Environmental Impact Assessment (Final)

Project Number: 51274-001
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THA: Bangkok Mass Rapid Transit (Pink Line) (Part 5 of 5)

Prepared by The Mass Rapid Transit Authority of Thailand.

CHAPTER 8

ENVIRONMENTAL MONITORING ACTION PLANS

CHAPTER 8

ENVIRONMENTAL MONITORING ACTION PLANS

An environmental monitoring action plan aims to monitor how a project will bring about environmental changes. The monitoring results will indicate the applicability and effectiveness of impact prevention and mitigation measures. They will also demonstrate whether the concerned parties have strictly complied with those measures. The environmental monitoring shall be carried out during pre-construction, construction and operation phases. The environmental monitoring action plans encompass 7 aspects, with details described herein.

(1) Surface water quality;

(2) Aquatic ecology;

(3) Air quality;

(4) Noise;

(5) Vibration;

(6) Transportation and accidents;

(7) Socio-economics.

8.1 ENVIRONMENTAL MONITORING ACTION PLAN FOR SURFACE WATER QUALITY

(1) Principle and Rationale

The construction works that pass through water sources will impact on water contamination such as increase in suspended solids and turbidity, as well as effluents from site supervision offices and worker camps. This may directly affect the surface water quality even though prevention and mitigation measures are set forth. To monitor the effectiveness of those measures, it is essential to monitor the water quality of water sources that may be affected by project activities. The monitoring results will be applied to the improvement of measures and plans to minimize the impacts.

(2) Objective

To monitor surface water quality of water sources crossed by the project route during construction and operation phases

(3) Operation Area

(a) Construction Phase

Monitoring will be conducted at 5 stations where the project alignment intersects a river or canal, as depicted in ***Figure 8.1-1***, with details as follows:

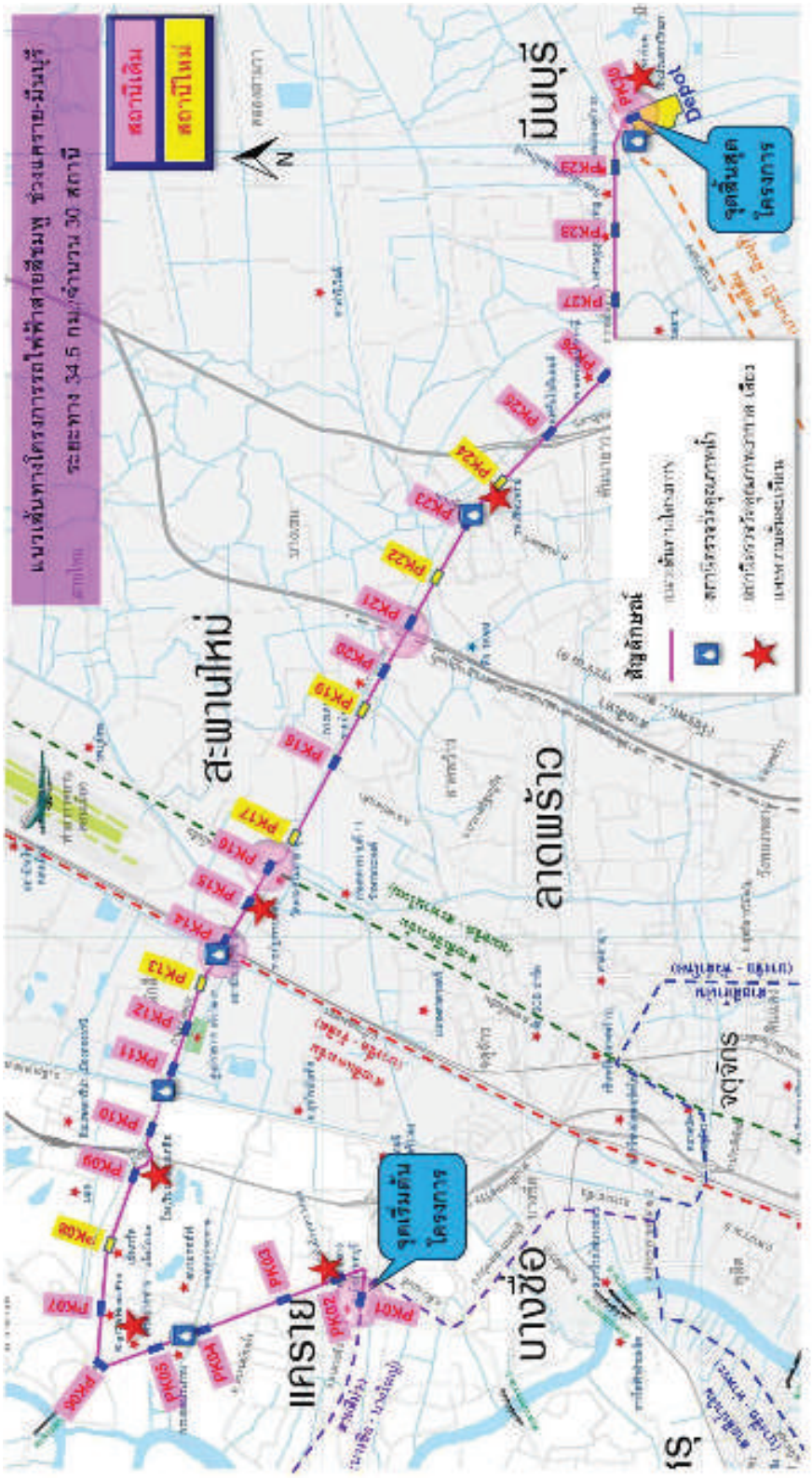

Figure 8.1-1 Sampling Stations of Water Quality and Aquatic Ecology, Air Quality, Noise and Vibration during Construction and Operation Phases

- Station W1: Khlong Bang Talat
- Station W2: Khlong Prapa
- Station W3: Khlong Prem Prachakon
- Station W4: Khlong Lam Chala
- Station W5: Khlong Song Ton Nun

(b) Operation Phase

Monitoring will be carried out at the same 5 stations as those in the construction phase where the project alignment intersects a river or canal, with two additional locations at the retention pond Zone A and retention pond Zone B near the depot and park & ride building. Therefore, there are totally 7 monitoring stations.

(4) Methodology

(a) Surface water quality sampling and analysis at the locations where the project alignment cuts across a river or canal, using Standard Methods for Examination of Water and Waste Water stipulated by APHA, AWWA and WPCF. The analysis parameters are given in ***Table 8.1-1***.

(b) Compliance will be rigorously monitored in accordance with the environmental impact prevention and mitigation measures during construction and operation phases.

(c) Preparation of monitoring report including recommendations.

(5) Monitoring Period

(a) Construction phase: every month during the period when construction works are undertaken in waterways;

(b) Operation phase: every month for 5 consecutive years after the start of services, and twice a year in the wet and dry seasons after the first 5 years.

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases:	MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.
Operation phase:	MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Details are presented in ***Table 8.1-2***.

Table 8.1-1 Surface Water Quality Parameters and Analysis Method

Properties	Surface Water Quality Parameters	Impact	Analysis Method
1. Physical	1.1 Depth	Construction activities during the wet season will cause soil erosion and increase suspended solids in water channels. This may result in sedimentation.	Meter Stick
	1.2 Temperature [1/]	Leakage of chemicals or construction materials to water bodies may cause reactions and have impact on temperature.	Thermometer
	1.3 Transparency	Construction activities during the wet season will cause soil erosion and reduce transparency in waterways.	Secchi Disc
	1.4 Salinity [1/]	Chloride volume in water will increase while dissolved oxygen will decline.	Refractometer
	1.5 Conductivity [1/]	Leakage of chemicals or acid soil will have impact on conductivity.	Conductivity Meter
	1.6 Velocity	High water velocity will contribute to soil erosion and an increase in suspended solids.	Flowmeter
2. Chemical	2.1 pH[1/]	Leakage of chemicals or construction materials to water bodies may impact on pH level	pH Meter
	Dissolved Oxygen[1/]	Water pollution in water sources will lower the dissolved oxygen level	Dissolved Oxygen Meter
	2.3 BOD_5[1/]	Waste water discharge from worker camps and offices will result in water pollution in the receiving water bodies.	Azide Modification
	2.4 Suspend Solids[1/]	Construction activities during the wet season will cause soil erosion and increase suspended solids in waterways.	Dried at 103-105°C
	Oil & Grease[3/]	Washing of oil and grease from machines or discharge of oil/engine lubricant without any prevention and mitigation measure will have impact on nearby water sources.	Partition-Gravimetric Method
	2.6 Total Iron[1/]	Disposal of construction debris, effluents, and waste to water sources may cause a rise in Total Iron in the receiving water bodies.	Phenanthroline Method
3. Biological	3.1 Total coliform bacteria [2/]	Waste water discharge from communities, worker camps and offices will cause water pollution and may lead to higher bacterial contamination in the receiving water bodies.	Multiple Tube Fermentation Technique
	3.2 Fecal coliform bacteria [2/]	Waste water discharge from communities, worker camps and offices will cause water pollution and may lead to higher bacterial contamination in the receiving water bodies.	Multiple Tube Fermentation Technique
4. Heavy Metal	4.1 Pb[1/]	Disposal of construction debris, effluents, and waste to water sources may lead to an increase in Pb in the receiving water bodies.	Air-C_2H_2 Flame Atomic Absorption Spectrometric Method
	4.2 Cd [1/]	Disposal of construction debris, effluents, and waste to water sources may cause an increase in Cd in the receiving water bodies.	Air-C_2H_2 Flame Atomic Absorption Spectrometric Method

Remarks: [1/] Water sampling at mid-depth, [2/] Water sampling at 30-cm depth from water surface, [3/] water sampling at the water surface

Table 8.1-2 Budget for Surface Water Quality Monitoring Action Plan

Phase and Operation Area	Analysis and Sampling Cost (baht/time/station)	Number of Stations	Frequency (times/year)	Total Cost (baht/year)
1. Construction	17,000	5	12	1,020,000
2. Operation	17,000	7	12	1,428,000

8.2 AQUATIC ECOLOGY MONITORING ACTION PLAN

(1) Principle and Rationale

The construction works that pass through water sources will create disturbance to the riverbed and water quality. This may have impact on the aquatic ecology. Hence mitigation measures are specified for preventing and mitigating environmental impacts from the project activities that may affect the aquatic ecology. However, an environmental monitoring action plan for aquatic ecology is essential to evaluate and monitor the effectiveness of those measures. The results will be adopted for further improvement of relevant measures and work plans.

(2) Objective

To monitor impacts on aquatic ecology during pre-construction, construction, and operation phases

(3) Operation Area

(a) Construction Phase

Monitoring will be conducted at 5 stations where the project alignment intersects a river or canal, which are the same as those for surface water quality measurement, as illustrated in ***Figure 8.1-1*****,** with the following details.

- Station W1: Khlong Bang Talat
- Station W2: Khlong Prapa
- Station W3: Khlong Prem Prachakon
- Station W4: Khlong Lam Chala
- Station W5: Khlong Song Ton Nun

(b) Operation Phase

Monitoring will be conducted at the same 5 stations as those in the construction phase where the project alignment intersects a river or canal. These stations are the same as those for surface water quality measurement, with two additional locations at the retention pond Zone A and retention pond Zone B near the depot and park & ride building. Hence there are totally 7 monitoring stations.

(4) Methodology

(a) Ecological monitoring will be conducted as follows:

Parameters
- Biodiversity
- Type and density of phytoplankton and zooplankton
- Benthos abundance

Sampling and analysis method
- Plankton will be collected, using plankton net, during the collection of 20-liter water sample. The collected specimens will be filtered and then preserved in 5% formalin solution for further identification and density analysis.
- Benthic animals will be collected, using Ekman dredge for riverbed sediment collection. The samples will be sorted by sieve and then preserved in 7% formalin solution for further identification and counting.

(b) Strict monitoring of compliance with ecological impact prevention and mitigation measures during construction and operation phases.

(c) Preparation of monitoring report including recommendations.

(5) Monitoring Period

(a) Construction phase: every month during the construction phase

(b) Operation phase: every month for 5 consecutive years after the start of services, and twice a year in the wet and dry seasons after that.

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases: MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.

Operation phase: MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Details are presented in ***Table 8.2-1***.

Table 8.2-1 Budget for Monitoring of Aquatic Ecology

Phase and Operation Area	Analysis and Sampling Cost (baht/time/station)	Number of Stations	Frequency (times/year)	Total Cost (baht/year)
1. Construction	22,000	5	12	1,320,000
2. Operation	22,000	7	12	1,848,000

8.3 AIR QUALITY MONITORING ACTION PLAN

(1) Principle and Rationale

The project construction activities and operation may have impact on air quality. For example, dust from construction activities may create impact on air quality during construction phase. Impacts from dust particles with a diameter less than 10 microns and nitrogen dioxide may occur during operation phase even though prevention and mitigation measures are put in place. Therefore, it is still necessary to monitor air quality in the environmentally sensitive areas, i.e. temples, schools, and communities along the project alignment in accordance with environmental monitoring measures. This aims to evaluate and monitor the effectiveness of those measures and the results will be applied to further improvement of work plans to minimize environmental impacts.

(2) Objective

To monitor air quality in the environmentally sensitive areas along the project alignment during construction and operation phases.

(3) Operation Area

(a) Construction Phase

Air quality monitoring will be carried out at 6 stations in the environmentally sensitive areas, i.e. temples, schools, and communities, along the project alignment, as shown in ***Figure 8.1-1*****,** with the following details.

- Station A1: Central Chest Institute of Thailand
- Station A2: Chonprathansongkhro School
- Station A3: Khlong Kluea School
- Station A4: Phranakhon Rajabhat University
- Station A5: Synphaet General Hospital
- Station A6: Min Prasat Witthaya School

(b) Operation Phase

Air quality will be monitored at 6 stations in the environmentally sensitive areas, i.e. temples, schools, and communities along the project alignment. These stations are the same as those in the construction phase.

(4) Methodology

(a) Air quality will be measured during construction and operation phases with the following details.

- Construction Phase

  Parameters
  - Wind velocity and direction
  - Total suspended particulates (TSP)
  - Dust particles less than 10 microns in diameter (PM-10)
  - Carbon Monoxide (CO)
  - Nitrogen Dioxide (NO_2)

Measurement method — Measurement in 5 consecutive days (covering working days and holidays) using the standard methods approved by the Pollution Control Department

- Operation Phase

  Parameters
  - Wind velocity and direction
  - Total suspended particulates (TSP)
  - Dust particles less than 10 microns in diameter (PM-10)
  - Carbon Monoxide (CO)
  - Nitrogen Dioxide (NO_2)

  Measurement method — Measurement in 5 consecutive days (covering working days and holidays) using the standard methods approved by the Pollution Control Department

(b) Strict monitoring of compliance with air quality impact prevention and mitigation measures during construction and operation phases.

(c) Preparation of environmental quality monitoring report.

(5) Monitoring Period

(a) Construction Phase

Measurement Frequency
- Once in one month prior to the start of construction works to be used as baseline data
- Every 3 months (4 times/year) by 5-day consecutive measurement (covering working days and holidays) until the completion of project construction

(b) Construction Phase

Measurement Frequency
- Every 3 months (4 times/year) by 5-day consecutive measurement (covering working days and holidays) for 5 years. After that, in the case that the value does not exceed the standard, measurement will be carried out twice a year.

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases: MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.

Operation phase: MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Details are provided in ***Table 8.3-1***.

Table 8.3-1 Budget for Air Quality Monitoring

Phase and Operation Area	Analysis and Sampling Cost (baht/station)	Number of Stations	Frequency (times/year)	Total Cost (baht/year)
1. Pre-construction	63,000	6	1	378,000
2. Construction	63,000	6	4	1,512,000
3. Operation	63,000	6	4	1,512,000

8.4 NOISE MONITORING ACTION PLAN

(1) Principle and Rationale

The project construction activities and operation may create noise impact even though noise control measures are stipulated. For example, noise impact during construction phase will be particularly high such as noise from machinery, bore piling, pile driving, etc. During operation phase, noise pollution may occur due to train operations. Coordination with the affected people will be undertaken during construction phase because it is difficult to avoid or reduce noise from construction activities. However, noise pollution can be minimized by specifying suitable construction hours. Moreover, noise impact prevention measures will be put in place in the operation phase such as installation of noise barrier, campaign board, etc. Nonetheless, monitoring of noise level is still necessary for the environmentally sensitive areas, i.e. temples, schools, and communities along the project alignment in accordance with environmental quality monitoring measures. This is to evaluate and monitor the effectiveness of those measures and the results will be adopted for improvement of work plans so as to minimize environmental impacts.

(2) Objective

To monitor noise levels in the environmentally sensitive areas along the project alignment during construction and operation phases.

(3) Operation Area

(a) Construction Phase

Noise levels will be monitored and measured at 6 stations in the environmentally sensitive areas, i.e. temples, schools, and communities along the project alignment, as illustrated in ***Figure 8.1-1*****,** with details as follows:

- Station N1: Central Chest Institute of Thailand
- Station N2: Chonprathansongkhro School
- Station N3: Khlong Kluea School
- Station N4: Phranakhon Rajabhat University
- Station N5: Synphaet General Hospital
- Station N6: Min Prasat Witthaya School

(b) Operation Phase

Noise measurement will be carried out at 6 stations in the environmentally sensitive areas, i.e. temples, schools, and communities along the project route. The monitoring stations are similar to those in the construction phase.

(4) Methodology

(a) Noise levels will be measured during construction and operation phases with the following details.

Parameters	- $L_{eq\ 24\ hrs}$ - L_{90} - L_{dn} - L_{max}
Measurement method	Measurement in 5 consecutive days (covering working days and holidays) using the standard methods approved by the Pollution Control Department

(b) Monitoring of compliance with noise impact prevention and mitigation measures during construction and operation phases.

(c) Preparation of environmental quality monitoring report.

(5) Monitoring Period

(a) Construction Phase

Measurement Frequency	- Once in one month before the beginning of construction works to be used as baseline data - Every 3 months (4 times/year) by measuring for 5 consecutive days (covering working days and holidays) until the completion of project construction

(b) Construction Phase

Measurement Frequency - Every 3 months (4 times/year) by measuring for 5 consecutive days (covering working days and holidays) for 5 years. After that, in the case that the value does not exceed the standard, measurement will be conducted twice a year.

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases: MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.

Operation phase: MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Details are presented in ***Table 8.4-1***.

Table 8.4-1 Budget for Noise Monitoring

Phase and Operation Area	Analysis and Sampling Cost (baht/day/station)	Number of Stations	Frequency (times/year)	Total Cost (baht/year)
1. Pre-construction	25,000	6	1	150,000
2. Construction	25,000	6	4	600,000
3. Operation	25,000	6	4	600,000

8.5 VIBRATION MONITORING ACTION PLAN

(1) Principle and Rationale

The project activities during construction and operation phases may have vibration impacts arising from the project development activities in the sensitive areas adjoining the right-of-way. In addition, buildings may be affected by vibration. Therefore, a vibration monitoring plan must be established. The results will be used to determine the applicability of the measures and to improve them in order to ensure maximum efficiency in the project implementation.

(2) Objective

To monitor vibration impacts arising from the project construction activities and train operations along the project alignment during construction and operation phases.

(3) Operation Area

(a) Construction Phase

Vibration will be monitored and measured at 6 stations in the environmentally sensitive areas, i.e. temples, schools, and communities, along the project alignment, as depicted in ***Figure 8.1-1*****,** with the following details.

- Station V1: Central Chest Institute of Thailand
- Station V2: Chonprathansongkhro School
- Station V3: Khlong Kluea School
- Station V4: Phranakhon Rajabhat University
- Station V5: Synphaet General Hospital
- Station V6: Min Prasat Witthaya School

(b) Operation Phase

Vibration will be monitored and measured at 6 stations in the environmentally sensitive areas, i.e. temples, schools, and communities, along the project alignment. The stations are the same as those in the construction phase.

(4) Methodology

(a) Vibration will be measured during construction and operation phases with the following details.

Parameters	- Peak particle velocity and frequency
Measurement method	Measurement in 5 consecutive days (covering working days and holidays) using the standard methods approved by the Pollution Control Department

(b) Monitoring of compliance with vibration impact prevention and mitigation measures during construction and operation phases.

(c) Preparation of environmental quality monitoring report.

(5) Monitoring Period

(a) Construction Phase

Measurement Frequency
- Once in one month prior to the start of construction works to be used as baseline data
- Every 3 months (4 times/year) by measuring for 5 consecutive days (covering working days and holidays) until the completion of project construction

(b) Construction Phase

Measurement Frequency
- Every 3 months (4 times/year) by measuring for 5 consecutive days (covering working days and holidays) for 5 years. After that, in the case that the value does not exceed the standard, measurement will be conducted twice a year.

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases: MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.

Operation phase: MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Details are shown in ***Table 8.5-1***.

Table 8.5-1 Budget for Vibration Monitoring

Phase and Operation Area	Analysis and Sampling Cost (baht/day/station)	Number of Stations	Frequency (times/year)	Total Cost (baht/year)
1. Pre-construction	30,000	6	1	180,000
2. Construction	30,000	6	4	720,000
3. Operation	30,000	6	4	720,000

8.6 ACTION PLAN FOR TRANSPORTATION AND ACCIDENT MONITORING

(1) Principle and Rationale

An action plan for transportation and accident monitoring are formulated for monitoring impacts on transportation and accidents that may arise from the project development, especially during construction phase. It is anticipated that road users will be affected. Similar action plan is also prepared for transportation and accident monitoring during operation phase. If it is found that the action plans and measures for environmental impact prevention and mitigation are not comprehensive, the monitoring results will be adopted for improving the action plans and measures to maximize their effectiveness.

(2) Objective

To monitor impacts on transportation and accidents during construction and operation phases.

(3) Operation Area

(a) Construction Phase

- Traffic volume: To monitor and record traffic volume at major intersections on the existing road network that may be impacted by project construction works;
- Accident statistics: Along the entire project alignment.

(b) Operation Phase

- Traffic volume: To monitor and record traffic volume at main intersections on the existing road network that may be affected by the project;
- Accident statistics: Along the entire project alignment.

(4) Methodology

(a) Transportation and accident monitoring will be conducted as follows:

Construction Phase: To examine the project traffic impacts on transportation and accidents in the following issues.

- Traffic volume: To measure and record traffic volume as well as vehicular direction and volume at sampling stations which are located at intersections where the project alignment will cross as well as those on highways that will be routes for transporting construction materials and equipment. These data will be analyzed to determine an incremental traffic volume on those highways.
- Accident statistics will be gathered including location, severity and causes of accidents.

Operation Phase: To assess the project impacts on the following issues:

- Traffic volume: To measure and record traffic volume, and vehicular direction and volume at sampling stations which are located at intersections where the project alignment will cross as well as those on highways that will be used for transporting construction materials and equipment. These data will be analyzed to determine an incremental traffic volume on those highways.
- Accident statistics will be collected including location, severity and causes of accidents.

(b) Monitoring of compliance with transportation and accident impact prevention and mitigation measures during construction and operation phases.

(c) Preparation of environmental quality monitoring report.

(5) Monitoring Period

(1) Construction Phase

- Measurement and recording of traffic volume once in one month prior to the beginning of construction works. The measurement will be conducted for 2 consecutive days (covering working days and holidays) to be used as baseline data. Locations of traffic-count stations are presented in ***Table 8.6-1*** and ***Figure 8.6-1***.
- Traffic count and recording every month. Measurement will be conducted for 2 consecutive days (covering working days and holidays) until the completion of project construction.
- Monitoring of accident statistics once a month throughout the construction phase.

Table 8.6-1 Traffic Survey Locations

No.	Intersection
1.	Khae Rai intersection
2.	Sanambin Nam intersection
3.	Pak Kret intersection
4.	Vibhavadi Rangsit Interchange
5.	Siam Park intersection
6.	Min Buri intersection

(2) Operation Phase

- Monitoring of accident statistics every 3 months (4 times/year) for 5 consecutive years. After that, in the case that the traffic volume in 24 months has a trend to decline more than 40% in comparison to those in the pre-project development period, traffic survey will be carried out once a year.

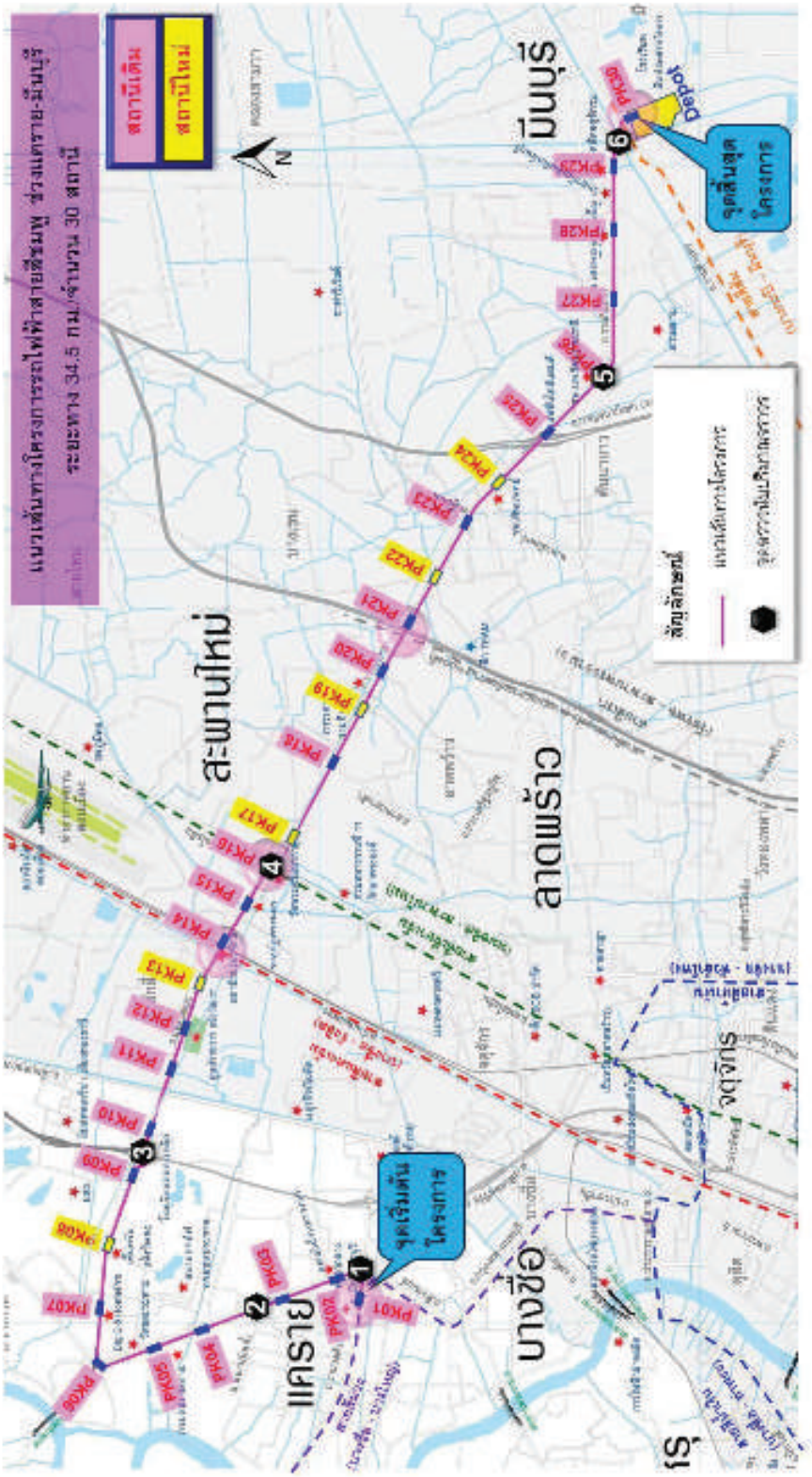

Figure 8.6-1 Locations of the Project's Traffic Survey Stations

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases: MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.

Operation phase: MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Details are given in ***Table 8.6-2***.

Table 8.6-2 Budget for Monitoring of Traffic Impacts on Transportation and Accidents

Phase	Traffic Survey (baht/time)	Number of Stations	Frequency (times/year)	Total Cost (baht/year)
1. Pre-construction	10,000	6	1	60,000
1. Construction	10,000	6	12	720,000
2. Operation	10,000	6	4	240,000

8.7 SOCIO-ECONOMIC MONITORING ACTION PLAN

(1) Principle and Rationale

As action plans and measures are proposed for mitigating probable impacts on the people living in the project vicinities, it is essential to establish environmental monitoring measures to monitor effective compliance with the measures as well as consequences. The results will be adopted for developing impact prevention approaches to cope with the actual problems.

(2) Objectives

- To monitor socio-economic impacts during pre-construction, construction and operation phases;
- To improve relevant measures to be more appropriate for dealing with impacts;
- To ease the concern of relevant people.

(3) Operation Area and Target Groups

People living in the right-of-way that must be relocated, and those living and doing business near the right-of-way, community leaders, and representatives of educational institutes and religious places

(4) Methodology

(a) Socio-economic survey in the project areas, with the following details;

Pre-Construction Phase:

Target Groups

- Directly affected people (by land expropriation and resettlement);
- People residing within a 500-m radius from the right-of-way and around the depot and park & ride building (community leaders and indirectly affected people)

Survey Method:
1. Interview with every household living within the right-of-way which must be relocated, that can be monitored;
2. Interview with at least 500 household heads, entrepreneurs, community leaders, and representatives of educational institutes and religious places within a 500-m radius from the right-of-way.

Construction Phase:

Target Groups

- People residing within a 500-m radius from the right-of-way and around the depot and park & ride building (community leaders and indirectly affected people)

Survey Method: Interview by using questionnaires with at least 500 household heads, entrepreneurs, and representatives of religious and educational institutions within a 500-m radius from the right-of-way

Operation Phase:

Target Groups

- People residing within a 500-m radius from the right-of-way around the depot and park & ride building (community leaders and indirectly affected people)

Survey Method: Interview by using questionnaires with at least 500 household heads, entrepreneurs, and representatives of religious places and educational institutes, within a 500-m radius from the right-of-way

(b) Monitoring of compliance with socio-economic impact prevention and mitigation measures during construction and operation phases;

(c) Preparation of environmental quality monitoring report.

(5) Monitoring Period

(a) Pre-construction Phase: 1 month prior to the commencement of project construction works

(b) Construction Phase: twice a year throughout the construction phase

(c) Operation Phase: once a year throughout the operation phase

(6) Responsible Agency

(a) Construction phase: Mass Rapid Transit Authority of Thailand (MRTA)

(b) Operation phase: Mass Rapid Transit Authority of Thailand (MRTA)

Remarks:

Pre-construction and construction phases: MRTA will oversee the contractors to ensure strict compliance with environmental prevention and mitigation measures as well as monitoring measures. The contractors shall be responsible for the implementation of these measures, using their own budget.

Operation phase: MRTA will oversee the operator to ensure strict compliance with environmental prevention and mitigation measures. The operator shall be responsible for the implementation of these measures, using its own budget.

(7) Budget

Budget details are provided in ***Table 8.7-1***.

Table 8.7-1 Budget for Socio-Economic Impact Monitoring

Phase and Operation Area	Sampling and Analysis Cost (baht/sample)	Number of Samples	Frequency (times/year)	Total Cost (baht/year)
1. Pre-construction	515	500	1	257,500
1. Construction	515	500	2	515,000
2. Operation	515	500	1	257,500

CHAPTER 9

ENVIRONMENTAL ECONOMICS

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9.1 INTRODUCTION

Environmental valuation involves determination of monetary values of environmental goods and services, and change in environmental quality with/without implementation of any measure. Environmental economists pay attention to environmental valuation concept and method, and consider natural and environmental resources as valueless services as they are not traded in the market. Besides, some resources are irreversible and nonrenewable.

The Pink Line (Khae Rai-Min Buri Section) will impact on environmental parameters to a certain degree. In economic viability study, the environmental impacts from project improvement generally are not included in the project costs or benefits. These are called external impacts. However, in the past, environmental impact assessment was expressed in physical unit instead of monetary unit, for example, sediment from construction activities, vibration, noise, air quality, risk of wildlife accidents, etc. These impacts could not be considered in economic viability analysis of a project. Therefore, the environmental economics are applied to monetarily value the environmental impacts, reflecting the actual costs and benefits of a project. The results will be used to analyze the project's economic feasibility in a more accurate and complete manner.

9.2 ENVIRONMENTAL ECONOMIC VALUATION

The environmental economic valuation is aimed to compute the environmental impacts in monetary unit.

9.3 INCLUSION OF ENVIRONMENTAL ECONOMIC VALUATION RESULTS IN PROJECT'S ECONOMIC VIABILITY ANALYSIS

The environmental economic valuation results are considered together with the project costs or benefits to derive the economic indicators, i.e. the net present value (NPV), the economic internal rate of return (EIRR), and the benefit-cost ratio (B/C), to evaluate the project viability. Whether a project is economically viable or not should be also taken into account by using any or all of the 3 economic indicators. It is viable when the overall benefits are higher than the whole costs.

9.4 ENVIRONMENTAL ECONOMIC STUDY RESULT

According to Thailand Development Research Institute (TDRI)'s criteria on economic values of the environmental impacts, the project will significantly bring about the positive impacts on climate and meteorology which are included in the physical

resources. The project will reduce the use of motor vehicles as people tend to use the rail-based mass transit system, thus decreasing combustion of fossil fuels (gasoline and diesel) which affect the climate and atmosphere. Two major impacts comprise air pollution which has effect on human health; and emission of greenhouse gases (Co_2, CH_4, and NO_2) which contribute to climate change and natural disasters. Decrease in combustion of fossil fuels will thus lower such impacts, which are considered as the project benefits. The study consists of two cases: distance-based fare collection and 20-baht flat fare collection in conformity with the government's policy. However, both scenarios will reduce combustion of fossil fuels. The study results are described below.

9.4.1 Estimation of the Costs of Air Pollution due to Motor Vehicle Emissions

9.4.1.1 Review of Related Studies

Air pollution due to motor vehicle emissions affects both environment and human health. Some pollutants directly impact on climate change. For example, CO_2 which is considered as GHG is the cause of global warming, and CO is harmful to human health and climate change. Air pollution from combustion of fuels may cause one or more impacts. Other impacts of air pollution from motor vehicle emissions are presented in ***Table 9.4–1*** and impacts of air pollutants on human health in ***Table 9.4-2***.

Table 9.4–1 Impacts of Air Pollution from Motor Vehicle Emissions

Emission	Description	Sources	Harmful Effects	Scale
Carbon dioxide (CO_2)	A product of combustion	Fuel production and tailpipes	Climate change	Global
Carbon monoxide (CO)	A toxic gas caused by incomplete combustion	Tailpipes	Human health, climate change	Very local
CFCs and HCFC	A class of durable chemicals	Air conditioners and industrial activities	Ozone depletion, climate change	Global
Fine particulates (PM_{10}; $PM_{2.5}$)	Inhalable particles consisting of bits of fuel and carbon	Diesel veh. Tailpipes and other sources	Human health, aesthetics	Local and Regional
Lead	Element used in older fuel additives	Fuel additives and batteries	Human health, ecological damages	Local
Methane (CH_4)	A flammable gas	Fuel production and tail pies	Climate change	Global
Nitrogen oxides (NO_x) and Nitrous oxide (N_2O)	Varius compounds, some are toxic, all contribute to ozone	Tailpipes	Human health, ozone precursor, ecological damage	Local and Regional
Ozone (O_2)	Major urban air pollutant caused by NO_x and VOCs combined in sunlight	NO_x and VOC	Human health, plants, aesthetics	Regional
Road dust (non-tailpipe particulates)	Dust particles created by vehicle movement	Vehicle use, brake linings, tire wear	Human health, aesthetics	Local
Sulfur oxides (SO_x)	Lung irritant and acid rain	Diesel vehicle tailpipes	Human health and ecological damage	Local and Regional
VOC (volatile organic hydrocarbons)	Various hydrocarbon (HC) gasses	Fuel production, storage & tailpipes	Human health, ozone precursor	Local and Regional
Toxics (e.g. benzene)	Toxic and carcinogenic VOCs	Fuel production and tailpipes	Human health risks	Very local

Sources: USEPA (2000), Indicators of the Environmental Impacts of Transportation, USEPA, 1999; ORNI., Transportation Energy Data Book ORNL.

Table 9.4-2 Impacts of Air Pollutants on Human Health

Pollutant	Quantified Health Effects	Unquantified Health Effects	Other Possible Effects
Ozone	Mortality Minor RADs Respiratory RADs Hospital admissions Asthma attacks Changes in pulmonary function Chronic sinusitis and hay fever	Increased airway responsiveness to stimuli Centroacinar fibrosis Inflammation in the lung	Immunologic changes Chronic respiratory diseases Extrapulmonary effects (Changes in the structure or function of the organs)
Particulate matter/TSP sulfates	Mortality Chronic and acute bronchitis Hospital admissions Lower respiratory illness Upper respiratory illness Chest illness Respiratory symptoms Minor RADS Days of work loss Moderate or worse asthma status	Changes in pulmonary function	Chronic respiratory diseases other than chronic bronchitis Inflammation of the lung
Carbon monoxide	Mortality Hospital admissions-congestive heart failure Decreased time to onset of angina	Behavioral effects Other hospital admissions	Other cardiovascular effects Developmental effects
Nitrogen oxides	Respiratory illness	Increased airway responsiveness	Decreased pulmonary function Inflammation of the lung Immunological changes
Sulfur dioxide	Morbidity in exercising asthmatics : Changes in pulmonary function Respiratory symptoms		Respiratory symptoms in non-asthmatics Hospital admissions
Lead	Mortality Hypertension Nonfatal coronary heart disease Nonfatal strokes Intelligence quotient (IQ) loss	Neurobehavioral function Other cardiovascular diseases Reproductive effects Fetal effects from maternal exposure Delinquent and antisocial behavior in children	

Source: Ken Gwilliam and Masami Kojima (2004), Urgan Air Pollution: Policy Framework for Mobile Sources, Prepared for the Air Quality Thematic Group, World Bank.

Table 9.4-3 presents the Victoria Transport Policy Institute (VTPI)'s estimates of air pollution costs by motor vehicle class (light vehicle, light truck, heavy vehicle) in urban and rural areas. The unit costs of air pollution are computed in the form of average air pollution cost/vehicle-distance/year based on the motor vehicle emissions standards published and released by the US government as shown in ***Table 9.4-4***.

Table 9.4-3 Estimates of Air Pollution Costs in 2002

	Urban					Rural				
	Unit Costs	Emissions	Mileage	Total Costs	Unit Costs	Unit Costs	Emissions	Mileage	Total Costs	Unit Costs
	Dollars Per Ton	Million Tons	Billion Miles	Billion Dollars	Dollars Per Mile	Dollars Per Ton	Million Tons	Billion Miles	Billion Dollars	Dollars Per Mile
Light Vehicles										
CO	$435	22.47	1,092	$9.8	$0.009	$0	11.94	580	$0.0	$0.000
NO_x	$11,209	1.42	1,092	$6.0	$0.015	$6,389	0.76	580	$1.7	$0.003
VOC	$8,963	1.63	1,092	$14.6	$0.013	$7,350	0.87	580	$2.2	$0.004
PM	$7,391	0.03	1,092	$0.3	$0.000	$3,622	0.02	580	$0.0	$0.000
CO_2	$12.50	113.99	1,092	$1.4	$0.008	$12.50	60.55	580	$0.3	$0.003
Totals			**1,092**	**$42.0**	**$0.045**			**580**	**$4.2**	**$0.009**
Light Trucks										
CO	$435	15.72	611	$6.8	$0.011	$0	9.59	373	$0.0	$0.000
NO_x	$11,209	0.88	611	$9.8	$0.016	$6,389	0.53	373	$1.3	$0.003
VOC	$8,963	1.02	611	$9.1	$0.015	$7,350	0.62	373	$1.7	$0.005
PM	$7,391	0.02	611	$0.1	$0.000	$3,622	0.01	373	$0.0	$0.000
CO_2	$12.50	89.70	611	$1.1	$0.010	$12.50	52.93	373	$0.3	$0.004
Totals			**611**	**$27.0**	**$0.053**			**373**	**$3.3**	**$0.012**
Heavy Vehicles										
CO	$435	1.58	94	$0.7	$0.007	$0	2.09	124	$0.0	$0.000
NO_x	$11,209	1.63	94	$18.3	$0.194	$6,389	2.15	124	$7.8	$0.063
VOC	$8,963	0.17	94	$1.5	$0.016	$7,350	0.23	124	$0.9	$0.008
PM	$7,391	0.05	94	$0.4	$0.004	$3,622	0.07	124	$0.1	$0.001
CO_2	$12.50	42.46	94	$0.5	$0.033	$12.50	56.01	124	$0.4	$0.019
Totals			**94**	**$21.4**	**$0.255**			**124**	**$9.3**	**$0.091**
Total Vehicles										
CO	$435	39.77	1,797	$17.3	$0.009	$0	7.87	1,077	$0.000	$0.000
NO_x	$11,209	3.93	1,797	$44.0	$0.075	$6,389	1.15	1,077	$3.595	$0.023
VOC	$8,963	2.82	1,797	$25.3	$0.015	$7,350	0.57	1,077	$1.632	$0.005
PM	$7,391	0.11	1,797	$0.8	$0.002	$3,622	0.03	1,077	$0.060	$0.000
CO_2	$12.50	243.16	1,797	$3.0	$0.017	$12.50	56.50	1,077	$0.304	$0.008
Totals			**1,797**	**$90.5**	**$0.118**			**1,077**	**$5.6**	**$0.037**

Source: VTPI, Air Pollution Costs Spreadsheet

Table 9.4-4 Air Pollution Unit Cost in 2002

	Urban	Rural
Carbon monoxide (CO)	$435	$0
Nitrogen oxides (NO_x)	$15,419	$8,789
Volatile organic compounds (VOC)	$14,419	$11,823
Particulate Matter (PM)	$5,346	$2,620
Carbon dioxide (CO_2)	$18.13	$18.13

Source: VTPI (2006), Air Pollution Costs Spreadsheet, VTPI

According to Donald R. McCubbin and Mark A. Delucchi's project entitled "The Health Costs of Motor-Vehicle-Related Air Pollution", estimation of air pollution costs comprises four steps as follows.

(1) Estimate Emissions RelatedtoMotor Vehicle Use

The estimation covers the following pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), Ozone (O_3), and particulate matter (PM), including PM less than 2.5 microns ($PM_{2.5}$), and PM between 2.5 microns to 10 microns (PM_{10}).

(2) EstimateChanges in Exposureto Air Pollution

The estimation of changes in exposure to air pollution is based on the micro environments method and related data and standards from the USA's Environmental Protection Agency (EPA).

(3) Relate Changes in Air Pollution Exposure to Changes in Physical Health Effects

Review of related documentssuggests different degrees of health effects of air pollution exposure: eye irritation, headache, respiratory illness and death.

(4) Relate Changes inPhysical Health Effects to Changes in Economic Value

The contingent valuation method (CVM) is used to find the relationship between the physical health effects and economic value. The willingness to pay (WTP) and the willingness to accept compensation (WTAC) are surveyed based on the degrees of air pollution impacts on human health.

According to the study based on the above-mentioned four steps, the unit cost for reduction in motor-vehicle emissions (vehicle-mile) is presented in ***Table 9.4–5***. Low and high levels of emission of different pollutants (PM, O_3, CO, NO_2 and Toxics) are also presented.

Table 9.4–5 Cost per Mile of Motor Vehicle Travel based on a 10 percent Reduction in Motor-Vehicle Related Emissions (cent per vehicle mile travelled in the USA in 1990)

Vehicle Type	Emission Source*	PM		O_3		CO		NO_2		Toxics		Total	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
LDGV	v	0.48	7.02	0.01	0.07	0.04	0.37	0.04	0.22	0.00	0.05	0.58	7.71
	v+u	0.55	7.52	0.01	0.07	0.04	0.37	0.04	0.22	0.00	0.05	0.66	8.20
LDGT	v	0.74	10.70	0.01	0.11	0.06	0.53	0.06	0.32	0.00	0.09	0.88	11.72
	v+u	0.50	11.58	0.01	0.11	0.05	0.95	0.06	0.32	0.00	0.06	1.04	12.56
HDGV	v	1.56	30.28	0.03	0028	0.15	1.63	0.12	0.74	0.81	0.29	1.85	33.12
	v+u	1.78	31.53	0.03	0.29	0.15	1.63	0.12	0.73	0.01	0.29	2.09	34.38
Gasoline	v	0.55	80.4	0.01	0.08	0.05	0.42	0.05	0.25	0.00	0.06	0.65	8.83
	v+u	1.64	8.61	0.01	0.08	0.056	0.42	0.05	0.25	0.00	0.06	0.75	9.40
LDDV	v	1.47	18.49	0.00	0.02	0.00	0.01	0.02	0.11	0.01	0.08	1.50	18.64
	v+u	1.50	18.70	0.00	0.02	0.00	0.01	0.02	0.11	0.01	0.08	1.53	18.84
LDDT	v	0.47	5.77	0.00	0.01	0.00	0.00	0.01	0.04	0.00	0.03	0.48	5.82
	v+u	0.52	6.14	0.00	0.01	0.00	0.00	0.01	0.04	0.00	0.03	0.53	6.19
HDDV	v	4.18	79.93	0.02	0.19	0.01	0.07	0.15	0.98	0.02	0.33	4.35	81.19
	v+u	4.43	81.37	0.02	0.20	0.01	0.07	0.15	0.99	0.02	0.33	4.61	82.63
Duesel	v	3.48	64.36	0.01	0.15	0.00	0.05	0.12	0.78	0.01	0.27	3.62	65.85
	v+u	3.68	66.03	0.02	0.16	0.01	0.05	0.12	0.78	0.01	0.27	3.83	67.03
All	v	0.78	12.57	0.01	0.03	0.04	0.39	0.08	0.29	0.00	0.08	0.89	13.37
	v+u	0.89	13.17	0.01	0.09	0.04	0.39	0.05	0.29	0.00	0.08	1.00	13.98

	PM							
	v		v+u		v+u+rd		v+u+rd+re	
	Low	High	Low	High	Low	High	Low	High
LDGV	0.48	7.02	0.56	7.50	0.60	10.92	0.65	12.2
LDGT	0.74	10.70	0.90	11.54	0.94	16.09	1.02	17.8
HDGV	1.56	30.28	1.78	31.53	1.92	42.55	2.07	46.7
Gasoline	0.55	8.04	0.64	8.61	68	12.3	0.74	13.7
LDDV	1.47	18.5	1.5	18.7	1.53	21.3	1.57	22.3
LDDT	0.47	5.77	0.52	6.14	0.57	10.1	0.63	11.6
HDDV	4.18	79.9	4.43	81.4	4.75	111	5.21	122
Diesel	3.48	64.9	3.68	66	3.93	89.6	4.3	98.4
All	0.78	12.6	0.89	13.2	0.94	18.5	1.02	20.5

Notes:* Each emission source is cumulative: v includes just motor vehicle emissions; v+u include v plus upstream emissions; v+u+rd include v+u plus paved road dust emissions; v+u+rd+re include v+u+rd plus unpaved road dust emissions.

** LDGV = Light-Duty Gasoline Vehicles LDDV = Light-Duty Diesel Vehicles
LDGT = Light-Duty Gasoline Trucks LDDT = Light-Duty Diesel Trucks
HDGV = Heavy-Duty Gasoline Vehicles HDDV = Heavy-Duty Diesel Vehicles

Source: Donald R. McCubbin and Mark A. Delucchi "The Health Costs of Motor–Vehicle–Related Air Pollution (1999)" from URMAP Project

The study result by Donald R. McCubbin and Mark A. Delucchi (1999) was referred to by the Urban Rail Transportation Master Plan in Bangkok and Surrounding Areas (URMAP) to estimate the cost for reduction in motor vehicle related emissions at the 2003 prices, adjusted by the inflation rate of 3% per year as presented in ***Table 9.4–6***.

Table 9.4–6 Cost for Reduction in Motor Vehicle Related Emissions at the 2003 Prices

Unit: Baht/vehicle-km

Vehicle Type	PM		O_3		CO		NO_2		Toxics		Total	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Light-Duty Gasoline Vehicles	0.180	2.656	0.000	0.028	0.019	0.142	0.019	0.028	0.000	0.019	0.217	2.912
Light-Duty Gasoline Trucks	0.284	4.046	0.019	0.038	0.019	0.199	0.019	0.123	0.000	0.038	0.331	4.434
Light-Duty Gasoline Vehicles	0.586	11.448	0.009	0.104	0.057	0.614	0.047	0.284	0.000	0.113	0.700	12.526
Gasoline	0.208	3.044	0.000	0.028	00.19	0.161	0.019	0.095	0.000	0.019	0.246	3.337
Light-Duty Diesel Vehicles	0.558	6.996	0.000	0.009	0.000	0.000	0.009	0.038	0.000	0.028	0.567	7.052
Light-Duty Diesel Trucks	0.180	2.184	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.009	0.180	2.203
Light-Duty Diesel Vehicles	1.579	30.223	0.009	0.076	0.000	0.028	0.057	0.369	0.009	0.123	1.645	30.706
Diesel	1.314	24.523	0.000	0.057	0.000	0.019	0.047	0.293	0.000	0.104	1.371	24.901
All Vehicles	0.293	4.755	0.000	0.038	0.019	0.151	0.019	0.113	0.000	0.028	0.340	5.058

Source: **McCubbin and Delucchi (1999). The Health Costs of Motor-Vehicle-Related Air Pollution.** From URMAP Project

9.4.1.2 Estimation Results

The mass rapid transit system will decrease the use of personal/public vehicles, motor vehicle emissions, and traffic congestion. According to the MRT Assessment Standardization of the Public Debt Management Office, the average cost for reduction in motor vehicle related emission is 5 Baht/PCU-km as presented in ***Table 9.4–7*** which was used to estimate the environmental cost savings in the benefit transfer method.

Estimation of environmental cost savings was conducted in two cases: distance-based fare collection case and 20-Baht flat fare collection case. The financial costs of the two cases are 49,716 million Baht and 54,065 million Baht respectively based on the assumption that the ridership of the 20-Baht flat fare case is higher than the distance-based fare case. The equation for estimating the environmental cost savings is shown below.

$$EC_{saving} = (EC \times VKT_{(w/o)}) - (EC \times VKT_{(w/)})$$

Where

EC_{saving} = Environmental cost savings (million Baht/year)

EC = Environmental cost of representative vehicle
= 5.00 Baht/PCU-km

$VKT_{(w/o)}$ = Total distance travelled in the without-project case (PCU-km/hr)

$VKT_{(w/)}$ = Total distance travelled in the with-project case (PCU-km/hr)

The estimation results of the environmental cost savings in cases of distance-based fare, and 20-Baht flat fare are presented in ***Tables 9.4–8*** and ***9.4–9*** respectively.

Table 9.4–7 Cost for Reduction in Motor Vehicle Emissions Based on MRT Assessment Standardization

Unit: Baht/PCU-km

	Notes
5.0	Average of the costs for light-duty vehicles using gasoline and diesel in Mc Cubin & Delucchi, 1999

Source: MRT Assessment Standardization of the Public Debt Management Office, Thailand

Table 9.4–8 Estimation of Environmental Cost Savings in the Distance-Based Fare Case

Year	Cost for Reduction in Motor Vehicle Emissions (Baht/PCU-km)	Without Project		With Project		Savings	
		VKT (PCU-km/hr)	Cost (Million Baht/hour)	VKT (PCU-km/hr)	Cost (Baht/hour)	Million Baht/hour	Million Baht/Year
2018	5.00	14,735,667	73.678	14,710,570	73.553	0.123	405.90
2022	5.00	16,142,918	80.718	16,105,143	80.526	0.189	623.70
2027	5.00	18,271,110	91.356	18,219,496	91.097	0.259	854.70
2032	5.00	20,029,687	100.148	19,963,711	99.819	0.329	1,085.70
2037	5.00	21,528,810	107.644	21,445,969	107.230	0.414	1,366.20

Note: Day to year converter = 330 Peak Hour Factor (PHF) = 10

Table 9.4–9 Estimation of Environmental Cost Savings in the 20-Baht Flat Fare Case

Year	Cost for Reduction in Motor Vehicle Emissions (Baht/PCU-km)	Without Project		With Project		Savings	
		VKT (PCU-km/hr)	Cost (Million Baht/hour)	VKT (PCU-km/hr)	Cost (Baht/hour)	Million Baht/hour	Million Baht/Year
2018	5.00	14,595,403	72.977	14,554,592	72.773	0.204	673.20
2022	5.00	15,947,639	79.738	15,896,720	79.484	0.254	838.20
2027	5.00	17,969,023	89.845	17,906,211	89.531	0.314	1,036.20
2032	5.00	19,787,443	98.937	19,711,743	98.559	0.378	1,247.40
2037	5.00	21,198,850	105.944	21,108,188	105.541	0.453	1,494.90

Note: Day to year converter = 330 Peak Hour Factor (PHF) = 10

9.5 GHG REDUCTION POLICY

The Earth's atmosphere consists of the Troposphere which absorbs, filters, and reflects the electromagnetic waves which are solar energy. Also, this layer of atmosphere helps prevent meteorites from hurtling into the Earth. Solar energy comes to the Earth in the form of radiation, 30% of which is reflected back to the space and 70% absorbed into the atmospheric layers and the Earth's surface, creating heat on the Earth's surface combined by the radiation gradually released from geothermal energy.

Global warming effect is caused by greenhouse gas emissions mainly from human activities and slightly from nature into the atmosphere. Due to the increasing concentrations of greenhouse gases, some thermal energy from the Earth's surface is not emitted to the space but trapped inside the atmosphere, rising global temperature. This occurrence is defined as global warming by the Intergovernmental Panel on Climate Change (IPCC) set up in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP). Three major greenhouse gases which contribute to global warming comprise (1) carbon dioxide (CO_2) caused by several types of combustions, (2) methane (CH_4) from burning of fossil fuels, and (3) chlorofluorocarbons (CFCs) from industrial factories, e.g. electric appliances, integrated circuits, computer circuits, and car parts.

Abundant greenhouse gases have accumulated in the atmosphere from the past to the present. Each GHG has a long duration of stay in the atmosphere, e.g. CO_2 persisting for 200-450 years; and different global warming potential (GWP), e.g. PFCs having GWP of 700-11,900 as presented in ***Table 9.5-1***. Thus, the continual GHG emissions from the present time to the future will further increase the accumulation of GHGs in the atmosphere, worsening the global warming effects.

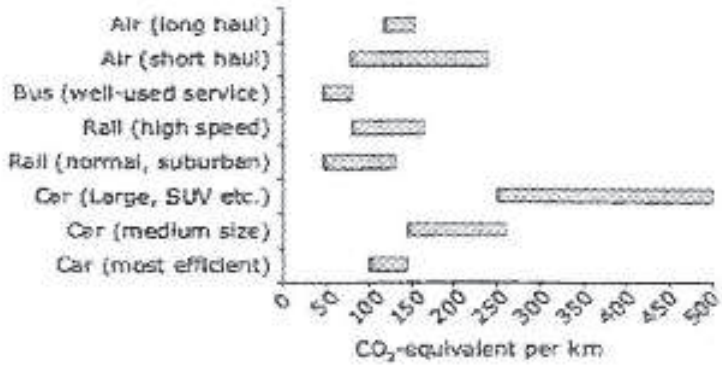
GHG emissions in transportation sector primarily come from burning fossil fuels and depend on transportation mode. According to the World Bank's study, the fuel of 5 liters can be used to transport goods for a distance of 100 km by land, 330 km by rail, and 500 km by water. It can be concluded that transportation by water causes the lowest GHG emission when compared to transportation by rail and by road.

Table 9.5–1 Atmospheric Life Time of Greenhouse Gases and GWP in Comparison to CO_2

Greenhouse Gas	Atmospheric Life Time (year)	Global Warming Potential	Emission Source
CO_2	200-450	1	Fossil fuel, land use
CH_4	9-15	23	Agriculture, livestock
N_2O	120	296	Nitrogen fertilizer
HCF	10-220	140-11,800	Refrigerant, foam, computer, television, toothpaste
PFCs	2,600-50,000	700-11,900	Refrigerant, foam, computer, television, toothpaste
SF_6	3,200	22,000	Refrigerant, foam, computer, television, toothpaste

Notes: CO_2= Carbon Dioxide, CH_4 = Methane, N_2O = Nitrogen Dioxide, HFC = Hydrofluorocarbon, PFC = Perfluorocarbon, SF6 = Sulphur Hexafluoride)
Source: Scenario Analysis for the Sea Level Rise Impacts on the Upper Coastal Areas of the Gulf of Thailand Project

GHG emissions are different depending on vehicle type and size. Large personal cars have high emissions in a range of 250-500 g CO_2e per km. Considering the passenger carrying capacity, all mass transit systems will reduce GHG emissions in the transportation sector as presented in ***Figure 9.5–1***. In addition, GHG emissions are based on fuel types as shown in ***Table 9.5-2***.



Source: Adapted from AEF, 2001

Figure 9.5-1 Emissions of CO_2 by Vehicle Type

Guidelines on Development of Green Transportation

Based on the Office of the National Economic and Social Development Board (NESDB)'s guidelines on implementation of the green transportation system adapted from the (draft) report on development of green transportation system by the World Bank in 2012, the national green transportation development consists of the following three levels (Source: Book entitled Thailand towards the Green Future (หนังสืออนาคตประเทศไทยบนเส้นทางสีเขียว), NESDB, September 2012).

Table 9.5–2 GHG Emissions by Fuel Type

Description	Unit	CO_2 Emission (g-CO_2)	CO_2Emission per 1 km*
Diesel oil	liter	2,699	216
B5	liter	2,564	205
B3	liter	2,618	209
Benzene	liter	2,182	175
E10	liter	1,963	164
E20	liter	1,745	145
E85	liter	327	27
LPG	liter	1,680	168
NGV	liter	2,037	146

Note: Prepared by NESDB with reference to the energy consumption rate by the Energy Policy and Planning Office
Source: Thailand Greenhouse Gas Management Organization (Public Organization)

(**1**) **System Level**: The whole transportation system will be intervened in order to bring about changes in economic structure, distribution of growth, and area development. By this way, the efficient modes of transportation will be developed, avoiding severe impacts on socio-economic conditions and environmental surroundings. According to the World Bank's forecast, without intervention in the entire system, energy consumption in the transportation sector will rise by 70%.

(2) Transportation Mode Level: Preparation of freight and passenger movement plan, and development of infrastructure facilities will enhance the transportation efficiency. Transportation by rail, water and pipeline will increase the energy consumption efficiency in the transportation sector and reduce GHG emissions. Transportation by road has constraints in terms of car engine capacity and load carrying capacity of roads.

(3) Vehicle Level: Importance is stressed on fuel consumption of existing and new motor vehicles to improve fuel use efficiency and decrease toxic emissions. The demand management measures are also established, together with fuel price determination. Disciplined driving should be promoted as it will help reduce fuel consumption by about 5-15%.

Table 9.5-3 shows the development framework and impacts of intervention on socio-economic conditions and environment.

Table 9.5-3 Development Framework and Impacts of Intervention on Socio-economic Conditions and Environment

System Level			Transportation Mode Level			Vehicle Level		
Impacts								
Economic	**Social**	**Environment**	**Economic**	**Social**	**Environment**	**Economic**	**Social**	**Environment**
High	High	High	High	Medium	Low	Low	Medium	High
Indicators								
• Transportation time per freight ton-kmor travel time per pax-km (economic aspect) • Consumed energy, emission of CO_2, emission of PM per freight ton-km orpax-km (environmental aspect)								
Principles								
• Intervention in the whole system to bring about change in area development and structure of economic activities			• Improvement of transit service efficiency to support multi-modal transportation			• Improvement of fuel consumption efficiency of new and existing vehicles to reduce toxic emissions		
Policies								
• Motivation on use of target areas together with the policy on distribution of industrial areas and public services (e.g. hospitals and educational institutions); provision of investment incentives; and preparation of infrastructure facilities • Control and management of parking areas			• Combination of transportation modes for efficient transportation • Development of efficient traffic system • Motivation to use public transportation • Vehicle access control			• Encourage people to use fuel-efficient vehicles, taking into consideration the number/type/life time of vehicles, as well as fuel capacity and type. • Establish standards for vehicles and engines based on fuel consumption efficiency and GHG emission for development of vehicle taxation system. Promote control of GHG emissions using modern technologies. • Management of Fleet Operation and promotion of eco-driving to reduce fuel consumption		
Examples of Government Investment Projects								
• Investment in construction of industrial estates, universities, airports, sea ports, etc. in the target areas to promote regional growth.			• Development of public transport system (rail, water, and mass rapid transit) • Widening of expressways and inter-city motorways to alleviate traffic congestion problem in urban area and communities			• Provision of fuel-efficient trains and buses • Development of sufficient infrastructure facilities to support the measures, e.g. service stations • Promote manufacturing of fuel-efficient cars which are environmentally friendly.		
Other Tools								
• Financial measures: tax incentive for fuel-efficient vehicles, development of vehicle taxation system based on GHG emissions of motor vehicles • Legal measures: regulations on pollution control and energy conservation, etc. • Information: creation of public awareness in regard to green transportation, campaign on application of traffic and transport technologies, etc. • To seek sustainable funding sources and mechanism								

Source: (Draft) Report on Development of Green Transportation System by the World Bank, 2012

Table 9.5-4 presents the measures on development of green transportation at vehicle level, especially those which can be immediately implemented and expected to materialize.

Table 9.5-4 Major Measures and Guidelines on Development of Green Transportation at Vehicle Level

Major Measures	Implementation Guidelines
1. Measures which can be immediately implemented	
1.1 Improvement of fuel consumption efficiency of new and existing vehicles to reduce toxic emissions	• Establishment of standards for vehicle engines, especially buses, trucks, and personal cars, and strict enforcement of related laws • Promote development and use of engines which have low fuel consumption and rely on clean energy, such as electricity, bio fuel, hybrid power. Transportation facilities should be also considered.
1.2Promotion of fuel-efficient vehicles	• Improvement of freight transportation system, e.g. fleet operation management to minimize empty hauls, determination of truck sizes with suitable load carrying capacity, etc. • Creation of public awareness about good driving habits and compliance with driving disciplines • Maintenance of car engine performance
1.3 Development of facilities to reduce use of personal vehicles in congested urban areas	• Development of bike lanes in urban areas • Provision of safe walkways linking to the rail-based mass transit system
1.4 Strict enforcement of laws	• Determination of suitable load carrying capacity of trucks and support of freight transportation by water and by rail • Inspection of vehicles and engines to ensure they meet the established standards and relevant regulations
1.5 Development of information technology system	• Development of the traffic and transportation technologies which are modern and suitable for the situation • Promotion and development of information technologies which reduce transportation, for instance, electronic transactions, etc.
2. Measures to be implemented upon readiness at transportation mode level	
2.1 Travel Demand Management (TDM)	• Setup of suitable management structure and determination of transportation behavior by fee collection, e.g. collection of entrance fees from vehicles entering traffic congested areas • Establishment of taxation structure, e.g. vehicle taxation based on vehicle lifetime.
2.2 Improvement of efficiency of freight transportation and multi-modal transportation	• Provision of vehicles and development of facilities for multi-modal transportation, for instance, design of container trucks which can be used with different modes of transportation

Source: The Office of the National Economic and Social Development Board

Estimation of Value for Reduction in GHG Emissions from Motor Vehicles

Emission of GHG to the atmosphere is a major cause of global warming, leading to many environmental hazards, e.g. sea level rise due to melting of glaciers and polar ice sheets. Besides, increase in global temperature also results in severe natural hazards, such as droughts, floods, storms, etc. Study of GHG emission reduction value is elaborated below.

(1) Estimation Framework: The project's direct benefits were estimated in the form of Vehicle Operating Cost Saving (VOC_{saving}), Value of Time Saving (VOT_{saving}), and Accident Cost Saving (ACC_{saving}). These benefits were already analyzed by the project's economics expert in order to assess the project's economic viability. VOC_{saving} was computed using a module of Highway Development & Management Model (HDM-4) based on the following factors.

- Fuel consumption
- Lubricant consumption
- Tire wear
- Maintenance parts
- Maintenance labor cost
- Depreciation and interest
- Crew time

According to the above factors, fuel consumption is a major cost. The market valuation method was employed to estimate the GHG emission reduction value in the with-project case. Primary and secondary data required for estimation are detailed below.

(2) Estimation Process: The amount of GHG emissions from reduction in fuel combustion in the with-project case was estimated and then expressed in CO_2 equivalent (CO_2e).

(3) Input Data:

Fuel consumption of representative vehicle: Fuel price is regarded the major factor in vehicle operating cost estimation. The HDM-4 program was used to compute the fuel consumption rates of representative vehicles at different speeds (km/l) as presented in ***Table 9.5–5***.

Table 9.5–5 Fuel Consumption Rates of Representative Vehicles

Unit: km/liter

Vehicle Type[3/]	PCU[1/] Factor	Speed (km/hr)[2/]									
		10	20	30	40	50	60	70	80	90	100
PC-M	1.00	3.04	5.89	8.31	10.30	11.80	12.76	13.22	13.23	12.89	12.30
PC-L	1.00	2.50	4.88	6.91	8.59	9.86	10.69	11.10	11.13	10.88	10.43
LT	1.75	3.19	6.19	8.96	11.29	12.95	13.79	13.86	13.32	12.41	11.32
MT	2.00	3.56	6.31	8.30	9.79	10.85	11.55	11.97	12.15	12.20	12.22
HT	2.50	1.18	2.10	2.93	3.62	4.16	4.51	4.71	4.76	4.66	4.57
LB	1.50	4.59	8.25	10.96	13.04	14.59	15.70	16.43	13.96	11.64	9.80
MB	2.10	3.56	6.31	8.29	9.78	10.84	11.53	11.94	12.12	12.16	12.17
Total	**11.85**	**35.55**	**65.10**	**88.67**	**107.38**	**121.07**	**129.72**	**134.01**	**130.26**	**124.53**	**118.66**
Average PCU-km/liter		**3.00**	**5.49**	**7.48**	**9.06**	**10.22**	**10.95**	**11.31**	**10.99**	**10.51**	**10.01**

Source: [1/]Office of the Commission for the Management ofLandTraffic, the Prime Minister's Office

[2/] Feasibility Study and Environmental Impact Assessment for Linkage between Don MueangInternational Airport and Suvarnabhumi Airport, 2003

[3/] PC-M = Medium Passenger Car PC-L = Large Passenger Car LT = Light Truck
MT = Medium Truck HT = Heavy Truck LB = Light Bus MB = Medium Bus

Input data for calculating speeds of representative vehicles: Fuel consumption rate varies according to speed of representative vehicle. Therefore, vehicle speeds in the with-project case and the without-project case were considered to estimate change in fuel consumption. The following traffic engineering data were considered in the calculation.

- $VKT_{w/o,t}$ = Vehicle-kilometer travelled in the without-project case, year t
- $VKT_{w,t}$ = Vehicle-kilometer travelled in the with-project case, year t
- $VHT_{w/o,t}$ = Vehicle hours of travel in the without-project case, year t
- $VHT_{w,t}$ = Vehicle hours of travel in the with-project case, year t
- PHF = Peak hour factor is used to convert the traffic volume in the peak hour into the average daily volume.
- The factor for converting day to year

Where

VKT is the total distance that vehicles travel in the studied system. It is calculated by multiplying the total vehicles in the studied system by the distance travelled (pcu-km/hr).

VHT is the total travel time of vehicles in the studied system. It is calculated by multiplying the total vehicles in the studied system by travel time (pcu-hr/hr).

GHG emissions by fuel type: Fuels used with vehicles comprise gasoline and diesel. Besides, to reduce emission of CO_2, ethanol is added to gasoline to produce different oil products, e.g. gasohol 95, E20, and E85. The products obtained from ethanol blended with diesel comprise B7, B5, and B3. CO_2 is mostly found in GHG emissions. CH_4 and NO_2 are slightly present in GHG. ***Table 9.5-6*** presents GHG emissions by fuel type expressed as carbon dioxide equivalent (CO_2e).

Table 9.5-6 Carbon Dioxide Equivalent (CO_2e)

Unit: grams per liter

Fuel Type	CO_2	CH_4	NO_2	Total CO_2 Equivalent	
CO_2 Equivalent Factor	1	21	310	Grams Per Liter	Grams Per Gallon
Gasoline	2,360	0.2273	0.3358	2,469	9,345
Diesel	2,730	0.0605	0.2	2,793	10,572
Ethanol 10	2,124	0.2273	0.3358	2,233	8,422
Ethanol 85	531	0.2273	0.3358	640	2,422
Conventional Aircraft Fuel	2,330	2.19	0.23	2,447	9,262
Jet Fuel	2,550	0.08	0.25	2,629	9,951

This table presents the CO_2e of various fuels.
Source: Transportation cost and benefits analysis – air pollution costs, Victoria Transport Policy Institute (www.vtpi.org)

Calculation formula is presented below.

Speed = VKT / VHT ……(1)

Where

$GHG_{saving\ .t}$ = Greenhouse gas saving, year t

$GHG_{w/o,t}$ = Greenhouse gas from fuel combustion in the without-project case, year t

$GHG_{w/,t}$ = Greenhouse gas from fuel combustion in the with-project case, year t

$VKT_{w/o,t}$ = Vehicle-kilometer travelled in the without-project case, year t

$VKT_{w,t}$ = Vehicle-kilometer travelled in the with-project case, year t

$GHG_{value,\ t}$ = $GHG_{saving,\ t}$ x P x PHF x T……(3)

(4) Study Result: Based on the input data and method for estimating the value of GHGemission reductionwhich is regarded as the project's indirect benefit, the coefficients in the study comprise the following.

(a) Fuel Consumption Rate depends on vehicle type and speed as presented in ***Table 9.5-5***. Fuel consumption rate of representative vehicle was applied in this project.

(b) GHG Emissions are different based on fuel type expressed as carbon dioxide equivalent (CO_2e) in ***Table 9.5–6***. To analyze the GHG emission, Ethanol 10 representing gasoline and B5 representing diesel at the ratio of 70:30 were applied. As a result, GHG emission is 2,360 g CO_2e/liter (computed from 2,233 x 0.7 + 2,656.8 x 0.3 = 2,360.14).

(c) Traffic Engineering Data comprise VKT, VHT, PHF = 10, and day to year converter = 330.

The average speed of representative vehicles was analyzed to find fuel consumption rates in the with and without-project cases; and then the GHG emissions from fuel combustion in the form of CO_2e in the distance-based fare case were computed as shown in ***Table 9.5-7*****.** Value of GHG emission reduction in the distance-based fare case is presented in ***Table 9.5-8***. As for the 20-Baht flat fare case, analysis of average speed of representative vehicles and GHG emissions are presented in ***Table 9.5–9*** and value of GHG emission reduction in ***Table 9.5–10***.

Summary of Environmental Economic Valuation Results

Implementation of the Pink Line (Khae Rai–Min Buri Section) will reduce use of motor vehicles as people will significantly turn to the rail-based mass transit services. Decrease in use of motor vehicles will reduce combustion of fossil fuels (gasoline and diesel), and thus lessen emission of air pollutants, including CO_2, CH_4, NO_2, which are GHG responsible for climate change. The environmental economic valuation was conducted in the form of GHG emission savings and GHG emission reductions in two cases: distance-based fare collection and 20-Baht flat fare collection.

In 2018 which is the first year the Pink Line is expected to provide service, the value of GHG emission saving will be 405.90 million Baht in the distance-based fare case and GHG emission will be reduced by 27 t CO_2e/hr. In the 20-Baht flat fare case, the value of GHG emission saving will be 673.20 million Baht and GHG emission will be decreased by 43 t CO_2e/hr. GHG emission savings and GHG emission reductions will be higher in the following years of project operations. ***Table 9.5-11*** presents the environmental economic valuation for fossil fuel (gasoline and diesel) combustion reduction.

Table 9.5-7Analysis of Average Speed of Representative Vehicle and GHG Emission for the Pink Line (Khae Rai–Min Buri Section) in the Distance-Based Fare Case

Description	2018		2022		2027		2032		2037	
	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)
Without Project	**14,735,667**	**685,176**	**16,142,918**	**762,754**	**18,271,110**	**876,362**	**20,029,687**	**989,853**	**2,152,881**	**1,132,954**
With Project	**14,710,570**	**681,372**	**16,105,143**	**756,894**	**18,219,496**	**867,774**	**19,963,711**	**978,187**	**21,445,969**	**1,117,752**
Without Project										
• Average Speed(km/hr.)		21.5064		21.1640		20.8488		20.2350		19.0037
• Fuel Consumption(km./liter)		5.7898		5.7216		5.6589		5.5368		5.2419
• GHG (g/pcu-km)		407.6134		412.4720		417.0422		426.2389		450.2184
With Project										
• Average Speed (km/hr.)		21.5896		21.2779		20.9957		20.4089		19.1867
• Fuel Consumption(km-hr./liter)		5.8063		5.7443		5.6881		5.5714		5.2875
• GHG (g/pcu-km)		406.4551		410.8421		414.9013		423.5919		446.3357

Note: VKT = Vehicle-kilometer travelled VHT = Vehicle hours of travel
Source: The Consultant, 2012

Table 9.5-8 Value of GHG Emission Reduction for the Pink Line (Khae Rai–Min Buri Section) in the Distance-Based Fare Case

Year	Without Project			With Project			GHG Reduction (t CO_2e/hr)
	GHG (g/pcu-km)	VKT (pcu-km/hr)	Total GHG (tCO_2e/hr)	GHG (g/pcu-km)	VKT (pcu-km/hr)	Total GHG (tCO_2e/hr)	
2018	407.6134	14,735,667	6,006	406.4551	14,710,570	5,979	27
2022	412.4720	16,142,918	6,659	410.8421	16,105,143	6,617	42
2027	417.0422	18,271,110	7,620	414.9013	18,219,496	7,559	61
2032	426.2389	20,029,687	8,537	423.5919	19,963,711	8,456	81
2037	450.2184	21,528,810	9,693	446.3357	21,445,969	9,572	121

Note: PHF = 10 Day to Year Converter = 330
Source: The Consultant, 2012

Table 9.5-9Analysis of Average Speed of Representative Vehicle and GHG Emission for the Pink Line (Khae Rai–Min Buri Section) in the 20-Baht Flat Fare Case

Description	2018		2022		2027		2032		2037	
	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)	VKT (pcu-km/hr)	VHT (pcu-hr/hr)
Without Project	14,595,403	662,902	15,947,639	732669	17,969,023	826,945	19,787,443	950737.000	21,198,850	1,073,923
With Project	14,554,592	657,059	15,896,720	724826	17,906,211	815,978	19,711,743	936486.000	21,108,188	1,055,895
Without Project										
• Average Speed (km/hr.)		22.0174		21.7665		21.7294		20.8127		19.7396
• Fuel Consumption(km/liter)		5.8915		5.8415		5.8342		5.6517		5.4252
• GHG (g/pcu-km)		400.5771		404.0058		404.5113		417.5735		435.0070
With Project										
• Average Speed (km/hr.)		22.1511		21.9318		21.9445		21.0486		19.9908
• Fuel Consumption (km-hr./liter)		5.9181		5.8740		5.8769		5.6987		5.4877
• GHG (g/pcu-km)		398.7766		401.7432		401.5723		414.1295		430.0527

Note: VKT = Vehicle-kilometer travelled VHT = Vehicle hours of travel
Source: The Consultant, 2012

Table 9.5-10 Value of GHG Emission Reduction for the Pink Line (Khae Rai–Min Buri Section) in the 20-Baht Flat Fare Case

Year	Without Project			With Project			Total GHG ($t CO_2e$/hr)
	GHG (g/pcu-km)	VKT (pcu-km/hr)	Total GHG (tCO_2e/hr)	GHG (g/pcu-km)	VKT (pcu-km/hr)	Total GHG (tCO_2e/hr)	
2018	400.5771	14,595,403	5,847	398.7766	14,554,592	5804	43
2022	404.0058	15,947,639	6,443	401.7432	15,896,720	6386	57
2027	404.5113	17,969,023	7,269	401.5723	17,906,211	7191	78
2032	417.5735	19,787,443	8,263	414.1295	19,711,743	8163	100
2037	435.0070	21,198,850	9,222	430.0527	21,108,188	9078	144

Note: PHF = 10 Day to Year Converter = 330
Source: The Consultant, 2012

Table 9.5–11 Summary of Environmental Economic Valuation for Fossil Fuel (Gasoline and Diesel) Combustion Reduction

Year	Distance-Based Fare Case		20-Baht Flat Fare Case	
	GHG Savings (MB)	GHG Reduction (t CO_2e/hr)	GHG Savings (MB)	GHG Reduction (t CO_2e/hr)
2018	405.90	27	673.20	43
2022	623.70	42	838.20	57
2027	854.70	51	1,036.20	78
2032	1,085.70	81	1,247.40	100
2037	1,366.20	121	1,494.90	144

CHAPTER 10

PUBLIC RELATIONS AND PUBLIC PARTICIPATION

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PUBLIC RELATIONS AND PUBLIC PARTICIPATION

10.1 INTRODUCTION

During the process of the Pink Line MRT Project Khae Rai-Min Buri (the Project) detailed information review, design revision and preparation of bidding document, the Consultant had focused on the issues of public relations and public participation which were carried out in the meantime. These activities were duly performed in accordance with the relevant laws and regulations i.e. Guidelines on Public Participation and Social Impact Assessment enacted by Environmental Impact Evaluation Bureau, Office of Natural Resources and Environmental Policy and Planning , the Constitution of the Kingdom of Thailand B.E.2550 as well as the Prime Minister Office Regulation on Public Participation B.E.2548.

Summary reports on the public relations and public participation for the Project are as follows.

10.2 PUBLIC PARTICIPATION

The Pink Line MRT Project Khae Rai-Min Buri initiated by Office of Transport and Traffic Policy and Planning was approved by the National Environment Board in the Meeting No. 2/2555 held on March 16, 2012. Now the Mass Rapid Transit Authority of Thailand (MRTA) takes on the responsibility for the entire project. Further study resulted in many changes i.e. additional stations and station relocations, decrease in number of maintenance centers as well as park-and-ride buildings. Therefore, additional public hearings were carried out in order that all stakeholders including the local public and private sectors would have a chance to participate in reviewing the Project alterations. Various issues of concern and suggestions raised by those residing along the Project route were taken into consideration so as to obtain proper designs for maximum benefit with least impacts on the residents.

(1) Objectives

- To give information to the target groups on the Project alterations in order to develop public awareness and understanding.
- To provide information to the target groups on the environmental impact prevention and mitigation measures which will lead to positive public attitudes towards the Project.
- To obtain various opinions and suggestions which will be taken into consideration in revising the Project detailed designs to suit the physical conditions and to satisfy the residents' needs.
- To relieve concerns among the target groups on probable impacts from the Project implementation.

(2) Target Areas

Target Areas are those along the Project route namely Amphor Pak Kret Nonthaburi Province, Bangkok Districts of Lak Si, Bang Khen, Bueng Kum, Khan Na Yao and Min Buri.

(3) Target Groups

(a) Local government authorities in the target areas i.e.

- Nonthaburi Government Center
- Nonthaburi City Municipality
- Pak Kret City Municipality
- Lak Si District Office
- Bang Khen District Office
- Bueng Kum District Office
- Khan Na Yao District Office
- Min Buri District Office
- Department of Highways
- Lak Si Depot Highway

(b) Authorities being responsible for infrastructure in the target areas i.e.

- Metropolitan Waterworks Authority, Bang Khen Branch Office
- Metropolitan Electricity Authority
- TOT Public Company Limited

(c) Medical care service providers in the target areas i.e.

- Central Chest Institute of Thailand
- Synphaet General Hospital

(d) Educational Institutes in the target areas i.e.

- Phranakhon Rajabhat University
- Setthabut Bamphen School

(e) Major Temple (Wat) i.e.

- WatPhra Si Maha That Woramahawihan

(f) Community Presidents/Heads in the target areas

(g) Department Stores/Shopping Malls in the target areas i.e.

- Central Plaza Chaengwattana and Ram Inthra Shopping Malls
- Fashion Island Shopping Mall
- Max Valu Supermarket Lak Si Branch
- IT Square Lak Si Department Store

(4) Scope of Work

Activities of the Project Public Participation and Public relations consist of the followings :

- Meeting with local executives
- Joining local authorities regular meetings
- Meeting with local opinion leaders

- In-depth interviews
- Public Hearings

(5) Summary Report on the overall implementation :

(a) Consultation with local executives/representatives of 20 public and private sectors

- Meeting with Executives of Fashion Island Shopping Mall on Friday 22 June, 2012, 10.00-12.00 a.m.

Figure 10.2-1 Meeting with Executives of Fashion Island Shopping Mall

Questions and Suggestions:

1. The executives asked for details of the Project.
2. The executives gave more information on development of Fashion Island Shopping Mall that in the near future an additional area of approximately 170,000 square meters would be operable and that this part of the city would be greatly expanded.
3. The executives suggested that the Consultant design a walkway connecting the East Outer Ring Station (PK 25) to the entrance of Fashion Island Shopping Mall.
4. In this regard, the walkway should not be too far from the Shopping Mallso that it would be convenient for passengers/ customers.
5. Suggestion that the East Outer Ring Station design be spacious and well-ventilated.
6. Suggestion on the station design to accommodate an increasing number of passengers/customers.
7. Suggestion on the station design connection to other means of transport in front of the Shopping Mall e.g. bus stop, taxi park and motorcycle service and etc.
8. Suggestion on changing name of the station from East Outer Ring Station to Fashion Island Station for better recognition.

- Meeting with Municipal Clerk of Pak Kret City Municipality on Thursday 9 July, 2012, 01.00-01.30 p.m. at the office of Chief, Civil Department.

Figure 10.2-2 Meeting with Municipal Clerk of Pak Kret City Municipality

Questions and Suggestions :

1. Query on the route and location of the stations in the area of Pak Kret City Municipality.
2. Query on the location of car park in the area of Muang Thong Thani.
3. Query on advantages and disadvantages of the monorail system.
4. The Consultant informed that there may be relocation of some stations within Nonthaburi area after consultation with Governor Nonthaburi Province.
5. The Consultant informed that the maintenance center may be relocated from the area of Pak Kret City Municipality to the golf course of Royal Irrigation Department.
6. The Consultant informed that the station entrance and exit would be relocated from the front of Administrative Court to somewhere else.
7. Query on commercial buildings on Pak Kret Inter section that may be affected by the route running into Chaengwattana Road.
8. Suggestion that the station be located on Pak Kret City Municipality where the community is situated.
9. Suggestion that the station be located on Pak Kret Intersection area and that a skywalk be constructed to accommodate passengers from Pak Kret crowded community.
10. Query on the location of Muang Thong Thani Station where the land would be reclaimed and the station near the express way entrance since Governor Nonthaburi Province requested for thorough consideration.
11. Suggestion if it would be possible to relocate the station to an unoccupied area opposite to Muang Thong Thani entrance.

12. Query as to the Project implementation period and when the Pink Line MRT Khae Rai - Min Buri would be put into operation.
13. Query on the MRT Network Junctions of the Pink Line and others.

- Meeting with Mayor Nonthaburi City Municipality and joining the regular meeting on Wednesday 18 July, 2012, 08.00-09.00 a.m. at 3rd floor meeting room of Nonthaburi City Municipality.

Figure 10.2-3 Meeting with Mayor Nonthaburi City Municipality and Joining the Regular Meeting

Questions and Suggestions :

1. Query as to how much (Rai) of the land in Sanamb in Nam area that would be used as a maintenance center.
2. Query as to the Pink Line MRT Khae Rai - Min Buri Route running across Nonthaburi City Municipality area and probable impacts on the people.
3. As for Sanambin Nam area where MRTA designated as a maintenance center, Nonthaburi City Municipality had already planned for development to accommodate local government authorities.
4. In this regard, Nonthaburi City Municipality proposed to relocate the maintenance center to somewhere else such as Chonlaprathan Market or residences of Royal Irrigation Department. Another alternate proposal is to shift the maintenance center to the adjacent Samakkhi Road in order to have least impacts in utilizing areas in Nonthaburi City Municipality.
5. During construction, it was recommended to take reasonable safety precautions to avoid impacts on surrounding buildings as well as infrastructures.
6. It was recommended to plan for traffic management during construction to alleviate the traffic jam.

7. It was recommended that Public relations cover all groups of people affected by the Project especially those living around the MRT stations and those whose lands would be reclaimed.

- Meeting with Director, Office of Asset Management, Administrative Court on Wednesday 18 July, 2012, 02.00-03.00 p.m. at 1st floor meeting room.

Figure 10.2-4 Meeting with Director Office of Asset Management, Administrative Court

Questions and Suggestions:

1. Query as to the Project implementation period and when the Pink Line MRT Khae Rai - Min Buri would be put into operation.
2. Query as to whether an existing location of Nonthaburi Government Center Station (PK 01) would block out the view of Administrative Court Building.
3. Query on additional plan of monorail MRT route.
4. It was recommended that design of PK 01 be grand, unique, spacious and well-ventilated.
5. It was recommended to relocate stairs on the exit of PK 01 from the front of Administrative Court to Department of Consular Affairs.
6. It was recommended that Public relations cover all groups of people affected by the Project and that appropriate measures be taken to alleviate the impacts.
7. It was recommended that station design layout of shops be properly located and also prepare for safe evacuation in case of emergency.

- Meeting with Director Setthabut Bamphen School on Tuesday 24 July, 2012, 08.30-09.30 a.m. at meeting room on the 1st floor of Building No. 1.


Figure 10.2-5 Meeting with Director Setthabut Bamphen School

Questions and Suggestions:

1. Query as to the Project implementation period and when the Pink Line MRT Khae Rai - Min Buri would be put into operation.
2. Query on the MRT Network Junctions of the Pink Line and others.
3. Query as to detailed design of Setthabut Bamphen Station (PK 28) if it would block out the view of Setthabut Bamphen School and it's signboard.
4. In this regard, it was recommended to relocate stairs on the exit of PK 28 from the front of Setthabut Bamphen School to somewhere else.

- Meeting with Chief of Civil Department, Bang Khen District Office on Monday 26 July, 2012, 011.30-12.30 a.m. at his office.


Figure 10.2-6 Meeting with Chief of Civil Department, Bang Khen District Office

Questions and Suggestions :

1. Query as to the Project implementation period and when the Pink Line MRT Khae Rai - Min Buri would be put into operation.
2. Query on the MRT Network Junctions of the Pink Line and others.
3. Query on the design of the Safeguarding Constitutional Monument Station near Lak Si Circle.

4. Query on the design of Lak Si Station (PK 14) on Vibhavadee Rangsit Road.
5. Query on selection of MRT Car Type.

- Meeting with Chief of Civil Department, Khan Na Yao District Office on Monday 26 July, 2012, 01.00-01.30 p.m. at his office.

Figure 10.2-7 Meeting with Chief of Civil Department, Khan Na Yao District Office

Questions and Suggestions:

1. Query as to the Project implementation period and when the Pink Line MRT Khae Rai - Min Buri would be put into operation.
2. Query on the MRT Network Junctions of the Pink Line MRT Khae Rai - Min Buri and others.
3. Query as to details of stations within the area of Khan Na Yao District i.e. number, name and design of the stations.
4. Query as to opinion of Fashion Island Shopping Mall Executives on the East Outer Ring Station (PK 25).
5. Query on selection of MRT Car Type.
6. Query on the Project Public Hearing.
7. It was recommended that public consultation be held among those groups of people affected by the Project.

- Meeting with Governor Nonthaburi Province on Monday 6 August 2012 at the 2nd floor meeting room of Nonthaburi Provincial Hall.

Figure 10.2-8 Meeting with Governor Nonthaburi Province

Questions and Suggestions:

1. It was requested to review the improper route line adjustment in front of Muang Thong Thani from street isle to footpath that would affect residences and shops nearby.
2. It was recommended to relocate Muang Thong Thani Station (PK 09) to the entrance of Muang Thong Thani (Chaengwattana-Pak Kret 33 Alley).
3. As it was designated that a maintenance center and a park-and-ride building be situated on the land of Nonthaburi City Municipality near Sanambin Nam Intersection, public consultation should be done among the land owner and those affected landlords nearby.
4. It was recommended to relocate Nonthaburi Government Complex Station (PK 01) which would block out the view of Makut Rommayasaran Park.
5. Governor Nonthaburi Province was willing to assist in the process of public relations/participation by inviting relevant local authorities to the meeting. However, the Consultant must provide the Governor with necessary information and answers to each issue of recommendation prior to an upcoming regular meeting of the province scheduled on August 30, 2012.
6. Representatives of Nonthaburi Chamber of Commerce and Nonthaburi City Municipality disagreed on using Sanamb in Nam area of Nonthaburi City Municipality for construction of a maintenance center and a park-and-ride building since it had been planned for a public service building and recreational area. Therefore, a maintenance center and a park-and-ride building should be relocated to golf course of Royal Irrigation Department.

- Meeting with Director M in Buri District Office on Friday 10 August, 2012, 01.00-02.30 p.m. at his office.


Figure 10.2-9 Meeting with Director Min Buri District Office

Questions and Suggestions:

1. It was recommended to increase car parks for passengers and to consider probability of underground parking.
2. Discount on car park fee was recommended so that passengers would be affordable.
3. It was recommended that the last station be relocated far away from the city to accommodate passengers living on the outskirts and it would be convenient for car parking.
4. It was recommended that Min Buri Station (Thai Watsadu) be relocated to somewhere else without a problem of traffic congestion.
5. It would be preferable that MRTA use the same car system as that of BTS.

- Meeting with Director Bueng Kum District Office on Tuesday 14 August, 2012, 02.00-03.30 p.m. at his office.

Questions and Suggestions:

1. Query whether there would be land reclamations.
2. Query whether the designated 30 stations would be relocated if necessary.
3. Query as to the manufacturer of MRT car system.
4. Some designated stations adjacent to bus stops should be relocated a little bit further in order to avoid traffic congestion.
5. It was recommended that Ram Inthra 40 (PK 22) be relocated a little bit closer to the community.
6. It was recommended that Khu Bon Station (PK 23) be relocated a little bit closer to Khu Bon Alley for the sake of passengers from the community.

- Meeting with Director Nopparat Rajathanee Hospitalon Tuesday 14 August, 2012, 01.00-02.30 p.m. at his office.

Questions and Suggestions:

1. Location of Nopparat Rajathanee Station (PK 26) was agreed upon ; however, the exit stairs descending to the hospital was not acceptable since there was limited space in front of the hospital.
2. Ask for comparison (advantages vs disadvantages) between Monorail and Heavy Rail Systems.
3. Ask for information on preliminary design of PK 26.

- Meeting with Abbot and Property Caretaker of Wat Phra Si Maha That Woramahawihan on Thursday 16 August, 2012, 03.30-05.00 p.m. at the temple.

Figure 10.2-10 Meeting with Abbot and Property Caretaker of Wat Phra Si Maha That Woramahawihan

Questions and Suggestions:

1. The Abbot had no objection to reclamation of the land which had been rented by government authorities, state enterprises and educational institutes.
2. The Property Caretaker suggested that the Consultant design an underground car park in the area of water pond in front of the Wat for the sake of passengers.
3. The Abbot and the clergy agreed upon connection between Green Line and Pink Line MRTs at the Circle of Constitution Safeguarding where the Wat remains intact and it would be convenient for passengers.
4. The Consultant was requested to submit a written notice about impacts on the Wat so that the clergy would take into further consideration.
5. The Consultant was suggested to explain to the tenants about impacts of the Project.

- Meeting with Director Min Buri District Office on Tuesday 21 August, 2012, 09.00-12.00 a.m. at the office meeting room.

Figure 10.2-11 Meeting with Director Min Buri District Office

Questions and Suggestions:

The Project development was agreed upon with an exception proposed by MPM in Buri District to adjust the route line from Siha Buranukit Road to Suwinthawong Road in order to avoid traffic congestion.

- Meeting with President of Phranakhon Rajabhat University on Wednesday 22 August, 2012, 01.00-02.00 p.m. at the university meeting room.

Figure 10.2-12 Meeting with President of Phranakhon Rajabhat University

Questions and Suggestions:

1. It was recommended to relocate the route of the Pink Line MRT Khae Rai-Min Buri to the opposite side of the university so as to incur no impact.

- Meeting with Executives of IT Square Lak Si Department Store on Thursday 23 August, 2012, 09.00-10.30 a.m. at the office meeting room.

Figure 10.2-13 Meeting with Executives of IT Square Lak Si Department Store

Questions and Suggestions:

1. It was acceptable to connect the Pink Line MRT Station to IT Square Lak Si Department Store; however, more information was needed for further decision making.

- Meeting with Executives of Max Valu Shopping Center Lak Si Branch on Thursday 23 August, 2012, 01.00-02.30 p.m. at the office meeting room.

Questions and Suggestions:

1. The Project was agreed upon and the executives were interested in jointly developing a car park in front of Max Valu Shopping Center Lak Si Branch.

- Meeting with Director, Central Chest Institute of Thailand on Friday 24 August, 2012, 09.00-10.00 a.m. at meeting room ofthe institute.

Figure 10.2-14 Meeting with Director, Central Chest Institute of Thailand

Questions and Suggestions:

1. The Director was concerned about noise impact on the six-storey nurse dormitory.
2. The Director suggested that the station in front of the institute be relocated to the position of a pedestrian flyover near a bus stop so as not to block out the institute signboard.

- Meeting with Director General of the Department of Highways on Monday 27 August, 2012, 09.00-12.00 a.m. at the meeting room in Phahon Yothin Building.

Figure 10.2-15 Meeting with Director General of the Department of Highways

Questions and Suggestions:

1. It was recommended that Nonthaburi Government Center Station (PK 01) be an interconnection between the Purple Line MRT Bang Yai-Bang Sue and the Pink Line MRT Khae Rai-Min Buri.
2. There was no objection to development of the Pink Line MRT Project; however, detailed design drawings must be submitted to Department of Highways for further consideration.
3. Space between Muang Thong Thani Station (PK 09) and the street is about 5 meters whereas it is required by the law to keep a distance of 4.2 meters. However, it is recommended to revise the space to 5.5 meters as a normal practice.
4. Department of Highways (DOH) has planned to construct a flyover at Sanambin Nam Intersection in the near future. Therefore, it was proposed that MRTA and DOH jointly redesign the intersection flyover integrating common structure with the Pink Line MRT. This would also be applicable for other flyovers at Samakkhi Intersection and Nopparat Rajathanee Hospital.
5. It was recommended that Lak Si Station be relocated to IT Square Lak Si Shopping Center because it would be convenient for interconnection with the Red Line MRT Bang Sue-Rangsit .Moreover, the proposed location is under the responsibility of Lak Si Depot Highway that has a plan for connection with Toll Way.

- Meeting with Manager of the Metropolitan Waterworks Authority, Bang Khen Branch Office on Monday 27 August, 2012, 09.00-12.00 a.m. at his office meeting room.



Figure 10.2-16 Meeting with Manager of the Metropolitan Waterworks Authority, Bang Khen Branch Office

Questions and Suggestions:

1. Detailed design of the Pink Line MRT KhaeRai-Min Buri at Lak Si Circle shall be submitted for consideration for fear of obstruction or damage to existing utilities because a water pipeline was embedded under the street isle.

(b) Small group meetings held 6 times :

Meeting No. 1 Residents in Pak Kret City Municipality, Nonthaburi Province

Tuesday 28 August 2012, 08.30-12.00 a.m. at meeting room of Pak Kret City Municipality

- President of Kritsada Nakhon Community disagreed with the designated location of Muang Thong Thani Station (PK09) on the footpath in front of the community. In this regard, he proposed to demolish the existing pedestrian flyover in front of Muang Thong Thani and reroute the MRT over the street isle.
- Mayor of Pak Kret City Municipality agreed on the relocation of Pak Kret Station from Kai Takra Restaurant to Pak Kret Intersection which was closer to the community but more pieces of land must be reclaimed.

Meeting No. 2 Residents in Bang Khen District

Tuesday 28 August 2012, 01.30-04.00 p.m. at meeting room of Bang Khen District Office

- As MRT route must give way to an existing pedestrian flyover at the Constitution Safeguarding Circle on the side of Max Valu Shopping Center (Lak Si Square Branch), a portion of land to be reclaimed is 700 meters long and 6 meters wide, still people in the affected area have never known about an exact reclamation before.

Meeting No. 3 Residents in Nonthaburi City Municipality, Nonthaburi Province

Wednesday 29 August 2012, 08.30-12.00 a.m. at meeting room of Central Chest Institute of Thailand

- It was recommended that the Consultant ask the Department of Highways whether there would be a construction of a flyover across Sanamb in Nam Intersection otherwise Sanamb in Nam Station should be relocated to the Quartermaster Royal Thai Army being closer to the intersection.

Meeting No. 4 Residents in Lak Si District

Wednesday 29 August 2012, 01.30-04.00 p.m. at meeting room of Lak Si District Office

- There was no objection to the Project development, still more information needed are exact locations of entrance and exit as well as an interconnection with the Red Line MRT at IT Square Shopping Center.

Meeting No. 5 Residents in Khan Na Yao District

Thursday 30 August 2012, 08.30-12.00 a.m. at meeting room of Khan Na Yao District Office

- Representative of the affected people residing in an area of RamInthra 6 Km. station requested to relocate the station closer to Nuan Jan Intersection as much as possible for the sake of passengers.
- Representative of the affected people residing in an area of Khu Bon Intersection requested to relocate the station closer to Khu Bon Inter section as much as possible for the sake of passengers.
- It was proposed to design a temporary car park for picking up passengers in order to avoid traffic jam.
- It was proposed to use co-tickets for boarding interconnecting lines of MRT Network in order to save passengers' cost.
- Most people in the community have been worried about impacts during construction on surrounded buildings.

Meeting No. 6 Residents in Min Buri District

Thursday 30 August 2012, 01.30-04.00 p.m. at meeting room of Min Buri District Office

- Mr. Wirat Meenchainan, Member of BMA Council proposed to reroute the line heading to Suwintawong Road i.e. access through Sihaburanukit Road and Min Buri Station because of traffic congestion.

  Nevertheless, residents along Min Buri Station Route agreed on the designated route according to a master plan of Office of Transport and Traffic Policy and Planning and they accepted more land reclamation for Min Buri maintenance center.

(c) Public Consultation/Public Hearing

Public Consultation/Public Hearing was held on Tuesday 25 September 2012, 08.30-12.00 a.m. at Miracle Grand Convention Hotel, Lak Si in order to give information on the Project to stakeholders especially people residing along the route and to obtain some opinion/suggestion from the participants.

Target groups comprised representatives of government authorities/state enterprise, educational institutes, hospitals, people in the project community, those interested in the Project, the press e.g. newspaper, TV and radio, etc. Total participants are 526 persons.

Opinion/suggestion raised by the participants are as follow.

Engineering design, interconnection and station design

- Representatives of Kritsadanakhon Community in front of Muang Thong Thani proposed to demolish a pedestrian flyover across Muang Thong 3 Intersection then locate the Pink Line MRT at the position of street isle. The designated station at the existing deserted petrol station near an expressway was not acceptable, instead it was suggested to move to the front of Muang Thong Thani (Chaengwattana 33 Alley).

- Request upon station review resulted in more stations from 24 to 30 to accommodate passengers going to shopping malls/department stores e.g. Central Plaza Chaengwattana, Big C Chaengwattana etc.
- Community heads proposed to review the Pink Line MRT connection with Chaengwattana Government Center where there would be a lot of passengers.
- Community heads proposed a single rate fee of 20 baht for each trip and to use co-tickets for boarding interconnecting lines of MRT Network in order that passengers would be affordable and convenient.
- Request upon sufficient car park especially at government centers and other major spots.
- As for Min Buri Route, there are 2 alternate ways i.e. Sihaburanukit Roador Suwinthawong Road.

  Those supported the design across Suwinthawong Road which connects tom any other roads for following reasons:

  1. Less density of Min Buri Community
  2. Expansion of the city for future development
  3. More convenience for people around Min Buri District e.g. Nong Jok Community
  4. Lower rate of land reclamation than that of Min Buri Market area

  With regard to the proposed route across Suwinthawong Road, skywalks should be constructed to connect Min Buri District Center.

  Those supported the design across Sihaburanukit Road for following reasons :

  1. Less traffic congestion inside Min Buri District Center because of MRT service
  2. Min Buri is center of transport on the east outer ring comprising buses, minivans and ships. The Pink Line MRT is expected to fulfill the transport system and it should also be integrated to other means of transport.
  3. Min Buri is also center of business and government affairs.
  4. No impacts on existing drainage system or areas reserved for agriculture (green-strip areas allocated in Bangkok Metropolitan Master Plan).

- Representatives of Maiyalap Community proposed to shift the station to the front of National Housing Authority Apartment in order not to affect the existing shops (construction materials and automobile traders).
- Development of the Pink Line MRT should consider integration of other means of transport for the sake of passengers e.g. buses, minivans and etc.

- Representatives of Nopparat Rajathanee Hospital proposed to review the station design (PK 26) in front of the hospital not to obstruct the ambulance going in and out.
- It was proposed to revise design of Ram Inthra 40 Station (PK 22) to be above the intersection for passengers' convenience.
- Representatives of Sailom Community supported the project development and agreed with the station location. Thus, the public and government authorities concerned should fully support the Project.
- Representatives of Tiwanon Community acknowledged that there would be neither maintenance center nor park-and-ride building in Sanambin Nam Area so as not affect land use of Nonthaburi City Municipality.

Environmental Issues

- It was proposed to appoint a joint committee being responsible for solving problems in land reclamation for 30 stations construction including reasonable compensations.
- It was acceptable that monorail MRT would have less noise impact than heavy rail MRT.

Public Participation and Public relations

- Representatives of Min Buri Community argued that most people still had no information on the Project and conclusions of the public consultation held on Saturday 22, 2012 so those attendants did not represent the community.

10.3 PUBLIC RELATIONS

Thai society nowadays has been focusing on information perception in order to cope with fast changes. Mass media particularly social media such as the internet has powerful influence in convincing or persuading the message receivers to believe and or to change their minds or attitudes.

In this regard, the Project Public relations by mass media is an effective way to convey the key messages to the public nationwide. Summary report on the activities are as follows.

(1) Objectives

- To give information and progress of the Project to the target groups
- To get feedbacks including proposals and complaints so that revisions or timely clarifications could be made
- To have more supporters which leads to the Project success
- To create positive image for the Project as well as the Owner

(2) Target groups

- Same target groups as the activities of Public Participation including people and all branches of mass media

(3) Implementations

(a) PI Activity There are 3 main categories of activity i.e. publication/ broadcast of activities through mass media, press conference and interviews.

(i) Publication/broadcast of activities through mass media : Public Consultation/Public Hearing was held on Tuesday 25 September 2012, 08.30-12.00 a.m. at Jupiter Room, Miracle Grand Convention Hotel, Lak Si.

There were 18 mass media 22 persons participated in the seminar comprising 2 TV Channels i.e. Channel 11 and Nation TV, Radio Thailand and 14 Newspapers i.e. Thairath, Daily News, Khao Sod, Matichon, Naewna, Bangkokbiz news, Post Today, Daily World Today, Prachachat, Thansettakij, Home Buyer Guide Magazine and Condo guide Magazine.

(ii) Press conference: On Tuesday 25 September 2012, at Virgo Room, Miracle Grand Convention Hotel, Lak Si, there was a press conference giving information on conclusion of the Project design review and preparation of bidding document.

There were 18 mass media 22 persons participated in the press conference including TV, radio and newspaper.

Executive Interviews on radio: 4 times on different stations i.e. FM 96.5 MHz, Jor Sor 100 FM 100 MHz, Communication Police FM 91.1 MHz and 106 Family News FM 106 MHz.

(b) Advertising Media There were many types of PR document publication and production of visual media which were distributed or displayed to the public, mass media and all stakeholders as follows.

(i) Printing Media :

- **Leaflet** 5,000 pieces (as shown in ***Figure 10.2-17***) giving information on the Pink Line MRT Project-Background, Scope of work, Route and Stations and activities of public participation. These were distributed in focus group meetings, public consultation with government officials/ private sectors and interested people.
- **Brochure** 2,000 pieces (as shown in ***Figure 10.2-18***) giving details of the Project including conclusions of study review of engineering, economy, environmental impacts and implementation of public participation. These were distributed in the seminars/meetings.

Figure 10.2-17 Leaflet Giving Information on the Pink Line MRT Project

Figure 10.2-18 Leaflet Giving Information on the Pink Line MRT Project

(i) Exhibition Board 10 pieces giving details of the Project including route, stations, maintenance centers, park-and-ride buildings and interconnections with other MRT Lines. These were exhibited in front of the seminar/meeting rooms for preliminary information prior to the meeting.

(ii) Visual Media There were 2 sets of video presentation i.e. Animation and Pictures with narration/description and overall project video presentation in Thai and English languages.

(4) Website www.monorialpinkline.com (as shown in ***Figure 10.2-19***)

Figure 10.2-19 Main Page of the Project Website