Improving Access to a Mass Transit Station in Suburb of Bangkok

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Abstract: Airport Rail Link (ARL) is an express rail system links center of Bangkok to Suvarnabhumi Airport. The system also works very well as a mass transit system that transports commuters between suburbs and downtown. However, ARL cannot cover its costs since ridership is low. Among all stations, Ban Thab Chang station has the lowest number of passengers due to its poor access. The study aims to promote ARL as a sustainable transportation choice for residents around the station to increase ridership. In this paper, field survey was conducted, officers from related government agencies were interviewed, and access improvements are proposed. Afterward, the residents will be interviewed to confirm the access improvements. Since mass transit systems are being expanded from center of Bangkok to suburbs, where many housing estates are located, this research is a useful case study to improve accesses from housing estates to the mass transit stations.

Keywords: Access to Mass Transit Station, Auto Access, Non-auto Access, Multi-modal Access

1. INTRODUCTION

Transportation accounts for about 60 per cent of total global consumption of liquid petroleum (UN, 2009) and also accounts for approximately 15 per cent of overall greenhouse gas (GHG) emissions (OECD, 2010). In 2009, Thailand was ranked the 23rd countries that produced CO_2 and 50 per cent of the CO_2 was from transportation sector (Shipper, 2009 cited in BMA, 2010). Bangkok is also well known about traffic congestion problems. Many related agencies have been solving the problems. Providing mass transit is one of sustainable solutions. The first phase of the Bangkok Mass Transit System (BTS) or the Green Line was opened in 1999 with a total of 23.1 km of routes and the underground Metro Line (MRT) or the Blue Line was opened in 2004 with a total of 20 km of routes. At that time, the mass transit lines are located only in the centre of Bangkok. At present, mass transit network are planed and being constructed to extend the mass transit lines to suburb of Bangkok.

In 2010, an express rail system i.e. the Airport Rail Link (ARL) was opened to link downtown of Bangkok to Suvarnabhumi Airport (SA). ARL provides 3 train systems that are SA Express, SA City Line and Phaya Thai Express Line. The system provides services to both airport passengers and commuters from the Eastern suburb of Bangkok. Actually, number of commuters is higher than number of the airport passengers. The SA City Line is very crowded during morning and evening peak hours while the SA Express does not have many passengers. At present, ARL cannot earn enough income to cover its costs since number of passengers on the three systems is lower than estimated number of passengers.

Among all 8 stations of ARL, Ban Thab Chang station has the lowest number of passengers. In January 2013, number of passengers at the station was only 1,500 passengers per day (SRT Electrical Train Co. Ltd., 2012). Since number of passengers is very low, half of the station area is closed to reduce costs of staff and maintenances. The study aims to promote ARL as a sustainable transportation choice for residents in housing estates around Ban Thap Chang Station in order to increase number of passengers. Field survey was conducted to understand transport network around the station area and problems. Officers from related government agencies were interviewed to get information about their policy in promoting the system. In this paper, access improvements are proposed based on results from the field surveys and interviews. Afterward, the residents will be interviewed to find their opinions about the system and their preferences. In addition, housing estates developers and local related government agencies will be interviewed to find their opinions about improving accesses to the station. Finally, recommendations for access improvements will be provided to promote ARL as a sustainable transportation choice for residents around Ban Thap Chang Station. Since mass transit lines are being expanded from the center of Bangkok to suburbs where many housing estates are located, this research will be a useful case study to improve linkages between the mass transit stations and the housing estates, and promote the mass transit as a sustainable mode choice for the residents.

2. ACCESSES TO TRANSIT STATIONS

Accesses to stations are very important for rail mass transit systems because conveniences of accesses influence passengers' satisfaction of the systems and affect increasing or decreasing of ridership. Improving station access can help to increase effectiveness of mass transit and number of passengers with more cost effective than improving the whole mass transit service system. Conveniences of accesses also encourage car users to be mass transit users and inspire non-regular mass transit users to be regular mass transit users. (Givoni and Rietveld, 2007 and Brons et.al. 2009)

Similarly, Selmer C. and Hale C. (2010) explain that quality of passenger access to stations and egress to destinations represents effectiveness of mass transit. In addition, accesses to mass transit stations influence commuters to use or not to use the mass transit systems. This will also affect ridership and income of the system. Therefore, agencies that provide mass transit services should pay attention to accessibility and station area planning. Accesses to rail mass transit stations in different cities are depend on transportation characteristics and network in the cities, locations of the stations, characteristics of land use around the stations, parking facilities at the stations and walking environments around the stations.

TCRP (2012a) observed how passengers access to stations of Bay Area Rapid Transit (BART) in San Francisco. It was found that most of passengers walk to stations in high density urban neighborhood. However, most of passengers drive to the stations in high density urban neighborhood that have parking spaces, and poor walking environments. Although stations have good walking environments but passengers drive to stations that have parking spaces. For stations in suburban neighborhood, most of passengers drive to the stations because there are plenty of parking spaces. This means availability of parking spaces i.e. park-and-ride at stations encourage passengers to drive to stations.

Givoni and Rietveld (2007) explain that in the Netherlands, distances between home and stations influence passengers' decisions in selection access modes. Most of the passengers who live within 3 km. from the stations travel to the stations by bicycling,

walking and riding buses respectively. Most of the passengers who live further than 3 km. from the stations travel to the stations by riding buses, bicycling, and driving cars respectively. Burns (1979) determined that suitable driving distance from home to park-and-ride at rail stations is within 5 km. It can be concluded that walking distance from home to stations is 500 m., bicycling distance is 3 km., and driving distance is 5 km. In conclusion, primary modes that rail passengers access to mass transit stations include auto access i.e. driving or being dropped-off by cars and riding feeder buses, and non-auto access i.e. walking and cycling. Walking and bicycling access to rail transit stations should be balanced with auto access in order to create multi-modal transit access systems (Replogle, 1992).

2.1 Auto access

Auto access includes using private cars and riding feeder buses. Using private cars comprises park-and-rides, where car users can park their cars and continue their trips by mass transit, and kiss-and-ride that mass transit passengers are being dropped by cars.

2.1.1 Park-and-Ride and Kiss-and-Ride

Previously, access to stations by cars was very common. Many rail transit stations are surrounded by huge parking spaces. Burns (1979) explains that park-and-ride is a combination of private car and mass transit usage. It contributes to energy conservation, air quality improvement and operation efficiency and safety of transportation network.

However, Selmer C. and Hale C. (2010) stated that cars are the most costly access mode for transit agencies since land needed for parking spaces is expensive. Access modes to transit should be sustainable. Walking, bicycling, and riding feeder transit can increase ridership without building more parking spaces. Providing park-and-ride is also wastes large land area, generates more traffic congestions at the area around the stations, affects environments around the stations in terms of air and noise pollutions from cars. The parking spaces should be developed as mixed-used development including residential and commercial areas or office according to Transit Oriented Development (TOD) concept. The development will benefit the rail transit system in term of ridership.

Kiss-and-ride area is for people who are being dropped-off by cars. Schank (2002) explains that parking lots design and regulation have an effect on kiss-and-ride usage. Parking lots with larger and more accessible drop-off points have higher kiss-and-ride percentages. However, parking lots with illegal-parking problems have lower kiss-and-ride percentages because it is difficult to find a drop-off place.

Green and Hall (2009, cited in Selmer C. and Hale C., 2010) recommended that number of parking spaces at stations in urban areas, where public transport and bicycling access are available, should be reduced. In many stations, parking spaces are converted to residential and commercial areas or office to capture real value of land and increase ridership. For example, TCRP (2012b) explained that TriMet – a transit provider in Portland, who has its goal to create communities that make transit a sustainable choice for all trips, attempt to integrate stations with nearby communities and develop a rail system that focuses on non-auto access. At Willow Creek/SW 185th station, where only 35% of park-and-ride was used, Trimet provided the surplus capacity to Portland Community College (PCC) to build an extension of the community college, state employment office, and coffee shop. The PCC Willow Creek has been successful for TriMet and the college. Number of students is higher as well as number of passengers at the station. In addition, activities at the station start from 7:00 a.m. to 10:00 p.m. and make the station area more secure.

2.1.2 Feeder Bus

Feeder bus is a desirable option for passengers that live further than walking distance to transit stations, especially for those who do not have private vehicles or cannot afford cost of parking at transit stations. Comparing to park-and-ride, feeder bus generate less traffic congestion and emissions. However, providing feeder bus service is costly when it has to time-competitive with cars, especially in low-density areas where number of passengers is low (TCRP, 2009).

Cervero (2006, cited in Selmer C. and Hale C., 2010 and TCRP, 2009) explained that a US survey of feeder bus usage found that service frequency is a key for successful of feeder bus service. In areas where development is not well connected to transit stations such as office development in suburbs, providing high-quality feeder buses, discounting transit fares, and limiting parking spaces at office can encourage employees to travel by the transit.

Yim and Ceder (2006, cited in TCRP, 2009) conducted a survey with BART users at Castro Valley BART station and found that the respondents revealed that travel time, cost and reliability are the most important aspects determining attractiveness of feeder bus services.

2.2 Non-auto access

Federal Highway Administration (FHWA, 1992) stated that improving nonmotorized transit access i.e. bicycling and walking to mass transportation is one of the most cost-effective ways to improve air quality and manage traffic congestion. However, Pedestrian and Bicycle Information Center (PBIC, 2013) explained that transit agencies usually manage only mass transit stations and parking spaces while sidewalks, crossings, pedestrians and cyclists elements on nearby streets are ignored. Thus, walking and cycling to the stations is unsafe and unattractive. To improve this situation, transit agencies should cooperate with local transportation agencies to improve pedestrian and bicycle access to mass transit stations.

2.2.1 Walking

TCRP (2009) explained that passengers who live within 800 m. from stations will walk to station. Similarly, PBIC (2013) clarified that transit riders usually walk one-fourth to one-half mile i.e. 5 to 10-minutes walk to and from transit stations. However, there are other factors that affect the decision on walking that are urban design, pedestrian facilities, crime and safety perceptions, and individual characteristics such as age and gender. Furthermore, Bicycle Federation of America (1998) explained that obstacles for pedestrian and disable people are as lack of sidewalks and/or narrow walkway widths, missing curb cuts, poorly constructed and/or maintained walking surfaces, difficult street crossings or lacking pedestrian crossings, inadequate facilities for access to transit services, and high-speed and high volume traffic.

Distance of walking distance and selection of transportation mode are affected by walking environment (O' Sullivan and Morrall, 1996). To improve pedestrian access to rail transit station, Otak Inc. (2003) clarified that needs of pedestrians are include safe streets and walking areas, convenience, nearby places to walk, visibility, comfort and shelter, attractive and clean environments, interesting things to look at while walking, and social interaction.

2.2.2 Cycling

Queensland Transport (2006, cited in Selmer C. and Hale C., 2010) explained that cycling

can help to increase rail transit catchment distance to 10 times greater than walking. Improvement cycling access will increase number of passengers at low access-service costs for transit providers. To encourage bike-and-ride connections, FHWA (1992) suggested that all mass transit stations, especially suburban stations, should provide secure bicycle parking.

In addition, Cervero *et al.* (2012) explained converting park-and-ride to bike-and -ride trips benefits environmental, energy conservation, and public-health. However, TCRP (2009) explained that some factors that influence transit users to bike to stations cannot be controlled by transit providers such as wide quality of bicycle facilities, topography, weather, and bicycle culture. Nonetheless, providing bicycle facilities at transit stations such as high-quality bike parking has an important impact on bicycle access. Additionally, permitting passengers to carry bicycles on rail cars is preferred option and provide more flexibility for passengers.

Martens (2004) studied bicycle usage as a feeder mode in Germany, the United Kingdom, and the Netherlands and found that bicycle usage for access trips is equivalent to overall levels of bicycle ridership for each country. Similarly, policies and infrastructure to support bicycle access to transit stations generally follow overall investments in bicycle infrastructure by country. The Netherlands has the highest amount of investment and ridership, followed by Germany, and the United Kingdom. Martens (2004) also found that in countries with well-developed bicycle networks, bicycles compete with local public transit services such as buses and trams, but supplement longer distance rail services. In addition, the Dutch government has invested in promotion of bike-and-ride since the early 1990s to increase the combined use of bike-and-train (Martens, 2007).

3. OVERVIEW OF THE AIRPORT RAIL LINK

Suvarnabhumi Airport - the newest and biggest international airport in Thailand has been opened for service since September 28, 2006. The airport is aimed to be Thailand's gateway and regional air transportation center with its capacity equivalent to leading international airports in the world. To complete services of the airport to international level and to provide convenience and reliable service to passengers with shorter travel time, an express rail system linking downtown of Bangkok to the airport has been provide since August 23, 2010. The express rail system is well-known as the Airport Rail Link (ARL).

Previously, ARL was operated by the State Railway of Thailand (SRT). However, there are many problems in operating the system. Therefore, SRT established a subsidiary company that is SRT Electrical Train Co. Ltd. (SRT ET) to operate the system in 2012. ARL comprises of almost entirely elevated railway and stations with the height of around 22 meters except for the section before entering the, which is at the ground level and lower into the tunnel underneath Suvarnabhumi Station. ARL (2013) explains that the system has total 8 stations as presented in Figure 1 and provides 3 train systems as described in the following.

1. Suvarnabhumi Airport Express or SA Express is an express electric train linking the airport and City Air Terminal or CAT, which is located at Makkasan Station. SA Express stops only at the airport and CAT. This line is 25 kilometers long. Travel time is 15 minutes. SA Express has 4 trains and each train has 3 passenger cars, which have 170 passenger seats, and 1 baggage car that makes up altogether 4 cars. It provides service from 06.00 to 24.00 daily. Fare is 150 Baht for a one-way ticket.

2. Suvarnabhumi Airport City Line or SA City Line is an electric train system that provides services in parallel with the SA Express. This line provides service between Phaya Thai Station, where passengers can transfer to a mass transit system i.e. BTS system, and the

airport. SA City Line stops at 6 stations along the way namely Rajprarop Station, Makkasan Station (CAT), Ramkhamhaeng Station, Hua Mark Station, Ban Thab Chang Station, and Lad Krabang Station, as presented in Figure 1. This line is 28 kilometers long. Travel time is 30 minutes. SA City Line has 5 trains and each train has 3 passenger cars with the capacity of 745 passengers per train. It provides service from 06.00 to 24.00 daily. Fares are varied from 15-40 Baht depends on travelling distances.

3. Phaya Thai Express Line provides services in parallel with the SA City Line but stops only at the airport and Phaya Thai station. Travel time is 17 minutes. Services are provided during 06.00 to 24.00 daily with headways of 40 minutes. Fares are 90 Baht for a one-way ticket and 150 Baht for a round trip ticket (available for 14 days).

Parking spaces or park-and-ride are provided at the stations except Ramkhamhaeng and Ratchaprerop stations that are located close to main roads and easily accessed by walking. A skywalk is available at Phaya Thai station to link ARL and BTS. At Makkasan, a skywalk is under construction to link the system to MRT.

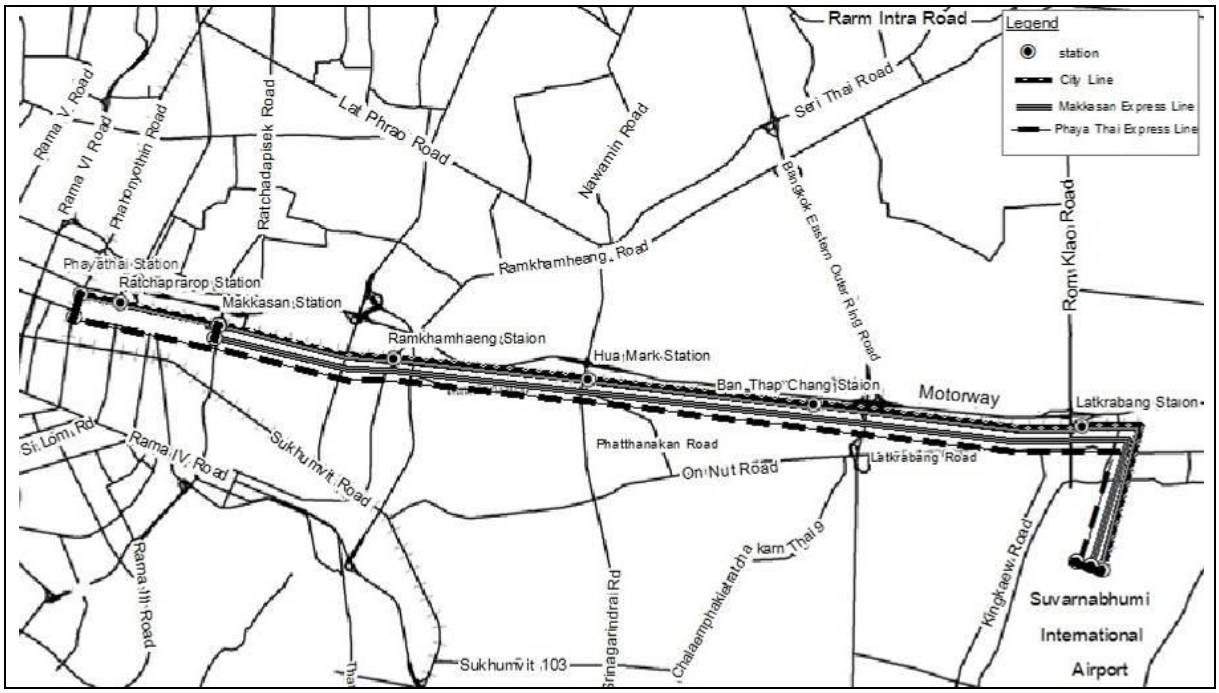


Figure 1. ARL 3 systems and stations

In 2012, Vichiensan V. conducted questionnaire surveys with around 6,100 passengers at the stations, except Suvarnabhumi Airport station. It was found that most of the respondents were employees in private companies and university students, ages 20-29 years old. Their household incomes were higher than 35,000 Baht/month. Trip purposes were home base work and home base other. Most of them travelled by the City Line and did not go to the airport. They travelled to the stations by walking (25.35%), private cars (15.64%), public bus (15.02%), and BTS/MRT (12.63%). Foe egress modes, most of the respondents travel from the stations by walking (38.63%), BTS/MRT (23.94%), Taxi (9.14%), public bus (8.56%), private cars (6.97%). Details of the access and egress modes that are presented in Table 1 show that ARL does not only transport commuters to the center of Bangkok but also play important role as a feeder service that feeds passengers to the mass transit systems i.e. BTS and MRT that located in the center.

At present, ARL cannot cover its costs because number of passengers on the system is

lower than estimated in 2006. A report from OTP (2006) shows that estimated number of passengers on the SA Express and SA City Line in 2012 should be 27,600 and 130,600 passengers per day respectively. However, number of passengers on SA Express and SA City Line in December, 2012 were 2,344 and 36,844 passengers per day respectively. Table 2 presents number of passengers at 8 stations. It was found that Ban Thap Chang station had the lowest number of passengers.

Table 1. Access and egress modes to ARL Stations

Modes	Access (%)	Egress (%)
Walking	25.35	38.63
Private cars	15.64	6.97
Public buses	15.02	8.56
BTS/MRT	12.63	23.94
Taxi	12.08	9.14
Motorcycle taxi	9.03	5.70
Motorcycles	1.90	0.88
Tuk tuk	1.13	1.93
Passenger vans	1.10	0.89
Bicycles	0.52	0.21
SRT trains	0.13	0.12
Other modes	5.47	3.04

Source: Prepared from Vichiensan V. (2012)

Table 2. Number of passengers on ARL in December, 2012

	Passengers on SA City Line		Passengers on SA Express	
Stations	Monthly	Daily	Monthly	Daily
Phaya Thai	291,114	9,391	23,713	765
Ratchaprarop	93,168	3,005	-	-
Makkasan	104,564	3,373	6,386	206
Ramkhamhaeng	109,686	3,538	-	-
Hou Mark	121,331	3,914	-	-
Ban Thap Chang	42,670	1,376	-	-
Ladkrabang	175,702	5,668	-	-
Suvarnabhumi Airport	203,914	6,578	42,576	1,373
Total	1,142,149	36,844	72,675	2,344

Source: Prepared from SRT Electrical Train Co. Ltd. (2012)

4. METHODOLOGY

The study aims to promote ARL as a sustainable transportation choice for residents in housing estates around Ban Thap Chang Station by improving access from the housing estates to the station. In mid of January, 2013, field survey was conducted at Ban Thap Chang station to understand physical environments around the station. Survey checklist included road network, existing land use and land development, and access and egress modes to the station. Informal interviews with a passenger, a motorcycle taxi rider, and staffs in housing

estates nearby the station were conduct to reveal access routes by different transportation modes and problems in travelling to the station.

After the field survey, officers from related government agencies that are SRT ET and Office of Transport and Traffic Policy and Planning (OTP) were interviewed to get information about their policies in promoting the system, increasing number of passengers, and improving accesses to the station.

In this paper, alternatives to improve accesses to Ban Thap Chang station are proposed based on results from the field survey and the interviews. These alternatives will be considered by residents in housing estates around the station using questionnaire surveys.

In the next step, questionnaire surveys with residents in housing estates will be conducted to find their opinions and preferences about accesses to the station. Developers, who invest in housing estates around the stations, will be interviewed to find their opinions about how to combine the ARL system in marketing their housing estates. Related government agencies will be interviewed to find their opinions about improving accesses to the station. Finally, recommendations will be provided to improve accesses to the station.

5. RESULTS FROM FIELD SURVEY AND INTERVIEWS

5.1 Results from Field Survey

5.1.1 Location and Road Network around the Station

Ban Thab Chang Station is located on a frontage road, south of Bangkok-Chonburi Motorway. Road network in the area includes Bangkok-Chonburi Motorway, On Nut road, Chaloem Phrakiat Ratchakan Thi 9 road and Krungthep Kritha road, as presented in Figure 2. Figure 3 presents access and conditions of road network around Ban Thab Chang Rail Station.

Bangkok-Chonburi Motorway or Route 7 is an intercity motorway. It stretches all the way from Sri Nakharin Road in Bangkok, passes Kanchanaphisek Outer Ring Road or Route 9, Suvarnabhumi Airport towards Pattaya nearly 150 km. Currently, sections of this route from Sri Nakharin Road to Chonburi are eight lanes wide. Its frontage road that links to Ban Thap Chang station has two lanes for two-ways traffic.

Chaloem Phrakiat Ratchakan Thi 9 road is function as a two-way main road that links Sri Nakharin road with On Nut road. It stretches from Sri Udomsook Intersection, passes Prawet Intersection and On Nut road toward Ban Thab Chang Rail Station nearly 8 kilometers. However, the road is end at the railway line. The road section from Prawet Intersection to the station is two lanes wide with no footpath or shoulder.

Krungthep Kritha road is function as a two-way local road in Nakkila Laem Thong Village and links Sri Nakarin road with the Outer Ring Road (Kanchanaphisek road). The route is four lanes wide.

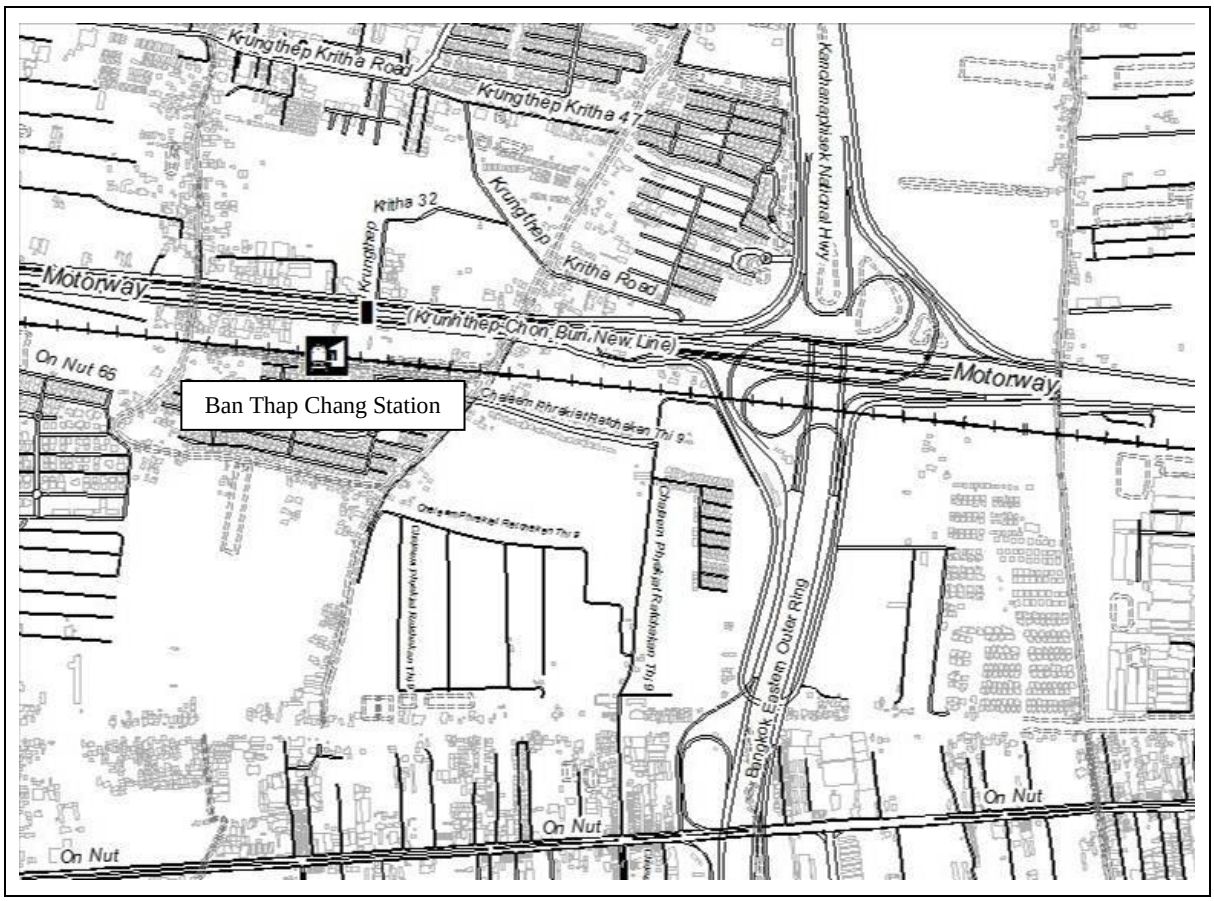


Figure 2. Location and Road Network around Ban Thap Chang Station

Pedestrian bridge above the Motorway

Entrance from the Motorway frontage road

Chaloem Phra Kiat Ratchakan Thi 9 road

Illegal parking on Krungthep Kritha road

Figure 3. Access and Road Network around Ban Thab Chang Rail Station

5.1.2 Land use and Land Development around the Station

According to the Bangkok Land Use Comprehensive Plan and Regulation B.E. 2556 (2013 A.D.), Ban Thab Chang Station is located in a yellow zone, which is a low-density residential area. It is designed to preserve and promote neighborhood of single dwellings for individual households at lower intensities. Flexibility in housing type is promoted by allowing detached single dwelling units, twin house and row house units. Compatible non-residential development, such as commercial buildings less than 300 sq. m., commercial row buildings, office less than 300 sq.m., row office building, slaughterhouse, cemetery, schools, churches, parks, hospital and child care facilities are permitted at appropriate locations and at an appropriate scale.

From field survey, it was found that the area around Ban Thap Chang Station has many subdivision projects i.e. housing estates, some are old communities and some are new projects that still under construction or unsold. The subdivision housing projects within 0.5 and 3.0 km. distance from Ban Thap Chang Station are shown in Figure 4. These projects have various amounts of units, type and price. Beside of that, recently, there are some new real estate development projects, as a condominium and medium-high single housing projects, as presented in Figure 5. According to that, we can predict the increasing of subdivision housing projects and density of community in nearly future. This will benefit ARL in terms of ridership and income. However, access from the housing estates to the station should be improved.

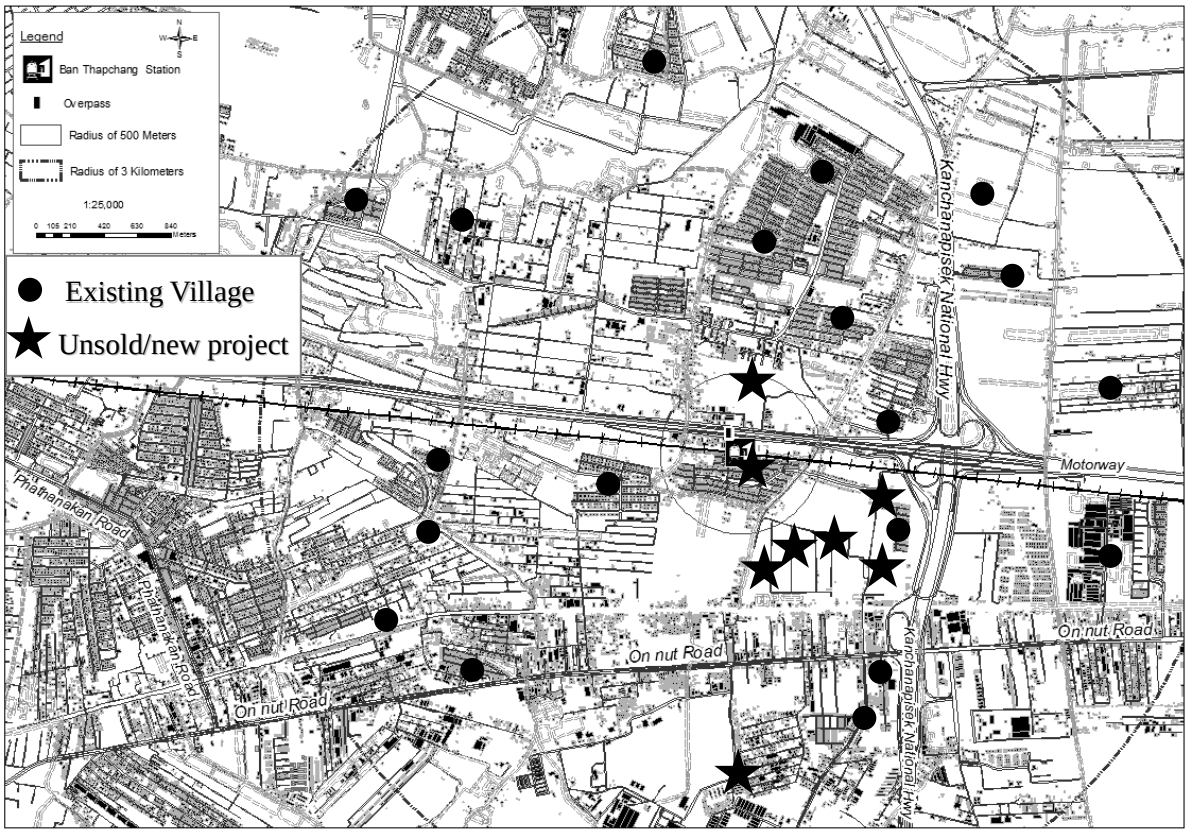


Figure 4. Housing estate projects around Ban Thap Chang station

The low density housing estate located next to Ban Thap Chang Station

Advertisements of new housing estates on Chaloem Phra Kiat Ratchakan Thi 9 road i.e. the entrance to Ban Thap Chang Station

Figure 5. The existing and new housing estates around Ban Thap Chang Station

5.1.3 Accesses to the Station

Ban Thab Chang ARL station is located close to Ban Thap Chang train station, south of Bangkok-Chonburi Motorway, and west of the Eastern Outer Ring Road, as presented in Figure 3. The railway line and the two primary roads are main obstructions that cause poor accesses to the station.

Figure 6 shows that passengers who live on On Nut road cannot access directly to the station by cars because the Chaloem Phra Kiat Ratchakan Thi 9 road ends at the railway line. Passengers who access to the station by this route travel by motorcycles, motorcycle taxis and bicycles since there is a narrow path across the railway line and link to the motorway frontage road. However, road condition is very poor, as presented in Figure10. Therefore, commuters drive to park at Hou Mark and Ladkrabung stations. Consequently, number of passenger at Ban Thab Chang station is very low compare to the two stations. Data from ARL (2013) shows that in January 2013, number of passengers at Hou Mark, Ban Thab Chang and Ladkrabung stations are 133,600, 48,600, and 208,100 passengers per month respectively.

Passengers who live in the north of the motorway can enter to the station by parking their cars, motorcycles or bicycles along local roads or using motorcycle taxi services, and walk to the station using a pedestrian bridge or overpass above the motorway, as presented in Figure 6.

There is a feeder bus service links Nakkila Laem Thong Village on Krungthep Kritha road to the motorway frontage, north of the station. The service provided free of charge by Bangkok Mass Transit Authority (BMTA). Passengers can get off the bus on the frontage road, cross the motorway by the pedestrian bridge, and walk to the station, as presented in Figure 7. For walking, the most convenience access is from Lalin Green Ville Village, as presented in Figures 7 and 8. Therefore, many residents in the village travel to downtown by ARL service. Another village that is located in walking distance from Ban Thap Chang station is Nirvana Village. However, walking environments on the road is unsafe. Therefore, the village provides an electric car as a shuttle service for its residents.

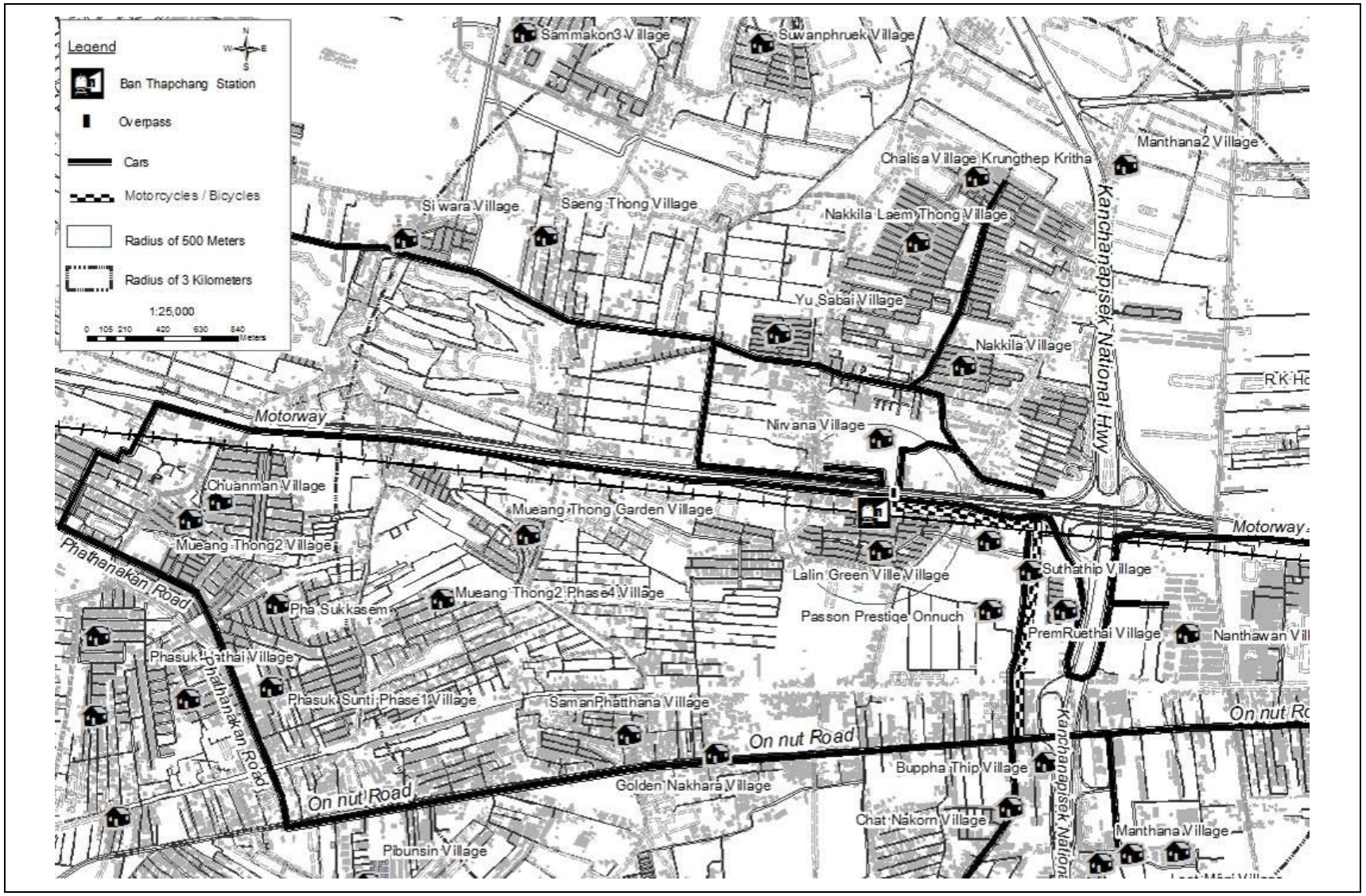


Figure 6. Access to Ban Thap Chang station by cars, motorcycles and bicycles

Road condition at the end of Chaloem Phra Kiat Ratchakan Thi 9 road

Informal walkway links Lalin Green Ville Village and the station

Figure 7. Access to Ban Thap Chang station

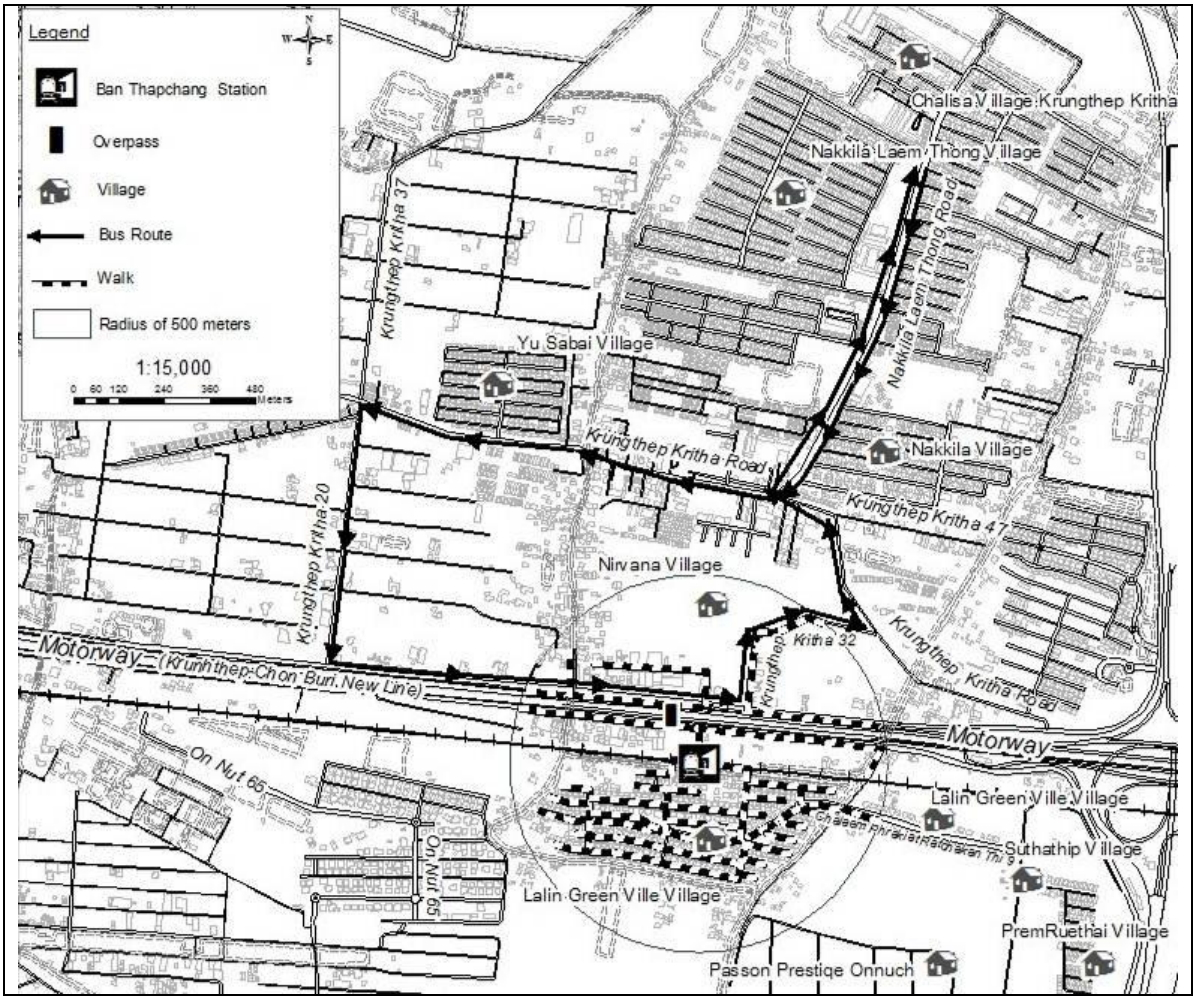


Figure 8. Access to Ban Thap Chang station by feeder buses and walking

5.2 Results from Interviews

From interviewing with OTP, it was found that OTP has plans to improve access to ARL station since 2006. However, SRT ET revealed that the plan to improve access to Ban Thap Chang station, as described in section 5.2.1 is not implemented. Nevertheless, SRT ET

revealed that two road projects by Bangkok Metropolitan Administration (BMA) will improve auto access to the station. Information of the road projects is explained in section 5.2.2. Since cost of providing park-and-ride is high, SRT ET requested the researcher to study other transportation modes that links the station and surrounding.

5.2.1 Improvement of Access to ARL Stations proposed by OTP

Before the ARL system was opened, OTP (2006) has conducted a study for improvement of access to ARL stations including Bang Thap Chang Station. The plans for the improvement were separated into 2 phases as follows:

Phase 1 includes:

- Construction of a 180 m. Sky walk connecting pedestrian bridge above the motorway with the station at concourse level to increase accessibility (Figure 9, No. 1).

- Construction of bus stops for Ban Thap Chang Station on North and South of Bangkok-Chonburi Motor way and coordinating with Bangkok Transit Mass Authority or related organization to provide bus services (Figure 9, No. 2).

- Provide more parking by using the space below the station (Figure 9, No. 3).

- Constructing a 120 meters street tunnel beneath the railway line at the intersection between Chaloem Phra Kiat Ratchakan Thi 9 road and a frontage road of Bangkok-Chonburi Motor way, to connect the station with Sukhumvit road (Figure 10, No. 4).

Phase 2 includes:

- Ban Thap Chang Station is located in residential areas and expects to attract more users in the future. The purpose for the second phase is to expropriate two pieces of land at the north and south of Bangkok-Chonburi Motor way for the total area of 6,400 sq. m., to make a 240 park and ride lots to services commuters from surrounding areas and to promote the use of ARL (Figure 9, No. 5).

The above plans show that OTP policy pay attention to auto access by providing park-and-ride, road access to the station and parking spaces at the station. However, during field survey in January 2013, it was found that only parking spaces below the station are provided. Nevertheless, from interviewing SRT ET, it was found that the sky walk will be implemented and the road extension with a tunnel beneath the railway line is being considered by the agency. Implementing the road extension is costly. In addition, private land will be acquired for the tunnel and the link between Chaloem Phra Kiat Ratchakan Thi 9 road and the motorway frontage road.

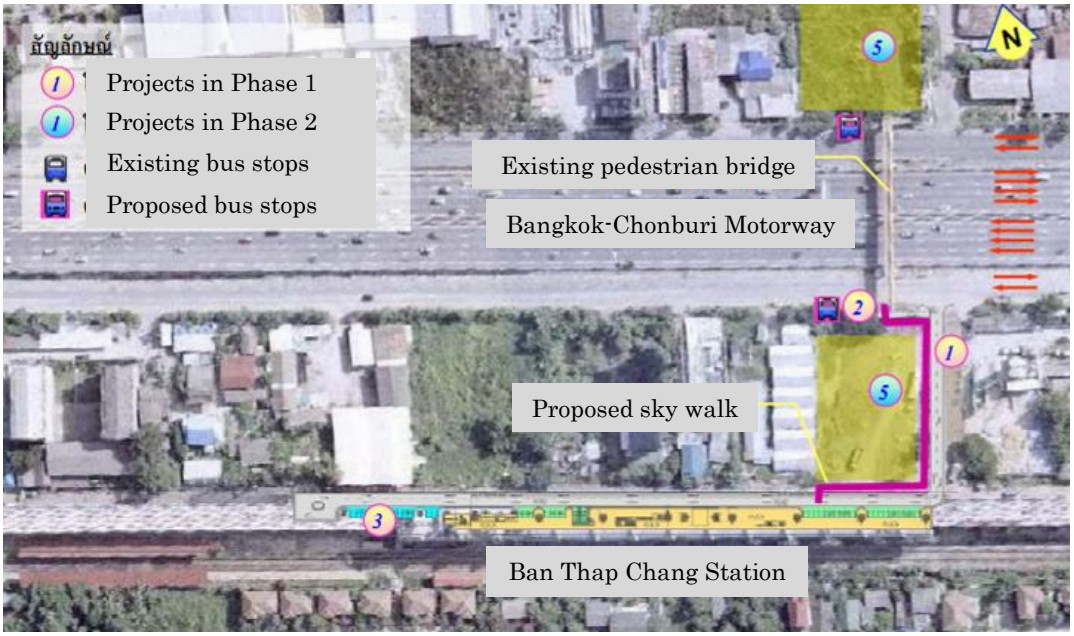


Figure 9. Proposed access improvement (prepared from OTP, 2006)

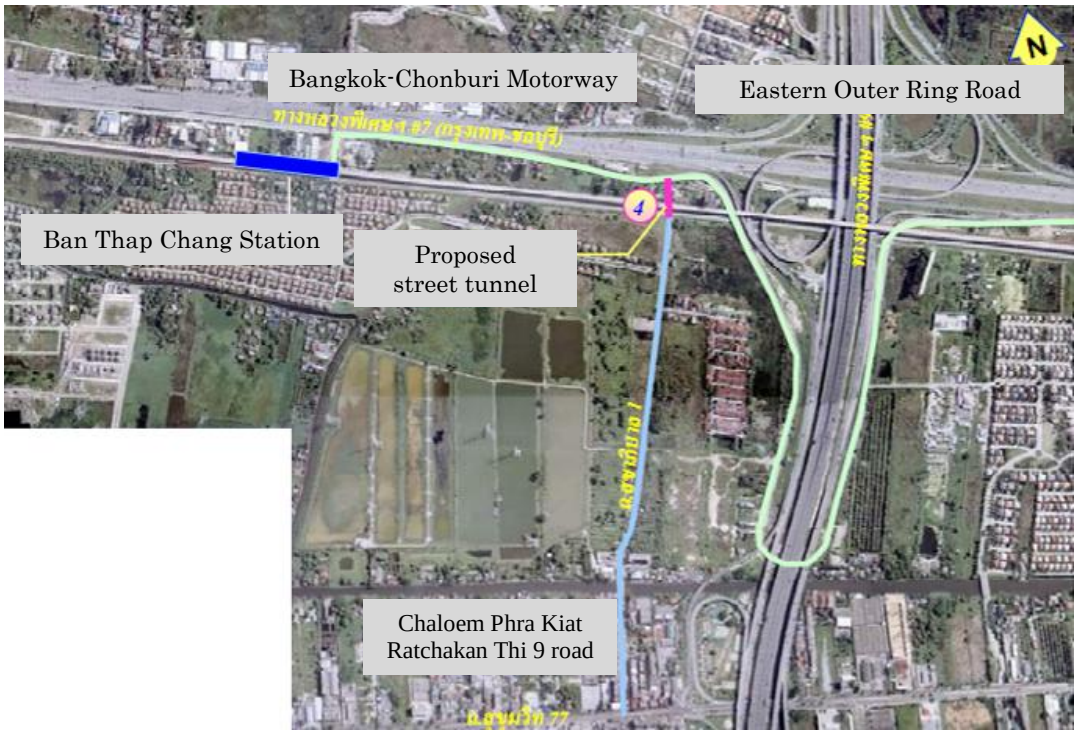


Figure 10. Proposed street tunnel (prepared from OTP, 2006)

5.2.2 Bangkok Metropolitan Administration (BMA) Road Projects

There are 2 road projects under BMA that can improve access to Ban Thap Chang station that are Chor 2 Road Project (ASDECON Corporation Co., Ltd., 2011) and the extension of Chaloem Phra Kiat Ratchakan Thi 9 road (ASDECON Corporation Co., Ltd., 2012). However, the projects are in processes of feasibility studies and seem unwelcome by land owners whose land parcels will be acquired for the construction. Proposed alignments of the road projects are presented in Figure 11 and information are described as the following.

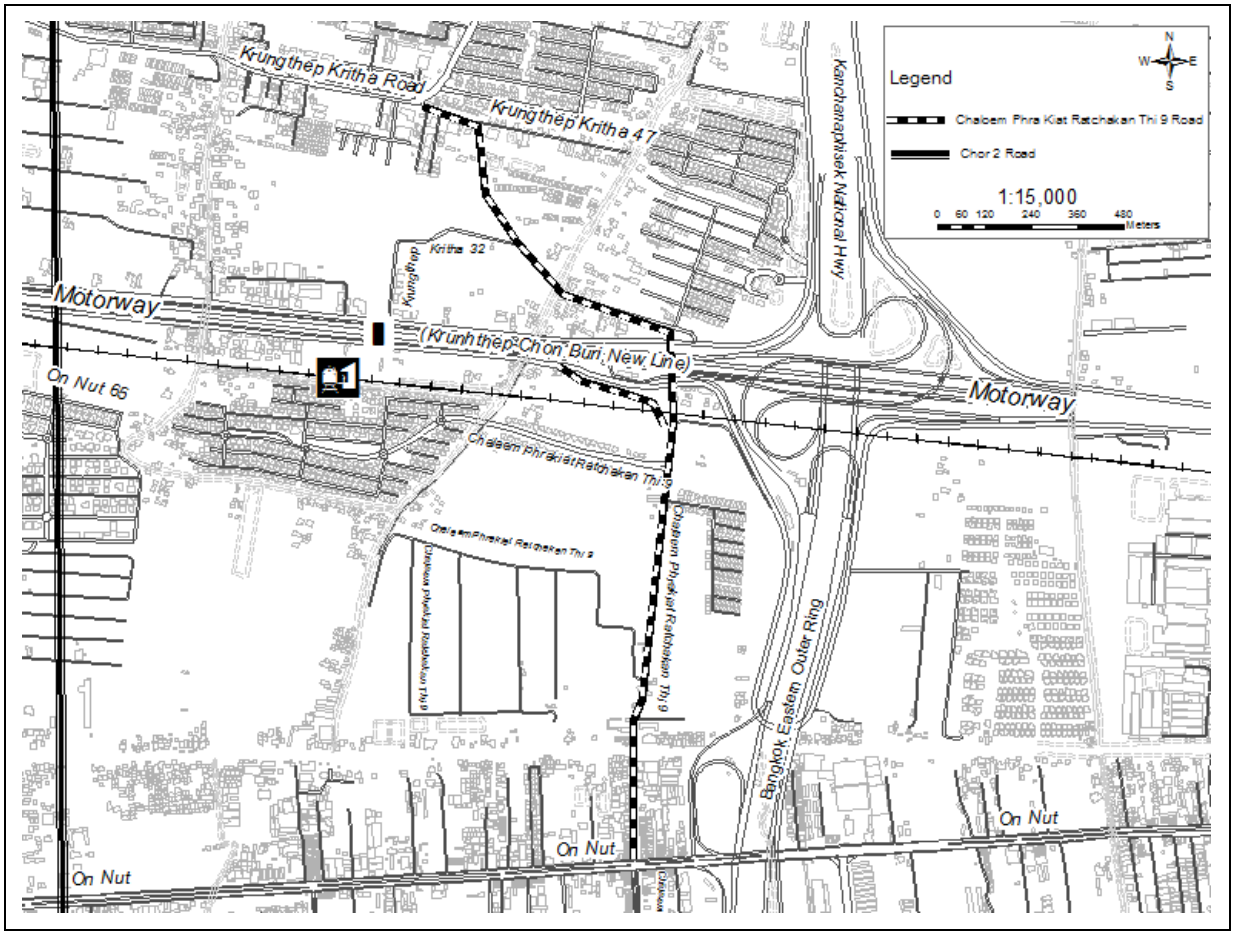


Figure 11. Proposed alignments of the BMA road projects

Chor 2 Road Project This road will connect the north and south route of Eastern Bangkok according to the Bangkok Comprehensive Plan, approximately 12.5 km long. One section of the road will connect Krungthep Krita road and On Nut road via Chaloem Phra Kiat Ratchakan Thi 9 road. This road can also connect to the motorway frontage road and Ban Thap Chang station.

The Extension of Chaloem Phra Kiat Ratchakan Thi 9 Road Chaloem Phra Kiat Ratchakan Thi 9 connects Sri Nakarin Road with On Nut road at Prawet intersection and hits Eastern Railway at Ban Thap Chang Rail Station. Due to the inconvenience use of the station, BMA planned to extent the road to the motorway frontage road and the station to provide more accessibility. There is an overpass crossing Eastern Railway at Bangkok-Chonburi Motorway, underneath ARL line, connecting Chaloem Phra Kiat Ratchakan Thi 9 road with Krung Thep Kirta road. The extension is around 2.4 km.

6. OPTIONS FOR ACCESS IMPROVEMENT

From literature reviews and results of field survey and interviews, three options for improvement of access to Ban Thap Chang station are provided. The three options include option 1) auto access, option 2) non-auto access, and option 3) multi-modal access, as presented in Figure 12. The three options have both advantages and disadvantages as described in the following. To select the option for implementation, opinions from main stakeholders that are passengers and developers of the housing estates around the station will be considered in the next step of this research.

6.1 Option 1: Auto access

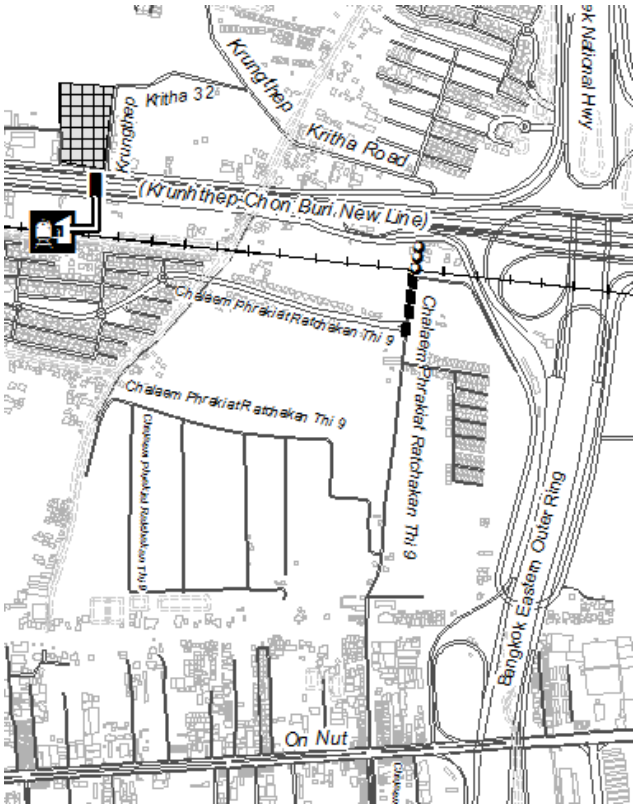
In this option, the road section from Chaloem Phra Kiat Ratchakan Thi 9 road to the railway line will be improved. A tunnel will be constructed beneath the railway line with a new road to link the tunnel to the motorway frontage road, as shown in Figure 12. By this construction, passengers on On Nut road will be able to drive to the station. For passengers who live in the north part of the motorway, a park-and-ride should be provided on Krungthep Kritha 32 road. Passengers can walk to the station using the pedestrian bridge and the proposed skywalk. However, disadvantage of this option is the construction costs and cost of renting/buying the land parcel. Income from the fares and parking fees might not cover the costs. In addition, commuters' cars might create traffic problems and pollutions to this area.

6.2 Option 2: Non-auto access

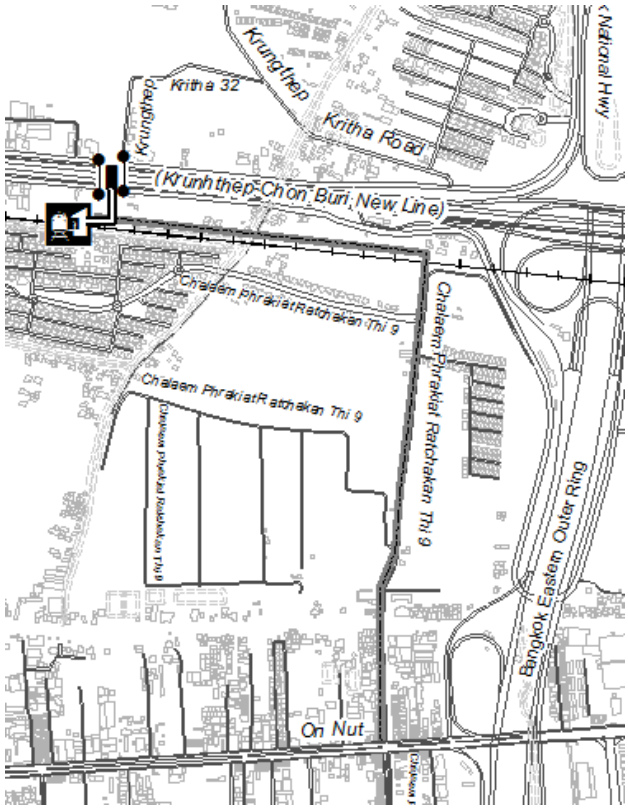
In this option, a bicycle lane and walkway will be constructed on Chaloem Phra Kiat Ratchakan Thi 9 road, cross the railway line, and run alongside with the ARL columns to the station, as presented in Figure 12. Bicyclists and motorcyclists can use this route to access to the station from On Nut road. Total distance of the bike lane from On Nut road to the station is around 2 kilometers. Even though, this option sounds a sustainable transportation mode, the physical environments along the bicycle route should be improved to create sense of security. Street furniture such as benches, drinking fountain, sunshade, public art, pedestrian-scale lighting should be provided. For safety of bicyclists and pedestrians, vehicle speed on Chaloem Phra Kiat Ratchakan Thi 9 road should be limited at not more than 30 km/hr. Traffic calming devices should be installed at appropriate locations. Since there is very few people travel on this route during off-peak hours, police patrol should be provided. For passengers who live in the north part of the motorway, the pedestrian bridge will be improved to allow bicyclists to bring bicycles on the pedestrian bridge and access to the station using the pedestrian bridge and the proposed skywalk.

6.3 Option 3: Multi-modal access

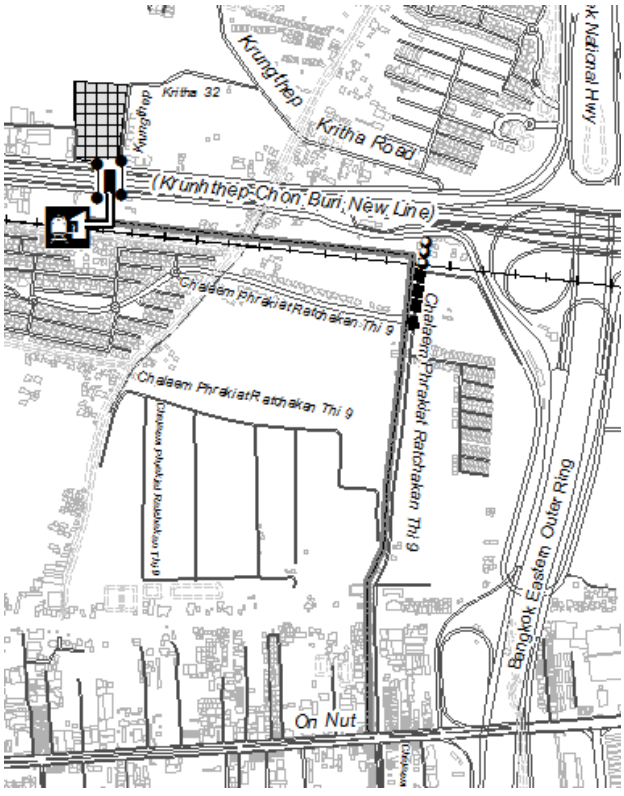
This option is a mixture of options 1 and 2. The tunnel and new road will bring more passengers to the station, especially passengers who live on On Nut road i.e. passengers who live further than 3 km. from the station. Better access will encourage car users to change to transit users. However, the passengers who drive to Ban Thap Chang station might be the existing ARL passengers who previously drive to park at Hou Mark and Ladkrabung stations. In addition, cars might create traffic problems to this area and higher number of cars might make the bicycle and walking trips unsafe. To increase safety for pedestrians and bicyclists, traffic calming devices should be installed on Chaloem Phra Kiat Ratchakan Thi 9 road.



Option 1: Auto access



Option 2: Non-auto access



Option 3: Multi-modal access

Legend:

- Sky walk
- Road improvement
- Park-and-ride
- A tunnel and new road
- Bike lane and walkway
- Pedestrian bridge improvement

Figure 12. Options for improvement of access to Ban Thap Chang station

7. CONCLUSIONS

Access to mass transit stations affects ridership and quality of the mass transit services. To increase ridership, access from residential areas to mass transit station should be improved in terms of physical environments and sense of security. In this paper, three options to improve access to Ban Thap Chang station are provided based on literature reviews that support sustainable transportation modes and results from field survey and interviews. However, opinions of the demand side i.e. ARL users should be considered. Therefore, in the next step, opinions from residents living around the station will be obtained using questionnaire survey and opinions from developers of the housing estates will be obtained by interviews. Related local government agencies will be interviewed to find their opinions about improving accesses to the station. Finally, recommendations will be provided to improve accesses to the station.

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