

Environmental Impact Assessment (Final)

Project Number: 51274-001
October 2017

THA: Bangkok Mass Rapid Transit (Pink Line) (Part 1 of 5)

Prepared by The Mass Rapid Transit Authority of Thailand.

The environmental impact assessment is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "Terms of Use" section of this website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Pink Line Mass Rapid Transit Project, Khae Rai-Min Buri section, is one of the mass rapid transits incorporated into the Mass Rapid Transit Master Plan in Bangkok Metropolitan Region (M-MAP) so as to accommodate travel demand in North Bangkok. On 6 May 2009, the Cabinet approved the incorporation of Pink Line MRT Project into Thai Khem Khaeng Action Plan (Economic Stimulus Plan, Phase 2: SP2) as Project Type 2 which was ready for implementation in the fiscal years 2010-2012. Pink Line MRT Project will be developed as an elevated straddle monorail system. The Pink Line starts near Khae Rai intersection, goes along Tiwanon Road and Chaeng Watthana Road, and passes Laksi intersection. The line then continues along Ram Inthra Road until Min Buri intersection before finally ending at Ramkhamhaeng–Rom Klao intersection. The entire length is about 34.5 kilometres, and the planned project features include 24 stations, 2 park and ride buildings, and 2 depots to be located at Sanam Bin Nam and Min Buri stations.

In the meeting on 9 March 2010, the Cabinet acknowledged and approved the resolutions of the meeting of Commission for the Management of Land Traffic which gave approval to the Mass Rapid Transit Master Plan in Bangkok Metropolitan Region (M-MAP). Relevant agencies have been assigned to implement the first 10-year phase of M-MAP (start of services in 2019) including Pink Line MRT Project, Khae Rai-Pak Kret-Min Buri section. The Office of Transport and Traffic Policy and Planning (OTP) was tasked with Feasibility Study, Preliminary Design and Environmental Impact Assessment of the project. *Figure 1.1-1* illustrates the project alignment and components in the previous study.

The previous Environmental Impact Assessment (EIA) report was approved by the National Environment Board (NEB) in the meeting No.2/2555 on 16 March 2012. However, the approval includes a stipulation that in case of any change in project descriptions or measures not affecting the essential issues of EIA and with positive impact on the environment, either better than or equivalent to the measures specified in the EIA report that was approved by the Expert Review Committee, such matters shall be submitted to local regulatory agencies, with a copy to the Office of Natural Resources and Environmental Policy and Planning (ONEP) for information. In the event that any change in project descriptions or measures will materially affect the key issues of EIA report, an EIA Addendum Report explicating the impacts associated with such change shall be submitted to ONEP for further submission to the Expert Review Committee for consideration prior to implementation.



Figure 1.1-1 Project Alignment and Components from the Previous Study, 2012

The Cabinet has thereafter assigned Mass Rapid Transit Authority of Thailand (MRTA) to undertake Feasibility Study Review, Preliminary Design Modification, and Preparation of Tender Documents for Pink Line MRT Project, Khae Rai-Min Buri section. Hence MRTA has employed a consulting consortium-comprising TEAM Consulting Engineering and Management Co., Ltd., TEAM Logistics and Transport Co., Ltd., SEA Consult Engineering Co., Ltd., New Model Engineering Consulting Co., Ltd., and Tonichi Engineering Consultant Inc. to carry out feasibility study review, preliminary design modification, and preparation of tender documents for the project. The Consultants commenced their works in July 2012, with a work period of 3 months. TEAM Consulting Engineering and Management Co., Ltd., has been assigned to conduct Environmental Impact Assessment and prepare an EIA Addendum Report for Pink Line MRT Project, Khae Rai-Min Buri section.

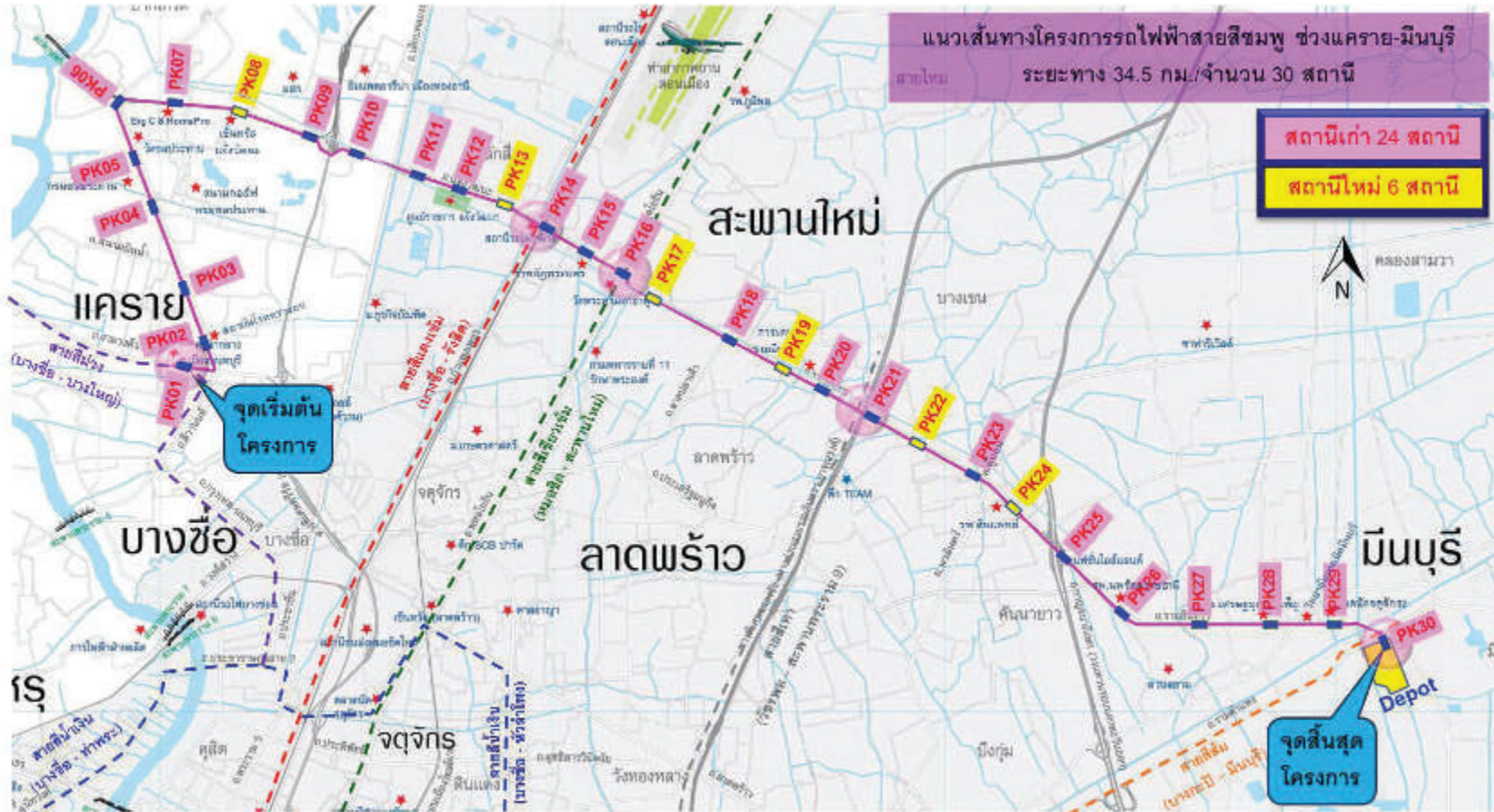
In the feasibility study review, the Consultants have reaffirmed that the elevated straddle monorail system will be adopted for the project along the original alignment of 34.5 kilometers in total distance. However, the number of stations will increase and changes will be made to the station locations, descriptions of the depot and park & ride building as well as project alignment and features, as depicted in *Figure 1.1-2*.

1.2 RATIONALE AND JUSTIFICATION OF EIA ADDENDUM

Environmental Impact Assessment of Pink Line MRT Project, Khae Rai-Min Buri section, was carried out in accordance with the NEB's condition for the approval of Environmental Impact Assessment Report of Pink Line MRT Project in the meeting No. 2/2555 on 16 March 2012. It is stipulated that in case of any change in project descriptions or measures not affecting the essential issues of EIA and with positive impact on the environment, either better than or equivalent to the measures specified in the EIA report that was approved by the Expert Review Committee, such matters shall be submitted to local regulatory agencies, with a copy to ONEP for information. In the event that any change in project descriptions or measures will materially affect the essential issues of EIA report, an addendum to the EIA report assessing the impacts associated with the change shall be submitted to ONEP for submission to the Expert Review Committee for consideration prior to commencement of construction works.

1.3 OBJECTIVES OF THE STUDY

- (1) To study and analyze changes in project descriptions and activities, namely change in station locations, additional number of stations, and change in descriptions of the depot and park & ride building;
- (2) To assess environmental impacts that may arise due to changes in project descriptions in pre-construction, construction and operation phases;
- (3) To improve/recommend additional environmental impact prevention, remedial and mitigation measures as well as environmental monitoring measures to be aligned with the altered project descriptions.



PK01 สถานีศูนย์ราชการนนทบุรี	PK04 สถานีสามัคคี	PK07 สถานีเลี้ยวเมืองปากเกร็ด	PK10 สถานีศรีรัศมิ์	PK13 สถานีฟิวท์ (สถานีใหม่)	PK16 สถานีวัดพระศรีมหาธาตุ (สถานีใหม่)	PK19 สถานีรามอินทรา 31 (สถานีใหม่)	PK22 สถานีรามอินทรา 40 (สถานีใหม่)	PK25 สถานีบางหว้าตะวันออก	PK28 สถานีนครปฐมบำรุงาพิเศษ
PK02 สถานีแคราย	PK05 สถานีกรมชลประทาน	PK08 สถานีแจ้งวัฒนะปากเกร็ด 28(สถานีใหม่)	PK11 สถานีแจ้งวัฒนะ 14	PK14 สถานีหลักสี่	PK17 สถานีรามอินทรา 3 (สถานีใหม่)	PK20 สถานีมีนยลาภ	PK23 สถานีคูบอน	PK26 สถานีพริตตราชธานี	PK29 สถานีตลาดมีนบุรี
PK03 สถานีสนามบินน้ำ	PK06 สถานีปากเกร็ด	PK09 สถานีเมืองทองธานี	PK12 สถานีศูนย์ราชการเฉลิมพระเกียรติ	PK15 สถานีราษฎร์บูรณะ	PK18 สถานีลาดปลาเค้า	PK21 สถานีวีรพล	PK24 สถานีรามอินทรา 83 (สถานีใหม่)	PK27 สถานีบางชัน	PK30 สถานีมีนบุรี

Figure 1.1-2 Project Alignment and Components from this Study

1.4 STUDY METHODOLOGY

(1) Review the EIA Report of Pink Line MRT Project, Khae Rai-Min Buri section, which was approved by the National Environment Board on 16 March 2012;

(2) Assess specific environmental impacts of the project that may arise due to the changes in project descriptions from the previous EIA report;

(3) Establish additional environmental impact prevention, remedial and mitigation measures as well as environmental monitoring plans for pre-construction, construction and operation phases as necessary;

(4) Prepare an EIA Addendum Report for the project for submission to ONEP.

1.5 SCOPE OF THE STUDY

The Environmental Impact Assessment and preparation of an EIA Addendum Report for Pink Line MRT Project, Khae Rai-Min Buri section, cover all the changes in project descriptions and environmental impacts specifically associated with the changes in project descriptions. The study areas are within a 500-m radius of the project areas.

1.6 ENVIRONMENTAL COMPONENTS AND ASPECTS

The environmental aspects were assessed along with environmental impacts that may arise from the changes in project descriptions in compliance with the EIA framework for land transport projects as stipulated by ONEP. The assessment covers four main environmental components: physical resource, biological resource, human use value, and quality of life value, encompassing 8 significant aspects, as well as Health Impact Assessment. The environmental aspects under assessment are as follows:

1) Physical Resources

- Topography
- Surface water quality
- Meteorology and air quality
- Noise
- Vibration

2) Biological Resources

- Aquatic ecology

3) Human Use Value

- Land use

4) Quality of Life Value

- Resettlement and land acquisition

5) Health Impact Assessment

1.7 REPORT STRUCTURE

This EIA Addendum Report for Pink Line MRT Project, Khae Rai-Min Buri Section, comprises the following chapters.

- Chapter 1 Introduction: This chapter presents the project background, objectives of the study, study methodology, scope of the study, and environmental components and aspects under assessment;
- Chapter 2 Changes in Project Descriptions: Changes in project descriptions are explained in this chapter;
- Chapter 3 Project Descriptions: This chapter discusses project descriptions that have been changed, namely station locations, additional number of stations, depot and park & ride building;
- Chapter 4 Existing Environmental Conditions: The existing environmental conditions in the project areas are described in this chapter;
- Chapter 5 Environmental Impact Assessment
- Chapter 6 Health Impact Assessment
- Chapter 7 Environmental Impact Prevention and Mitigation Measures
- Chapter 8 Environmental Monitoring Action Plan
- Chapter 9 Environmental Economics
- Chapter 10 Public Participation and Public Relations

CHAPTER 2

ALTERATION OF PROJECT FEATURES

ALTERATION OF PROJECT FEATURES

2.1 ALTERATION OF PROJECT FEATURES

Alteration of the project features for the Pink Line (Khae Rai–Min Buri Section) according to the National Environmental Board (NEB)'s approval of the Environmental Impact Assessment (EIA) Report by the Office of Transport and Traffic Policy and Planning (OTP) (currently operated by the Mass Rapid Transit Authority of Thailand (MRTA)) on 16 March 2012 is as follows.

(1) Project Features

The Pink Line has been defined as a minor mass transit system in the form of elevated straddle monorail. Station design was modified to be more suitable for the operations. The top of rail is typically 15 m (+16.00 MSL) above the existing road level and the guide way goes along the centerline of the existing roads. However, where some existing constraints are encountered, the alignment is shifted to the roadside. For some sections, the track level is about 9 m above the existing road level (+10.00 MSL). There is one depot and park & ride building at Romklao intersection on Ramkhamhaeng road.

(2) Increase in the Number of Train Stations and Relocation Thereof

There are totally 30 train stations, increasing from 24 stations in the previous study. The 6 additional stations are as follows.

- (a) Chaeng Watthana-Pak Kret 28 Station
- (b) TOT Station
- (c) Ram Inthra 3 Station
- (d) Ram Inthra 31 Station
- (e) Ram Inthra 40 Station
- (f) Ram Inthra 83 Station

Due to the increase in the number of train stations, relocation of some stations is necessary to ensure suitable distance between train stations.

(3) Change in the Names of Train Stations

The names of the following 8 train stations were changed.

- (a) From Chonprathan Station to Royal Irrigation Department Station
- (b) From Muang Thong 1 Station to Chaeng Watthana 14 Station
- (c) From Bangkok Government Center Station to Bangkok Government Complex Station
- (d) From Phranakhon Rajabhat University Station to Phranakhon Rajabhat Station

- (e) From Phithak Ratthathammanun Monument Station to Wat Phra Si Maha That Station
- (f) From Ram Inthra Community Housing Station to Maiyalap Station
- (g) From Ram Inthra KM 8 Station to Khu Bon Station
- (h) From Khan Na Yao Station to East Outer Ring Road Station

(4) Depot and Park & Ride Facilities

(a) The depot and park & ride facilities at Sanambin Nam intersection in Nonthaburi province were cancelled. This is because Nonthaburi City Municipality has planned to construct buildings to provide services to people and to house municipality offices in the future. Also the area will be used for recreational activities.

(b) The area of the depot and park & ride facilities at Romkloa intersection will be expanded from 80,916 sq.m. or 50.57 rai to 366,400 sq.m. or 229 rai. The previously designed parking garage of 9 floors with a capacity of 1,500 cars was adjusted to be the car park of 3 floors with a capacity of 3,000 cars.

(5) Preventive, Corrective and Mitigating Measures for Environmental Impacts

The following preventive, corrective and mitigating measures were changed.

- (a) Change of Preventive, Corrective and Mitigating Measure for Noise Impact

Operation Period: In the previous study, installation of sound barrier walls in the form of opaque tunnel-like structures was suggested along the viaduct, passing 6 sensitive receptors: Siam Business Administration College, Boromarajonani College of Nursing, Central Chest Institute of Thailand, Quartermaster Department Royal Thai Army, Phranakhon Rajabhat University, and Synphaet General Hospital. However, the noise level measuring results reveal that the major source of noise is traffic and activities around there. Besides, the Pink Line will use the trains with rubber wheels which will straddle and run along the guideway, causing low noise from contact between the wheels and the rails. Installation of sound barrier walls in the form of opaque tunnel-like structures will cause visual impact. As a result, installation of sound barrier walls in the form of tunnel-like structures was cancelled. However, installation of sound absorptive materials will remain under Samakkhi station (PK04) and Phranakhon Rajabhat station (PK15) as stated in the previous EIA Report.

- (b) Change of Preventive, Corrective and Mitigating Measure for Hydrological and Drainage Impacts

Operation Period: Two retention ponds at the depot and park & ride building at Romkloa intersection were changed in capacity from 750 m³ each (total capacity of 1,500 m³ for two ponds) to 2,031 m³ and 9,095 m³. The increase in capacity will serve the expansion of the depot and park & ride facilities.

(6) Environmental Impact Monitoring Measures

MRTA is responsible for environmental impact monitoring of the Pink Line Project (Khae Rai–Min Buri Section) during the construction and operation periods.

(a) Surface Water Quality

(i) Number of Sampling Stations

- Decrease from 10 stations to 5 stations during the construction period:

- 1) Station W1 (Khlung Bang Talat)
- 2) Station W2 (Khlung Prapa)
- 3) Station W3 (Khlung Prem Prachakon)
- 4) Station W4 (Khlung Lam Chala)
- 5) Station W5 (Khlung Song Ton Nun)

- Decrease from 14 stations to 7 stations during the operation period:

Seven stations comprise 5 from the construction period and the following two stations at the depot and park & ride facilities:

- 1) Station W6 (Retention Pond in Zone A)
- 2) Station W7 (Retention Pond in Zone B)

(ii) Expenses/Budget

Previous Study:

- 17,000 Baht/time/station during the construction period
- 25,000 Baht/time/station during the operation period

Present Study:

- 17,000 Baht/time/station during the construction and operation periods

(b) Aquatic Ecology

(i) Monitoring of project impacts on aquatic ecology will be conducted at the same stations as those of the surface water quality during the construction and operation periods.

(ii) Frequency of monitoring aquatic ecology at surface-water bodies during the construction period

- Construction Period: Monitoring should be conducted every month or 12 times/year throughout the construction period or until completion of construction of train stations and the depot and park & ride facilities.

- Operation Period: Monitoring should be conducted every month or 12 times/year for the first 5 years, and then every 6 months or twice a year. Each monitoring will take 5 consecutive days (including weekdays and holidays).

(iii) Expenses/Budget

22,000 Baht/time/station during the construction and operation periods

(c) Air Quality, Noise, and Vibration

(i) Number of Monitoring Stations

Previous Study:

- Air Quality and Noise Monitoring Stations
 - Construction Period: 27 stations
 - Operation Period: 18 stations
- Vibration Monitoring Stations
 - Construction Period: 20 stations
 - Operation Period: 12 stations

Present Study:

Six monitoring stations during the construction and operation periods comprise:

- 1) Station A1, N1, V1 (Central Chest Institute of Thailand)
- 2) Station A2, N2, V2 (Chonprathansongkhro School)
- 3) Station A3, N3, V3 (Khlung Kluea School)
- 4) Station A4, N4, V4 (Phranakhon Rajabhat University)
- 5) Station A5, N5, V5 (Synphaet General Hospital)
- 6) Station A6, N6, V6 (Min Prasat Witthaya School)

(ii) Air Quality Parameters during Construction Period

Previous Study:

3 parameters:

1. TSP
2. PM-10
3. Wind direction and speed

Present Study:

The following 2 additional parameters will be also considered:

1. CO
2. NO₂

(iii) Expenses/Budget

1. Air Quality

Previous Study:

- 40,000 Baht/time/station during the construction period
- 75,000 Baht/time/station during the operation period

Present Study:

- 63,000 Baht/time/station during the pre-construction, construction and operation periods

2. Noise

Previous Study:

- 10,000 Baht/time/station during the construction and operation periods

Present Study:

- 25,000 Baht/time/station during the construction and operation periods

3. Vibration

Previous Study:

- 35,000 Baht/time/station during the construction and operation periods

Present Study:

- 30,000 Baht/time/station during the construction and operation periods

(d) Transportation

(i) During the construction period, the number of intersections where transportation impact will be monitored was reduced from 9 to 6 as follows.

1. Khae Rai intersection
2. Sanambin Nam intersection
3. Pak Kret intersection
4. Vibhavadi Rangsit intersection
5. Suan Siam intersection
6. Min Buri intersection

The transportation impact will be also estimated at the above 6 intersection during the operation period.

(ii) Frequency

Previous Study

- Construction Period: Monitoring should be conducted every month. Each monitoring will take 3 consecutive days (including weekday and holiday).
- Operation Period: Monitoring should be conducted every 3 months or 4 times/year. Each monitoring will take 3 consecutive days (including weekday and holiday).

Present Study

Construction Period: Traffic data should be checked and recorded every month. Each time will take 2 consecutive days (including weekday and holiday) until completion of project construction.

- Operation Period: Statistics on accidents should be examined every 3 months (4 times/year) for 5 consecutive years. After that, if the number of accidents during the period of 24 months tend to be more than 40% lower when compared to that before the project development, monitoring will be performed once a year.

Each monitoring will take 2 consecutive days (including weekday and holiday) during the construction and operation periods.

(iii) Expenses/Budget

Previous Study:

- 25,000 Baht/time during the construction and operation periods

Present Study:

- 10,000 Baht/time during the construction and operation periods

(e) Socio-Economic Conditions

(a) Frequency

Previous Study:

- Construction Period: Monitoring will be undertaken 1) upon completion of not less than 25% of construction works (about Month 12), and 2) upon completion of not less than 60% of construction works (about Month 24).

Present Study:

- Construction Period: Monitoring will be undertaken every 6 months or 2 times/year

(b) Expenses/Budget

Previous Study:

- 600,000 Baht/time during the construction and operation periods

Present Study:

- 515,000 Baht/time during the construction period

- 257,500 Baht/time during the operation period

(f) Health Impact Assessment (Additional Item)

(g) Environmental Economics Study (Additional Item)

Summary of changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) by OTP (currently operated by MRTA), approved by NEB on 16 March 2012 is presented in *Table 2.1–1*.

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
1. Project Features				
1.1	Project Features and Depot and Park & Ride Facilities	The elevated straddle monorail system with a total length of 34.5km, and two depots and park & ride facilities at Sanambin Nam intersection in Nonthaburi province and Romklao intersection on Ramkhamhaeng road	The elevated straddle monorail system with a total length of 34.5 km, and a depot and park & ride facilities at Romklao intersection on Ramkhamhaeng road	To be in harmony with the existing conditions of the project areas where the rail route alignment will pass
2. Increase in the Number of Train Stations and Relocation Thereof				
2.1	Increase in the Number of Train Stations (6 Additional Stations)	24 train stations	Increase in the number of stations by 6 from 24 to 30. The 6 additional stations are as follows. 1) Chaeng Watthana-Pak Kret 28 Station 2) TOT Station 3) Ram Inthra 3 Station 4) Ram Inthra 31 Station 5) Ram Inthra 40 Station 6) Ram Inthra 83 Station	Increase in the number of train stations and relocation thereof will ensure distance between stations will be more suitable. Besides, they will serve government offices, state enterprises, private organizations, residential and commercial areas which are the centers of activities and attract more trips. Passengers will have more accessibility to convenient transportation. Traffic problem will be alleviated. Details of new stations are as follows. 1) Chaeng Watthana-Pak Kret 28 Station: It will serve large residential and commercial areas both roadsides between Chaeng Watthana Soi 26 and Chaeng Watthana Soi 28. Software Park building, office buildings, international school, Central Plaza Chaeng Watthana, and the World Medical Center are located around there. 2) TOT Station: A large number of office buildings and companies are located in the vicinity of the station such as Thailand Post Company Limited, Na Nakorn Building, Chaengprasis Building, and residential areas on Chaeng Watthana Soi 10, which attract more trips to the area. 3) Ram Inthra 3 Station: It will serve high-density residential areas between Ram Inthra Soi 3 and Soi 5 as well as Lumpini Condominium Ram Inthra–Lak Sito the north of the station. Moreover, Central Plaza Ram Inthra and the Royal Thai Army Sports Center are in its vicinity. 4) Ram Inthra 31 Station: It will serve large residential and commercial areas from Ram Inthra Soi 29 to Soi 39 and

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012 (Cont’d)

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
2.1	Increase in the Number of Train Stations (6 Additional Stations) (Cont'd)			Soi 8 to Soi 10. Moreover, the station catchment areas include Foodland supermarket and the densely-populated Ram Inthra housing estate of the National Housing Authority. 5) Ram Inthra 40 Station: It will serve large residential and commercial areas along both sides of Ram Inthra road. It will also serve passengers from Soi Watcharaphon via Ram Inthra Soi 65 and from Nuan Chan road. 6) Ram Inthra 83 Station: It will serve large residential and commercial areas along both sides of Ram Inthra road. Moreover, Synphaet General Hospital is within the station catchment zone.
	Impacts	-	The 6 additional stations are located along the existing route alignment. Therefore, the impacts will be similar to those in the EIA Report approved on 16 March 2012.	-
	Environmental Impact Preventive, Corrective and Mitigating Measures	-	No Change: Environmental impact preventive, corrective and mitigating measures approved on 16 March 2012 will be applied.	-
	Environmental Impact Monitoring Measures	-	No Change: Environmental impact monitoring measures approved on 16 March 2012 will be applied.	-
2.2	Relocation of Train Stations	-	Nearly all train stations will be relocated, except Muang Thong 1, Setthabutbampnen and Min Buri.	Due to the increase in 6 new train stations, some stations will be relocated to keep suitable distance between train stations.
3.	Change in the Names of Train Stations			
	8 Stations	Previous Name 1) Chonprathan Station 2) Muang Thong 1 Station 3) Bangkok Government Center Station 4) Phranakhon Rajabhat University Station 5) Phithak Rattathammanun Monument Station 6) Ram Inthra Community Housing Station 7) Ram Inthra KM 8 Station 8) Khan Na Yao Station	New Name 1) Royal Irrigation Department Station 2) Chaeng Watthana 14 Station 3) Bangkok Government Complex Station 4) Phranakhon Rajabhat Station 5) Wat Phra Si Maha That Station 6) Maiyalap Station 7) Khu Bon Station 8) East Outer Ring Road Station	Names of train stations were changed to be more suitable for the existing locations and linkage with other rail routes.

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012 (Cont’d)

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
4.	Depot and Park & Ride			
4.1	Cancellation of the depot and park & ride facilities at Sanambin Nam intersection in Nonthaburi province	Two depots and park & ride facilities at Sanambin Nam intersection in Nonthaburi province and Romkloa intersection on Ramkhamhaeng road.	One depot and park & ride facilities at Romkloa intersection on Ramkhamhaeng road.	The Sanambin Nam intersection is under the responsibility of Nonthaburi City Municipality. The Municipality has planned to construct buildings to provide services to people and to house municipality offices in the future. Also the area will be used for recreational activities.
	Impacts	Relocation and Expropriation of Land and Buildings - Land at Sanambin Nam intersection: 48.63 rai, and land at Romkloa intersection: 50.57 rai - 30 buildings at Sanambin Nam intersection	No expropriation of Land and Building at Sanambin Nam intersection	-
	Environmental Impact Preventive, Corrective and Mitigating Measures	Relocation and Expropriation of Land and Buildings Construction Period <ul style="list-style-type: none"> Organization of meetings to inform the affected people of related information at least 18 months prior to construction Setup of the committee to determine the compensation for the land, buildings, and agricultural products to be expropriated Determination of compensation for immovable property at the fair and reasonable rate acceptable to the affected people Operation Period <ul style="list-style-type: none"> No impact due to no acquisition of additional land 	No expropriation of Land and Building at Sanambin Nam intersection	-
4.2	Expansion of the depot and park & ride facilities at Romkloa intersection	Area of 80,916 sq.m. or 50.57 rai <ul style="list-style-type: none"> Car park building of 9 floors Parking capacity: 1,500 cars 	Expansion of area to 366,400 sq.m. or 229 rai from 80,916 sq.m. or 50.57 rai <ul style="list-style-type: none"> Car park building of 3 floors Parking capacity: 3,000 cars There will be 28 tracks to serve 56 trains (6-cars). 	<ul style="list-style-type: none"> Due to cancellation of the depot and park & ride facilities at Sanambin Nam intersection in Nonthaburi province, workshop, operation & control center, and stabling yard will be at the depot and park & ride facilities at Romkloa intersection. Due to the policy of 20-baht flat fare collection, the ridership will be higher and the additional trains will be required.
4.2	Impacts	Relocation and Expropriation of Land and Buildings <ul style="list-style-type: none"> Expropriation of 49.85 rai of land at Romkloa intersection No expropriation of building 	Expropriation of additional 178.43 rai of land and no expropriation of building as it is the vacant area and farmland	<ul style="list-style-type: none"> An expanse of area is required for the operation & control center, workshop, and stabling yard to sufficiently serve trains and to provide service to people.

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012 (Cont’d)

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
	Environmental Impact Preventive, Corrective and Mitigating Measures	Relocation and Expropriation of Land and Buildings Construction Period <ul style="list-style-type: none"> • Organization of meetings to inform the affected people of related information at least 18 months prior to construction • Setup of the committee to determine the compensation for the land, buildings, and agricultural products to be expropriated • Determination of compensation for immovable property at the fair and reasonable rate acceptable to the affected people Operation Period <ul style="list-style-type: none"> • No impact due to no acquisition of additional land 	Relocation and Expropriation of Land and Buildings Construction Period Addition of environmental impact preventive, corrective, and mitigating measures during the construction period <ul style="list-style-type: none"> • Criteria for determining the compensation for immovable property to be expropriated for MRTA’s route extension and new route projects. 	Addition of environmental impact preventive, corrective, and mitigating measures in regard to relocation and expropriation of land to be in conformity with the criteria of MRTA
5. Change of Environmental Impact Preventive, Corrective and Mitigating Measures				
5.1	Change of Preventive, Corrective and Mitigating Measure for Noise Impact	Operation Period <ul style="list-style-type: none"> • The Contractor, before and after the operation period, shall install sound barrier walls in the form of opaque tunnel-like structures (at least 200 m/location in length) along the viaduct, passing the following 6 sensitive receptors: <ul style="list-style-type: none"> • Siam Business Administration College(SBAC) • Boromarajonani College of Nursing • Central Chest Institute of Thailand • Quartermaster Department Royal Thai Army • Phranakhon Rajabhat University • Synphaet General Hospital • This is to reduce the noise level from the contact between the wheels and rails. 	Cancellation of the measure which requires installation of sound barrier walls in the form of opaque tunnel-like structures along the viaduct, passing 6 sensitive receptors, as approved by the Cabinet on 16 March 2012.	<ul style="list-style-type: none"> • Based on the assessment of the noise levels during the operation period at the sensitive receptors, it is not much different from the noise level measurement result which is higher than the established threshold (70dB(A)). However, noise will be mainly generated by the straddle monorail. Besides, the Pink Line will use the trains with rubber wheels which will straddle and run along the guide way, causing low noise from contact between the wheels and the rails. Therefore, the noise impact on sensitive receptors will be at low level. As for safety aspect, in case of fire, the sound barrier walls in the form of opaque tunnel-like structures will retain smoke inside, making it difficult to help passengers. • As a result, installation of sound barrier walls in the form of tunnel-like structures was cancelled, but installation of sound absorptive materials will remain under Samakkhi station (PK04) and Phranakhon Rajabhat station (PK15)
5.2	Change of Preventive, Corrective and Mitigating Measure for Hydrological and Drainage Impacts	Construction Period <ul style="list-style-type: none"> • Two retention ponds at the depot and park & ride facilities at Romklao intersection with a capacity of 750 m³ each (total capacity of 1,500 m³ for two ponds) 	Construction Period <ul style="list-style-type: none"> • Change in capacity of two retention ponds at the depot and park & ride facilities at Romklao intersection from 750 m³ each (total capacity of 1,500 m³) to 2,031 m³ and 9,095 m³ 	<ul style="list-style-type: none"> • The increase in capacity of the retention ponds will serve the expansion of the depot and park & ride facilities.

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012 (Cont’d)

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
6. Change of Environmental Impact Monitoring Measures				
MRTA is responsible for environmental impact monitoring of the Pink Line Project (Khae Rai–Min Buri Section)				
6.1	Surface Water Quality Change of Number of Sampling Stations	<ul style="list-style-type: none"> • Measurement of surface water quality shall be performed at the following stations: - Construction period: 10 stations - Operation period: 14 stations (including at the depot and park & ride facilities) 	<ul style="list-style-type: none"> • Decrease from 10 stations to the following 5 stations during the construction period: <ol style="list-style-type: none"> 1) Station W1 (Khlung Bang Talat) 2) Station W2 (Khlung Prapa) 3) Station W3 (Khlung Prem Prachakon) 4) Station W4 (Khlung Lam Chala) 5) Station W5 (Khlung Song Ton Nun) - Decrease from 14 stations to 7 stations during the operation period. Seven stations comprise 5 from the construction period and the following two stations at the depot and park & ride facilities: <ol style="list-style-type: none"> 1) Station W6 (Retention Pond in Zone A) 2) Station W7 (Retention Pond in Zone B) 	Based on the survey of surface-water bodies where the project route will pass, people use water from only 5 large water bodies. Therefore, measurement of surface water quality shall be conducted at significant water bodies only.
		<ul style="list-style-type: none"> • Expenses/Budget - Construction Period: 12,000 Baht/time/station - Operation Period: 25,000 Baht/time/station 	<ul style="list-style-type: none"> • Change of Expenses/Budget - Construction and Operation Periods: 17,000 Baht/time/station 	To reflect the present costs
6.2	Aquatic Ecology during the Construction and Operation Periods	No monitoring of project impact on aquatic ecology	<ul style="list-style-type: none"> • Addition of monitoring of project impacts on aquatic ecology at the same stations as those of the surface water quality during the construction and operation periods • Frequency - Construction Period: Monitoring should be conducted every month throughout the construction period or until completion of construction of train stations and the depot and park & ride facilities. - Operation Period: Monitoring should be conducted every month for the first 5 years, and then every 6 months or twice a year. Each monitoring will take 5 consecutive days (including weekdays and holidays). • Expenses/Budget - Construction and Operation Periods: 22,000 Baht/time/station 	The previous EIA Report did not include aquatic ecology monitoring plan. Therefore, the present study covers monitoring of both surface water quality and aquatic ecology.

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012 (Cont’d)

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
6.3	Change in the Number of Monitoring Stations	<p>Construction Period</p> <ul style="list-style-type: none"> • Air quality: 27 stations • Noise level: 27 stations • Vibration: 20stations <p>Operation Period</p> <ul style="list-style-type: none"> • Air quality: 19 stations • Noise level: 19 stations • Vibration:12stations 	<p>Construction and Operation Periods</p> <ul style="list-style-type: none"> • Decrease in the number of monitoring stations: There are six monitoring stations during the construction and operation periods comprising: <ul style="list-style-type: none"> Station1Central Chest Institute of Thailand (near Station PK02: about 20 m. away) Station2 Chonprathansongkhro School (near Station PK05: about30 m. away) Station 3 Khlong Kluea School (near Station PK09: about 30m. away) Station 4 Phranakhon Rajabhat University (near Station PK15: about 30 m. away) Station 5 Synphaet General Hospital (near Station PK24: about 20 m. away) Station6Min Prasat Witthaya School (Depot and P&R: about 200 m. away) 	<p>To determine the locations of monitoring stations to represent the sensitive receptors near train stations, consideration was made on five sites at about 20-30 m far away from the project route alignment and one site near the depot and park & ride facilities, totaling six sites.</p>
		<p>3 Indicators of Air Quality during Construction Period:</p> <ol style="list-style-type: none"> 1. TSP 2. PM-10 3. Wind direction and speed 	<p>2 Additional Indicators</p> <ol style="list-style-type: none"> 1. CO 2. NO₂ 	<p>To ensure monitoring covers all indicators as specified in the Notifications on Ambient Air Quality Standards No. 10 (B.E. 2538) and No. 24 (B.E. 2547)</p>
		<p>Expenses/Budget</p> <ol style="list-style-type: none"> 1) Air Quality <ul style="list-style-type: none"> - Construction Period:40,000Baht/time/station - Operation Period:75,000Baht/time/station 2) Noise <ul style="list-style-type: none"> - Construction and Operation Periods: 10,000 Baht/time/station 3) Vibration <ul style="list-style-type: none"> - Construction and Operation Periods: 35,000 Baht/time/station 	<p>Adjustment of Expenses</p> <ol style="list-style-type: none"> 1) Air Quality <ul style="list-style-type: none"> - Construction and Operation Periods: 63,000Baht/time/station 2) Noise <ul style="list-style-type: none"> - Construction and Operation Periods: 25,000 Baht/time/station 3) Vibration <ul style="list-style-type: none"> - Construction and Operation Periods: 30,000 Baht/time/station 	<p>To reflect the present costs</p>
6.4	Transportation Reduce the number of intersections where transportation impact will be monitored.	<p>Number of intersections for transportation monitoring</p> <ul style="list-style-type: none"> - Construction Period:9 intersections - Operation Period:6 intersections 	<p>Reduce the number of intersections where transportation impact will be monitored during the construction and operation periods from 9 to 6 as follows.</p>	<p>There are only 6 important intersections along the project route alignment.</p>

Table 2.1–1 Summary of Changes from the EIA Report of the Pink Line Project (Khae Rai–Min Buri Section) Approved by NEB on 16 March 2012 (Cont’d)

No.	Item	EIA Report Approved on 16 March 2012	Change in Project Features	Reason of Change
6.4	Transportation (Cont’d)		1. Khae Rai intersection 2. Sanambin Nam intersection 3. Pak Kret intersection 4. Vibhavadi Rangsit intersection 5. Suan Siam intersection 6. Min Buri intersection	
		Frequency - Construction Period: Monitoring should be conducted every month. Each monitoring will take 3 consecutive days (including weekday and holiday). - Operation Period: Monitoring should be conducted every 3 months or 4 times/year. Each monitoring will take 3 consecutive days (including weekday and holiday).	Reduce the number of days for monitoring to 2 consecutive days (including weekday and holiday) during the construction and operation periods.	
		Expenses/Budget - Construction and Operation Periods: 25,000 Baht/time	Adjustment of Expenses - Construction and Operation Periods: 10,000 Baht/time	To reflect the present costs
6.5	Socio-economics Frequency	- Construction Period: Monitoring shall be undertaken 1) upon completion of not less than 25% of construction works (about Month 12), and 2) upon completion of not less than 60% of construction works (about Month 24)	Change in Monitoring Period - Construction Period: Monitoring will be undertaken every 6 months or 2 times/year.	To ensure it will be in compliance with the project construction activities
		Expenses/Budget - Construction and Operation Periods: 600,000 Baht/time	Adjustment of Expenses - Construction Period: 515,000 Baht/time - Operation Period: 257,500 Baht/time	To reflect the present costs
7.	Health Impact Assessment			
		No study	Addendum: Health Impact Assessment	To ensure EIA covers all aspects
8.	Environmental Economics Study			
		No study	Addendum: Environmental Economics Study	To ensure EIA covers all aspects

2.1.1 Project Structural Design

(1) Structural design for the Pink Line Project (Khae Rai–Min Buri Section) in the previous study (2012) can be summarized below.

(a) Viaduct Structure consisting of:

- Substructure: The viaduct structure was supported by the foundation which was a single wet process bored pile of 2.0 m in diameter.
- Superstructure: Prestressed concrete girders were selected and as pan length was about 22-30 m.

(b) Depot

In the previous study, there were two depots as follows.

- Depot at Sanambin Nam intersection on Tiwanon road encompassing an area of about 77,814 sq.m.
- Depot at Romklao intersection on Ramkhamhaeng road covering an area of about 80,916 sq.m.

(b) Park & Ride Facilities

Two park & ride facilities were provided in the depots.

- Park & ride facilities at Sanambin Nam intersection: A parking lot with a capacity of 225 cars was located near Tiwan on road for convenient access to the MRT system.
- Park & ride facilities at Romklao intersection: The parking garage of 9 floors had a capacity of 1,500 cars. Located near Ramkhamhaeng road and Min Buri station (the last station), the building would serve personal cars, bicycles and all types of taxis.

(2) Structural design for the Pink Line Project (Khae Rai–Min Buri Section) in the present study can be summarized below.

(a) Viaduct Structure consisting of:

- Substructure: The viaduct structure is supported by the foundation which is a single wet process bored pile of 2.0 m in diameter.
- Superstructure: Prestressed concrete girders will be used and aspan length is about 22-30 m.

(b) Depot and Park & Ride Facilities

The area for the development of the depot and park & ride facilities at Sanambin Nam intersection belongs to Nonthaburi City Municipality. The Municipality has planned to construct buildings to provide services to people and to house municipality offices in the future. Also the area will be used for recreational activities. Therefore, the depot and park & ride facilities at Sanambin Nam intersection in Nonthaburi province were cancelled. The area of the depot and park & ride facilities at Romklao intersection will be expanded to 366,400 sq.m. or 229 rai. The newly designed parking garage of 3 floors will have a capacity of 3,000 cars (1,000 cars/floor).

2.1.2 Increase in the Number of Train Stations and Relocation Thereof

(1) Number of Train Stations in the Previous Study (2012)

There were 24 stations in the previous study as presented in *Table 2.1–2*.

Table 2.1–2 Train Stations of the Pink Line (Khae Rai–Min Buri) in the Previous Study (2012)

Name of Station	Platform Type	Structure Type	Elevation of Concourse Level (m)	Elevation of Platform Level (m)
1. PK-1 Nonthaburi Government Center Station	Island Platform	Elevated	+7.60	+15.60
2. PK-2 Khae Rai Station	Side Platform	Elevated	+8.60	+16.60
3. PK-3 Sanambin Nam Station	Side Platform	Elevated	+7.46	+15.46
4. PK-4 Samakphi Station	Side Platform	Elevated	+6.98	+14.58
5. PK-5 Chonprathan Station	Side Platform	Elevated	+7.60	+15.60
6. PK-6 Pak Kret Station	Side Platform	Elevated	+7.65	+15.65
7. PK-7 Pak Kret Bypass Station	Side Platform	Elevated	+7.52	+15.52
8. PK-8 Muang Thong Thani Station	Side Platform	Elevated	+7.58	+15.58
9. PK-9 Si Rat Station	Side Platform	Elevated	+1.20	+10.00
10. PK-10 Muang Thong 1 Station	Side Platform	Elevated	+7.49	+15.49
11. PK-11 Bangkok Government Center Station	Side Platform	Elevated	+7.60	+15.60
12. PK-12 Lak Si Station	Side Platform	Elevated	+9.45	+9.54
13. PK-13 Phranakhon Rajabhat University Station	Side Platform	Elevated	+1.20	+7.85
14. PK-14 Phithak Rattathammanun Monument Station	Side Platform	Elevated	+1.20	+8.80
15. PK-15 Lat Pla Khao Station	Side Platform	Elevated	+7.64	+15.64
16. PK-16 Ram Inthra Community Housing Station	Side Platform	Elevated	+7.54	+15.54
17. PK-17 Watcharaphon Station	Side Platform	Elevated	+7.57	+15.57
18. PK-18 Ram Inthra KM 8 Station	Side Platform	Elevated	+7.45	+15.45
19. PK-19 Khan Na Yao Station	Side Platform	Elevated	+7.56	+15.56
20. PK-20 Nopparat Rajathanee Station	Side Platform	Elevated	+7.60	+15.60
21. PK-21 Bang Chan Station	Side Platform	Elevated	+7.60	+15.60
22. PK-22 Setthabutbampfen Station	Side Platform	Elevated	+7.60	+15.60
23. PK-23 Min Buri Market Station	Side Platform	Elevated	+1.30	+9.60
24. PK-24 Min Buri Station	Side Platform	Elevated	+1.30	+9.60

(2) Number of Train Stations from Feasibility Study Review, Preliminary Design Plan Modification, and Preparation of Tender Documents for Pink Line Project, Khae Rai–Min Buri Section

In the present study, there are totally 30 train stations, increasing by 6 from 24 stations in the previous study. The 6 new stations comprise PK08: Chaeng Watthana-Pak Kret 28 station; PK13 TOT station; PK17 Ram Inthra 3 station; PK19 Ram Inthra 31 station; PK22 Ram Inthra 40 station; and PK24 Ram Inthra 83 station, the details of which are presented in *Table 2.1–3*.

Table 2.1–3 Train Stations of the Pink Line (Khae Rai–Min Buri) in the Present Study

Name of Station	Platform Type	Structure Type	Elevation of Concourse Level (m)	Elevation of Platform Level (m)
1. PK01Nonthaburi Government Center Station	Side Platform	Elevated	+7.5	+15.5
2. PK02Khae Rai Station	Side Platform	Elevated	+7.5	+15.5
3. PK03Sanambin Nam Station	Side Platform	Elevated	+7.5	+15.5
4. PK04Samakhi Station	Side Platform	Elevated	+7.5	+15.5
5. PK05Royal Irrigation Department Station (Name Changed)	Side Platform	Elevated	+7.5	+15.5
6. PK06Pak Kret Station	Side Platform	Elevated	+7.5	+15.5
7. PK07 Pak Kret Bypass Station	Side Platform	Elevated	+7.5	+15.5
8. PK08 Chaeng Watthana Pak Kret 28 Station (New Station)	Side Platform	Elevated	+7.5	+15.5
9. PK09 Muang Thong Thani Station	Island Platform	Elevated	+1.5	+9.5
10. PK10 Si Rat Station	Side Platform	Elevated	+7.5	+15.5
11. PK11 Chaeng Watthana 14 Station (Name Changed)	Side Platform	Elevated	+7.5	+15.5
12. PK12 Bangkok Government Complex Station (Name Changed)	Side Platform	Elevated	+7.5	+15.5
13. PK13 TOT Station (New Station)	Side Platform	Elevated	+7.5	+15.5
14. PK14 Lak Si Station	Side Platform	Elevated	+1.5	+9.5
15. PK15 Phranakhon Rajabhat Station(Name Changed)	Side Platform	Elevated	+7.5	+15.5
16. PK16 Wat Phra Si Maha That Station (Name Changed)	Side Platform	Elevated	+11.16	+11.16
17. PK17 Ram Inthra 3 Station (New Station)	Side Platform	Elevated	+7.5	+15.5
18. PK18 Lat Pla Khao Station	Side Platform	Elevated	+7.5	+15.5
19. PK19 Ram Inthra 31 Station(New Station)	Side Platform	Elevated	+7.5	+15.5
20. PK20Maiyalap Station (Name Changed)	Side Platform	Elevated	+7.5	+15.5
21. PK21 Watcharaphon Station	Side Platform	Elevated	+7.5	+15.5
22. PK22 Ram Inthra 40 Station (New Station)	Side Platform	Elevated	+7.5	+15.5
23. PK23 Khu Bon Station(Name Changed)	Side Platform	Elevated	+7.5	+15.5
24. PK24 Ram Inthra 83 Station (New Station)	Side Platform	Elevated	+7.5	+15.5
25. PK25 East Outer Ring Road Station (Name Changed)	Side Platform	Elevated	+7.5	+15.5
26. PK26Noppharat Rajathanee Station	Side Platform	Elevated	+7.5	+15.5
27. PK27Bang Chan Station	Side Platform	Elevated	+7.5	+15.5
28. PK28Setthabutbampphen Station	Side Platform	Elevated	+7.5	+15.5
29. PK29Min Buri Market Station	Side Platform	Elevated	+7.5	+15.5
30. PK30Min Buri Station	Side Platform	Elevated	+7.5	+15.5

Note: Change in the Names of Train Station

- PK05 Royal Irrigation Department Station (previously named Chonprathan Station)
- PK11 Chaeng Watthana 14 Station (previously named Muang Thong 1Station)
- PK12 Bangkok Government Complex Station (previously named Bangkok Government Center Station)
- PK15 Phranakhon Rajabhat Station (previously named Phranakhon Rajabhat University Station)
- PK16 Wat Phra Si Maha That Station (previously named Phithak Ratthathammanun Monument Station)
- PK20 Maiyalap Station (previously named Ram Inthra Community Housing Station)
- PK23 Khu Bon Station (previously named Ram Inthra KM 8 Station)
- PK25 East Outer Ring Road Station (previously named Khan Na Yao Station)

To design train stations for the Pink Line (Khae Rai–Min Buri section), consideration was made on the existing conditions of the roads where the project route will pass, e.g. Rattanathibet road, Tiwanon road, Chaeng Watthana road, Ram Inthra road, and Sihaburanukit road. Also taken into account was the connectivity of the Pink Line to 4 mass transit lines: Purple Line, Bang Yai–Bang Sue section (at Nonthaburi Government Center station); Red Line, Bang Sue–Rangsit (at Lak Si station); Dark Green Line, Mo Chit–Saphan Mai (at Wat Phra Si Maha That station); and Orange Line, Bang Kapi–Min Buri (at Min Buri station). As a result, the elevations and the number of levels of train stations are different. There are both 2-level and 3-level stations. The elevations of concourse levels and platform levels are presented in **Table 2.1–4** and summarized as follows.

The platform levels of PK09 Muang Thong Thani station and PK14 Lak Si station are at the elevation of +9.5 m. This is because the track level near PK09 Muang Thong Thani station will pass under Si Rat expressway and the section near PK14 Lak Si station runs beneath Uttraphimuk (Don Mueang) Tollway. Since both expressways are at the 3rd level, the rail tracks are at the 2nd level or +9.5 m above the road level, going beneath the elevated highways. The concourse levels of the two stations are at the elevation of +1.5 m above the road level.

The platform level and the concourse level of PK16 Wat Phra Si Maha That station are at the elevation of +11.16 m above the road level. It is an interchange station providing linkage to the Dark Green Line (Mo Chit–Saphan Mai section). The Pink Line runs beneath the Dark Green Line and the train stations of both elevated rail lines are close to each other. As a result, the platform level and the concourse level are at the same elevation of +11.16 m to provide convenience to passengers.

The station design shall be consistent with MRT train operations. Design considerations include interconnectivity with both present and future mass transportation systems, convenient and safe access to and egress from station for passengers and the disabled. The design of station elements is in compliance with the international standards for fire protection and life safety : the Standard for Fixed Guideway Transit and Passenger Rail System (NFPA 130) and NFPA 101 (Life Safety Code). According to NFPA 130, nonflammable materials which cause low smoke and nontoxic gas will be used. Evacuation of passengers shall be in compliance with NFPA 101. Facilities for the elderly and the disabled shall be designed in conformity with the ministerial regulations regarding facilities in building for the disabled and the elderly B.E. 2548 (promulgated in the Government Gazette, Volume 122, Part 52a, dated 2 July 2005).

Table 2.1–5 presents comparison between the station locations in the study by OTP as approved on 16 March 2012 and the locations in the present study. Details of station locations are elaborated below.

(1) PK01 Nonthaburi Government Center Station

In the previous study in 2012, it was the beginning station linking to the Purple Line (Bang Yai–Bang Sue) on Rattanathibet road in front of Nonthaburi Government Center and Thaicom Public Company Limited, about 50 m far from the Purple Line.

Table 2.1–4 Elevations of Concourse Levels and Platform Levels of Pink Line Stations

Elevation	Station Name	
a. Concourse Level		
7.5 m. (27stations)	PK01 Nonthaburi Government Center Station	PK02 Khae Rai Station
	PK03 Sanambin Nam Station	PK04 Samakkhi Station
	PK05 Royal Irrigation Department Station	PK06 Pak Kret Station
	PK07Pak Kret Bypass Station	PK08 Chaeng Watthana Pak Kret 28 Station
	PK10 Si Rat Station	PK11 Chaeng Watthana 14 Station
	PK12 Bangkok Government Complex Station	
	PK13 TOT Station	PK15 Phranakhon Rajabhat Station
	PK17 Ram Inthra 3 Station	PK18 Lat Pla Khao Station
	PK19Ram Inthra 31 Station	PK20 Maiyalap Station
	PK21 Watcharaphon Station	PK22 Ram Inthra 40 Station
	PK23 Khu Bon Station	PK24 Ram Inthra 83 Station
	PK25 East Outer Ring Road Station	PK26 Nopparat Rajathanee Station
	PK27Bang Chan Station	PK28 Setthabutbamphen Station
PK29 Min Buri Market Station	PK30 Min Buri Station	
1.5 m. (2 stations)	PK09 Muang Thong Thani Station	PK14 Lak Si Station
11.16 m. (1 station)	PK16 Wat Phra Si Maha That Station	-
b. Platform Level		
15.5 m. (27 stations)	PK01 Nonthaburi Government Center Station	PK02 Khae Rai Station
	PK03 Sanambin Nam Station	PK04 Samakkhi Station
	PK05 Royal Irrigation Department Station	PK06 Pak Kret Station
	PK07Pak Kret Bypass Station	PK08 Chaeng Watthana Pak Kret 28 Station
	PK10 Si Rat Station	PK11 Chaeng Watthana 14 Station
	PK12 Bangkok Government Complex Station	
	PK13 TOT Station	PK15 Phranakhon Rajabhat Station
	PK17 Ram Inthra 3 Station	PK18 Lat Pla Khao Station
	PK19 Ram Inthra 31 Station	PK20 Maiyalap Station
	PK21 Watcharaphon Station	PK22 Ram Inthra 40 Station
	PK23 Khu Bon Station	PK24 Ram Inthra 83 Station
	PK25 East Outer Ring Road Station	PK26 Nopparat Rajathanee Station
	PK27Bang Chan Station	PK28 Setthabutbamphen Station
PK29 Min Buri Market Station	PK30 Min Buri Station	
9.5m. (2stations)	PK09 Muang Thong Thani Station	PK14 Lak Si Station
11.16m. (1station)	PK16 Wat Phra Si Maha That Station	-

In the present study, it is situated in front of Nonthaburi Government Center and about 50 m relocated from the previous location to avoid blocking the view of the Makut Rommayasaran Park. It is still the beginning station of the Pink Line which enables linkage to the Purple Line by the skywalk at the Nonthaburi Government Center station. Locations of the Nonthaburi Government Center station in the previous study and the present study are presented in *Figures 2.1–1* and *2.1–2* respectively.



Figure 2.1-1 Location of Nonthaburi Government Center Station in the Previous Study (2012)



Figure 2.1-2 Location of Nonthaburi Government Center Station in the Present Study

(2) PK02 Khae Rai Station

In the previous study in 2012, it was on Tiwanon road, in front of Tesco Lotus (Rattanathibet branch) and the Central Chest Institute of Thailand.

In the present study, it is sited on Tiwanon road, and moved closer to Khae Rai intersection, about 200 m far from the previous location, and in front of the Central Chest Institute of Thailand. The new site will serve the expansion of residential and business areas along Tiwanon road. Locations of the Khae Rai station in the previous study and the present study are presented in *Figures 2.1-3* and *2.1-4* respectively.



Figure 2.1–3 Location of Khae Rai Station in the Previous Study (2012)



Figure 2.1–4 Location of Khae Rai Station in the Present Study

(3) PK03Sanambin Nam Station

In the previous study in 2012, it was on Tiwanon road about 360 m before reaching Sanambin Nam intersection, and in front of Siam Commercial Bank (Sanambin Nam Branch).

In the present study, it is on Tiwanon road near Sanambin Nam intersection and moved closer to Khae Rai intersection, about 50 m far from the previous location. This is because the Department of Highways has planned to construct the flyover to cross Sanambin Nam intersection in the future. The station will accommodate the expansion of residential and business areas along Tiwanon and Sanambin Nam roads, and around the Quartermaster Department Royal Thai Army. Locations of the Sanambin Nam station in the previous study and the present study are presented in *Figure 2.1–5* and *2.1–6* respectively.



Figure 2.1-5 Location of Sanambin Nam Station in the Previous Study (2012)

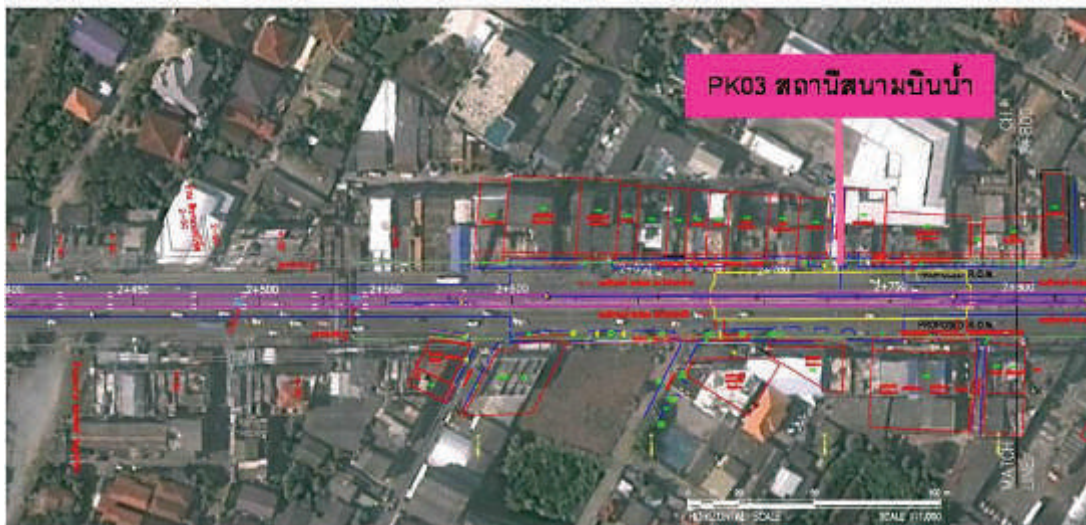


Figure 2.1-6 Location of Sanambin Nam Station in the Present Study

(4) PK04 Samakkhi Station

In the previous study in 2012, it was in front of the Government Savings Bank (Tiwanon Branch) on Tiwanon Rd., about 50 m before reaching Soi Samakkhi.

In the present study, it is located on Tiwanon Rd., between Soi Samakkhi and Khlong Bang Talat. The station is moved towards Khae Rai intersection, about 25 m far from the previous location to avoid installation of station foundation piles in Khlong Bang Talat. It is situated before reaching the bridge to cross Khlong Bang Talat and will serve high-density residential and commercial areas along Tiwanon and Samakkhi roads. The station is also close to the Department of Highways' future overpass construction project from Sanambin Nam intersection to Soi Samakkhi. Locations of the Samakkhi station in the previous study and the present study are presented in *Figures 2.1-7* and *2.1-8* respectively.

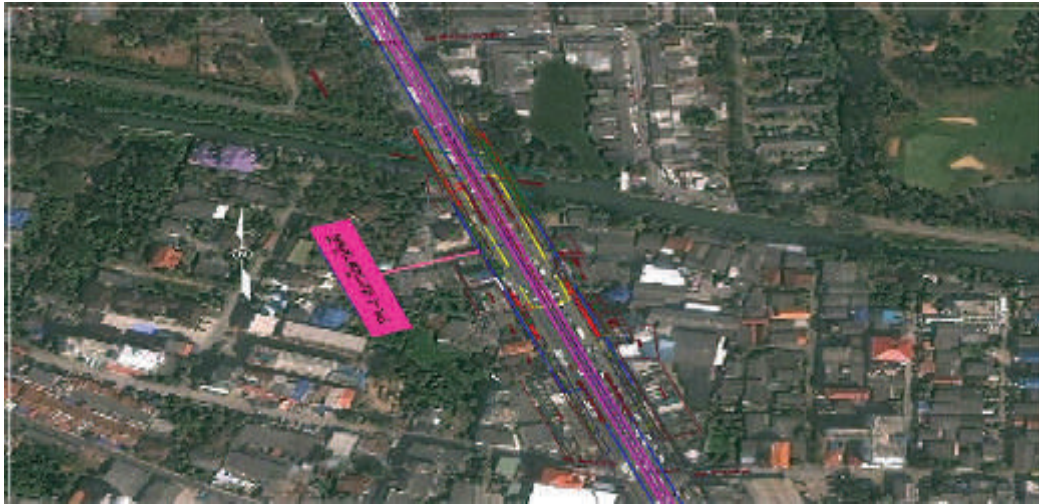


Figure 2.1–7 Location of Samakkhi Station in the Previous Study (2012)

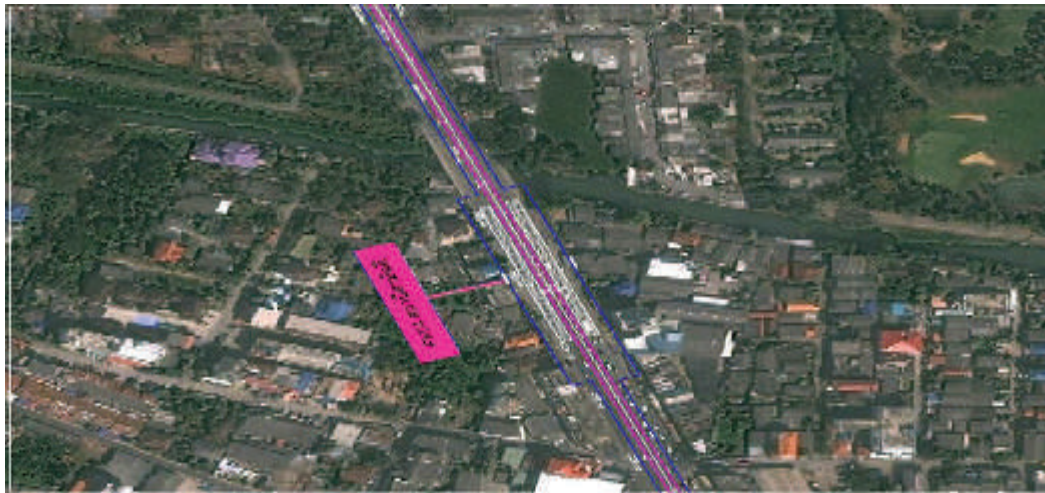


Figure 2.1–8 Location of Samakkhi Station in the Present Study

(5) PK05 Royal Irrigation Department Station

In the previous study in 2012, it was on Tiwanon Rd., in front of the Royal Irrigation Department (RID) and RID golf club.

In the present study, its name was changed from Chonprathan Station to Royal Irrigation Department Station.

According to the meeting between RID Director-General, the representatives from MRTA, and the Consultants on Thursday 10 October 2013, the RID Director-General suggested relocation of the station towards the front of Chonprathan Wittaya School to serve students and people traveling to Chonprathan Rangsarit Temple. The travel demand around here is high. The station is therefore about 150 m moved towards the right of the previous location. It is on Tiwanon road in front of Chonprathan

withthaya School and Chonprathan Rangsarit Temple, serving the educational institution, residential and commercial areas on Tiwanon road before reaching Pak Kret intersection. Locations of the Royal Irrigation Department station in the previous study and the present study are presented in *Figures 2.1–9* and *2.1–10* respectively.



Figure 2.1–9 Location of Royal Irrigation Department Station in the Previous Study (2012)



Figure 2.1–10 Location of Royal Irrigation Department Station in the Present Study

(6) PK06 Pak Kret Station

In the previous study in 2012, it was situated on Chaeng Watthana–Pak Kret road, in front of SCB Information Center and the access to Siththarom Village.

In the present study, it is about 650 m moved from the previous location towards Pak Kret intersection between Tiwanon and Chaeng Watthana roads to serve high-density residential and commercial areas around Pak Kret intersection. Its catchment area includes high-density communities along Chaiyaphruek Road, with a trend for significant urban expansion and a potential for land development in the vicinity. Locations of the Pak Kret station in the previous study and the present study are presented in *Figures 2.1–11* and *2.1–12* respectively.



Figure 2.1–11 Location of Pak Kret Station in the Previous Study (2012)



Figure 2.1–12 Location of Pak Kret Station in the Present Study

(7) PK07 Pak Kret Bypass Station

In the previous study in 2012, it was sited on Chaeng Watthana road, in front of Pak Kret electricity sub-station and Bangkok Bank (Chaeng Watthana branch).

In the present study, it is the first station on Chaeng Watthana road. The station is about 550 m moved from the previous location towards the intersection with Pak Kret bypass to serve high-density residential and commercial areas along Pak Kret bypass and Chaeng Watthana road, including new office buildings. Huge travel demand will be generated due to the presence of several office and commercial buildings in its vicinity, such as Big C Supercenter, Home Pro, Jasm in International Tower, and Spansion

(Thailand) Co., Ltd. Locations of the Pak Kret Bypass station in the previous study and the present study are presented in *Figures 2.1-13* and *2.1-14* respectively.



Figure 2.1-13 Location of Pak Kret Bypass Station in the Previous Study (2012)



Figure 2.1-14 Location of Pak Kret Bypass Station in the Present Study

(8) PK08Chaeng Watthana-Pak Kret 28Station

It is the new station located on Chaeng Watthana road, around Chaeng Watthana-Pak Kret Soi 28, near Central Plaza Chaeng Watthana to serve large residential and commercial areas on both sides of Chaeng Watthana road between Chaeng Watthana-Pak Kret Soi 26 and Soi 28. The station catchment area covers Software Park Thailand, companies, Hampton International School, etc. Moreover, Bangkok Chain Hospital will be constructed in the future. As a result, huge travel demand is anticipated in these areas.

Location of the Chaeng Watthana–Pak Kret 28 station in the present study is presented in *Figure 2.1–15*.



Figure 2.1–15 Location of Chaeng Watthana-Pak Kret 28 Station in the Present Study

(9) PK09Muang Thong Thani Station

In the previous study in 2012, it was located on Chaeng Watthana road between the Ministry of Justice, Software Park Thailand and the flyover to Muang Thong Thani. A skywalk would be provided to link the station to the Ministry of Justice, Central Plaza Chaeng Watthana, and Soi Muang Thong Thani.

In the present study, it is on Chaeng Watthana road, around Chaeng Watthana-Pak Kret Soi 35, before Si Rat Expressway, near Muang Thong Thani village. It is about 1 km moved from the previous location to the right side of the project route to serve people living around Chaeng Watthana-Pak Kret Soi 30 and passengers from Si Rat expressway, Khlong Kluea School, Sukhothai Thammathirat Open University, a condominium project-the Key-in the station vicinity, and IMPACT Arena, Exhibition and Convention Center. Locations of the Muang Thong Thani station in the previous study and the present study are illustrated in *Figures 2.1–16* and *2.1-17* respectively.



Figure 2.1–16 Location of Muang Thong Thani Station in the Previous Study (2012)



Figure 2.1–17 Location of Muang Thong Thani Station in the Present Study

(10) PK10 Si Rat Station

In the previous study in 2012, it was on Chaeng Watthana road, in front of the Office of Maintenance, Department of Highways (DOH), and Makro Superstore (Chaeng Watthana).

In the present study, the station is about 100 m moved from the previous location to the right side of the project route to serve the expansion of residential areas and business premises, including IMPACT Arena, Exhibition and Convention Center. Also it will serve passengers from Si Rat expressway and Prachachuen road. Locations of the Si Rat station in the previous study and the present study are illustrated in *Figures 2.1-18* and *2.1-19* respectively.



Figure 2.1–18 Location of Si Rat Station in the Previous Study (2012)



Figure 2.1–19 Location of Si Rat Station in the Present Study

(11) PK11 Chaeng Watthana 14 Station

In the previous study in 2012, it was located on Chaeng Watthana road, in front of Phong Phet market and Chaeng Watthana Telephone Junction.

In the present study, the station name was changed from Muang Thong 1 to Chaeng Watthana 14 but the location remains unchanged. It is situated on Chaeng Watthana road to serve large residential and commercial areas on both roadsides. The station catchment areas include large housing estates along Chaeng Watthana Soi 14, and Kongthapbok Upatham Kraiumnuayvittaya School. Locations of the Chaeng Watthana 14

station in the previous study and the present study are illustrated in *Figures 2.1–20* and *2.1–21* respectively.



Figure 2.1–20 Location of Chaeng Watthana 14 Station in the Previous Study (2012)



Figure 2.1–21 Location of Chaeng Watthana 14 Station in the Present Study

(12) PK12Bangkok Government Complex Station

In the previous study in 2012, it was located on Chaeng Watthana road, in front of the head office of CAT Telecom PCL and Ban Metta.

In the present study, the station name was changed from *Bangkok Government Center* to *Bangkok Government Complex*. It is on Chaeng Watthana road, in front of the Department of Consular Affairs, near the Bangkok Government Complex.

The station is about 300 m moved from the previous location to the left side of the project route. Its catchment areas include several government offices such as Department of Consular Affairs, Administrative Court, Department of Special Investigation, Antiaircraft Artillery Regiment1, Long Range Reconnaissance Patrol Company of Division 1, King's Guard, etc. There are various activities in these places that will create large travel demand. Locations of the Bangkok Government Complex station in the previous study and the present study are illustrated in *Figures 2.1–22* and *2.1–23* respectively.



Figure 2.1–22 Location of Bangkok Government Complex Station in the Previous Study (2012)



Figure 2.1–23 Location of Bangkok Government Complex Station in the Present Study

(13) PK13 TOT Station

It is the new station located on Chaeng Watthana road, in front of TOT Corporation PCL. A large number of office buildings and companies are located in the vicinity of the station such as Thailand Post Company Limited, Na Nakorn Building, Chaengprasisit Building, which attract more trips to this area. There are also several large residential areas in the neighborhood, especially on Chaeng Watthana Soi 10. Location of the TOT station in the present study is presented in *Figure 2.1–24*.



Figure 2.1–24 Location of TOT Station in the Present Study

(14) PK14Lak Si Station

In the previous study in 2012, it was located on Chaeng Watthana road, in front of Lak Si Plaza. The station was parallel with the flyover to cross the Vibhavadi Rangsit road and beneath Utraphimuk elevated road (Don Muang Tollway).

In the present study, the station is located at the crossing between Chaeng Watthana road and Vibhavadi Rangsit road. It is about 120 m moved from the previous location to the right side of the project route. It is an interchange station linking the Pink Line to the Red Line (Bang Sue-Rangsit) via a skywalk. This station is also near Lak Si railway station of the State Railway of Thailand (SRT), enabling intermodal transfer between the mass transit system and SRT's commuter trains. In its catchment areas, there are IT Square, Chulabhorn Hospital, and Chulabhorn Research Institute, Office of the National Broadcasting and Telecommunications Commission, residential areas along

Chaeng Watthana and Vibhavadi Rangsit roads, and Lak Si Housing Project. Locations of the Lak Si station in the previous study and the present study are depicted in **Figures 2.1–25** and **2.1–26** respectively.

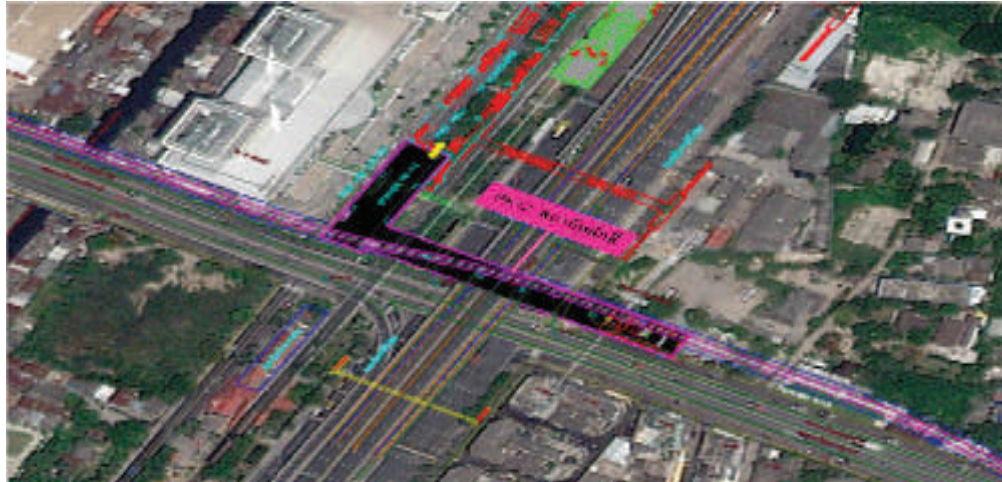


Figure 2.1–25 Location of Lak Si Station in the Previous Study (2012)



Figure 2.1–26 Location of Lak Si Station in the Present Study

(15) PK15 Phranakhon Rajabhat Station

In the previous study in 2012, it was located on Chaeng Watthana road, in front of Phranakhon Rajabhat University and Max Valu Supermarket (Laksi Square).

In the present study, the station name was changed from *Phranakhon Rajabhat University* to *Phranakhon Rajabhat*. The last station on Chaeng Watthana road is about 30 m moved from the previous location to the left side of the project route. Besides, its location was changed from being adjacent to the footpath to the road median

to avoid acquisition of land and buildings. This station is in front of Phranakhon Rajabhat University and Max Valu Supermarket (Laksi Square). It can serve large residential and commercial areas between Chaeng Watthana Soi 1 and Soi 4. Locations of the Phranakhon Rajabhat station in the previous study and the present study are depicted in *Figures 2.1–27* and *2.1–28* respectively.

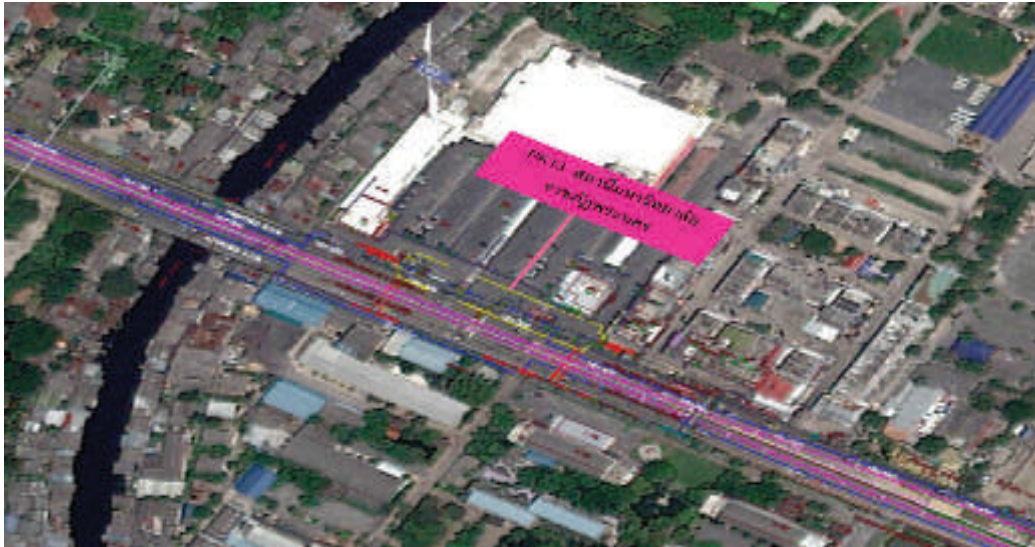


Figure 2.1–27 Location of Phranakhon Rajabhat Station in the Previous Study (2012)

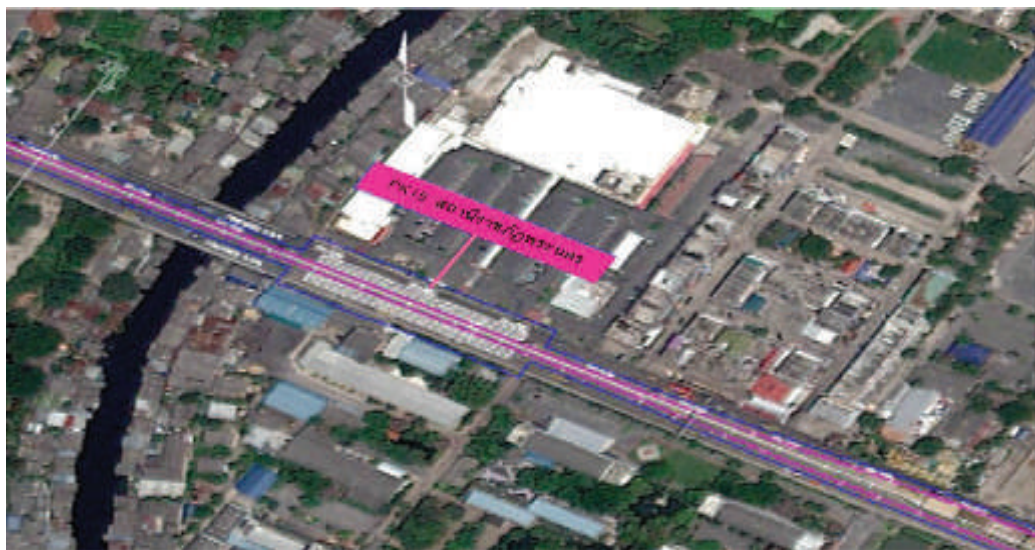


Figure 2.1–28 Location of Phranakhon Rajabhat Station in the Present Study

(16) PK16 Wat Phra Si Maha That Station

In the previous study in 2012, it was located on Ram Inthra road, in front of Krirk University and the 2nd Infantry Battalion.

In the present study, the station name was changed from *Phithak Ratthathammanun Monument* to *Wat Phra Si Maha That*. It is about 350 m moved from the previous location to be closer to Phithak Ratthathammanun Monument and connects with the Dark Green Line (Mo Chit–Saphan Mai) via the skywalk. The EIA Report of the Bangkok Mass Transit Project: Mo Chit–Saphan Mai Section was approved by the NEB on 31 October 2012. Locations of the Wat Phra Si Maha That station in the previous study and the present study are depicted in *Figures 2.1–29* and *2.1–30* respectively.

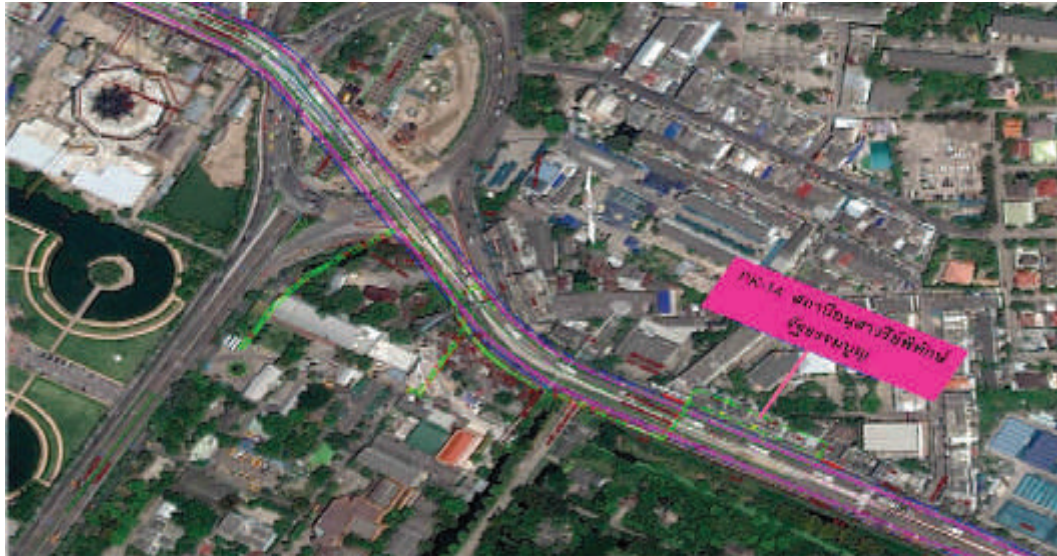


Figure 2.1–29 Location of Wat Phra Si Maha That Station in the Previous Study (2012)



Figure 2.1–30 Location of Wat Phra Si Maha That Station in the Present Study

(17) PK17 Ram Inthra 3 Station

This new station is the first station located on Ram Inthra road. It is located in front of Lumphini Condominium (Ram Inthra–Lak Si) and the Royal Thai Army Sports Center Ram Inthra, near Central Plaza Ram Inthra. It will serve high-density residential areas in Ram Inthra Soi 3 and Soi 5. Location of the Ram Inthra 3 station in the present study is presented in *Figure 2.1–31*.



Figure 2.1–31 Location of Ram Inthra 3 Station in the Present Study

(18) PK18 Lat Pla Khao Station

In the previous study in 2012, it was located on Ram Inthra road, in front of Communications Police Division of the Royal Thai Police and Big C Supercenter (Ram Inthra).

In the present study, it is on Ram Inthra road, between Ram Inthra Soi 21 and Soi 23. The station is about 25 m moved from the previous location to the right side of the project route to serve large residential and commercial areas along both sides of Ram Inthra Road and Soi Lat Pla Khao which connects to Kaset Nawamin Road. Major trip attractions in the station vicinity include Ram Inthra department store, and Big C Supercenter. Locations of the Lat Pla Khao station in the previous study and the present study are depicted in *Figures 2.1–32* and *2.1–33* respectively.



Figure 2.1–32 Location of Lat Pla Khao Station in the Previous Study (2012)

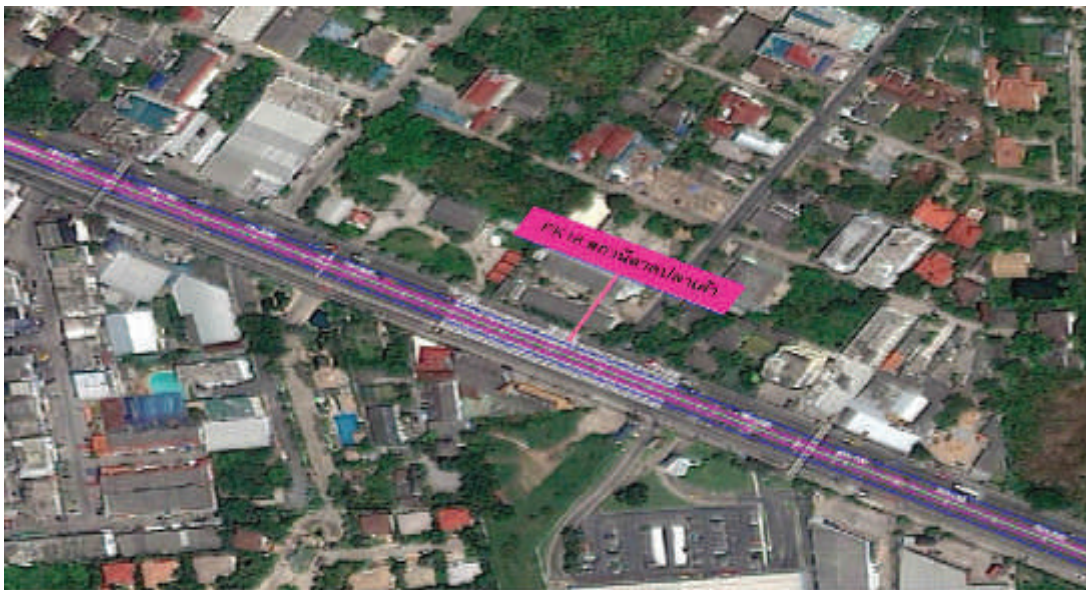


Figure 2.1–33 Location of Lat Pla Khao Station in the Present Study

(19) PK19 Ram Inthra 31 Station

This new station is located on Ram Inthra road, around Ram Inthra Soi 31 to serve large residential and commercial areas from Ram Inthra Soi 29 to Soi 39 and Soi 8 to Soi 10. Location of the Ram Inthra 31 station in the present study is presented in *Figure 2.1–34*.

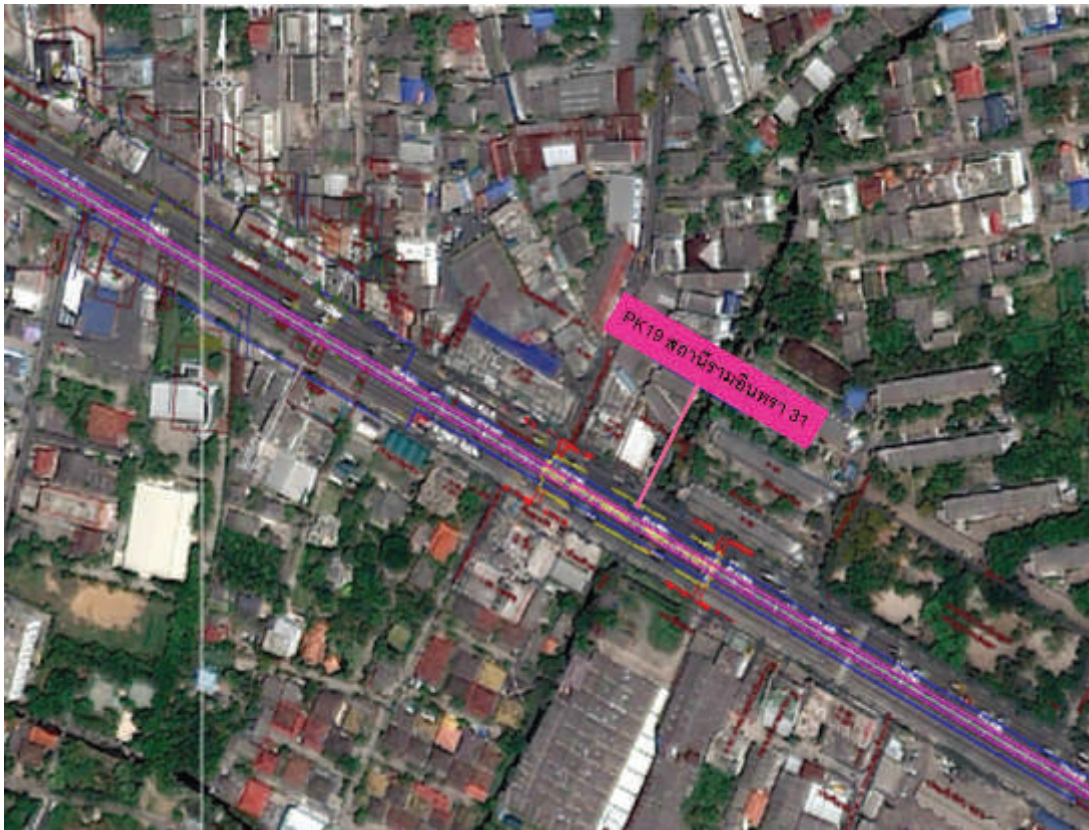


Figure 2.1–34 Location of Ram Inthra 31 Station in the Present Study

(20) PK20 Maiyalap Station

In the previous study in 2012, it was located on Ram Inthra road, in front of Ram Inthra Community Housing and Pan Thong market.

In the present study, the station name was changed from *Ram Inthra Community Housing* to *Maiyalap*. About 550 m moved from the previous location, it is located on Ram Inthra road, at the entrance to Ram Inthra Soi 41, near Maiyalap three-way intersection. The station will serve large residential areas such as Ram Inthra Community Housing, and commercial areas along Ram Inthra road, from Ram Inthra Soi 12 to Chalong Rat (Ram Inthra-At Narong) expressway. Furthermore, this station can serve passengers traveling from the expressway and the frontage road south of Ram Inthra Road. Locations of the Maiyalap station in the previous study and the present study are illustrated in *Figures 2.1–35* and *2.1–36* respectively.



Figure 2.1–35 Location of Maiyalap Station in the Previous Study (2012)



Figure 2.1–36 Location of Maiyalap Station in the Present Study

(21) PK21 Watcharaphon Station

In the previous study in 2012, it was sited on Ram Inthra road between Ram Inthra Soi 63 and Soi 63/1, around Bang Chak service station.

In the present study, it is located on Ram Inthra road, next to Chalong Rat Expressway, between Ram Inthra Soi 59 and Soi 61. About 510 m moved from the previous location to the left side of the project route (from Khae Rai to Min Buri), the station will serve large residential and commercial areas along Soi Watcharaphon. Passengers can transfer between the Pink Line and Chalong Rat (Ram Inthra-At Narong)

expressway. Locations of the Watcharaphon station in the previous study and the present study are presented in *Figures 2.1–37* and *2.1–38* respectively.



Figure 2.1–37 Location of Watcharaphon Station in the Previous Study (2012)



Figure 2.1–38 Location of Watcharaphon Station in the Present Study

(22) PK22Ram Inthra 40Station

This new station is located on Ram Inthra road between Ram Inthra Soi 40 and 42 to serve residential and commercial zones along Ram Inthra road, including residential areas along Nuan Chan road. Besides, it will accommodate passengers

traveling from Soi Watcharaphon via Ram Inthra Soi 65. Location of the Ram Inthra 40 station in the present study is presented in *Figure 2.1-39*.



Figure 2.1-39 Location of Ram Inthra 40 Station in the Present Study

(23) PK23 Khu Bon Station

In the previous study in 2012, it was situated on Ram Inthra road before the flyover to Nawamin road and between Ram Inthra Soi 69 and Soi Khu Bon.

In the present study, the station name was changed from *Ram Inthra KM 8* to *Khu Bon*. About 50 m moved from the previous location to the left side of the project route, it is located on Ram Inthra road between Ram Inthra Soi 69 and Soi 46. The station will serve large residential and commercial zones along Ram Inthra road, including Sai Net market. Also it will accommodate people living in Soi Wat Khu Bon and its vicinity. Locations of the Khu Bon station in the previous study and the present study are presented in *Figures 2.1-40* and *2.1-41* respectively.



Figure 2.1–40 Location of Khu Bon Station in the Previous Study (2012)



Figure 2.1–41 Location of Khu Bon Station in the Present Study

(24) PK24Ram Inthra 83Station

This new station is located on Ram Inthra road between Ram Inthra Soi 83 and Soi 85, and near Synphaet General Hospital to serve residential areas, commercial zones and office buildings along Ram Inthra road. Location of the Ram Inthra 83 station in the present study is presented in *Figure 2.1–42*.

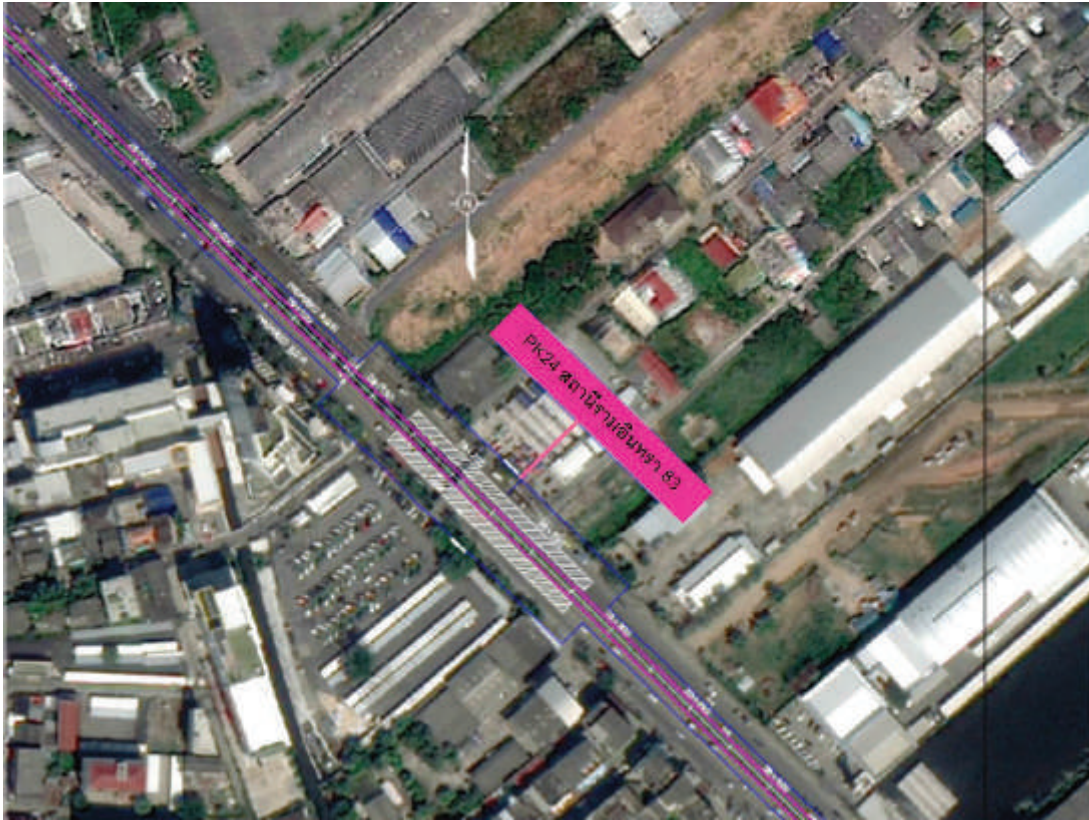


Figure 2.1–42 Location of Ram Inthra 83 Station in the Present Study

(25) PK25 East Outer Ring Road Station

In the previous study in 2012, it was situated on Ram Inthra road near Fashion Island and entrance to motorway.

In the present study, the station name was changed from *Khanna Yao* to *East Outer Ring Road*. About 150 m moved from the previous location to the left side of the project route, it is sited on Ram Inthra road, next to the East Outer Ring Road. The station will serve large residential areas on Ram Inthra and Nawamin roads. Also it provides linkage to the Outer Ring Road. The station is in front of huge shopping malls, namely Fashion Island and The Promenade, which are significant trip productions and attractions. Locations of the East Outer Ring Road station in the previous study and the present study are presented in *Figures 2.1–43* and *2.1–44* respectively.



Figure 2.1-43 Location of East Outer Ring Road Station in the Previous Study (2012)



Figure 2.1-44 Location of East Outer Ring Road Station in the Present Study

(26) PK26 Nopparat Rajathanee Station

In the previous study in 2012, it was situated on Ram Inthra road, in front of Nightingale Ramintra Sport Field, Nopparat Rajathanee Hospital, and Thai Venus factory.

In the present study, about 250 m moved from the previous location to the right side of the project route, the station is located on Ram Inthra road around Soi Suan Siam, next to Nopparat Rajathanee Hospital. It will serve large residential and commercial areas along Ram Inthra road, particularly those along Suan Siam road.

Locations of the Nopparat Rajathanee station in the previous study and the present study are presented in *Figures 2.1-45* and *2.1-46* respectively.

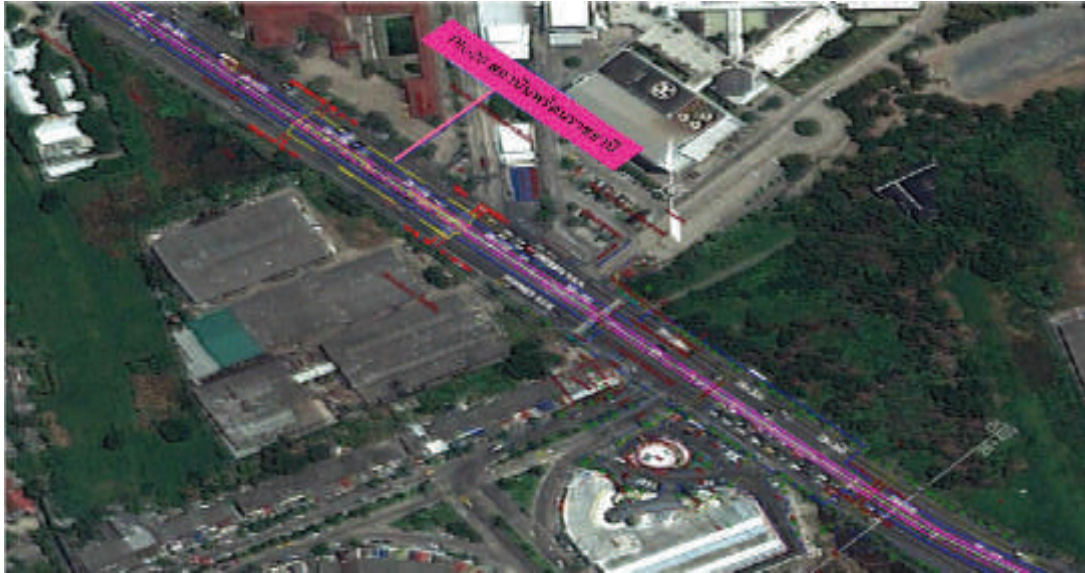


Figure 2.1-45 Location of Nopparat Rajathanee Station in the Previous Study (2012)

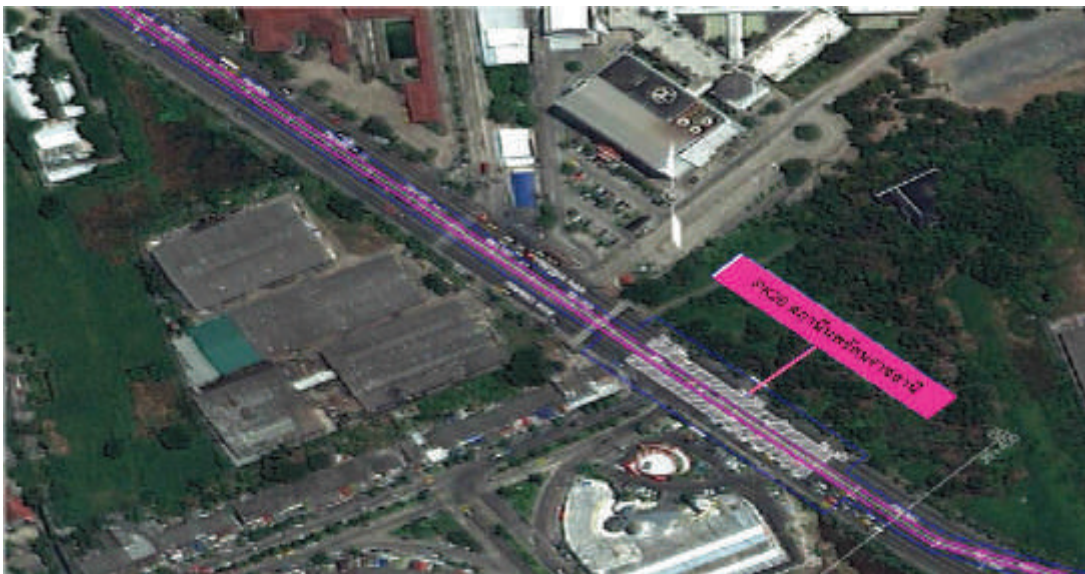


Figure 2.1-46 Location of Nopparat Rajathanee Station in the Present Study

(27) PK27 Bang Chan Station

In the previous study in 2012, it was situated on Ram Inthra road at the entrance to Ram Inthra Soi 109.

In the present study, about 300 m moved from the previous location to the right side of the project route, it is located on Ram Inthra road, around Ram Inthra Soi 115 and Soi 109 (Soi Phraya Suren) and Ram Inthra Soi 113. It will serve high-density residential and commercial zones along Ram Inthra road, especially along Ram Inthra Soi 109 (Soi Phraya Suren), which have high development potential in the future. Locations of the Bang Chan station in the previous study and the present study are presented in *Figures 2.1-47* and *2.1-48* respectively.

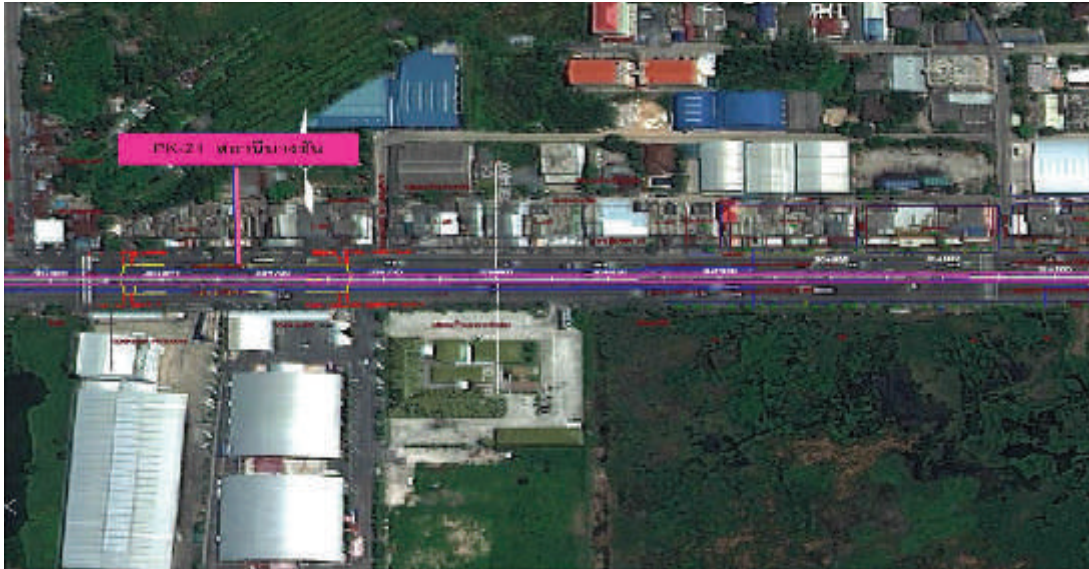


Figure 2.1-47 Location of Bang Chan Station in the Previous Study (2012)



Figure 2.1-48 Location of Bang Chan Station in the Present Study

(28) PK28 Setthabutbamphen Station

In the previous study in 2012, it was situated on Ram Inthra road, near Setthabutbamphen School, at the entrance to Ram Inthra Soi 123 and Siam Nissan Standard Co., Ltd.

In the present study, its location remains unchanged. It is the last station on Ram Inthra road and will serve passengers around Min Buri intersection and those living along Seri Thai and Suwinthawong roads. Locations of the Setthabutbamphen station in the previous study and the present study are presented in *Figures 2.1-49* and *2.1-50* respectively.



Figure 2.1-49 Location of Setthabutbamphen Station in the Previous Study (2012)

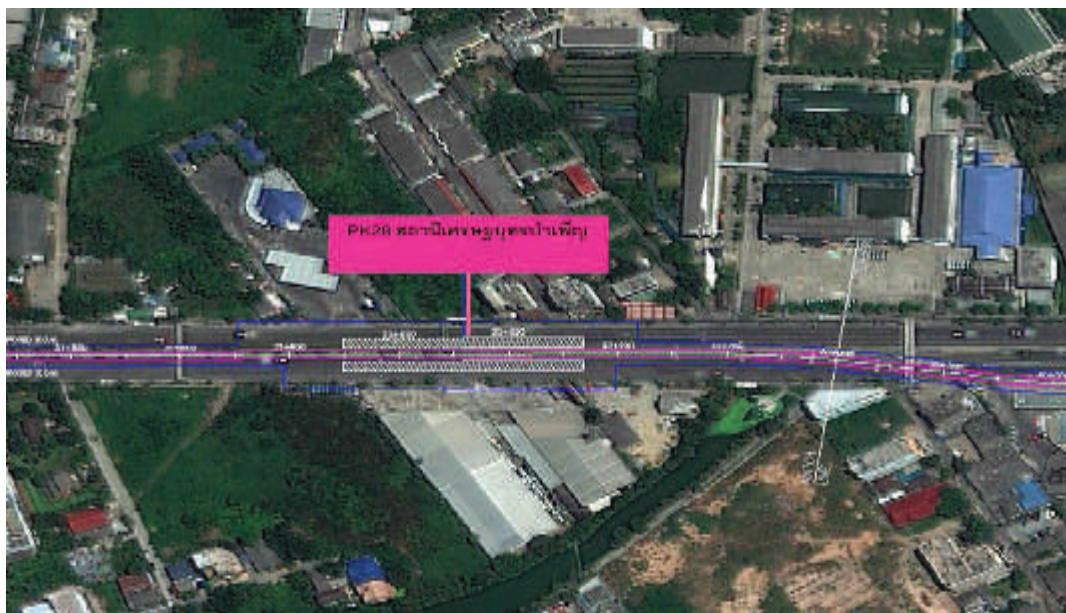


Figure 2.1-50 Location of Setthabutbamphen Station in the Present Study

(29) PK29 Min Buri Market Station

In the previous study in 2012, it was situated on Sihaburanukit road, at the entrance to Chatuchak Market 2, between Sihaburanukit Soi 16 and Soi 18.

In the present study, Min Buri Market station - the first station on Sihaburanukit Road - is located in front of Chatuchak Market 2. It is about 20 m moved from the previous location to the right side of the project route to serve large residential and commercial zones of Min Buri. Locations of the Min Buri Market station in the previous study and the present study are presented in *Figures 2.1-51* and *2.1-52* respectively.

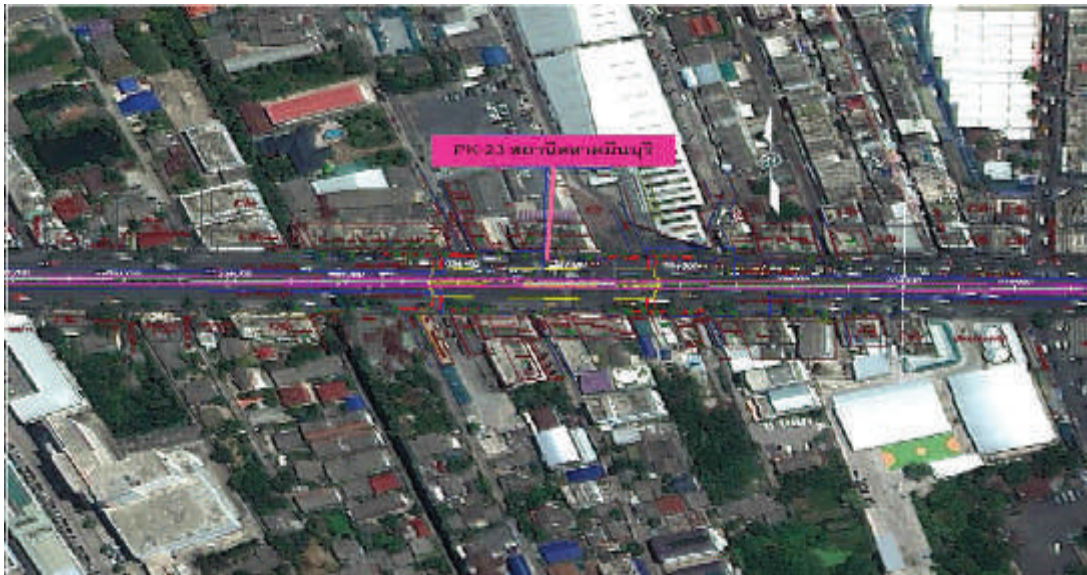


Figure 2.1-51 Location of Min Buri Market Station in the Previous Study (2012)



Figure 2.1-52 Location of Min Buri Market Station in the Present Study

(30) PK30 Min Buri Station

In the previous study in 2012, it was located around the depot of the Pink Line, near Ramkhamhaeng road.

In the present study, its location remains unchanged. The last station of the Pink Line is located on Ramkhamhaeng road between Ramkhamhaeng Soi 192 and Khlong Song Ton Nun. The depot and park & ride facilities are also located here. Besides, it is an interchange station providing connection by a skywalk to the Orange Line (Bang Kapi-Min Buri section). Locations of the Min Buri station in the previous study and the present study are presented in *Figures 2.1-53* and *2.1-54* respectively.



Figure 2.1-53 Location of Min Buri Station in the Previous Study (2012)



Figure 2.1-54 Location of Min Buri Station in the Present Study

Table 2.1–5 Summary of Changes in Station Locations Approved on 16 March 2012 in Comparison with the Present Locations

As Approved on 16 March 2012			Changes in Project Details			
Station	Station Name	Previous Location	Station	Station Name	Present Location	Reasons for Relocation
PK-1	Nonthaburi Government Center	<ul style="list-style-type: none"> It is the beginning station linking to the Purple Line (Bang Yai–Bang Sue) on Rattana Thibet road in front of Nonthaburi Government Center and Thaicom Public Company Limited, about 50 m far from the Purple Line station. 	PK01	Nonthaburi Government Center	<ul style="list-style-type: none"> It is moved to the left side of the project route alignment, about 50 m far from the previous location. It is in front of Nonthaburi Government Center. 	<ul style="list-style-type: none"> To avoid blocking the view of the Makut Rommaya-saran Park in front of Nonthaburi Government Center To enable linkage with the Purple Line (Bang Yai–Bang Sue) through Skywalk from Nonthaburi Government Center
PK-2	Khae Rai	<ul style="list-style-type: none"> It is on Tiwanon Rd., in front of Tesco Lotus (Rattana Thibet branch) and the Central Chest Institute of Thailand. 	PK02	Khae Rai	<ul style="list-style-type: none"> It is moved towards Khae Rai intersection, about 200 m far from the previous location, and in front of the Central Chest Institute of Thailand. 	<ul style="list-style-type: none"> To serve the expansion of residential and business areas, as well as people using the services of the Central Chest Institute of Thailand and people living along Tiwanon road
PK-3	Sanambin Nam	<ul style="list-style-type: none"> It is on Tiwanon Rd., about 360 m before reaching Sanambin Nam intersection. In front of Siam Commercial Bank (Sanambin Nam Branch) 	PK03	Sanambin Nam	<ul style="list-style-type: none"> It is moved towards Khae Rai intersection, about 50 m far from the previous location. It is on Tiwanon Rd., near Sanambin Nam intersection, and at the entrance to Soi Tiwanon 40. 	<ul style="list-style-type: none"> The Department of Highways has planned to construct the flyover to cross Sanambin Nam intersection in the future. To accommodate the expansion of residential and business areas along Tiwanon and Sanambin Nam roads, and around the Quartermaster Department Royal Thai Army
PK-4	Samakkhi	<ul style="list-style-type: none"> It is in front of the Government Savings Bank (Tiwanon Branch) on Tiwanon Rd., about 50 m before reaching Soi Samakkhi. 	PK04	Samakkhi	<ul style="list-style-type: none"> It is moved towards Khae Rai intersection, about 25 m far from the previous location. It is located on Tiwanon Rd., between Soi Samakkhi and Khlong Bang Talat. The station is located before reaching Bang Talat bridge. 	<ul style="list-style-type: none"> To avoid installation of station foundation piles in Khlong Bang Talat and to serve high density residential areas along Tiwanon and Samakkhi roads
PK-5	Chonprathan	<ul style="list-style-type: none"> It is on Tiwanon Rd., in front of the Royal Irrigation Department (RID) and RID golf club. 	PK05	Royal Irrigation Department (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Chonprathan to Royal Irrigation Department. It is about 150 m moved from the previous location towards the right side of the project route. It is on Tiwanon Rd. between the RID golf club and Chonprathan Rangsarit Temple. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To accommodate the expansion of residential and business areas on Tiwanon road before reaching Pak Kret intersection

Table 2.1–5 Summary of Changes in Station Locations Approved on 16 March 2012 in Comparison with the Present Locations (Cont’d)

As Approved on 16 March 2012			Changes in Project Details			
Station	Station Name	Previous Location	Station	Station Name	Present Location	Reasons for Relocation
PK-6	Pak Kret	<ul style="list-style-type: none"> It is on Chaeng Watthana–Pak Kret road, in front of SCB Information Center and the entrance to Sitharom Village. 	PK06	Pak Kret	<ul style="list-style-type: none"> It is about 650 m moved from the previous location on Chaeng Watthana–Pak Kret road. It is moved towards Pak Kret intersection between Tiwanon and Chaeng Watthana–Pak Kret roads. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve the expansion of residential and business areas around Pak Kret intersection and people from Chaiyaphruek road which is densely populated and the increase in population around the areas is likely.
PK-7	Pak Kret Bypass	<ul style="list-style-type: none"> It is on Chaeng Watthana–Pak Kret road, in front of Pak Kret electricity sub-station and Bangkok Bank (Chaeng Watthana branch). 	PK07	Pak Kret Bypass	<ul style="list-style-type: none"> It is about 550 m moved from the previous location towards Pak Kret intersection, in front of Big C Supercenter and Home Pro. It is the first station on Chaeng Watthana road before reaching the intersection with Pak Kret bypass. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve the expansion of residential and business areas along Pak Kret bypass and Chaeng Watthana road, including new office buildings in the future.
-	-	-	PK08	Chaeng Watthana-Pak Kret 28	<p>New Station</p> <ul style="list-style-type: none"> It is on Chaeng Watthana road, around Soi Chaeng Watthana-Pak Kret 28, near Central Plaza Chaeng Watthana. 	<ul style="list-style-type: none"> The new station is added to ensure suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is high.
PK-8	Muang Thong Thani	<ul style="list-style-type: none"> It is on Chaeng Watthana–Pak Kret road between the Ministry of Justice and the flyover to Muang Thong Thani. There will be a skywalk linking the station to the Ministry of Justice, Central Plaza Chaeng Watthana, and Soi Muang Thong Thani. 	PK09	Muang Thong Thani	<ul style="list-style-type: none"> It is about 1 km moved from the previous location to the right side of the project route (from Khae Rai to Min Buri direction). It is on Chaeng Watthana road, around Soi Chaeng Watthana-Pak Kret 35, before Si Rat Expressway, near Muang Thong Thani village. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve large residential, commercial, and education areas where the transportation demand is high.
PK-9	Si Rat	<ul style="list-style-type: none"> It is on Chaeng Watthana road, around the Office of Maintenance, Department of Highways (DOH), and Makro Superstore (Chaeng Watthana). 	PK10	Si Rat	<ul style="list-style-type: none"> It is about 100 m moved from the previous location to the right side of the project route. It is on Chaeng Watthana road in Nonthaburi province. It is next to Si Rat Expressway, around ISUZU Ung Nguan Tai Auto Sales Ltd. between Pak Kret Soi 36 and 38, near Makro Superstore (Chaeng Watthana). 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is high.
PK10	Muang Thong 1	<ul style="list-style-type: none"> It is on Chaeng Watthana road, in front of Phong Phet market and Chaeng Watthana Telephone Junction. 	PK11	Chaeng Watthana 14 (Name Changed)	<ul style="list-style-type: none"> The location remains unchanged. The station name was changed from Muang Thong 1 to Chaeng Watthana 14. 	-

Table 2.1–5 Summary of Changes in Station Locations Approved on 16 March 2012 in Comparison with the Present Locations (Cont'd)

As Approved on 16 March 2012			Changes in Project Details			
Station	Station Name	Previous Location	Station	Station Name	Present Location	Reasons for Relocation
PK11	Bangkok Government Center	<ul style="list-style-type: none"> It is on Chaeng Watthana road, in front of the head office of CAT Telecom PCL and Ban Metta. 	PK12	Bangkok Government Complex (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Bangkok Government Center to Bangkok Government Complex. It is about 300 m moved from the previous location to the left side of the project route. It is on Chaeng Watthana road, in front of the Department of Consular Affairs, near the Bangkok Government Complex. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To meet the high transport demand as it is the center of government agencies
-	-	-	PK13	TOT	New Station <ul style="list-style-type: none"> It is on Chaeng Watthana road, in front of TOT Corporation PCL. 	<ul style="list-style-type: none"> The new station is added to ensure suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is high
PK12	Lak Si	<ul style="list-style-type: none"> The interchange station links to the Red Line (Bang Sue–Rangsit) on Chaeng Watthana road, in front of Lak Si Plaza. It is located on Chaeng Watthana road. The station lies along the flyover to cross the Vibhavadi Rangsit road and under Utraphimuk elevated road (Don Muang Tollway). 	PK14	Lak Si	<ul style="list-style-type: none"> It is about 120 m moved from the previous location to the right side of the project route. It is located at the crossing between Chaeng Watthana road and Vibhavadi Rangsit road, connecting to the Red Line (Bang Sue–Rangsit) via the skywalk. This station also links between the electric train and locomotive train systems as it is close to Lak Si train station. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve the areas where large residences, commercial buildings and medical establishments are located as the transportation demand is quite high
PK13	Phranakhon Rajabhat University	<ul style="list-style-type: none"> It is on Chaeng Watthana road, in front of Phranakhon Rajabhat University and Max Value Supermarket. 	PK15	Phranakhon Rajabhat (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Phranakhon Rajabhat University to Phranakhon Rajabhat. It is the last station on Chaeng Watthana road. It is about 30 m moved from the previous location to the left side of the project route. It is on Chaeng Watthana road, in front of Phranakhon Rajabhat University and Max Value Supermarket (Lak Si Square Branch). 	<ul style="list-style-type: none"> Its location was changed from being on the footpath to the road median to avoid acquisition of land and buildings.
PK14	Phithak Ratthathammanun Monument	<ul style="list-style-type: none"> It is located on Ram Inthra road, in front of Krirk University and the 2nd Infantry Battalion. The station connects to the Dark Green Line (Mo Chit–Saphan Mai). 	PK16	Wat Phra Si Maha That (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Phithak Ratthathammanun Monument to Wat Phra Si Maha That. It is moved 350 m closer to Phithak Ratthathammanun Monument. 	<ul style="list-style-type: none"> To connect with the Dark Green Line (Mo Chit–Saphan Mai) via the skywalk from Wat Phra Si Maha That (N17) station

Table 2.1–5 Summary of Changes in Station Locations Approved on 16 March 2012 in Comparison with the Present Locations (Cont'd)

As Approved on 16 March 2012			Changes in Project Details			
Station	Station Name	Previous Location	Station	Station Name	Present Location	Reasons for Relocation
-	-	-	PK17	Ram Inthra3	New Station <ul style="list-style-type: none"> It is the first station on Ram Inthra road to accommodate the large residential area between Ram Inthra Soi 3 and 5. It is located in front of Lumphini Condominium (Ram Inthra–Lak Si) and the Royal Thai Army Sports Center Ramindra, near Central Plaza Ramindra. 	<ul style="list-style-type: none"> The new station is added to ensure suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
PK15	Lat Pla Khao	<ul style="list-style-type: none"> It is located on Ram Inthra road, in front of Communications Police Division of the Royal Thai Police and Carrefour (Ram Inthra). 	PK18	Lat Pla Khao	<ul style="list-style-type: none"> It is about 25 m moved from the previous location to the right side of the project route. It is on Ram Inthra road, between Ram Inthra Soi 21 and Soi 23. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations.
-	-	-	PK19	Ram Inthra31	New Station <ul style="list-style-type: none"> It is on Ram Inthra road, around Ram Inthra Soi 31. 	<ul style="list-style-type: none"> The new station is added to ensure suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
PK16	Ram Inthra Community Housing	<ul style="list-style-type: none"> It is located on Ram Inthra road, in front of Ram Inthra Community Housing and Pan Thong market. 	PK20	Maiyalap (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Ram Inthra Community Housing to Maiyalap. It is about 550 m moved from the previous location. It is located on Ram Inthra road, at the entrance to Ram Inthra Soi 41, near Maiyalap three-way intersection. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
PK17	Watcharaphon	<ul style="list-style-type: none"> It is located on Ram Inthra road between Ram Inthra Soi 63 and 63/1, around Bang Chak service station. 	PK21	Watcharaphon	<ul style="list-style-type: none"> It is about 510 m moved from the previous location to the left side of the project route. It is located on Ram Inthra road, next to Chalong Rat Expressway, around Ram Inthra Soi 59 and Soi 61. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
-	-	-	PK22	Ram Inthra40	New Station <ul style="list-style-type: none"> It is located on Ram Inthra road between Ram Inthra Soi 40 and Soi 42. 	<ul style="list-style-type: none"> The new station is added to ensure suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
PK18	Ram Inthra KM 8	<ul style="list-style-type: none"> It is located on Ram Inthra road before the flyover to Nawamin road, between Ram Inthra Soi 69 and Soi Khu Bon. 	PK23	Khu Bon (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Ram Inthra KM8 to Khu Bon. It is about 50 m moved from the previous location to the left side of the project route. It is located on Ram Inthra road between Ram Inthra Soi 69 and Soi 46. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations.

Table 2.1–5 Summary of Changes in Station Locations Approved on 16 March 2012 in Comparison with the Present Locations (Cont'd)

As Approved on 16 March 2012			Changes in Project Details			
Station	Station Name	Previous Location	Station	Station Name	Present Location	Reasons for Relocation
-	-	-	PK24	Ram Inthra83	<p>New Station</p> <ul style="list-style-type: none"> It is located on Ram Inthra road between Ram Inthra Soi 83 and Soi 85, and near Synphaet General Hospital. 	<ul style="list-style-type: none"> The new station is added to ensure suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
PK19	Khanna Yao	<ul style="list-style-type: none"> It is located on Ram Inthra road, near Fashion Island and entrance to motorway. 	PK25	East Outer Ring Road (Name Changed)	<ul style="list-style-type: none"> The station name was changed from Khanna Yao to East Outer Ring Road. It is about 150 m moved from the previous location to the left side of the project route. It is located on Ram Inthra road, next to the East Outer Ring Road. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations.
PK20	Nopparat Rajathanee	<ul style="list-style-type: none"> It is located on Ram Inthra road, in front of Nightingale Ramintra Sport Field, Nopparat Rajathanee Hospital, and Thai Venus factory. 	PK26	Nopparat Rajathanee	<ul style="list-style-type: none"> It is about 250 m moved from the previous location to the right side of the project route. It is located on Ram Inthra road, around Soi Suan Siam, next to Nopparat Rajathanee Hospital. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations.
PK21	Bang Chan	<ul style="list-style-type: none"> It is located on Ram Inthra road, at the entrance to Ram Inthra Soi 109. 	PK27	Bang Chan	<ul style="list-style-type: none"> It is about 300 m moved from the previous location to the right side of the project route. It is located on Ram Inthra road, around Ram Inthra Soi 115 and Ram Inthra Soi 109 (Soi Phraya Suren) and Ram Inthra Soi 113. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations. To serve large residential and commercial areas where the transportation demand is quite high
PK22	Setthabutbamphen	<ul style="list-style-type: none"> It is located on Ram Inthra road, near Setthabutbamphen School, at the entrance to Ram Inthra Soi 123 and Siam Nissan Standard Co., Ltd. 	PK28	Setthabutbamphen	<ul style="list-style-type: none"> The location remains unchanged. 	-
PK23	Min Buri Market	<ul style="list-style-type: none"> It is located on Sihaburanukit road, at the entrance to Chatuchak Market 2, between Sihaburanukit Soi 16 and Soi 18. 	PK29	Min Buri Market	<ul style="list-style-type: none"> It is the first station on Sihaburanukit road. It is about 20 m moved from the previous location to the right side of the project route. It is in front of Chatuchak Market 2. 	<ul style="list-style-type: none"> The relocation is aimed to keep suitable distance between train stations.
PK24	Min Buri	<ul style="list-style-type: none"> Linking to the Orange Line, the station is located around the depot of the Pink Line, near Ramkhamhaeng road. 	PK30	Min Buri	<ul style="list-style-type: none"> The location remains unchanged. It is the last station of the Pink Line. It is located on Ramkhamhaeng road, between Ramkhamhaeng Soi 192 and Khlong Song Ton Nun. It links to the Orange Line (Bang Kapi-Min Buri) via the skywalk. 	-

2.1.3 Depot and Park & Ride

In the previous study in 2012, two depots and park & ride facilities were designed for the Pink Line Project (Khae Rai-Min Buri Section). The depot and park & ride facilities at Sanambin Nam intersection covered an area of Approximately 77,814 sq.m. or 48.63 rai whereas the depot and park & ride facilities at Romklao intersection encompassing an area of about 80,916 sq.m. or 50.57 rai as depicted in *Figures 2.1-55* and *2.1-56* respectively.

According to the feasibility study review, **the depot and park & ride facilities at Sanambin Nam intersection in Nonthaburi province were cancelled.** As a result, there is only 1 depot and park & ride at Romklao intersection.



Figure 2.1-55 Location of the Depot and Park & Ride at Sanambin Nam Intersection on Tiwanon Road in the Previous Study in 2012

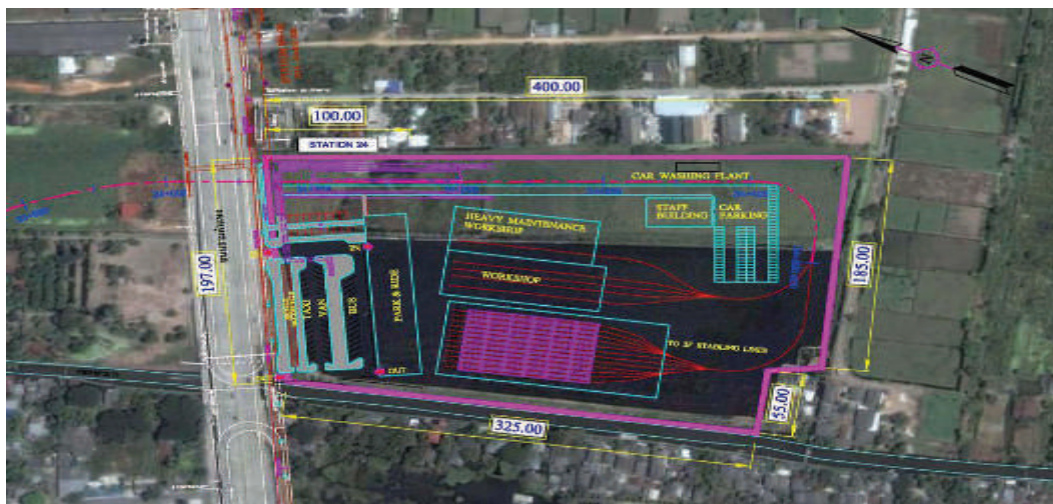


Figure 2.1-56 Location of the Depot and Park & Ride at Romklao Intersection on Ramkhamhaeng Road in the Previous Study in 2012

2.1.4 Depot and Park & Ride at Romklao Intersection

The depot and park & ride facilities at Romklao intersection, covering about 229 rai of land, are located on Ramkhamhaeng road between Ramkhamhaeng Soi 192 and Khlong Song Ton Nun. Major components consist of a park& ride building of 3 floors with the capacity of 3,000 cars (1,000 cars/floor), a main workshop with 7 tracks for train maintenance, and an OCC building. *Figure 2.1-57* presents the location of the depot and park & ride building at Romklao intersection.



Figure 2.1-57 Location of the Depot and Park & Ride Building at Romklao Inter section in the Present Study

2.1.5 Noise Impact Prevention and Mitigation Measures

According to the previous study in 2012, before and after the project operation, the sound barrier walls (for a length of at least 200 m/site) shall be installed along the viaduct, passing the following 6 sensitive receptors: Siam Business Administration College (SBAC), Boromarajonani College of Nursing, Central Chest Institute of Thailand, Quartermaster Department Royal Thai Army, Phranakhon Rajabhat University, and Synphaet General Hospital, in order to reduce the noise level from the contact between the wheels and rails. The recommended types of sound absorptive materials were fiberglass reinforced plastics (FRP), or other materials (e.g. aluminium, metal sheets, or celocrete) which are lightweight (less than 10 kg/sheet) and have a useful life of over 30 years as shown in *Figure 2.1-58*.

The present study confirms that the elevated monorail will be adopted for the project, with a total distance of 34.5 km. There are two sources of noise: 1) noise generated by the train system of the Pink Line, and 2) noise generated by vehicles under train station.

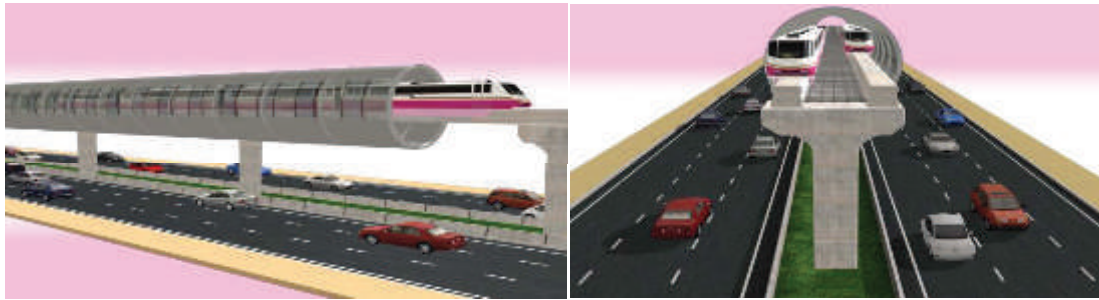


Figure 2.1-58 Installation of Sound Absorptive Materials along Viaduct, Passing Noise-Sensitive Receptors as Presented in the Previous EIA Report in 2012

According to the previous EIA Report (March 2012), the noise impact of the Pink Line during the operation period resulted from the contact between the rails and wheels. Referring to the “Transit Noise and Vibration Impact Assessment, 2006 Second Edition”, Federal Transit Administration (FTA), USA, the noise level from the monorail system would be 82 dB(A) at the distance of 50 feet (about 15 m) from the rail when running at the speed of 80 km/hr (for the straight section of the alignment). However, in case of the curve section of the alignment, squeals of wheels would make the noise level higher than the straight section as presented in *Table 2.1-6*.

Table 2.1-6 Increased Noise Level at Each Radius of Curvature

Radius of Curvature(m)	Increased Noise Level (dB(A))
1. Lower than 300 m.	+8
2. 300-less than 500 m.	+3
3. More than 500 m.	+0

During the operation period of the Pink Line (Khae Rai-Min Buri section), the major activities involve the service of the straddle-type monorail. Hence, the noise impact during the operation period will be generated by the contact between the rails and wheels. The mathematic model developed by the Federal Transit Administration (FTA) was employed to assess the noise level caused by the monorail system based on the principles and equation stated in FTA’s Guidance Manual on Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06, May 2006) published by the Department of Transportation, United States of America, in the form of spreadsheet. *Figure 2.1-59* shows an example for assessment of noise level caused by the train system by using the Noise Impact Assessment Spreadsheet based on the FTA’s General Transit Noise Assessment.

Federal Transit Administration
 Noise Impact Assessment Spreadsheet
 Copyright 2007 HMMH Inc.
 version: 7/3/2007

Project: **Monorail Pink Line**

Receiver Parameters

Receiver:	10 meter
Land Use Category:	3. Institutional
Existing Noise (Measured or Generic Value):	dBA

Noise Source Parameters

Number of Noise Sources: 1

Noise Source Parameters

Noise Source Parameters		Source 1
	Source Type:	Fixed Guideway
	Specific Source:	Monorail
Noisiest hr of Activity During Sensitive hrs	Number of Vehicles/train	7
	Speed (mph)	50
	Number of Events/hr	3
Distance	Distance from Source to Receiver (ft)	10
	Number of Intervening Rows of Buildings	
Adjustments	Noise Barrier?	No

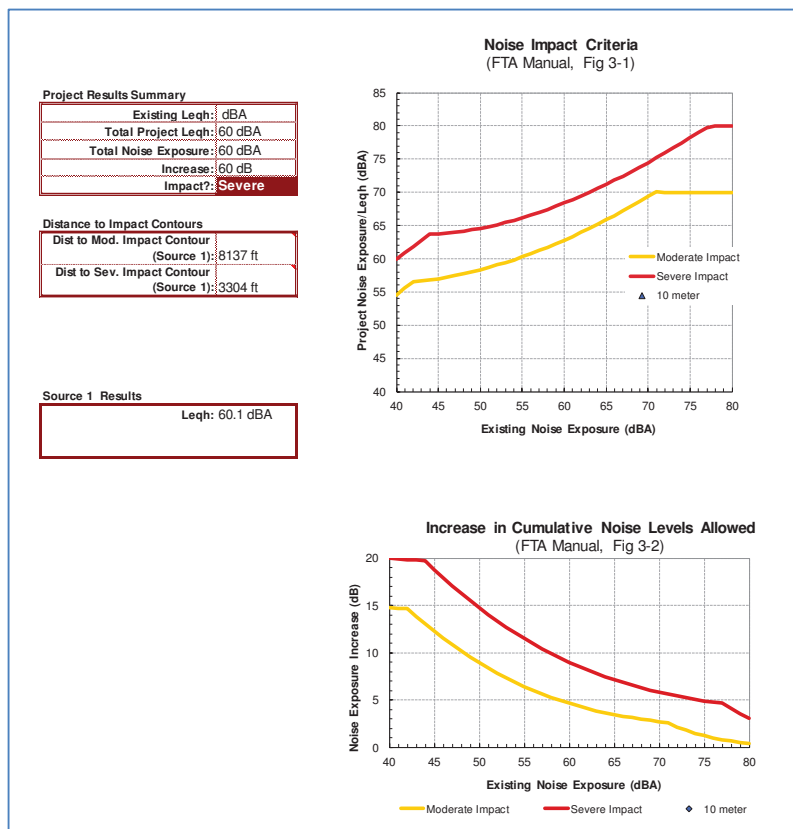


Figure 2.1–59 Example for Assessment of Noise Level Caused by the Train System by Using the Noise Impact Assessment Spreadsheet based on the FTA’s General Transit Noise Assessment

The following data were also considered.

- Estimated number of trains: 56 trains/day or 3 trains/hr at the maximum
- The highest speed of 80 km/hr (about 50 miles/hr)
- Sensitive receptors within the radius of 15-500 m from the project route alignment and environmentally sensitive areas in its vicinity

According to the assessment result using the mathematical model as mentioned above, during the operation period, the average Leq 24 hr. within the radius of 10-500 m from the project route (at the height of the viaduct) is in a range of 34.6–60.1 dB(A) which is lower than the generally accepted standard of 70 dB(A) as presented in **Table 2.1–7**.

Table 2.1–7 Noise Level Assessment Result at Various Distances from the Project Route during the Operation Period for Case 1 (Three-Track Railway) and Case 2 (Four-Track Railway) during 2016–2036

Distance from the Project Route (m)	Noise Level from the Model (Leq 24 hr.) (at the Height of the Viaduct)
10	60.1
20	55.6
50	49.6
100	45.1
200	40.6
300	37.9
400	36.1
500	34.6
Standard^{1/}	70

Note: 1/ With reference to the NEB's Notification No. 15 (B.E. 2540) on establishment of the generally-accepted noise level standards

As for the noise level at the environmentally sensitive areas in the vicinity of the project, the average Leq 24 hr. is lower than the generally accepted standard of 70 dB(A). However, when considering together with the maximum noise level (Leq 24 hr.) obtained from noise level measurement along the project route, Leq 24 hr. is generally higher than 70 dB(A). This is because the noise levels from actual measurement are generally higher than 70 dB(A), for example, 70.5 dB(A) at Siam Business Administration Nonthaburi Technological College, 85.7 dB(A) at Phranakhon Rajabhat University, and 74.2 dB(A) at Synphaet General Hospital due to the vehicles running on the existing roads: Tiwanon, Chaeng Watthana, and Ram Inthra. **Table 2.1–8** shows noise level assessment results during the operation period at environmentally sensitive areas in the project's vicinity.

**Table 2.1–8 Noise Level Assessment Results during the Operation Period
at Environmentally Sensitive Areas in the Project’s Vicinity**

No.	Environmentally Sensitive Area	Station	Distance from the Project Alignment		Noise Level from the Model (Leq 24 hr.) at the Height of the Viaduct (dB(A))		
					Average Leq 24 hr during the Operation Period (dB(A))	Maximum Leq 24 hr from Measurement* (dB(A))	Average Leq 24 hr during Operation Period and Max Leq 24 hr from Measurement* (dB(a))
			m	ft			
1	Nonthaburi Government Center	PK01	361	1184	36.7	70.5	70.5
2	NBTC Area 1 Nonthaburi		67	220	47.7	70.5	70.5
3	Siam Business Administration Nonthaburi		98	321	45.2	70.5	70.5
4	Boromarajanani College of Nursing		57	187	48.8	70.5	70.5
5	Central Chest Institute of Thailand		127	417	43.5	70.5	70.5
6	Nonthaburi Phitthayakhom School	PK02	323	1059	37.5	68.3	68.3
7	Santiwan School		55	180	49.0	68.3	68.4
8	Ban Samrit Health Promoting Hospital, Tha Sai		465	1525	35.1	68.3	68.3
9	Central Preventorium for Children		77	253	46.8	68.3	68.3
10	Than Samrit Withthaya School	PK03	352	1155	36.9	68.3	68.3
11	Quartermaster Department, Royal Thai Army		264	866	38.8	66.4	66.4
12	Saman Phichakon School		79	259	46.6	66.4	66.4
13	Masjid Darulmuttakeen	PK04	57	187	48.8	66.4	66.5
14	Chonprathansongkhro School		145	476	42.7	66.4	66.4
15	Royal Irrigation Department	PK05	249	817	39.2	66.4	66.4
16	Chonprathanwittaya School		236	774	39.5	66.4	66.4
17	Wat Choniapraphanrangsarit		246	807	39.2	66.4	66.4
18	Watthana Phrueksa Kindergarten		470	1542	35.0	66.4	66.4
19	Watthana Phrueksa School	PK06	456	1496	35.2	66.4	66.4
20	Suankularb Wittayalai Nonthaburi School		387	1269	36.3	66.4	66.4
21	Church of Jesus Christ	PK07	71	233	47.3	66.4	66.5
22	The World Medical Center		87	285	46.0	66.4	66.4
23	The Royal Thai Police Band		165	541	41.8	66.4	66.4
24	Tambon Bang Talat Health Promoting Hospital		334	1096	37.3	66.4	66.4
25	Ministry of Justice		126	413	43.6	66.4	66.4
26	Panyapiwat Institute of Management	PK08	133	436	43.2	66.4	66.4
27	Khlong Kluea School	PK09	63	207	48.1	66.4	66.5
28	Mongkutwattana General Hospital	PK11	145	476	34.9	66.4	66.4
29	Department of Consular Affairs	PK12	211	692	40.2	85.7	85.7
30	1st Antiaircraft Artillery Regiment		296	971	38.0	85.7	85.7
31	The Administrative Court		85	279	46.2	85.7	85.7
32	Department of Juvenile Observation and Protection,		51	167	49.5	85.7	85.7
33	Government Complex Commemorating His Majesty the King's 80th Birthday Anniversary		281	922	38.4	85.7	85.7

Notes: * The representative maximum noise level around the station PK-01 is 70.5 dB(A) which is the maximum noise level (Leq 24 hr.) measured at Siam Business Administration Nonthaburi Technological College.
The representative maximum noise level around the station PK-02 is 68.3 dB(A) which is the maximum noise level (Leq 24 hr.) measured at Boromarajanani College of Nursing.
The representative maximum noise level from the stations PK-03 to PK-11 is 66.4 dB(A) which is the maximum noise level (Leq 24 hr.) measured at Quartermaster Department Royal Thai Army.
The representative maximum noise level from the stations PK-12 to PK-17 is 85.7 dB(A) which is the maximum noise level (Leq 24 hr.) measured at Phranakhon Rajabhat University.
The representative maximum noise level from the stations PK-20 to PK-30 is 74.2dB(A) which is the maximum noise level (Leq 24 hr.) measured at Synphaet General Hospital.

Table 2.1–8 Noise Level Assessment Results during the Operation Period at Environmentally Sensitive Areas in the Project’s Vicinity (Cont’d)

No.	Environmentally Sensitive Area	Station	Distance from the Project Alignment		Noise Level from the Model (Leq 24 hr.) at the Height of the Viaduct (dB(A))			
					Average Leq 24 hr during the Operation Period (dB(A))	Maximum Leq 24 hr from Measurement* (dB(A))	Average Leq 24 hr during Operation Period and Max Leq 24 hr from Measurement* (dB(a))	
			m	ft				
34	Lak Si District Office	PK13	130	426	43.4	85.7	85.7	
35	Chulabhom Research Institute		363	1191	36.7	85.7	85.7	
36	Wat Lak Si		385	1263	36.3	85.7	85.7	
37	Wat Lak Si School		502	1647	34.6	85.7	85.7	
38	Rattanakosin Technological College	PK14	196	643	40.7	85.7	85.7	
39	Charoenphon Witthaya School		49	161	49.8	85.7	85.7	
40	Phranakhon Rajabhat University	PK15	189	620	41.0	85.7	85.7	
41	Wat Phra Si Maha That Demonstration Secondary		76	249	46.9	85.7	85.7	
42	Wat Phra Si Maha That		461	1512	35.2	85.7	85.7	
43	College of Buddhist Studies and Philosophy		71	233	47.3	85.7	85.7	
44	Thainiyomsongkroa School		326	1069	37.4	85.7	85.7	
45	Bang Khen District Office	PK16	94	308	45.5	85.7	85.7	
46	Prachapiban School		106	348	44.7	85.7	85.7	
47	Office of Disease Prevention and Control 1,		197	646	40.7	85.7	85.7	
48	Krikk University		72	236	47.2	85.7	85.7	
49	2 nd Infantry Battalion	PK17	245	804	39.3	85.7	85.7	
50	Pramot Witthaya Ram Inthra School		85	279	46.2	85.7	85.7	
51	Iamphanit Witthaya School	PK20	237	777	39.5	85.7	85.7	
52	Thai Police Aviation Division		332	1089	37.3	74.2	74.2	
53	Ramborirug Ram Inthra School		434	1424	35.5	74.2	74.2	
54	Association of Army Welfare Development Village		268	879	38.7	74.2	74.2	
55	Bureau of Personnel Competency Development,	PK21	82	269	46.4	74.2	74.2	
56	Pramot Phatthana Kindergarten		203	666	40.5	74.2	74.2	
57	Saiksom School		63	207	48.1	74.2	74.2	
58	Chao Mae Suea Shrine	PK22	28	92	53.4	74.2	74.2	
59	Chatr Wittaya School		108	354	44.6	74.2	74.2	
60	Masjid Al-Aokof School		370	1214	36.6	74.2	74.2	
61	Masjid Al-Aokof	PK28	353	1158	36.9	74.2	74.2	
62	Synphaet General Hospital		PK23	76	249	46.9	74.2	74.2
63	Nopparat Rajathanee Hospital		PK25	283	928	38.3	74.2	74.2
64	Taksina Business Administration and Technological College		PK26	77	253	46.8	74.2	74.2
65	Setthabutbamphen School		PK28	134	440	43.2	74.2	74.2
66	Seriruk Hospital			185	607	41.1	74.2	74.2
67	Navaminthra Hospital			204	669	40.5	74.2	74.2
68	Minburi Technical College			152	499	42.4	74.2	74.2
69	Navamin 9 Hospital			104	341	44.9	74.2	74.2
70	Min Buri Business School			507	1663	34.5	74.2	74.2
71	Suknet School	100		328	45.1	74.2	74.2	
72	Min Buri Sueksa School	232		761	39.6	74.2	74.2	
73	Health Center 43, Min Buri	PK29	218	715	40.0	74.2	74.2	
74	Min Buri District Office		367	1204	36.6	74.2	74.2	
75	Min Buri Remand Prison		495	1624	34.7	74.2	74.2	
76	Office of Min Buri Public Prosecution		133	436	43.2	74.2	74.2	
77	Minburi School		210	689	40.3	74.2	74.2	
78	Satni Setthabutbamphen School		435	1427	35.5	74.2	74.2	
79	Min Prasat Witthaya School		288	945	38.2	74.2	74.2	
80	Kasem Bundit University, Romkiao Campus		PK30	720	2362	32.2	74.2	74.2

Calculation of Annoyance Noise Level

In case the noise level from the project activities in the sensitive areas during the operation period is found higher than the residual noise level, such project activities cause impact to the sensitive areas. Annoyance level at the sensitive receptor shall be computed based on the 29th Notification of the National Environment Board, B.E. 2550 (2007), regarding annoyance noise level (which should not be more than 10 dB(A)). The equation is presented below.

$$\text{Annoyance Level} = \text{Specific Noise Level} - \text{Background Noise Level (L}_{90}\text{)}$$

According to the noise level assessment results during the operation period at the sensitive receptors in the project's vicinity, the maximum noise level from the project activities is found at the Bangkok Observation and Protection Center which is located about 51 m (or 167 feet) far from the project route. The average Leq 24 hr. from the assessment is 49.5 dB(A). However, the average Leq 24 hr. from measurement is 85.7 dB(A) which is higher than the generally accepted standard of 70dB(A). Since the major source of noise during the operation period is the monorail system which use the trains with rubber wheels, causing low noise from contact between the wheels and the rails, the average Leq 24 hr. during the operation period ranges between 32.2 and 53.4 dB(A) which is lower than that of 66.4-85.7 dB(A) from measurement. As a result, it is anticipated that the service of the Pink Line (Khae Rai–Min Buri section) will cause low impact to the sensitive areas in the project's vicinity. Besides, rubber wheels will be used instead of the iron wheels, causing lower noise level; and the train straddles the guide way, keeping noise while running as shown in *Figure 2.1–60*. In summary, the monorail system causes lower noise than the heavy rail system.

Construction Gallery - Okinawa, Japan.

photographs courtesy of Teruaki Masochi

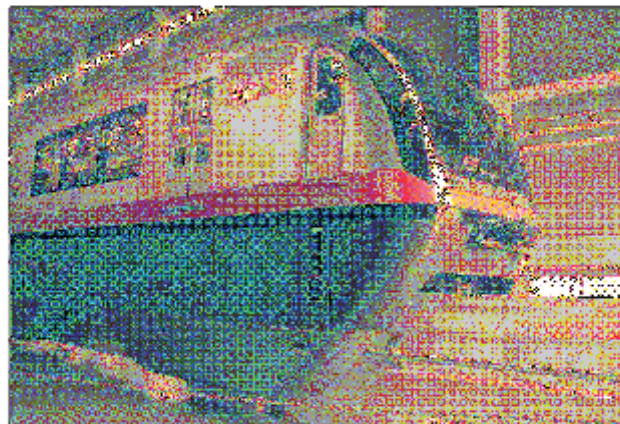


Figure 2.1–60 Straddle-Type Monorail System

For these reasons, the Consultants cancelled installation of sound barrier walls in the form of tunnel-like structures (at least 200 m/site) along the viaduct, passing 6 sensitive receptors, i.e. Siam Business Administration College, Boromarajonani College of Nursing, Central Chest Institute of Thailand, Quartermaster Department Royal Thai Army, Phranakhon Rajabhat University, and Synphaet General Hospital. The solid sound barrier walls would also cause negative impacts to the scenery of many significant places

along the project route, accident and safety. In case of fire, the opaque tunnel-like structures would block smoke inside and make it difficult for firemen to extinguish the fire and help passengers.

According to the survey of the existing conditions along the project alignment of 34.5 km in length, open areas are mainly found with the existence of human-built structures and commercial buildings along the mass transit route. However, they are not adjacent to the roadsides. This is except for Samakkhi station (PK04) on Tiwanon road (33-m wide ROW), and Phranakhon Rajabhat station (PK15) on the northern part of Chaeng Watthana road (32-m wide ROW) where 3-floor high commercial buildings, educational institutions and government offices are present along both roadsides. It is regarded as semi-closed areas where sound reflection will occur to a certain degree. Thus, during the construction period, the sound absorptive materials will be installed under Samakkhi station (PK04) and Phranakhon Rajabhat station (PK15). The suggested types are fiberglass reinforced plastics (FRP), or other materials (e.g. aluminium, metal sheets, or celocrete) which are lightweight (less than 10 kg/sheet) and have a useful life of over 30 years. *Figure 2.1-61* shows the absorptive materials suggested for installation under the two stations.

Absorptive Barrier

The absorptive barrier absorbs the noise which is transformed into thermal energy and kept inside without reflecting outside. It is very suitable for the urban areas where high-rise buildings are densely located. However, it has short useful life due to its lightweight and perforated structure. Besides, it is costly when compared to other normal sound barriers.

Types of Absorptive Barriers

(1) **Fiber (or Fiberglass) Reinforced Aluminium** has a sound absorptive capacity of 57-93% (according to the data from Chulalongkorn University and USA). The installation cost may be higher than 5,000 Baht/sq.m.

Fiberglass is produced by gradually melting “silica” to liquid form and then solidifying it. Silica is the material produced from glass burnt at the temperature of about 1,000 °C for 50-800 minutes.

Fiberglass Properties:

- Fire resistance and electrical insulation
- Thermal resistance
- Dimensional stability
- Resistance to erosion or decomposition
- Corrosion-free
- It is not stiffer at low temperature.

(2) **Glass Reinforced Cement (GRC)** is produced using the cement mixing technology reinforced with special glass fiber to obtain lightweight material which can be used to create any shape or structure as required. The cost of constructing a wall of 1 m in length, 1 m in height, and 83 kg in weight is about 6,500 Baht/sq.m. It was used in Don Muang Tollway project, and construction of Lat Pla Khao road crossing under Rap 11 road.

GRC Properties:

Since glass fiber has high tensile strength when compared to other equivalent fibers, it is mixed with cement which has compressive strength properties, resulting in an innovative material or GRC.

GRC is a mixture of Portland cement, sand, water, and glass fiber of 5% by weight. With combination of tensile and compressive strengths, it can be cast into any shape or structure. Besides, it can be manufactured to a thickness of 6 mm when compared to the steel reinforced concrete which requires at least 2.5 cm in thickness. Therefore, GRC is lighter than steel reinforced concrete for the structure with the same load bearing capacity.

Benefits of GRC

1. It can be used to design any shape or structure as required by architect.
2. Lightweight
3. Strong, durable, and safe
4. It is high impact strength material which resists crack formation
5. It is easily installed and suitable for all weather conditions. It will not cause pollution.
6. It can be coated with paints like other concrete works.
7. It can be used to produce works of the same characteristics in a large quantity.
8. Fire resistance, easy maintenance, no asbestos
9. It does not easily shrink or stretch upon change in temperature.
10. It is free of fungal-influenced corrosion and can be used with other materials.
11. It can be easily cut by general hand tools.
12. It can be used to create more types of texture.

As for the installation of fiber reinforced aluminium sheets on the roof and the ceiling under train stations to reduce reflection of noise due to traffic volume, the sound absorption coefficient shall not be less than 70% at the frequency of 400 Hz and 80% at the frequency of 1,000 Hz. According to the Environmental Protection Department and Highways Department, Government of the Hong Kong SAR., 2003, an aluminium sheet of 1.59-6.35 mm in thickness has the transmission loss of about 23-27 dB(A).

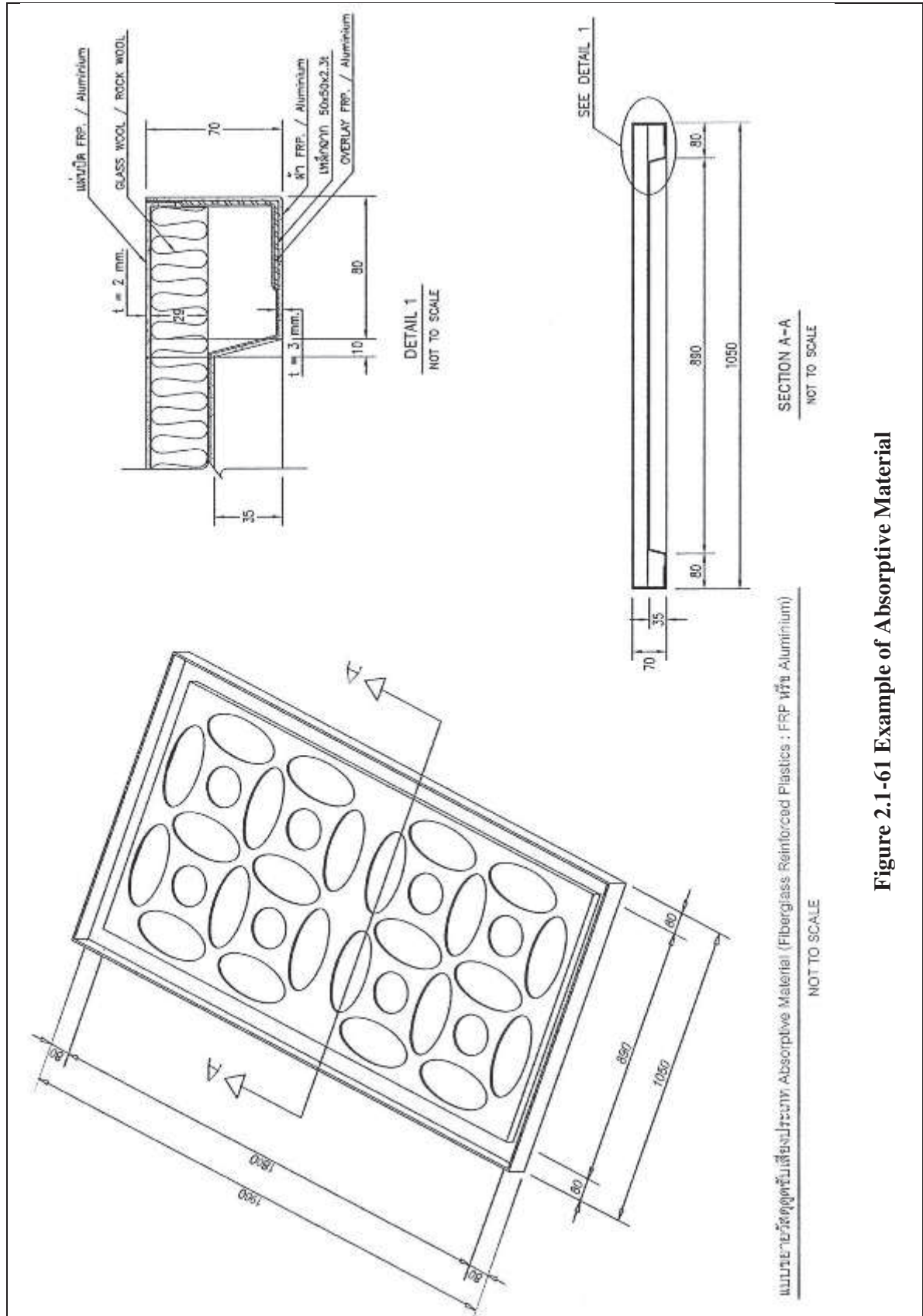


Figure 2.1-61 Example of Absorptive Material