# DESIGN FOR ARRIVAL ZONE OF NON-ROAD ADJACENT ELEVATED METRO STATION: A CASE STUDY OF THREE BANGKOK AIRPORT RAIL LINK (ARL) STATIONS

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A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Architecture Program in Architectural Design

Department of Architecture

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# การออกแบบพื้นที่เข้าใช้บริการจากจุดที่ไม่ติดถนนของสถานีรถไฟฟ้ายกระดับจากพื้น: กรณีศึกษาสถานีรถไฟฟ้าแอร์พอร์ตเรลลิงค์ 3 แห่งในกรุงเทพฯ

นาย เกร็กกอเรียส อนุเกรา เกกานา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสถาปัตยกรรมศาสตรมหาบัณฑิต
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รถไฟในเขตมหานครเป็นส่วนหนึ่งในระบบการเดินทางที่จำเป็นของประชาชน จำเป็นที่จะต้องมีจุดเชื่อมต่อกับระบบขนส่งสาธารณะอื่นๆและการเดินทางด้วยวิธีต่างๆ อาทิ รถยนต์ส่วนบุคคล และการเดินเท้า เพื่อเข้าสู่พื้นที่ใช้บริการขาเข้า อย่างไรก็ตาม สถานีรถไฟฟ้าแอร์พอร์ต เรล ลิงค์ ส่วนใหญ่สร้างห่างจากถนนสายหลัก จากการสำรวจของผู้วิจัย ผู้ใช้บริการได้แจ้งปัญหาต่างๆ เช่น การเข้าถึงได้ยากการขนส่งสาธารณะและรถยนตร์ส่วนบุคคล ไม่มีสิ่งอำนวยความสะดวกในการเปลี่ยนการเดินทาง ขาดพื้นที่จอดรถที่เพียงพอ บางพื้นที่เสี่ยงต่ออันตราย การข้ามถนนเสี่ยงต่ออุบัติเหตุ จุดประสงค์ในการศึกษานี้คือ การศึกษาความเป็นไปได้ของการมีพื้นที่เชื่อมต่อระหว่างสถานีรถไฟฟ้าแอร์พอร์ต เรล ลิงค์กับถนนหลักเพื่ออำนวยความสะดวกในการเปลี่ยนสู่หรือเปลี่ยนจากการเดินทางแบบอื่นๆ ในการศึกษานี้เน้นไปที่สถานีรถไฟฟ้าแอร์พอร์ต เรล ลิงค์ ย่านชานเมือง 3 สถานี ได้แก่ สถานีหัวหมาก สถานีบ้านทับช้าง สถานีลาดกระบัง ซึ่งเป็นพื้นที่ที่ยังไม่มีแผนพัฒนา ในการศึกษาวรรณกรรมที่เกี่ยวข้องและการสำรวจความต้องการของผู้ใช้บริการการศึกษานี้แสดงให้เห็นถึงตัวอย่างของสิ่งอำนวยความสะดวกในพื้นที่ใช้บริการขาเข้าของสถานีซึ่งมพันธ์กับถนนหลักและ/หรือการเดินทางวิธีอื่นๆโดยที่ตั้งของสถานีมีข้อจำกัดต่างๆ เช่น มีพื้นที่จำกัด การหนาแน่นในการเดินทางต่ำ กฎหมายและข้อบังคับที่ควบคุมการพัฒนาพื้นที่ชานเมือง ปัจจัยต่างๆ ทางวัฒนธรรมที่มีผลต่อจำนวนรูปแบบการเดินทางแบบต่างๆกับที่มีผลต่อกิจกรรมในพื้นที่สาธารณะ รวมถึงอนาคตของการพัฒนาเมือง จากผลการศึกษาพบว่า แม้ว่าพื้นที่ที่ต่างกันทั้ง3 จะมีสภาพแวดล้อมหลายอย่างที่ต่างกัน แต่สามารถที่จะหาองค์ประกอบหลักๆในการออกแบบร่วมกันได้ อาทิ ทางเดินเท้าที่แยกอย่างชัดเจนจากพื้นที่ที่ใช้พาหนะต่างๆ สะพานข้ามหรือทางเดินลอยฟ้าเพื่อความปลอดภัย พื้นที่จอดจักรยานยนตร์และจักรยานเมื่อผ่านทางเข้าหลักด้านนอกสถานี พื้นที่ที่มีการใช้สอยหน้าแน่นที่สุดถัดจากทางเข้าหลักของสถานีควรติดกับพื้นที่ร้านค้าและห้องน้ำสาธารณะ พื้นที่กว้างหรือสวนหย่อมที่ทำให้สถานีเป็นจุดเด่นมากขึ้น พื้นที่จอดรถที่แยกห่างจากจุดทางเข้าหลักของสถานีแต่เชื่อมต่อกับทางเดินเท้า

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GREGORIUS ANUGERAH GEGANA: DESIGN FOR ARRIVAL ZONE OF NON-ROAD ADJACENT ELEVATED METRO STATION: A CASE STUDY OF THREE BANGKOK AIRPORT RAIL LINK (ARL) STATIONS. THESIS ADVISOR: PONN VIRULRAK, Arch.D., 271 pp

Metro train is a part of passenger's total journey. It requires interchanges with other public transport system and other modes of transport, such as cars and walking in its arrival zone. However, most of the Bangkok Airport Rail Link (ARL) stations are not conveniently located with respect to main public roads. Difficult to reach by public transportation and private car, lack of parking space, unsecured access, and dangerous crossing are some problems reported by station users during the field survey. The aim of this study is to explore the possibility of creating connecting spaces from ARL stations to the main roads that can facilitate the interchange to other transportation modes. This study focuses on 3 suburban ARL stations: *Hua Mak, Ban Tap Chang,* and *Lat Krabang* stations; since no plan has been developed for these areas. Based on literature review and survey of user needs, this study gives examples for an integrated facility in station's arrival zone to connect the ARL stations to main roads and other transport carriers in the face of various challenges, e.g.: limited space, low-density and regulations that limit development in suburban areas, cultural factors that affect availability of alternative transportation modes and activities in public space, and future city development. The results of the study show that, although situated 3 different site conditions, there are several common design elements that can be drawn from the design process such as, separation of pedestrian and vehicular zones, implementing pedestrian crossing bridges or skywalks for safety, providing motorcycle and bicycle parking behind the main entrance, locating main congested area next to the main entrance with retail facility, station plaza/ park to signify the presence of the stations, and providing car parking facility away from the main station entrance but allow direct access to pedestrian areas.

Field of Study : Architectural Design Student's Signature .....

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# CHAPTER I
# INTRODUCTION

## 1. BACKGROUND

Bangkok, the capital of Thailand, faces the same main problems as other developing cities in South East Asia region, i.e.: traffic congestion and public transportation availability. To solve these problems Bangkok Metropolis Authority (BMA) has been trying to develop metro train systems that can reach various places within the city. Currently, there are 3 metro systems in Bangkok: Bangkok mass Transit System (BTS), Metropolitan Rapid Transit (MRT), and Airport Rail Link (ARL). BTS and ARL are elevated metro trains, while MRT is underground. Each metro is operated and owned by different company without real system integration between them.

Airport Rail Link (ARL) is the latest metro system built in Bangkok, connecting the city to *Suvarnabhumi* Airport. Owned by State Railway of Thailand, it provides service at the speed of 160 km/h on an elevated platform along the eastern state railway, has a distance of 28 km through 8 stations: *Phaya Thai, Ratchaprarop, Makkasan* City Terminal*, Ramkhamhaeng, Hua Mak, Ban Tap Chang, Lat Krabang,* and *Suvarnabhumi* Airport*;* with capacity of 14,000 - 50,000 passengers/ day/ direction (Bangkok Airport Rail Link, 2012: online). Unlike BTS and MRT, ARL was built not along the arterial roadway. Except the airport, all ARL stations were built adjacent to local train station and the elevated railway is along the existing state railway that is owned by State Railway of Thailand as well. Therefore, most of ARL stations are far-off from the main road that is served by other public transportations.

## 2. PROBLEM AND SIGNIFICANCE

Metro train, as any public transport, is a part of passenger's total journey. It requires interchanges with other elements of public transport system, such as local buses and taxis, and integration with other modes of transport, such as cars, walking, and cycling (Wright and Fjellstrom, 2001). In this regard, stations act as collection and connection points between modes of service by providing transfer facilities at the station and/ or connecting the station to such facilities using pedestrian walkway (Goetz and Rodrigue, 1999: 2).

Typically, railway station consists of 3 main zones that can be accessed by public: arrival zone, main station/ facilities zone, and platform zone. The arrival zone is where multiple user types utilize a variety of modes and methods to reach the transit station (Network Rails, 2011: 9).

However, since most of ARL stations are located far from the main road, only paratransit, such as taxi and motor-taxi, and private vehicle can reach the ARL station directly. Another way, people need to walk for 100 – 300 m to reach the station. Because of physical environment, such as distance, access road width, and turning radius requirement; it is impossible for bus or other public transport along the main road to reach ARL station entrance directly. There have been complaints that the terminals at the stations are badly signposted, no escalators, lack of a car park and no facilities linking the stations to public transport (Bangkok Post, 2011: online). Difficult to reach by public transportation and private car, no connecting facility, lack of parking space, unsecured access, and dangerous crossing are also some problems reported by station users during the field survey.

## 3. OBJECTIVE AND FRAMEWORK

Objective of this research are as the followings:

1. To identify the issues that happen in the arrival zone of ARL station as it is located away from the main street
2. To find a possible architectural design proposal as an example to establish the connection between ARL station and other transportation modes, especially for ARL stations located in Bangkok suburban/ residential area

While many commercial centers have been developed and planned to connect with metro stations in downtown area, ARL stations in suburban area, such as: *Hua Mak*, *Ban Tap Chang*, and *Lat Krabang*, are still untouched by development planning as BMA regulation limits the commercial development for suburban area. Therefore, since there are future development plans for the stations in downtown area, the scope of this study focuses on arrival zone of 3 ARL stations located in Bangkok suburban/ residential area: *Hua Mak, Ban Tap Chang,* and *Lat Krabang*.

## 4. METHODOLOGY

### 4.1. RESEARCH METHODOLOGY

The overall research will involve 5 phases, i.e.: literature review, Airport Rail Link review, site analysis, questionnaire survey, and design proposal. The overall research methodology can be seen on Figure 1.1 below.

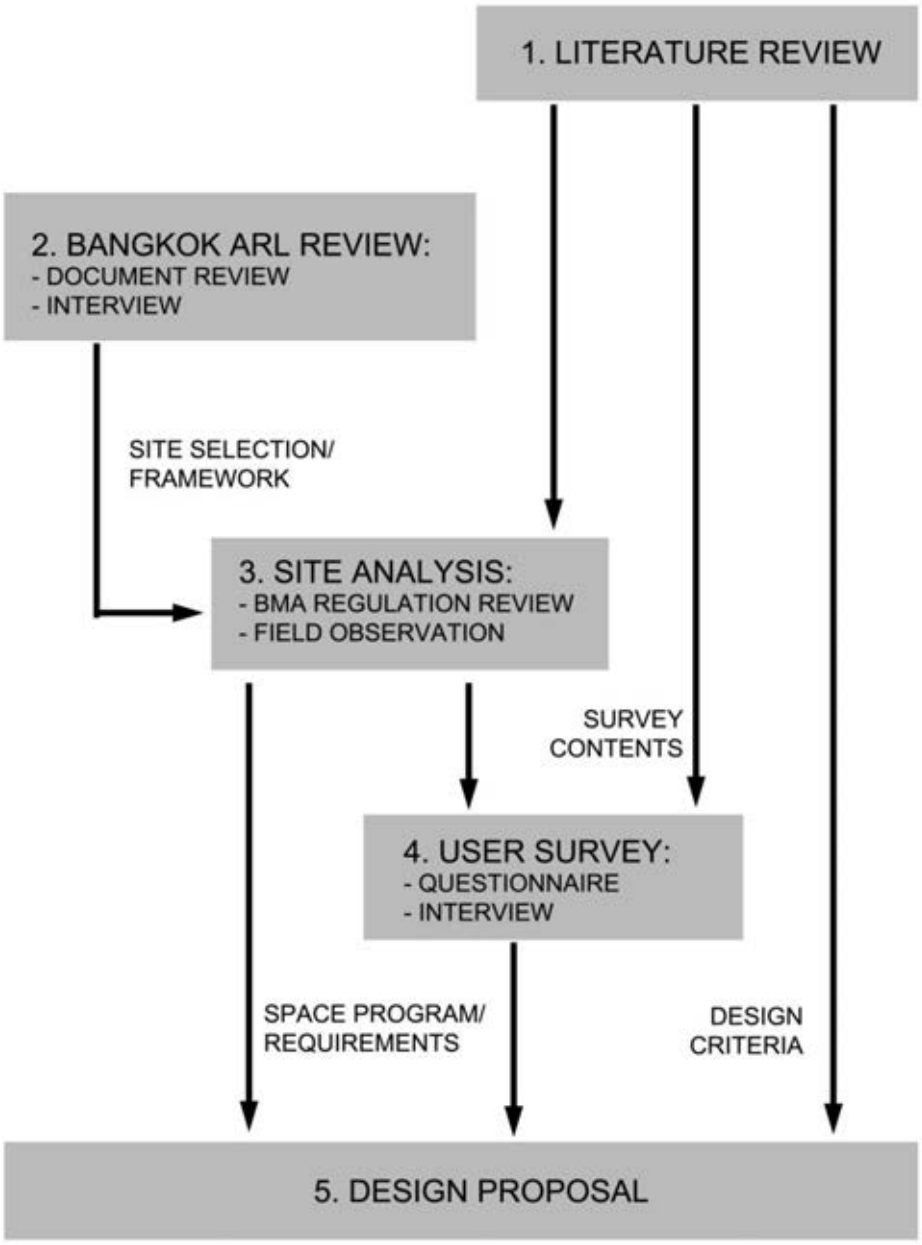



**Figure 1.1 Overall research methodology**

The first step, literature review, looks the overall zones of metro station and defines the arrival zone as the connecting area between station and other transportation modes from previous studies and theories. Afterwards, various transit facilities are divided based on the mode of passenger's arrival to the station and their priority hierarchy. Next, the cross analysis of different station guidelines and related studies is performed to categorize the spatial issue or criteria for station's arrival zone. The strategies to fulfill those criteria based on the theory/ guidelines are also reviewed.

The next step of study looks the overview of all elevated ARL stations. There are 7 elevated ARL stations. Through field observation, 7 ARL elevated stations are compared in terms of surrounding area or buildings, user majority and how they use at different time, public transport, and main road access. From this process, it is found that there are 2 different city areas of ARL stations: urban/ downtown and suburban/ residential. Next, this study phase also reviews the future development that already planned by SRT or other developments for the ARL stations area. This step is mainly carried out through literature review of Airport Rail Link documents from official sources and interview with organization that is involved with ARL project such as Design Concept Co., Ltd. and Airport Link Square Co., Ltd.

Site analysis phase includes the review of site/ area regulation and field observation to daily life at chosen ARL stations. From the previous step, it was found that the future developments for ARL station are only for the stations in downtown/ commercial area. Therefore, the study focuses more for the station in suburban/ residential area. It covers all 3 ARL stations in suburban area: *Hua Mak, Ban Tap Chang,* and *Lat Krabang*. Therefore, this step, through literature review, studies site/ area regulation determined by Bangkok Metropolis Administration (BMA) to understand limitation of development and the overall building types around the station based on city area where the station is located. The field observation is carried out to observe daily transit activity in 3 suburban ARL stations. The transit activities are categorized based on literature study of passenger's arrival modes. The condition of each transit facility is also reviewed to know the differences with the literature/ theory. Afterwards, the overall users of station area are categorized. Each user type's activities and their relation to existing facilities are analyzed.

The next phase, user survey, is conducted mainly to know the other activities that do not happen on the site currently but wanted by the user. Moreover, the literatures mention other activities than transit. The user survey also has purpose to know the user opinion for current transit facility of ARL station. The survey was carried out for each type of station user defined in site analysis by direct interview and filling the questionnaire. The answer options for survey questions is derived from literature review about activities or facilities other than walking and changing from train to other modes. For the second purpose, the answer options are derived from literature review about transit modal types/ interchange facility to reach station area.

The design phase concludes the study by propose a design for connecting the station to the main street as the arrival zone. The first step of design is the proposed programs for the space between the main street and the station based on previous 3 phases. Spatial program requirements; such as numbers of parking, street vendors, and facilities dimension; are assembled based on measurement of current site conditions during the field observation. Therefore, although the spatial program for 3 stations are same, their specific requirements are different, depends on specific conditions of each site. Next, the programs are arranged in order to fulfill the criteria from literature review. Finally, the arranged programs are developed into tangible form of design as recommendation of possible development that can be done for those 3 ARL stations.

**4.2. DESIGN MODELING**

Building Information Modeling (BIM) is utilized in the whole design process, from the site modeling and analyses until the design documentation. The use of BIM application is purposed to help to model and simulate the site and building quickly. During the site analysis and modeling, BIM software can measure the site area and projected building area quickly. It is also used to help in determining building orientation and placement based on solar/ shading studies on site orientation and existing ARL station. The use of BIM is also meant to help the design options exploration/ studies during schematic design and design development phase as the changes can be made quickly in 3D model without worrying about the drawing documentation as it is done automatically.

## 5. EXPECTED RESULT

Since people will walk during the transit interchange from one transportation mode to another transportation mode, all public transport users are pedestrians (Griffin, 2004). Therefore, it needs integrated transit facility to make it more convenient for people to connect to other means of transportation. The integrated facility should make walking journey for pedestrian from ARL train station to other means of transportation modes safe, secured, accessible for disabled people, fulfill transit requirement, and make the neighborhood more vibrant by engaging other activities in it.

# CHAPTER II
# LITERATURE REVIEW

## 1. STATION ZONES

Typically, the railway station consists of 3 main zones that can be accessed by public: **arrival zone, main station/ facilities zone,** and **platform zone** (Network Rails, 2011: 9). The service/ operation area, as any other building types, is inaccessible by public and has separated access. The descriptions for each main zone of the station are as the following:

- The arrival zone is where multiple user types utilize a variety of modes and methods to reach the transit station.
- The main station zone funnels people from surrounding access route and pedestrian gathering areas through a secure checkpoint with a ticket booth or machine, on to the platform. It consist minimum facility of the station, i.e.: ticketing (vending machine and kiosk), ticket gate, information center, and waiting/ meeting area.
- The platform zone is place for passengers waiting to board the transit system and the area where they also enter as they get off the transit system.

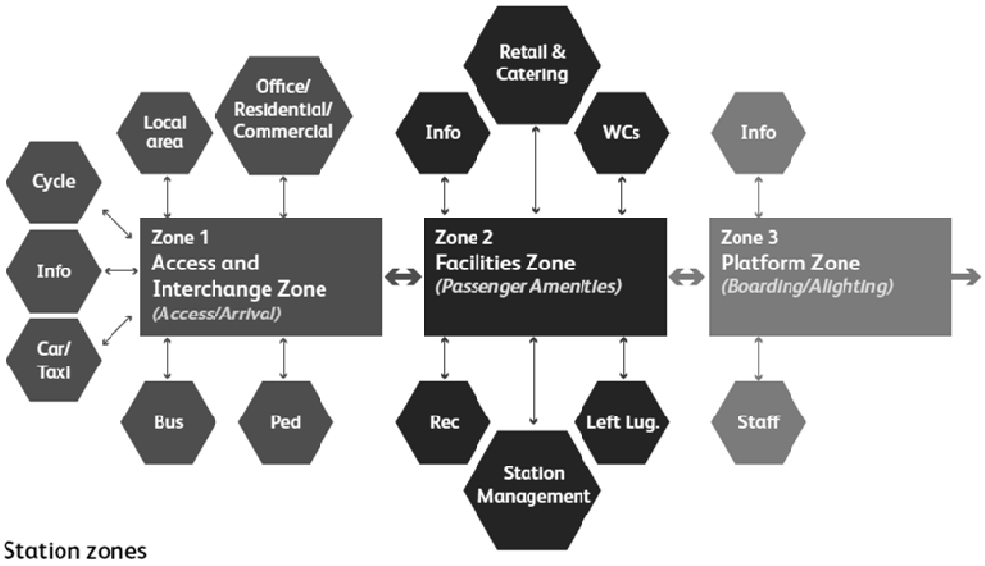



**Figure 2.1 Station zones (Network Rails, 2011: 9)**

## 2. ARRIVAL ZONE: MODAL INTERCHANGE

Metro train, as any public transport, is a part of passenger's total journey. As in train station case, passengers will come to the station from their origins by bus, taxi, car, bike, or walk; to change riding the train from the station. At the destination station, train passengers will get out from the train and using other modes to reach their final destination. Therefore, all Mass Rapid Transit systems require interchanges with other elements of public transport system in its arrival zone, such as local buses and taxis, and integration with other modes of transport, such as cars, walking, and cycling (Wright and Fjellstrom, 2001: 4). In this regard, terminals/ stations act as collection and connection points between modes of service (Goetz and Rodrigue, 1999: 2) by providing transfer facilities at the station and/ or connecting the station to such facilities using pedestrian walkway. This concept is also known as inter-modal and defines the transportation facilities of the 21st century (Kandee, 2004: 1).

The arrival zone starts from the point where the passengers arrive with other modes and step out, walking, ride escalator/ elevator, until arrive at the main station area to buy the ticket. Since people will walk during the change from one transportation mode to another transportation mode, all public transport users are pedestrians (Griffin, 2004: 13). The highest rank of access to the metro station is for **pedestrians**; followed by **bicyclist, bus/ shuttle, rental vehicles, car drop-off/ pick-up,** and **private car parking** (California High-Speed Rail Authority, 2011: 46; Griffin, 2004; Network Rails, 2011: 44-45; Regional Tranport District Transit Access Committee, 2009: 8; EDSA, 2010: 80).

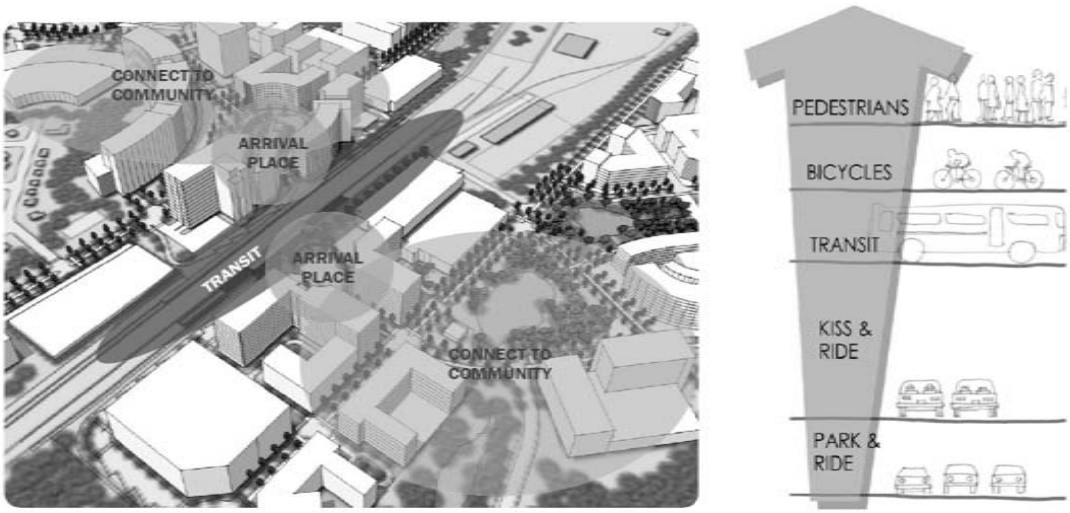



**Figure 2.2 Station's position to surrounding (left) and user arrival hierarchy (right) (California High-Speed Rail Authority, 2011: 46)**

Based on those users, the minimum facilities should include:

- Pedestrian network (sidewalk, walkway, crosswalk, pedestrian bridge, ramps, and curbs cuts) that connect the station entrances with transit area and local properties or public space
- Sheltered bike rack near station entrance or other high-use area
- Sheltered bus/ shuttle stop or terminal/ layover, maximum 500ft (150m) from station
- Sheltered drop-off/ pick-up point/ curbs for incoming taxi and cars, maximum 600ft (180m) from station
- Vehicle stands for taxi, shuttle, and other rental vehicles, maximum 600ft (180m) from station
- Car parking at maximum 1500ft (400m) from station, if the station is: terminal station/ end of line, located in suburban or low density area, near the exit of highway or arterial road (or within ½ mile), or in traffic packed area

**2.1. PEDESTRIAN NETWORK**

Pedestrian network connects the main station to: other transit facilities; neighborhood, either private business properties or public spaces (Griffin, 2004: 43-62; Network Rails, 2011: 64); and revitalize the street life by accommodating economic activities, reducing private vehicle use to improve environment, and showing social activities (Sihombing and Hadi, 2003: 1). According to (Griffin, 2004: 13), pedestrian network in the arrival zone includes:

- **Sidewalks**: are pedestrian facilities along the streets. **Walkways**: are pedestrian facilities serving corridors not served by streets
- **Crosswalk and pedestrian bridge**: to provide crossing at intersections along primary pedestrian routes for both pedestrian and bicycle users
- **Ramps and curbs cuts**: to provide accessibility for disabled and elderly users

The pedestrian network can span up to ¼ - ½ mile (400 – 800 m) radius according to normal people walking distance in 10 minutes. The availability of pedestrian network around those radii is important for Transit Oriented Development[1] (TOD) in the area around the station (California High-Speed Rail Authority, 2011: 32). However, the theory that "build the station and TOD will come" not always played out in reality. Surrounding the stations with parking, locating the station in areas with little or no development potential, and providing poor pedestrian connection; are station design manners that is hostile to TOD (Arrington and Brinckerhoff, 2003: 190).

The denser the development, the wider is the pedestrian walk. Mixed-use main streets should be 14 – 18 ft (4.2 – 5.4 m). High density urban centers should be 16 – 24 ft (4.8 – 7.2 m) (California High-Speed Rail Authority, 2011: 22) but must not be wider than 10 – 15 m for not giving impression of almost being a square (Muller, 1981: 127).

### 2.2. BICYCLE FACILITIES

Bicycle parking must be located directly next to the station entry to promote surveillance. Ideally, bike parking should be secured, sheltered, provide changing and shower facilities, and repair and rental shops (California High-Speed Rail Authority, 2011: 50).

### 2.3. PUBLIC TRANSPORT STOPS

Public transport stops include sheltered bus/ shuttle stop or terminal/ layover if the station becomes terminal for other public transport. It should be located maximum 500ft (150m) from station. Bus drop-off areas should be of adequate size for 1 – 2 bus lengths at a minimum and sheltered when possible. One-way counter clockwise loop bus lane circulation is preferable. Two-way circulation should be avoided. Minimum turning radii are 35 ft (10.5 m) for inner and 55 ft (16.5 m) for outer (EDSA, 2010: 90-92).

[1] Transit Oriented Development (TOD) is a mixed-use residential or commercial area intended to maximize access to public transportation (Holmes and van Hemert, 2008). To its supporters, TOD will increase the ridership since it will encourage people to walk to the station which positively impact to relieve traffic congestion along roads paralleling rail transit lines, reduce automotive emissions, and increase revenue for the transit operator as well as for the community around the station (Cervero, et al., 1993). Neighborhoods oriented toward transit should at a minimum have a mixture of land uses, a commercial center near the train station, public spaces, and walking environment (Edwards and Phillips, 2003)

## 2.4. PARATRANSIT STANDS

Paratransit facilities include stands for: taxi, shuttle, and other rental vehicles that do not have fixed route or schedule and need to wait for its passenger. It is located maximum 600ft (180m) from station. It should be: separated from drop off point, bus stops, and parking area; daylit; and sheltered (EDSA, 2010: 22; Network Rails, 2011: 45).

## 2.5. KISS AND RIDE FACILITIES

Kiss and ride facility is basically sheltered drop-off/ pick-up point/ curbs for incoming taxi, paratransit, and private cars. It should be located maximum 600ft (180m) from station. The drop-off should allow for stacking of 2-3 cars and not allow for automobile queuing to impede pedestrian (EDSA, 2010: 92).

## 2.6. PARK AND RIDE FACILITIES

Car parking must be located at maximum 1500ft (400m) from station. Car parking is often considered not convenient for pedestrian area and its existence can promote driving to the station (California High-Speed Rail Authority, 2011: 24). However, not providing car parking can be seen as cutting access to the station that can make people drive along their total journey than drive to the station and change to the train (Givoni and Rietveld, 2007: 360). According to (Metropolitan Council, 2012: 9), metro station should provide car parking if the station is:

- Terminal station/ end of line
- Located in sub-urban or low density area
- Near the exit of highway or arterial road (or within ½ mile), or
- Located in traffic packed area

Car parking should be secured with controlled access, gate (Griffin, 2004: 15-16), and can be observed from activity place (Childs, 1999: 174-175).

## 3. ARRIVAL ZONE CRITERIA

As the highest user access, generally pedestrian network and overall the arrival zone of metro station should have criteria as the following: **secure** from crime/ fear, **safe** from accident, and have direct **wayfinding** to the station (California High-Speed Rail Authority, 2011; EDSA, 2010; Griffin, 2004; Metropolitan Council, 2012). Beside those criteria, there are facilities beside the transit interchange that should be provided for **disabled users' access** and **activity engagement** along the pedestrian network (California High-Speed Rail Authority, 2011; Network Rails, 2011; Prasertsubpakij and Nitivattananon, 2012).

### 3.1. SECURITY

Security in this context is defined as the design of physical features that deter or remove opportunities for criminal/ terrorist behavior against passenger or property (Griffin, 2004: 251). According to social studies, the proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime (Crowe, 2000). This approach is known as Crime Prevention through Environmental Design (CPTED). There are 4 built environment aspects that promote CPTED in public space: natural surveillance, access control, territoriality, and maintenance of the facility (Marzbali, et al., 2012: 85).

**Natural surveillance** involves the location and use of physical built environment (features, mechanical/ electrical devices) and people to maximize **visibility** (Marzbali, et al., 2012: 87). They key-point to invoke natural surveillance is to see and be seen. Physical aspects of environment that affect visibility always involve: sightline and lighting (Cozens, et al., 2003: 128-129; Griffin, 2004: 254-260; Marzbali, et al., 2012: 87). Visibility also relies on people's presence along the path (Childs, 1999: 174-175). Studies argued that street visibility/ observation by residents or passers-by is important to prevent crime incidence (Cozens, et al., 2003: 128-129; Marzbali, et al., 2012: 87).

- Layout should be simple/ open with transparency for its vertical barriers to make visual connection to neighborhood. Facilities should not be positioned in isolated location. Dead ends, turns greater than 90 degree should be avoided (Regional Tranport District Transit Access Committee, 2009: 10).

- Visual obstruction (walls, columns, fences, plants, furniture, utilities, parking cars, etc) between 0.76 – 2.13 m above the grade that can be concealment for the offenders should be eliminated (Childs, 1999: 177-178).

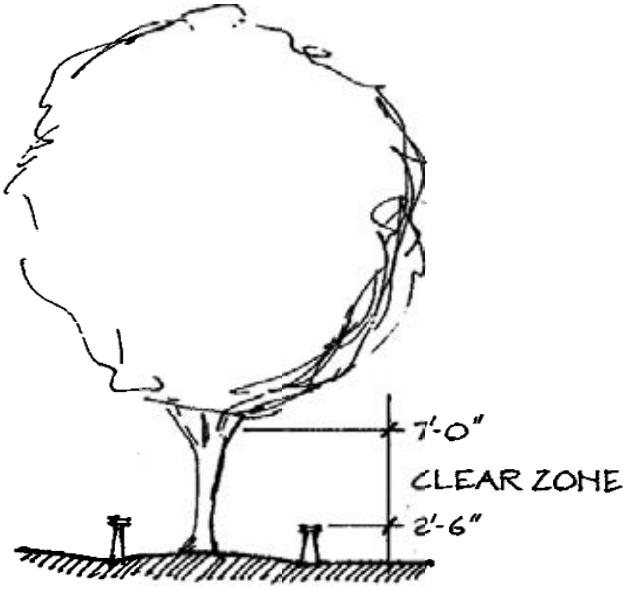



**Figure 2.3 Minimum vertical clearance for sightline (Childs, 1999: 177)**

- Minimum horizontal illuminance level at 1 m above grade for night time artificial lighting is 150 – 200 lux for horizontal passage and 200 – 250 lux for vertical circulation elements (Griffin, 2004: 216-217). The minimum vertical illuminance on half-cylindrical surface at 1.5 m height is 1.5 lux to identify the face (Fördergemeinschaft Gutes Licht, 2003: 11). The contrast between minimum and maximum illuminance should not exceed 1:10 so it will not result glare that can obstruct visual performance. To avoid direct glare from luminaries, the mounting angle should not exceed 70 degree measured from vertical plane downward (The Institution of Lighting Professionals, 2011: 3).
- Other activities; such as: commercial, community center, street vendors, local attractions, etc; should be integrated to arrival zone or along the pedestrian network and parking to ensure the space use and observation (Childs, 1999: 174-175; EDSA, 2010: 134; Maher and Skinner, 2011: 13).
- Traditional streets are safe because they have pedestrian and vehicular movement along them and, occasionally, police patrols; and they are supervised by the user of bordering buildings (Marzbali, et al., 2012: 87).

**Access control** focuses on reducing opportunities for crime by denying access to potential target and directing pedestrian and vehicular traffic to simple flow (Marzbali, et al., 2012: 87). It consists of real physical and symbolic barriers (Newman, 1972: 51-117). Physical barriers refer to any edge with 55 cm height or above, such as: walls, fences, or security bars. Symbolic barriers refer to any edge with height less than 55 cm that may not be physically prevent access to the premises (Marzbali, et al., 2012: 88-89).

- Layout should be simple/ open with limited intersection and guided using physical or symbolic barriers (Marzbali, et al., 2012: 88-89).
- Access or entry/ exit points to station area should be limited to prevent multiple escape routes and make it easier for security guard control/ screening (Griffin, 2004: 261; Queensland Rail, 2010: 139). Gates and information booth should be positioned adjacent to paid area, parking lots, bicycle racks, etc. (Griffin, 2004).

**Territoriality** involves creating sense of the user ownership so the offenders perceive a territorial influence which makes it difficult for them to carry out crimes. Natural surveillance and access control, in fact, contribute toward fostering territoriality by enhancing legitimate user's informal social control (Marzbali, et al., 2012: 89).

- Features such as landscape planting, pavement surface design, gateway, and fences are used to define property lines and mark the territory (California High-Speed Rail Authority, 2011: 76; Marzbali, et al., 2012: 89).
- Landmark can be incorporated to promote positive identity to locals thus integrating the station to local community and invoke sense of belonging to them (Network Rails, 2011: 73-75).
- The use of sign can mark the space occupancy and inducing guilt or shame (Griffin, 2004: 259; Marzbali, et al., 2012: 89).

**Maintenance** of built environment routinely ensures that the physical environment continues to function and sends positive signals to all users. The problems may be traced back to litter, vandalism, graffiti, burnt out lights, and overgrown vegetations (Marzbali, et al., 2012: 89). Regarding to this, previous studies showed that maintenance issues involve design/ planning and the operation/ management (Griffin, 2004: 256-260; Network Rails, 2011: 48).

### 3.2. SAFETY

Safety in this context is defined as the design of physical features that minimize incidents harmful to passengers and employees (Griffin, 2004: 251). Collision with vehicles, based on previous studies analysis, should be reduced by incorporating 3 aspects of built environment: lane separation between pedestrian and vehicular way, speed limitation of the vehicles, and visibility of user (Griffin, 2004; Movahed, et al., 2012: 582; UK Department of the Environment, 1973).

- According to traditional ideal concepts in town planning, pure pedestrian streets should be free of any kind of non-pedestrian traffic (Monheim, 1984). Pedestrian way, bicycle lane, and vehicular road should be separated and intersections/ crossings between them should be minimized. The strategies include creating pavement for marking different lanes, grade separation, and physical barriers such as railing, bollard, and planting for directing pedestrian route (California High-Speed Rail Authority, 2011: 42; EDSA, 2010: 83-85; Griffin, 2004: 13; Metropolitan Council, 2012: 35; Movahed, et al., 2012: 574; Network Rails, 2011: 54; Queensland Rail, 2010: 53; Regional Tranport District Transit Access Committee, 2009: 5; UK Department of the Environment, 1973: 44-46).
- Where the intersection between pedestrian and vehicle should happen due to service/ emergency access reason or any crosswalk point between pedestrian circulation and street, vehicle speed should be reduced (Muller, 1981: 131). It is usually associated with the speed less than 2 mph (3.2 km/h) (Rudofsky, 1969: 20). Speed limitation can be achieved by making narrow streets, employing on-street/ side parking, planning short blocks with short intersection radii in site plan, and creating pavement and raised/ speed platforms at crosswalks (Griffin, 2004: 13-14; Movahed, et al., 2012: 585; UK Department of the Environment, 1973: 47-48).
- Visibility is important for every intersection between pedestrian and vehicular way, such as crosswalk. Just as for wayfinding and security requirements, it involves sightline and lighting. The visual obstruction that can block the sight of driver and pedestrian crosser, such as: street furniture, utilities, walls, planting, and parking car; should be removed especially around intersections and crosswalk (UK Department of the Environment, 1973: 50-53).

### 3.3. WAYFINDING

First used by Kevin Lynch, an urban planner, in his book The Image of the City, Wayfinding is described as ability to reach an objective in a short time without experiencing fear and stress (Peponis, et al., 1990 cited in Hidayetoglu, et al., 2012: 50).

The components of city plan readability and for creating a perceptible environment revealed by Lynch: **paths, edges, districts, nodes, and landmarks[2]; have frequently used by designers to build people wayfinding** (Hidayetoglu, et al., 2012: 51). There are 3 physical characteristics of built environment that affect people's wayfinding: complexity, differentiation, and visibility (Omer and Goldblatt, 2007: 521).

**Complexity** is the quality of the plan configuration, the spatial relations between the objects of the environment (Omer and Goldblatt, 2007: 521). Route between facilities should be close and direct.

- Wayfinding was found easier when the plan configurations are simple, symmetry, regular, and continue (Hidayetoglu, et al., 2012: 51; Omer and Goldblatt, 2007: 521).
- Turns greater than 90 degree and dead ends for pedestrian way should be avoided or minimized (Regional Tranport District Transit Access Committee, 2009: 10)

**Visibility** or visual access is the degree to which different parts of an environment (origin and destination) can be observed from various view points along the route (Omer and Goldblatt, 2007: 521).

- Landmark and landscaping such as: sculpture, water feature, etc; should be incorporated (Network Rails, 2011: 64).
- High degree of overlapping visual fields of origin and destination landmark (where people can see landmark from another landmark) helps people to construct spatial knowledge and perform navigation tasks (Omer and Goldblatt, 2007: 520).

[2] *Paths* are major and minor circulation routes used by people. *Districts* are areas of residential, business, industry, urban, and suburban. *Edges* are linear elements that act as boundary between 2 districts or more. *Nodes* are the point that can be entered and destination of people. *Landmarks* are the point that cannot be entered and becomes symbol or reference of a place, usually a 3-dimensional object. (Lynch, 1960)

- As the focal point of entire arrival zone, station entrance (and its associated plaza) should be clearly identified (California High-Speed Rail Authority, 2011: 43) and visible from other landmarks positions. Stairs, escalators, and elevators should be located along the direct path and line sight so it is identifiable as a means of access to the other level (Griffin, 2004: 19-20). In his book, Childs explained the perceptual distances of a space that affect people's sightline as shown on Table 2.1.

**Table 2.1 Perceptual distances (Childs, 1999: 65)**

| Distance | Notes | Reference |
|---|---|---|
| **1.5 – 2.5 ft (0.45 – 0.76 m)** | Close personal distance. People can easily touch each other | (Hall, 1966) |
| **2.5 – 4 ft (0.76 – 1.22 m)** | Arm's length. The viewer's $15^0$ cone of clear vision covers the upper face of subject | (Hall, 1966) |
| **4 – 7 ft (1.22 – 2.13 m)** | "Umbrella space" Close social distance. The viewer's $1^0$ cone of sharp vision covers one of the subject's eyes | (Hall, 1966) |
| **7 – 12 ft (2.13 – 3.66 m)** | Far social distance. The full figure of the subject is visible at glance. This is the end of the "circle of involvement" | (Hall, 1966) |
| **12 – 25 ft (3.66 – 7.6 m)** | Public distance. A person can take evasive action to move away. The viewer's $1^0$ cone of sharp vision covers subject's entire face | (Hall, 1966) |
| **45 ft (13.7 m)** | Can see face clearly | (Lynch, 1971) |
| **40 – 80 ft (12.2 – 24.4 m)** | "Pleasant human scale" plaza | (Lynch, 1971) |
| **65 – 80 ft (19.8 – 24.4 m)** | Maximum distance to read facial expressions and recognize a person | (Lynch, 1971)<br>(Gehl, 1987) |
| **230 – 330 ft (70 – 100 m)** | Maximum distance to follow events | (Gehl, 1987) |
| **450 ft (137 m)** | Limit of successful historic enclosed squares | (Lynch, 1971) |
| **4000 ft (1220 m)** | Limit of detecting a person | (Lynch, 1971) |

**Differentiation** is the degree to which different parts of the environment have different layout, size, color, etc (Omer and Goldblatt, 2007: 521). Differentiations of a part makes that part more memorable thus have high environmental legibility. Recent study by (Hidayetoglu, et al., 2012) showed that color and lighting has impact to the wayfinding.

- Circulation elements shall use color, texture, and lighting to increase visual pleasure and guidance (Network Rails, 2011: 31; Regional Tranport District Transit Access Committee, 2009).
- Warm and bright colors, such as red, are more attractive; provide stimulus and orientation while neutral and dark colors, such as grey, are perceived as negative and overwhelming ambience (Muller, 1981: 111; Hidayetoglu, et al., 2012: 57).

### 3.4. ACCESS FOR DISABLED USERS

Two factors are important for accessibility performance evaluation: activity engagement and the opportunity of different user groups (Prasertsubpakij and Nitivattananon, 2012: 57). Disability is an umbrella term encompassing impairments of body, activity limitations, and participation restrictions, which are all dynamically influenced by environmental and individual factors (World Health Organization, 2001: 3). It is important that everybody, including persons with disability, is able to access and use the internal and external facilities (Soltani, et al., 2012: 91). Based on analysis to previous studies: (Griffin, 2004; Prasertsubpakij and Nitivattananon, 2012; Soltani, et al., 2012), providing access for disable people in built environment always involves 2 aspects: assisting the mobility and fulfilling special needs of disabled people.

**Mobility** of disabled people should be made smoother by removing obstacle, hazard, and physical features that can impede disabled movement along pedestrian route and provide total integration of individuals with disabilities and able-bodied persons (Griffin, 2004: 112). Physical barriers such as curbs between roads and walkway should be minimized and replaced by other alternatives such as wheel stops, bollards, and paving.

**Special needs** of disabled persons needs to be considered by providing facilities/ equipments for them. The following facilities are important to provide for accessibility of disabled people.

- Elevators: to provide access to train platform on another level (Griffin, 2004: 116)
- Seating facilities: disabled and elderly find that standing for any length of time is uncomfortable, or even impossible (Soltani, et al., 2012: 92)
- Parking for disabled: car is the most practical method for some disabled people (Soltani, et al., 2012: 91)
- Slopes, suitable toilet, handrail, and wheelchair stands (Chang and Chen, 2011; Soltani, et al., 2012: 91)

All equipments should be located and operable so that is reachable in short distance from entrance/ congestions area, safe, secured, and no assistance required (Griffin, 2004: 112).

### 3.5. ACTIVITIES

People activity is one factor that can invoke natural surveillance as people need to see and be seen by others. There are 3 kinds of activities in public space: necessary activities, optional activities, and social activities (Movahed, et al., 2012: 573).

**Necessary activities** include those that are compulsory where for the station area such as going to work, waiting for train/ bus, departure/ arrival, or a person running errands. Basically this kind of activity is related tightly to walking.

**Optional activities** are the activities that can be done by the participant if there is a wish to do so and if time and place make it possible. In the station area, this kind of activity can include sitting, looking around, eating, and stopping for buying something.

**Social activities** are all activities that depend on presence of others in public space, such as talking, children playing, or simply seeing and hearing other people. Planners and architects can affect the possibilities for meeting, seeing, and hearing people.

Previous studies showed that the station area could and should accommodate optional and social activities as well beside train departure/ arrival (California High-Speed Rail Authority, 2011; Maher and Skinner, 2011; Network Rails 2011). A station also should be a point of opportunity to connect communities that are divided by the railway (Griffin, 2004). In their research, (Maher and Skinner, 2011) suggested the following optional and social activities integration with station area:

- **Commercial** use: market, café, food stalls, shops, big commercial
- **Community** use: civic hall, library, gallery, museum, music/ art performance
- **Family** use: park/ plaza, playground, children care
- **Local attraction**: zoo, aquarium, amusement park

A mixed use, different vital activities at different times of the day and night in compact pedestrian oriented area, is highly recommended in station's arrival zone (California High-Speed Rail Authority, 2011; Network Rails, 2011).

Study by (Ja'afar, et al., 2012) mentioned that landscape features: softscape (water, vegetations, and topography) and hardscape (street furniture and pavement), determines activity and meaning/ symbol of an open space. The study also emphasized **comfort** aspect to support the activities that are associated with: the calmness of environment and street amenities.

**Calmness of environment** is generated by softscape: water and vegetations; that also provide orientation to the place. Overall, water and vegetations make the quality of view better (Ja'afar, et al., 2012: 647).

**Amenities** are provided mainly by street furniture. Benches are essential to provide comfort to street user and generating social activities. The activity type, especially food (street vendors or café), contributes to user's comfort (Ja'afar, et al., 2012: 651). Ja'afar's study also argued that public toilet is essential part of the basic infrastructure of a successful public space (Ja'afar, et al., 2012: 649). However, since the toilet has potential to be isolated facility, it should be positioned in commonly used/ passed by or access controlled area (Network Rails, 2011: 35). Shading/ shelter is generally known needed for any congestion and activity area to protect people from weather, especially from burning sun in tropical country. The traditional repertory of sunshades-the giant umbrellas and sun-sails of market stalls, the trellises and house-to-house awnings, screens (from paper to perforated stone), the arbors and tents-have not lost their usefulness (Rudofsky, 1969: 218). Based on activity type, Childs made the rank of amenity that should be provided as shown on Table 2.2.

**Table 2.2 Ranking of amenities based on activity type, from highest (1) to lowest (5) (Childs, 1999: 99)**

| Amenity | Work trip | Social/ Recreational | Shopping |
|---|---|---|---|
| **Benches** | 5 | 4 | 3 |
| **Shade** | 3 | 1 | 4 |
| **Restrooms** | 1 | 3 | 1 |
| **Newsstands** | 4 | 5 | 5 |
| **Water fountains** | 2 | 2 | 2 |

## 4. SUMMARY OF LITERATURE REVIEW

The literature review reveals that there are 3 zones of station area: arrival zone, main station zone, and platform zone. The arrival zone is the area that connects the metro station to variety of modes and methods used by passengers to reach the transit station. The transit facilities in this area reflect other transportation modes according to its user priority, i.e.: pedestrian way, bicycle facility, public transport stops, paratransit stands, kiss-and-ride, and park-and-ride facility. Compiling from literature analysis, summary of criteria and strategies for pedestrian network in metro station's arrival zone can be seen on Figure 2.4.

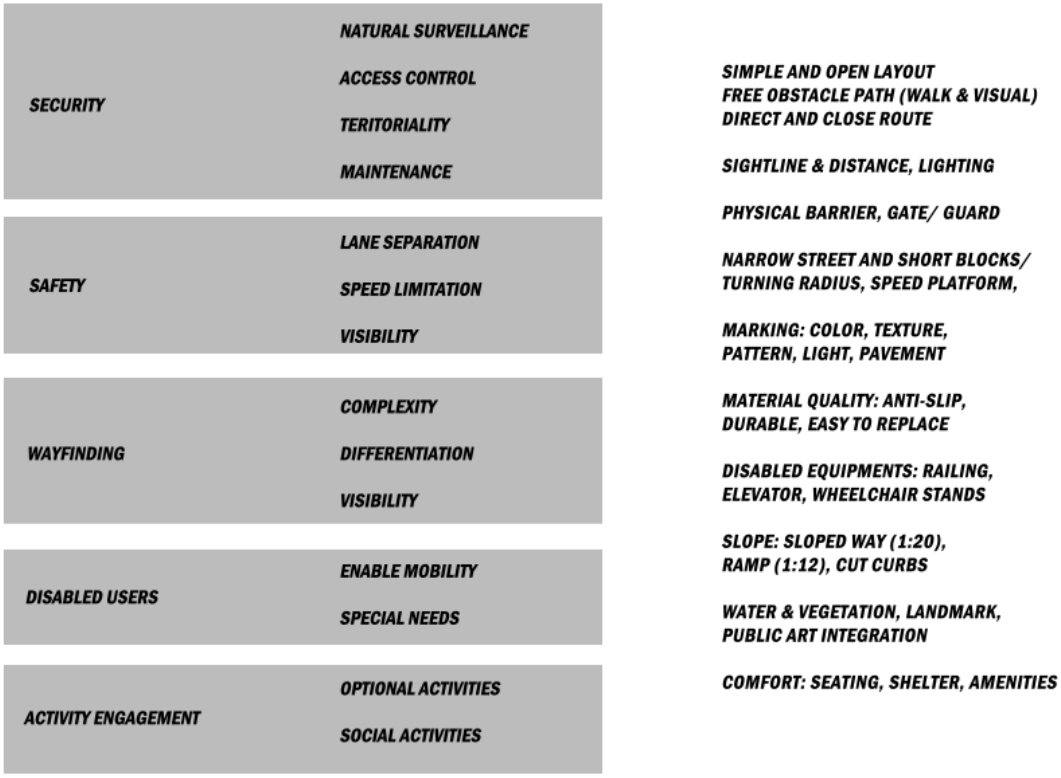



**Figure 2.4 Summary of criteria and strategies for arrival zone of metro station**

# CHAPTER III
# BANGKOK AIRPORT RAIL LINK

## 1. ARL SYSTEM OVERVIEW

Metro system is defined as one type of Mass Rapid Transit that serves within urban area and has completely separated track from street and national railway system, either underground or elevated (Wright and Fjellstrom 2001). Bangkok Airport Rail Link (ARL) is one of three metro systems besides Bangkok mass Transit System (BTS), Metropolitan Rapid Transit (MRT) that serve Bangkok downtown and nearby suburban. The comparison between 3 Bangkok metro systems can be seen on Table 3.1.

According to (Bangkok Airport Rail Link, 2012: online), ARL system provides service at the speed of 160 kilometers per hour on an elevated platform parallel with the eastern railway, has distance of 28 kilometers that goes through 8 stations and passenger capacity of 14,000 to 50,000 passengers per day per direction. It has the objective to provide transportation service for passengers who wish to travel from downtown to the airport (Suvarnabhumi Airport) with more convenient, faster, and more flexible. The rail system is owned by State Railway of Thailand (SRT) and operated by SRT Electrified Train (SRTET). The project construction has begun since October 1, 2003. It was completed 3 years afterwards and started to operate since September 26, 2006.

| | |
|---|---|
| **Owner** | State Railway of Thailand |
| **System Line** | 28 km, 8 stations |
| **Contractors** | • B. Grimm International Co., Ltd.<br>• B. Grimm MBM Hong Kong Ltd.<br>• Siemens Aktiengesellschaft Co., Ltd.<br>• Siemens Co., Ltd.<br>• Sino-Thai Engineering and Construction Public Co., Ltd. |
| **Consultants** | • Asian Engineering Consultants Co., Ltd.<br>• Thai Engineering Consultants Co., Ltd.<br>• Pacific Consultants International Co., Ltd.<br>• Chotichinda Mouchel Consultants Co., Ltd.<br>• DE-Consult Dentsche Eisenbahn – Consulting Gmbh<br>• Wisit Engineering Consultants Co., Ltd.<br>• Design Concept Co., Ltd. |
| **Total development cost** | 25.907 billion Baht |

**Table 3.1 Current Bangkok metro rail systems: BTS, MRT, and ARL**

| | **BTS**  Photo: Bangkok Mass Transit System | **MRT**  Photo: Bangkok Metro | **ARL**  Photo: State Railway of Thailand |
|---|---|---|---|
| **Rail system** | Elevated | Underground | Elevated |
| **Began Operation** | 1999 | 2004 | 2010 |
| **Operating route line** | Shukumvit line<br>(Mo Chit – Bearing)<br>Silom Line<br>(National Stadium – Wongiwan Yai) | Blue line<br>(Hua Lamphong – Bang Sue) | Phaya Thai – Suvarnabhumi Airport<br>2 train types: city line and express line |
| **Route configuration** | 2 rail lines above 2 main roads | Loop around city | 1 rail line above main railway (eastern SRT line) |
| **Station Number** | 30 | 18 | 8 |
| **Owner** | Bangkok Metropolitan Administration (BMA) | Mass Rapid Transit Authority of Thailand (MRTA) | State Railway of Thailand (SRT) |
| **Operator** | Bangkok Mass Transit System | Bangkok Metro | State Railway of Thailand Electrified Train (SRTET) |
| **Cars/ train** | 3 – 4 | 3 | 3 |
| **Common user** | Bangkok citizens/ commuter and tourist traveling inside the city<br>Commuter from suburban | Bangkok citizens/ commuter and tourist traveling inside the city | Commuter from suburban area<br>Air traveler/ tourist come from and to airport |
| **Station configuration** | Elevated | Underground | Elevated (except airport terminal) |
| **Station type(s)** | Regular BTS station<br>Central station (Siam) for transit between 2 lines | Regular MRT station | Regular ARL station<br>City Air Terminal (Makassan) for express line terminal<br>Airport terminal station |
| **Levels** | 3<br>1F Street level:<br>Entrance (stairs/ escalators, elevators)<br>Typical number: 4; 2 for each side of the street and each end of station<br>2F Concourse level:<br>Sky-bridge, retails, ticketing<br>3F Platform level: Side platform (except Siam: central platform), 6 cars length | 3 – 4<br>1F Street level:<br>Entrance (stairs/ escalators, elevators)<br>Typical number: 4; 2 for each side of the street and each end of station<br>B1/ B2 Concourse level:<br>Hallway, underpass, ticketing<br>B2-B3 Platform level: Central platform, 6 cars length | 4<br>1F Street level:<br>Entrance (stairs/ escalators, elevators)<br>Typical number: 2; for each end of station<br>2F Walkway:<br>Walkway, sky-bridge (Phaya Thai station), empty space<br>3F Concourse Level:<br>Hallway, ticketing<br>4F Platform Level: Side platform (except Makassan and Hua Mak: island platform), 10 cars length |
| **Nearby transit** | Main street, road intersection<br>Direct sky-bridge to malls and, buildings<br>MRT stations (3)<br>ARL station Phaya Thai<br>Boat pier Saphan Taksin<br>BRT Chong Nongsi | Main street, road intersection<br>Direct underpass to mall (Jamjuree Square) and buildings<br>BTS stations (3) | SRT train stations (all ARL station except airport)<br>BTS station Phaya Thai<br>Suvarnabhumi Airport |

**Table 3.2 Comparison of elevated ARL Stations**

| | PHAYA THAI | RATCHAPRAROP | MAKKASAN | RAMKHAMHAENG | HUA MAK | BAN TAP CHANG | LAT KRABANG |
|---|---|---|---|---|---|---|---|
| **Closest main road** | | | | | | | |
| | Phaya Thai 25m (west) | Ratchaprarop 5m | AsokDinDaeng 208m (east) | Ramkhamhaeng 41m (east) | Srinagarindra 340m (west) | Express toll 175m (north) | Rom Klao 120m (west) |
| | Si Ayutthaya 150m (north) | Si Ayutthaya 92m (north) | Petchaburi 317m (south) | Petchaburi 270m (south) | Express toll 251m (north) | | Express toll 30m (north) |
| **Public transport access** | | | | | | | |
| **Bus** | 29, 34, 36, 54, 59, 62, 139, 187, 542 | 13, 54, 73, 77, 164, 183, 204, 504, 513, 514, 536, 547 | 98, 136, 185, 206, 556 | 22, 40, 58, 60, 71, 92, 93, 99, 109, 115, 173, 174, 501, 517, 545 | 145, 182, 207, 519, 537 | 93 | 46 |
| **Stop** | 25m | 5m | 315m | 55m | 380m | | |
| **Metro** | BTS 25m connect with sky-bridge | | MRT 315m | | | | |
| **Other** | | | | | | *Songtaew* 272m | *Songtaew* 120 m |
| **Users majority** | | | | | | | |
| **Commuter** | Destination Origin | Destination | Destination | Origin Destination | Origin | Origin | Origin |
| **Air Traveler** | Destination Origin | | Destination Origin | | | | |
| **Buildings within ¼ mile (400m) radius** | | | | | | | |
| **North** | Apartment Office, Club Hospital: Deja General Gov office: Ratchadewi School: Senarak | Office Hotel Shop-houses | | Gov office: Bang Kapi Metropolitan Electric Authority Office: MCO Bldg | | | Parking lot |
| **East** | Hotel Office Shop-houses | Gov office: National Youth Bureau, Industrial Estate Authority Apartment Shop-houses | Hospital/ beauty: Skin Hospital Showroom: Honda Club: Monalisa Shop-houses | Hotel: NASA Vegas, NASA Tower | | | |
| **South** | Apartment Office Gov office: Dept of Livestock Development | Hotel Office Apartment Shop-houses Market: Prathunam | School: Don Bosco Tech, St. Dominic Hotel: FX Makassan, Classic Place Apartment: Villa Asoke Office: Suthi Bldg, DHL, Chaiyong Showroom: LV Auto Shop-houses | Restaurant: A&W Cross Petchaburi: Retail: Spmilkcenter Office: Wijit Bldg Detached housing | Detached housing Hotel: P Park Residence Apartment: Floraville Hospital: Vibraham H Warehouse Parking lot | Detached housing | Detached housing |
| **West** | Apartment Office | Hospital Apartment | Apartment: Oscar, Grand Amarin Hotel: Prince, Le Fenix | Cross canal: Showroom: Toyota Detached house Office | | | |
| **Future Development** | | | | | | | |
| | - | Makkasan Complex | | A-Link Square | - | - | - |

## 2. ARL STATIONS OVERVIEW

Besides the underground station at Suvarnabhumi Airport, there are 7 elevated ARL stations as can be seen on Figure 3.1, i.e. *Phaya Thai, Ratchaprarop, Makkasan, Ramkhamhaeng, Hua Mak, Ban Tap Chang,* and *Lat Krabang*. There are 2 different train services for ARL corridor, i.e. Suvarnabhumi Airport (SA) Express that stops only at the airport and city terminals (*Makkasan* and *Phaya Thai*) and SA City Line that stops at all stations. The SA City Line then is not only used by air traveler but also by commuters in suburban area. Based on field observation, the comparison of ARL stations can be seen on Table 3.2.

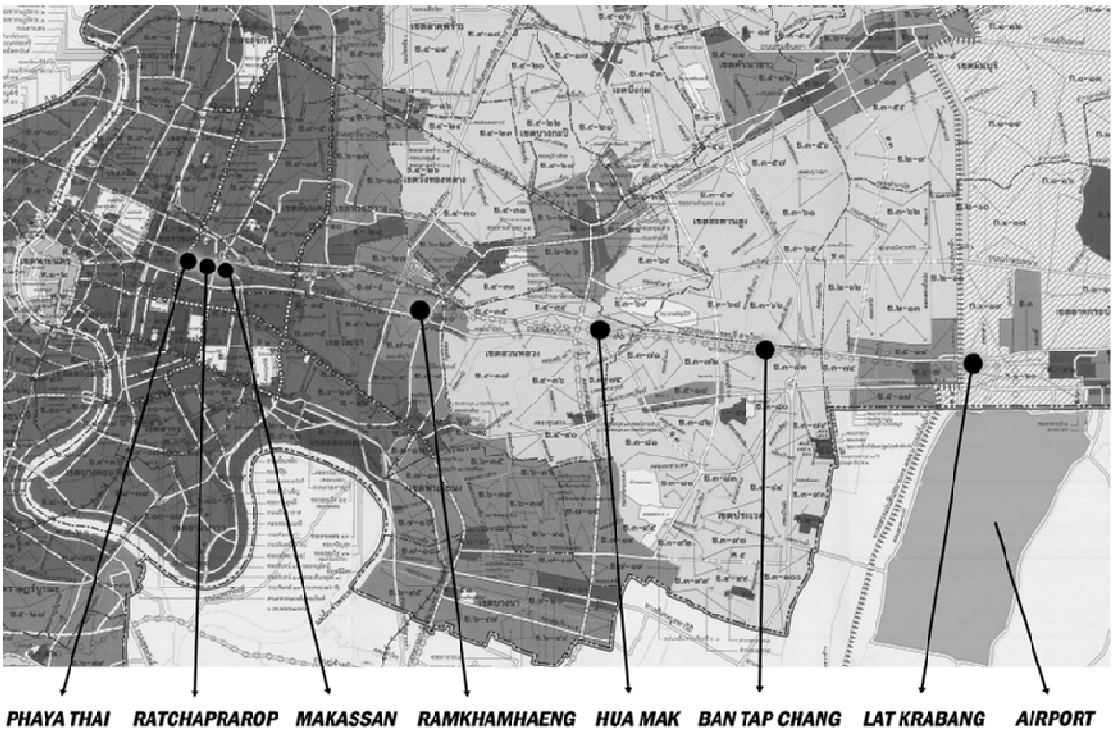



**Figure 3.1 ARL stations on BMA land-use map**

If all ARL stations are laid over Bangkok Metropolis Administration (BMA) land-use map as on Figure 3.1 and compared each other as on Table 3.2, there are 4 stations located in urban area and 3 stations located in suburban area.

Four ARL stations located in urban area are *Phaya Thai, Ratchaprarop, Makkasan,* and *Ramkhamhaeng*. The area around these stations is mainly populated by commercial buildings and/or offices. Those stations are also very busy in the morning as it becomes destination for most commuters from suburban. In the evening, those stations are full of passengers to go towards suburban direction.

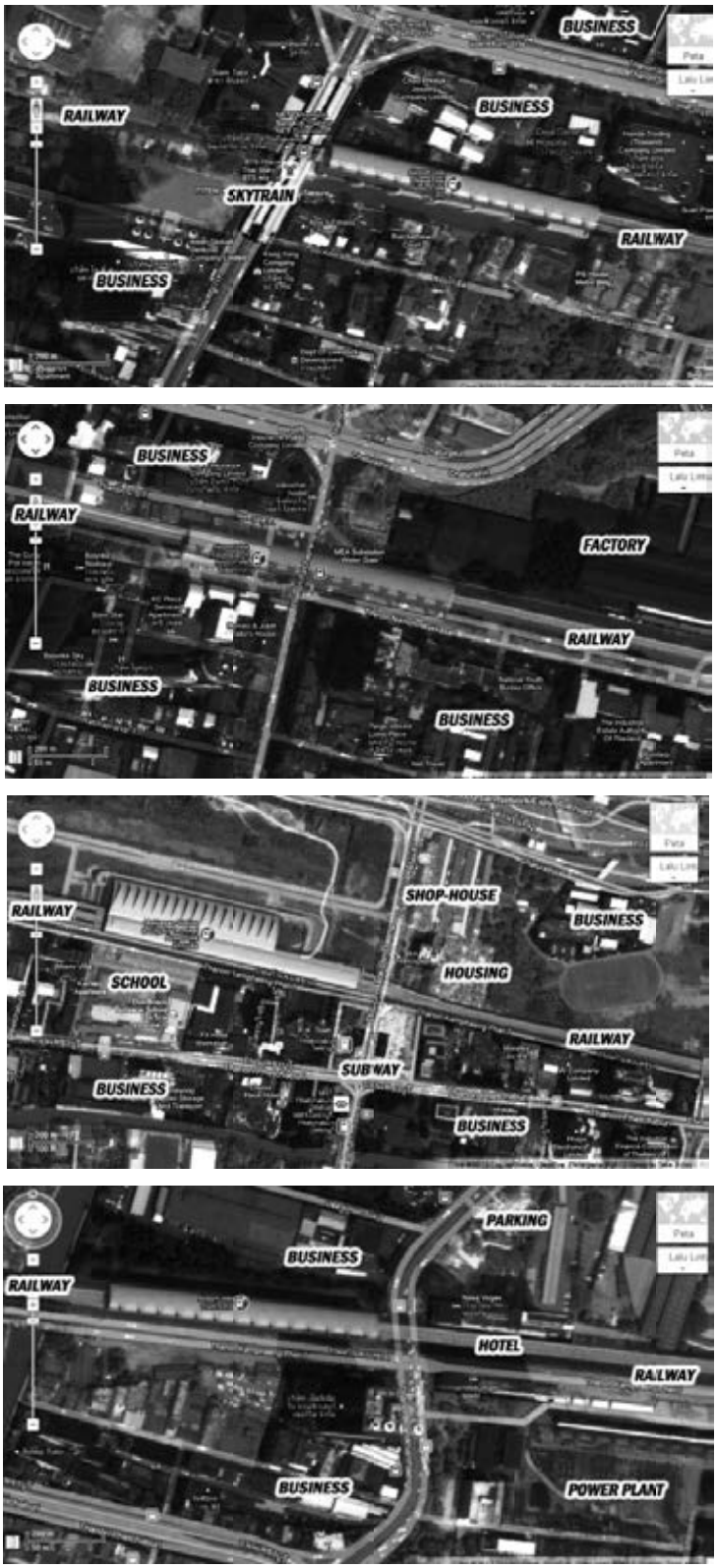



**Figure 3.2 Buildings around 4 ARL stations that are located in urban/ commercial area: *Phaya Thai* (first), *Ratchaprarop* (second), *Makkasan* (third), and *Ramkhamhaeng* (fourth)**

Other 3 stations: *Hua Mak, Ban Tap Chang,* and *Lat Krabang*; are located in suburban area. The situation in the morning and evening are almost the reverse of 4 urban stations. In the morning, the station is full by passengers who want to go to city direction while in the evening the station is full by the people who just coming back from city direction. The area around stations is also mostly populated by residential buildings.

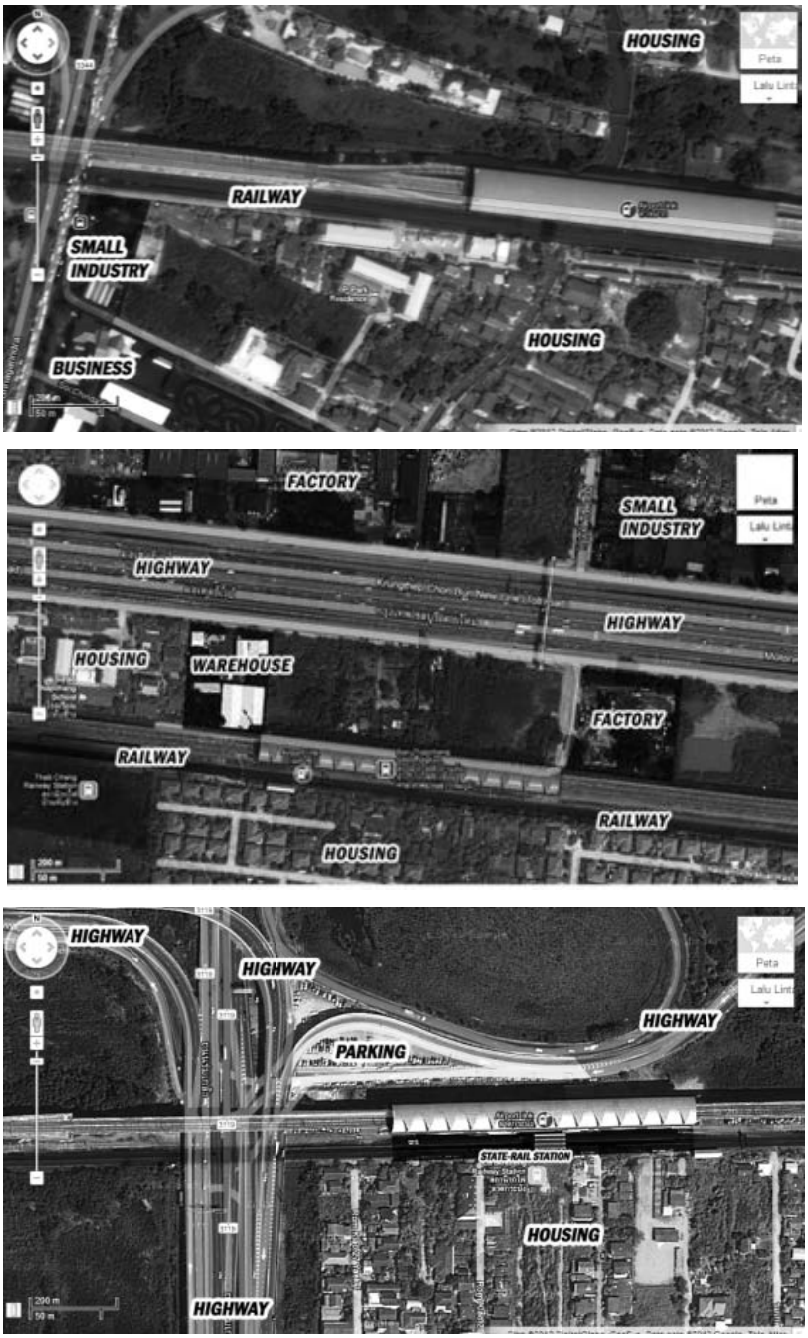



**Figure 3.3 Buildings around 3 ARL stations that are located in suburban/ residential area: *Hua Mak* (first), *Ban Tap Chang* (second), and *Lat Krabang* (third)**

Although BTS and ARL are both elevated metro system, ARL system was not built following the main road like BTS. Instead, it was built along the existing state railway that is owned by SRT as well. Furthermore, unlike BTS and MRT stations, most ARL stations were built off from the main road that is served by other public transportations. Thus, the station's entrance/ main stair is not directly reachable from the main road. People that use public transportation have to walk through railway, vehicular road, or parking bays in unoccupied area to reach the station. As the ARL station is positioned deep inside small road with limited land area, it is also has very limited accommodation for incoming private vehicles.

## 3. FUTURE DEVELOPMENT FOR ARL STATION AREA

Despite of its restricted initial development of ARL stations, there are some efforts already by State Railway of Thailand as the owner of ARL and other developer in order to make transit area for ARL station. Currently, there are 2 future developments for 2 ARL station areas: *Makkasan* and *Ramkhamhaeng*; according to official sources of Airport Rail Link. Both stations are located in downtown/ commercial area.

### 3.1. *MAKKASAN* COMPLEX

**Figure 3.4 *Makkasan* Complex aerial view (Design Concept Co., Ltd., 2012: online)**

| | |
|---|---|
| **Developer** | State Railway of Thailand (SRT) |
| **Consultants** | Thai Engineering Consultant<br>Design Concept Co., Ltd. |
| **Site area** | 913,600 m2 |
| **Total development cost** | 195 billion Baht |

### 3.1.1. SITE OVERVIEW

This project is an urban development for *Makkasan* area, spanning from *Ratchaprarop* ARL station to *Makkasan* ARL station. The whole land for development is also basically owned by State Railway of Thailand and currently used as train depot and maintenance. As can be seen on Figure 3.5, overall *Makkasan* area is situated in commercial area "red R5" according to BMA land use map. In this area, the Floor Area Ratio can be up to 10:1 and the Open Space Ratio can be as small as 3%. BMA permits the land use for most types of buildings: residential, commercial, market, gas/ fuel station, office, hotel, conference, entertainment venue, auditorium, zoo/ amusement park, education, healthcare, childcare, elderly care, and government/ institution, without limitation of building height or size.

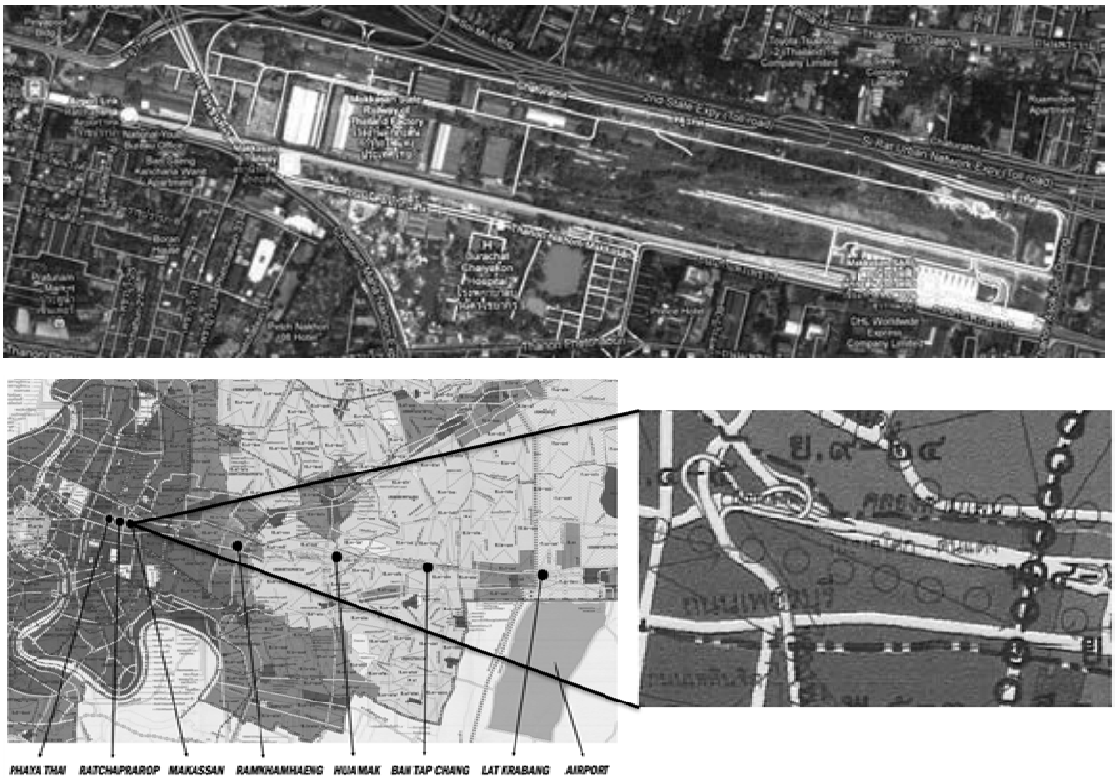



**Figure 3.5 Site location of *Makkasan* Complex (top) and its position to BMA land use map (bottom)**

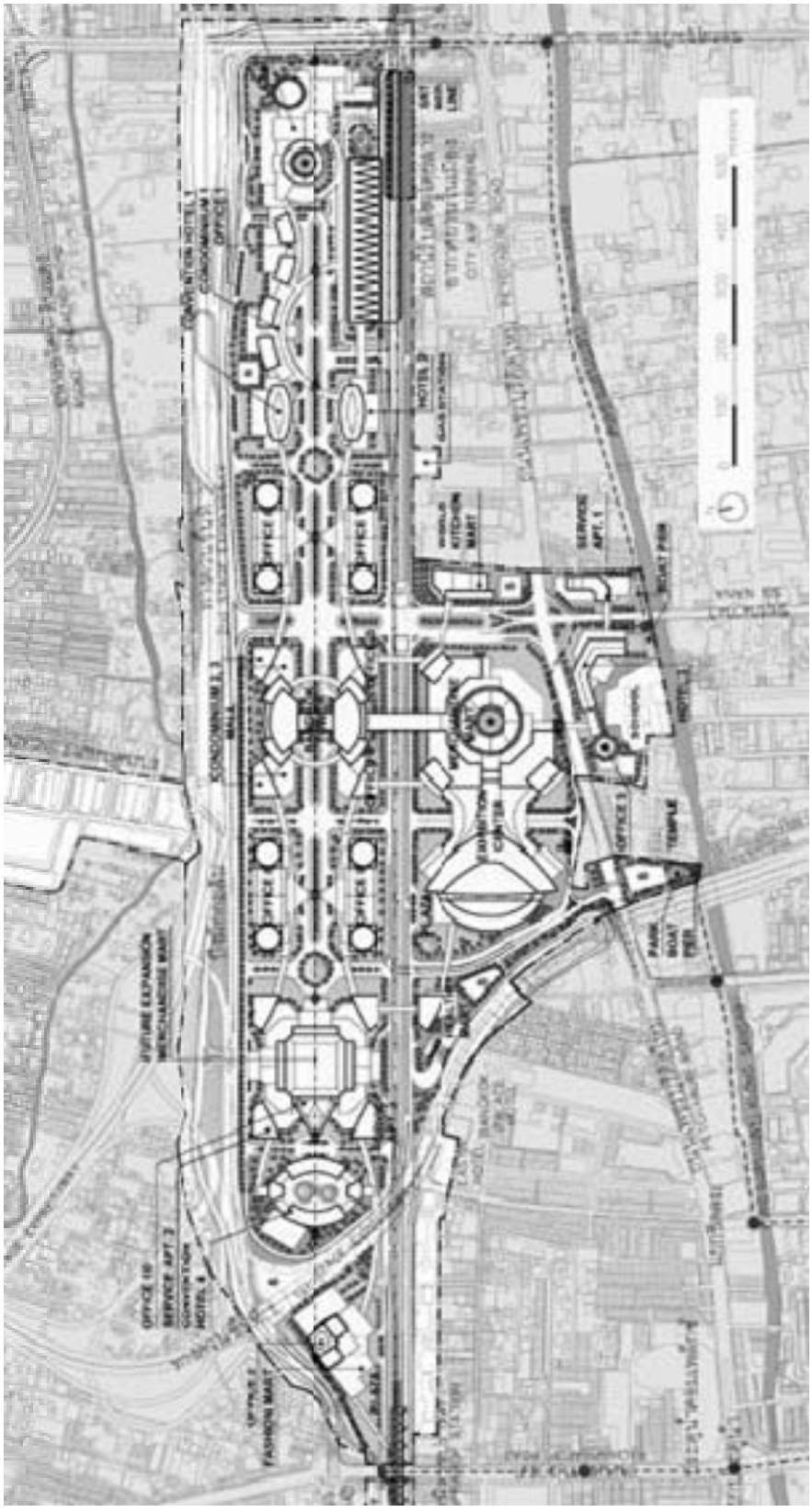


**Figure 3.6 Master Plan of *Makkasan* Complex (Design Concept Co., Ltd., 2012: online)**

### 3.1.2. PROGRAM

According to the masterplan of *Makkasan* Complex that can be seen on Figure 3.6, the overall programs for the area are as the followings:

- Twin Office Towers: 99 stories, 508,400 m2
- Hotel: 8,500 rooms; 470,100 m2
- Convention Center: 897,800 m2
- Exhibition and Shopping Center: 112,500 m2
- Serviced Apartment: 5,300 Units; 289,650 m2
- 50 years leased-hold Condominium: 8,600 Units; 390,000 m2

According to Bangkok Airport Rail Link, the whole complex will be developed in 5 years and divided into 3 phases of development. The first phase includes the development of trade/ exhibition centre in southern part, shopping centre and entertainment complex, hotel, and residential condominiums/ apartments in eastern part. The second phase includes the development of 99 stories twin office tower in central area which also becomes the landmark of this complex and more units of condominiums/ apartments. The third phase will be reserved for future development in the west area.

**Figure 3.7 Overall perspective of Makkasan Complex (Design Concept Co., Ltd., 2012: online)**

### 3.2. A-LINK SQUARE

**Figure 3.8 A-Link Square overall perspective (Airport Link Square Co.,Ltd, 2012: online)**

| | |
|---|---|
| **Developer** | Airport Link Square Co., Ltd. |
| **Site area** | 11,300 m2 |
| **Floor area** | 40,000 m2 |
| **Total development cost** | 900 million Baht |

#### 3.2.1. SITE OVERVIEW

The project site is located in *Ramkhamheng* area, adjacent to *Ramkhamhaeng* ARL station. This overall Ramkhamhaeng area, according to BMA land use map, is categorized as medium-density residential “orange R7” area. However, as can be seen on Figure 3.9, the land around the ARL station is categorized as commercial “red C3” area according to BMA land use map. In this area, the Floor Area Ratio can be up to 7:1 and the Open Space Ratio must not less than 4.5%. Just as for commercial C5 area, BMA permits the land use for most types of buildings in this land: residential, commercial, market, gas/ fuel station, office, hotel, conference, entertainment venue, auditorium, zoo/ amusement park, education, healthcare, childcare, elderly care, and government/ institution.

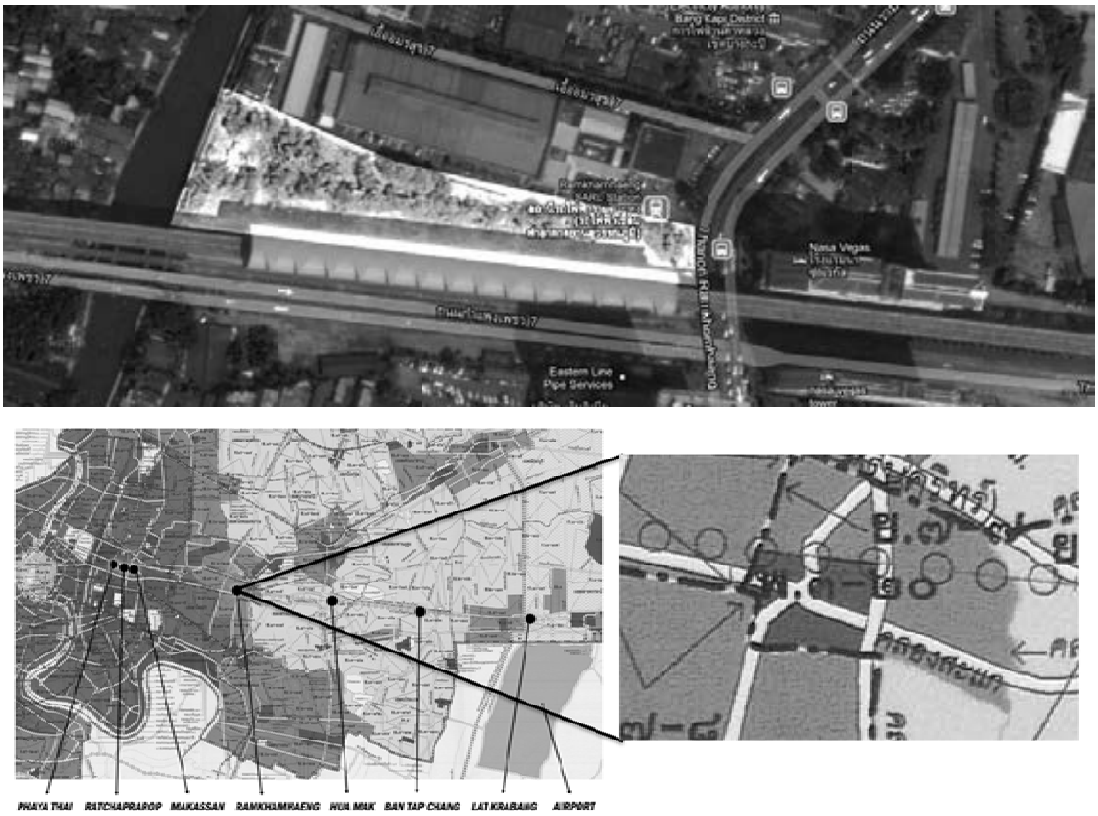



**Figure 3.9 Site location of A-Link Square (top) and its position to BMA land use map (bottom)**

### 3.2.2. PROGRAM

The overall floor area is divided into 4 parts of development. Part A – C of the area is for shopping mall development. The shopping mall consists of 6 floors with total of 133 shops and 2 basement levels for parking of 300 cars. Overall shops in the mall will be composed as: 38% for restaurants, 18% for fashion stores, 13% for lifestyle stores, 10% for spas and beauty salons, 6% for banks, 9% for cafés and bakeries, 3% for mini-shops, and 3% for supermarket (Matichon Public Co.,Ltd., 2012: online). According to Airport Link Square's study, the biggest area priority for restaurant is driven by the current trend of young people or university graduates that want to have a business in culinary. Therefore, this shopping mall is an effort to provide more space to support them. The mall's main consumers target are neighboring residents living on *Sukhumvit 71, Ekamai, Thonglor, Khlong Tan, Phatthanakan, Rama IX, Ramkhamhaeng,* and *Petchaburi* roads (Apimonton, 2012: online). However, it also targets the air travelers and tourists that want to buy something before getting to airport (Matichon Public Co.,Ltd. , 2012: online).

Part D of the area is developed for (self proclaimed) 6 stars hotel, branded Niras Bangkok Hotel. This hotel only consists of 63 rooms. With easy access from airport using ARL, the hotel has purpose to attract foreign tourists and provide accommodation for people from other provinces that attend the event in Bangkok. It also has parking area for 600 cars, making total car parking capacity for this site is 900 cars. The overall development is targeted to complete in second quarter of 2013 (Apimonton, 2012: online) and hoped to bring Return of Investment in 6 years.

## 4. SUMMARY OF BANGKOK AIRPORT RAIL LINK

This chapter has provided comparison between 3 Bangkok Metro systems serving city commuters: BTS, MRT, and ARL. It also has reviewed overall elevated ARL station and their planning to BMA planning map. Besides underground airport terminal, there are 7 elevated ARL stations. After going through field observation to compare all elevated RAL station and mapping all stations position on BMA land-use map, we can see that there are 4 stations located in urban area that become train passengers destination and 3 stations located in suburban area that become train passengers origin.

This chapter has also provided 2 future developments for ARL station area according to State Railway of Thailand. The first one is *Makkasan* Complex, an urban development consists of office, hotel, apartment, convention, and shopping, that will be developed by State Railway of Thailand on their owned land that spans from *Makkasan* station to *Ratchaprarop* station. The second development is A-Link Square, a mix of shopping mall and hotel that will be developed by Airport Link Square for *Ramkhamhaeng* area. Both developments, however, are planned for the station located in urban/ commercial area that almost has no restriction in terms of development type and size. Until now, there is still no development revealed yet by ARL for 3 stations in suburban area: *Hua Mak, Ban Tap Chang*, and *Lat Krabang*.

# CHAPTER IV
# RESARCH: SITE ANALYSIS

## 1. OBJECTIVES

The first objective of this part is to understand the area of *Hua Mak, Ban Tap Chang,* and *Lat Krabang* according to BMA land use regulation and majority buildings in its neighborhood, whether it is commercial, residential, or industrial area. Furthermore, it is also to understand daily life situation on the site of each station, such as: transit activities, time, transportation modes available, and movement pattern. Lastly this part is also to figure out the station user types and their activities on station's arrival zone.

## 2. METHODOLOGY

To address the objectives, there are 2 steps need to be done: literature review about the regulation and field observation. Literature review is mainly to study the area function according to BMA land use map year 2549 B.E. and the building regulation related to it.

Field observation is the main methodology for this research part, firstly, to look the overview building around the station in reality, whether it matches the BMA land use map or not. Secondly, it is to understand the daily transit activities in the station. The transit modals used by passenger is categorized according to literature review. The condition of each transit facility is also reviewed to know the differences with the literature/ theory. Next, the interchange points are drawn in a map and the movement pattern of the passengers and drivers to/ from the station from/ to other transportation modes is drawn in diagram. Lastly, field observation is also to figure out the station user types. The station users, their activities, and facilities related to the activities are categorized and listed on Tables. The result of this will be the base for next part of research.

To understand the daily life of station, field observation is done several times during different times of the day: morning, afternoon, and evening; and different days of the week: weekdays and weekend.

## 3. SITE ANALYSIS: *HUA MAK* ARL STATION

### 3.1. AREA OVERVIEW

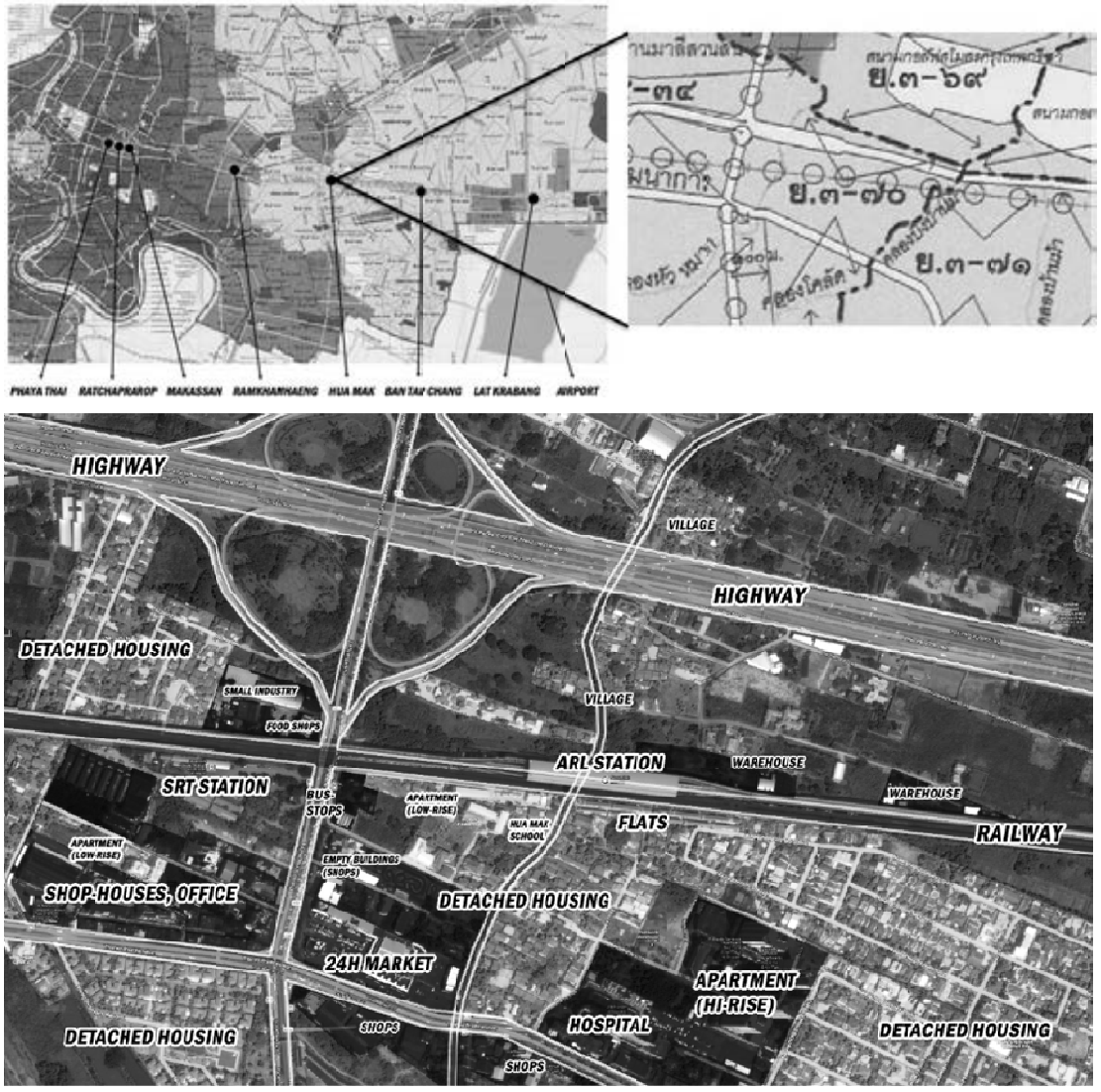



**Figure 4.1 *Hua Mak* ARL station position to BMA land use map (top) and buildings around the station (bottom)**

#### 3.1.1. REGULATIONS

*Hua Mak* ARL station is located in low-density residential area "yellow R3" according to BMA land use map 2549. According to it, the Floor Area Ratio (FAR) must not exceed 2.5:1 and the Open Space Ratio (OSR) must not less than 12.5%. There is no limitation for the building height. The land uses for the area are as the followings:

- **Residential**: single family house, duplex house, town house/ shop-house/ row house, residential combined if located adjacent to public way not less than 10 m width or within 500 m from train station, residential up to 10,000 m2 if located adjacent to public way not less than 30 m width or within 500 m from train station
- **Commercial:** shop-houses, commercial less than 200 $m^2$, commercial between 200 – 2,000 $m^2$ if located within 500 m from train station or adjacent to public way not less than 16 m width, commercial up to 10,000 m2 is located within 500 m from train station or adjacent to public way not less than 30 m width
- **Market:** up to 2,000 $m^2$ if located adjacent to public way not less than 30 m width
- **Gas/ fuel:** Gas/ fuel station if located adjacent to public way not less than 16 m width, natural gas supply/ distributor and food supply
- **Office**: shop-house, office less than 100 $m^2$, office between 200 – 2,000 $m^2$ if located adjacent to public way not less than 10 m width or within 500 m from train station, office up to 10,000 $m^2$ if located adjacent to public way not less than 16 m width or within 500 m from train station
- **Conference/ convention** if located within 500 m from train station or adjacent to public way not less than 30 m width
- **Zoo/ amusement park** if located adjacent to public way not less than 30 m width and has open space or setback conditions
- **Factory/ warehouse** up to 500 $m^2$ if follows the ministerial regulation notes
- **Industry**: concrete mixing facility depends on the size and service, construction waste trade if it is located adjacent to public way not less than 10 m width, waste management facility under permit from BMA
- **Community**: Education, healthcare with/ without admission, childcare, elderly care
- **Government/ institution**
- **Others**: Slaughter house, cemetery/ cremation, billboards

The roads around *Hua Mak* ARL station are *Thanon Srinagarindra* which has width of 30 – 33 m and the local road under station which has width of 6 – 7 m. The area itself is within 500m radius from *Hua Mak* ARL station and *Hua Mak* train station. Therefore, all mentioned land uses for R3 area are applicable for *Hua Mak* ARL station area.

### 3.1.2. BUILDINGS

Within 400 m radius, most of buildings around *Hua Mak* ARL station are located in southern part, crossing the ground railway from ARL station. Right across the station, the area is dominated by low-rise residential building that consists of 1 – 2 stories detached housing and flats or apartments with less than 5 stories height. In the midst of this community, there is 1 school: *Hua Mak school*, that also can be seen from ARL station. The only high rise apartment *is Floraville Apartment* that has to be accessed from *Thanon Patthanakan* 350 m in the south (around 1 km total walking distance), along with *Vibharam Hospital*.

**Figure 4.2 Low-rise apartment and detached housing (top) *Hua Mak* school and Floraville apartment (bottom)**

The commercial buildings are mainly located along *Thanon Srinagarindra*, 300 m to the west from ARL station, and *Thanon Patthanakan* in the south. The most noticed commercial building is market complex with 24 hours supermarket and 2 – 3 stories restaurants/ shops. It is located at the corner of intersection between *Thanon Srinagarindra* and *Thanon Patthanakan*, 537 m walking distance to south-west from ARL station exit. Although the market is easily accessed from both main streets, due to its far distance from the ARL station, it was hard to see ARL passenger walks from the station to stop by this place. Other commercial buildings are mainly row of shop-houses with height of 3 – 4 stories and some offices along *Thanon Patthanakan*. There is a row of shops with height of 1 storey along *Thanon Srinagarindra* on the east side, but most of them have been broken and abandoned.


**Figure 4.3 24-hours market complex (top) and shop-houses row (bottom)**

The main SRT railway station is located 400 m to the west of ARL station, across *Thanon Srinagarindra*. Although it is announced in ARL train that passenger can interchange from ARL line to SRT line, each line seems have different customer and no interchange between two lines. This could be caused each line has the same route, connecting the suburban (*Hua Mak* in this case) and city center, but with different end point of journey. The ARL line ends at *Phaya Thai BTS station* while SRT line ends at *Hua Lamphong* train station in city center. Therefore, people with different end point destination will pick different line as well. However, the passengers of both transit line modes are connected to other transit modes serving the main street. From ARL and SRT station, passenger will go to the same main road, *Thanon Srinagarindra*, and pack same bus stops along it.

**Figure 4.4 *Hua Mak* train station**

To the north of ARL station, there are not many buildings. Most of the areas are empty lots with undeveloped lush area bordered by highway: *Krungthep Chon Buri New Line*. There is small area of 1 – 2 stories residential houses that can be accessed from walkway along the canal under the ARL station.

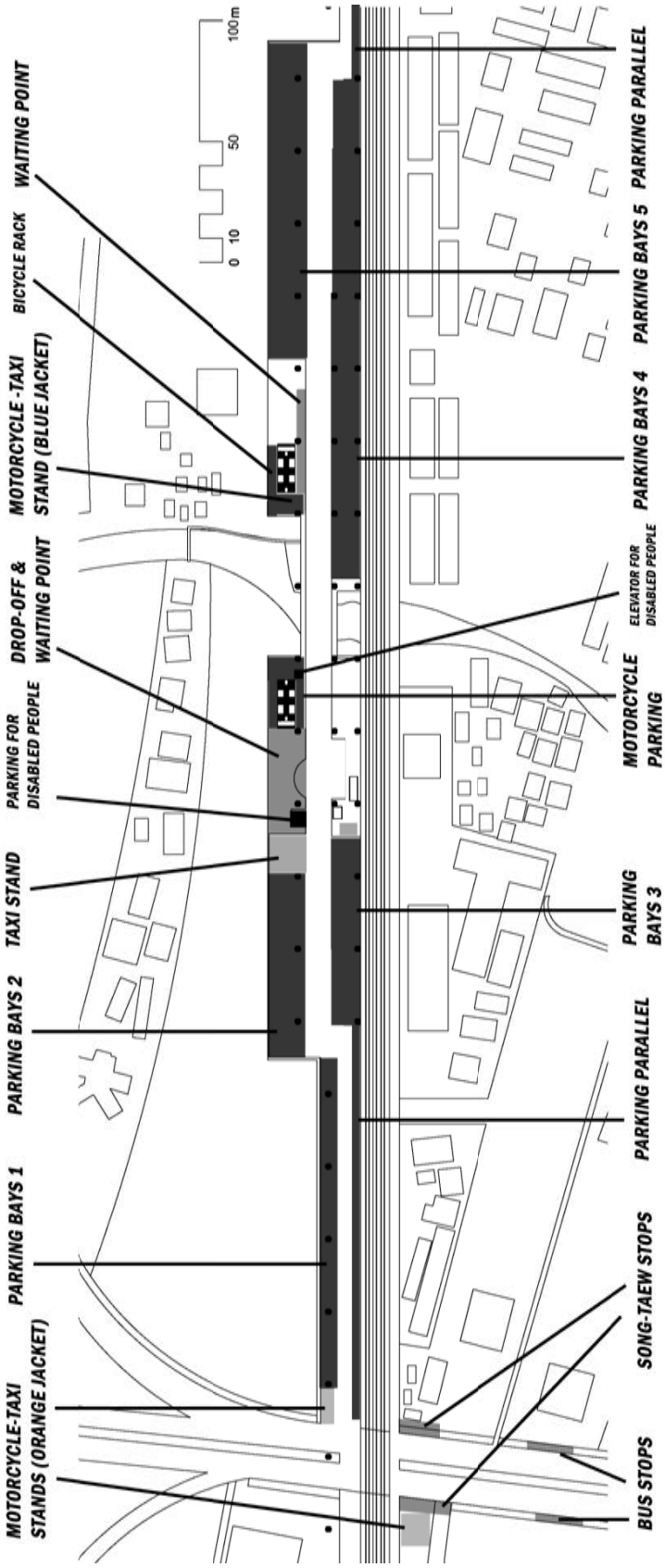



**Figure 4.5 Current nodes of transit modals of *Hua Mak* ARL Station**

### 3.2. NODES OF OTHER TRANSIT MODALS

As mentioned in literature review, there are several modes of transportation for ARL user approaching and leaving the station: by bus, *song-taew*, paratransit van, taxi, motorcycle-taxi, private vehicle (as passenger), driving own vehicle (car, motorcycle, and bicycle), and walking. There are different stop points for each mode as can be seen on Figure 4.5.

#### 3.2.1. PUBLIC TRANSPORT STOPS

##### 3.2.1.1. Bus

The closest bus stops are located on *Thanon Srinagarindra*, 400 m walking distance from station exit to the south-west. There are 5 bus lines serving this road: 145, 182, 207, 519, and 537. There are different conditions of bus stop on this road. The bus stop on the west lane (heading north) has shelter and seating, while the bus stop on east lane (heading south) does not have them although it still has the sign of bus stop.

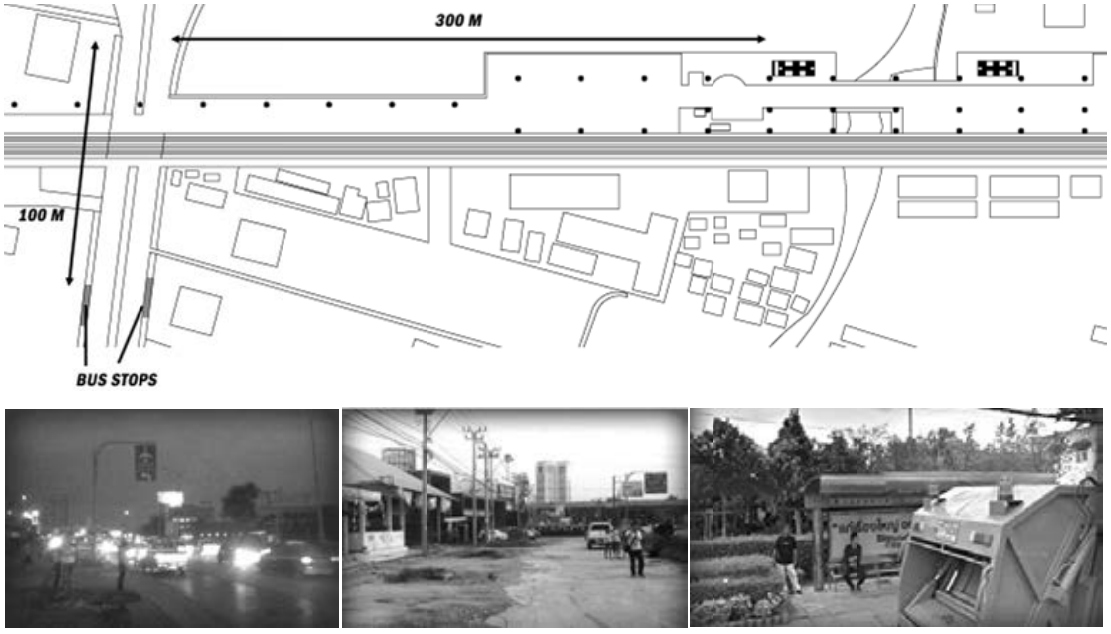



**Figure 4.6 Top: Bus stops location near *Hua Mak* ARL station; bottom: bus stop condition: east lane (left and middle) and west lane (right)**

### 3.2.1.2. *Song-taew*

The pickup-van/ *song-taew* is different than bus. Although both bus and *song-taew* are public transport, used by many people at once, the *song-taew* do not stop at provided bus stop. Instead, they prefer to stop and drop the passengers near or in the middle of railway crossing due to slowing down vehicle speed at this point and closest walking distance for passenger (300 m). There is no formal stop for *song-taew*. Passenger who takes *song-taew* also waits near the railway crossing. Since the stop is informal, there is no sign, shelter, nor fixed seating for waiting passengers. The seating is apparently owned by local people.

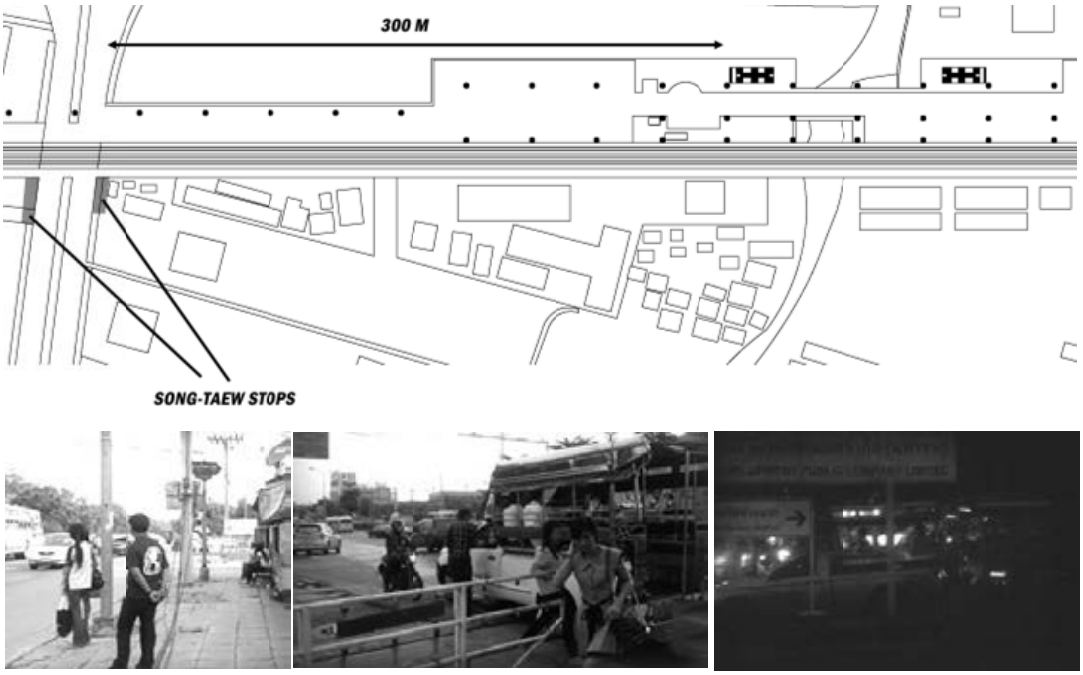



**Figure 4.7 *Song-taew* stop near *Hua Mak* ARL station**

All public transport stops distance to the station already exceed the maximum distance in general station guidelines, 150 m. However, because of physical environment such as distance, access road width, and turning radius requirement; it is impossible for bus or other public transport along the main road to reach ARL station entrance directly. People still need to walk 300 – 400 m from the station exit to the main road in order to reach other public transportation stops. The walking facility is discussed further in section Pedestrian Route.

### 3.2.2. PARATRANSIT STANDS

#### 3.2.2.1. Taxi

Taxi facilities for the station include 3 types: taxi stand/ parking, passenger drop-off, and driver's rest area. All of facility types are located adjacent each other.

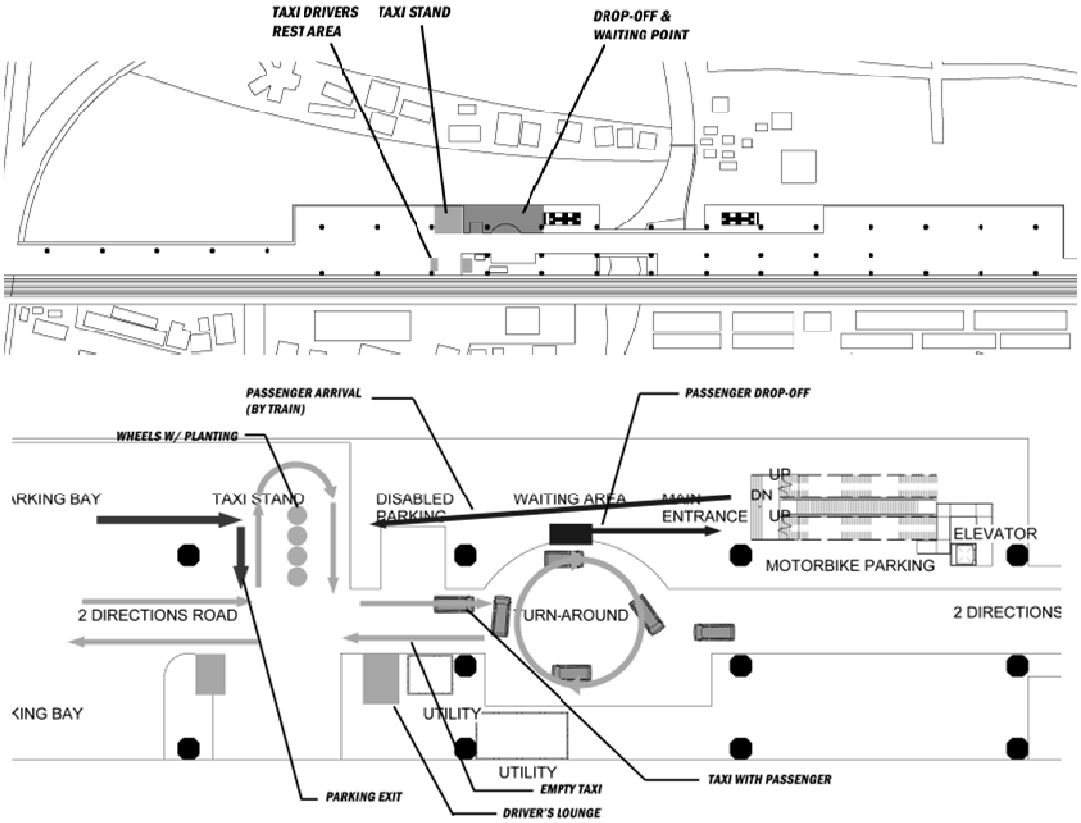



**Figure 4.8 Taxi stand and drop-off position (above) and pattern of taxi circulation and driver's facility (bottom)**

The taxi stand is located 40 m to the west from station entrance. It takes up the exit way of west parking bays. It is not sheltered and has capacity around 6 – 8 cars. The taxi stand also acts as pick-up point for taxi passenger. The taxi that comes to station will drop the passenger at the same drop-off point as kiss-and-ride facility, which also the turnaround point for the road under station. In the morning after the taxi drop-off the passenger, it mostly will turn back to *Thanon Srinagarindra*. However, in the afternoon where the road traffic is much lighter, after dropping-off the passenger, the taxi will turn back and park at taxi stand. The taxi drivers take break, do social activities, and buy food from passing vendors at the driver's rest area, across to the taxi parking, as can be seen on Figure 4.9. There are benches and tables set up at those spots that support mentioned activities.

**Figure 4.9 Drop-off area (top), taxi parking (middle), and driver's rest (bottom) at *Hua Mak* ARL station**

Apparently, the circulation for taxi was not planned as the entry of taxi parking is same as exit way of car parking. There is only informal separator made from wheels and planting to separate the car parking exit and taxi stand. The driver's rest area is not sheltered and only has dirt as its ground.

#### 3.2.2.2. Motorcycle-Taxi

There are 3 motorcycle-taxi stands in this area: 2 spots are located near railway crossing/ *Thanon Srinagarindra*, 300 m walking distance from ARL station and another 1 is located under east entrance/ stair of ARL station. According to the field observation, each stand serves passenger for different destination/ origin and the drivers have different jacket color. The first stand (*orange jacket I*) located in front of *Hua Mak* rail station (SRL), mainly serves passenger coming from and to *Hua Mak* train station. The motorcycle-taxi stand across it (*orange jacket II*) serves the passenger coming out from bus or *song-taew* to ARL station or residential. The motorcycle-taxi stand located under the ARL station (*blue jacket*) serves the passengers from ARL station, mainly to east direction/ local residents. The stand of orange jacket driver has more members, around 10 – 15 motorcycles for each stand. Mean while, the stand of blue jacket driver only has 5 – 6 motorcycles.

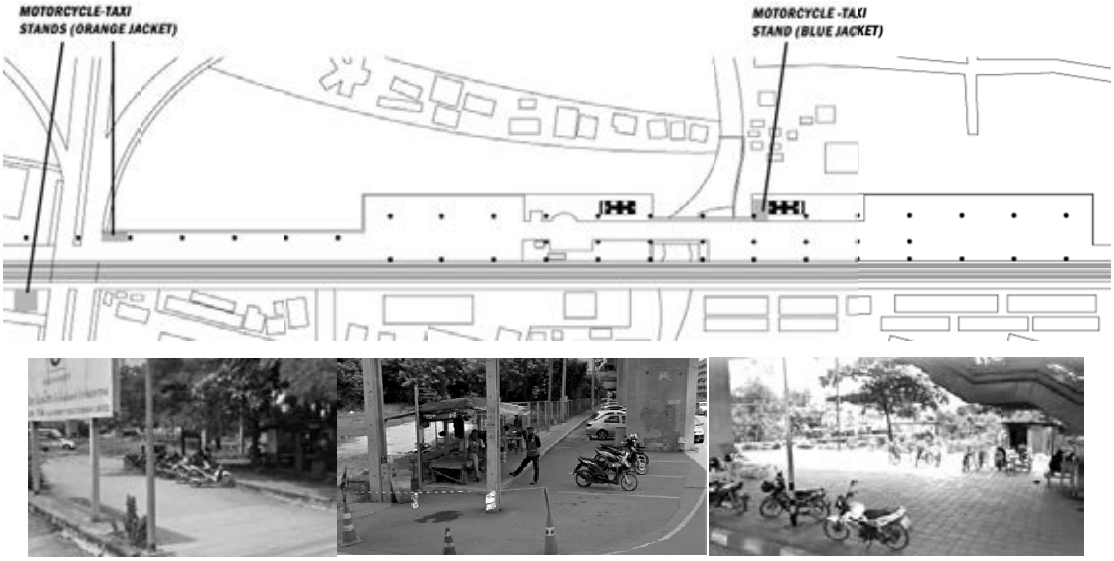



**Figure 4.10 Top: position of motorcycle-taxi stands near *Hua Mak* ARL station; bottom: the stand of orange jacket drivers I (left), orange jacket drivers II (middle), and blue jacket drivers (right)**

As in many other places, motorcycle-taxi stands are not provided in the station planning but informally by the drivers. The motorcycle-taxi stands consist of non-permanent shelter and furniture. It takes the space of pedestrian sidewalk and road shoulder (orange jacket I), parking bays (orange jacket II), and bicycle rack (blue jacket). The stands of orange jacket driver are only partially sheltered. The shelter only covers the seating while the motor parking is not sheltered. On the other hand, the stand of blue jacket driver is fully sheltered under the ARL station. Just as the taxi drivers, the motorcycle-taxi drivers also do social activities, maintaining their motorcycle, and buy the food from passing through street vendors. In the evening, some street vendors are also seen standing by near the motorcycle-taxi stand (orange jacket II). During this time, passengers that walk from the station also buy the food from the street vendors.

**Figure 4.11 Street vendor near motorcycle-taxi stand in the evening**

The drop-off point for motorcycle-taxi passenger is basically same as the drop-off for private vehicle/ taxi. However, motorcycle-taxi drivers from west direction often ride up to the pedestrian sidewalk through provided curb-cuts for disabled to drop the passenger right in front of the main stair, especially in the morning time when the road traffic is packed. After finish dropping-off, they come back to that direction to stay at the stand near the main road. By waiting at the road intersection, the chance to get their passengers is higher, not only come to ARL station, but also the passengers that go to residential area around the station.

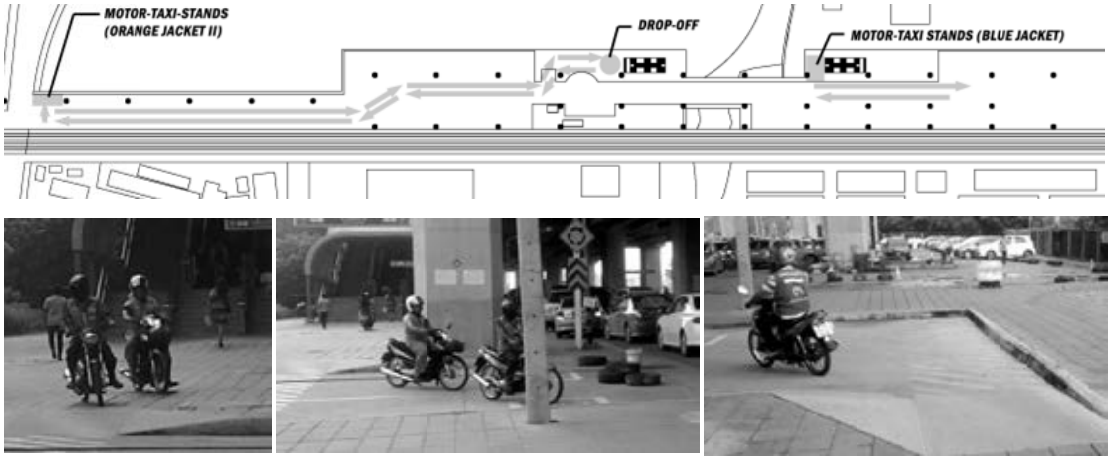



**Figure 4.12 Motorcycle-taxi route (top) and motorcycle-taxi drop-off (bottom) at *Hua Mak* ARL station**

### 3.2.3. KISS-AND-RIDE

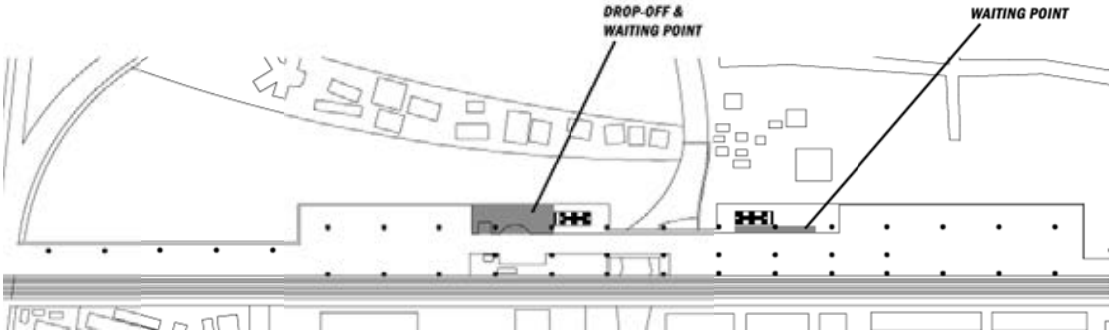



**Figure 4.13 Kiss-and-ride area of *Hua Mak* ARL station**

Kiss-and-ride facilities for this ARL station consist of main drop-off/ pick-up point and secondary waiting point. Drop-off/ pick-up area is located right in front of west station entrance/ main stairs. Secondary waiting point is located near east entrance of the station.

### 3.2.3.1. Drop-Off and Waiting Point

**Figure 4.14 Drop-off/ waiting area at *Hua Mak* ARL station during weekdays in the morning (top), evening (middle), and weekend (bottom)**

Drop-off/ pick-up point is used by the drivers of private vehicle, paratransit van, taxi, and motorcycle-taxi to drop the passenger in the morning. Due to space limitation, this drop-off point also acts as turnaround point for vehicle circulation from east and west direction with outer turning radius of 6 – 7 m without middle island. The ideal drop-off point should allow 2 -3 cars stacking. However, since basically it is also the turnaround point, the queuing makes traffic jam for both direction. The overall vehicle circulation will be discussed in section Vehicle Circulation.

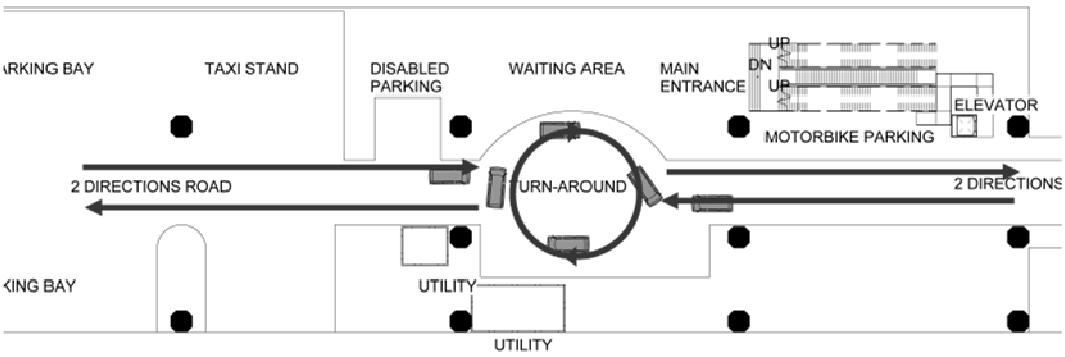



**Figure 4.15 Traffic direction in drop-off/ waiting area at *Hua Mak* ARL station**

The drop-off/ pick-up point is packed by passengers moving to the station in the morning, between 07.00 – 09.00 AM, and by passengers waiting for their relatives to pick them up in the evening, between 05.00 – 09.00 PM. During weekend, there is no significant people congestion.

This facility is not sheltered nor has seating. Therefore, most of waiting passenger can just only stand while waiting. Unless the ones who use motorcycle which can be illegally parked on pedestrian sidewalk, most people that come to pick-up the passengers cannot wait in the station area since the car parking bays are always full. Some of waiting people that are tired can only sit on the stairs. During the rain, passengers also can only wait on the stairs. However, during the rush hour, it impedes passenger circulation from and to the station.

**Figure 4.16 People are sitting on the stair since there is no seating facility**

### 3.2.3.2. Secondary Waiting Point

The secondary waiting point is located near the east stair and motorcycle-taxi stand. This point however only becomes the waiting point for the passengers that want to be picked up in the evening. It does not become the drop-off point in the morning. The passengers who wait at this point are usually picked-up by vehicle that moves to the east from main road. There are seating facilities/ benches for waiting in this area but it is not sheltered.

**Figure 4.17 Secondary waiting area at *Hua Mak* ARL station**

### 3.2.4. PARK-AND-RIDE

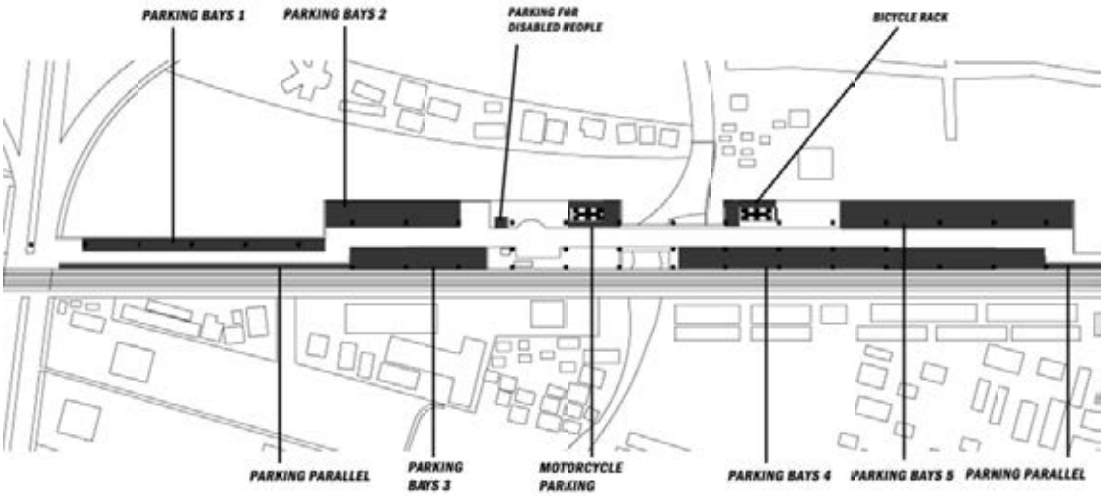



**Figure 4.18 Parking bays facility and parallel parking around *Hua Mak* ARL station currently**

There are 5 car parking bays area prepared for this ARL station, as can be seen on Figure 4.18. Counting from the field, total parking bay capacity is ±230 cars: ±100 cars on the west section and ±130 cars on the east section. While during weekend and holiday most parking bays are empty, during weekdays from morning to evening, the number of vehicles parked there is estimated 400 – 500 cars.

**Figure 4.19 Car parking bays of *Hua Mak* ARL station during weekend (top), weekdays (middle), and parallel parking during weekdays (bottom)**

As the result of exceeding car numbers, many cars are parked parallel on street and make the street narrower than it should be, from 6 – 7 m to 3.5 – 4 m for 2 directions. Parallel parking also makes it difficult for other cars to get out from parking bays. Parallel parking spans from the intersection with *Thanon Srinagarindra* until 700 m to the east, 260 m from the east end of ARL station, mainly along southern side of the road.

The ARL station has 2 parking bays for disabled that is located next to drop-off point. It includes curb-cuts to enable wheeled-chair person's movement. This 2 cars capacity parking bay is mostly empty all the time and closed with wheels to prevent other cars parking here.

### 3.2.5. BICYCLE AND MOTORCYCLE PARKING

Originally, there are 2 bicycle parking area under each station stair. Each bicycle parking has rack with 8 bicycle capacity. It makes 16 bicycles capacity rack in total. However, no one is seen to use bicycle to the station. Each bicycle parking now is used as another function.

Bicycle parking under the main stair on the west is used as motorcycle parking. Since the motorcycle parking here was not provided in station planning, people must access this parking place through pedestrian sidewalk. There are around 50 motorcycles parked at this place. Therefore, the motorcycles parked here also blocked the access towards disabled people elevator. People just park the motorcycle at this point due it is closest to the main stair. To park the motorcycle, the drivers will go through pedestrian sidewalk from curb-cuts for disabled people. The parking is also not secured. Bicycle parking under the east stair is used as motorcycle-taxi stands. It also has no motorcycle access from street.

**Figure 4.20 Motorcycle parking at *Hua Mak* ARL station (left & middle) and bicycle stand that become motorcycle-taxi stand (right)**

## 3.3. PEDESTRIAN ROUTE

### 3.3.1. SIDEWALK

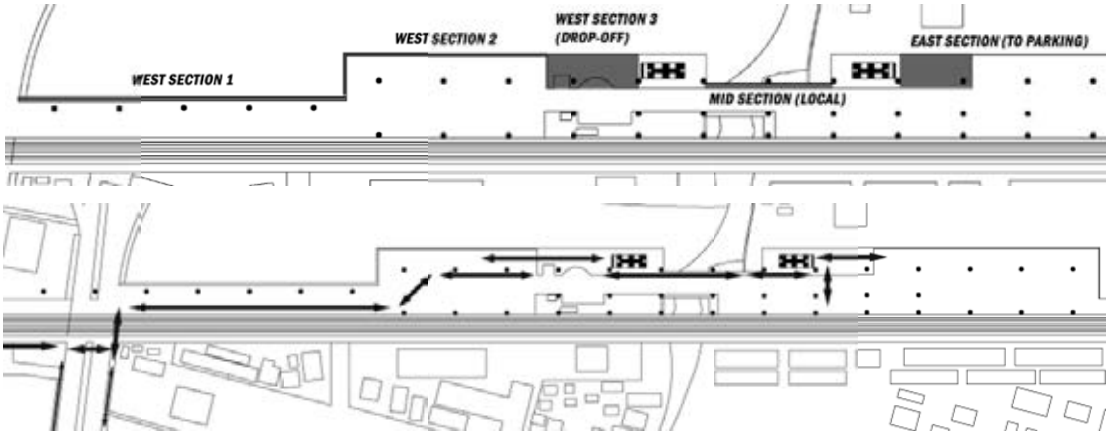



**Figure 4.21 Sidewalk (top) and actual pedestrian route (bottom) to *Hua Mak* ARL station from the main street**

Starting from the west ARL station stair, to the west, the pedestrian sidewalk is only located on the north side of the road. On this side, due to ARL station configuration, the sidewalk can be divided into 3 sections: the first section spans 150 m from parking bays to the main road, the second section spans 90 m along the taxi stand and parking bays, and the third section spans 40 from entrance to taxi stand. The third section is the widest part with 15 m width and becomes the waiting area as.

The first and second section has 1 m width and located behind parking bays, as it is shown on Figure 4.22, concealed by parking cars. The lighting fixture does not illuminate the sidewalk at night-time. The concealed and dark conditions of the sidewalk make it difficult to invoke personal surveillance. The parking bays are flooded after heavy rain and make it difficult for crossing from this sidewalk to the bus stop. Due to these factors, not many people use this part of sidewalk. People prefer to walk in the middle of street.

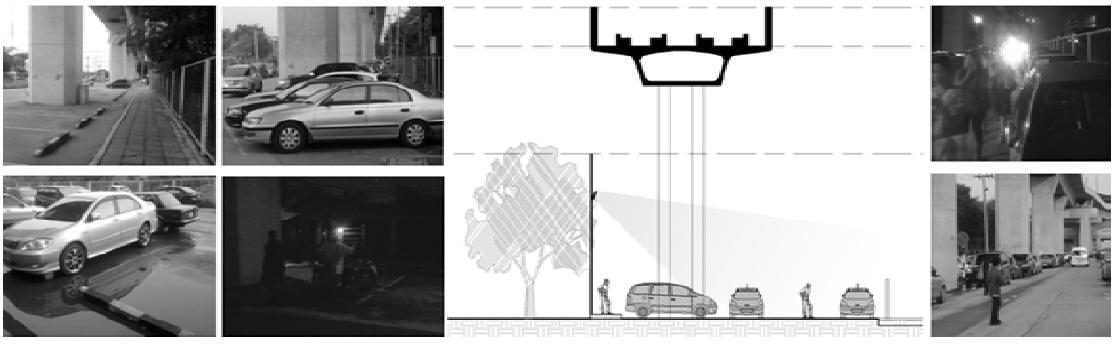


**Figure 4.22 Section of access road/ sidewalk**

There is no walk-able destination (within 400 m) to the east of the ARL station until the end of the road that connects to *Mueang Thong 2 Project 3 Soi 11*. The south side of the road is all bounded by main railway and concrete blocks that separate it from the road. The north side of the road is all bordered by empty lot and industrial warehouse surrounded by fence. The pedestrian sidewalk on the east also stops at the end of ARL station. Therefore, people usually travel to the east using motorcycle-taxi.

### 3.3.2. CROSSWALK

**Figure 4.23 Crossing point of *Thanon Srinagarindra***

Currently, the preferred crossing point of *Thanon Srinagarindra* is located adjacent to the railway crossing, although there is no actual/ legal crosswalk marking. It is safe to cross the main road here when the gate are closed due to passing train and make all cars stop. Low speed of incoming vehicle due to crossing through railway also help pedestrian to cross. However, at mid-to-high traffic volume around mid-day without any train crossing, the vehicle can still come at high speed. With 3 lanes width for each direction and high speed vehicles, it is difficult and dangerous for crossing.

### 3.3.3. WALKWAY

Under the station, there is only 1 walkway adjacent to the canal in the middle. It connects the street to local residential area in the north and only has width between 1 – 1.2 m. Therefore, only local people or motorcycle-taxi drivers use this walkway.

**Figure 4.24 Walkway under *Hua Mak* ARL station to local residential**

### 3.4. DISABLED PEOPLE ACCESS

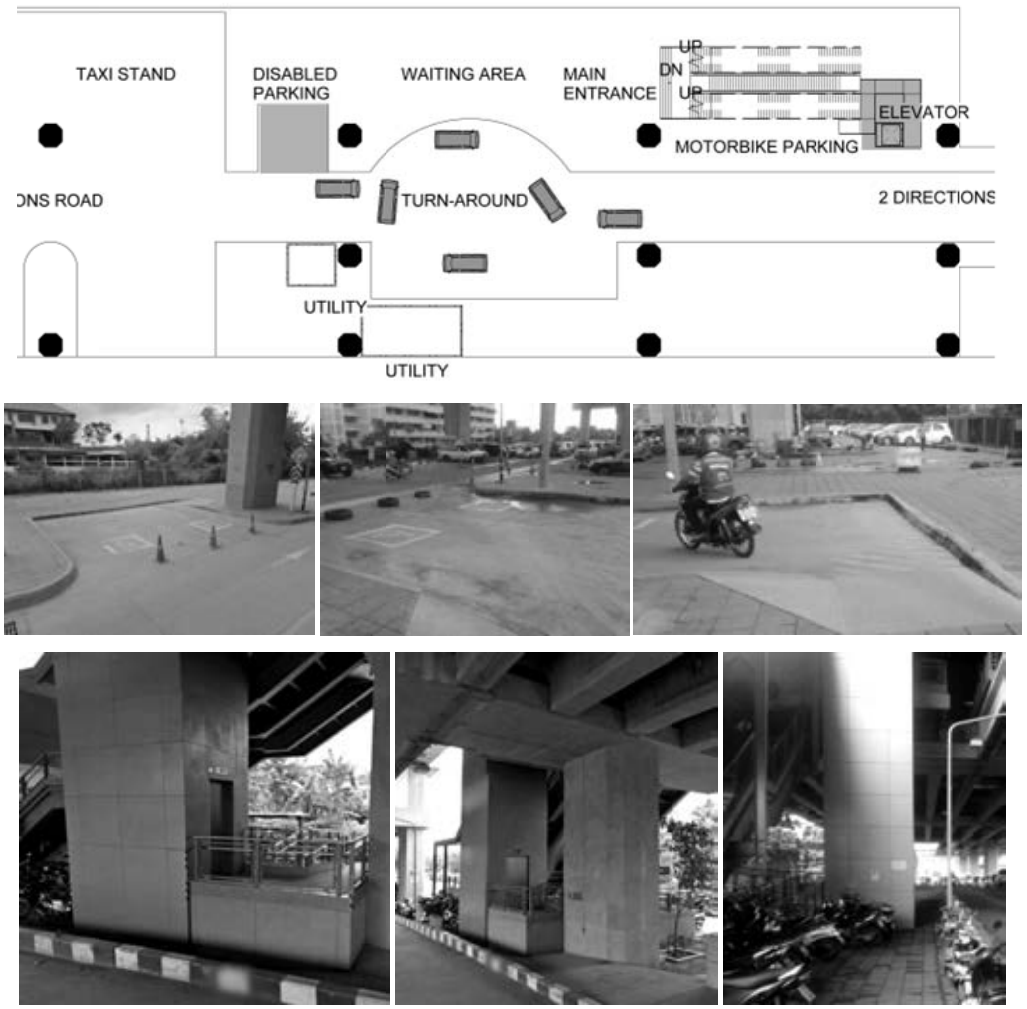



**Figure 4.25 Location of disabled people provisions for *Hua Mak* ARL station (top), condition of parking bays for disabled (middle), and condition of access elevator for disabled (bottom)**

As shown on Figure 4.25 above, there are 2 provisions for disabled people in this station: parking bays for disabled and elevator to access the concourse level from the street.

**Parking bays for disabled** people located between taxi stand and drop-off area, 30 m from main stair entrance. It has capacity of 2 cars and has 1 m wide curb-cut for wheel chair access. During the field observation, the parking bays are not used and closed with an array of wheels. The provided curb-cut is used by motorcycle to get on pedestrian sidewalk.

**The elevator for disabled** is located behind the main stair, 50 m from disabled parking, facing the opposite direction from main entrance. It has 1 m wide ramp for accessing the elevator. However, as can be seen on Figure 4.25, the area in front of the elevator becomes motorcycle parking thus the parked motorcycles block the access to the elevator.

### 3.5. VEHICULAR CIRCULATION

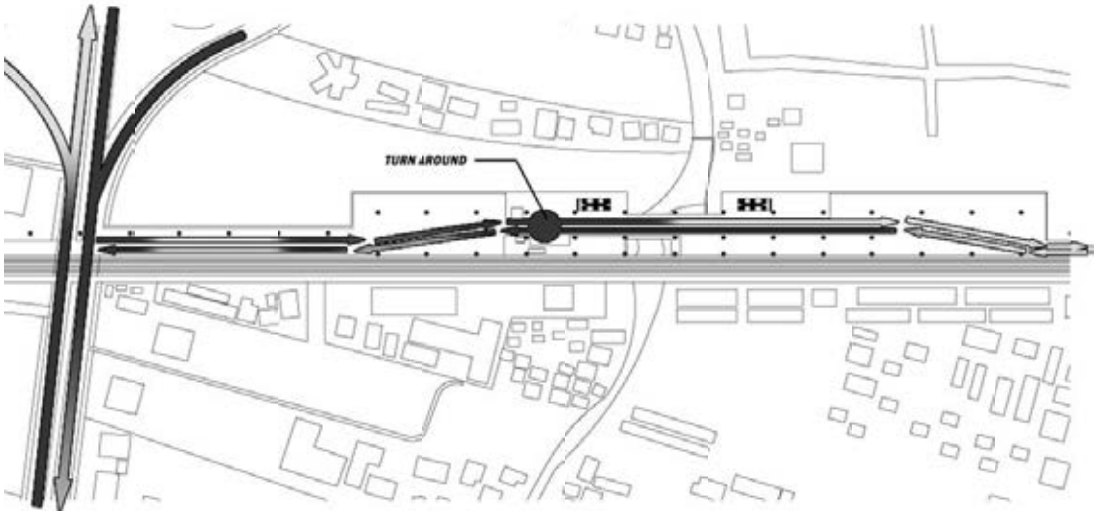



**Figure 4.26 Current vehicle traffic at *Hua Mak* ARL station**

Decreasing road width due to parallel parking along the street under the station makes traffic jam on local road under station, especially during peak hour in the morning and evening. During this time also, most vehicles from east and west that want to drop off/ pick up the passenger also make turn around at drop-off/ pick-up point which is also turn around point. Therefore, traffic deadlock often happen at this point due to the vehicle that stop and vehicles from both direction that want to turn back. To the west from ARL station, slow traffic also happen due to pedestrian that also walk in the middle of the street instead taking narrow pedestrian sideway behind parking bays.

**Figure 4.27 Turnaround point at drop-off area during weekend and midday (left), evening (middle), and morning (right)**

### 3.6. SPACE USER AND ACTIVITIES

From the overall field observation, the major users of transit facilities in arrival zone of this station can be divided into: train passengers, paratransit drivers, and private vehicle drivers; as can be seen on Table 4.1.

**The train passengers** arrive to/ depart from ARL station through and use transit nodes described in Section II and III. The peak number of passengers usually happens in the morning: 7.00 – 9.00 AM and evening: 5.00 – 9.00 PM on weekdays. The main pattern for them is “moving” to the station in the morning. In the evening they have 2 main patterns: “moving” to the main street or parking area and “waiting” for the vehicle drivers to pick them up. Currently, most of the passengers do not have optional/ secondary activities while they are waiting. Some people who are tired of standing sit on the stair. However, at the rush hours, it is difficult for them to sit on the stair.

**The paratransit drivers** (taxi and motorcycle-taxi drivers) are the main user of paratransit nodes. The main pattern for this user type is “waiting” for the passenger. Compared to other space users, paratransit drivers spend longer time in station area. Therefore, social and optional activities are important to them. Usually these activities are done at or around the paratransit vehicle parking.

**The private vehicle drivers** follow the time of passenger’s arrival and departure. Since they just drop-off or pick-up passengers, they mainly use the road and kiss-and-ride point. Unless in the weekend, it is difficult for the car drivers to wait the passenger since the parking facilities are always full for the whole day. The drivers that wait for the train passenger are mostly motorcycle users since the motorcycle does not take much space for parking. Thus, they usually just take the motorcycle on the pedestrian sidewalk. The main pattern for private-vehicles entering the station area is “moving” and “turning back” to previous direction after dropping-off/ picking-up.

Besides the major users, there are people that act as basic services for the station. There are 2 basic services, i.e.: station staffs and street vendors.

**Station staffs,** such as security guard and cleaning service, are the people who work for this station. They are mainly situated on concourse and platform level of ARL station.

**Street vendors** are very few in this station. They mainly interact with paratransit drivers that take break and are spotted during afternoon or evening during weekdays. Therefore, they are seen around the paratransit stands only.

**Table 4.1 Current users, activities, and facilities at *Hua Mak* ARL Station**

| | NECESSARY ACTIVITIES | OPTIONAL ACTIVITIES | SOCIAL ACTIVITIES |
|---|---|---|---|
| **Passengers** | | | |
| Public transport users/ pedestrian | Departure: walking to station<br>Arrival: walking to street, waiting | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Sidewalk, crosswalk, Bus stops | Facilities:<br>- | Facilities:<br>- |
| Motorcycle-taxi users | Departure: dropped-off, pay, walking<br>Arrival: walking to motorcycle-taxi stand | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Drop-off place, Motorcycle-taxi stand | Facilities:<br>- | Facilities:<br>- |
| Taxi users | Departure: dropped-off, walking<br>Arrival: walking to taxi stand | Departure:<br>Arrival: | Departure:<br>Arrival: |
| | Facilities:<br>Drop-off place, Taxi stand | Facilities:<br>- | Facilities:<br>- |
| Kiss-and-ride | Departure: dropped-off, walking<br>Arrival: waiting, standing | Departure:-<br>Arrival: sitting | Departure:-<br>Arrival: meeting people |
| | Facilities:<br>Drop-off and waiting place | Facilities:<br>Stair | Facilities:<br>- |
| Park-and-ride | Departure: parking, walk to station<br>Arrival: walking to parking | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Car parking bays, Sidewalk | Facilities:<br>- | Facilities:<br>- |
| Local residents | Departure: walking<br>Arrival: walking | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Sidewalk, walkway | Facilities:<br>- | Facilities:<br>- |
| Disabled people | Departure: drop-off, move to station<br>Arrival: move to car | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Parking bays, elevator | Facilities:<br>- | Facilities:<br>- |
| **Private vehicle drivers** | | | |
| Private vehicle drivers | Departure/ arrival: driving, drop-off/ pick-up, turnaround, driving | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Drop-off/ waiting point, turnaround | Facilities:<br>- | Facilities:<br>- |
| **Paratransit drivers** | | | |
| Taxi drivers | Departure: drop-off<br>Arrival: waiting | Buying food, repair vehicle, rest | Interacting/ chatting, playing |
| | Facilities:<br>Taxi stand | Facilities:<br>Shelter, benches | Facilities:<br>Shelter, benches, table |
| Motorcycle-taxi drivers | Departure: drop-off<br>Arrival: waiting | Buying food, repair vehicle, rest | Interacting/ chatting, playing |
| | Facilities:<br>Motorcycle-taxi stands | Facilities:<br>Shelter, benches | Facilities:<br>Shelter, benches, table |

## 4. SITE ANALYSIS: *BAN TAP CHANG* ARL STATION

### 4.1. AREA OVERVIEW


**Figure 4.28 *Ban Tap Chang* ARL station position to BMA land use map (top) and buildings around it (bottom)**

#### 4.1.1. REGULATIONS

As *Hua Mak* ARL station, *Ban Tap Chang* ARL station is located in low-density residential area "yellow R3" according to BMA land use map 2549. Therefore, the regulation for the area is same as *Hua Mak*, i.e.: Floor Area Ratio (FAR) must not exceed 2.5:1 and the Open Space Ratio (OSR) must not less than 12.5% with the land use as the followings:

- **Residential**: single family house, duplex house, town house/ shop-house/ row house, residential combined if located adjacent to public way not less than 10 m width or within 500 m from train station, residential up to 10,000 m2 if located adjacent to public way not less than 30 m width or within 500 m from train station
- **Commercial:** shop-houses, commercial less than 200 $m^2$, commercial between 200 – 2,000 $m^2$ if located within 500 m from train station or adjacent to public way not less than 16 m width, commercial up to 10,000 m2 is located within 500 m from train station or adjacent to public way not less than 30 m width
- **Market:** up to 2,000 $m^2$ if located adjacent to public way not less than 30 m width
- **Gas/ fuel:** Gas/ fuel station if located adjacent to public way not less than 16 m width, natural gas supply/ distributor and food supply
- **Office**: shop-house, office less than 100 $m^2$, office between 200 – 2,000 $m^2$ if located adjacent to public way not less than 10 m width or within 500 m from train station, office up to 10,000 $m^2$ if located adjacent to public way not less than 16 m width or within 500 m from train station
- **Conference/ convention** if located within 500 m from train station or adjacent to public way not less than 30 m width
- **Zoo/ amusement park** if located adjacent to public way not less than 30 m width and has open space or setback conditions
- **Factory/ warehouse** up to 500 $m^2$ if follows the ministerial regulation notes
- **Industry**: concrete mixing facility depends on the size and service, construction waste trade if it is located adjacent to public way not less than 10 m width, waste management facility under permit from BMA
- **Community**: Education, healthcare with/ without admission, childcare, elderly care
- **Government/ institution**
- **Others**: Slaughter house, cemetery/ cremation, billboards

The main road around *Ban Tap Chang* ARL station is *Krungthep Chon Buri New Line* express way which cannot be accessed from the area around it. Each accessible side road of the express way only has 7 – 9 m width with 2 direction lanes. The area itself is within 500m radius from *Ban Tap Chang* ARL and main train station. Therefore, the applicable land uses for this area are residential combined, commercial up to 10,000 $m^2$, office up to 10,000 $m^2$, conference, factory and industry, community, and government/ institution.

### 4.1.2. BUILDINGS

Overall *Ban Tap Chang* area can be divided into 3 parts: the area in the north of highway, the area between highway and railway, and the area in the south of railway. The north of highway mainly consists of industrial facilities such as factory and carpentry. There is a real estate complex, Nirvana real estate, in *Soi Krung Thep Kiritha* 32, 615 m walking distance from ARL station. The area between highway and railway consists of industrial facilities, such as warehouse and concrete mixing facility, and detached housing. There is also 1 school in this area: *Surao Tapchang* School. Although it is very close, the area in the south of railway is basically inaccessible by any vehicle from ARL station as it is bordered by fence and wall along the railway. This area mainly consists of real estate complex: Green Ville real estate. To access this housing complex, the car must take a detour and take the entry from *Soi Chaloem Phrakiat Ratchakan Thi* 9, 1.2 km to the east from ARL station.

**Figure 4.29 Top: Residential area: Green Ville real estate (left), Nirvana real estate (middle), and *Surao Tapchang* school (right); bottom: industrial area: concrete mixing (left), carpentry (middle), and factory (right)**

The main SRT railway station is adjacent to ARL station. As other SRL stations next to ARL station, it has different customers than ARL and no interchange between 2 train systems as it has the same alignment to city center.

**Figure 4.30 *Ban Tap Chang* train station**

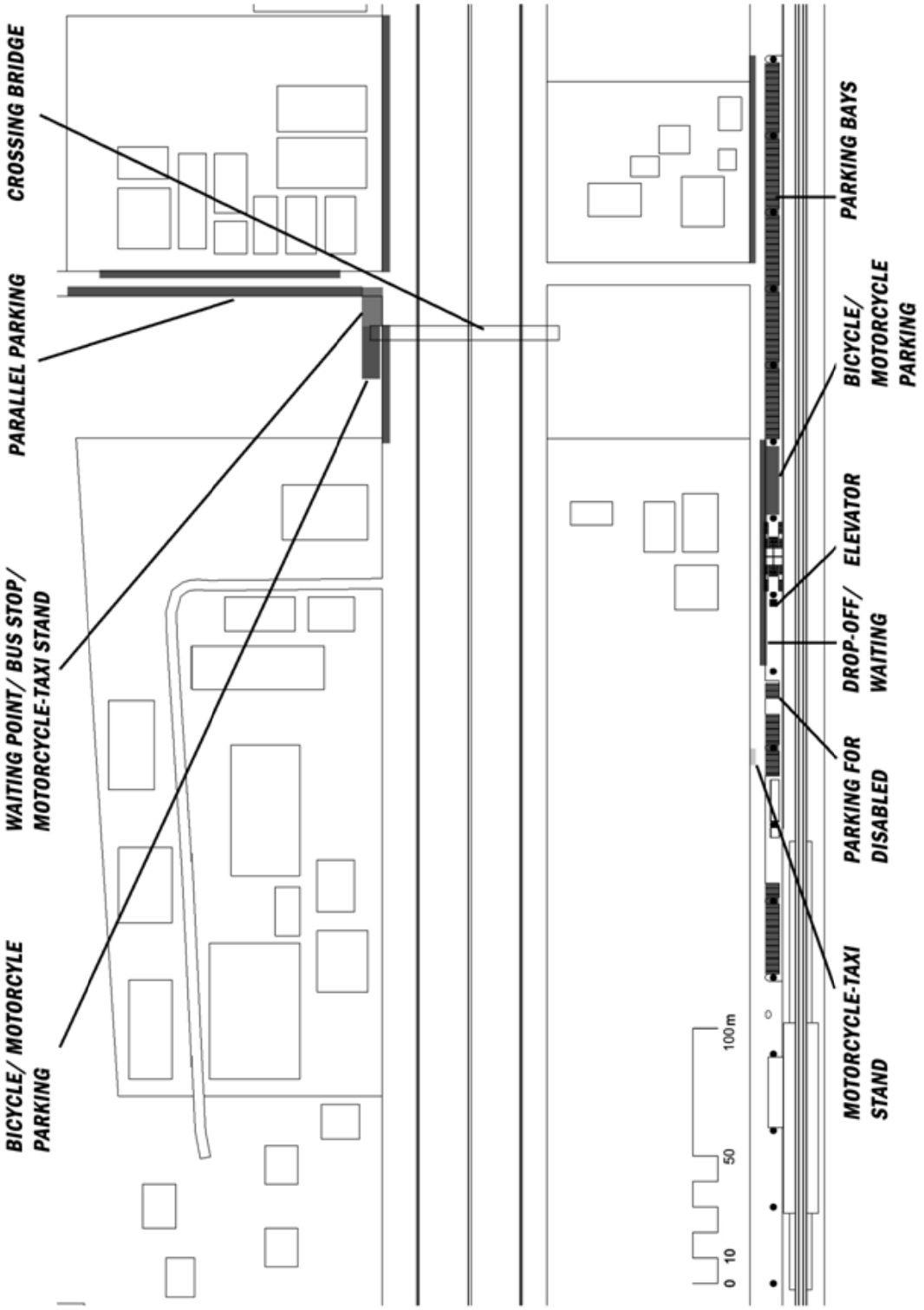



**Figure 4.31 Current nodes of transit modals of *Ban Tap Chang* ARL station**

## 4.2. NODES OF OTHER TRANSIT MODALS

Compared to previous station, *Hua Mak*, there are not many choices for train passenger to reach *Ban Tap Chang* ARL station since it is located near the highway. There is no taxi stand near the station. Private vehicles and taxis from north area that want to reach the station must find a turn near highway exit, which is about 1.2 km away from station to the east.

Since the area around ARL station is divided by express way, the arrival zone of *Ban Tap Chang* ARL station can be seen as 2 parts: to the north of highway and to the south of highway, adjacent to station. The arrival zone consists of most facilities such as parking is the area adjacent to the station since the land is still part of SRT properties. However, since it is very difficult for the vehicles from the north of highway to access the station directly, people also park their vehicles, drop-off, and waiting in this area.

### 4.2.1. PUBLIC TRANSPORT STOPS

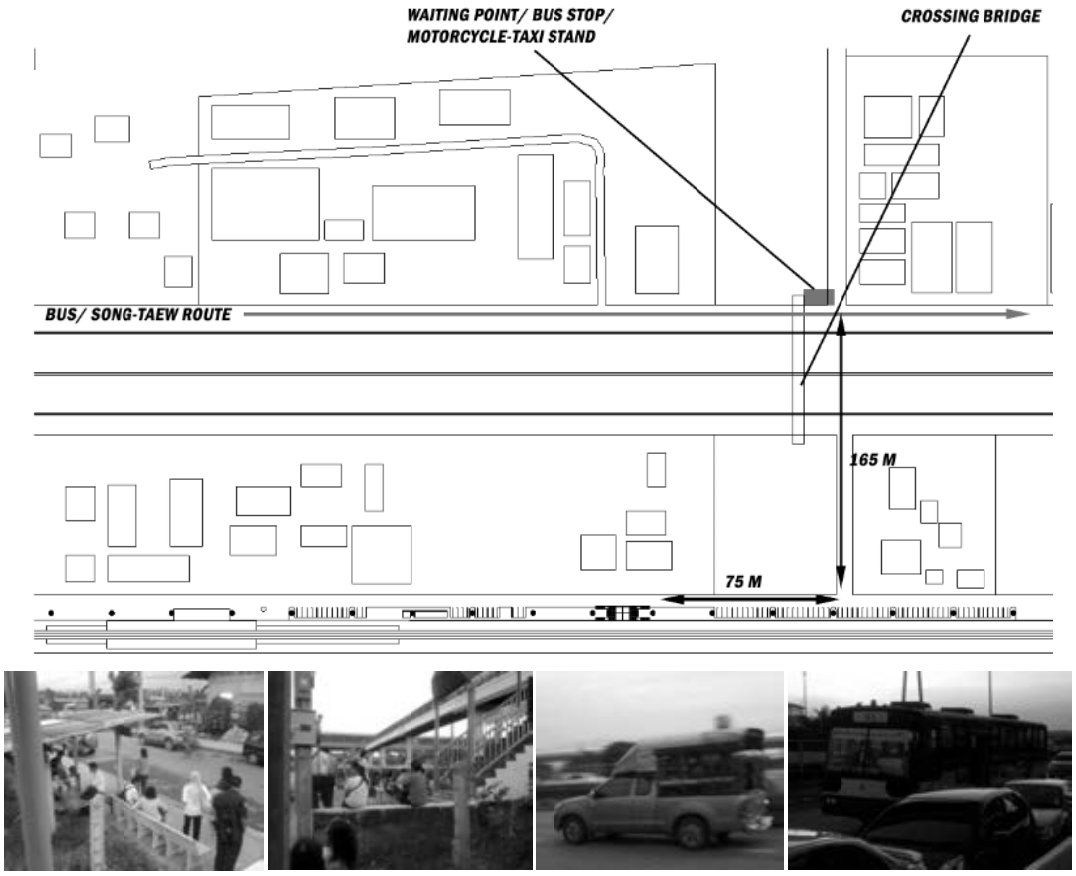



**Figure 4.32 Public transport stop/ drop-off/waiting point across the expressway**

There is no formal public transport stop around *Ban Tap Chang* ARL station. People usually wait for bus and *song-taew* near the pedestrian crossing bridge across the highway. There is only one free bus line serving this area, i.e. bus no 93. The bus and *song-taew* only serve this north side road and come in 1 direction: from west to east direction. Passengers also wait for motorcycle-taxi and cars that pick them up at this place.

As can be seen on Figure 4.32, this waiting point itself is 240 m walking distance from the ARL station and completely outside of State Railway's property. The existing seating and shelter facility is informally provided as this place also act as motorcycle-taxi stand.

### 4.2.2. PARATRANSIT STANDS

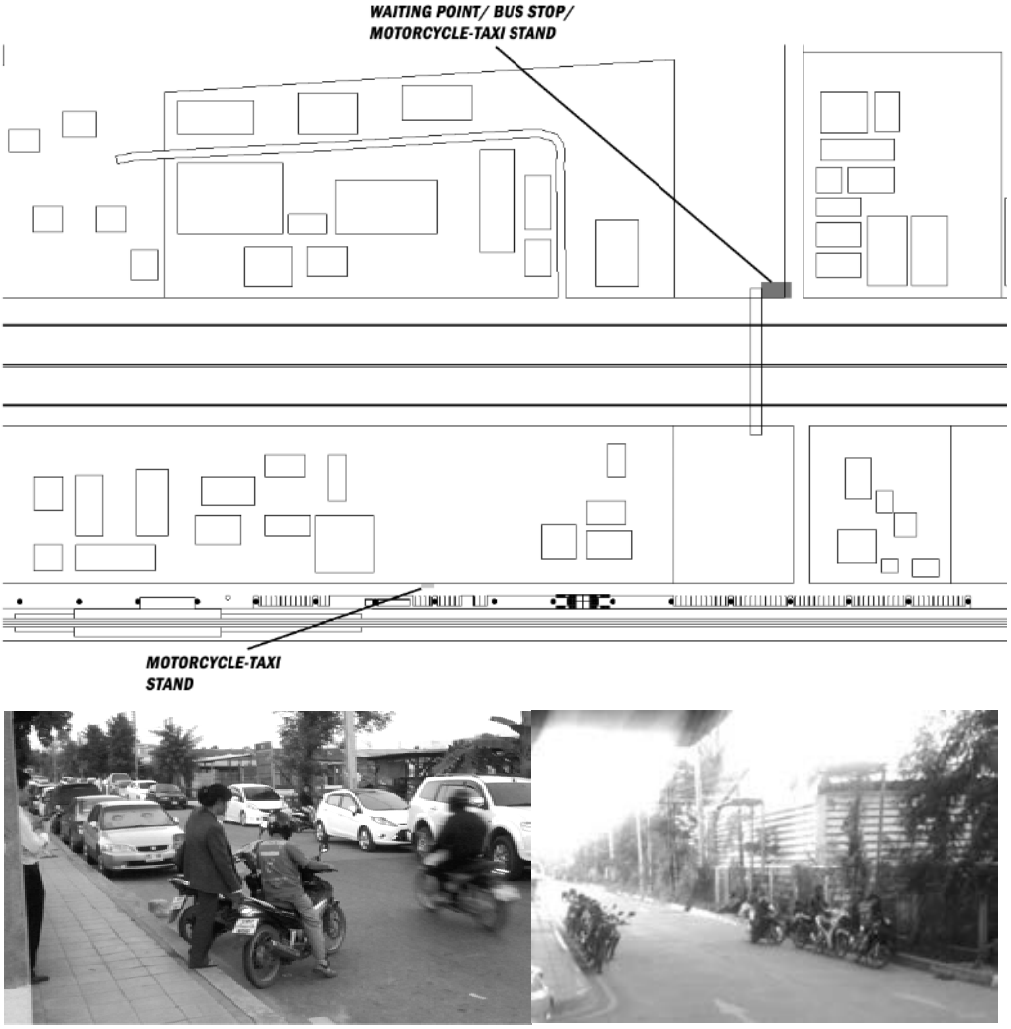



**Figure 4.33 Top: position of motorcycle-taxi stands; bottom: motorcycle-taxi stand across the highway (left) and under *Ban Tap Chang* ARL station (right)**

There are 2 motorcycle-taxi stands near *Ban Tap Chang* ARL station as can be seen on Figure 4.6. The first motorcycle-taxi stand is located under the ARL station. The stand is usually occupied by 15 – 20 drivers. However, it does not any facility at all such as seating or shelter. The drivers just sit on the curb-cuts when taking a break. Based on their information, the existence of motorcycle-taxi within station boundary is basically illegal according to SRT regulation. However, since the only effective access to and from *Ban Tap Chang* station is motorcycle-taxi, the station officer allows them to operate in this area.

The second motorcycle-taxi stand is located across the highway, near the pedestrian crossing bridge. This stand has less motorcycle-taxi drivers, only about 5 persons, and rarely occupied.

### 4.2.3. KISS-AND-RIDE

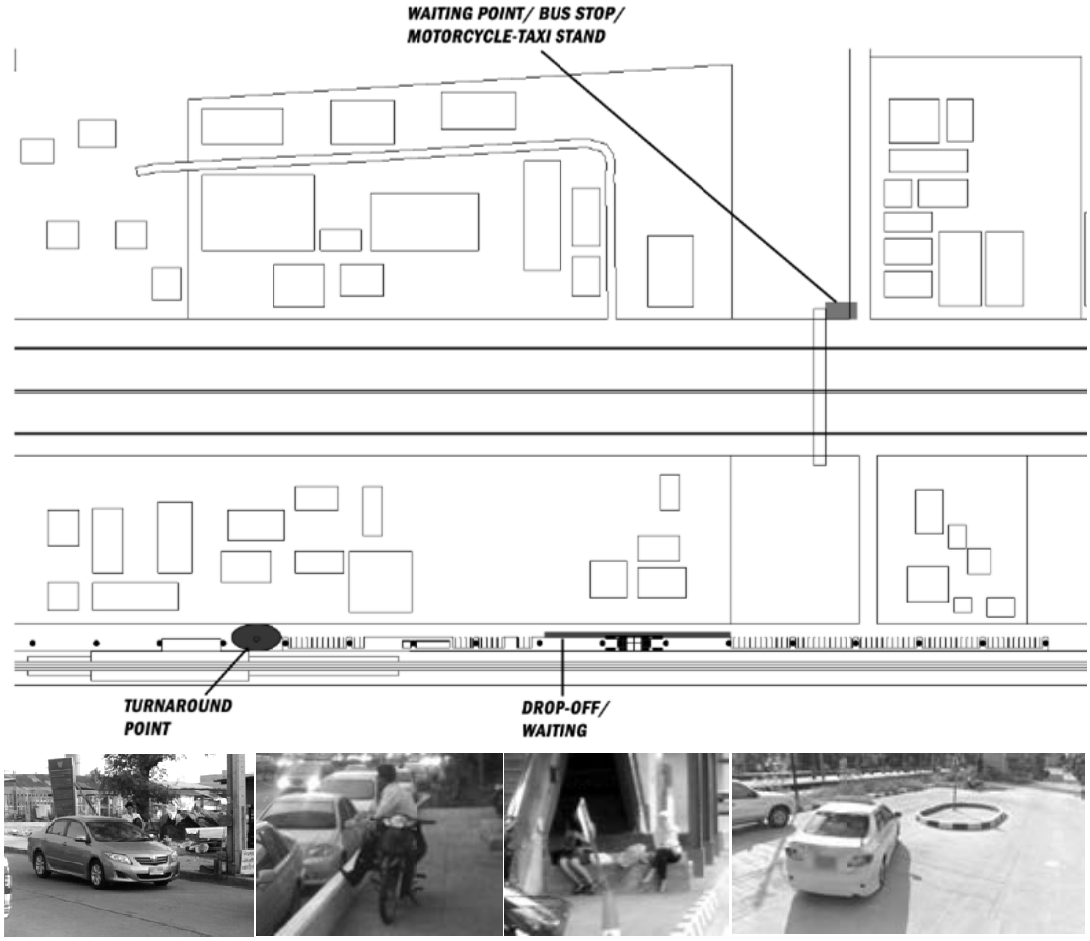



**Figure 4.34 Top: drop-off/ waiting area positions around *Ban Tap Chang* ARL station, bottom: drop-off/ waiting area on the north of highway (left), and drop-off/ waiting area under ARL station with turnaround point (right)**

There are 2 locations of drop-off and waiting around *Ban Tap Chang* ARL station. The first location is under ARL station itself. Currently, this drop-off/ waiting facility is mainly used by motorcycle-taxi drivers and the passengers that use motorcycle-taxi. Although it also can be used by cars or taxi, other vehicles than motorcycle are rarely seen to reach the ARL station since it is located near the highway and 180 m deep inside small road with 6 m width. The turnaround point provided for vehicle is even deeper, 170 m to the west of drop-off point.

The second drop-off/ waiting point is the same place as public transport stop and motorcycle stand across the highway. This drop-off/ waiting place is more commonly used by passengers, taxis, motorcycle-taxis, and private vehicles as the main road traffic goes through north side road and people can access residential complex from this road. Although many people use this location, there is no formal transit facility provided as the area across the highway is not in SRT authority.

As *Hua Mak* ARL stations, the drop-off/ pick-up point is packed by passengers moving to the station in the morning, between 07.00 – 09.00 AM, and by passengers waiting for their relatives to pick them up in the evening, between 05.00 – 09.00 PM.

**4.2.4. PARK-AND-RIDE**

In the ARL station boundary, the car parking bays are provided in the east and west side of the station. The parking bays have total capacity of 68 cars. There are also 2 parking bays for disabled people in the west side of station that always empty most of the time. Since there are not many cars can access the station, the parking facility is not usually overflowed with cars as in *Hua Mak* station. Some cars that cannot get into parking bays are parked parallel in the east side of station. However, since the road is not packed by traffic or accessed by many people, the parallel parking does not bring significant traffic problem. The small parking area is also still within range of security guard situated under the ARL station. Thus, until now, there is no significant security issue according to the station users.

Across the highway, although there is no parking facilities provided, people still park their vehicles parallel to the main street and along *Soi Krung Thep Kiritha* 32 since the vehicles from this area cannot access the station. This parking is obviously without any security and controlled access.

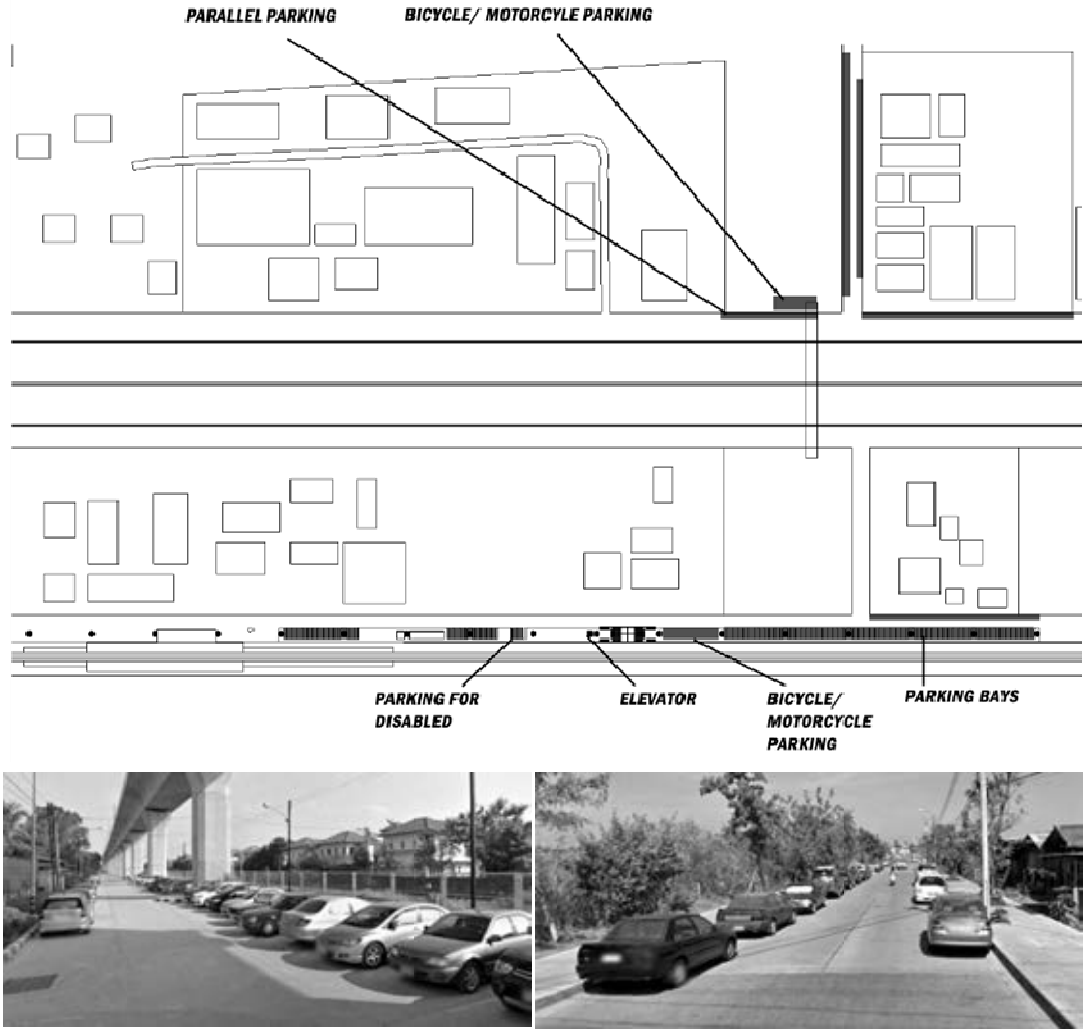



**Figure 4.35 Top: car parking positions around *Ban Tap Chang* station (top), car parking bays under ARL viaduct (left) and parallel parking across the highway (bottom)**

### 4.2.5. BICYCLE AND MOTORCYCLE PARKING

As the car parking, there are 2 motorcycle/ bicycle parking locations. The main parking facility for bicycle (and also used by motorcycle) is located under the ARL station, adjacent to main escalator/ stairs, and has security guard posted there. This place can be filled with 50 – 60 motorcycles and 15 – 20 bicycles on weekdays. People who come from the north side of highway cannot cross the highway using bicycle/ motorcycle. Therefore, they just park their motorcycle/ bicycle under the pedestrian bridge. It can be filled with 15 – 20 motorcycle and bicycle on weekdays. This parking place is obviously not secured as the parking facility under the ARL station.


**Figure 4.36 Secured motorcycle/ bicycle parking at *Ban Tap Chang* ARL station (top) and unsecured motorcycle/ bicycle parking under pedestrian bridge across the highway (bottom)**

## 4.3. PEDESTRIAN ROUTE

### 4.3.1. SIDEWALK

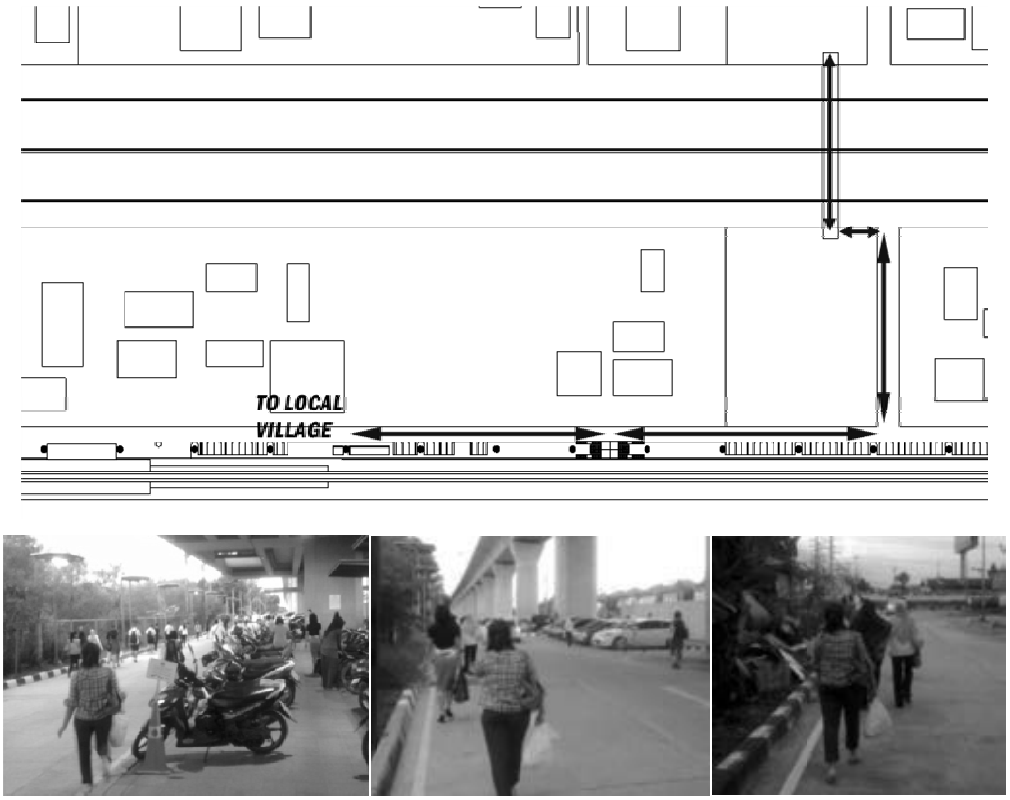



**Figure 4.37 Pedestrian route from to *Ban Tap Chang* ARL station**

The sidewalk under ARL station only spans along the parking bays. There is no sidewalk connecting the station and main road. Located behind the parking bays, occupied by motorcycle parking, and lead to nowhere; the existing sidewalk cannot be used by pedestrian, both that go to main road and that go to local neighborhood. People just walk on the vehicle road as can be seen on Figure 4.37.

### 4.3.2. CROSSING BRIDGE

**Figure 4.38 Crossing bridge of *Krungthep Chon Buri New Line* express way**

There is one pedestrian bridge near *Ban Tap Chang* ARL station to help people crossing the highway. The bridge is sheltered and has width of 1.5 m. However, as it is complained by many users, the bridge does not have any artificial lighting that makes people crossing at nighttime unsecured.

## 4.4. DISABLED PEOPLE ACCESS

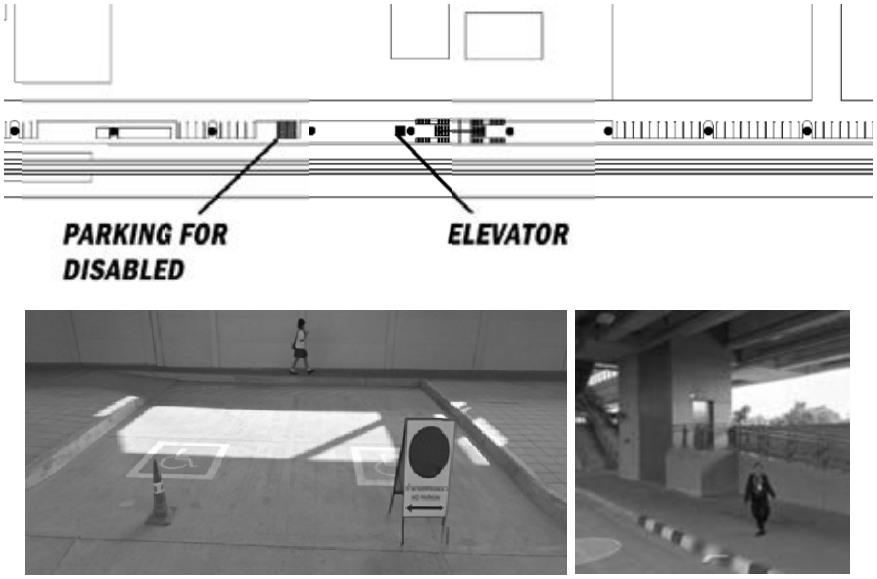



**Figure 4.39 Location of disabled people provisions for *Ban Tap Chang* ARL station (top), parking bays and elevator for disabled (bottom)**

As shown on Figure 4.39, there are 2 provisions for disabled people in this station: parking bays for disabled and elevator to access the concourse level from the street.

- **Parking bays for disabled** people located 30 m to the west from main stair entrance. It has capacity of 2 cars and has 1 m wide curb-cut for wheel chair access. During the field observation, the parking bays are not used and closed with planks.
- **The elevator for disabled** is located 30 m from disabled parking. It has 1 m wide ramp for accessing the elevator.

## 4.5. VEHICULAR CIRCULATION

Unlike *Hua Mak*, there is no significant traffic problem on the roads around *Ban Tap Chang* ARL station due to transit activities since the station area is rarely accessed by vehicle. As can be seen on Figure 4.40, the heavy traffic only happens in 1 direction/ lane of the north side road. However, the traffic jam is not entirely related to passengers' transit activity. It usually happens along the road in the evening time, between 5.00 – 7.00 pm, on the weekdays.

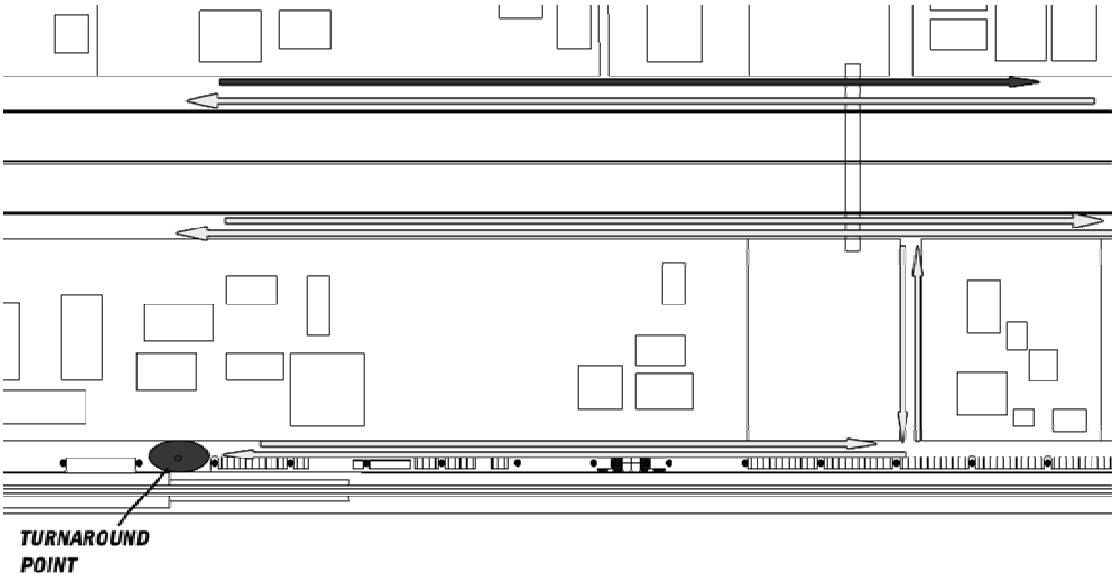



**Figure 4.40 Current vehicle traffic around *Ban Tap Chang* ARL station**

**4.6. SPACE USER AND ACTIVITIES**

As in the previous station, from the overall field observation, the major users of transit facilities in arrival zone of this station can be divided into: train passengers, paratransit drivers, and private vehicle drivers; as can be seen on Table 4.2.

**The train passengers** arrive to/ depart from ARL station through and use transit nodes described in Section II and III. The peak number of passengers usually happens in the morning: 7.00 – 9.00 AM and evening: 5.00 – 9.00 PM on weekdays. The main pattern for them is “moving” to the station in the morning and “moving” to the main street in the evening.

**The paratransit drivers** only consist of motorcycle-taxi drivers as the main user of motorcycle-taxi stand. The main pattern for this user type is “waiting” for the passenger. Motorcycle-taxi drivers also spend longer time in *Ban Tap Chang* ARL station area. Therefore, social and optional activities are important to them. Furthermore, since the ARL station is difficult to reach by vehicle or walking, their existence is very important for this station. Ironically, there is even no facility for them to rest near the station.

**The private vehicle drivers** follow the time of passenger’s arrival and departure. Since they just drop-off or pick-up passengers, they mainly use the road and drop-off/ waiting places. Compared to *Hua Mak* station, the private vehicle drivers that wait for their relatives are very few. Most of them are motorcycle users since the motorcycle is easy to park in limited space and it is the most effective vehicle to reach the ARL station or waiting place across the highway.

The only basic service for this station is station staffs**,** such as security guard and cleaning service, are the people who work for this station.

**Table 4.2 Current users, activities, and facilities at *Ban Tap Chang* ARL Station**

| | NECESSARY ACTIVITIES | OPTIONAL ACTIVITIES | SOCIAL ACTIVITIES |
|---|---|---|---|
| **Passengers** | | | |
| Public transport users/ pedestrian | Departure: walking to station<br>Arrival: walking to street, waiting | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Sidewalk, crossing bridge, shelter | Facilities:<br>- | Facilities:<br>- |
| Motorcycle-taxi users | Departure: dropped-off, pay, walking<br>Arrival: walking to motorcycle-taxi stand | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Drop-off place, Motorcycle-taxi stand | Facilities:<br>- | Facilities:<br>- |
| Taxi users | Departure: dropped-off, walking<br>Arrival: - | Departure:<br>Arrival: | Departure:<br>Arrival: |
| | Facilities:<br>Drop-off place | Facilities:<br>- | Facilities:<br>- |
| Kiss-and-ride | Departure: dropped-off, walking<br>Arrival: waiting, standing | Departure:-<br>Arrival: sitting | Departure:-<br>Arrival: meeting |
| | Facilities:<br>Drop-off and waiting place | Facilities:<br>Bench | Facilities:<br>- |
| Park-and-ride | Departure: parking, walk to station<br>Arrival: walking to parking | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Car parking bays, sidewalk, crossing bridge | Facilities:<br>- | Facilities:<br>- |
| Local residents | Departure: walking<br>Arrival: walking | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Sidewalk | Facilities:<br>- | Facilities:<br>- |
| Disabled people | Departure: drop-off, move to station<br>Arrival: move to car | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Parking bays, elevator | Facilities:<br>- | Facilities:<br>- |
| **Private vehicle drivers** | | | |
| Private vehicle drivers | Departure/ arrival: driving, drop-off/ pick-up, turnaround, driving | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Drop-off/ waiting point, turnaround | Facilities:<br>- | Facilities:<br>- |
| **Paratransit drivers** | | | |
| Motorcycle-taxi drivers | Departure: drop-off<br>Arrival: waiting | Rest, eating | Interacting/ chatting |
| | Facilities:<br>Motorcycle-taxi stands | Facilities:<br>- | Facilities:<br>- |

## 5. SITE ANALYSIS: *LAT KRABANG* ARL STATION

### 5.1. AREA OVERVIEW

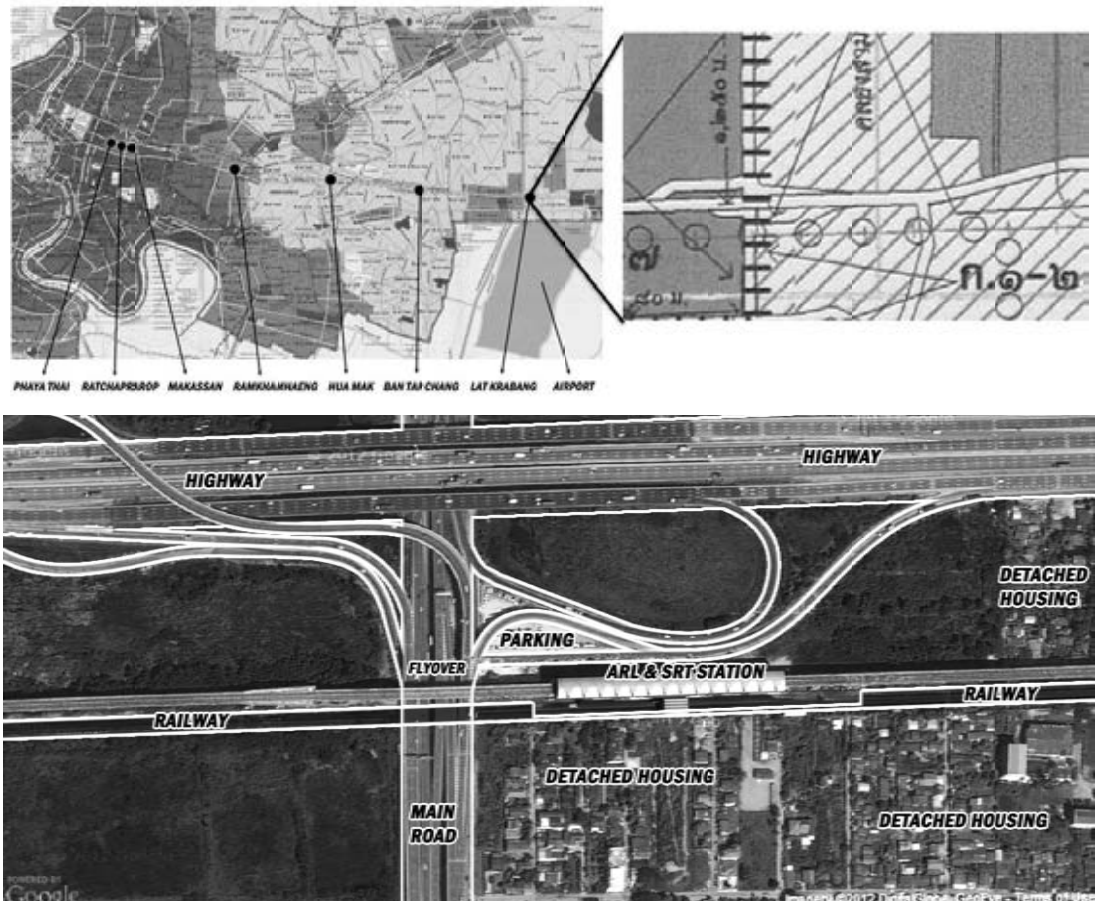



**Figure 4.41 *Lat Krabang* ARL station position to BMA land use map (top) and buildings around it (bottom)**

#### 5.1.1. REGULATIONS

*Lat Krabang* ARL station is located in wetland conservation rural and agricultural (green hatch A1) area according to BMA land use map 2549. According to it, the Floor Area Ratio (FAR) must not exceed 1:1 and the Open Space Ratio (OSR) must not less than 40%. The limit of building height is 12 m with the minimum setback 2 m from all sides. The land uses for the area are as the followings:

- **Residential**: single family house
- **Commercial:** commercial less than 300 $m^2$ if located adjacent to public way not less than 16 m width and has open space
- **Market:** up to 300 $m^2$ if located adjacent to public way not less than 16 m width
- **Gas/ fuel:** Gas/ fuel station if located adjacent to public way not less than 16 m width, natural gas supply/ distributor and food supply
- **Office**: office less than 2,000 $m^2$ if located within land allocation for clubhouse
- **Factory/ warehouse** up to 100 $m^2$ if follows the ministerial regulation notes
- **Industry**: concrete mixing facility depends on the size and service, scrap metals trade, construction waste trade, agriculture silo, and commercial animal farm
- **Community**: Education, healthcare with/ without admission, childcare, elderly care
- **Government/ institution**
- **Others**: Slaughter house, cemetery/ cremation, billboards

The main access road to *Lat Krabang* ARL station is *Thanon Rom Klao*. It connects *Lat Krabang* area to *On Nut* road and *Krungthep Chon Buri New Line* express way. This road has 2 direction lanes on ground level with 6 – 9 m of width for each lane, separated by flyover. Therefore, the building types allowed for the area are industry, community, and government/ institution only.

### 5.1.2. BUILDINGS

Just as *Hua Mak*, most of buildings around *Lat Krabang* ARL station are located in southern part, crossing the ground railway from ARL station. This area is dominated by low-rise residential building that consists of 1 – 2 stories detached housing and 4 – 5 stories apartment. People can go to residential area through main SRT station under ARL station. The passengers of SRT and ARL are connected to other transit modes serving the main street and share same transit facilities, such as parking or drop-off place.

**Figure 4.42 *Lat Krabang* main railway station**

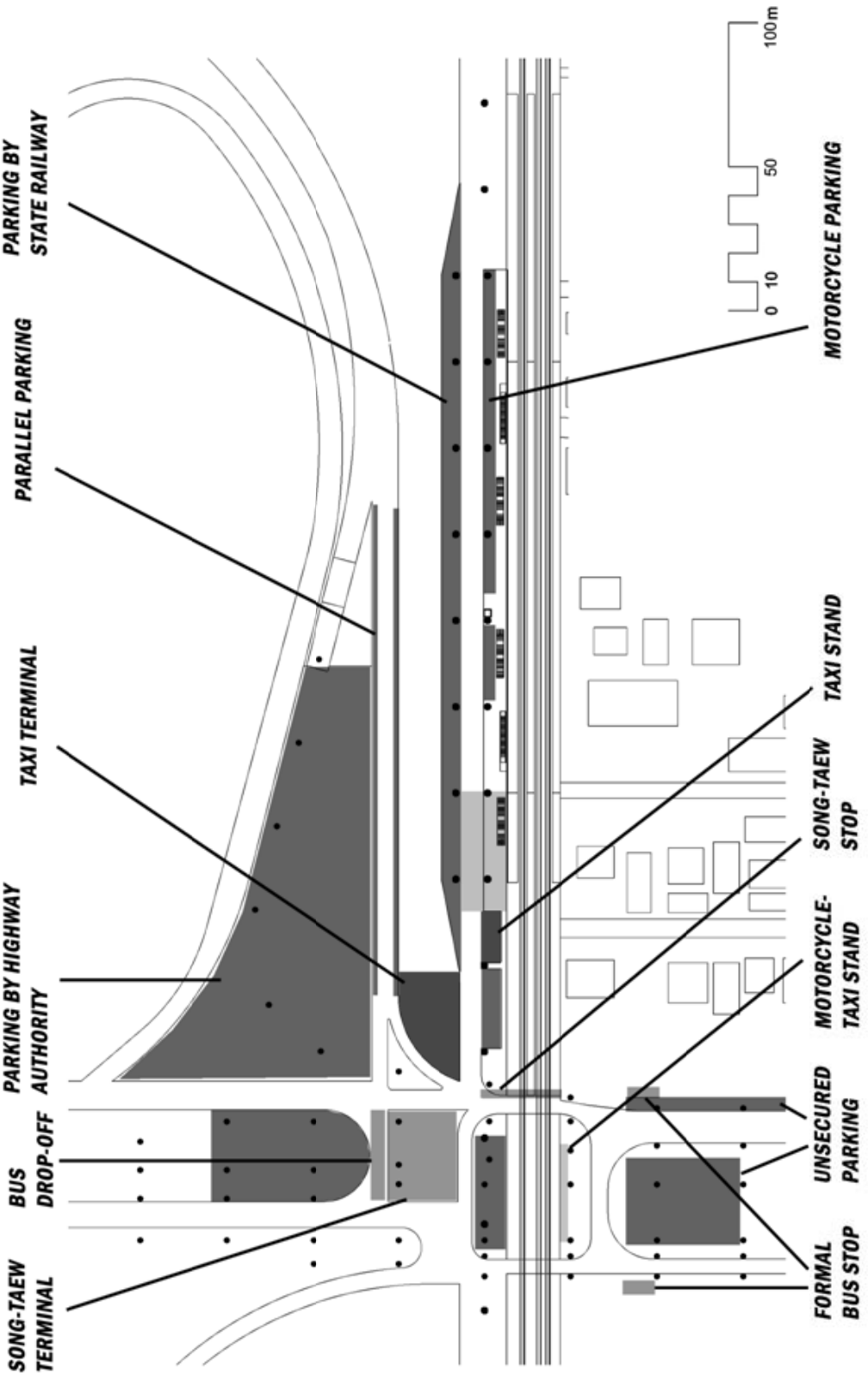



**Figure 4.43 Current nodes of transit modals of *Lat Krabang* ARL station**

## 5.2. NODES OF OTHER TRANSIT MODALS

As mentioned in literature review, there are several modes of transportation for ARL user approaching and leaving the station: by bus, *song-taew*, paratransit van, taxi, motorcycle-taxi, private vehicle (as passenger), driving own vehicle (motorcycle and car), and walking. There are different stop points for each mode as can be seen on Figure 4.43.

### 5.2.1. PUBLIC TRANSPORT STOPS

#### 5.2.1.1. Bus

The bus lines serve this area are 151 and AC 92. There are 2 formal bus stops, complete with shelter and seating, near the intersection between between *Thanon Rom Klao* and railway, under the flyover. However, the bus stop on east side is not used by the passengers and blocked by informal parking. Besides 2 formal stops, some buses from the north direction also drop the passengers at the turnaround under the flyover.

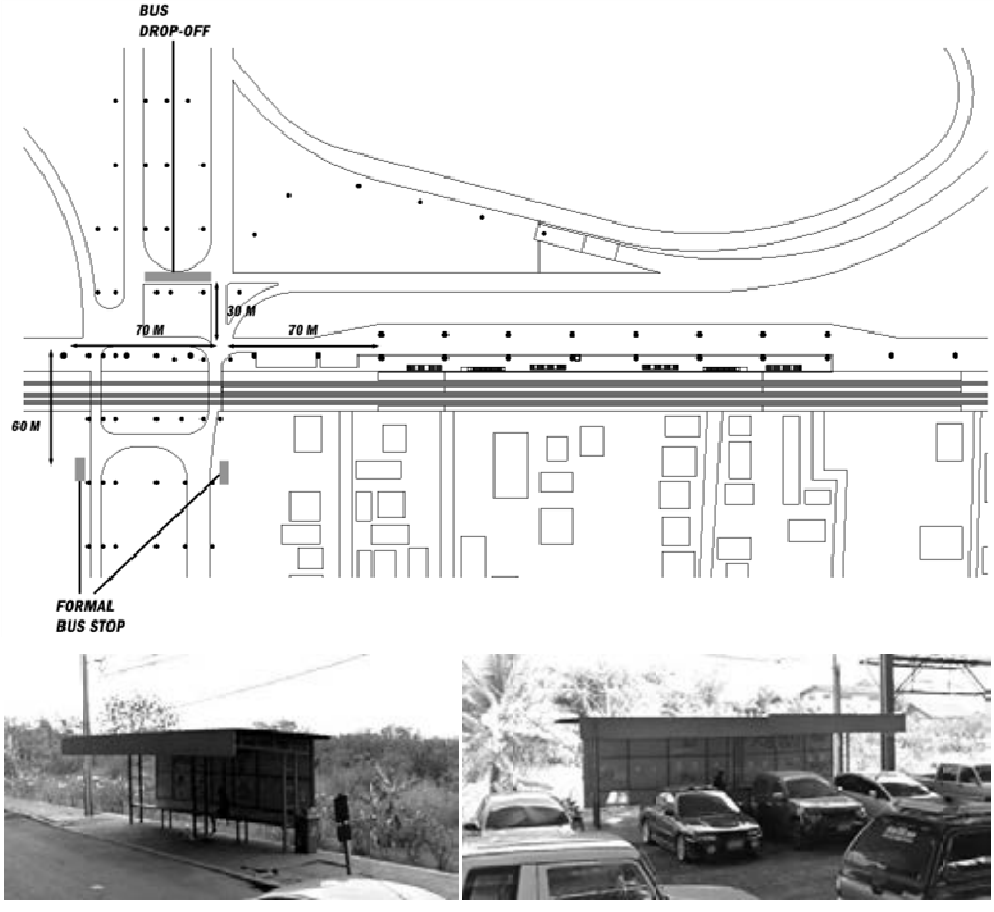



**Figure 4.44 Bus stop position around ARL station (top) and formal bus stop (bottom)**

#### 5.2.1.1. *Song-taew*

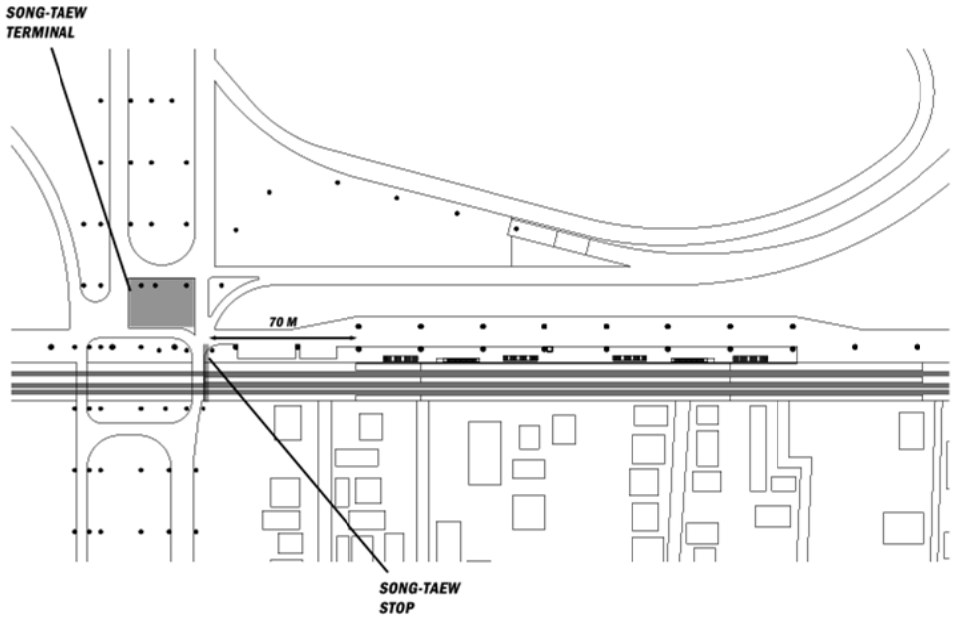



**Figure 4.45 Position of *song-taew* terminal and stop around *Lat Krabang* ARL station**

There are 2 different lines of *song-taew* serving this area. In here, *song-taew* has 2 different places for transit activities: the stop and terminal. Like in other 2 station, the places for *song-taew* are informal. Therefore, there is no facility such as seating, shelter, and sign.

There is no actual stop facility for *song-taew*. People just wait for *song-taew* at the intersection between *Thanon Rom Klao* and railway, under the flyover. Due to its critical location and many people packed there waiting for *song-taew*, this place always has traffic jam problem especially during peak hours 5.00 – 09.00 PM in the weekdays. It is also not safe for the people when the train is passing by. Because this place is always crowded by passengers, many street vendors also sell their goods, mainly food, at this place.

Besides the stop place, *song-taew* drivers also make a terminal for them to rest. The terminal is located across the stop place but still under the flyover, as can be seen on Figure 4.45 and 4.46. There are 10 *song-taews* can be parked in this area. Like *song-taew* stops, this terminal is also informal and has no facility for the drivers. It is just an attempt to use the leftover space under the flyover by *song-taew* drivers. In this terminal, the drivers just rest and do not take the passengers from here. They will drive out from terminal to the usual stop place for getting the passengers.

**Figure 4.46 *Song-taew* terminal (top), *song-taew* stop at railway intersection (middle), and street vendors around *song-taew* stop (bottom)**

Most of public transport stops are still within maximum range of 150 m, as described in general station guidelines. However, since the station was planned in critical location, at the intersection between railway, highway exit, and *Thanon Rom Klao*; the public transport stops in this area bring traffic jam problem. In addition, it is dangerous to reach by people walking due to the traffic and passing train.

### 5.2.2. PARATRANSIT STANDS

#### 5.2.2.1. Taxi

Taxi facilities for the station include 3 types: taxi stand/ parking, passenger drop-off, and drivers' rest area. Taxi parking takes up 5 parking bays to the west of drop-off point. Usually, taxi drivers do not use these parking bays in the evening as there are many people waiting for taxi already at main drop-off/ waiting point.

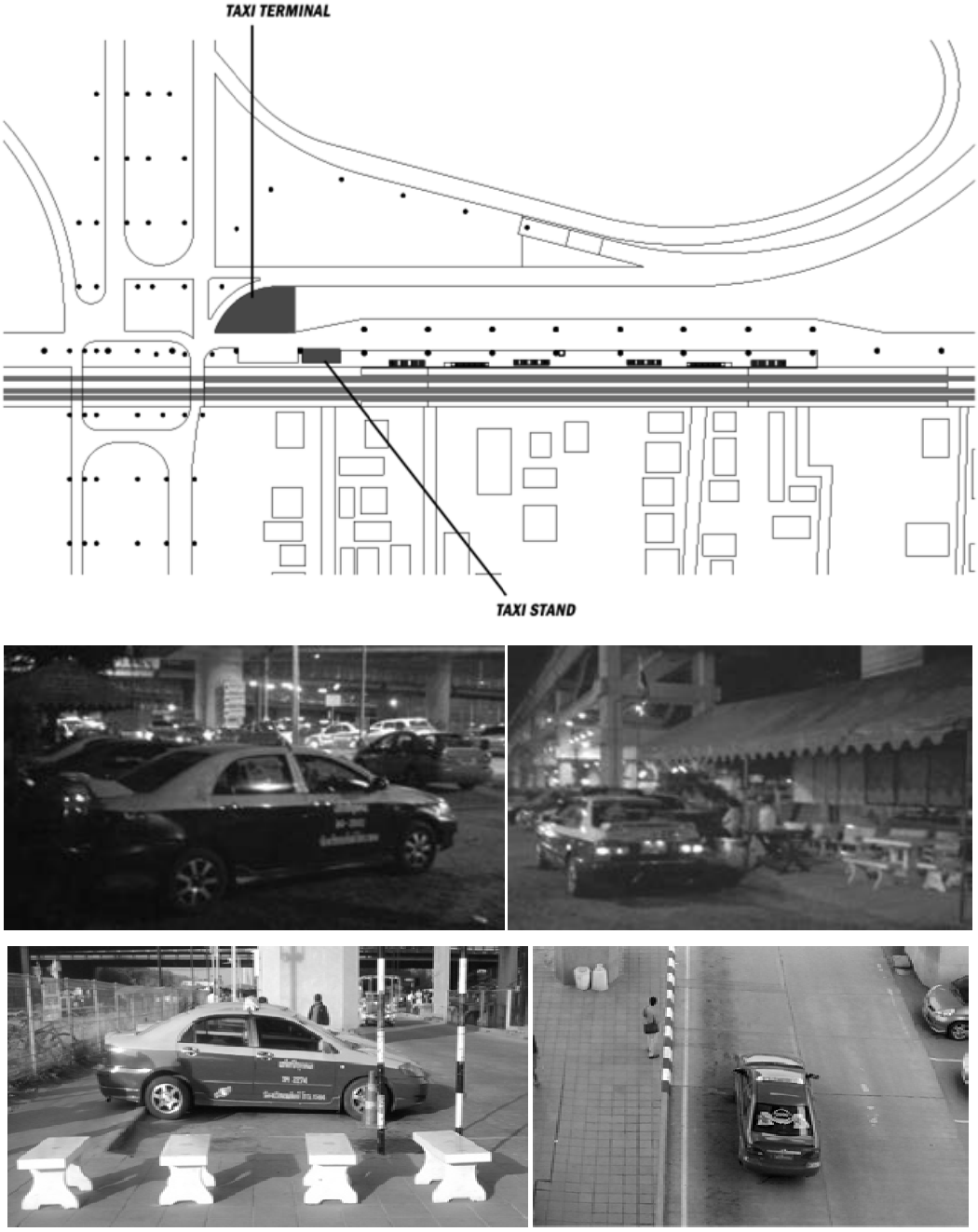



**Figure 4.47 Taxi stand and drop-off position (above) and pattern of taxi circulation and driver's facility (bottom)**

Taxi drivers' rest area is located outside the ARL station property. The land for this facility is owned by Highway Authority. They allowed the taxi drivers group of *Lat Krabang* station area to use the place for resting area temporary. There are total 50 taxi drivers that use this terminal, but not at the same time. As in *song-taew* terminal, most taxi drivers usually do not take the passengers from this rest area. They will get to drop-off area for taking passengers. The taxi circulation is shown on Figure 4.47. The resting area has various facilities such as: tent, chair, table, and water dispenser.

Passenger drop-off and pick-up point is the same as drop-off for private vehicles, right in front of west entrance. Passenger will wait the taxi from this point as well in the evening. Those who do not want to compete with other passengers to get taxi can wait on provided benches.

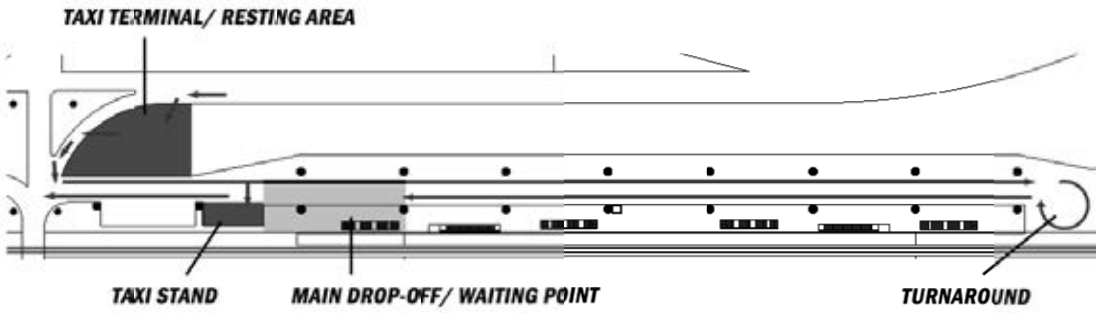



**Figure 4.48 Taxi circulation pattern at *Lat Krabang* station**

### 2.2.2. Motorcycle-Taxi

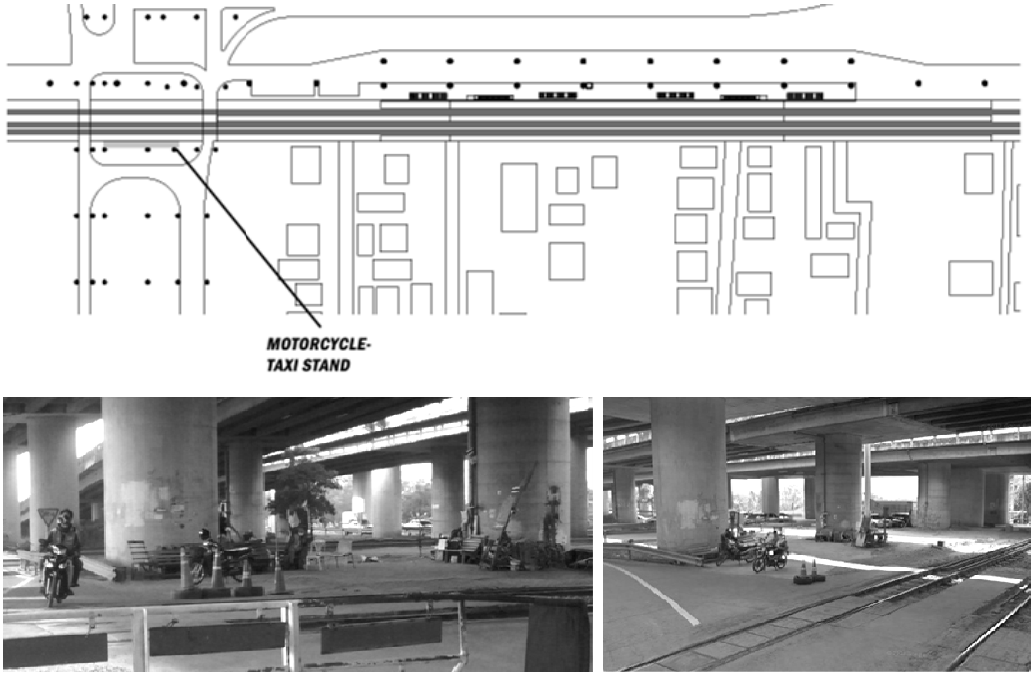



**Figure 4.49 Motorcycle-taxi stand near *Lat Krabang* station**

As shown on Figure 4.49, there is only one motorcycle-taxi stand in this area, located under the flyover. It has only 6 – 8 drivers at one time. The small number of motorcycle-taxi could be affected by the fact that there are many transportation choices already for this area: different bus lines, different *song-taew* lines, and taxi. Moreover, the distance from the main road to the station is not over 100 m and there are not many buildings around it to access.

### 5.2.3. KISS-AND-RIDE

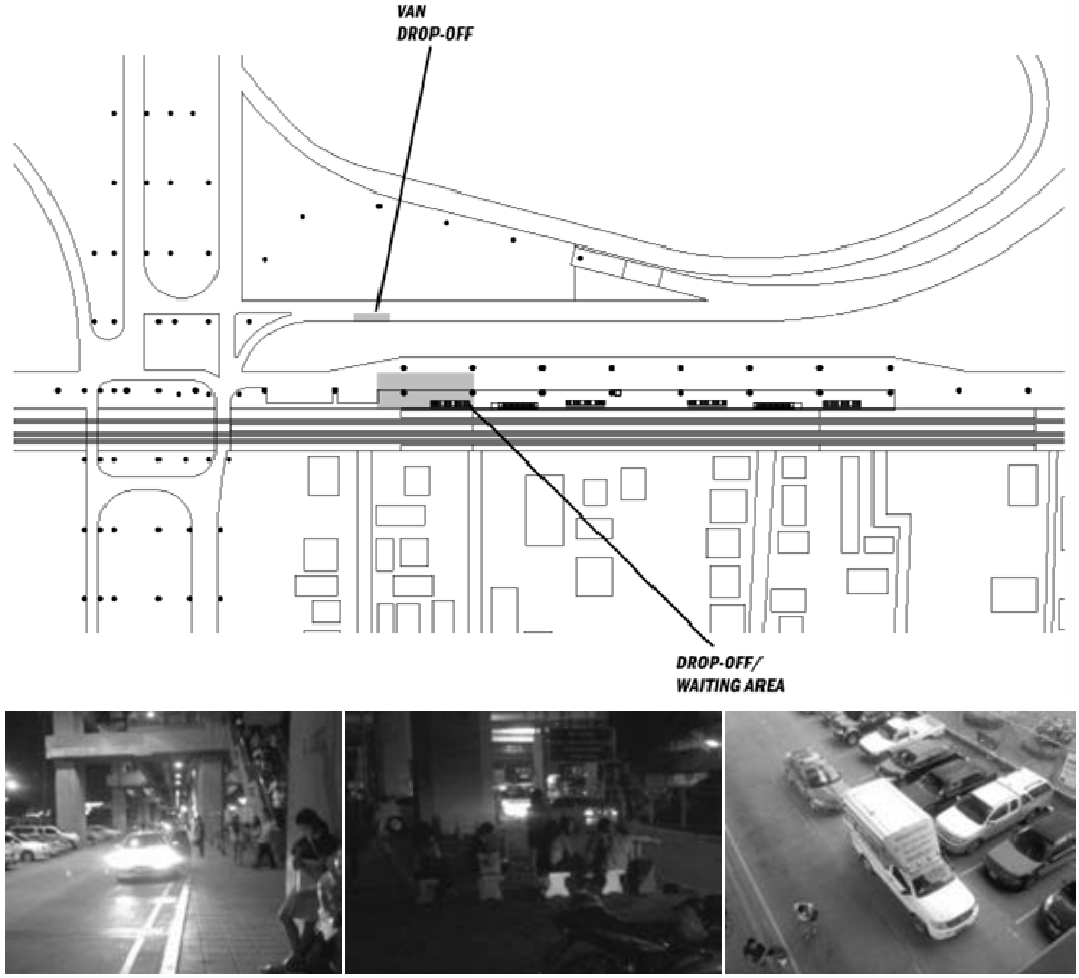



**Figure 4.50 Drop-off/ waiting area during weekdays in the evening (left & middle) and morning (right)**

Kiss-and-ride facilities for this ARL station consist of main drop-off/ pick-up point and secondary waiting point. Drop-off/ pick-up area is located under ARL station, right in front of west entrance/ main stairs. It is used by the drivers of private vehicle, *song-taew*, paratransit van, taxi, and motorcycle-taxi to drop the passenger in the morning. There is seating facility at this point but it is not sheltered. In the evening, it is packed by passengers that wait for private vehicle and taxi, as well as private vehicle (motorcycle) drivers that wait for their relatives to pick up. The motorcycle users usually stop on the sidewalk in front of west entrance. As can be seen on Figure 4.50, the cars must go deep inside station access road and take the turnaround before queuing at drop-off/ waiting place.

Secondary waiting point is located on the side of highway exit. It is usually used by paratransit van and private vehicle (car) drivers to wait for their relatives to pick up. These drivers usually want to avoid the mess traffic and queuing on station access road.

As other ARL stations, the drop-off/ pick-up point is packed by passengers moving to the station in the morning, between 07.00 – 09.00 AM, and by passengers waiting for their relatives to pick them up in the evening, between 05.00 – 09.00 PM. During weekend, there is no significant people congestion.

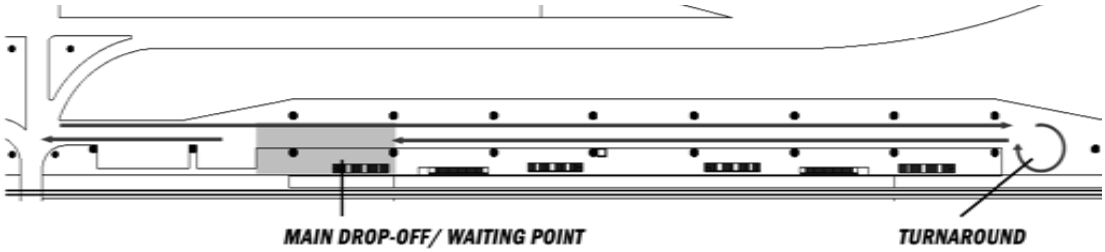



**Figure 4.51 Traffic direction in drop-off/ waiting area at *Lat Krabang* ARL station**

### 5.2.4. PARK-AND-RIDE

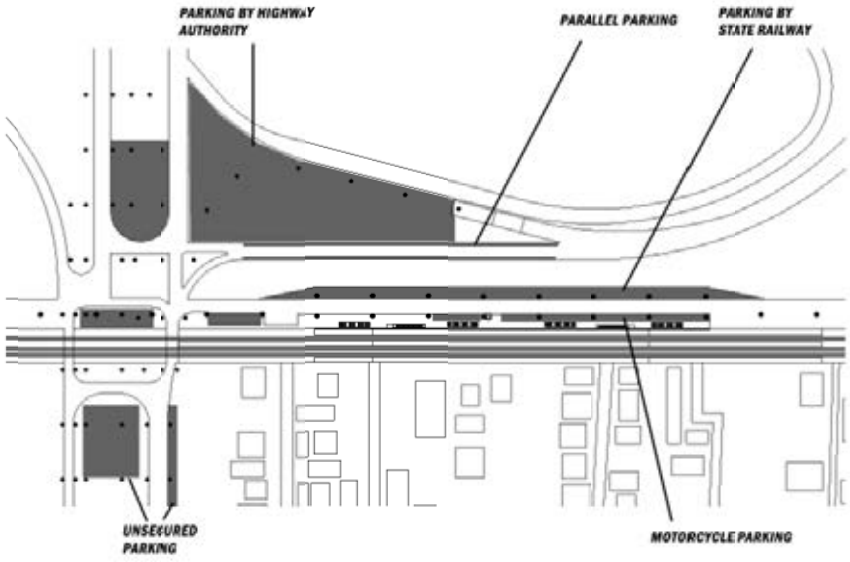



**Figure 4.52 Parking bays facility and parallel parking around station currently**

There are 2 main car parking facilities in this area. The first one is provided by State Railway itself, directly under ARL station. It has capacity of 100 cars in total and has security guard stationed. As any other ARL station, there are 2 parking bays provided for disabled people in this parking facility. The second parking facility is provided by Highway Authority, located across the ARL station. It has bigger capacity than parking bays under the station, i.e.: about 200 cars, and has access control through fence gate for security reason. However, the parking by provided by Highway Authority is difficult to reach by passengers as they have to cross the road with heavy traffic.

**Figure 4.53 Parking bays provided by State Railway (top), parking bays provided by Highway Authority (middle), and parallel parking along highway exit under flyover (bottom)**

Nevertheless, even with 2 parking lot provided, the number of cars still exceeds the parking capacity. There are more than 100 cars need to be parked outside those parking facilities. As shown on Figure 4.53, in result, people still park their car parallel to the road, especially near the highway exit and use the leftover space under the flyover for parking. These parking places are obviously not secured.

### 5.2.5. BICYCLE AND MOTORCYCLE PARKING

As previous 2 stations, although it was not intended to be, bicycle and motorcycle parking for *Lat Krabang* station is located on the sidewalk under the ARL station. It spans between east and west entrance of the station. The parking place can be crammed by up to 300 motorcycles during weekdays. 8 bicycle racks here are also used as motorcycle parking.

**Figure 4.54 Motorcycle parking under *Lat Krabang* ARL station**

## 5.3. PEDESTRIAN ROUTE

### 5.3.1. SIDEWALK

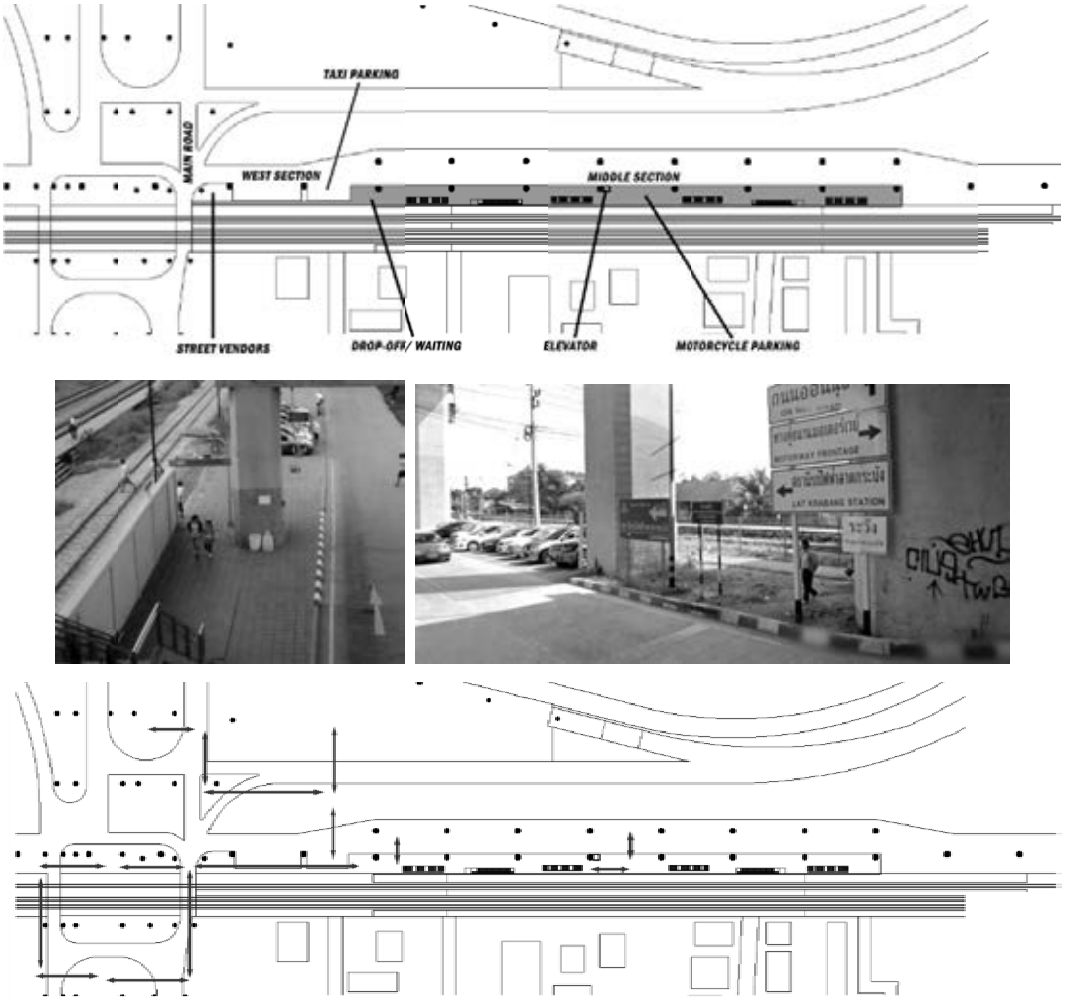



**Figure 4.55 Sidewalk for *Lat Krabang* ARL station (top and middle) and pedestrian route from ARL station to other transit facilities (bottom)**

There are 2 sections of sidewalk for *Lat Krabang* ARL station: west and middle, as shown on Figure 4.55. The whole sidewalk is located in the southern side of station access road. The west section of sidewalk connects the drop-off place/ west entrance of ARL station to *Thanon Rom Klao*. It is also used by people to access main railway station. It has width of 2 m and located behind taxi parking bays. After the parking bays, the end of sidewalk is crowded by street vendor. The middle section of sidewalk has width of 7 m and spans along ARL station length. After the west entrance, it is mainly crammed by motorcycle parking.

Normally, people do not walk to north direction as the station area is bordered by express way on north side. People also do not walk to the west across the flyover as the traffic is dangerous and there is no building on the land to the west of flyover as well.

### 5.3.2. CROSSWALK

Unlike *Ban Tap Chang* station, there is no crossing facility for *Lat Krabang* ARL station area. As various transit activities are spread around the junction, it is difficult for people walk or cross the road with heavy traffic. Moreover, most of the area under flyover is not treated with pavement for pedestrian walking area and separation with vehicular road or railway. Therefore, pedestrian walking there is not safe from vehicle traffic and passing train.

**Figure 4.56 Pedestrians cross around critical junction area**

## 5.4. DISABLED PEOPLE ACCESS

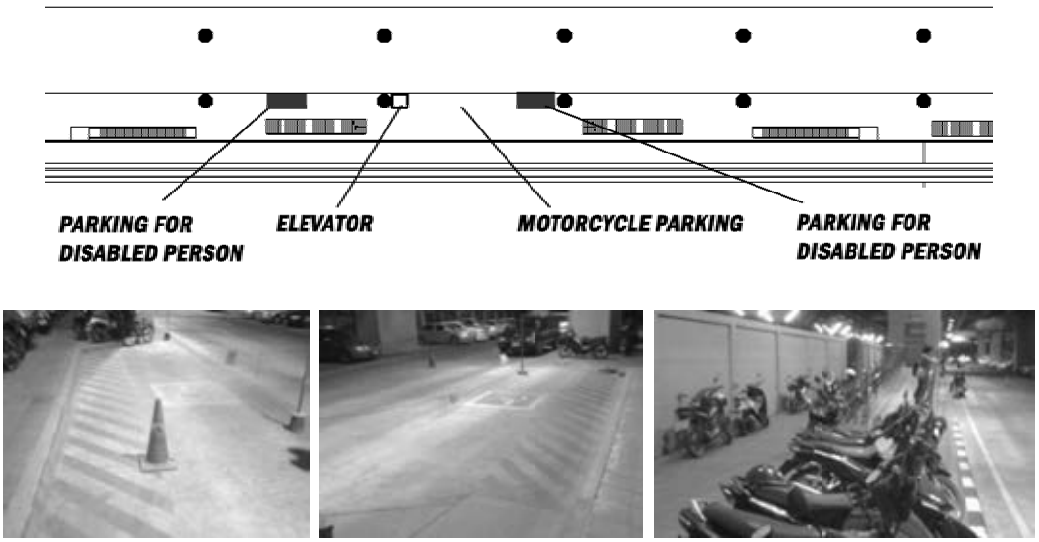



**Figure 4.57 top: location of disabled people provisions; bottom: parking bays for disabled people (left and middle) and elevator (right)**

As the universal design for other ARL stations, there are 2 provisions for disabled people in this station: parking bays for disabled and elevator to access the concourse level from the street. There are 2 parking bays for disabled person, one is located under the west/ main entrance and other one is located in the middle of station, near motorcycle parking. During the field observation, the parking bays are not used and closed with street separator and rope. The elevator for disabled people is located 30 m to the east from west entrance, between 2 parking bays for disabled people. Like in *Hua Mak* station, the access to elevator from these parking bays is obstructed by motorcycle parking on the sidewalk.

## 5.5. VEHICULAR CIRCULATION

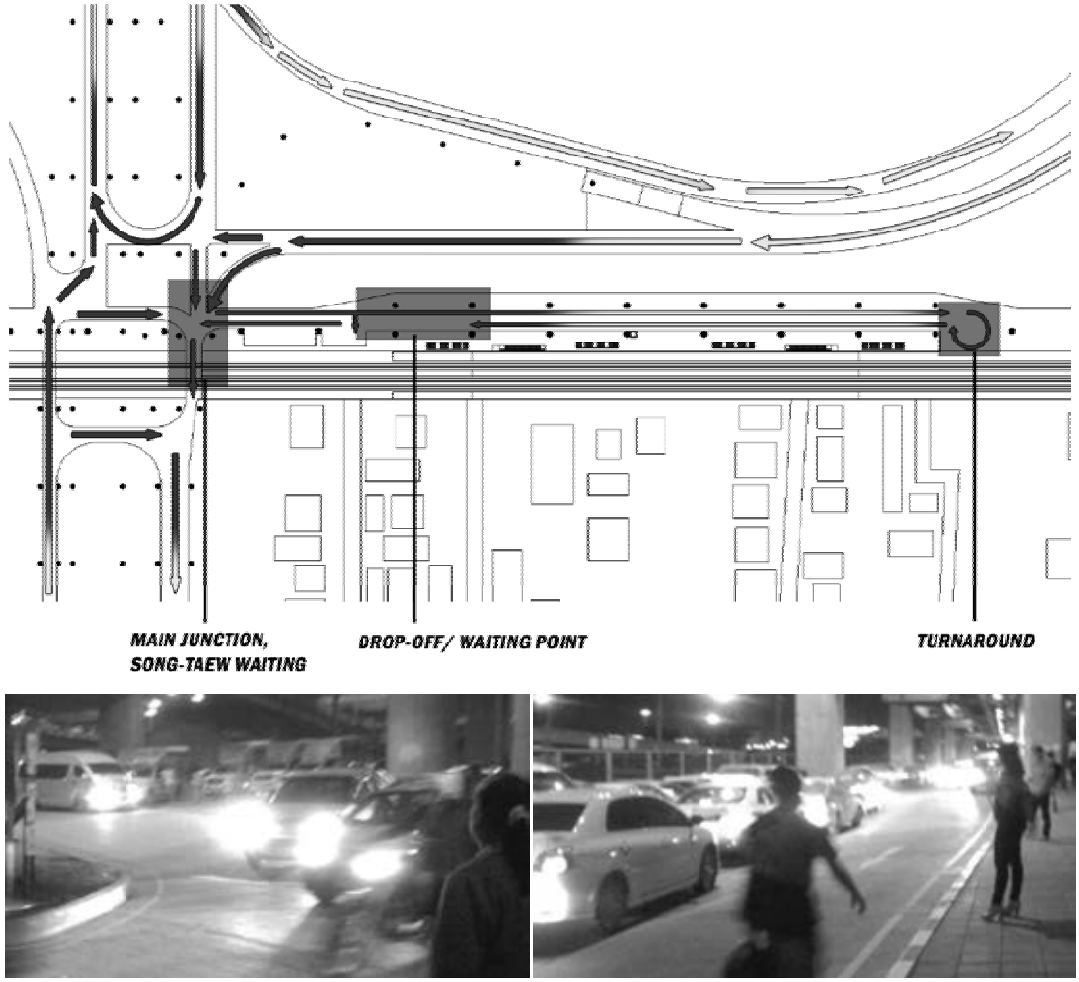



**Figure 4.58 Current vehicle traffic around *Lat Krabang* station**

Traffic jam always happens during peak hour in the morning and evening in this area due to critical intersection at the access road entrance to the station. As shown on Figure 4.18, this point is the crossing between *Thanon Rom Klao*, railway, highway exit, and access road to the station. Furthermore, many people wait for *song-taew* and bus around this junction and the drivers also stop at this place for dropping-off and picking up the passengers. The taxi drivers also try to get access to the ARL station from their rest area by turning around at this junction. The traffic jam also span along the access road under the station due to drop-off activities.

### 5.6. SPACE USER AND ACTIVITIES

From the overall field observation, the major users of transit facilities in arrival zone of this station can be divided into: train passengers, paratransit drivers, and private vehicle drivers. However, besides taxi drivers and motorcycle-taxi drivers, there is one additional user in this station area, i.e.: *song-taew* drivers.

**The train passengers** arrive to/ depart from ARL station through and use transit nodes described in Section II and III. The peak number of passengers happens in the morning: 7.00 – 9.00 AM and evening: 5.00 – 9.00 PM on weekdays. The main pattern for them is “moving” to the station in the morning. In the evening they have 2 main patterns: “moving” to the main street or parking area and “waiting” for the vehicle drivers to pick them up.

**The paratransit drivers** (taxi, motorcycle-taxi, and *song-taew* drivers) are the main user of paratransit nodes. The main pattern for this user type is “waiting” for the passenger and rest in the terminal. *Song-taew* drivers have similar activities to taxi drivers that have their own terminal to rest. However, *song-taew* terminal does not have a lot of facility as taxi terminal. Compared to other space users, paratransit drivers spend longer time on station area. Therefore, social and optional activities are important to them.

**The private vehicle drivers** follow the time of passenger’s arrival and departure. Since they just drop-off or pick-up passengers, they mainly use the road and kiss-and-ride point. The main pattern for private-vehicles entering the station area is “moving” and “turning back” to previous direction before/ after dropping-off/ picking-up. Car drivers and motorcycle drivers wait the passenger at different point.

**Table 4.3 Current users, activities, and facilities at *Lat Krabang* ARL Station**

| | NECESSARY ACTIVITIES | OPTIONAL ACTIVITIES | SOCIAL ACTIVITIES |
|---|---|---|---|
| **Passengers** | | | |
| Public transport users/ pedestrian | Departure: walking to station<br>Arrival: walking to street, waiting | Departure:-<br>Arrival: buying food | Departure:-<br>Arrival:- |
| | Facilities:<br>Sidewalk, crosswalk, Bus stops | Facilities:<br>Street vendors | Facilities:<br>- |
| Motorcycle-taxi users | Departure: dropped-off, pay, walking<br>Arrival: walking to motorcycle-taxi stand | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Drop-off place, Motorcycle-taxi stand | Facilities:<br>- | Facilities:<br>- |
| Taxi users | Departure: dropped-off, walking<br>Arrival: walking to taxi stand | Departure:<br>Arrival: | Departure:<br>Arrival: |
| | Facilities:<br>Drop-off place, Taxi stand | Facilities:<br>- | Facilities:<br>- |
| Kiss-and-ride | Departure: dropped-off, walking<br>Arrival: waiting, standing | Departure:-<br>Arrival: sitting | Departure:-<br>Arrival: meeting people |
| | Facilities:<br>Drop-off and waiting place | Facilities:<br>Bench | Facilities:<br>- |
| Park-and-ride | Departure: parking, walking to station<br>Arrival: walking to parking | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Car parking bays, Sidewalk | Facilities:<br>- | Facilities:<br>- |
| Local residents | Departure: walking<br>Arrival: walking | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Sidewalk, walkway | Facilities:<br>- | Facilities:<br>- |
| Disabled people | Departure: drop-off, move to station<br>Arrival: move to car | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Parking bays, elevator | Facilities:<br>- | Facilities:<br>- |
| **Private vehicle drivers** | | | |
| Private vehicle drivers | Departure/ arrival: driving, drop-off/ pick-up, turnaround, driving | Departure:-<br>Arrival:- | Departure:-<br>Arrival:- |
| | Facilities:<br>Drop-off/ waiting point, turnaround | Facilities:<br>- | Facilities:<br>- |
| **Paratransit and song-taew drivers** | | | |
| Taxi drivers | Departure: drop-off<br>Arrival: waiting | Buying food, repair vehicle, rest/ sleep | Interacting/ chatting, playing |
| | Facilities:<br>Taxi stand | Facilities:<br>Tent, benches, chair, table, water dispenser | Facilities:<br>Tent, benches, chair, table, water dispenser |
| Motorcycle-taxi drivers | Departure: drop-off<br>Arrival: waiting | Rest | Interacting/ chatting<br>Playing takraw |
| | Facilities:<br>Motorcycle-taxi stands | Facilities:<br>- | Facilities:<br>- |
| *Song-taew* drivers | Departure: drop-off<br>Arrival: waiting | Buying food, repair vehicle, rest/ sleep | Interacting/ chatting, playing |
| | Facilities:<br>Taxi stand, Motorcycle-taxi stands | Facilities:<br>- | Facilities:<br>- |

Besides the major users, there are people that act as basic services for the station. There are 2 basic services, i.e.: station staffs and street vendors.

**Station staffs,** such as security guard and cleaning service, are the people who work for this station. They are mainly situated on concourse and platform level of ARL station.

**Street vendors** are spotted along the sidewalk around the junction where the passengers wait for *song-taew* and bus. There are 10 – 15 street vendors in this area, mainly sell food. They are mostly come from neighboring residential area and can stay in this area for the whole day, from the morning until late night.

## 6. SUMMARY OF SITE ANALYSIS

In the beginning, this chapter has discussed the regulation from Bangkok Metropolis Administration for this area and the overview of existing buildings around each ARL station. The site analysis also has explored daily events in each transit facilities based on literatures and explored the issues that happen in the arrival zone of ARL station as it is located away from the main road. During field observation, people reach the ARL station by public transportation and walking from the main road, motorcycle-taxi, taxi, dropped-off by their relatives using private car/ motorcycle, and driving own vehicle. Lastly, the site analysis sees different types of station users and their activities as well as station facilities that support them. There are 3 types of station users, i.e.: train passengers, paratransit drivers waiting on their stands, and private vehicle drivers that wait in station area in the evening. From here, it can be seen that currently the users do not have many optional and social activities. The ARL station itself also does not have many facilities to enable the optional and social activities. On the other hand, the literature review mentioned the integration of optional and social activities to the station.

# CHAPTER V
# RESEARCH: USER SURVEY

## 1. OBJECTIVES

The literatures mention the optional activity and social activity should be accommodated with facilities as well besides train or other transportation modes departure/ arrival. However, following the conclusion of site analysis, there are not many optional and social activities are done since there is no supporting facility for them in ARL station area now. Therefore, the first purpose of survey is to know the additional facilities that users want for doing optional and social activities. The second objective of survey is to know the improvement that users want for existing transit facilities.

## 2. METHODOLOGY

The target users for this survey are the major users of arrival zone at *Hua Mak, Ban Tap Chang,* and *Lat Krabang* ARL station, i.e.: train passengers, private vehicle drivers, paratransit drivers, and *song-taew* drivers (for *Lat Krabang* only). The result of user survey is presented in percentage of respondents on pie chart diagram. The numbers of respondents taken for each station are as the following:

- *Hua Mak*: 30 train passengers, 8 private vehicle drivers, 8 taxi drivers, and 14 motorcycle-taxi drivers
- *Ban Tap Chang*: 30 train passengers, 10 motorcycle-taxi drivers, 5 private vehicle drivers
- *Lat Krabang*: 30 train passengers, 10 private vehicle drivers, 15 taxi drivers, 5 motorcycle-taxi drivers, and 10 *song-taew* drivers

The questionnaire survey was carried out directly to station users by asking the questions verbally/ direct interview and letting the respondent to filling up the questionnaire. The survey schedule was as the following:

- *Hua Mak*: 3 times in the weekday (5th, 8th, and 14th November 2012) and 1 time in the weekend (11th November 2012)
- *Ban Tap Chang*: 2 times in the weekday (3rd and 13th December 2012) and 1 time in the weekend (7th December 2012)
- *Lat Krabang*: 3 times in the weekday (11th, 19th, and 26th December 2012) and 1 time in the weekend (16th December 2012)

Since during weekday in the morning most of the users are in hurry to catch the train, the survey is carried out in the evening when the most users are going back from the station. Therefore, the survey result mainly reflects the opinion from station users that wait at the station after working hours.

## 3. SURVEY CONTENTS

Survey content is divided by the user of the station arrival zone. There are 3 different set of questionnaire for different users, i.e.: for passengers, for private vehicle drivers, and for paratransit drivers. There are 3 sections for each questionnaire set. The first section is to know the demographic and the use frequency of the ARL station. For the passengers, it is also for to know their transportation mode to approach the ARL station. The second section is to know the time the respondents spend in ARL station area and the activity they would like to do while they are being there, regardless the activity can be actually done or not currently. The survey questionnaires are attached in the appendix of thesis.

The last questionnaire section is to fulfill the 2 main objectives. In this section, respondents are asked to choose 3 answers from option. To fulfill the first objective, the answer options are based on facilities that are mentioned in literature review and allowed in residential area by BMA land use regulation. All facilities mentioned in both sources were spread, cross checked for its allowance, and grouped based on similar activity or service. From cross analysis between literature review and BMA regulation, the possible additional facilities are as the followings:

- Public toilet
- Commercial: Food vendors: street vendor, stalls, kiosk, café, restaurant, etc
- Commercial: Retails/ shops (other than food)
- Commercial: Gas station
- Meeting and recreation: plaza/ park
- Community building: civic hall, museum, library
- Public service: healthcare, childcare
- Attraction: zoo, amusement park

To fulfill the second objective, the answer options are derived from existing transit facilities at 3 ARL stations and criteria from literature review as the followings:

- Pedestrian way: sidewalk and crossing
- Drop-off/ waiting area: shelter and seating for waiting
- Bus stop: shelter and seating for waiting
- Secured/ more Car parking
- Secured/ more Motorcycle parking
- Secured/ more Bicycle rack
- Taxi/ Motorcycle-taxi stand
- Disabled people amenities: elevator, special parking

## 4. SURVEY RESULT: *HUA MAK*

### 4.1. TRAIN PASSENGERS

In the first section of questionnaire, from total of 30 passengers, the respondent compositions are 40% students, 53% workers or people at working ages, and 7% elderly. Most of the passengers, students and workers, come to the *Hua Mak* ARL station during weekdays for school and working purpose respectively. Mostly, the transportation modes used by the passengers to reach *Hua Mak* ARL station are private vehicle as the passenger (33%), public transport (27%), and driving own vehicle (17%), as can be seen on Figure 5.1.

In the second section result as shown on Figure 5.1, 72% of respondents answer that they averagely wait for 10 – 20 minutes in station area before they get picked up or going home. During waiting, most of them (53%) mainly want to sit at waiting area and since there is no seating facility for waiting area currently, they just sit on floor or stair. Moreover, they also want to buy foods or drinks during waiting. Other passengers want to do shopping (8%) and watching entertainment (5%). The young respondents, such as students, also answer that they want to hang-out with their friends first while waiting at station area, chatting or playing games in their gadget together or even study. They currently do these activities and sit around the main stair since there is no seating facility.

In the last section, matched with the activity they would like to do, the passengers (28%) want improvement for shelter and seating in waiting area. 23% of passengers also want the improvement for pedestrian sidewalk and installation of pedestrian cross bridge since currently it is difficult and dangerous for crossing *Thanon Srinagarindra*. 18% of passengers want adequate car parking to make it easy for parking or getting out the car from the station without blocked by parallel parked car. The parking security also becomes concern to them.
The rest of them want better bus stop with shelter and seating (15%), improvement for disabled people (14%), and secured motorcycle parking (2%). For the additional facilities of *Hua Mak* ARL station area, 28% of passengers want the public toilet. As it has been predicted in literature review, 24% of passengers want a commercial area that they can buy food, 22% of passengers also want the stores other than food. Many passengers (18%) also want a place for hang-out such as park or plaza. The rest 8% of passengers answer that they would like to have a community building such as civic hall.

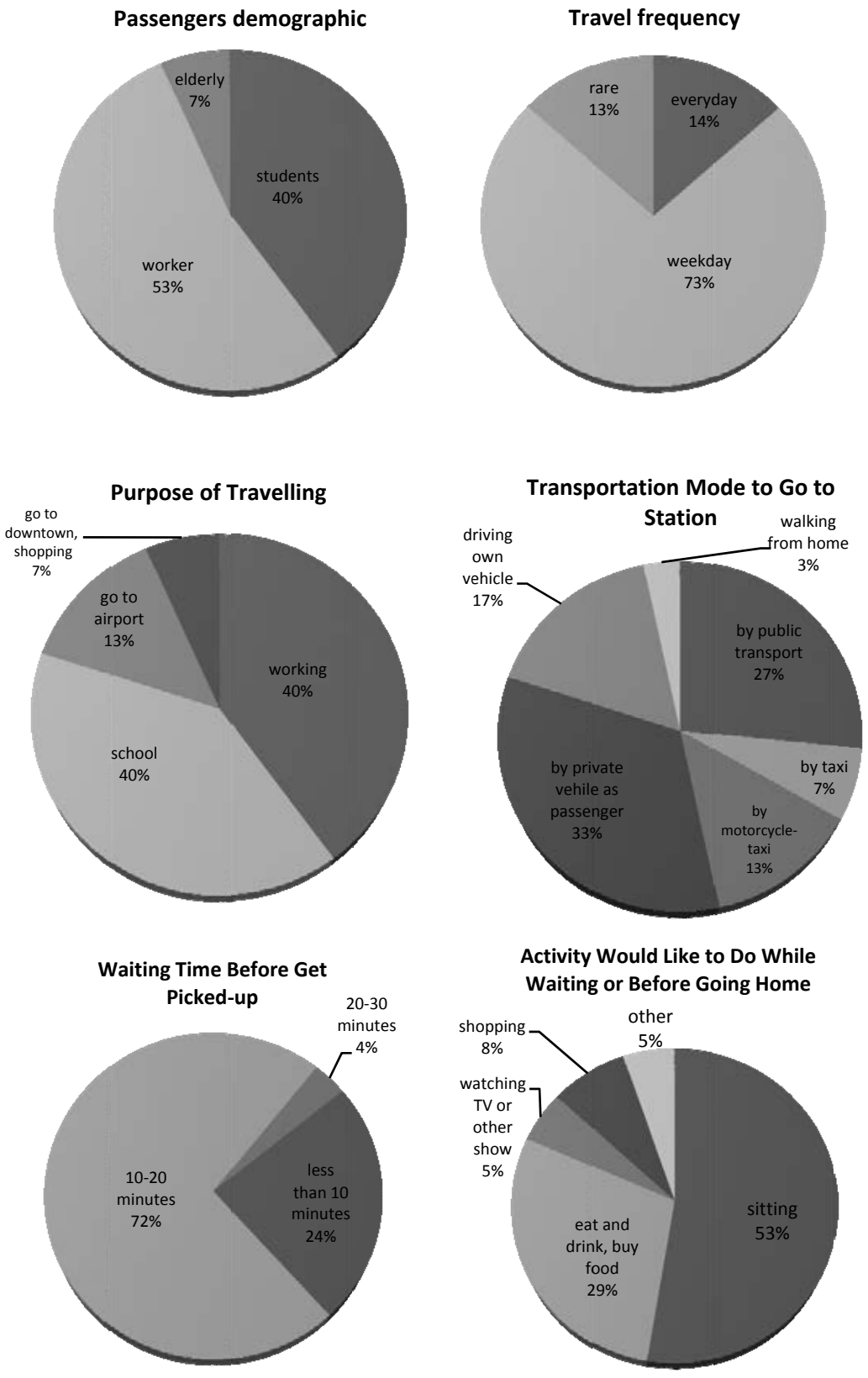



**Figure 5.1 Result of first section (top and middle) and second section (bottom) questionnaire for train passengers at *Hua Mak***

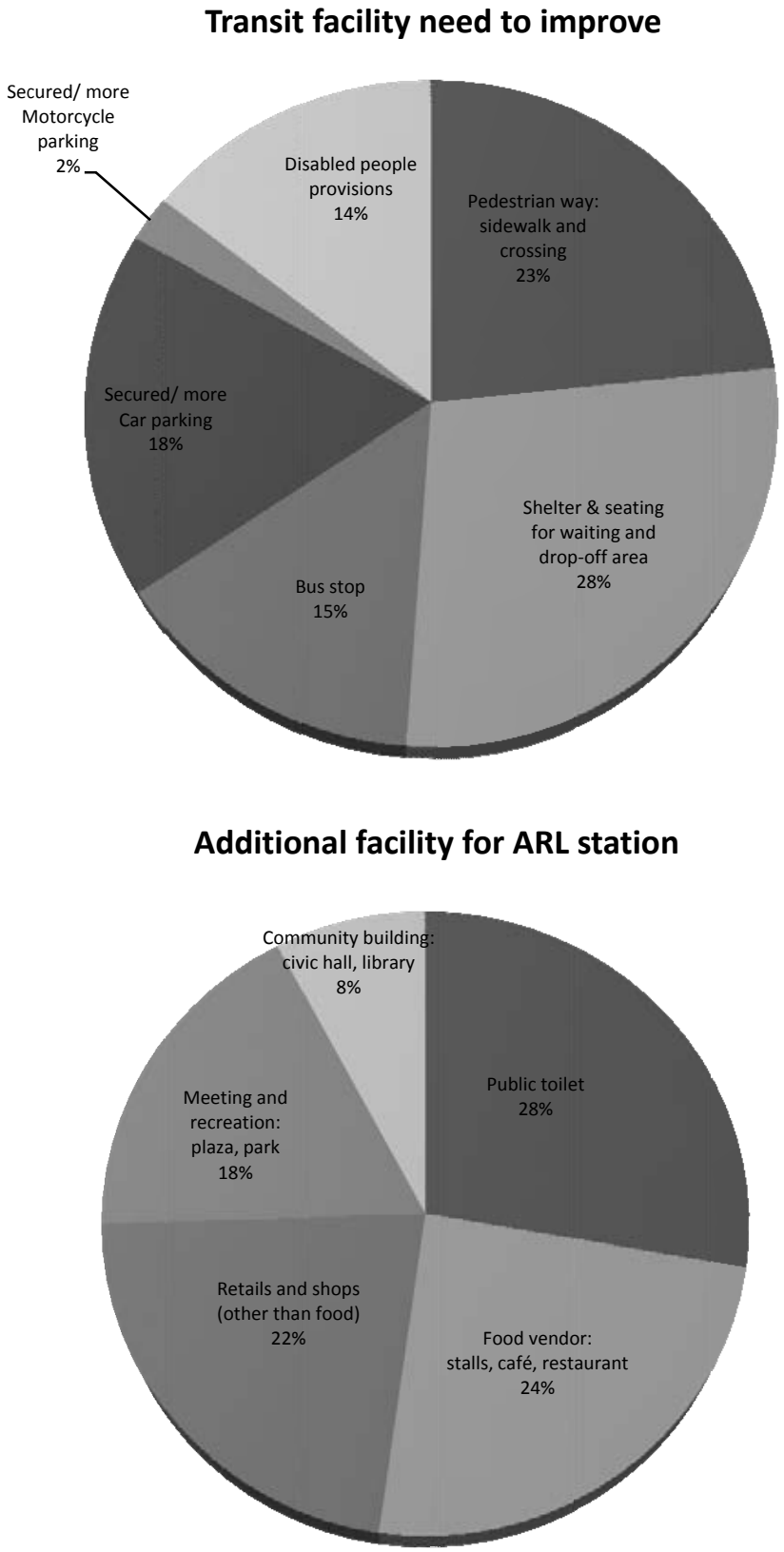



**Figure 5.2 Result of third section of questionnaire for train passengers at *Hua Mak***

## 4.2. PRIVATE VEHICLE DRIVERS

There are not many private vehicle drivers found waiting at *Hua Mak* ARL station area. From total of 8 driver respondents, 75% of them are motorcycle users that go to the station every weekday for picking-up their relatives after working hours. The car users are only 25% that found in the weekend and rarely come to *Hua Mak* ARL station. This is matched with the car parking area's condition that is always full during weekday and makes it nearly impossible for people who come in the evening to find a parking place. As can be seen from Figure 5.3 below, the private vehicle drivers mostly wait at the station less than 10 minutes (50%) and less than 20 minutes (37%). Most of them want a place for seating (43%) and buy some foods (43%) while waiting.


**Figure 5.3 Result of first section (left) and second section (middle and right) of questionnaire for private vehicle drivers at *Hua Mak***

Most of private vehicle drivers (71%) want the improvement for waiting and drop-off area with shelter and seating as they also wait at this area. The rest of respondents also said that more motorcycle parking (12%) and car parking (12%) are needed for ARL station. Only 4% mentioned the improvement for disabled people facilities. As shown on Figure 5.4, commercial facilities, especially food vendors, are important to most of respondents (33%). Just as the passengers' responses, public toilet is also seen important for private vehicle drivers (29%) while waiting. The rest answers are retails and shops other than food (21%) and plaza/ park for meeting and recreation (17%)

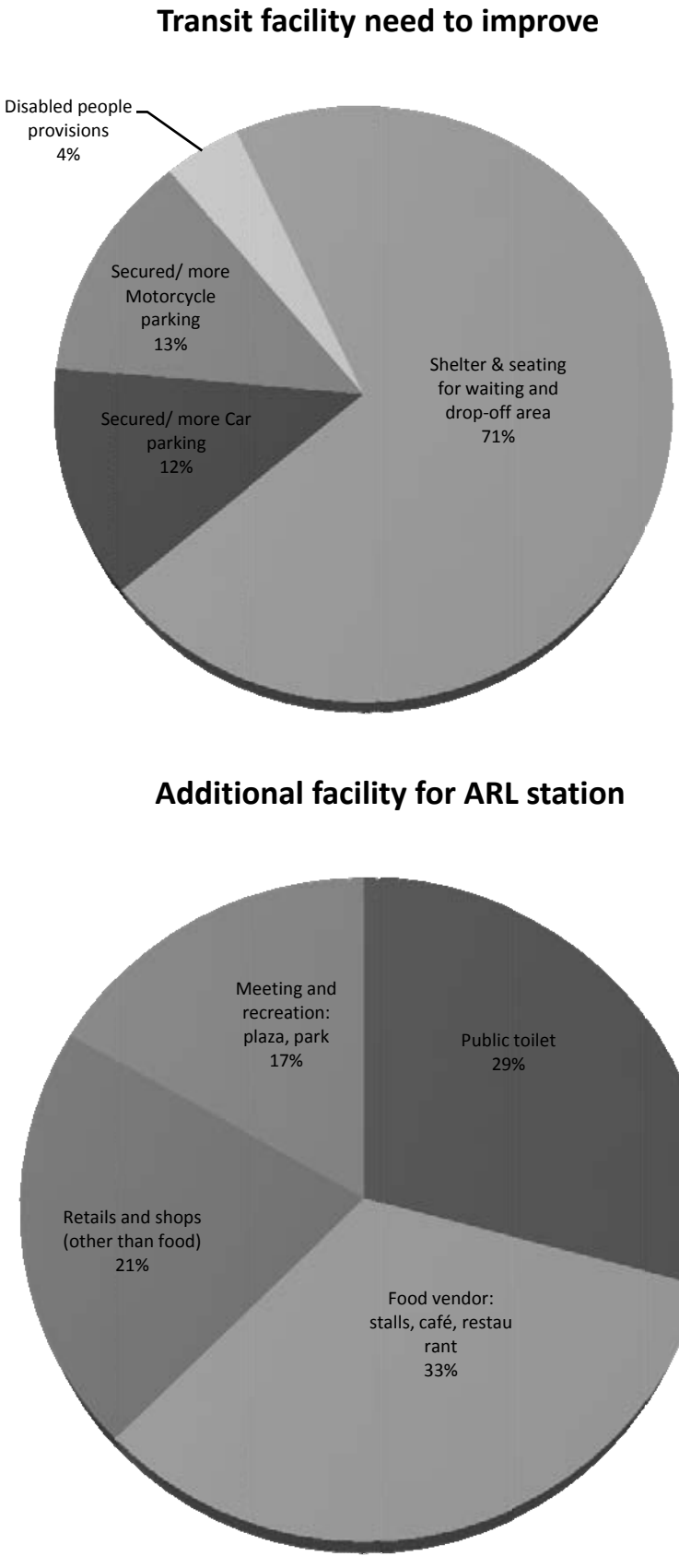



**Figure 5.4 Result of third section of questionnaire for private vehicle drivers at *Hua Mak***

### 4.3. PARATRANSIT DRIVERS

The first and second survey section results for paratransit drivers (taxi and motorcycle-taxi drivers) are shown on Figure 5.5. 82% of 22 total driver respondents actually come to *Hua Mak* ARL station every day. It is usually takes 10 – 20 minutes for them (53%) waiting at *Hua Mak* ARL station before getting the passenger. The longer time (41%) can take 20 – 30 minutes when they want to take a rest. 32% of paratransit drivers want to sit while chatting or buying food and beverages during this waiting time. 27% of them also want to do other activities such as playing card, chess, or maintaining their vehicles.

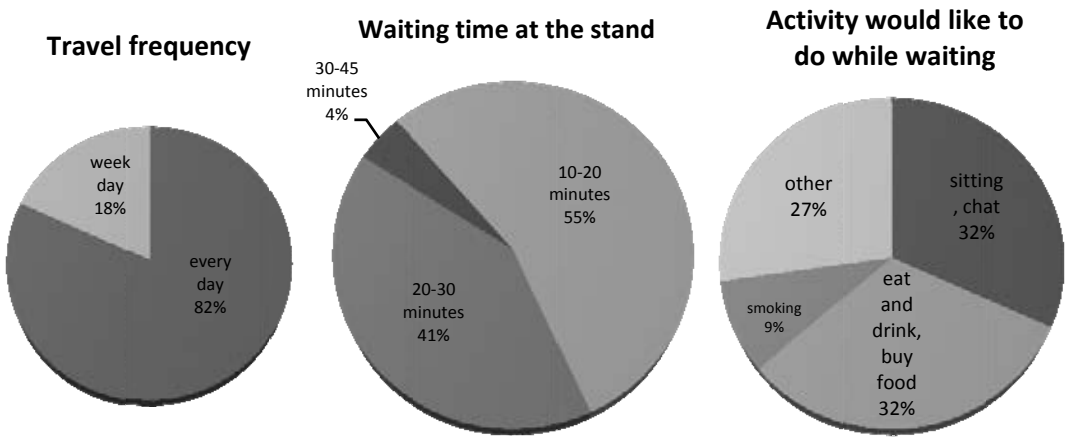
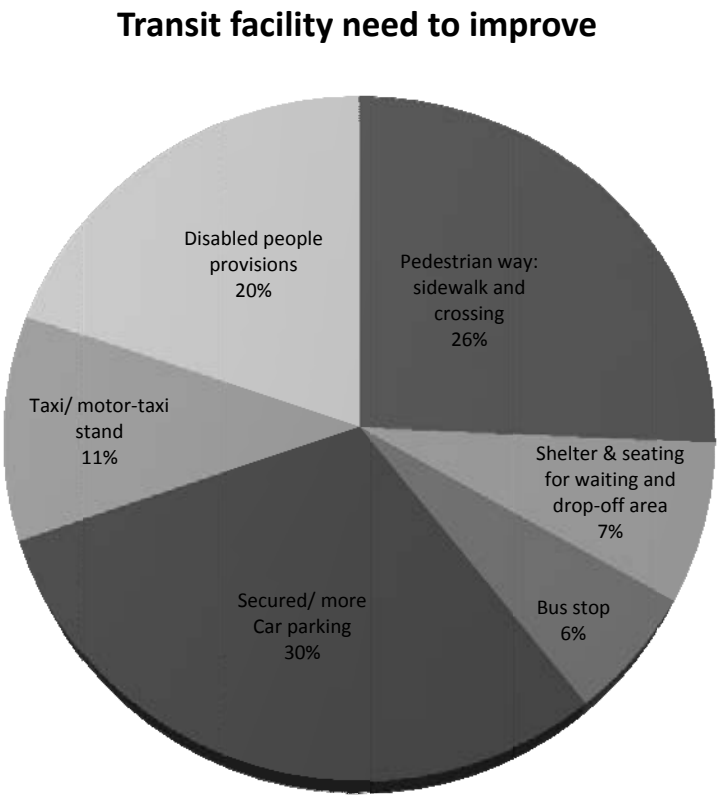



**Figure 5.5 Result of first section (left) and second section (middle and right) of questionnaire for paratransit drivers at *Hua Mak***

The third survey section results for paratransit drivers are shown on Figure 5.6. Surprisingly, 30% of paratransit drivers see car parking as the transit facility that needs immediate improvement. Currently, it is difficult for them to park their vehicle, especially for taxi drivers, as the vehicles block their way. Furthermore, according to their witnesses, unsecured and open access to the parking place from the street encourages vandalism cases. 26 % of respondents also see the need to improve the sidewalk and make pedestrian cross bridge to help people cross the road safely. 20% drivers want the improvement for disabled people facility and 11% want improvement for paratransit stands so they can park their taxi easier and take shelter during rain. Most of paratransit drivers want additional facility for they can buy more food (33%) and other things (29%) easier. They answer that public toilet is important facility to be added as well (24%) as they often hear the passengers complaint about it. Some of paratransit drivers (12%) also see the station plaza or park as a good addition to *Hua Mak* ARL station.



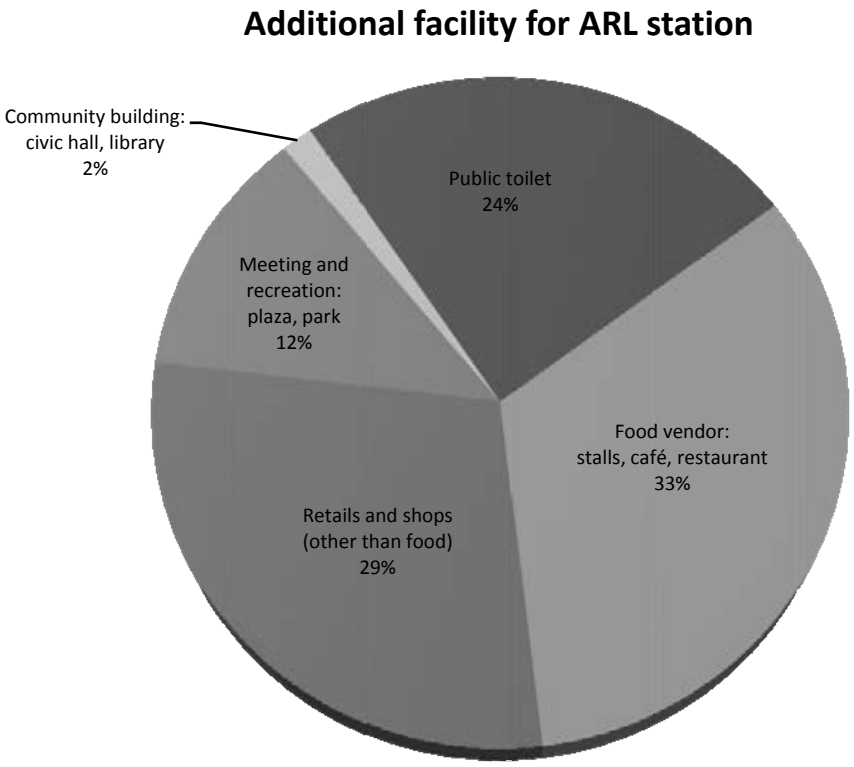




**Figure 5.6 Result of third section of questionnaire for paratransit drivers at *Hua Mak***

## 5. SURVEY RESULT: *BAN TAP CHANG*

### 5.1. TRAIN PASSENGERS

In the first section of questionnaire, from total of 30 passengers, the respondent compositions are 47% students, 50% workers or people at working ages, and 3% elderly. Students and workers come to the ARL station during weekdays for school and working purpose respectively. 13% of passengers said that they use usually use SRT train from *Ban Tap Chang* train station more often compared ARL since it is cheaper. They just use the ARL when they are in hurry. Mostly, the transportation modes used by the passengers to reach *Ban Tap Chang* ARL station are bus or *song-taew* (34%), motorcycle-taxi (20%), and private vehicle as passenger (20%), as can be seen on Figure 5.7. 13% of passengers said they just walk from their home in local village in the west of ARL station.

As can be seen on Figure 5.7, the second part result shows that 50% of passengers wait for 10 – 20 minutes in the station area and 33% wait for 20 – 30 minutes. The longer waiting time in this station is due to the location that is difficult to reach by cars or taxi and served only by one bus line in one direction. During waiting, 63% passengers mainly want to have seating at waiting area, 27% also want to buy foods or drinks during waiting, and 10% passengers want to buy something other than food.

In the last section, as shown on Figure 5.8, most of the passengers (33%) demand the improvement of pedestrian walking path, especially the crossing bridge above the highway. Currently, they do not feel secured when passing through the bridge as it does not have lighting at nighttime. The second highest demands are bus stop (26%) and waiting place (19%) with shelter and seating, especially across the highway where they usually wait for the bus or car to pick them up. Parking is the least concern for the passengers as they mostly come by public transport or dropped off by their relatives. For additional facilities of *Ban Tap Chang* ARL station area, as in *Hua Mak* station, public toilet is the biggest need for train passengers (33%). Passengers also demands for retails such as food vendors (22%) and other shops (20%) so they can buy something while waiting or to take back home. 16% of passengers also answers plaza/ park as good addition for the station.

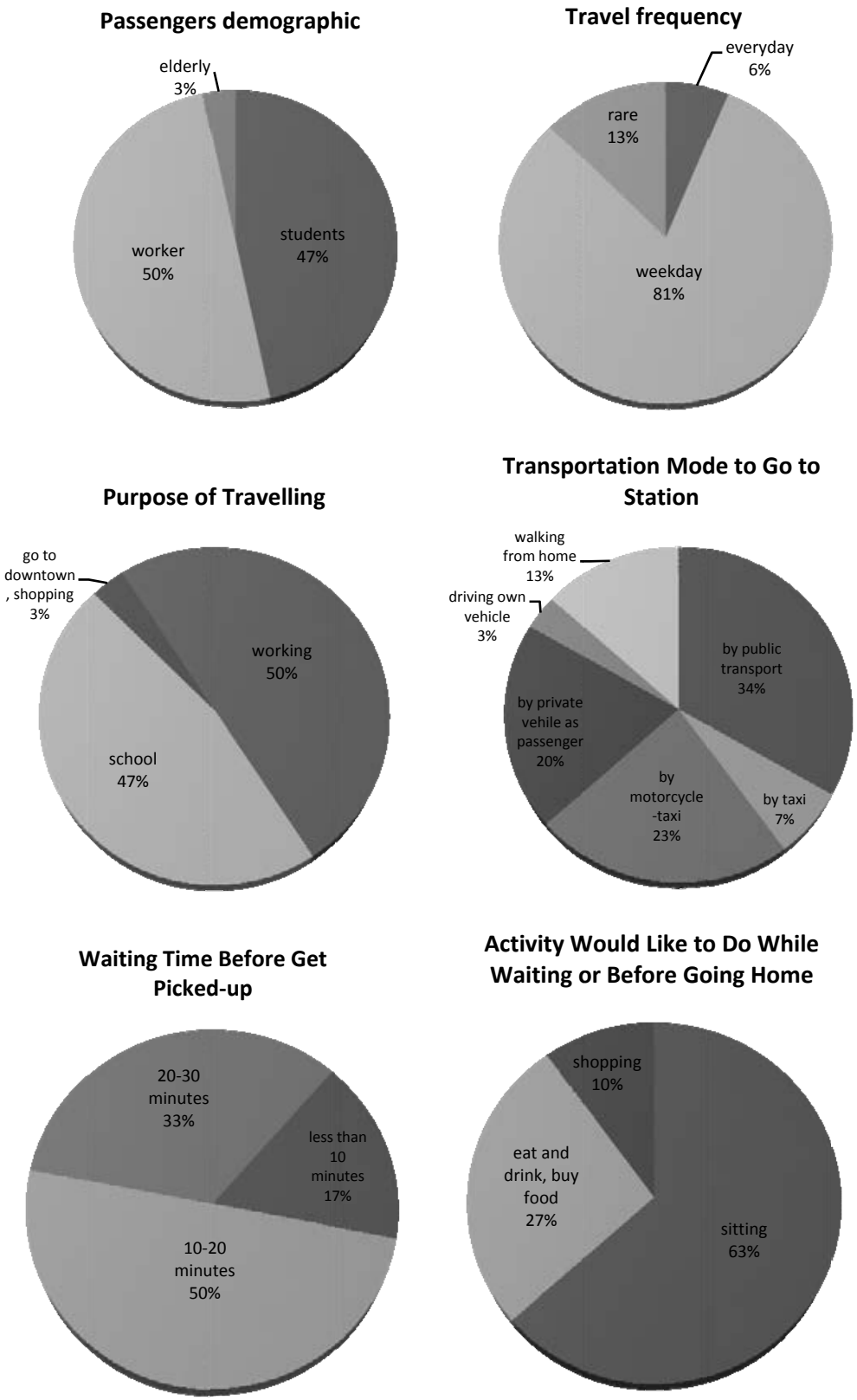



**Figure 5.7 Result of first section (top and middle) and second section (bottom) questionnaire for train passengers at *Ban Tap Chang***

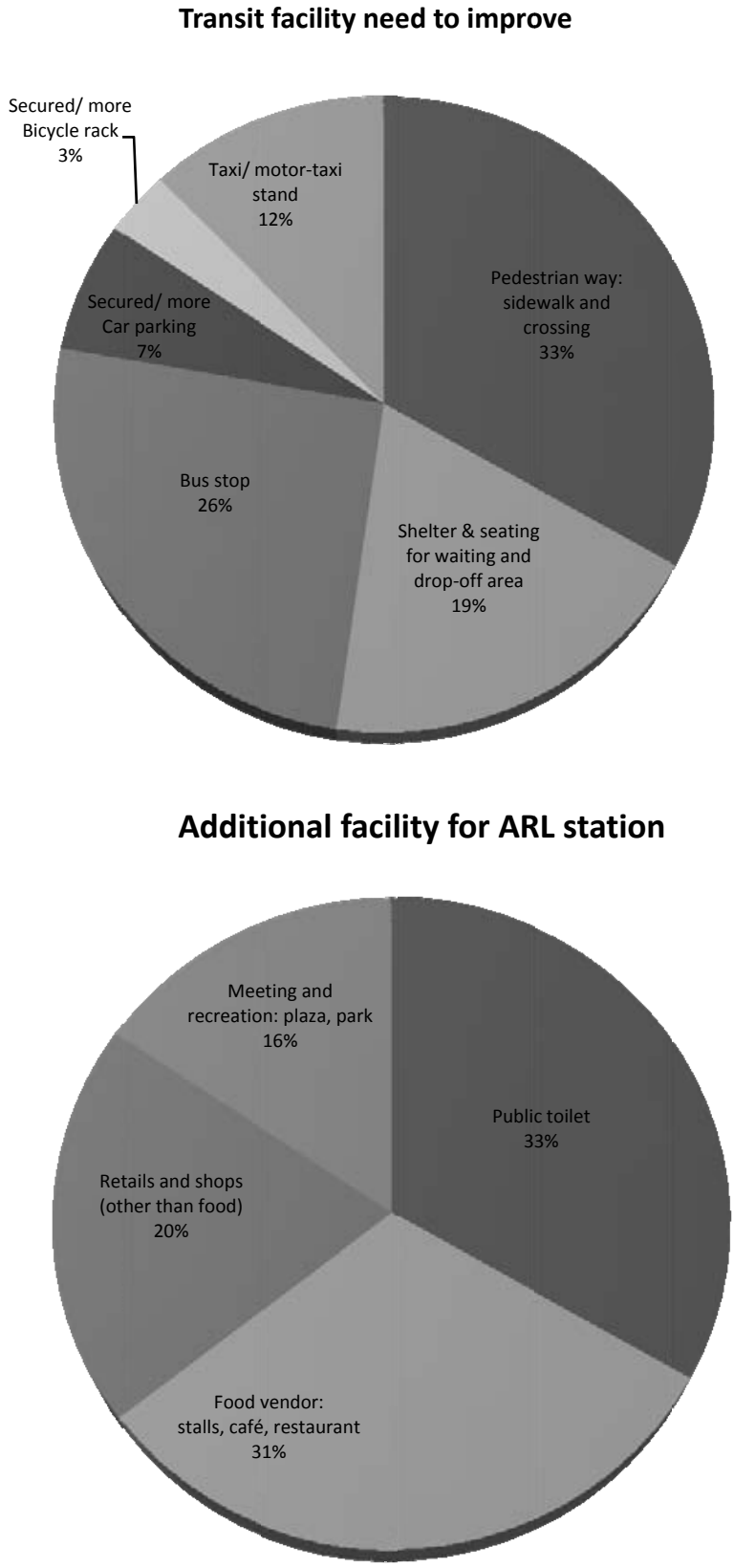



**Figure 5.8 Result of third section of questionnaire for train passengers at *Ban Tap Chang***

## 5.2. PRIVATE VEHICLE DRIVERS

There are not many private vehicle drivers found waiting at *Ban Tap Chang* ARL station area. All 5 respondents found are motorcycle users that go to the station every weekday for picking-up their relatives after working hours. 3 of them were found waiting in the station entrance area while the others were found waiting across the highway, at motorcycle-taxi stand and bus stop area. The car drivers that wait for their relatives were not found during the survey. The ARL station location itself is difficult to reach by car due to highway and the waiting area across the highway does not have parking for car waiting. As can be seen on Figure 5.8, the motorcycle drivers only wait under 20 minutes in station area. Most of them just need for seating or parking. Only 20% want to buy food and beverages during waiting.

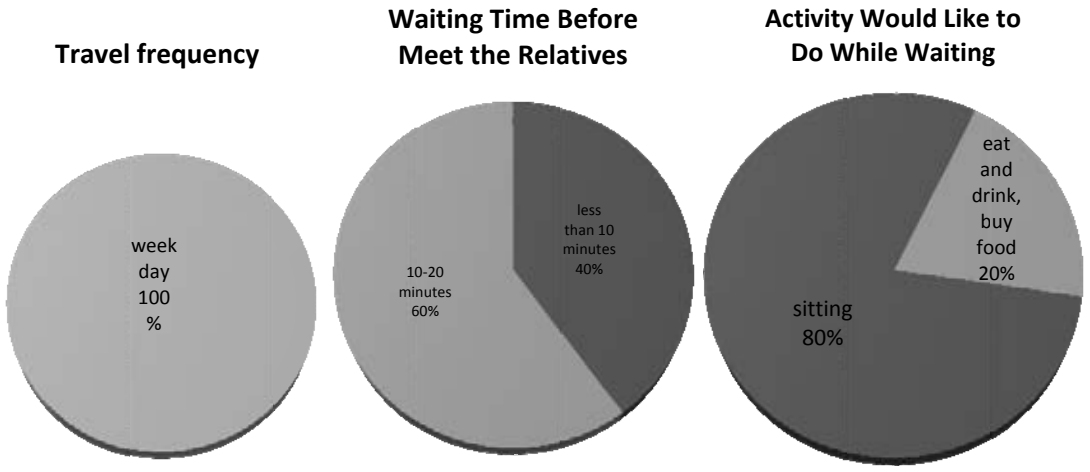



**Figure 5.9 Result of first section (left) and second section (middle and right) of questionnaire for private vehicle drivers at *Ban Tap Chang***

As shown on Figure 5.10, most of private vehicle drivers (33%) requires for sheltered waiting area, especially those who wait at waiting place across the highway. Other drivers see bus stop (27%), car parking (27%), and bicycle parking (13%) as station facilities that need to improve. For the additional facilities, same as the train passengers, public toilet (47%) and food vendors (33%) are additional facilities required by the drivers. The rest of them want for station plaza/ park (13%) and retails other than food vendors (7%).

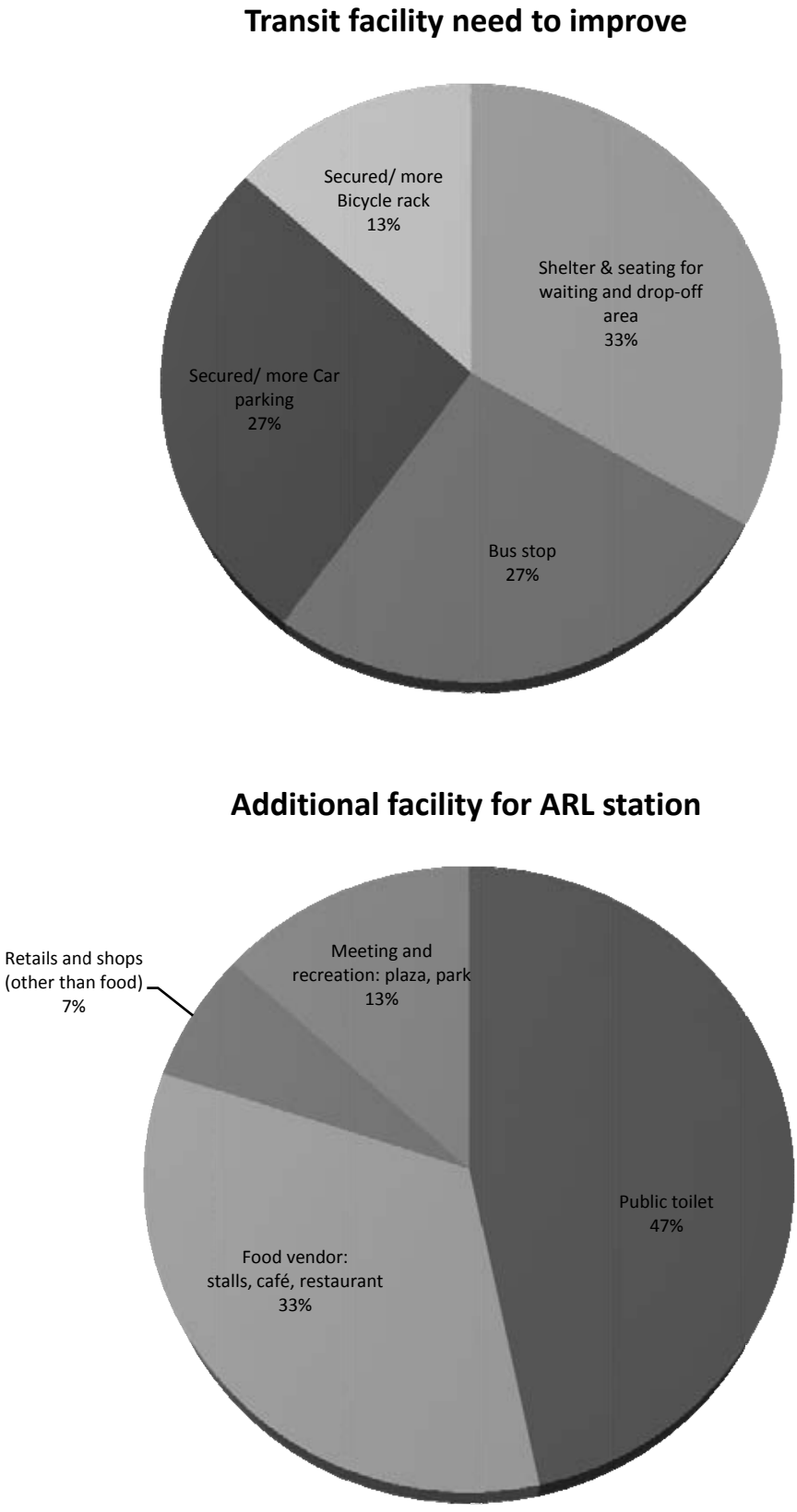



**Figure 5.10 Result of third section of questionnaire for private vehicle drivers at *Ban Tap Chang***

## 5.3. PARATRANSIT DRIVERS

Motorcycle-taxi is the only paratransit vehicle that can be found in this area. There are 2 different bases for this area, one under the ARL station and another one across the highway. All of drivers found at the first base are local resident and live in village to the west side of *Ban Tap Chang* station. Most of them (70%) wait at the stand around 10 – 20 minutes. Only 10% of respondent wait less than 10 minutes at their stand, i.e. the motorcycle-taxi drivers that operate at the stand across the highway. As in *Hua Mak* station, they mostly want to sit together, interacting, eating, and smoking at the stands. However, they do not have place or facility for those activities currently and have to sit on the street curbs.

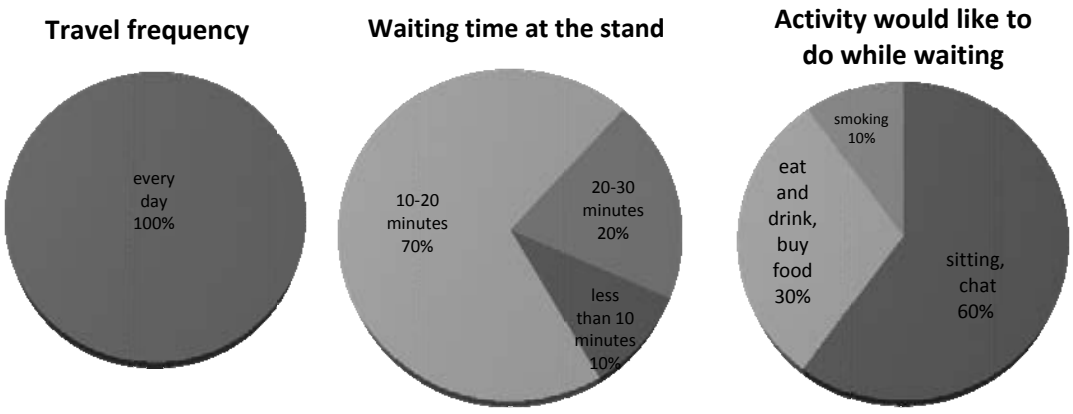



**Figure 5.11 Result of first section (left) and second section (middle and right) of questionnaire for paratransit drivers at *Ban Tap Chang***

In the last section result as shown on Figure 5.12, most of motorcycle-taxi drivers (33%) require for better pedestrian walking path and street, especially crossing bridge. They shared their thoughts that it would be better if the crossing bridge could accommodate motorcycle crossing as well so they can reach the residential area across the highway quickly. Another highest requirement (33%) is better motorcycle-taxi stand with shelter and seating to take a break and eat while waiting for the passengers. Other 27% also ask for improvement in waiting area across the highway. For the additional facilities for the station, most of motorcycle-taxi drivers (33%) still see the public toilet as the most important facility. Currently, they often get a request from the passengers to take them to the closest gas station to find a public toilet. Other 33% see retail shop as good facility to add. Station plaza is also seen as another best additional facility by 27% of motorcycle-taxi drivers. Different from other respondents, motorcycle-taxi drivers have less worry about food vendors as they can bring the food from their home that is very close to the station.

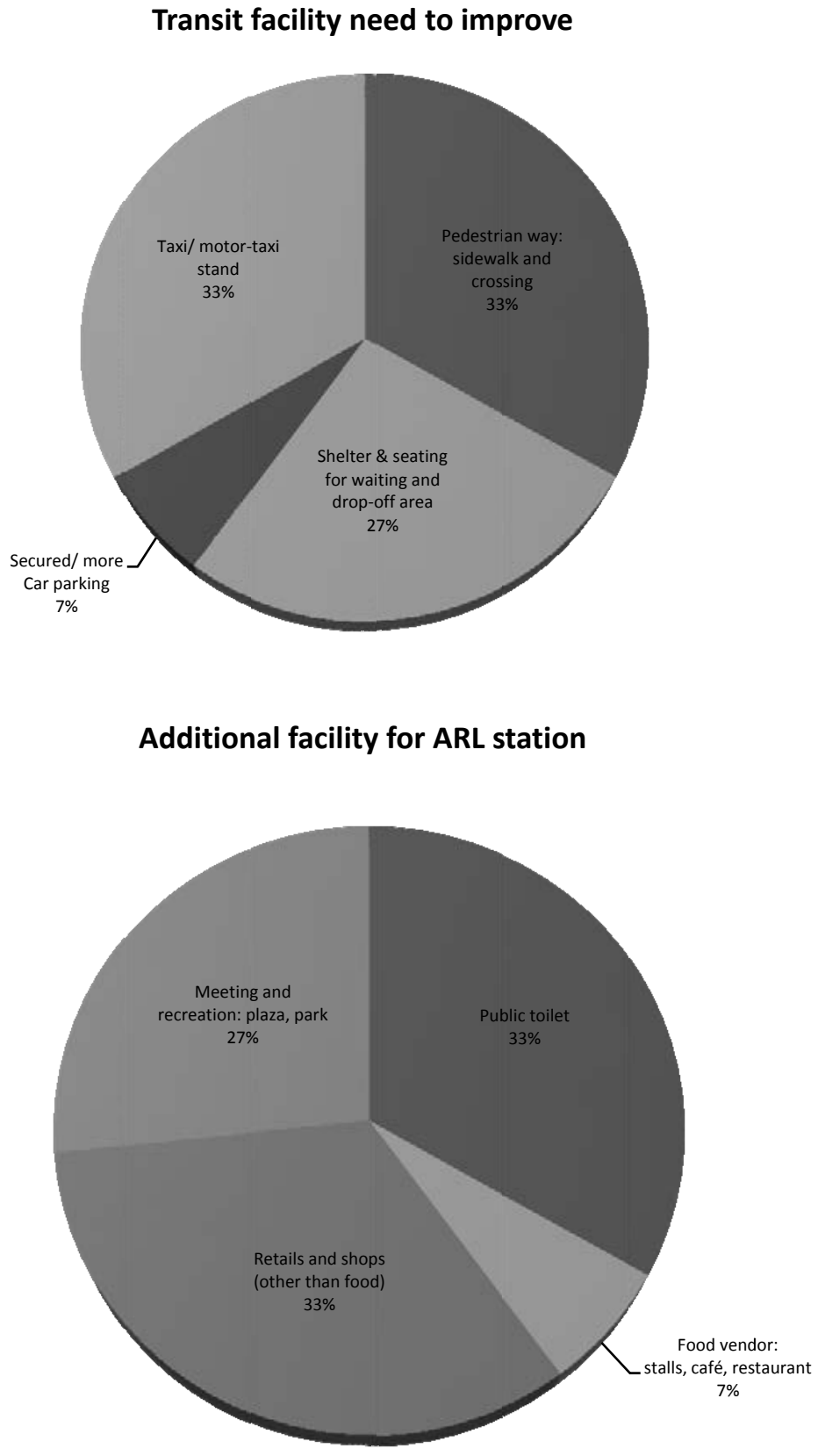



**Figure 5.12 Result of third section of questionnaire for paratransit drivers at *Ban Tap Chang***

## 6. SURVEY RESULT: *LAT KRABANG*

### 6.1. TRAIN PASSENGERS

In the first section of questionnaire, from total of 30 passengers, the respondent compositions are 40% students and 60% workers or people at working ages that come to the *Lat Krabang* ARL station during weekdays for school and working purpose respectively. Most of the passengers (58%) use public transportation to reach *Lat Krabang* station since there are many options of public transportation. Other widely used modes are taxi (15%), private vehicle as passengers (15%), and driving own vehicle (8%).

As can be seen on Figure 5.13, the result of second section shows 70% of passengers wait 10 – 20 minutes around the station for bus, *song-taew*, taxi, or their relatives that pick them up. The main activities that would like to be done by the passengers are sitting (50%) and buy food/ drink (40%). Currently, the seating facility is available in drop-off/ waiting area of the station, mainly used by people waiting for taxi and relatives to pick them. The street food vendors are currently located along sidewalk near the road intersection. People who use public transportation often buy some food before waiting for bus/ *song-taew* in the evening or before walking to station in the morning.

In the last section of questionnaire, the passengers have quite diverse answers as shown on Figure 5.14. 33% of respondents ask for better and safer pedestrian sidewalk and crossing bridge/ sky-walk from the station to parking and stop facilities spread around the junction and highway exit. The second most important improvements are shelter/ seating for waiting area (21%) and bus stop (18%). The rest of passengers look for more motorcycle parking (13%), easy-to-reach taxi/ motorcycle-taxi stand (8%), and more secured car parking space (7%). For the additional facilities, once again, public toilet becomes the most demanded facility by all passengers. Although currently there is toilet facility at main train station, the passengers still require easy-to-access and more public toilet facilities. Food vendors also still become popular demand by most train passengers (30%). Street food vendors near the ARL station also said that they always have a lot of customers in the morning and evening time. 23% of passengers see park or plaza as good addition to the station and other 13% look for the retails/ vendors other than food as well.

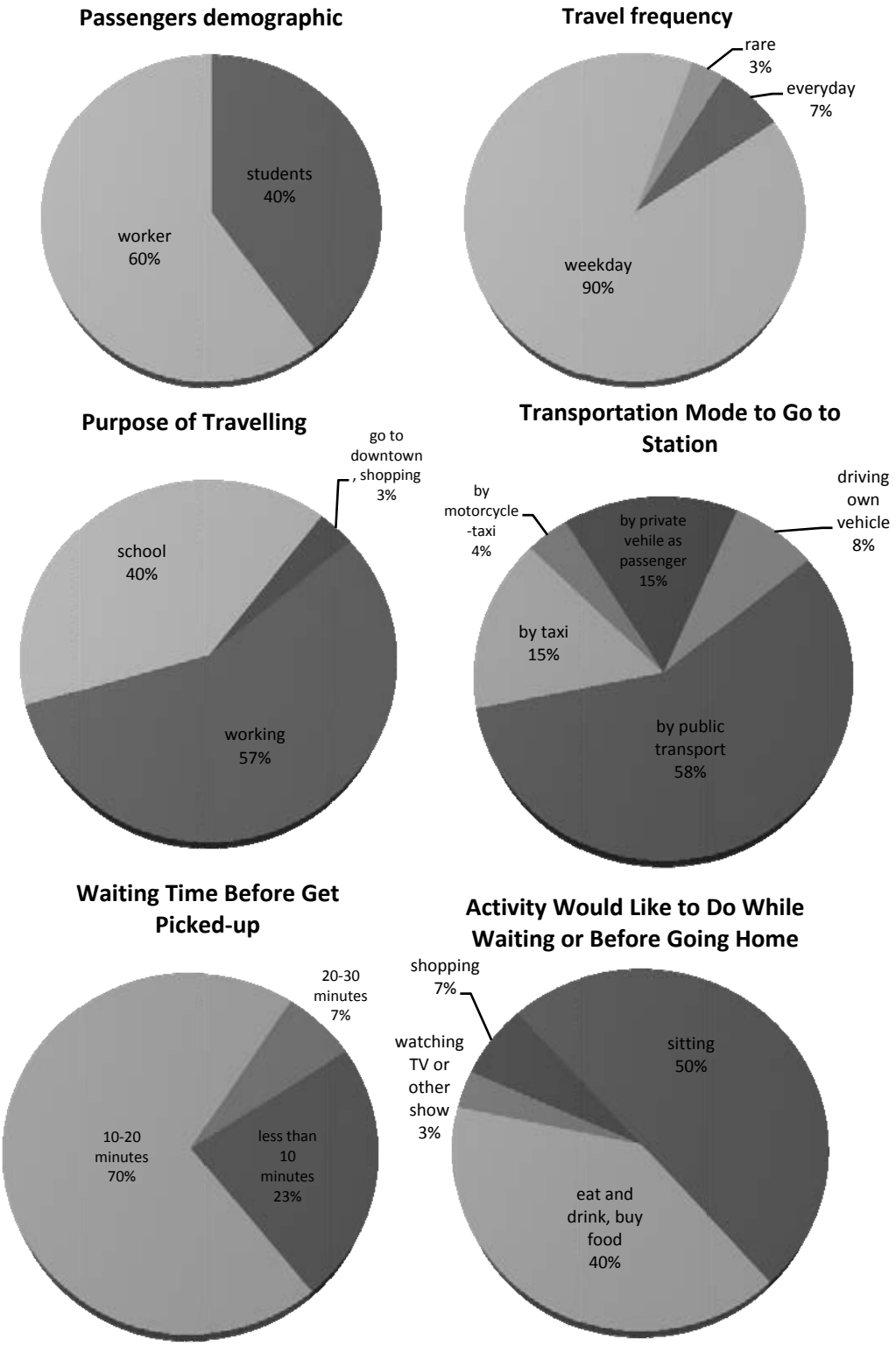



**Figure 5.13 Result of first section (top and middle) and second section (bottom) questionnaire for train passengers at *Lat Krabang***

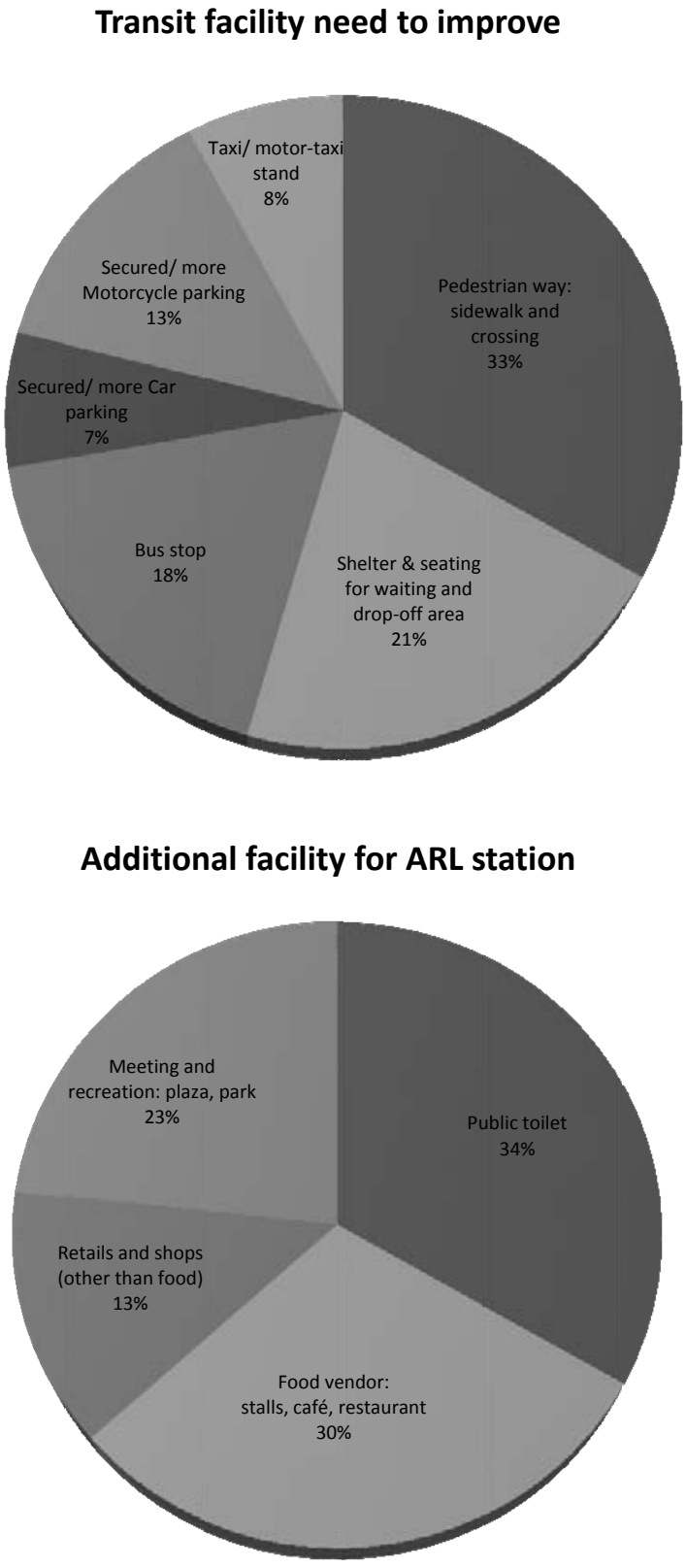



**Figure 5.14 Result of third section of questionnaire for train passengers at *Lat Krabang***

## 6.2. PRIVATE VEHICLE DRIVERS

There were 10 private vehicles drivers found waiting around *Lat Krabang* ARL station during survey period. As in *Hua Mak* station, most of them are motorcycle users (80%) that wait at drop-off/ waiting point of the station. The car users mainly wait on the road outside station boundary, next to taxi terminal. As can be seen on Figure 5.15, all of them answered that they come to ARL station on every weekdays. Most of them (60%) wait around the station area for 10 – 20 minutes. Other 20% of respondent answered they usually wait less than 10 minutes and other 20% wait between 20 – 30 minutes. The respondents that answered have longer time waiting are mostly the car drivers. They mostly want a place for seating (50%) and buy some foods (40%) while waiting.

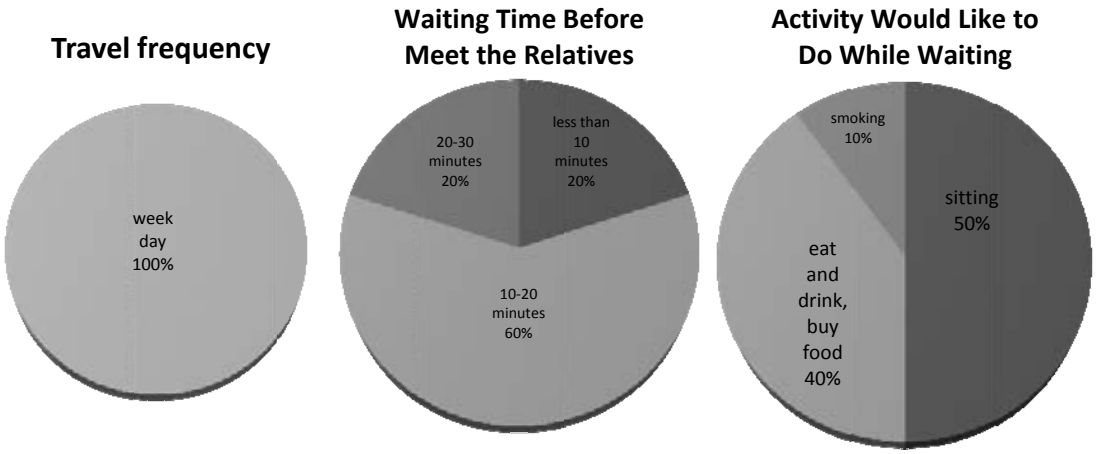



**Figure 5.15 Result of first section (left) and second section (middle and right) of questionnaire for private vehicle drivers at *Lat Krabang***

The last section result, as can be seen on Figure 5.16, shows that most of private vehicle drivers (30%) want the improvement for waiting area so they can wait without impeding the traffic, have easier access, and easy to find by their relatives. More parking for motorcycle (30%) and car (23%) are also seen as the most important improvement facility by the drivers. For additional station facility, just as the train passengers, most of private vehicle drivers look for public toilet (33%) and food vendors (27%) as the most important. Park/ plaza is also seen as good addition by 27% of respondents. The rest 13% want more retails/ vendors that sell other goods than food as well.

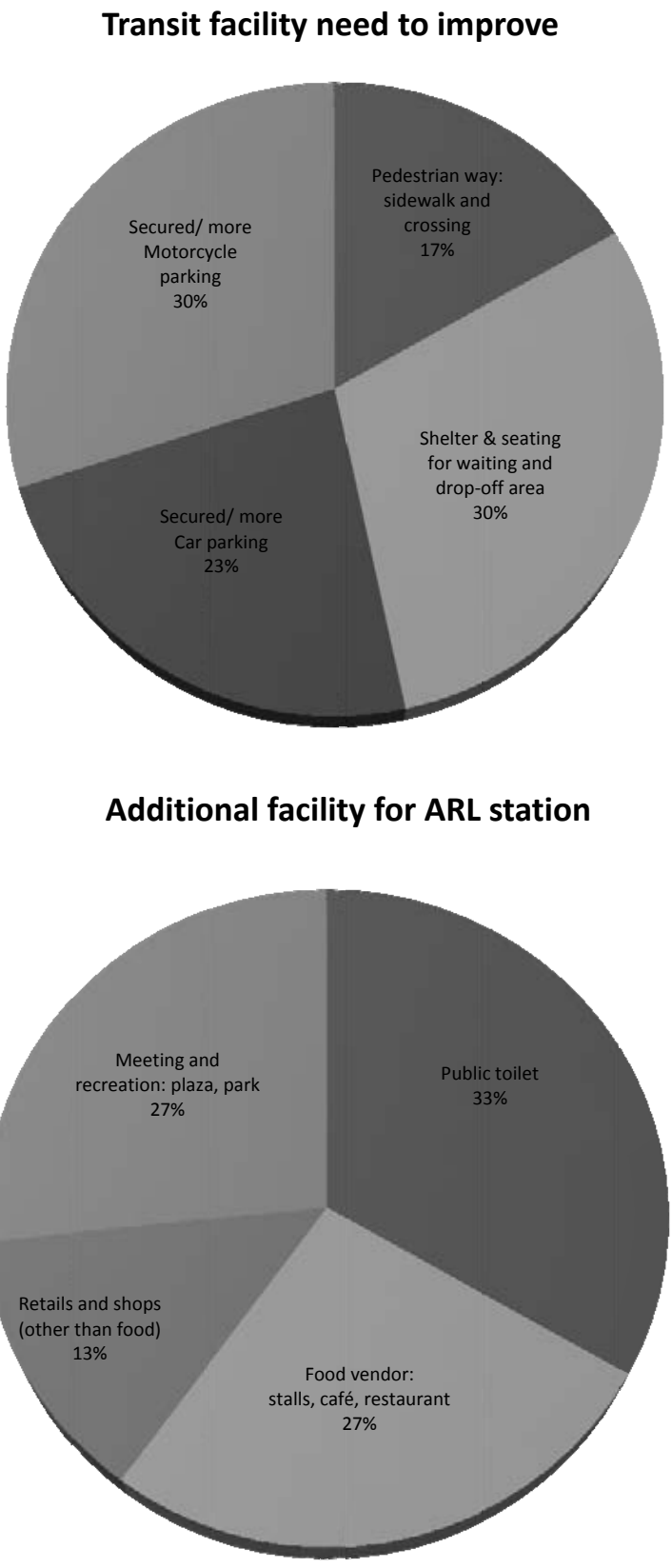



**Figure 5.16 Result of third section of questionnaire for private vehicle drivers at *Lat Krabang***

## 5.3. PARATRANSIT DRIVERS

Most of paratransit driver respondents (taxi, motorcycle-taxi, and song-taew) come to *Lat Krabang* station area every day. Their waiting time in this area varies from the shortest, under 20 minutes up to 1 hour if they want to take a break or sleep since taxi and *song-taew* drivers have terminal near *Lat Krabang* station. However, they wait around 20 – 30 minutes at their stands mostly. Like drivers at *Hua Mak* station, they want to do various activities while waiting such as sitting together and chat (50%), eat or buy food/ drink (27%), smoking (6%), and other activities (17%) like playing cards and sleep.

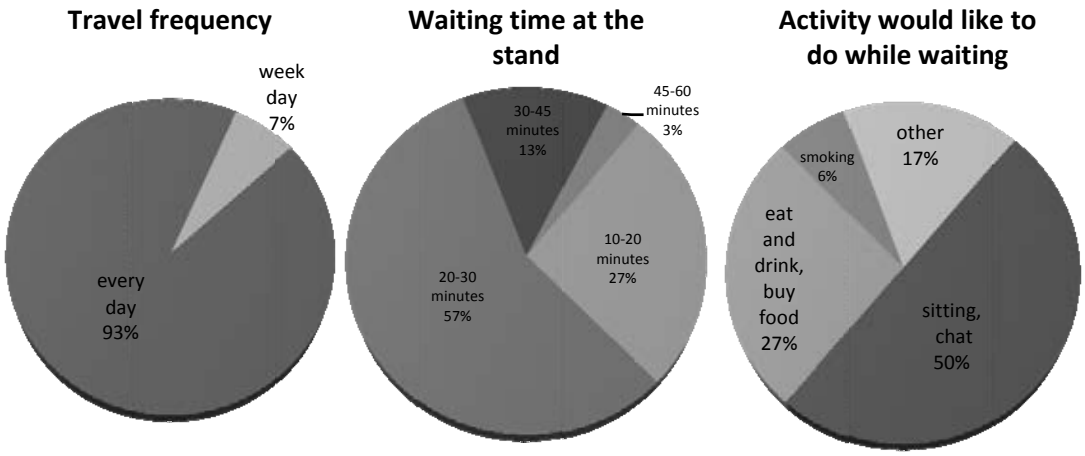



**Figure 5.17 Result of first section (left) and second section (middle and right) of questionnaire for paratransit and song-taew drivers at *Lat Krabang***

Regarding the facility improvement, paratransit drivers also have diverse answer as can be seen on Figure 5.18, just like the train passengers. 28% of them see there is a need to make safer pedestrian crossing at intersection to connect bus/ *song-taew* stop, motorcycle-taxi stand, and parking to the station. Respondents also want better paratransit stands (26%) and public transport stops (15%) with safe and easier access for passengers and vehicles without disturbing or being disturbed by main traffic. The rest of them want more car parking space (13%), waiting area (12%), and more motorcycle parking (6%). For additional facilities, just like train passengers and private vehicle drivers, public toilet (33%) and food vendors (30%) are still the most important facility according to paratransit drivers. Based on their opinion, it would be better if they can have public toilet facility near their terminals as well since currently they have to use the toilet in main train station that is difficult to reach. 25% of respondents also answered station plaza/ park as good addition. The rest 12% answered that they want retails or vendors that sell other things than food as well.

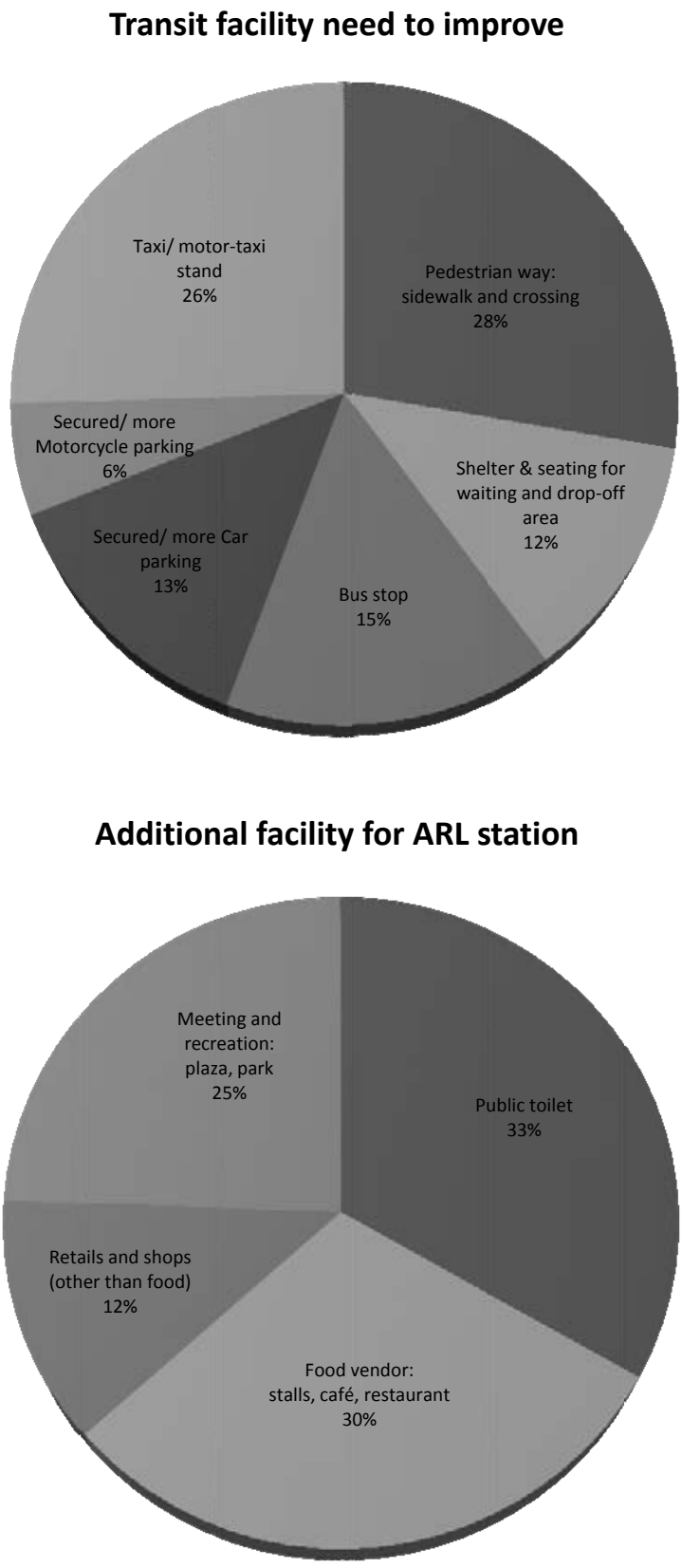



**Figure 5.18 Result of third section of questionnaire for paratransit drivers at *Lat Krabang***

## 7. SUMMARY OF USER SURVEY

This chapter has discussed the improvement and new facilities required by station users. Compiling the answers from all respondents to fulfill the main survey objectives, the survey result summary can be seen on Figure 5.19 – 5.21.

At *Hua Mak* ARL station, since most of respondents that can be found are train passengers, 26% of respondents answer that shelter and seating are the most important improvement for drop-off/ waiting area. 22% of respondents and all three user types also see the car parking area is currently inadequate. 21% of respondents also need improvement in pedestrian sidewalk and making of crossing bridge on *Thanon Srinagarindra* for crossing safety. Most of respondents (38%) and all three user types require public toilet as the most important additional facility to the station. Food vendors, such as café, restaurant, shop, and food stalls; are seen as essential facility by 33% of total respondents. The rest of respondents want retail facility other than food (16%), park/ plaza (11%), and community building (2%).

At *Ban Tap Chang* ARL station, 30% of respondents require improvement for crossing bridge and make it to accommodate motorcycle as well. Many respondents also seek out the improvement of waiting/ drop-off place (22%) and public transport stop (20%). The demand of improved paratransit stand comes from 15% of respondents, especially motorcycle-taxi drivers. Only 9% respondents ask for better car parking and 4% for better motorcycle parking since driving own vehicle is the least option for getting to the station. As in *Hua Mak* station, most of respondents (35%) and all three user types agree that public toilet is the most important addition. The rest of respondents want food vendors (26%), retails other than food (21%), and station plaza/ park (18%).

At *Lat Krabang* ARL station, the total respondents have more various answers. 29% of respondents require safer pedestrian crossing from the station to various transit stops across the junction. Other respondents seek out for shelter and seating for drop-off/ waiting area (19%) and bus stop (14%), accessible paratransit stand (14%), more space for car parking (12%), and motorcycle parking (12%). As in previous stations, public toilet is the most important additional facility for most respondents (33%) from all user types. They also chose food vendors (30%) and station plaza/ park (24%) as significant additional facilities. The rest 13% would also like to have retails other than food vendors.

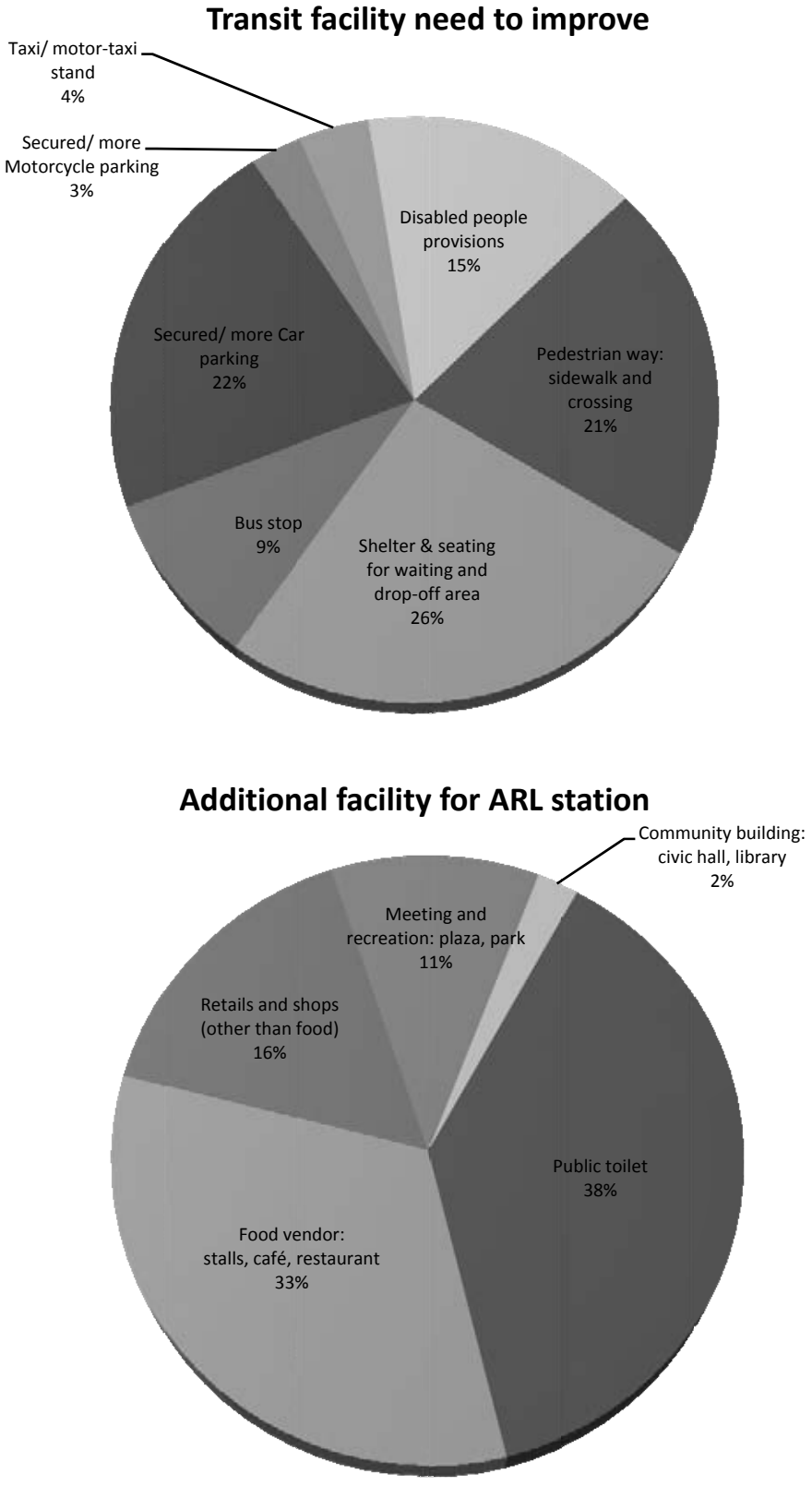
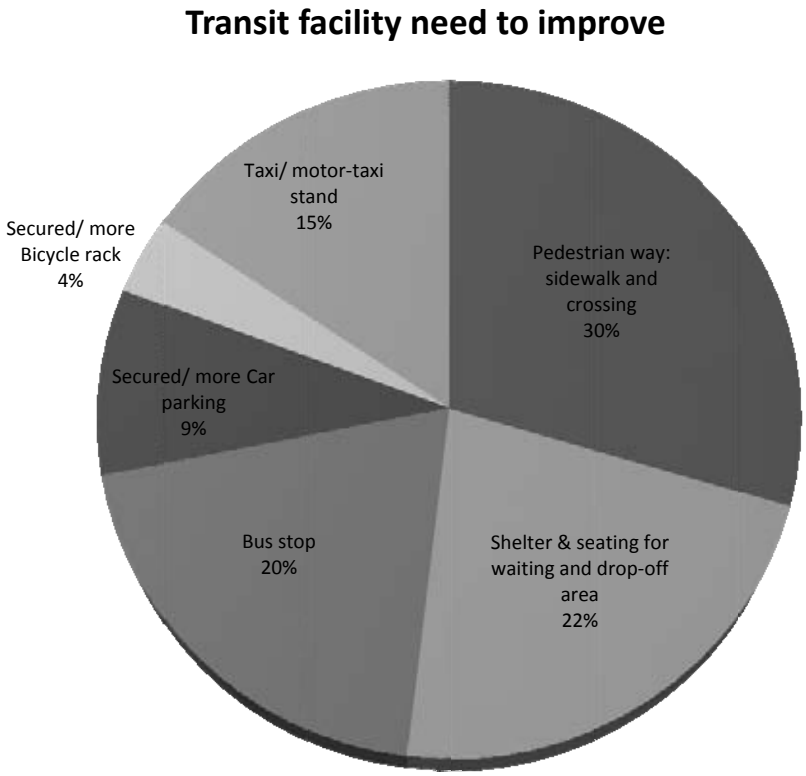



**Figure 5.19 Result summary of user survey for *Hua Mak***



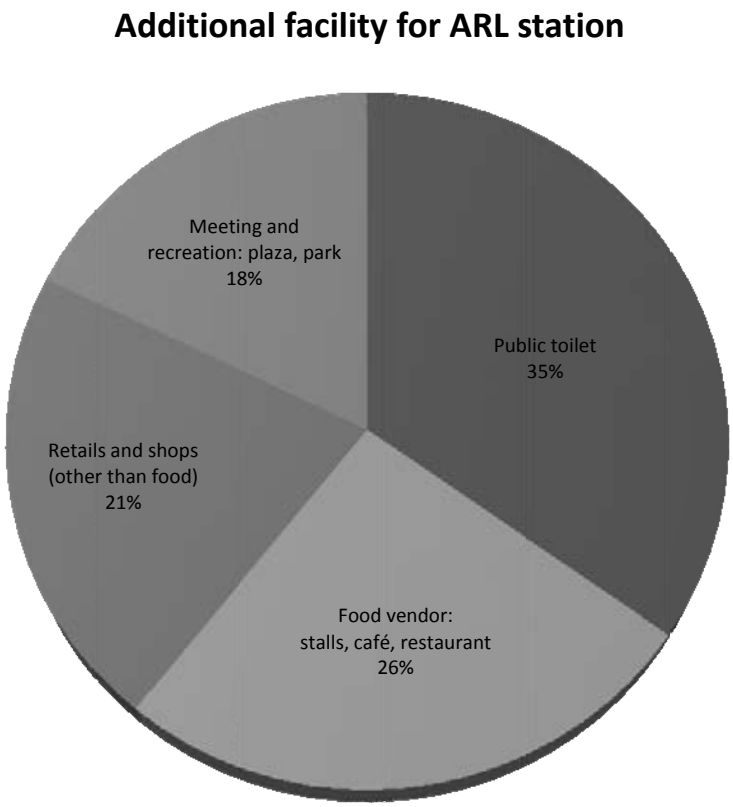




**Figure 5.20 Result summary of user survey for *Ban Tap Chang***

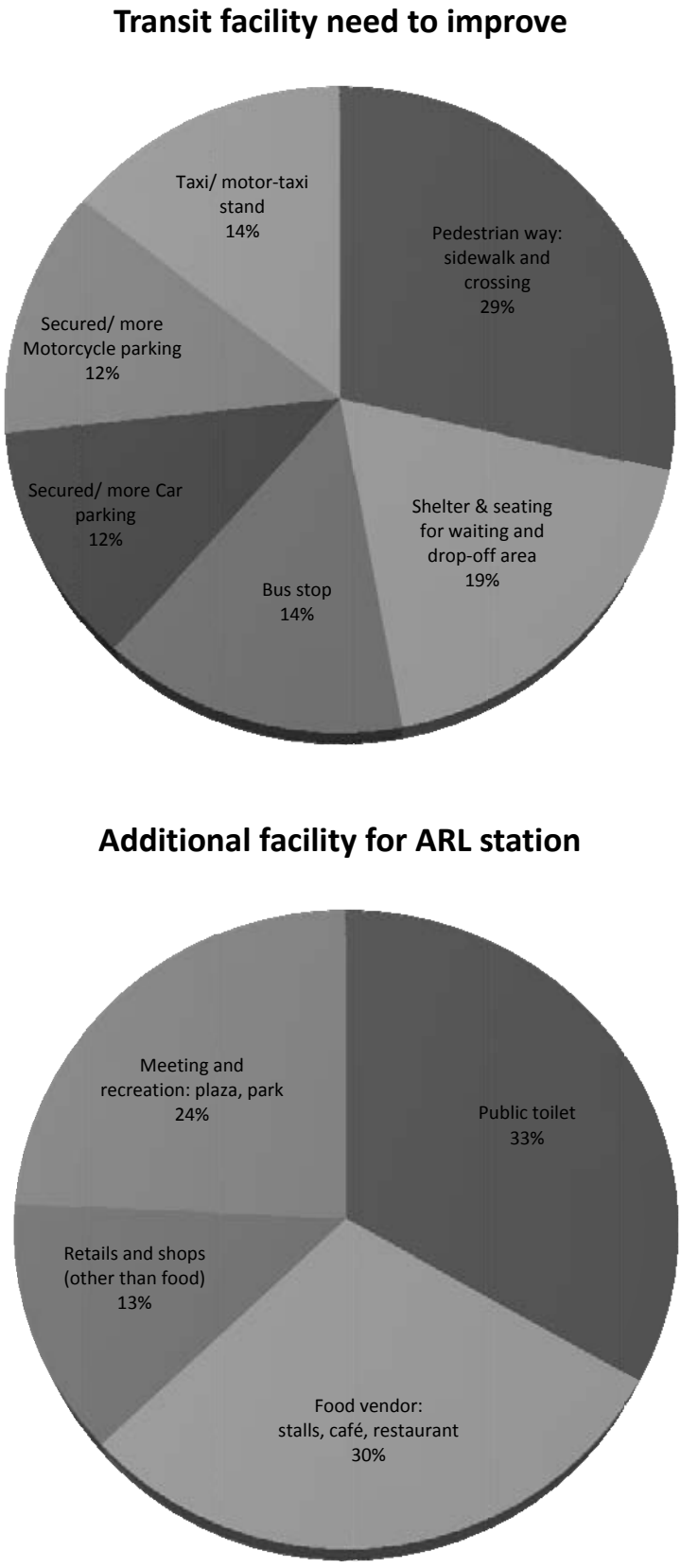



**Figure 5.21 Result summary of user survey for *Lat Krabang***

# CHAPTER VI
# DESIGN IDEA

## 1. RESEARCH CONCLUSION

Metro train requires interchange with other public transportation system and integration with other transportation modes such as cars and walking in its arrival zone. Nevertheless, from the field observation and interview to station users, the initial planning of ARL station that far away from main road creates many problems for the station users doing transit activities in station's arrival zone. Difficult to reach by public transportation and private car, no connecting facility, lack of parking space, unsecured parking, unsecured access road, and dangerous crossing are some problems reported by station users during the field survey in 3 suburban ARL stations.

In station's arrival zone, people will walk during the transit interchange from one transportation mode to other transportation modes. Thus, all station users are pedestrian. Based on literature analysis, as mainly pedestrian area, the station's arrival zone should have the criteria of secured from criminality, pedestrian safely from accident, easy wayfinding, encourage disabled users activity, and engaging optional and social activities for all users besides walking and main transit interchange activities to invoke natural surveillance.

Due to the absence of connecting facility to the station, there is not much optional and social activities can be done by the station users. According to field observation in 3 suburban ARL stations, there are 3 types of station users, i.e. train passengers, private vehicle drivers, and paratransit (taxi and motorcycle-taxi) drivers. During the interview and survey, all station users wanted new additional facilities such as public toilet, retails that sell food and other things, and park/ plaza. In addition, people also wanted improvement for existing facilities such as safer pedestrian crossing, more capacity and secured parking area, and sheltered waiting/ drop-off area.

## 2. SPATIAL PROGRAMMING

As can be seen on Table 6.1 – 6.3; based on literature review, site analysis, and user survey result; the following facilities should be designed for the site adjacent to ARL station, connecting it to the main road:

- Pedestrian walk: sidewalk/ walkway and crossing bridge
- Public transport stops/ terminal
- Paratransit stands for taxi and motorcycle-taxi
- Drop-off and waiting area
- Parking for: cars, motorcycle, bicycle, and disabled people
- Activities engagement: retails, street vendors, toilet, and station plaza/ park

According to literature review and site condition of ARL station, the distance hierarchy of transit facilities from the main entrance of station to the main street is as the following:

- Parking for bicycle and motorcycle
- Drop-off and waiting area, paratransit stands for taxi and motorcycle-taxi
- Parking for cars
- Public transport stops

From the user survey result, it is clear that public toilet is the most demanded new facility by all users. Public toilet is essential part of the basic infrastructure of a successful public space (Ja'afar, et al., 2012: 649). However, since the toilet has potential to be isolated facility, it should be positioned in commonly used/ passed by or access controlled area (Network Rails, 2011: 35). To ensure the maintenance and access control to public toilet, the best option is to emerge it within big retail facility.

Current parking bays for disabled people on all ARL stations are 2 bays only. However, since the number of parking increased, parking for disabled people will follow ADA standards. More specific requirements for each spatial program are built based on field measurements during site observations to meet current condition and nearby future requirements.

**Table 6.1 Spatial program for *Hua Mak* ARL station's arrival zone**

| FACILITY | | *HUA MAK* | |
|---|---|---|---|
| | | EXISTING PROVIDED | DESIGN/ REQUIREMENTS |
| **Pedestrian walk** | | | |
| **Pedestrian walk** | Sidewalk/ walkway | Width: 1 m, 15 m (drop-off area) | Width: 10 – 15 m<br>Open to vehicle road<br>Street lighting |
| | Cross bridge/ sky walk | - | Pedestrian:<br>Width: 2 m |
| **Public transport** | | | |
| Bus/ song-taew | Stops | - | - |
| | Terminus | - | - |
| **Paratransit stands** | | | |
| **Taxi** | Stands | Capacity: approx. 8 cars, parallel parking | Capacity:<br>Parallel queuing: 7 – 8 cars<br>Shelter, seating/ benches/ table |
| | Terminus | - | - |
| **Motorcycle-taxi** | Stands | - | Capacity:<br>• West: 15 – 20 motorcycles<br>• East: 8 – 10 motorcycles<br>Shelter, seating/ benches/ table |
| **Kiss-and-ride: drop-off/ waiting** | | | |
| **Drop-off/ waiting area** | Drop-off | Capacity: 2 cars queuing<br>Turn around: outer radius: 6 – 7 m | Capacity:<br>• 2 – 3 cars queuing<br>Turnaround: outer r: 12 m<br>Shelter, seating |
| **Park-and-ride** | | | |
| **Car** | Parking bays | Capacity: 230 cars<br>Overload: 270 cars | Capacity:<br>• Parking building: 510 cars<br>• Existing: 155 cars<br>Secured access/ gate |
| **Motorcycle & bicycle** | Parking bays | Capacity: 16 bicycles<br>Overload: 50 motorcycles | Capacity:<br>101 motorcycles, 27 bicycles<br>Sheltered, Secured access<br>Closest to main entrance |
| **Disabled people provisions** | Parking for disabled | Capacity: 2 cars<br>Curb cuts | Capacity (ADA standards):<br>• Parking building: 12 cars<br>Curb cuts |
| | Elevator access | Main entrance: 1 | Main entrance: 1<br>Plaza: 1 |
| **Activities engagement** | | | |
| **Optional Activities** | Big retail: supermarket, food court | - | • 600 m2 sales area<br>• 200 m2 food court |
| | Public toilet<br>(inside big retail) | - | WC numbers:<br>• 5 F, 5 M, 1 D |
| | Small retail/ shops | - | 9 shops @ 100 m2<br>Connected to parking building |
| | Street vendors | - | 17 stalls<br>Open to park/ plaza & parking |
| **Social Activities** | Station plaza/ park | - | Landmark, water feature, vegetation<br>Benches |
| **Site area** | | | 20,600 m2 |

**Table 6.2 Spatial program for *Ban Tap Chang* ARL station's arrival zone**

| FACILITY | | *BAN TAP CHANG* | |
|---|---|---|---|
| | | EXISTING PROVIDED | DESIGN/ REQUIREMENTS |
| **Pedestrian walk** | | | |
| **Pedestrian walk** | Sidewalk/ walkway | - | Width: 5 m<br>Open to vehicle road<br>Street lighting, Sheltered |
| | Cross bridge/ sky walk | Pedestrian:<br>Width: 1.5 m | Pedestrian:<br>Width: 2 m, ramps 1:12<br>Motorcycle:<br>Width: 3 m, ramps 1:12 |
| **Public transport** | | | |
| Bus/ song-taew | Stops | - | Capacity:<br>• North: 4 buses/ 7 cars<br>• South: 2 buses queuing<br>Shelter, seating |
| | Terminus | - | - |
| **Paratransit stands** | | | |
| **Taxi** | Stands | - | Capacity:<br>• Parallel queuing: 3 – 4 cars<br>Shelter, seating/ benches/ table |
| | Terminus | - | - |
| **Motorcycle-taxi** | Stands | - | Capacity:<br>• North: 10 – 15 motorcycles<br>• South: 10 – 15 motorcycles<br>Shelter, seating/ benches/ table |
| **Kiss-and-ride: drop-off/ waiting** | | | |
| **Drop-off/ waiting area** | Drop-off | Capacity: 2 cars queuing<br>Turn around: outer radius: 6 – 7 m | Capacity:<br>• 2 – 3 cars queuing<br>Turnaround: outer r: 12 m<br>Shelter, seating |
| **Park-and-ride** | | | |
| **Car** | Parking bays | Capacity: 68 cars<br>Overload: 80 cars | Capacity:<br>• North: 83 cars<br>• South: 46 cars<br>• Existing: 40 cars<br>Secured access/ gate |
| **Motorcycle & bicycle** | Parking bays | Capacity: 16 bicycles<br>Overload: 60 motorcycles (south), 20 motorcycles (north) | Capacity:<br>• North: 60 motorcycles, 36 bicycles<br>• South 1: 28 motorcycles<br>• South 2: 79 motorcycles, 36 bicycles<br>Sheltered, Secured access<br>Closest to main entrance |
| **Disabled people provisions** | Parking for disabled | Capacity: 2 cars<br>Curb cuts | Capacity (ADA standards):<br>• North: 4 cars (supermarket)<br>• South 1: 2 cars<br>• South 2: 2 cars (supermarket)<br>Curb cuts, ramps |
| | Elevator access | Main entrance: 1 | Main entrance: 1<br>Bridge: 2 |
| **Activities engagement** | | | |
| **Optional Activities** | Big retail: supermarket, food court | - | • North: 300 m2 sales area<br>• South: 200 m2 sales area |
| | Public toilet<br>(inside big retail) | - | WC numbers:<br>• North: 4 F, 3 M, 1 D<br>• South: 4 F, 3 M, 1 D |
| | Small retail/ shops | - | - |
| | Street vendors | - | - |
| **Social Activities** | Station plaza/ park | - | Landmark, vegetation<br>Benches |
| **Site area** | | | 13,800 m2 |

**Table 6.3 Spatial program for *Lat Krabang* ARL station's arrival zone**

| FACILITY | | *LAT KRABANG* | |
|---|---|---|---|
| | | **EXISTING PROVIDED** | **DESIGN/ REQUIREMENTS** |
| **Pedestrian walk** | | | |
| **Pedestrian walk** | Sidewalk/ walkway | Width: 1 m, 6 m (drop-off area) | Width: 5 m<br>Open to vehicle road & street vendors<br>Street lighting |
| | Cross bridge/ sky walk | - | Pedestrian:<br>Width: 2 – 3 m |
| **Public transport** | | | |
| Bus/ song-taew | Stops | Capacity: 1 bus queuing<br>Shelter, seating | Capacity: 3 buses queuing/ direction<br>Shelter, seating |
| | Terminus | Capacity: 10 song-taew | Capacity: 10 song-taew |
| **Paratransit stands** | | | |
| **Taxi** | Stands | - | - |
| | Terminus | Capacity: approx. 20 cars<br>Tent | Capacity:<br>• Parking bays: 11 cars<br>• Parallel queuing: 6 cars<br>Shelter, seating/ benches/ table |
| **Motorcycle-taxi** | Stands | - | Capacity:<br>• 8 – 10 motorcycles<br>Shelter, seating/ benches/ table |
| **Kiss-and-ride: drop-off/ waiting** | | | |
| **Drop-off/ waiting area** | Drop-off | Capacity: 4 cars queuing | Capacity:<br>• 7 – 8 cars queuing/ side<br>Turn around: outer radius: 9 m<br>Shelter, seating |
| **Park-and-ride** | | | |
| **Car** | Parking bays | Capacity: 100 cars<br>Overload: 300 cars | Capacity:<br>• North 1: 345 cars<br>• North 2: 75 cars<br>• South: 109 cars<br>• East: 87 cars<br>Secured access/ gate |
| **Motorcycle & bicycle** | Parking bays | Capacity: 8 bicycles<br>Overload: 350 motorcycles | Capacity:<br>• 310 motorcycles, 36 bicycles<br>Sheltered, Secured access<br>Closest to main entrance |
| **Disabled people provisions** | Parking for disabled | Capacity: 2 cars<br>Curb cuts | Capacity (ADA standards):<br>• North 1: 9 cars<br>• East: 8 cars<br>Curb cuts, elevator |
| | Elevator access | Main entrance: 1 | Main entrance: 2<br>North parking: 1; East parking: 1 |
| **Activities engagement** | | | |
| **Optional Activities** | Big retail: convenient store | - | • 110 m2 sales area |
| | Public toilet<br>(inside big retail) | - | WC numbers:<br>• 3 F, 2 M |
| | Small retail/ shops | - | 2 kiosk on 2nd floor |
| | Street vendors/ kiosk | - | • 6 stalls on ground<br>• 9 kiosk on skywalk<br>Open to access road/ sidewalk/ walkway |
| **Social Activities** | Station plaza/ park | - | Landmark, water feature, vegetation<br>Benches |
| **Site area** | | | 24,500 m2 |

## 3. SPATIAL QUALITY

The integrated facility shall make the transit interchange and walking journey for pedestrian from the main road to the station and vice versa safe, secured, accessible for disabled people, and makes the neighborhood more vibrant by engaging other activities in it.

Based on literature review, the proposed programs are arranged to meet several spatial quality idea, i.e.: security, safety, easy wayfinding, accessible for disabled users, and optional/ social activities engagement. Some important space ideas are: pedestrian and vehicular zones separation, pedestrian crossing, motorcycles and bicycles parking, most people congested area, station plaza, and car parking facilities. The spatial arrangement can be seen on Figure 6.1.

### 3.1. PEDESTRIAN AND VEHICULAR ZONES SEPARATION

Pedestrian walking route should be separated from vehicular road with minimum intersection between them to make safety for pedestrian walking. The separation between 2 lines can be done through making different zoning for pedestrian and vehicle. The other way to make this separation is using skywalk network on limited land plot.

To invoke the surveillance, pedestrian zone should be “the front face” of area, adjacent to access road, and the vehicle zone for parking is behind the pedestrian zone, buffered by user activities. Therefore, it is supervised by pedestrian and vehicular movement along them and the user of activity space such as street vendors.

Therefore, pedestrian zone starts from public transport stops and crossing bridge and includes facility programs of station plaza, drop-off/ waiting area, taxi stand, motorcycle-taxi stand, big commercial and public toilet, small retails, kiosk and street vendors, and the station main entrance. Vehicle zone includes parking for car, motorcycle, and bicycle.

As specifically located in tropical country, the activity space and most of pedestrian zone should be sheltered to protect from the sun’s heat. This sun protection can be made out of physical building/ shelter for commercial activity or tress for the plaza/ park. However, there should be at least a sheltered corridor along the pedestrian walking route from the station to the street and parking area to protect people from the sun and the rain. This corridor should be sufficient for two people walking (minimum 1.5 – 2 m width).

### 3.2. PEDESTRIAN CROSSING

Since ARL station is not located in the middle of road median such as BTS station, pedestrian crossing (crossing bridge or skywalk) is a most to make safety for pedestrian since train passengers come from both direction of road lanes. Pedestrian crossings should connect the area across the road or other transit facilities with station plaza or ARL station directly. As a part of pedestrian zone, the pedestrian crossing also should be sheltered to protect people from tropical sun heat.

### 3.3. MOTORCYCLES AND BICYCLES PARKING

The literature review mentions that bicycle parking facility should be located next to the main entrance for ensure the security of bicycle parking area. As in developing countries such as Thailand, motorcycle is one of the main transit issues as can be seen through the large number of motorcycles in Bangkok. The field observation shows that people tend to park their motorcycle close to the main station entrance/ stair to make it easy for them getting to the station. As there is no motorcycle parking area provided, people just park their motorcycle on pedestrian sidewalk in front of the station entrance, impeding the pedestrian walking route.

Based on that theory and field conditions, the closest transit facility to the main entrance should be bicycle and motorcycle parking. To minimize the intrusion to the pedestrian zone, it should be located behind the main staircase/ entrance and has access from vehicular road.

### 3.4. MOST PEOPLE CONGESTED AREA

Other transit facilities next to the main station entrance are *drop-off waiting area, taxi stand,* and *motorcycle-taxi stand*. These 3 transit facilities are positioned next each other in front of the main station entrance, forming the “most people congested area”. As mentioned in earlier literature, this area should be located in the maximum distance of 180 m from the station’s entrance and sheltered as well as equipped with seating facilities.

Big retail such as supermarket or convenient store should take place in this area as well. Therefore, people can just buy something while they are waiting or walk passing by this most congested area.

Public toilet is the most wanted facility by all station users. However, in the real field conditions, ARL authority does not provide the public toilet within the stations. Looking from the past experience, the public toilet within train station and terminal always has the issue about cleaning and maintenance, as it happened in main *Lat Krabang* train station. The literature review also mention that the public toilet, if provided, should be located in the area the most passed by area to ensure its security and avoid it to be used as a crime scene. Therefore, to solve these issues and fulfilling the needs of station users, public toilet facility should be emerged within the big retail in most people congested area to ensure its cleaning maintenance and access control.

### 3.5. STATION PLAZA/ PARK

As the metro station's position is away from the main street, the presence of station plaza with the landmark next to the main road is important to signify the presence of metro station in the area. As a part of pedestrian zone, the station plaza connects the main road and the "most people congested area". As the passengers walking through it from the road to metro station and vice versa, the station plaza can enrich the walking experience and view for pedestrian, and, in the end, make the safer route for pedestrian walking. In this tropical country case, the station plaza/ park should have big trees planted along the pedestrian route to shelter the pedestrian from the sun heat. It also should directly open to vehicular road and have outdoor lighting to ensure the security in the nighttime when people are passing the park to go back home from the train station.

### 3.6. CAR PARKING FACILITY

Based on the maximum normal walking distance, car parking area could be located away at maximum distance of 400 m from the station entrance. The parking facility could be parking buildings for the high density area or a parking field for lower density area such as in *Ban Tap Chang* case. The parking area can also be separated into several parts or different areas if the site condition does not make possible to build one big parking facility. All parking facilities provided should have pedestrian access/ exit to pedestrian zone such as station plaza, commercial area, or skywalk to make people walk from parking area to the station safely. It also must have security post and gate to ensure the access control of facility.

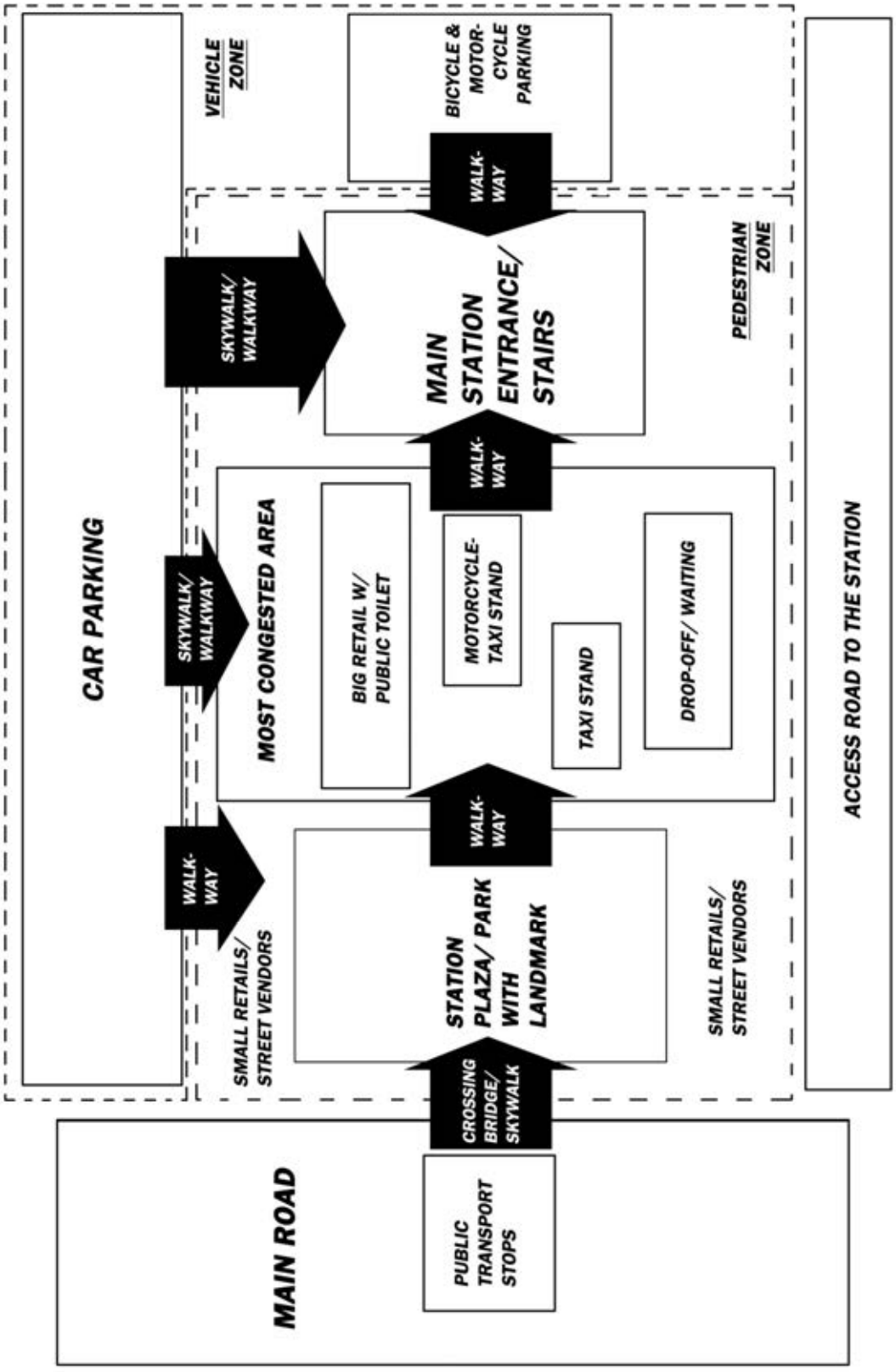



**Figure 6.1 Spatial arrangement for transit facility connecting the main road and ARL station**

# CHAPTER VII
# DESIGN PROPOSAL

## 1. PROJECT SITE AND MODEL

### 1.1. PROPOSED SITE

As can be seen on Figure 7.1 – 6.3, the proposed site for new facility of each ARL station is the empty land adjacent to the station to avoid tearing down any existing building. The proposed site area for each station is as the following:

- *Hua Mak*: ARL station: 3,600 m2; new land plot: 17,000 m2; total: 20,600m2
- *Ban Tap Chang*: ARL station: 2,500 m2; new land plot: 11,300 m2; total: 13,800 m2
- *Lat Krabang*: ARL station: 7,100 m2; new land plot: 17,400 m2; total: 24,500 m2

Currently, the proposed new land plots do not belong to State Railway of Thailand. In *Hua Mak* and *Ban Tap Chang* stations, the lands belong to private party. In *Lat Krabang*, the land around the station belongs to Highway Authority and local government of *Lat Krabang* district. However, as this project is government project for public facility, the State Railway of Thailand can own the land that belong to private property according to Eminent Domain Law and give the compensation to previous owner. As for *Lat Krabang* station, the coordination between State Railway of Thailand, Highway Authority, and *Lat Krabang* district government is needed.

### 1.2. BIM MODELING

Building Information Modeling (BIM) is utilized in the whole design process, from the site modeling and analyses until the design documentation. During the site analysis, BIM is used to measure the area more accurate through site modeling and provide daylight/ shading analysis based on site true north orientation and existing ARL station to determine building orientation and placement. As the design enters the schematic design and design developments, the using of BIM, different design options can be explored deeper in 3 dimensional model and changes can be made quickly since the time for documentation has been greatly reduced by BIM automatic drawing documentation.

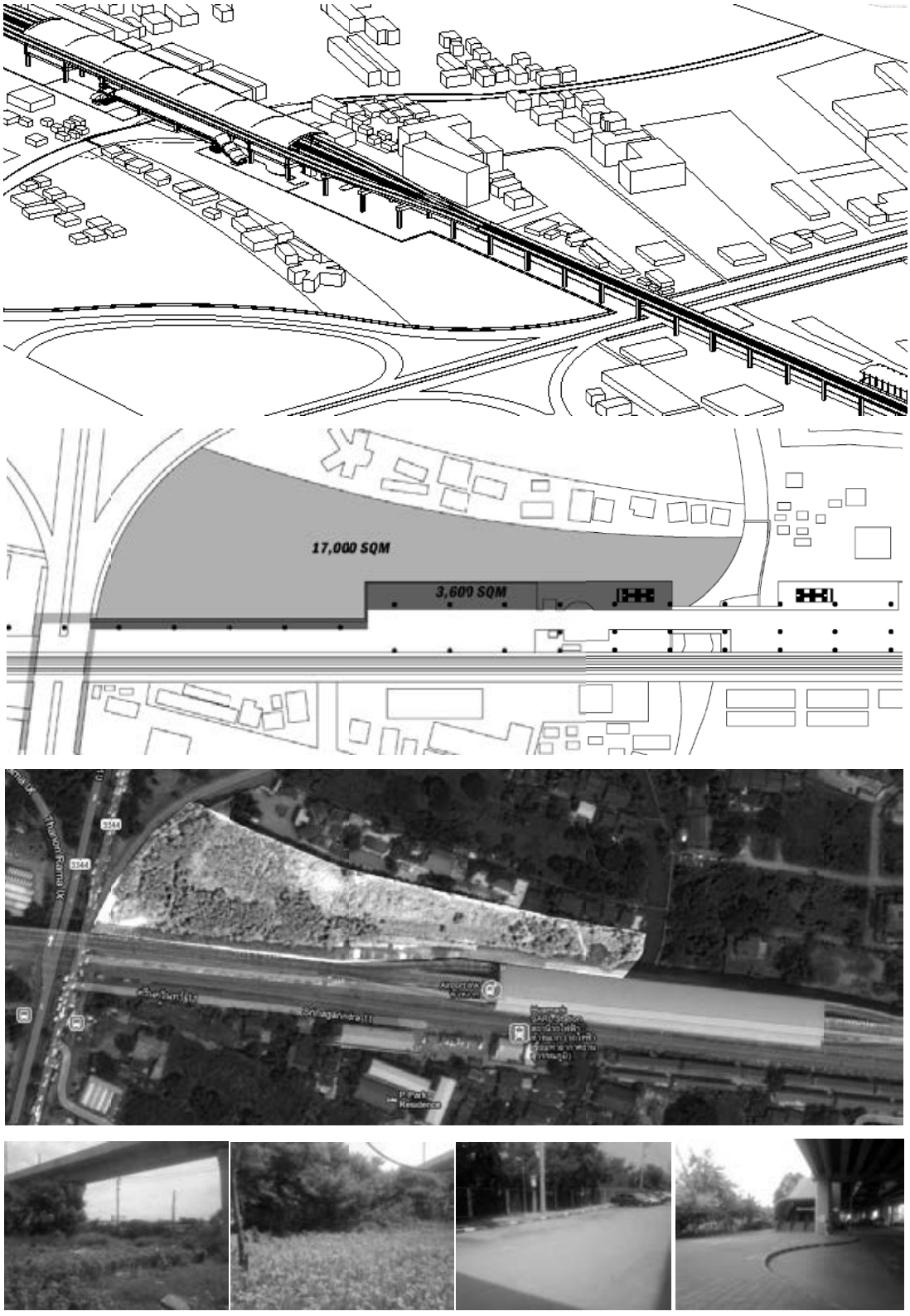



**Figure 7.1 Proposed site for *Hua Mak* ARL station**

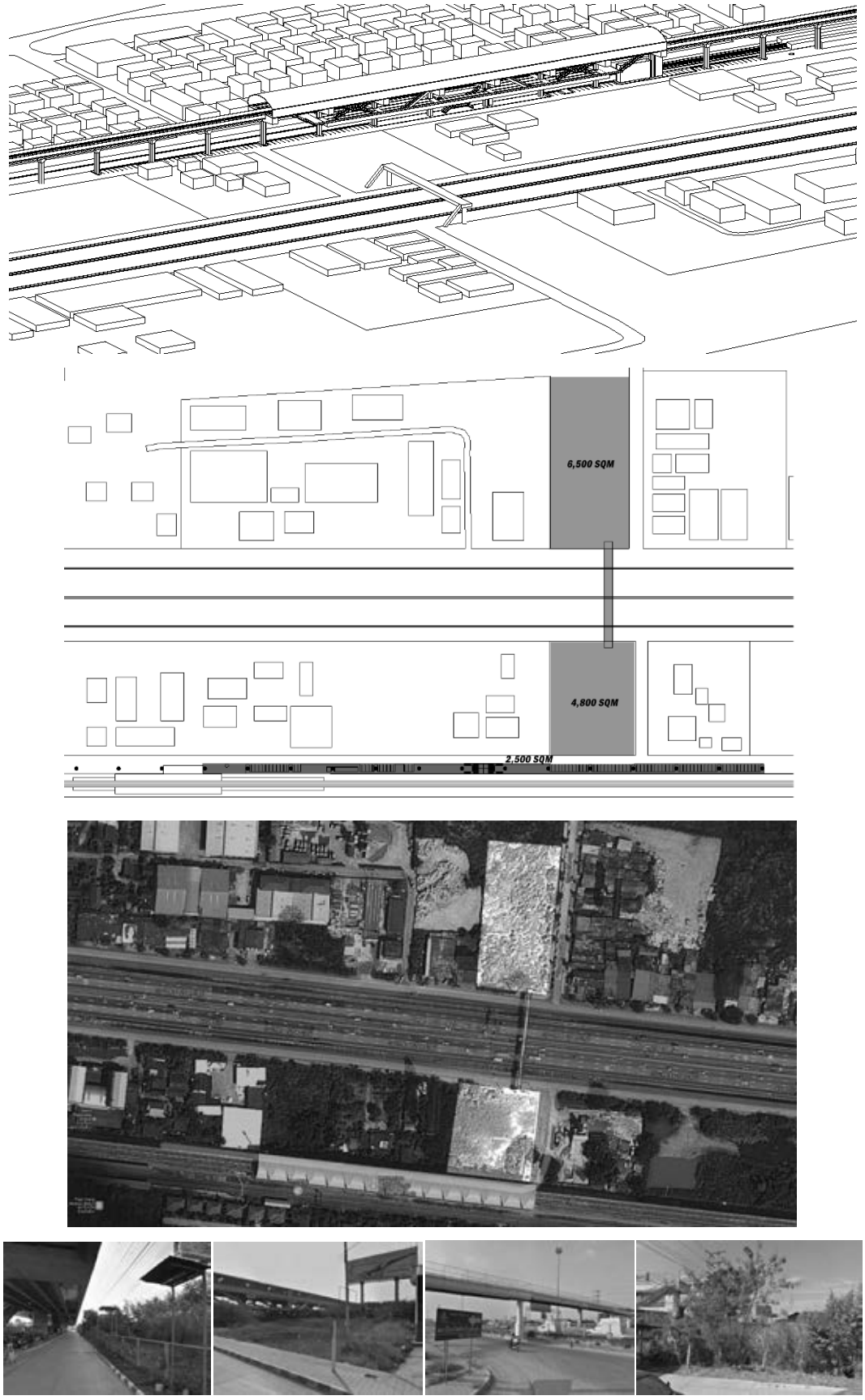



**Figure 7.2 Proposed site for *Ban Tap Chang* ARL station**

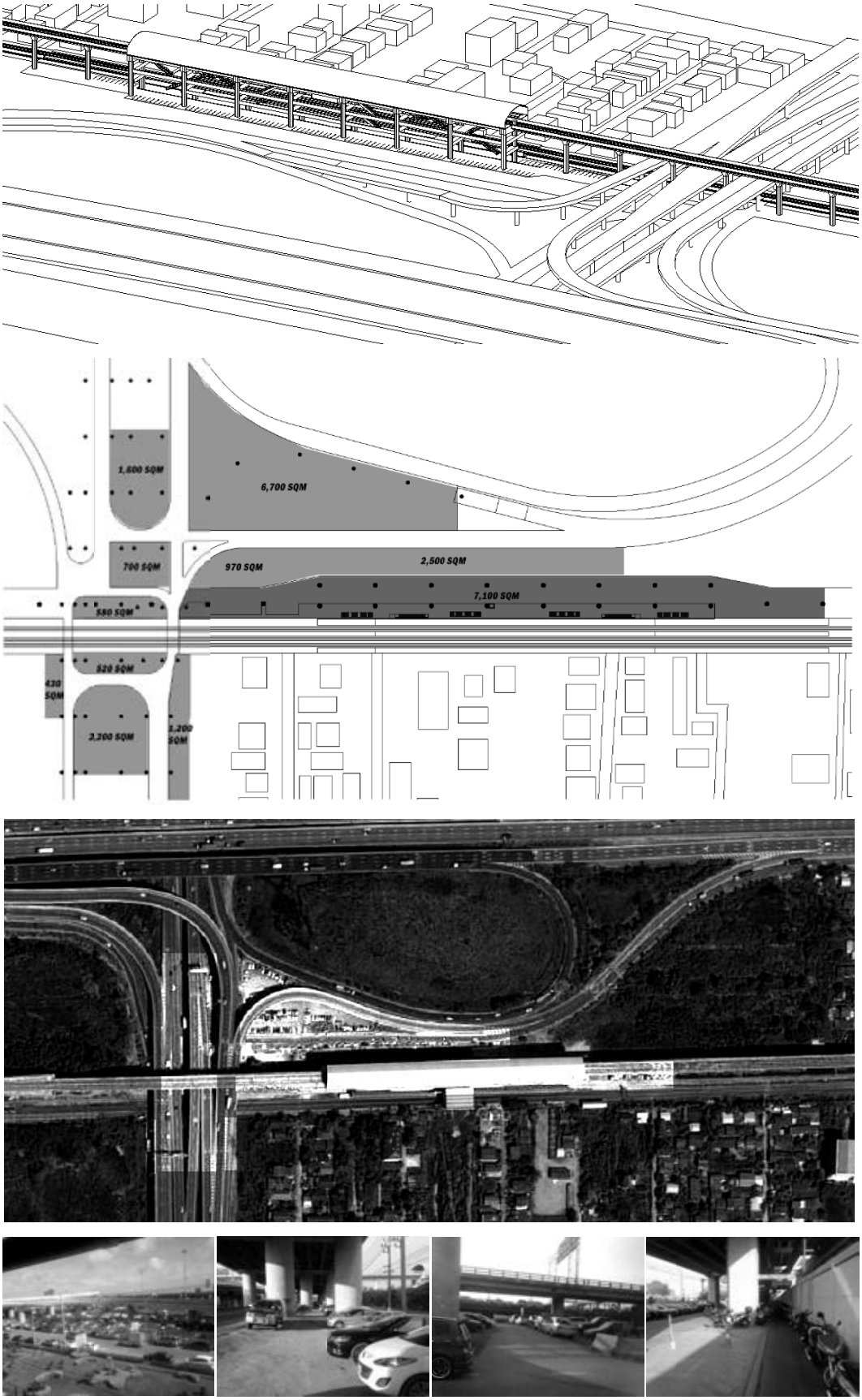



**Figure 7.3 Proposed site for *Lat Krabang* ARL station**

## 2. DESIGN PROPOSAL: *HUA MAK* ARL STATION

### 2.1. SITE OVERVIEW

The site for *Hua Mak* ARL station is an empty land plot adjacent to the station. The main road, *Thanon Srinagarindra*, is a big public road with 3 lanes on each direction and served by public transportation such as bus and *song-taew*. Therefore, one big strip of land, spanning from the station up to the main road, is suitable to make new facility for the arrival zone. However, as can be seen on Figure 7.4, due to the site location in the intersection between *Thanon Srinagarindra* and exit road of the highway, the space program for public transportation stops cannot be accommodated within the proposed site. The public transportation stops will still be located after the railway, exactly same as current bus stop's position. Although it cannot be accommodated within proposed program, the connection, especially crossing, from the main facility on the proposed site to public transport stops is still within the design program.

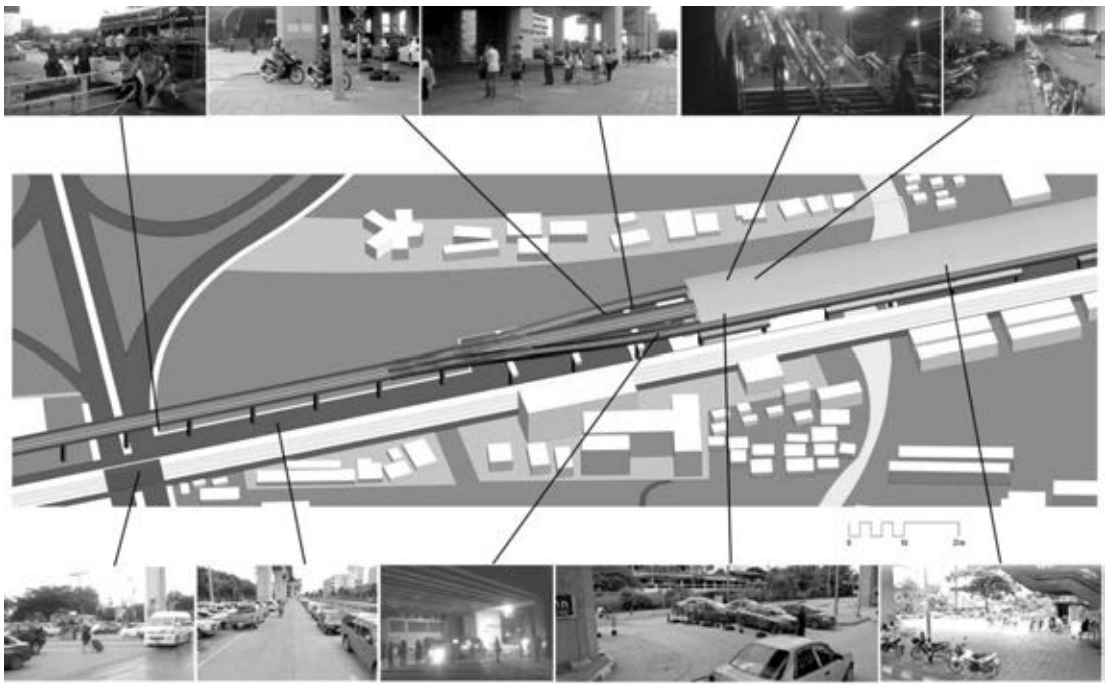


**Figure 7.4 *Hua Mak* site overview**

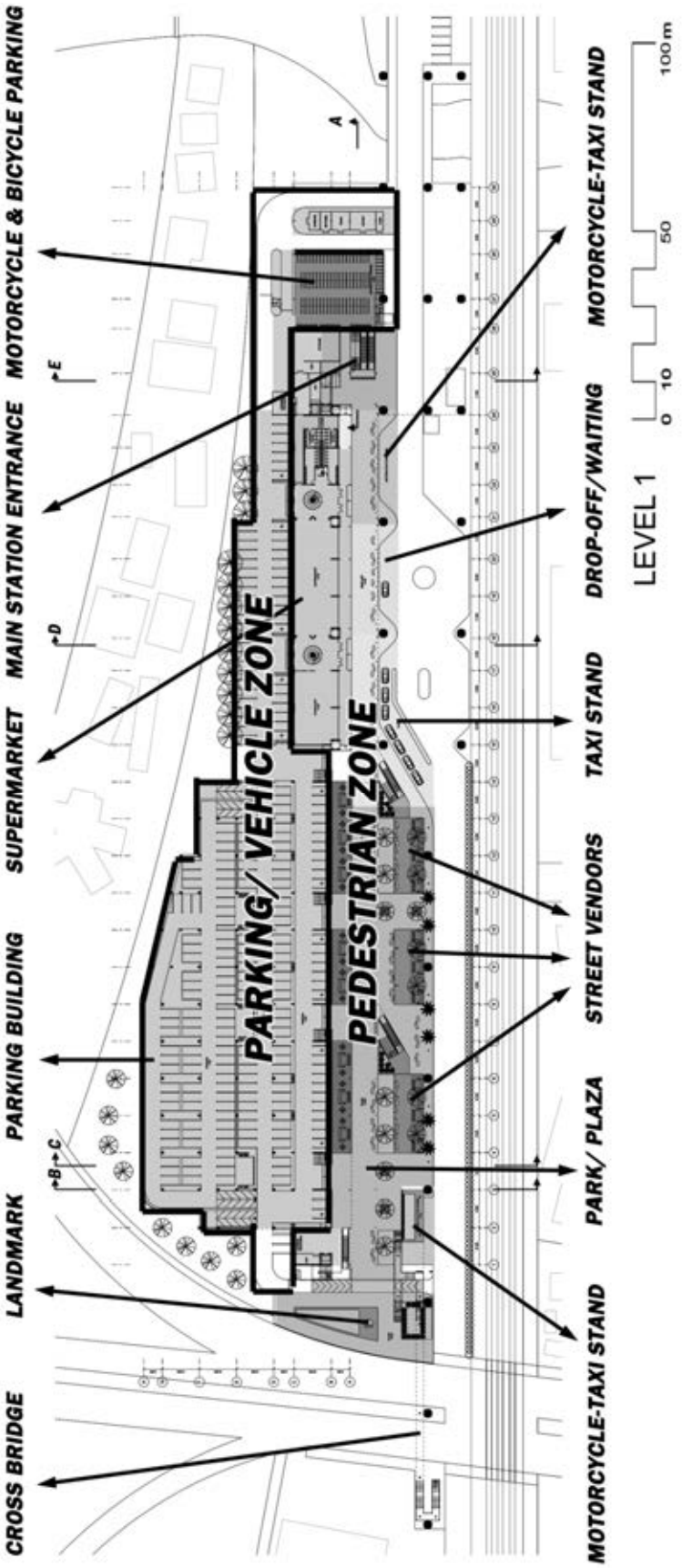



**Figure 7.5 Overall proposed zoning for *Hua Mak* ARL station level 1**

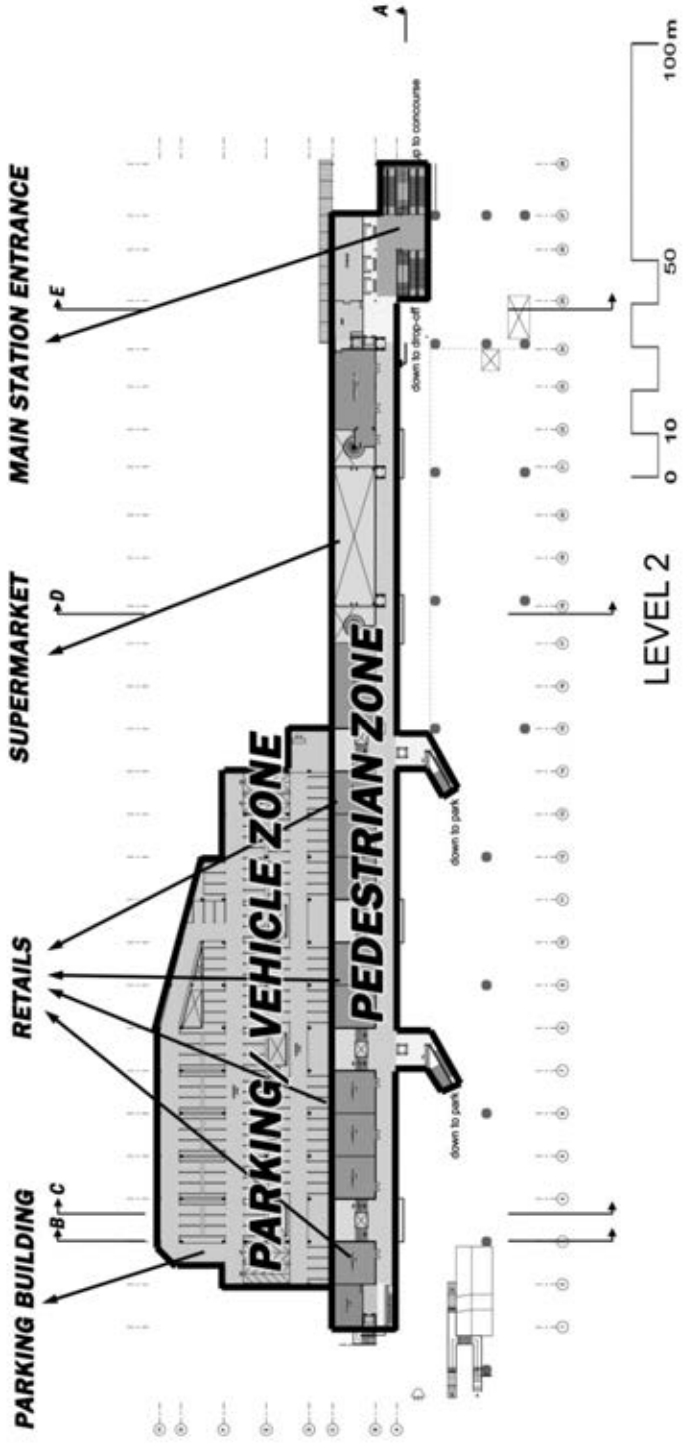



**Figure 7.6 Overall proposed zoning for *Hua Mak* ARL station level 2**

## 2.2. PEDESTRIAN WALK

### 2.2.1. SIDEWALK/ WALKWAY

People need to walk quite distance from the station to the main road, in this *Hua Mak* station is about 300 m, to reach other public transportation stops. There are 2 key-ideas for the design proposal of pedestrian access: “safety and surveillance” and “route and visibility”

#### 2.2.1.1. Safety and Surveillance

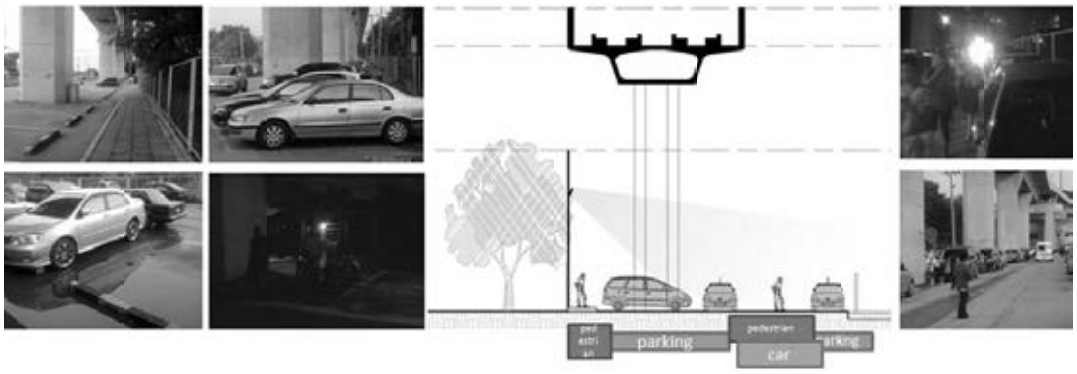



**Figure 7.7 Current road section**

Looking from Figure 7.7, pedestrian sidewalk/ walkway condition is difficult to invoke natural surveillance and not comfortable for walking. Therefore, people do not use pedestrian sidewalk. At the same time, by walking on the vehicle road, it is not safe for pedestrian and impedes the vehicular traffic. Therefore, there is the need to improve the sidewalk/ walkway for making people use it so they can safely walk and feel secured when walking. The improvement to safety and security is based on the following theories:

- According to traditional ideal concepts in town planning, pure pedestrian streets should be free of any kind of non-pedestrian traffic (Monheim, 1984). Pedestrian way, bicycle lane, and vehicle road should be separated and intersections between them should be minimized.
- Other activities; such as: commercial, community center, street vendors, local attractions, etc; should be integrated to arrival zone or along the pedestrian network and parking to ensure the space use and observation (Childs, 1999; EDSA, 2010: 134; Maher and Skinner, 2011: 9).

- Traditional streets are safe because they have pedestrian and vehicular movement along them and, occasionally, police patrols; and supervised by the user of bordering buildings (Marzbali, et al., 2012: 87).

Based on background theories, the proposed section of the road to make better surveillance and safety is as the diagram on Figure 7.8 below.

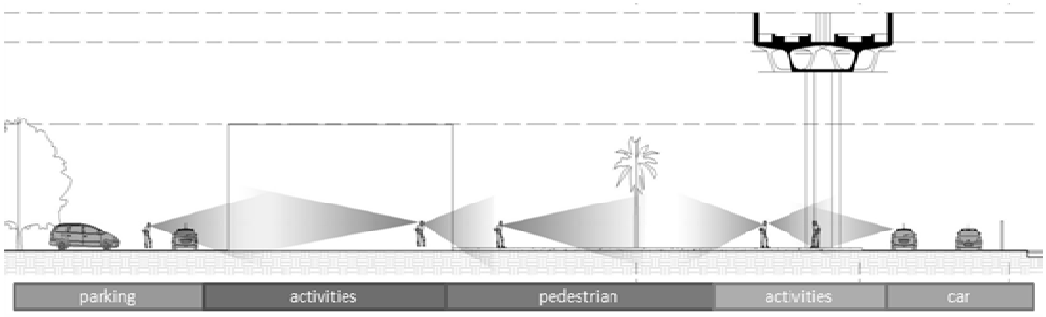



**Figure 7.8 Proposed street section**

### 2.2.1.2. Route and Visibility

Following the aim to make people walk on pedestrian sidewalk/ walkway, the improvement of pedestrian sidewalk/ walkway is expected to make clear view of station entrance in order to help people orient themselves. The improvement of walking route and visibility is based on the following theories:

- Orientation was found easier when the plan configuration is: simple, symmetry, regular, and continue (Hidayetoglu, et al., 2012: 51; Omer and Goldblatt, 2007: 521).
- Landmark and landscaping such as: public art, water feature, etc; should be incorporated (Network Rails, 2011; Regional Tranport District Transit Access Committee, 2009).
- High degree of overlapping visual fields of origin and destination landmark (where people can see landmark from another landmark) helps people to construct spatial knowledge and perform navigation tasks (Omer and Goldblatt, 2007: 527-529).
- As the focal point of entire arrival zone, station entrance (and its associated plaza) should be clearly identified (EDSA, 2010; California High-Speed Rail Authority, 2011) and visible from other landmarks positions.
- Stairs, escalators, and elevators should be located along the direct path and line sight so it is identifiable as a means of access to the other level (Griffin, 2004).

Based on those background theories, the proposed plan of pedestrian route to make better visibility is as the diagram on Figure 7.10 below.

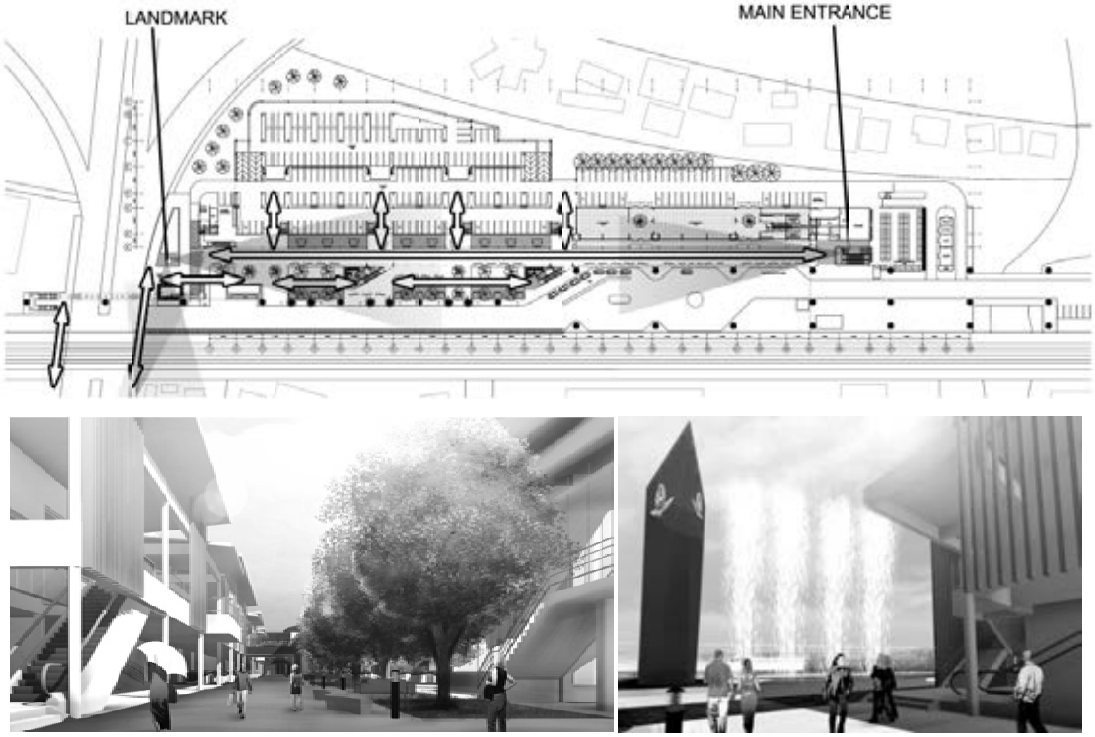



**Figure 7.9 Proposed pedestrian route and visibility (top) and pedestrian way situation and landmark (bottom)**

### 2.2.2. CROSSING

Crossing bridge is needed mainly to make safety for pedestrian crossing *Thanon Srinagarindra*. The proposed crossing bridge is spanning under ARL viaduct, connecting the landmark plaza with the area across the road.

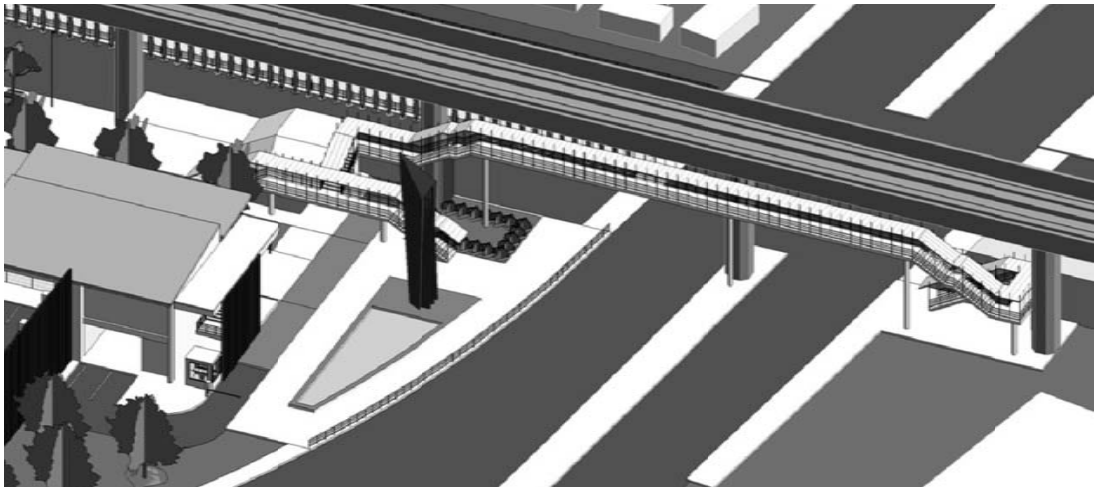


**Figure 7.10 Crossing bridge across *Thanon Srinagarindra* connecting station plaza and sidewalk/ walkway across**

## 2.3. PARATRANSIT STANDS

### 2.3.1. TAXI STAND

Proposed taxi stand is located 60 m from the main stair/ entrance, adjacent to drop-off/ waiting area as can be seen on Figure 7.11. The capacity for taxi stand is 7 – 8 cars queuing, based on number of taxi queuing at a time in this station currently.

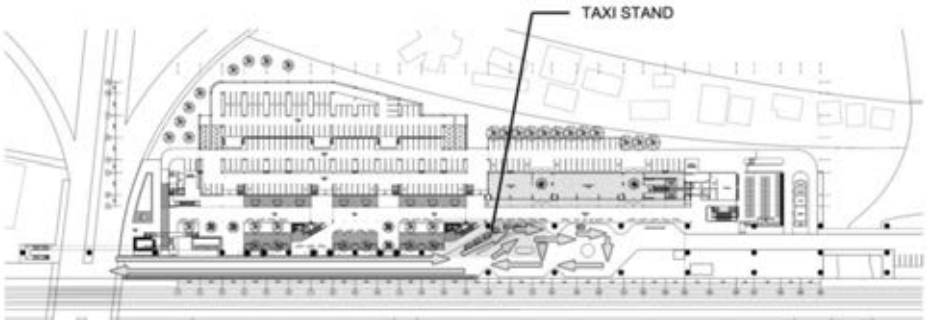



**Figure 7.11 Proposed taxi stand and circulation at *Hua Mak* ARL station**

### 2.3.2. MOTORCYCLE-TAXI STANDS

Motorcycle-taxi is one of the unique transportation modes in Bangkok. Although in many places its existence is unofficial and not counted among transit modes, motorcycle-taxi is still needed by passengers and plays important role in transit interchange due to its fast and practical movement. In this station, people use motorcycle-taxi to reach the station from the main street quickly as the station has a distance of 300 m from the main road. Therefore, there is a need to make transit facility for motorcycle-taxi. There are 2 proposed motorcycle-taxi stands for this station, one near the main street for serving passengers from the main road to the station and nearby residential area, another one near the main station entrance serving passengers from the station to the main street and other destinations.

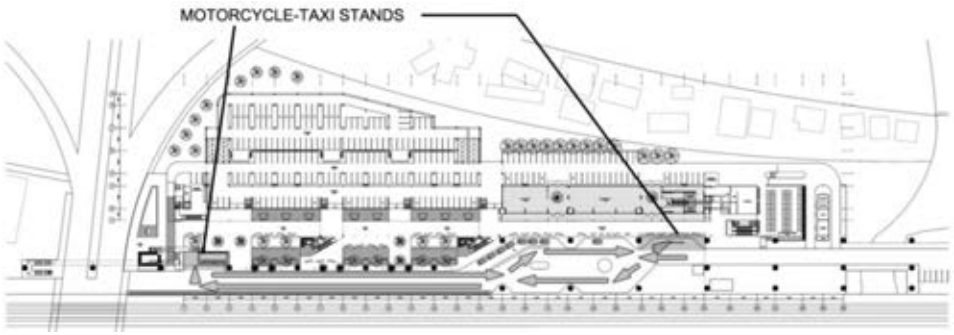



**Figure 7.12 Proposed motorcycle-taxi stands and circulation at *Hua Mak* ARL station**

## 2.4. DROP-OFF/ WAITING AREA

Proposed drop-off/ waiting point is located 30 m from the main staircase/ entrance, adjacent with taxi stand and motorcycle-taxi stand. As the main congested area, drop-off/ waiting area, together with taxi stand and motorcycle-taxi stand, are covered with translucent shelter to cover from rain but still allowing the sun light to shine in as shown on Figure 7.13. The area coverage is also meant to give the mark of big corridor entrance viewed from the plaza. Same as existing precedence, the drop-off area still has the turning point for car circulation. Furthermore, this facility is also connected to big retail facility/ supermarket.

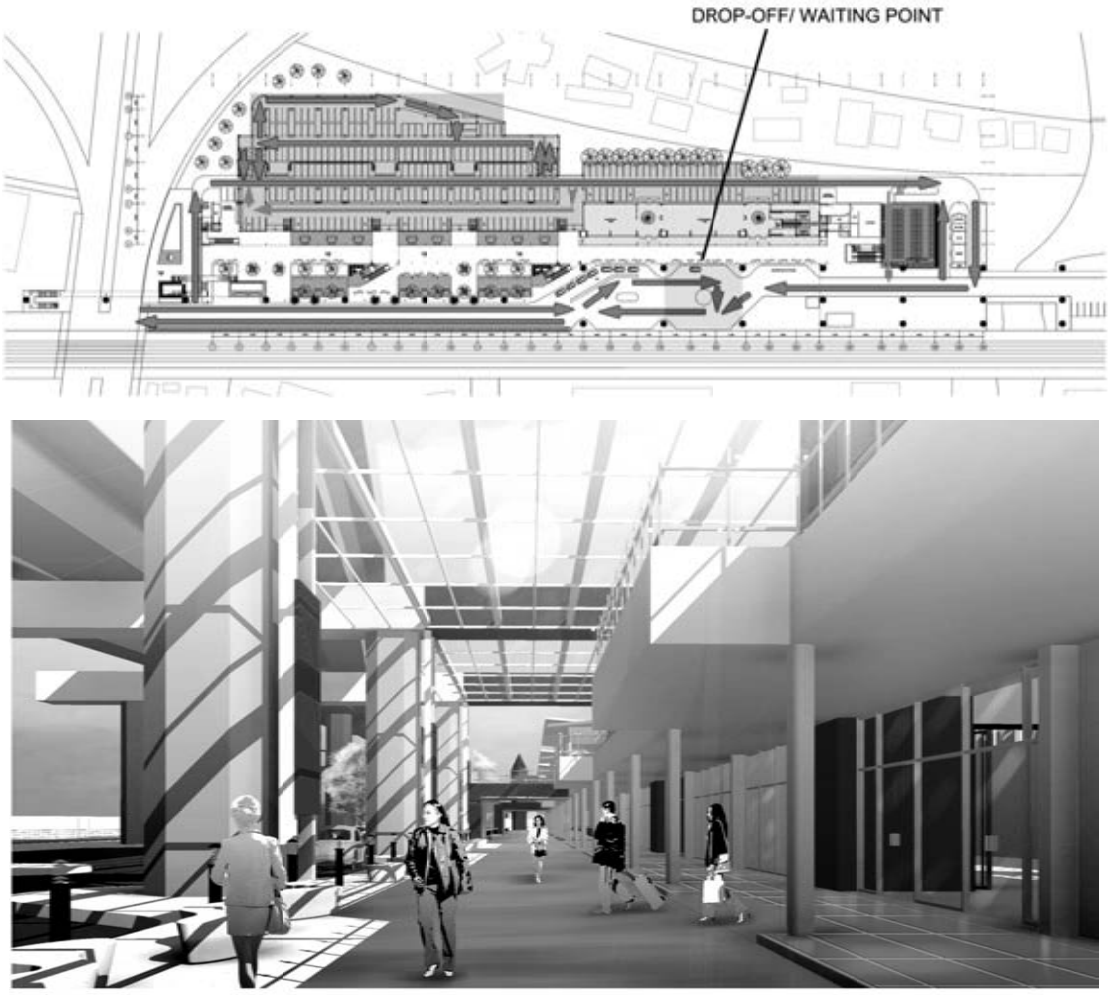



**Figure 7.13 Proposed drop-off/ waiting point and vehicle circulation at *Hua Mak* ARL station (top) and drop-off/ waiting area sequence (bottom)**

## 2.5. PARKING

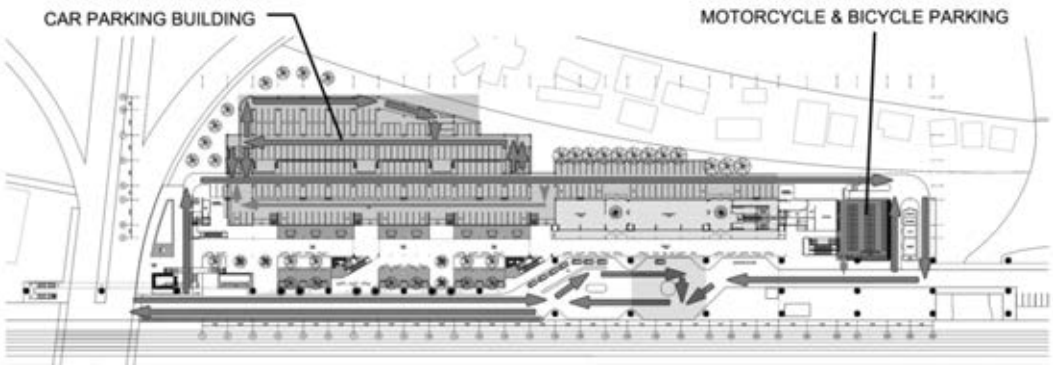



**Figure 7.14 Proposed vehicle circulation and parking facilities at *Hua Mak* ARL station**

### 2.5.1. CAR PARKING

Parking facilities is still needed as the station is located in suburban area. However, in the user priority, park-and-ride facility is in the last priority with the maximum distance of 400 m from station (EDSA, 2010: 94). Therefore, following the new pedestrian way program that will be "the front face" of arrival zone, parking facility rearrangement is needed to fulfill the parking needs. Furthermore, according to the user survey, current parking facility gets complaints from many station users as the capacity is not enough, difficult to parking the cars, and is not secured.

The parking bays will be relocated beyond the activities row to maintain the surveillance from activities area to parking bays, have controlled/ secured access, and make people walk from parking area through pedestrian way to the station. Parking facility location follows the proposed section in pedestrian access. Due to station's parking requirements for 400 – 500 cars in total, there is a need to make multi-stories parking to fit them in limited land plot as can be seen on Figure 7.15 below. Due to the flood that always threats this city, parking building is more preferable than deep underground parking.

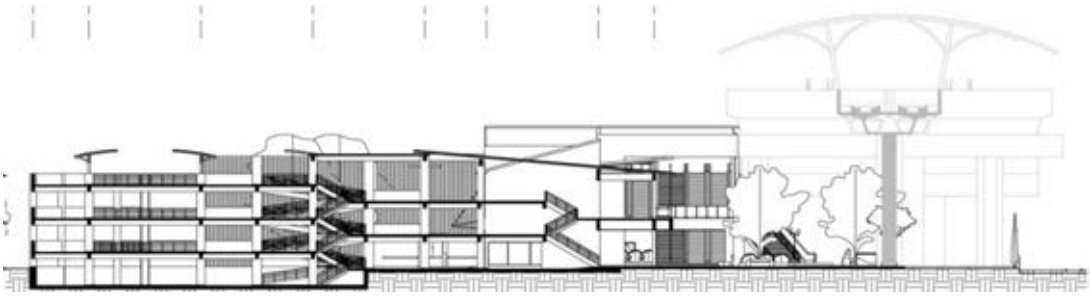


**Figure 7.15 Section of parking building**

### 2.5.2. BICYCLE AND MOTORCYCLE PARKING

Based on literature review, bicycle parking is the highest rank of transit after pedestrian and the facility should be placed next to the main entrance to have quick access by passengers and invoke surveillance. Furthermore, based on field observation, people always park their bicycle and motorcycle in the area closest to main entrance. Therefore, proposed parking for bicycle and motorcycle is located behind the main staircase/ entrance and has access from vehicular way or parking building to make it has closest distance to the entrance but at the same time it does not impede the pedestrian access.

### 2.5.3. DISABLED PEOPLE PROVISIONS

It is important that everybody, including persons with disability, is able to access and use the internal and external facilities (Soltani, et al., 2012: 91). As the overall parking facilities will be rearranged, the parking for disabled will be redesigned as well. To prevent miss-use of curb cuts, disabled parking will not be arranged near motorcycle path and pedestrian way, separated from other parking bays. Instead, it will be located and spread within parking building, together with other car parking bays, but on the first floor only. Following increasing number of parking bays in 510 parking bays in total, the number of parking bays for disabled people is also increased according to Americans with Disabilities Act (ADA) standards, becoming 12 parking bays in total.

There are 2 elevators for disabled people, as can be seen on Figure 7.16 below, one at the main entrance and another one at the end of plaza. Therefore, they can access all facility in pedestrian zone, such as park, commercial, and the station; from parking area, same as other people without impairment.


**Figure 7.16 Position of elevators for disabled people at *Hua Mak* ARL station**

## 2.6. ACTIVITIES ENGAGEMENT

### 2.6.1. COMMERCIAL AREA

As low-density residential area “yellow R3”, commercial building around *Hua Mak* station is limited up 10,000 m2. The program for commercial space in this facility includes big retail/ supermarket, small retails/ shops, and street vendors.

The supermarket is directly connected to most congested area, in this case drop-off/ waiting area – taxi stand – motorcycle-taxi stand. Therefore, people can go to the supermarket to buy food or any goods while waiting. The presence of big retail is also important to accommodate public toilet within it. Public toilet is the most wanted facility by the passengers all station users currently. However, it must be carefully located to ensure the maintenance, access control, and prevent being misused as a crime place.

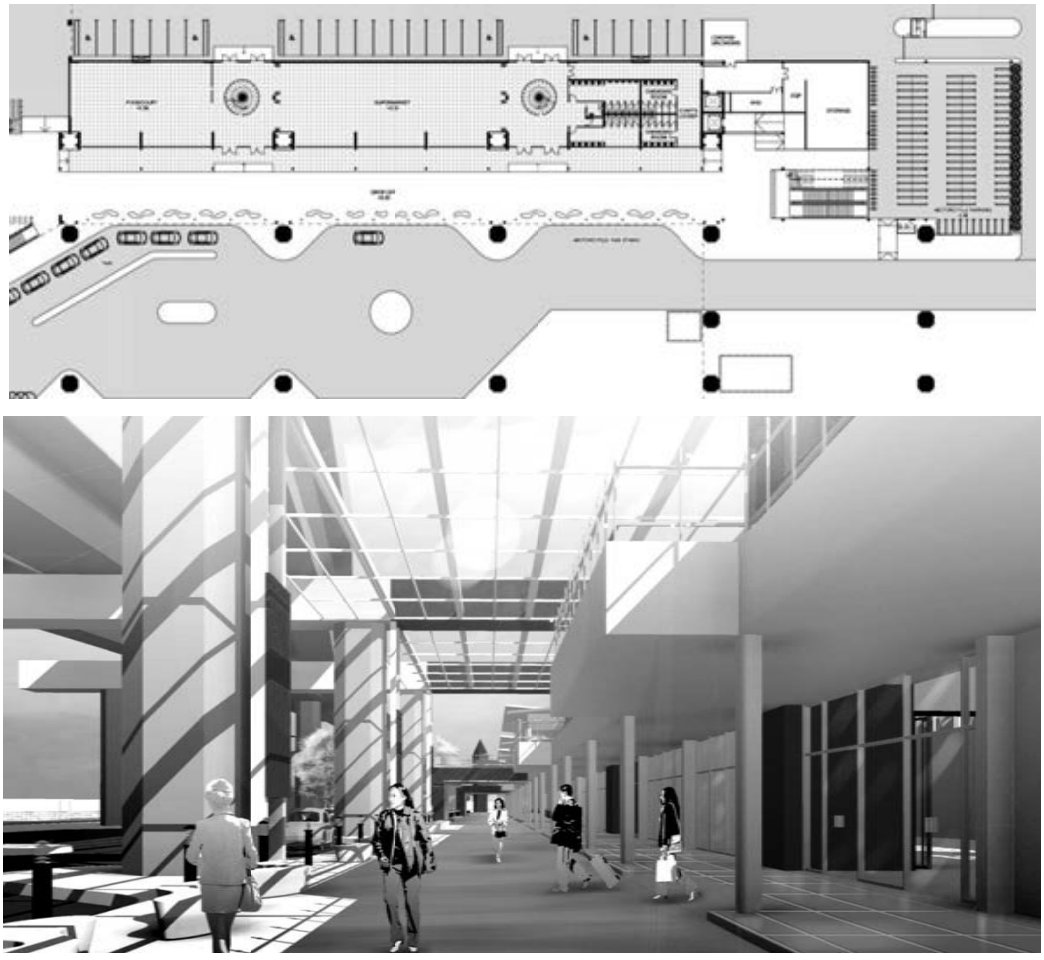


**Figure 7.17 Supermarket in congested area**

Small retails/ shops are located on second floor only, buffering the parking building and the pedestrian corridor. Therefore, people who walk to parking building, or to the plaza bellow, will pass through the shops and can buy something on their way. To keep the area as low-density area according to BMA regulation, the number of small retails is limited to 9 with the area of 100 m2 for each shop and the height of overall commercial facility is limited to 2 stories, not exceeding the ARL station itself. The height limitation is also intended to make visual control to plaza area below is easier so it can invoke the surveillance by daily activity.

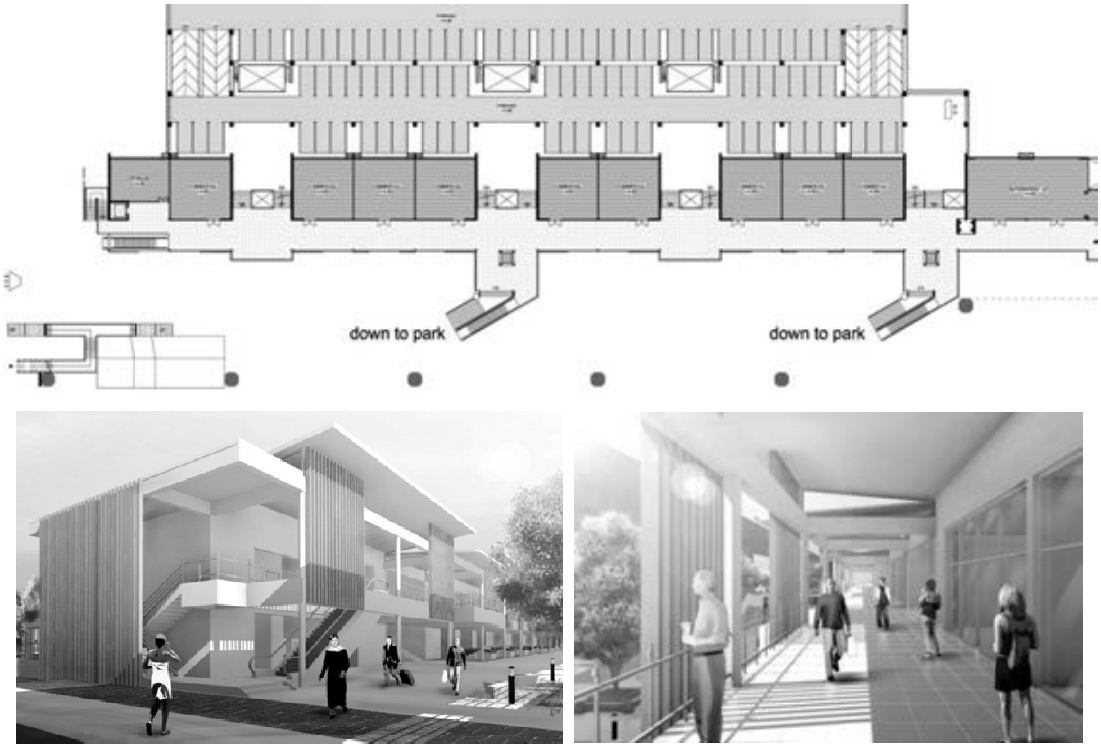



**Figure 7.18 Small retails/ shops on second floor, connecting parking building and pedestrian corridor**

On the first floor, along the pedestrian walking route, commercial activities program takes more lay-low approach by accommodating street vendors at station plaza/ park. Although often seen as plagues, illegal, or making disorder; the existence of street vendors cannot be denied, especially in congested area like stations or terminals. Moreover, street vendors play important role in making the urban space more vibrant by providing cheap option of food or goods, especially for low – mid class people such as train passengers, taxi drivers, and motorcycle-taxi drivers. They also ensure the space along the pedestrian route is occupied so it can invoke natural surveillance for the pedestrian.

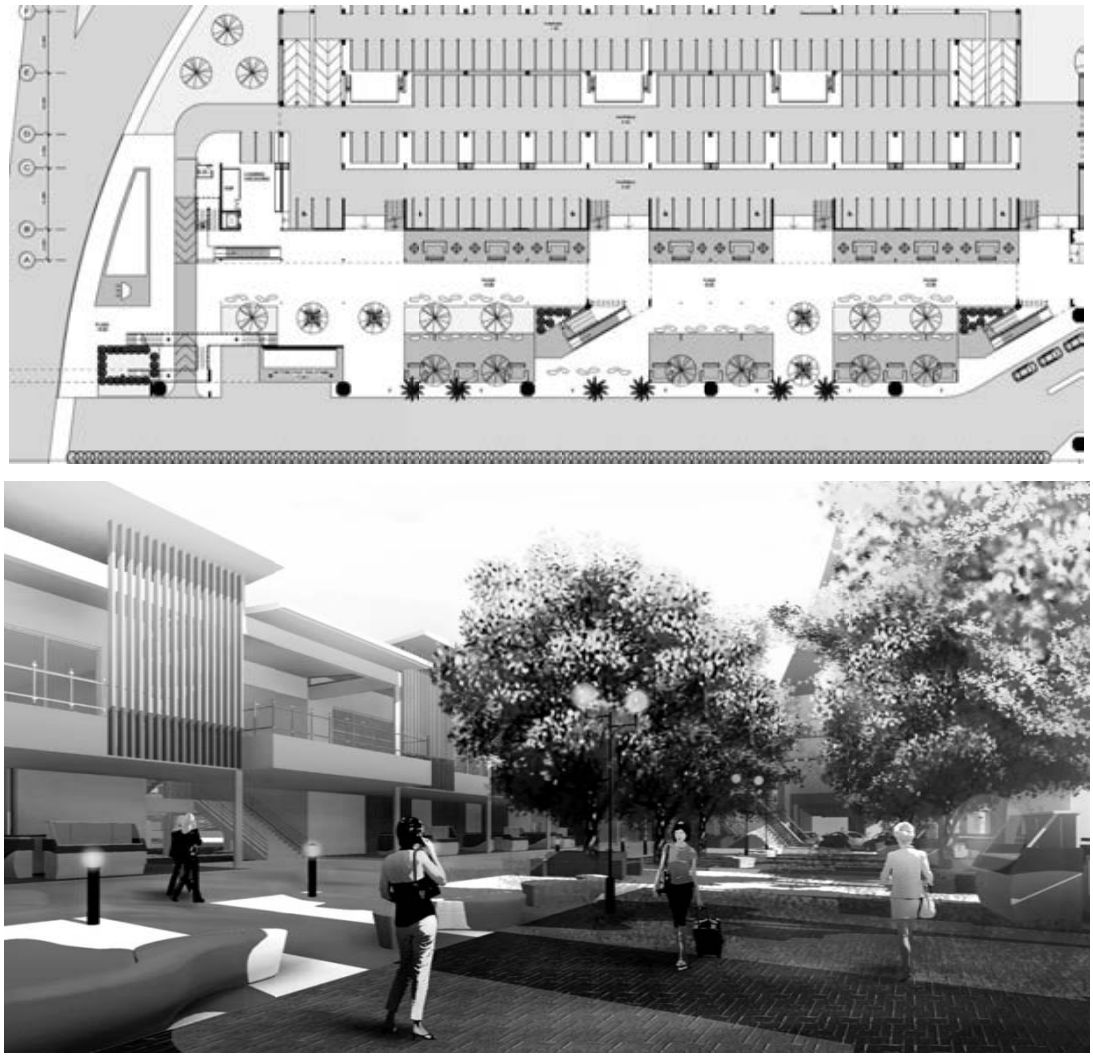


**Figure 7.19 Station plaza and street vendors along the plaza**

### 2.6.2. STATION PLAZA/ PARK

As the metro station's position is away from the main street, the presence of station plaza with the landmark next to the main road is important to signify the presence of metro station in the area. Furthermore, it can be a point of opportunity to connect communities that are divided by the railway (Griffin, 2004), generating social and economic activities. In the end, it makes walking experience of passengers from the main street to the ARL station safer, secured, and more fun. Therefore, the station plaza/ park for this station is spanning from the main road to the drop-off/ waiting area and taxi stand. As the result, people will walk through the station plaza, passing through street vendors and retails, from the main road to reach the ARL station.

**Figure 7.20 *Hua Mak* ARL station proposed design overview**

## 3. DESIGN PROPOSAL: *BAN TAP CHANG* STATION

### 3.1. SITE OVERVIEW

*Ban Tap Chang* ARL station is located near the highway, *Krungthep Chon Buri New Line,* as can be seen on Figure 7.21. As it has been complained by many passengers and motorcycle-taxi drivers during the survey, one of main problem specific for this site is the connectivity between the area across the highway and the station. Currently, users that come from north area, across the highway, is difficult to reach the ARL station and there is no crossing for motorcycle-taxi although they are the primary available transportation modes in this area. Since the passengers come from the north and south side of the highway, the transit facility for the arrival zone should be developed on 2 land plots, on both sides of the highway. Crossing/ connectivity between facility in the north and facility in the south is one of the main design agenda.

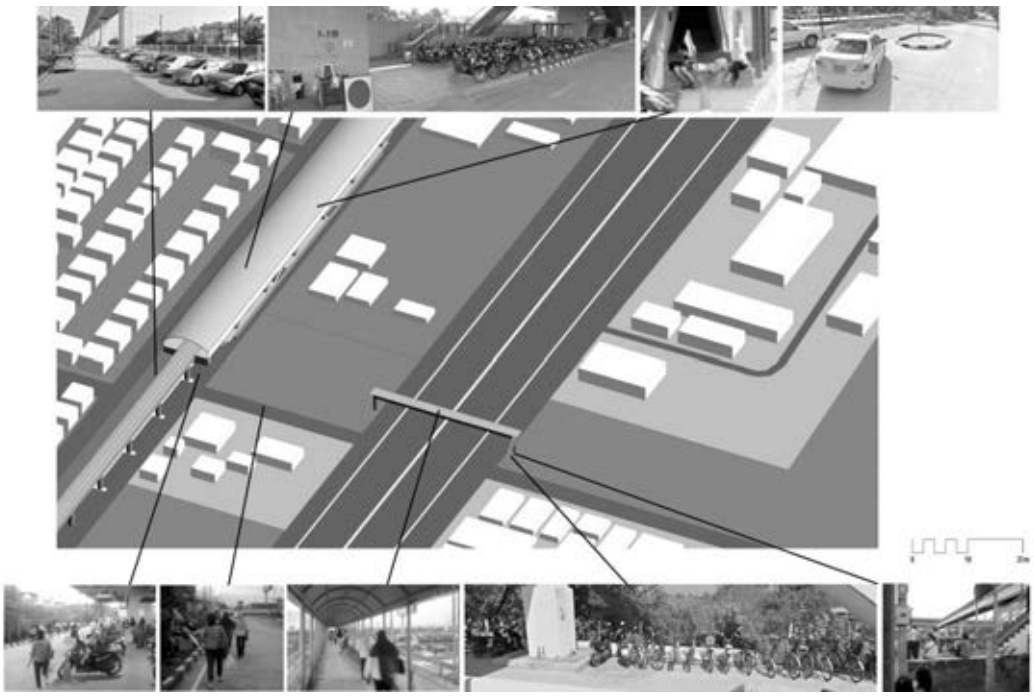


**Figure 7.21 *Ban Tap Chang* site overview**

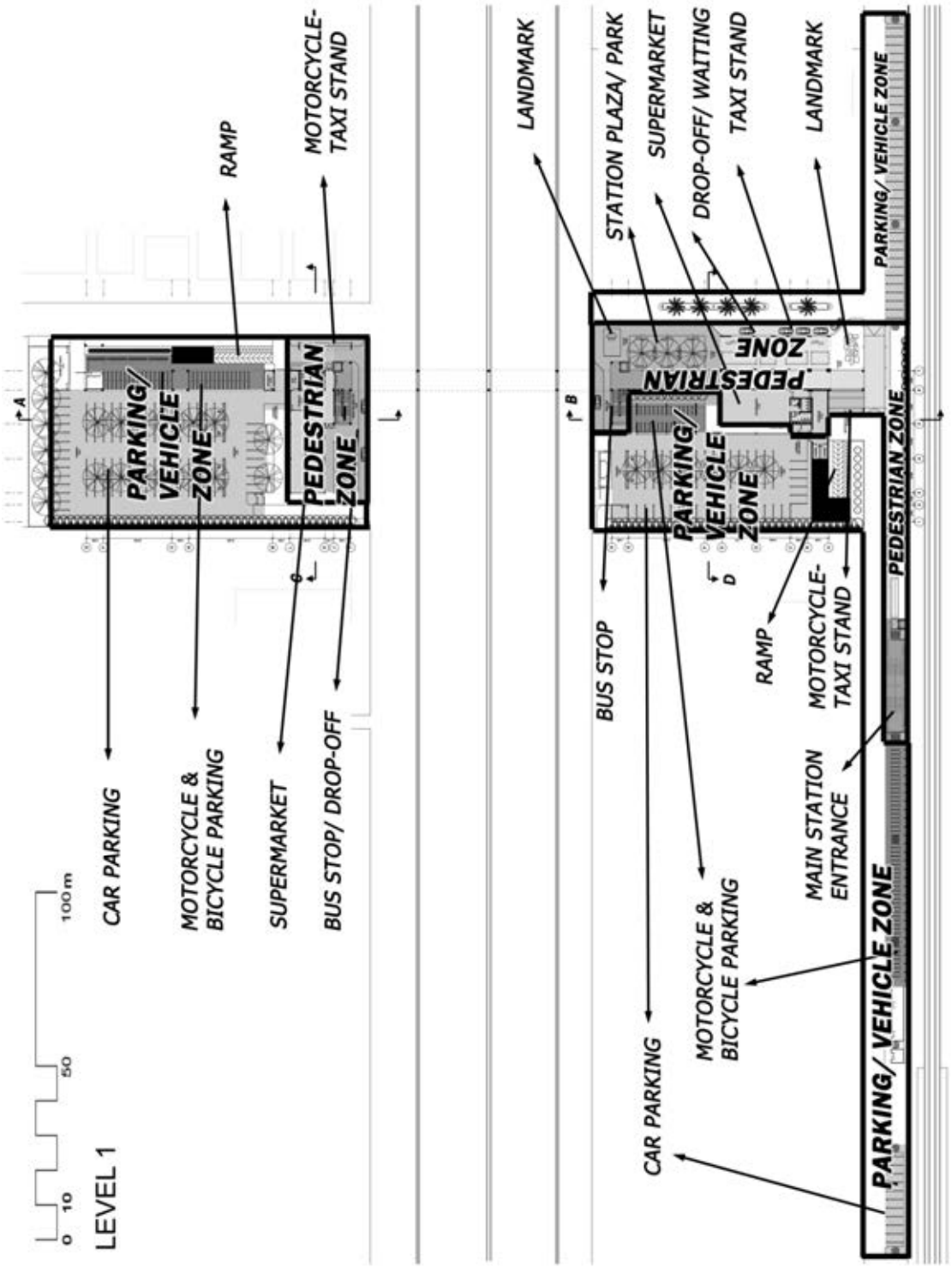



**Figure 7.22 Overall proposed zoning for *Ban Tap Chang* ARL station**

### 3.2. PEDESTRIAN WALK

#### 3.2.1. SIDEWALK/ WALKWAY

As *Hua Mak* ARL station, people also need to walk about 200 m from the street to reach the station. The key ideas for making better pedestrian access are still same: “safety and surveillance” and “route and visibility”.

##### 3.2.1.1. Safety and Surveillance

**Figure 7.23 Current access road’s condition without pedestrian sidewalk**

As can be seen on Figure 7.23, current access road does not have pedestrian sidewalk, forcing people to walk on the vehicle road. Furthermore, along the access road there are just empty land and parking. Therefore, there is the need to make the sidewalk/ walkway so they can safely walk and feel secured when walking. Same as *Hua Mak* ARL station, the improvement to safety and security is based on the following theories:

- According to traditional ideal concepts in town planning, pure pedestrian streets should be free of any kind of non-pedestrian traffic (Monheim, 1984). Pedestrian way, bicycle lane, and vehicle road should be separated and intersections between them should be minimized.
- Other activities; such as: commercial, community center, street vendors, local attractions, etc; should be integrated to arrival zone or along the pedestrian network and parking to ensure the space use and observation (Childs, 1999; EDSA, 2010: 134; Maher and Skinner, 2011: 9).
- Traditional streets are safe because they have pedestrian and vehicular movement along them and, occasionally, police patrols; and supervised by the user of bordering buildings (Marzbali, et al., 2012: 87).

Based on background theories, the proposed section of the road to make better surveillance and safety is as the diagram on Figure 7.24 below.

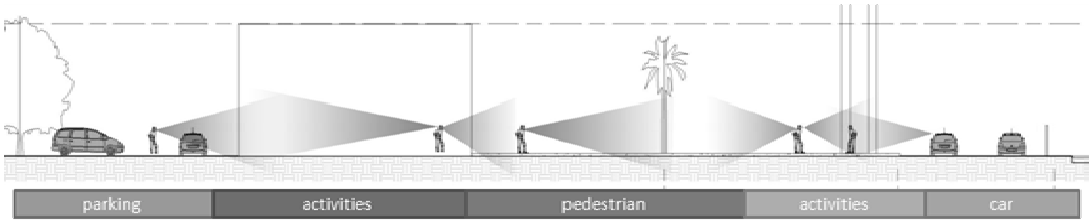



**Figure 7.24 Proposed street section**

### 3.2.1.2. Route and Visibility

*Ban Tap Chang* ARL station is located behind another land plot/ property. Therefore, the station entrance is hidden from the main street. The improvement of pedestrian sidewalk/ walkway is expected to help people orient themselves. The improvement of walking route and visibility is based on the following theories:

- Landmark and landscaping such as: public art, water feature, etc; should be incorporated (Network Rails, 2011; Regional Tranport District Transit Access Committee, 2009).
- High degree of overlapping visual fields of origin and destination landmark (where people can see landmark from another landmark) helps people to construct spatial knowledge and perform navigation tasks (Omer and Goldblatt, 2007: 527-529).
- As the focal point of entire arrival zone, station entrance (and its associated plaza) should be clearly identified (EDSA, 2010; California High-Speed Rail Authority, 2011) and visible from other landmarks positions.

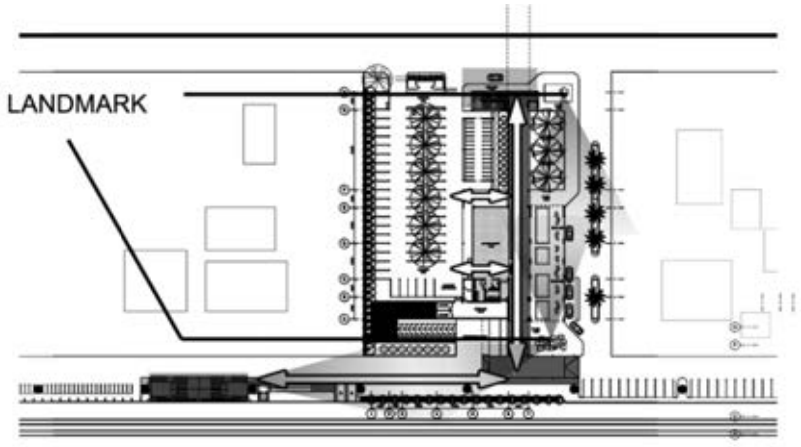



**Figure 7.25 Proposed pedestrian route and visibility at *Ban Tap Chang* ARL station**

**Figure 7.26 Pedestrian walking path and landmark at *Ban Tap Chang* ARL station**

### 3.2.2. CROSSING

Crossing bridge for this station is not only for pedestrian route design agenda but also for motorcycle route as one of the problems is connectivity between north area and south area divided by the highway. To respond the requirement both from pedestrian and motorcycle circulation, there are 2 different entry points to the bridge, i.e.: stairs and elevator for pedestrian and 1:12 ramps for motorcycle, as shown on Figure 7.27. Total width of crossing bridge is 5 m with the elevation of 8.5 m from ground level.

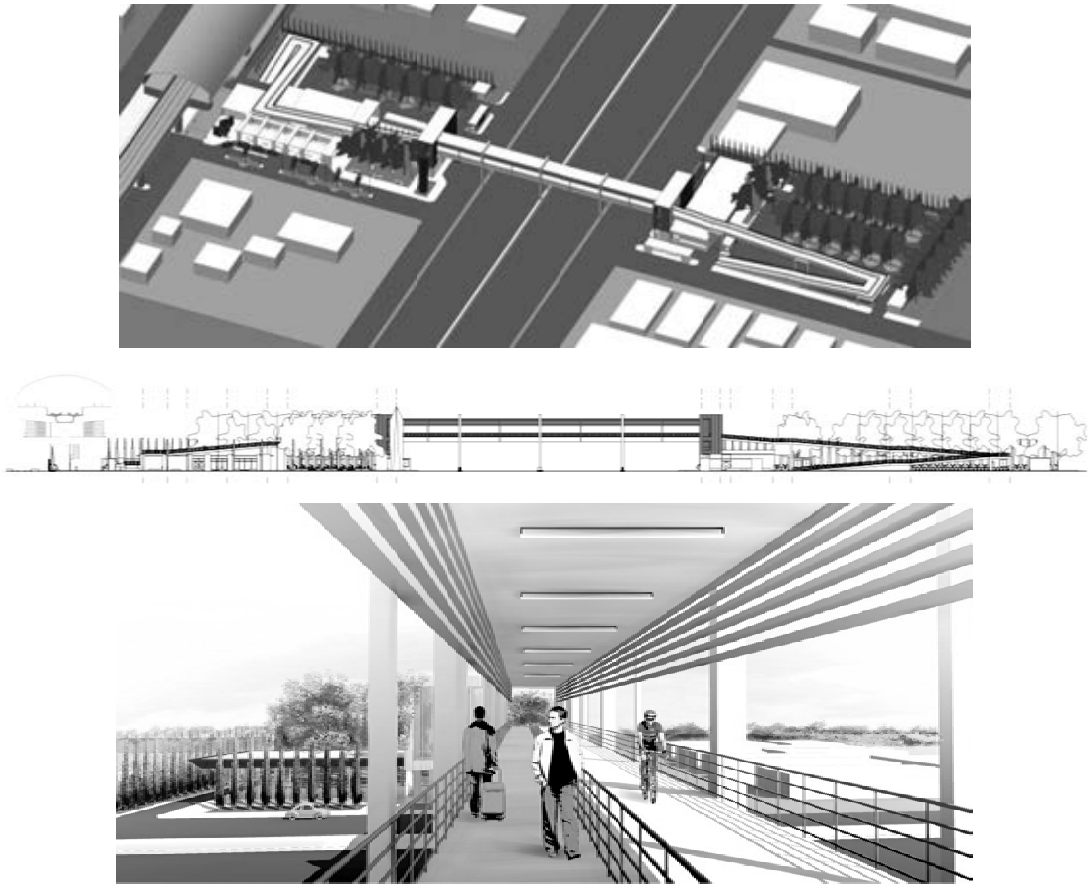


**Figure 7.27 Proposed crossing bridge for pedestrian and motorcycle**

### 3.3. PUBLIC TRANSPORT STOPS

There are 2 public transport stops designed, 1 for each lane. The public transport stops is directly connected to staircase to the crossing bridge. The stop on the north lane has bigger capacity for 7 cars queuing as it is also used for private car and taxi drop-off/ waiting area.

**Figure 7.28 Public transport stop for the south lane (left) and north lane (right)**

### 3.4. PARATRANSIT STANDS

#### 3.4.1. TAXI STAND

As in *Hua Mak* station, the new taxi stand is located adjacent to drop-off/ waiting area in the south zone and connected directly to supermarket. Although there are no many taxis operate in this area, the passengers still need to be able to access the station using taxi. Therefore, the taxi stand only has capacity of 3 – 4 taxis queuing and located in congested and commonly passed area, along with drop-off, motorcycle-taxi stand, and supermarket

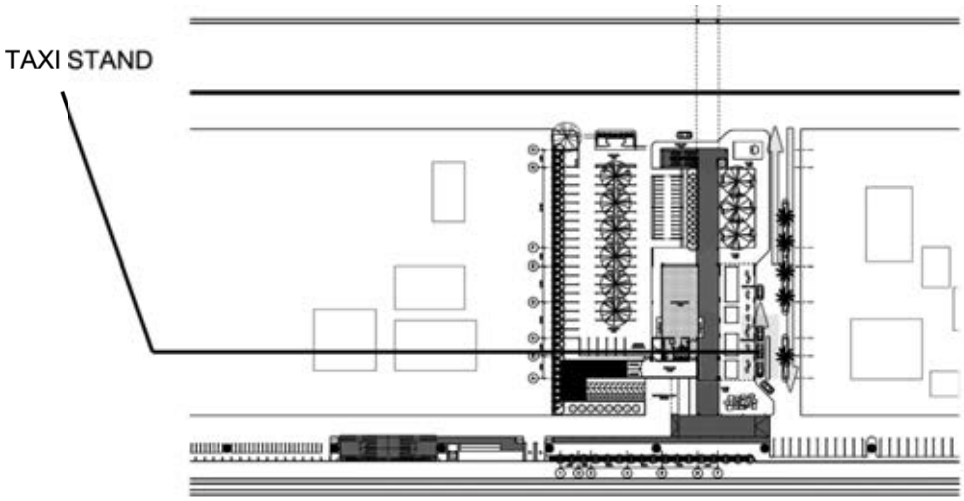



**Figure 7.29 Position of taxi stand and taxi circulation route at *Ban Tap Chang* ARL station**

### 3.4.2. MOTORCYCLE-TAXI STANDS

Motorcycle-taxi is the primary transportation modes to reach *Ban Tap Chang* ARL station. Therefore, it needs specific facility to accommodate the transit interchange and for motorcycle-taxi drivers waiting the passengers. As shown on Figure 7.30, there are 2 new motorcycle-taxi stands. Each stand is located at the end of the ramps of crossing bridge for easy access route. Next to it are supermarket, taxi stand, and drop-off/ waiting area. Motorcycle-taxi stand in the south zone is located 60 m from the main station entrance and directly visible from it.

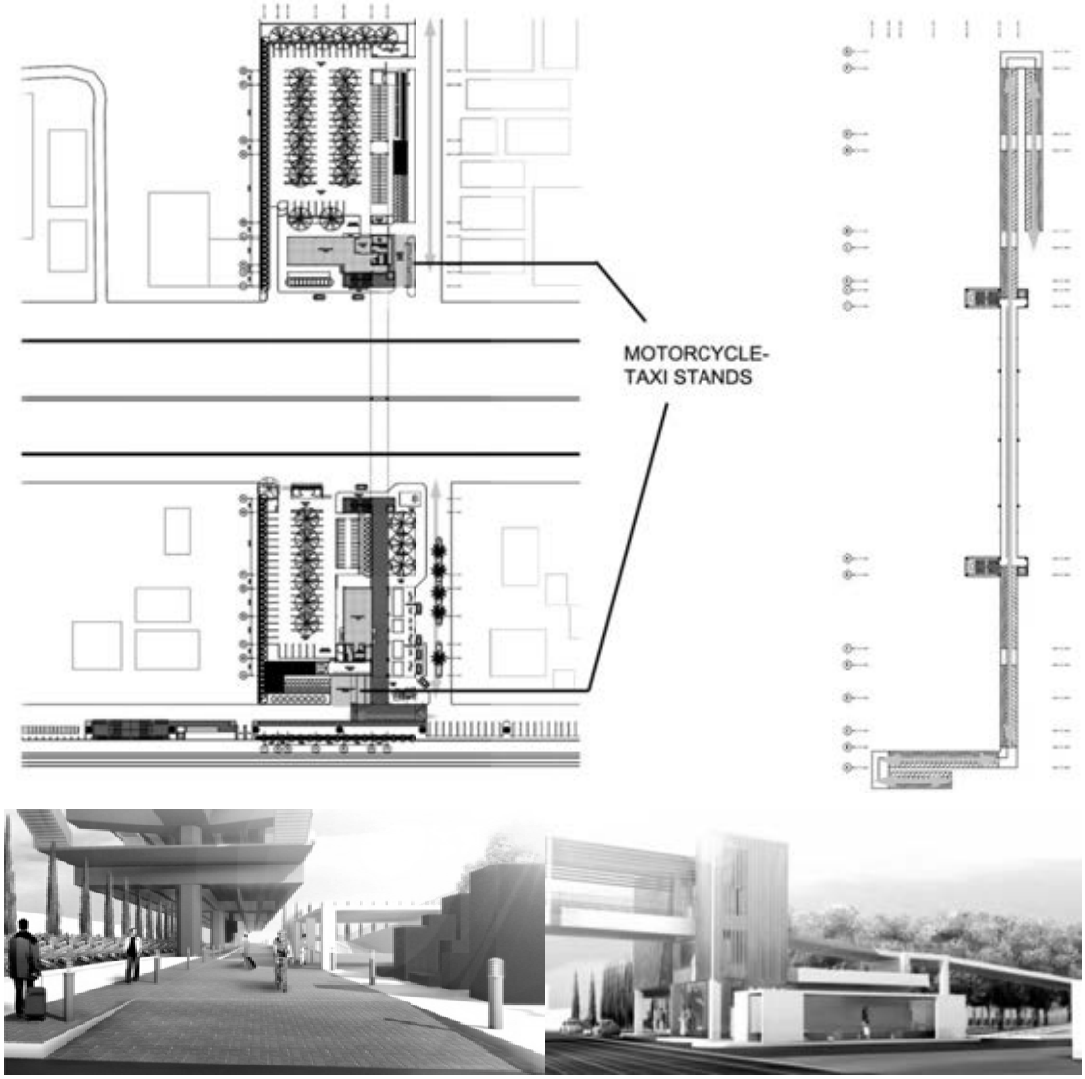



**Figure 7.30 The new motorcycle-taxi stands and motorcycle-taxi route on crossing bridge**

### 3.5. DROP-OFF/ WAITING AREA

As public transport stops and paratransit stands, there are also 2 drop-off/ waiting points for this station as can be seen on Figure 7.31. The first drop-off/ waiting point is located in the south zone, 90 m from station entrance, next to taxi stand and motorcycle-taxi stand. Same as in *Hua Mak* station, this area is also meant t be most congested area as it is always passed through by passengers with the supermarket and station plaza connected directly to it. The second drop-off waiting point is the same location as the bus stop in the north zone. As the drop-off area in the south zone, this area is also most congested area that connected to supermarket and motorcycle-taxi stand.

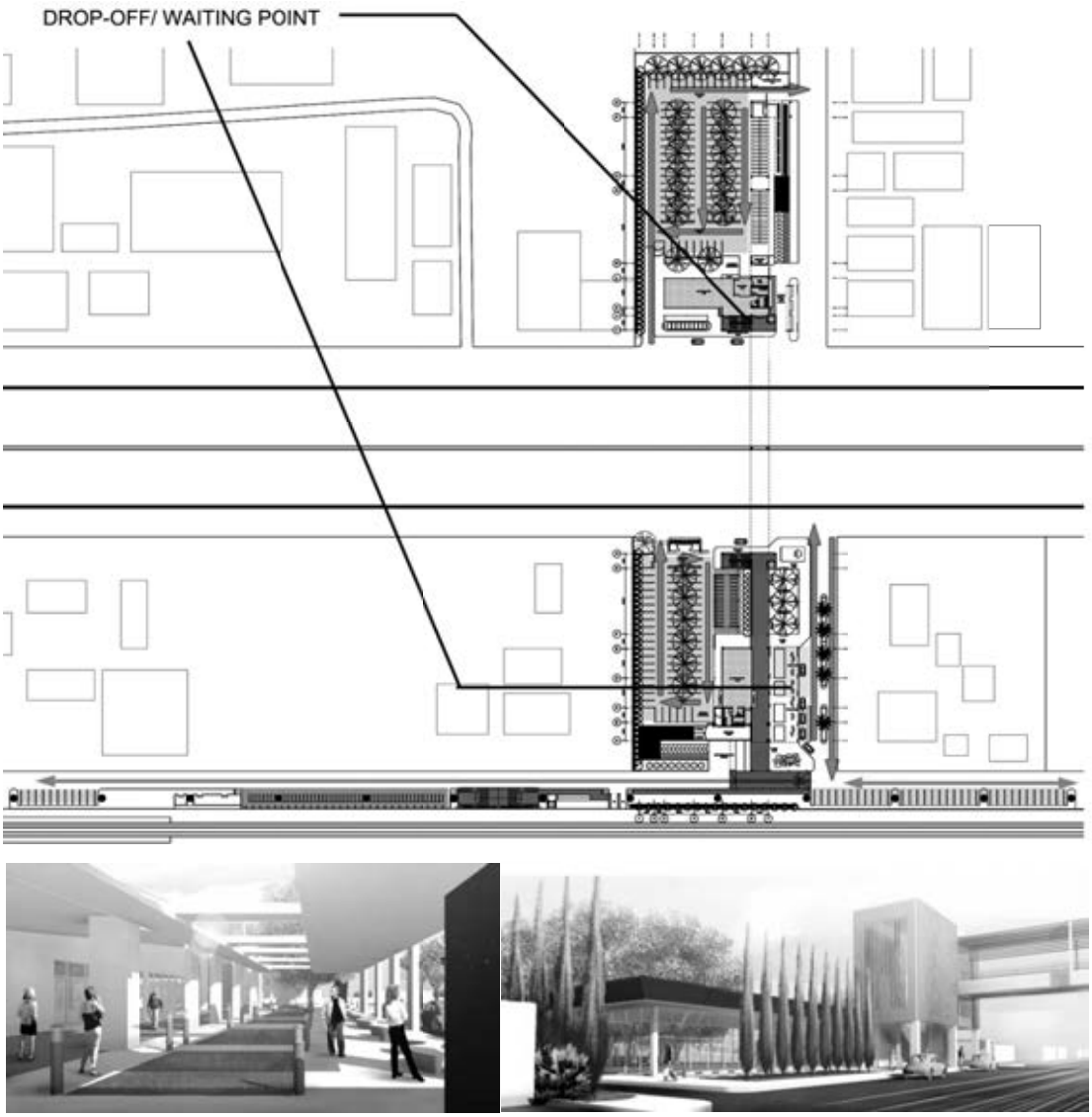



**Figure 7.31 Top: drop-off area location; bottom: drop-off point for the south zone (left) and the north zone adjacent to supermarket (right)**

### 3.6. PARKING

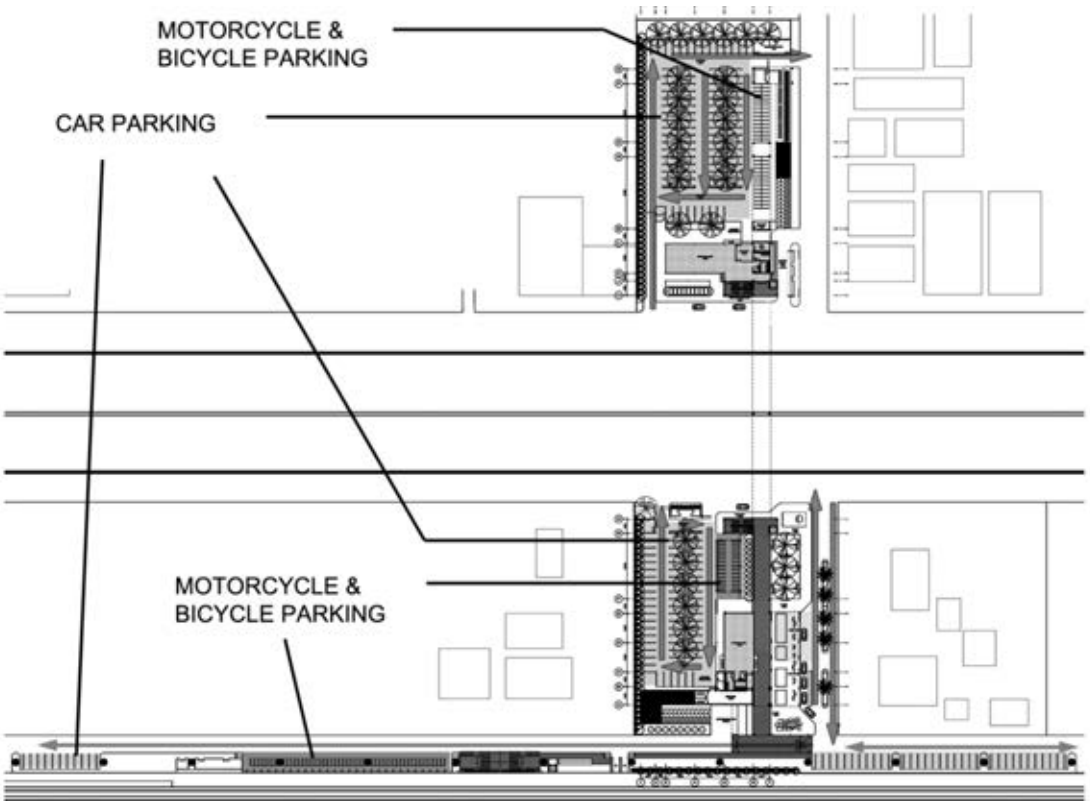



**Figure 7.32 Proposed vehicle circulation and parking facilities at *Ban Tap Chang* ARL station**

#### 3.6.1. CAR PARKING

Although there are not many passengers drive own car to reach the station due to its location next to the highway, parking facilities is still needed as the station is located in suburban area. Park-and-ride facility is in the last priority with the maximum distance of 400 m from station (EDSA, 2010: 94).

As can be seen on Figure 7.32, there are 2 main parking facilities added for this area, one in the north zone with the capacity of 83 cars and another one in the south zone with the capacity of 46 cars. Other existing parking bays with smaller capacity are in the east and west side of the station with total capacity of 40 cars. Since there is not much demand for parking, the parking facility is just a parking field with secured access. As the most rural area compared to other 2 stations, in addition for parking function, the presence of parking field is also meant to be used for community activity at the certain times as the extended space of station plaza/ park. As in *Hua Mak* station, parking facilities are also located behind activities area, separated from pedestrian zone.

### 3.6.2. BICYCLE AND MOTORCYCLE PARKING

Bicycle parking is the highest rank of transit after pedestrian and the facility should be placed next to the main entrance to have quick access by passengers and invoke surveillance (California High-Speed Rail Authority, 2011: 50). However, for *Ban Tap Chang* station, since the area is divided by the highway, another bicycle and motorcycle parking facility should be added as well in the north zone for the people that do not want to bring their bicycle or motorcycle crossing the bridge. As can be seen on Figure 7.32, there are total of 3 motorcycle parking facilities, one next to the station entrance, one next to the supermarket in the south, and one behind the supermarket in the north, next to end of the ramp.

### 4.6.3. DISABLE PEOPLE PROVISIONS

As the universal design standards, provisions for people with disabilities is needed for making the able to access and use the internal and external facilities (Soltani, et al., 2012: 91). Same as at *Hua Mak* station, increasing parking bays number should be followed by increasing number of parking for disabled people. Since there are 3 parking facilities, parking bays for disabled are also spread into 3 locations: 4 parking bays in the north facility, 2 parking bays in the south facility, and 2 other parking bays next to the main station entrance. 2 elevators are also added to the crossing bridge for disabled people access the facility across the highway.

## 3.7. ACTIVITIES ENGAGEMENT

### 3.7.1. COMMERCIAL AREA

*Ban Tap Chang* station is located in low-density residential area “yellow R3”. Therefore, commercial building is limited up to 10,000 m2. Nevertheless, the station’s location near the highway makes this area very rural with low demand of commercial building. Thus, the commercial space for this station is limited to big retail/ supermarket, placed at the most congested area in the south zone and north zone so people still able to buy something on their way home or while waiting to be picked up. As in previous station, the presence of big retail is also important to accommodate public toilet within it as public toilet is the most wanted facility by all station users.

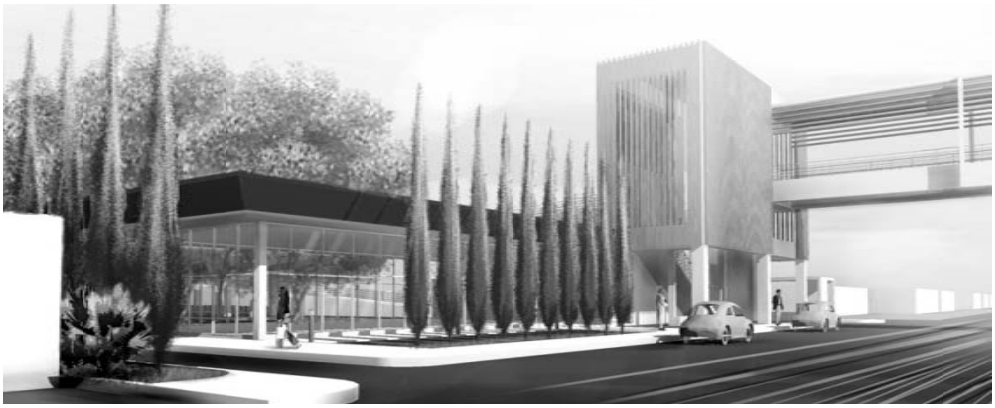


**Figure 7.33 Supermarket in the north zone facility adjacent to bus stop/ drop-off point**

### 3.7.2. STATION PLAZA/ PARK

The presence of station plaza with landmark next to the main street is important to signify the presence of metro station in the area as the station entrance is located hidden behind another property. Furthermore, it makes walking experience of passengers from the main street to the ARL station is safer and secured.

**Figure 7.34 Station plaza with landmark at *Ban Tap Chang* ARL station**

**Figure 7.35 *Ban Tap Chang* ARL station proposed design overview**

# 4. DESIGN PROPOSAL: *LAT KRABANG* STATION

## 4.1. SITE OVERVIEW

Compared to other 2 stations, *Lat Krabang* has unique condition as it is located at critical junction area where the highway exit, flyover piles, ARL viaduct, the main road, and railway intersect each other as can be seen on Figure 7.36. As the result, transit points in this area are scattered on different small land plots, separated by various road sections. Traffic jam as well as dangerous traffic for crossing is one of the problems complained by station users. Since the passengers use different transit points and there is no big one land plot adjacent to the station, the proposed developments should include various small land plots around the junction. Connectivity between fragmented facilities is one of main design program.

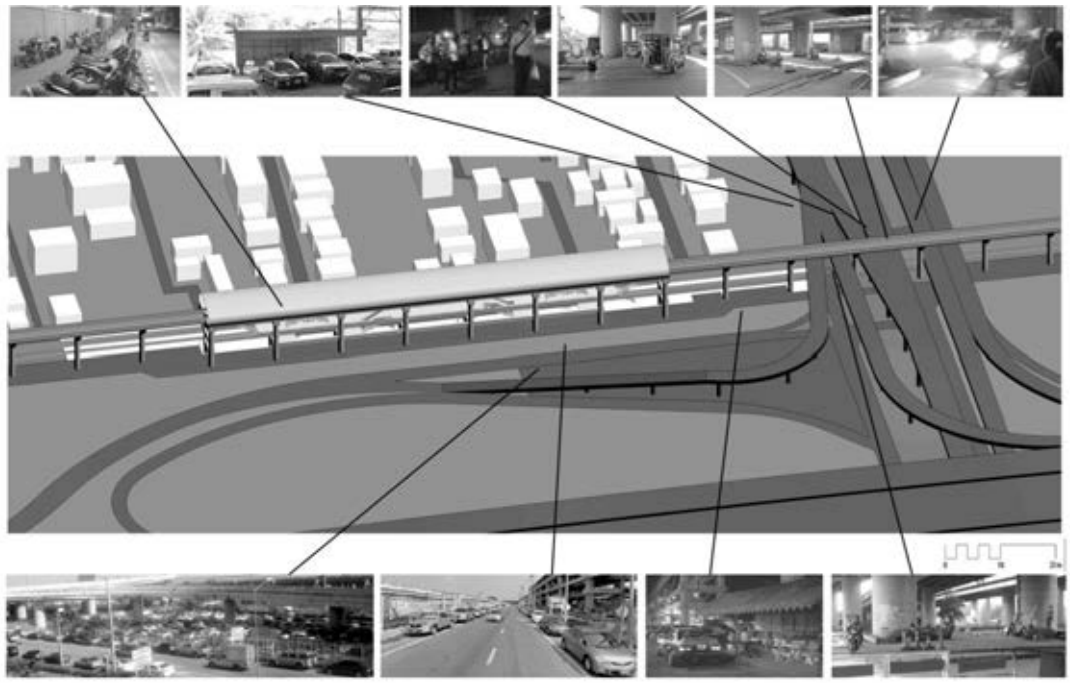


**Figure 7.36 *Lat Krabang* site overview**

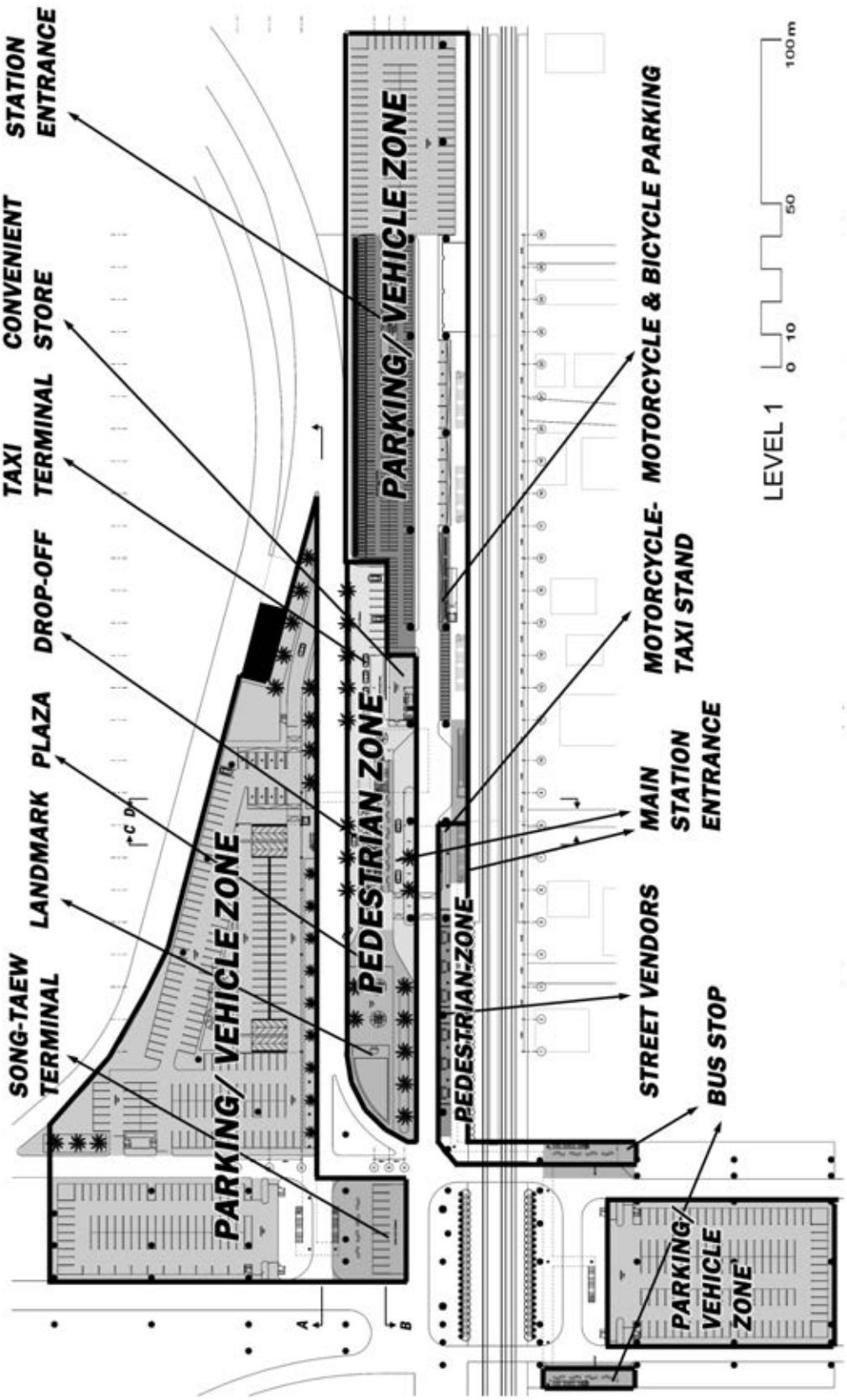



**Figure 7.37 Overall proposed zoning for *Lat Krabang* ARL station level 1**

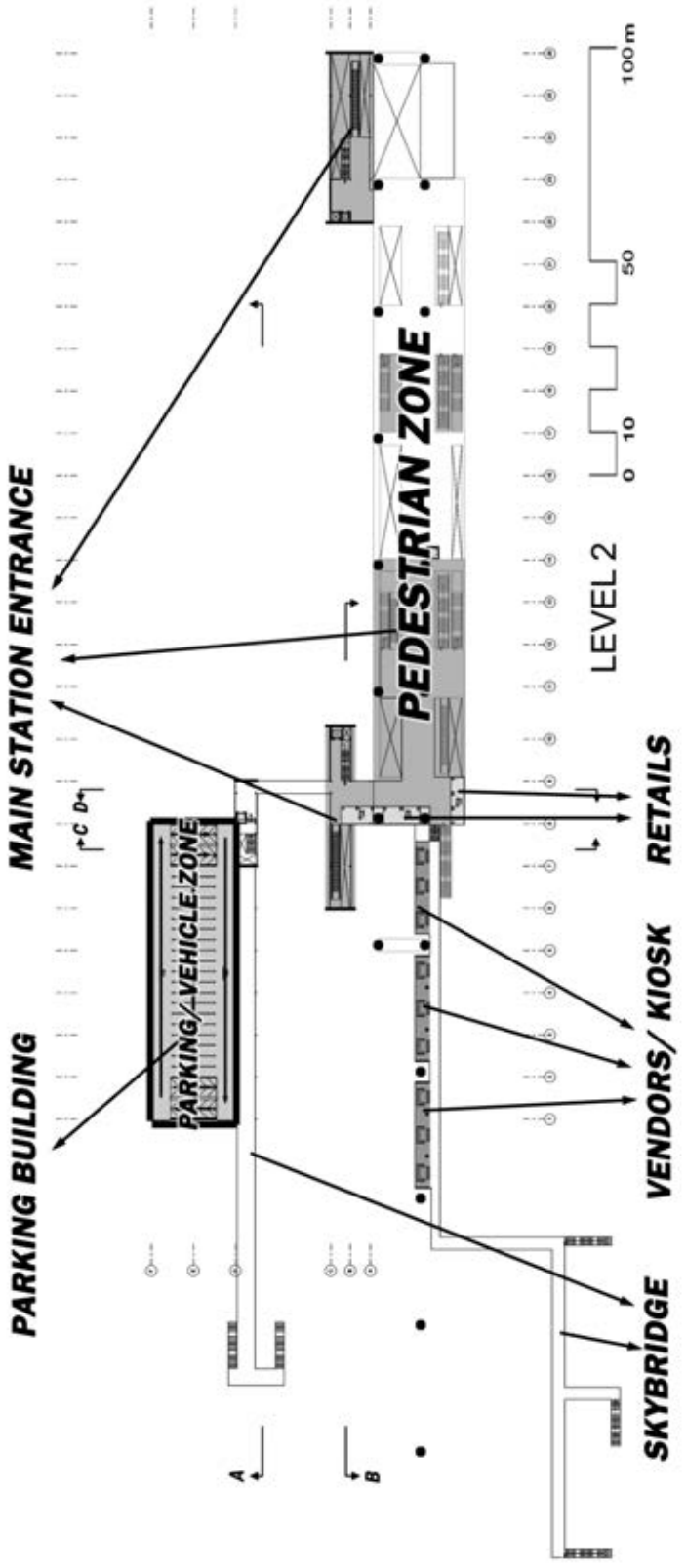



**Figure 7.38 Overall proposed zoning for *Lat Krabang* ARL station level 2**

## 4.2. PEDESTRIAN WALK

### 4.2.1. SIDEWALK/ WALKWAY

As in previous 2 stations, the key ideas for making better pedestrian access are still same: “safety and surveillance” and “route and visibility”. However, in his station, the sidewalk/ walkway route part is not as long as in other 2 stations and due to site limitation, there is not much room for improvement on ground level. The main sidewalk/ walkway route is still same, connecting ARL station and the local train station exit to the bus stop as can be seen on Figure 7.39 below. The parking bays adjacent to it are removed to make more space for street vendors to engage the activities along pedestrian sidewalk/ walkway.

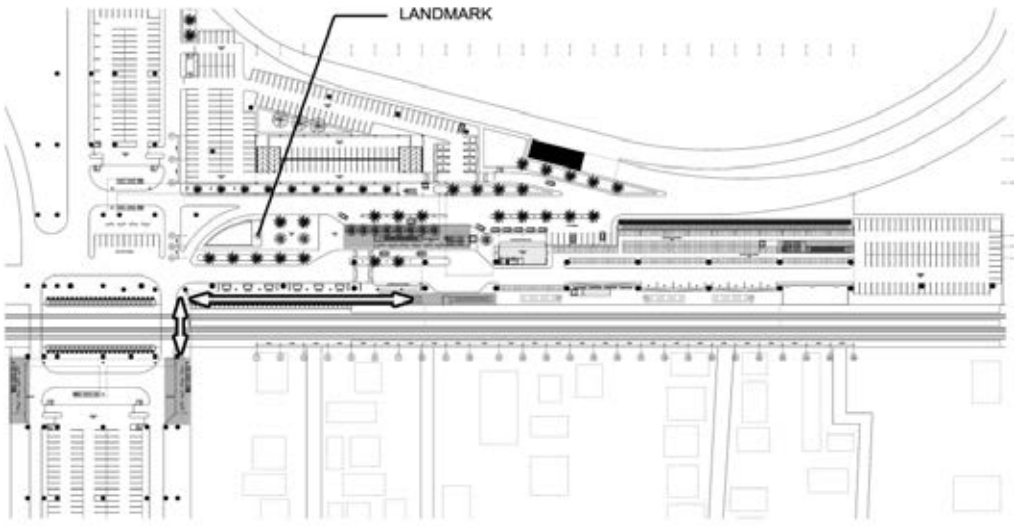



**Figure 7.39 Proposed sidewalk/ walkway route at *Lat Krabang* ARL station**

Grade separation between pedestrian walk and vehicular road for safety improvement is mainly done through the making of skywalk that connects different part of facilities that will be discussed in the next part.

### 4.2.2. CROSSING

Due to dangerous traffic and critical intersections, pedestrian crossing takes form of skywalk network that connects mezzanine level of the ARL station to different facilities such as parking and bus stops in various locations. It has 2 – 3 m width and the elevation of 6 m above the ground level. Along the skywalk from the station to the bus stops, there are spaces for food vendors/ small kiosks to enable passengers buying something while passing through.

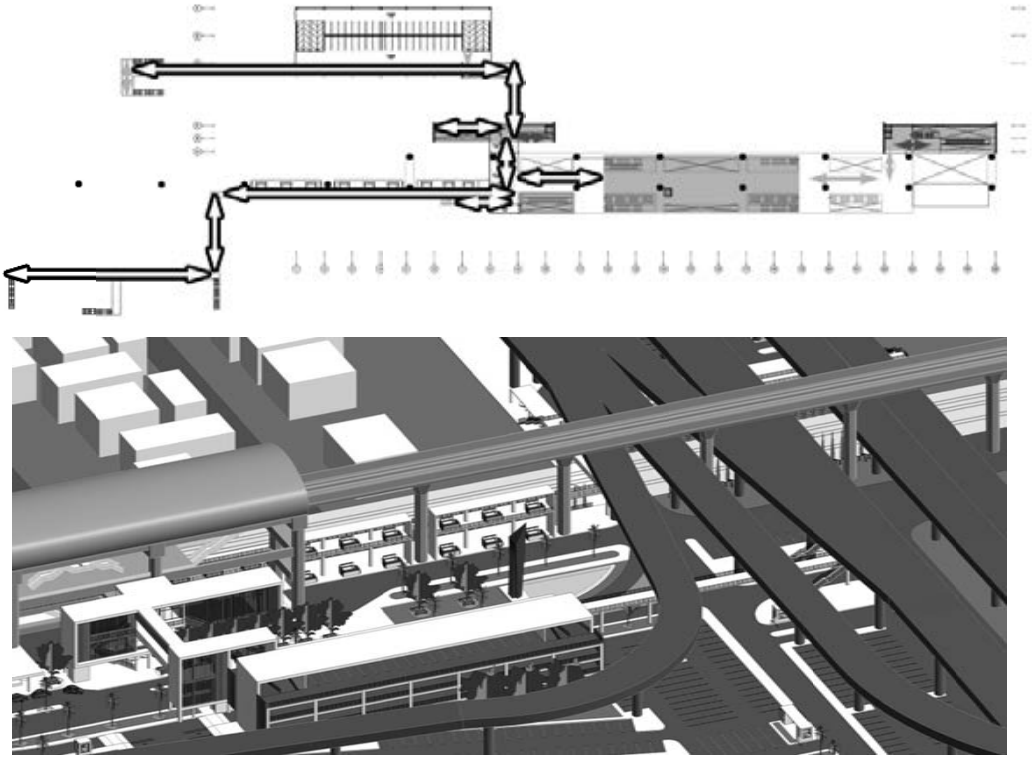


**Figure 7.40 Pedestrian skywalk network at *Lat Krabang* ARL station**

### 4.3. PUBLIC TRANSPORT STOPS

Due to limited land plot and existing bus route, public transport stops positions are still same as the existing positions. It includes 2 bus stops, one for each lane direction, and a *song-taew* terminal with the capacity of 10 cars queuing as can be seen on Figure 7.41 below.

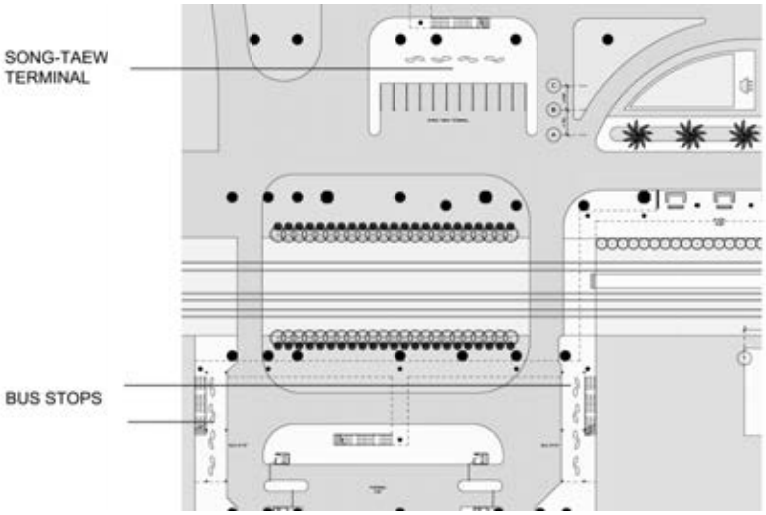



**Figure 7.41 Public transport stops position at *Lat Krabang* ARL station**

## 4.4. PARATRANSIT STAND

### 4.4.1. TAXI TERMINAL

From its previous location at the junction corner, the new taxi terminal is relocated to the middle section adjacent to drop-off area and near the convenient store to provide better access and make the taxi drivers close to other facilities they can use such as shop and public toilet. Total capacity for the new taxi terminal is 17 taxis with 11 parking bays and 6 cars capacity queuing lane.

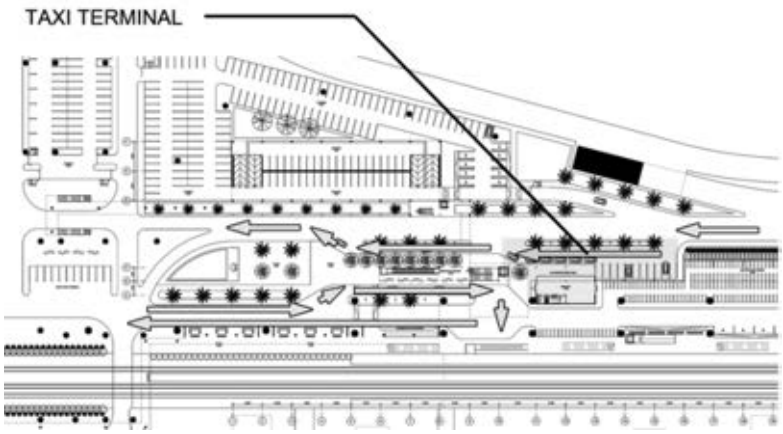



**Figure 7.42 Proposed taxi terminal and circulation at *Lat Krabang* ARL station**

### 4.4.2. MOTORCYCLE-TAXI STAND

To provide better access for the passengers, motorcycle-taxi stand is also relocated from its previous position under the flyover to the new position adjacent to main entrance. The new motorcycle-taxi stand has capacity of 8 – 10 motorcycles with shelter and seating.

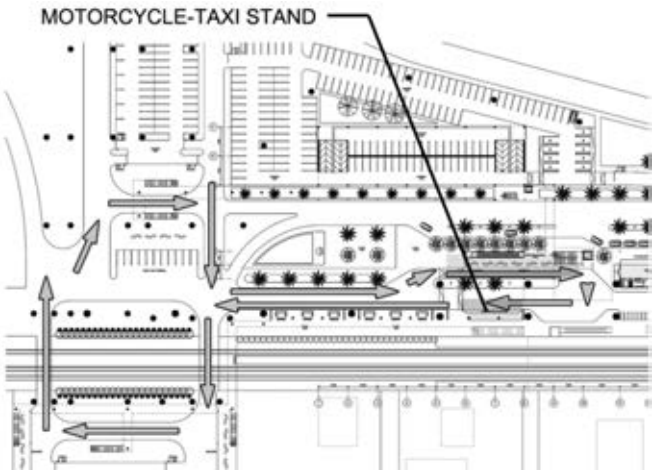



**Figure 7.43 Proposed motorcycle-taxi stand and circulation at *Lat Krabang* ARL station**

### 4.5. DROP-OFF/ WAITING AREA

The new drop-off/ waiting point is slightly moved from previous position to the north. As can be seen on Figure 7.44, the proposed drop-off/ waiting point faces 2 roads: the station access road and the public road (exit road of the highway) to facilitate the passengers that wait for the van in this area. As in previous 2 stations, it is also adjacent to station main entrance, taxi terminal, big commercial (convenient store), and station plaza. Therefore, it also becomes the most congested area. Nevertheless, the passengers' circulation to public transport stop will not go through drop-off point as the access has been separated on the 2nd level. The drop-off area also has turnaround point for the access road under the station for easing turning after dropping-off or picking up the passengers.

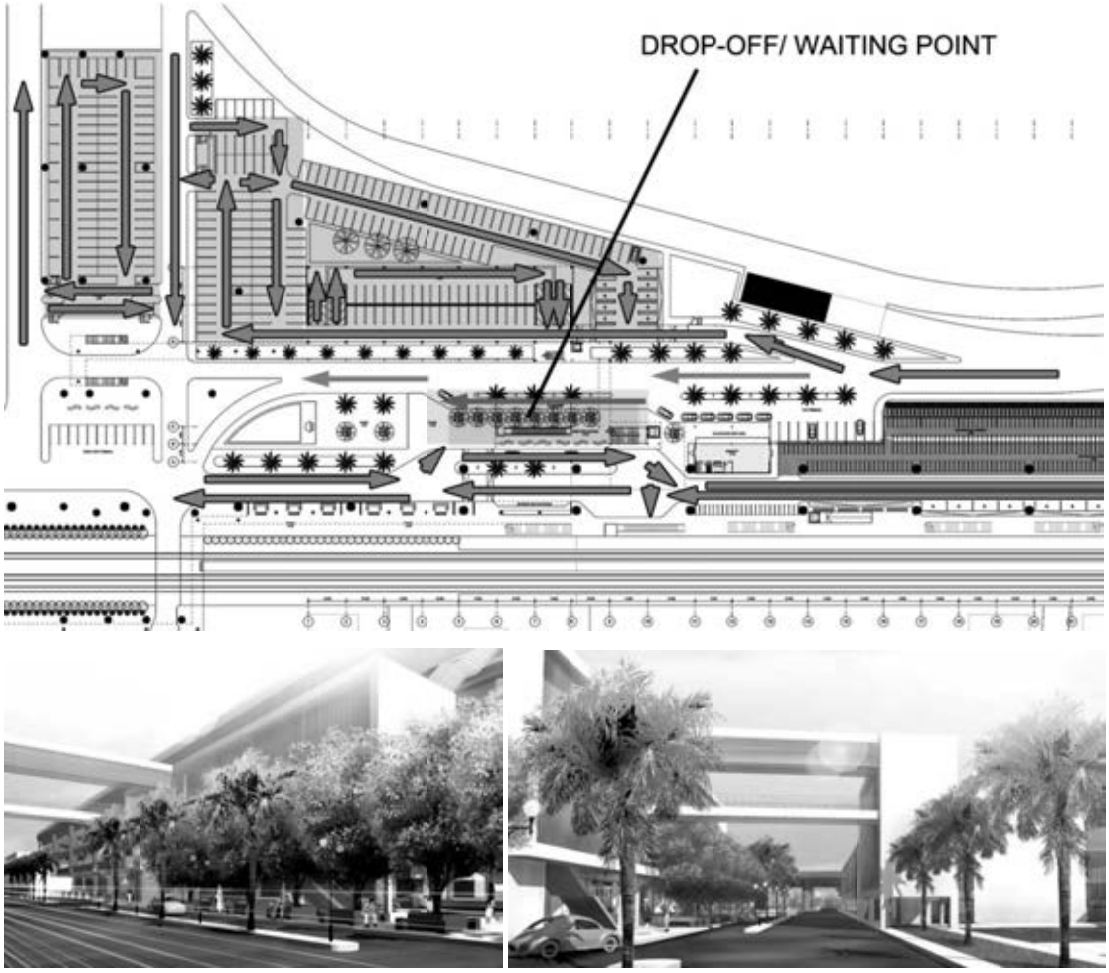



**Figure 7.44 New drop-off/ waiting area for *Lat Krabang* station**

## 4.6. PARKING

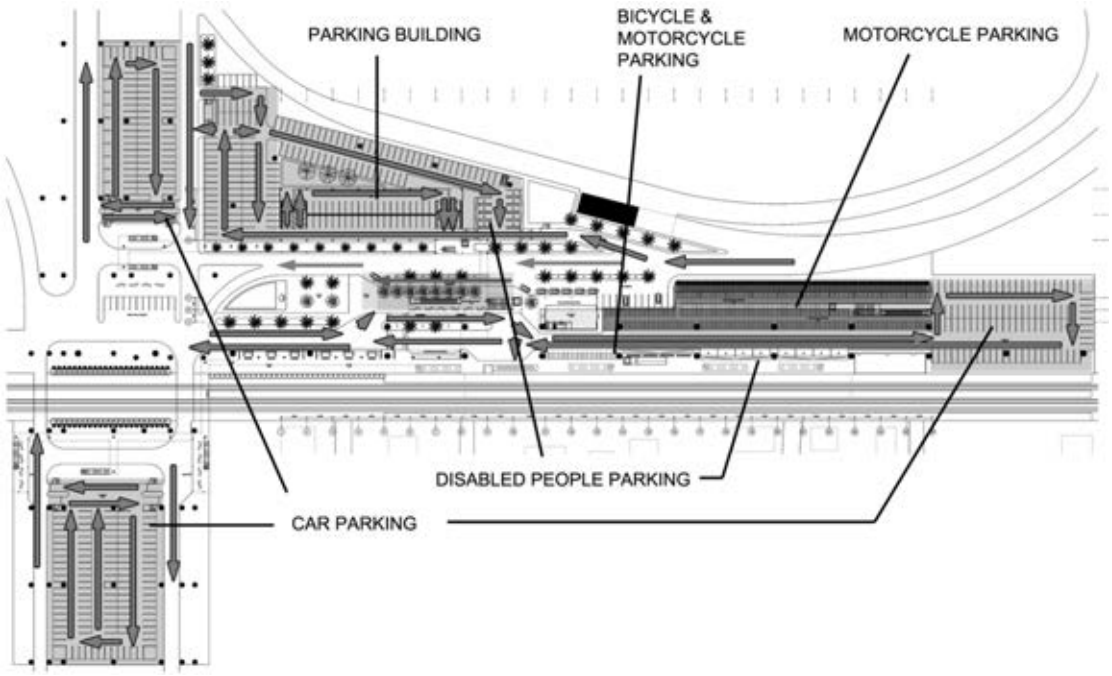



**Figure 7.45 Proposed vehicle circulation and parking facilities at *Lat Krabang* ARL station**

### 4.6.1. CAR PARKING

As can be seen on Figure 7.45, there are several parking facilities in this area due to high requirement of parking numbers and very limited site. Most of parking facilities location is still same with existing parking pattern. Under the flyover, there are 2 parking fields with the capacity of 75 and 109 cars. At the end of station access road there is still existing parking bays that expanded to 87 cars capacity.

The biggest parking facility still stands on the land owned by Highway Authority now. To fulfill high parking numbers requirement, there is a need to make multi-stories parking. As in *Hua Mak* station area, parking building is created to fit 345 cars on this site. Multi-stories parking building is more preferable than deep underground parking to avoid being flooded and minimize the intrusion to surrounding from construction work. This parking building is connected with the mezzanine level of the station through the skywalk. All of parking facilities have secured access with gates and security posts.

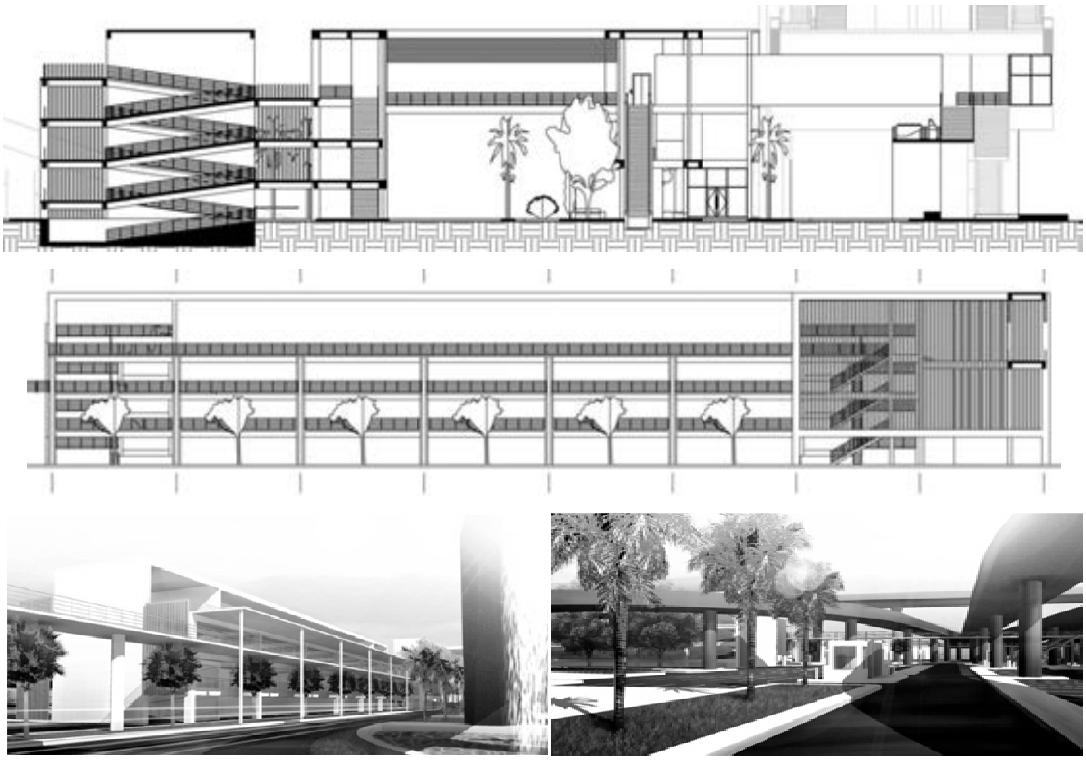


**Figure 7.46 Parking building for *Lat Krabang* ARL station: top: section, middle: elevation, bottom: perspective of parking building (left) and access gate to parking building (right)**

### 4.6.2. BICYCLE AND MOTORCYCLE PARKING

Bicycle and motorcycle parking still get the highest priority to be closest with the station entrance. However, due to the high parking number requirement, 300 motorcycles, the space needed for motorcycle parking must also be expanded as can be seen on Figure 7.45. Therefore, the new east entrance needs to be added to connect the station mezzanine and motorcycle parking.

**Figure 7.47 East station entrance and motorcycle parking**

### 4.6.3. DISABLED PEOPLE PROVISIONS

Provisions for disabled people include parking bays for disabled people and elevators. As in previous 2 stations, increasing parking bays numbers makes the parking bays for disabled to be added according to Americans with Disabilities Act (ADA). There are 2 parking bays for disabled people locations as shown on Figure 7.45. The existing parking bays for disabled located under ARL station. The capacity is now expanded to 8 cars. Another location of parking bays for disabled is on the ground floor of parking building, across the road from the station. It has capacity of 9 cars in total. To enable disabled people access these new parking bays, taxi transit facility, and convenient store, there are 2 new elevators added on each ends of skywalk connecting parking building and main entrance as shown on Figure 7.48.

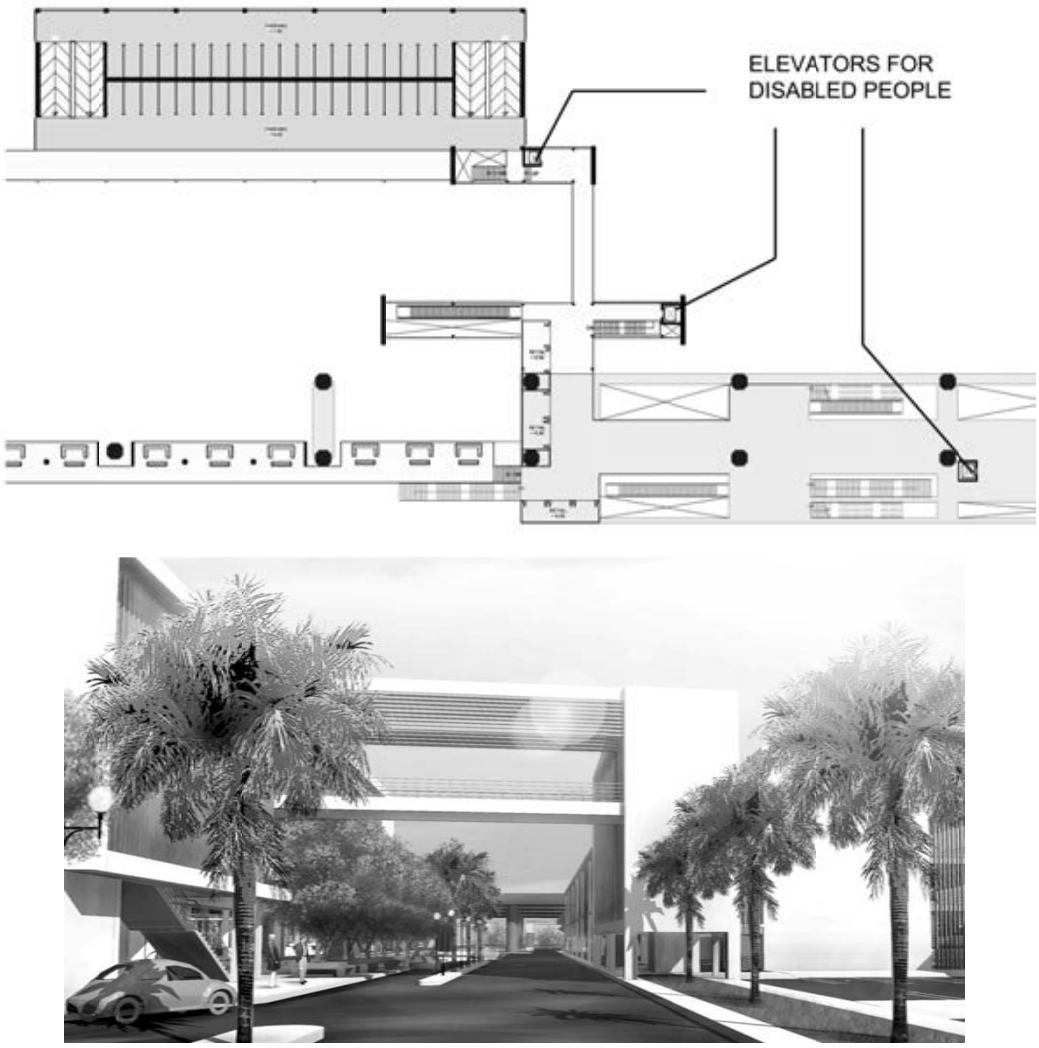



**Figure 7.48 Position of elevators for disabled people access (top) and skywalk access from the station to the parking building (bottom)**

## 4.7. ACTIVITIES ENGAGEMENT

### 4.7.1. COMMERCIAL AREA

Located in wetland conservation rural and agricultural area “green hatch A1”, commercial building in this area is very limited, only up to 300 m2. Furthermore, very limited site condition does not allow building any big commercial space. The main commercial activities for this station focus more on street vendors on the ground level and small kiosk on the skywalk level. Nevertheless, although cannot be too big, the presence of big commercial is still needed to contain public toilet facility as in 2 previous stations. The biggest commercial is convenient store that is located at most congested area, adjacent to drop-off point and taxi terminal. The convenient store has 110 m2 sales area and public toilet facility inside it.

### 4.7.2. STATION PLAZA/ PARK

Unlike 2 previous stations, the limited land plot and critical position of the station near the junction point make it difficult for people doing social and economic activities or connecting communities in big open public space. Nevertheless, the presence of station plaza with the landmark is still needed to signify the presence of the station, enrich the walking experience and view for pedestrian, and, in the end, make the environment safer and secured.

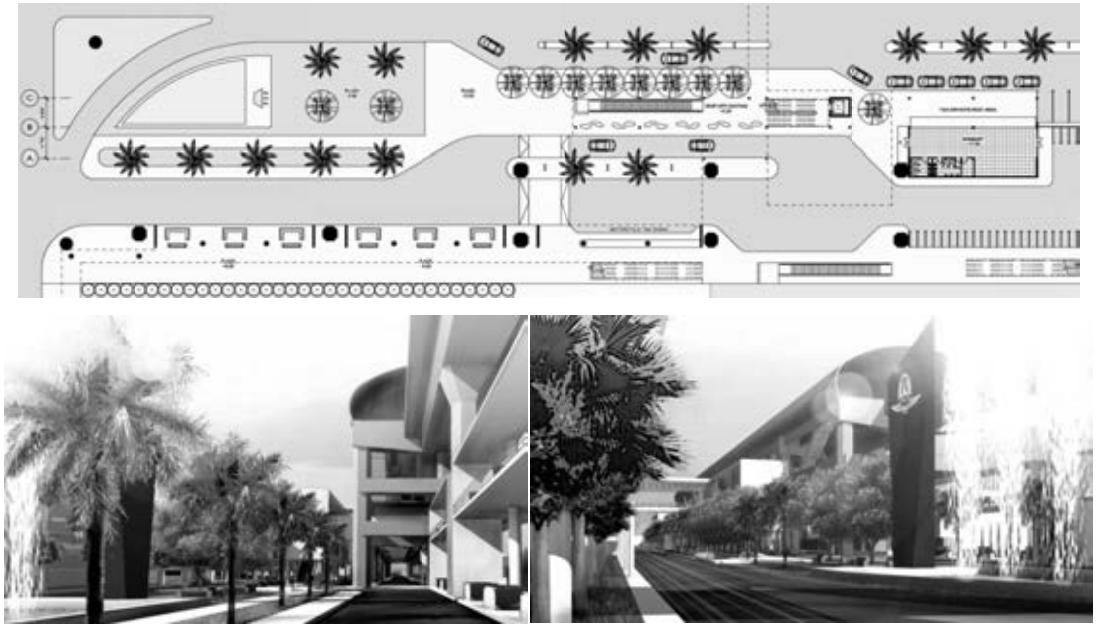


**Figure 7.49 Position of station plaza at the corner adjacent to drop-off/ waiting area (top) and *Lat Krabang* station plaza with landmark (bottom)**

**Figure 7.50 *Lat Krabang* ARL station proposed design overview**

## 5. SUMMARY OF DESIGN PROPOSAL

This chapter has discussed the possible architectural design proposal as an example to establish the connection between ARL station and the main road and other transportation modes for 3 ARL stations located in Bangkok suburban area: *Hua Mak, Ban Tap Chang,* and *Lat Krabang*. The complete design drawing documents are attached in appendices section of this book.

All of the proposed sites for new facility of each ARL station are the empty land plots adjacent to the station to avoid tearing down any existing building. Therefore, the design proposal faced the challenge of limited site as well as limited development due to BMA regulation and low-density condition.

According to literature review, site analysis, and user survey, the facility programs proposed for the site are as the followings:

- Pedestrian walk: sidewalk/ walkway and crossing bridge
- Public transport stops/ terminal
- Paratransit stands for taxi and motorcycle-taxi
- Drop-off and waiting area
- Parking for: cars, motorcycle, bicycle, and disabled people
- Activities engagement: retails, street vendors, toilet, and station plaza/ park

# CHAPTER VIII
# CONCLUSION AND SUGGESTION

## 1. CONCLUSION

Bangkok Airport Rail Link (ARL) is one of three metro systems besides Bangkok mass Transit System (BTS) and Metropolitan Rapid Transit (MRT) that serve Bangkok downtown and suburban. Owned and operated by State Railway of Thailand, Airport Rail Link connect downtown Bangkok to *Suvarnabhumi* Airport through 7 elevated stations, spread in urban and suburban area, and 1 underground station at the airport.

Unlike BTS and MRT, ARL was built along the existing railway instead of the arterial roadway. All elevated ARL stations were built adjacent to local train station that is owned by State Railway of Thailand as well and far-off from the main road that is served by other public transportations. Therefore, only paratransit and private vehicle can reach the station or people need to walk for 100 – 400 m from the main road to the station. In urban area, some commercial planning, such as *Makkassan* Complex and A-Link Square for *Makkassan – Ramkhamhaeng* area, has been developed on the area near ARL station to be connected with the ARL station directly and fill the gap between the station and the main road. Nevertheless, in suburban area, such as *Hua Mak, Ban Tap Chang,* and *Lat Krabang*, the area development planning has not been resolved and still leaves the station stands in the middle of barren land. Moreover, Bangkok Metropolis Administration has the regulation that limits the development in suburban area. This factor, besides the low density area and land limitation, makes big commercial area approach, as the ones have been planned for *Makkassan – Ramkhamhaeng* area, difficult to apply for suburban stations.

### 1.1. DESIGN CONCLUSION

Through design experiments in 3 different suburban ARL station site conditions, it is revealed that there are several mutual outlines for determined spatial arrangement as can be seen on Figure 7.1, such as: pedestrian and vehicular zones separation, pedestrian crossing, motorcycles and bicycles parking, most people congested area, station plaza, and car parking facilities.

Pedestrian walking route should be separated from vehicular road with minimum intersection between them to make safety for pedestrian walking. The separation between 2 lines can be done through making different zoning for pedestrian and vehicle. To invoke the surveillance, pedestrian zone should be “the front face” of area, adjacent to access road, and the vehicle zone for parking is behind the pedestrian zone, buffered by user activities. The other way to make this separation is using skywalk network on limited land plot.

Since ARL station is not located in the middle of road median such as BTS station, pedestrian crossing (crossing bridge or skywalk) is a most to make safety for pedestrian since train passengers come from both direction of road lanes. It should connect the area across the road with station plaza or ARL station directly.

The closest transit facilities to the main entrance is bicycle and motorcycle parking according to literature review and current people’s habit to park their bicycle and motorcycle next to the main entrance. To minimize the intrusion of pedestrian zone, it should be located behind the main staircase/ entrance and has access from vehicular road.

Other transit facilities next to the main station entrance are drop-off waiting area, taxi stand, and motorcycle-taxi stand. These 3 transit facilities are positioned next each other in front of the main station entrance, forming the “most people congested area”. Big retail such as supermarket or convenient store should take place in this area as well. Public toilet facility should be emerged within this big retail to ensure the maintenance and access control to it.

As the metro station’s position is away from the main street, the presence of station plaza with the landmark next to the main road is important to signify the presence of metro station in the area. The station plaza is connecting the main road and the “most people congested area”. As the passengers walking through it from the road to metro station and vice versa, the station plaza can enrich the walking experience and view for pedestrian, and, in the end, make the environment safer and secured.

Car parking area could be located away at maximum distance of 400 m from the station entrance. It should have pedestrian access/ exit to pedestrian zone such as station plaza, commercial area, or skywalk to make people walk from parking area to the station safely.

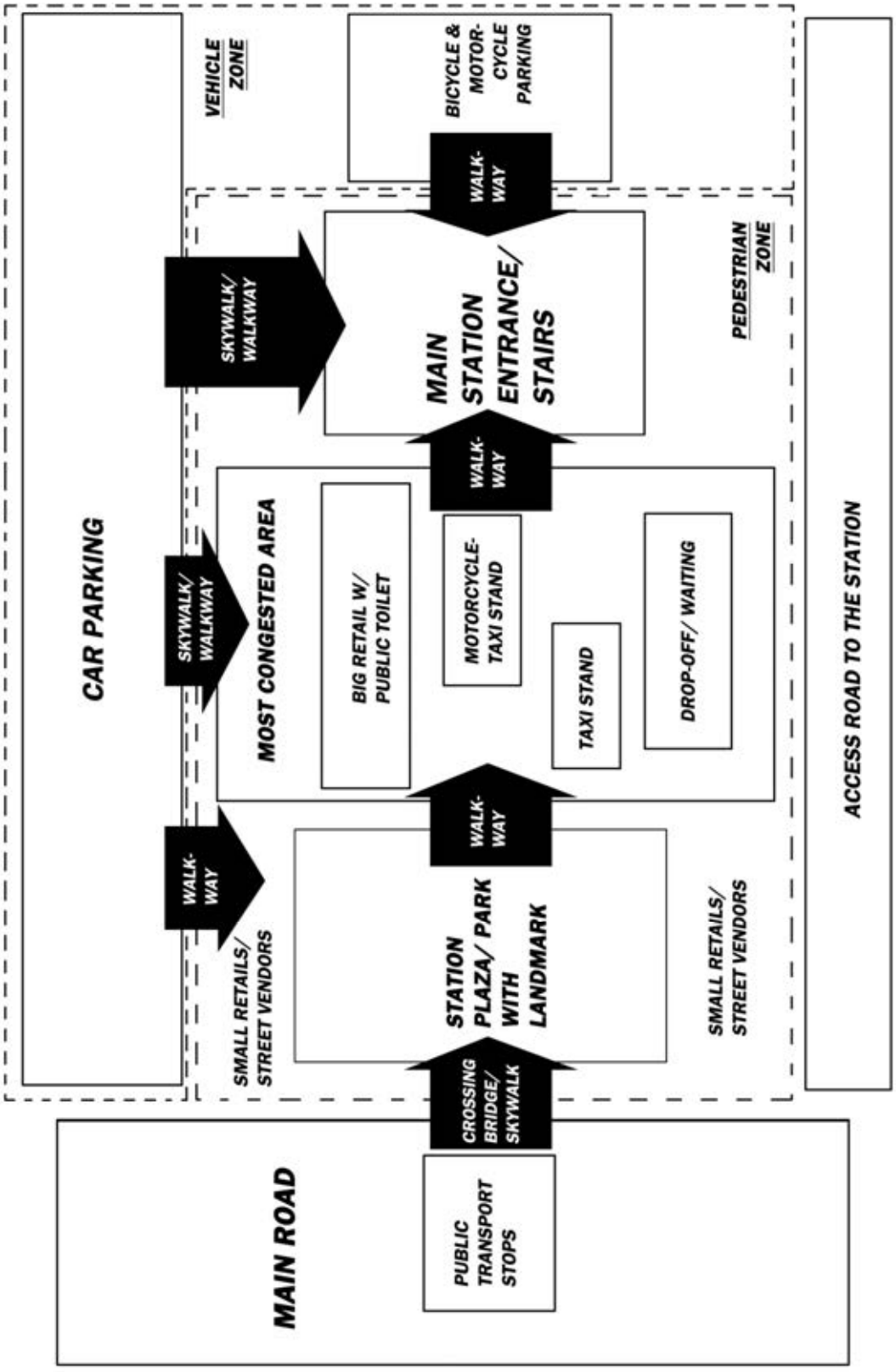



**Figure 8.1 Spatial arrangement for transit facility connecting the main road and ARL station**

## 1.2. STUDY CONCLUSION

Due to limited access to the authority, the data gathering method is mainly done by direct approach method: through field observation and questionnaire survey to the station users; instead of analyzing data obtained from the authority. The specific requirements, such as dimension and quantity, are measured directly on the field. This method however is not practical, especially if the research needs to make generalization from various site's condition. Nevertheless, the direct approach method can obtain the actual condition and current passenger opinion to the transit facility to assemble the spatial program requirements. It also can give a surprising result that has not been hypothesized by literature review nor assumed by the authority before, such as motorcycle parking facility, motorcycle-taxi needs, sheltered corridor, and station plaza. Therefore, this method is suitable for condition in Bangkok: tropical and developing city, which is not specified in most literature that is based on western situation.

The use of Building Information Modeling (BIM) application in the design process, from the site analysis modeling until design completion, was also a great help to model and simulate the site and building quickly. The actual measurement such as site orientation, site area, space dimension, building and shading orientation, and other quantity requirements for the designed building can be predicted in more accurate way. The building design also can be explored more in detail as the 3D model is easier to comprehend and the documentation can be done automatically.

## 2. SUGGESTION FOR FURTHER RESEARCH

This study mainly approaches the problem based on users' demand, ideal condition from literature theory, and site restriction as the framework. Another approach that can be done for further research is based on developer's or owner's requirement, in this case State Railway of Thailand or any other private developers. Thus, the economic feasibility can be also consideration factor in deciding the spatial program for transit facility. The next research for Airport Rail Link can also be more focused on specific aspect such as commercial area connected to metro station.

Due to limitation of resource and time, this research does not included much data from official ARL sources. Therefore, if the next research shall approach from ARL perspective, it should include complete data from ARL officials as well. The next research also can include the experts' opinion and review to judge the design decision. It should also study more about the law and regulation for station/ public building in Bangkok to make more realistic approach.

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# APPENDICES

**APPENDIX A:**

**แบบสอบถามเกี่ยวกับโครงการระบบขนส่งทางรถไฟเชื่อมท่าอากาศยานสุวรรณภูมิและสถานีขนส่งผู้โดยสารอากาศยานในเมือง(แอร์พอร์ตเรลลิงค์)**

แบบสอบถามชุดนี้เป็นงานวิจัยสำรวจพฤติกรรมและความต้องการของผู้ที่เกี่ยวข้องต่อการใช้บริการระบบขนส่งทางรถไฟเชื่อมท่าอากาศยานสุวรรณภูมิและสถานีขนส่งผู้โดยสารอากาศยานในเมือง (แอร์พอร์ตเรลลิงค์)เฉพาะสถานีหัวหมาก เพื่อประกอบวิทยานิพนธ์เรื่อง Design Guidelines for Arrival Zone Of Non-Road Adjacent Elevated Metro Station: Case Study of Bangkok Airport Rail Link (ARL) Station ของ GregoriusGeganaนิสิตปริญญาโท หลักสูตรสถาปัตยกรรมศาสตร์มหาบัณฑิต(นานาชาติ) คณะสถาปัตยกรรมศาสตร์จุฬาลงกรณ์มหาวิทยาลัย

ดังนั้นจึงใคร่ขอความร่วมมือจากท่าน กรุณาตอบแบบสอบถามให้สมบูรณ์ ข้อมูลทั้งหมดที่ท่านตอบมาจะเป็นประโยชน์อย่างยิ่งสำหรับงานวิจัยครั้งนี้ จะไม่มีผลกระทบต่อท่าน ขอขอบคุณที่ท่านให้ความร่วมมือในการตอบ แบบสอบถามครั้งนี้

**<u>สำหรับผู้ใช้บริการโดยสาร</u>**

**<u>ตอนที่1</u>**

1. ท่านใช้บริการโดยสารแอร์พอร์ตเรลลิงค์บ่อยเท่าใด
   - ก. ทุกๆวัน
   - ข. ทุกวันธรรมดา(วันทำงานหรือวันเรียน)
   - ค. ทุกวันหยุดเสาร์อาทิตย์ หรือวันหยุดราชการ
   - ง. ประมาณเดือนละครั้ง
   - จ. นานๆ ครั้ง
2. สาเหตุหลักที่ท่านใช้บริการโดยสารแอร์พอร์ตเรลลิงค์คือ
   - ก. เพื่อไปทำงาน
   - ข. เพื่อไปเรียน
   - ค. เพื่อเดินทางไปสนามบิน
   - ง. เพื่อการเข้าเมือง(จากสนามบิน)
   - จ. อื่นๆ(กรุณาระบุ).....
3. ท่านเดินทางเพื่อมาใช้บริการโดยสารแอร์พอร์ตเรลลิงค์สถานีหัวหมากอย่างไร
   - ก. โดยรถโดยสารสาธารณะ(เช่น รถเมล์ รถสองแถว)
   - ข. โดยรถแท็กซี่
   - ค. โดยรถจักรยานยนตร์รับจ้าง
   - ง. โดยรถส่วนบุคคลที่มีผู้อื่นมาส่ง

จ. โดยขับรถส่วนบุคคลมาเอง

ฉ. โดยขี่จักรยาน

ช. โดยการเดิน

**ตอนที่ 2**

4. ท่านต้องใช้เวลาเท่าใดในการรอในบริเวณสถานีเพื่อโดยสารแอร์พอร์ตเรลลิงค์สถานีหัวหมาก หรือ รอที่จะเดินทางออกจากสถานีไปที่อื่น (ประมาณ)

ก. น้อยกว่า 10 นาที

ข. 10-20 นาที

ค. 20-30 นาที

ง. 30-45 นาที

จ. 45-60 นาที

ฉ. มากกว่า 60 นาที

5. กิจกรรมใดที่ท่านอยากใช้เวลาเมื่อท่านรอรับญาติหรือคนรู้จักที่สถานี

ก. นั่ง

ข. ซื้ออาหาร ขนมขบเคี้ยว หรือเครื่องดื่ม

ค. ชมรายการโทรทัศน์ หรือการแสดงบันเทิงอื่นๆ

ง. ช็อปปิง

จ. สูบบุหรี่

ฉ. อื่นๆ (กรุณาระบุ).....

**ตอนที่ 3**

6. ท่านคิดว่าสิ่งอำนวยความสะดวกใดที่ควรปรับปรุงในบริเวณแอร์พอร์ตลิงค์ สถานีหัวหมาก

   กรุณาเลือก 3 ข้อที่ท่านคิดว่าควรปรับปรุง โดยมีลำดับความสำคัญจาก 1 ไปถึง 3

   - […] ทางเท้า
   - […] ที่นั่งรอที่มีหลังคาคลุมภายในสถานี
   - […] ที่รอรถโดยสารประจำทาง
   - […] ที่จอดรถ(ปรับปรุง หรือเพิ่มปริมาณ)
   - […] ที่จอดจักรยานยนตร์(ปรับปรุง หรือเพิ่มปริมาณ)
   - […] ที่จอดจักรยาน(ปรับปรุง หรือเพิ่มปริมาณ)
   - […] ที่รอรถรับจ้าง(แท็กซี่ หรือจักรยานยนตร์รับจ้าง)
   - […] สิ่งอำนวนความสะดวกสำหรับผู้พิการ(เช่น ลิฟท์ที่จอดรถพิเศษเป็นต้น)
   - […] อื่นๆ (กรุณาระบุ) …

7. ท่านคิดว่าสิ่งอำนวยความสะดวกใดที่ควรมีเพิ่มในบริเวณแอร์พอร์ตลิงค์ สถานีหัวหมาก

   กรุณาเลือก 3 ข้อที่ท่านคิดว่าควรมีเพิ่ม โดยมีลำดับความสำคัญจาก 1 ไปถึง 3

   - […] ห้องน้ำ
   - […] ที่ขายอาหาร ขนมขบเคี้ยว หรือเครื่องดื่ม
   - […] ร้านขายสินค้า(อื่นๆ นอกจากอาหารและเครื่องดื่ม)

- […] สถานีเติมน้ำมัน หรือ แก๊ส
- […] ที่พักผ่อนหย่อนใจ(เช่น สวนหย่อม สวนเด็กเล่น)
- […] ส่วนสาธารณะที่เกิดประโยชน์ เช่น พิพิธภัณฑ์ หรือ ห้องสมุด
- […] บริการสาธารณะ เช่น บริการสาธารณสุข บริการดูแลเด็ก
- […] แหล่งท่องเที่ยว (เช่น สวนสนุก สวนสัตว์ เป็นต้น)
- […] อื่นๆ (กรุณาระบุ) …

**APPENDIX B:**

**แบบสอบถามเกี่ยวกับโครงการระบบขนส่งทางรถไฟเชื่อมท่าอากาศยานสุวรรณภูมิและสถานีขนส่งผู้โดยสารอากาศยานในเมือง(แอร์พอร์ตเรลลิงค์)**

แบบสอบถามชุดนี้เป็นงานวิจัยสำรวจพฤติกรรมและความต้องการของผู้ที่เกี่ยวข้องต่อการใช้บริการระบบขนส่งทางรถไฟเชื่อมท่าอากาศยานสุวรรณภูมิและสถานีขนส่งผู้โดยสารอากาศยานในเมือง (แอร์พอร์ตเรลลิงค์)เฉพาะสถานีหัวหมาก เพื่อประกอบวิทยานิพนธ์เรื่อง Design Guidelines for Arrival Zone Of Non-Road Adjacent Elevated Metro Station: Case Study of Bangkok Airport Rail Link (ARL) Station ของ GregoriusGeganaนิสิตปริญญาโท หลักสูตรสถาปัตยกรรมศาสตร์มหาบัณฑิต(นานาชาติ) คณะสถาปัตยกรรมศาสตร์จุฬาลงกรณ์มหาวิทยาลัย

ดังนั้นจึงใคร่ขอความร่วมมือจากท่าน กรุณาตอบแบบสอบถามให้สมบูรณ์ ข้อมูลทั้งหมดที่ท่านตอบมาจะเป็นประโยชน์อย่างยิ่งสำหรับงานวิจัยครั้งนี้ จะไม่มีผลกระทบต่อท่าน ขอขอบคุณที่ท่านให้ความร่วมมือในการตอบ แบบสอบถามครั้งนี้

**สำหรับผู้เดินทางมาสถานีหัวหมากโดยพาหนะส่วนบุคคล เพื่อรับส่งคนรู้จัก (เพื่อน หรือญาติ)**

**ตอนที่1**

1. ท่านเดินทางมาแอร์พอร์ตเรลลิงค์สถานีหัวหมากอย่างไร

   ก. รถส่วนบุคคล

   ข. จักรยานส่วนบุคคล

2. ท่านเดินทางมาที่แอร์พอร์ตเรลลิงค์สถานีหัวหมากเพื่อรับส่งคนรู้จัก บ่อยเท่าใด

   ก. ทุกๆวัน

   ข. ทุกวันธรรมดา(วันทำงาน)

   ค. ทุกวันหยุดเสาร์อาทิตย์ หรือวันหยุดราชการ

   ง. ประมาณเดือนละครั้ง

   จ. นานๆ ครั้ง

3. ช่วงเวลาใดที่ท่านมีโอกาสรับส่งญาติหรือคนรู้จักที่แอร์พอร์ตลิงค์ บ่อยที่สุด(กรุณาระบุ)

**ตอนที่ 2**

4. ท่านต้องใช้เวลาเท่าใดในการรอรับลูกค้า (ประมาณ)

   ก. น้อยกว่า 10 นาที

   ข. 10-20 นาที

   ค. 20-30 นาที

   ง. 30-45 นาที

   จ. 45-60 นาที

   ฉ. มากกว่า 60 นาที

5. กิจกรรมใดที่ท่านอยากใช้เวลาเมื่อท่านรอรับลูกค้าที่สถานี

ก. นั่ง

ข. ซื้ออาหาร ขนมขบเคี้ยว หรือเครื่องดื่ม

ค. ชมรายการโทรทัศน์ หรือการแสดงบันเทิงอื่นๆ

ง. ช็อปปิง

จ. สูบบุหรี่

ฉ. อื่นๆ (กรุณาระบุ).....

**<u>ตอนที่ 3</u>**

6. ท่านคิดว่าสิ่งอำนวยความสะดวกใดที่ควรปรับปรุงในบริเวณแอร์พอร์ตลิงค์ สถานี หัวหมาก

กรุณาเลือก 3 ข้อที่ท่านคิดว่าควรปรับปรุง โดยมีลำดับความสำคัญจาก 1 ไปถึง 3

- [...] ทางเท้า
- [...] ที่นั่งรอที่มีหลังคาคลุมภายในสถานี
- [...] ที่รอรถโดยสารประจำทาง
- [...] ที่จอดรถ(ปรับปรุง หรือเพิ่มปริมาณ)
- [...] ที่จอดจักรยานยนตร์(ปรับปรุง หรือเพิ่มปริมาณ)
- [...] ที่จอดจักรยาน(ปรับปรุง หรือเพิ่มปริมาณ)
- [...] ที่รอรถรับจ้าง(แท็กซี่ หรือจักรยานยนตร์รับจ้าง)
- [...] สิ่งอำนวนความสะดวกสำหรับผู้พิการ(เช่น ลิฟท์ที่จอดรถพิเศษเป็นต้น)

- […] อื่นๆ (กรุณาระบุ) …

7. ท่านคิดว่าสิ่งอำนวยความสะดวกใดที่ควรมีเพิ่มในบริเวณแอร์พอร์ตลิงค์ สถานีหัวหมาก กรุณาเลือก 3 ข้อที่ท่านคิดว่าควรมีเพิ่ม โดยมีลำดับความสำคัญจาก 1 ไปถึง 3

- […] ห้องน้ำ
- […] ที่ขายอาหาร ขนมขบเคี้ยว หรือเครื่องดื่ม
- […] ร้านขายสินค้า(อื่นๆ นอกจากอาหารและเครื่องดื่ม)
- […] สถานีเติมน้ำมัน หรือ แก๊ส
- […] ที่พักผ่อนหย่อนใจ(เช่น สวนหย่อม สวนเด็กเล่น)
- […] ส่วนสาธารณะที่เกิดประโยชน์ เช่น พิพิธภัณฑ์ หรือ ห้องสมุด
- […] บริการสาธารณะ เช่น บริการสาธารณสุข บริการดูแลเด็ก
- […] แหล่งท่องเที่ยว (เช่น สวนสนุก สวนสัตว์ เป็นต้น)
- […] อื่นๆ (กรุณาระบุ) …

**APPENDIX C:**

**แบบสอบถามเกี่ยวกับโครงการระบบขนส่งทางรถไฟเชื่อมท่าอากาศยานสุวรรณภูมิและสถานีขนส่งผู้โดยสารอากาศยานในเมือง(แอร์พอร์ตเรลลิงค์)**

แบบสอบถามชุดนี้เป็นงานวิจัยสำรวจพฤติกรรมและความต้องการของผู้ที่เกี่ยวข้องต่อการใช้บริการระบบขนส่งทางรถไฟเชื่อมท่าอากาศยานสุวรรณภูมิและสถานีขนส่งผู้โดยสารอากาศยานในเมือง (แอร์พอร์ตเรลลิงค์)เฉพาะสถานีหัวหมาก เพื่อประกอบวิทยานิพนธ์เรื่อง Design Guidelines for Arrival Zone Of Non-Road Adjacent Elevated Metro Station: Case Study of Bangkok Airport Rail Link (ARL) Station ของ GregoriusGegana นิสิตปริญญาโท หลักสูตรสถาปัตยกรรมศาสตร์มหาบัณฑิต(นานาชาติ) คณะสถาปัตยกรรมศาสตร์จุฬาลงกรณ์มหาวิทยาลัย

ดังนั้นจึงใคร่ขอความร่วมมือจากท่าน กรุณาตอบแบบสอบถามให้สมบูรณ์ ข้อมูลทั้งหมดที่ท่านตอบมาจะเป็นประโยชน์อย่างยิ่งสำหรับงานวิจัยครั้งนี้ จะไม่มีผลกระทบต่อท่าน ขอขอบคุณที่ท่านให้ความร่วมมือในการตอบ แบบสอบถามครั้งนี้

**<u>สำหรับผู้ที่ขับขี่รถรับจ้าง(รถแท็กซี่ หรือ จักรยานยนต์รับจ้าง)</u>**

**<u>ตอนที่1</u>**

1. ท่านเดินทางมาที่แอร์พอร์ตเรลลิงค์สถานีหัวหมากเพื่อรับส่ง บ่อยเท่าใด

   ก. ทุกๆวัน

   ข. ทุกวันธรรมดา(วันทำงาน หรือ วันเรียน)

   ค. ทุกวันหยุดเสาร์อาทิตย์ หรือวันหยุดราชการ

   ง. ประมาณเดือนละครั้ง

   จ. นานๆ ครั้ง

**<u>ตอนที่ 2</u>**

2. ท่านต้องใช้เวลาเท่าใดในการรอรับลูกค้า (ประมาณ)

   ช. น้อยกว่า 10 นาที

   ซ. 10-20 นาที

   ฌ. 20-30 นาที

   ญ. 30-45 นาที

   ฎ. 45-60 นาที

   ฏ. มากกว่า 60 นาที

3. กิจกรรมใดที่ท่านอยากใช้เวลาเมื่อท่านรอรับลูกค้าที่สถานี

   ช. นั่ง

   ซ. ซื้ออาหาร ขนมขบเคี้ยว หรือเครื่องดื่ม

ฌ. ชมรายการโทรทัศน์ หรือการแสดงบันเทิงอื่นๆ

ญ. ช็อปปิง

ฎ. สูบบุหรี่

ฏ. อื่นๆ (กรุณาระบุ).....

**ตอนที่** 3

4. ท่านคิดว่าสิ่งอำนวยความสะดวกใดที่ควรปรับปรุงในบริเวณแอร์พอร์ตลิงค์ สถานี หัวหมาก

กรุณาเลือก 3 ข้อที่ท่านคิดว่าควรปรับปรุง โดยมีลำดับความสำคัญจาก 1 ไปถึง 3

- [...] ทางเท้า
- [...] ที่นั่งรอที่มีหลังคาคลุมภายในสถานี
- [...] ที่รอรถโดยสารประจำทาง
- [...] ที่จอดรถ(ปรับปรุง หรือเพิ่มปริมาณ)
- [...] ที่จอดจักรยานยนตร์(ปรับปรุง หรือเพิ่มปริมาณ)
- [...] ที่จอดจักรยาน(ปรับปรุง หรือเพิ่มปริมาณ)
- [...] ที่รอรถรับจ้าง(แท็กซี่ หรือจักรยานยนตร์รับจ้าง)
- [...] สิ่งอำนวนความสะดวกสำหรับผู้พิการ(เช่น ลิฟท์ที่จอดรถพิเศษเป็นต้น)
- [...] อื่นๆ (กรุณาระบุ) ...

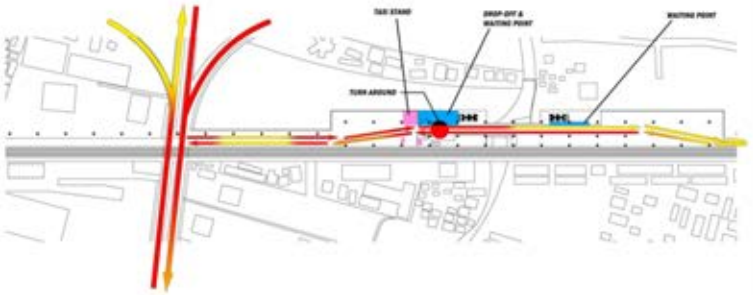
5. ท่านคิดว่าสิ่งอำนวยความสะดวกใดที่ควรมีเพิ่มในบริเวณแอร์พอร์ตลิงค์ สถานีหัวหมาก กรุณาเลือก 3 ข้อที่ท่านคิดว่าควรมีเพิ่ม โดยมีลำดับความสำคัญจาก 1 ไปถึง 3

- [...] ห้องน้ำ
- [...] ที่ขายอาหาร ขนมขบเคี้ยว หรือเครื่องดื่ม
- [...] ร้านขายสินค้า(อื่นๆ นอกจากอาหารและเครื่องดื่ม)
- [...] สถานีเติมน้ำมัน หรือ แก๊ส
- [...] ที่พักผ่อนหย่อนใจ(เช่น สวนหย่อม สวนเด็กเล่น)
- [...] ส่วนสาธารณะที่เกิดประโยชน์ เช่น พิพิธภัณฑ์ หรือ ห้องสมุด
- [...] บริการสาธารณะ เช่น บริการสาธารณสุข บริการดูแลเด็ก
- [...] แหล่งท่องเที่ยว (เช่น สวนสนุก สวนสัตว์ เป็นต้น)
- [...] อื่นๆ (กรุณาระบุ) ...

**APPENDIX D: DESIGN DRAWINGS: *HUA MAK* ARL STATION**

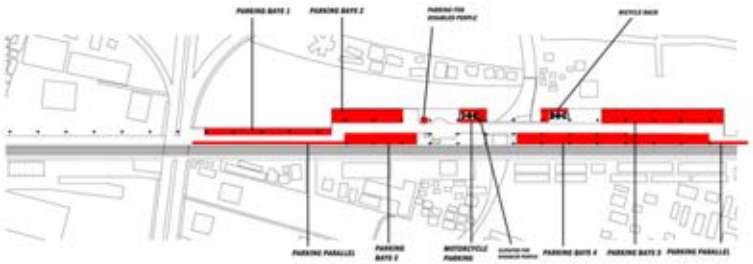

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title LOCATION MAP | Drg. No. A-1<br>Date 03/22/13<br>Scale 1:2000 |

PUBLIC TRANSPORT STOP AND PEDESTRIAN SIDEWALK



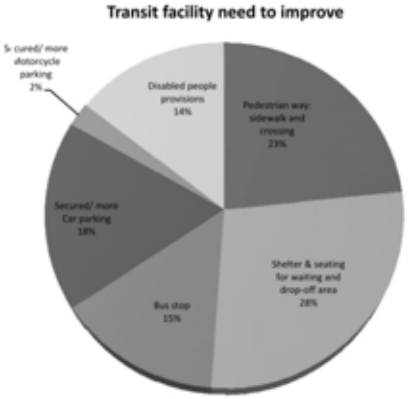
KISS-AND-RIDE AND CAR CIRCULATION

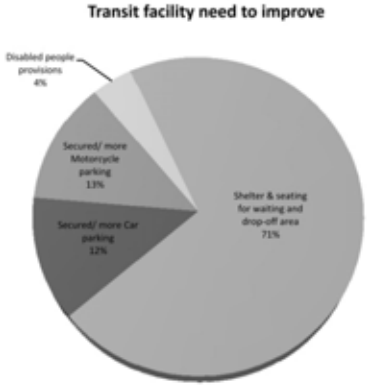
MOTORCYCLE-TAXI CIRCULATION

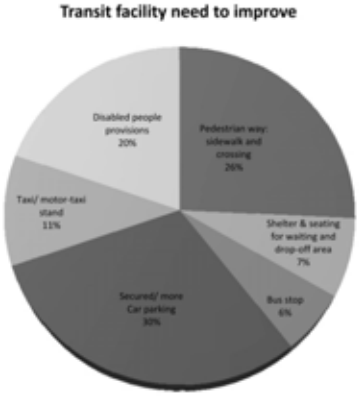


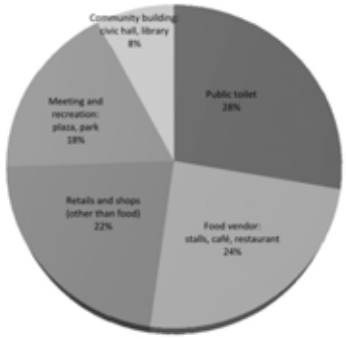
PARK-AND-RIDE LOCATION

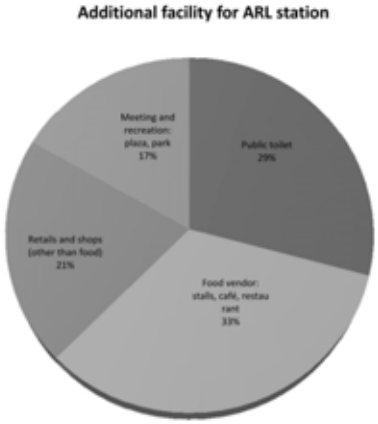
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title SITE ANALYSIS | N<br>Drg. No. A-2<br>Date 03/22/13<br>Scale |

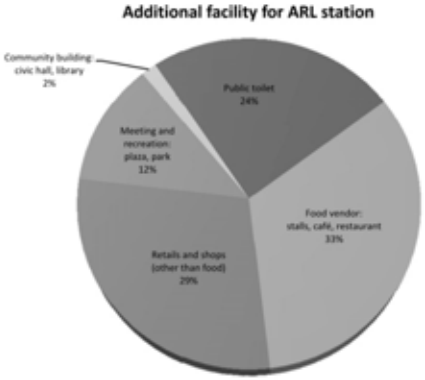


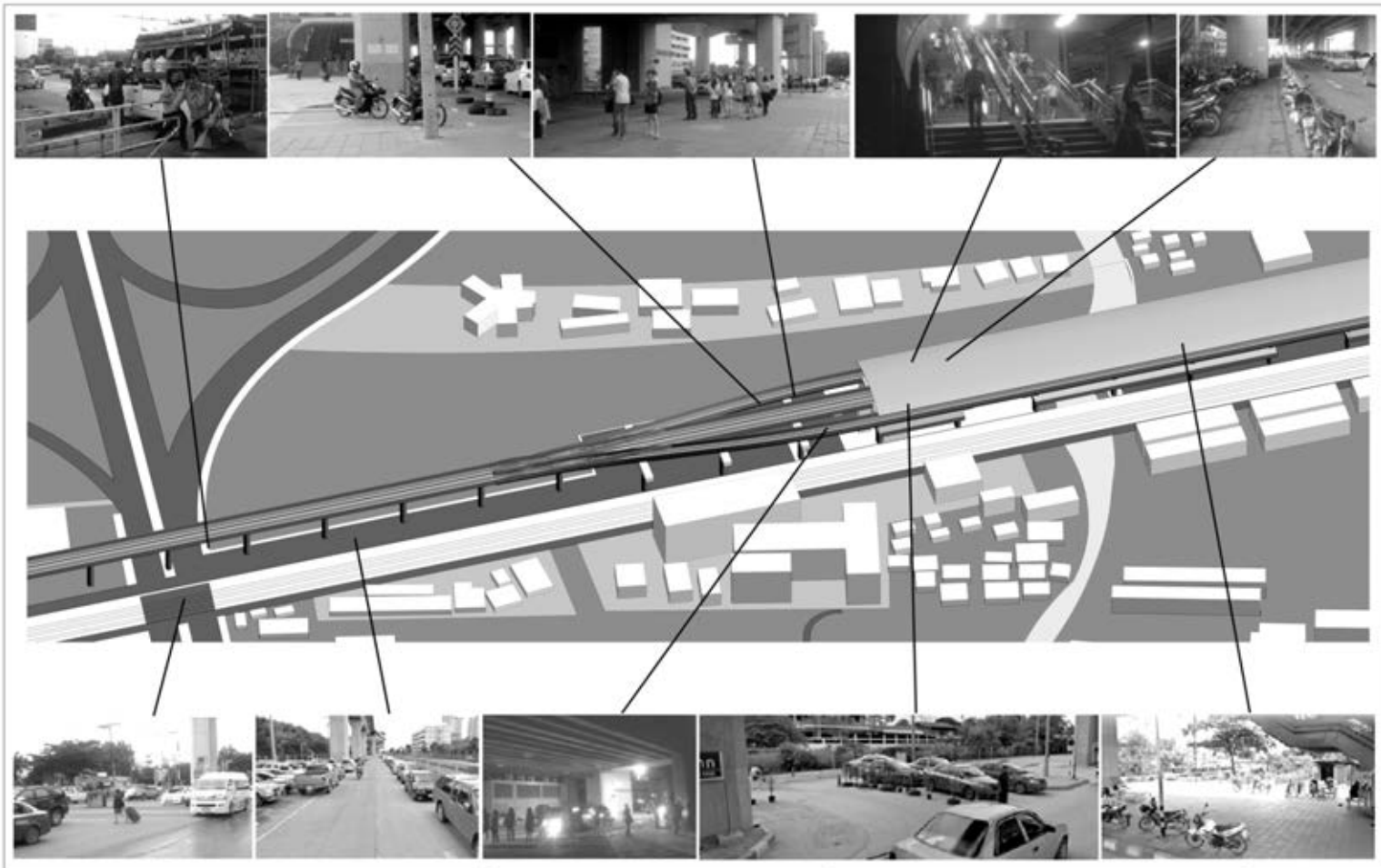




1. USERS SURVEY: PASSENGERS

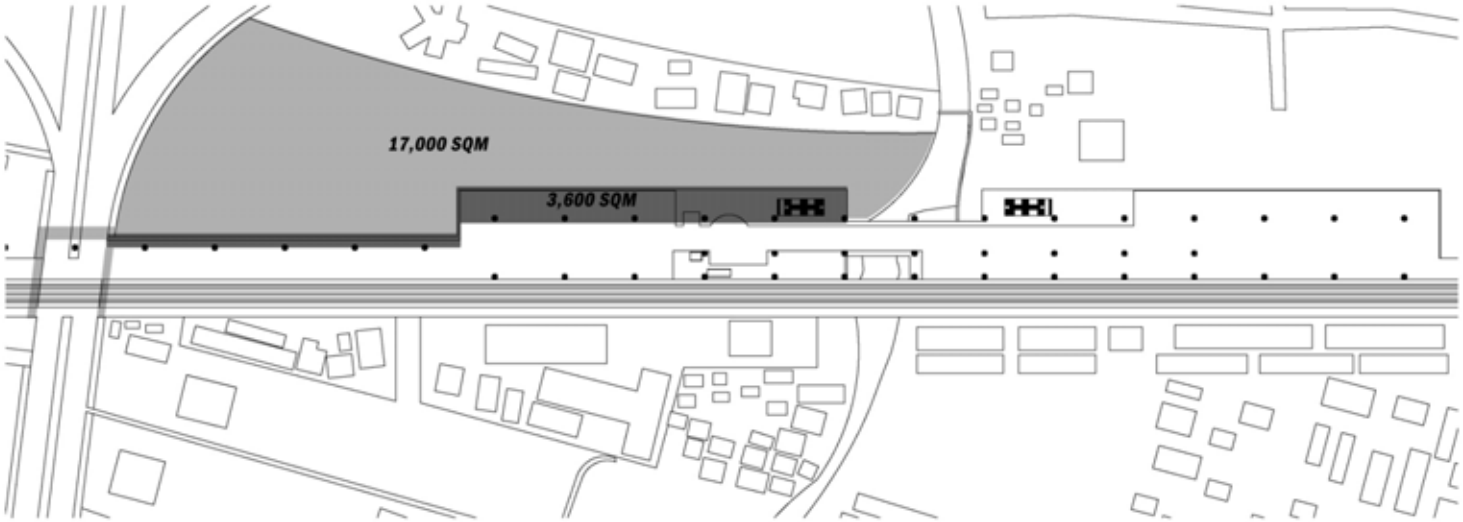
2. USERS SURVEY: DRIVERS

3. USERS SURVEY: PARATRANSIT

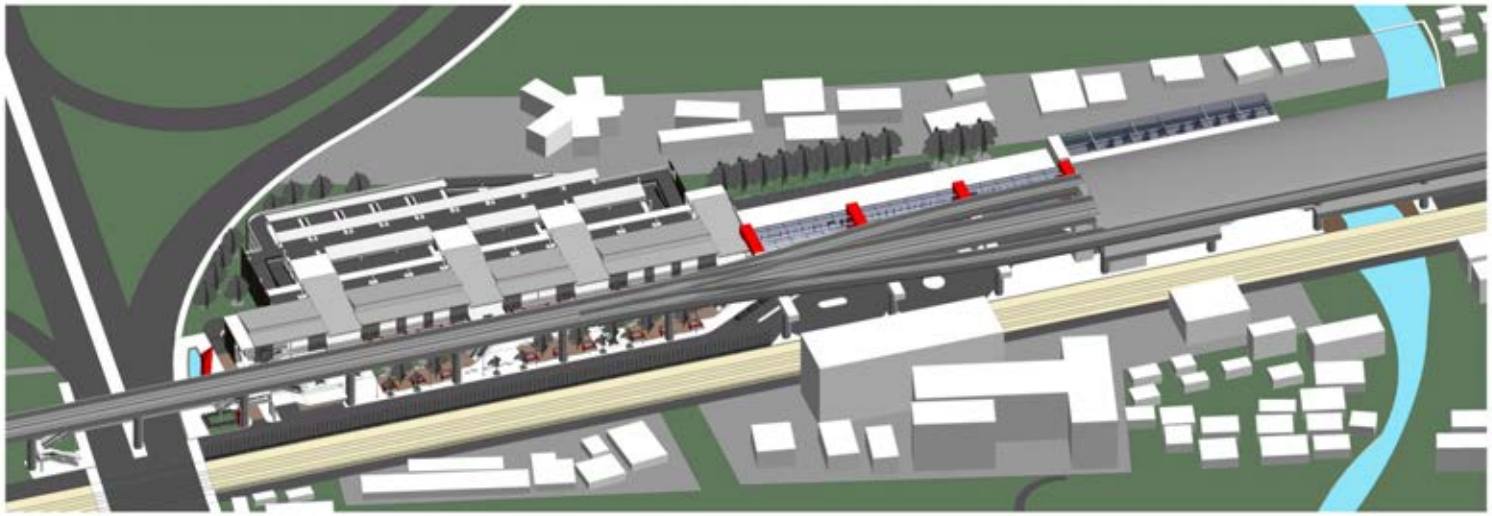
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title USERS SURVEY RESULT | Drg. No. A-3<br>Date 03/22/13<br>Scale |



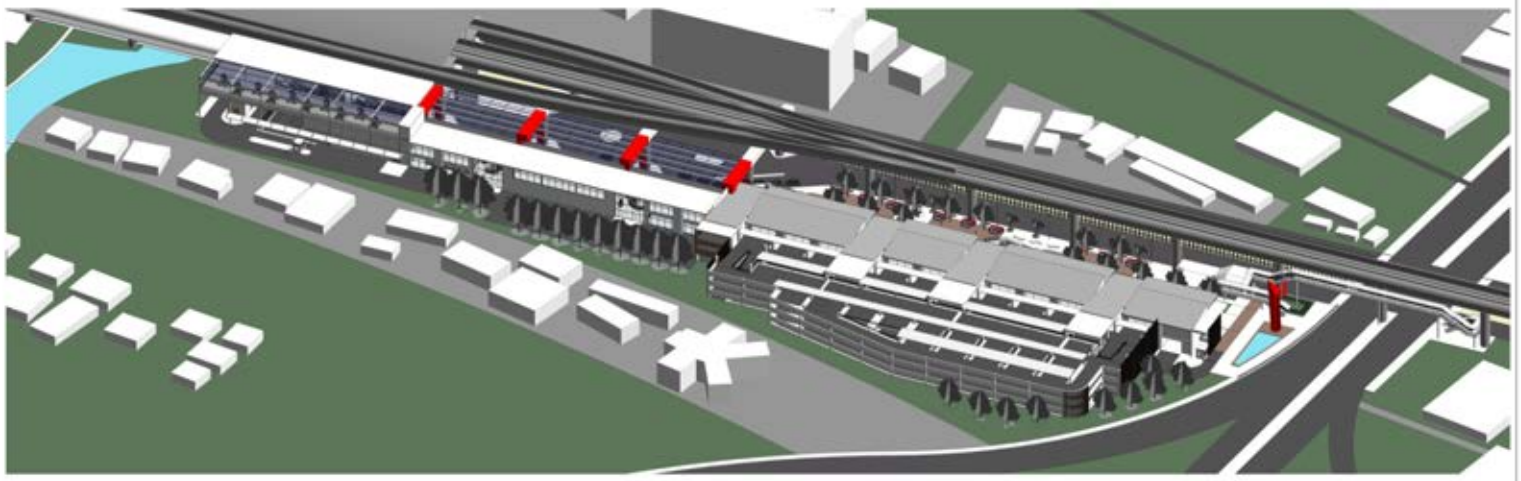
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title SITE CONDITION | Drg. No. A-4<br>Date 03/22/13<br>Scale |




| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title PROPOSED SITE | N<br>Drg. No. A-5<br>Date 03/22/13<br>Scale 1:1600 |

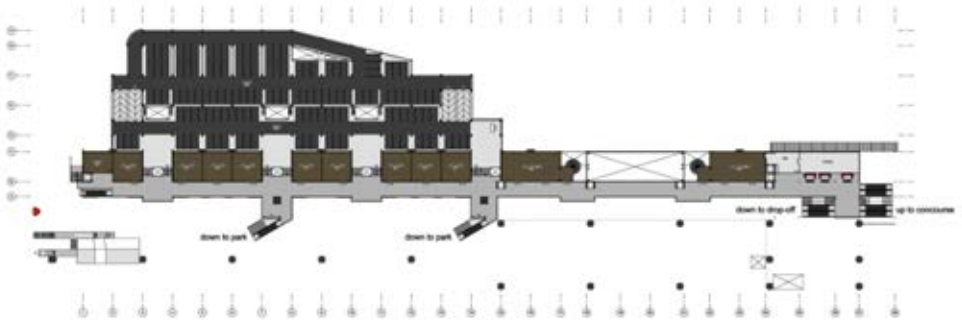


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title OVERALL ISOMETRIC 1 | Drg. No. A-6<br>Date 03/22/13<br>Scale |

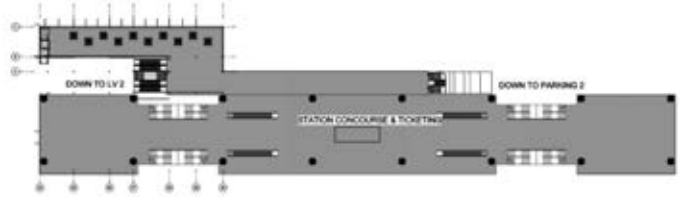


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title OVERALL ISOMETRIC 2 | Drg. No. A-7<br>Date 03/22/13<br>Scale |

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title OVERALL SITE PLAN | N<br>Drg. No. A-8<br>Date 03/22/13<br>Scale 1:1250 |




FLOOR PLAN LEVEL 2



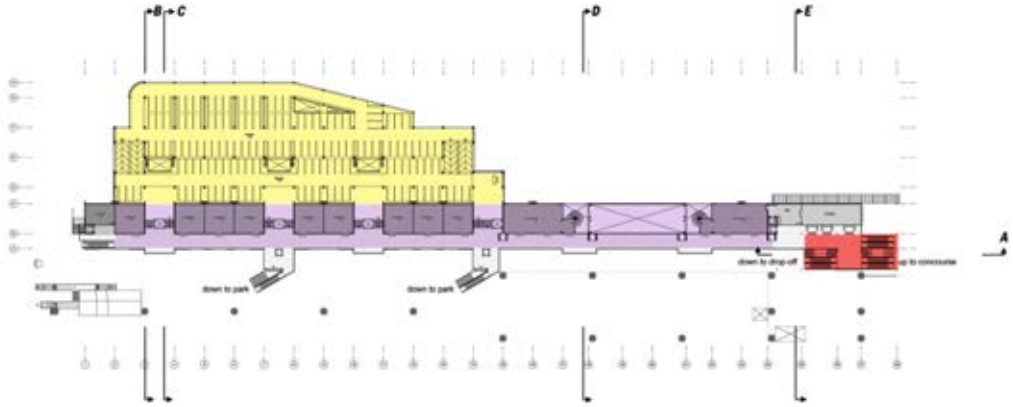

FLOOR PLAN LEVEL 3

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title FLOOR PLAN LEVEL 2 & 3 | N<br>Drg. No. A-9<br>Date 03/22/13<br>Scale 1:1250 |

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title ROOF PLAN | N<br>Drg. No. A-10<br>Date 03/22/13<br>Scale 1:1250 |


PLAZA/ PARK
CAR PARKING
MOTORCYCLE & BICYCLE
PUBLIC TRANSPORT STOP/ TERMINAL
TAXI STAND/ TERMINAL
MOTORCYCLE TAXI
RETAILS
STREET VENDOR
SERVICE AREA
DROP-OFF
MAIN ENTRANCE/ STAIR

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title PROGRAM ZONING LEVEL 1 | N<br>Drg. No. A-11<br>Date 03/22/13<br>Scale 1:1250 |




PLAZA/ PARK
CAR PARKING
MOTORCYCLE & BICYCLE
PUBLIC TRANSPORT STOP/ TERMINAL
TAXI STAND/ TERMINAL
MOTORCYCLE TAXI
RETAILS
STREET VENDOR
SERVICE AREA
DROP-OFF
MAIN ENTRANCE/ STAIR

Project Name
Thesis Design: HUA MAK ARL STATION

GREGORIUS A GEGANA A
I+MARCH PROGRAM

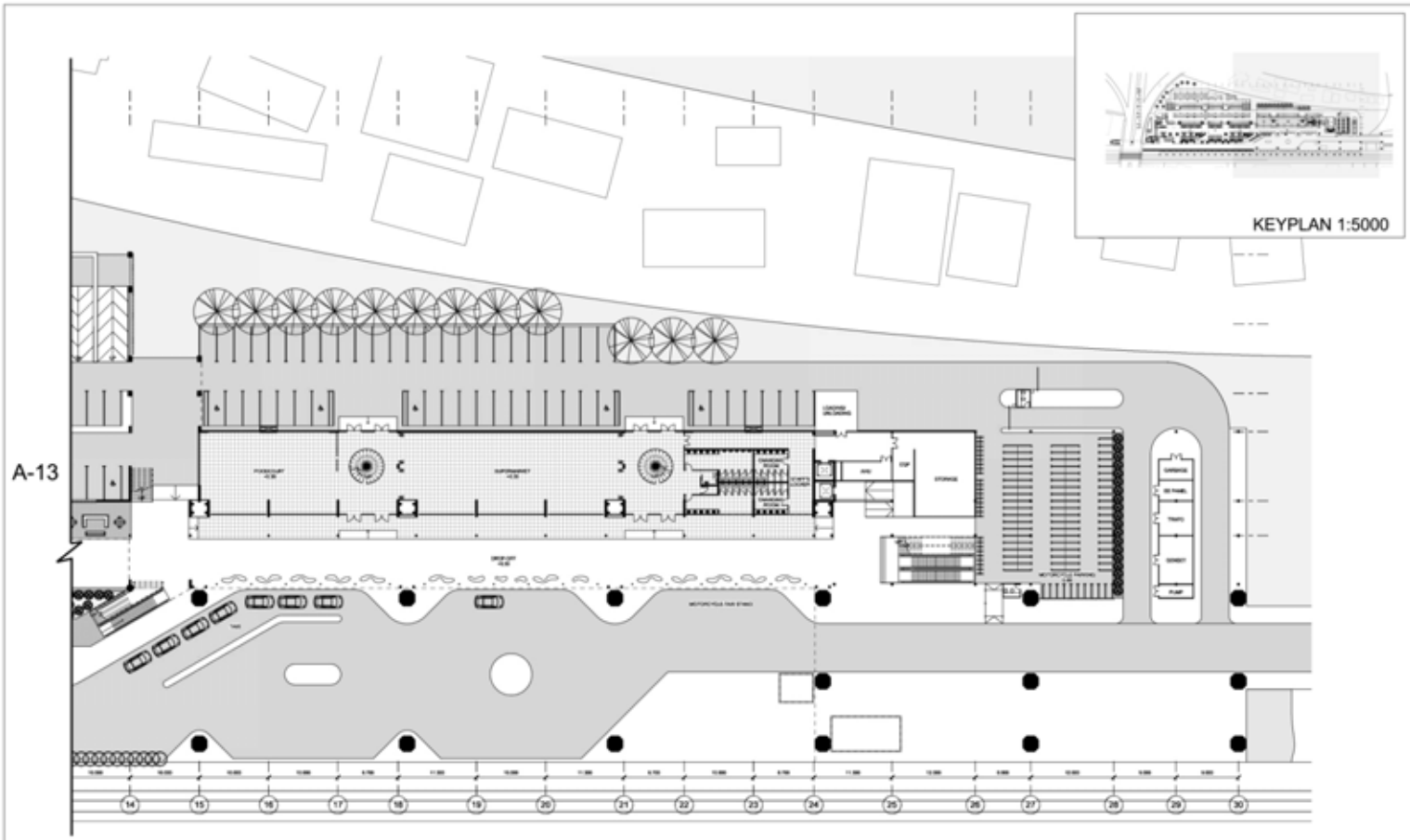
0 10 50 100 m

Drg. Title PROGRAM ZONING LEVEL 2

N

Drg. No. A-12
Date 03/22/13
Scale 1:1250


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title FLOOR PLAN LEVEL 1 ZONE 1 | N<br>Drg. No. A-13<br>Date 03/22/13<br>Scale 1:500 |




Project Name
Thesis Design: HUA MAK ARL STATION

GREGORIUS A GEGANA A

I+MARCH PROGRAM

0 15 30m

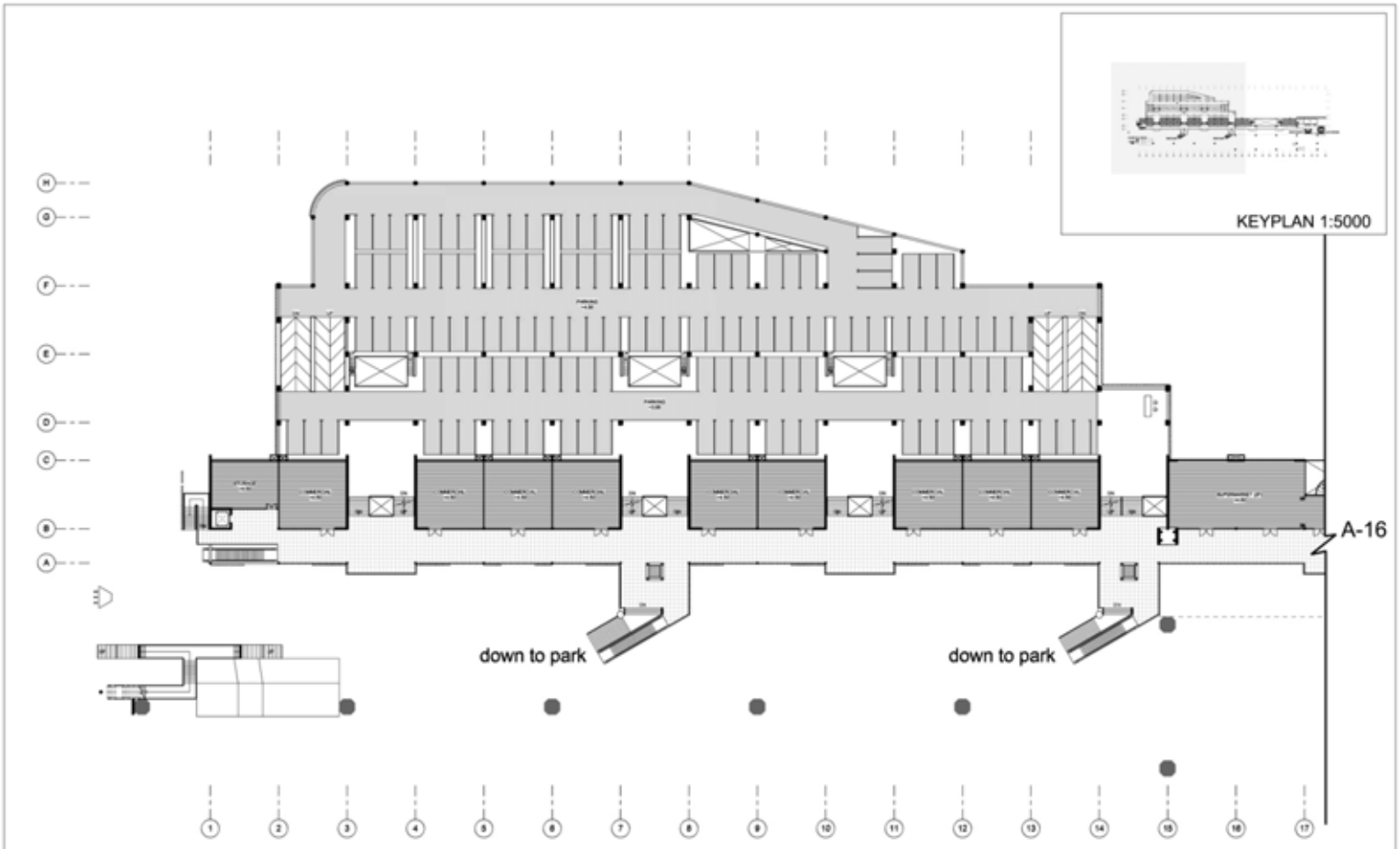
Drg. Title FLOOR PLAN LEVEL 1 ZONE 2

N

Drg. No. A-14

Date 03/22/13

Scale 1:500




Project Name
Thesis Design: HUA MAK ARL STATION

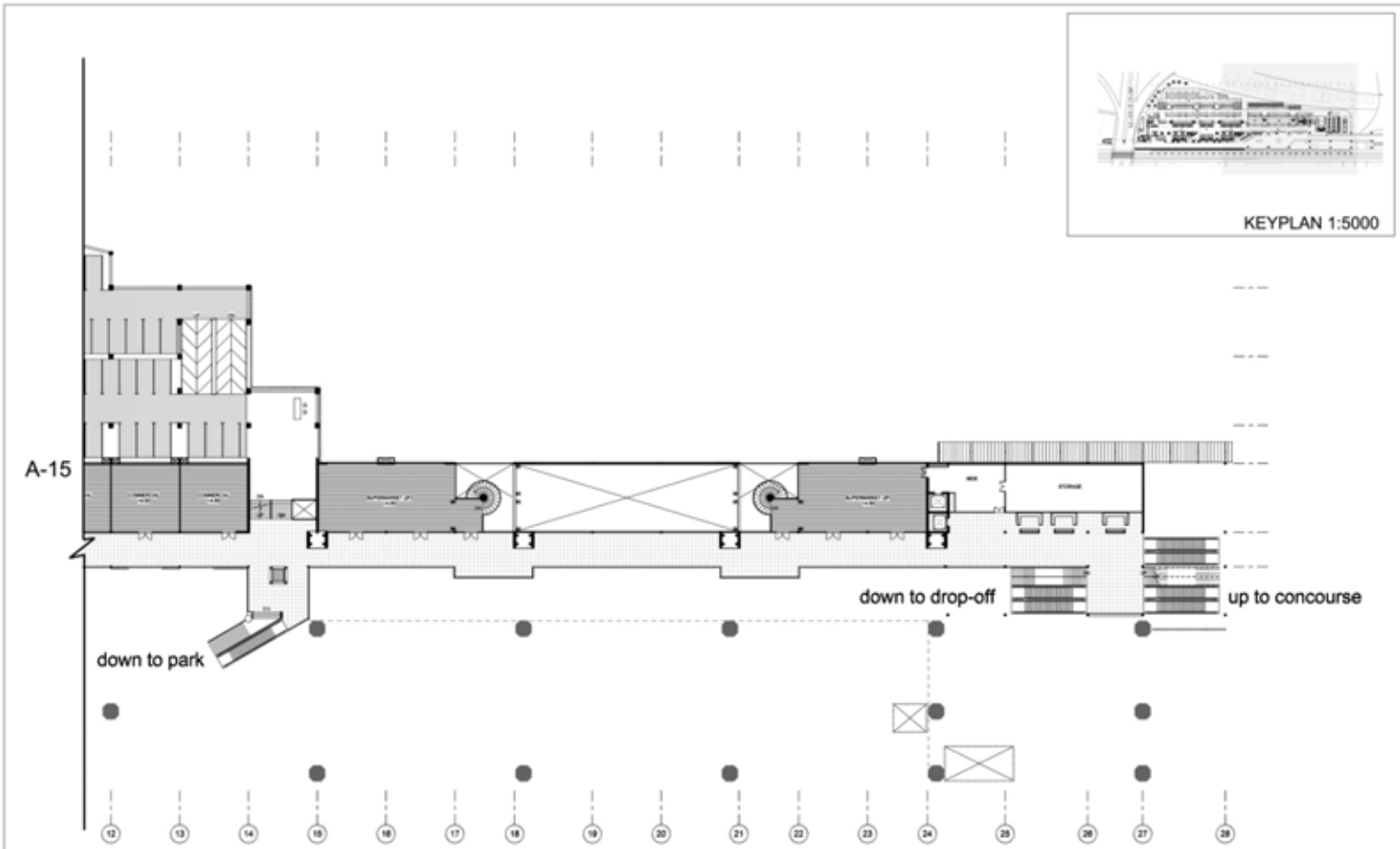
GREGORIUS A GEGANA A
I+MARCH PROGRAM

0 15 30m

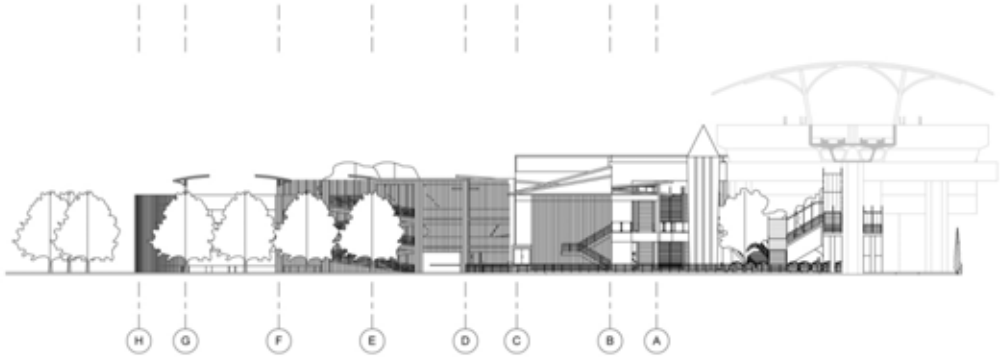
Drg. Title FLOOR PLAN LEVEL 2 ZONE 1

N

Drg. No. A-15
Date 03/22/13
Scale 1:500

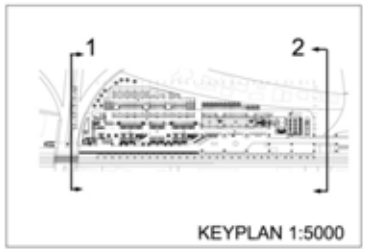



| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title FLOOR PLAN LEVEL 2 ZONE 2 | N<br>Drg. No. A-16<br>Date 03/22/13<br>Scale 1:500 |




1. WEST ELEVATION

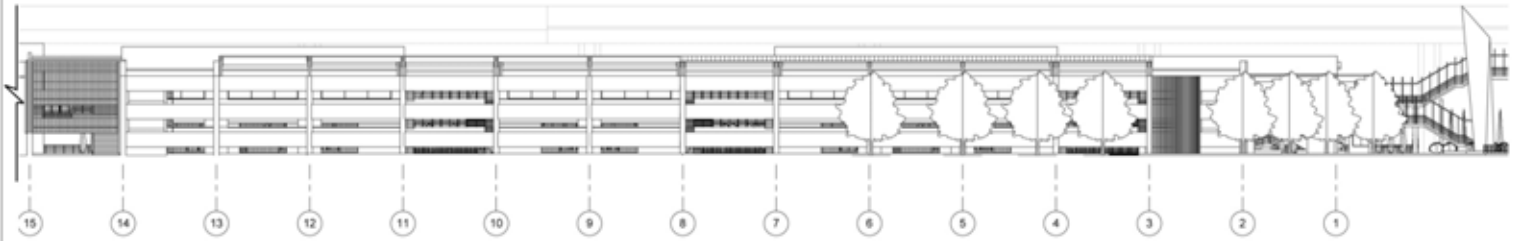

2. EAST ELEVATION




KEYPLAN 1:5000

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title ELEVATION | Drg. No. A-17<br>Date 03/22/13<br>Scale 1:400 |

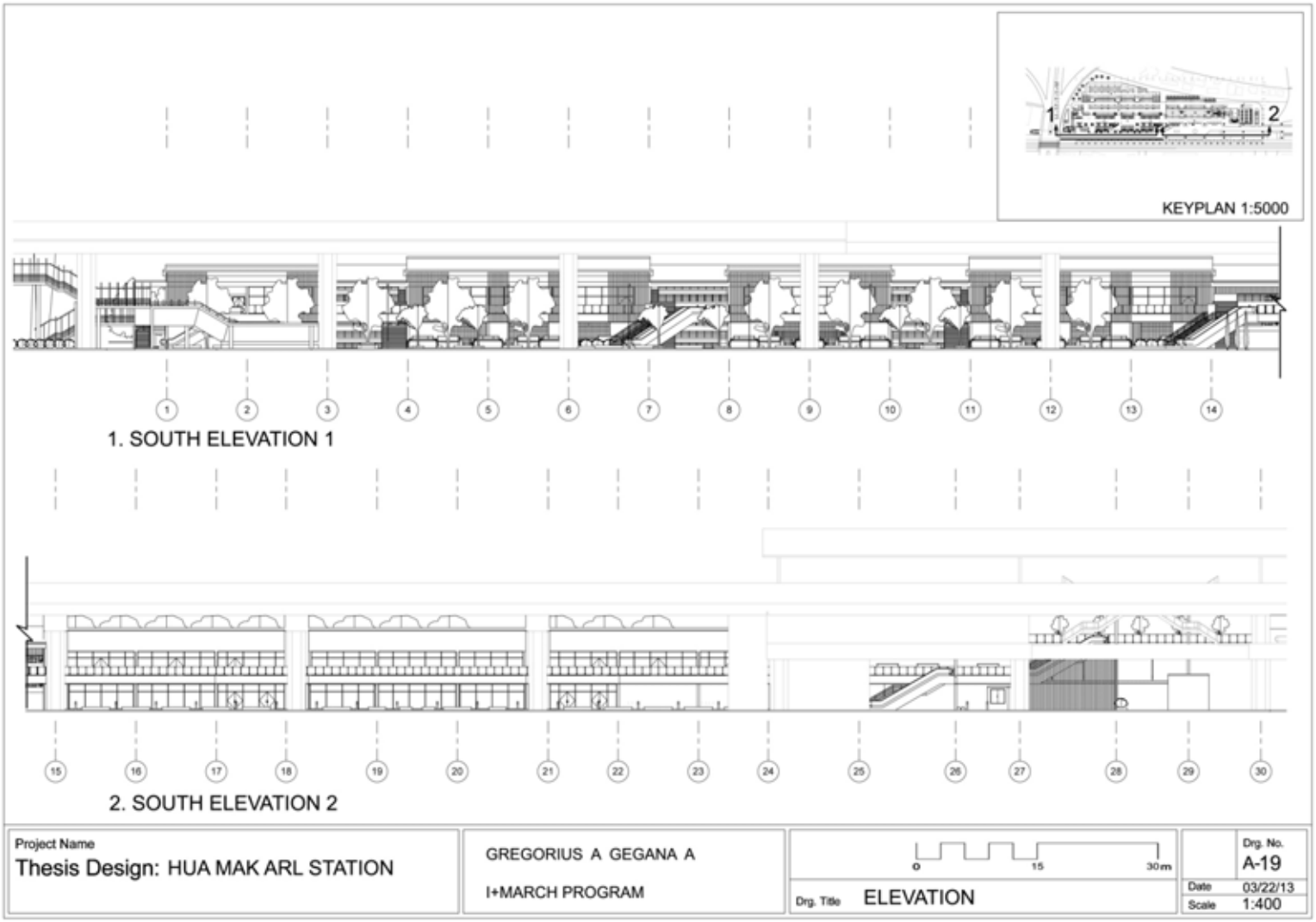

KEYPLAN 1:5000

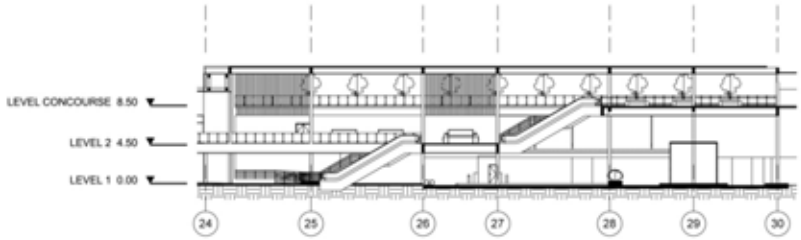



1. NORTH ELEVATION 1

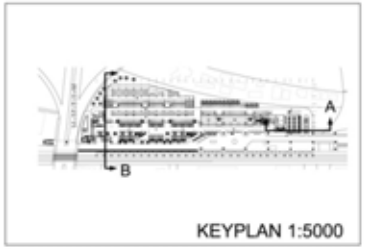

2. NORTH ELEVATION 2

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title ELEVATION | Drg. No. A-18<br>Date 03/22/13<br>Scale 1:400 |

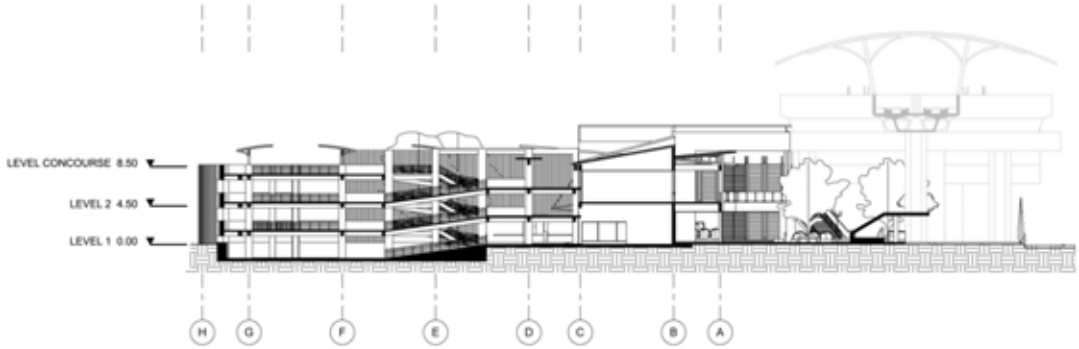

1
2
KEYPLAN 1:5000
1 2 3 4 5 6 7 8 9 10 11 12 13 14
1. SOUTH ELEVATION 1
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
2. SOUTH ELEVATION 2
Project Name
Thesis Design: HUA MAK ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
0 15 30m
Drg. Title ELEVATION
Drg. No. A-19
Date 03/22/13
Scale 1:400




1. SECTION A-A'

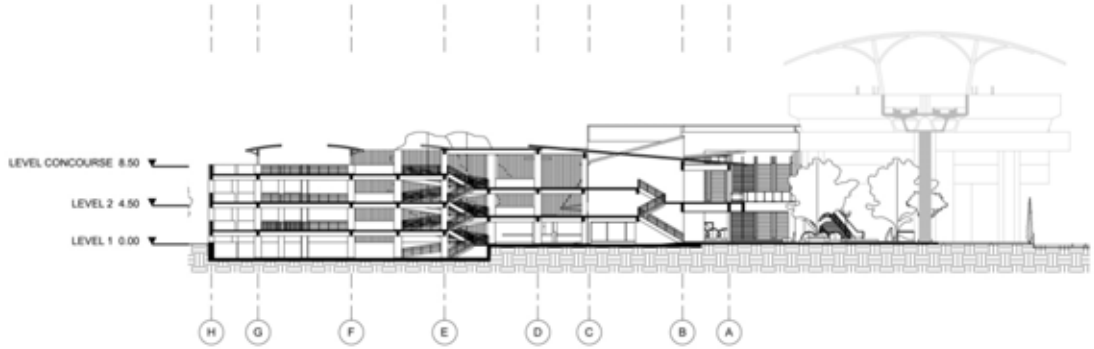



KEYPLAN 1:5000

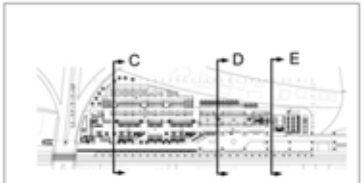



2. SECTION B-B'

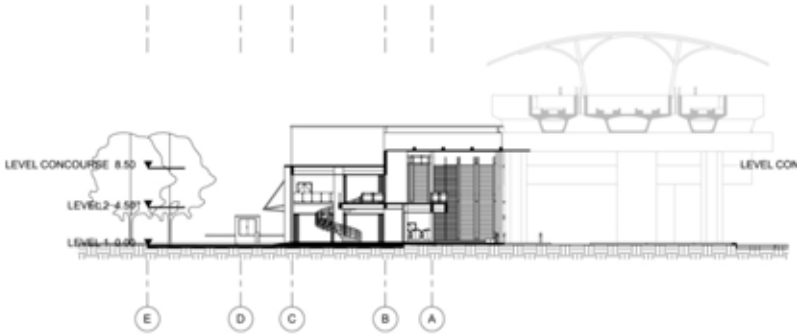
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title SECTION | Drg. No. A-20<br>Date 03/22/13<br>Scale 1:400 |



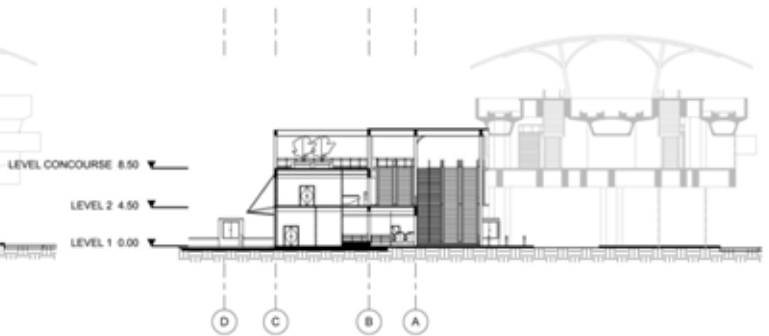

1. SECTION C-C'




KEYPLAN 1:5000

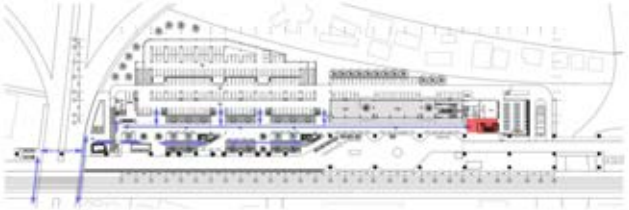



2. SECTION D-D'

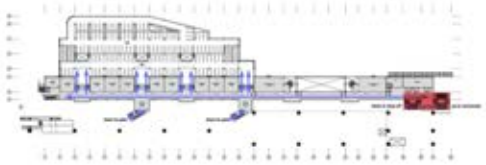



3. SECTION E-E'

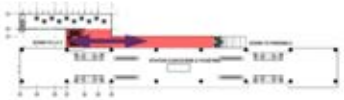
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title SECTION | Drg. No. A-21<br>Date 03/22/13<br>Scale 1:400 |



1. PEDESTRIAN CIRCULATION LEVEL 1

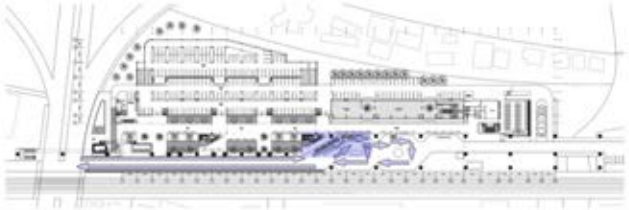


2. PEDESTRIAN CIRCULATION LEVEL 2



3. PEDESTRIAN CIRCULATION LEVEL CONCOURSE

4. MOTORCYCLE-TAXI CIRCULATION



5. TAXI CIRCULATION

6. PRIVATE VEHICLE CIRCULATION

PLAZA/ PARK
CAR PARKING
MOTORCYCLE & BICYCLE
PUBLIC TRANSPORT STOP/ TERMINAL
TAXI STAND/ TERMINAL
MOTORCYCLE TAXI
RETAILS
STREET VENDOR
SERVICE AREA
DROP-OFF
MAIN ENTRANCE/ STAIR

Project Name
Thesis Design: HUA MAK ARL STATION

GREGORIUS A GEGANA A
I+MARCH PROGRAM

0 10 50 100m

Drg. Title CIRCULATION

N

Drg. No. A-22
Date 03/22/13
Scale

| Project Name | | | |
|---|---|---|---|
| Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: AERIAL VIEW | Drg. No. A-23<br>Date 03/22/13<br>Scale - |

1. PLAZA

2. PLAZA

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-24<br>Date 03/22/13<br>Scale - |

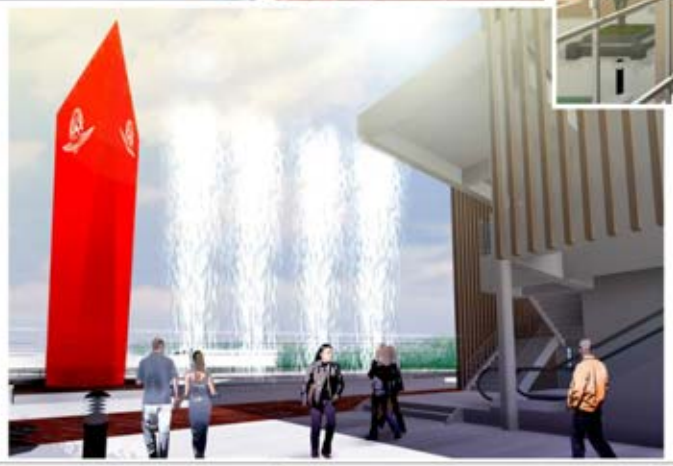
1. DROP-OFF/ WAITING AREA
& SUPERMARKET

2. MAIN ENTRANCE

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-25<br>Date 03/22/13<br>Scale - |

1. COMMERCIAL
& PARKING
BUILDING

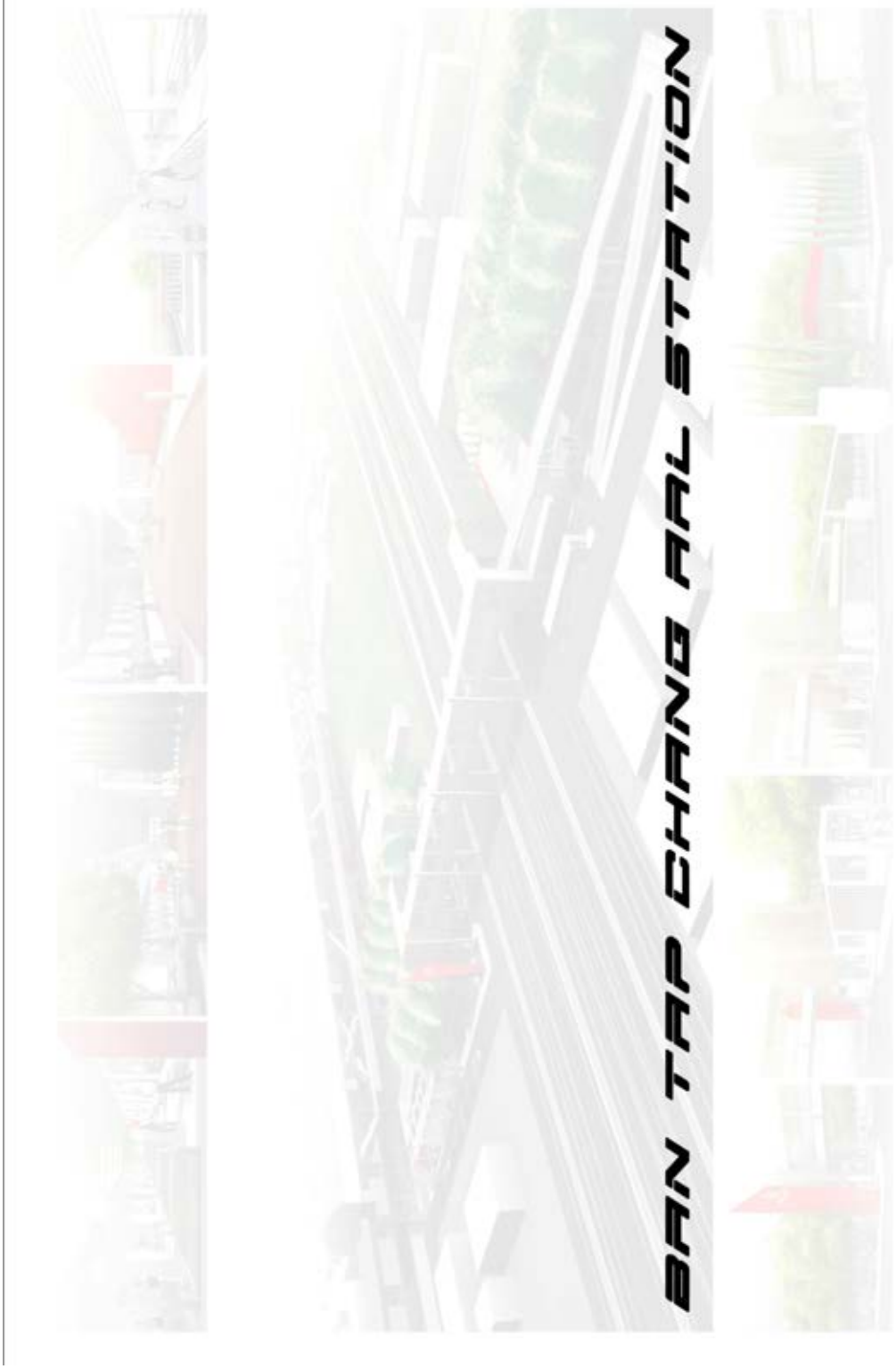
2. COMMERCIAL 2ND FLOOR

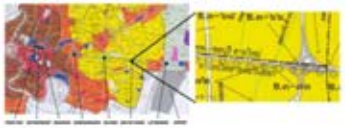


3. LANDMARK

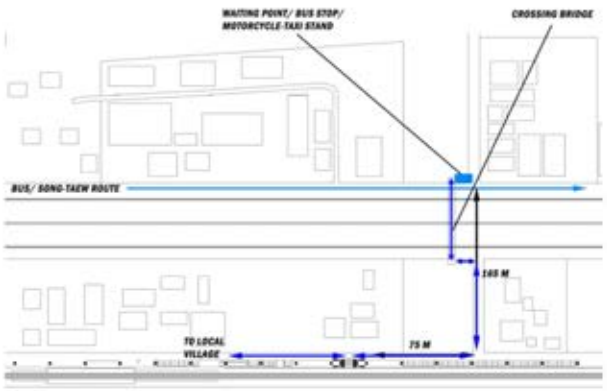
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: HUA MAK ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-26<br>Date 03/22/13<br>Scale - |

**APPENDIX E: DESIGN DRAWINGS: *BAN TAP CHANG* ARL STATION**

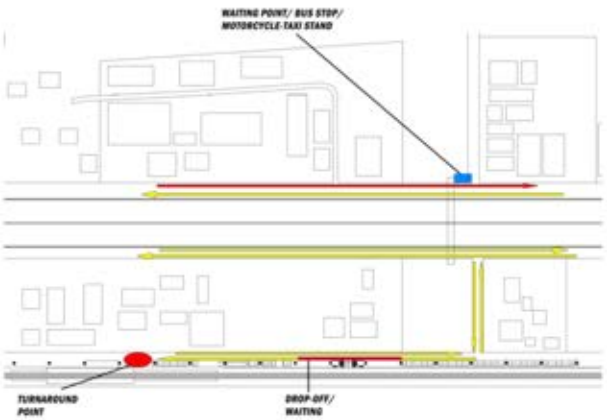




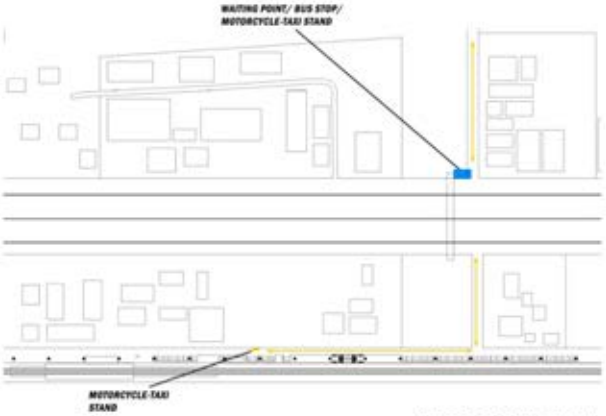

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title LOCATION MAP | Drg. No. A-1<br>Date 03/22/13<br>Scale 1:2000 |



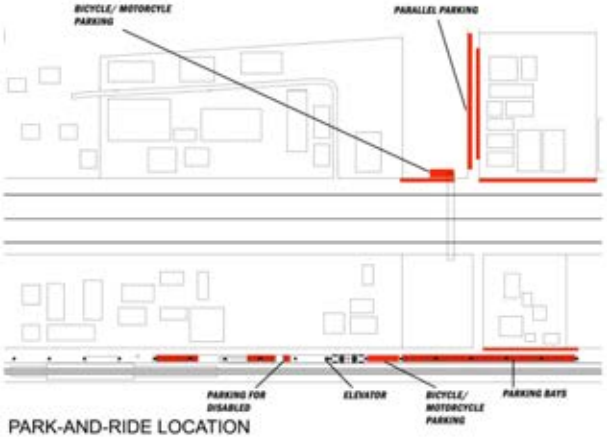

PUBLIC TRANSPORT AND PEDESTRIAN WALK




KISS-AND-RIDE AND CAR CIRCULATION

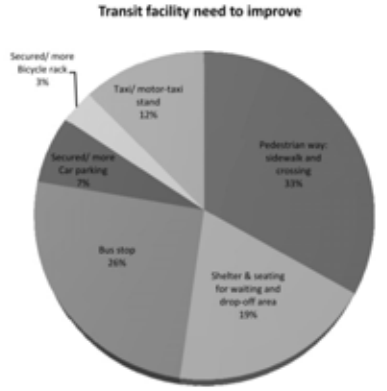


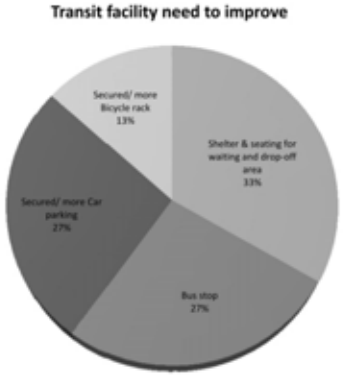

MOTORCYCLE-TAXI

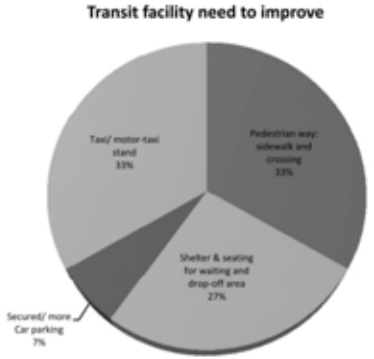


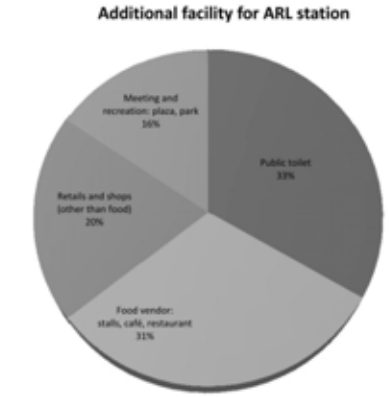

PARK-AND-RIDE LOCATION

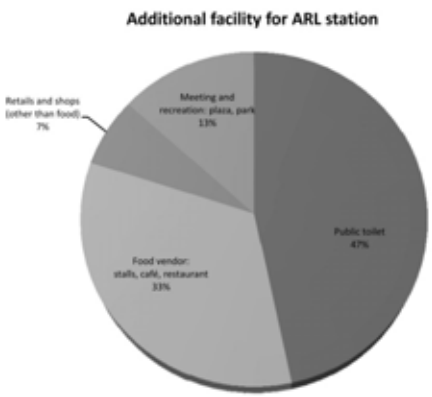
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100m<br>Drg. Title SITE ANALYSIS | N<br>Drg. No. A-2<br>Date 03/22/13<br>Scale |

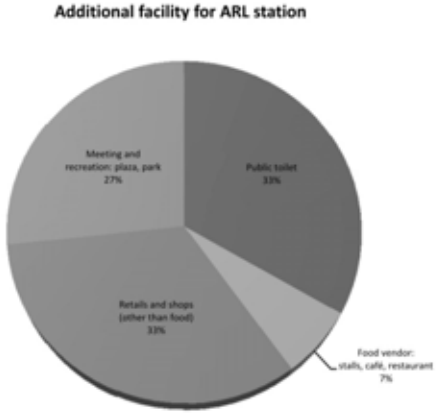


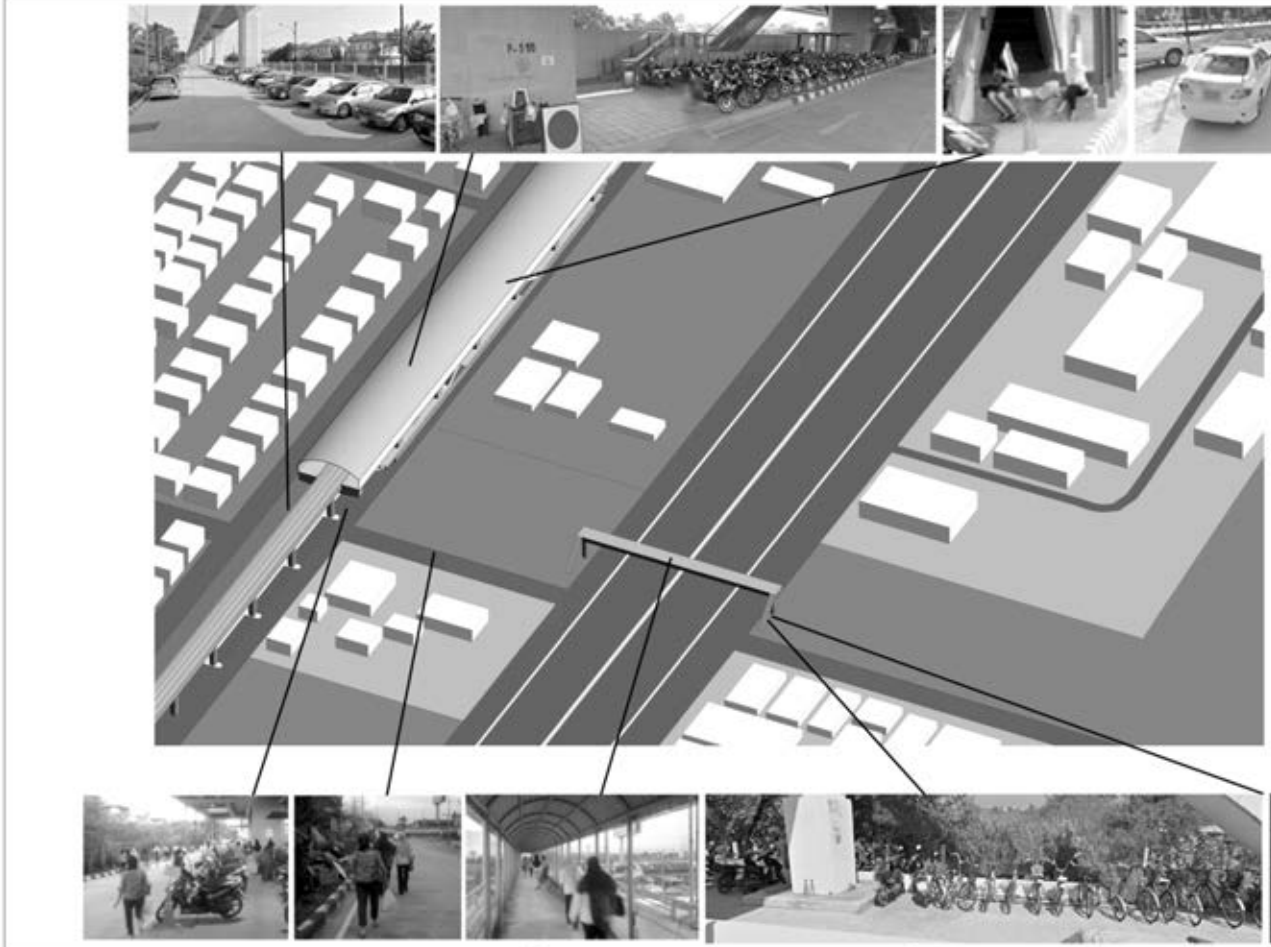




1. USER SURVEY: PASSENGERS

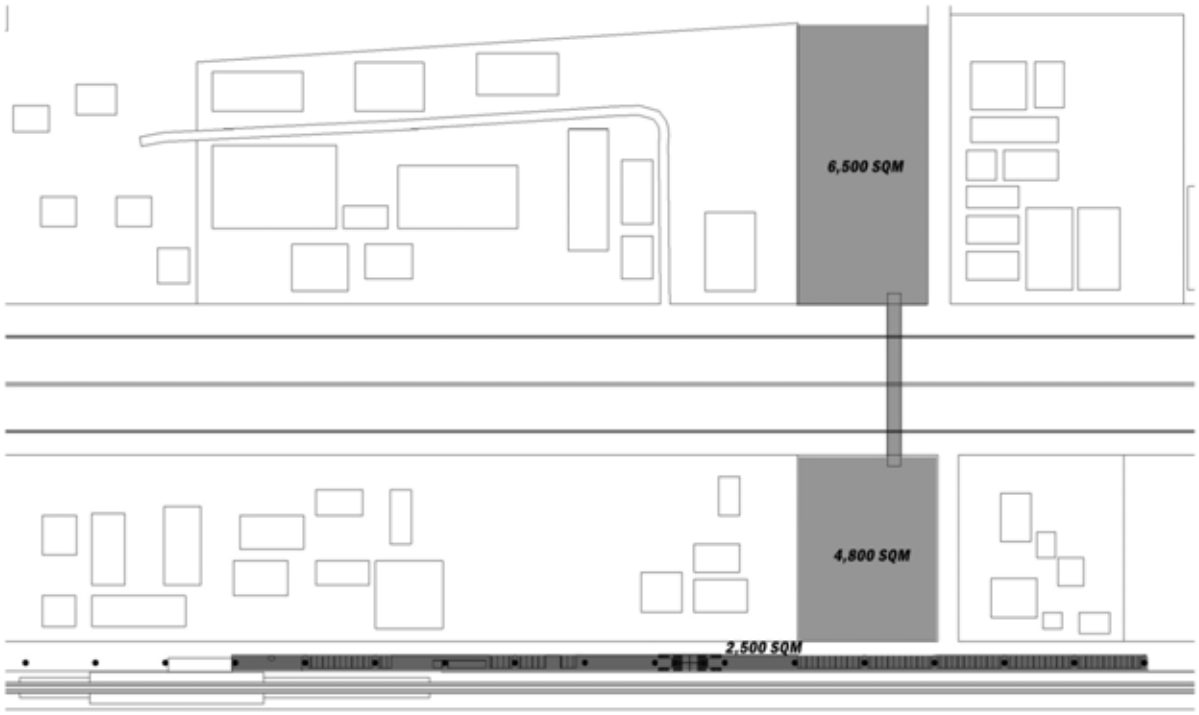
2. USER SURVEY: DRIVERS

3. USER SURVEY: PARATRANSIT

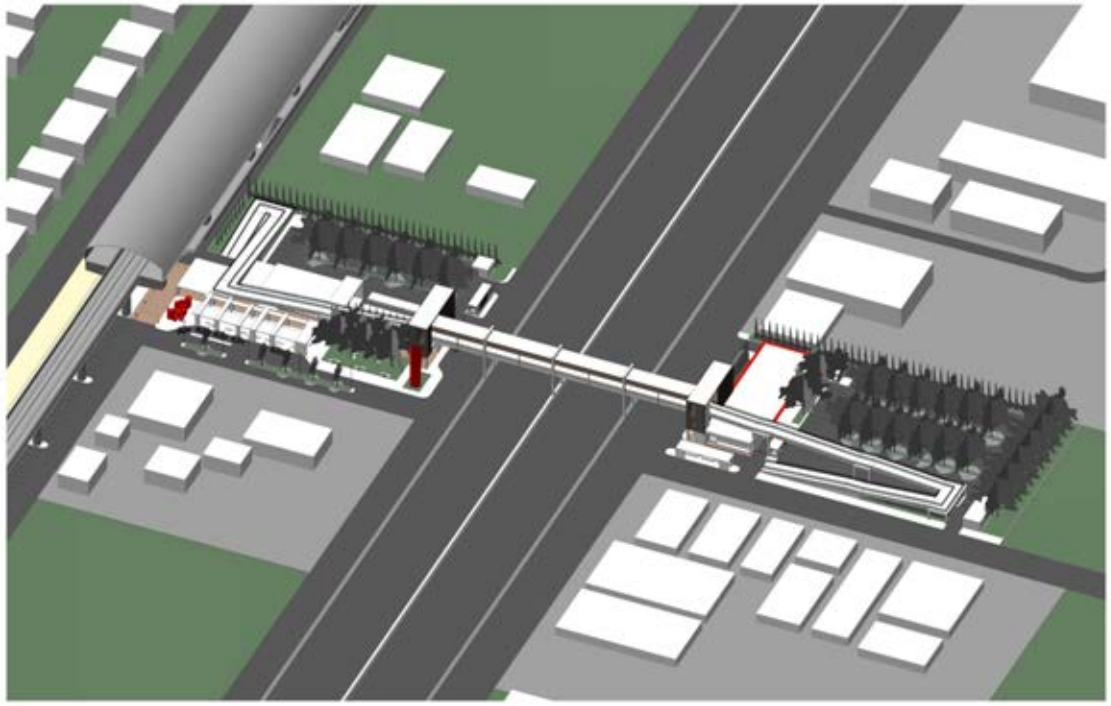
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title USERS SURVEY RESULT | Date 18/12/13<br>Scale |



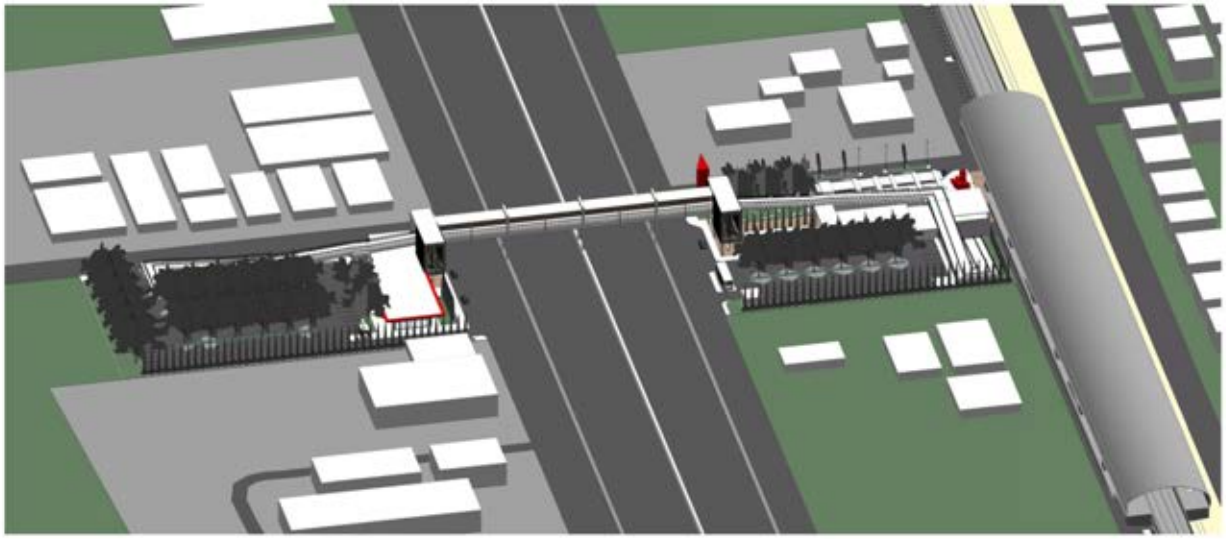
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title SITE CONDITION | Drg. No. A-4<br>Date 03/22/13<br>Scale |




| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title PROPOSED SITE | N<br>Drg. No. A-5<br>Date 03/22/13<br>Scale 1:1600 |

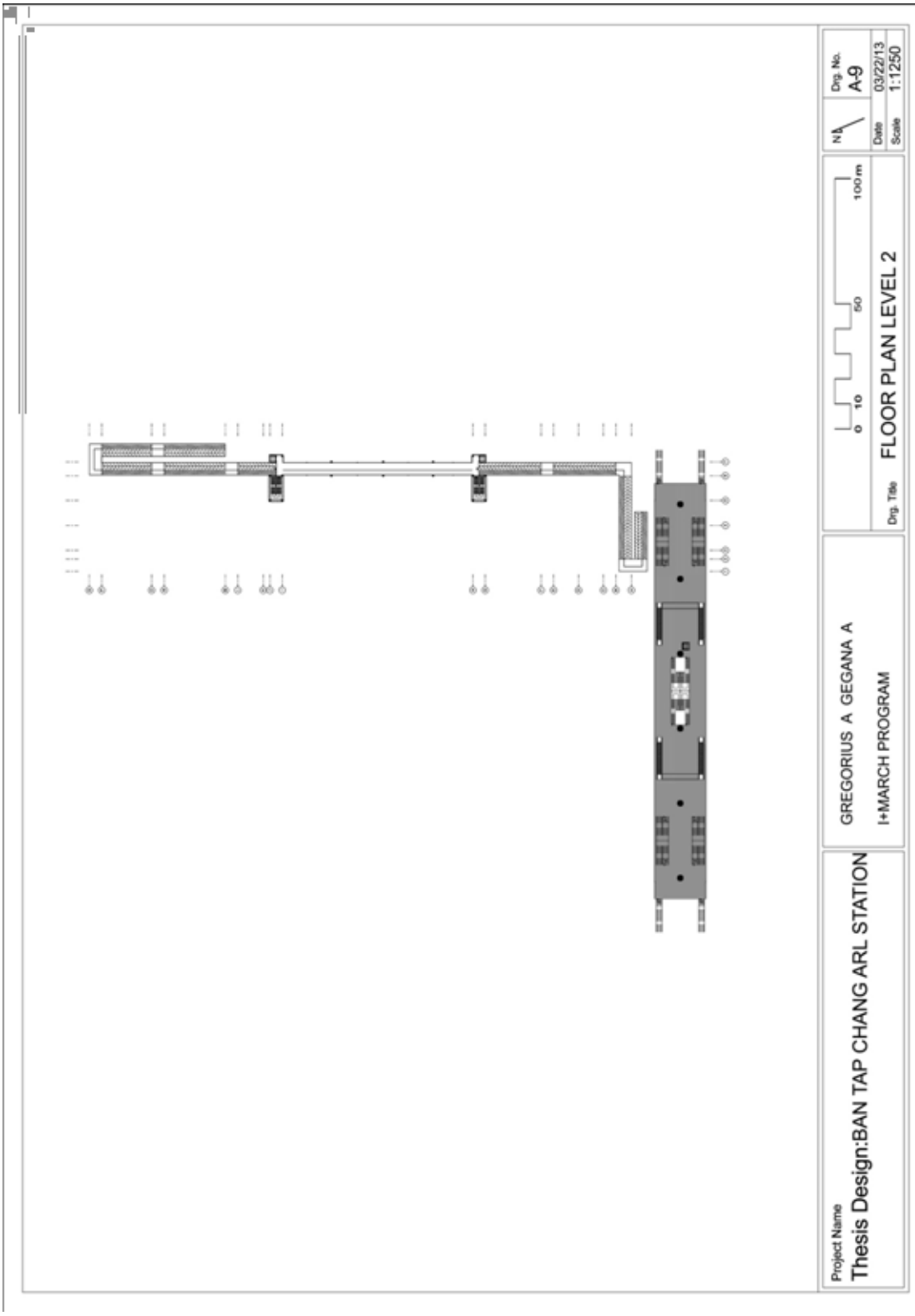


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title OVERALL ISOMETRIC 1 | Drg. No. A-6<br>Date 03/22/13<br>Scale |

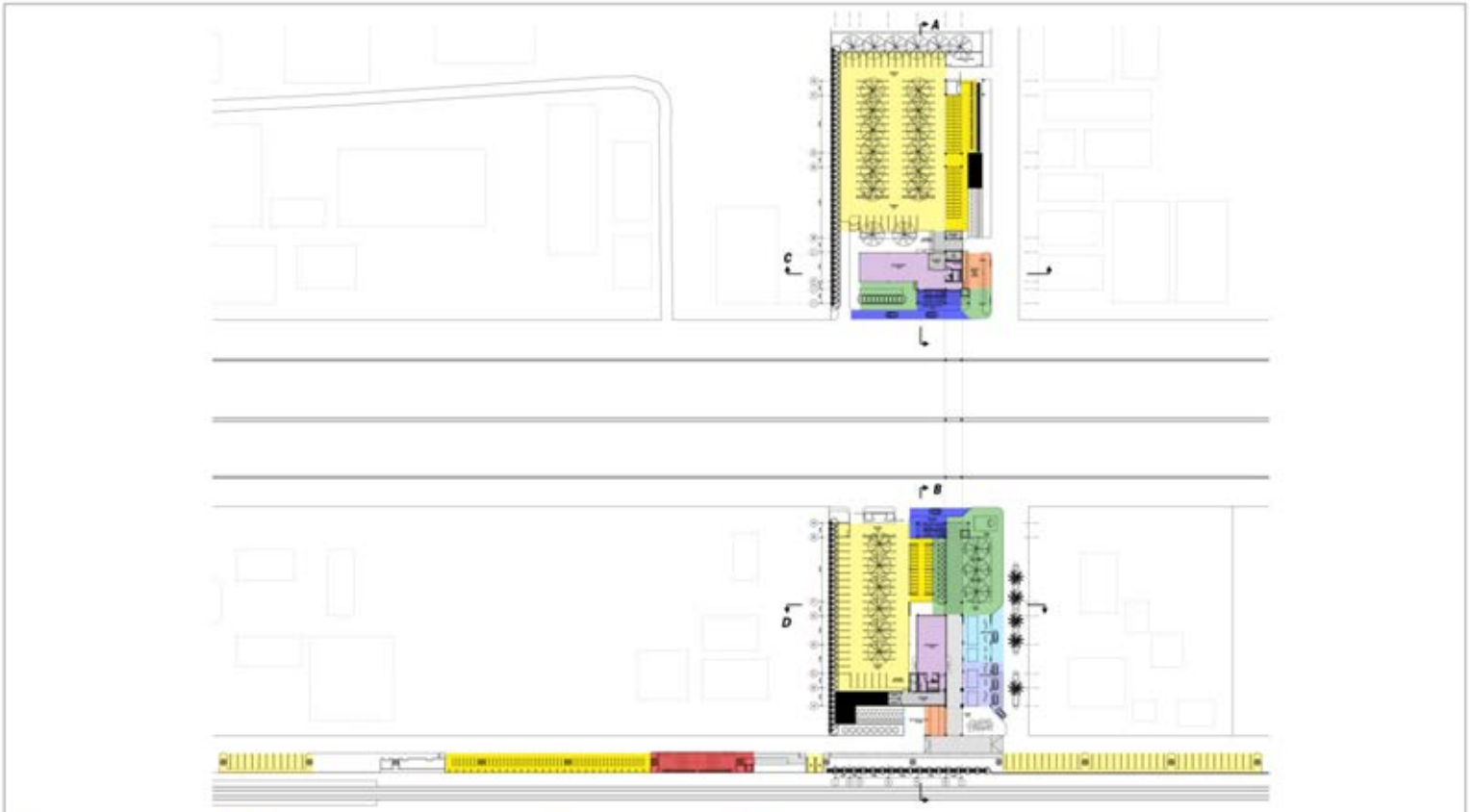


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title OVERALL ISOMETRIC 2 | Drg. No. A-7<br>Date 03/22/13<br>Scale |

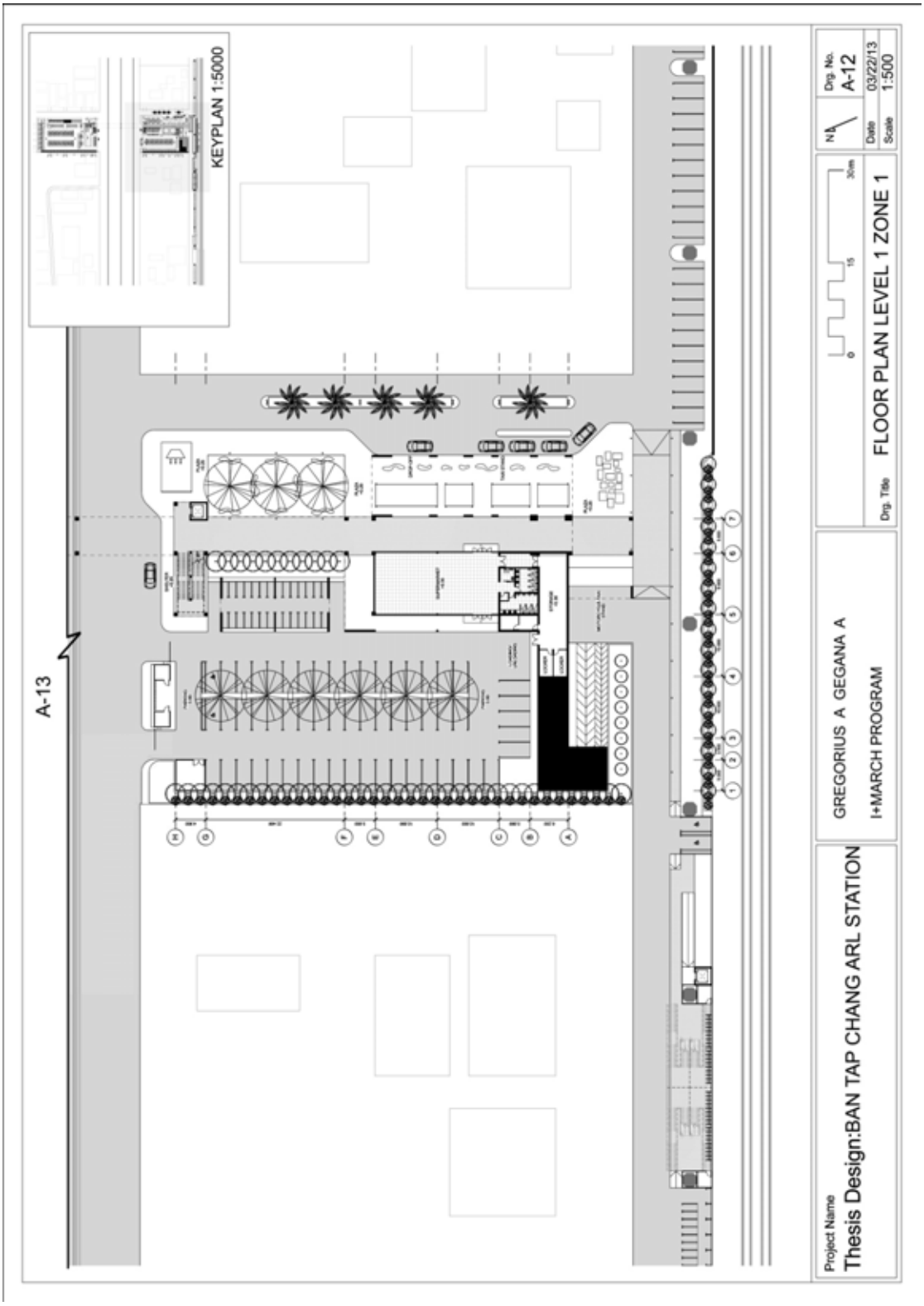
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title OVERALL SITE PLAN | N<br>Drg. No. A-8<br>Date 03/22/13<br>Scale 1:1250 |

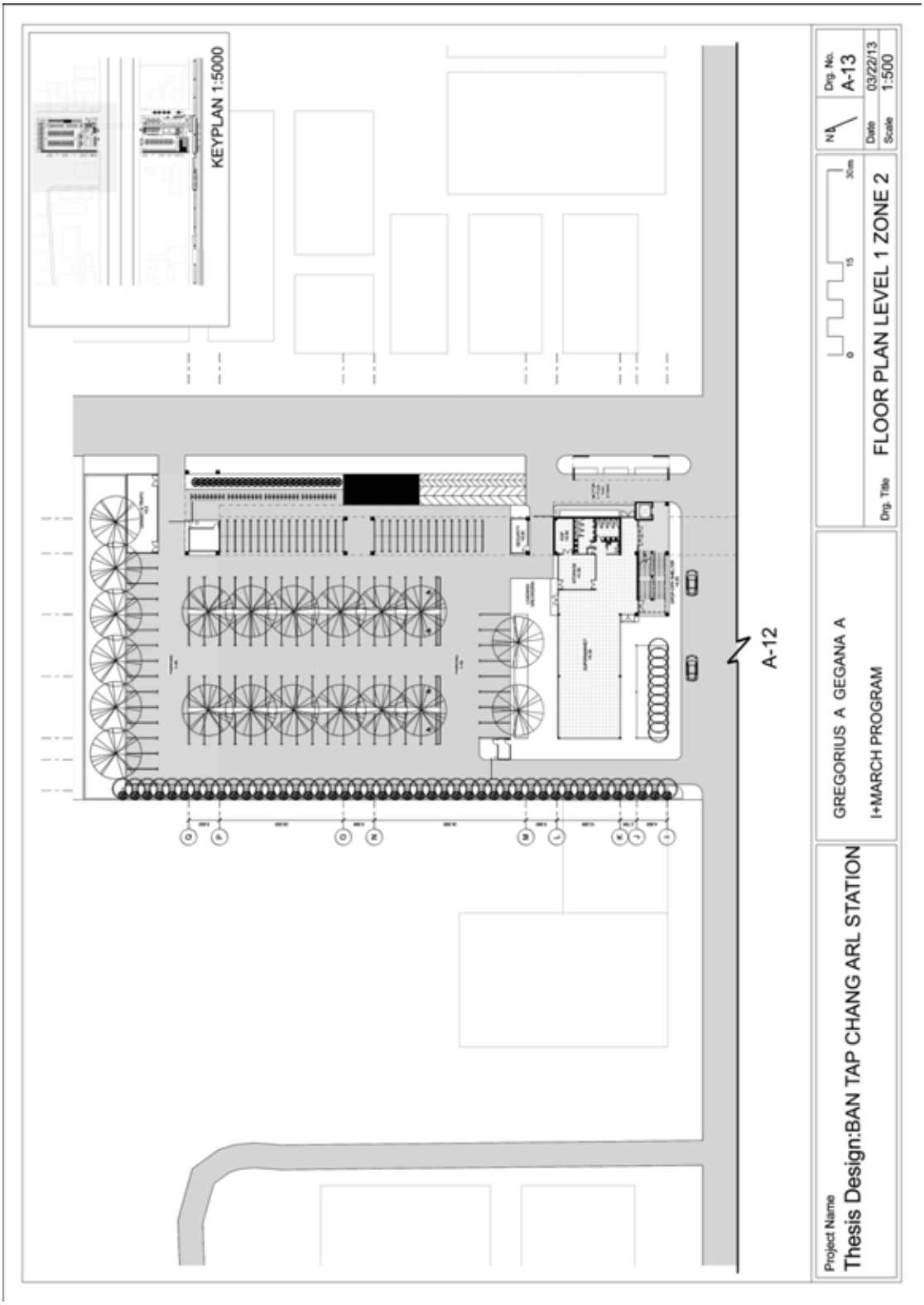

Project Name
Thesis Design:BAN TAP CHANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Drg. Title
FLOOR PLAN LEVEL 2
0 10 50 100 m
N
Drg. No.
A-9
Date
03/22/13
Scale
1:1250

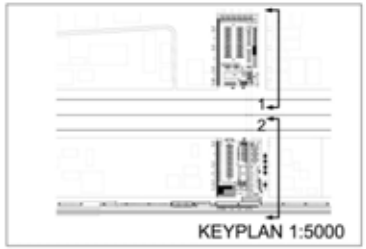
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100m<br>Drg. Title ROOF PLAN | N<br>Drg. No. A-10<br>Date 03/22/13<br>Scale 1:1250 |



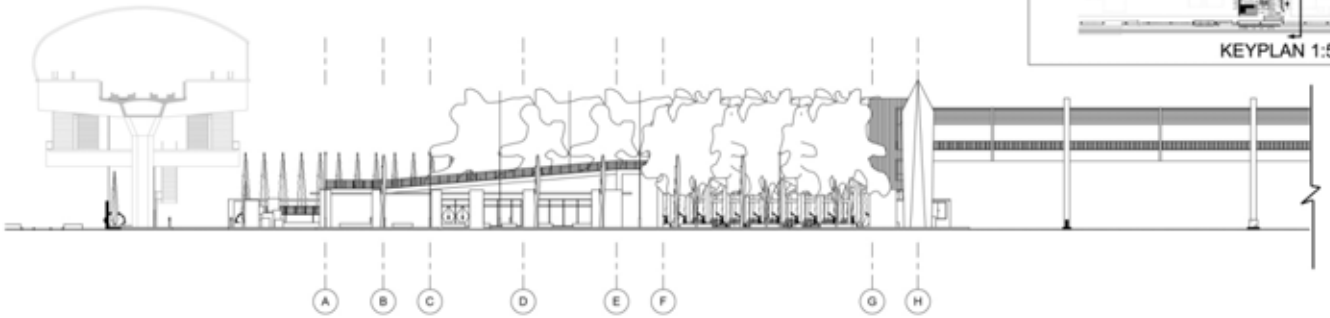

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title PROGRAM ZONING LEVEL 1 | N<br>Drg. No. A-11<br>Date 03/22/13<br>Scale 1:1250 |


KEYPLAN 1:5000
A-13
Project Name
Thesis Design:BAN TAP CHANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Dwg. Title
FLOOR PLAN LEVEL 1 ZONE 1
0
15
30m
N
Dwg. No.
A-12
Date
03/22/13
Scale
1:500

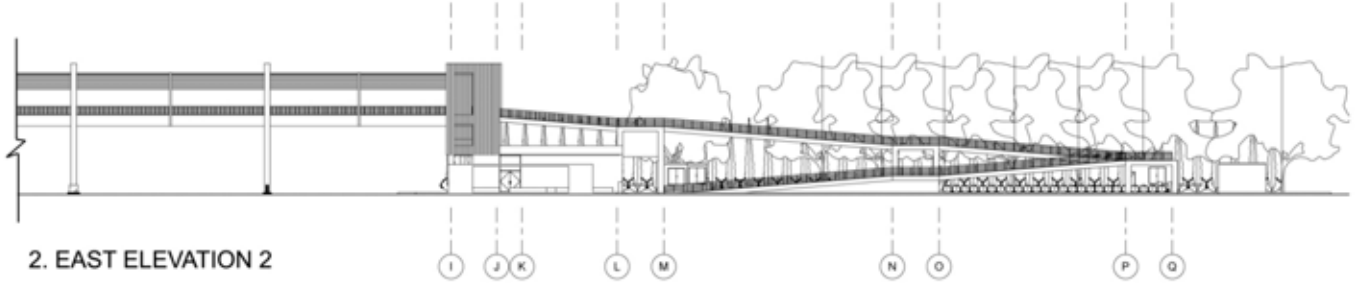

KEYPLAN 1:5000
A-12
Project Name
Thesis Design:BAN TAP CHANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Dwg. Title
FLOOR PLAN LEVEL 1 ZONE 2
Dwg. No.
A-13
Date
03/22/13
Scale
1:500




KEYPLAN 1:5000

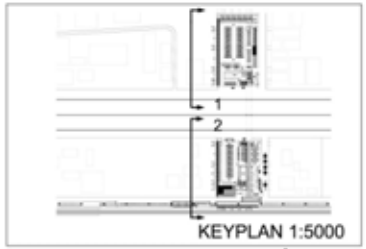



1. EAST ELEVATION 1



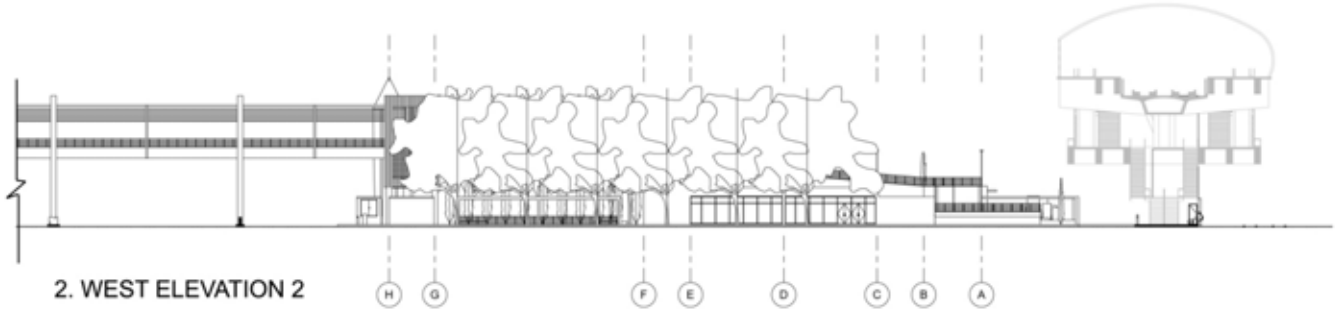

2. EAST ELEVATION 2

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title ELEVATION | Drg. No. A-14<br>Date 03/22/13<br>Scale 1:400 |



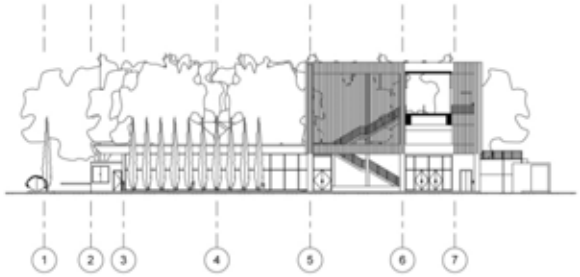


1. WEST ELEVATION 1

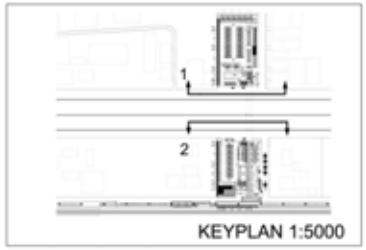



2. WEST ELEVATION 2

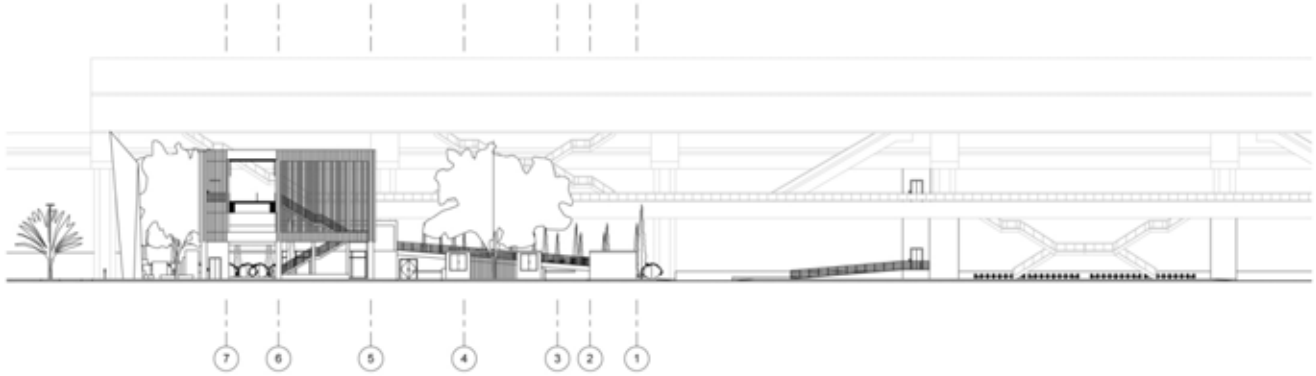
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title ELEVATION | Drg. No. A-15<br>Date 03/22/13<br>Scale 1:400 |




1. SOUTH ELEVATION (NORTH ZONE)

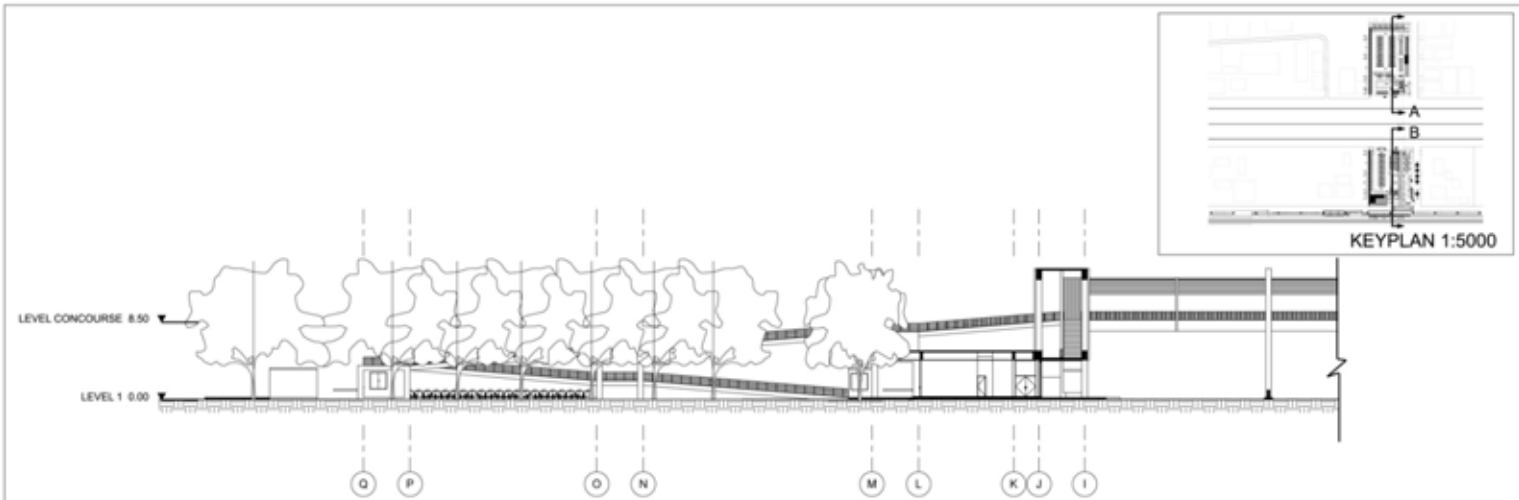



KEYPLAN 1:5000

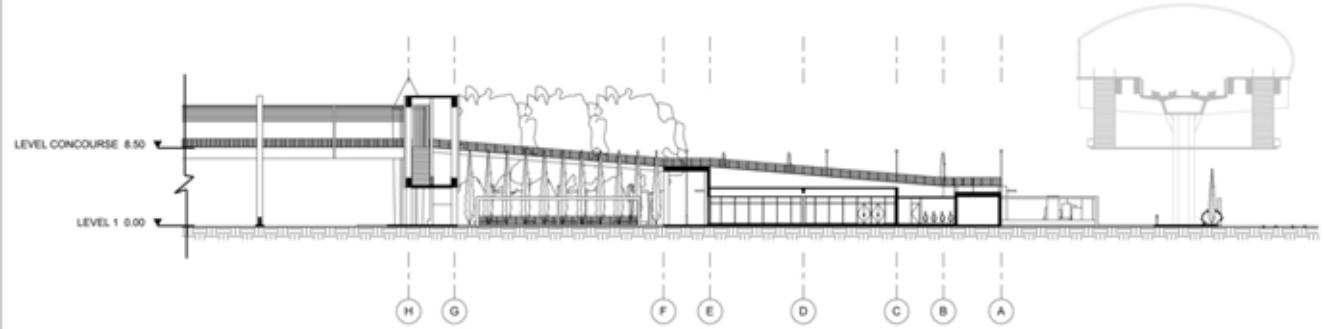



2. NORTH ELEVATION (SOUTH ZONE)

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title ELEVATION | Drg. No. A-16<br>Date 03/22/13<br>Scale 1:400 |

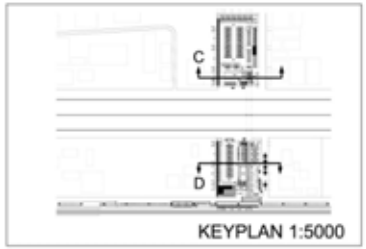



1. SECTION A-A'

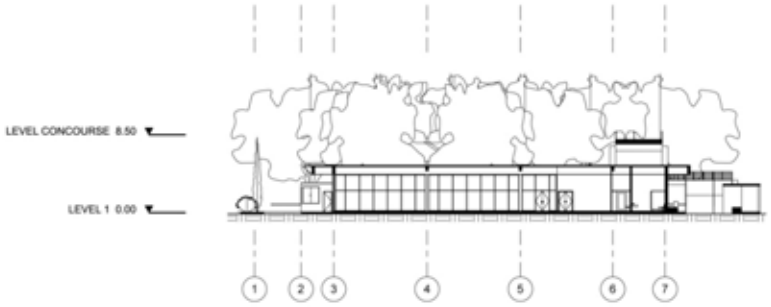



2. SECTION B-B'

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title SECTION | Drg. No. A-17<br>Date 03/22/13<br>Scale 1:400 |



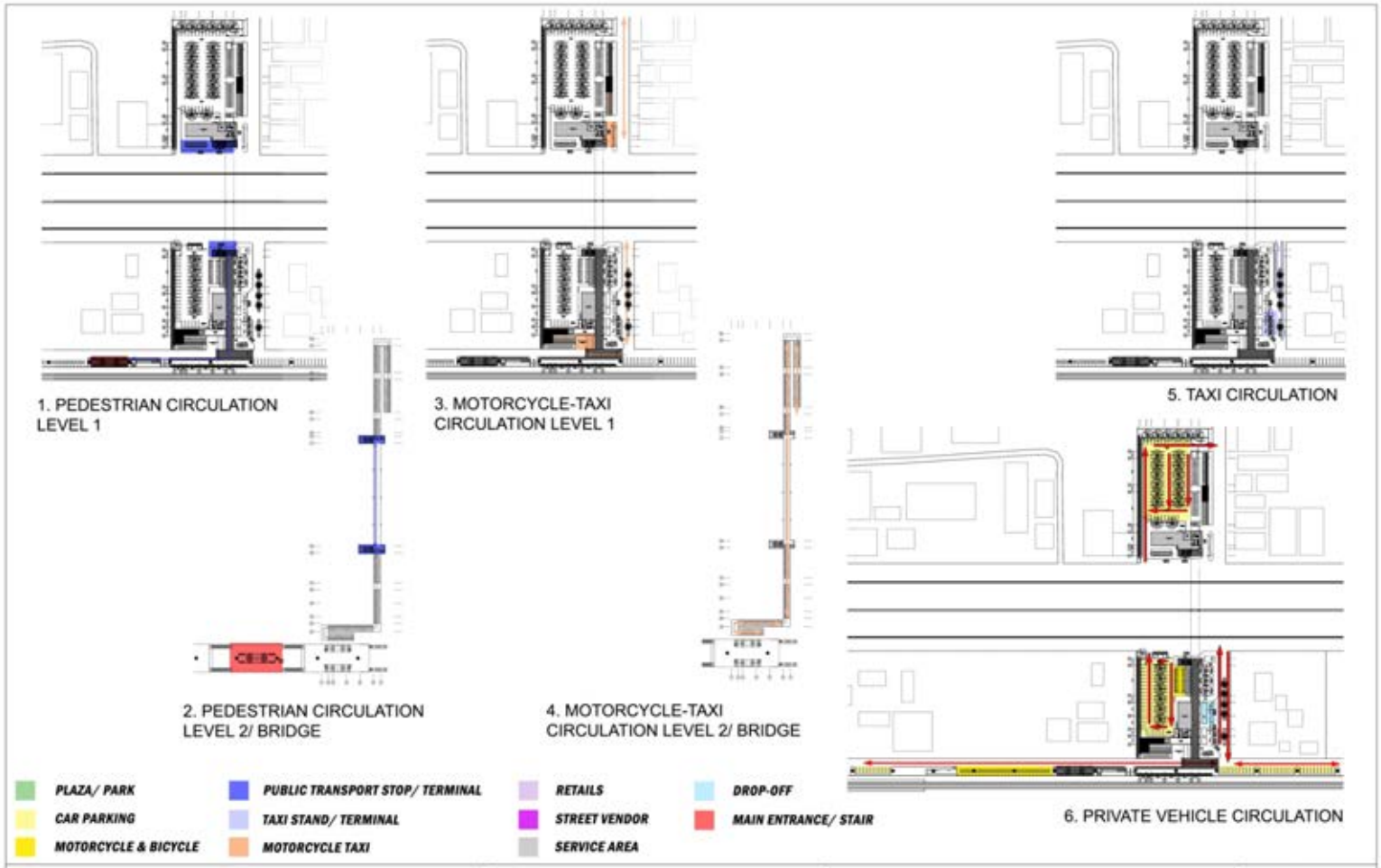

KEYPLAN 1:5000




1. SECTION C-C'


2. SECTION D-D'

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title SECTION | Drg. No. A-18<br>Date 03/22/13<br>Scale 1:400 |




Project Name
Thesis Design:BAN TAP CHANG ARL STATION

GREGORIUS A GEGANA A

I+MARCH PROGRAM

Drg. Title CIRCULATION

Drg. No. A-19

Date 03/22/13

Scale

| Project Name | | | |
|---|---|---|---|
| Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: AERIAL VIEW | Drg. No. A-20<br>Date 03/22/13<br>Scale - |

1. SOUTH ZONE SHELTER & LANDMARK

2. SOUTH ZONE SHELTER & PARKING

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-21<br>Date 03/22/13<br>Scale - |


**APPENDIX D: DESIGN DRAWINGS: *HUA MAK* ARL STATION**

1. PLAZA

2. DROP-OFF & SUPERMARKET

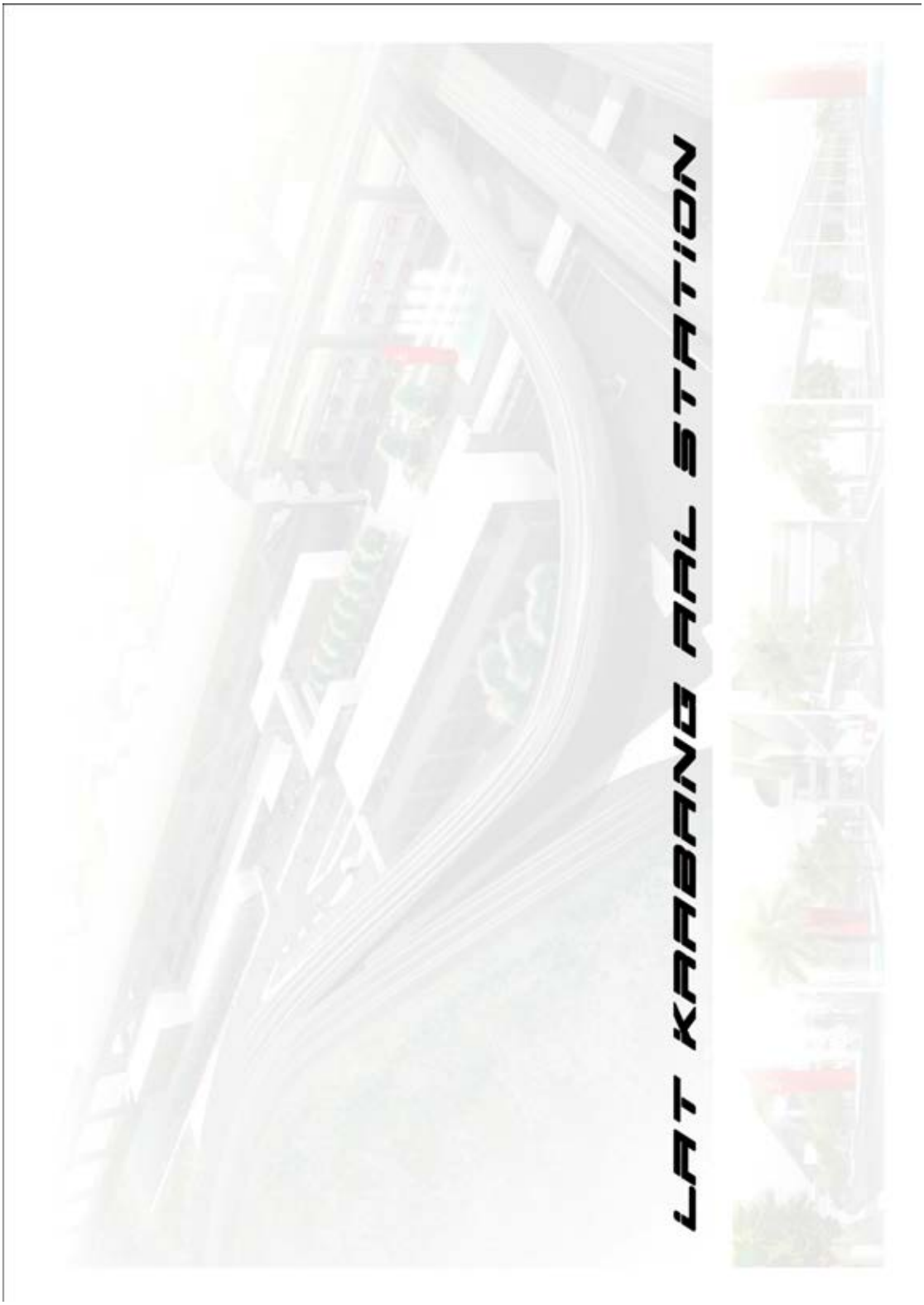
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-23<br>Date 03/22/13<br>Scale - |

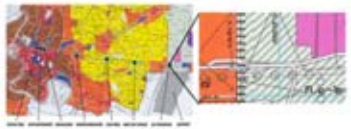
1. ACCESS ROAD

2. CROSSING BRIDGE

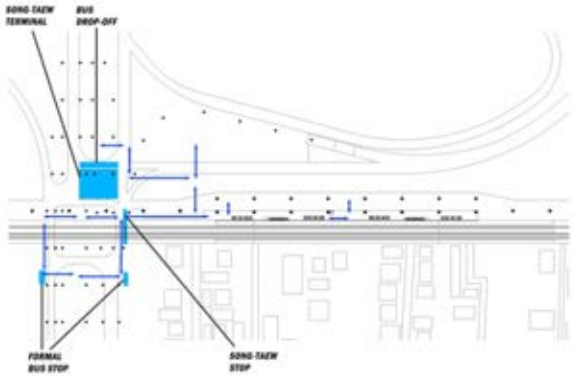
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design:BAN TAP CHANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-24<br>Date 03/22/13<br>Scale - |

**APPENDIX D: DESIGN DRAWINGS: *LAT KRABANG* ARL STATION**

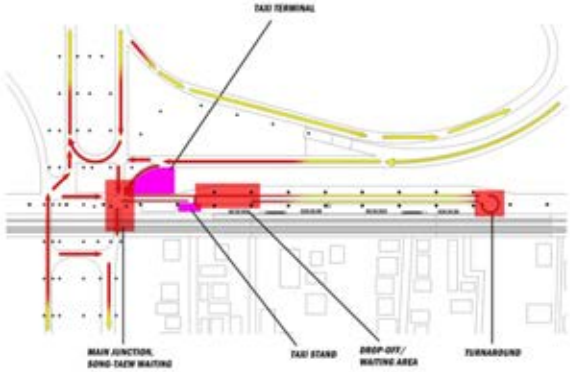




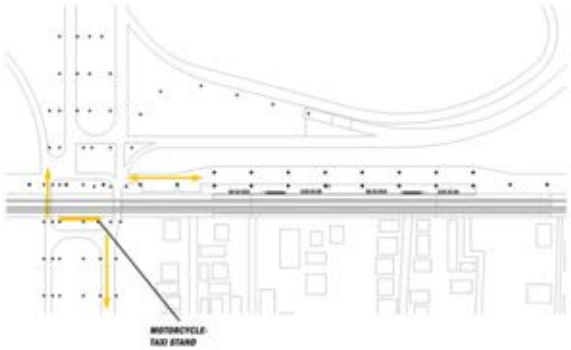

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title LOCATION MAP | Drg. No. A-1<br>Date 03/22/13<br>Scale 1:2000 |



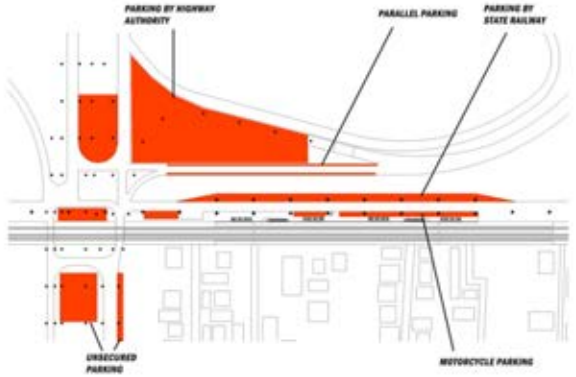

PUBLIC TRANSPORT STOP AND PEDESTRIAN WALK




KISS-AND-RIDE AND CAR CIRCULATION

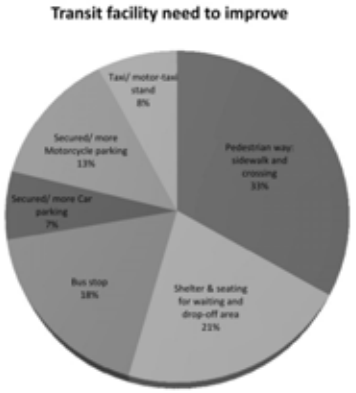


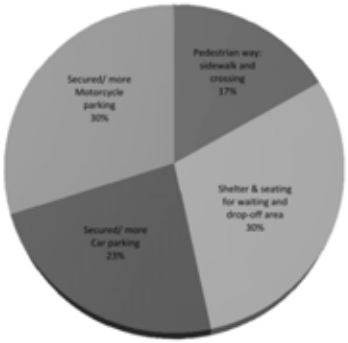

MOTORCYCLE-TAXI

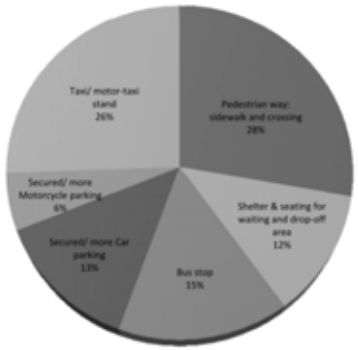


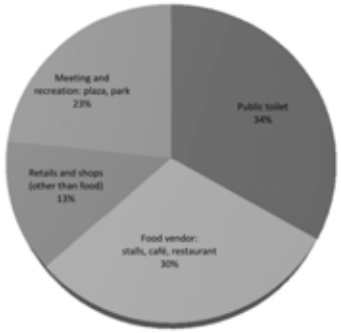

PARK-AND-RIDE LOCATION

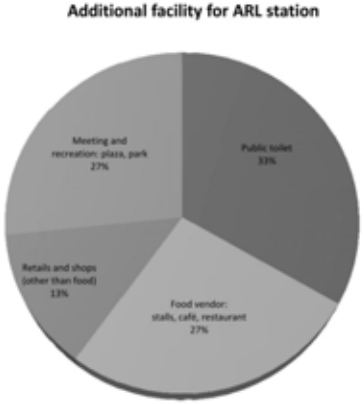
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100m<br>Drg. Title SITE ANALYSIS | N<br>Drg. No. A-2<br>Date 03/22/13<br>Scale |

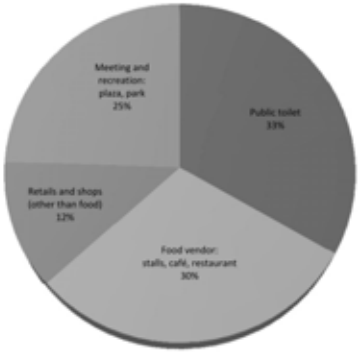



1. USER SURVEY: PASSENGERS

2. USER SURVEY: DRIVERS

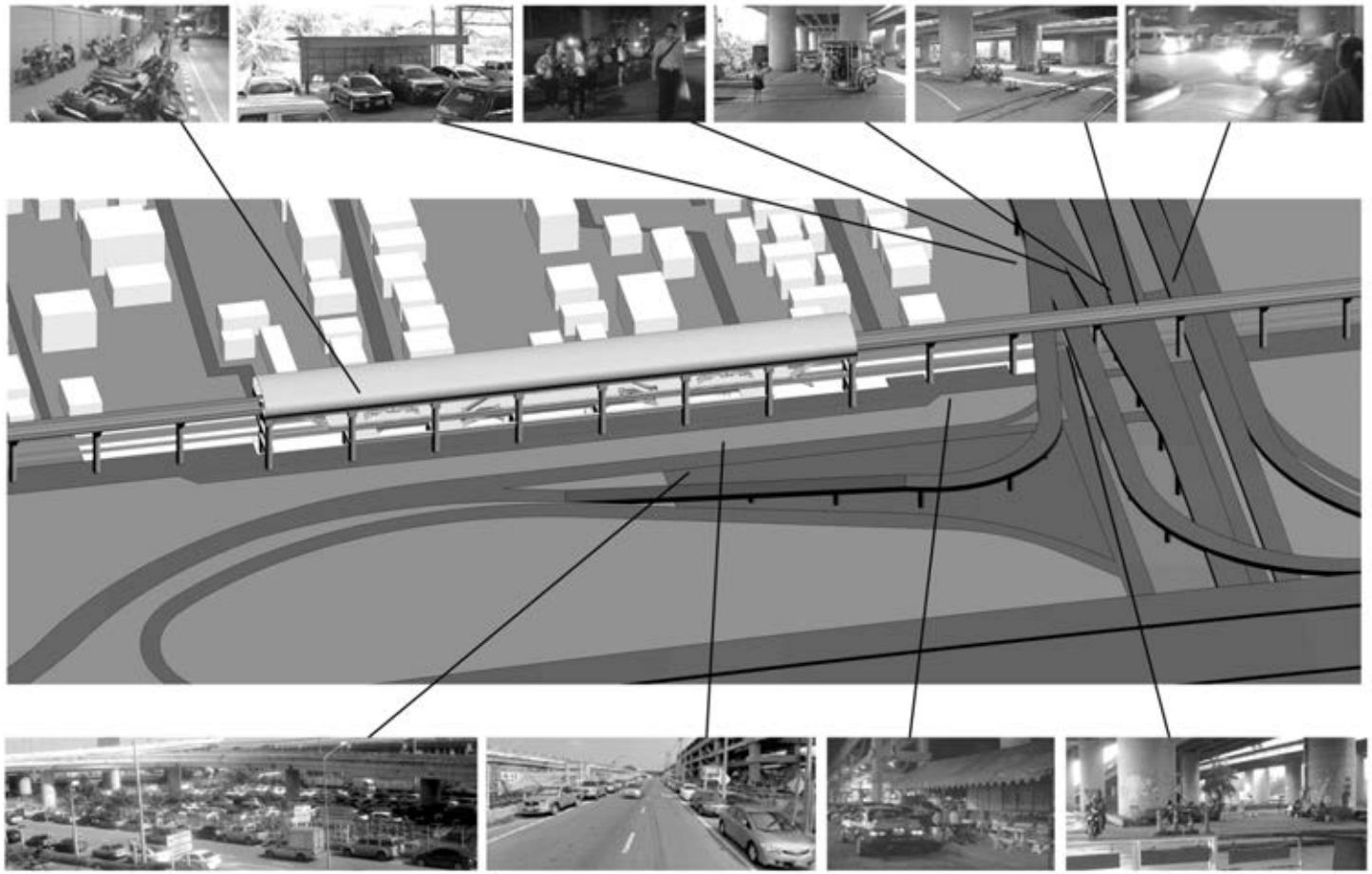
3. USER SURVEY: PARTRANSIT

Project Name:
Thesis Design: LAT KRABANG ARL STATION

GREGORIUS A GEGANA A
I+MARCH PROGRAM

Drg. Title: USERS SURVEY RESULT

Drg. No. A-3
Date 03/22/13
Scale



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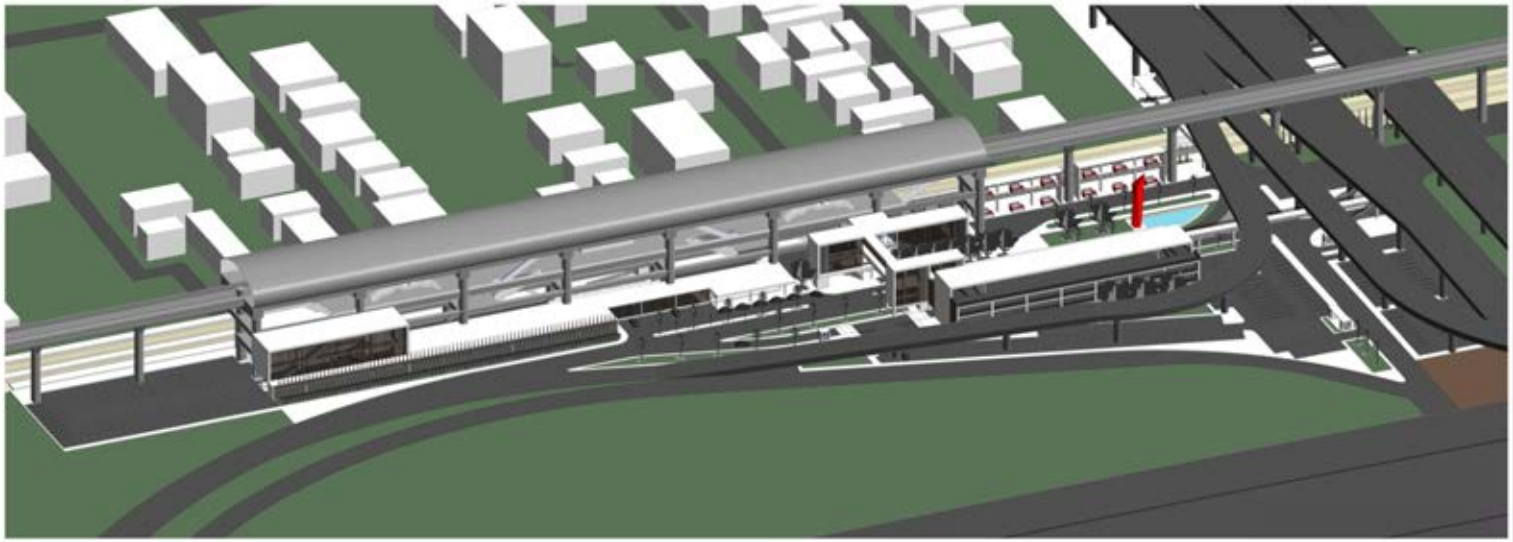
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title SITE CONDITION | Drg. No. A-4<br>Date 03/22/13<br>Scale |


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title PROPOSED SITE | N<br>Drg. No. A-5<br>Date 03/22/13<br>Scale 1:1600 |



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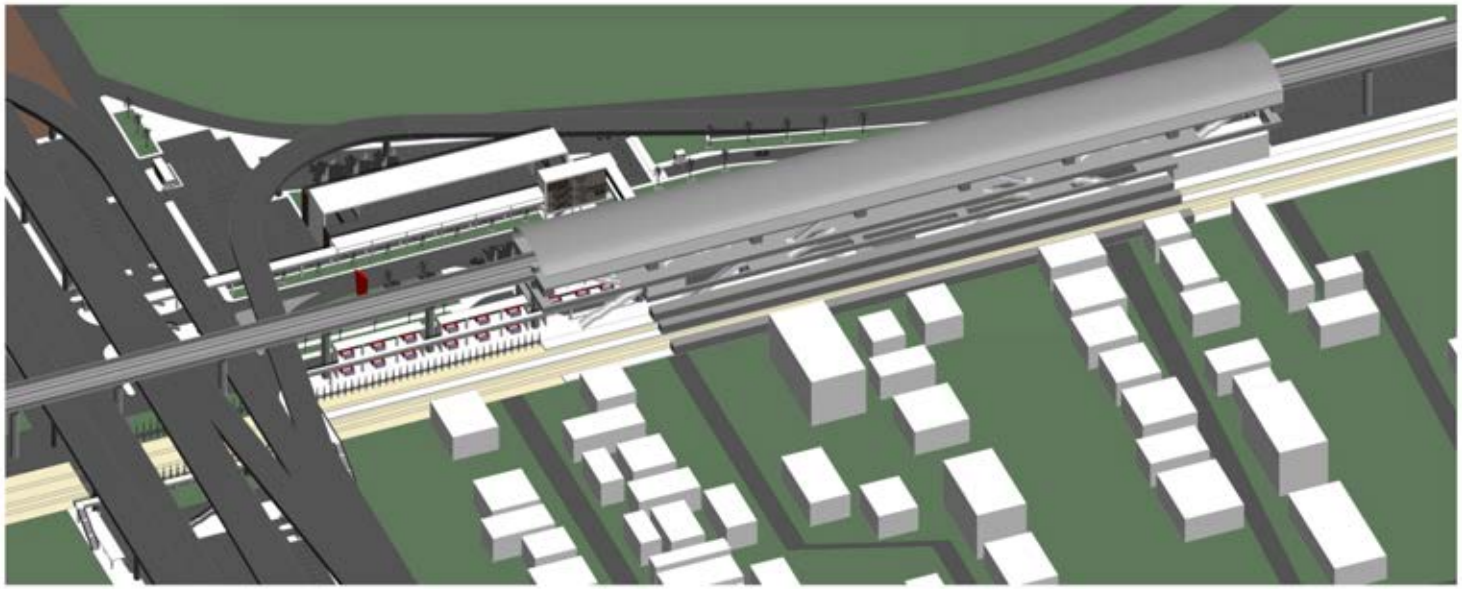
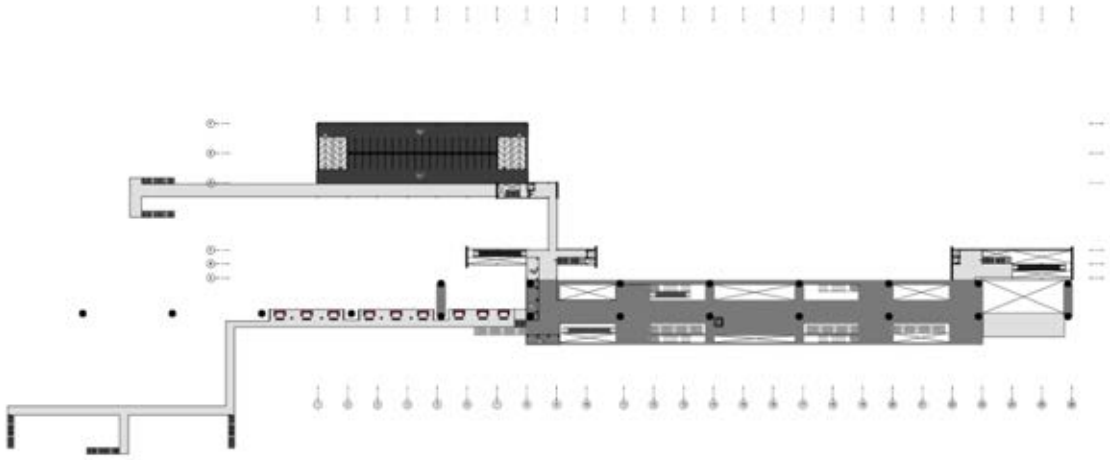
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title OVERALL ISOMETRIC 1 | Drg. No. A-6<br>Date 03/22/13<br>Scale |

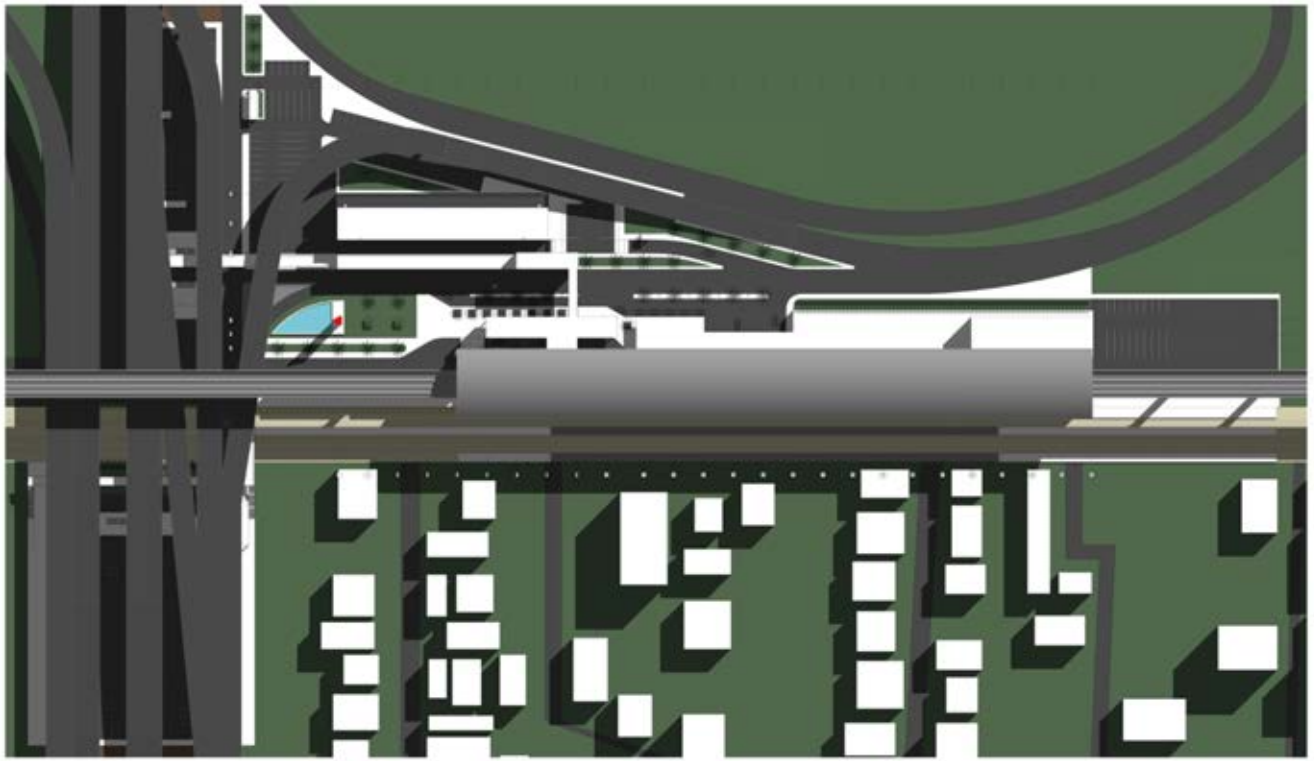


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title OVERALL ISOMETRIC 2 | Drg. No. A-7<br>Date 03/22/13<br>Scale |

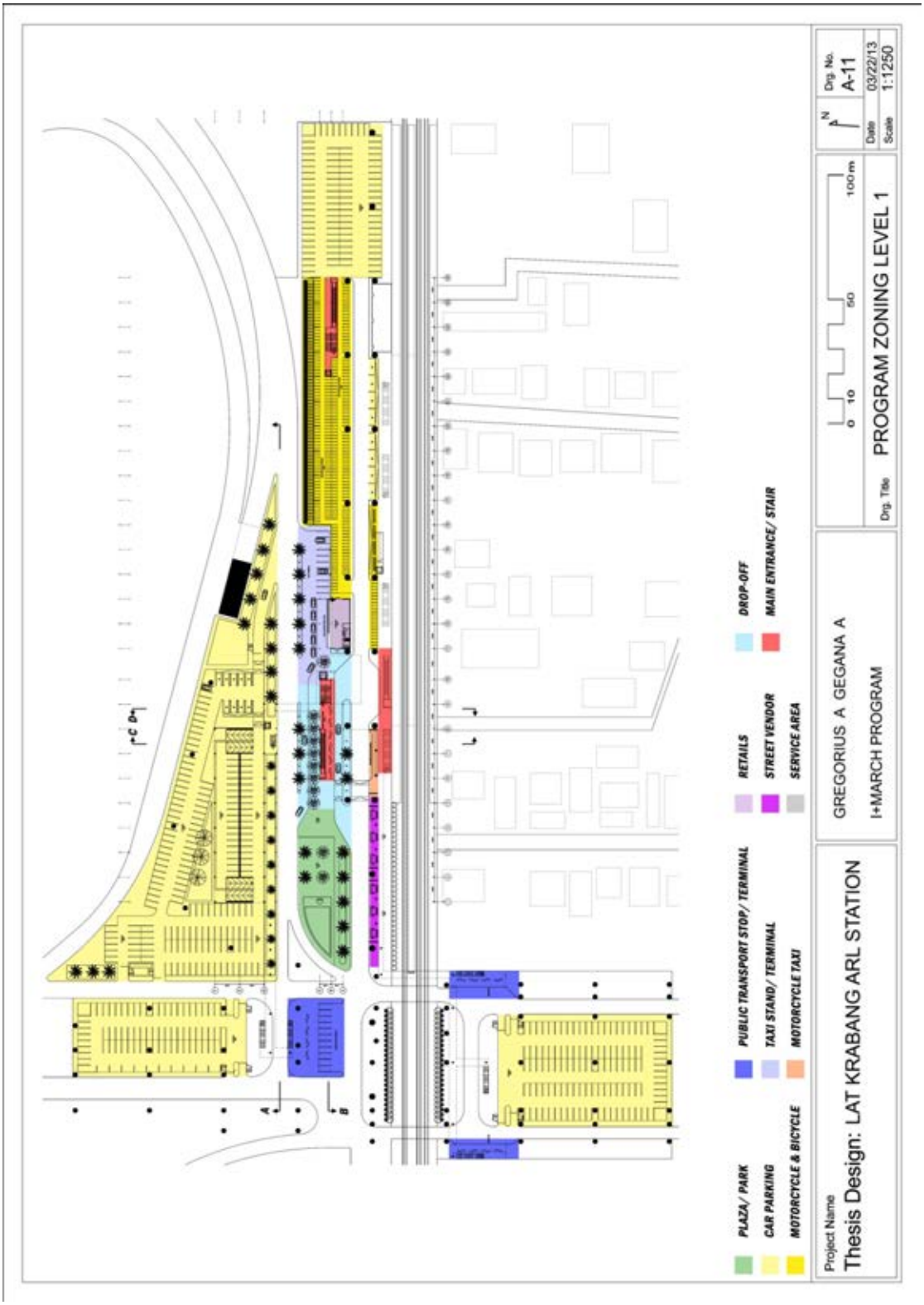
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title OVERALL SITE PLAN | N<br>Drg. No. A-8<br>Date 03/22/13<br>Scale 1:1250 |

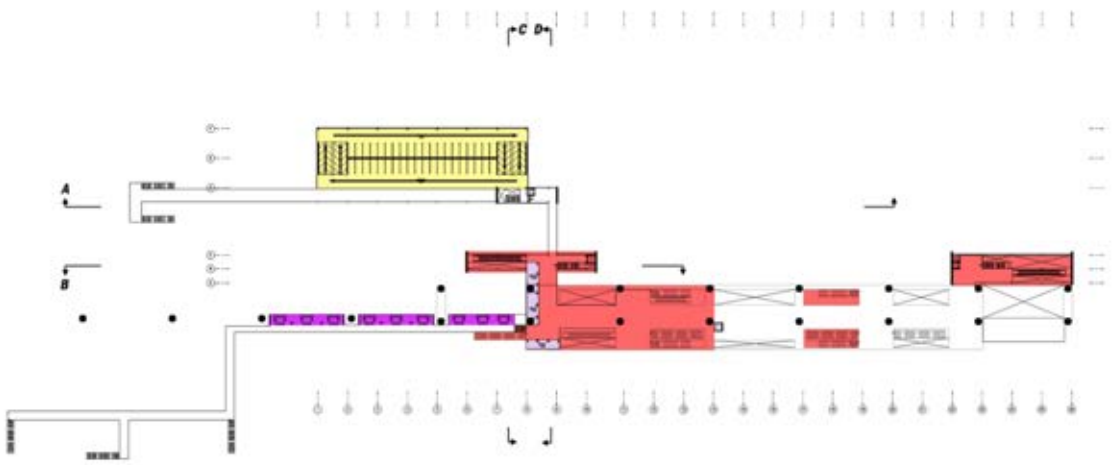


| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title OVERALL FLOOR PLAN LEVEL 2 | N<br>Drg. No. A-9<br>Date 03/22/13<br>Scale 1:1250 |



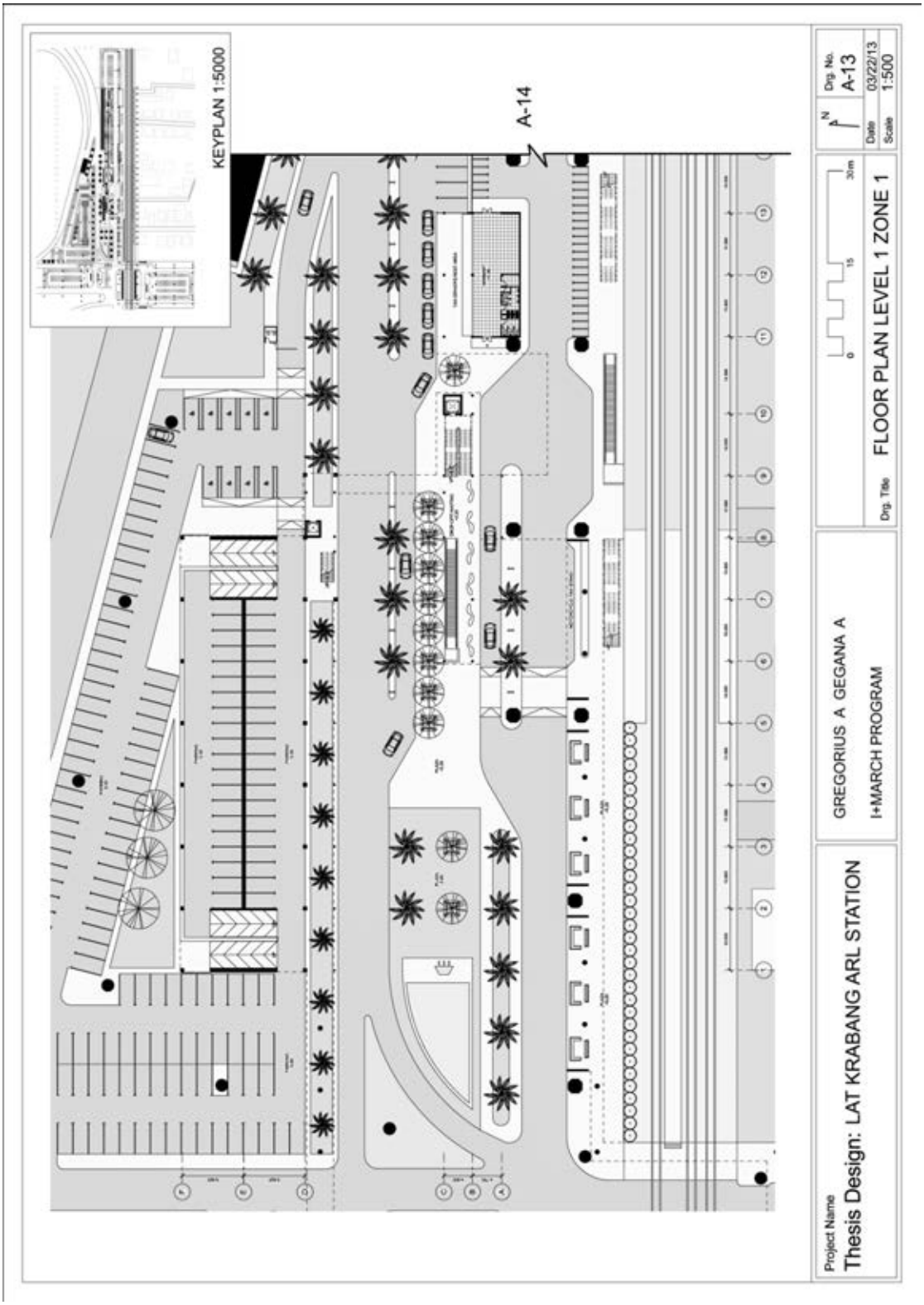
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title ROOF PLAN | N<br>Drg. No. A-10<br>Date 03/22/13<br>Scale 1:1250 |

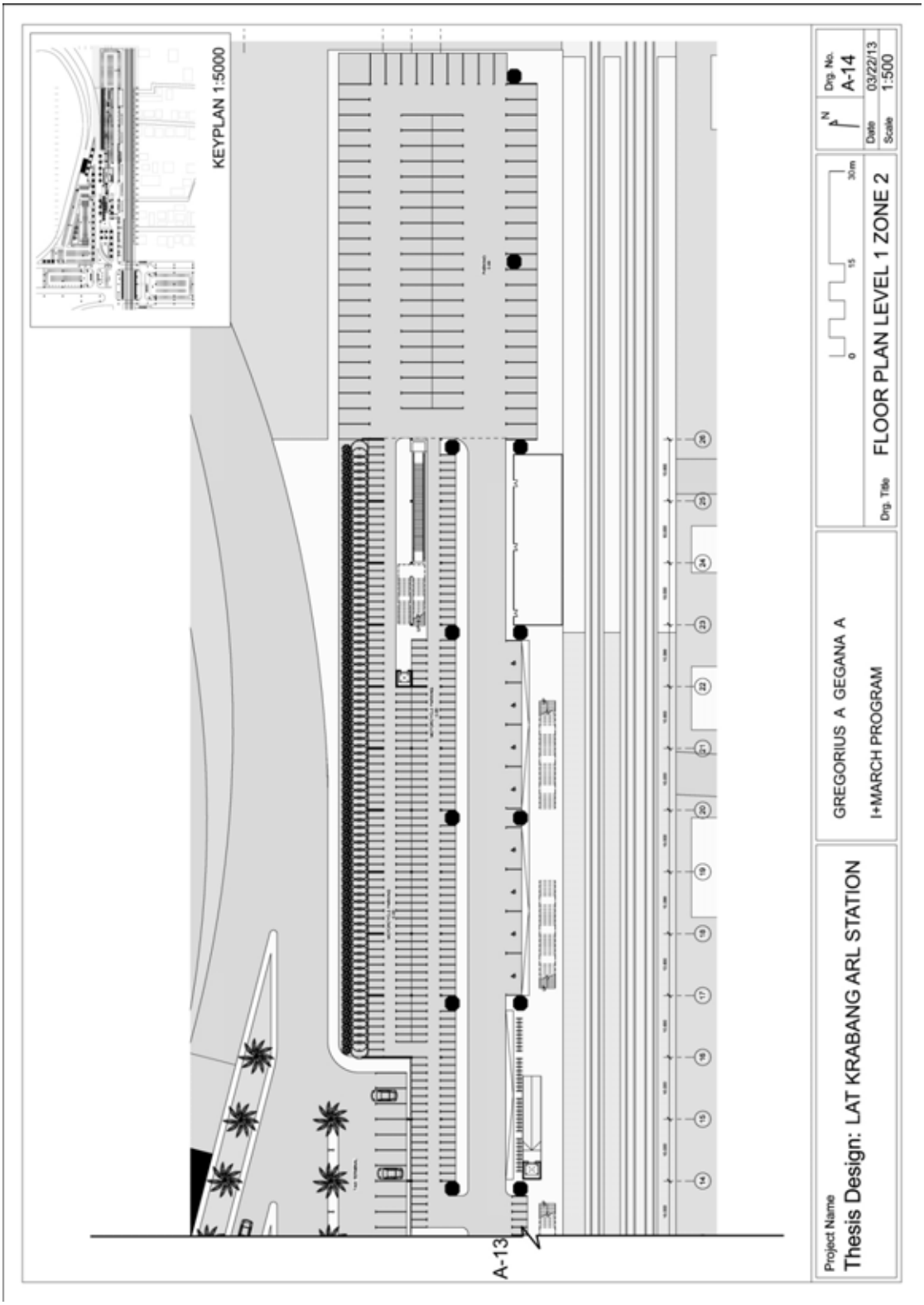

PLAZA/ PARK
CAR PARKING
MOTORCYCLE & BICYCLE
PUBLIC TRANSPORT STOP/ TERMINAL
TAXI STAND/ TERMINAL
MOTORCYCLE TAXI
RETAILS
STREET VENDOR
SERVICE AREA
DROP-OFF
MAIN ENTRANCE/ STAIR
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Drg. Title
PROGRAM ZONING LEVEL 1
0 10 50 100m
N
Drg. No.
A-11
Date
03/22/13
Scale
1:1250

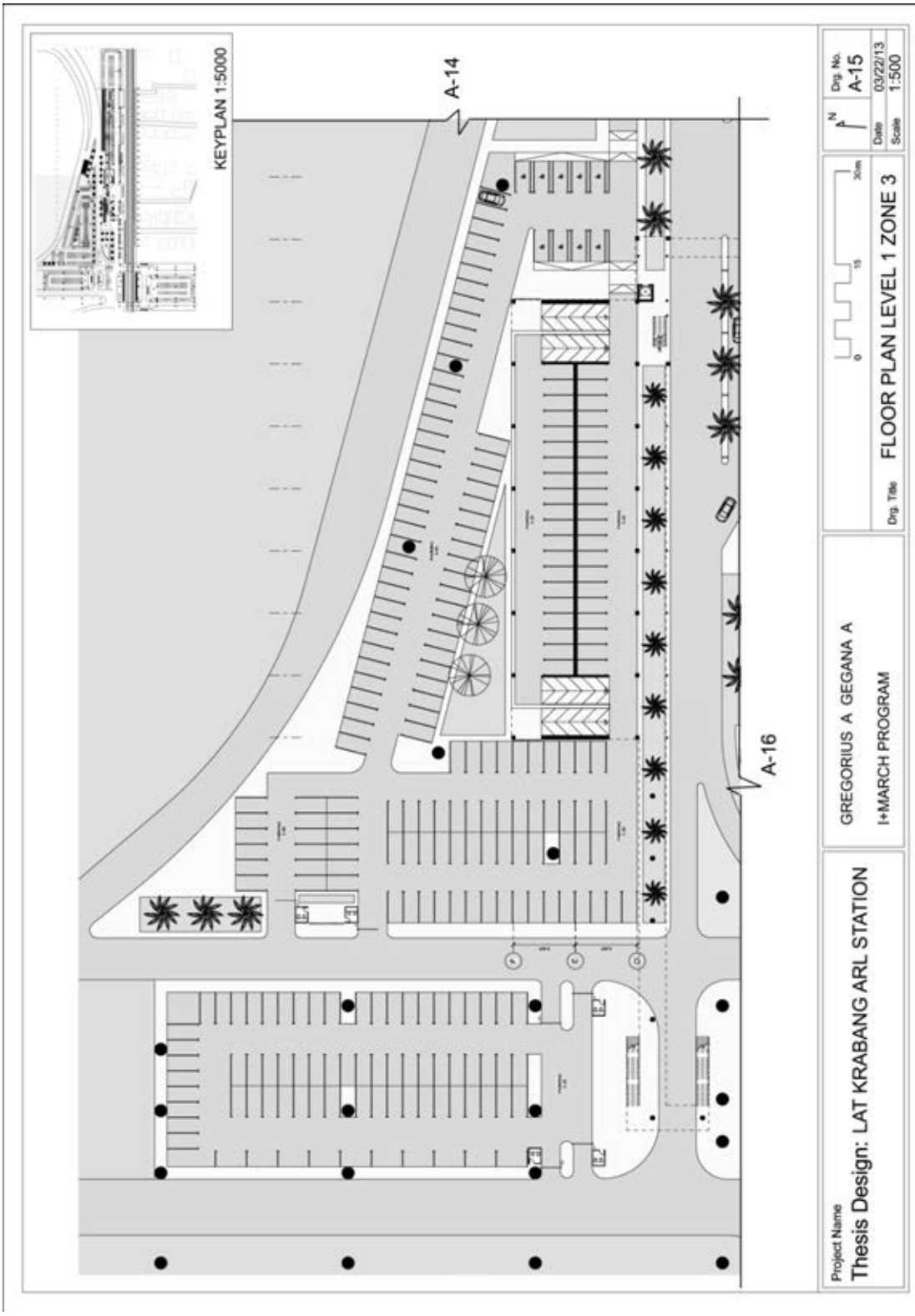


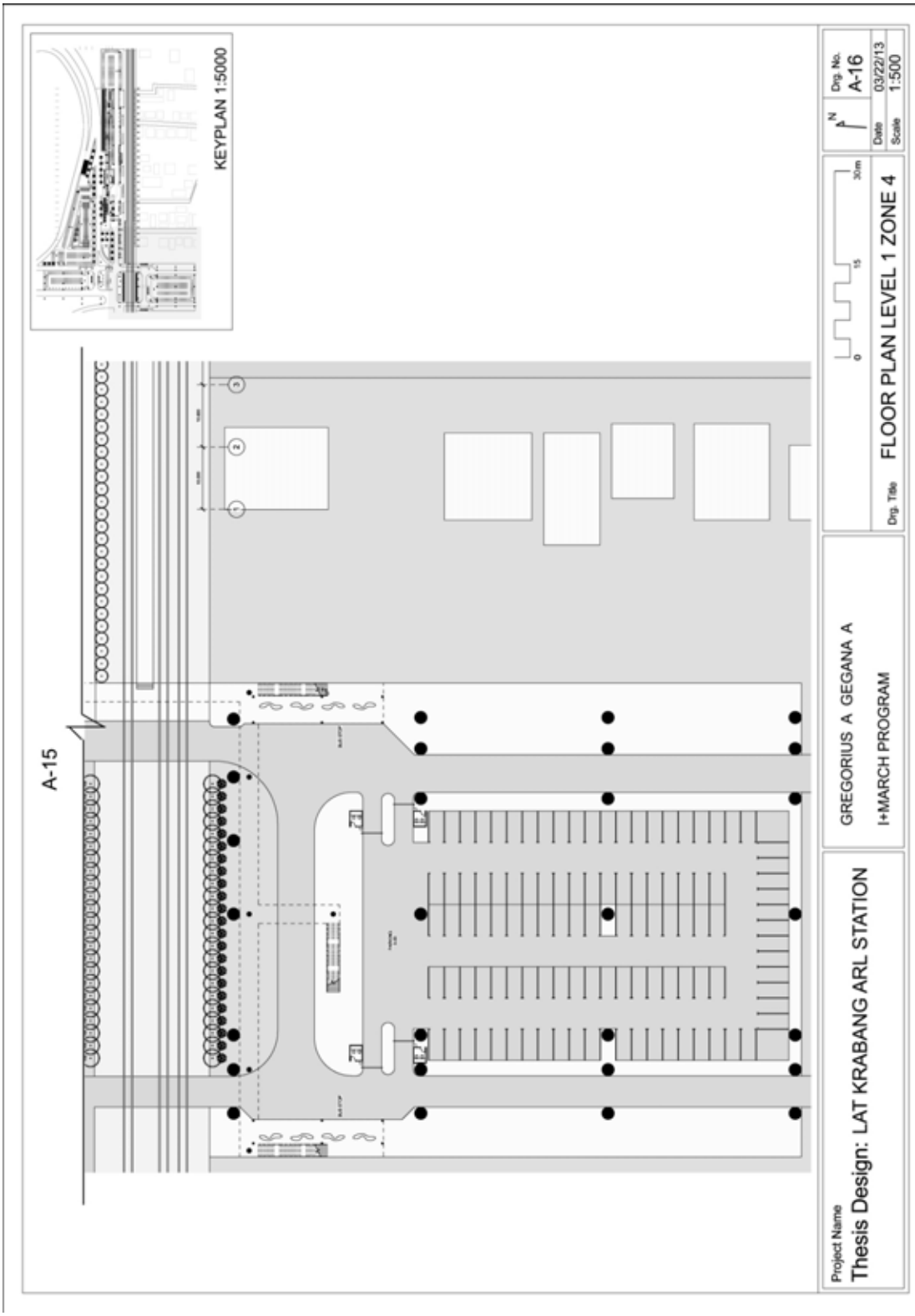

PLAZA/ PARK
CAR PARKING
MOTORCYCLE & BICYCLE
PUBLIC TRANSPORT STOP/ TERMINAL
TAXI STAND/ TERMINAL
MOTORCYCLE TAXI
RETAILS
VENDOR
SERVICE AREA
DROP-OFF
MAIN ENTRANCE/ STAIR

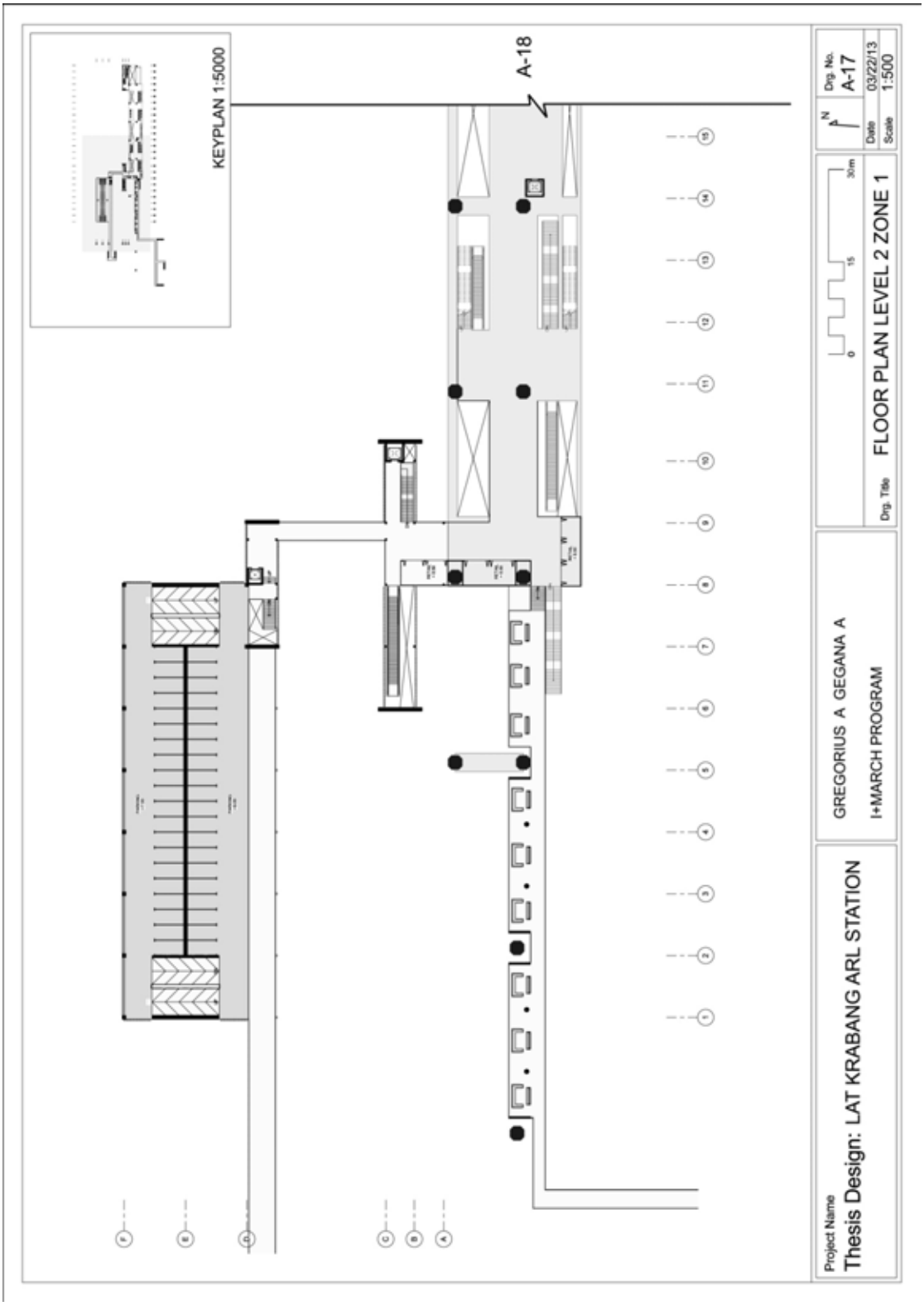
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 10 50 100 m<br>Drg. Title PROGRAM ZONING LEVEL 2 | N<br>Drg. No. A-12<br>Date 03/22/13<br>Scale 1:1250 |

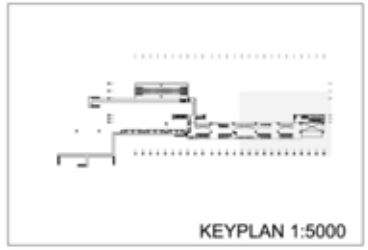

KEYPLAN 1:5000
A-14
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Dwg. Title
FLOOR PLAN LEVEL 1 ZONE 1
Dwg. No.
A-13
Date
03/22/13
Scale
1:500


KEYPLAN 1:5000
A-13
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Dwg. Title
FLOOR PLAN LEVEL 1 ZONE 2
Dwg. No.
A-14
Date
03/22/13
Scale
1:500


KEYPLAN 1:5000
A-14
A-16
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Dwg. Title
FLOOR PLAN LEVEL 1 ZONE 3
Dwg. No.
A-15
Date
03/22/13
Scale
1:500

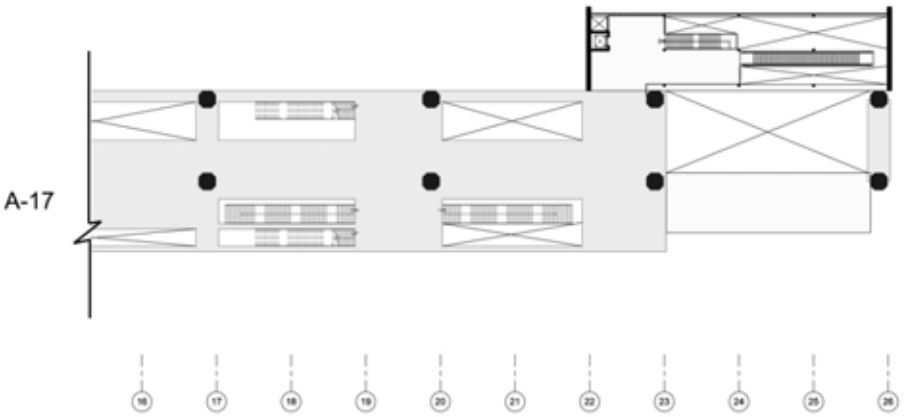

KEYPLAN 1:5000
A-15
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Drg. Title
FLOOR PLAN LEVEL 1 ZONE 4
Drg. No.
A-16
Date
03/22/13
Scale
1:500


KEYPLAN 1:5000
A-18
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Dwg. Title
FLOOR PLAN LEVEL 2 ZONE 1
Dwg. No.
A-17
Date
03/22/13
Scale
1:500

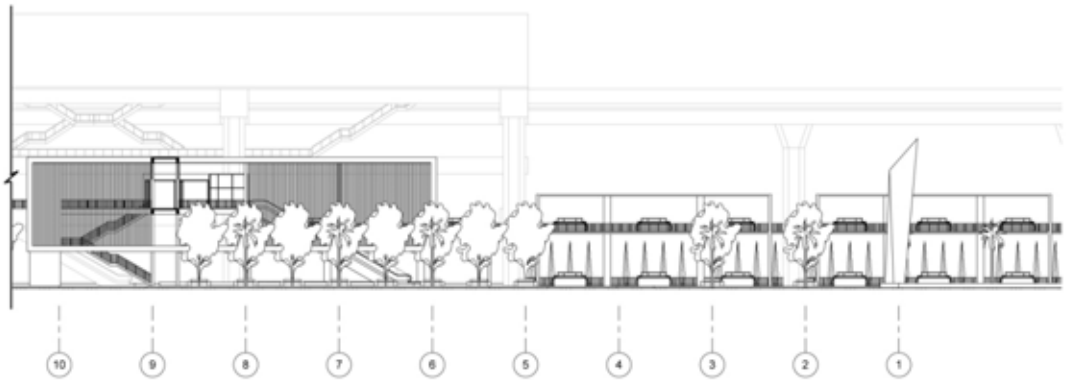


KEYPLAN 1:5000

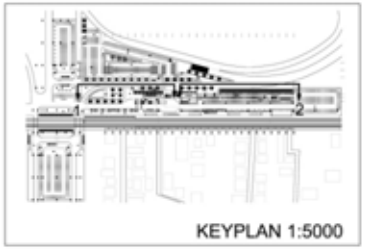
A-17



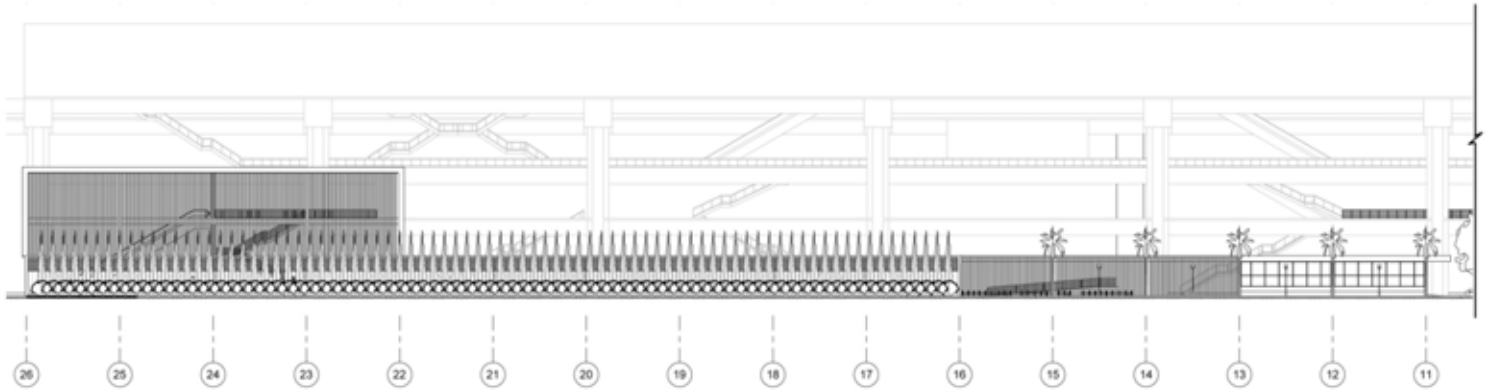
| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title FLOOR PLAN LEVEL 2 ZONE 2 | N<br>Drg. No. A-18<br>Date 03/22/13<br>Scale 1:500 |




1. NORTH ELEVATION 1 (SOUTH ZONE)

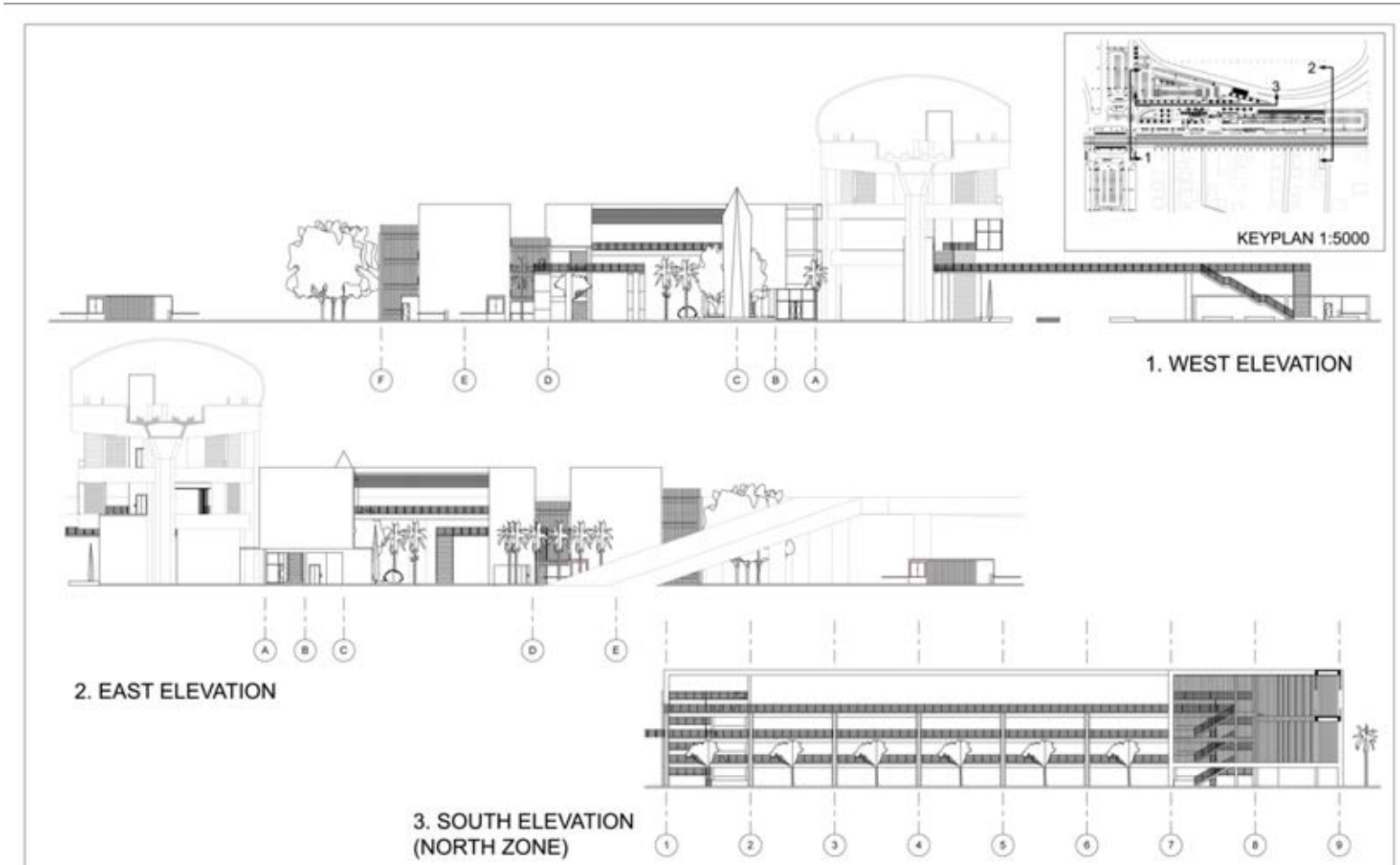


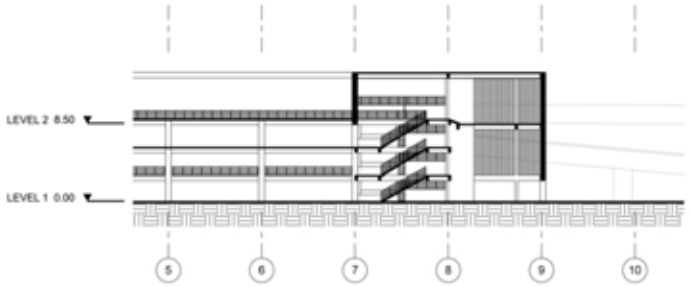
KEYPLAN 1:5000



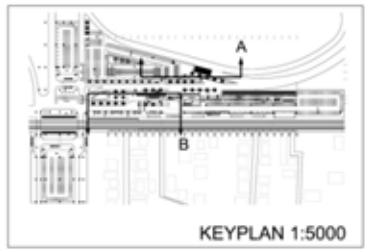

2. NORTH ELEVATION 2 (SOUTH ZONE)

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title ELEVATION | Drg. No. A-19<br>Date 03/22/13<br>Scale 1:400 |

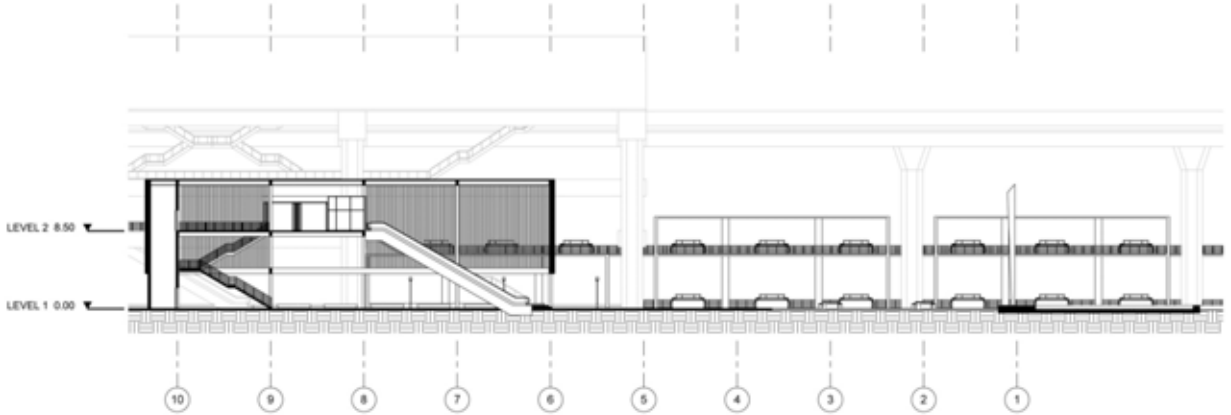

KEYPLAN 1:5000
1. WEST ELEVATION
2. EAST ELEVATION
3. SOUTH ELEVATION
(NORTH ZONE)
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
0
15
30m
Drg. Title ELEVATION
Drg. No.
A-20
Date 03/22/13
Scale 1:400




1. SECTION A-A'

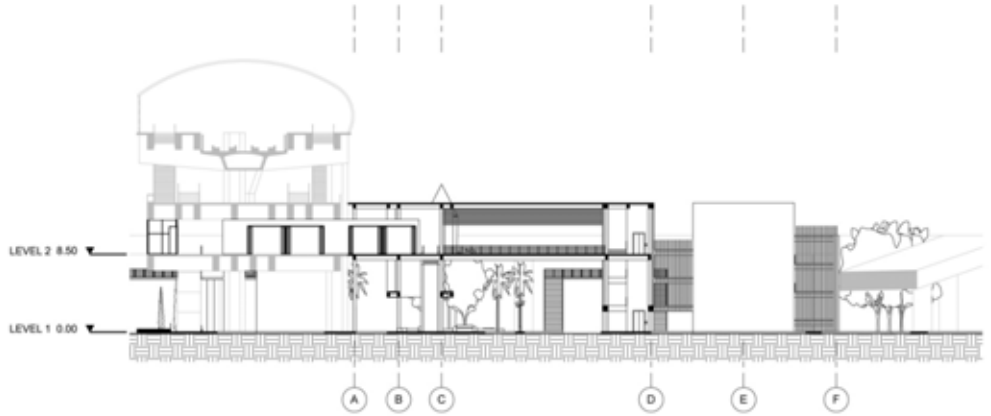



KEYPLAN 1:5000

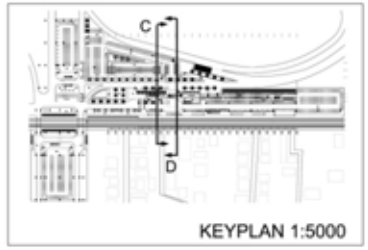


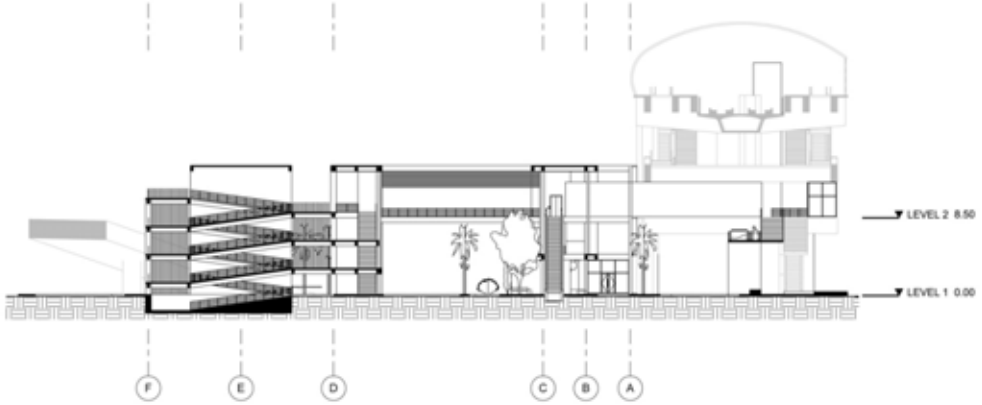

2. SECTION B-B'

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | 0 15 30m<br>Drg. Title SECTION | Drg. No. A-21<br>Date 03/22/13<br>Scale 1:400 |




1. SECTION C-C'




2. SECTION D-D'

| | | | |
|---|---|---|---|
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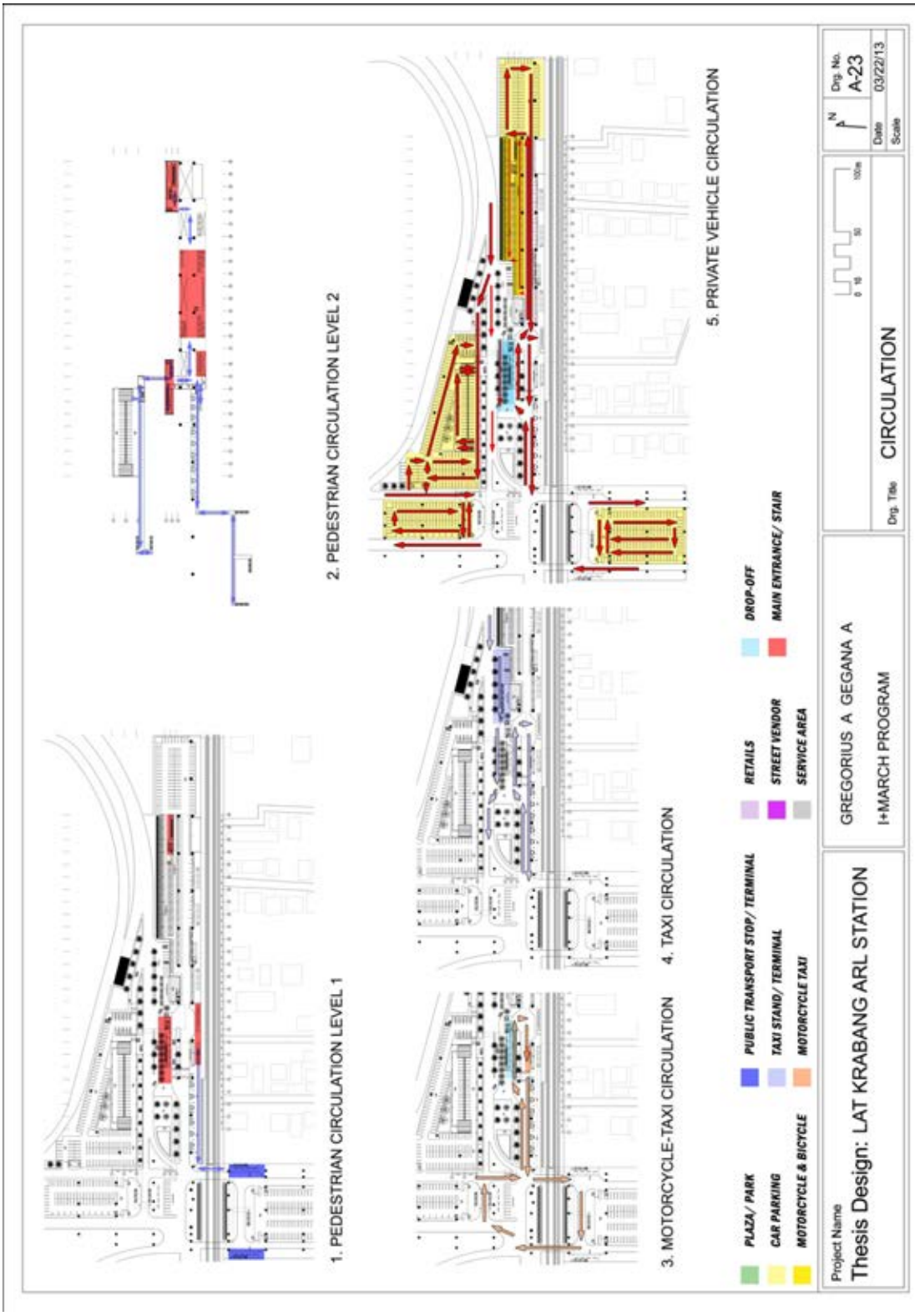

1. PEDESTRIAN CIRCULATION LEVEL 1
2. PEDESTRIAN CIRCULATION LEVEL 2
3. MOTORCYCLE-TAXI CIRCULATION
4. TAXI CIRCULATION
5. PRIVATE VEHICLE CIRCULATION
PLAZA/ PARK
CAR PARKING
MOTORCYCLE & BICYCLE
PUBLIC TRANSPORT STOP/ TERMINAL
TAXI STAND/ TERMINAL
MOTORCYCLE TAXI
RETAILS
STREET VENDOR
SERVICE AREA
DROP-OFF
MAIN ENTRANCE/ STAIR
Project Name
Thesis Design: LAT KRABANG ARL STATION
GREGORIUS A GEGANA A
I+MARCH PROGRAM
Drg. Title
CIRCULATION
Drg. No.
A-23
Date
03/22/13
Scale

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: AERIAL VIEW | Drg. No. A-24<br>Date 03/22/13<br>Scale - |

1. PLAZA & ACCESS ROAD

2. PLAZA & LANDMARK

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-25<br>Date 03/22/13<br>Scale - |

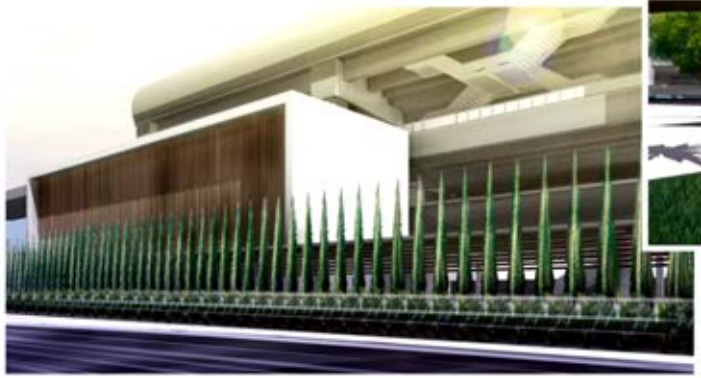
1. DROP-OFF/ WAITING AREA & TAXI STAND

2. DROP-OFF/ WAITING AREA & TAXI STAND

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-26<br>Date 03/22/13<br>Scale - |

1. PARKING BUILDING

2. PARKING NORTH GATE



3. EAST ENTRANCE & MOTORCYCLE PARKING

| | | | |
|---|---|---|---|
| Project Name<br>Thesis Design: LAT KRABANG ARL STATION | GREGORIUS A GEGANA A<br>I+MARCH PROGRAM | Drg. Title 3D: PERSPECTIVE | Drg. No. A-27<br>Date 03/22/13<br>Scale - |

# BIOGRAPHY

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Work experience:

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RAFA + Architect, Bangkok

2006 – 2011

Teaching Assistant (2006 – 2008)

Part-time Lecturer (2008 – 2011)

University of Indonesia, Department of Architecture Faculty of Engineering

September 2007 – December 2007

Lighting Designer

PT. Lumina Arsi Dinamika, Jakarta