4.7 Three Options for a New International Container Terminal

(1) Development Fully Concentrated at off North Kalibaru (Option-1)

In this section, long-term development plan for Tanjung Priok Terminal has been studied. In this study off North Kalibaru has been considered only space for further expansion for Tanjung Priok Terminal so as to meet increasing demand of international containers towards the target year 2030.

1) Target Container Volume for the New Terminal at North Kalibaru

According to the result of cargo demand forecast, the total volume of international containers in the target year of 2030 has been estimated as 13.4 million TEUs. The capacity of the existing facilities of Tanjung Priok Terminal has been estimate as 4.9 million TEUs and the volume is forecast to reach by mid 2010's.

Based on the above assumption, and taking account of the conversion of JICT II and MTI currently used for international containers into domestic container terminals, the required capacity for the new terminal has been estimated as 9.4 million TEUs in 2030.

million TEUs –4.0 million TEUs = 9.4 million TEUs per annum

2) Required Berth Length

Taking account of possible configuration of North Kalibaru container berth and phased implementation, the berth has been proposed as so-called continuous berth with the same water depth in the condition that various types of container ships will berth at various places rather than fixed places according to their various LOAs.

To simplify the calculation of required length of its berth by avoiding complicated berthing assumption, actual unit productivity per unit berth length achieved by JICT North in 2009, viz. 1,600 TEUs/m/year, has been applied. The resulting figure is 5,800 m as shown below:

Required berth length: 9,400,000 TEUs/year /(1,600 TEUs/m/year) = 5,800 m

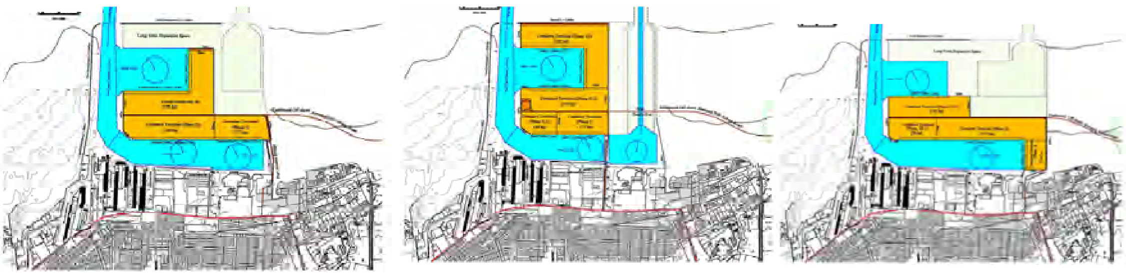
3) Facility Components and Layout Plans of North Kalibaru Terminal of Option-1

The three alternative layout plans satisfying facility requirements to the new terminal at off North Kalibaru in the stage of the Master Plan have been made (see Figure 4.7-1). The main components of each alternative are shown in Table 4.7-1.

Table 4.7-1 Facility Components of Alternative Plans at North Kalibaru (Option-1)

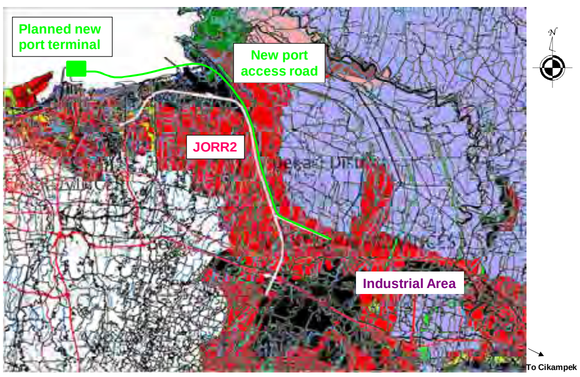
Component			Alternative - 1	Alternative - 2	Alternative - 3
Access Channels	West	Bottom width (m)	310	310	310
		Water depth (m)	15.5	15.5	15.5
Basins	Northwest	Water depth (m)	15.5	15.5	15.5
	South	Water depth (m)	15.5	15.5	15.5
New Breakwaters	West	Length (m)	2,640	2,640	2,640
	North	Length (m)	2,790	70	2,300
Seawalls (Open Sea)		Length (m)	620	2,840	1,420
Revetment		Length (m)	2,050	2,210	2,670
Container Terminal	Phases (I~III)	Berth length (m)	5,800	5,800	5,800
		Water depth (m)	15.5	15.5	15.5
		Container yard (ha)	400	440	450
Land use area (ha)		Terminal area total	420	470	460
North-South Access Road	Bridge	Length (m)	1,100	670	1,090
	Land road	Length (m)	950	600	420
Eastbound Access Road	Coastal Bridge	Length (m)	10,300	11,020	9,700
	Land road	Length (m)	26,400	26,400	26,400

Source: JICA Study Team



Source: Made by the Study Team

Figure 4.7-1 Facility Layout Plan of North Kalibaru Expansion in 2030 (Alternatives-1~3)



Source: Made by the Study Team

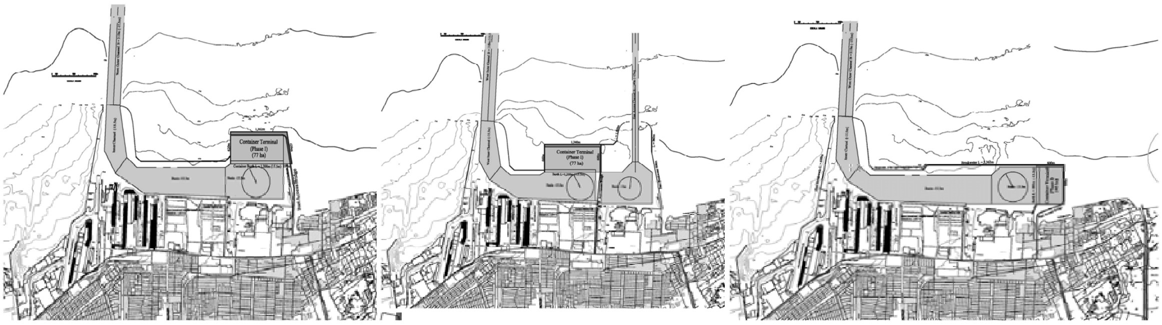
Figure 4.7-2 Access Road to North Kalibaru (Option-1)

(2) Development Split to off North Kalibaru and Cilamaya (Option-2)

Option-2 with the two terminals has been planned; one terminal has been planned at off North Kalibaru and the other terminal at Cilamaya. The former terminal coincides with North Kalibaru Phase I Plan 1 as a part of entire Option-1 plan described in the previous Clause “(1)”.

1) North Kalibaru Phase I Terminal of Option-2

North Kalibaru Phase I Terminal Plan has the three alternatives, viz. Alternative-1, Alternative-2 and Alternative-3 by partly succeeding Option-1 plan. Facility layout plans are shown in Figure 4.7-3.



Source: Made by the Study Team

Figure 4.7-3 Facility Layout Plan of North Kalibaru Expansion in Phase I (Option-2:Alternatives-1~3)

2) Cilamaya Terminal

a. Target Container Volume for the New Terminal at Cilamaya

The required capacity to Kalibaru Phases II~III have been estimated as 7.5 million TEUs in total in the stage of Master Plan with the target year of 2030. The same target volume has been applied for Cilamaya Terminal.

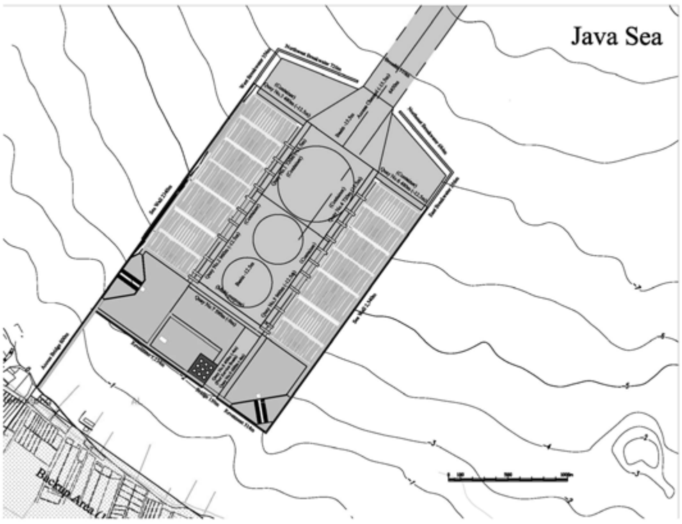
b. Facility Components and a Layout Plan of Cilamaya Terminal

Main components and a facility layout plan of Phases II~III of Cilamaya Terminal are summarized in Table 4.7-2 (see Figure 4.7-4). An access channel to the new terminal at Cilamaya is shown in Figure 4.9-3. An access road to the new terminal at Cilamaya is shown in Figure 4.7-5

Table 4.7-2 Facility Components of Option-2 (Phases II ~ III at Cilamaya)

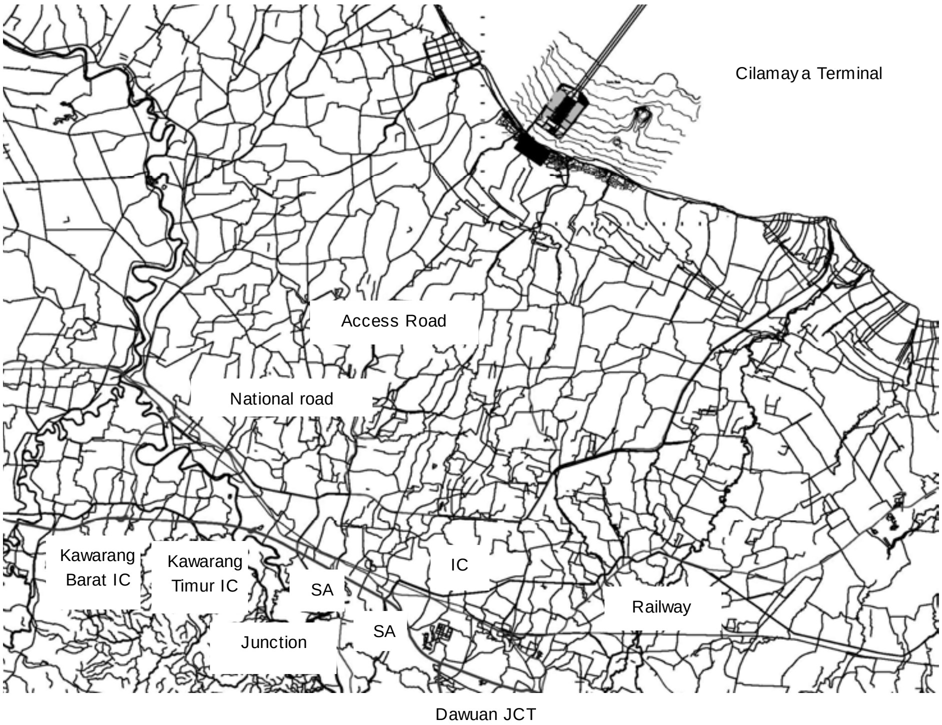
Component			Amount
Access channel		Bottom width (m)	310
		Water depth (m)	15.5
Breakwaters	West	Length (m)	360
	Northwest	Length (m)	720
	Northeast	Length (m)	680
	East	Length (m)	360
Seawalls（Open Sea）		Length (m)	4,680
Revetment		Length (m)	1,630
Container Terminal	No.1 ~ No.6 Quay	Berth number (unit)	16
		Berth length (m)	4,320
		Water depth (m)	12.5~15.5
		Container yard (sq. m)	1,728,000
Multi- purpose Terminal	No.7 Quay	Berth number (unit)	3
		Berth length (m)	590
		Water depth (m)	9
		Open yard (sq. m)	147,500
Port service boats basin	No.8 Quay	Berth length (m)	1,000
		Water depth (m)	4
Land use area (ha)		Terminal area total	290
Access Road	North-South Bridge	Length (m)	800
	East-West Bridge	Length (m)	150
	Land road	Length (m)	30,600

Source: Made by the Study Team



Source: Made by the Study Team

Figure 4.7-4 Facility Layout Plan of a New Cilamaya Terminal in Phases II and III (2030)



Source: Made by the Study Team

Figure 4.7-5 Access Road to a New Cilamaya Terminal

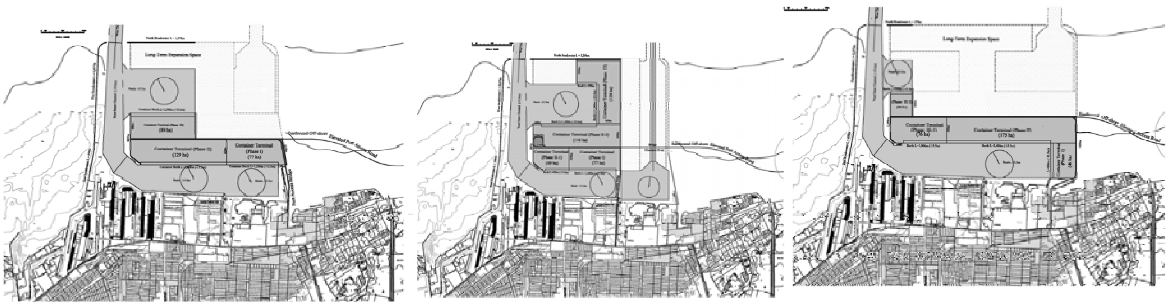
(3) Development Split to off North Kalibaru and Tangerang (Option-3)

Option-3 with the two terminals has been planned; one terminal has been planned at off North Kalibaru and the other terminal at Tangerang.

1) North Kalibaru Terminal

The North Kalibaru Terminal of Option-3 is composed of the three phased plans, viz. Phases I, II and III. Phases I and II of Option-3 are the same as those of Option-1. Phase III of Option-1 has been curtailed by 2 million TEUs in terms of container-handling capacity per annum. Then the curtailed portion has been allocated to Tangerang Terminal so as to keep the same capacity of 9.4 million TEUs per annum in Option-3 in total.

The Kalibaru Terminal plan of Option-3 has the three alternatives, viz. Alternative-1, Alternative-2 and Alternative-3 by partly succeeding Option-1 plan. The respective facility layout plans are shown in Figure 4.7-6.



Source: Made by the Study Team

Figure 4.7-6 Facility Layout Plan of North Kalibaru Expansion in 2030 (Alternatives-1~3)

2) Tangerang Terminal

a. Target Container Volume

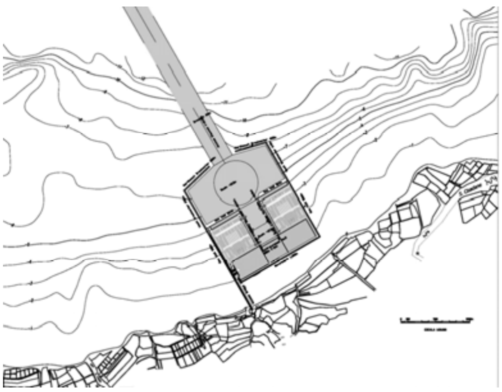
As mentioned in the clause "(1)" of this section, an amount of two million TEUs per annum has been allocated to Tangerang Terminal in 2030.

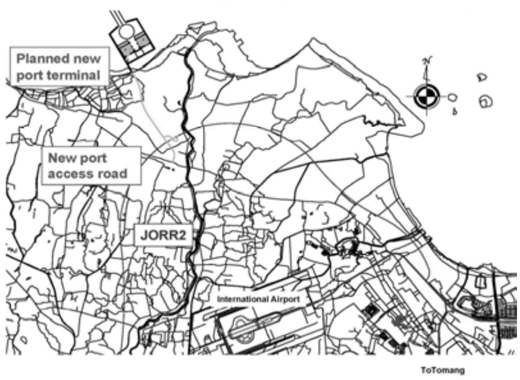
b. Facility Components and a Layout Plan

Main components and a facility layout plan of Tangerang Terminal are summarized in Table 4.7-3 (see Figure 4.7-7). An access road to the new terminal at Tangerang is shown in Figure 4.7-8

Table 4.7-3 Facility Components of Tangerang Terminal (Option-3)

Component			Amount
Access channel		Bottom width (m)	310
		Water depth (m)	15.5
Breakwaters	West	Length (m)	630
	Northwest	Length (m)	510
	Northeast	Length (m)	470
	East	Length (m)	640
Seawalls（Open Sea）		Length (m)	1,860
Revetment		Length (m)	2,460
Container Terminal	No.1~No.4 Quay	Berth number (unit)	4
		Berth length (m)	1,200
		Water depth (m)	12.5~15.5
		Container yard (ha)	60
Multi- purpose Terminal	No.5 Quay	Berth number (unit)	1
		Berth length (m)	320
		Water depth (m)	9
		Open yard (sq. m)	10
Land use area (ha)		Terminal area total	100
Access Road	North-South Bridge	Length (m)	420
	Land road	Length (m)	4,600





Source: Made by the Study Team

Figure 4.7-7 Facility Layout Plan of Tangerang Terminal in 2030 (Option-3)

Figure 4.7-8 Access Road to a New Container Terminal at Tangerang

(4) Comparison of the three Options and Selection of the Optimum Option

A comparison matrix on a quantitative basis by scoring each item has been made to facilitate the comparison (see Table 4.7-4 ~ Table 4.7-6).

So as to evaluate comparison items quantitatively, the respective quantitative indices have been used as well as weights by comparison item. Then scores have been given to the respective options by comparison item. In the evaluation by item and option, scores in the range from “1” to “3” have been given. “3”, “2” and “1” mean high, medium and low. Each score has been given according to the quantitative index shown in the tables.

Then, each score has been multiplied the corresponding weight of which summation has been adjusted to be 100%. Thus, the maximum possible score should be “3”.

In putting weights, the three cases have been examined. The first one is the case in which solving the current overconcentration to the JABODETABEK area and simultaneously narrowing the socio-economic disparity between the area and its periphery areas through the regional development are given priority. The weights of the items contributing to the solution to the problems mentioned above (Economic items) have been given 70% in total, whereas the remaining items (Natural items), 30% in total as shown in Table 4.7-4. As shown in the table, Option-2 has obtained the highest score of “2.5”, followed by Option-1 with the score of “1.8” and Option-3 with the score of 1.6.

Although the Option-2 with the highest score in the former case has some negative impacts on the natural environment at its project site, it has been judged that the supposed impacts could be mitigated by adequate measures to the extent that the activities relating to the new port, and human livings and natural environment including fauna and flora peripheral to the project site could co-exist. The necessary mitigation measures, if any, will be revealed through the EIA in the feasibility study to be implemented after this.

The second one is the case in which merely preserving environment at the project site disregarding the problems of the overconcentration to the JABODETABEK area and regional disparity is given priority. The weights of the items contributing to the environmental preservation mentioned above (Natural items) have been given 70% in total, whereas the remaining items (Economic items), 30% in total as shown in Table 4.7-5. As shown in the table, Option-1 has obtained the highest score of “2.3”, followed by Option-3 with the score of “2.0” and Option-2 with the score of 1.8.”.

The third one is the case in which equal weights are put on the Natural Items and Economic Items mentioned above. (Natural items) have been given 50% in total, whereas the remaining items (Economic items), 50% in total as shown in Table 4.7-6. As shown in the table, Option-2 has obtained the highest score of “2.1”, followed by Option-1 with the score of “2.0” and Option-2 with the score of 1.8.”.

Through the measurement of the sensitivity of weights of the category, viz. economic items and natural items, Option-2 obtained the highest scores twice, viz. in the first case and the third case among the above three cases. In the second case, although Option-2 obtained the lowest score, it has been judged that its anticipated negative impacts on the natural environment at its project site could be mitigated by adequate measures as mentioned above. From the above, Option-2 has been selected as the optimum plan.

Table 4.7-4 Weight with Solving Overconcentration to JABODETABEK and Contributing Regional Development

Category	Comparison Item	Weight	QuantitativeIndex for comparison	Option-1	Option-2	Option-3
Economic Items (Weight: 70%)	Narrowing the gap of socio-economic disparity	23.3%	GRDP per capita ('000 Rp.)	56	15	43
			Score	1	3	2
	Influence of container traffic to the new container terminal on road traffic congestion within JABODETABEK	23.3%	Container traffic volume to/from JABODETABEK area from/to Bekasi-Karawang industrial estates in the year of 2030 (passenger car unit (pcu) per day)	13.8	4.3	13.8
			Score	1	3	1
	Construction cost	23.3%	tillion Rp.	49	37	52
			Score	2	3	1
Natural Items (Weight: 30%)	Rice field conservancy	7.5%	Area of rice field to be altered to land for road (ha)	56	72	65
			Score	3	1	2
	Resettlement and land use alteration	7.5%	Building to be removed for road construction	About 160	About 160	About 160
			Score	2	2	2
	Natural environment (coral reef)	7.5%	Distance from the nearest coral reef (km)	far	2	far
			Score	3	1	3
	Impact on fishery	7.5%	Area of fishing grounds to be disappered for port construction (sq. km)	0.3	14	6
			Score	3	1	2
Weight Total		100.0%	Total score multiplied by weight	1.8	2.5	1.6

Source: Study Team
Note) Numbers of building to be removed for road construction are excluding Phase I project at North Kalibaru.

Table 4.7-5 Weight with Preserving Environment at the Project Site

Category	Comparison Item	Weight	QuantitativeIndex for comparison	Option-1	Option-2	Option-3
Natural Items (Weight: 70%)	Rice field conservancy	17.5%	Area of rice field to be altered to land for road (ha)	56	72	65
			Score	3	1	2
	Resettlement and land use alteration	17.5%	Building to be removed for road construction	About 160	About 160	About 160
			Score	2	2	2
	Natural environment (coral reef)	17.5%	Distance from the nearest coral reef (km)	far	2	far
			Score	3	1	3
	Impact on fishery	17.5%	Area of fishing grounds to be disappered for port construction (sq. km)	0.3	14	6
			Score	3	1	2
Economic Items (Weight: 30%)	Narrowing the gap of socio-economic disparity	10.0%	GRDP per capita ('000 Rp.)	56	15	43
			Score	1	3	2
	Influence of container traffic to the new container terminal on road traffic congestion within JABODETABEK	10.0%	Container traffic volume to/from JABODETABEK area from/to Bekasi-Karawang industrial estates in the year of 2030 (passenger car unit (pcu) per day)	13.8	4.3	13.8
			Score	1	3	1
	Construction cost	10.0%	tillion Rp.	49	37	52
			Score	2	3	1
Weight Total		100%	Total score multiplied by weight	2.3	1.8	2.0

Source: Study Team

Note) Numbers of building to be removed for road construction are excluding Phase I project at North Kalibaru.

Table 4.7-6 Equal Weights on Economic Items and Natural Items

Category	Comparison Item	Weight	QuantitativeIndex for comparison	Option-1	Option-2	Option-3
Economic Items (Weight: 50%)	Narrowing the gap of socio-economic disparity	16.7%	GRDP per capita ('000 Rp.)	56	15	43
			Score	1	3	2
	Influence of container traffic to the new container terminal on road traffic congestion within JABODETABEK	16.7%	Container traffic volume to/from JABODETABEK area from/to Bekasi-Karawang industrial estates in the year of 2030 (passenger car unit (pcu) per day)	13.8	4.3	13.8
			Score	1	3	1
	Construction cost	16.7%	tillion Rp.	49	37	52
			Score	2	3	1
Natural Items (Weight: 50%)	Rice field conservancy	12.5%	Area of rice field to be altered to land for road (ha)	56	72	65
			Score	3	1	2
	Resettlement and land use alteration	12.5%	Building to be removed for road construction	About 160	About 160	About 160
			Score	2	2	2
	Natural environment (coral reef)	12.5%	Distance from the nearest coral reef (km)	far	2	far
			Score	3	1	3
	Impact on fishery	12.5%	Area of fishing grounds to be disappered for port construction (sq. km)	0.3	14	6
			Score	3	1	2
Weight Total		100.0%	Total score multiplied by weight	2.0	2.1	1.8

Source: Study Team

Note) Numbers of building to be removed for road construction are excluding Phase I project at North Kalibaru.

(5) Comparison of the three Alternatives of Option-2 Selected as the Optimum Option and the Selection of the Optimum Alternative

The selected Option-2 is divided into the three phased plans, viz. Phase I planned at North Kalibaru with three alternatives and Phase II and III planned at Cilamaya without alternatives. Hence, the three alternatives of North Kalibaru Phase I of Option-2 have been compared with each other from the various points.

The Alternatives have been compared by using comparison matrix on a quantitative basis (see Table 4.7-7).

As shown in the table, alternative-1 has obtained the highest score of “2.5”, followed by Alternative-2 with the score of “2.4”. Thus, Alternative-1 has been selected as the optimum plan. In this regard, there are no decisive differences between Alternative 1 and Alternative 2 in scores and Alternative 2 has an advantage over Alternative 1 in Involuntary Resettlement.

Table 4.7-7 Summary of Quantitative Evaluation on Alternatives

Assessment Items		Alternative-1	Alternative-2	Alternative-3
Navigational Safety		3	1	1
Necessity of the mainenance dredging in the second channel		3	1	3
Consistency with Urgent Rehabilitation Project		3	3	1
Strategic Environmental Assessment	Obstacle to navigation of fishing boats	3	2	1
	Elimination of fishing ground	3	3	1
	Impact on water quality within the port basins	3	3	1
	Impact on smell within the port area	2	3	1
	Involuntary resettlement	1	3	1
	Impact on noise, vibration and safety along port access road at Kalibaru	1	3	1
Project cost		3	2	1
Weight Total		2.5	2.4	1.2

Source: Made by the Study Team

4.8 Development of Terminals for Domestic Containers and Conventional cargoes

In this section, long-term development plan for handling domestic containers and conventional cargoes at Tanjung Priok Terminal has been studied so as to meet the increasing demand for those cargoes towards the future and also the requirement of transfer of petroleum as typical dangerous cargoes and dusty bulk cargoes such as coal, sand and clinker from the existing terminal areas in the vicinity of urban areas to off the existing terminal areas.

Berth allocation plan for domestic containers and conventional cargoes at Tanjung Priok Terminal is shown below.

(1) Petroleum Products to be Allocated off North Kalibaru

The volumes of petroleum products to be transferred to a new petroleum terminal in 2030 have been estimated as 4.4 million MT. Its breakdown is shown as follows:

To handle the above volume for PERTAMINA, two berths are sufficient. It is said that petroleum dealers other than PERTAMINA are requesting to set up their terminals. Taking account of the request, four berths have been planned as follows:

- Total berth length 270 m/berth x 4 berths = 1,080 m
- Water depth -15.5m

(2) Dry Bulk Cargoes Allocated off Kalibaru

The volumes of dusty dry bulk cargoes to be transferred to a new dry bulk terminal in 2030 have been estimated as 18.4 million MT.

To handle the above volume, a total berth length has been estimated to be 915 m. To ensure flexible berthing, dry bulk berth has been planned as a continuous berth with the same water depth.

Taking account of that petroleum terminal and container terminal have been planned to be located on the west and on the east of the bulk terminal respectively with the same water depth of 15.5m, so as to facilitate possible maintenance dredging and ensure safe maneuvering operations of vessels, the same water depth of 15.5 m has been adopted in the bulk terminal planning throughout the berth line.

(3) Domestic Containers Allocated within the Existing Conventional Wharves

The volume of domestic containers has been estimated to be 4.4 million TEUs in 2030.

To handle a large amount of domestic containers in 2030, the Third Wharf of Tanjung Priok Terminal has been redeveloped for a container terminal specialized for domestic containers except for MAL terminal in addition to convert MTI and JICT II to domestic container terminals.

Berth length for domestic containers is shown as follows

- The third Wharf:	1,800m	(West: 750m, East: 1,050m)
- MTI:	410m	
- JICT II:	520m	
Total	2,730m	

To ensure efficient container handling, two units of container gantry cranes per berth have been planned to be introduced, totaling 18 units of the quayside cranes. Conventional Cargoes Allocated at the Existing Conventional Wharves

(4) Conventional Cargoes Allocated at the Existing Conventional Wharves

The total volume of conventional cargoes to be handled at the First Wharf, the Second wharf and Island (Nusantara) Wharf excluding dusty cargoes to be transferred to a new berth off North Kalibaru has been estimated as 16.3 million MT. To ensure efficient cargo handling, sufficient units of mobile harbor cranes (tower cranes) have been planned to be introduced. For handling conventional general cargoes, the following berths are recognized to be available (Japat River Wharf has not been counted):

- Island Wharf: 14 berths,
- First Wharf: 13 berths (MTI berths are excluded)
- Second Wharf: 12 berths (JICT II berths are

(5) Cargoes handled at Berths for Exclusive Use for Specified Cargoes

The total volume of conventional cargoes to be handled at exclusive use for specified cargoes has been estimated as 10.1 million MT. Main berths are as follows:

- Bogasari (Sarpindo) berths for wheat and wheat bran
- Pertamina berth for LPG
- Car Terminal berth
- Bulk cement berth at the West Side of the Second Wharf
- MEDCO berth for High Speed Oil
- DKP berth for Chemical Products

(6) Imported and Exported Vehicles

Imported and exported vehicles are currently handled at the Car Terminal at the east end of the existing terminal. To meet the future demand two berths and car storage yards with around 128,000 sq. m have been estimated to be required. Currently one berth with a length of 220m and a yard of 156,000 sq. m are available. Thus one berth with a length of 240m and a yard with an area of 28,000 sq. m will be additionally required in the stage of 2030.

4.9 Master Plan of Tanjung Priok Port

(1) Requirements for the Master Plan by Law No. 17

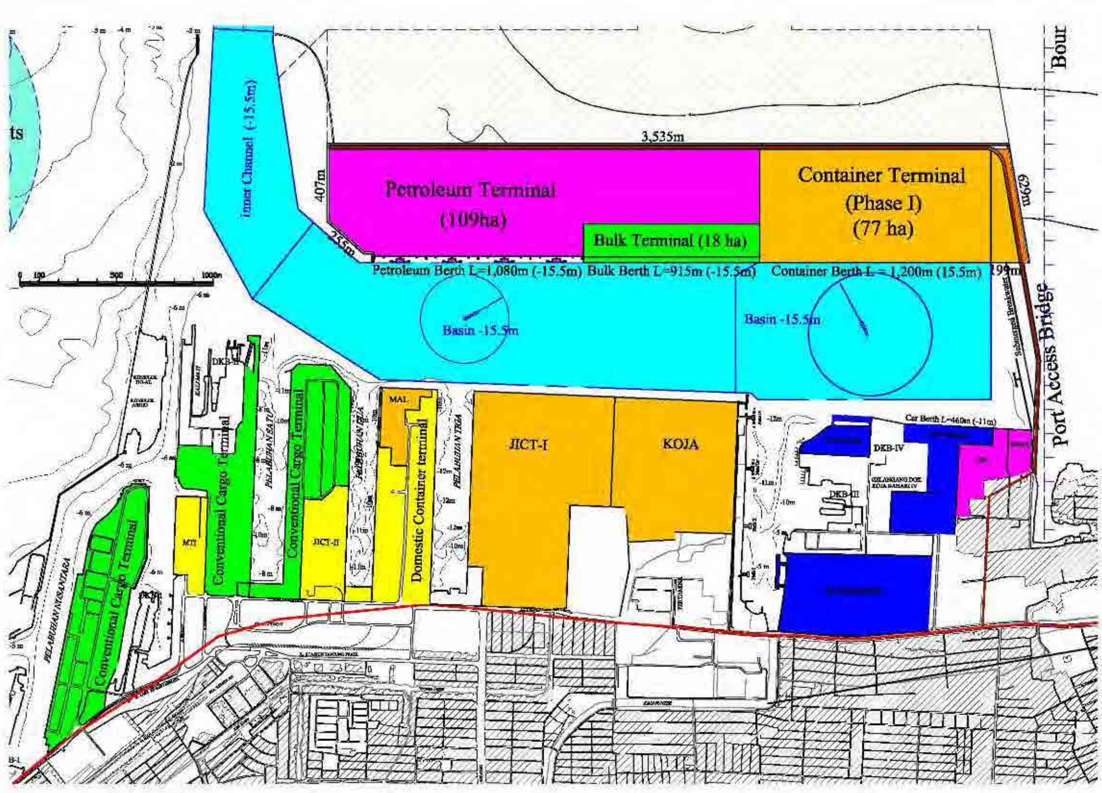
Tanjung Priok Port as a public port is administrated by its port authority which was established in December of 2010 by Law of Republic of Indonesia No.17 Year 2008. Its jurisdictional area is located along the northern coast extending from Banten Province, DKI Jakarta and West Java Province.

Tanjung Priok Port must have its Port Master Plan stipulated by the Minister of Transport in compliance with the New Shipping Law No.17. The Master Plan of Tanjung Priok Port in compliance with the Law must fulfill the following requirements by the Law.

- National Territory Spatial Layout Plan,
- Provincial Spatial Layout Plan
- Regency Area Spatial Layout Plan
- Harmony and Balance with other related activities at the port location
- Technical, economic and environmental feasibility
- Safety and secure of ship traffic

(2) Principal Port Development Plans

In this study, the two principal port development plans have been proposed at Tanjung Priok and at Cilamaya as shown in Sections 4.7 and 4.8. Facility layout plan of Tanjung Priok Terminal is shown in Figure 4.9-1. The figure includes the redevelopment plan for domestic containers and conventional cargoes within the existing Tanjung Priok Terminal and the development plan of the new petroleum and bulk terminals off North Kalibaru in the stage of Master Plan. International container terminals comprising JCT and the new terminal off North Kalibaru are also shown in the figure. On the other hand, Cilamaya Terminal is shown in Figure 4.7-4.



Legend

(yellow)	Domestic Containers
(green)	Public Use for Conventional Cargoes (Existing Wharves and North Kalibaru
(blue)	Exclusive Use for Specified Cargoes (Bogasari Terminal and Car Terminal)
(magenta)	Exclusive Use for Specified Cargoes (DKP, MEDCO, Petroleum Terminal at North Kalibaru)
(orange)	International Containers (JICT, KOJA, MAL, North Kalibaru)

Source: Made by the Study Team

Figure 4.9-1 Facility Layout Plan of Tanjung Priok Terminal in the Stage of Master

(3) Directions of Marine Terminals under Tanjung Priok Port other than Tanjung Priok Terminal and Cilamaya Terminal

1) Public Terminals other than Tanjung Priok Terminal and Cilamaya Terminal

In addition to Tanjung Priok Terminal and the newly proposed Cilamaya Terminal, the following public terminals are also under the umbrella of Tanjung Priok Port:

- Sunda Kelapa Terminal in DKI Jakarta
- Patimban Terminal in Kabupaten Indramayu (to be constructed)
- Bojonegara Terminal in Banten Province

In addition to the above three existing terminals, the following potential terminals might join as public terminals:

- Marunda in DKI Jakarta

- Marunda in Kabupaten Bekesi
- Tarumajaya in Kabupaten Bekesi

2) Proposed Principle When Making Port Development Plan

From the standpoints mentioned in the above Paragraphs "(2)" and "(3), the following principles when making a port development plan have been proposed:

To make the most of spatial resources

The coastal area along the Greater Jakarta Metropolitan Area is already densely used and space is limited and valuable. Hence it is essential to make the most of such spatial resources.

To concentrate financial resources on a limited port development

It is essential to concentrate financial resources on limited port development so as to save financial resources and to avoid duplicated investment

To coordinate other activities to share limited spatial resources

It is essential to coordinate properly with other various activities to share limited space with each other so as to make the most of spatial resources

To make adequate functional allotment among marine terminal under the umbrella of Tanjung Priok Port

It is essential to make adequate functional allotment among marine terminal under the umbrella of Tanjung Priok Port so as to avoid duplicated port investment and to ensure smooth coordination with non-port related activities as a whole in the port field.

3) Development Directions of Marine Terminals under Tanjung Priok Port

The following development directions of marine terminals under Tanjung Priok Port have been proposed:

a. Sunda Kelapa Terminal in DKI Jakarta

It is recommendable to convert it to a recreation terminal with some marine museum to exhibit its history.

b. Bojonegara Terminal in Banten Province

The conversion of the terminal to a petroleum terminal and the usage of the existing berth for multi-purpose terminal are considered to be adequate to serve the west of Banten Province rather than to serve for Jakarta Metropolis taking account of the geographical location having a distance from there.

c. Marunda in DKI Jakarta, Marunda and Tarumajaya in Kabupaten Bekesi

These three potential terminals will be suitable to be set up as shallow terminals rather than deep-sea terminals. They are expected to serve for barges having a sea-transport network involving Tanjung Priok Terminal.

As to dry bulk cargoes such as coal and sand, these potential terminals are expected to alleviate the current congestion in Tanjung Priok Terminal by receiving the cargoes. As to containers, it is considered that to transport containers by barge between Tanjung Priok Terminal and these potential shallow terminals could be viable by taking account of serious road congestion in the JABODETABEK area. Needless to say, it is essential to develop road network behind their hinterland as a precondition of these shallow terminal development.

(4) Port-Related Waters Area Use Plan of Tanjung Priok Port

1) Waters Area Use Plan in Jakarta Bay

Port-related waters use plan in Jakarta Bay has been drafted based on the development plan of Tanjung Priok Terminal and taking account of the three potential public terminals along the coast of Marunda and Tarumajaya as shown in Figure 4.9-2.

When drafting the waters use plan, the harmonization with JABODETABEK spatial plan based on the Presidential Regulation No 54/2008 has been considered.

Source: Made by the Study Team

Figure 4.9-2 Port-Related Waters Area Use Plan in Jakarta Bay

Waters Area Use Plan off Karawan Coast

Port-related waters use plan off Karawan Coast in the vicinity of the planned new container terminal at Cilamaya is shown in Figure 4.9-3.

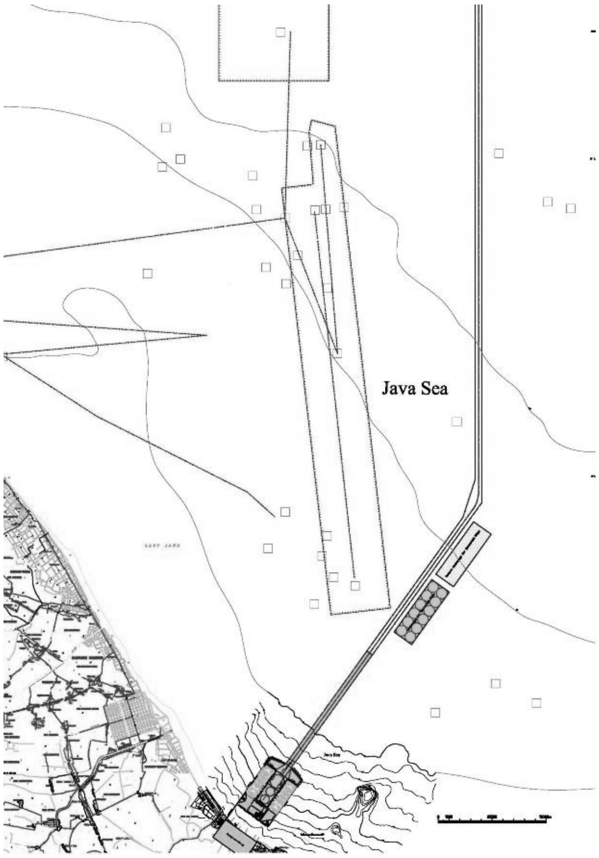


Figure 4.9-3 Port-Related Waters Area Use Plan in Karawan Coast

As to the harmonization with the spatial plans of local governments containing those of the West Java Province and Regency of Karawan, any waters use plans have not been made.

On the other hand, waters area in front of “Zone of Protected Forest” designated by the Ministry of Forestry corresponding to Zone N1 in case of JABODETABEK spatial plan in the range of several hundred meters, development activities are prohibited in principle. On the coast in the vicinity of Cilamaya Terminal “Zone of Protected Forest” is not designated.

According to the regulation stipulated by DGST, port-related activities such as installation of access channel and anchorage, at least one km needs to be kept from submerged pipelines of oil and gas. The regulation has been taken into account when drafting the waters area use plan of off Cilamaya Terminal.

5. PRELIMINARY DESIGN, COST ESTIMATE AND DEVELOPMENT SCHEDULE

5.1 New Container Terminal Development

(1) Breakwater Construction

1) Design Criteria for Breakwater

Harbour Calmness Analysis for Breakwater Layout Determination

Breakwater layouts are designed so that the probability percentage of non-exceeding occurrences of the threshold wave height for cargo handling for basins in front of mooring facilities shall be achieved for 97.5% or more of the days of the year. The threshold wave height is determined as 0.5m considering reference values of threshold wave height for cargo handling works not affected by swell, or long period waves. For verification of the above mentioned conditions inside the harbour, harbour calmness analysis is conducted for ordinary wave conditions.

Design Waves for Breakwater Design

For verification of the structure's stability, analysis is based on 100-year return period waves (defined as low-occurrence waves). Design deepwater waves off Tanjung Priok were estimated based on the yearly peak waves of 22 years of data from 1980 to 2001. Wave transformation during the propagation of waves as they move from deepwater off Tanjung Priok toward the proposed location of the breakwater construction is calculated using the Energy Balance Equation Model Method. Design waves are determined based on the extraction of the maximum waves near the breakwater to be designed.

For breakwater performance evaluations, 1-year return period waves (defined as high-occurrence waves) are employed. Design waves for this purpose are set by referring to the results of the JICA Study 2003.

Tides

Mean sea level at Tanjung Priok port is used to define Zero Level (MSL=0.0m) for planning and designing of roads and railways in this Project. However, for the port facilities, lowest low water level (LLWL) at Tanjung Priok port is defined as the Datum Level as follows. To avoid confusion, both elevations are described as follows.

HHWL	(Highest high water level)	+ 1.05 m	(0.57 m +MSL)
MHWS	(Mean high water spring)	+0.91 m	(MSL + 0.43 m)
MSL	(Mean sea level)	+0.48 m	(0.00 m)
MLLWS	(Mean low water spring)	+0.09 m	(MSL - 0.39 m)
DL	(Datum level)	0.00 m	(MSL - 0.48 m)
	(Defined as DL = LLWL: Lowest low water level)		

2) Estimation of the Design Deep water Waves at off Tanjung Priok

Base data

Wave data off Tanjung Priok are obtained by SMB method based on the five (5) year wind information during 1997 to 2001 observed at Cengkareng Meteorological Station of BMKG (Badan Meteorologi Klimatologi dan Geofisika).

Yearly peak waves off Tanjung Priok

The extreme high deep water waves off Tanjung Priok port are estimated based on the existing information of yearly peak waves for the 18 years from 1980 to 1997 (1980-1997; wave hindcast by ITB, July 2000) and hindcast data from 1997 to 2001 which was estimated in the Study for Development of the Greater Jakarta Metropolitan Ports, December 2003 (hereinafter called "the 2003 JICA Study").

Design Deepwater Waves off Tanjung Priok

a. Low-occurrence waves

Considering the 50 year life time of the facilities and less than 40% encounter probability, the following 100-year return period waves are chosen for the design deepwater waves off Tanjung Priok.

Table 5.1-1 Design Deepwater Waves (100 year return period)

Wave \ Direction	W	NW	N	NE	E	Max
Height (m)	2.84	3.56	3.32	3.11	4.13	4.24
Period (s)	6.48	8.73	8.70	6.46	10.47	11.01

b. High-occurrence waves

Referring to the results of the JICA Study 2003, the following 1 year return period waves are given as the high occurrence design wave.

Table 5.1-2 Design Deepwater Waves (High Occurrence, 1 year return period)

Wave \ Direction	W	NW	N	NE	E
Height (m)	1.78	1.98	1.68	1.45	1.70
Period (s)	5.92	6.30	5.96	5.59	6.04

3) Harbour Calmness Analysis

Analysis method

Wave transformation as they move from deep water off Tanjung Priok to the port entrance at each candidate site is calculated by the Energy Balance Equation Model Method, and calmness analysis inside the harbour is calculated by Takayama's Method.

Calmness is evaluated in front of berths, turning and port basins, port entrance and the access channel about 1km off the port entrance.

Harbor Calmness of North Kalibaru in Tanjung Priok

Alternative-1

For Alternative-1 development plan the following two cases of analysis are considered.

Case 1: after completion of Phase 1 and 2
Case 2: after completion of Phase 3

Based on the results in Table 5.1.3(1), the harbour area is sufficiently calm through the year as shown in the following table. Therefore, the breakwater layout is sufficient.

Alternative-2

Calmness Analysis for Alternative-2 is conducted for the following three cases.

Case 1: after completion of Phase 1
Case 2: after completion of Phase 2

Case-3 after completion of Phase 3

Calculation results are as shown in Table 5.1-3 (2). Harbour area is sufficiently calm through the year. Breakwater layout is sufficient.

Alternative-3

Calmness Analysis for Alternative-3 is represented by the results of Alternative-1 since the port layout is similar to Alternative-1.

Table 5.1-3 Summary of Non-exceeding Percentage of 0.5 m Height Waves

(1) North Kalibaru New Terminal (Alternative-1)

	Location	Non-exceeding Percentage
Phase 1 & 2	Quay No.1	100% ≧ 97.50%
	Quay No.2	100% ≧ 97.50%
	Turning Basin No.1	100% ≧ 97.50%
	Turning Basin No.2	100% ≧ 97.50%
	Port Entrance	95.0%
	Access channel 1km off	95.4%
Phase 3	Quay No.3	98.5% ≧ 97.50%
	Quay No.4	99.6% ≧ 97.50%
	Port Basin	99.5% ≧ 97.50%
	Port Entrance No.1	94.6%
	Port Entrance No.2	93.7%
	Access channel 1km off	94.8%

(2) North Kalibaru New Terminal (Alternative-2)

	Location	Non-exceeding Percentage
Phase 1	Quay No.1	100% ≧ 97.50%
	Port Basin	100% ≧ 97.50%
	Port Entrance No.1	94.0%
Phase 2	Quay No.1	98.6% ≧ 97.50%
	Quay No.2	98.6% ≧ 97.50%
	Quay No.3	98.5% ≧ 97.50%
	Port Basin	99.5% ≧ 97.50%
	Port Entrance No.1	94.4%
Phase 3	Quay No. 3	98.8% ≧ 97.50%
	Quay No. 4	100% ≧ 97.50%
	Quay No. 5	99.9% ≧ 97.50%
	Port Basin	100% ≧ 97.50%

Harbour Calmness of Cilamaya Terminal

Calmness analysis is conducted taking into account the new terminal layout plan. Inside of the harbour is sufficiently calm according to the results as shown in Table 5.1-4 below.

Table 5.1-4 Summary of Non-exceeding Percentage of 0.5 m Height Waves

Location	Non-exceeding Percentage
Quay No.1	97.50% ≧ 97.50%
Quay No.2-1	97.60% ≧ 97.50%
Quay No.2-2	97.60% ≧ 97.50%
Quay No.3	98.40% ≧ 97.50%
Quay No.4	97.80% ≧ 97.50%
Quay No.5-1	97.60% ≧ 97.50%
Quay No.5-2	98.00% ≧ 97.50%
Quay No.6	99.50% ≧ 97.50%
Quay No.7	98.00% ≧ 97.50%
Access channel 1km off	92.30%
Port Entrance	93.10%
Turning Basin No.1	97.40%
Turning Basin No.2	98.20%

Harbour Calmness of Tangerang Terminal

Inside of the harbour is sufficiently calm according to the results of calmness analysis as shown in Table 5.1-5.

Table 5.1-5 Summary of Non-exceeding Percentage of 0.5 m Height Waves

Location	Non-exceeding Percentage
Quay No.1	97.60% ≧ 97.50%
Quay No.2	98.40% ≧ 97.50%
Quay No.3	97.80% ≧ 97.50%
Quay No.4	98.60% ≧ 97.50%
Quay No.5	98.10% ≧ 97.50%
Revetment No.1	97.60%
Revetment No.2	97.30%
Access channel 1km off	94.70%
Port Entrance	94.70%
Turning Basin No.1	97.20%
Turning Basin No.1	98.30%

4) Breakwater Design for Low and High Occurrence Design Waves

Design Waves at Each Site

<u>Extraction of Maximum Waves in front of the Breakwater</u>

Equivalent deepwater waves at each site are estimated by the wave transformation of deepwater waves off Tanjung Priok as they move toward the shallow water area at the new terminal candidate site. Wave transformation by refraction and shoaling effect due to bathymetry is calculated by the Energy Balance Equation Model. Design waves are determined by the extractions of maximum waves in front of the new terminal facilities to be designed at each site.

<u>Design waves for north seawall to be constructed in Phase 1 and 2 Development in North Kalibaru</u>

It is decided that the design waves chosen for Dam Tenggah breakwater rehabilitation be applied for the north seawall design.

Design waves for east breakwater planned in Alternative-2

For the design of the land side east breakwater in Alternative-2, the same design wave (low occurrence higher wave) was chosen as the one chosen for the Dam Tengah breakwater rehabilitation under the Urgent Rehabilitation Project.

Summary of design waves for breakwater design

Low-occurrence design waves for verification of structural stability are as follows.

Table 5.1-6 Low-occurrence Design Waves

Site	Wave Height (m)	Wave Period
Tanjung Priok (other than north seawall)	3.7	8.8
Tanjung Priok (for west breakwater Alt.2)	2.5	7.5
Cilamaya	2.8	8.7
Tangerang (for N and E side breakwater)	2.1	8.8
Tangerang (for West side breakwater)	1.1	6.5

High-occurrence design waves for performance evaluation such as estimation of over-topping wave amounts and calculation of transmitted wave height are as follows.

Table 5.1-7 High-occurrence Design Waves

Site	Wave Height (m)	Wave Period
Tanjung Priok (other than north seawall)	2.0	6.3
Tanjung Priok (north seawall)	1.5	6.0
Cilamaya	2.0	6.3
Tangerang (for N and E side breakwater)	2.0	6.3
Tangerang (for West side breakwater)	1.0	6.3

At North Kalibaru Area

Considering the 2003 JICA Study and sections determined based on the comparison study on the Urgent Rehabilitation Project of Tanjung Priok Port, rubble mound slope type breakwater is applied.

The crown height is set as DL +3.50m which is 0.6 times higher than the significant wave height ($H_{1/3}$). Estimated over-topping wave rate is smaller than 0.01 m^3/m/s.

Required mass of armour is determined by Huddson’s formula. Wave height inside of the breakwater is assumed using the refraction coefficient of Kr= 0.6. Necessary armour weight is reduced considering the approximately 60 degree wave incident angle to the east and west breakwaters. Armour types of the breakwaters are summarized in the Table below.

Table 5.1-8 Summary of Breakwater Armour Layers

Type	Sea Side Armour	Harbor Side Armour	Location
A	Tetrapod 6.3t type	Concrete Cube 0.9m	North Breakwater
B	Tetrapod 3.2t type	Concrete Cube 0.7m	West & East Breakwaters
C	Tetrapod 2.0t type	Concrete Cube 0.7m	West Breakwater (Alt.2)

For the layer under the armour material, rubble stones are used which are approximately 1/10 to 1/15 of the armour unit weight or more.

Coping concrete is provided to reduce the transmitted wave height behind the breakwater. Provision must be made to prevent sliding and overturning of the coping concrete from the wave pressure that acts on the concrete. The estimated transmitted wave is less than 0.5m which is the threshold wave height for cargo handling operations.

Silt and clay (fine materials) are deposited under the seabed in a layer about 8 to 10 m thickness, therefore, the unsuitable materials are to be improved by PVD and the upper part of the drain is to be replaced with sand considering the settlement of the under layer of fine materials. Typical sections of breakwaters are as shown in Figure 5.1-1.

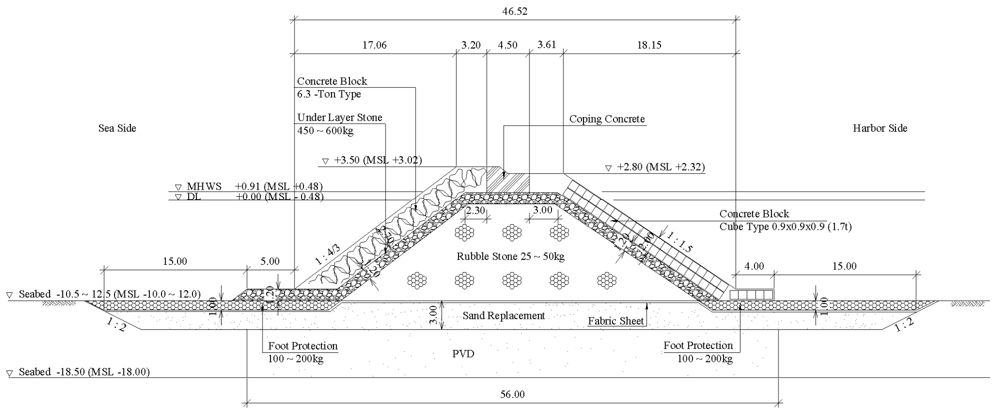


Figure 5.1-1 Typical Section of Breakwater in North Kalibaru New Terminal

At Cilamaya Area

Structure type and design method is the same as the North Kalibaru terminal. Type and size of armour materials are as summarized in Table 5.1-9. A layer of loose materials of about 5 m thickness lies under the seabed and must be improved by PVD. Typical section of the breakwater is as shown in Figure 5.1-2.

Table 5.1-9 Summary of Breakwater Armour Layers

Type	Sea Side Armour	Harbor Side Armour	Location
A	Tetrapod 3.2t type	Concrete Cube 0.7m	North Breakwater
B	Concrete Cube 0.9m	Concrete Cube 0.5m	West & East Breakwaters

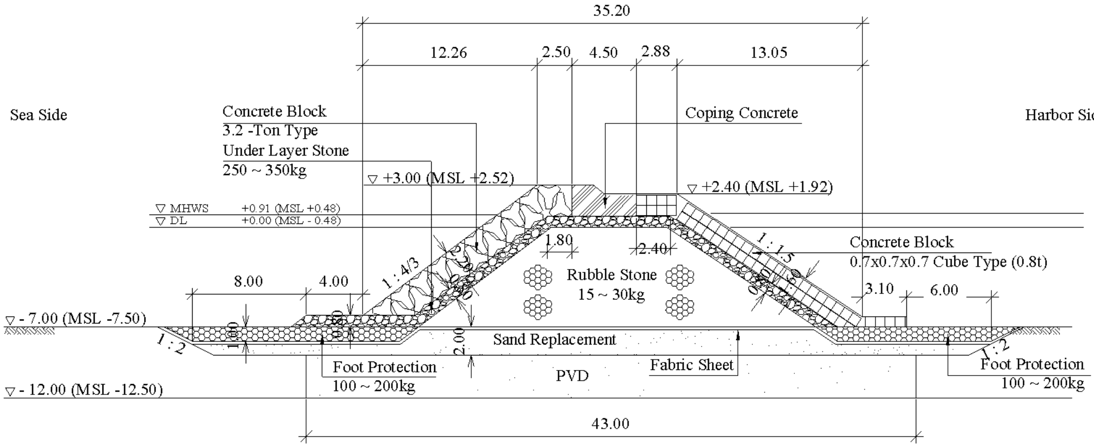


Figure 5.1-2 Typical Section of Breakwater in Cilamaya New Terminal

At Tangerang Area

Structure type and design method is the same as North Kalibaru and Cilamaya terminal. Crown height is D.L.+3.0m, which is +0.5m higher than the elevation of 0.6 times the significant wave height ($H_{1/3}$), DL +2.5, since over topping rate is more than the 0.01 m^3/m/s.

Type and size of armour materials are as summarized in Table 5.1-10. A layer of loose materials of about 5 m thickness lies under the seabed and must be improved by PVD. Typical section of the breakwater is as shown in Figure 5.1-3.

Table 5.1-10 Summary of Breakwater Armour Layers

Type	Sea Side Armour	Harbor Side Armour	Location
A	Tetrapod 2.0t type	Concrete Cube 0.7m	Other than West Breakwater
B	Concrete Cube 0.7m	Concrete Cube 0.7m	West Breakwater

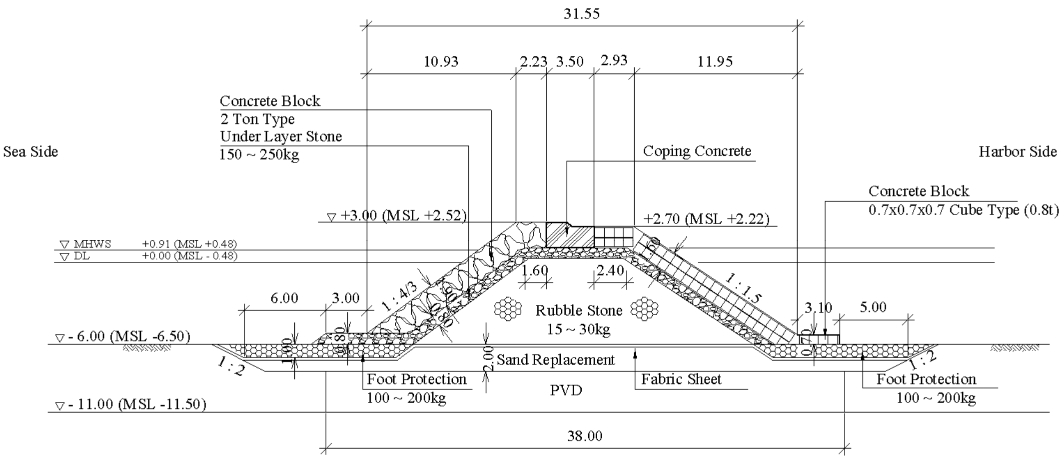


Figure 5.1-3 Typical Section of Breakwater in Tangerang New Terminal

(2) New Container Terminal Development at North Kalibaru

1) Requirement of Existing Access Channel and Turning Basin Improvement

Nautical and Operational Aspects of Existing Port

The near-shore waves off the Terminal at North Kalibaru are comparatively mild throughout the year. The predominant directions of waves to the terminals are in the range of 310 degrees N to 30 degrees N.

The existing breakwaters protect the Terminals against those waves, except in its eastern part, where parts of the breakwater are almost submerged during high tides due to settlement/collapse of the structure. The currents in and around the Terminals entrance are rather weak, resulting in no significant maneuvering problem for incoming/outgoing ships.

The Terminals of Tanjung Priok has two entrances, which are a western entrance and an eastern entrance. The eastern entrance is heavily silted and very shallow (around -5 m) and only small ships like fishing boats and tug boats are using for sailing in and out.

The western entrance with the water depth of 14 m and the channel width of 150 m serves as a main entrance of the Terminals of Tanjung Priok. Through the western entrance two ways traffic is permitted to vessels shorter than 150 m in LOA equivalent to 15.000 DWT in size.

In principle less than 300m in LOA is allowed to enter the Tanjung Priok Terminals. However, the maximum ship size ever recorded to call in the Port was 325 m in LOA.

The present outer and inner channels are planned to be improved by widening to 300m and deepening to -14.0m for allowing two way traffic of 50,000 DWT under the Urgent Rehabilitation Project of Tanjung Priok Port (URPT) by JICA finance (Ex-JBIC).

Planning for Access Channel and Turning Basin Improvement.

The expected maximum ship size is set the Post-Panamax (DWT; 87,545, LOA; 318m, Draft; 14.0m, Beam; 40.06m). The dimensions of channel and basin are planned as follows:

Table 5.1-11 Dimensions of Channel, Basin and Berth by Objective Ship

Description	Dimension for two way traffic
Objective Container Ship Size	87,545DWT, D=14.0m, LOA=318m, B=40.06m
Depth and Width of Channel	D=15.5m, W=310m
Depth and Width of Turning Basin	D=15.5m, W=640m
Depth of Berth and Length	D=15.5m, W=360m

Source: JICA Study Team

2) Design of Access Channel and Turning Basin

Inner Channel and Turning Basin by URPT

In front of the Jakarta International Container Terminal I (JICT-I), a turning basin of 560 m (280 m x 2) diameter is planned to be provided with a 40 m wide space left to clear the ships mooring along the quays. When no ship is berthed alongside the quay, a turning basin of 600 m diameter will be secured.

In this Study a 640 m diameter basin will be provided with a 50 m wide space for berthing ships in front of the new terminal. This basin arrangement will allow simultaneous turning of two ships, one for the maximum of 50,000 GT and another for the maximum of 87,000GT.

It is proposed that the remaining portion of the existing breakwater "Dam CITRA" which is located about 330m away from face line of JICT be removed for securing 740m (Turning basin 640m + 50m of berthing area on both sides) between the berth of JICT/KOJA and the new terminal berth.

3) Scope of Access Channel and Turning Basin Improvement Works

Dredging Requirements for Navigation Channel

The dredging requirement is calculated by the water depth at -15.5 m at the channel and turning basin and side slope to be 1 to 5.

The net volume of dredging requirements for the long term plan is summarized in Table below.

Table 5.1-12 Dredging Volume Requirement in Long Term Plan

Location	Design Depth	Dredging Volume (m3)		
		Phase 1	Phase 2	Phase 3
Total Volume	-15.5 m	16,184,400	2,134,400	19,701,300

Source: JICA Study Team

Length of breakwater, seawall and revetment for New Terminal for Phase 1

Table 5.1-13 Planned length of New Breakwater, Seawall & Revetment

Location	Length
West and East sides of reclamation	1,200m
North side of reclamation land	1,320 m
Dam Citra re-named as New Dam CITRA breakwater	633 m
Total length to be constructed as Phase 1	3,609.8m

Source: JICA Study Team

Removal of the portion of Dam Citra Left over under URPT

The existing breakwater with a length of 1,548 m is planned to be removed under URPT for widening the turning basin and inner channel and deepening from 12m to 14.0m. A new Dam Tengah breakwater will be constructed opposite of JICT.

The temporary breakwater about 314m for closing the gap between the new Dam Tengah and existing Dam Citra is planned. Under the proposed project it is recommends that this temporary breakwater be extended in the east direction perpendicular from the new Dam Tengah 1 alignment to obtain the clear water way along the berths of new container terminals.

Demolish Existing Remaining Breakwater for New Terminal

The length of about 3,268 m, which is the remaining portion of the existing breakwater will be removed for widening and deepening the water way from JICT/KOJA terminals for the new terminal. These materials are planned to be recycled for use in the construction of a revetment/seawall.

Table 5.1-14 Plan of Demolish of Existing Breakwater and Recycle

Removal Breakwater	Present Location	Length of removal	Recycled place after demolish
Dam CITRA	In front of KOJA Terminal	1,548m	Material of 1,148m length will be recycled for construction of new breakwater "New DAM CITRA"
Dam PERTAMINA East	Car Terminal area	713m	Material removed will be recycled for construction of revetment /seawall
Dam PERTAMINA West	Products Terminal area	1,007m*	Material removed will be recycled for construction of revetment/seawall.
Total length of Breakwater to Remove		3,268m	Total required length of revetment/seawall is estimated about 2,450 m.

Source: JICA Study Team

New Berth Alignment with co-existence of New Dam Tengah 1 Breakwater

The berth alignment of new container terminal is planned about 50m from the edge of the concrete head of the breakwater in the water area, so that in future the newly constructed breakwater by URPT will be utilized by forming parts of retaining wall of the reclamation of the new container terminal.

Construction of breakwater for the long term development plan

Long term development of Tg Priok Terminal under the Alternative 1 case is planned toward the off shore beyond the Phase I container terminal. In order to protect the Terminal facilities it is planned that a new breakwater is constructed for Phase 3 development at the depth of around 10 m and distance of about 3.6-4.0km away from the existing berthing facilities of JICT/KOJA.

Construction of new breakwater for Urgent Terminal Development at North Kalibaru

The existing breakwater in front of the JICT/KOJA is planned to be demolished and a new breakwater named New Dam Tengah under URPT will be constructed to protect the existing port facilities and cargo handling operation along the berth of JICT/KOJA.

The new breakwater is planned to be constructed at the depth of around 4 m and distance of about 640m away between the planned new off shore container terminal and New Dam Tengah breakwater of URPT under the Phase 1 Project of North Kalibaru development Project.

The design wave has been determined as follows;.

- The high-frequency design wave; H1/3 = 1.5 m, T = 6.0s, Direction of Incident Wave: North (1 year return)
- The low frequency design wave: H1/3 =:2.5 m, T = 7.5s, Direction of Incident Wave: North (50 years return)

Considering the soil conditions at North Kalibaru area and to minimize environmental impacts, the rubble mound type with PVD for improvement of soft soil foundation is planned.

4) Preliminary Design of Quay wall Structure

Design Criteria

The adopted design criteria for design of container terminal facilities are as follows.

Objective Ship Size

The same type of container ship will use the Cilamaya new terminal and Tangerang new terminal.

Tide, Current and Wave Conditions and Design Wind

The tide level, current, and design wind of Tanjung Priok Terminal are summarized below.

Table 5.1-15 Tide, Current and Wave Conditions of Tanjung Priok Terminal

	Tanjung Priok Port
Tide (cm)1	
High Water Level (HWL)	+91.00
Mean Sea Level (MSL)	+48.00
Design Low Tide Level (DLT)	0.0
Current (m/sec)2	
Maximum velocity	0.50
Wave at Berth,	
Significant Wave Height H1/3(m)	0.50 m
Significant Wave Period T1/3	Less than 2 sec
Wave at Revetment	
Design Wave Height (m)	1.5 m
Design Wave Period (sec)	Less than 2 sec
Wave at Breakwater	
Significant Wave Height H1/3 (m)	3.0m
Significant Wave Period T1/3	Around 8 sec

Source 1,2: Dinas Hidro-Oseanografi, Indonesia

Subsoil Condition

The soil investigation at the planned site of the new container terminal at North Kalibaru was carried out in November/December 2010. The preliminary design is carried out by the following soil data obtained.

Borehole No.3 at the Noth Kalibaru for new berthing area

-5.0 m	Silty Clay N = 0, ϕ = 0
-13.0 m	Sandy Silt N= 6 – 38, γt = 1.53 tf/m3, γ' = 0.53 tf/m3
-24.0 m	Silty Clay, N = 38 - 52 c = 30 kPa, ϕ = 30°, γ' = 0.9 tf/m3
-30.0 m	Dense to very dense sand N = more than 50 c = 0 kPa, ϕ = 35°, γ' = 1.5 tf/m3

Crown Height

The crown height of the berth is set as follows.

HWL + 2.0 m + H1/3 = + 3.5 m

This crown height of the quay wall is applied for the case of Cilamaya and Tangerang new terminal facilities.

Seismic Coefficient

The seismic coefficient for the proposed port facility and access road structure at North Kalibaru area are computed as follow:

Kh = K x C x I = 1.0 x 0.05 x 1.5 = 0.075

Kv = not considered = 0

It is therefore recommended to adopt 0.1 for Kh for the Port facilities. This seismic coefficient is applied for preliminary design of Cilamaya and Tangerang facilities.

Loads on the Wharf

Quay wall structure of container terminal is designed to sustain quay container cranes. The berth dimension for objective ship is set as Length 360m, Depth -15.5m DL Crown height +3.50 DL. The following loads of container cranes is taken

Quay crane Rail Gauge :	30 m
Overall Weight : approximately:	1,300 tf/unit
Nominal rated capacity:	41 tf under spreader
Live load and load conditions of QGC (Quay Gantry Crane);	35 kN/m2
Live load of container yards and Road in the terminal;	45 kN/m2

The following wheel loads are considered:

Standard Truck (H22 - 44) :	8.0 tf/wheel
Tractor Trailer (40’) :	5.8 tf/wheel

The above wheel load and live loads for preliminary design of the new terminal is also applied for Cilamaya and Tangerang.

Mooring Force and Fender System

Tractive force acting on mooring bitts is set at 100 tf per unit. The spacing is set at 30 m intervals under the assumption that the berthing speed of vessels with assistance is assumed to be 0.10 m/sec. The berthing angle to the face line is taken as 10 degrees. Reaction by fender is 157-160 ton, absorbing energy by fender is 95.85 t-m.

The above tractive and mooring forces are applied for the quay wall of 87,000 DWT in the new terminal of Cilamaya and Tangerang.

Selection of Suitable Type Quay wall Structure

The optimum type of quay wall structure is selected from 5 alternatives i.e. 1) Concrete Block type, 2) Caisson type, 3) Steel Sheet Pile type, 4) Steel Frame Structure type, 5) Concrete Deck on Open Steel Pipe Pile type by evaluating each type with the following aspects:

- Soil Conditions, Construction Materials, Construction Methods, Construction Period
- Experience on Similar Projects Maintenance Costs

The studied types of structure are commonly adopted for deep-water quay walls.

detailed comparison of the selected three structural types is analyzed and as a result of the comparison study, "Concrete deck on Steel Pipe Pile type" is considered suitable for the new container terminal at the three candidate sites

The particulars of quay wall are shown in the table below.

Table 5.1-16 Selected Type of Quay wall Structure for New Terminal at North Kalibaru Phase 1

Location	North Kalibaru New Terminal in Tajung Priok
Target Throughput	1,900,000 TEU
Berth Length	1,200m
Berth Water Depth	CDL-15.5m
Number of Berths for Urgent Plan	4
Target Vessel Size	87,545 DWT
Quay wall Structure	Concrete Deck on Open Steel Pipe Pile Ø1200,t=20mm, driven up to - 32.50m DL (N-,50), with retaining wall by concrete blocks on top of rubble mound
Crown Height of Quay wall	CD+3.50m
Terminal Yard Length	600 m
Quay Cranes and Yard Cranes	12 QGC + 32 RTG, 60 units of Yard Tractors
Fender	Rubber Fender 1150H, @12m
Bollard	100 tons @ 30m

Source: JICA Study Team

5) Container Yard Planning and Container Cargo Handling Equipment

Planned layout of the new container terminal at North Kalibaru Phase consists of two (2) terminals having 600m length of berth each and 6 quay cranes and 4,100 ground slots at each terminal. The concept of one terminal layout is planned in terms of 2 berths (300m*2) by one terminal operator.

Required Number of Cargo handling Equipment

Design Condition of Handling Capacity by 1 berth (300m) and quantity of cargo handling equipment is set as follow.

Estimate Handling Capacity by 1 berth

Capacity (TEUs/Year・berth)	480,000
Av. Days of Stock	3.3
Stacking efficiency	0.75
Peak ratio	1.3
Feeder ratio	0.02
Yard Capacity(TEUs)	7,375
Tier	4
Calculated Ground slots(TEUs)	1,844

Cargo handling equipment per 1 terminal (600m)

QGC	6
Yard tractor	36
Yard chassis	38
RTG	15
Top lifter	3
Forklift 5t	6
Forklift 10t	6

Long term Planned Cargo Handling Equipment

The required cargo handling equipment for the new container terminal development at North Kalibaru is worked out below.

Table 5.1-17 Long Term Planned of Major Cargo Handling Equipment

	Phase 1	Phase 2	Phase 3	Total
Berth Length (m)	1,200	2,000	2,600	5,800
Capacity(million TEUs)	1.9	3.2	4.3	9.4
Ground Slot(TEUs)	7,376	12,292	15,980	35,648
QCG No.	12	18	24	54
RTG	30	45	60	135

Source: JICA Study Team

6) Yard Development by Reclamation

Design of Revetment of Container yard

New Breakwater (New Dam Tengah)

A new sea wall for development of the container yard will be constructed off-shore behind the reclamation yard by taking around 940 m away from the existing breakwater (Dam Tengah and Citra).

A new breakwater is required between the end point of the new breakwater (Dam Tengah) and the west end of the new container terminal; total length is about 640m

The crown height of a newly constructed breakwater (New Dam Tengah) is set at +2.5 m from CDL considering designed wave height of 1.5 m, design wave period of 6 sec and dominating direction of North West.

The break water structure is made with rubble mound type and concrete armour stones placed on the ruble stone on both side slopes.

New seawall for North side

The yard for new terminals of Phase 1 and 2 is planned to be developed by reclamation toward off shore. The new sea wall on the north side of 1,250m in length will be constructed to protect reclaimed land from the wave and sediment material.

The seawall structure is designed with the following concept.

- To accept over topping the crown height of revetment by design wave
- The design wave height is taken at 1.5m, which is adopted as design wave height for revetment design at North Kalibaru, Cilamaya and Tangerang.
- The crown height of the revetment is set at HWL + 1/2 Wh (1.5 m)

The soil improvement of the existing soft surface seabed is planned with PVD (Plastic Vertical Drain) methods, instead of removal of soft material and replaced by fine sand considering the cost and environmental consideration of dredging and dumping soft material.

The north side revetment is constructed with steel sheet pile (SSP), which is driven to – 25m and armour stones are placed on sea sides of SSP for stability.

Revetment of West side / East side

The soil improvement of the existing soft surface seabed is planned with PVD (Plastic Vertical Drain) methods, instead of removal of soft material and replaced by fine sand considering the cost and environmental consideration of dredging and dumping soft material.

The north side revetment is constructed with steel sheet pile (SSP), which is driven to – 25m and armour stones are placed on sea sides of SSP for stability.

Reclamation works

Reclamation material will be brought in from the quarry around the project sites. The in fill materials are transported by dump trucks to the project site. The infill material should be filled from the existing sea bed up to +2.0 m from CDL. Average thickness of reclamation will be 6 to 7 m. The estimated volume for respective phases will be as follows. Average elevation of the planned yard is set at +3.5 m (MSL+3.0m).

Table 5.1-18 Reclamation Volume (m3) by Phases at North Kalibaru Development

	Phase 1	Phase 2	Phase 3	Total
Total (m3)	8,290,000	15,605,500	39,032,000	62,927,500

Source: JICA Study Team

Soil Improvement

The soil improvement for the reclamation area is considered necessary. Tentatively the PVD Method is considered at the foundation of stock yard, terminal inner roads and building areas.

During the reclamation works, the silt protector shall be placed in the water area in order to prevent the proliferation of water pollution.

Yard Pavement and Drainage in New Terminal Area

Pavement

Based on the operation planning of the yard, the pavement type to be adopted for the usage of respective areas is selected with drainage system. The designs of the pavement depending on the usage of terminal area are conducted

7) Road for Terminal Development

Access Road between Kalibaru Terminal and New Terminal

The access road is planned by extending from the Kalibaru Terminal by bridge on the sea water area to the west end of the reclaimed land of North Kalibaru. The construction of this access road shall be implemented at the same time as parts of the new terminal development works.

For the Phase 2 development, the access road is planned along the coastal area to connect from the North Kalibaru terminal to Tarmajaya in the Bekasi region through DKI Marunda terminal and Marunda Center terminal. This planned access road will function mainly as port oriented traffic services road by connecting from the Tanjung Priok Terminal to Karawan Industrial Region in the west Jakarta directly.

Terminal inner Road

The terminal related traffic from the western regions mainly enters and exits from the port area through the exclusive gate of a new container terminal, which is planned at the western end of the terminal yard, where the access road from Kalibaru Terminal area will be joined.

The terminal inner road in a new terminal is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land outside the container yards.

The terminal inner road is planned to have 12 m width for 3 lanes and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard truck’s (H22-44) wheel load of 8.0 ton/wheel.

8) Utility Supply, Buildings, Environmental facilities and Security System Facilities

Water Supply

The water source should be from the main supply line of the public water of the Water Supply Works Department of the DKI.

Power Supply

Electric power demand for the container terminal is 15 MVA

The electric power requirement will be taken from the National Electric Cooperation (PLN). A standby generator set for emergency purposes will be installed.

Environmental Treatment Facilities

The following environmental treatment facilities are planned for the new container terminal.

- Drainage/sewerage outfall facilities
- Solid wastes management facilities
- Ballast and Bilge Waste Treatment System

Building works

All the buildings inside the container terminal, car terminal, passenger terminal and multipurpose berth will be designed in conformity with relevant national codes and standards, such as National Structural Code for Buildings, National Plumbing Code of the Indonesia, Indonesia Electrical Code, Fire Code of the Indonesia, etc.

Security System Facilities,

The security system facilities are designed so as to satisfactorily comply with SOLAS amendments and ISPS Code entered into force on 1st July 2004.

The cargo container X-ray inspection system, CCTV system, gate control and fences are considered to meet the requirements of SOLAS and ISPS code. The fences around the terminal area should be 8 feet high (= 2.44m) based on the requirements of SOLAS and ISPS.

(3) New Container Terminal Development at Cilamaya Site

1) Requirement of Access Channel and Turning Basin Development

Nautical and Operational Aspects of candidate site of new terminal

The near-shore waves off the planned new terminal are comparatively mild throughout the year. The predominant directions of waves to the shore at Cilamaya / Ciparage are north-east direction. Wave conditions at site are summarized as follows;

- The wave from west is sheltered geographically.
- N & E waves are directly approach to the planned terminal area.
- 95.9 % of the wave height at -10m depth is less than 0.5 m height.

The currents in and along the coast of planned area are rather weak, resulting in no significant maneuvering problem for incoming/outgoing ships.

The seabed is very gentle slope and the contour lines are mostly parallel to the beach. The shore is stable, in which erosion and sedimentation are not observed. Distances of -10 m and -15 m depth are about 5 km and 10 km from the shoreline respectively. Seabed slope is about 1/500 up to about -10 m depth contour line, and between -10 m to -15 m is 1/1000. The area is muddy beach and seabed deposits are mud and fine particles.

Oil rig platforms are observed in the off shore area in front of the candidate site of the Cilamaya terminal, which had been developed by PERTAMINA for oil and gas exploration. They installed 20” to 24” submerged pipe lines to connect between the oil rigs at a depth of more than 20m. The area submerged pipeline is installed cannot be used as an anchorage of ships.

According to DINAS PERIKANAN, KELANTAN PETERNAKAN, Kabupaten, Karawang (Karawang Branch Office of Marine Affairs and Fisheries), they identified that the irregular shallower parts in the hydrographic chart of planned terminal site is the coral reef. The provincial government plans to develop this coral reef area as tourist spots.

Regarding shore changing in this area the obvious backward shoreline change is observed in this area (1940 ~ 1993: -130 ~ -380 m). The yearly rate of shoreline change is estimated around -3 ~ -7 m/year.

Planning Criteria for Development of Access Channel/Basin

To receive the design size of vessel the shallow parts less than 16m depth, which is about 5-6km away the new terminal is required to be dredged to -15.5m. The total length of the access channel is estimated around 47 km from the entrance of the new terminal in order not to disturb existing oil rigs operation.

The entrance of the access channel is located at the depth of -39m and the alignment is selected between oil rigs of Pertamina and coral reef area.

The basic space requirements and bending of the navigation channel and basin were determined in accordance with the international standards including PIANC.

2) Scope of Access Channel and Turning Basin Development

Dredging Requirements for Navigation Channel

The net volume of dredging requirements for Phase 1 and Phase 2 is 27.725 mil m3 and 0.205 mil m3 respectively and in total 27.93 mil m3.

Construction of breakwater for the long term development plan

The terminal facilities are planned to be protected by constructing a breakwater with a length of 2,130m and seawall with a length of 4,680m for development of reclamation at about 3.6-4.0km away from the existing shore line of Cilamaya.

3) Preliminary Design of Quay wall Structure

Phased Development of New Terminal Facilities at Cilamaya

The new container terminal at Cilamaya is planned to be developed after the development of the first phase of North Kalibaru terminal, assuming that the urgent new terminal development at North Kalibaru in Tanjung Priok will meet the traffic demands by 2019.

Design Criteria for Preliminary Design of Quay wall

The same design criteria of marine and civil works as described in chapter 5.1(2) is applied, except the objective ship size, soil and wave conditions of Cilamaya site.

Objective ship size

The following two different sizes of container ships are planned to call the new terminal. The dimensions of the container ships used for the new terminal are summarized below.

Table 5.1-19 Objective Container Ship Size

Objective Container Ship	Post-Panamax	Medium Size
Dead Weight Ton (DWT)	87,545	33,750
Loading Volume (TEU)	5,648	2,550
LOA (m)	318	207
Beam (m)	40.06	29.84
Draft (m)	14.0	11.4

Source: Containerization International

Tide and wave conditions at Cilamaya

Table 5.1-20 Tide, Current and Wave Conditions of Cilamaya site

	Cilamaya site
Tide (cm)1	
High Water Level (HWL)	+107.00 CDL (MSL +59.0)
Mean Sea Level (MSL)	+59.00 DL(MSL +0.00)
Design Low Tide Level (DLT)	0.0 DL(MSL – 48.0)
Wave at Berth,	
Significant Wave Height H1/3(m)	0.50 m
Significant Wave Period T1/3	Less than 2 sec
Wave at Revetment/Seawall	
Design Wave Height (m)	1.5 m
Design Wave Period (sec)	Around 6 sec
Wave at Breakwater	
Significant Wave Height H1/3 (m)	3.00m
Significant Wave Period T1/3	Around 9 sec

Source: JICA Study Team by site observation record in 2010 May/June

Subsoil Condition

The following parameters of soil conditions are taken based on the geotechnical investigation of Cilamaya site.

Table 5.1-21 Soil Profile of Cilamaya site for Preliminary Design

Depth from Existing sea bed	Elevation from DL 0.00	Soil Profile
- 4.0 m to 8.0 m	-9.0 to -13.0m	Silty Clay to sandy clay very soft grey in color N= 0 ~ 2
- 8.0m-12.0m	-13.0 to-17.0m	Clay or clayer silt mixed with fragmented shell, stiff consistency N= 8 ~18, ϕ = 30°, γ’ = 1.37 tf/m3
-12.0 m-20.0m	-17.0m	Sandy Clay hard consistency N= 18 ~- <60 ϕ = 30°, γ’ = 1.79 tf/m3
-20.0 m	-25.0m	Clayer silt very stiff consistency, N = <60 ϕ = 30°, γ’ = 1.86 tf/m3
-30.0 m	-35.0m	Sandy Clay hard consistency N = more than 50, ϕ = 35°, γ’ = 1.77 tf/m3

Crown Height of Quay wall

The crown height of Quay wall is set at 3.5m from DL (+3.0m from MSL)

Selection of Quay wall structures

Considering the similar site condition and soil conditions, same seismic coefficient zone, live loads of cranes, vehicles of the Cilamaya sites, the same type of quay wall structures i.e.; "Concrete Deck on Open Steel Pipe Pile type" as designed for North Kalibaru in Tanjung Priok is applied for the new quay wall structure at Cilamaya.

The corresponding dimensions of berthing facilities and turning basin for the objective ship size are set as follows:

Table 5.1-22 Berth Dimension Corresponding Ship Size

Objective Ship Size	Berth Dimension		Diameter of Turning Basin (m)
	Depth (m)	Length (m)	
Medium Size ((33,750DWT)	12.5	240	420
Post- Panamax (87,545DWT)	15.5	360	640
Small Size	9.0	200	-

The quay wall for medium size is designed considering the following elements, although dead and live load on the quay wall is the same as 87,000 DWT.

- The berthing reaction of 33,750 DWT by fenders is about 120 to 130 ton
- The water depth in front of berth is set at -12.5m, shallower than Post panamax and
- The hard layer is encountered at the depth of around -25 m of the site soil condition.
- As a result of stability checking the foundation pile (SPP) size is reduced to Ø900mm, t=16mm from the case of Post Panamax and penetration length is estimated up to-28 m (MSL -28.5m)

The cross section of Quay wall for Post-Panamax (-15.5m) is the same as applied for North Kalibaru.

4) Container Yard Planning and Container Cargo Handling Equipment

Layout Plan of Container Terminal

The layout plan of the container terminal is 240m per one berth, which involves building quays with a total length of 4,910m by Phase II and Phase III. The space in the back up area is 480m with the exception of the bank space.

Design Conditions for Required Number of Container Handling Equipment

Design condition to estimate required container handling equipment for 1 berth is shown below.

Capacity(TEUs/Year/berth)	384,000
Av. Days of Stock	3.3
Stacking Efficiency	0.75
Peak Ratio	1.3
Feeder Ratio	0.02
Yard Capacity(TEUs)	5,900
Tier	4
Calculated Ground Slots(TEUs)	1,475

And required quantity and type of major cargo handling equipment of one terminal (720m) are listed below.

CGC	6
Yard tractor	36
Yard chassis	38
RTG	15
Top Lifter	3
Forklift 5t	6
Forklift 10t	6

The composition of berth depth and length by the receiving of different-sized ships is indicated in the table below. The total number of berths and length of Phase 2 and 3 are 8 and 11 respectively in total 19 and the length 2,160m and 2,750m respectively in total 4,910 m.

Long term Cargo Handling Equipment of Phased Development of Terminal Area

Corresponding required major cargo handling equipment of the new container terminal at Cilamaya for phase 2 and 3 stages are worked out and listed below.

Table 5.1-23 Proposed Type and Quantity of Major Container Handling Equipment

	Phase 2	Phase 3	Total
Berth Length (m)	2,160	2,750	4,910
Depth (m)	12.5～15.5	9.0～15.5	
Capacity(million TEUs)	3.2	4.3	7.5
Ground Slot(TEUs)	10,202	15,255	25,427
QGC No.	24	30	54
RTG	60	75	135

5) Yard Development by Reclamation

Seawall and Revetment construction

The new sea wall of east and west sides for 2,340 m x 2 =4,680m length will be constructed.

The soil condition of the foundation is clay at the upper layer of depth -4.5m, where soft and loose grey sand is encountered. The revetment foundation is reinforced by PVD and upper structure is designed by Gravity Type.

The crown height of the seawall/revetment is set at +2.5 m from CDL considering designed wave height of 1.5 m, design wave period of 6 sec and dominating direction of North East.

Both sides of the seawall are constructed with rubble mound with armor stones and concrete block to be placed on the top of the stone mound as planned for the North Kalibaru terminal.

Revetment construction on the south side of reclaimed land

The revetment on the south side facing to the coast area is planned for reclamation works of off shore island.

Reclamation works

The soil conditions from the seabed indicate that the dredged material is not suitable to use for the reclamation material. It is planned to obtain such reclamation material from outside of the project area.

Average depth of reclamation will be 6 to 7 m. The estimated volume for respective phases will be shown in the Table below. Average elevation of the planned yard after pavement will be +3.5

m (MST+3.0m). The total reclamation volume of Phase 2 and Phase 3 are estimated at 13.64 mil m3 and 15.73 mil m3 respectively and in total 29.36 mil m3.

Soil Improvement

The existing surface of sea bed at the foundation area of seawall/breakwater foundation, stock yard, roads and building area of the shore area is sandy stiff and hard layer around the depth of -12 to 14 m from the existing sea bed level of -5 .0m. The foundation soil is reinforced by the PVD Method.

Yard Pavement and drainage in new terminal area

Since the operation planning inside the container terminal at the Cilamaya new terminal will be same as North Kalibaru, the pavement type for the usage of respective areas are selected according to the same type and quality as adopted for North Kalibaru case. The drainage system will be planned together with the pavement works.

6) Terminal inner road development

Access Road Connection from the Toll way to the Port

The new access road connecting from the regional industrial complex to the planned new terminal is required for operating the Cilamaya new terminal. The detailed planning of alignment from the existing toll way of Jakarta and Cikanpek and design of access road structure are described in Chapter 5.3 “Access Road Development”.

Terminal inner Road

The terminal inner road is planned from the exclusive gate of a new container terminal at the eastern end of the terminal and will be connected by a 800 m long bridge from off shore terminal.

The terminal inner road will accommodate about 7.5 mil truck chassis in 2030 annually. The terminal inner road is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land outside the container yards.

The terminal inner road is designed with 12 m width for 3 lanes and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard trucks (H22-44) wheel load 8.0 ton/wheel.

The terminal inner road is planned on east sides L= 2,340 m for Phase II and on west side L=2,340 m for Phase III project. The terminal inner road on the south side of the terminal service area L=1,140m is constructed for Phase II project and L= 660 m is constructed as Phase III project.

7) Utility supply, Buildings, Environmental Facilities and Security System Facilities

Water Supply

Water supply system will consist of water reservoir, pump house, elevated water tank and distribution system for general purpose of the office, ship, hydrant, and fire fighting inside of the terminal area. The same volume of water demand as North Kalibaru terminal Phase 1 will be required for each phase of development of Cilamaya new terminal.

The water source should be arranged from the main supply line of the public water of the Water Supply Works Department of the Karawang Regency.

Power Supply

The same electric power demands for new container terminals as provided at North Kalibaru will be required for each phase of development of Cilamaya new terminal.

The electric power requirement of the new terminal at Cilamaya should be arranged from the regional power supply station of National Electric Cooperation (PLN). A standby generator set for emergency purpose of the office use in the new terminal will be installed.

Environmental Treatment Facilities

The environmental treatment facilities as planned for North Kalibaru will be provided for the new container terminal at Cilamaya.

Building works

The same size of floor area for each building as planned for North Kalibaru is planned for a new container terminal at Cilamaya.

Security System Facilities

The same security system facilities as planned for the new terminal at North Kalibaru is planned for the new terminal at Cilamaya to comply with SOLAS amendments and ISPS Code in order to function as an international container terminal.

(4) New Container Terminal Development at Tangerang Site

1) Requirement of Access Channel and Turning Basin Development

Nautical and Operational Aspects of candidate site of new terminal

<u>Topographic conditions</u>

The topographic condition of the planned site is low and flat area with muddy beach. There are many fishing grounds off the coast. The area of the candidate site is the coast between Tanjung Kait and Tanjung Burung. Between these two capes, rivers such as Ci Rarab and Ci Tuis and S. Apuran flow into the sea.

The Sugai Cisadane is the largest river and its estuary is Tanjung Burung and Tanjung Pepuloa in the candidate site. The area is mostly flat between Tanjung Kait to Ci Rarab. Some villages are developed close to the coast from Ci Rarab to Tanjung Burung. There are marshy and fish ponds down close to the beach. There are fairly high trees near the coastal area.

<u>Hydrographic condition</u>

The depth of -10 m and -15 m is located about 4 km and 7.5km away from the shore respectively. The sea bed is generally gentle with its slope of 1/400. The soil conditions of the area are muddy beach and seabed deposits are mud and fine particles.

However, a number of islands are scatted about 10 to 18 km away in the north from the candidate site of a new terminal at depth of about 20 m and 33m respectively.

The near-shore waves off the new terminal area are comparatively mild throughout the year. The predominant directions of waves to the port are from North West.

Wave conditions at site are summarized as follows;

- The wave from east is sheltered geographically.
- N & W waves are directly approach to the port area.
- 95.9 % of the wave height at -10m depth is less than 0.5 m height.

The currents in and around the terminal are rather weak, resulting in no significant maneuvering problem for incoming/outgoing ships.

- Shore line changes

A shoreline change is observed in this coast around the river-mouth area of Ci Sadane (1940 ~ 1993: 500 ~ 1,050 m; 1993 ~ 2009: 480 ~900 m). The yearly rate of shoreline change is estimated as 10 ~ 20 m/year from 1940 - 1993 and 30 ~ 56 m/year from 1993 - 2009. The shoreline change is still progressing and getting bigger in recent years. The change width was 200 to 300 m in the 50 to 60-year period. The yearly rate of shoreline change is estimated at about 4 m/year.

Planning he Development o Access Channel and and Turning Basin

The access channel alignment is planned based on the sea charts to reach the water depth more than 16 m depth without interference of the scattering small islands. The distance of the access channel is planned at the depth of -20m to the west of the Lancang Islands area. The total length of the access channel is estimated at around 11 km from the entrance of the new terminal.

This shallow parts of the planned access channel will be dredged to -15.5m CDL (MSL -16.0m).

The basic space requirements and bending of the navigation channel and basin is determined in accordance with the international standards including PIANC.

The expected maximum ship size to call the terminal is set as the same size as planned for North Kalibaru and Cilamaya Terminals. To receive this size of vessel the basic space requirements of the navigation channel and basin are the same as planned for North Kalibaru Terminal.

2) Scope of Access Channel and Turning Basin Development

Dredging Requirements for Navigation Channel

The net volume of dredging requirements for the long term plan is summarized below.

Table 5.1-24 Dredging Volume Requirement in Long Term Plan

Location	Design Depth	Dredging Volume (m3)
Access Channel	-15.5m	20,167,950
Harbor Turning Basin		
Outer Basin 1	-15.5m	9,711,824
Inner Basin 2	-15.5m	1,647,360
Inner Basin 3	-12.5m	929,280
Total Volume		32,456,414

Construction of breakwater for the long term development plan

The new terminal at Tangerang is planned to be developed in the off shore island. In order to protect the terminal facilities it will be constructed about 420m away from the existing shore line.

The off shore terminal is protected by a new north west breakwater with a length of 510m and northeast breakwater with a length of 470m. The length of west and east breakwater is 640 m x 2 = 1,280m.

3) Preliminary Design of Quay wall Structure

Design Criteria

The design criteria of marine and civil works adopts the same design standards and reference as applied for North Kalibaru new terminal development described in Chapter 5.1.2, except the objective ship size, soil and wave conditions of construction site.

Objective ship size

The following two different sizes of container ships are planned to call the new terminal.

Table 5.1-25 Objective Container Ship Size for planning Quay wall Structure

Type of Container Ship	Post-Panamax	Medium Size
Dead Weight Ton (DWT)	87,545	33,750
Loading Volume (TEU)	5,648	2,550
LOA (m)	318	207
Beam (m)	40.06	29.84
Draft (m)	14.0	11.4

Source: Containerization International

Tide and wave conditions at Tangerang site

The tide level and wave conditions at Tangerang site are summarized below.

Table 5.1-26 Tide, Current and Wave Conditions of Tangerang site

	Tangerang site
Tide (cm)1	
High Water Level (HWL)	+108.00 CDL (MSL +59.0)
Mean Sea Level (MSL)	+59.00 DL(MSL +0.00)
Design Low Tide Level (DLT)	0.0 DL(MSL – 48.0)
Wave at Berth,	
Significant Wave Height H1/3(m)	0.50 m
Significant Wave Period T1/3	Less than 2 sec
Wave at Revetment	
Design Wave Height (m)	1.5 m
Design Wave Period (sec)	Around 6 sec
Wave at Breakwater	
Significant Wave Height H1/3 (m)	2.50m
Significant Wave Period T1/3	Around 9 sec

Source: JICA Study team by site observation record in 2010 May/June

Subsoil Condition

The following soil conditions are taken from the soil investigation at the exact location of developing breakwater of off shore terminal for the preliminary design for the new terminal facilities.

Table 5.1-27 Soil Profile for Preliminary Design

BH01 - BH02 Off shore of Tangerang Site		
Depth from Existing sea bed (0.8 ~-5.0m)	Elevation from DL 0.00	Soil Profile
- 4.5 m	-12.0m	Silty Clay to silty clay mixed with small parts of organic, very soft grey in color N= 0
- 8.0m	-16.5 m	Sandy silt mixed fragmentak shell to silty sand, hard to very dense condition consistency N= 13 ~18 , ϕ = 30°, γ' = 1.37 tf/m3
-14.0 m	-22.5m	Silty clay to Sandy Clayer silt, stiff to very stiff, light grey N= 18 ~27, ϕ = 30°, γ' = 1.79 tf/m3
-25.5 m	-34.0m	Silty Sandy mixed with small part of gravel, dense to very dense condition, N =20 ~>60, ϕ = 30°, γ' = 1.86 tf/m3
-30.0 m	-39.5m	Sandy Clayer silt, hard consistency, dark grey in color N = more than 50 ϕ = 35°, γ' = 1.77 tf/m3

Crown Height of Quay wall

The crown height is set at the same level as at North Kalibaru and Cilamaya: 3.5m from DL (+3.0m from MSL) considering the ship size and tidal condition.

Selection of Quay wall structures

Considering the similar site condition and soil conditions, same seismic coefficient zone, live loads of cranes, vehicles of the Tangerang sites, the same type of quay wall structures i.e. "Concrete Deck on Open Steel Pipe Pile type" as designed for North Kalibaru in Tanjung Priok Port is applied for the new terminal at Tangerang.

The corresponding dimensions of berthing facilities for the objective ship size are set as shown in Table 5.1-28.

Table 5.1-28 Berth Dimension Corresponding Ship Size

Objective Ship Size	Berth Dimension		Diameter of Turning Basin (m)
	Depth (m)	Length (m)	
Small Size	9.0	200	-
Medium Size ((33,750DWT)	12.5	240	420
Post- Panamax (87,545DWT)	15.5	360	640

The medium-sized quay wall is designed considering the following factors.

- The berthing reaction by ship of 33,750 DWT is about 120-130 ton

The dimensions of pile foundation between medium and Post Panamaz ship are shown below.

Table 5.1-29 Dimension of Berth Foundation Corresponding Ship Size

Objective Ship Size	Water depth(m)		Pile depth	Diameter of SPP
	Berth	Sea bed	From sea bed	
Medium Size ((33,750DWT)	-12.5	-4.0/-5.0	-28.0	Ø900mm, t=16mm
Post- Panamax (87,545DWT)	-15.5	-4.0/-5.0	-37.0	Ø1200mm, t=20mm

The Quay wall for designed depth of -12.5m for medium size container ship is the same type as adopted for the Cilamaya site.

Container Yard Planning and Container Cargo Handling Equipment

Layout Plan of Container Terminal

The layout plan of the container terminal consists of two berths having 360m and 240m, which involves building quays of 1,520m in total length by Phase II and Phase III. The space in the back up area is 480m with the exception of the bank space.

Design Conditions for Required Number of Container Handling Equipment

Design condition to estimate required container handling equipment for 240m berth is shown

Capacity(TEUs/Year/berth)	560,000
Av. Days of Stock	3.3
Stacking Efficiency	0.75
Peak Ratio	1.3
Feeder Ratio	0.02
Yard Capacity(TEUs)	8,604
Tier	4
Calculated Ground Slots(TEUs)	2,151

The required quantity and type of cargo handling equipment of one terminal (600m) are shown below.

CGC	6
Yard tractor	36
Yard chassis	38
RTG	15
Top Lifter	3
Forklift 5t	6
Forklift 10t	6

The composition of berth depth and length by receiving different-sized ships is indicated in the table below. The total number of berths is 5 and the total length is 1,520m.

Table 5.1-30 Planned Berth Composition (Tangerang)

	Water depth (m)	Length (m)	Berth	Subtotal (m)
No.1,No.3	15.5	360	2	720
No2,No.4	12.5	240	2	480
No.5	9.0	320	1	320
Total (m)			5	1,520

Long term Cargo Handling Equipment of Phased Development of Terminal Area

Corresponding required major cargo handling equipment of new container terminal at Tangeran is listed below.

Table 5.1-31 Proposed Type and Quantity of Container Handling Equipment

Berth Length in total (m)	1,520
Berth front depth (m)	9.0～15.5
Handling Capacity(million TEUs)	2.0
Ground Slot(TEUs)	7,636
QGC No.	14
RTG	35

4) Yard Development by Reclamation

New seawall for West and East sides of Reclamation;

The new sea wall of east and west sides for 930 m x 2 =1,860m length and the revetment in the length of 1,320m on the south side of the off shore island will be constructed.

The soil condition of the foundation is soft clay and loose sand grey at the existing sea bed depth of -4.5m. The soft soil foundation is reinforced by PVD and upper structure is designed by Gravity Type. The seawall/revetment structure is designed with the same concept as adopted for the North Kalibaru.

The crown height of the seawall/revetment is set at +2.5 m from CDL considering designed wave height of 1.5 m, design wave period of 6 sec and dominating direction of North East.

Both sides of the seawall are constructed with rubble mound with armour stones and concrete block to be placed on the top of the stone mound as planned for the North Kalibaru terminal.

The revetment on the south side of the off shore island is designed with similar type of structure as adopted for revetment works of North Kalibaru.

Reclamation works

The soil conditions from the seabed indicate that the dredged material is not suitable to use for the reclamation material. It is planned to obtain such reclamation material from outside of the terminal area (possibly from Bojonegara area in Banten Province).

Average thickness of reclamation will be 6 to 7 m. The estimated volume for reclamation works is shown in the Table below. Average elevation of the planned yard after pavement will be +3.5 m (MST+3.0m). The total reclamation volume is estimated at about 11.96 mil cum.

Soil Improvement

Based on the soil data obtained from the investigation, there is soft clay soil upper layer from the existing sea bed to depth of 4 .0m. This soft layer up to -11.0m may be reinforced by adopting PVD as soil improvement works. The sandy stiff and hard layer will be encountered around the depth of -12 to 14 m from the existing sea bed level.

Yard Pavement and Drainage

Since the operation planning inside the container terminal at the Tangerang new terminal will be same as North Kalibaru and Cilamaya, the pavement type for the usage of respective areas are selected according to the same type and quality as adopted for North Kalibaru case for each type and area of the pavements. The drainage system will be planned together with the pavement works.

5) Road for Terminal Development

Access Road Connection from the Toll way to the Port

The new access road is planned from the planned JORR2 route to the new terminal for operating the Tangerang new terminal. The off shore terminal which is planned about 420m away from the existing shore line is connected by a PC girder bridge from the shore. The detailed planning of alignment of the access road from the planned JORR 2 route and design of access road structure are described in Chapter 5.3 "Access Road Development"

Terminal inner Road

The terminal inner road is planned to be constructed between the sea wall / revetment and the edge of container yards on the east side in the length of 1,480m (930 +550m) and on the west side of 1,480m (930 +550m). The port inner road on the south side of the terminal service area in the length of 1,420m is constructed.

The Tangerang new terminal will accommodate about 2.0 mil truck chassis in 2030 annually. The terminal inner road is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land outside the container yards.

The terminal inner road in the new terminal is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land outside the container yards.

The terminal inner road is planned to have 12 m width for 3 lanes and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard trucks (H22-44) wheel load 8.0 ton/wheel.

6) Utility supply, Buildings, Environmental Facilities and Security System Facilities

Utility Supply

Water Supply

Water supply system consists of water reservoir, pump house, elevated water tank and distribution system for general purpose of the office, ship, hydrant, and fire fighting inside of the terminal area. The water supply to the vessels, fire fighting and buildings are provided. The same volume of water demand as planned for North Kalibaru terminal Phase 1 will be required for Tangerang new terminal.

It is assumed that the water source should be arranged from the main supply line of the public water of the Water Supply Works Department of the Tangerang Regency.

Power Supply

The same electric power demands for new container terminals as planned for North Kalibaru Phase 1 will be required for Tangerang new terminal since the same number of Quay cranes will be used. The electric power supply of new terminal at Tangerang should be arranged from the regional power supply station of National Electric Cooperation (PLN). A standby generator set for emergency purpose of the office use in the new terminal will be installed.

Environmental Treatment Facilities

The environmental treatment facilities as planned for the North Kalibaru will be provided for the new container terminal at Tangerang.

Building works

The same size of floor area for each building as planned for North Kalibaru Phase 1 is provided for the new container terminal at Tangerang terminal.

Security System

The security system facilities as planned for North Kalibaru new terminal are provided for new terminal at Tangerang to comply with SOLAS amendments and ISPS Code in order to function as an international container terminal.

(5) Implementation Schedule of Master Plan

1) Option-1 (Concentrated development at North Kalibaru)

The first development scenario consists of three phased container terminal developments fully concentrated at offshore Tanjung Priok Port (North Kalibaru). The sequence of development as Scenario 1 (North Kalibaru) is assumed as follows.

North Kalibaru Phase I

Planned quay wall length in the development of North Kalibaru Phase I is 1,200 m having two terminals in operation; the construction period for the quay wall construction is estimated as roughly 34 months at least

The dredging volume to deepen the channel and harbor basins up to -15.5 m in the development of North Kalibaru Phase I amounts to 16 million m^3. Assuming the use of cutter suction dredger and considering busy port operation and ship traffic in the port area of Tanjung Priok, the work period is estimated at a minimum of 40 months by deploying three (3) fleets of dredger vessels.

In order for the container terminal to be operational in the 5th year after L/A (4th year after implementation of construction), the staged development of the container terminal Phase I should be taken into consideration.

Phase I development of the North Kalibaru Container Terminal is targeting container throughput of 1.9 million TEU/year as the capacity to accommodate by quay wall length: 1,200 m). The construction process of the terminal is divided into two stages by the length of quay wall (600 m + 600 m). It is assumed to implement the construction works in each stage as follows.

Stage 1 (2nd – 4th Year)

The following works will be carried out; Dredging of channel and basins, demolition of the existing breakwaters, re-construction of breakwaters, construction of protective facilities (seawalls, revetments), quay wall 600 m, reclamation and development of container terminal yard.

Stage 2 (4th – 5th Year)

Quay wall 600 m, reclamation and development of container terminal yard.

North Kalibaru Phase II

Construction works of Phase II development of North Kalibaru consists of (i) demolition of the existing breakwater (Dam Barat) sheltering western entrance of Tanjung Priok Port, (ii) additional dredging of the basin (around 4.3 million m^3) in front of Phase II terminal, (iii) reclamation and development of Container Terminal Phase II (129 ha).

Construction period is estimated four years for construction works of North Kalibaru Phase II development. The first 2 berths (quay wall: 600 m) will be operational in the 4th year of construction in line with the requirement of demand forecast of container throughput.

North Kalibaru Phase III

Construction works of Phase III development of North Kalibaru consists of (i) extension of the breakwater (2,637 m) to shelter the channel and basin in front of Phase III terminal, (ii) dredging of the channel and basin (around 17.6 million m^3) in front of Phase III terminal, (iii) reclamation and development of Container Terminal Phase III (190 ha).

Five years period is estimated for construction works of North Kalibaru Phase III development.

The first terminal (2 berths@350 m; quay wall length 700 m) will be enabled to start operation in the 4th year of construction in line with the requirement of demand forecast. Terminal 2 (3 berths@300; quay wall 900 m) and Terminal 3 (2berths@350 m and 1 berth@300 m; quay wall 1,000

m) will be enabled to start operation in the 5th and 6th year after implementation of the construction. Implementation schedule of Scenario 1 is shown in Table 5.1.32.

2) Option-2 (North Kalibaru Phase I and Cilamaya Phases II ~III)

Cilamaya New Terminal Phase II

Construction works of Phase I development of Cilamaya container terminal will start with (i) construction of port access road (30.6 km) to connect the Cilamaya site with Cikampek Toll Road. The early stage of the port access road will be used as temporary road for transportation of laborers, materials and equipment of construction works.

(ii) Construction of the Protective facilities will start with;

Breakwaters:	Northwest 726 m,	West 356 m
	Northeast 684 m,	East 356 m
Seawalls	West 2,340 m,	East 2,340 m

followed by (iii) Dredging of the channel and basin (around 28 million m^3) to the design depth -15.5 m, and (iv) Reclamation and development of Container Terminal Phase II (80 ha).

Quay No.1	2 berths@360 m (MSL-16 m), 1.4 million TEU
Quay No.2	4 berths@240 m (MSL-13 m), 1.4 million TEU
Quay No.3	2 berths@240 m (MSL-16 m), 0.7 million TEU

Four year period is estimated for construction works of Cilamaya Phase I development.

Quays No.1 and No.3 will be ready for operation in the 4th year after implementation of construction in line with the requirement of demand forecast. Quay No.2 will start operation in the 5th year after construction.

Cilamaya New Terminal Phase III

Construction works of Cilamaya Phase III development consists of (i) reclamation and development of Container Terminal Phase III (190 ha), and (ii) development of Multi-purpose berth and Terminal Service area.

Quay No.4	2 berths@360 m (MSL-16 m), 1.4 million TEU
Quay No.5	4 berths@240 m (MSL-13 m), 1.4 million TEU
Quay No.6	2 berths@240 m (MSL-16 m), 0.7 million TEU
Quay No.7	3 berths@200 m (MSL-9.5 m), 1.1 million TEU

The development target of Cilamaya Phase III amounts to 4.3 million TEU/year of container throughput. Three year period is estimated for construction works of Cilamaya Phase III development.

Quays No.4 and No.6 will start operation in the 3rd year after implementation of construction in line with the requirement of demand forecast. Quay No.5 will start operation in the 4th year after construction. Implementation schedule of Scenario 2 is shown in Table 5.1-33.

3) Option-3 (North Kalibaru Phases I ~ III and Tangerang Phase III)

Tangerang New Terminal Phase III

Construction works of Tangerang container terminal will start with (i) construction of terminal access road (4.9 km) to connect the Tangerang site with JORR2 at Teluknaga. The early stage of the terminal access road will be used as temporary road for transportation and construction works.

(ii) Construction of the Protective facilities will start with;

Breakwaters:	Northwest 510 m,	West 640 m
	Northeast 470 m	East 640 m
Seawalls	West 930 m	East 930 m

followed by (iii) Dredging of the channel and basin (around 32 million m^3) to the design depth -15.5 m, and (iv) Reclamation and development of Container Terminals (58 ha).

Quay No.1:	1 berth@360 m (MSL-16 m), 0.7 million TEU
Quay No.2:	1 berth@240 m (MSL-13 m), 0.3 million TEU
Quay No.3:	1 berth@360 m (MSL-16 m), 0.7 million TEU
Quay No.4:	1 berth@240 m (MSL-13 m), 0.3 million TEU
Quay No.5:	1 berth@320 m (MSL-9.5 m), Multi-purpose

The development target of Tangerang container terminal amounts to 2.0 million TEU/year of container throughput. Four-year period is estimated for construction works of Tangerang development. .

Quays No.1 and No.2 will start operation in the 4th year after implementation of construction in line with the requirement of demand forecast. Quays No.3 and No.4 will commence operation in the 5th year after implementation of the construction.

Implementation schedule of Scenario 3 is shown in Table 5.1-34.

Table 5.1-32 Implementation schedule of Development Option-1

Description	Ist Year After L/A	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
North Kalibaru Phase I							
1. Administration Procedure	Q1–Q4						
2. Construction Stage							
2.1 Access Road and Bridge		Q1–Q4	Q1–Q2				
2.2 Stage 1 of Container Terminal							
Breakwaters and Seawalls		Q2–Q4	Q1				
Dredging of Channel and Basin		Q2–Q4	Q1–Q4	Q1–Q4			
Container Terminal Stage 1		Q3–Q4	Q1–Q4				
Terminal Buildings				Q1–Q4			
Container Handling Equipment				Q1–Q4			
Security and Utility			Q3–Q4	Q1–Q4			
Start of Terminal Operation Stage 1					Q1–Q4	Q1–Q4	Q1–Q4
2.3 Stage 2 of Container Terminal							
Container Terminal Stage 2				Q1–Q4	Q1–Q2		
Terminal Buildings					Q1–Q4		
Container Handling Equipment					Q1–Q4		
Utility Facilities					Q1–Q4		
Start of Terminal Operation Stage 2						Q1–Q4	Q1–Q4

Description	2015	2016	2017	2018	2019	2020	2021
North Kalibaru Phase II							
1. Administration Procedure	Q1–Q4						
2. Construction Stage							
2.1 Offshore Road and Bridge; 11.6 km		Q3–Q4	Q1–Q4	Q1–Q4	Q1–Q2		
2.2 Container Terminal							
Demolition of Dam Barat		Q1–Q2					
Seawalls and Revetment		Q2–Q4	Q1–Q4	Q1–Q2			
Dredging of Channel and Basin		Q3–Q4	Q1–Q2				
Quay Wall Construction (2,000 m)		Q3–Q4	Q1–Q4	Q1–Q4			
Container Terminal II-1 (2 berth@300 m)				Q3–Q4	Q1–Q2		
Container Handling Equipment				Q3–Q4	Q1–Q2		
Start of Terminal Operation Tereminal 1					Q3–Q4	Q1–Q4	Q1–Q4
Container Terminal II-2 (2 x 2 berths @350 m)				Q3–Q4	Q1–Q4		
Container Handling Equipment				Q3–Q4	Q1–Q4		
Security and Utility				Q3–Q4	Q1–Q2		
Start of Terminal Operation Tereminal 2						Q1–Q4	Q1–Q4

Description	2020	2021	2022	2023	2024	2025	2026
North Kalibaru Phase III							
1. Administration Procedure	Q1–Q4						
2. Construction Stage							
Breakwaters							
Construction		Q1–Q4	Q1–Q4	Q1–Q4			
Demolition of Dam Barat				Q1–Q4			
Seawalls and Revetment			Q1–Q4	Q1–Q4	Q1–Q2		
Dredging of Channel and Basin		Q1–Q4	Q1–Q4	Q1–Q4			
Quay Wall Construction (2,600 m)			Q1–Q4	Q1–Q4	Q1–Q4	Q1–Q4	
Reclamation of Container Yard			Q1–Q4	Q1–Q4	Q1–Q4		
Container Terminal III-1 (2 berth@350 m)				Q1–Q4	Q1–Q2		
Container Handling Equipment				Q3–Q4	Q1–Q2		
Start of Operation Tereminal III-1					Q3–Q4	Q1–Q4	Q1–Q4
Container Terminal III-2 (3 berth@300 m)				Q3–Q4	Q1–Q4		
Container Handling Equipment					Q1–Q4		
Start of Operation Tereminal III-2						Q1–Q4	Q1–Q4
Container Terminal III-3 (2 berth@350 m + 1berth@300 m)					Q1–Q4	Q1–Q4	
Container Handling Equipment					Q3–Q4	Q1–Q4	
Start of Operation Tereminal III-3							Q1–Q4

Table 5.1-33 Implementation schedule of Development Option-2

Description	Ist Year After L/A	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
North Kalibaru Phase I							
1. Administration Procedure	////						
2. Construction Stage							
2.1 Access Road and Bridge		////	//--				
2.2 Stage 1 of Container Terminal							
Breakwaters and Seawalls		-///	/---				
Dredging of Channel and Basin		-///	////	////			
Container Terminal Stage 1		--//	////				
Terminal Buildings				////			
Container Handling Equipment				////			
Security and Utility			--//	////			
Start of Terminal Operation Stage 1					////	////	////
2.3 Stage 2 of Container Terminal							
Container Terminal Stage 2				////	//--		
Terminal Buildings					////		
Container Handling Equipment					////		
Utility Facilities					////		
Start of Terminal Operation Stage 2						////	////

Description	2015	2016	2017	2018	2019	2020	2021
Cilamaya Phase I							
1. Administration Procedure	////						
2. Construction Stage							
2.1 Access Road and Bridge		////	////	////			
2.2 Container Terminal							
Breakwaters		////	//--				
Seawalls and Revetment		---/	////	//--			
Dredging of Channel and Basin		--//	////	////			
Berth No.1; Quay Wall and Reclamation			////	//--			
Yard Pavement and Buliding				////			
Container Handling Equipment				////			
Start of Terminal Operation Berth No.1					////	////	////
Berth No.2; Quay Wall and Reclamation				////	//--		
Yard Pavement and Buliding					////		
Container Handling Equipment					////		
Start of Terminal Operation Berth No.2						////	////
Quay No.3			////				
Terminal Service Area; Reclamation			////	////			
Container Handling Equipment			--//	////			

Description	2021	2022	2023	2024	2025	2026	2027
Cilamaya Phase II							
1. Administration Procedure	////						
2. Construction Stage							
Berth No.4; Quay Wall and Reclamation		////	//--				
Yard Pavement and Buliding			////				
Container Handling Equipment			////				
Start of Terminal Operation Berth No.4				////	////	////	////
Berth No.5; Quay Wall and Reclamation			////	//--			
Yard Pavement and Buliding				////			
Container Handling Equipment				////			
Start of Terminal Operation Berth No.5					////	////	////
Quay No.6		////					
Multi-purpose Berth; Reclamation			////				
Yard Pavement and Buliding				////			
Start of Terminal Operation Multi-purpose					////	////	////
Terminal Service Area; Reclamation			////				
Yard Pavement and Buliding			////				
Security and Utility			////	////			

Table 5.1-34 Implementation schedule of Development Option-3

Description	Ist Year After L/A	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
North Kalibaru Phase I							
1. Administration Procedure	///						
2. Construction Stage							
2.1 Access Road and Bridge		///	///				
2.2 Stage 1 of Container Terminal							
Breakwaters and Seawalls		///	///				
Dredging of Channel and Basin		///	///	///			
Container Terminal Stage 1		///	///				
Terminal Buildings				///			
Container Handling Equipment				///			
Security and Utility			///	///			
Start of Terminal Operation Stage 1					///	///	///
2.3 Stage 2 of Container Terminal							
Container Terminal Stage 2				///	///		
Terminal Buildings					///		
Container Handling Equipment					///		
Start of Terminal Operation Stage 2						///	///
Utility Facilities					///		

Description	2015	2016	2017	2018	2019	2020	2021
North Kalibaru Phase II							
1. Administration Procedure	///						
2. Construction Stage							
2.1 Offshore Road and Bridge; 11.6 km		///	///	///	///		
2.2 Container Terminal							
Demolition of Dam Barat		///					
Seawalls and Revetment		///	///	///			
Dredging of Channel and Basin		///	///				
Quay Wall Construction (2,000 m)		///	///	///			
Container Terminal II-1 (2 berth@300 m)				///	///		
Container Handling Equipment				///	///		
Start of Operation Tereminal II-1					///	///	///
Container Terminal II-2 (2 x 2 berths @350 m)				///	///		
Container Handling Equipment				///	///		
Start of Operation Tereminal II-2						///	///
Security and Utility				///	///		

Description	2020	2021	2022	2023	2024	2025	2026
North Kalibaru Phase III (2.3 million TEU)							
1. Administration Procedure	///						
2. Construction Stage							
Breakwaters							
Construction		///	///	///			
Demolition of Dam Barat				///			
Seawalls and Revetment		///	///	///	///		
Dredging of Channel and Basin		///	///	///			
Quay Wall Construction (1,600 m)		///	///	///			
Reclamation of Container Yard			///	///			
Container Terminal III-1 (2 berth@350 m)				///	///		
Start of Operation Tereminal III-1					///	///	///
Container Terminal III-2 (3 berth@300 m)				///	///		
Start of Operation Tereminal III-2						///	///

Description	2020	2021	2022	2023	2024	2025	2026
Tangerang							
3. Construction Stage							
3.1 Access Road and Bridge		///					
3.2 Container Terminal							
Breakwaters		///	///	///			
Seawalls and Revetment		///	///	///			
Dredging of Channel and Basin		///	///	///			
Berth No.1 and No.2; 600 m			///	///			
Container Handling Equipment			///	///			
Start of West Terminal Operation					///	///	///
Berth No.3 and No.4; 600 m				///	///		
Container Handling Equipment					///		
Start of East Terminal Operation						///	///
Security Facilities				///			
Seervice Area and Utility Facilities			///	///	///		

(6) Construction Methods and Schedule

1) Dredging Work

Selection of Dredger Type

The total dredging volume for widening and deepening of the channel and basin of Tanjung Priok Port is estimated at over 20 million cubic meters in the stage of Phase I development of North Kalibaru. In order to complete the required dredging works in the limited work period, the best dredging method needs to be selected.

In the case of capital dredging of channel and basin, the deposit material is consolidated after compaction. The Cutter Suction Dredger is thus considered more suitable than TSHD.

Therefore, the combination of Cutter Suction Dredger and hopper barge is applied in the port development project as an economical dredging method with high productivity.

Use of Grab bucket dredger will be effective in the dredging works of deepening and expansion of the harbour basins and channel at the limited area.

Disposal Plan of Dredged Material

Tanjung Priok

The water area designated by ADPEL as the dumping site for the dredged material from Java Bay area in Tanjung Priok has been located in the area called Muara Gembong and was defined by the following coordinates.

05º 56’ 09”S, 106º 59’ 24”E ～ 06º 00’ 42”S, 106º 58’ 30”E

According to a recent instruction by ADPEL (Adpel Utama Tanjung Priok, 10th February 2010), the new dumping site is designated at a new location in the water area offshore Karawang, where the water depth is around 30 meters. Distance between the new dumping site and Tanjung Priok Port is around 26 km (14 nautical miles). The geographical location is given by the coordinates as follows.

1.	05º 51’ 54”S	106º 58’ 24”E	2	05º 51’ 04”S,	107º 00’ 40”E
3.	05º 51’ 56”S,	107º 01’ 09”E	4.	05º 53’ 02”S,	106º 58’ 47”E

Proposed Dumping Site for Cilamaya and Tangerang Development

In the construction planning of this study, new locations of the dumping site for the container terminal development projects are planned at offshore Cilamaya and Tangerang at a water depth of over 30 meters..

The distance between the site of Cilamaya Container Terminal and the proposed dumping site is 22 km (around 12 nautical miles).

The distance between the site of Tangerang Container Terminal and the proposed dumping site is 18 km (around 10 nautical miles).

Productivity of Dredging Plans

Proposed Dredger Fleet

Dredger fleet for the dredging works of channel and basin at Tanjung Priok Port and other development site as well is planned by employing Cutter suction dredgers operated by PT RUKINDO, a state-owned dredging company, instead of mobilizing such type of dredger from Singapore or Europe.

Two hopper barges are to be deployed for transportation and dumping of the dredged material.

-	Cutter Suction Dredger	equivalent to Batang Anai
-	Dredging depth:	24 m,
-	Dredging capacity	1,200 m3/hour
-	Base Port	Tanjung Priok
-	Anchor Boat	65 GT Class, 150 HP
-	Hopper Barge	Capacity: 2,000 m3 x 2
-	Tug Boat	Pusher 200 GT Class (1,600 HP) x 2

Productivity of Dredging

Productivity of the proposed dredging system is examined for Tanjung Priok Port (North Kalibaru development; Phase I and II) as follows (refer to Table 5.1-35).

-	Dredging Performance The concentration of the dredged material is assumed as 40 % in the hopper. The dredged soil volume in the hopper barge is calculated as follows. 2,000 m^3 x 40 % = 800 m^3 (Dredging Performance per cycle)
-	Time to fill the capacity of 2,000 m3 hopper barge Dredging capacity of the dredger is 1,200 m3/hour as above-mentioned. The time to fill the capacity of the barge is calculated as 0.67 hour (= 800/1,200).
-	Sailing time (loaded) inside the harbor basin where port operations are busy; Sailing speed (loaded) is assumed as 3 knots; 3 (miles) / 3 (knots) = 1.0 hours
-	Sailing time (loaded) from the dredging site to the disposal site Sailing speed (loaded) is assumed as 6 knots; 14 (miles) / 6 (knots) = 2.33 hours
-	Dumping time at the disposal site: 0.25 hours (15 minutes)
-	Sailing time (empty) from the disposal site to the dredging site Sailing speed (empty) is assumed as 8 knots; 14 (miles) / 8 (knots) = 1.75 hours
-	Working Cycle Time: 0.67 + 1.0 + 2.33 + 0.25 + 1.75 +1.0 = 7.0 hours
-	Dredging and disposal cycles per day Effective Working Time is assumed as 21 hours/day 21 (hours/day) / 7.0 (hours) = 3 cycles/day
-	Productivity of dredging and disposal by two barges per day is calculated as follows. 3 (cycles/day) x 800 (m3/barge) x 2 (barges) = 4,800 m3/day
-	Working-day is assumed as 28 days per month. 4,800 (m3/day) x 28 (days/month) = 134,400 m3/month

Over-dredging

It is empirically necessary to consider an over-dredging depth of 0.5 m in the dredging volume in order to achieve the design depth of the channel and basin. As the total dredging area for the proposed dredging work is about 1,750,000 m2, the assumed over-dredging volume amounts to 875,000 m3 (0.5 m x 1,750,000 m2), which is equivalent to about 10 % of the total design volume of dredging.

Productivity of the dredging work is also examined assuming the conditions of Cilamaya and Tangerang, which are presented in Table 5.1-36.

Table 5.1-35 Productivity of Dredging Work (North Kalibaru)

Description	Calculation
Dredging Performance per cycle	800 m3 per cycle
Working Cycle Time	5.0 hours
Time to fill 2,000 m3 barge	0.67 hour; (2,000 x 40%)/1,200 m3/hour
Sailing Time (inside the harbor)	2 x 1.0 hour (3 miles / speed: 3 knots)
Sailing Time (loaded; to dumping site)	2.33 hours (14 miles / speed: 6 knots)
Dumping Time	0.25 hour
Sailing Time (empty)	1.75 hours (14 miles / speed: 8 knots)
Effective Working Time per Day	21 hours/day
Dredging Cycle per Day	3.0 cycles/day
Production per Day	4,800 m3/day (2 x 3 (cycles/day) x 800 m3)
per month	130,000 m3/month; 28 days/month

Table 5.1-36 Productivity of Dredging Work

(1) Cilamaya (Dumping site: 12 nautical miles distant)

Description	Calculation
Dredging Performance per cycle	800 m3 per cycle
Working Cycle Time	5.0 hours
Time to fill 2,000 m3 barge	0.67 hour; (2,000 x 40%)/1,200 m3/hour
Sailing Time (loaded; to dumping site)	2.0 hours (12 miles / speed: 6 knots)
Dumping Time	0.25 hour
Sailing Time (empty)	1.5 hours (12 miles / speed: 8 knots)
Effective Working Time per Day	21 hours/day
Dredging Cycle per Day	4.75 cycles/day (4.42 hours/cycle)
Production per Day	7,500 m3/day (2 x 4.7 (cycles/day) x 800 m3)
per month	210,000 m3/month; 28 days/month

(2) Tangerang (Dumping site: 10 nautical miles distant)

Description	Calculation
Dredging Performance per cycle	800 m3 per cycle
Working Cycle Time	5.0 hours
Time to fill 2,000 m3 barge	0.67 hour; (2,000 x 40%)/1,200 m3/hour
Sailing Time (loaded; to dumping site)	1.67 hours (10 miles / speed: 6 knots)
Dumping Time	0.25 hour
Sailing Time (empty)	1.25 hours (10 miles / speed: 8 knots)
Effective Working Time per Day	21 hours/day
Dredging Cycle per Day	5.5 cycles/day (3.84 hours/cycle)
Production per Day	8,800 m3/day (2 x 5.5 (cycles/day) x 800 m3)
per month	240,000 m3/month; 28 days/month

2) Reclamation and Soil Improvement

Procurement of Reclamation Material

A number of sources for procurement of reclamation material have been examined carefully not only in the area of West Java but also in neighbour regions such as the following candidate sites, Bojonegara (Banten Province, around 100km from Jakarta), Lampung (South Sumatra, around 200 km from Jakarta), and Bangka and Belitung Islands (Bangka-Belitung Province, around 350 km from Jakarta) are named as the candidate sources.

Sea sand mining has been strictly regulated on the coast of Tangerang and West Java considering beach erosion control and environmental conservation.

Average prices of reclamation material were advised as for mountain sand from Bojonegara as "20,000 Rp/ m^3 + transportation: 85,000 Rp/ m^3", and as for procurement from Bangka / belitung Islands as "170,000 Rp/ m^3 including Transportation cost".

The source in the Bojonegra area closest to Jakarta among the candidate sites is assumed for procurement of reclamation material, where the required quality will be satisfied for the reclamation works planned in the projects of North Kalibaru, Cilamaya and Tangerang.

It is observed that the providing capacity of a provider is on the level of 5,000 m^3 per day if it is equipped with belt conveyer system from mining point of the sand to the shipping point, and 20-ton class wheel loader and 40-ton class bulldozer with rippers. In order to secure safe and constant procurement of the material, two or three providers of this scale are necessary.

Transportation of Reclamation Material

Considering the environment of the development sites and the source area of reclamation material, transportation by floating barge is recommendable for smooth procurement of the material. Due to the following three main reasons, sea transport is selected over land transport.

- The first is, in case of on land transportation by dump trucks, heavy traffic congestion and disturbing urban traffic in and around Jakarta city will directly affect the construction schedule.
- The second is, a dump truck can carry only 10 tons of sand, and work efficiency will be very difficult to reach the target of the completion.
- The third is, dump truck transportation of a large volume material requires a large stockyard with a jetty for transhipment to the destination.

Due to the above reasons, sea transportation by floating barges is effective for the projects.

In order to secure safe and constant sea transportation of the material, and considering the distance from Bojonegara to the terminal construction sites on the north coast of West Java, the 2,000 - 5,000 tons capacity of hopper barge will be required.

For the Cilamaya project, a candidate source of reclamation material is located at Cipatat, around 25 km northwest of Bandung, where sufficient quantity and satisfactory quality of reclamation material for the project will be expected.

The quarry site is located inland 75km southwest from Cilamaya, and on land transportation by dump trucks will be applied in this case. The existing road condition of the route except toll highway is narrow and poor for heavy loaded vehicles, therefore construction of a temporary working road should be considered in the construction schedule connecting the existing highway junction with the development site of the Cilamaya terminal.

Recycle of Dredged Material

Considering tight construction schedule and the large reclamation volume, recycling of dredged material of the channel and basin should be examined.

As the result of Subsoil Conditions Survey in the development areas, the upper layers of the seabed consist of clay and silt with N value 0 – 2. The average depth of these very soft layers is from 8 to 10 meters in Tanjung Priok.

A possible way to make use of fine material from reclamation work is by applying the method of cement soil improvement. In case of using fluid mud, there are two methods of cement soil improvement. The first is a conventional method, in which cement soil improvement is done after reclamation by a pump dredger. The second is a new technology invented in Japan called "pipe-mixing method".

The basic principle of the method is that dredged soft material is mixed with cement mortar and treated in the process of conveying in dredging pipe. In case of using this “pipe-mixing method”, the special purpose working barge and related devices for the system must be mobilized from Japan. The procurement cost of this system is considerably more expensive than conventional soil improvement method, i.e., vertical drain method, PVD, etc.

A preliminary cost estimate is carried out for applying “Pipe-mixing Method” for treatment of soft material in Jakarta Bay and to recycle the dredged material. Consequently the cost will range from 200,000 – 400,000 Rupiah for a cubic meter of treatment of soil. Thus by making use of recycled soft material, the cost will be double that of using mountain sand from quarries in the Bojonegara area.

Although applying the “pipe-mixing method” has a big merit in which the work period for reclamation can be shortened, its disadvantages are the higher construction cost and the inability to apply the recycling method.

Reclamation Works

Planned reclamation area for the projects are quite large (i.e., North Kalibaru Project Phase I: 77 ha, Phase II: 129 ha, and Phase III: 190 ha). Hence enclosure revetments should be constructed in advance of land reclamation. This is the method called “Section Landfill method” and is applied for the North Kalibaru Project.

Assuming required reclamation volume as 10,000～15,000 m^3 per day, one segmented area can be planned to have around 25 ha. To divide the reclamation area into sections, partition dykes are constructed with rubble stone mound structure.

According to the subsoil conditions survey in the offshore area of North Kalibaru, the very soft layers with SPT-N value less than 10 has a 10 meters thickness from the seabed. The vertical drain method (PVD = Plastic Vertical Drain for example with 1 meter interval) will be applied in the reclamation area to accelerate consolidation of the soft layer and to acquire required foundation strength. Immediately after this work, pre-loading of surcharge soil method using imported mountain sand of good quality is placed on the PVD ground.

Based on experience in placing reclamation material in the water area of Tanjung Priok Port, ground is expected to settle with 3 meters thickness by consolidation of the soft layers and resulting subsidence. Therefore 3 meters thickness of mountain sand will be taken into consideration in the estimate of reclamation volume.

Soil Improvement

Vertical Drain Method

The foundation of breakwater was originally designed as sand replacement method. Sand Replacement, which is to replace soft layers with good quality sand, will not be applied due to the following reasons.

The existing soft layer has thickness of more than 5 m, and the volume to be removed is so great that the dredging volume and infill volume would raise costs considerably.

On the other hand, based on the soil characteristics, combination of Preloading and Vertical Drain methods will be appropriate and effective for compaction process of the poor soil layer and for accelerating the consolidation up to 90%.The project cost is estimated assuming that this method is applied for the reclamation works.

Sand Compaction / Deep Soil Mixing

For the construction of breakwater and revetment, Sand Compaction Pile method or Deep Soil Mixing method on the existing sea bed should be examined. In the case of applying Sand Compaction method, a huge amount of fine sand is required. However, considering environmental aspect and the surroundings in/ around the North Kalibaru area, it might be difficult to acquire such volume and quality of sand.

In the case of Deep Soil Mixing method, cement as main material seems to be easily procured and work quality seems to be controlled easier. The residual settlement is serenely generated in case that improvement is done by bearing layer. However, it must be noted that the cost of the method is relatively higher and that such an advanced method has never been applied before in Indonesia.

Compaction/Jet Grouting

As another option, Compaction/Jet Grouting method can be considered to increase the rate of consolidation and reduce the total amount of settlement.

In terms of reuse of dredged soft material as reclamation material, Pipe Mixing method, which is to improve soft soil characteristics by adding sprayed cement during the process of soil conveying into dredging pipe, seem to be effective. Cemented soil is relatively lightweight and it contributes to decreasing overburden loading by reclaimed.

Considering the advantages/disadvantages of the above applicable methods, combination of PVD with preloading is considered more practical among other methods; moreover, this method has been employed in Indonesia in the past.

As another option, Compaction/Jet Grouting method was considered to increase rate of consolidation and reduce total amount of settlement.

3) Quay Wall Construction

The structure of quay wall of the container terminal is designed as steel pipe piles foundation (D: 900 - 1,200 mm, L: 28 – 40 m) with upper RC (reinforced concrete) deck. The whole Quay Wall is comprised of divided blocks and the planned size of unit block is 30 m x 35 m. Estimated concrete volume is 500 m^3 per block.

Piling Works

The foundation of the quay walls is planned as vertical steel pipe pile structure (D: 1200 mm, L: 40 m for North Kalibaru and Tangerang project; D: 900 mm, L: 28m for Cilamaya project). The steel pipe piles will be procured domestically from Indonesian local manufacturers.

The pile foundation will be constructed with battering method of piles by pile hammer. Considering the pile dimensions, the length and the sub soil conditions in each site, as long as using natural drop method by diesel hammer or hydraulic hammer, it is assumed that the ram weight of 8-ton hammer will be needed. The hammer is equipped to an appropriate capacity of piling barge.

Concrete Works on Upper Deck

The upper part of the quay wall is planned as In-situ RC structure. After completion of the piling works, temporary scaffolding at the bottom to support the loads of upper RC structure will be fabricated.

Fresh ready-mixed concrete for the projects will be considered for hot weather concrete in which daily average temperature is 25ºC or higher. The concrete for North Kalibaru project will be procured from several concrete plants located in the Jakarta area. Considering heavy traffic congestion through the Jakarta metropolitan region during the daytime, concrete should be transported at night time. To decrease the risk mentioned above, it is recommended that the contractor set up a concrete plant facility at each site.

Concrete Placing will be carried out with concrete pump(s) having appropriate pressure and working range. Considering planar dimensions of a unit block as 30 m x 35 m, concrete volume of a unit block and concrete leveling and finishing speed, the minimum requirement of a concrete pump truck should be 22-ton class (50 – 120 m3/hour, piston type) equipped with minimum 40 m working range including extension hose.

4) Breakwater and Seawall Constructions

Breakwater will be constructed to provide shelter not only to the port basin but also the working area of the construction from wave actions particularly during stormy conditions and northwest monsoon season. The construction schedule of those protective facilities should be placed as the forerunner of the implementation schedule.

Foundation and Soil Improvement

The foundation of breakwater was originally designed as sand replacement method. Considering the tight construction schedule and high price of good quality sand, it is recommended that combined use of Vertical Drain Method and Pre-loading of surcharge load (mountain sand) at the foundation be adopted instead of sand replacement method aiming at compaction of the layers of soft material and enhancement of the shear strength.

The Vertical Drain Method will be applied up to the depth of the layers where SPT-N value is less than 10, and placement of mountain sand (surcharge load) follows to accelerate consolidation and compaction of the soft layers.

The basic structure of breakwater is planned as rubble-mound type and wave dissipating concrete blocks (6.3-ton, 2-ton types of Tetrapod, for example) and concrete blocks (0.9 - 0.7m cube) will be used for the armour layers.

In the case of North Kalibaru Project, the materials from the existing breakwater (planned to be demolished or relocated) will be recycled for the construction of the new breakwater and revetment for the purposes of saving construction cost and reducing environmental risks by dumping.

Rubble Stone Mound

Rubble stone will be procured from several sources mainly around Bojonegara area and stones will be transported on the sea by floating barge. As the first step of rubble mound construction, the rubble stones will be loaded on the flat barge by wheel loader (20-ton class) and excavator (2 m^3 class) to gain assumed daily-required volume as 4,000 m^3.

According to the Consultant’s field studies, existing providers around the Bojonegara area work on a relatively small scale, that is, average capacity of their own equipment is the level of excavator (1.2 m^3 class) and wheel loader (2.2 m^3 class). Hence, in order to gain the required volume, material should be procured from a number of sources or new additional investment to enhance the equipment capacity will be required.

Barges having size of 2,000 – 5,000-ton class are assumed to be employed for the works schedule planning

Wave Dissipating Concrete Blocks and Cube Blocks

<u>Fabrication of Blocks</u>

Fabrication of concrete blocks for the projects will be executed in and around the contractor’ s construction site on land. For North Kalibaru projects, two potential candidate yards will be available in Marunda area behind Marunda Harbor located within 10 km distance from Tanjung Priok Port. The cost estimate of these works is based on the fabrication around these sites

<u>Ready-mixed Concrete</u>

There are many concrete mixing plants commercially operated in the Jakarta area. Supply capacity is approximately 300 m^3 per day in average by each plant and generally their quality control is stable.

<u>Installation</u>

Considering the weight of one wave dissipating block (6.3-ton or 2-ton), the installation equipment will be a crane barge (80~50-ton class crane outfitted properly on 1,000-ton ~ 1,500-ton class barge).

Crown Concrete

Crown concrete is placed by in-situ method. Considering the sectional shape, Expansion joint will be installed usually every 10 m in longitudinal direction.

Ready mix concrete transported by concrete agitating trucks will be carried to the placing point on the sea by using flat barge.

5) Revetment

Foundation and Soil Improvement

The revetment structure is designed with rubble-mound type with coping concrete, except the north revetment of North Kalibaru site that has steel sheet piles (L=25m) foundation behind of rubble mound and under coping concrete.

Soil improvement works by Vertical Drain Method will be applied at the foundation aiming at compaction of the layers of soft material and enhancement of the shear strength. Soil improvement is designed up to the depth of the layers where SPT-N value is less than 10, and placement of mountain sand (surcharge load) follows to accelerate consolidation and compaction of the soft layers.

Rubble mound

Rubble stones of revetment/seawall for each project will be procured from Bojonegara by barge transportation on the sea. After rubble mound is piled up, geo-textile sheets, which prevent diffluence of reclamation material, should be carefully placed.

Armor Stone

Armor stones of revetment for all projects as well are assumed to be procured mainly from Bojonegara. Installation of armour stones is executed by crane (50-ton class) from reclaimed land or by crane barge (50-ton class) on the sea.

Coping Concrete

Ready-mixed concrete suitable for hot weather is procured from concrete plants nearby each project site considering mixing capacity and transportation time. Material of Formworks is basically woody comprised plywood, 4 x 4, and 2 x 4 square timber. Concrete placing will be done by using crane barge (50-ton class) equipped with hopper. Concrete blocks will be fabricated in temporary fabrication yard prepared for each project.

6) Maintenance Dredging at Tanjung Priok Port

Sedimentation in Tanjung Priok Port

Sedimentation at Tanjung Priok Port and maintenance dredging of the navigation channels and harbor basins have been studied in the previous JICA Study (2002 – 2003). Reviews on the previous studies and the findings of the progress of latest 5 years are presented in this section.

Port Location

Tanjung Priok Port is located on the northeastern coastline at the outskirts of DKI Jakarta. The surrounding area of the port is flat with the elevation of approximately 2 m (MSL), and the coastline runs nearly in the east-west direction. According to the navigation chart of the Jakarta Bay area, the seabed slope is about 1/500 and the depth contour lines are seen parallel with the coastline of the bay.

Many rivers and drainage canals run in the south-north direction through the flat terrain surrounding the port. The following three rivers or drainage canals flow into the waters of Tanjung Priok Port.

- Kali Sunter Baru flows into Pelabuhan Minyak (Pertamina) at the eastern end of the port

- Terusan Lagoa flows into the water area between JICT and TPK Koja
- Kali Ancor flows into Pelabuhan Nusantara at the western end of the port

The areas surrounding Tanjung Priok Port have been rapidly urbanized through 1950s to 1980s. Thus the harbor basins of Tanjung Priok Port accept the rain water drainage from the urbanized Jakarta with their carrying solid wastes.

Sedimentation in the Water Areas of Tanjung Priok Port

The sounding surveys for the purpose of Pre- and Post-Dredging of the harbor basins and channels have been carried out several times a year by PELINDO II (Cabang Tanjung Priok). Those existing sounding data (1991 - 2001) were analyzed in the previous JICA Study to study the seabed changes in the water areas of Tanjung Priok Port. The following features were verified by the study.

- In the west access channel to the Tanjung Priok Port (Ambang Luar Barat), the seabed had risen for about +0.5 m per year in average at the channel center. The seabed rise presents smaller with respect to the distance from the entrance of the harbor (Pintu Masuk).
- The outlet area of Kali Sunter Baru at Pelabuhan Minyak presented the highest value of seabed rise, which was evaluated about +7.0 m per year. The second highest was about +2.0 m per year at the middle of Pertamina berth.
- The seabed rise at the harbor basins Pelabuhan I, II and III was evaluated very small and estimated at less than +10 cm per year.
- While the seabed rises at the harbor basins and the water areas inside the breakwater were evaluated higher, it was evaluated lower at the channel outside the breakwater. The seabed rises along the approach channel (Ambang Luar Barat; around 3 km) were evaluated 0.1 m to 0.5 m per year.

The main source of the seabed rise at the water areas inside the breakwater is considered due to sedimentation of the materials carried by the drainage canals such as Kali Sunter Baru, Terusan Lagoa and Kali Japat, into the harbor basins of Tanjung Priok.

Maintenance Dredging

Maintenance dredging in Tanjung Priok Port has been carried out regularly and maintained at the designed depth at major channels and basins.

Summary of Maintenance Dredging Volume at Tanjung Priok Port

The records of maintenance dredging volume are presented in the following table.

Table 5.1-37Average Annual Dredging Volume for 2005 - 2009

Year	Dredging at Channels	Dredging at Harbor Basins	Total Contract Volume
2005	300,000	305,592	605,592
2006	474,455	156,955	631,410
2007	430,231	37,618	467,849
2008	553,165	247,521	800,686
2009	241,942	117,958	359,900
Average	399,959	173,129	573,087

(Source: PELINDO II, Cabang Tanjung Priok, Technical Division; Unit: m3/year)

According to the average maintenance dredging at each part of the channel and harbour basin in Tanjung Priok Port, the following findings are noted.

Dredging in Channels

The annual volume is around 400,000 m^3/year in the navigation channels, and the east – west channel from the eastern innermost of the port (DKP) to the west entrance (Alur DKP s/d Pintu Masuk; depth: -14 m, length: 3,530 m) shows the largest maintenance dredging volume, accounting for over 50 % of the volume (181,000 m3/year + around 55,000 m3/year at Dermaga TPK Koja and Dermaga JICT).

The access channel to the west entrance of the port (Ambang Luar Barat; -14 m, 3 km) accounts for around 25 % of the volume (105,000 m^3/year).

Dredging in Harbor Basins

As for the harbor basins, the annual volume is around 180,000 m^3/year, and the basin Pelabuhan Mynyak accounts for the most portion of the volume (113,000 m^3/year). The smaller basins of Pelabuhan I, II and III account for around 25 % of the volume (45,000 m3/year).

The sedimentation in the harbor basins of Tanjung Priok is largely affected by the materials transported by the drainage canals such as Kali Sunter Baru, Terusan Lagoa and Kali Japat, flowing into the harbor of Tanjung Priok Port. That is the reason why the sedimentation volume in the areas of Pelabuhan Minyak and Alur DKP s/d Masuk Barat shows larger figures.

Meanwhile, as for the channel inside and outside the east entrance, no maintenance dredging has been executed in the last 20 years. This section of the channel is neither maintained nor used by any outgoing or entering vessels except some small boats.

As mentioned and discussed in the previous sub-section, the major reason of the maintenance dredging in the port area of Tanjung Priok is due to sedimentation of the materials carried by the drainage canals such as Kali Sunter Baru, Terusan Lagoa and Kali Japat, into the harbor basins of Tanjung Priok.

Table 5.1-38 presents the characteristic factor for the average volume of yearly sedimentation as the parameter of horizontal projection area of the channel or basin.

The sedimentation in the approach channel (outside the breakwater) due to wave actions and longshore current can be considered not large in Jakarta Bay and the surrounding area of Tanjung Priok, which accounts for around 20 % of the total volume of maintenance dredging at Tanjung Priok Port (Amabng Luar Barat 2000 – 2009: 105,000 m3/year, and Total Contract Volume 2005 – 2009: 575,000 m3/year).

The sedimentation in the approach channel (outside the breakwater) due to wave actions and longshore current can be considered not large in Jakarta Bay. The average sedimentation per year is evaluated as $\underline{0.22\ m^3/year/m^2}$.

As for the harbor basin (inside the breakwater), where not largely affected by the river effluence and materials, the average sedimentation per year is evaluated as $\underline{0.15\ m^3/year/m^2}$.

Table 5.1-38 Records of Maintenance Dredging Volume at Tanjung Priok Port (Average 2000 - 2009)

Division of Channel / Basin	Depth (m) Width (m) Length (m) Side Slope	A: Maintenance Dredging Volume (2000 - 2009)	B: Horizontal Area of Channel / Basin	Average Sedimentation per Year (A / B)
Alur DKP s/d Pintu Masuk Barat	-14 m 100 m 3,530 m 1:4.0	181,000 (m3/year)	353,000 m2	0.51 m3/year/m2
Alur Utara Pelabuhan I s/d Pintu Masuk	-14 m 100 m 1,925 m 1:4.0	28,000 (m3/year)	192,500 m2	0.15 m3/year/m2
Ambang Luar Barat	-14 m 100~150 m 3,000 m 1:4.0	105,000 (m3/year)	483,000 m2	0.22 m3/year/m2

Source: JICA Study Team based on data from PELINDO II (Cabang Tanjung Priok)

Dumping Site of Dredged Soils

The dumping site of the dredged material from Tanjung Priok Port has been designated in the water area called Muara Gembong which is located at the water area offshore Karawang at a depth of around 30 meters. Distance between the new dumping site and Tanjung Priok Port is around 26 km (14 nautical miles).

(7) Preliminary Cost Estimate

1) Construction Procurement

Construction Materials

Almost all the construction materials are produced domestically in Indonesia and can be procured in the market. The prices have been relatively stable in the recent years.

Construction Equipment

There exists a well-developed leasing market of construction equipment in Indonesia. According to the hearings from the major construction companies, most of the general-purpose construction equipment (such as bulldozers, backhoes, shovel loaders, concrete mixers, etc.) mobilized in the large-scale construction of public works can be procured from the leasing market.

Capability of Construction Companies

The fields of construction where the Indonesian local companies have experience are mainly building and housing development, road construction, water supply and sewerage construction, irrigation, etc. They also have relatively sufficient experience in marine construction.

2) Basis of Construction Cost

Unit price of labour / material / equipment

Unit price of each element such as labour, construction material and construction equipment are to be determined on the basis of the information collected in the field study (Jakarta and Bandung, July and October 2010).

Exchange Rate of Currencies

The basic prices are as of July and October 2010 and the foreign exchange rate is given as follows considering the current trend at the end of 2010.

1 USD = 9,000 Rupiah, 100 Yen = 11,000 Rupiah

Foreign and Local Portion in Prices

Each unit price was split into foreign currency and local currency portions, both indicated in Rupiah, estimated in the following classifications;

The foreign currency component consists of:

- Imported construction materials
- Foreign components of depreciation and operation/maintenance cost for construction equipment and plant
- Foreign component of domestic materials
- Salaries and costs of foreign personnel

The local currency component consists of:

- Local construction materials
- Local components of depreciation and operation /maintenance cost for construction equipment and plant
- Salaries and costs of local personnel
- Import duty on imported materials
- Indonesian taxes

3) Basic Cost of Project Works

Construction Works

The breakdown of unit costs of the construction works are to be prepared by accumulating costs of labour, materials, equipment and also the indirect costs such as general temporary works, overheads profit and so on.

The combined cost for major construction works is estimated from the costs of labour, required materials, required construction equipment, and the site expense of labour and equipment. The utilities cost of such as water, electric power and drainage refers to the other projects in the equivalent scale.

In addition to the construction cost and procurement cost, the engineering fee for the detail design and construction supervision, physical contingency and VAT are estimated in this study. The engineering cost for survey, detailed design and construction supervision is assumed as about 3 % of the direct construction cost in this case of port development. The physical contingency is assumed as 10 % for the construction cost.

Unit Cost of Container Handling Equipment

The unit cost of container handling equipment will include the costs of design, manufacturing, workshop tests, delivery and installation. Procurement Cost for the major equipment is given as follows for the preliminary engineering study (as of October 2010).

Price of imported products such as cargo handling equipment, computer systems and navigation aids are to be estimated based on the CIF Jakarta price and some transportation cost to the development site is considered. Japan or China is assumed as the place of manufacturing.

Maintenance Cost (Facility, Equipment, Dredging)

The yearly maintenance cost for civil works is set out as 1 % of the facility construction cost based on the annual maintenance fee of the facilities. Also, 3 to 5 % of the procurement cost of the equipment is adopted as the maintenance cost for the equipment.

Access channels and basins of Tanjung Priok Port are maintained by periodical maintenance dredging, which is financed by PELINDO II and carried out by P.T RUKINDO. The average annual volume of maintenance dredging is about 550,000 m^3/year based on average from 2005 - 2009.

The unit price of maintenance dredging is estimated as follows based on the actual contract record of 2008 between PELINDO II and PT RUKINDO. The yearly rate of inflation is assumed as 5 % for the period 2008 to 2010 (IMF, World Economic Outlook Database, September 2010 for Indonesia).

- Grab Dredging Rp. 31,000/m3 (Rp 28,000/m3 as 2008 price)
- Hopper Dredging Rp. 21,000/m3 (Rp 19,000/m3 as 2008 price)

5.2 New Bulk Terminal Development

(1) New Bulk Terminal Development at North Kalibaru

1) Petroleum Terminal

The volumes of petroleum products to be transferred to a new petroleum terminal in 2030 have been estimated as 4.4 million MT. To handle the above volume for PERTAMINA and additional volumes for the potential dealers other than Pertamina, four berths in total have been planned as follows:

- Total berth length: 270 m/berth x 4 berths = 1,080 m
- Water depth: -15.5m

2) Dry Bulk Terminal

The volumes of dusty dry bulk cargoes to be transferred to a new dry bulk terminal in 2030 have been estimated as 18.4 million MT. To handle the above volume, total berth length has been estimated to be 915 m. The same water depth of 15.5 m has been adopted in the bulk terminal planning throughout the berth line.

(2) Implementation Schedule of Master Plan

1) Petroleum Terminal

It is planned to implement the Petroleum Terminal in the latter half of the third phased implementation stage in the period from 2020 to 2030.

2) Dry Bulk Terminal

It is planned to implement the Petroleum Terminal in the latter half of the third phased implementation stage in the period from 2020 to 2030.

(3) Preliminary Design and Cost Estimate

1) Facility Plan of dry bulk terminal and petroleum products Terminal

Dry Bulk Terminal

- Quay wall ; Length 915m, Depth -15.5m
- Stock Yard development by Reclamation, Revetment;
  Yard Area; Backup distance 200 m, length 900 m along the berth, Area 18 ha.
  Concrete pavement with drainage system
- Terminal Inner Road;
  The terminal inner road is planned to have 12 m width for 3 lanes with two-way traffic and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard trucks (H22-44) wheel load of 8.0 ton/wheel. The road is planned to be constructed between the revetment wall and edge of bulk cargo stock yards on the north sides with a length of 1,010m.

Petroleum Product storage terminal

It is assumed that the following facilities of petroleum yard will be developed.

- Quay wall is planned as dolphin detached type structure, which shall be designed by the users according to their usage and type of tankers to call.
  Tentatively the necessary water front distance is planned to develop 4 berths.
  There will be a breakwater (New Dam Tengah) on the inner channel side, which will be developed under URPT and can be used as revetment of the reclaimed land for petroleum products storage yard.
- Storage yard will be developed by reclamation and construction of seawall and revetment; Yard Area is planned to have a backup distance of 600 m and water front length of 1,080 m along the berthing facilities, Area; about 60 ha.
  The yard pavement is not planned, which shall be determined the specified areas and type by users.
- Terminal inner road will be developed with drainage system

2) Design Criteria

All the applicable design criteria of the above facilities except the following is the same criteria as described in Chapter 5.1.2, since its construction site is located adjacent to the new container terminal berth at North Kalibaru.

Objective ship size is as shown in 2) above for dry bulk carrier.

Loading conditions such as surcharge on the dry bulk berth is set at 25 kN/m2 considering the type of bulk cargo handling equipment, while it is set at 35 kN/m2 on the dry bulk stock yard.

The design criteria for preliminary design of petroleum tanker berthing facilities will be decided by users

3) Design of Quay wall structure of bulk cargo

As a result of the comparison study, "Concrete deck on Steel Pipe Pile type" is considered suitable as the selected quay wall type for the new bulk cargo terminal due to similar soil conditions, seismic conditions at site, which is located adjacent to the new container terminal. The quay wall structure is planned to be constructed in front of the rubble mound type breakwater (Dam CITRA), which is required as part of the new container terminal development at North Kalibaru.

The retaining wall between the back up yard reclamation and quay wall is planned by steel sheet pile to protect the channel as dredged up to -15.5m and from sliding this breakwater and the reclaimed material for storage area.

The new bulk berth is planned on the same line as the new container berths

Table 5.2-1 Particulars of Quay wall of Bulk Cargo

Location	North Kalibaru New Terminal in Tajung Priok
Target Throughput	18, 395,000 Ton/year
Berth Length	915m
Berth Water Depth	CDL-15.5m
Number of Berths	1 for Panamax, 2 for coal barge, 4 for sand barge
Target Vessel Size	80,000 DWT
Quay wall Structure	Concrete Deck on Open Steel Pipe Pile Ø1200,t=20mm, driven up to - 32.50m DL (N-,50), with retaining wall by concrete blocks on top of rubble mound
Crown Height of Quay wall	CD+3.50m
Terminal Yard Backup Length	200 m
Bulk handling cranes	Movable cranes lifting and grab type
Fender	Rubber Fender 1150H, @12m
Bollard	100 tons @ 30m

Source: JICA Study Team

4) Yard Development by Reclamation for dry bulk terminal

New seawall on the north side and east side revetment of reclaimed land

The yard for new bulk terminals is planned to be developed by reclamation to the west of the new container terminal at North Kalibaru. The new sea wall on the north side (L=1,200m) will be constructed to protect reclaimed land from the wave and sediment material carried by the current with rubble stones piled up and armour stones thereon.

The soil condition of the foundation at the upper layer of depth -4.5m is soft and loose sand grey. The same type of seawall structure for reclamation as adopted for the new container terminal at North Kalibaru is selected due to the location on the extension of such container berth.

The seawall structure is designed with the same concept as planned for the new container terminal at North Kalibaru.

The revetment on the east side as boundary of the petrochemical products storage area is planned by the same type (rubble stone mound type with PVD for sea bed soil improvement) as planned for the new container terminal at North Kalibaru.

For development of the petroleum yard, the seawall for petroleum storage yard on the north side and revetment on the east side are required for development of the reclamation. Under this Study the same type of seawall and revetment structures of the bulk terminal are applied for petroleum storage yard protection.

Reclamation works

Reclamation works will be carried out by filling material such as quarry run and rubble stones taken from the quarry around the project sites. The infill materials will be transported by dump trucks from the existing quarry near the project site.

The infill material should be filled from the existing sea bed up to +2.0 m from CDL. Average thickness of reclamation will be 6 to 7 m. Average elevation of the planned yard after pavement will be +3.5 m (MSL+3.0m).

The soil improvement for the reclamation area is considered by the Plastic vertical drain (PVD) method at the foundation of the seawall, revetment and terminal inner roads areas. This method is one of the most practical methods of compaction for granular material.

Yard Pavement

Based on the operation planning inside the bulk cargo storage area and petroleum storage area, the pavement type shall be planned and selected by users according to their usage of respective areas. The pavement of the terminal inner road will be planned and developed by the Land developer (Port Authority), which shall be sustaining the following wheel loads as the critical condition for each type and area of the pavements.

5) Cargo handling equipment for dry bulk cargo

For loading and unloading clinker (export) and gypsum (import) on the berth the following type of handling equipment is tentatively considered for preliminary design of berthing facilities. Required number and type of such equipment shall be determined depending on the progress of demands and user's requirement.

Table 5.2-2Applicable Typical Handling equipment for Dry Bulk

Crane lifting capacity	20 ton x 21.5 m working radial
Grab lifting capacity	25 ton x 18.8 m working radial
Loading arm length	About 30m
Height of crane, width	About 25 m, control room height; about 13-15m, Width between wheel on both sides; 9.0 m

The suitable unloading equipment of petroleum products on the working platform and dolphins at each berthing facilities will be determined by each user's own choice.

(4) Preliminary Cost Estimate of Bulk Terminal Development

Preliminary project cost estimate is carried out for the Bulk Terminal development in Tanjung Priok. The development is assumed to be implemented following Container Terminal development at North Kalibaru (Phase I of Alternative-1) targeting the bulk cargo and petroleum cargo demands in 2030.

The following work items are taken into account in the preliminary cost estimate of the terminal development.

Table 5.2-3 The Project Components of Bulk Terminal Development

	Facilities Development	Scope of works	
1	Breakwater and Seawalls	Demolition of Dam Barat:	535 m, existing breakwater sheltering West Entrance of Port
		North Seawall:	2,210 m, protection seawall behind Petroleum Terminal
		Revetment:	725 m, West end of terminal along Channel and Basin
2	Dredging	West Channel:	2.13 million m3, to deepen and widen West Channel
3	Bulk Terminal	Quay Wall:	915 m, SP type Quay Wall, -15.5 m
		Reclamation:	1.89 million m3, yard construction with soil improvement
		Yard Pavement:	18 ha
4	Petroleum Terminal	Quay Wall (revetment)	1,080 m, -15.5 m, without Berthing structure
		Reclamation	11.45 million m3, yard construction with soil improvement
		Yard Pavement:	109 ha
5	Terminal Inner Road	Bulk Terminal:	3-lane (18 m wide) x 915 m inside Bulk Terminal
		Petroleum Terminal	3-lane (18 m wide) x 2,210 m inside Petroleum Terminal
6	Utility Facilities	Lump Sum	

Preliminary cost estimate is presented in Table 5.2-4. Total project cost is estimated as 6,274,071 million Rupiah (around 697 million USD, or 57,037 million Yen).

Table 5.2-4 Preliminary Cost Estimate of Bulk Terminal / Petroleum Terminal

Description	Unit	Quantity	Local Portion (1,000 Rupiah)	Foreign Portion (1,000 Rupiah)	Summation
1. General Cost			**155,530,618**	**84,120,710**	239,651,328
2. Direct Construction Cost					
(1) Breakwaters					
Demolition of Dam Barat	m	535	7,490,000	11,235,000	18,725,000
(2) Seawalls					
North Seawall	m	2,210	140,803,994	101,375,881	242,179,875
Revetment	m	725	23,762,588	4,065,416	27,828,003
(3) Port Inner Road	m	3,150			
(4) Dredging Channel and Basin					
Deepening (-15.5 m)		2,134,306	69,900,250	92,332,045	162,232,295
(5) Bulk Terminal					
Quay Wall	m	915	354,239,089	213,728,537	567,967,625
Yard Construction	ha	18			
Reclamation (DL+3.5 m)	m^3	1,350,000	132,285,682	53,493,982	185,779,664
Reclamation (Surcharge 3 m	m^3	540,000	52,914,273	21,397,593	74,311,865
Soil Improvement	m^2	180,000	21,668,790	9,286,624	30,955,414
Passage Pavement	m^2	180,000	68,040,000	45,360,000	113,400,000
(6) Petrol Terminal					
Revetment (Quay Wall)	m	1,080	230,217,451	172,593,454	402,810,905
Yard Construction	ha	109			
Reclamation (DL+3.5 m)	m^3	8,175,000	801,063,297	323,935,778	1,124,999,075
Reclamation (Surcharge 3 m	m^3	3,270,000	320,425,319	129,574,311	449,999,630
Soil Improvement	m^2	1,090,000	131,216,561	56,235,669	187,452,229
Passage Pavement	m^2	1,090,000	412,020,000	274,680,000	686,700,000
(7) Utility Faclities					
Utility Faclities	l.s.	1	252,409,046	130,028,595	382,437,641
Sub-total of Direct Cost (DC)			**3,110,612,355**	**1,682,414,207**	**4,793,026,562**
3. Project Related Expenses (PE)			**435,485,730**	**235,537,989**	**671,023,719**
(1) Engineering Services	l.s.	1	93,318,371	50,472,426	143,790,797
(2) Contingency	l.s.	1	311,061,236	168,241,421	479,302,656
(3) Administration Cost	l.s.	1	31,106,124	16,824,142	47,930,266
4. Total Construction Cost			**3,701,628,703**	**2,002,072,906**	**5,703,701,609**
VAT			370,162,870	200,207,291	570,370,161
Grand Total of Bulk and Petroleum Tertminals Develo			**4,071,791,573**	**2,202,280,197**	**6,274,071,770**

1 USD =	9,000	Rupiah	**697,119**	***1,000 USD**
1 Yen =	11,000	Rupiah	**57,037,016**	***1,000 Yen**

5.3 Access Road Development

(1) Access Road Development for the Master Plan at North Kalibaru

1) Summary of access road

The project of North Kalibaru is the expansion of the existing Tanjung Priok Terminal. The proposed terminal will be constructed on the land reclamation area off shore of Jakarta bay.

Two alternatives for the layout of the new terminal of North Kalibaru are proposed by the Study Team. An access road is also designed for each layout. In order for traffic on the new access road to avoid the current congested road network in Jakarta Metropolitan Area, the access road will connect the new terminal to the East Metropolitan Region through the off shore area.

2) Traffic demand forecast

The development of North Kalibaru is divided into three phases based on future cargo demand and the construction schedule. The targeted annual capacity of North Kalibaru will reach 1.9 million TEU in Phase 1, 3.2 million TEU in Phase 2 and 4.3 million TEU in Phase 3. The total cargo capacity of North Kalibaru will reach 9.4 million TEU. Total cargo handing capacity of Tanjung Priok Terminal will reach 13.4 million TEU including the existing capacity of 4.0 million TEU.

Phase 1 of North Kalibaru terminal will start operation with a handling capacity of 1.9 million TEU. The traffic volume for phase 1 of North Kalibaru is 16,304 pcu/day.

The terminal of North Kalibaru will be expanded in 2019 for Phase 2 and in 2024 for Phase 3. Planned additional handling capacity of North Kalibaru in Phase 2 is 3.2 million TEU and 4.3 million TEU in Phase 3. Total capacity of North Kalibaru will reach 9.4 million TEU including that of Phase 1. The traffic volumes for phase 2 and 3 of North Kalibaru are 43,780 pcu/day and 80,680 pcu/day respectively.

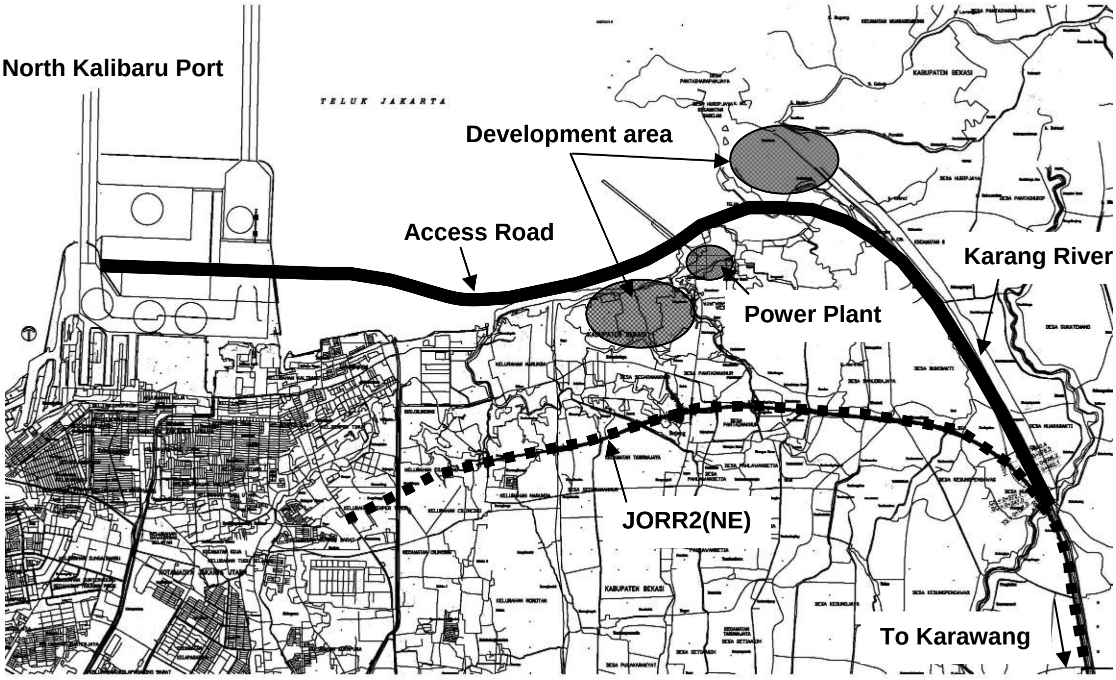
After Phase 2 is completed, there will be two access roads available, one is the arterial road to southward and the other is the dedicated road eastward.

According to the result of the traffic survey, 65% of traffic shall pass through the dedicated access road (to East) and 35% of traffic shall pass through the arterial road (to South and West). The estimated traffic volume in 2030 is 52,442 PCU/day on the dedicated road and 28,238 PCU/day on the arterial road.

3) Preliminary design of access road

A four-lane road is sufficient for the access road to North Kalibaru.

The access road connects the new terminal facility with JORR2, passing through the coastal area in front of the development area of Marunda and Bekasi. The total length of the access road is 19.3 km, consisting of 9.0 km inland and 10.2 km along the coast.



Source: JICA Study Team

Figure 5.3-1 Plan for access road for North Kalibaru

While the road level on the inland section is almost the same as the ground level, a certain vertical clearance must be secured in the coastal section. In addition, it is necessary to secure a certain horizontal and vertical clearance for the car carrying vessel plying the east access channel of North Kalibaru for alternative 2.

4) Implementation schedule

The construction of Access Road for Alternative 1 will require for three years.

- To integrate environmental and social consideration into evaluating and prioritizing development alternatives for a new container terminal.
- To contribute to decision making on formulating the master plan.

- Road: 4-lane, L=9.0km, 2 bridge, 1 Interchange
- Overpass bridge: 2 places
- Port Access Bridge: 4-lane, L=10.3km

The construction of Access Road for Alternative 2 will require for four years.

- Road: 4-lane, L=9.0km, 2 bridges, 1 Interchange
- Overpass bridge: 2 places
- Approach from Extra dosed bridge to harbor facilities: 4-lane, L=0.5km
- Port Access Bridge: 4-lane, L=13.3km
- Extra dosed bridge: 4-lane, L=0.3km

5) Preliminary Cost Estimate

The construction cost of Alternative 1 “Access Road” is estimated at Rp 11,940,860 million.

The construction cost of Alternative 2 "Access Road" is estimated at Rp 14,124,850 million.

(2) Access Road Development for the Master Plan at Cilamaya

1) Summary of access road

The candidate terminal of Cilamaya is located about 80km from Tanjung Priok Port to the east along the coast. The surrounding area is largely covered by rice fields and most of the local roads in this area are very narrow with many houses and buildings on the roadsides. The access road is planned as a dedicated road to connect the new terminal with the Cikampek Toll Road by the shortest route. In addition, frontage roads should be provided along the access road on both sides to secure the accessibility to the surrounding areas.

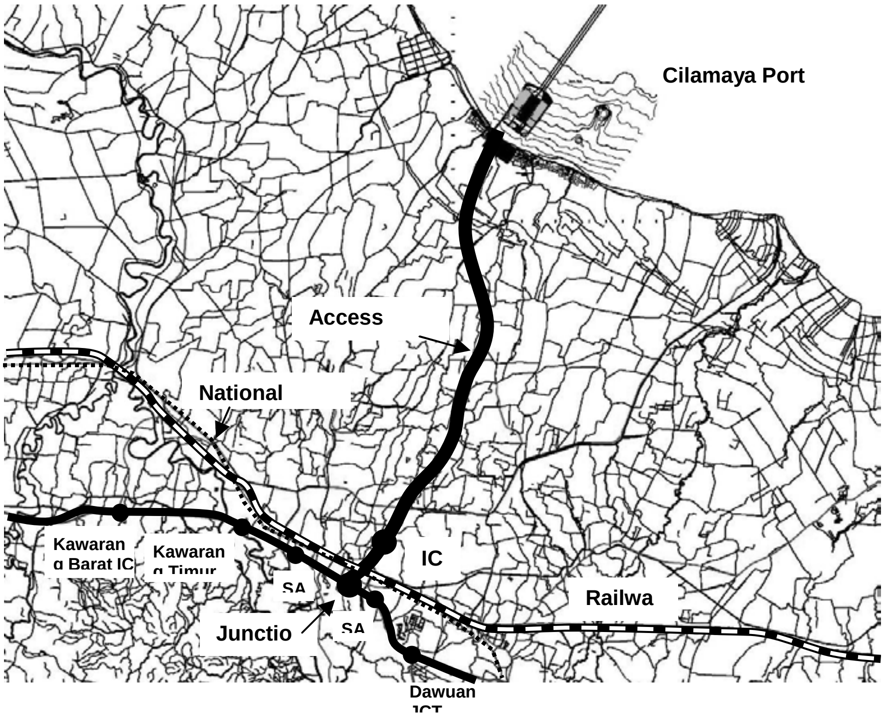
2) Traffic demand forecast

Cilamaya terminal is planned to open in 2019 after the saturation of North Kalibaru and will be developed in two phases. The targeted annual capacity of Cilamaya will reach 3.2 million TEU in Phase 2 and 4.3 million TEU in Phase 3. The total cargo capacity of Cilamaya will reach 7.5 million TEU. The traffic volumes for phase 2 and 3 of Cilayama are 27,477 pcu/day and 64,384 pcu/day respectively.

3) Preliminary design of access road

A four-lane road is sufficient for the access road to Cilamaya.

The total length of the access road is 30.6 km. The dedicated road finishes and links up with the frontage road about 1 km before the terminal. An interchange is to be installed at the beginning of the access road.



Source: JICA Study Team

Figure 5.3-2 Plan for access road for Cilamaya

The topography in the area of the proposed road is low and flat while the ground elevation is 30 to 40 m around the area of the interchange and railway. The road height should be basically almost the same as the existing ground level.

4) Implementation schedule

Project implementation period will be 48 months including project preparation and 36 months of construction works.

Access Road Development of Cilamaya:

- Road: 4-lane, L=29.8km, 6 bridges
- Interchange: 1 place
- Overpass bridge: 1 place
- Access Bridge: 4-lane, L=0.8km

5) Preliminary Cost Estimate

The construction cost of Cilamaya Access Road Development is estimated at Rp 2,663,586 million.

(3) Access Road Development for the Master Plan at Tangerang

1) Summary of access road

Tangerang terminal is planned about 30km west along the coast from Tanjung Priok Port. The access road shall be the arterial road as the estimated traffic volume is low at the time of terminal opening. The access road shall connect the terminal with JORR2 through the interchange which is planned by Bina Marga.

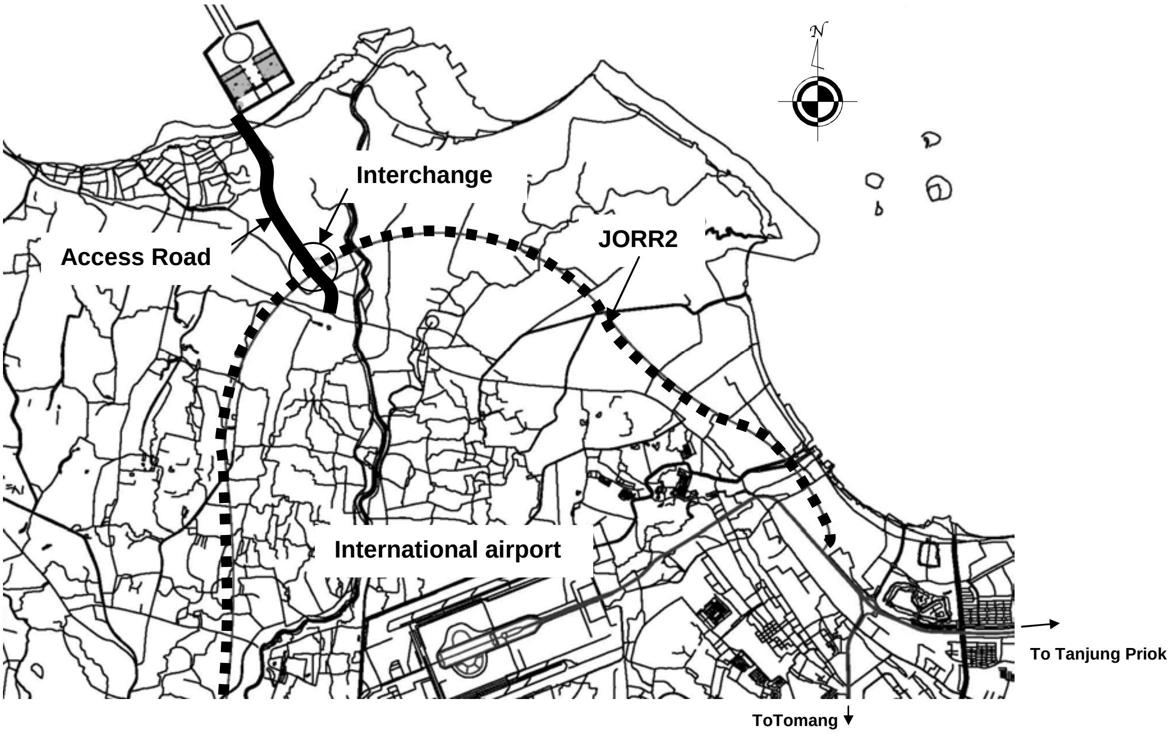
2) Traffic demand forecast

Tangerang terminal is planned to open in 2025. The targeted capacity of Tangerang will reach 2.0 million TEU. The traffic volume for phase 3 of Tangerang is 17,894 pcu/day.

3) Preliminary design of access road

A two-lane road is sufficient for the access road of Tangerang.

The total length of the access road is 5.0 km



Source: JICA Study Team

Figure 5.3-3 Plan for access road for Tangerang

The area around the access road is low and flat. The road height should be basically almost the same as the existing ground level. The vertical alignment is raised only for the crossing with JORR2. For the bridge to the terminal, the vertical clearance is 5.0 m from HWL.

4) Implementation Schedule

Project implementation period will be 30 months including project preparation and 18 months of construction works.

Access Road Development of Tangerang:

- Road: 2-lane, L=4.5km, 1 bridge
- Interchange: 1 place
- Port Access Bridge: 2-lane, L=0.5km

5) Preliminary Cost Estimate

The construction cost of Tangerang Access Road Development is estimated at Rp 404,071million.

(4) Access Road Development for Urgently Required Terminal at North Kalibaru

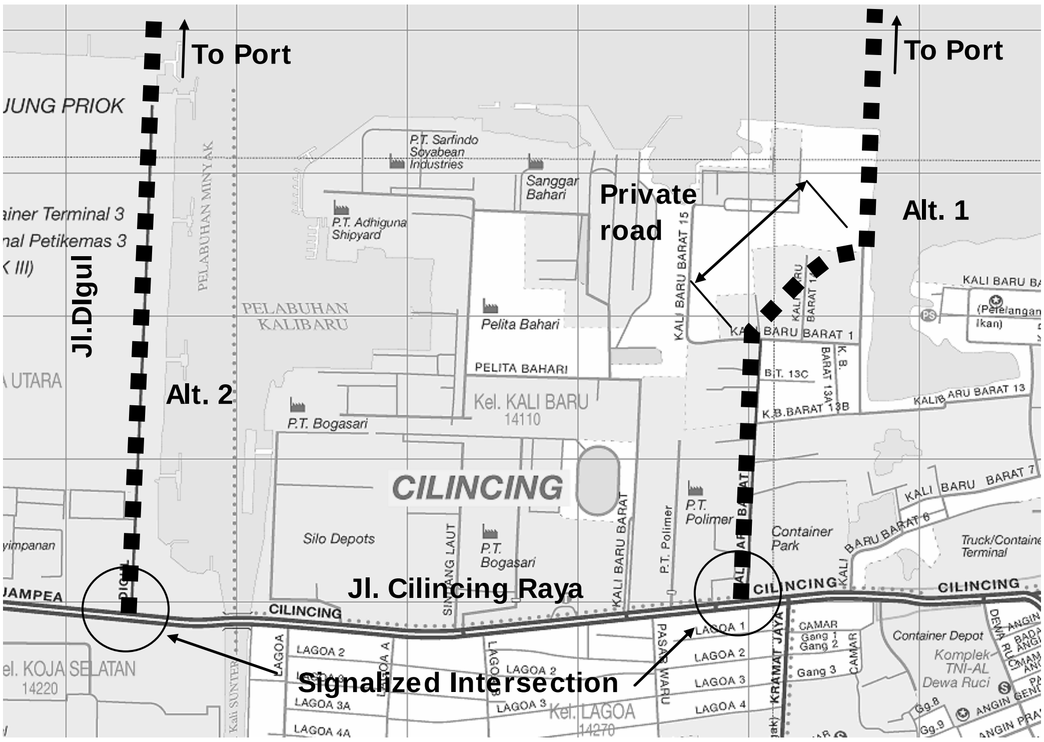
1) Summary of access road

The development of North Kalibaru consists of 3 phases. The access road connecting the new terminal with the existing road needs to be provided for phase 1, which is a so called “Urgent Project”. The concept of the access road is as follows.

- To be the arterial road due to the need for prompt construction
- To utilize the existing road to minimize resettlement
- To construct the bridge between the land and terminal
- To install a signalized intersection for connecting with the existing road

2) Preliminary design of access road

At least a two-lane road is required for the access road, and four-lane road is proposed for Alternative-2. The route of access road on land for Alternative-1, -2 are considered as below.



Source: JICA Study Team

Figure 5.3-4 Plan for access road for Tangerang

The road height should be almost the same as the ground level, about 1.5 to 3.0 m above M.S.L. For the bridge section, the road is raised to secure the vertical clearance of 16.0m above HHWL for tugboats passing under the bridge for Alternative-2.

PC girders (PC-I, PC-U) bridge with 35-40 m span, which is the same type of standard span bridge as North Kalibaru, is applied for the access bridge. The length of access road is 2.1 km for both Alternative-1 and Alternative-2.

3) Construction method of bridge

The main bridge portion has a number of piers in the sea. Therefore steel pile with 1.0m diameter is used for the foundation of the piers in the sea.

For the excavation of the riverbed material (sand and gravel), the hammer grab excavation and the reverse circulation method can be considered. However, for the rock excavation under the riverbed material, only the reverse circulation method with rock roller bit is applicable.

The bridge pile driving will be done from the deck of a temporary jetty constructed out to the pile locations in the sea.

After completion of the pier structure, the superstructure will be started from the land side according to the Contractor's construction program.

4) Implementation schedule

Project implementation period will be 2.5 years including project preparation (1.0 year) and construction works (1.5 years).

a) Alternative-1

Road	: 2-lane, L=0.90 km
Port Access Bridge on land	: 2-lane, L=0.47 km
Port Access Bridge in the sea	: 2-lane, L=0.73 km
Total	: 2-lane, L=2.10 km

b) Alternative-2

Road	: 4-lane, L=0.33 km
Port Access Bridge on land	: 4-lane, L=1.04 km
Port Access Bridge in the sea	: 4-lane, L=0.73 km
Total	: 4-lane, L=2.10 km

5) Preliminary Cost Estimate

The total project cost of Alternative-1 is estimated at 514 billion including VAT of 10%, and the total project cost of Alternative-2 is estimated at 1,045 billion including VAT of 10%.

5.4 Summary of Total Project Cost of Master Plan of Three Sites

Total project cost of the container terminal development in conjunction with Port Access Road Construction is presented in line with the phased development plan for each proposed project site, North Kalibaru, Cilamaya and Tangerang.

(1) North Kalibaru

Summary of the project cost estimate for the Phase I development through Phase III under Alternative 1 is presented in the following Table 5.4-1.

Construction cost for at-grade road (0.95 km, 2-lane) and an access bridge (1.2 km) are added to the project cost of Phase I.

As for Phase II development, construction of road (9.0 km, 4-lane) along the river bank including 2 flyovers, access bridge (10.3 km), etc. is considered in the project cost. The figures include VAT (10 % of the estimated project cost).

Table 5.4-1 Total Project Cost of Development Option 1

North Kalibaru		Project Cost (Million Rupiah)	Project Cost (1,000 USD)	Project Cost (Million Yen)
Phase I (1.9 million TEU)	Port	8,230,382	914,487	74,822
	Road	513,692	57,077	4,670
Phase II (3.2 million TEU)	Port	10,875,477	1,208,386	98,868
	Road	11,940,860	1,326,762	108,553
Phase III (4.3 million TEU)	Port	17,913,623	1,990,404	162,851
Total		49,474,034894	5,497,115	449,764

(2) North Kalibaru and Cilamaya

Summary of the project cost estimate for the second development scenario is presented in Table 5.4-2.

Port access road (around 31.4 km) connecting the new container terminal with a new junction at Cikampek Toll Road at Karawang is considered in the project cost.

The port access road consists of road construction (30.6 km, 4-lane) including 6 flyovers, access bridge (800 m, 4-lane) and interchange construction. The figures include VAT (10 % of the estimated project cost).

Table 5.4-2 Total Project Cost of Development Option 2

North Kalibaru Phase I and Cilamaya		Project Cost (Million Rupiah)	Project Cost (1,000 USD)	Project Cost (Million Yen)
Kalibaru: Phase I (1.9 million TEU)	Port	8,230,382	914,487	74,822
	Road	513,692	57,077	4,670
Cilamaya: Phase II (3.2 million TEU)	Port	13,072,629	1,452,514	118,842
	Road	2,663,586	295,954	24,214
Cilamaya: Phase III (4.3 million TEU)	Port	12,811,356	1,423,484	116,467
Total		37,291,645	4,143,516	339,015

(3) North Kalibaru and Tangerang

Summary of the project cost estimate for the third development scenario is presented in Table 5.4-3.

Port access road (around 5 km) connecting the new container terminal with a new junction on JORR2 is considered in the project cost.

The port access road consists of at-grade road (4.5 km, 2-lane) including flyovers, access bridge (500 m, 2-lane) and an interchange construction. The figures include VAT (10 % of the estimated project cost).

Table 5.4-3 Total Project Cost of Development Option 3

North Kalibaru and Tangerang		Project Cost (1,000 Rupiah)	Project Cost (1,000 USD)	Project Cost (Million Yen)
Kalibaru: Phase I (1.9 million TEU)	Port	8,230,382	914,487	74,822
	Road	513,692	57,077	4,670
Kalibaru: Phase II (3.2 million TEU)	Port	10,875,477	1,208,386	98,868
	Road	11,940,860	1,326,762	108,553
Kalibaru: Phase III (2.3 million TEU)	Port	11,353,928	1,261,548	103,218
Tangerang (2.0 million TEU)	Port	8,815,333	979,481	80,139
	Road	404,071	44,897	3,673
Total		52,133,743	5,792,638	473,943

6. EVALUATION ROAD MAP TOWARD INTERNATIONAL CONTAINER TERMINAL DEVELOPMENT IN GREATER JAKARTA METROPOLITAN AREA

6.1 Economic Feasibility

(1) Development Options

Following three (3) development options for the new container terminals for 2030 have been proposed in this study so far, hence their economic feasibility is evaluated in this section:

Option 1	North Kalibaru Phase II and III
Option 2	Cilamaya Phase II and III
Option 3	Tangerang with North Kalibaru II and part of III

It is assumed for all options that new container terminals with 1,200 m in length alongside berth have been in operation at North Kalibaru prior to realization of these development options.

(2) Methodology Employed in this Economic Feasibility Analysis

Two-step methodology is applied in this economic feasibility. For the first step Cost Minimization method is applied for ranking the project options and selecting the least cost one. Cost Minimization method is a useful analytical tool to select the least cost project from mutually exclusive projects if the project benefits are almost identical among the options. Unfortunately, however, the Cost Minimization method does not say about the economic viability of the project; it is unknown whether earnings from the project are higher than the costs necessary for the project. Therefore, for the second step, EIRR method is applied in this study to the best option selected in the first step for evaluation of the economic feasibility of the project.

(3) Cost Minimization Analysis

In the Cost Minimization analysis, "Construction costs of terminals and access roads" and "Land transportation cost" are summed up as the cost of each development option.

Construction costs basically consist of costs for breakwaters and seawalls, channel and basin, container terminals (quay wall, yard pavement, and terminal buildings), cargo handling equipment, security and utility, and the project related indirect costs. The cost for the port access road is also one of the important cost components of the project. The construction cost is firstly estimated by market price. After transfer items are removed, the costs expressed by market price are converted into economic pricing using conversion factors. Integrated conversion factor of this category is set at 0.96 taking the cost component of construction costs into consideration.

Land transportation costs for every option between the new terminal and shippers/consigners are estimated taking trucking distance and congestion level into consideration. In this estimation, it is assumed that the 2nd JORR road networks have been constructed and in operation. Port access road which is proposed in each development option is operational, too. Land transportation costs are estimated in economic price.

Cash flow and Present Value of combined construction cost and transportation cost of each development option are summarized in Table 6.1-1 in economic pricing. In expressing the Index of the Present Value, Option 1 is 125.0 and Option 3 is 129.9 while Option 2 serves as the base (=100). As having the minimum cost, Option 2 is selected as the best choice from the economic view point, based on the cost minimization approach.

Table 6.1-1 Present Value of Construction and Trucking Costs of Each Development Option

(Unit: Million Rupiah)

	Option 1			Option 2			Option 3		
	Construction Cost	Trucking Cost	Discounted Cost in 2015	Construction Cost	Trucking Cost	Discounted Cost in 2015	Construction Cost	Trucking Cost	Discounted Cost in 2015
2011	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0
2015	127,834	0	127,834	217,166	0	217,166	127,834	0	127,834
2016	693,556	0	603,092	2,170,246	0	1,887,170	693,556	0	603,092
2017	2,235,482	0	1,690,346	4,822,155	0	3,646,242	2,235,482	0	1,690,346
2018	3,242,351	0	2,131,898	5,304,918	0	3,488,070	3,242,351	0	2,131,898
2019	3,016,670	632,588	2,086,475	1,012,059	429,143	824,012	3,016,670	632,588	2,086,475
2020	634,373	884,364	755,081	230,490	599,946	412,873	663,058	884,364	769,342
2021	4,100,761	1,204,612	2,293,659	150,589	817,200	418,402	5,328,548	1,204,612	2,824,465
2022	7,570,574	1,526,508	3,419,930	3,134,428	1,035,571	1,567,657	9,191,074	1,526,508	4,029,136
2023	7,559,365	1,849,771	3,075,863	4,530,881	1,254,870	1,891,372	9,819,787	1,849,771	3,814,799
2024	4,317,645	2,174,180	1,845,382	2,791,201	1,474,947	1,212,705	3,334,181	2,161,193	1,562,128
2025	1,924,407	2,537,755	1,102,978	367,060	1,721,594	516,283	346,346	2,513,784	706,980
2026	184,242	2,982,361	680,640	225,883	2,023,211	483,427	0	2,937,407	631,376
2027	0	3,427,044	640,539	0	2,324,880	434,537	0	3,361,102	628,214
2028	0	3,871,792	629,274	0	2,626,593	426,895	0	3,784,857	615,145
2029	0	4,316,592	610,058	0	2,928,343	413,859	0	4,208,660	594,804
2030	0	4,761,438	585,154	0	3,230,122	396,964	0	4,632,506	569,309
2031	0	4,761,438	508,830	0	3,230,122	345,186	0	4,632,506	495,052
2032	0	4,761,438	442,461	0	3,230,122	300,162	0	4,632,506	430,480
2033	0	4,761,438	384,749	0	3,230,122	261,010	0	4,632,506	374,330
2034	0	4,761,438	334,564	0	3,230,122	226,966	0	4,632,506	325,505
2035	0	4,761,438	290,925	0	3,230,122	197,361	0	4,632,506	283,047
2036	0	4,761,438	252,978	0	3,230,122	171,619	0	4,632,506	246,128
2037	0	4,761,438	219,981	0	3,230,122	149,234	0	4,632,506	214,025
2038	0	4,761,438	191,288	0	3,230,122	129,768	0	4,632,506	186,108
2039	0	4,761,438	166,337	0	3,230,122	112,842	0	4,632,506	161,833
2040	0	4,761,438	144,641	0	3,230,122	98,123	0	4,632,506	140,725
2041	0	4,761,438	125,775	0	3,230,122	85,325	0	4,632,506	122,369
2042	0	4,761,438	109,370	0	3,230,122	74,195	0	4,632,506	106,408
2043	0	4,761,438	95,104	0	3,230,122	64,518	0	4,632,506	92,529
2044	0	4,761,438	82,699	0	3,230,122	56,102	0	4,632,506	80,460
2045	0	4,761,438	71,912	0	3,230,122	48,785	0	4,632,506	69,965
PV			**25,699,819**			**20,558,833**			**26,714,309**
Index			125.0			100.0			129.9

Notes: 30th daily traffic ratio is equal to 1.04
Social Discount Rate is set at 15% per year, and discounted back to the base year 2015.
US$1 = 9,000 Rupiah
(Source: JICA Study Team)

(4) EIRR Analysis of Option 2

Option 2 (Cilamaya Terminal) is selected as the best option from the economic point of view, based on the Cost Minimization approach. In order to evaluate the economic feasibility of the project, the EIRR method is applied to Option 2. In the EIRR method, the profitability of a project is measured through discounted cash flow method. Returns and costs of the option are going to be quantified by the difference between those of the “with-the-Project” case and the “Without-the- Project” case.

In the "Without" case, no port facility development projects are carried out in the Greater Jakarta Metropolitan area, hence 7.5 million TEUs of international containers will overflow from the terminal. Consequently, Indonesian economy will lose corresponding amount of foreign earnings.

Following items are counted as the cost components of the project:

- Construction cost of port facilities and access road
- Management and operation cost
- Maintenance cost
- Replacement cost of cargo handling equipment

Methodology to estimate the construction cost has already been explained above. The annual costs for maintaining the port facilities are estimated as a fixed rate of the initial investment, specifically 0.2% for port infrastructure (breakwaters, seawalls, quay walls, yard pavement, and buildings) and 5% of the original construction costs of the port access road. Annual maintenance costs for cargo handling equipment are estimated at 1% of their initial procurement cost. It is expected that maintenance dredging will be required every five years but its volume will be minimal. Conversion factor of this category is set at 0.95 taking the cost component into consideration.

Personnel costs for management and operation of the terminals are estimated based on information obtained through interviews with the port management body and terminal operators. Utility costs including electricity are estimated at 2% of the initial equipment procurement costs. It is assumed that 50 % of the total work force is skilled labour and the rest is unskilled. Conversion factor of this category is set at 0.91 taking the composition of the work force into consideration.

Cargo handling equipment will be replaced after its service life expires. Service life of the equipment is set individually by types of equipment: 25 years for quay cranes and 4 years for yard vehicles, and so on. Conversion factor of this category is set at 0.97 taking the cost component into consideration.

Value added of exporting commodities which will be handled at the Cilamaya Container Terminal is counted as the benefit of the project. Although both export commodities and import commodities contribute to generating value added in Indonesia, only value added generated from export commodities are counted in this EIRR analysis to simplify the calculation, This assumption will yield less than the actual benefits, and thus can be considered a conservative estimate.

Based on two independent data sources, i.e., Indonesian Customs statistics on Tanjung Priok port and study results on Indonesian container export to Japan, value of exporting commodities is estimated at US$30,000/Laden Export TEU for this economic analysis

Percentage of operating income of individual firm varies widely from a few percentages up to 20 percent. Average percentage of the operating income of the about 30 samples is in the vicinity of 7 percent, which is adopted to estimate the value added in this economic analysis.

Resultant EIRR of the Cilamaya Terminal Development Project is calculated at 46.2% as shown in Table 6.1-2.

A sensitivity analysis is implemented in order to see whether the project is still feasible when some conditions change. Even when both cost increases by 10% and benefit decreases by 10%, EIRR is 41.2%, which is much higher than the opportunity cost of capital in Indonesia. This means that the planned project is economically feasible.

Table 6.1-2 EIRR of Cilamaya Terminal Development Project

(Unit: Rp. Billion)

	Project Cost					Benefit	Net Project Benefit
	Construction Cost	Manag't & Oper'n Cost	Maintenance Cost	Replacement Cost	Sub Total	Value Added	
2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2015	217.2	0.0	0.0	0.0	217.2	0.0	(217.2)
2016	2,170.2	0.0	0.0	0.0	2,170.2	0.0	(2,170.2)
2017	4,822.2	0.0	0.0	0.0	4,822.2	0.0	(4,822.2)
2018	5,304.9	0.0	0.0	0.0	5,304.9	0.0	(5,304.9)
2019	1,012.1	123.5	0.0	0.0	1,135.6	666.4	(469.2)
2020	230.5	123.5	127.5	0.0	481.5	7,806.6	7,325.1
2021	150.6	123.5	127.5	0.0	401.6	10,644.4	10,242.9
2022	3,134.4	123.5	127.5	0.0	3,385.4	13,389.6	10,004.2
2023	4,530.9	123.5	127.5	9.6	4,791.5	16,043.5	11,252.0
2024	2,791.2	282.7	127.5	11.5	3,213.0	18,607.7	15,394.8
2025	367.1	282.7	183.2	0.0	833.0	21,084.1	20,251.2
2026	225.9	282.7	180.2	0.0	688.9	24,395.5	23,706.6
2027	0.0	282.7	180.2	157.2	620.2	27,593.2	26,972.9
2028	0.0	282.7	180.2	9.6	472.6	30,685.1	30,212.5
2029	0.0	282.7	180.2	44.4	507.4	33,664.0	33,156.6
2030	0.0	282.7	183.2	0.0	465.9	36,538.1	36,072.2
2031	0.0	282.7	180.2	9.6	472.6	36,753.7	36,281.1
2032	0.0	282.7	180.2	194.8	657.8	36,753.7	36,095.9
2033	0.0	282.7	180.2	0.0	463.0	36,753.7	36,290.7
2034	0.0	282.7	180.2	1,034.4	1,497.4	36,753.7	35,256.3
2035	0.0	282.7	183.2	157.2	623.2	36,753.7	36,130.5
2036	0.0	282.7	180.2	9.6	472.6	36,753.7	36,281.1
2037	0.0	282.7	180.2	0.0	463.0	36,753.7	36,290.7
2038	0.0	282.7	180.2	0.0	463.0	36,753.7	36,290.7
2039	0.0	282.7	180.2	1,288.6	1,751.6	36,753.7	35,002.1
2040	0.0	282.7	183.2	194.8	660.7	36,753.7	36,093.0
2041	0.0	282.7	180.2	0.0	463.0	36,753.7	36,290.7
2042	0.0	282.7	180.2	0.0	463.0	36,753.7	36,290.7
2043	0.0	282.7	180.2	157.2	620.2	36,753.7	36,133.5
2044	0.0	282.7	180.2	2,361.6	2,824.6	36,753.7	33,929.1
2045	0.0	282.7	183.2	0.0	465.9	36,753.7	36,287.8
						IRR =	46.2%

Source: JICA Study Team

6.2 PPP Scheme for Port Development and Management System including Finance Resources

(1) Project to Be Examined

Chimalaya Container Terminal Development Plan (Master Plan Phase II and III) is examined.

Table 6.2-1 shows major characteristics of Phase II and III.

Table 6.2-1 Major Characteristics of Phase II and III of Master Plan

	Phase II, III
Terminal	Cilamaya
Quay Length	4,920 m
Capacity	7.5 million TEU
Estimated Cost*	2,876 million US$ 25,884 billion IRP

*: Cost does not include an expenditure for access road.

(2) Preliminary Financial Analysis for Evaluation of PPP Scheme

Since FIRR can provide sufficient information to analyse the preferable PPP scheme, other statements and indexes including cash flow statement, profitability, operational efficiency and loan payment capacity, will not be analyzed.

In this section, FIRR of chosen project is to be calculated to evaluate the PPP schemes. Financial analysis could be divided into the following 3 cases;

Base Case

In the Base Case, public entities including port authority are assumed to implement whole projects. Corporate tax is not taken into account in FIRR calculation. FIRR of this case provides a general idea on long-term project viability from the viewpoint of financial soundness.

PPP Scheme (1): Case-1

In Case-1, the port authority procures major facilities and conducts major works including breakwater, seawalls, channel/water basin, land reclamation, soil improvement, direct access road/bridge to port, power/water supply, drainage, lighting and basic facilities for safety/security.

Private business entities procure container terminal facilities including quay walls, yard pavement, terminal buildings, container handling equipment including quay-side gantry cranes, RTG and other machineries, and operation system.

PPP Scheme (2): Case-2

In Case-2, port authority procures only fundamental port facilities including breakwater and channel/water basin.

Private business entities procure not only container terminal facilities including quay walls, yard pavement, terminal buildings, container handling equipment including quay-side gantry cranes, RTG and other machineries, and operation system but also other major facilities which were provided by port authority in PPP scheme (1), Case-1.

FIRR is summarized in Table 6.2-2.

Table 6.2-2 FIRR of Option 2 by case (Phase II, III)

Items	Base Case	Case 1		Case 2	
		Public	Private	Public	Private
FIRR	10.9 %	2.9 %	14.1 %	14.3 %	8.2 %

Source: JICA Study Team

(3) PPP Scheme from the Viewpoint of FIRR

Based on the above analysis, following items are recommended;

- Public sector should play a significant role in the procurement of infrastructure. For example. public sector should basically procure major facilities and conduct major works including breakwater, seawalls, channel/water basin, land reclamation, soil improvement, direct access road/bridge to port, power/water supply, drainage, lighting and basic facilities for safety/security.
- Public sector should utilize low interest fund including foreign assistance as much as possible.
- Private sector should increase port investment drastically when the proposed master plan will be implemented.

6.3 Road Map toward International Container Terminal Development

(1) Approval and Notification of Master Plan

Since there is no Port Master Plan stipulated by the New Shipping Law (N0.17/2008), Master Plan should be authorized as soon as possible. The following actions are required.

- Recommended Master Plan is authorized as a draft Master Plan of port authority.
- Port authority submits the draft Master Plan to the Ministry of Transport for approval as the Master Plan.
- Port authority/the Ministry acquires the recommendation from Governor of the Province.
- The Minister approves the draft Master plan as the Master Plan of Tg. Priok Port.
- The Ministry notifies the result.

(2) Implementation of the Master Plan

There are a lot of procedures and activities to do, documents to be prepared and Ministerial/Organization interactions. These issues should be dealt with in a timely and precise manner. Table 6.3-1 illustrates phased procedures stipulated by the National Development Planning Agency Regulation (No.4/2010). Figure 6.3-1 illustrates a flowchart of the regulation. And Table 6.3-2 shows required activities of MOT/Port Authority stipulated by regulations concerned.

Based on these Figure and Tables, a roadmap for the implementation of Master Plan (Phase II, Cilamaya international container terminal development projects) is illustrated in Figure 6.3-2

Table 6.3-1 Phased procedures stipulated by Bappenas Regulation

STAGE I: PARTNERSHIP PROJECT PLANNING	STAGE II: PREPARATION FOR FEASIBILITY PRE-STUDY OF PARTNERSHIP PROJECT			STAGE III: TRANSACTION FOR PARTNERSHIP PROJECT	STAGE IV: MANAGEMENT FOR IMPLEMENTATION OF PARTNERSHIP PROJECT
Partnership Project Identification Partnership Project Selection Decision for Priority of Partnership Project	Preparation by Basic Assessment of Feasibility Pre-Study of Partnership Project	Preparation by Assessment on Readiness of Partnership Project	Completion by Final Assessment of Feasibility Pre-Study of Partnership Project	Business Entity Procurement Plan Implementation for Business Entity Procurement Signature of Partnership Agreement	Management Planning for Implementation of Partnership Agreement Management for Implementation of Partnership Agreement
Output: List of Priorities for Partnership Project and Document of Preparatory Study	Output: Document of Feasibility Pre-Study of Partnership Project			Output: Signature of Partnership Agreement	Output: Document of Report on Management for Implementation of Partnership Agreement
	Process of Application for Needs Government Support (DP) & Government Guarantee (JP)			Confirmation of Government Guarantee by PPRF/BUPI	
LAND PROCUREMENT PROCESS					
INVOLVEMENT OF GOVERNMENT AGENCIES/INSTITUTIONS					
Partnership Project Responsible Party (PJPK) / National Development Planning Agency (BAPPENAS)	PJPK, KKPPI, BKPM, BAPPENAS, Ministry of Finance (PPRF/BUPI)			PJPK, KKPPI, PPRF/BUPI, BKPM, BAPPENAS	PPJK, PPRF/BUPI, BKPM, BAPPENAS
Public Consultation: Information Dissemination	Public Consultation: Consultative Interaction		Public Consultation: Market Sounding		
	List of Planned Partnership Projects				

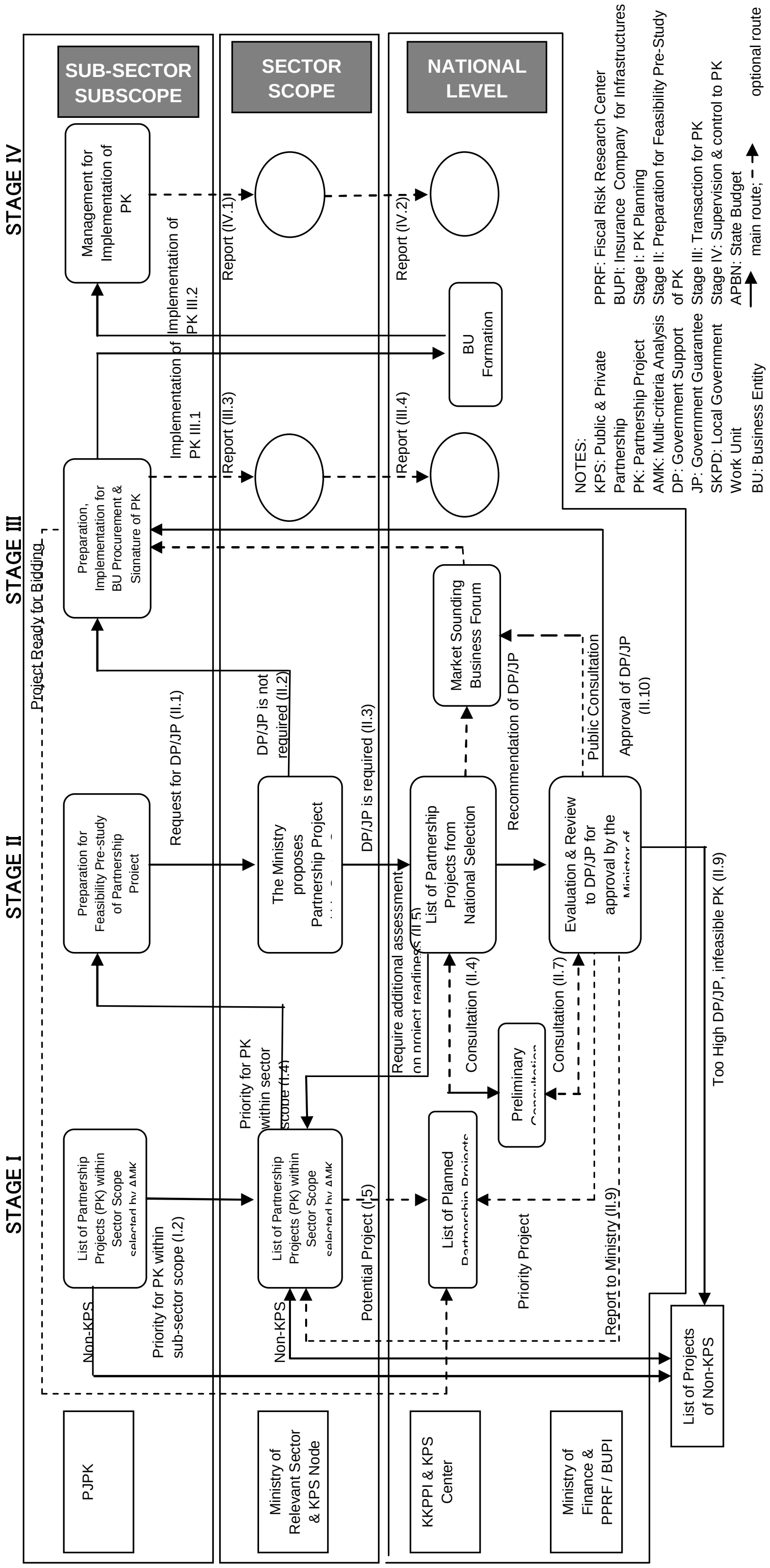


Figure 6.3-1 Flowchart of Implementation for National Partnership Project

Table 6.3-2 Activities of MOT/Port Authority

Port Master Plan

Stage	Internal				Inter-Ministerial
	Major Activities	**Institutional**	**Studies**	**Documents**	
I	-Identification and Selection of PP -Public Consultation	-Unit in charge of PP	-Pre-feasibility Study (which could be utilized in a later stage as a Feasibility Pre-Study referred in National Development Planning Agency Regulation No.4, Year 2010	-Report of Pre-feasibility Study -Priority List of PP	-Submission of Priority List to Ministry of Planning (the Ministry evaluates the list)
II	-Basic Assessment -Assessment in Readiness -Final Assessment -Public Consultation	-Executive Team/PP Management Board	-Feasibility Pre-Study (if necessary) (Environmental Assessment is IEE) -Study on EIA (If necessary)	-Report of Feasibility Pre-Study -Report of Basic Assessment -Report of Basic Assessment in Readiness -Report of Final Assessment	-Request for Government's Support/Guarantee (if necessary) -Submission of PP to KKPPI (KKPPI evaluate PP)
III	-Market Sounding -PQ Announcement -PQ Evaluation and -Announcement of Results -Procurement Briefing -Bidding Evaluation and Announcement of Results -Signing of P.A. -Public Consultation	-Procurement Committee -Managing Unit of PP		-HPS (Self-Calculated Price) -PQ Document Procurement (Tender) Document -PQ Criteria PQ Evaluation Report -Bidding Evaluation Criteria	
IV	-Procurement of Budget and Fund -Public Consultation	-Team for Assets Transfer		-Management Plan -Report of Implementation -Report of Activity -Report of Monitoring -Report of Assets Appraisal	

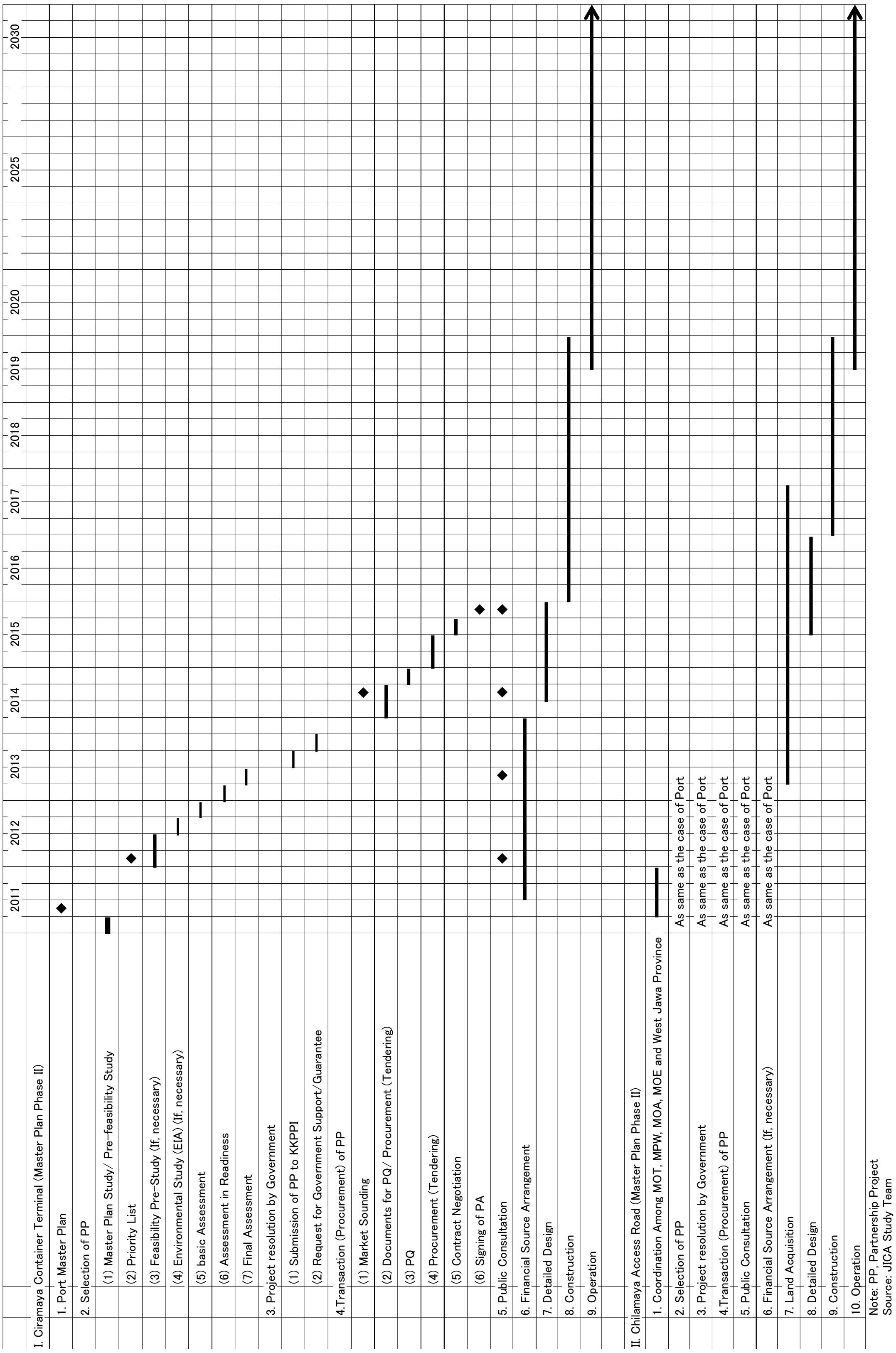


Figure 6.3-2 Road Map for Cilamaya Container Terminal (Master Plan Phase II)

7. STRATEGIC ENVIRONMENTAL ASSESSMENT

7.1 Objectives

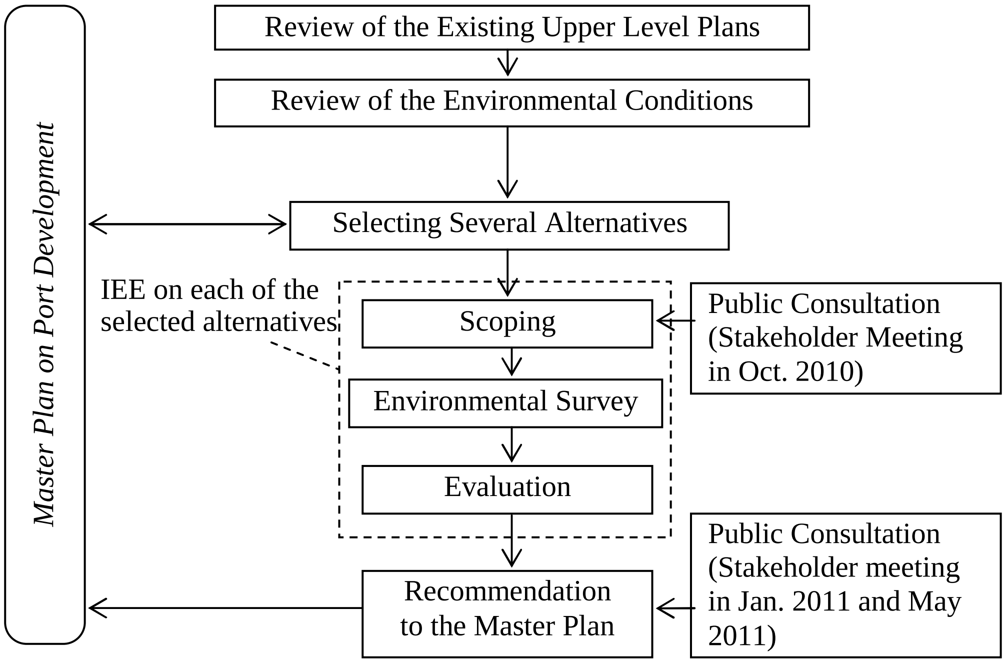
In accordance with Law No.32/2009, Strategic Environmental Assessment (SEA) was conducted in this master plan study. The objectives of the SEA study are described as follows aiming to make wise decision for sustainable development on formulating the master plan.

Objectives of the SEA Study

- To integrate environmental and social consideration into evaluating and prioritizing development alternatives for a new container terminal.
- To contribute to decision making on formulating the master plan.

7.2 Methodology of SEA

The flow chart of the SEA is shown in Figure 7.2-1. For public consultation, two meetings (Focus Group Discussion and Stakeholder Meeting) were held during the study period.



Source: JICA Study Team

Figure 7.2-1 Flow Chart of the SEA

7.3 Selecting Several Alternatives

Considering the results of the preliminary review and the analysis of natural condition and traffic capacity, criteria shown in Table 7.3-1 were selected to screen the nine candidate sites for the new container terminal in terms of environmental and social considerations. The results of screening by the criteria were shown in Table 7.3-2.

Combined with the other evaluation results apart from the environmental viewpoints, the candidate sites for the new container terminal were narrowed down to the three: (1) North Kalibaru, (2) Cilamaya and (3) Tangeran as shown in the Chapter 4.

Table 7.3-1 Criteria for Selecting Alternatives from the Nine Candidate Sites in Terms of Environmental and Social Considerations

Criteria Items		Explanation
Natural Environment	Regulated Forest Area (Protected Forest)	Some sites are located in the regulated forest area designated by the Ministry of Forestry for conservation of the forest function. The protected forest is also described in the spatial plans of local governments; therefore, obedience to the spatial plans was also evaluated together with the designation by the Ministry.
	Ecological Importance	In terms of ecological conservation, developmental projects need to avoid ecologically important areas, such as bird habitats.
	Coastal Line Changes	Coastal line changes caused by natural erosion and sedimentation indicate instability of the coastal environment. Areas with large amount of changes are concerned about a risk of environmental balance change when the port structure is constructed.
Social Environment	Traffic Congestion	Since JABODETABEK area has already suffered from serious traffic congestion, the sites which alleviate the problem are desirable in terms of social environment.

Source) JICA Study Team

Table 7.3-2 Selecting Alternatives in Terms of Environmental and Social Considerations

		Criteria Items	Natural Environment					Social Environment
			Regulated Forest Area (Protected Forest)			Ecological Importance	Coastal Line Changes	JABODETABEK Traffic Congestion
Area		Sites	Regulation by the Ministry of Forestry	Spatial Plan of Provincial Government	Spatial Plan of the Government of Regent			
DKI Jakarta		1 North Kalibaru						Acceleration
		2 Marunda (Jakarta)						Acceleration
West Java	Bekasi Regent	3 Marunda Center						Acceleration
		4 Tarumajaya	Disobedience				Excessive	Acceleration
		5 Muara Gembong	Disobedience	Disobedience	Disobedience	Important for birds	Unstable	Acceleration
	Karawang Regent	6 Cilamaya						Alleviation
	Subang Regent	7 Ciasem	Disobedience	Disobedience	Disobedience			Alleviation
Banten	Tangerang Regent	8 Tangerang						Acceleration
	Serang Regent	9 Bojonegara						Acceleration

[shaded box]: Negative evaluation results for the new container terminal.
Source) JICA Study Team

7.4 Scoping

In order to decide an appropriate site for the new terminal in terms of environmental aspects, possible environmental consequences shown in Table 7.4-1 were evaluated for each of the three selected alternatives

Table 7.4-1 Possible Consequences to be Evaluated in the Stage of Site Selection (Scoping for SEA level)

No.	Possible Consequences (Evaluation Items)	Brief Description
Social environment		
1	Impact on rice field	In Indonesia, agricultural land is conserved for securing food production. New access road may cause impact on the rice field.
2	Socio-economic effects	The new terminal is expected to bring positive effects on socio-economic condition such as increasing opportunities for employment.
3	Traffic congestion	The new terminal may accelerate traffic congestion of JABODETABEK area.
4	Involuntary resettlement and alteration of land use	Involuntary resettlement will be required for the new access road.
5	Impact on fishery	Fishing ground may be eliminated by the reclamation and the channel dredging. Fishing activity may be affected by appearance of the new terminal.
6	Impact on existing infrastructures and services	New access road may split the existing road and communities.
Natural environment		
7	Impact on mangrove, coral reefs and tidal flats	Mangrove, coral reefs and tidal flats in/around the project site may be affected by construction of the new terminal.
8	Impact on fauna and flora	Aquatic/terrestrial flora and fauna in/around the project site may be affected by construction of the new terminal and the new road.

Source) JICA Study Team

7.5 Evaluation

In accordance with the scoping results, possible consequences in each option for the new terminal (Table 7.5-1) were discussed and the summarized in Table 7.5-2. In addition, comparison between three alternatives in the case of Kalibaru is summarized in Table 7.3-1.

Table 7.5-1 Outline of Each Option

Option	Outline
Option-1 North Kalibaru Phase II-III	Fully concentration to the existing Tanjung Priok Terminal with North Kalibaru Phase I-III. There are three alternatives for the layout of the new terminal: alternative 1, 2 and 3.
Option-2 Cilamaya	Split to the existing Tanjung Priok Terminal and Cilamaya with North Kalibaru Phase I. New terminal is constructed in Cilamaya.
Option-3 North Kalibaru Phase II-III and Tangerang	Split to the existing Tanjung Priok Terminal and Tangerang with North Kalibaru Phase I-III. New terminal is constructed in Kalibaru and Tangerang.
Without project	No infrastructure is prepared for increased port cargo. Overflowed cargo is handled in Marunda Port using barges.

Source) JICA Study Team

Table 7.5-2 Summary of Evaluation for SEA

	Alternatives Items	Op.1 Kalibaru	Op. 2 Cilamaya	Op. 3 Kalibaru & Tangerang	Without Project (zero-option)
1	Impact on rice field [Area of rice field to be altered to land for road (ha)]	[56 ha] Some of the rice field needs to be altered for the access road.	[72 ha] Some of the rice field needs to be altered for the access road.	[65 ha] Some of the rice field needs to be altered for the access road.	-
2	Socio-economic effects on narrowing the regional economic gaps [GRDP per capita of the regions of the project area]	[56,000 Rp.] No effect on narrowing the regional economic gap.	[15,000 Rp.] Socio-economic gap against DKI Jakarta will be narrower by investment to Karawang.	[43,000 Rp.]* Socio-economic gap against DKI Jakarta will be narrower by investment to Tangerang; however the effect is small because the planned cargo capacity of the new terminal in Tangerang is relatively small.	- No effect on narrowing the regional economic gap
3	Traffic congestion in JABODETABEK area [Container traffic volume to/from JABODETABEK area from/to Bekesi ~ Carawan industrial estates in the year of 2030]	[101,000pcu/day] Congestion will be accelerated although new access road is prepared.	[29,000pcu/day] Congestion will be alleviated since part of the port traffic will move out of JABODETABEK area.	[101,000pcu/day] Congestion will be accelerated although new access road is prepared.	[101,000pcu/day] Congestion will be accelerated due to traffic increase in JABODETABEK area.
4	Involuntary resettlement [Building to be removed for road construction]	[About 160houses] Middle-classed inhabitants' houses, shops, offices and warehouses are required to be resettled for the access road.	[About 170houses] Middle-classed inhabitants' houses, shops, offices and warehouses are required to be resettled for the access road.	[About 160houses] Middle-classed inhabitants' houses, shops, offices and warehouses are required to be resettled for the access road.	-
5	Impact on fishery [Area of fishing grounds to be disappeared for port construction]	[0.3 sq.km] Reclamation area is outside of the fishing ground.	[14 sq.km] Part of the fishing ground will be eliminated by the new terminal.	[6 sq.km] Part of the fishing ground in Tangerang will be eliminated by the new terminal.	-
6	Impact on existing infrastructures and services	(The impact needs to be assessed in detail when the detailed route alignment is discussed.) New access road will split existing communities.	New access road will split existing communities.	New access road will split existing communities.	-
7	Impact on	[far]	[2km]	[far]	-

	mangrove , coral reefs and tidal flats [Distance from the nearest coral reef]	No large scale mangrove, coral reefs and tidal flats around the site.	Consideration is required to protect coral reefs near the site. Impact on the tidal flat is reduced since the reclamation area is offshore.	Impact on the tidal flat is minimized since the reclamation area is offshore.	
8	Impact on fauna and flora	(Further study is required in EIA)			-
		No rare species have been found around the site.	No rare species have been found around the site.	No rare species have been found around the site.	

Table 7.5-3 Comparison between Alternatives for Kalibaru

		Alternative-1	Alternative-2	Alternative-3
Impact on the Residents	Involuntary resettlement	Tens of residential houses are required to be resettled for the access road.	Resettlement is not required for utilizing the existing road.	Warehouses and tens of residential houses are required to be resettled for the access road.
	Impact on noise, vibration and safety along port access road at Kalibaru	Residents along the acsess road will be affected.	No residents along the planed acsess road	Residents along the acsess road will be affected.
Impact on Fishery	Obstacle to navigation of fishing boats	No obstacle to the existing navigation.	No obstacle to the existing navigation.	Fishing boats have to go around due to the new terminal.
	Elimination of fishing ground	Fishing ground will be secured.	Fishing ground will be secured.	A part of shallow fishing ground for shell acuaculture will be eliminated.
Impact on Water Quality	Impact on water quality within the port basins	Water exchange will be secured to prevent water quality degradation.	Water exchange will be secured to prevent water quality degradation.	Water stagnation may cause degradation of water quality.
	Impact on smell within the port area	Reclamation for new terminal will not cause water quality degradation, which may cause bad smell.	Reclamation for new terminal will not cause water quality degradation, which may cause bad smell.	Water quality degradation may cause bad smell.

Note: [dotted pattern] Negative factor

Source) JICA Study Team

7.6 Recommendation

Considering the results of the evaluation, Option-2, which consists of Phase I at North Kalobaru and Phase II-III at Cilamaya, was selected as the new terminal project.

The SEA study has been basically focused on the site selection from a broad perspective; therefore, the details of the impacts and the mitigation measures need to be discussed in the next study phase. Based on the information obtained through the SEA study, following recommendations are made for the next study phase.

(1) It is necessary to implement EIA study properly to assess the impacts and develop necessary measures for mitigation and management. Specific recommendation for the EIA study was extracted in this study.

(2) Especially for the phase II & III at Cilamaya, necessary information for assessing impacts on the coral reef and fishery is limited at this moment. It is necessary to conduct studies to comprehend the detailed current condition and

assess the impact carefully in cooperation with the local government, communities, researchers and NGO.

(3) In the stage of discussing the detailed route alignment of the access road for phase II & III at Cilamaya, the impacts on rice fields and communities (e.g. relocation of houses) need to be minimized.

(4) Dialogue and coordination with local communities are indispensable for minimizing the negative impacts and enhancing the benefits of the project.

8. FORMULATION OF IMPROVEMENT PLAN FOR RAIL ACCESS TRANSPORT CONNECTING TG. PRIOK PORT WITH ITS HINTERLAND

8.1 Preliminary Railway Access Plans Corresponding the Respective Port Plans

(1) Candidate Sites for Marine Container Terminals

In accordance with the port development projects proposed by authorities and private entities in Indonesia, the Team studied preliminary plans for railway access to the following locations.

Table 8.1-1 Candidate Sites for Marine Container Terminals

Province	Port Development Projects
DKI Jakarta	Off Kalibaru at Tanjung Priok Terminal
West Java Province	Cilamaya Coast in Regent Karawan (Kabupaten Karawan)
Banten Province	Tangeran Coast in Regent Tangeran (Kabupaten Tangeran)

(2) Operational Route Plans

Brief profiles of each operational route are summarized below:

Table 8.1-2 Proposed Operational Routes

Route	Total Route Length (km)	Existing (km)	New (km)
Proposed Freight Corridors			
Direct Access to Tanjung Priok Terminal			
Tpk-Cikampek-Bandung-Gedebage Dryport	187.5	187.0	0.5
Alt-1: Cilamaya New Terminal			
Cilamaya-Cikampek-Bandung-Gedebage	132.1	95.5	36.6
Cilamaya-Karawang-Cikarang Dryport	63.2	26.6	36.6
Alt-2: Tangerang New Terminal			
Tangerang-Jatinegara-Cikampek-Bandung-Gedebage	208.4	183.7	24.7
Tangerang-Jatinegara-Bekasi-Cikarang Dryport	86.3	61.7	24.7

Source: Study Team

1) Alternative-1: Access to Cilamaya New Terminal

36.6-kilometer of new access to Cilamaya Terminal with single track at grade level is proposed. The access will be connected with existing rail network nearby Klari Station.

Train operation plan is indicated below.

Table 8.1-3 Train Operation Plan (Railway Access to Cilamaya New Terminal)

Section	No. of TEU by railway per day		Operation Plan In 2030	
	Inbound	Outbound	No. of Trains/day	Adjusted
Cilamaya Terminal - Gedebage	130	130	5	5
Cilamaya Terminal - Cikarang	1210	1210	19	23

(3) Alternative-2: Access to Tangerang New Terminal

24.7-kilometer new access route to Tangerang Terminal with single track at grade level is proposed. The access will be connected with existing rail network nearby Batuceper Station. The route immediately north of existing Tangerang Line is broad enough to accommodate single railway track on surface level.

Table 8.1-4 Train Operation Plan (Railway Access to Cilamaya New Terminal)

Section	No. of TEU by railway per day		Operation Plan In 2030	
	Inbound	Outbound	No. of Trains/day	Adjusted
Tangerang Terminal - Gedebage	130	130	5	5
Tangerang Terminal - Cikarang	1210	1210	19	23

8.2 Freight Transportation Development Scenario

(1) Existing Railway Freight Capacity for Port Cargo

Existing rail services for container traffic, between Tanjung Priok Terminal, Pasoso (POO) and Gedebage (GDB), comprise 4 trains, 2 trains each way over a 24 hour period. This accounts for an annual transport capacity of 11,680 TEU, but actual volume of the container traffic is 4,891 TEU with an estimated loading rate of 41.8 %.

Table 8.2-1 Existing Railway Freight Capacity for Port Cargo

	Distance (km)	Ave. Trip Time (min)	Trips per day	Wagons per train	Annual Capacity (TEU)	Actual Volume (TEU)	Estimated Loading Rate (%)
Pasoso - Gedebage	187	278 (one way)	4 trains (2 r-trips)	16	11,680	4,891 (*1)	41.8

Source: Based on PT.KA Annual Report
(*1) Assumed that 1 TEU = 25 ton

Following figure indicates the route of existing container transportation.

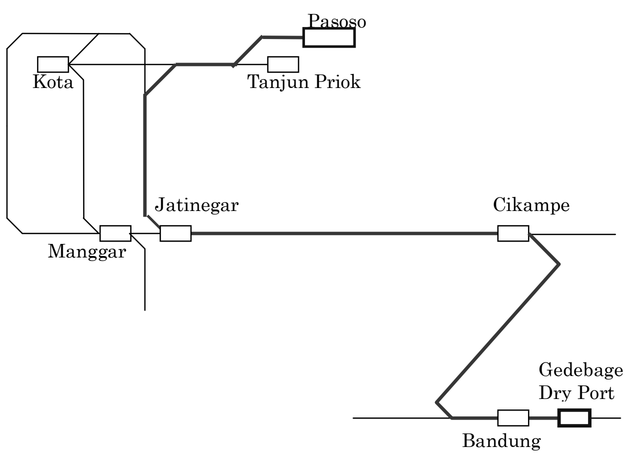


Figure 8.2-1 Existing railway transportation of port container

(2) Current and Future Operational Bottlenecks

Train running times between Tanjung Priok Terminal, POO and GDB, at present, are generally within the range of 5 hours to 5 hours and 30 minutes. The travel time from TPK Terminal and POO accounts for 30 minutes to 1 hour depending on the road traffic congestion.

It is perceived that current railway freight tariff has little or no advantages largely due to the cost of feeder trucking charge from/to GDB.

Following figure indicates line capacity of railway route and number of train in current diagram.

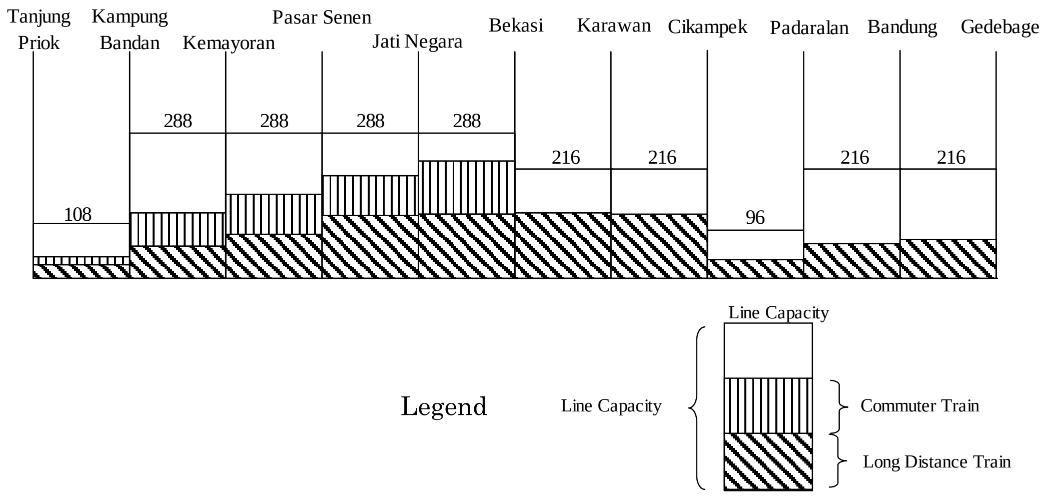


Figure 8.2-2 Line Capacity of Railway Route

(3) Container Transportation Demand Forecast

As presented in Chapter 5, Throughput at Tanjung Priok Terminal will grow from the current 2.7 million TEU in 2009 to 4.0 million TEU in 2020 and onwards, whilst the same at New Terminal will account for 9.4 million TEU in 2030.

(4) Current Construction and Planning Efforts

- Direct Access to JICT Terminal (in Progress)
- Cikarang as New Destination for Railway Freight
- Location of the New Terminal

Among candidate sites for the New Terminal, the Team selected the Cimalaya Terminal as the most suitable site.

(5) Future Railway Freight Capacity for Port Cargo

Two Cases are considered for Origin.

Case I Tanjung Priok as Origin
Case II : Cilmalaya Terminal as Origin

Route map of each case is indicated below.

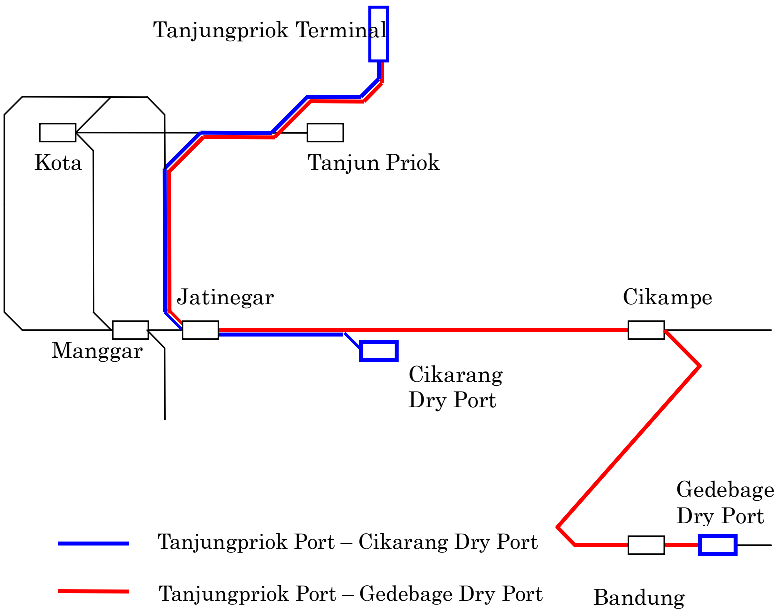


Figure 8.2-3 Origin and Destination of Case I

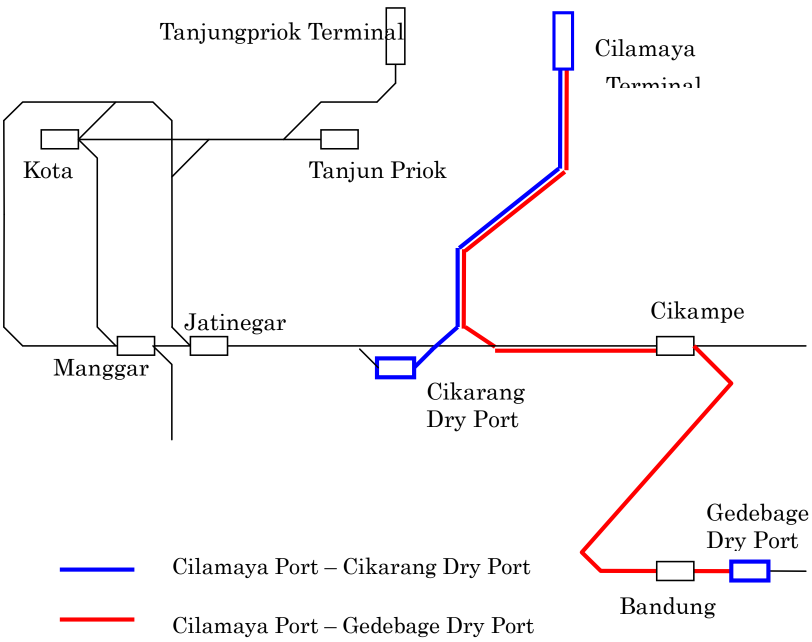
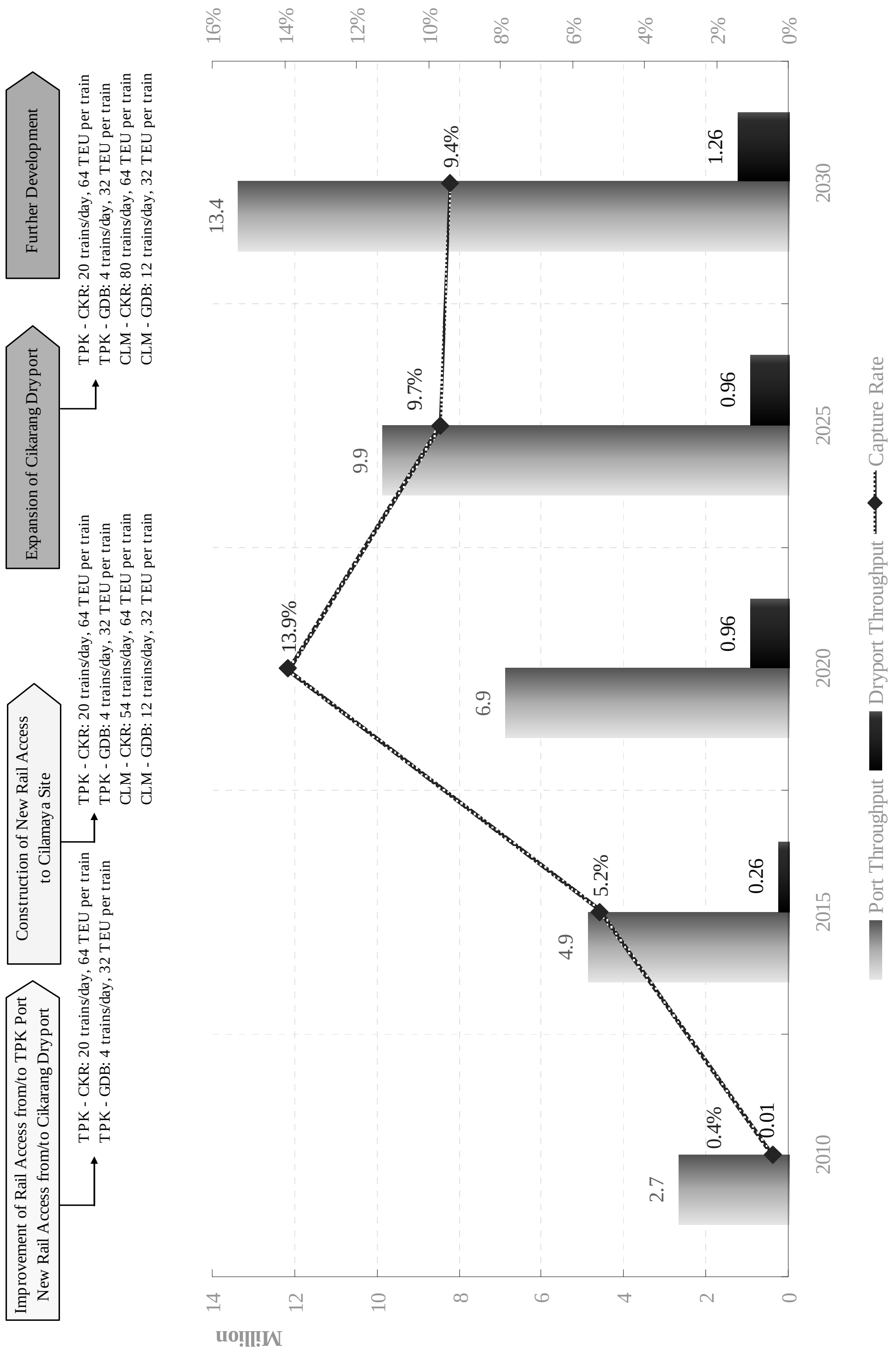


Figure 8.2-4 Origin and Destination of Case II

Roadmap for promotion of railway freight transportation for port cargo is indicated in following figure.



Source: JICA Study Team

Figure 8.2-5 Roadmap for Promotion of Railway Freight Transportation for Port Cargo

8.3 Railway Freight Facilities Improvement Plan

(1) Formulation of Improvement Plan of Railway Freight from/to Tanjung Priok Terminal (Phase I)

1) Initial Stage after access railway to Tanjung Priok is connected

As the Stage1 of Case I development, following works are required to achieve the target throughput.

- Direct rail access to Tanjung Priok Terminal
- Improvement of Gedebage Dryport
- Construction of Cikarang Dryport and the access from main line
- Procurement of rolling stock

Operation plan of this stage is indicated in following table.

Table 8.3-1 Operation Plan for Railway Freight from/to Tanjung Priok

	Distance (km)	Trip Time (min)	Trips Per day	Wagons per train	Throughput (TEU)
Tg. Priok - Gedebage	191.5	278	2	16	23,360
Tg. Priok – Cikarang	52.0	61	10	32	233,600

Study Team Estimate

Following figure indicates loading/unloading track at Tanjung Priok Terminal and stabling track at Pasoso.

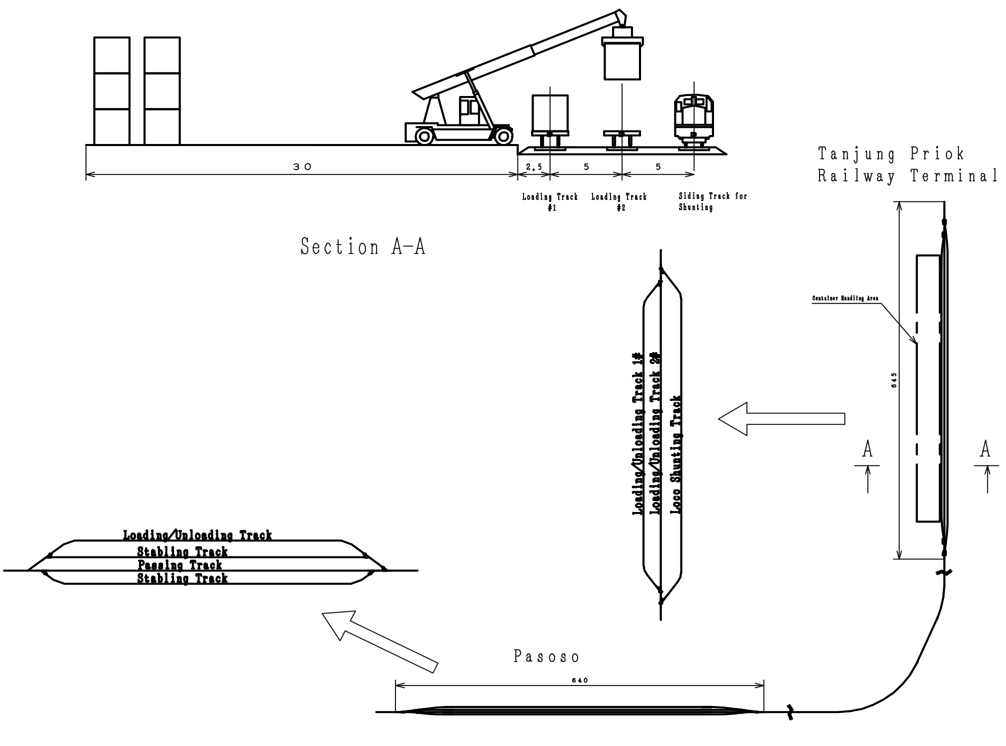


Figure 8.3-1 Proposed Loading Track of Tanjung Priok and Stabling Track of Pasoso

Proposed track layout of Cikarang Dryport is as follows.

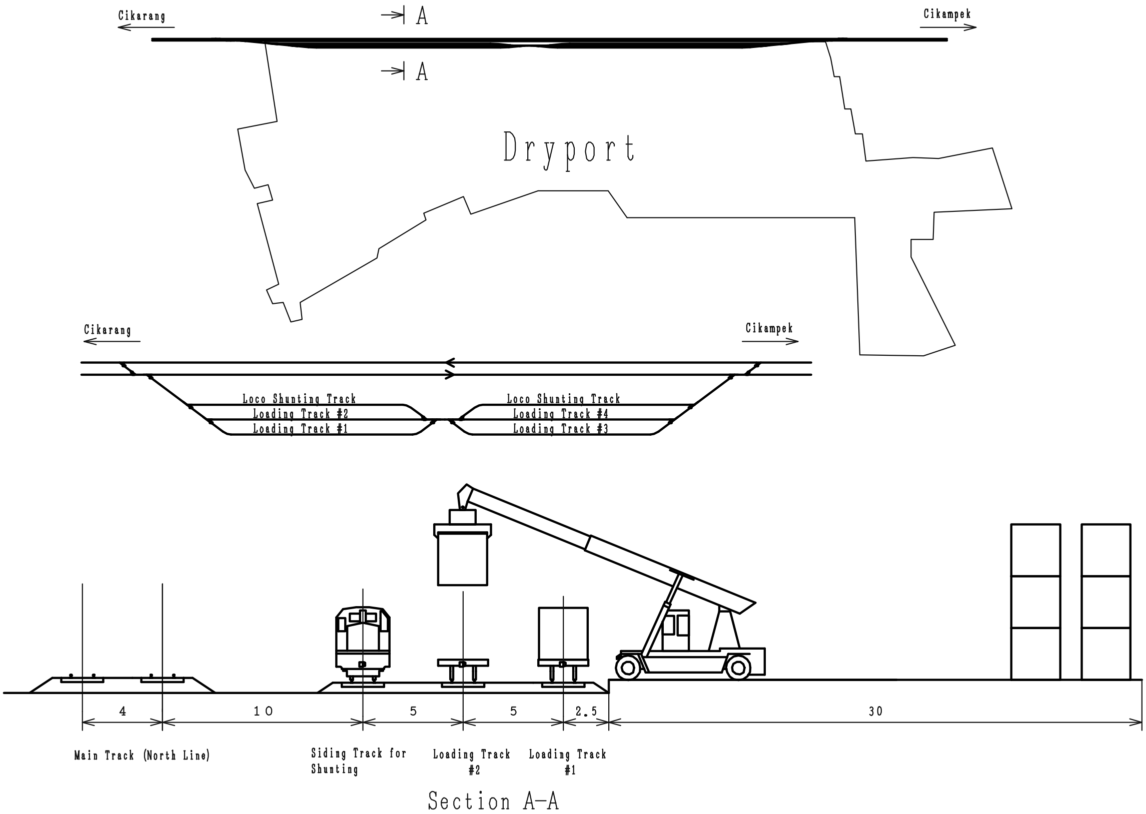


Figure 8.3-2 Proposed Track Layout of Cikarang Dryport

Rolling stock procurement plan of this stage is indicated in following table.

These works are likely be carried out by 2015

2) Second stage when Jabodetabek Network is improved

Jabodetabek network will be improved to transport 3 million passengers per day from the current 0.7 million. To synchronize with this improvement, a 50% increase in the number of trains is required. Following works are required to achieve the target throughput.

- Construction of stabling yard at Tanjung Priok
- Procurement of rolling stock

Operation plan of this stage is indicated in the following table.

Table 8.3-2 Operation Plan for Railway Freight from/to Tanjung Priok

	Distance (km)	Trip Time (min)	Trips Per day	Wagons per train	Throughput (TEU)
Tg. Priok - Gedebage	191.5	278	3	16	35,040
Tg. Priok – Cikarang	52.0	61	15	32	350,400

Source: Study Team Estimate

These works are likely be carried out by 2020.

(2) Formation of Access Railway Plan to Cilamaya Site (Case II)

Following works are proposed to achieve railway transportation of Cilamaya site.

- Construction of single track between Cilamaya Terminal and Cikarant Dryport
- Construction of stabling yard at Cikarang
- Construction of container termianl at Cilamaya New Terminal
- Procurement of rolling stock

Location of access railway is indicated below.

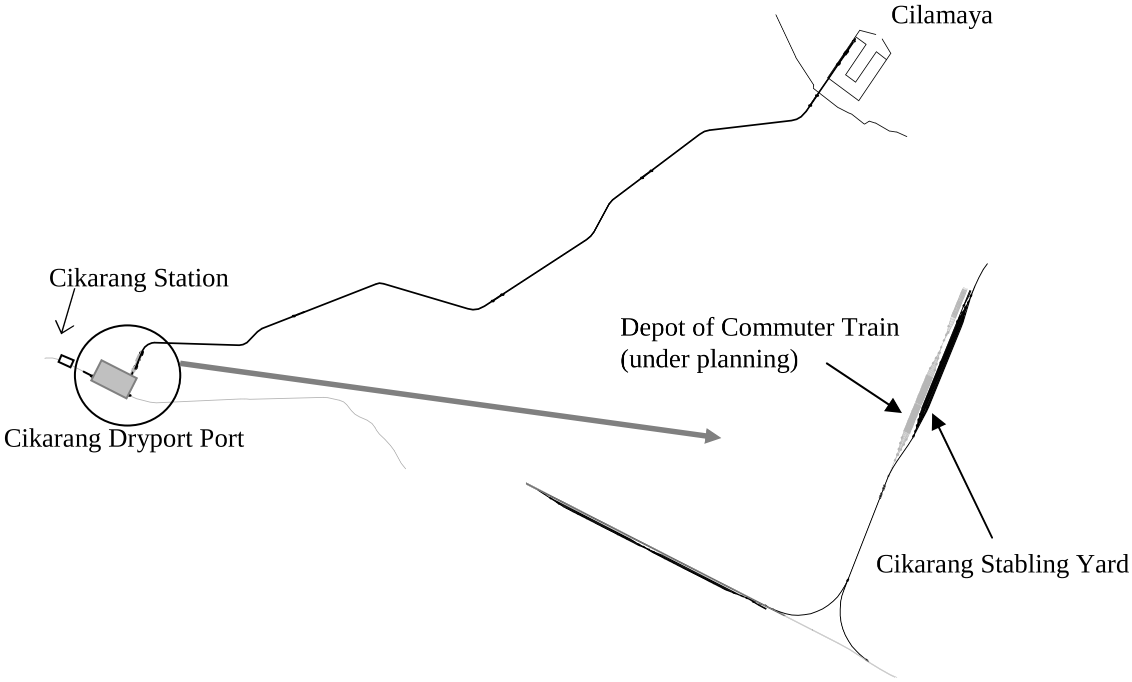


Figure 8.3-3 Location of Cimalata Access Railway

Operation plan is indicated below.

Table 8.3-3 Operation Plan for Railway Freight from/to Cilamaya New Terminal

	Distance (km)	Trip Time (min)	Trips per day	Wagons per train	Throughput (TEU)
Cilamaya - Gedebage	178.5	307	6	32	70,080
Cilamaya – Cikarang	41.5	78	27	64	584,000

Source: Study Team Estimate

These works are likely to be carried out by 2020

8.4 Basic Stakeholder Analysis of Railway Freight Business

(1) Stakeholders and their Roles

An important objective of this project is to ensure that facilities and operating systems are improved and expanded so as to accommodate a significant increase in rail services and achieve higher quality performance. The operation and maintenance of the railway cargo would be done by PT KA, while at Cilamaya, loading and unloading of trains is to be undertaken by assumed newly appointed terminal operator. Similarly, an independent operator would be in charge of handling containers at Cikarang Dry-Port.

A brief description of the roles, costs, and revenues of the main stakeholders in the container business is stated in Table 8.4-1.

Table 8.4-1 Stakeholder Analysis: Roles, Costs, and Revenues

Stakeholder	Role	Cost & Revenue
Container Yard Operator (Pelindo, MTI)	Handling TEU at port yard, Lo/Lo, depot management.	Capital investment of handling facilities O&M costs of handling facilities and equipment Revenue for handling, hauling, Lo/Lo, storage.
Central Government Directorate General of Railways	Acquiring ROW, infrastructure, rolling stock	Capital investment of infrastructure, rolling stock, and ROW Revenue : TAC.
Railway Freight Operator (PT. KA)	Transport of TEU by train from port to dry-port.	Capital investment of station facilities O&M costs of all railway facilities and equipment Revenue for transportation by train.
Dry-port Operator	Handling TEU at dry-port yard, Lo/Lo, depot management.	Capital investment of dry-port facilities O&M costs of dry-port handling facilities and equipment Revenue for handling, Lo/Lo, storage.
Truck Feeder	Transport by truck from dry-port to factory, stuffing & unloading.	O&M costs of trucks Revenue for transportation by truck

(2) Revenue Model

The revenue model for this project is assumed taking into consideration the current pattern of pricing for truck and train cargo transportation. The competitiveness of railway freight business was compared with the transport of containers by trucks. In this case, the price estimated is from "door-to-door", i.e., from port yard to factory. The competitiveness of the railway freight business was confirmed to have a lower price tag than its competitor, trucks.

In case of railway cargo, in the current model, most of the TEU are moved one way empty to the factory to be loaded, and then moved full to the port for export, or vice versa in case of import.

We assume that the direct access project to Tanjung Priok from Pasoso station will be executed and therefore the current expenses of handling fee and hauling from port container depot to/from Pasoso station will not be considered.

In order to determine the revenue scheme, each individual stakeholder's revenue stream was indentified.

The Return on Investment of Operator (ROI2) is determined from the viewpoint of the railway operator. For the use of the infrastructure and rolling stock, the railway operator (PT. KA) is obliged to pay a fee to the Government (DGR) called Track Access Charge (TAC).

Then, the unit price for railway freight was calculated and it is shown in Table 8.5-2 for ROI1 and Table 8.5-3 for ROI2.

8.5 Feasibility Analysis of Railway Freight Business

The main parameter to evaluate for the feasibility of the project is the Internal Rate of Return (IRR). In our case two different IRR are studied: One is the common Return on Investment (ROI1) considering the entire project, regardless of the ownership of the portions of the revenue, as it is divided into several stakeholders, as indicated in Section 8.4(1). The other is Return on Investment (ROI2) from the view point of the investment of Railway stakeholder, PT KA, which is assumed to be the operator of the railway portion of the freight business.

There are two cases to be studied:

a) Case 1: Freight from Tanjung Priok to Cikarang (only cost of railway facilities is included) and from Tanjung Priok to Gedebage, assuming completion of direct access from Pasoso station to JICT. The implementation timeline is from 2011 to 2015, including acquisition of rolling stock.

b) Case 2: Freight from Cilamaya to Cikarang (only cost of railway facilities is included) and from Cilamaya to Gedebage. The implementation timeline is from 2015 to 2020, including acquisition of rolling stock and ROW.

(1) Total Investment Project Cost

The cost estimation is compiled on a single currency, US Dollars, at an FX rate of 1US$=9000 Rp and 1US$=82 JPY. The construction unit cost is settled based on unit costs of similar projects in Indonesia and other South East Asian countries.

The cost is shown for later use on estimation of Return on Investment (ROI). ROI1 considers total investment cost of the entire project, regardless of the source of funds. On the other hand, ROI2 considers only investment cost borne by the railway freight operator.

(2) Project Revenue Estimate

The revenue is estimated separately for both IRRs, on project (ROI1) and on operator's investment (ROI2).

In case of ROI, all revenue acquired due to infrastructure built under this project is considered as project revenue. Thus, the revenue would not only be the freight fee of rail, but also the handling fee at Cilamaya (Case 2). Trucking feeders' fee is not included.

Since the facilities of Tanjung Priok, Gede Bage, and Cikarang are not part of this project, the revenue generated there is not considered.

Summary of revenues for FIRR on Project (ROI1) is shown in Table 8.5-2. In case of IRR on Investment of operator (ROI2), the price of transportation of the train (empty and full) only is considered as revenue of the operator. Summary of revenues for ROI2 is shown in Table 8.5-3.

Table 8.5-1 Construction Cost Estimate for Case 1 and Case 2 Project

Item	Cost (ROI1)			Cost (ROI2)	
	Case 1		Case 2	Case 1	Case 2
	US$	US$	US$	US$	US$
	Stage 1	*Stage 2*			
1. Civil Works			125,730,200		
2. Building Works	2,430,000		12,110,000	2,430,000	12,110,000
3. Track Works	1,380,000	5,280,000	44,700,000		
4. Signalling Works		24,000,000	21,000,000		
5. Telecom Works			6,830,000		
6. Maintenance Facilities			4,500,000		4,500,000
7. Container Handling	3,600,000		14,400,000		
8. Rolling Stock					
Diesel Locomotives	36,000,000	9,000,000	48,000,000	0	0
Freight Wagons	45,300,000	7,500,000	58,050,000	0	0
Subtotal	*81,300,000*	*16,500,000*	*106,050,000*	*0*	*0*
9. Land Acquisition			13,806,000		0
Construction Cost	***88,710,000***	***45,780,000***	***349,126,200***	***2,430,000***	***16,610,000***
Engineering Cost (6%)	5,322,600	2,746,800	20,119,212	145,800	996,600
Contingency Cost (7%)	6,209,700	3,204,600	24,438,834	170,100	1,162,700
Taxes and Duties (10%)	8,871,000	4,578,000	33,532,020	243,000	1,661,000
Total Investment Cost	***109,113,300***	***56,309,400***	***427,216,266***	***2,988,900***	***20,430,300***

SSou
rce: Study Team Estimate

Table 8.5-2 Revenue Estimate for of Total Project (ROI1)

Options			Unit Price round trip	Quantity	Revenue		
					per section	per Case	
	from/to	*to/from*	*Rp/TEU*	*TEU/year*	*Million Rp/year*		*Million $/y*
Case 1 *(2015)*	Tanjung Priok	Gede Bage	991,950	23,360	23,172	**114,767**	**12.75**
	Tanjung Priok	Cikarang	392,100	233,600	91,595		
Case 1 *(2020)*	Tanjung Priok	Gede Bage	991,950	35,040	34,758	**172,150**	**19.13**
	Tanjung Priok	Cikarang	392,100	350,400	137,392		
Case 2	Cilamaya	Gede Bage	954,550	70,080	66,895	**280,318**	**31.15**
	Cilamaya	Cikarang	365,450	584,000	213,423		

Source: Study Team Estimate

Table 8.5-3 Revenue Estimate for Investment of Operator (ROI2)

Options			Unit Price round trip	Quantity	Revenue		
					per section	per Case	
	from/to	*to/from*	*Rp/TEU*	*TEU/year*	*Million Rp/year*		*Million $/y*
Case 1 *(2015)*	Tanjung Priok	Gede Bage	823,450	23,360	19,236	**71,469**	**7.94**
	Tanjung Priok	Cikarang	223,600	233,600	52,233		
Case 1 *(2020)*	Tanjung Priok	Gede Bage	823,450	35,040	28,854	**107,203**	**11.91**
	Tanjung Priok	Cikarang	223,600	350,400	78,349		
Case 2	Cilamaya	Gede Bage	767,550	70,080	53,790	**158,005**	**17.56**
	Cilamaya	Cikarang	178,450	584,000	104,215		

Source: Study Team Estimate

(3) Operation and Maintenance Costs

Operation and maintenance costs for the railway operator are as shown in the Table 8.5-4.

Table 8.5-4 Annual Operation and Maintenance Costs

Million USD / year

Item	Case 1 *(2015)*	Case 1 *(2020)*	Case 2
Energy Cost			
Fuel Cost	1.786	2.679	4.195
Power for facilities	0.002	0.002	0.013
Personnel Cost	0.204	0.312	0.312
Maintenance Material Cost			0.000
Civil Infrastructure	0.240	0.360	0.836
Track Work	0.610	0.914	2.124
E&M	0.137	0.205	0.476
Rolling Stock Maintenance	1.173	1.428	1.541
Overhead Cost *(15%)*	0.623	0.885	1.425
TAC *(25%)*	1.194	1.696	2.730
Total Cost	5.969	8.481	13.652

Source: Study Team Estimate

The O&M expenses mentioned before in Table 8.5-6 correspond to those expenses of the railway operator only, i.e., from the view point of investment of PT KA (ROI2). The O&M Cost for the whole project (ROI1) shall include the costs of the Tanjung Priok and Climaya handling facilities for Case 1 and case 2, respectively. The total O&M costs for (ROI1) are shown in Table 8.5-5 below.

Table 8.5-5 Annual Operation and Maintenance Costs (ROI1)

Million USD / year

Item	Case 1 *(2015)*	Case 1 *(2020)*	Case 2
Railway O&M Cost (ROI2)	5.969	8.481	13.652
Ports Handling O&M Costs	0.991	0.991	1.322
Total O&M Cost (ROI1)	6.960	9.472	14.974

Source: Study Team Estimate

(4) Financial Returns

The purpose of the financial analysis is to verify the feasibility of the freight railway transport from Cilamaya New terminal to the Cikarang dry port project from viewpoint of business enterprise and as project investment. As mentioned above, the FIRR on ROI1 of the project and on investment of the operator (ROI2) are calculated.

The financial analysis as FIRR of each case for the Cilamaya port and railway facilities is estimated as shown Table 8.5-6.

Table 8.5-6 Financial Returns of the Project

FIRR	ROI1	ROI2
Case 1	3.59%	55.76%
Case 2	0.79%	16.83%

Source: Study Team Estimate

8.6 Recommendation

The return on investment of the project for both cases, Case 1 and Case 2, is not high enough to make them financially feasible as the increase in revenue due to the project is very limited by the lack of capacity of the main line, and on the other hand, a considerable capital investment is required on rolling stock. On the other hand, considering only the return on investment of the operator, the result is financially feasible (55.76% for Case 1 and 16.83% for Case 2), yielding good profit to the train operator.

The return on investment of operator is acceptable and there is no doubt that the railway cargo business is attractive for the possible railway operators. However, there are question marks concerning the feasibility of the entire investment seen from the view point of the country as a whole.

However, there are some issues that should be considered as they expect to deliver advantage and social benefits by introducing the railway transport of the harbour freight.

There is a typical and successful example of collaboration of railway and truck transport of port cargo in Thailand at the Laem Chabang Port (LCP). This case is very similar in technical and background matters with the case of the development of Cilamaya port, where the traffic is between the new constructed port and a Railway Inland Container Depot (ICD) at the Lard Krabang area, about 100km north for LCP.

In this endeavor the port developers also had the strong support from the central government through the Directorate General of Railway of Thailand (DGR) and State Railway of Thailand (SRT). This has been a success for all stakeholders, port authorities, truck companies, and railway operator.

Case 1: Recommending Improvement of Railway Freight to Tanjung Priok

The lack of capacity of roads and the large number of small inland container depots (ICD) in the hinterland of the Tanjung Priok Port is creating enormous traffic congestion for the transport of cargo, and beyond that, to non-cargo users in the vicinity of Tanjung Priok and along the expressway of Jakarta.

It is therefore clear that even with an internal return on the investment of only 4%, the benefits brought by the project are remarkable. The most important part is to materialize the direct connection between railway and JICT, by extending the tracks from Pasoso station to the yard of JICT. This will avoid additional transport by truck (hauling) double handling (loading/unloading) of containers, and thus will reduce the congestion of container yard.

Case 2: Recommending railway transport access to the new Cilamaya terminal

The railway transport is expected to create considerable advantages, particularly enhancement of handling capacities of the terminal with the limited terminal facilities and at the same time the railway transport will form basic social infrastructure for regional development.

The railway transport will help to reduce the dwelling time of containers in the terminal in cooperation with truck transport by quick dispatch of cargo from the terminal. Subsequently the stock area in the yards will be provided for the next cargoes unloaded from the ships. As a result, the railway transport will contribute to enhance the handling capacity of the terminal.

Moreover, the lower return on investment should not prevent this project from going forward; in addition, this project should be considered beyond the time frame for the Master Plan and beyond the geographic area now covered. This is because railway freight services might open opportunities for new dry-port along the route or beyond to the east, which will lead to increased capacity and social development of this area.

9. PRE-FEASIBILITY STUDY

9.1. Extraction of the Urgent Development Project

The following urgent development project has been extracted from the first phased implementation plan in the proposed Master Plan (see 4.7.2 (3) of Chapter 4):

- Construction Project of North Kalibaru Container Terminal

The outlines of the project are shown in the following sections.

9.2. Construction of a Container Terminal

(1) Project Site

The Project site for development of a new container terminal is located at the North Kalibaru area in the Tanjung Priok Port. The scope and site location is shown in the Figure 9.2-1.

(2) Project Components

The project is planned to be executed by PPP (Public Private Partnership) scheme by sharing the following components between the public and private sectors.

Table 9.2-1 Project Components of Urgent Development Project

Components of Off shore Container Terminal	Responsible of Implementation	
1. Development of New Container Terminal Facilities	Public sector	Private sector
2. Dredging works for Channel and Turning Basin Depth -15.5m, W=320m Diameter =740m	○	
2. Demolishing Existing Breakwater L=3,308m	○	
3. Construction of new Breakwater by recycle of demolished breakwater material L=633m	○	
4. Construction of Seawall (L=1,935m) and Revetment (L=820m) for Reclamation works	○	
5. Reclamation works (DL+3.5m) for 2-terminals	○	
6. Soil Improvement works By public; Seawall; Revetment; Terminal inner road; Stock yard & Public security area.	○	
7. Quay wall construction for 87,000DWT Length=600 m x 2 terminals and Depth -15.5m		○
8. Procurement of Cargo Handling Equipment 6 units of QGC, 16 units of RTG x 2 terminals and others		○
9. Yard Pavement works with Drainage system		○
10. Terminal Inner Road, (3 lanes, 12m width and concrete pavement for heavy loaded trucks)	○	
11. Utility Supply (Power supply and water supply)		○
12. Building works		○
13. Environmental Treatment Facilities	○	
14. Security System Facilities	○	
Access Road /Bridge Development		
1. Access Road and bridge Construction Road (L=0.95 km, 2 lanes) and Bridge (L= 1.1 km, 2 lanes)	○	
Consulting Services; DD, Tender Assist, Construction supervisory	○	

Figure 9.2-1 Project site for development of new container terminal at North Kalibaru

(3) Design of Project Facilities

1) Offshore Terminal Facilities

Channel and Turning Basin Development

The expected maximum ship size is Post-Panamax (DWT; 87,545, LOA; 318m, Draft; 14.0m, Beam; 40.06m). To allow two-way traffic of vessels of above-mentioned type, the new navigation channel will have a width of 310 m and depth of 15.5 m.

The water depth for dredging the channel and turning basin has been set at -15.5 m and side slope of the dredging section is assumed to be 1 to 5.The total dredging volume under Phase I project is estimated as 16.184 mil cum.

The existing breakwaters are removed for development of Phase 1 new terminals at NKB. Parts of the new breakwater (section totalling 3,609.8m in length) will be constructed by recycling demolished material.

A new rubble mound type breakwater with PVD foundation soil improvement is planned at the depth of around 4 m between the planned new off shore container terminal and the New Dam Tengah breakwater to be constructed by Tanjung Priok Urgent Rehabilitation Project (URPT) under the Phase 1 Project.

Preliminary Design of Quay wall Structure

Adopting the design criteria as described in 5.1.2 (2) the quay wall structure is designed with concrete deck on steel pipe pile at the design depth of -15.5 m and crown height of +3.50m in the length of 600m x 2 terminals and in the width of 35m.

Container Yard Development by Seawall and Revetment

Adopting design criteria and concept of accepting overtopping local waves as described in 5.1.2 (4) the seawall and revetment to protect reclamation land is designed with steel sheet piles driven to -25m and gravity type (Concrete blocks wall placed on the rubble mound) at the slope of 1:4/3 ~ 2 and to the crown height of +2.50m with Plastic Vertical Drain (PVD) Method for soil improvement.

Reclamation works

Reclamation works will be carried out by filling material of quarry run and rubble stones taken from the quarry around the project sites. The infill material should be placed from the existing sea bed up to +2.0 m from CDL. Average thickness of reclamation will be 6 to 7 m. The estimated volume for respective phases is 8.29 mil cum. Average elevation of the planned yard after pavement will be +3.5 m (MSL+3.0m).

Yard Pavement and Drainage in new terminal area

Based on the operation planning of the yard area and corresponding to critical wheel load, 4 different types of pavement structure (RO concrete, RC concrete block + asphalt, asphalt concrete, Interlocking concrete block) are designed.

Terminal Inner Road

The new Kalibaru terminal is expected to handle about 1.9mil TEUs of container in future. The Terminal road is planned to have 12 m width for 3 lanes (2 lanes for through traffic and 1 lane for gate queue) and concrete pavement with gravel foundation to sustain truck wheel load of H22-44. The inner road will surround the reclaimed land outside the container yards.

(4) Design Concept of Access Road

The access road was planned to connect the off shore new terminal at North Kalibaru from the existing arterial road as the Urgent Project of new Container terminal development considering following aspects.

- To be the arterial road
- To utilize the existing road to minimize resettlement
- To construct a bridge between land and the terminal
- To install a signalized intersection for connecting with the existing road

1) Cross Section of Access road

The estimated traffic volume for the access road is 28,238 PCU/day in 2030. According to the design standards in Indonesian, a lane has a capacity of 20,000 PCU/day. Therefore, a two-lane road is planned for the access road having 7m width for each lane (14 m width in total); pavement type is cement concrete.

2) Plan and Profile

Horizontal alignment

Three routes were examined for the horizontal alignment of the access road on the land section. Although the land around the proposed area is administrated by PERINDO 2, the area is occupied by houses, shops, warehouses and a market. As a result of an evaluation of alternative routes and Route 1" Existing access road to Kalibaru port" is selected. The total length of the access road is 2.1 km; road sections comprise 950 m and bridge sections 1,100m.

Vertical alignment

The road height should be almost the same as the ground level, about 1.5 to 3.0 m above M.S.L. For the bridge section, the road is raised to secure the vertical clearance of 5.0m above M.S.L for fishing boats passing under the bridge.

Bridge Structure

A PC- I shape-girder bridge with a 35m span, which is the same type of standard span bridge as North Kalibaru, is applied for the bridge parts of the planned access road. The section of bridge has 14 m width for two lanes with concrete slab on the PC girder. The length of the bridge is 1,100m.

It is planned that the RC concrete pier structure supported by cast-in site concrete piles to be driven to -20 m-25m depth from the RC footing structure is constructed at every 35 m as the foundation of girder bridge.

(5) Cost Estimates of Urgent Development of Container Terminal at North Kalibaru

1) The Cost Estimate of Off shore Terminal Development

The work items and their quantities, construction costs are detailed in the Table 9.2-3.

Total Project Cost of the new terminal (including indirect cost of construction, contingency, cost for engineering services and administration, VAT) is estimated as 8,230,382 million Rupiah (around 914 .5 million USD, or 74,822 million Yen).

In line with the proposed sharing project cost between Public Sector and Private Sector, Table 9.2-2 presents following shares of each investment. The detailed breakdown is shown in Table 9.2-7

Table 9.2-2 Project Cost Share by Public and Private Sectors for Urgent Project at North Kalibaru (unit; million Rupiah)

	Works	Public	Private	Total
1	Construction Cost: Stage 1 of Kalibaru Terminal	2,535,371 (62%)	1,584,617 (38%)	4,119,988
2	Construction Cost: Stage 2 of Kalibaru Terminal	582,929 (27%)	1,584,617 (73%)	2,167,546
3	General Cost of Terminal Construction works, Mob/Demob etc	155,914 (44%)	158,461 (56%)	314,375
4	Project Related Cost, ES cost, Contingency etc	563,331 (61%)	363,461 (39%)	926,792
5	Total Construction cost of Terminal Development	3,837,546 (48%)	3,644,619 (52%)	7,482,165
6	Construction Cost of Access Road and Bridge at North Kalibaru	466,994 (100%)	None (0%)	466,994
7	Total Construction Cost by Terminals and Access road	4,300,165 (53%)	3,644,619 (47%)	7,945,234
8	Total Project Cost including VAT	4,730,677 (55%)	4,009,081 (45%)	8,739,758
	In term of USD (million)	525.0	445.5	971.1
	In term of Japan yen (million)	43,006	36,446	79,452

Table 9.2-3 Project Cost Estimate of North Kalibaru Phase I (Stage 1 development)

Description	Unit	Quantity	Project Cost (1,000 Rupiah) Local Portion	Foreign Portion	Summation
1. General Cost			**137,642,116**	**176,734,572**	**314,376,688**
2. Direct Construction Cost					
2.1 Stage 1 of Construction					
(1) Breakwaters					
Construction					
Dam Tengah Extension	m	640	15,625,390	39,326,760	54,952,150
Demolition					
Dam Citra	m	1,548	21,672,000	32,508,000	54,180,000
Dam Pertamina	m	1,760	31,680,000	47,520,000	79,200,000
(2) Seawalls					
North Seawall	m	1,305	83,144,440	59,862,228	143,006,668
Revetment (West)	m	620	28,013,751	2,402,540	30,416,291
East Seawall	m	630	27,582,414	2,395,968	29,978,382
Revetment (-3 m)	m	200	7,005,414	6,680,543	13,685,957
(3) Port Inner Road	m	1,335	36,700,317	17,293,350	53,993,667
(4) Dredging of Channel and Basin					
Deepening (-14 m ~ -15.5 m)	m^3	4,479,362	146,702,717	193,781,308	340,484,025
Basin in front of New Terminal	m^3	7,701,183	252,219,961	333,160,251	585,380,212
Basin in front of Koja Terminal	m^3	4,003,986	131,133,779	173,216,118	304,349,897
(5) Container Terminal Stage 1					
Quay Wall (-15.5 m)	m	600	190,843,236	89,192,554	280,035,791
Yard Construction					
Reclamation (DL+3.5 m)	m^3	2,475,000	242,523,750	98,072,300	340,596,050
Reclamation (Surcharge 3 m	m^3	990,000	97,009,500	39,228,920	136,238,420
Soil Improvement	m^2	330,000	39,726,115	17,025,478	56,751,592
Stacking Yard Pavement	m^2	134,750	76,807,500	51,205,000	128,012,500
Passage Pavement	m^2	195,250	73,804,500	49,203,000	123,007,500
Terminal Buildings	m^2	6,000	17,568,000	4,392,000	21,960,000
Container Handling Equipment and Operation System			92,294,100	830,646,900	922,941,000
(6) Security and Utility					
Reclamation (DL+3.5 m)	m^3	810,980	79,467,439	32,135,222	111,602,660
Soil Improvement	m^2	70,520	8,489,350	3,638,293	12,127,643
Ground Pavement	m^2	70,520	26,656,560	17,771,040	44,427,600
X -ray Inspection House	l.s.	1	14,400,000	129,600,000	144,000,000
Utility Faclities of Stage 1	l.s.	1	73,828,260	34,831,925	108,660,185
Sub-total of Direct Cost (Stage 1)			**1,814,898,494**	**2,305,089,697**	**4,119,988,192**

Table 9.2-4 Project Cost Estimate of North Kalibaru Phase I (Stage 2 development)

Description	Unit	Quantity	Project Cost (1,000 Rupiah) Local Portion	Foreign Portion	Summation
2.2 Stage 2 of Construction					
(7) Port Inner Road	m	1,220			
Road Pavement	m^2	21,960	8,300,880	5,533,920	13,834,800
Reclamation (DL+3.5 m)	m^3	164,700	16,138,853	6,526,266	22,665,119
Reclamation (Surcharge 3 m)	m^3	65,880	6,455,541	2,610,506	9,066,048
Soil Improvement	m^2	21,960	2,643,592	1,132,968	3,776,561
(8) Container Terminal 2					
Quay Wall	m	600	190,843,236	89,192,554	280,035,791
Yard Construction					
Reclamation (DL+3.5 m)	m^3	2,475,000	242,523,750	98,072,300	340,596,050
Reclamation (Surcharge 3 m	m^3	990,000	97,009,500	39,228,920	136,238,420
Soil Improvement	m^2	330,000	39,726,115	17,025,478	56,751,592
Stacking Yard Pavement	m^2	134,750	76,807,500	51,205,000	128,012,500
Passage Pavement	m^2	195,250	73,804,500	49,203,000	123,007,500
Terminal Buildings	m^2	6,000	17,568,000	4,392,000	21,960,000
Container Handling Equipment and Operation System			92,294,100	830,646,900	922,941,000
(9) Utility Facility of Stage 2					
Utility Faclities	l.s.	1	73,828,260	34,831,925	108,660,185
Sub-total of Direct Cost (Stage 2)			**937,943,828**	**1,229,601,737**	**2,167,545,565**
Direct Construction Cost (DC; Stage 1 + Stage 2)			**2,752,842,323**	**3,534,691,434**	**6,287,533,757**
3. Project Related Expenses (PE)			**385,397,925**	**494,856,801**	**880,254,726**
(1) Engineering Service	l.s.	1	82,585,270	106,040,743	188,626,013
(2) Contingency	l.s.	1	275,284,232	353,469,143	628,753,376
(3) Administration Cost	l.s.	1	27,528,423	35,346,914	62,875,338
4. Total Construction Cost			**3,275,882,364**	**4,206,282,807**	**7,482,165,171**
VAT			**327,588,236**	420,628,281	748,216,517
Grand Total of Phase I Development			**3,603,470,601**	**4,626,911,088**	**8,230,381,688**

1 USD =	9,000	Rupiah	**914.5**	**million USD**
100 Yen =	11,000	Rupiah	**74,822**	**million Yen**

2) Cost Estimate of Access road construction

The construction cost of Access Road Development of Urgent Required Terminal was estimated at Rp 513,692 million as shown in Table 9.2-5.

Table 9.2-5 Construction cost of access road for North Kalibaru Phase 1

Description	Unit	Unit Cost (RP.)	Quantity	Cost Estimate(million Rp)		
				Local Portion	Foreign Portion	Summation
1 GENERAL	l.s		1	**19,229**	**392**	**19,622**
2 Direct Construction Cost						
Road						
a:Earthwork	m3	60,000	5,611	337		337
b:Pavement	m2	500,000	14,425	7,068	144	7,213
c:Drainage	m	1,000,000	1,916	1,877	38	1,916
d:Miscellaneous	l.s	250,000,000	1	212	38	250
e:Pile Slab	m2	4,000,000	630	2,469	50	2,520
Subtotal				**11,963**	**270**	**12,235**
Bridge						
a:Preparation works	l.s	110,000,000,000	1	88,000	22,000	110,000
b:Sub-structure works	m2	5,000,000	18,346	73,384	18,346	91,730
c:Super-structure	m2	8,000,000	18,346	117,414	29,354	146,768
d:Pavement	m2	700,000	14,912	10,229	209	10,438
e:Drainage	m	1,000,000	2,260	1,808	452	2,260
f:Miscellaneous	l.s	19,000,000,000	1	16,150	2,850	19,000
Subtotal				**306,985**	**73,210**	**380,196**
Direct Costruction CostTotal				**318,948**	**73,481**	**392,432**
3 Project Related Expensise						
a Contingency	l.s		1	**31,894**	**7,348**	**39,243**
b Engineering Service	l.s		1	**7,063**	**4,710**	**11,773**
c. Administration Cost				**3,924**		**3,924**
d Sub Total				**42,882**	**12,058**	**54,940**
4. Construction Cost	l.s			**381,058**	**85,931**	**466,993**
5 VAT				**38,105**	**8,593**	**46,699**
6. Total Project Cost	l.s			**419,163**	**94,524**	**513,692**

Table 9.2-6 Proposed Sharing Plan of Project Cost between Public and Private Sectors (1/2)

Description	Unit	Quantity	Project Cost (1,000 Rupiah) Public Investment	Private Investment	Summation
1. General Cost			**155,914,990**	**158,461,698**	**314,376,688**
2. Direct Construction Cost					
2.1 Stage 1 of Construction					
(1) Breakwaters					
Construction					
Dam Tengah Extension	m	640	54,952,150		
Demolition					
Dam Citra	m	1,548	54,180,000		
Dam Pertamina	m	1,760	79,200,000		
(2) Seawalls					
North Seawall	m	1,305	143,006,668		
Revetment (West)	m	620	30,416,291		
East Seawall	m	630	29,978,382		
Revetment (-3 m)	m	200	13,685,957		
(3) Port Inner Road	m	1,335	53,993,667		
(4) Dredging of Channel and Basin			1,230,214,134		
(5) Container Terminal Stage 1					
Quay Wall (-15.5 m)	m	600		280,035,791	
Yard Construction					
Reclamation (DL+3.5 m)	m^3	2,475,000	340,596,050		
Reclamation (Surcharge 3 r	m^3	990,000	136,238,420		
Soil Improvement	m^2	330,000	56,751,592		
Stacking Yard Pavement	m^2	134,750		128,012,500	
Passage Pavement	m^2	195,250		123,007,500	
Terminal Buildings	m^2	6,000		21,960,000	
Container Handling Equipment and Operation System				922,941,000	
(6) Security and Utility					
Reclamation (DL+3.5 m)	m^3	810,980	111,602,660		
Soil Improvement	m^2	70,520	12,127,643		
Ground Pavement	m^2	70,520	44,427,600		
X -ray Inspection House	l.s.	1	144,000,000		
Utility Faclities of Stage 1	l.s.	1		108,660,185	
Sub-total of Direct Cost (Stage 1)			**2,535,371,216**	**1,584,616,976**	**4,119,988,192**
			62%	38%	100%
2.2 Stage 2 of Construction					
(7) Port Inner Road	m	1,220	49,342,527		
(8) Container Terminal 2					
Quay Wall	m	600		280,035,791	
Yard Construction					
Reclamation (DL+3.5 m)	m^3	2,475,000	340,596,050		
Reclamation (Surcharge 3 r	m^3	990,000	136,238,420		
Soil Improvement	m^2	330,000	56,751,592		
Stacking Yard Pavement	m^2	134,750		128,012,500	
Passage Pavement	m^2	195,250		123,007,500	

Table 9.2-7 Proposed Sharing Plan of Project Cost between Public and Private Sectors (2/2)

Description	Unit	Quantity	Project Cost (1,000 Rupiah) Public Investment	Private Investment	Summation
Terminal Buildings	m^2	6,000		21,960,000	
Container Handling Equipment and Operation System				922,941,000	
(9) Utility Facility of Stage 2					
Utility Faclities	l.s.	1		108,660,185	
Sub-total of Direct Cost (Stage 2)			**582,928,590**	**1,584,616,976**	**2,167,545,565**
			27%	73%	100%
Direct Construction Cost (DC; Stage 1 + Stage 2)			**3,118,299,806**	**3,169,233,952**	**6,287,533,757**
			49.6%	50.4%	100%
3. Project Related Expenses (PE)			**563,331,331**	**316,923,395**	**880,254,726**
(1) Engineering Service	l.s.	1	188,626,013		188,626,013
(2) Contingency	l.s.	1	311,829,981	316,923,395	628,753,376
(3) Administration Cost	l.s.	1	62,875,338		62,875,338
4. Total Construction Cost of Container Terminals			**3,837,546,127**	**3,644,619,044**	**7,482,165,171**
VAT			383,754,613	364,461,904	748,216,517
5. Access Road Construction at North Kalibaru					
5.1 Genneral			58,864,734		58,864,734
5.2 Direct Construction Cost					
(1) Road	m		12,235,160		12,235,160
(2) Bridge			380,196,400		380,196,400
Sub-total of Direct Construction Cost			**392,431,560**		**392,431,560**
5.3 Contingency			39,243,156		39,243,156
5.4 Engineering Service			49,054,000		49,054,000
5.5 Total Construction Cost of Access Road			**539,593,450**		**539,593,450**
VAT (10%)			53,959,345		53,959,345
6. Total of Project Cost (Container Terminal and Road)					
6.1 Construction Cost (1.+ 2.+ 5.1+ 5.2)			3,725,511,090	3,327,695,649	7,053,206,739
6.2 Engineering Service			237,680,013		237,680,013
6.3 Contingency			351,073,137	316,923,395	667,996,532
6.4 Administration Cost			62,875,338		62,875,338
Total Project Cost			**4,377,139,577**	**3,644,619,044**	**8,021,758,621**
VAT (10%)			437,713,958	364,461,904	802,175,862
Grand Total (1,000 Rupiah)			**4,814,853,534**	**4,009,080,949**	**8,823,934,483**
Grand Total	**in**	**million USD**	**535.0**	**445.5**	**980.4**
	in	**million Yen**	**43,771**	**36,446**	**80,218**
			55%	45%	100%

1 USD = 9,000 Rupiah
100 Yen = 11,000 Rupiah

(6) Implementation Schedule Urgent Development Project of New Container Terminal for Phase 1Terminal Development Project

Considering urgency of each project component and step-by-step development, Implementation schedule is made taking into consideration the time of the administration procedures and in accordance with construction capability.

Urgent Development Scenario at North Kalibaru is presented as follows.

Planned extension of quay wall in the development of North Kalibaru Phase I is 1,200 m for two terminals and the planned dredging volume to deepen the channel and turning basins up to -15.5 m in the development of North Kalibaru Phase I amounts to 16 million m^3.

In order for the planned container terminal to be operational in the 5th year after L/A (4th year after implementation of construction), the staged development of the container terminal Phase I is taken into consideration.

Phase I development of the North Kalibaru Container Terminal is targeting container throughput of 1.9 million TEU/year (quay wall length: 1,200 m). The construction works are divided into two stages along the length of quay wall (600 m + 600 m). The construction works managed in each stage are assumed as follows.

Stage 1 (2nd – 4th Year)

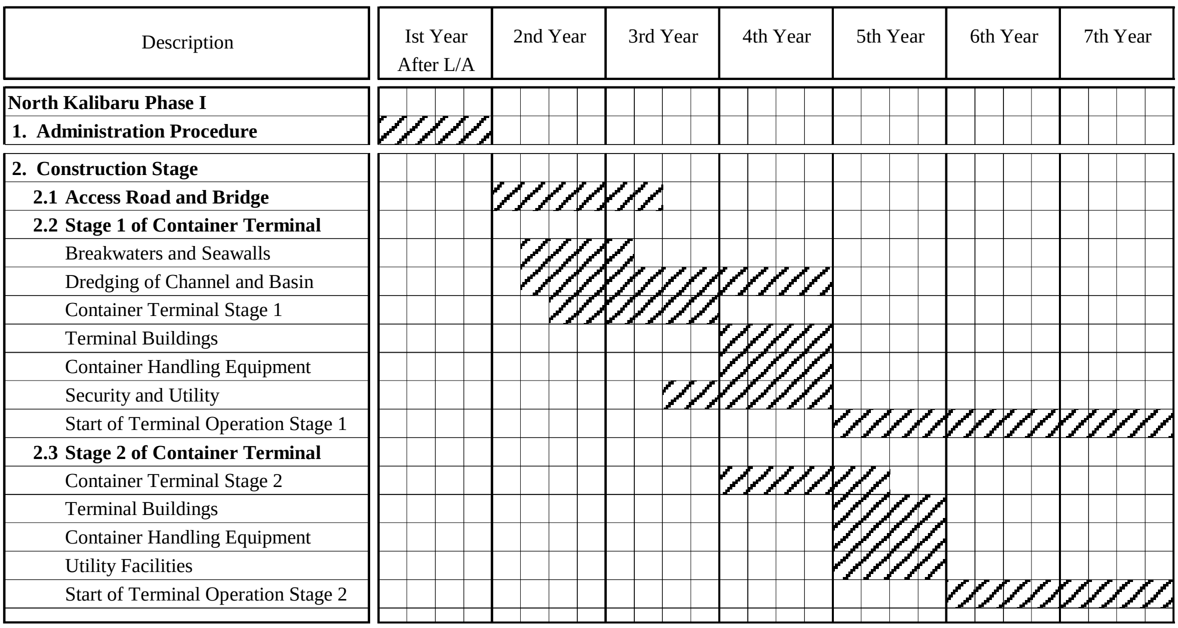
Dredging of channel and basins, demolition of the existing breakwaters, re-construction of breakwaters, construction of protective facilities (seawalls, revetments), construction of quay wall 600 m, reclamation and development of container terminal yard with on land facilities.

Stage 2 (4th – 5th Year)

Construction of Quay wall 600 m, reclamation terminal yard and development of container terminal on land facilities.

Implementation schedule of North Kalibaru Phase I is presented in Table 9.2-8.

Table 9.2-8 Implementation Schedule of Urgent Development Project at North Kalibaru



Access Road and Bridge Construction

The construction of the access road is scheduled to take about 3.5 years including project preparations.

Access Road construction for Urgent Terminal Development Project will be started in second year after the project finance is completed and completed in the middle of the third year.

9.3. Economic Analysis

(1) Purpose and Methodology of Economic Analysis

The economic analysis is carried out to study economic benefits as well as economic costs arising from the project, and to evaluate whether the benefits of the project exceed those that could be obtained from other investment opportunities in Indonesia.

In the economic analysis the development plan, namely “With the project” case, will be compared to the “Without the project” case. All of the benefit and cost differences between the “With” case and “Without” case will be calculated in market price, then they will be converted to economic price.

In this study, the Economic Internal Rate of Return (EIRR) method is used to evaluate and appraise the economic feasibility of the project. Sensitivity analysis is also conducted.

(2) “Without” Case

In the “With” case, the new container terminals at North Kalibaru 1st Phase will accommodate up to 1.9 million TEUs of international containers.

In the “Without” case, international containers will overflow after the existing terminals are saturated. Extra space is not available at Tanjung Priok Terminal for loading and unloading international containers. It is assumed in this Economic Analysis that in the “Without” case, a total of 400,000 TEUs of international containers are loaded/unloaded at Ciwandan Port and Merakmas Port in the Banten province and transported by trucks over land to/from consignees and exporters. However, 1.5 million TEUs of international containers still cannot pass through the port. Consequently, Indonesian economy will lose corresponding amount of foreign earnings. Container throughputs for “With” and “Without” case are summarized in Table 9.3-1.

Table 9.3-1 Container Throughput for "With" and "Without" Case

(Unit: '000 TEUs)

Year (after LA)	Estimated Throughput for International Container				
	JCT	"With"	"Without"		Total
		North Kalibaru I	Ports in Banten	Missed Throughput	
1st Year	4,029				4,029
2nd Year	4,460				4,460
3rd Year	4,850				4,850
4th Year	4,850				4,850
5th Year	4,850	858	400	458	5,708
6th Year	4,850	1,245	400	845	6,095
7th Year	4,850	1,632	400	1,232	6,482
8th Year	4,850	1,900	400	1,500	6,869
9th Year	4,000	1,900	400	1,500	7,255
10th Year	4,000	1,900	400	1,500	7,777
-----	-----	-----	-----	-----	-----

Source: Estimated by the Study Team

Note: Jakarta Container Terminal containing JICT, KOJA and MAL at Tanjung Priok Terminal

(3) Benefits of the Projects

Following items are identified as economic returns brought about by the implementation of container terminal development project at North Kalibaru Phase I..

- Value added of exporting commodities
- Savings in land transportation cost between terminals and factories/warehouses

Value added of export commodities which will be handled at the North Kalibaru Phase I. Container Terminal is counted as the benefit of the project. Although both export commodities and import commodities contribute to generate value added in Indonesia, only value added generated from export commodities are counted in this EIRR analysis.

Based on the two independent data sources, i.e., Indonesian Customs statistics on Tanjung Priok port and study results on Indonesian container export to Japan, value of exporting commodities is estimated at US$30,000/Laden Export TEU. Percentage of operating income of individual firm varies widely from a few percentages up to 20 percent. Average percentage of the operating income of the about 30 samples is in the vicinity of 7 percent, which is adopted to estimate the value added in this economic analysis.

Land transportation costs for 400,000 TEUs between the North Kalibaru and shippers /consigners are estimated taking trucking distance and congestion level into consideration, and compared with that of the "Without" case, i.e., alternatively using Ciwandan/Merakmas Ports. Land transportation cost difference between them is counted as one of the benefits of the project. Land transportation costs are estimated in economic price.

(4) Costs of the Projects

Following items are counted as the cost components of the project:

- Construction cost of port facilities and access road
- Management and operation cost
- Maintenance cost
- Replacement cost of cargo handling equipment

Construction costs basically consist of costs for breakwaters and seawalls, channel and basin, container terminals (quay wall, yard pavement, and terminal buildings), cargo handling equipment, security and utility, and the project related indirect costs. The cost for the port access road is also one of the important cost components of the project. The construction cost is firstly estimated by market price. After transfer costs such as VAT are removed, the costs expressed by market price are converted into economic pricing using conversion factors.

Personnel costs for management and operation of the terminals are estimated for both “With” case and “Without” case. Utility costs including electricity are estimated at 2% of the initial equipment procurement costs.

The annual costs for maintaining the port facilities are estimated as a fixed rate of the initial investment, specifically 0.2% for port infrastructure (breakwaters, seawalls, quay walls, yard pavement, and buildings) and 5% of the original construction costs of the port access road. Annual maintenance costs for cargo handling equipment are estimated at 1% of their initial procurement cost. It is expected that maintenance dredging will be required every five years but its volume will be minimal.

Cargo handling equipment will be replaced after its service life expires. Service life of the equipment is set individually by type of equipment: 25 years for quay cranes and 4 years for yard vehicles.

(5) EIRR and Economic Feasibility

The Economic Internal Rate of Return (EIRR) is the discount rate which makes the costs and benefits of a project during the project life equal. As shown in Table 9.3-2, EIRR of Kalibaru Phase I project is estimated at 53%.

In order to see whether the project is still feasible when some conditions change, a sensitivity analysis is also conducted. Even if in the case in which both the costs increase by 10% and the benefits decrease by 10%, the EIRR of this scenario is estimated at 46.5%.

An EIRR of the project is compared with the opportunity cost of capital in the project country, and if the former is higher than the latter, then it can be said that the project is economically feasible. Even under the worst scenario the EIRR of the project is much higher than the opportunity cost in Indonesia.

This means that the planned project is economically feasible.

Table 9.3-2 IRR of Kalibaru Phase I Project

(Unit: Rp. Billion)

Year	Project Cost					Project Benefit				Net Project Benefit
	Construction Cost	Manag't & Oper'n Cost	Maintenance Cost	Replacement Cost	Sub Total	Value Added	Operation Cost Saving	Land Trans'n Cost Saving	Sub Total	
1st Year	124.8	0.0	0.0	0.0	124.8	0.0	0.0	0.0	0.0	(124.8)
2nd Year	1,589.0	0.0	0.0	0.0	1,589.0	0.0	0.0	0.0	0.0	(1,589.0)
3rd Year	1,669.0	0.0	0.0	0.0	1,669.0	0.0	0.0	0.0	0.0	(1,669.0)
4th Year	2,624.4	0.0	0.0	0.0	2,624.4	0.0	0.0	0.0	0.0	(2,624.4)
5th Year	1,690.1	36.4	27.4	0.0	1,753.9	2,768.7	19.7	170.8	2,959.1	1,205.1
6th Year	144.9	72.9	42.3	0.0	260.0	4,980.1	19.7	170.8	5,170.5	4,910.5
7th Year	0.0	72.9	42.3	0.0	115.2	7,078.2	19.7	170.8	7,268.6	7,153.4
8th Year	0.0	72.9	42.3	11.5	126.7	8,400.1	19.7	170.8	8,590.5	8,463.9
9th Year	0.0	72.9	42.3	14.6	129.8	8,642.0	19.7	170.8	8,832.4	8,702.6
10th Year	0.0	72.9	44.7	3.2	120.8	8,506.5	19.7	170.8	8,696.9	8,576.1
11th Year	0.0	72.9	42.3	0.0	115.2	8,372.0	19.7	170.8	8,562.4	8,447.2
12th Year	0.0	72.9	42.3	58.2	173.4	8,238.7	19.7	170.8	8,429.1	8,255.7
13th Year	0.0	72.9	42.3	58.2	173.4	8,106.8	19.7	170.8	8,297.2	8,123.8
14th Year	0.0	72.9	42.3	14.7	129.9	7,976.3	19.7	170.8	8,166.8	8,036.9
15th Year	0.0	72.9	44.7	14.7	132.3	7,847.6	19.7	170.8	8,038.0	7,905.7
16th Year	0.0	72.9	42.3	11.5	126.7	7,720.5	19.7	170.8	7,910.9	7,784.3
17th Year	0.0	72.9	42.3	11.5	126.7	7,595.3	19.7	170.8	7,785.7	7,659.1
18th Year	0.0	72.9	42.3	0.0	115.2	7,472.0	19.7	170.8	7,662.4	7,547.3
19th Year	0.0	72.9	42.3	249.7	364.9	7,350.7	19.7	170.8	7,541.2	7,176.3
20th Year	0.0	72.9	44.7	307.9	425.5	7,350.7	19.7	170.8	7,541.2	7,115.7
21st Year	0.0	72.9	42.3	58.2	173.4	7,350.7	19.7	170.8	7,541.2	7,367.8
22nd Year	0.0	72.9	42.3	0.0	115.2	7,350.7	19.7	170.8	7,541.2	7,426.0
23rd Year	0.0	72.9	42.3	0.0	115.2	7,350.7	19.7	170.8	7,541.2	7,426.0
24th Year	0.0	72.9	42.3	26.2	141.3	7,350.7	19.7	170.8	7,541.2	7,399.8
25th Year	0.0	72.9	44.7	26.2	143.8	7,350.7	19.7	170.8	7,541.2	7,397.4
26th Year	0.0	72.9	42.3	0.0	115.2	7,350.7	19.7	170.8	7,541.2	7,426.0
27th Year	0.0	72.9	42.3	0.0	115.2	7,350.7	19.7	170.8	7,541.2	7,426.0
28th Year	0.0	72.9	42.3	58.2	173.4	7,350.7	19.7	170.8	7,541.2	7,367.8
29th Year	0.0	72.9	42.3	637.0	752.2	7,350.7	19.7	170.8	7,541.2	6,789.0
30th Year	0.0	72.9	44.7	578.8	696.4	7,350.7	19.7	170.8	7,541.2	6,844.7
31st Year	0.0	72.9	42.3	0.0	115.2	7,350.7	19.7	170.8	7,541.2	7,426.0
32nd Year	0.0	72.9	42.3	11.5	126.7	7,350.7	19.7	170.8	7,541.2	7,414.5
33rd Year	0.0	72.9	42.3	11.5	126.7	7,350.7	19.7	170.8	7,541.2	7,414.5
34th Year	0.0	72.9	42.3	261.2	376.4	7,350.7	19.7	170.8	7,541.2	7,164.8
35th Year	0.0	72.9	44.7	261.2	378.8	7,350.7	19.7	170.8	7,541.2	7,162.3
									IRR =	53.0%

Source: JICA Study Team

9.4. PPP Scheme and Financial Analysis

(1) Regulatory Framework of PPP for Port Development

Principal laws and regulations governing PPP project in port sector are Presidential Regulation No.42 and No.67, year 2005, (concerning establishment of KKPPI and PPP utilization in infrastructure provision), Ministry of Finance Regulation No.38/PMK.01/2006 (concerning government support and compensation on PPP implementation), BAPPENAS Regulation No.4/2010 and new shipping law and its government regulation No. 61/2009.

Among these laws and regulations, MOF regulation No.38/PMK.01/2006 stipulates necessary documents to apply PPP project as pre-feasibility study report, plan of cooperation form, plan for project financing and source of funds, plan for offering of cooperation project, including schedule, process and evaluation method and documentation of the results of the public consultation.

Detailed procedure for implementation of PPP project in the port sector is shown in Figure 9.4-1.

Implementation Flow of Port PPP Projects under the New Shipping Law
and Presidential Regulation No.67/'05 & Ministry of Finance Regulation No.38/PMK.01/'06

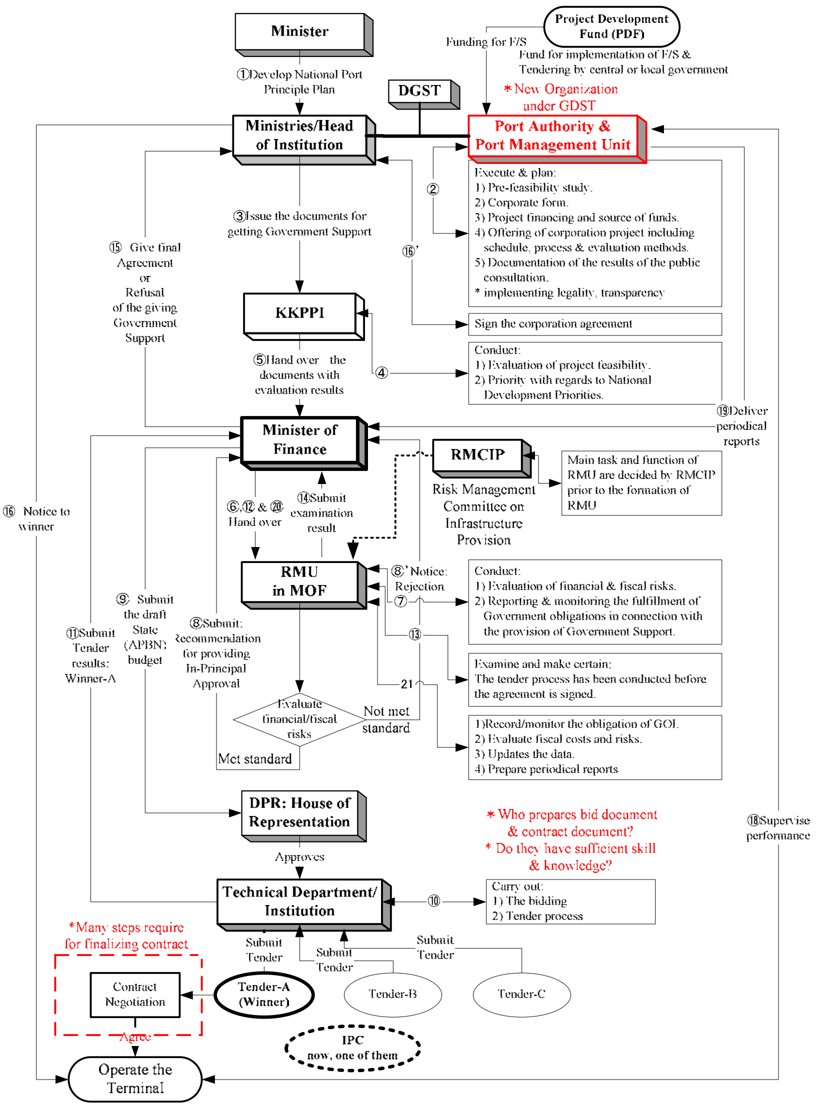


Figure 9.4-1 Implementation Flow of Port PPP Projects under the New Shipping Law

(2) Type of PPP for the Development of North Kalibaru Phase I

1) Possible type of PPP for North Kalibaru phase I development

Table 9.4-1 shows the typical form of PPP scheme provided in port sector.

Table 9.4-1 Possible PPP Scheme

Authority Type	Description
Agreement	Port-related services provided on port property
Concession Agreement	Commercial use of state property, long-term agreements, typically 30+years
Lease	Fixed term leases typically 10-15 years
Order	Port infrastructure (streets, sewers, etc.) permit with public agencies.
Revocable Permit	Leases that may be revoked with 13-120 days notice. Typically of indeterminate length

Source: JICA Study Team

Shipping law stipulates that provision of breakwater, channel and navigation aid is the obligation of the Port Authority and hence Port Business Entity is expected to provide mainly terminal and other ancillary facilities and services when it is expected to be commercially viable.

Hence, PPP scheme to be applied to the development of North Kalibaru phase I should be based on these possible PPP schemes.

For the development of Phase I, required investment cost is rather high and IPC2 seems incapable of raising all the necessary funds on its own and hence the following two PPP schemes will be considered for Phase I development.

- Case 1: Port Authority invests in breakwater, channel and reclamation with soft loan and Private Terminal Operator invests in terminal
- Case 2: Port Authority invests in breakwater, channel with soft loan and Private Terminal Operator invests in reclamation and terminal

Under these cost sharing schemes, it is considered to be reasonable and rational to set the concession fees with fixed fee at an amount sufficient for the public sector to recover its own initial investment cost including the amount to be paid for interest (if any) for land reclamation (breakwater and road which is commonly used by all the port users, and variable fee which is the revenue share to be paid as a royalty.

In this scheme, variable fee can be adjustable and negotiable with the profitability of each operating year of the concessionaire.

2) Assumption for the development of North Kalibaru Phase I

Planned capacity of the terminal is set as 1.9 million TEUs with 1200mx-15.5m quay wall.

Considering the estimated vessel size to use the terminal, one unit of terminal to be conceded to the operator is set as 600m (2berths) as is shown in Figure 9.4-2.

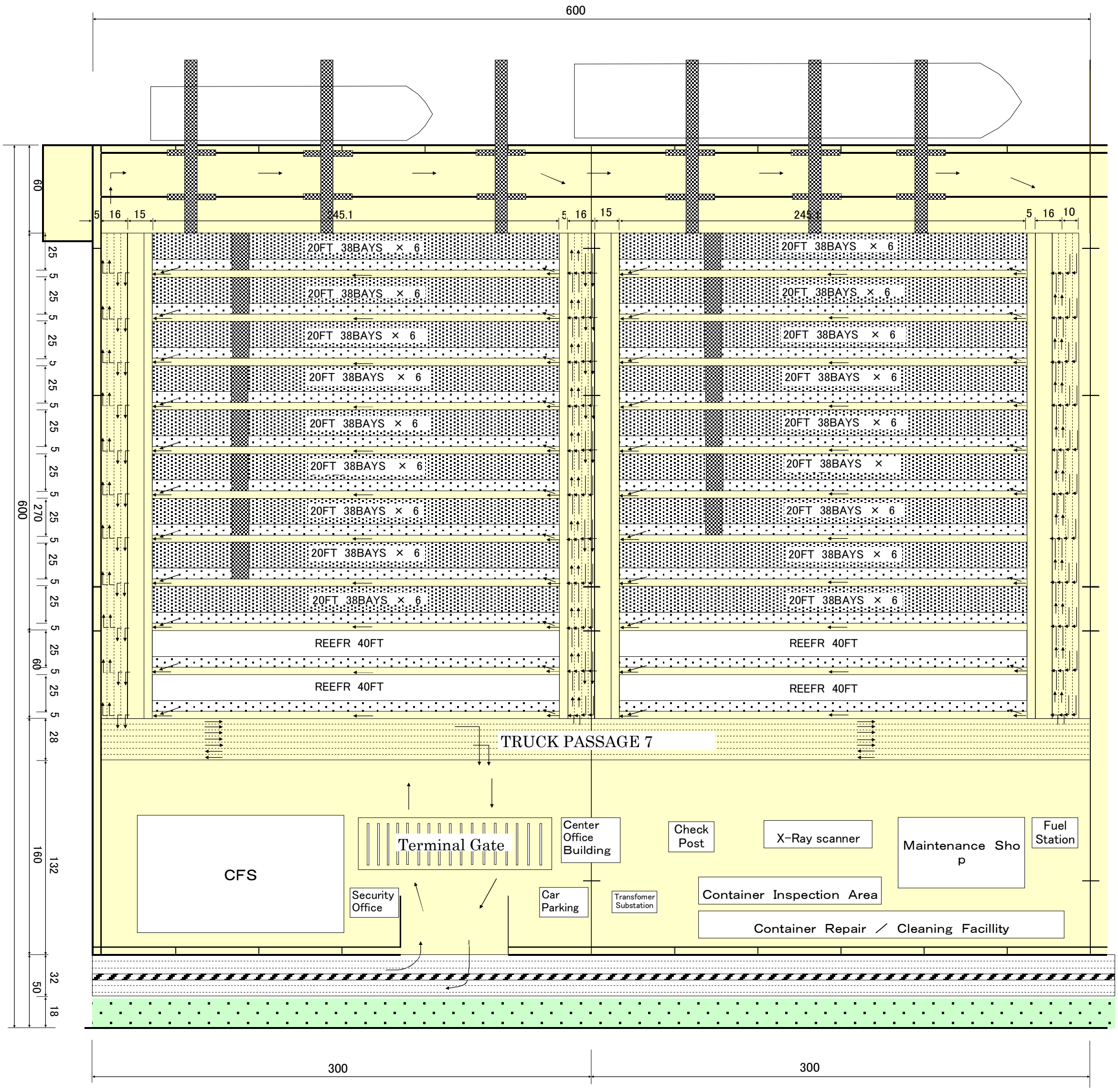


Figure 9.4-2 Container Yard Layout (360m and 240m)

Operation cost for Port Authority is estimated based only on the necessary staffs for concession management and excluding other cost for general management and operation of Port Authority. Number of required personnel is assumed to be 31 persons.

Operation cost for terminal operator for the operation of 2 berths is estimated based on the number of required personnel for terminal management office and operation office, 36 persons and 357 persons respectively.

(3) Financial Analysis on Proposed PPP Scheme

1) Assumptions for Financial Analysis

Concession Term and Fees

Concession Fees consist of fixed part and variable part. Fixed part is set as necessary investment cost and repayment of interest by the Port Authority on the initial investment excluding those for breakwater and channel. Variable part is set as 10% of the revenue of terminal operator as a base case.

Variable part of concession fee can be adjusted to balance the financial conditions of TOC and PA throughout the concession period.

Concession period is set as 30 years after operation of the terminal for each of the two operators. (It is assumed that one operator operates two berths (600m) as one unit of terminal.)

Revenues of Port Authority and Terminal Operator

Revenue of Port Authority is concession fees from two operators and light due and harbor due for the use of channel and navigation aids from vessels using North Kalibaru Terminal.

Revenue of Terminal Operator is wharfage, charges for mooring and unmooring, hatch opening and closing, container handling charge, container storage charge, charge for PTI (pre-trip investigation) on reefer container and lift on lift off charge at yard

Financial Resources

Investment cost of the Port Authority is financed by soft loan with 0.3% interest, loan term of 30 years and grace period of 3 years (considering the average preparation period for tender of construction work after loan agreement) on initial investment excluding VAT and administration cost.

Investment cost of the Terminal Operating Company (Concessionaire) is from its capital cost (30%/40%) and loan from the bank (13% interest, repayment 10 years after completion of construction for 70%/60% of total investment cost.

2) Cases of Financial Analysis

For the purpose of financial analysis and sensitivity analysis, initial investment cost sharing between PA and TOC is assumed to be as follows;

PA : breakwater, channel, inner port road, security and utility and (reclamation)
TOC : terminal facilities and equipment including quay wall and (reclamation)

Reclamation is conducted either by PA or TOC

Evaluation of cases are conducted using financial indicators of FIRR (financial internal rate of return), profitability (rate of return on net fixed assets), operating ratio, working ratio, debt service covering ratio and retained earnings at the end of concession period.

Possible scheme is firstly selected by evaluating FIRR of both PA and TOC; results are shown in Table 9.4-2.[1]

From this table, the most desirable scheme is considered to be the case where PMB bears investment cost for reclamation and TOC provides the financial resource with debt/equity of 60/40 (case-9).

If investment cost for reclamation is borne by TOC (case-8), it is rather difficult to expect a reasonable return on investment and TOC will suffer from serious deficit in the initial years of operation.

[1] In evaluating financial viability, it is generally considered to be feasible if FIRR is over the average interest rate, but in this case it is considered that equity should also return to shareholders with a rate at least similar to the interest rate.

Table 9.4-2 FIRRs of Both PA and TOC

Finance Condition	Reclamation	Accounting	70/30(13%)	60/40(13%)	70/30(5%)*
TOC	Base Case	PA	4.89%	4.89%	4.89%
		TOC	12.94%	13.16%	13.98%
PA		PA	4.27%	4.27%	4.27%
		TOC	16.92%	17.17%	18.07%
TOC	Demand -10%	PA	4.76%	4.76%	4.76%
		TOC	12.27%	12.48%	13.25%
PA		PA	4.19%	4.19%	4.19%
		TOC	15.89%	16.12%	16.94%
TOC	Cost +10%	PA	4.47%	4.47%	4.47%
		TOC	12.22%	12.43%	13.22%
PA		PA	4.02%	4.02%	4.02%
		TOC	16.15%	16.39%	17.26%

*: Reference only
Source: JICA Study Team

Under 10% variable fee condition, retained earnings at the end of concession period are considerably imbalanced (TOC=$756million, PA=$390 million)

If the variable portion of concession fee is raised to 15% after 5 years of initial operation, imbalance would be greatly improved (TOC=$685mill, PA=$568million) without causing any serious problem to TOC.

3) Recommended PPP Scheme

Considering the stipulation of Government Regulation No.61 year 2009 and results of financial analysis, following scheme is recommended to be applied to the development of Kalibaru Phase I urgent project.

In many cases of concession, concessionaire is often obligated to maintain debt/equity ratio of 60/40 for the terminal operation avoid serious financial risk and to ensure that the terminal remains public use.

Furthermore, it is reasonable to reserve the proprietorship of terminal land by the public sector considering the concession condition set forth in ii) of Article 71 of Government Regulation No. 61.

In order to balance profitability between TOC and PA and considering the rather unfavorable demand in the initial years of operation, variable portion of concession fee is better to be set as 10% for the first 5 years and 15% thereafter.

Summarizing above, recommended PPP scheme is as follows;

Investment Demarcation	:	PA invests in breakwater, channel and basin, inner road, security and utility facilities and reclamation TOC invests in quay wall and equipment
Financial Scheme	:	PA request soft loan similar to STEP of JICA TOC prepares 40% by its own equity and 60% from commercial bank
Concession Period	:	30 years after commencement of operation with fixed fee of about $5.4mil/year and variable fee of 10% of revenue for the first 5 years and 15% of revenue thereafter.