

2) Two-Dimensional Finite Element Analysis

a) Sta.25+320 (BH-1: At Slope Area)

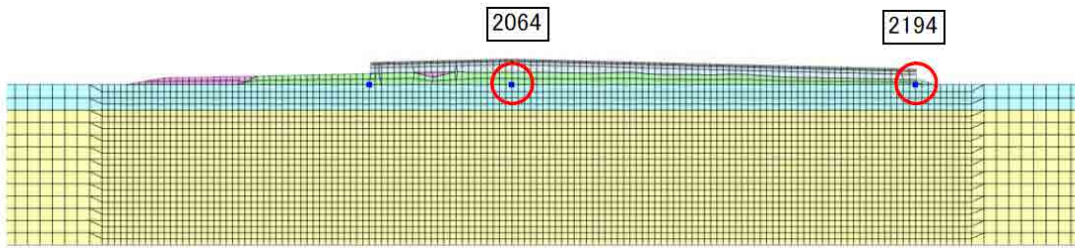


Figure 2-2-2-9.10 Node Point (Sta.25+320)

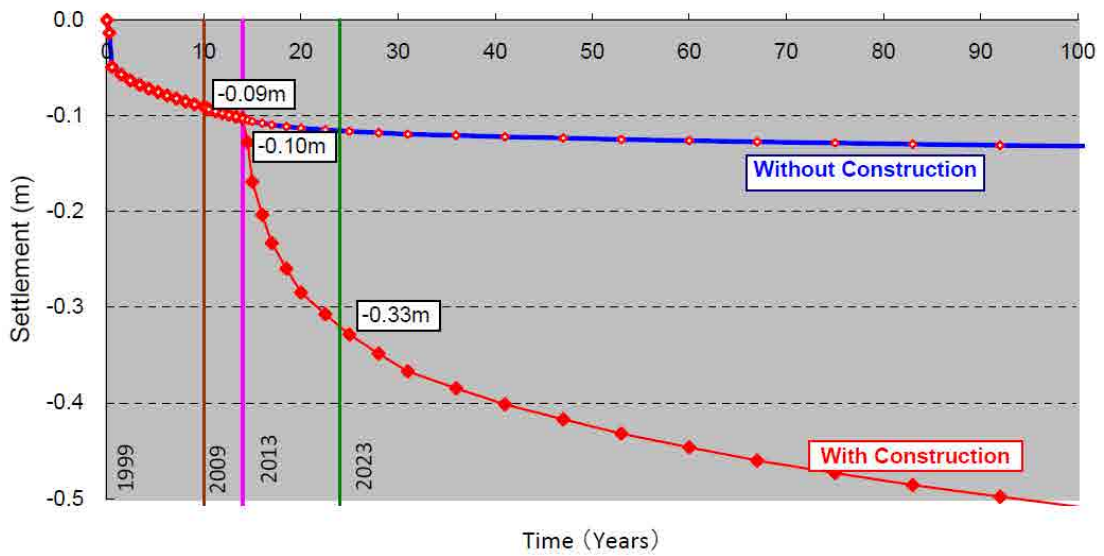


Figure 2-2-2-9.11 Time-Settlement Curve at Node 2064 (Sta.25+320)

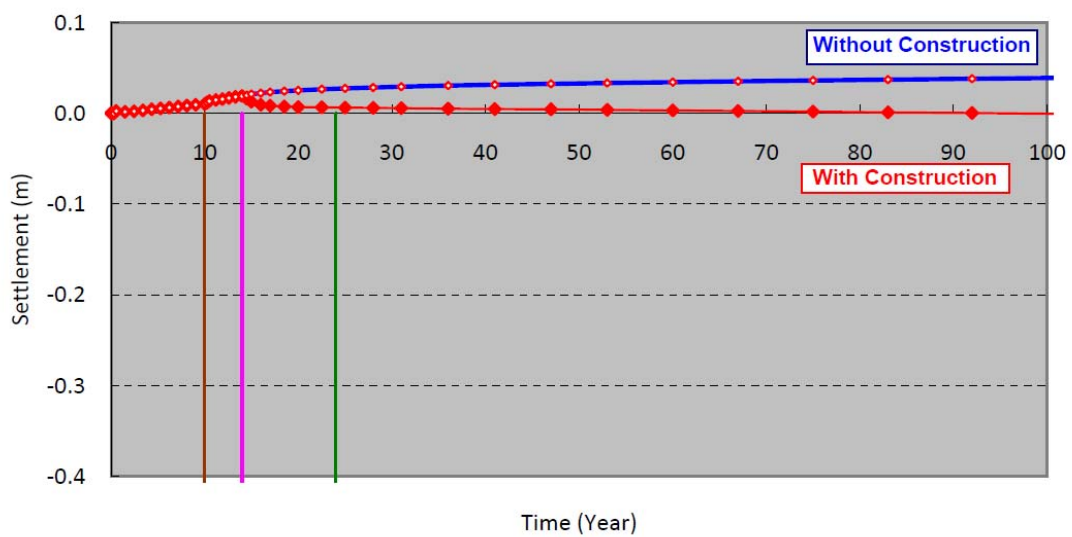


Figure 2-2-2-9.12 Time-Settlement Curve at Node 2194 (Sta.25+320)

b) Sta.25+320 (BH-1: On Carriage Way)

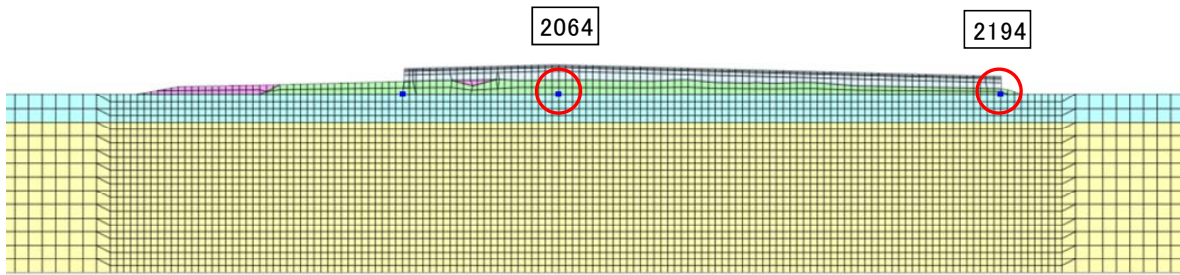


Figure 2-2-2-9.13 Node Point (Sta.25+90)

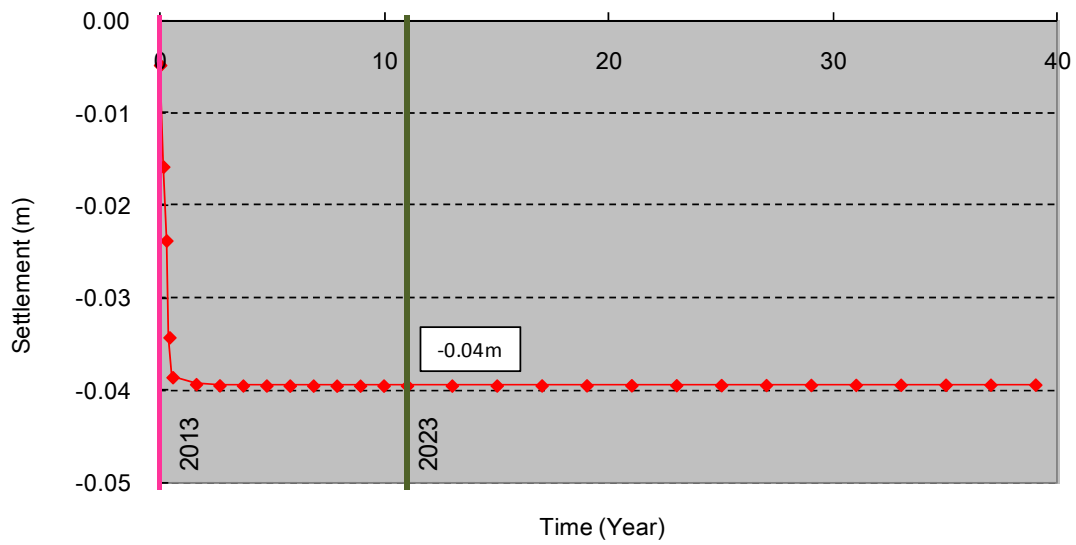


Figure 2-2-2-9.14 Time-Settlement Curve at Node 2194 (Sta.25+90)

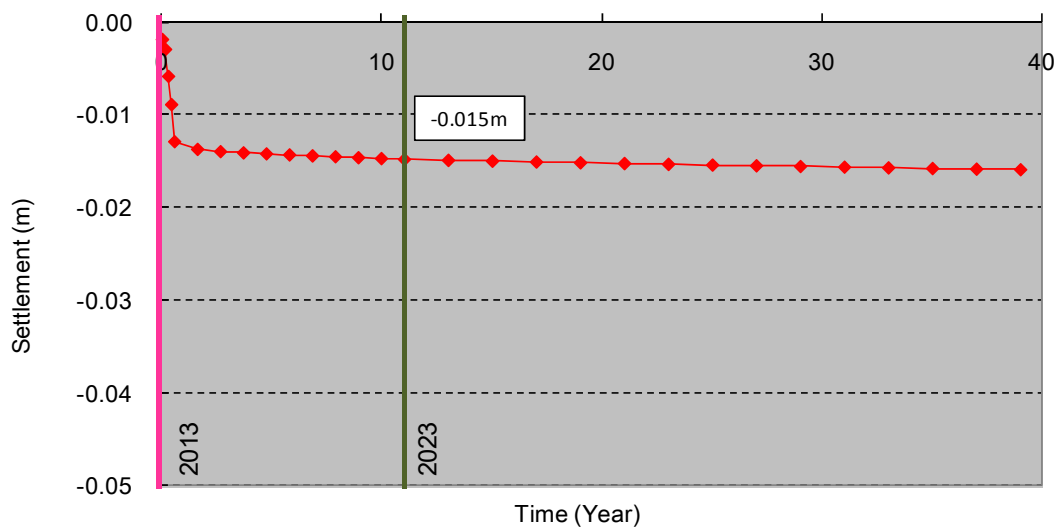


Figure 2-2-2-9.15 Time-Settlement Curve at Node 2194 (Sta.25+90)

c) Sta.16+700 (BH-3: At Slope Area)

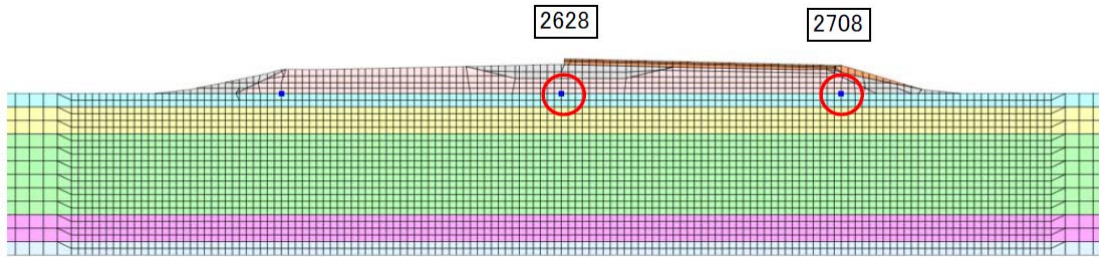


Figure 2-2-2-9.16 Node Point (Sta.16+700)

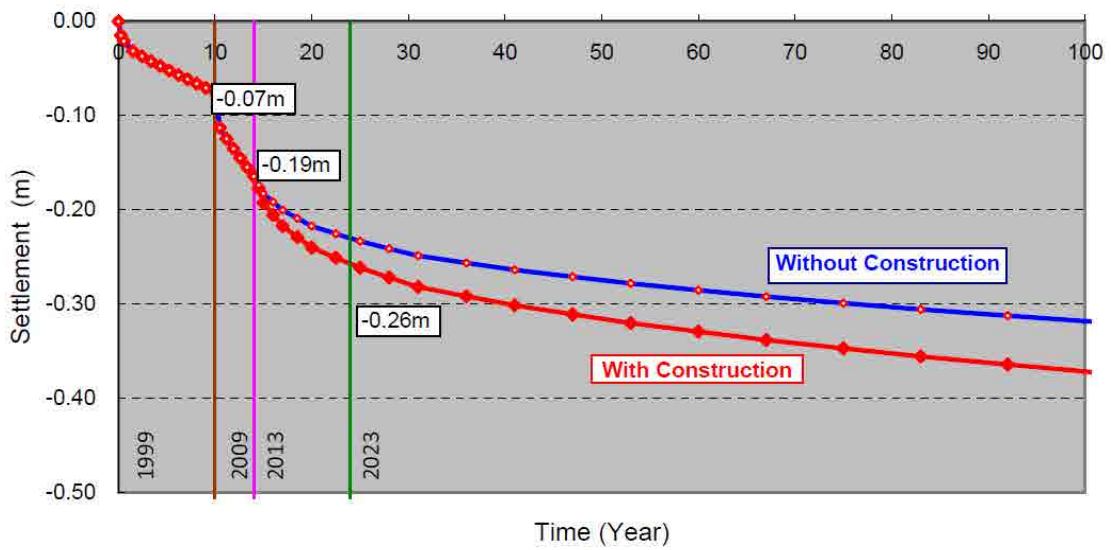


Figure 2-2-2-9.17 Time-Settlement Curve at Node 2628 (Sta.16+700)

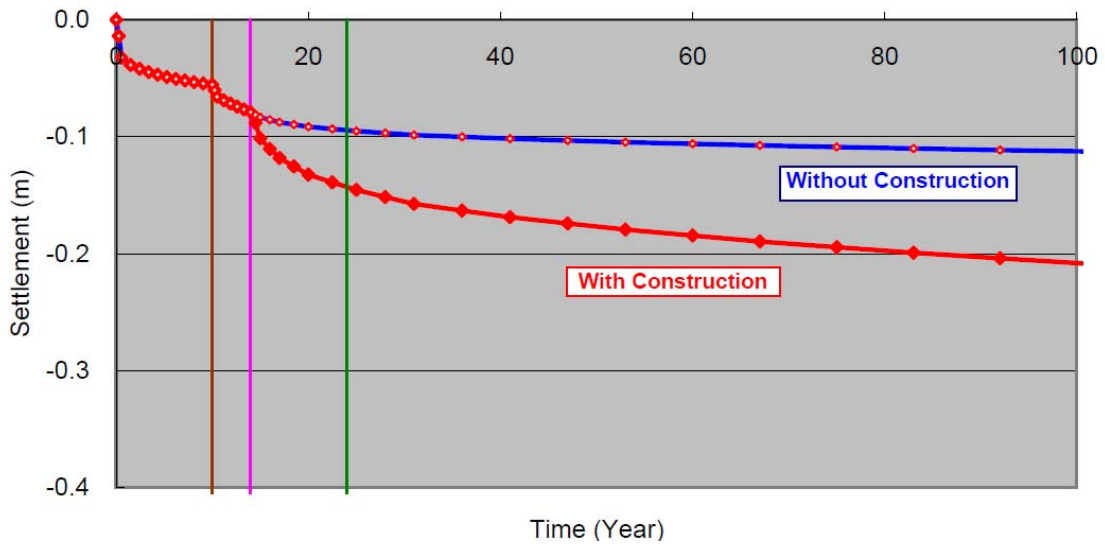


Figure 2-2-2-9.18 Time-Settlement Curve at Node 2708 (Sta.16+700)

d) Sta.16+700 (BH-3: On Carriage Way)

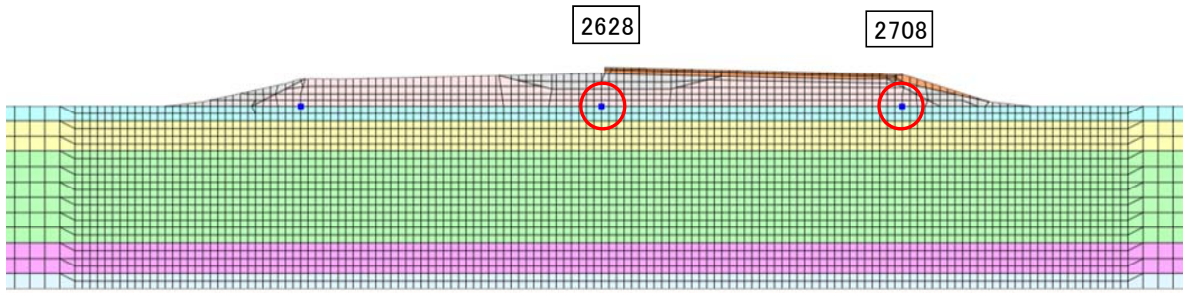


Figure 2-2-2-9.19 Node Point (Sta.16+700)

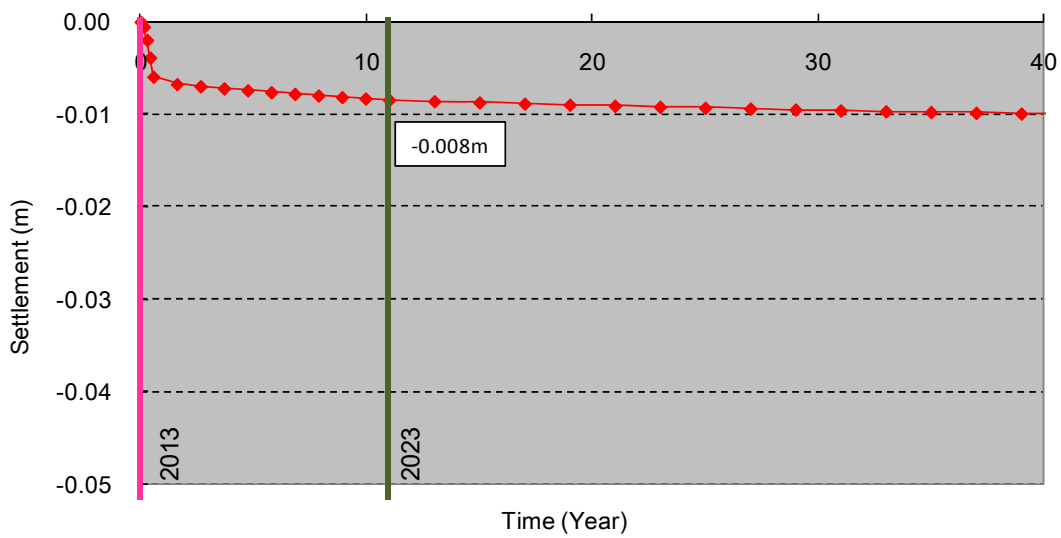


Figure 2-2-2-9.20 Time-Settlement Curve at Node 2628 (Sta.16+700)

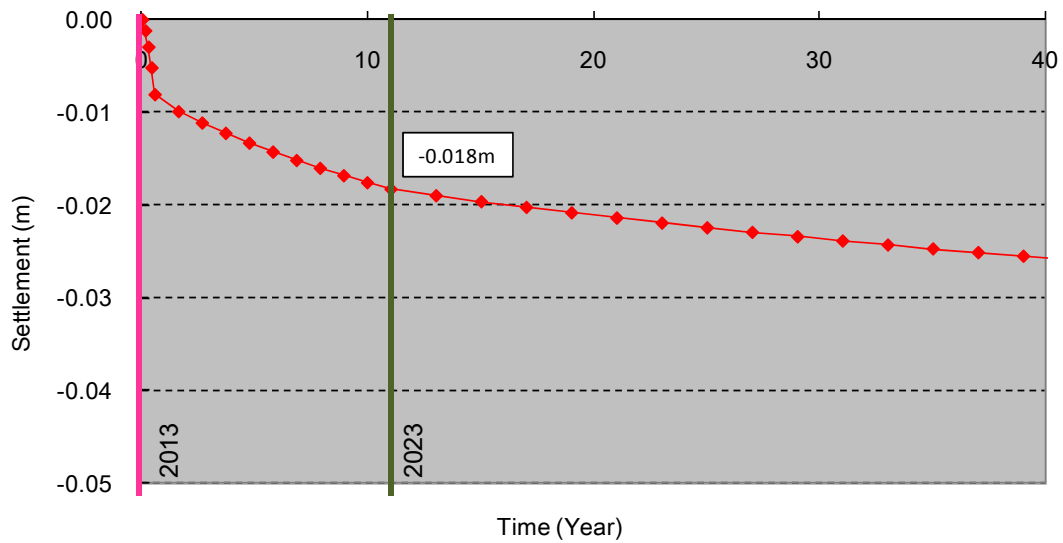


Figure 2-2-2-9.21 Time-Settlement Curve at Node 2708 (Sta.16+700)

(4) Conclusion

Table3 shows the summary of consolidation settlement. There are few difference in the result based on one dimensional analysis due to the assumption which the coefficient of permeability never changes during calculation.

As mentioned above, when using the ground constant of slope area, previous consolidation was considered from 1999. When using the ground constant of carriage way, consolidation calculation was conducted from 2012 without considering previous consolidation.

In the case of using ground constant of slope area, the settlement degree is estimated as 20 cm at toll gate area. On the other hand, the settlement degree is estimated as 4 cm at standard section using ground constant of carriage way. The reasons of difference between them are thought as follows;

- Consolidation with progressive by embankment and traffic loading
- Previous consolidation time

Although the boring survey of BH-1 and BH-3 was conducted at about same point respectively, the thicknesses of soft clay layer are different. It is difficult to estimate the geological distribution of the objective area from the results of boring survey. Therefore, estimated consolidation settlement degree in this project shall be set considering safety side shown below.

- ✓ **Toll Gate Area** : **-23cm from proposed height at design center line**
- ✓ **Standard Section** : **-7cm from proposed height at design center line**

Table3 Summary of Consolidation Settlement

| | | Around Sta.25 (Toll Gate) | | Sta.16+700 (Standard Area) | |
|----------------------------------|----------|---------------------------|-----------------|----------------------------|-----------------|
| | | At Slope Area | On Carriage Way | At Slope Area | On Carriage Way |
| Height of Embankment (Average) | | 0.9m | | 0.4m | |
| Width of Embankment | | 43m | | 19m | |
| Thickness of Consolidated Layer | | 11m | 8m | 9m | 8m |
| Estimated Settlement (1999~2013) | One-Dim. | 0.23m | — | 0.28m | — |
| | Two-Dim. | 0.10m | — | 0.19m | — |
| Estimated Settlement (2013~2023) | One-Dim. | 0.19m | 0.21m | 0.04m | 0.04m |
| | Two-Dim. | 0.23m | 0.04m | 0.07m | 0.02m |

(5) Measures to be Considered in Near Future

1) Allowable Consolidation Settlement

The purpose of the Project is to secure the function of logistic network even in the time of flood disaster (similar to 2011 flooding), by raising the 4 lanes on the north bound roadway surface of the Outer Bangkok Ring Road. To achieve this purpose, the road elevation to be raised in the Project was established in the preparatory survey and is as follows:

Toll Gate Section: Plus ten (+10) cm from the largest recorded level in 2011

Reason: Toll gate, especially toll booth where toll fee is collected at hand, should not be affected

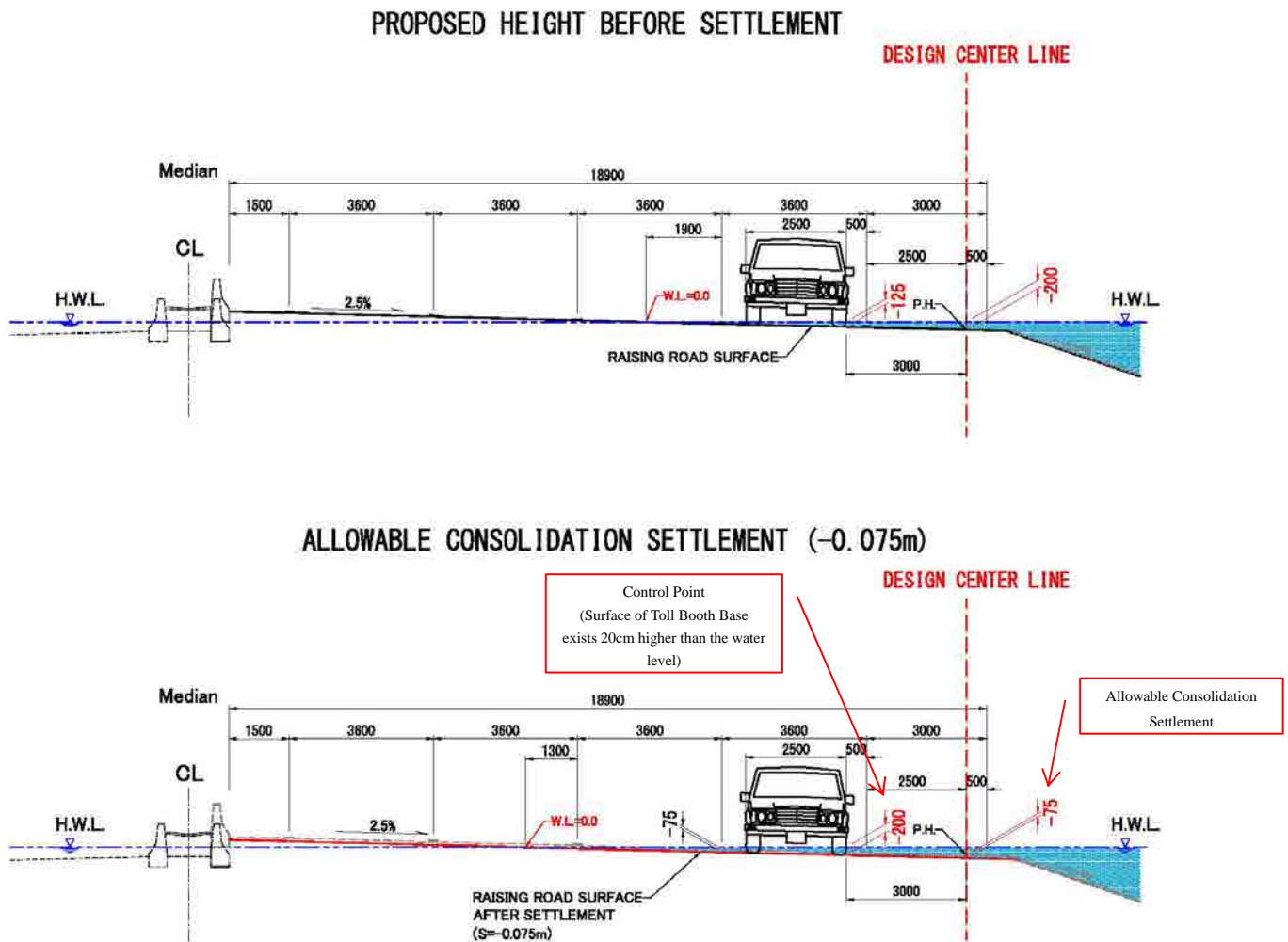


Figure 2-2-2-9.23 Allowable Consolidation Settlement at Standard Section

2) Warranty Period (One year after completion)

Based on the analysis, the anticipated degree of the consolidation settlement during the warranty period is about 3.1 cm in the toll gate section and about 1.3cm in other section (refer to **Table 2-2-2-9.4** and **Table 2-2-2-9.5** respectively).

As aforementioned, the analysis illustrates the occurrence of a settlement to the certain degree in the overall objective road. The settlement appears to uniformly occur. Given the condition, the anticipated degree of the consolidation settlement is not considerable enough to seriously affect the pavement structure. However, this analysis result does not guarantee the degree of the consolidation settlement mentioned above, and there is a possibility of the consolidation settlement to a larger extends than assumed. Thus, since the countermeasures for the anticipated consolidation settlement in the detail design is not considered, it is proper that the obligation for the settlement should be exempted in the warranty.

Table 2-2-2-9.4 Time-Variable Settlement at Toll Gate Area

| Period | Settlement Degree | | Remarks |
|--------------|------------------------|-------------------|---------------------------|
| | Accumulated Settlement | Annual Settlement | |
| 1999 to 2013 | 10.3cm | — | Affected by Existing Road |
| 2014 | 16.9cm | 6.6cm | During Construction |
| 2015 | 20.0cm | 3.1cm | Warranty Period |
| 2023 | 32.8cm | 12.8cm | Performance Period |
| | 計 | 22.5cm | |

Table 2-2-2-9.5 Time-Variable Settlement in Standard Section

| Period | Settlement Degree | | Remarks |
|--------------|------------------------|-------------------|---------------------------|
| | Accumulated Settlement | Annual Settlement | |
| 1999 to 2013 | 16.4cm | — | Affected by Existing Road |
| 2014 | 19.2cm | 2.8cm | During Construction |
| 2015 | 20.5cm | 1.3cm | Warranty Period |
| 2023 | 26.1cm | 5.6cm | Performance Period |
| | 計 | 9.6cm | |

To justify the cause of the defects, it is necessary to request that DOH conduct the periodical measurement for the degree of the settlement after the construction completion, keep watch and measurement for any defects related to the settlement if discovered. Also, in order for two sides to agree with the warranty against defects, the nature, the necessary information and extent of the defects, which clearly indicates the relation of the work with the defects, should be collected and shared between two sides.

After the warranty period, the Client, the Contractor and the Consultant should have discussion on it, based on the collected data, and decide the repair point.

The allowable degree of the dysfunctional defects such as Rutting should be discussed and agreed upon before the completion of the construction.

3) Performance Period of the Pavement (After Warranty Period)

It is requested that after warranty period, the implementing organization, DOH, carries out the periodic inspection for the consolidation settlement and properly maintains the objective road. When the aforementioned degree of the consolidation settlement occurs, for example, it should be of a necessity to raise elevation level of the objective road, conducting the overlay method in order to keep functionalizing the objective road.

2-2-2-10 Application of Modified Asphalt Concrete

(1) Outline

Modified asphalt concrete is a type of asphalt having high fluidity and abrasion produced by mixing straight asphalt with a polymer or rubber. In Japan, application of modified asphalt concrete commercially started from 1963.

(2) Application in the Project

DOH added specifications of the modified asphalt concrete in 2006, and started the trial construction through pilot projects. Modified asphalt concrete is mainly used in the section with high number of heavy and oversized vehicles.

There are 6 construction sites where modified asphalt concrete has been applied. The location of these sites are shown in **Figure 2-2-2-10.1**,

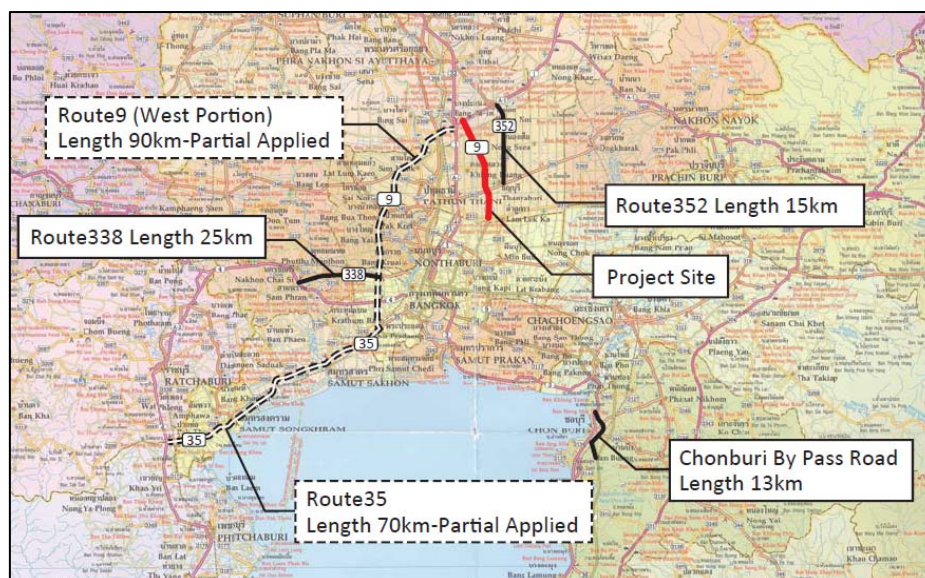


Figure 2-2-2-10.1 Construction Sites by using Modified Asphalt Concrete

(3) Pavement of Objective Section

According to the survey conducted by DOH, the traffic volume of the objective road was 29,600 vehicles in 2010. Of them, 4,000 are oversized vehicle. The objective road has been in service for almost three years. The traffic lane of the left edge (outermost lane), where much of the oversized traffic ply, is particularly rutted. According to visual judgment, the depth is about 1cm.

(4) Justification of Use in the Project

Considering the policy for application of modified asphalt concrete in Thailand and the current application conditions, the use of modified asphalt in this project is justified for the reasons mentioned below.

- ✓ Modified asphalt concrete has been adopted on lanes having high oversized vehicle (the heavy traffic volume of the objective road was 4,000 vehicles as of 2010).

- ✓ Modified asphalt concrete is being used on other roads subject to rehabilitation.
- ✓ Rutting due to heavy traffic can be observed along the objective road also. This is considered to deteriorate in the future causing difficulty in securing safety and smooth traffic flow.

(5) Policy of Applying Modified Asphalt Concrete

In consideration with the present conditions and economic efficiency, policy for applying modified asphalt concrete is set as below.

- ✓ Polymer modified asphalt concrete will be applied at the toll gate area. In comparison to other sections, the pavement at the toll gates and toll gate area (Sta.24+875 - Sta.25+600:725m), is more exposed to extra load from the vehicles due to breakings and idling and sudden acceleration. In other area (Sta.24+400 - Sta.25+725:475m) in toll gate area, asphalt concrete shall be applied for all lanes.
- ✓ In other area except above, Polymer modified asphalt concrete will be applied to two (2) outer lanes for heavy traffic.

(6) Quality Control of Modified Asphalt Concrete

Investigation results from quality control perspective of modified asphalt concrete in Thailand are as shown as blow.

1) Specification

DOH has the specification for quality control of modified asphalt concrete. However, there is no specification related to post-construction stage.

- a) Material
- b) Mix Design
- c) Machine and Equipment
- d) Pre-Construction Preparation
- e) Construction Stage

2) Test for Checking Quality

Marshall Test has been applied for quality control for modified asphalt concrete and DOH does not have Wheel Tracking Test Machine which is used to measure the plastic deformation.

At present, DOH Bureau of Material Analysis and Inspection Division have two Wheel Tracking Test Machines, one is rubber wheel and another is iron wheel which is old and out of order. Normally, they are used for the research only.

3) Presence of Wheel Tracking Test Machine

No universities and institutes in Bangkok have Wheel Tracking Test Machine. However, the Soil Testing Siam Company has this machine. However, the system is based on Europe Standards and

is not leased or rented.

4) Policy for Quality Control

The modified asphalt concrete has not been applied in any sections in this project. However, a part of the west side of Route 9 is being constructed for about 90km using modified asphalt concrete.

In Thailand, modified asphalt concrete is applied only to surface course of pavement in the area with high traffic volume of oversized vehicle. Generally, it is considered that dynamic stability increases to apply modified asphalt concrete to both of surface course and binder course. In Japan, it is applied mostly when traffic volume exceeds 3,000 vehicles per day

Sometimes modified asphalt concrete is only applied to surface course in highways since effects of sudden acceleration, frequent application of brakes and low speed running vehicles, are smaller than in general roads.

According to the above, the roads where modified asphalt concrete was applied have been increased. However, the tests to check the durability has never been done after design and construction. Specially, dynamic stability test which is very important to check the quality of modified asphalt concrete has never been carried out.

In planning application of modified asphalt concrete, performance evaluation of modified asphalt concrete shall be conducted to confirm dynamic stability so that the performance period can be ensured for 10 years.

2-2-3 Outline Design Drawing

The design drawings that have been already prepared and the drawings that are scheduled to be prepared under this Project are listed in **Table 2-2-2-10.1** respectively.

Table 2-2-2-10.1 List of Design Drawings

| | |
|--|--|
| 1. GENERAL | |
| 1-1 | PROJECT LOCATION MAP |
| 1-2 | ALIGNMENT LAYOUT |
| 2. MOTORWAY | |
| 2-1 | TYPICAL CROSS SECTIONS |
| 2-2 | PLAN / PROFILE OF MOTORWAY |
| 2-3 | PLAN / PROFILE OF RAMP AND FRONTAGE ROAD |
| 2-4 | CROSS SECTIONS |
| 3. TOLL GATE | |
| 4. PEDESTRIAN OVERPASS FOR TOLL GATE ACCESS | |
| 5. DRAINAGE WORK | |
| 5-1 | HEIGHT ADJUSTMENT OF EXISTING CATCH BASIN AT MEDIAN |
| 5-2 | HEIGHT ADJUSTMENT OF EXISTING CATCH BASIN AT SHOULDER |
| 5-3 | DETAILS OF INLET CATCH BASIN AT MEDIAN & PIPE CULVERT |
| 5-4 | DETAILS OF OUTLET CATCH BASIN AT SHOULDER |
| 5-5 | DETAILS OF INLET / OUTLET PROTECTION |
| 6. MEDIAN WORK | |
| 6-1 | CONCRETE BARRIER |
| 6-2 | L-TYPE PRECAST CONCRETE WALL |
| 6-3 | DETAILS OF SIGN POST AT MEDIAN |
| 7. SAFETY WORK | |
| 7-1 | DETAILS OF GUARDRAIL |
| 7-2 | DETAILS OF GUIDE POST |
| 7-3 | DETAILS OF SIGN POST |
| 7-4 | DETAILS OF SIGNAGE & PAVEMENT MARKING |
| 7-5 | DETAILS OF REUSING FACILITIES |
| 7-6 | STAIRWAY WORK |
| 8. TRAFFIC MANAGEMENT DURING CONSTRUCTION | |

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The basic prerequisites for implementation of this project under Japan's 'Grant Aid for Disaster Prevention and Reconstruction' are as follows:

- This project will be implemented under the Grant Aid Scheme of the Government of Japan (GOJ) after signing of the Grant Aid Exchange of Notes (E/N) for this project by the Government of both countries followed by the signing of the Grant Agreement (G/A) for the project by JICA and the project implementation organization of Thai Government.
- The executing agency for the implementation of the project is Department of Highways (DOH), the Ministry of Transport (MOT) of the Kingdom of Thailand.
- The consulting services including tender-related works and construction supervision services will be provided by a Japanese consulting firm in accordance with the consultancy contract that shall be executed with Department of Highways.
- The construction of the rehabilitation work of this project will be executed by a Japanese construction firm that shall be selected through pre-qualification and bidding, in accordance with the construction work contract that shall be executed between the said construction firm and GOT.

The basic policies for the construction/procurement of this project are as follows:

- The equipment, materials and labor for construction shall be, as much as possible, procured locally. In cases where local procurement is not possible, they shall be procured either from a third country or from Japan where it is most economical insofar as the required quality and supply are secured.
- Construction method and the construction process shall be consistent with the local climate, topography, geology and natural conditions including the river characteristics.
- Appropriate and rational planning shall be carried out including construction method, machinery, equipment, skilled labor etc.
- Construction work will be conducted on a motorway (full access-controlled motorway) and requires occupying its area. Facilities (concrete barrier, barricade, temporary traffic signs, guardsman) for securing the traffic route and traffic safety during the construction period will be provided adequately and in accordance with the requirements for motorways in Thailand. Discussions and close coordination with the implementing organization (DOH) will be conducted when establishing the construction plans and determining the order of construction.
- Select areas designated by the GOT (DOH) for disposal site for debris of asphalt, concrete, and waste soil generated during construction, construction yards to install plants or to store temporary concrete barriers and contribute in the preservation of the environment by reducing

the influence of environment.

2-2-4-2 Implementation Condition

The Objective road of this project is a full access-controlled motorway. The construction work needs to be conducted by occupying some of the existing lanes for construction while leaving some of the lanes open for ordinary traffic.

(1) Points to Be Considered during Implementation

Construction work is planned to be executed by securing one lane of the north bound roadway for ordinary traffic. **Figure 2-2-4-2.1** illustrates the method of construction planning (occupation scheme).

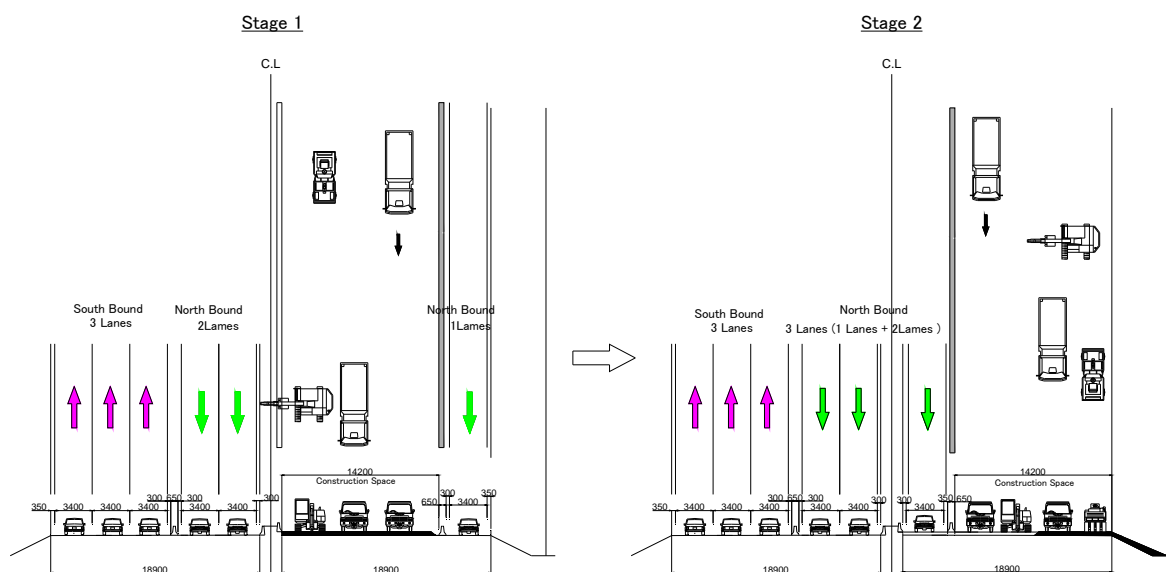


Figure 2-2-4-2.1 Occupation Scheme Drawing

(2) Consideration Points of Procurement

1) Securing of Material

In this project, due to the limited schedule for completion of construction work, securing of material is of the importance for the implementation. Materials like crushed stones that are to be used in excessive amount will be stocked at the temporary stock yards. Proper management control and supervision of these materials will be conducted to avoid idling of the construction work. Asphalt concrete is planned to be procured from private asphalt plants available in the vicinity of the site. However, as a precaution against failures of these plants, securing manufacturing plants for supplement must be taken into consideration.

2) Temporary Materials to be Procured Prior to Construction

The manufacturing capacity of the concrete barriers to be used for dividing the carriageways will be taken into consideration for establishing procurement plan of these barriers as these

barriers are required to be procured prior to the commencement of the construction.

(3) Consideration Points of Safety Management for Traffic

The execution work is to be conducted on the north bound of the full access-controlled motorway (4 lanes in each north and south bound: total 8 lanes).

In terms of construction method, exclusive use of work area and day and night work shift is adopted and execution vehicle has to obey the one way traffic flow. Given this execution constraints, width of work area should be at least 14.20m based on schedule analysis.

On the other hand, traffic flow for regular vehicle is set up on south bound (18.90m width: 4 lanes and shoulder), outside of work area, and within this area, 3 lanes for south bound and 2 lanes for north bound are planned to be placed. Also, on the north bound (18.90m width: 4 lanes and shoulder), work zone, only one lane for north bound is planned to be placed. The total lanes for regular vehicle on south and north bounds in the construction stage amounts 6 lanes.

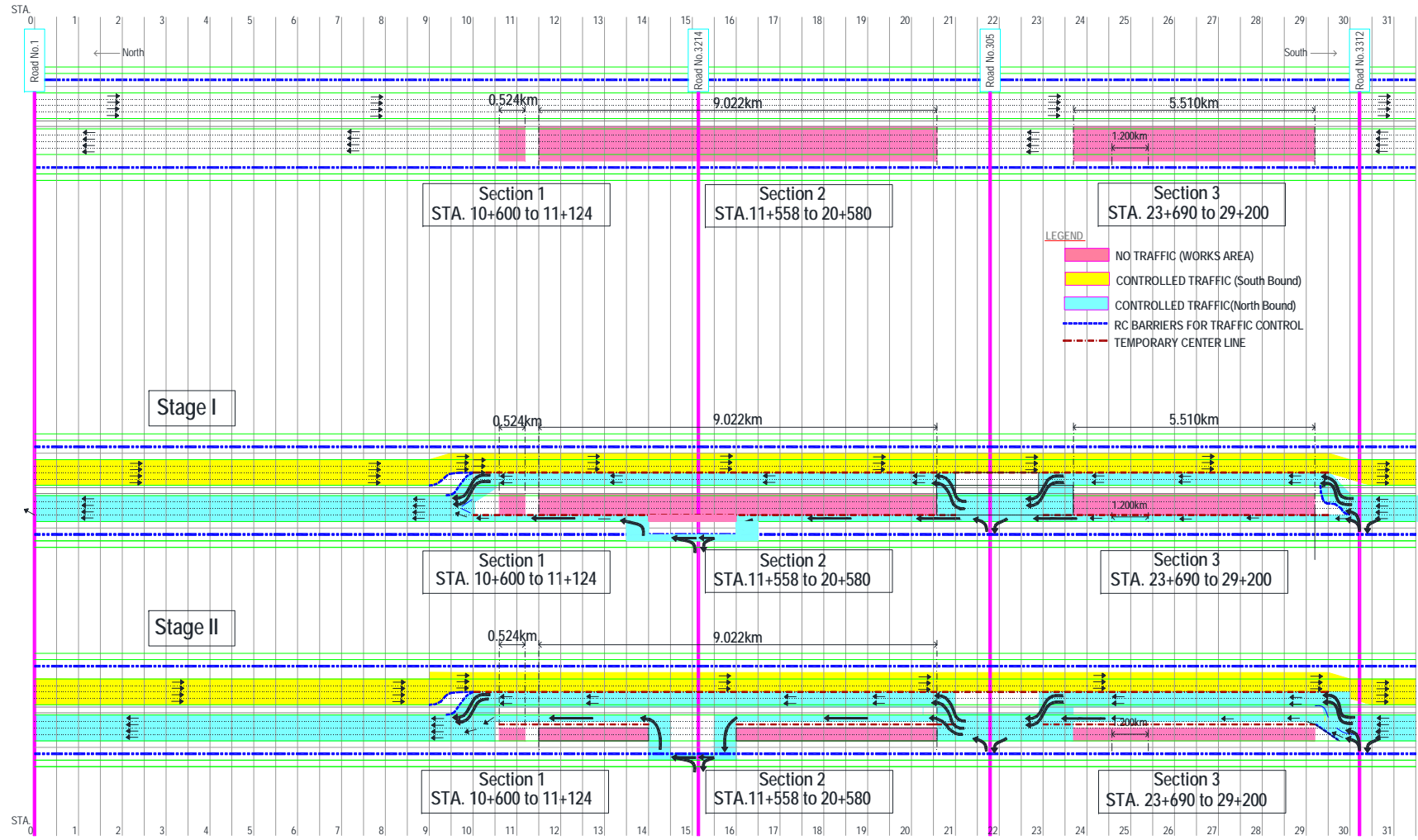
As mentioned above, exclusive use of work area and day and night work is assumed to shrink a term of construction. As a result, further discussion with Intercity Motorways Division the managing and operating organization of the objective road should be held, and safety facilities for traffic control during construction have to be planned in accordance with the motorway traffic regulation of Thailand.

In addition, there are overhead facilities that traverse the objective road. The facility requires to be raised because the vertical clearance cannot be secured following the raising of the existing road surface level. In such circumstances, the north bound roadway needs to be temporarily closed to ordinary traffic during the work. In such case, execution of such work during night time, when traffic volume is minimum, should be considered following discussions with the implementing organization (DOH) pertaining to instruction of measures for mitigation of traffic congestion or ensuring safety.

(4) Securing Safety of Ordinary Vehicles

This project is to raise the surface level of objective road under exclusive use of work area so that the execution will be conducted under the occupation scheme. Since the objective road is an arterial road that covers the large amount of traffic volume, it must be significant that the execution is conducted on the secured traffic lanes for ordinary vehicle during construction stage. The secured traffic lanes for ordinary vehicle are shown in **Figure 2-2-4-2.2**.

Preliminary Traffic Control Plan by Working Stages



2-86

Figure 2-2-4-2.2 The secured traffic lanes for ordinary vehicle

(5) Securing Safety of Third-Party and Project-Related Participants

Since construction work will be conducted on a motorway (full access-controlled motorway) and requires occupying its area, it is of an importance to secure safety of ordinary vehicle, third-party, and project-related participants.

1) Securing Safety of Third Party

- Exclusive use of work area will be clearly shown, occupation area for execution will be covered by concrete barrier, and third party will be kept out of work area.
- In excavation for Road Facilities, opened points in work area will be covered by temporary fence or net and significant road lighting will also be installed. Those equipments will be inspected at all times, and accidents due to defect of those equipments will be stopped.
- Drivers to carry materials or heavy equipments will be instructed for safety role in order to make the best effort to stop traffic accidents.
- In removing the existing incidental road facilities closed to ordinary vehicle, preventive measures against fine particles will be taken into consideration.
- 15m length opening at 500m interval will be applied to concrete barrier for emergency situation.

2) Securing Safety of Project-Related Participants

- In excavation for incidental Road Facilities, opened points in work area will be covered, and accidents by falling down into the points will be prevented.
- In the construction stage, the time to carry materials for embankment, base/subbase course into execution field will increase and then guardsman will be provided adequately for prevention from traffic accidents.
- To utilize the heavy equipment for construction, adequate numbers of safety control person who carefully observe activity of heavy equipment and alert construction worker to the equipment will be provided to protect workers from accident.

(6) Consideration on the Natural Conditions

In terms of climate, located outside the typhoon belt, Thailand can be divided into two climatic zones. The north, north-east, and central regions including Bangkok have a climate with three districts seasons: Rainy, from June to October; cool, from November to February; and hot of highest temperatures and sunny weathers from March to May. Temperatures in Bangkok vary between 25 C in December and 34 C with an average temperature of 29 C. The average rainfall in these regions is 1,500mm per year. Given this condition, the construction execution will be conducted all the year around. Additionally, by taking into consideration to secure the quality of concrete and asphalt concrete under the climatic condition, construction process and schedule will be planed.

(7) Environmental Consideration

In the project, to reduce effect on environment, the basic points for construction and procurement are as mentioned below:

1) Disposal Area of Construction Debris

Debris generated from excavation/scarifying of the existing asphalt will be carried to and disposed at the site designated by the implementing organization (DOH). Disposal area of construction debris comprised of 5 Interchange Areas along route 7 and 9, such as Bang Pa-In, Ram Inthra, Thap Chang, Ram Klao, Luang Phaeng. The Designated areas are shown in **Figure 2-2-4-2.3** and through **Photo 2-2-4-2.1**.

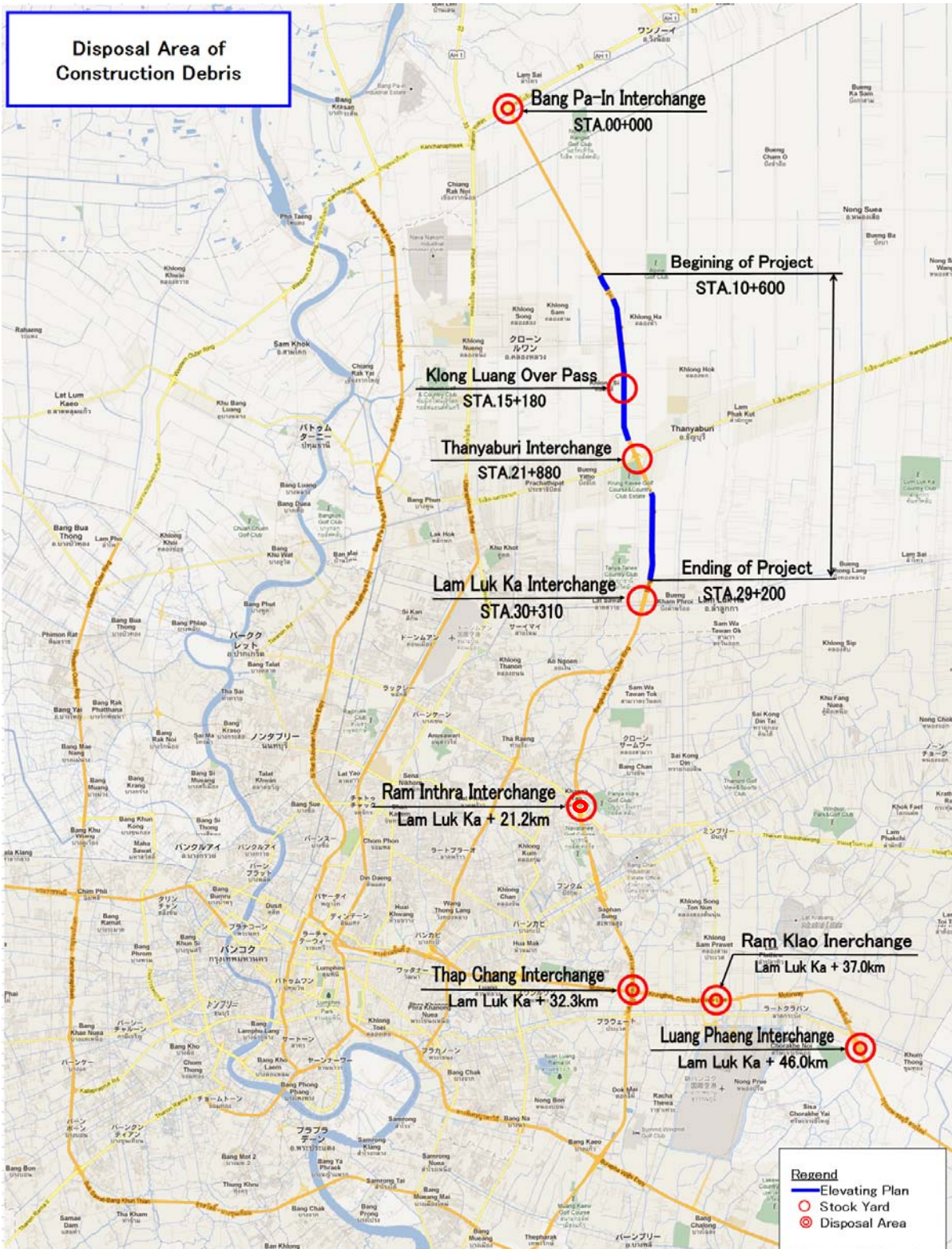


Figure 2-2-4-2.3 Disposal Area of Construction Debris

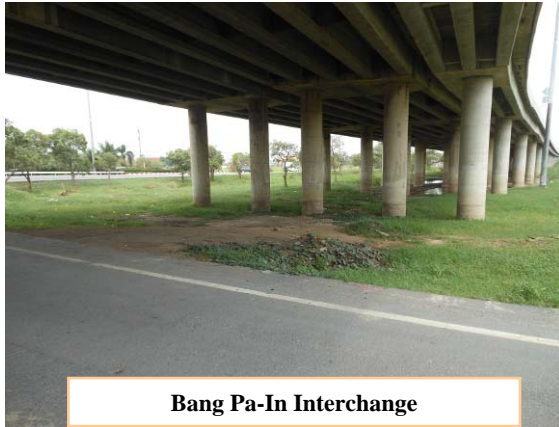


Photo 2-2-4-2.1 Disposal Area of Construction Debris

2) Social Environmental Consideration in Construction

The objective road in the project is located within right of way owned by DOH. Area along the objective road is classified as district for paddy field and house, however. In construction, plan to reduce the effect on environment should be implemented, sprinkling water to execution area.

Regarding the items including air and water quality that are easy to influence on the natural environment, it is required to conduct a schematic monitoring, analysis and observation during construction stage.

The Project does not require an EIA report to be conducted in accordance with the EIA system in Thailand, and this is agreed with the operator, DOH. However, as impacts on the environment by using construction equipments are expected, an initial environmental examination (IEE) is essential according to the latest JICA Guidelines. Based on the latest JICA Guidelines, an impact on the environment by the project is categorized as B. As a result, it is required to conduct a schematic monitoring, analysis and observation during construction stage. **Table 2-2-4-2.1** indicates a draft of environmental monitoring plan, but there remains room to review the contents by changing the work plan in the future.

Table 2-2-4-2.1 Draft of Environmental Monitoring Plan

| Item | Check Item | Location | Frequency | Criteria | Responsible Organization |
|------------------------------|---|--|---|-----------------------------|--------------------------|
| At Work ^{*1} | | | | | |
| Air Quality | TSP, CO, NO ₂ , SO ₂ | 2 sites including sensitive receptors near the project site or others (e.g.: STA.16+600, 26+000) ^{*2} | Quarterly, or adjusted based on air pollutant-generating activities | Thai Standard | Contractor |
| Water Quality | pH, SS, DO, BOD, Oil | 1 processed water (final effluent) | Bi-Monthly (Once every 2 months) | Thai Standard ^{*3} | |
| Noise and Vibration | L _{eq} , L _{max} Vibration Level | 2 sites including sensitive receptors near the project site or others (e.g.: STA.16+600, 26+000) ^{*3} | Quarterly, or adjusted based on noise-generating activities | Thai Standard ^{*4} | |

*1: Monitoring results regarding environmental issues (air and water quality, noise & vibration) before the Project basically refer to those from previous surveys. An actual monitoring would be done when DOH judges it is necessary.

*2: Sites chosen to match the sampling sites carried out in prior monitoring study by DOH in 2011

*3: To apply criteria in Class 4. As for SS criterion, however, apply the one in Japanese Type C. The criterion for oil is defined as 'no oil slick on the water surface.'

*4: Vibration criterion applies the Japanese standard for construction work (75dB).

2-2-4-3 Scope of Works

The responsibilities to be borne by Japan and the Kingdom of Thailand are summarized in **Table 2-2-4-3.1**.

Table 2-2-4-3.1 Responsibility of Each Government

| Item | Content | Responsibility | | Remarks |
|--------------------------|---|----------------|----------|---|
| | | Japan | Thailand | |
| Procurement | Procurement of Materials and equipment | ○ | | |
| Construction Preparation | Land Acquisition necessary for construction | | ○ | Project Office, Accommodation Construction Yard |

| Item | Content | Responsibility | | Remarks |
|---|--------------------------------------|----------------|----------|-----------------------|
| | | Japan | Thailand | |
| | Securing Detour road | ○ | | Existing Road |
| | Securing Base/Subbase material | ○ | | |
| | Securing embankment material | ○ | | |
| | Disposal Area of Construction Debris | | ○ | DOH-Designated Site |
| | Other than above | ○ | | |
| Removal/Relocation of Obstruction to construction | Relocation of Obstruction | | ○ | Tree, Sign Board etc. |
| Main Construction | Construction of Rehabilitation | ○ | | |

2-2-4-4 Consultant Supervision/Procurement

Basically, the Japanese Consultant will enter into an agreement with the Kingdom of Thailand to undertake the support for bidding activities and the construction supervision.

(1) Bidding Activities

The Major tasks to be undertaken from making bidding document, bidding announcement to construction agreement include:

- Verification of detailed design
- Preparation of bid documents
- Bid announcement
- Pre-qualification of bidders
- Bidding
- Evaluation of bid documents
- Preparation of contract agreement

The period of the bid-related activities is about 4.0 months.

(2) Construction Supervision

The consultant will supervise the contractor's planning and implementation of the construction contract. The major tasks under this stage include:

- Verification/Approval of related surveys and quantities
- Review/Approval construction plans
- Quality Control
- Process Control
- Work Output Control

- Safety Management
- Turnover Inspection and Acceptance

The period of construction supervision is approximately 18 months (excluding demobilization).

Construction supervision team shall consist of: 3 Resident/Chief Engineer (Japanese), 2-Site Engineer (Local) and 1-Utility Personnel (Local). Moreover, the Chief Engineer may dispatch Inspector/s for turnover inspection during completion.

In terms of construction execution, exclusive use of work area and day and night work is assumed to shrink a term of construction. As a result, taking into account to manage safety, accidents due to construction execution have to be prevented based on the discussion between consultant safety manager and construction supervisor.

2-2-4-5 Quality Control Plan

The tasks to be carried out for quality control during the construction period are as follow:

- Earthwork
- Base/Subbase Works
- Pavement Works
- Concrete Works
- Reinforcing Bars and Formworks
- Structural Shapes and Dimensions

Based on the above, while the quality control items for pavement and earthworks are presented in **Table 2-2-4-5.1**, the quality control items for Concrete works are presented in **Table 2-2-4-5.2**.

Table 2-2-4-5.1 Quality Management Plan for Earthwork and Pavement Work

| Item | Test Items | Test Method | Test Frequency |
|---------------------------|---------------------------------|--|--|
| Embankment | Density Test (Compaction) | AASHTO T191 | Every 500m ² |
| Base Course | Field Density Test (Compaction) | AASHTO T191 | Every 1,000m ³ |
| | Dry Density Test | AASHTO T180 | Every 1,000m ³ |
| Asphalt Pavement | Temperature | Temperature in carrying, spreading, and compacting | Five times per a day |
| | Abrasion Test | AASHTO T96 | Once before placing and once every 1,500m ³ or change in source/quarry location (check supplier data) |
| Modified Asphalt Concrete | Dynamic Stability Test | Measurement of Plastic Deformation by Wheel Tracking Machine | At Trial Mix: Once per 1 mix At Construction : Once per paving asphalt of 1,000 ton |

Table 2-2-4-5.2 Quality Management Plan for Concrete Work

| Item | Test Items | Test Method | Test Frequency |
|------------------|-------------------------------|--------------------|--|
| Cement | Cement Property/Physical Test | AASHTO M85 | Once before trial mix and every once every 500 m ³ batch of concrete; or change in source/quarry location |
| Fine Aggregate | Property/Physical Test | AASHTO M6 | Once before trial mix and every once every 500 m ³ batch of concrete; or change in source/quarry location (check supplier data) |
| | Sieve Analysis | AASHTO T27 | Once a month |
| coarse aggregate | Property/Physical Test | AASHTO M80 | Once before trial mix and every once every 500 m ³ batch of concrete; or change in source/quarry location (check supplier data) |
| | Sieve Analysis | AASHTO T27 | Once a month |
| Water | Water Quality Test | AASHTO T26 | Once before trial mix and when necessary |
| Concrete | Slump Test | AASHTO T119 | Twice a day |
| | Air Content Test | AASHTO T121 | Twice a day |
| | Compressive Strength Test | AASHTO T22 | 6 samples per batch or 6 samples for every 75m ³ of concrete (3 samples each for 7-day strength and 28-day strength) |
| | Temperature | — | Twice a day |
| | Salinity Concentration Test | — | Twice a day |

2-2-4-6 Procurement Plan

The major construction materials and equipments for procurement, based on field research for procurement, are mentioned below.

(1) Procurement of Major Construction Materials

Procurement policies for construction materials are mentioned below.

- The basic construction material such as asphalt and base/subbase aggregate and crush rock are basically available locally, based on the quality and schedule.
- The construction materials of coarse and fine aggregate for ready mixed concrete are basically available locally, based on the quality and schedule.
- Considering quality and schedule, reinforcement bar, steel structure and precast concrete product registered with Thai Industrial Standard is available through the local market.
- Concrete barrier as temporary execution material is necessary to be procured, taking into consideration of quality and schedule.

Procurement of construction materials necessary for the project, such as asphalt concrete and ready mixed concrete, will be analyzed based on size, specification, standard for environment, quantity, current market condition, price, and lead time. Also, comparing the several alternatives, the most economically and effectively optimal supplier should be selected.

Table 2-2-4-6.1 presents the major construction materials for procurement.

Table 2-2-4-6.1 Procurement of Major Construction Materials

| Item | | Procurement Area | | | Procurement Reason | Procurement Routes |
|---------------------------|--------------------------------------|------------------------------|-------|---------------|--------------------|--------------------|
| | | Local (Thailand) | Japan | Third Country | | |
| Item Name | Description | | | | | |
| Major Item | Asphalt Concrete | Surface Course Mixed Asphalt | ○ | | | Bangkok |
| | Asphalt Concrete | Binder Course | ○ | | | Bangkok |
| | Asphalt Concrete | Bounded Base | ○ | | | Bangkok |
| | Ready Mixed Concrete | 24N/mm ² | ○ | | | Bangkok |
| | Ready Mixed Concrete | 21N/mm ² | ○ | | | Bangkok |
| | Ready Mixed Concrete | 18N/mm ² | ○ | | | Bangkok |
| | Reinforcing Bars | D13~29 | ○ | | | Bangkok |
| | Cement | Portland | ○ | | | Bangkok |
| | Sand | For Mortar | ○ | | | Bangkok |
| | Aggregate for Base Course | M-40 | ○ | | | Saraburi |
| | Aggregate for Subbase Course | C-40 | ○ | | | Saraburi |
| | Embankment material | | ○ | | | Lan Ta Sap |
| | Soil for Slope Protection | | ○ | | | Lan Ta Sap |
| | Pre-cast Concrete Barrier | Type-I | ○ | | | Bangkok |
| Pre-Cast Concrete Barrier | Type-II | ○ | | | Bangkok | |
| Main Item | Pre-Cast L-Type Wall | H=1.1m | ○ | | | Bangkok |
| | Rocks for Protection of Inlet/Outlet | RENO-200 | ○ | | | Bangkok |
| | Geo-textile | W=140g/m ² | ○ | | | Bangkok |
| | Guard Rail | Guard Post | ○ | | | Bangkok |
| | Lawn for Slope | | ○ | | | Bangkok |
| | Fuels, Oils and Lubricants | | ○ | | | Bangkok |
| Item for Temporary Works | Temporary Steel | | ○ | | | Bangkok |
| | Concrete Pipe for Temporary Drainage | φ500 | ○ | | | Bangkok |
| | Barbed Wire | | ○ | | | Bangkok |
| | | | | | | |

(2) Procurement of Major Construction Equipment

Procurement policies for construction equipments are mentioned below.

- Most of the major construction equipment used for the construction of road is available locally. Fundamentally, the equipment is owned by construction companies, but equipment leasing or supplying companies are also capable of providing the equipment. Considering the purpose to

shrink project schedule through day and night work shift, it is reasonable that the contractor take on a subcontract with a local contractor, from the perspective of procurement risk management to lease equipment from leasing companies, rather than from the contractors.

- Asphalt manufacturing plants are located within 20 to 30 km of the project site. These plants are considered capable of providing asphalt of required quality. Also there are several general contractors or specialist contractors which possess asphalt manufacturing plant closed to the project site.
- In terms of procurement of ready mixed concrete, the number of its manufacturing plants sited near the project site is about ten. Like the contractors possessing the asphalt manufacturing plants, there are several contractors which own concrete manufacturing plant system and agitator trucks.
- In the project, schedule is put into the highest priority over any other managerial categories, and so as construction method, day and night work shift is planned to carry out execution. Also it is planned to give the contractor exclusive use of the work area to shrink the schedule. Given the schedule constraint, both concrete and asphalt manufacturing plants should be installed by the above mentioned contractors at certain locations close to the project site. Application of this kind construction method can enable day and night work shift.

Procurement of equipments necessary for the project, such as manufacturing plants and construction heavy machine, should be analyzed based on size, specification, standard for environment, quantity, current market condition, price and lead time. Also, comparing the several alternatives, the most economically and effectively optimal supplier should be selected.

Table 2-2-4-6.2 presents the major construction equipment for procurement.

Table 2-2-4-6.2 Procurement of Major Construction Equipment

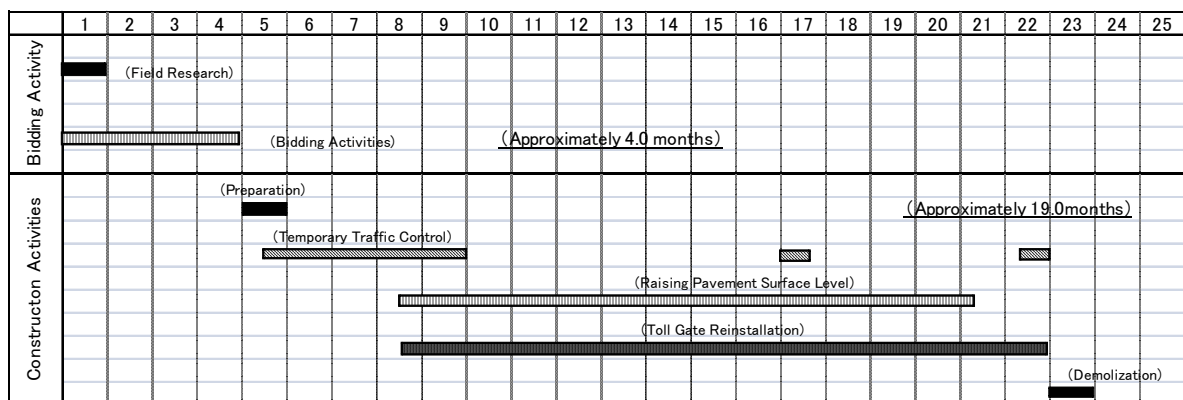
| Item | | | Procurement Area | | | Procurement Reason | Procurement Routes |
|---------------------|--------------------|-----------|------------------|-------|---------------|--------------------|--------------------|
| Item Name | Description | Rent/ Buy | Local (Thailand) | Japan | Third Country | | |
| Backhoe | 0.2m ³ | Rent | ○ | | | | Bangkok |
| Backhoe | 0.35m ³ | Rent | ○ | | | | Bangkok |
| Backhoe | 0.8m ³ | Rent | ○ | | | | Bangkok |
| Bulldozer | 3t | Rent | ○ | | | | Bangkok |
| Bulldozer | 6t | Rent | ○ | | | | Bangkok |
| Bulldozer | 15t | Rent | ○ | | | | Bangkok |
| Wheel Loader | 2.4m ³ | Rent | ○ | | | | Bangkok |
| Dump Truck | 4t | Rent | ○ | | | | Bangkok |
| Dump Truck | 10t | Rent | ○ | | | | Bangkok |
| Truck | 2t | Rent | ○ | | | | Bangkok |
| Truck | 11t | Rent | ○ | | | | Bangkok |
| Truck with Crane | 2.9t | Rent | ○ | | | | Bangkok |
| Truck with Crane | 4.9t | Rent | ○ | | | | Bangkok |
| Truck Mounted Crane | 20t | Rent | ○ | | | | Bangkok |
| Truck Mounted Crane | 35t | Rent | ○ | | | | Bangkok |
| Rough terrain Crane | 25t | Rent | ○ | | | | Bangkok |

| Item | | | Procurement Area | | | Procurement Reason | Procurement Routes |
|--------------------------|------------------------|----------|------------------|-------|---------------|--------------------|--------------------|
| Item Name | Description | Rent/Buy | Local (Thailand) | Japan | Third Country | | |
| Concrete Breaker | 30kg | Rent | ○ | | | | Bangkok |
| Concrete Breaker | 600~800kg | Rent | ○ | | | | Bangkok |
| Motor Grader | 3.1m | Rent | ○ | | | | Bangkok |
| Motor Grader | 3.7m | Rent | ○ | | | | Bangkok |
| Road Roller | 10~12t | Rent | ○ | | | | Bangkok |
| Tire Roller | 8~20t | Rent | ○ | | | | Bangkok |
| Vibrator Roller | Guide Type | Rent | ○ | | | | Bangkok |
| Vibrator Roller | Riding Type | Rent | ○ | | | | Bangkok |
| Tampa | 60kg | Rent | ○ | | | | Bangkok |
| Vibrator Compactor | 40kg | Rent | ○ | | | | Bangkok |
| Concrete Crusher | 86~100t | Rent | ○ | | | | Bangkok |
| Asphalt Finisher | 2.4~6.0m | Rent | ○ | | | | Bangkok |
| Asphalt Distributor | 2,000~3,000L | Rent | ○ | | | | Bangkok |
| Line Marking Machine | Hopper 130kg | Rent | ○ | | | | Bangkok |
| Water Distributor | 6,000L | Rent | ○ | | | | Bangkok |
| Concrete Cutter | 45~56cm | Rent | ○ | | | | Bangkok |
| Water Pump | 150mm | Rent | ○ | | | | Bangkok |
| Electric Welding Machine | 100A | Rent | ○ | | | | Bangkok |
| Compressor | 3.7m ³ /min | Rent | ○ | | | | Bangkok |
| Compressor | 7.5m ³ /min | Rent | ○ | | | | Bangkok |
| Diesel Generator | 20KVA | Rent | ○ | | | | Bangkok |
| Diesel Generator | 50KVA | Rent | ○ | | | | Bangkok |
| Diesel Generator | 300KVA | Rent | ○ | | | | Bangkok |
| Trailer | 30t | Rent | ○ | | | | Bangkok |

2-2-4-7 Implementation Schedule

Table 2-2-4-7.1 presents the implementation schedule.

Table 2-2-4-7.1 Implementation Schedule in the Rehabilitation Project of the Outer Bangkok Ring Road



2-3 OBLIGATION OF RECIPIENT COUNTRY

The undertakings required from the GOT for the smooth execution of this project are as follows:

- To provide documents, data and information necessary for the execution of this project;
- To acquire land for construction yard;
- To secure land for construction yard, stock yard, disposal area for construction debris, site office yard, and detour routes;
- To secure borrow pits, spoil-banks, and industrial waste disposal areas;
- To obtain all necessary permits, to coordinate and share necessary information with concerning organizations regarding the method of road occupancy of the Motorway, method for allowing public vehicles, traffic restrictions, and day-time, night time works;
- To release information and take necessary steps before hand regarding blockage of road for public vehicles during relocation of overhead facilities such as traffic signs;
- To coordinate with the concerned organization of underground utilities pertaining to its protection, reinforcement/repair and to release information as well as to take necessary steps to alert the road users and the locals in case disruption of water and electricity are anticipated;
- To coordinate with the concerned organization of street lights and electronic traffic sign regarding its protection or/and its relocation and to take necessary steps to inform the road users before hand in case of disruption of electricity is anticipated;
- To obtain necessary permits for allowing the personnel engaged in the construction work such as the supervision engineer, construction workers etc. to access the motorway;
- To obtain necessary permits to allow the construction vehicles and equipments to enter and exit the motorway;
- To bear the Advising Commission and Payment Commission to the Japanese bank where an account related to the project is opened, for the banking services like service charge and disbursement charge;
- To bear the value-added-tax related to the project;
- To assist in the process for exemption of materials imported for the construction work from taxation and Customs clearance in order to ensure smooth inland transportation;
- To assist in the process for exemption of Japanese nationals engaged in the construction work from Customs duties and other fiscal levies on products and services necessary for the execution of the project;
- To assist in the process for exemption of Japanese nationals from all legislation measures necessary for entering and staying in the Kingdom of Thailand;
- To ensure proper use and maintenance of the road after its construction;

- To cooperate in solving potential troubles with the local people or any third party in connection with the execution of the project;
- To measure the settlement degree after construction periodically; and
- To bear all expenses required for the execution of the project, other than those borne by the Grant-Aid of Japan.

2-4 PROJECT OPERATION PLAN

2-4-1 Organization for Operation and Maintenance

The implementing organization, Department of Highways (DOH), will be in charge of operation and maintenance of the objective road after commencement of construction. DOH organization for operation and maintenance is as mentioned in 2-1-1(1).

In terms of road (highway) management, Inter-City Motorway Division, DOH, is mainly responsible for maintenance plan, administration, and technical training for maintenance. Actual road maintenance works, such as periodic inspection, routine maintenance, and repair, are carried out by Bangkok Bureau of Highways and Highway maintenance District under Bangkok Bureau of Highways.

Maintenance works of the objective road in this project, Motorway No. 9 stretching 63km, is conducted based on toll revenue. (Reference: **Figure 2-1-2.1** in section 2-1-1(2)) Budget for its road maintenance, about from 15.3B to 21.6B THB, is allocated each year. The budget and expenditure for the objective road, after it was expanded from 4 lanes to 8 lanes as a full access controlled motorway, have been increased since 2009.

According to analysis of securing budget and organization structure as aforementioned, it is concluded to sustain operation of a constructed facility and keep it in good condition.

2-4-2 Contents of Operation and Maintenance

Maintenance work fundamentally follows Manual for road maintenance, published by Bureau of Material Analysis and Inspection as well as Bureau of Highways Maintenance Management under DOH. Method for maintenance work, which DOH build up based on experiences, is categorized as two, Regular Maintenance and Particular Maintenance.

Main work of Regular Maintenance is composed of periodic inspection, routine maintenance, and repair. Additionally, Particular Maintenance is basically periodic rehabilitation when service life of objective roads cannot be sustained, otherwise when DOH analyzes and evaluate road quality after receiving the requests from motorway user.

Contents of Regular Maintenance and Particular Maintenance in Motorway Route 9 are shown in **Table 2-4-2.1** as well as in **Table 2-4-2.2**.

Table 2-4-2.1 Content of Regular Maintenance

| Maintenance Item | Task |
|---|--|
| Pavement of Carriageway and Shoulder | <ul style="list-style-type: none"> • Leveling Repair for Asphalt Concrete (Binder Course) • Partial Overlay for Asphalt Concrete (Surface Course t=5cm) • Patching for Asphalt Concrete (Surface Course t=5cm) • Tuck Court Repair for Pavement Surface • Partially Scarifying Repair (t=5cm) • Repair of Partial Broken Point for Road Marking |
| Interchange, Viaduct, Box culvert, Drainage System | <ul style="list-style-type: none"> • Repair of Rump Section • Repair of Shoulder and Pavement Surface in Viaduct • Repair in Box Culvert and Pipe Culvert, • Repair of Defects of Drainage System |
| Facility for road functional management, traffic management and safety management | <ul style="list-style-type: none"> • Repair for Defects in Road Marking • Repair and Reinstallation in Defect Point of Guardrail • Repair for Defect Point of Distance-Post • Inspection and Repair of Lights • Inspection and Repair Railing on Viaduct • Reinstallation and Change of Defect Point of Road Rivet • Reinstallation and Change of Defect Point of Sign Post • Repair of Defect Point in Viaduct Railing, Sign Board, Concrete Wall, Fence, Lights, Distance Post |
| Median and Shoulder | <ul style="list-style-type: none"> • Weeding • Cleaning • Planting |

Table 2-4-2.2 Content of Particular Maintenance

| Maintenance Item | Task |
|--|---|
| Cross Sectional Structure, Pavement Structure | <ul style="list-style-type: none"> • Overlay Maintenance by Reused Asphalt Concrete • Overlay Maintenance Based on Service Life • Rehabilitation of Asphalt Concrete Surface • Road Expansion and Cross sectional Rehabilitation |
| Viaduct and Drainage System | <ul style="list-style-type: none"> • Repair of Viaduct Furniture • Rehabilitation of Drainage System |
| Road Functional Management and Traffic Management Facility | <ul style="list-style-type: none"> • Installation of Lights • Installation of Overpass • Installation of Guardrail • Cleaning and Painting of Fence • Installation of Concrete Wall and Fence • Repair of Road Marking • Installation of Distance Post |
| Median and Shoulder Slope | <ul style="list-style-type: none"> • Planting • Cleaning and Painting for Concrete Barrier • Repair for Slope in Shoulder • Installation of Concrete barrier |

2-4-3 Current Status of Road Operation and Maintenance

To realize full benefits of the project and its facilities, and to sustain its operation and keep it in good driving condition, it is important improve its durability. In addition, the objective road is as the full access controlled motorway so that it is of significance to secure the highway characteristics which matter most to the driver are speed of travel, safety, comfort, and convenience, implementing facility maintenance related to road functional management, traffic management and safety management. The following needs should be noted:

- Inspect regularly to know the current condition of facility
- Cleaning of road and incidental road facilities – especially drainage system
- Implementing regular facility inspection, cleaning and maintenance related to road functional management, traffic management and safety management
- Secure budget necessary for maintenance

The objective road to be rehabilitated in this project is durable and strong against the environment in Thailand and serious technical problems as well major repair is not expected to occur in the immediate future. Routine maintenance however is encouraged to promote durability of the bridge. With that in mind, it is important to allocate budget for operation and maintenance.

2-5 PROJECT COST ESTIMATE

2-5-1 Initial Cost Estimate (D/D I)

(1) Thailand's Contribution

Table 2-5-1.1 indicates the costs borne by the Thai side.

Table 2-5-1.1 Approximate Cost Estimate of Thai Contribution

| Item | Amount (Million THB) |
|---------------|-------------------------|
| ① Bank Charge | 6.70 |
| Amount | 6.70 |

(2) Cost Estimation Condition

- ① Cost Estimation Date : April. 2012
- ② Foreign Exchange Rate : US\$1.00 = 79.38 JPY
THB1.00 = 2.61 JPY
- ③ Construction Period : Schedule of construction supervision is shown in the schedule of implementation
- ④ Others : The project is carried out based on the Japanese Government's Grant Aid Scheme.

2-5-2 Operation and Maintenance Cost

The implementing organization, Department of Highways (DOH), will be in charge of operation and maintenance (Periodic Inspection, Routine Maintenance, and Repair) of the objective road in this project, Motorway No. 9 stretching 63km and covering 8 lanes, is conducted. (Reference: Section 3-4) Budget necessary for maintenance work is as shown in Table 2-5-2.1.

Since design concept of the objective road for service life is based on 10 years, it would not be necessary to extensively rehabilitate it, and technically unsolvable problem would not be encountered when necessary routine maintenance is implemented.

However, if the routine maintenance work in the beginnings of service level is not appropriately carried out, that improper activities would influence service life, and as a result, service life designated in the project could not be secured. Therefore, the routine maintenance work in the beginnings of service level is of the significance.

Also, the implementing organization, DOH, have previously prepared road maintenance manual, and then based on the manual, road maintenance work, as mentioned in section 3-4-2, has been

conducted. Therefore, the operation and maintenance of the facility is possible to be performed in the basis of organization structure and technical level.

Annual maintenance cost for the objective road, Motorway No. 9, is shown in Table 2-5-2.1. The cost used for annual periodic inspection and routine maintenance is approximately 11.33M THB, and also one for repair is about 10.32M THB. The total amount of annual maintenance cost is approximately 21.65M THB. Plus, as the last five-year maintenance cost for entire motorway of the Outer Bangkok Ring Road is shown in Table 2-5-2.1, maintenance cost in 2011 is indicated as 90.50M THB.

As mentioned above, compared to the 2011 expenditure for maintenance by the implementing organization, the annual maintenance cost for the objective road correspond to approximately 24 %.

It should be justifiable that entities in-charge can maintain and operate the objective road given the currently allocated budget and organization structure.

Table 2-5-2.1 Maintenance Item to be checked and Annual Maintenance Cost

1. Periodic Inspection

(Unit: Million THB)

| Facility Name | Items to be checked | Frequency | Cost |
|--|--------------------------------------|----------------|------|
| Pavement of Carriageway and Shoulder | | | |
| Pavement | Clacks, Undulations, Pot halls etc. | 22 times/month | 1.75 |
| Road Marking | Defects, Deformation, Abrasion, Dirt | | |
| Interchange, Viaduct, Box culvert, Drainage System | | | |
| Pavement | Clacks, Undulations, Pot halls etc. | 22 times/month | 0.63 |
| Box culvert | Siltation, Obstacles | | |
| Drainage System | Siltation, Obstacles | | |

| Facility Name | Items to be checked | Frequency | Cost |
|---|--------------------------------------|----------------|------|
| Facility for road functional management, traffic management and safety management | | | |
| Road Marking | Defects, Deformation, Abrasion, Dirt | 22 times/month | 3.92 |
| Sign Board | Defects, Deformation, Dirt | | |
| Overhead Crossing | Defects, Deformation, Dirt | | |
| Facility | Defects, Deformation, Dirt | | |
| Guard Rail | Defects, Condition | | |
| Lights | Defects, Deformation, Dirt | | |
| Fence | | | |
| Median, Shoulder and Slope | | | |

| Facility Name | Items to be checked | Frequency | Cost |
|-------------------------------------|------------------------------|----------------|------|
| Median | Defects, Deformation, Dirt | 22 times/month | 0.70 |
| Slope in Shoulder | Erosion, Collapse, Condition | | |
| Amount cost for Periodic Inspection | | | 7.00 |

2. Routine Maintenance

(Unit: Million THB)

| Facility Name / Items to be checked | Frequency | Cost |
|---|--------------|-------|
| Pavement of Carriageway and Shoulder | | |
| • Cleaning of Pavement Surface | Twice/ month | 0.52 |
| Interchange, Viaduct, Box culvert, Drainage System | | |
| • Cleaning of Rump Section • Cleaning of Shoulder and Pavement Surface in Viaduct • Removal of Siltation in Box Culvert and Pipe Culvert, Removal of Obstacles | Twice/ month | 0.66 |
| Interchange, Viaduct, Box culvert, Drainage System | | |
| • Cleaning of Signboard • Cleaning of Overhead Crossing Facility • Cleaning of Facility for Safety | Twice/month | 2.22 |
| Median, Shoulder and Slope | | |
| • Cleaning and Painting of Median Concrete Barrier • Weeding and Cleaning for Slope in Shoulder • Planting for Slope in Shoulder | Twice/month | 0.93 |
| Amount cost for Routine Maintenance | | 4.33 |
| Amount cost for Periodic Inspection and Routine Maintenance | | 11.33 |

3. Repair

(Unit: Million THB)

| Facility Name / Items to be checked | Frequency | Cost |
|--|-------------|-------|
| Pavement of Carriageway and Shoulder | | |
| <ul style="list-style-type: none"> • Leveling Repair for Asphalt Concrete (Binder Course) • Partial Overlay for Asphalt Concrete (Surface Course t=5cm) • Patching for Asphalt Concrete (Surface Course t=5cm) • Tuck Court Repair for Pavement Surface • Partially Scarifying Repair (t=5cm) • Repair of Partial Broken Point for Road Marking | Twice/month | 3.12 |
| Interchange, Viaduct, Box culvert, Drainage System | | |
| <ul style="list-style-type: none"> • Repair of Rump Section • Repair of Shoulder and Pavement Surface in Viaduct • Repair in Box Culvert and Pipe Culvert, Repair of Defects | Twice/month | 0.66 |
| Facility for road functional management, traffic management and safety management | | |
| <ul style="list-style-type: none"> • Repair for Defects in Road Marking • Repair and Reinstallation in Defect Point of Guardrail • Repair for Defect Point of Distance-Post • Inspection and Repair of Lights • Inspection and Repair Railing on Viaduct • Reinstallation and Change of Defect Point of Road Rivet • Reinstallation and Change of Defect Point of Sign Post • Repair of Defect Point in Viaduct Railing, Sign Board, Concrete Wall, Fence, Lights, Distance Post | Twice/month | 5.92 |
| Median and Shoulder | | |
| <ul style="list-style-type: none"> • Repair for Median Concrete Barrier • Repair for Slope in Shoulder | Twice/month | 0.62 |
| Amount cost for Repair | | 10.32 |
| Total Amount | | 21.65 |

CHAPTER 3. PROJECT EVALUATION

3-1 PRECONDITIONS TO IMPLEMENT THE PROJECT

The project preconditions related to the required undertaking from the GOT are as follows.

- Temporary yard, surplus soil and waste products occurred from site shall be prepared by DOH
- The Procedure of necessary tax exemption shall be implemented in accordance with E/N and G/A.
- The process for exemption of materials imported from third country or Japan from taxation shall be quickly carried out.

This project does not require an EIA report to be conducted in accordance with the EIA system in Thailand. However, as impacts on environment of water and air pollution in and after construction are anticipated, a schematic monitoring is necessary to implement. Environmental management plan and monitoring plans are as afore mentioned.

3-2 NECESSARY INPUT BY RECIPIENT COUNTRY

To bring out benefit of the entire project, the necessary input by recipient country is as follows.

- To secure the service life of pavement and its structure, periodic inspection shall be carried out, and then routine maintenance such as cleaning and removal of sediment and obstacles in road surface and drainage system. No sooner than the damage is found, it is necessary to perform appropriate repair. Securing the annual maintenance cost, as shown in ***, is justifiable in order to sustain road function.
- Once the project is complete, the operational system in toll gate shall be set up to collect the toll in order to operate and maintain motorway.
- Settlement of about 20 cm at toll gate section (Sta.25+150) and about 5 cm at standard section (Sta.16+350) to be occurred in 10 years will be considered due to the soft soil existence under the objective road. Periodic measurement for settlement shall be conducted because the purpose of the project is to raise height of road surface to minimize the influential impacts of historical highest flood level recorded in 2011. Once settlement is recognized, such necessary repair as overlay shall be provided. It is assumed that appropriate location for measurement is at intervals of about 500m. The toll booth important for motorway shall be included as measuring location.

Frequency for settlement measurement

- First 1 year after construction : 4 times per year
- Second year to fifth year : 2 times per year
- After five year since completion : Once per year

- Fifth year after construction : Once a year

* The frequency of measurement is based on the result of settlement analysis.

3-3 IMPORTANT ASSUMPTIONS

The important assumption in order to exert and carry on an effect of the project is shown below.

- As the result of the project, Motorway No. 9 connecting from Bangkok to northern Thailand, can certainly secure traffic function in occurrence of historical highest level recorded in 2011. It is necessary to keep up to conduct countermeasures for flooding, and to improve accessibility to various regions, however.
- DOH's plans of raising surface height of general roads parallel to the objective road and constructing road dykes will be surely implemented to mitigate risk of flooding damage.

3-4 PROJECT EVALUATION

3-4-1 Relevance

- General nation including poorest segment of the population can have benefit from this project, and the number of them is numerous.
- This project will contribute to reduce the impact of stoppage of distribution of goods and human interaction, and urgently support for stability of people's lives.
- There is little negative effect for environmental.
- This project will contribute to the near-term, medium-term and long-term flood countermeasure plan of Thailand.
- There are demand and superiority which apply highway engineering and techniques of Japan to this project, and implementation of this project will be possible due to grant aid, without particular difficulty
- Policy of restoration support is consistent with one of Japan.

3-4-2 Effectiveness

(1) Quantitative Effect

Transportation had completely been stopping during the flood in 2011. If this road is constructed, stability, smoothness and safety transportation in flooding are secured.

Prospective quantitative effect by conducting is shown in **Table 3-4-2-1**.

As it is no possible to predict the flood, the year when flooding is occurred is not set up.

Table 3-4-2-1 Quantitative Effect

| Index | Standard Value | Target Value |
|-----------------------------------|-----------------------|---------------------|
| Resolution of road blocked period | 10 Days | Zero |

(2) Quantitative Effect

1) Securing of stable supplies transportation

Securing of stable supplies transportation when flooded, expecting escalation of price increase by distribution circumstances.

2) Securing of BHN

Securing of accessibility to center of Bangkok when flooded, transportation in emergency case, and procurement of daily necessities.

3) Stability of people's lives

Securing of commuter line of workers along the route 9 when flooded, and stability of people's lives

4) Securing of urgent transportation

Securing of road urgent transportation and emergency vehicle, and supporting stably for the damage by flood.

APPENDICES

Appendix 1: Member List of the Study Team

Appendix 2: Study Schedule

Appendix 3: List of Parties Concerned in the Recipient Country

Appendix 4: Minutes of Discussions (M/D)

- a) **Inception Report**
- b) **Progress Report**
- c) **Final Report**
- d) **Final Report, Detailed Design Drawings and Tender Document**

Appendix 5: Department of Highways' Committee for the Project

Appendix 6: Technical Notes

Appendix 7: List of Information Acquirement

Appendix 1: Member List of the Study Team

1. Member List

Inception Report Explanation (D/D I) :

22nd February, 2012 (Wednesday)~29th February, 2012 (Wednesday) (8 days)

| Name | Designation | Affiliation |
|-------------------------|--|--|
| Mr. YONEDA Kazuhiro | Team Leader | Chief Representative, Thailand Office, JICA |
| Mr. MATSUMOTO Hideaki | Project Coordinator | Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Dep., JICA |
| Mr. MATSUMOTO Yoshiharu | Leader/ Comprehensive Flood Mitigation Plan | CTI Engineering International Co., Ltd. |
| Mr. MISHINA Takahiro | Deputy Leader Implementation Program Specialist (Component II) | CTI Engineering International Co., Ltd. |
| Mr. MIURA Minoru | Chief Engineer | CTI Engineering International Co., Ltd. |
| Mr. WATANABE Ryohei | Road Design Engineer II | CTI Engineering International Co., Ltd. |
| Mr. SHRESTHA Robinson | Road Design Engineer III | CTI Engineering International Co., Ltd. |
| Mr. LONG Chantha | Structural Engineer | CTI Engineering International Co., Ltd. |
| Mr. ISHIZUKA Kazuhiro | Topographic Survey | CTI Engineering International Co., Ltd. (Kokusai Kogyo Co., Ltd.) |
| Mr. HATANO Takayuki | Environmentalist | CTI Engineering International Co., Ltd. |

Progress Report Explanation (D/D I) :

27th May, 2012 (Sunday)~1st June, 2012(Friday) (6 days)

| Name | Designation | Affiliation |
|-----------------------|---|--|
| Mr. YONEDA Kazuhiro | Team Leader | Chief Representative, Thailand Office, JICA |
| Mr. MATSUMOTO Hideaki | Project Coordinator | Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Dep., JICA |
| Mr. MISHINA Takahiro | Chief Engineer | CTI Engineering International Co., Ltd. |
| Mr. ISHI Masaki | Ass. Chief Engineer/ Implementation Program Specialist (Component II) | CTI Engineering International Co., Ltd. |
| Mr. MIURA Minoru | Chief Engineer | CTI Engineering International Co., Ltd. |
| Mr. SAGARA Hidetaka | Road Design Engineer I | CTI Engineering International Co., Ltd. |
| Mr. SUNOUCHI Noriaki | Road Design Engineer III | CTI Engineering International Co., Ltd. |
| Mr. SHRESTHA Robinson | Road Design Engineer III | CTI Engineering International Co., Ltd. |
| Mr. KIYOTANI Keisyuke | Road Design Engineer IV | CTI Engineering International Co., Ltd. |
| Mr. RYU Jikyo | Drainage Engineer | CTI Engineering International Co., Ltd. |
| Mr. OGATA Hiromitsu | Construction Planner/ Cost Estimator | CTI Engineering International Co., Ltd. |
| Mr. KIYOTA Daisaku | Environmentalist | CTI Engineering International Co., Ltd. |

Final Report Explanation (D/D I) :

26th August, 2012(Sunday)~31st August, 2012(Friday) (5 days)

| Name | Designation | Affiliation |
|-----------------------|--|---|
| Mr. YAMAUCHI Kunihiro | Team Leader | Global Environment Dept, JICA |
| Mr. MATSUMOTO Hideaki | Project Coordinator | Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Dept., JICA |
| Mr. MISHINA Takahiro | Chief Engineer | CTI Engineering International Co., Ltd. |
| Mr. ISHI Masaki | Ass. Chief Engineer/ Implementation Program Specialist | CTI Engineering International Co., Ltd. |
| Mr. MIURA Minoru | Chief Engineer | CTI Engineering International Co., Ltd. |
| Mr. SAGARA Hidetaka | Road Design Engineer I | CTI Engineering International Co., Ltd. |
| Mr. WATANABE Ryohei | Road Design Engineer II | CTI Engineering International Co., Ltd. |
| Mr. OGAWA Junichiro | Road Design Engineer IV | CTI Engineering International Co., Ltd. |

Appendix 2: Study Schedule

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | Mr. MATSUGOTO Hiashi JICA | Mr. MISHINA Takahiro Chief Engineer | Mr. MURA Minoru Chief Engineer | Mr. SAGARA Hirotaka Road Design Engineer 1 | Mr. WATANABE Ryosuke Road Design Engineer 2 | Mr. SUGIUCHI Noriaki Road Design Engineer 3 | Mr. SHIBESTIA Robinson Road Design Engineer 3 | Mr. KIYOTANI Kenzaki Road Design Engineer 4 | Mr. OGAWA Junichiro Road Design Engineer 4 | Mr. NAKAIMA Takashi Drainage Engineer | Mr. RYU Rikyo Drainage Engineer | Mr. LONG Chantha Structural Engineer | Mr. OGATA Hiromasa Construction Planner |
|----------------|------------------------|--|---|---|---|--|--|--|--|---|--|------------------------------------|---|--|
| February 1 Wed | | | | | | | | | | | | | | |
| 2 Thu | | | | | | | | | | | | | | |
| 3 Fri | | | | | | | | | | | | | | |
| 4 Sat | | | | | | | | | | | | | | |
| 5 Sun | | | | | | | | Transport TGF4 | | | | | Transport TGF4 | |
| 6 Mon | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 7 Tue | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 8 Wed | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 9 Thu | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 10 Fri | | | | | | | | Data Sorting | | | | | Data Sorting | |
| 11 Sat | | | | | | | | Data Sorting | | | | | Data Sorting | |
| 12 Sun | | | | | | | | Data Sorting | | | | | Data Sorting | |
| 13 Mon | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 14 Tue | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 15 Wed | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 16 Thu | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 17 Fri | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 18 Sat | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 19 Sun | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 20 Mon | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 21 Tue | | | | | | | | Filed Investigation | | | | | Filed Investigation | |
| 22 Wed | JICA Site Observation | Transport ICR Explanation | Transport JI77 | JICA Site Observation | Transport JI77 | ICR Explanation | Transport JI77 | ICR Explanation | | | | | ICR Explanation | |
| 23 Thu | (Conferece with RIB) | Signature of MD (RIB) (RIB) (RIB) Embassy Report | MD Signature (RIB) (RIB) Embassy Report | MD Signature (RIB) (RIB) Embassy Report | MD Signature (RIB) (RIB) Embassy Report | Filed Investigation | Filed Investigation | Filed Investigation | | | | | Filed Investigation | |
| 24 Fri | Signature of MD | Signature of MD | Signature of MD | Signature of MD | Signature of MD | Signature of MD | Signature of MD | Signature of MD | | | | | Signature of MD | |
| 25 Sat | JICA Site Observation | JICA Site Observation | JICA Site Observation | JICA Site Observation | JICA Site Observation | Filed Investigation | Filed Investigation | Filed Investigation | | | | | Filed Investigation | |
| 26 Sun | JICA Site Observation | JICA Site Observation | JICA Site Observation | JICA Site Observation | JICA Site Observation | Filed Investigation | Filed Investigation | Filed Investigation | | | | | Filed Investigation | |
| 27 Mon | (JICA Meeting) | (JICA Meeting) | (JICA Meeting) | (JICA Meeting) | (JICA Meeting) | Filed Investigation | Filed Investigation | Filed Investigation | | | | | Filed Investigation | |
| 28 Tue | (JICA TICA Conference) | (JICA TICA Conference) | (JICA TICA Conference) | (JICA TICA Conference) | (JICA TICA Conference) | Filed Investigation | Filed Investigation | Filed Investigation | | | | | Filed Investigation | |
| 29 Wed | JICA Embassy Report | JICA Embassy Report | JICA Embassy Report | JICA Embassy Report | JICA Embassy Report | Data Sorting | Data Sorting | Data Sorting | | | | | Data Sorting | |

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | Mr. MATSUYAMA Hirotaka | Mr. MISHINA Takahiro | Mr. MIURA Minoru | Mr. SAGARA Hirotaka | Mr. WATANABE Yoshiki | Mr. SUGIUCHI Noriaki | Mr. SHIBUHA Reishiro | Mr. KIYOTANI Kenzaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Rikyo | Mr. LONG Chantha | Mr. OGATA Hirohisa |
|--------|--|------------------------|----------------------|---|------------------------|---|------------------------|------------------------|---|------------------------|---|-------------------|-----------------------------------|---|
| | | JICA | Chief Engineer | Chief Engineer | Road Design Engineer 1 | Road Design Engineer 2 | Road Design Engineer 3 | Road Design Engineer 3 | Road Design Engineer 4 | Road Design Engineer 4 | Drainage Engineer | Drainage Engineer | Structural Engineer | Construction Planner |
| 1 Thu | | Transport | Meeting | Field Investigation | | Field Investigation | | | | | | | Field Investigation | Transport TG643 |
| 2 Fri | | | Meeting | Field Investigation | | Field Investigation | | | | | | | Field Investigation | Field Investigation |
| 3 Sat | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | | | | | Field Investigation | Making of Material for Conference |
| 4 Sun | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | | | | | Data Sorting | Making of Material for Conference |
| 5 Mon | Conference with DOH | | Meeting | Conference with DOH | | Conference with DOH | | | | | | | Conference with DOH | Conference with DOH |
| 6 Tue | | | Meeting | Making of Material for Conference | | Field Investigation | | | | | | | Field Investigation | Field Investigation |
| 7 Wed | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | | | | | Making of Material for Conference | Making of Material for Conference |
| 8 Thu | Conference with DOH | | Meeting | Conference with DOH | | Conference with DOH | | | | | | | Conference with DOH | Conference with DOH |
| 9 Fri | | | Meeting | Conference on Local Subcontracting | | Transport IL074 | | | | | | | Transport TG676 | Field Investigation |
| 10 Sat | | | Meeting | Making of Material for Conference | | Transport IL074 | | | | | | | | Field Investigation |
| 11 Sun | | | Meeting | Making of Material for Conference | | Transport IL074 | | | | | | | | Field Investigation |
| 12 Mon | Contract Agreement on Local Subcontracting | | Meeting | Conference on Local Subcontracting | | | | | | | | | | Field Investigation |
| 13 Tue | | | Meeting | Contract Agreement on Local Subcontracting | | | | | | | | | | Field Investigation |
| 14 Wed | Geo-Technical Investigation Location with presence of DOH | | Meeting | Making of Material for Conference | Transport IL077 | Transport IL077 | | | Transport IL077 | | | | | Field Investigation |
| 15 Thu | | | Meeting | Investigation Location with presence of DOH | | Investigation Location with presence of DOH | | | Investigation Location with presence of DOH | | | | | Field Investigation |
| 16 Fri | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | | | | Field Investigation |
| 17 Sat | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | | | | Field Investigation |
| 18 Sun | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | | | | Field Investigation |
| 19 Mon | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Making of Material for Conference | | | | | Making of Material for Conference |
| 20 Tue | Conference with DOH | | Meeting | Conference with DOH | | Conference with DOH | | | Conference with DOH | | | | | Conference with DOH |
| 21 Wed | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | | | | Conference of Contractors |
| 22 Thu | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | | | | Conference of Contractors |
| 23 Fri | | | Meeting | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | | | | Conference of Contractors |
| 24 Sat | | | Transport IL078 | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | Transport TG641 | | | Conference of Contractors |
| 25 Sun | | | Transport IL078 | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | Field Investigation | | | Conference of Contractors |
| 26 Mon | | | | Making of Material for Conference | | Making of Material for Conference | | | Field Investigation | | Field Investigation | | | Data Sorting |
| 27 Tue | Technical Note Conference on Local Subcontracting with DOH | | | Making of Material for Conference | | Making of Material for Conference | | | Making of Material for Conference | | Making of Material for Conference | | | Making of Material for Conference |
| 28 Wed | Technical Note Conference with DOH | | | Conference on Local Subcontracting with DOH | | Conference on Local Subcontracting with DOH | | | Conference on Local Subcontracting with DOH | | Conference on Local Subcontracting with DOH | | | Making of Material for Conference |
| 29 Thu | Technical Note Conference with DOH | | | Conference on Local Subcontracting with DOH | | Conference on Local Subcontracting with DOH | | | Conference on Local Subcontracting with DOH | | Conference on Local Subcontracting with DOH | | | Conference on Local Subcontracting with DOH |
| 30 Fri | | | | Transport IL078 | | Transport IL078 | | | Field Investigation | | Field Investigation | | | Transport TG640 |
| 31 Sat | | | | Transport IL078 | | Transport IL078 | | | Making of Material for Conference | | Making of Material for Conference | | | Transport TG640 |

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | JICA | Chief Engineer | Chief Engineer | Mr. MURA Minoru | Mr. SAGARA Hiroaki | Mr. WATANABE Yoshio | Mr. SUGIUCHI Noriaki | Mr. SHIBUSAWA Robinson | Mr. KYOTANI Kenaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Jkyo | Mr. LONG Chantha | Mr. OGATA Hiroaki |
|--------|--|------|----------------|----------------|---|--------------------|---------------------|----------------------|------------------------|---------------------------------------|---------------------|---------------------------------------|-------------------|---------------------------------------|---------------------------------------|
| April | | | Chief Engineer | Chief Engineer | Mr. MURA Minoru | Mr. SAGARA Hiroaki | Mr. WATANABE Yoshio | Mr. SUGIUCHI Noriaki | Mr. SHIBUSAWA Robinson | Mr. KYOTANI Kenaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Jkyo | Mr. LONG Chantha | Mr. OGATA Hiroaki |
| | | | | | Engineer 1 | Engineer 2 | Engineer 3 | Engineer 3 | Engineer 3 | Engineer 4 | Engineer 4 | Drainage Engineer | Drainage Engineer | Structural Engineer | Construction Planner |
| 1 Sun | | | | | Making of Material for Conference | | | | | Making of Material for Conference | | Making of Material for Conference | | Transport TG61 | |
| 2 Mon | Technical Note Conference with DOH | | | | Making of Material for Conference | | | | | Making of Material for Conference | | Making of Material for Conference | | Transport TG61 | |
| 3 Tue | | | | | Technical Note with DOH | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Conference on Technical Note with DOH | |
| 4 Wed | | | | | Field Investigation | | | | | Field Investigation | | Field Investigation | | Field Investigation | |
| 5 Thu | | | | | Field Investigation | | | | | Field Investigation | | Field Investigation | | Field Investigation | |
| 6 Fri | | | | | Field Investigation | | | | | Field Investigation | | Data Sorting | | Data Sorting | |
| 7 Sat | | | | | Field Investigation | | | | | Field Investigation | | Data Sorting | | Data Sorting | |
| 8 Sun | | | | | Making of Material for Conference | | | | | Making of Material for Conference | | Making of Material for Conference | | Making of Material for Conference | |
| 9 Mon | | | | | Making of Material for Conference | | | | | Making of Material for Conference | | Making of Material for Conference | | Making of Material for Conference | |
| 10 Tue | Technical Note Conference with DOH | | | | Conference on Technical Note with DOH | | | | | Conference on Technical Note with DOH | | Conference on Technical Note with DOH | | Conference on Technical Note with DOH | |
| 11 Wed | | | | | Field Investigation | | | | | Field Investigation | | Field Investigation | | Field Investigation | Transport JL717 |
| 12 Thu | | | | | Field Investigation | | | | | Field Investigation | | Field Investigation | | Field Investigation | Field Investigation |
| 13 Fri | | | | | Field Investigation | | | | | Field Investigation | | Field Investigation | | Data Sorting | Field Investigation |
| 14 Sat | | | | | Making of Material for Conference | | | | | Field Investigation | | Field Investigation | | Data Sorting | Data Sorting |
| 15 Sun | | | | | Making of Material for Conference | | | | | Field Investigation | | Field Investigation | | Data Sorting | Data Sorting |
| 16 Mon | | | | | Conference on local subcontracting | | | | | Field Investigation | | Field Investigation | | Transport TG642 | Data Sorting |
| 17 Tue | Contract Agreement on local subcontracting | | | | Conference on local subcontracting | | | | | Conference on Local Subcontracting | | Conference on Local Subcontracting | | Transport JL717 | Field Investigation |
| 18 Wed | | | | | Conference on local subcontracting | | | | | Conference on Local Subcontracting | | Conference on Local Subcontracting | | Field Investigation | Field Investigation |
| 19 Thu | Technical Note Conference with DOH | | | | Conference on Technical Note with DOH | | | | | Conference on Local Subcontracting | | Conference on Local Subcontracting | | Field Investigation | Conference of Contractors |
| 20 Fri | | | | | Field Investigation | | | | | Making of Material for Conference | | Conference on Technical Note with DOH | | Data Sorting | Conference of Contractors |
| 21 Sat | | | | | Field Investigation for Material | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Conference on Technical Note with DOH | Conference on Technical Note with DOH |
| 22 Sun | | | | | Contract agreement on local subcontracting | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Field Investigation | Data Sorting |
| 23 Mon | Technical Note Conference with DOH | | | | Conference on local subcontracting with DOH | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Making of Material for Conference | Making of Material for Conference |
| 24 Tue | | | | | Making of Material for Conference | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Making of Material for Conference | Conference on Technical Note with DOH |
| 25 Wed | Technical Note Conference with DOH | | | | Conference on Technical Note with DOH | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Making of Material for Conference | Making of Material for Conference |
| 26 Thu | | | | | Making of Material for Conference | | | | | Conference on Technical Note with DOH | | Technical Note with DOH | | Conference on Technical Note with DOH | Conference on Technical Note with DOH |
| 27 Fri | | | | | Making of Material for Conference | | | | | Conference on local subcontracting | | Local Subcontracting | | Data Sorting | Conference of Contractors |
| 28 Sat | | | | | Making of Material for Conference | | | | | Conference on local subcontracting | | Local Subcontracting | | Data Sorting | Conference of Contractors |
| 29 Sun | | | | | Making of Material for Conference | | | | | Conference on Local Subcontracting | | Conference on Local Subcontracting | | Data Sorting | Conference of Contractors |
| 30 Mon | | | | | Conference on local subcontracting | | | | | Conference on Local Subcontracting | | Conference on Local Subcontracting | | Data Sorting | Conference of Contractors |

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | JICA | Chief Engineer | Chief Engineer | Mr. MURA Minoru | Mr. SAGARA Hiroaki | Mr. WATANABE Yoshio | Mr. SUGIUCHI Noriaki | Mr. SHIBATA Ryohei | Mr. KYOTANI Kenaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Jkyou | Mr. LONG Chantha | Mr. OGATA Hiroaki |
|--------|--|---------------------------------|------------------|--|--|--|--|--|--|--|--|--|-----------------------------------|---------------------|---------------------------|
| May | Contract Agreement on Local Subcontracting | | Meeting | Contract agreement with local subcontracting | Contract agreement on local subcontracting | Contract Agreement on Local Subcontracting | Contract Agreement on Local Subcontracting | Contract Agreement on Local Subcontracting | Contract Agreement on Local Subcontracting | Contract Agreement on Local Subcontracting | Contract Agreement on Local Subcontracting | Contract Agreement on Local Subcontracting | Data Sorting | Structural Engineer | Construction Planner |
| 1 Tue | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | JL77 | |
| 2 Wed | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 3 Thu | Conference with DOH | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Conference with DOH | | |
| 4 Fri | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Field Investigation | | |
| 5 Sat | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 6 Sun | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 7 Mon | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 8 Tue | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 9 Wed | Conference with DOH | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Conference with DOH | | |
| 10 Thu | Conference with DOH | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Conference with DOH | | |
| 11 Fri | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Report | | |
| 12 Sat | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Report | | |
| 13 Sun | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 14 Mon | Explanation of Technical Note | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Material for Conference | | |
| 15 Tue | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Explanation of Technical Note | | |
| 16 Wed | | | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Making of Report | | |
| 17 Thu | | | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | Making of Material for Conference | | |
| 18 Fri | Conference with DOH | | | | | | | | | | | | Conference with DOH | | |
| 19 Sat | | | | | | | | | | | | | Making of Report | | |
| 20 Sun | | | | | | | | | | | | | Making of Report | | |
| 21 Mon | | | | | | | | | | | | | Making of Report | | Transport TG64 |
| 22 Tue | Before Dispatch Meeting (In Japan) | | | | | | | | | | | | Making of Report | | Conference of Contractors |
| 23 Wed | | | | | | | | | | | | | Making of Material for Conference | | Conference of Contractors |
| 24 Thu | | | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | Making of Material for Conference | | Conference of Contractors |
| 25 Fri | Conference with DOH | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Conference with DOH | | Conference with DOH |
| 26 Sat | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Report | | Field Investigation |
| 27 Sun | | Transport TG67 | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Report | | Field Investigation |
| 28 Mon | PR Conference | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Report | | PR Explanation |
| 29 Tue | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | PR Explanation | | Field Investigation |
| 30 Wed | | | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Meeting | Making of Report | | Transport TG66 |
| 31 Thu | Signature of MOM | Signature of MOM Transport TG62 | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Signature of MOM | Making of Report | | Transport JL78 |

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | Mr. MATSUMOTO Hirotaka | Mr. MISHINA Takahiro | Mr. MURA Minoru | Mr. SAGARA Hirotaka | Mr. WATANABE Ryosuke | Mr. SUGIUCHI Noriaki | Mr. SHIBUOTA Ryohei | Mr. KIYOTANI Kenaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Rikyo | Mr. LONG Chanthi | Mr. OGATA Hiromasa |
|------------|-------|------------------------|----------------------|-----------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|---------------------|-------------------|---------------------|----------------------|
| | | JICA | Chief Engineer | Chief Engineer | Road Design Engineer 1 | Road Design Engineer 2 | Road Design Engineer 3 | Road Design Engineer 3 | Road Design Engineer 4 | Road Design Engineer 4 | Drainage Engineer | Drainage Engineer | Structural Engineer | Construction Planner |
| June 1 Fri | | | Meeting | Transport JL78 | | | | | | | | | | |
| 2 Sat | | Transport T0642 | Transport JL78 | Transport JL78 | | | | | | | | | | |
| 3 Sun | | | | | | | | | | | | | | |
| 4 Mon | | | | | | | | | | | | | | |
| 5 Tue | | | | | | | | | | | | | | |
| 6 Wed | | | | | | | | | | | | | | |
| 7 Thu | | | | | | | | | | | | | | |
| 8 Fri | | | | | | | | | | | | | | |
| 9 Sat | | | | | | | | | | | | | | |
| 10 Sun | | | | | | | | | | | | | | |
| 11 Mon | | | | | | | | | | | | | | |
| 12 Tue | | | | | | | | | | | | | | |
| 13 Wed | | | | | | | | | | | | | | |
| 14 Thu | | | Transport JL77 | | | | | | | | | | | |
| 15 Fri | | | Meeting | | | | | | | | | | | |
| 16 Sat | | | Meeting | | | | | | | | | | | |
| 17 Sun | | | Meeting | | | | | | | | | | | |
| 18 Mon | | | Meeting | | | | | | | | | | | |
| 19 Tue | | | Meeting | | | | | | | | | | | |
| 20 Wed | | | Meeting | | | | | | | | | | | |
| 21 Thu | | | Meeting | | | | | | | | | | | |
| 22 Fri | | | Meeting | | | | | | | | | | | |
| 23 Sat | | | Meeting | | | | | | | | | | | |
| 24 Sun | | | Meeting | | | | | | | | | | | |
| 25 Mon | | | Meeting | | | | | | | | | | | |
| 26 Tue | | | Meeting | | | | | | | | | | | |
| 27 Wed | | | Meeting | | | | | | | | | | | |
| 28 Thu | | | Meeting | | | | | | | | | | | |
| 29 Fri | | | Meeting | | | | | | | | | | | |
| 30 Sat | | | Meeting | | | | | | | | | | | |

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | Mr. MATSUYAMA Hiroyuki | Mr. MISHINA Takahiro | Mr. MIURA Minoru | Mr. SAGARA Hiroaki | Mr. WATANABE Yoshiki | Mr. SUZUKI Nobuaki | Mr. SHIBATA Ritsuhiko | Mr. KIYOTANI Kenzaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Rikyo | Mr. LONG Chanthi | Mr. OGATA Hiromasa |
|------------|----------------------|------------------------|----------------------|--|--|--|--|--|------------------------|------------------------|---------------------|-------------------|---------------------|----------------------|
| | | JICA | Chief Engineer | Chief Engineer | Road Design Engineer 1 | Road Design Engineer 2 | Road Design Engineer 3 | Road Design Engineer 3 | Road Design Engineer 4 | Road Design Engineer 4 | Drainage Engineer | Drainage Engineer | Structural Engineer | Construction Planner |
| July 1 Sun | | | Meeting | | | | | | | | | | | |
| 2 Mon | | | Meeting | Transport JL77 | Transport JL77 | Transport JL77 | Transport JL77 | | | | | | | |
| 3 Tue | Conference with DOIH | | Meeting | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | | | | | | | |
| 4 Wed | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 5 Thu | Signature of EN | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Transport T6G4 | | | | | | |
| 6 Fri | Conference with DOIH | | Meeting | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | | | | | | |
| 7 Sat | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 8 Sun | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 9 Mon | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 10 Tue | Conference with DOIH | | Meeting | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | | | | | | | |
| 11 Wed | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 12 Thu | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 13 Fri | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 14 Sat | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 15 Sun | | | Meeting | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | | | | | | | |
| 16 Mon | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 17 Tue | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 18 Wed | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 19 Thu | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 20 Fri | Conference with DOIH | | Meeting | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | | | | | | | |
| 21 Sat | | | Meeting | Field Investigation | Field Investigation | Field Investigation | Field Investigation | | | | | | | |
| 22 Sun | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 23 Mon | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 24 Tue | Conference with DOIH | | Meeting | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | | | | | | | |
| 25 Wed | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 26 Thu | Signature of GA | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 27 Fri | Conference with DOIH | | Meeting | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | Conference with DOIH for Conference and Report | | | | | | | |
| 28 Sat | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 29 Sun | | | Meeting | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | Making of Material for Conference and Report | | | | | | | |
| 30 Mon | Conference with DOIH | | Meeting | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | | | | | | | |
| 31 Tue | | | Meeting | Transport JL78 | Transport JL78 | Transport JL78 | Transport JL78 | | | | | | | |

2. Study Schedule on The Rehabilitation Project of The Outer Bangkok Ring Road in The Kingdom of Thailand

| Date | Items | Mr. MATSUNO Hiroshi | Mr. MISHINA Takahiro | Mr. MURA Minoru | Mr. SAGARA Hirotaka | Mr. WATANABE Yoshiki | Mr. SUGIUCHI Noriaki | Mr. SHIBATA Reihomaru | Mr. KIYOTANI Kenzaki | Mr. OGAWA Junichiro | Mr. NAKAIMA Takashi | Mr. RYU Rikyo | Mr. LONG Chanthi | Mr. OGATA Hiromasa |
|--------|---------------------------------|---------------------------------|----------------------|-----------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|---------------------|-------------------|---------------------|----------------------|
| | | JICA | Chief Engineer | Chief Engineer | Road Design Engineer 1 | Road Design Engineer 2 | Road Design Engineer 3 | Road Design Engineer 3 | Road Design Engineer 4 | Road Design Engineer 4 | Drainage Engineer | Drainage Engineer | Structural Engineer | Construction Planner |
| 1 Wed | Meeting | | | | | | | | | | | | | |
| 2 Thu | Meeting | | | | | | | | | | | | | |
| 3 Fri | Meeting | | | | | | | | | | | | | |
| 4 Sat | Meeting | | | | | | | | | | | | | |
| 5 Sun | Meeting | | | | | | | | | Making of Report | | | | |
| 6 Mon | Meeting | | | | | | | | | Transport TG642 | | | | |
| 7 Tue | Meeting | | | | | | | | | Transport TG642 | | | | |
| 8 Wed | Meeting | | | | | | | | | | | | | |
| 9 Thu | Meeting | | | | | | | | | | | | | |
| 10 Fri | Meeting | | | | | | | | | | | | | |
| 11 Sat | Meeting | | | | | | | | | | | | | |
| 12 Sun | Meeting | | | | | | | | | | | | | |
| 13 Mon | Meeting | | | | | | | | | | | | | |
| 14 Tue | Meeting | | | | | | | | | | | | | |
| 15 Wed | Meeting | | | | | | | | | | | | | |
| 16 Thu | Meeting | | | | | | | | | | | | | |
| 17 Fri | Meeting | | | | | | | | | | | | | |
| 18 Sat | Meeting | | | | | | | | | | | | | |
| 19 Sun | Meeting | | | | | | | | | | | | | |
| 20 Mon | Meeting | | | | | | | | | | | | | |
| 21 Tue | Meeting | | | | | | | | | | | | | |
| 22 Wed | Meeting | | | | | | | | | | | | | |
| 23 Thu | Meeting | | | | | | | | | | | | | |
| 24 Fri | Meeting | | | | | | | | | | | | | |
| 25 Sat | Meeting | | | | | | | | | | | | | |
| 26 Sun | TRD Site Observation/Conference | Transport | | | | | | | | | | | | |
| 27 Mon | TRD Site Observation/Conference | TRD Site Observation/Conference | | | | | | | | | | | | |
| 28 Tue | TRD Site Observation/Conference | TRD Site Observation/Conference | | | | | | | | | | | | |
| 29 Wed | Signature of MID (RD/DOH) | Signature of MID (RD/DOH) | | | | | | | | | | | | |
| 30 Thu | Meeting | | | | | | | | | | | | | |
| 31 Fri | Meeting | | | | | | | | | | | | | |

| Outward Itinerary | Homecoming Itinerary |
|--|---|
| J-207 J-717 J-5007 TG643 TG661 | J-208 J-304 J-5008 TG642 TG676 |
| NRT → BKK NRT → BKK BKK → BKK NRT → BKK HND → BKK | BKK → NRT BKK → HND BKK → NRT BKK → NRT BKK → NRT |
| 18:00 - 22:40 11:00 - 16:40 11:00 - 16:30 12:00 - 18:30 24:30 - 4:30 | 04:00 04:00 06:00 06:30 06:50 |
| 8:10 - 16:25 21:40 - 6:00 23:10 - 5:35 23:50 - 6:10 7:35 - 15:45 | 01:50 06:20n 01:50n 06:20n 01:00n |

| |
|---|
| JICA JICA INTERNATIONAL COOPERATION AGENCY E/A Embassy of New Grant Agreement PR Position Report PR Progress Report |
|---|

| |
|--------------------------------|
| Transport Bangkok, Thailand |
|--------------------------------|

Appendix 3: List of Parties Concerned in the Recipient Country

3. List of Parties Concerned in the Recipient Country

Embassy of Japan in Thailand

| | |
|----------------------|-----------------------------------|
| Mr. Otaka Masahito | A Minister of Economic Department |
| Mr. Ishimoto Takeshi | First Secretary |
| Mr. Hayashi Ryotaro | Second Secretary |

JICA Thailand Office

| | |
|----------------------------|------------------------|
| Mr. Yoneda Kazuhiro | Chief Representative |
| Mr. Kawabata Tomoyuki | Senior Representative |
| Mr. Taniguchi Hajime | Representative |
| Mr. Miyahara Ai | Representative |
| Mr. Miyashita Yojiro | Representative |
| Ms. Katharine Maneethapodi | Senior Program Officer |

Strategic Committee for Water Resources management (SCWRM)

| | |
|------------------|-------------------------|
| Mr. Takeya Kimio | Visiting Senior Advisor |
|------------------|-------------------------|

ROJANA INDUSTRIAL PARK PUBLIC Co.,LTD.

Mr. Hayashi Kuniaki

Department of Highways, Ministry of Transport

| | |
|-------------------|-------------------------|
| Mr. Chusak Gaywee | Deputy Director General |
|-------------------|-------------------------|

Inter-City Motorway Division, Department of Highways

| | |
|---------------------------------|---|
| Mr. Sittichai Boonsaat | Director of Inter-City Motorway Division |
| Mr. Aditt Thongkun | Secretary of Inter-City Motorway Division |
| Mr. Suvichan Surabal | Senior Civil Engineer |
| Mr. Somnuk Wangamornmit | Civil Engineer |
| Dr. Thanasak Wongtanakitemaroon | Civil Engineer |
| Dr. Niphan Yaiaboon | Civil Engineer |
| Mr. Rung Buayaoraksa | Civil Engineer |
| Ms. Kavalin Wangsiripaisal | Civil Engineer |

Inter-City Motorway Maintenance District, Department of Highways

| | |
|--------------------------|--|
| Mr. Yongyos Vonnapradite | Director of Inter-City Motorway Maintenance District |
|--------------------------|--|

Bureau of Material Analysis and Inspection, Department of Highways

| | |
|---------------------------------|---|
| Dr. Montri Dechasakulsom | Director Bureau of Material Analysis and Inspection |
| Mr. Boonkua Janbanjong | Director of Analysis Group |
| Ms. Jeerikun Boonkhum | Director of Pavement Design Group |
| Dr. Poranic Jitareekul | Civil Engineer |
| Mr. Piyapong Jiwatanakulpaosarn | Civil Engineer |

Bureau of International Highways Cooperation, Department of Highways

| | |
|----------------------------|--|
| Dr. Chayatan Phromsorn | Director of Bureau of International Highways Cooperation |
| Ms. Manlika Nuankerd | Director of Foreign Relations Group |
| Dr. Punya Chupanit | Director of Management Group in Bureau of International Highways Cooperation |
| Mr. Natthasak Ariyapurk | Senior Civil Engineer |
| Mr. Thanapon Wirojarust | Civil Engineer |
| Mr. Parin Mruetneatorn | Civil Engineer |
| Ms. Kamonporn Sutthisuksri | Foreign Relations Officer |
| Ms. Sanirat Ketkaew | Foreign Relations Officer |
| Ms. Win Trivitayanurak | Foreign Relations Officer |

Management Group in Bureau of International Highways Cooperation

| | |
|--------------------|--|
| Dr. Punya Chupanit | Director of Management Group in Bureau of International Highways Cooperation |
|--------------------|--|

Bureau of Location and Design, Department of Highways

| | |
|-------------------------|---|
| Mr. Sombat Jaroenpat | Director of Bureau of Location and Design |
| Mr. Anuparp Oharuensale | Senior Civil Engineer |
| Mr. Pakorn Sripanwong | Civil Engineer |

Bureau of Planning, Department of Highways

| | |
|-------------------|--------------------------------|
| Mr. Chusak Gaywee | Director of Bureau of Planning |
|-------------------|--------------------------------|

Office of Environment and Public Involvement, Department of Highways

| | |
|---------------------------|--|
| Mr. Surajit Thipayakesorn | Director of Office of Environment and Public Involvement |
| Dr. Win Trivitayanurak | Environmentalist |

Bureau of Highway Construction 2, Department of Highways

| | |
|-------------------------|--|
| Mr. Phaithun Khumvongdi | Director of Bureau of Highway Construction 2 |
|-------------------------|--|

Local Contractor

Vichitbhan Construction Co., Ltd.

Mr. Vivat Chavananand Officer in Business Development Department

Mr. Chalermpon Phetsawad Civil Engineer

SSV Construction Co., Ltd.

Mr. Jirachai Na Caiyo Vice President

Mr. Vichan Lerthirancharoen Civil Engineer

D.B.T. Engineering Co., Ltd.

Sarit jenyavanija Director

Mr. Decha Horsuwan Director

NTP Applicater Co., Ltd.

Mr. Kittirote Punasiri General Manager

Banchakij Co., Ltd.

Mr. Patarachai Banchawattana Director

Mr. Patcharin Banchawattana Manager

Local Consulting Company

Asian Engineering Consultants Co., Ltd.

Mr. Somchai Achavanuntakul Chairman

Dr. Sakda Santathadaporn Vice Chairman

Mr. Charoon Patai Executive Director and Manager

Geo-Technology Consultants Co., Ltd.

Mr. Krittanon Nilpanich Director and Sr. Manager Engineering

Mr. Suchart Suksa-ard Senior Field Work and Testing Manager

STS Engineering Consultants Co., Ltd.

Mr. Unnop Tiyajamorn Manager in Survey and Design Division

S.P.S Consulting Service Co., Ltd.

Ms. Sukon Khawgrib Senior Environmental Scientist

Appendix 4: Minutes of Discussions

a) Inception Report

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE REHABILITATION PROJECT
OF THE OUTER BANGKOK RING ROAD (EAST PORTION)
IN THE KINGDOM OF THAILAND

In response to a request from the Government of the Kingdom of Thailand (hereinafter referred to as "GOT"), the Government of Japan decided to conduct a Project for Comprehensive Flood Management Plan for the Chao Phraya River Basin (hereinafter referred to as "the umbrella Project") which consists of (i) Comprehensive flood management plan (Component 1), (ii) Outline design for Japanese Grant Aid (Component 2) and (iii) Pilot projects for emergency rehabilitation (Component 3). The Japan International Cooperation Agency (hereinafter referred to as "JICA") has started the umbrella Project since December 2011, and had series of discussions on the project selection of Component 2 among organization concerned. Finally, a project titled "The Rehabilitation Project of the Outer Bangkok Ring Road (East Portion)" (hereinafter referred to as "the Project") has been selected by the Department of Highways, Ministry of Transport (hereinafter referred to as "DOH") and JICA. Necessary procedures and arrangements are in progress in respective governments.

According to the Record of Discussions of the umbrella Project signed on 13 January, JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team"), which was headed by Mr. Kazuhiro Yoneda, Chief Representative, JICA Thailand Office, and was scheduled to stay in the country from February 22nd to the end of August, 2012. The Team held discussions with the officials concerned of GOT and conducted a field survey in the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Bangkok, February 24, 2012



Mr. Kazuhiro Yoneda
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Mr. Wanchai Parkluck
Director General
Department of Highways,
Ministry of Transport

ATTACHMENT

1. Background

| | |
|-----------------------|---|
| October 2012 | The flood of the Chao Phraya River began to affect the people and economy of the Kingdom of Thailand. |
| October 19 – 28, 2011 | JICA Needs Survey Team investigated the flood damages. |
| November 7, 2011 | Government of Thailand (Ministry of Foreign Affairs) officially requested the umbrella Project proposed by the RID and DWR. |
| December 22, 2011 | Minutes of Meetings which described basic understanding both sides about framework, contents and important issues to be concerned of the umbrella Project was signed and exchanged by RID, DWR and JICA witnessed by the National Economic and Social Development Board (hereinafter referred to as “NESDB”). |
| December 22, 2011 | Consultant Team of the umbrella Project was assigned by JICA. |
| January 13, 2012 | Record of Discussion (hereinafter referred to as “R/D”) which stipulated contents of the umbrella Project was signed and exchanged by NESDB, RID, DWR and JICA. |

2. Outline of the umbrella Project

- Component 1: Comprehensive flood management plan considering the effect of the climate change and land development. This component consists of two (2) sub-components as follows;
- Sub-component 1-1: Preparation of a detailed map necessary for reviewing the M/P of 1999 (Sub-component 1-2)
 - Sub-component 1-2: Review of the “Study on integrated plan for flood mitigation in Chao Phraya River Basin” (hereinafter referred to as “M/P”)
- Component 2: Outline design for Japanese Grant Aid for Disaster Prevention and Reconstruction
- Component 3: Pilot projects of emergency rehabilitations and/or urgent countermeasures to protect the priority area such as the industrial complex and/or Bangkok are implemented

- This Preparatory Survey will be conducted under the Component 2.

3. Project Title

Both sides agreed that the project title for this survey was “The Rehabilitation Project of the Outer Bangkok Ring Road (East Portion)”.

W. Parkluck. 

4. Objective of the Project

The objective of the Project is to secure the function of logistic network even in the time of flood disaster by heightening the Outer Bangkok Ring Road (East Potion).

5. Project site

The site of the Project is located on the Outer Bangkok Ring Road (East Potion) from the traffic origin to 30 kilometers point as shown in ANNEX 1.

6. Responsible and Implementing Agency

The responsible and implementing entity for the Project is the Department of Highways, Ministry of Transport.

7. Items requested by the Government of Thailand

Through discussions between DOH and the Team, the requested components were confirmed as below.

➤ Heightening one side of the road surface level of the Outer Bangkok Ring Road (East Potion) which goes to the north bound where:

- (1) the level of the road surface is 20 centimeter or more lower than the highest level of the 2011 flood, and
- (2) the toll gates are situated.

Appropriateness and necessity of the request will be assessed and specifications of the request will be decided based on the result of the Preparatory Survey and additional survey done by the JICA's consultant in consideration with budget availability of Japan's Grant Aid and operation and maintenance capacity of DOH.

8. Japan's Grant Aid Scheme

8-1 Thai side understands the Japan's Grant Aid Scheme explained by the Team, as described in ANNEX 2. Thai side also understands that the procedure for the Project is specially arranged due to emergency treatment.

8-2 Thai side will take the necessary measures, as described in ANNEX 3, for smooth implementation of the Project.

9. Schedule of the Survey

9-1 The Team will proceed for further studies in Thailand until the end of August, 2012.

9-2 The Team will prepare the progress report of the Preparatory Survey in English. JICA will dispatch a mission to explain its contents in May.

Contents of the progress report will consist of technical notes, preliminary design, undertakings and inputs from each Government and necessary measures for environmental

and social consideration.

9-3 JICA will prepare the final report of the Preparatory Survey and dispatch a mission to explain its contents in August.

Contents of the final report will be detailed design, implementation plan, cost estimation, and maintenance and monitoring plan.

In addition to the final report, a set of reference documents for making bid documents will be prepared.

9-4 JICA will finalize the final report and send it to the GOT by the end of August, 2012.

10. Other relevant issues

10-1 Responsibility for the detailed design and bid document

Through the Preparatory Survey and additional survey, JICA will prepare detailed design and related documents just as reference documents for conducting bidding procedure. GOT has to take necessary procedure to authorize the detailed design and the bid document after receiving reference documents.

10-2 Provision of Disposal Area of Construction Debris

Thai side agreed to provide the area for construction debris which was from removing the existing pavement and its foundation of the road to be heightened by the Project and take necessary measures according to the related law before the commencement of the construction work.

10-3 Environmental and Social Considerations

Both sides agreed that it is not necessary to take procedures for the approval of Environmental Impact Assessment (hereinafter referred to as "EIA") for the Project according to the laws and regulations of Thailand.

The Team explained that the Project is temporally categorized as "B" based on JICA's Guidelines for Environmental and Social Considerations (April, 2010) because the Project does not have significant adverse impact but needs careful consideration for environmental and social impact as it is new construction project. Thus Initial Environmental Examination (hereinafter referred to as "IEE") shall be conducted for the Project.

Both sides agreed that IEE have to be applied to the Project, and IEE will be confirmed by DOH with support from the Team by the time of discussion on the progress report of the Preparatory Survey.

GOT shall have a full responsibility for explanation to stakeholders about environmental impacts of the Project, if necessary.

Also GOT is requested to take actions such as preparing environmental check list as shown in ANNEX 4 as a blank form and taking the monitoring procedure in accordance with the monitoring form as shown in ANNEX 5.

The environmental check list and the monitoring form have to be prepared by the time of discussion on the progress report of the Preparatory Survey.

10-4 Design Policy and Condition

Both sides agreed on the design policy and condition as shown in the Inception Report as the related document to this Minutes of Discussions. If any changes and/or detailed technical issue to be confirmed between both sides arise, technical note will be made, signed and exchanged by both sides. Representative of JICA side for this technical matter is a leader of consultant team, and representative of Thai side is Deputy Director General for Engineering of DOH.

10-5 Arrangement for the Survey

As response to the request by the Team, Thai side agreed to arrange following items:

- (1) To provide the Team with available data, information and materials necessary for the execution of the Survey which was agreed in R/D.
- (2) To prepare the answers for the Questionnaires presented by the Team,
- (3) To assign full-time counterparts to the Team during their stay in Thailand and to play the following roles as the coordinator to the Team:
 - 1) To make the appointments and to set up the meetings with the authorities, departments and all other factories and firms whatever the Team intends to visit,
 - 2) To attend site survey and any other visiting place with the Team and to make any convenience on accommodation, working room, adequate transportation, getting the permissions if required, etc., and
 - 3) To assist and to advise the Team for their collection of data and information as much as possible,
- (4) To take any necessary measures deemed necessary to secure the safety of the members of the Team, and
- (5) To make arrangements to allow the Team to bring back to Japan any necessary data, maps and materials related to the Preparatory Survey, subject to approval by the GOT, in order to prepare the report.

10-6 Operation and Maintenance cost

Necessary cost for operation and maintenance of the project after the completion of the Project will be surveyed through the Preparatory Survey.

10-7 Confidentiality of the Project

All the information related to the Project such as detailed drawings, specifications, and the result of cost estimation shall not be released to a third party before conclusion of all the contract(s) for the Project, because they are confidential documents that contain


information related to the tender.

10-8 Tax Exemption

The tax exemption including Value Added Tax (VAT), custom duty, and any other taxes and fiscal levies in Thailand which is to be arisen from the Project activities will be ensured by DOH. DOH and the Thailand International Development Cooperation Agency will take any procedures necessary for tax exemption with the Ministry of Finance of Thailand at their responsibility.

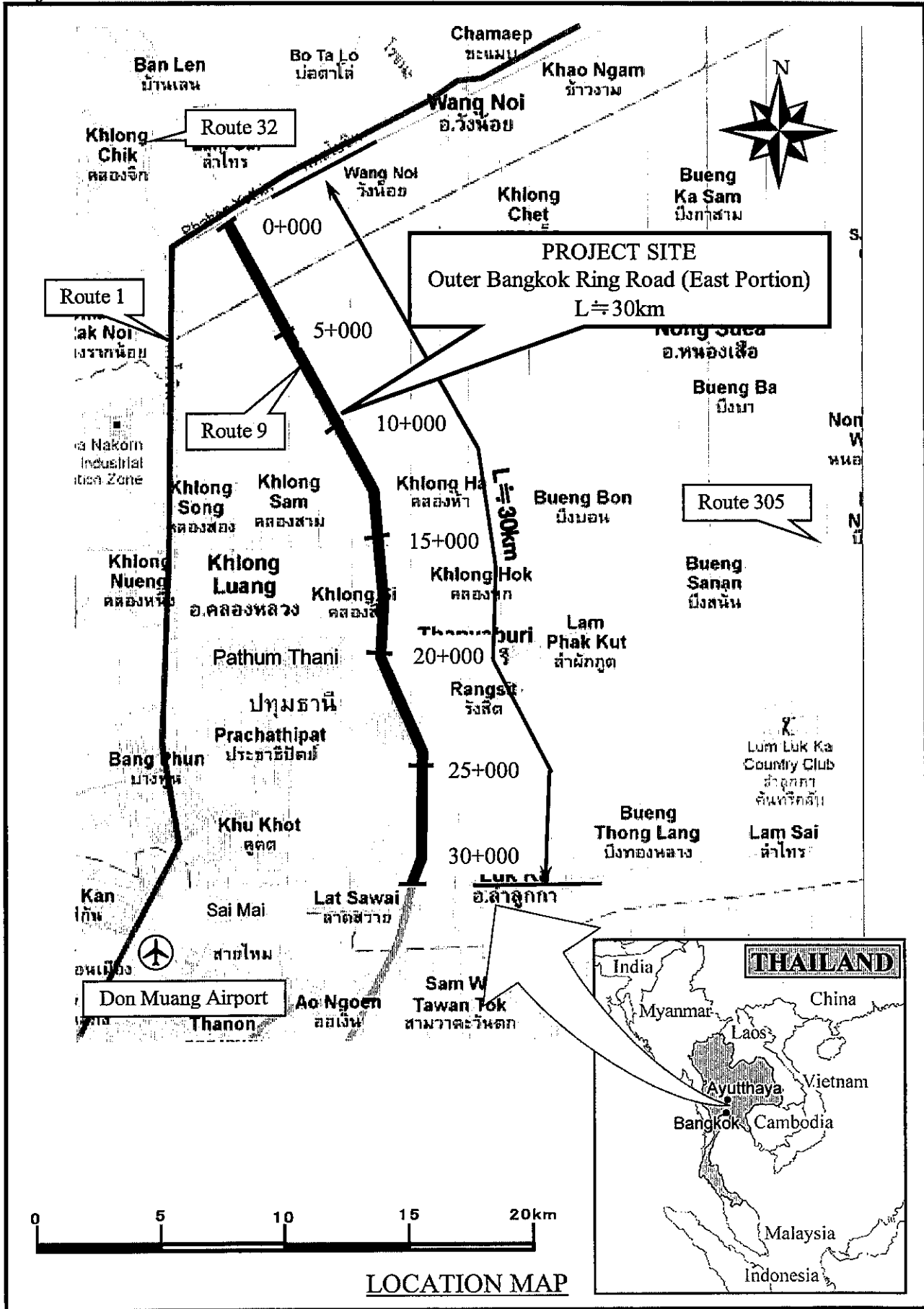
- Annex 1: Project Site
- Annex 2: Grant Aid Scheme JAPAN'S GRANT AID
- Annex 3: Major Undertakings to be taken by Each Government
- Annex 4: Environmental Checklist
- Annex 5: Monitoring Form

Related Document to the Minutes of Discussions: Inception Report



W. Porakul.

Project Site



N. Parkkuck

Grant Aid Scheme JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and a recipient country
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of this Preparatory Survey is to provide reference documents for making bid document for the contract of the Project. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design and detailed design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Detailed Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed

by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and transfers it to the Government of recipient country.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex 3.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

W. Park

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

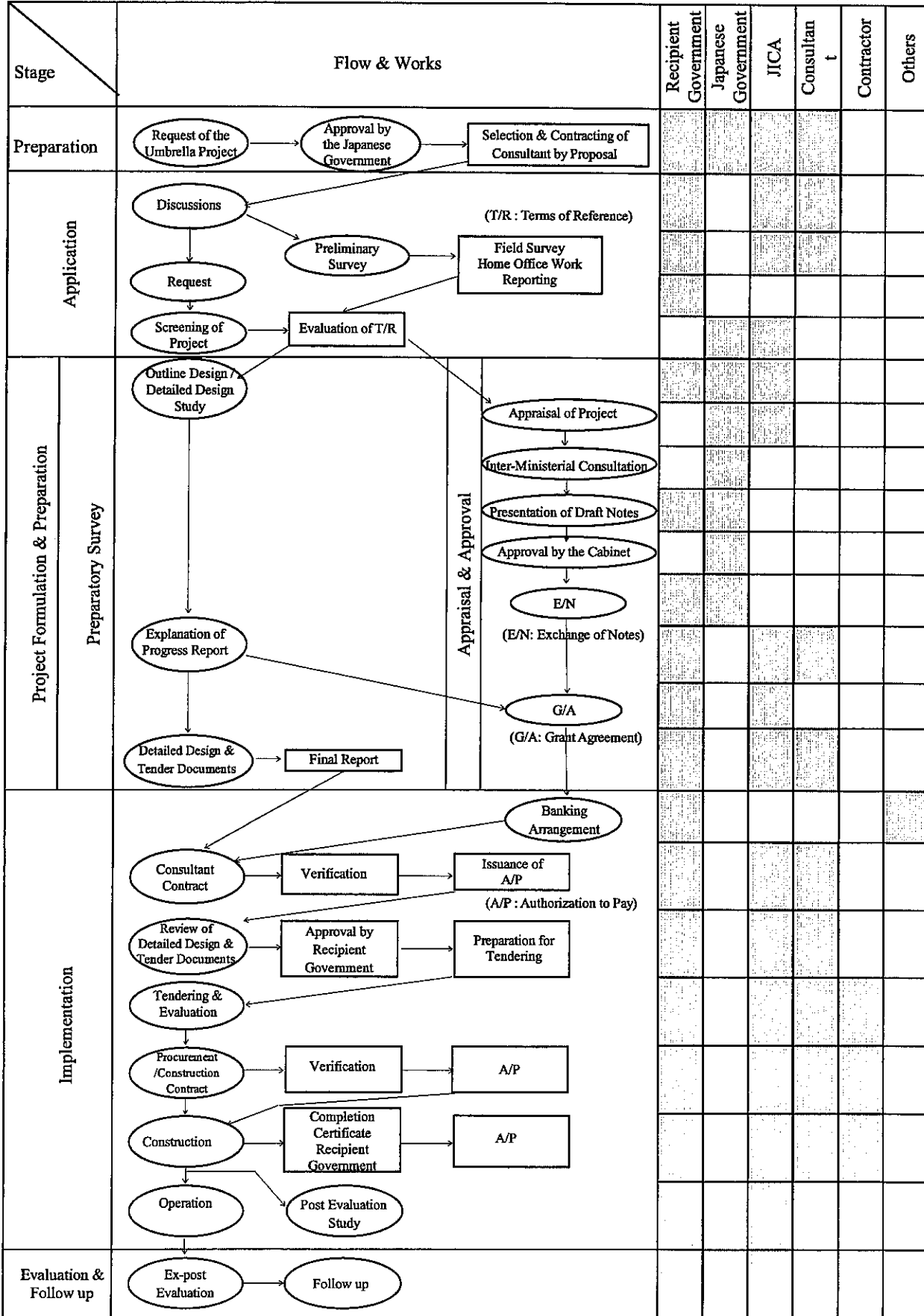
(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA's Guidelines for Environmental and Social Considerations (April, 2010).



W. Parkluck

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES IN THIS CASE



W. Parkhuck.

Major Undertakings to be taken by Each Government

| No. | Items | To be covered by Grant Aid | To be covered by Recipient Side |
|-----|--|----------------------------|---------------------------------|
| 1 | to secure [a lot]/[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites]; | | ● |
| 2 | To ensure prompt customs clearance of the products and to assist internal transportation of the products in the recipient country | | |
| | 1) Marine (Air) transportation of the Products from Japan to the recipient country | ● | |
| | 2) Tax exemption and custom clearance of the Products at the port of disembarkation | | ● |
| | 3) Internal transportation from the port of disembarkation to the project site | (●) | (●) |
| 3 | To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services [be exempted] / [be borne by the Authority without using the Grant] | | ● |
| 4 | To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work | | ● |
| 5 | To ensure that the Facilities be maintained and used properly and effectively for the implementation of the Project | | ● |
| 6 | To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project | | ● |
| 7 | To bear the following commissions paid to the Japanese bank for banking services based upon the B/A | | |
| | 1) Advising commission of A/P | | ● |
| | 2) Payment commission | | ● |
| 8 | To give due environmental and social consideration in the implementation of the Project. | | ● |

(B/A : Banking Arrangement, A/P : Authorization to pay)

N. Parkleuk

Environmental Checklist: 7. Roads

| Category | Environmental Item | Main Check Items | Yes: Y No: N | Confirmation of Environmental Considerations (Reasons, Mitigation Measures) |
|---------------------------|---|---|--------------------------|--|
| 1 Permits and Explanation | (1) EIA and Environmental Permits | <p>(a) Have EIA reports been already prepared in official process?</p> <p>(b) Have EIA reports been approved by authorities of the host country's government?</p> <p>(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p> | (a) (b) (c) (d) | (a) (b) (c) (d) |
| | (2) Explanation to the Local Stakeholders | <p>(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?</p> <p>(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?</p> | (a) (b) | (a) (b) |
| | (3) Examination of Alternatives | <p>(a) Have alternative plans of the project been examined with social and environmental considerations?</p> | (a) | (a) |
| 2 Pollution Control | (1) Air Quality | <p>(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken?</p> <p>(b) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?</p> | (a) (b) | (a) (b) |
| | (2) Water Quality | <p>(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas?</p> <p>(b) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater?</p> <p>(c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?</p> | (a) (b) (c) | (a) (b) (c) |
| | (3) Wastes | <p>(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?</p> | (a) | (a) |

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| | | | | |
|----------------------------|-------------------------|---|--|--|
| | (4) Noise and Vibration | <p>(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?</p> <p>(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?</p> <p>(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?</p> <p>(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?</p> <p>(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?</p> <p>(d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock?</p> <p>(e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?</p> <p>(f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?</p> | (a) | |
| (1) Protected Areas | | | (a) | |
| (2) Ecosystem | | | (a) (b) (c) (d) (e) (f) | |
| (3) Hydrology | | <p>(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?</p> <p>(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?</p> <p>(b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?</p> <p>(c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?</p> | (a) | |
| (4) Topography and Geology | | | (a) (b) (c) | |

3 Natural Environment

W. Park-Neeb

| | | |
|-----------------------------|--|---|
| <p>(1) Resettlement</p> | <p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?(d) Are the compensations going to be paid prior to the resettlement?(e) Are the compensation policies prepared in document?(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?(g) Are agreements with the affected people obtained prior to resettlement?(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?(i) Are any plans developed to monitor the impacts of resettlement?(j) Is the grievance redress mechanism established?</p> | <p>(a)(b)(c)(d)(e)(f)(g)(h)(i)(j)</p> |
| <p>4 Social Environment</p> | <p>(2) Living and Livelihood</p> | <p>(a) Where roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?</p> |

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| | | | | |
|----------------------|--|---|--------------------------|--------------------------|
| | (3) Heritage | (a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws? | (a) | (a) |
| | (4) Landscape | (a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken? | (a) | (a) |
| | (5) Ethnic Minorities and Indigenous Peoples | (a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected? | (a) (b) | (a) (b) |
| 4 Social Environment | (6) Working Conditions | (a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures being taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents? | (a) (b) (c) (d) | (a) (b) (c) (d) |
| 5 Others | (1) Impacts during Construction | (a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? | (a) (b) (c) | (a) (b) (c) |

W. Parkhach.

| | | |
|----------------|---|--------------------------|
| | <p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p> | (a) (b) (c) (d) |
| (2) Monitoring | | (a) (b) (c) (d) |
| 6 Note | <p>Reference to Checklist of Other Sectors</p> | (a)(b) |
| | <p>Note on Using Environmental Checklist</p> | (a) |

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

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MONITORING FORM

-If environmental reviews indicate the need of monitoring by JICA, JICA undertakes monitoring for necessary items that are decided by environmental reviews. JICA undertakes monitoring based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

-When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase) should be considered.

1. Responses/Actions to Comments and Guidance from Government Authorities and the Public

| Monitoring Item | Monitoring Results during Report Period |
|---|---|
| ex.) Responses/Actions to Comments and Guidance from Government Authorities | |

2. Mitigation Measures

- Air Quality (Emission Gas / Ambient Air Quality)

| Item | Unit | Measured Value (Mean) | Measured Value (Max.) | Country's Standards | Referred International Standards | Remarks (Measurement Point, Frequency, Method, etc.) |
|-----------------|------|-----------------------|-----------------------|---------------------|----------------------------------|--|
| SO ₂ | | | | | | |
| NO ₂ | | | | | | |
| CO | | | | | | |
| O ₃ | | | | | | |
| Soot and dust | | | | | | |
| SPM | | | | | | |
| Dust | | | | | | |

- Water Quality (Effluent/Wastewater/Ambient Water Quality)

| I. II. III. Item | 1. 2. 3. Unit | Measured Value (Mean) | Measured Value (Max.) | Country's Standards | Referred International Standards | Remarks (Measurement Point, Frequency, Method, etc.) |
|------------------------|---------------------|-----------------------|-----------------------|---------------------|----------------------------------|--|
| pH | | | | | | |
| SS (Suspended Solid) | | | | | | |
| BOD/COD | | | | | | |
| DO | | | | | | |
| Total Nitrogen | | | | | | |

| | | | | | | |
|-----------------------------|--|--|--|--|--|--|
| Total Phosphorus | | | | | | |
| Heavy Metals | | | | | | |
| Hydrocarbons / Mineral Oils | | | | | | |
| Phenols | | | | | | |
| Cyanide | | | | | | |
| Temperature | | | | | | |

- Waste

| Monitoring Item | Monitoring Results during Report Period |
|-----------------|---|
| | |

- Noise / Vibration

| Item | Unit | Measured Value (Mean) | Measured Value (Max.) | Country's Standards | Referred International Standards | Remarks (Measurement Point, Frequency, Method, etc.) |
|-----------------|------|-----------------------|-----------------------|---------------------|----------------------------------|--|
| Noise level | | | | | | |
| Vibration level | | | | | | |

- Odor

| Monitoring Item | Monitoring Results during Report Period |
|-----------------|---|
| | |

3. Natural Environment

- Ecosystem

| Monitoring Item | Monitoring Results during Report Period |
|---|---|
| ex.) Negative effects/Actions to Valuable species | |

4. Social Environment

- Resettlement

| Monitoring Item | Monitoring Results during Report Period |
|-----------------|---|
| | |

- Living / Livelihood

| Monitoring Item | Monitoring Results during Report Period |
|-----------------|---|
| | |

W. Park/cek

b) Progress Report

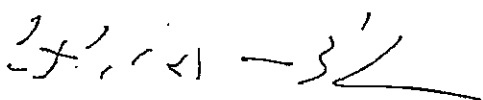
MINUTES OF MEETINGS
ON THE PREPARATORY SURVEY
ON THE REHABILITATION PROJECT
OF THE OUTER BANGKOK RING ROAD (EAST PORTION)
IN THE KINGDOM OF THAILAND

According to the Minutes of Discussions on the Preparatory Survey on "The Rehabilitation Project of the Outer Bangkok Ring Road (East Portion)" (hereinafter referred to as "the Project") on February 29, 2012, JICA Study Team conducted series of field survey and discussion among related organization, and finally made Progress Report as attached.

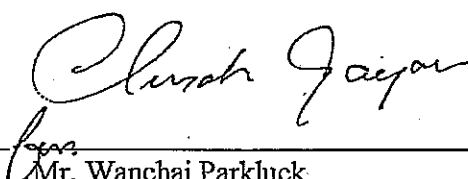
On this occasion, the JICA Preparatory Survey Team (hereinafter referred to as "the Team"), which was headed by Mr. Kazuhiro Yoneda, Chief Representative, JICA Thailand Office and Department of Highways (hereinafter referred to as "DOH") had discussions on the contents of the Progress Report, and reached to the agreement.

The contents of the discussions which should be taken note are attached as the Annex.

Bangkok, May 31, 2012



Mr. Kazuhiro Yoneda
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Mr. Wanchai Parkluck
Director General
Department of Highways,
Ministry of Transport

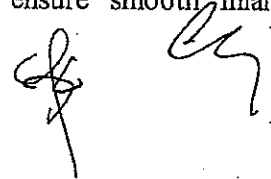
1. Technical Issue

The Thai side basically understood and agreed on the Technical Note as the Attachment-3 of the Progress Report as main points of technical issues and preliminary design of the road and related structures.

2. Obligation of Thai side

2-1 The Team explained the obligations of Thai side and Thai side agreed on the contents as follow.

- (1) To provide documents, data and information necessary for the execution of this project;
- (2) To acquire land for construction works;
- (3) To secure land for the construction yard, stock-piling yard, site office, girders' manufacturing yard, and detour routes;
- (4) To secure borrow pits, spoil-banks, and industrial waste disposal areas;
- (5) To obtain all necessary permits, to coordinate and share necessary information with concerning organizations regarding the method of road occupancy of the Motorway, method for allowing public vehicles, traffic restrictions, and day-time, night-time works;
- (6) To release information and take necessary steps before hand regarding blockage of road for public vehicles during relocation of overhead facilities such as traffic signs ;
- (7) To coordinate with the concerned organization of underground utilities pertaining to its protection, reinforcement/ repair and to release information as well as to take necessary steps to alert the road users and the locals in case disruption of water and electricity are anticipated;
- (8) To coordinate with the concerned organization of street lights and electronic traffic sign regarding its protection or/and its relocation and to take necessary steps to inform the road users beforehand in case of disruption of electricity is anticipated;
- (9) To obtain necessary permits for allowing the personnel engaged in the construction work such as the supervision engineer, construction workers etc. to access the motorway;
- (10) To obtain necessary permits to allow the construction vehicles and equipment to enter and exit the motorway;
- (11) To bear the Advising Commission and Payment Commission to the Japanese bank where an account related to the project is opened, for the banking services like service charge and disbursement charge;
- (12) To bear the value-added-tax related to the project;
- (13) To assist in the process for exemption of materials imported for the construction work from taxation and Customs clearance in order to ensure smooth inland transportation;



- (14) To assist in the process for exemption of Japanese nationals engaged in the construction work from Customs duties and other fiscal levies on products and services necessary for the execution of the project;
- (15) To assist in the process for exemption of Japanese nationals from all legislation measures necessary for entering and staying in the Kingdom of Thailand;
- (16) To ensure proper use and maintenance of the road after its construction;
- (17) To cooperate in solving potential troubles with the local people or any third party in connection with the execution of the project; and
- (18) To bear all expenses required for the execution of the project, other than those borne by the Grant-Aid of Japan.

Thai side explained that some items such as Customs Clearance, Customs Duties, and Fiscal Levies were not responsibility of DOH, and DOH could just assist for those items. The Team understood it, and the Team requested DOH to consult with responsible organizations and Thailand International Development Cooperation Agency on the issue. DOH agreed on it.

2-2 According to the request from Thai side, the Team agreed that following issue would be included into the Japanese Grant Aid Project.

- (1) To install equipment for electricity at the site office;
- (2) To remove or/and relocate obstacles of construction (toll gate facilities, trees); and
- (3) To pay the toll fees for construction vehicles and equipment to enter and exit the motorway.

3. Environmental Consideration

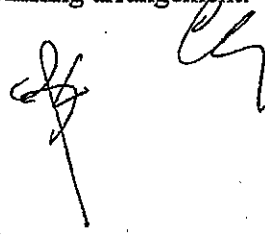
3-1 Both sides basically agreed on the draft of Initial Environmental Examination Report for the Project. Although the result of evaluation will not be changed from the draft version, it needs some modification on the wording according to the comments from the section/department in charge of the environmental issue of the both sides. The report will be finalized within three weeks by Thai side with the technical support from the Team and be confirmed by another minutes of meetings signed by Chief Engineer of the Team and representative of DOH.

3-2 DOH questioned regarding the Mitigation Plan whether the mitigation plans could be included into the contract and DOH would just conduct monitoring or not. The Team answered that contents of the mitigation plan could be included into the contract and DOH monitor those activities.

4. Banking Account

Thai side questioned to the Team whether the Bank could be Japanese Bank which has a branch in Bangkok or not. The Team answered that DOH has to open the Banking Account in Japan and opening the account in any branch in Bangkok or Thailand could not be accepted.

Thai side understood it and requested the Team to assist for the Process. The Team answered that Bank in Japan and consultant Team can assist DOH for banking arrangement.

Two handwritten signatures in black ink. The signature on the left is more complex and stylized, while the one on the right is simpler and more cursive.

MINUTES OF MEETINGS
ON THE PREPARATORY SURVEY
ON THE REHABILITATION PROJECT
OF THE OUTER BANGKOK RING ROAD (EAST PORTION)
IN THE KINGDOM OF THAILAND

According to the Minutes of Meetings on the Preparatory Survey on “The Rehabilitation Project of the Outer Bangkok Ring Road (East Portion)” (hereinafter referred to as “the Project”) on May 31, 2012, Department of Highways, Ministry of Transport (hereinafter referred to as “DOH”) finalized the Initial Environmental Examination Report (hereinafter referred to as “the IEE Report”) with the technical support from the JICA Preparatory Survey Team (hereinafter referred to as “the Team”) as attached.

On the meeting, DOH and the Team had discussions on the contents of the IEE Report, and reached the agreement.

Bangkok, June 19, 2012

Mr. Takahiro MISHINA
Chief Engineer
JICA Preparatory Survey Team

Mr. Chusak GAYWEE
Deputy Director General for Engineering
Department of Highways
Ministry of Transport

c) Final Report

MINUTES OF MEETINGS
ON THE PREPARATORY SURVEY
ON THE REHABILITATION PROJECT OF THE OUTER BANGKOK RING ROAD
IN THE KINGDOM OF THAILAND

According to the Minutes of Discussions on the Preparatory Survey on “The Rehabilitation Project of the Outer Bangkok Ring Road” (hereinafter referred to as “the Project”) on February 24, 2012, JICA Survey Team conducted series of field survey and discussion among related organizations, and finally made draft report of the survey.



In order to explain and consult with Department of Highways (hereinafter referred to as “DOH”) on the components of the draft report, JICA sent the Draft Report Explanation Team (hereinafter referred to as “the Team”), headed by Mr. Kunihiro Yamauchi, Deputy Director General for Planning and Coordination, Global Environment Department, Japan International Cooperation Agency, from August 26 to 29, 2012.

As a result of the discussions, both sides confirmed the items described on the attached sheets.

Bangkok, August 29, 2012



Mr. Kunihiro Yamauchi
Leader
Draft Report Explanation Team
Japan International Cooperation Agency

Mr. Wanchai Parkluck
Director General
Department of Highways,
Ministry of Transport

Attachment

1. Components of the draft report and related documents

DOH agreed with and accepted the contents of the draft report and the related document prepared by the JICA survey team. The Japanese side will finalize the Final Report according to the comments from DOH.

2. Schedule of the Survey

The Team explained the tentative implementation schedule as shown in Annex-2.

DOH requested to minimize construction period to be not more than one and a half years in order to minimize traffic congestion period.

The team answered to consider the request and report in the Final Report.

3. Japan's Grant Aid Scheme

DOH understood Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Thailand as explained by the Team which was described in the Minutes of Meetings signed on February 24, 2012.

4. Confidentiality on Detailed Specifications

Both sides confirmed all the information related to the Project including technical specifications and drawings and other technical information shall not be released to any other party(ies) before the signing of all the Contract(s) for the Project.

5. Undertakings of Government of Thailand

5-1 To provide documents, data and information necessary for the execution of this project;

5-2 To acquire land for construction works;

5-3 To secure land for the construction yard, stock yard, disposal area for construction debris, site office yard and detour routes;

5-4 To secure borrow pits, spoil-banks, and industrial waste disposal areas;

5-5 To obtain all necessary permits, to coordinate and share necessary information with the organizations concerned regarding the method of road occupancy of the Motorway, method for allowing public vehicles, traffic restrictions, and day-time, night-time works;

5-6 To release information and take necessary steps before hand regarding blockage of road for public vehicles during relocation of overhead facilities such as traffic signs;

- 5-7 To coordinate with the organizations concerned of underground utilities pertaining to its protection, reinforcement/repair and to release information as well as to take necessary steps to alert the road users and the locals in case disruption of water and electricity are anticipated;
- 5-8 To coordinate with the organizations concerned of street lights and electronic traffic sign regarding its protection or/and its relocation and to take necessary steps to inform the road users beforehand in case of disruption of electricity is anticipated;
- 5-9 To obtain necessary permits for allowing the personnel engaged in the construction work such as the supervision engineer, construction workers etc. to access the motorway;
- 5-10 To bear toll collection system;
- 5-11 To bear the advising commission and payment commission to the Japanese bank where an account related to the Project is opened, for the banking services like service charge and disbursement charge;
- 5-12 To exempt the value added tax related to the Project;
- 5-13 To assist in the process for exemption of materials imported for the construction work from taxation and customs clearance in order to ensure smooth inland transportation;
- 5-14 To assist in the process for exemption of Japanese nationals engaged in the construction work from customs duties and other fiscal levies on products and services necessary for the execution of the Project;
- 5-15 To assist in the process for exemption of Japanese nationals from all legislation measures necessary for entering and staying in the Kingdom of Thailand;
- 5-16 To ensure proper use and maintenance of the road after its construction;
- 5-17 To cooperate in solving potential troubles with the local people or any third party in connection with the execution of the Project; and
- 5-18 To bear all expenses required for the execution of the Project, other than those borne by the Grant Aid of Japan.

Thai side explained that some items such as value added tax, customs clearance, customs duties, and fiscal levies were not responsibility of DOH, and DOH could just assist for those items. The Team understood it, and the Team requested DOH to consult with responsible organizations and Thailand International Development Cooperation Agency on the issue, DOH agreed on it.

6. Design Policy and Liability on submergence in case of flooding

The Team explained and DOH agreed that:

- (1) the objective of the project is to secure the function of logistic network even in the time of flood disaster by raising existing road elevation;
- (2) the design road elevation is raised with an concept of allowing upto 20cm submergence of water above road surface during similar flooding as in 2011 which recorded historical highest flood level in the surrounding area of the Project sites; and
- (3) in case that the road structure will be soaked or submerged due to flooding and damage of the road occurs, Japanese side including the Consultant and the Contractor shall not be liable for such damages.

7. Consolidation Settlement

7-1 Additional boring investigation

The Team explained and DOH agreed the result of estimation of consolidation settlement, the prospected situation that submergence on the road would be still acceptable level, and that the countermeasures for settlement would not be provided under the Project.

The JICA survey team will conduct additional boring investigation located at the existing carriageway to confirm the calculation of consolidation settlement done by the JICA survey team.

7-2 Allowable consolidation settlement

Both sides agreed that allowable consolidation settlement should be specified in the technical specification of the tender document.

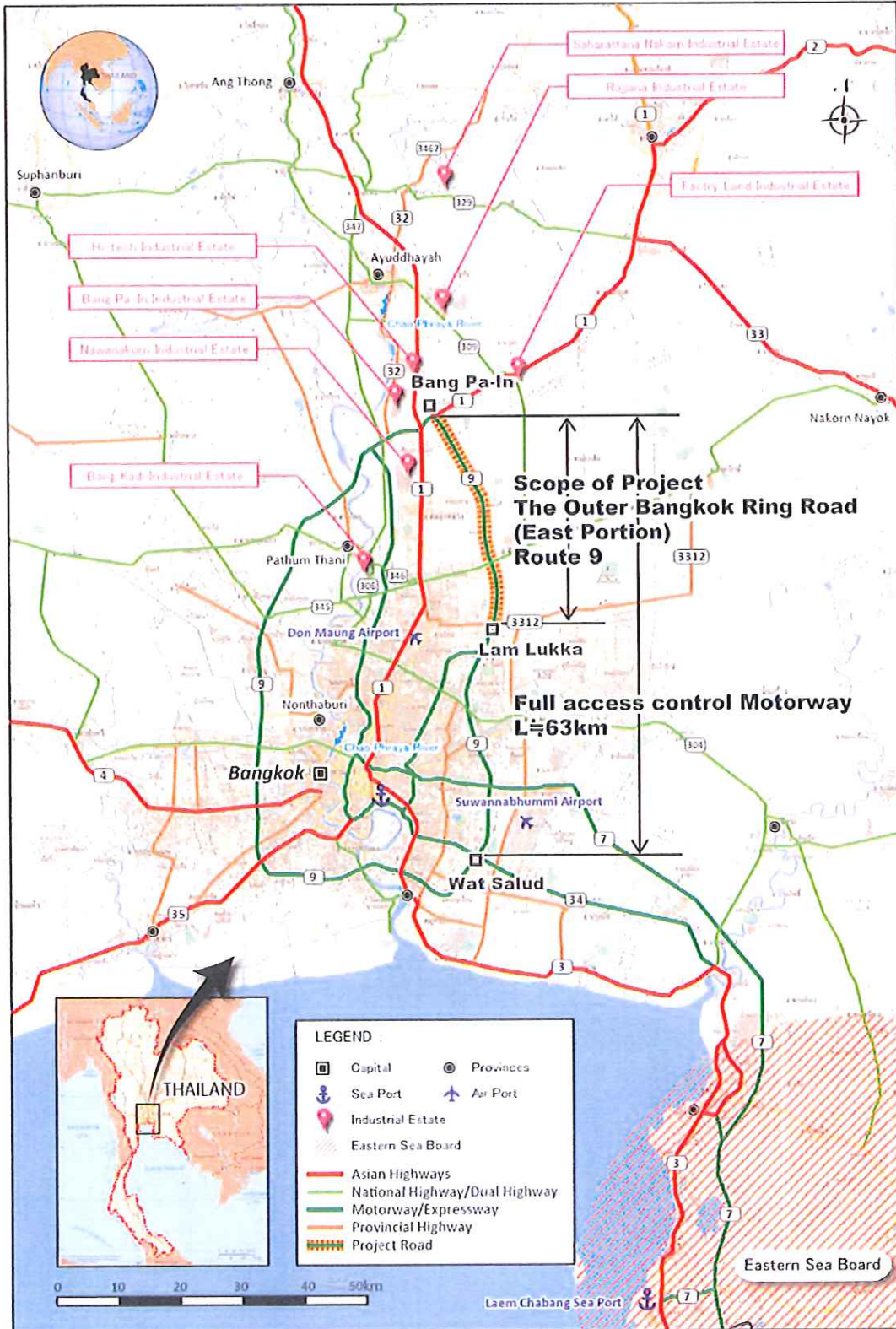
8. Modified Asphalt Concrete Pavement

Both sides agreed that modified asphalt concrete pavement would be applied on the toll gate area and two outer lanes of the normal section for heavy vehicles.



The Contents of the Project

1. Site Location



2. Scope of Work

The Project's scope of work consists of the following items.;

| Work Items | | Unit | Quantity |
|-----------------|---|------|----------|
| Removal Work | | L.S. | 1 |
| | Asphalt Concrete Pavement in Motorway | | |
| | Cement Concrete Pavement in Toll Gate | | |
| | Median Concrete Barrier | | |
| Pavement Work | | L.S. | 1 |
| | Motorway | | |
| | Toll Gate | | |
| | Ramp and Frontage Road | | |
| Median Work | | L.S. | 1 |
| | Concrete Barrier, | | |
| | L-Type Precast Concrete Wall | | |
| Drainage Work | | L.S. | 1 |
| | Catch Basin | | |
| | Inlet/Outlet Protection | | |
| Safety Work | | L.S. | 1 |
| | Sign Post, Guide Post | | |
| | Guardrail | | |
| | Signage, Pavement Marking | | |
| Road Earthwork | Slope Protection Work | L.S. | 1 |
| Toll Gate Work | Toll Gate, Pedestrian Overpass for Toll Gate Access | L.S. | 1 |
| Temporary Works | Traffic Control | L.S. | 1 |

