TEL and PEL), and
  3) the probable effect range within which adverse biological effects frequently occur (i.e., more than 50% adverse effects occur above the PEL).

表 5　浚渫土処分のための CEFAS ガイドライン

Substance	Units	Action Level 1	Action Level 2
Arsenic (As)	mg/kg	10	25-50
Cadmium (Cd)	mg/kg	0.2	2.5
Chromium (Cr)	mg/kg	20	200
Copper (Cu)	mg/kg	20	200
Lead (Pb)	mg/kg	25	250
Mercury (Hg)	mg/kg	0.15	1.5
Nickel (Ni)	mg/kg	10	100
Zinc (Zn)	mg/kg	65	400
Organotins	mg/kg	0.1	1
PCBs: sum 7 congeners	mg/kg	0.01	-
PCBs: sum 7 congeners	mg/kg	0.02	0.02
Oil (petroleum hydrocarbons)	mg/kg	100	-
DDT: sum DDT + derivatives	mg/kg	0.001	-
Dieldrin	mg/kg	0.005	-

出典：環境・漁業・養殖科学センター（CEFAS）浚渫土処分ガイドラインアクションレベル（2003）

金属分析の結果は、Wawa 1 の底質のヒ素（As）、銅（Cu）及び水銀（Hg）濃度は Wawa 2 の濃度と比較して高かったことを示した。他方、Wawa 2 の堆積物は Wawa 1 の堆積物の濃度に比較して ニッケル（Ni）と亜鉛（Zn）が高かった。

カナダ ISQG に基づくと、2 採取地点で以下の推察が可能である：
ヒ素（As）とクロム（Cr）は TEL を下回り、銅（Cu）、水銀（Hg）と鉛（Pb）は TEL と PEL の間、亜鉛（Zn）は PEL を超えていた。カドミウム（Cd）濃度は、間違いなく PEL 以下であるが、定量限界値が TEL を超えており確定されなかった。ニッケル（Ni）の TEL 値、PEL 値はなく評価ができない。

CEFAS ガイドラインに基づくと以下の評価が導き出される：
Wawa 1 のヒ素（As）とクロム（Cr）はニッケル（Ni）はアクションレベル 1 を下回り、Wawa 2 の銅（Cu）、鉛（Pb）、水銀（Hg）とニッケル（Ni）及び Wawa 1 の亜鉛（Zn）は、アクションレベル 1 と 2 の間、Wawa 2 の亜鉛（Zn）はアクションレベル 2 と同じ濃度であった。同様に、カドミウム（Cd）濃度は定量下限値が高く評価できない。しかし、その濃度はアクションレベル 2 以下である。

すべての有機化合物の分析結果は 0.1 mg/kg（100µg/kg）から 0.2 mg/kg（200µg/kg）の範囲にあり、定量下限値を下回っていた。いくつかの物質で、分析中、高い含水率と試料マトリックスのために下限値が大きくなって報告された。一般的に、Wawa 1 の底質は多くの物質で濃度が高かった。

6.　結論と提言

事業地の潜在的な影響評価のためには、現場の自然環境を理解することが必須である。これには、流域の物理的、化学的な性質の検討を含む。

Wawa 1 及び Wawa 2 地区の底質は人為的汚染の可能性がある。リンは、家庭洗剤が各戸から直接泥地に放流されるためと考えられる。有機物は、現地周辺のゴミ投棄場の存在に起因すると考えられる。従って、廃棄物管理を検討すべきである。

先述のガイドラインに基づくと、高濃度の亜鉛（Zn）による悪影響がたびたび発生し、高濃度の亜鉛（Zn）を含む浚渫土の海洋投棄処分は許容されないかもしれない。従って、Zn のモニタリング及び評価について特に注意を払う必要がある。塩素系有機物質濃度は定量下限値以下の

結果であったが、TEL または PEL 以下であることを意味していない。残留性有機汚染物質（POPs）及び PAHs 濃度は TEL レベルで、あるいは PEL レベルであうかもしれない。これは、Wawa 1 及び Wawa 2 地区は廃棄物処分場に近いこと、さらに、多数の周辺居住民がゴミ堆積の一因となっている。したがって、工事前段階において、より多くの底質試料を採取し厳密に分析して、汚染レベルの程度を調査することが必要である。

河口域環境への潜在的な影響及び緩和策

提案開発事業の工事期間中、浚渫及び開削工事により現場の表層堆積物が除去される。このことは表層よりも汚染レベルが低い深部の堆積物や岩盤が露出することになる。この点では、わずかであるが正の影響が期待できる。

他方、浚渫及び開削工事は、濁水を発生させ、河川や海域に放出されると濁度が増加する。濁って不透明な水では、水中深部への太陽光の侵入を減じ、淡水・海水域の生物へゆくゆくは影響を与える。底質に含まれる化学汚染物質は海域で堆積する。

不要の水質影響を最小化するため、浚渫及び開削工事で、掘削する土砂量や掘り返す空間面積について、制限を遵守させる必要がある。もしコントラクターが必要とすれば、拡散防止膜等の構造的な対策の検討を詳細設計で行うことを提案する。

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付属資料 E-3　サテライトデポにおける被影響世帯リスト

ID no.	Location	Name of Household Head	HH Size	Year of Residency	Occupation (HH Head)	Tenurial Status	Use of Structure	Type of Structure	Remarks (change from 2008 census)
1	Wawa2	Enot,Conchita Elleran	2	10	Fish Vendor	Owner	Residential	Temporary/Movable	
2	Wawa2	Dote,JunRey Andno	5	10	Side-car Driver	Renter	Residential	Temporary/Movable	
3	Wawa2	Violen,Luisito Papauran	8	12	Taho Vendor	Owner	Residential	Temporary/Movable	
4	Wawa2	Mahusay, Eleonor Enot	8	10	Fish Vendor	Owner	Residential	Semi-permanent	
5	Wawa2	Mancinldo,Rogelio Santos	2	?	Carpenter	Owner	Residential	Semi-permanent	
6	Wawa2	Cabanza, Marissa	5	?	Construction Worker	Owner	Residential	Semi-permanent	New Household
9	Wawa2	Traboc, Andres Dayon	5	?	Home Helper	Owner	Residential	Semi-permanent	
10	Wawa2	Rosales, Danle Mantal	6	12	Fish Vendor	Owner	Residential	Semi-permanent	
11	Wawa2	Dapadap, Ramilo Guelas	6	12	Fisherman	Owner	Residential	Semi-permanent	
12	Wawa2	Cancillar,Ledelina Aguellas	5	3	Manicure	Owner	Residential	Temporary/Movable	New Household
13	Wawa2	Cantuba, Jordan O.	4	4	Side-Car Driver	Owner	Residential	Temporary/Movable	New Household
14	Wawa2	Cantuba,Jaymar Ordono	4	3	Pedi-Cab Driver	Owner	Residential	Temporary/Movable	New Household
15	Wawa2	Cantuba,Antonio Armogera	5	11	Pedi-Cab Driver	Owner	Residential	Semi-permanent	
16	Wawa2	Pacleta,Diomedes Omin	10	8	Pedi-Cab Driver	Owner	Residential	Semi-permanent	
17	Wawa2	Janaban,Rudy Villafuerte	8	6	Electrician	Owner	Residential	Semi-permanent	
18	Wawa2	Dumagan,Rommel Bucado	6	?	Pedi-Cab Driver	Owner	Residential	Temporary/Movable	
19	Wawa2	Recososa,Alfredo Atal	6	10	Carpenter	Owner	Residential	Temporary/Movable	
20	Wawa2	Donor, Gregorio Sr.	4	12	Construction Worker	Owner	Residential	Temporary/Movable	
21	Wawa2	Donor, Greaorio Bolor Jr.	8	4	Garbage Collector	Owner	Residential	Temporary/Movable	
22	Wawa2	Pioquid, Joselito 8alais	6	7.5	Garbage Collector	Owner	Residential	Temporary/Movable	
23	Wawa2	Corcillar, Roderick Guelas	3	8	Barber	Owner	Residential	Semi-permanent	
24	Wawa2	Lopez, Noel Melgar	4	9	Security Guard	Owner	Residential	Semi-permanent	
25	Wawa2	Maestre, Bien Picardal	5	7	Construction Worker	Renter	Residential	Temporary/Movable	
26	Wawa2	Holar, Raul Rodriguez	4	6	Driver	Owner	Resid/Comm	Temporary/Movable	
27	Wawa2	Lucinisio, Ricky Etleran	3	5	Fisherman	Owner	Residential	Temporary/Movable	
28	Wawa2	Tolones, Ricardo N.	2	1	-	Renter	Residential	Temporary/Movable	New Structure
29	Wawa2	Clamor, Jose Fortun	4	8	Welder	Owner	Residential	Temporary/Movable	
30	Wawa2	Amante, Rex Odober	5	9	Fisherman	Owner	Residential	Temporary/Movable	

ID no.	Location	Name of Household Head	HH Size	Year of Residency	Occupation (HH Head)	Tenurial Status	Use of Structure	Type of Structure	Remarks (change from 2008 census)
31	Wawa2	Aranda,ricardo alfonso	6	2.5	Auto painter	Renter	Residential	Temporary/Movable	New Household
32	Wawa2	Mang aran, Mario. Castro	3	0.42	Construction Worker	Renter	Residential	Semi-permanent	New Household
33	Wawa2	Yepis, Susana Cadaro	3	5	Landry	Rent-fre	Resid/Comm	Temporary/Movable	
34	Wawa2	PacHta, Alfonzo Umen	3	12	Carpenter	Owner	Resid/Comm	Temporary/Movable	
35	Wawa2	Rigo, Faustino Espinosa Jr.	4	0.5	Construction Worker	Renter	Residential	Temporary/Movable	New Household
36	Wawa2	Reyes, Nestor Igloso	3	12	Fisherman	Owner	Residential	Temporary/Movable	
37	Wawa2	Dapitan, Noli Lagarto	4	11	Construction Worker	Owner	Residential	Semi-permanent	New Household
38	Wawa2	Gallano,Jonell C.	6	-	Security Guard	Owner	Residential	Temporary/Movable	New Household
39	Wawa2	Castillo, Nino	7	0.42	Security Guard	Renter	Residential	Temporary/Movable	New Household
40	Wawa1	Merciales, Ricardo Cedeno	5	11	Fisherman	Owner	Residential	Temporary/Movable	
41	Wawa1	Casica, Emar Bola	5	?	-	Owner	Residential	Temporary/Movable	
42	Wawa1	Cyrus, Santos Merciaus	2	2	Sari-Sari Store	Owner	Resid/Comm	Temporary/Movable	New sari-sari
	Total		194	-	-	-	-	-	-

Source: LRTA Community Relations

付属資料 E-4　エンタイトルメントマトリクス案

表 1　非正規居住者のためのエンタイトルメントマトリクス案

Type of Loss	Application	Entitled Person	Compensation/Entitlements	Responsible Organization	Remarks/ Issues to be accomplished by LRTA
HOUSEHOLDS OF INFORMAL SETLLERS	Landless, informal occupants of public land and private land, except Professional Squatters and Squatting Syndicates as defined in RA 7279.	Qualified beneficiary households: a. The household has not availed of any government housing assistance. b. The household shall have agreed to dismantle his/her structure from the affected areas of the project. c. The household must be included in the Census Masterlist of the Project in 2008. (*1) Beneficiaries shall be prioritized as follows: Priority I: Qualified structure owners Priority II: Qualified non-structure owners (renters and rent-free occupants)	• The housing package option: 1) A house and lot package at Gen. Trias, Cavite. (Rent with option to buy: *2) or 2) Financial assistance equivalent to minimum wage multiplies by 60 days (UDHA 7279); or, Cash compensation for affected structures at full replacement cost. (whichever is higher: *3) •Transportation and manpower assistance to the relocation sites for family members and personal possessions during actual relocation (including disqualified families) • Food Assistance during transfer: A minimum of three (3) days food assistance provided by the sending LGUs for every family being relocated. 3)Balik-Probinsya (Back to the province) Program: (*4)	LRTA, Cavite Province	(*1) The validation of beneficiary list of informal settlers in RAP (2008) has been undertaken from the middle of July 2012 by retagging operation and re-census survey. The validation survey will be completed in three months. If discrepancy is found to be large due to encroachment or moving-out, reevaluation by the Beneficiary Selection, Awards and Arbitration Committee shall be considered. (*2) Rent is not determined yet, but it depends on the result of the census based on the income and expenses of the affected family. (*3) The gap should be filled in. According to LRTA, no affected households chose the financial assistance option. (*4) The availability and eligibility of the Balik-Probinsya Program should be confirmed. According to LRTA, no affected households chose the Balik-Probinsya Program.
	Structures	Qualified structure owners	Ditto	LRTA, Cavite Province	
	Crops, Trees and Perennials (*5)	Qualified households	Cash compensation for crops (which are not yet suitable for harvesting), trees, and perennials at current market value.	LRTA, Cavite Province	(*5) No households whose livelihood depends on land based activities such as agriculture.

Type of Loss	Application	Entitled Person	Compensation/Entitlements	Responsible Organization	Remarks/ Issues to be accomplished by LRTA
	Livelihood rehabilitation assistance and training	Qualified beneficiary households/families who relocated will be relocated to Gen. Trias, Cavite	➢ Training • Skills training to match labor demands of the economic zones • Small business development training and assistance with business management training and marketing ➢ Micro credit • Loans to establish small business and enterprise ➢ Job placement • Assistance to find jobs with local employers • Assistance to secure contracts and/or subcontractors for worker guilds ➢ Cooperatives • Assistance to establish cooperatives for service providers, producers, consumers, transport and credit associations. ➢ Education Assistance •Unit schools are established within the relocation site; • Every elementary and high school student will be guaranteed enrolment in the nearest public school.	LRTA, Cavite Province	

出典：調査団

表 2 正規資産所有者の E ためのエンタイトルメントマトリクス案

This draft entitlement matrix is based on the DPWH "Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy, 3rd edition (2007)

Type of Loss	Application	Entitled Person	Compensation/Entitlements	Responsible Organization	Remarks/ Issues to be accomplished by LRTA
LAND (Classified as Agricultural, Residential, Commercial, or Institutional) (*6)	More than 20% of the total landholding lost or where less than 20% lost but the remaining land holding become economically unviable.	Affected Family (AF) with Torrens Title Certificate (TCT) or tax declaration (Tax declarations that can be legalized to full title), or other acceptable proof of ownership	• Cash compensation for loss of land at full replacement cost at the informed request of PAFs • If feasible, land for land will be provided in terms of a new parcel of land of equivalent productivity, at a location acceptable to PAFs. • Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP xx,000 (*7) will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity.	LRTA	(*6) Land acquisition has been undertaken in accordance with the procedures based on RA 8974. (*7) For example, PhP 15,000 according to DPWH's LARRIP Policies (2007).
		AF with no title or tax declaration to the land or other acceptable proof of ownership	•Cash compensation for damaged crops at market value at the time of taking. • Agricultural lessors are entitled to disturbance compensation equivalent to five times the average of the gross harvest for the past 3 years but not less than PhP xx,000. (*8,9)	LRTA	(*8) According to LRTA, there are no agricultural activities in the private lands. (*9) For example, PhP 15,000 according to DPWH's LARRIP Policies (2007).
	Less than 20% of the total landholding lost or where less than 20% lost or where the remaining land holding still viable for use.	AF with TCT or tax declaration (Tax declarations that can be legalized to full title), or other acceptable proof of ownership	• Cash compensation for loss of land at full replacement cost at the informed request of PAFs	LRTA	
		AF with no title or tax declaration to the land or other acceptable proof of ownership	•Cash compensation for damaged crops at market value at the time of taking. • Agricultural lessors are entitled to disturbance compensation equivalent to five times the average of the gross harvest for the past 3 years but not less than PhPxx,000. (*8,9)	LRTA	

Type of Loss	Application	Entitled Person	Compensation/Entitlements	Responsible Organization	Remarks/ Issues to be accomplished by LRTA
STRUCTURES (Classified as Residential/ Commercial/ Industrial)	More than 20% of the total landholding loss or where less than 20% loss but the remaining structures no longer function as intended or no longer viable for continued use.	Owners of structure with full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership	• Cash compensation for entire structure at full replacement cost. • Transportation assistance • Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP xx,000 (*7) will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity.	LRTA	
		Owners of structures, have no title or tax declaration to the land or other acceptable proof of ownership	• Cash compensation for entire structure at full replacement cost. • Transportation assistance • Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP xx,000 (*7) will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity.	LRTA	
		Renters (tenants) of leased affected structures	• If shifting is required, PAF is given transitional allowance equivalent to one month rent of a similar structure within the same area (*10) • Transportation assistance	LRTA	(*10) For example, according to DPWH's LARRIP Policies (2007), rental subsidy equivalent for 3-month, maximum Php15,000.
	Less than 20% of the total landholding lost or where the remaining structure can still function and is viable for continued use.	Owners of structure with full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership	• Cash compensation for the affected portion of the structure as replacement cost, including the cost of restoring the remaining structure with no depreciation nor deduction for salvaged building materials (full replacement cost).	LRTA	
		Owners of structures, have no title or tax declaration to the land or other acceptable proof of ownership	• Ditto	LRTA	

Type of Loss	Application	Entitled Person	Compensation/Entitlements	Responsible Organization	Remarks/ Issues to be accomplished by LRTA
IMPROVEMENTS	Severely or marginally affected	Owners of improvements, PAF with or without TCT, tax declaration, etc.	• Cash compensation for the affected improvements at full replacement cost.	LRTA	
CROPS, TREES, PERRENIALS			• Cash compensation for crops (which are not yet suitable for harvesting), trees, and perennials at current market value. (*5)	LRTA	
BUSINESS (*11)	Entire shop affected or when the remaining structure becomes not viable for continued use, with or without a building permit	Owner of structure with or without full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership	• Compensation in cash for the entire structure at full replacement cost. • Subsistence allowance of PhP xx,000 (*12) to each PAF • Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP xx,000 will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity. • If household is relocating, PAF will be entitled to: - Free transportation - Substitute lot of equal or bigger area and, preferably, near the PAF household's original place	LRTA	(*11) According to LRTA, there are no affected business owners. (*12) For example, PhP 15,000 according to DPWH's LARRIP Policies (2007).
		Renters (tenants) of affected shops	• Subsistence allowance of PhP xx,000. (*12) • If shifting, either permanently or temporarily is required, shop renters are entitled to free transportation • Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP xx,000 (*12) will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity.	LRTA	

Type of Loss	Application	Entitled Person	Compensation/Entitlements	Responsible Organization	Remarks/ Issues to be accomplished by LRTA
	Shops, with or without building permit, partially affected and the remaining structures are still viable for continued use.	Owners of structure with or without full title or tax declaration to the land or those who are covered by customary law (e.g., possessory rights, usufruct) or other acceptable proof of ownership	• Compensation in cash for affected portion of the structure, including the cost of restoring the remaining structure and reconnection of any damaged utilities with no deduction for salvaged building materials. • PAF will be entitled to a transitional allowance to cover for their computed income loss during the demolition and reconstruction of their ships, but not to exceed a 1 month period.	LRTA	
		Renters (tenants) of affected shops	• Shop renters will be entitled to a transitional allowance to cover for their computed income loss during the period that their business is interrupted.	LRTA	
VENDORS	Ambulant vendors in Baclaran area	Ambulant vendors permitted by LGUs	• Transportation assistance •Temporary relocation site within the area where they can still continue their business	LRTA, LGUs	
PUBLIC STRUCTURES	Loss of, or damage to, public infrastructure (e.g., Barangay waiting shed, military outpost).	-	• Compensation in cash at replacement cost to respective barangay governments.	LRTA, LGUs	
LIVELIHOOD REHABILITATION ASSISTANCE AND TRAINING	If the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity	Land based activities (agriculture) Business (shops)	Refer to corresponding entitlements. • Rehabilitation assistance in the form of skills training and other development activities and equivalent to PhP xx,000 (*12) will be provided in coordination with other government agencies if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity.	LRTA	(*12) For example, PhP 15,000 according to DPWH's LARRIP Policies (2007).

出典：調査団

付属資料 E-5　LRT 1 号線カビテ延伸事業の環境チェックリスト（鉄道）案

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) N	(a) The Environmental Impact Statement (EIS) was submitted to the Environmental Management Bureau (EMB) on June 19, 2012. (b) Under review by EMB and the EIA Review Committee. (c) Approval will come in the form of an Environmental Compliance Certificate (ECC) which will be issued by the EMB after the substantive review process. (d) This is outside the purview of the ECC issuance and EIA review process. However, specific permits (e.g., discharge permit, authority to construct wastewater treatment facilities, etc.) will be secured before commencement of constrution.
	(2) Explanation to the Local stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) For the current ECC application, Public Consultation meetings were conducted on March 9, 12 and 13, 2012 in Bacoor, Cavite, Las Pliñas and Parañaque, respectively, to gather issues and concerns that the stakeholder and communities may have towards the Project. (b) The comments and issues were resolved and these are continually monitored by the LRTA.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Several alternative alignments had been examined in 1990s. The Project, as currently proposed, is a result of a selection process which considered the minimization of social and environmental impacts.
2. Pollution Control	(1) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Do effluents from the project facilities, such as stations, comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) Y (b) Y, N	(a) Although it is foreseen to be minimal, best practices in construction and site management can easily prevent sediment-laden runoff from reaching adjacent water bodies. (b) The design of physical structures will conform to the Philippine building and environmental standards and regulations. No untreated effluents will be discharged from the facilities to water bodies.
	(2) Wastes	(a) Are wastes generated from the project facilities, such as stations and depot, properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) The Project is governed by Presidential Decree No. 984 and Department of Environment and Natural Resources Administrative Order No. 35, Series of 1992 (DAO 35) – regulations on effluents and Republic Act No 6969 – regulations on hazardous wastes. Specific permits (e.g., discharge permit, authority to construct wastewater treatment facilities, etc.) will be secured later.
	(3) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) Y	(a) A study was undertaken to predict the noise level to be generated by the proposed Project that could affect the Baclaran Church. It can be deduced from these findings that the operation of the LRT trains, will not

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				significantly affect the Baclaran Church activities in terms of nuisance from the noise it will generate. Although the effects on the Baclaran Church religious rites/activities are expected to be minimal, it would still be prudent to adopt noise minimization measures such as the provision of noise barriers, or by using shock absorber pads and ballast to help reduce noise and vibration.
	(4) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence (especially in case of Undergrounds/Subways)?	(a) N	(a) Not Applicable
3. Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The alignment will traverse highly urbanized and mostly built-up areas.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of rail roads will have impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) N (d) Y (e) N (f) N	(a) The route alignment will pass through dominantly urban and built-up areas. No sensitive ecosystem or habitat will be affected. A Satellite Depot at Zapote is planned in the former mangrove swamp, but where already deteriorated by the informal settles. (b) No. (c) Not Applicable (d) No disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock will be anticipated. (e) Native plant species will be used for re-vegetation. (f) Not Applicable
	(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) The study for flood protection measures at Satellite Depot in Detailed Design shall be conducted, since one of the flood flow routes in the swamp will be reclaimed at Satellite Depot at Zapote.
	(4) Topography and Geology	(a) Is there a soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to	(a) Y (b) N	(a) More detailed investigation will be necessary during the Detailed Design stage so that potential for liquefaction and ground settlement for

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(c) Y, Y	critical sections will be able to be thoroughly assessed. (b) There is no large-scale filling and cutting work. (c) Contractor will be prohibited from stockpiling construction spoils anywhere near water courses nor artificial drainage systems to avoid clogging of these drainage systems. Conventional sediment and erosions control measures will be put in place. Sufficient and effective drainage systems will be incorporated in the detailed design of the structures and stations to offset effects of increase in amount of impermeable surfaces as well as to compensate for the differences in elevation between the raised (constructed) areas and the surrounding low-lying communities.
4. Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) In 2002 a Resettlement Action Plan (RAP) was once prepared for LRTA by Test Consultants, Inc. However, the LRT Line Extension Project was not implemented. In November 2008 the Relocation Action Plan (RAP) was made based on a series of consultations with households, giving attention to the informal settlers, who would be directly affected by the L1CEP within the ROW of the proposed alignment. The RAP was revised by LRTA in 2012 to update the relocation work schedule started from April 2012. Relocation Action Plan (2008) reported that the result of the census registered 1714 affected families in all the areas and 1941 structures to be demolished. “Resumption of works of Consultancy for Social Preparation and Pre-Relocation” schedule in 2012 for the re-validation of actual number of more or less 2,000 affected families and more or less 1,914 structures that need to be demolished. In the proposed satellite depot at Zapote, 42 households (194 persons) may likely to be relocated. (b) A series of public consultations were held in October to November 2008 in Bacoor, Cavite, Las Piñas City and Parañaque. (c) & (d) The housing package option would be a compromise of a house and lot package at fully developed and serviced sites at General Trias, Cavite or financial assistance equivalent to minimum wage multiplies by 60 days (Urban Development Housing Act of 1992). The selected resettlement site located in Gen. Trias, Cavite with an area of approximately 20 hectares (ha) was acquired. This site was selected based on the survey results, consultation meetings and internationally-accepted guidelines on relocation of informal settlers, who opted for relocation within the Province of Cavite. Horizontal development of the resettlement site is substantially complete; there are about 180 housing units that have been constructed. The documented number of households to be relocated is about 2,000. The construction of the remaining 1,820 housing units will

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				be started as soon as LRTA has transferred the additional fund to the Province of Cavite. (e) Refer to (a) (f) Within the frame work of the RAP, women's participation will be achieved through the gender planning. (g) Refer to (a) (h) To facilitate the smooth implementation of the relocation program and to ensure that basic services needed are provided, an inter-agency committee was organized. The inter-agency committee is composed of representatives coming from LRTA, NHA, PCUP, HUDDC, MMDA, LGU of Paranaque, Las Pinas, Bacoor Cavite and the Provincial government of Cavite. (i) The monitoring plan is developed in RAP. Monitoring and evaluation of all assistance packages will be undertaken by the Community Relations Office of LRTA. All families receiving any type of assistance will be monitored monthly by the estate management office of the Governor. The scope of monitoring shall include implementation schedule, assistance package, community participation, and grievance resolution. (j) The grievance redress mechanism is established in RAP. The LRTA has created an Award and Arbitration Committee (AAC) in each sending LGU to determine qualified beneficiaries for relocation, arbitrate in matters of claims and disputes and safeguard of the affected families. The AAC is composed of NHA as chair, LRTA as co-chair, concerned LGU, PCUP, Barangay Officials, and community representative of the area concern.
	(2) Living and Livelihood	(a) Where railways are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate	(a) Y, N (b) N (c) N (d) Y (e) N (f) N	(a) The Project may affect the existing means of transportation (public bus, jeepney, tri-cycles, etc.), but the associated workers may move to other locations such as the new stations. The Project will not cause any significant changes in sources of livelihood and unemployment. (b) The Project will not cause any significant adversely impacts on the living conditions of other inhabitants. (c) Since workers will be locally employed in accordance with Republic Act No. 6685, no influx of workers from other areas is expected. (d) The Traffic Management Plan was one of the requirements stipulated in the ECC issued to LRTA in 2002 and submitted to EMB in January 2002. The plan would still be applicable, however there may have been changes in traffic routing and the opening of new roads near and around the route alignment such that some of the findings and recommendations

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)? (e) Is there any possibility that railways will impede the movement of inhabitants? (f) Is there any possibility that structures associated with railways (such as bridges) will cause a sun shading and radio interference?		in the traffic study may no longer hold true. An updating or validation of the traffic study must be undertaken by LRTA to properly address the potential impacts of the Project on traffic. This may be required as a post-ECC requirement in order to incorporate plans and strategies in the Detailed Engineering Design and overall Project implementation plans. (e) Since the railway is elevated guide way, the movement of inhabitants is not changed. (f) No significant impacts are expected.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archaeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) Refer to "Landscape" below. There is no possibility that the Project will directly damage local archaeological, historical, cultural and religious heritage sites along proposed railway.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) Y, Y	(a) The degree to which views of/from historically or culturally significant buildings and other structures is obstructed or otherwise affected warrants consideration in isolation from a purely aesthetic perspective. Local/city landmark and religious buildings and monuments are of particular interest. Effects are expected to vary since some corridor sections are part of a dense built urban fabric and others have open views capes. The potential loss of archaeological or built heritage features must be addressed at the Detailed Design stage, to minimize potential effects to the greatest degree possible, by design consideration.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) N	(a) Not Applicable (b) Not Applicable
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security	(a) Y (b) Y (c) Y (d) Y	(a) LRTA shall not violate any Laws and Ordinances associated with the working condition in the project. On the contrary, such laws and ordinances shall be strictly observed and implemented. (b) LRTA shall ensure safety measures for the individuals involved in the project; this provision shall be incorporated in the Health and Safety Management Plan that shall be established as part of the contracts between the proponent and the contractor. (c) Safety instruction for new recruits, safety meetings and safety patrols shall be undertaken periodically. (d) LRTA shall ensure that security guards shall not violate the safety of other individuals involved or local residents; this provision shall also be incorporated as part of the Health and Safety Management Plan to be established by the contractor with approval of the project proponent.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		guards involved in the project not to violate safety of other individuals involved, or local residents?		
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) Y (c) Y (d) Y	(a) An Impact Management Plan (IMP) is included in EIS containing measures to address all impacts likely to occur throughout all phases of Project development. This is in accordance with the guidelines in Department of Environment and Natural Resources Administrative Order No. 30, Series of 2003 (DAO 2003-30). (b) Refer to (a). (c) Some of the aspects that are analyzed in the context of development intervention relate to: • improvement or impoverishment of livelihoods; • access to or exclusion from resources; and • expansion of knowledge. After a thorough study of the history and present conditions prevalent in the areas of concern, the Community Relations (ComRel) Team of the LRTA conducted an extensive and exhaustive community immersion to validate the views of social analysts regarding squatter colonies. In light of the above, the ComRel Team of LRTA drafted a Social Development Plan (SDP) relative to the Project, the impacts on the informal settlers and the corresponding mitigating measures to at least alleviate the impacts on those who will be directly affected by the Project. (d) The Traffic Management Plan was one of the requirements stipulated in the ECC issued to LRTA in 2002 and submitted to EMB in January 2002. The plan would still be applicable, however there may have been changes in traffic routing and the opening of new roads near and around the route alignment such that some of the findings and recommendations in the traffic study may no longer hold true. An updating or validation of the traffic study must be undertaken by LRTA to properly address the potential impacts of the Project on traffic. This may be required as a post-ECC requirement in order to incorporate plans and strategies in the Detailed Engineering Design and overall Project implementation plans.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	(a) Y (b) Y (c) Y (d) Y	(a) (b) (c) & (d) A Monitoring Program will be established as stipulated in Department of Environment and Natural Resources (DENR) Administrative Order No. 30, Series of 2003 (DAO 2003-30), a Multi-Partite Monitoring Team (MMT) must be formed immediately after the issuance of the ECC. The main goal of the MMT is to monitor the Proponent's as well as the Contractor's compliance to the ECC conditions, the IMP, and other applicable laws, rules, and regulations.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?		
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) Y (b) Y	(a) A permit to cut shall be secured by the Contractor from the DENR prior to cutting of trees along the road sides and satellite depot. (b) The Program Management Office will start the utility management planning process during the Preliminary Design Phase, and will establish an inter-active dialogue and communication with the authorities and companies having jurisdiction over utilities. The Program Management office will produce and obtain approval for detailed Utility Management Plans during the detailed design and construction phases.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans boundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as trans boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) Y	(a) The LRT system will have positive impacts in terms of reduction of Greenhouse Gas due to transition in the mode of transportation from motor vehicle to railway.

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