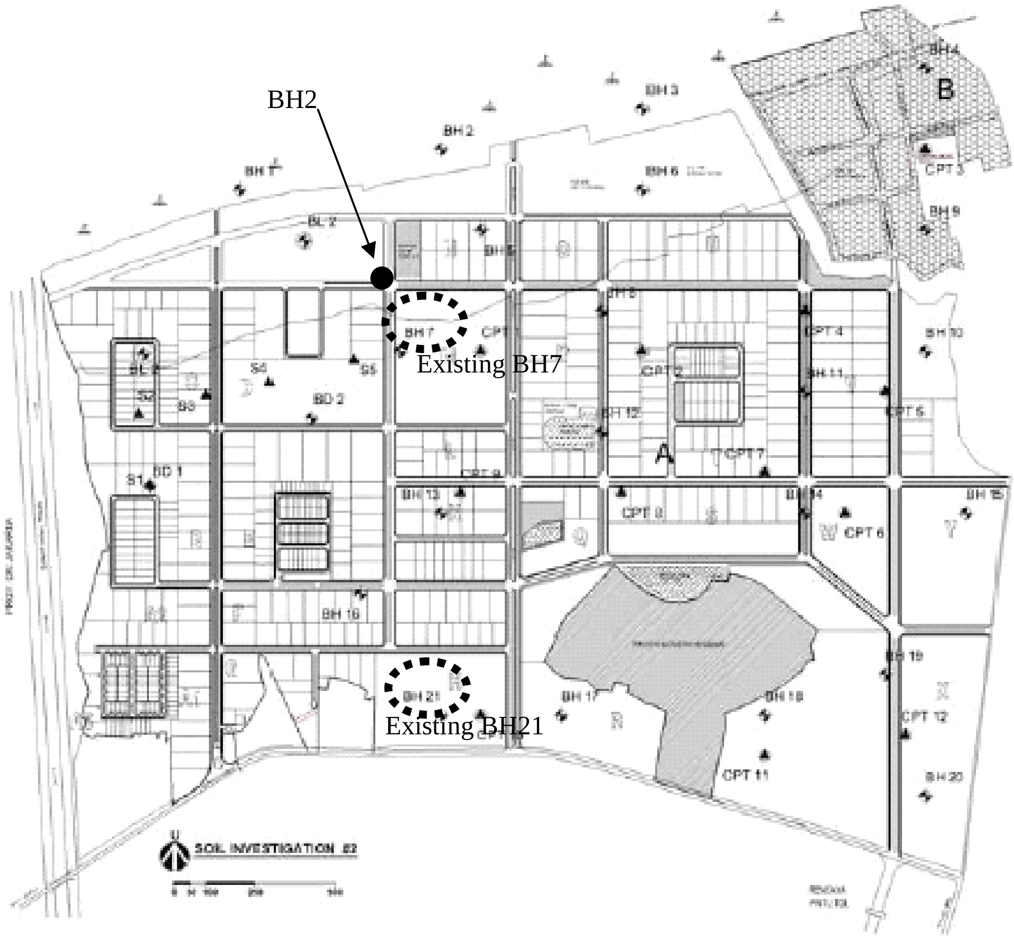
(2) Marunda-Bekasi

1) Existing Borehole Data

The private investor for development of the Marunda Center had carried out number of subsoil conditions surveys including exploratory boring, undisturbed sampling and laboratory test in their commercial area.

The developer shared the soil data as obtained with the JICA study team. The location and soil profile of the subsoil conditions survey as carried out by them are shown in Figure 3.5-9 and Figure 3.5-10.

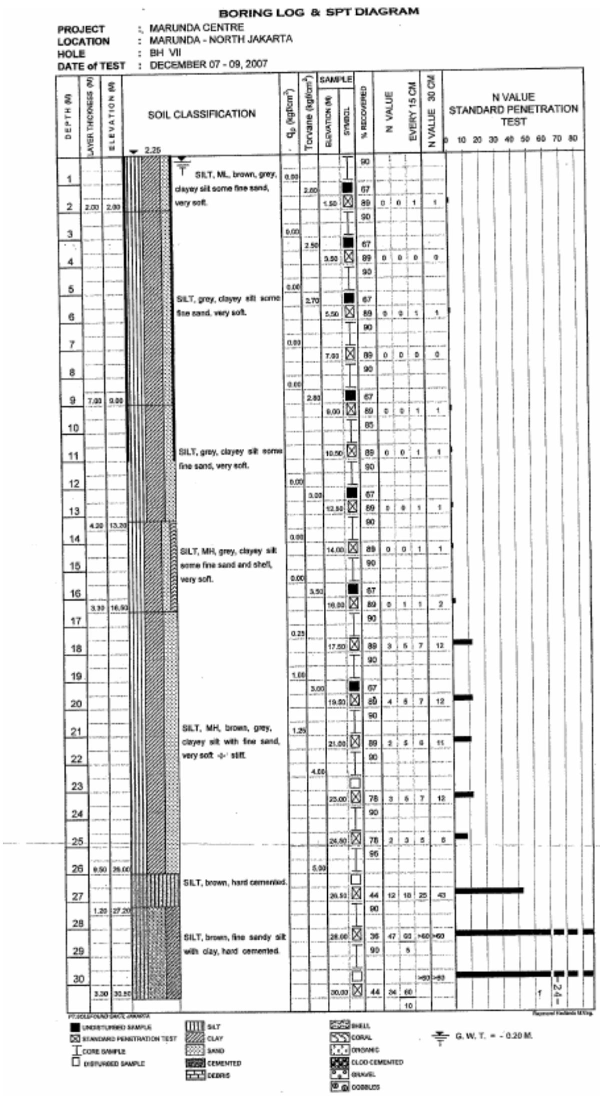
The survey indicates that the very soft layer (N value = 0 to 3) assumed deposited in alluvium covers the top of the surface, and medium stiff clayey silt, likely Pleistocene sediment (N-value = 5 to 12), is laid below the alluvium sediment. Stiff to hard clayey silt appeared under the Pleistocene sediment at Existing-BH7. The N-value of this hard silt shows 40 to 60 or over.



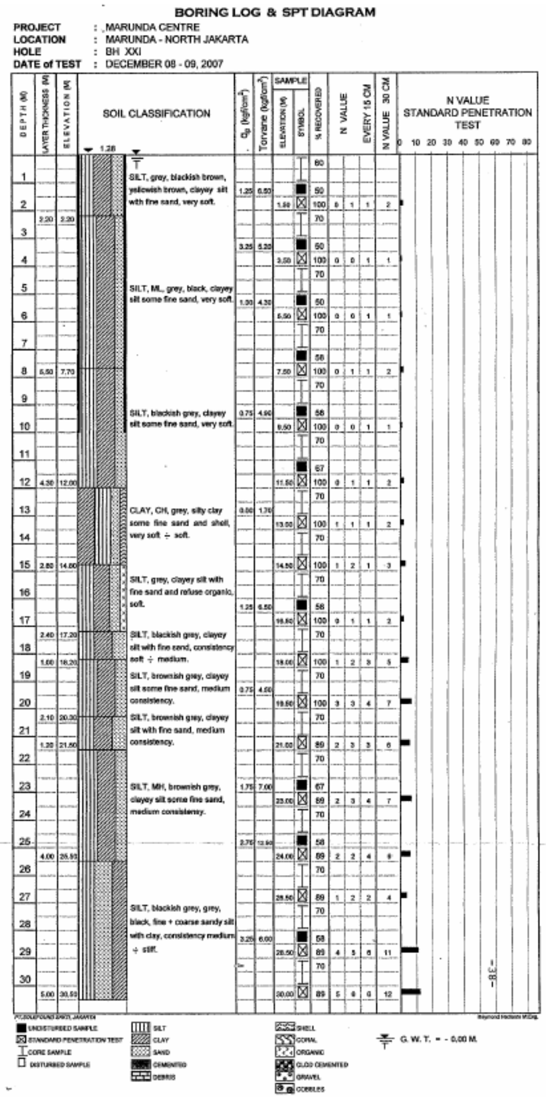
Source: Location map provided by "Marunda Center"

Figure 3.5-9 Location map of existing Boreholes in Marunda Center

BH7



BH21



Source: Borehole logs provide by "Marunda Center"

Figure 3.5-10 Borehole Logs in Marunda Center

2) Outline of Boring Logs

Two onshore borings and three offshore borings are carried out in Marunda-Bekasi in this study. The boring results are summarized in the following Table 3.5-4 – Table 3.5-8. According to the results, the thickness of soft layer (i.e. N=4 or less) in this area ranges from 12m at BH04 to 21m at BH05.

Hard layer (i.e. N=30 or over) appears at -23.8m at BH02 to -34.9m at BH01, and dominated clayey silt or silty clay with sand. It consists of silty sand at BH03.

Table 3.5-4 Result of Boring log at BH01

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-4.70.0~-17.70	Silty clay	2 to 3	Very soft and soft consistency, grey in color
-17.70~28.70	Silty clay	5 to 14	Stiff consistency, brown in color
-28.70~34.90	Clayey Silt	26 to 27	Very stiff consistency, brown in color
-34.90~-36.20	Silty clay	60over	Very dense, dark grey in color

Source: JICA Study Team

Table 3.5-5 Result of Boring log at BH02

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
2.20~-1.80	Silty clay	2	Soft consistency, grey in color
-1.80~-4.80	Sandy clayey silt	8, 10	Hard consistency, grey in color
-4.80~-23.80	Silty clay or Clayey silt	2 to 5	Soft to medium stiff consistency, grey in color
-23.80~-27.80	Sandy silt or Silty Sand	60over	Hard consistency, brown in color

Source: JICA Study Team

Table 3.5-6 Result of Boring log at BH03

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-6.00~-20.00	Silty clay	1 to 4	Very soft or soft consistency and grey in color
-20.00~-29.00	Silty clay or Cemented Silt	6 to 47	Stiff or hard consistency, brown in color
-29.00~-33.00	Silty sand	60 over	Very hard consistency, dark brown in color

Source: JICA Study Team

Table 3.5-7 Result of Boring log at BH04

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
0.40~-16.60	Silty clay or Sandy silty clay	2 to 6	Soft or medium stiff consistency, grey in color
-16.60~-25.60	Silty Clay	7 to 14	Stiff consistency, grey in color
-25.60~-27.80	Sandy silt	60 over	Hard consistency, dark brown in color

Source: JICA Study Team

Table 3.5-8 Result of Boring log at BH05

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-3.00~-24.00	Silty clay	1 to 3	Very soft or soft consistency and grey in color
-24.00~-28.50	Silty clay	6 to 7	Medium stiff consistency, grey in color
-28.50~-33.00	Sandy silt	60 over	Very hard consistency, brownish grey in color

Source: JICA Study Team

3) Laboratory test

Both disturbed samples and undisturbed samples of thin-wall sampling were subjected to physical testing in laboratory to gain the information of physical characteristics of the soils. The results of physical tests are shown in Table 3.5-9 and Table 3.5-10.

Water content of Ac layer tends to be close to Liquid Limit (L.L) while the one of Dc and Tc tend to be in the middle between L.L. and Plastic Limit (P.L.). Ac and Dc are mostly composed of Silt and Clay.

The strengths of unconfined compression test (qu) are 0.25 to 0.56 kg/cm2. OCR calculated from Pre-consolidation stress (Pc) and Effective Pressures at a sampling depth (Pe) vary from 0.31 to 2.13. However, Pc of BH02 is not obvious enough to be identified according to e-logP curve, so OCR should be considered as 0.68 to 2.13.

Table 3.5-9 Summary of Average for Each Layer (Physical test)

Layer	Specific Gravity	Water Content (%)	Atterberg Limit (%)		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	2.608	86.76	98.48	36.65	0	5.47	36.12	58.42
Dc	2.605	53.03	79.44	34.70	0	4.06	35.76	60.18
Tc	2.615	50.04	79.60	34.75	0	23.68	30.75	45.57
Tc	2.615	50.04	79.60	34.75	0	23.68	30.75	45.57

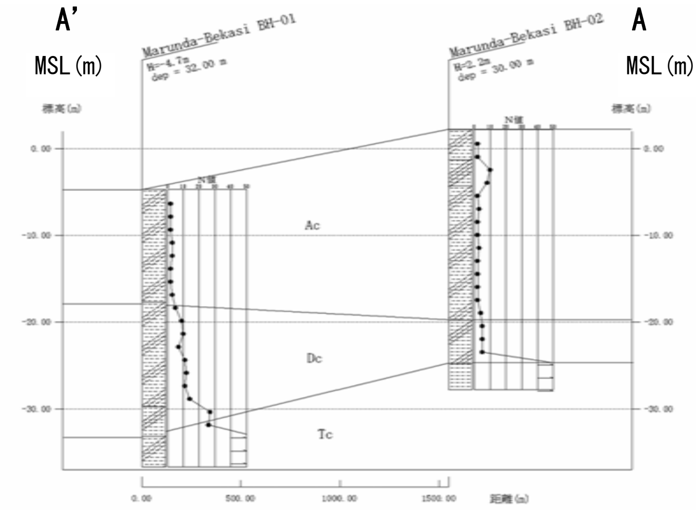
Source: JICA Study Team

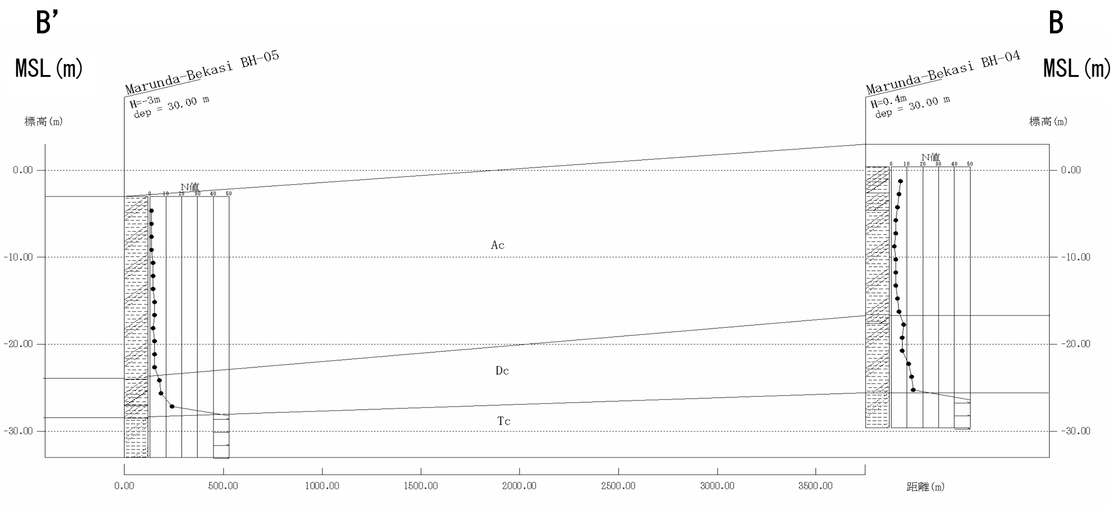
Table 3.5-10 Summary of Average for Each Layer (Mechanical test)

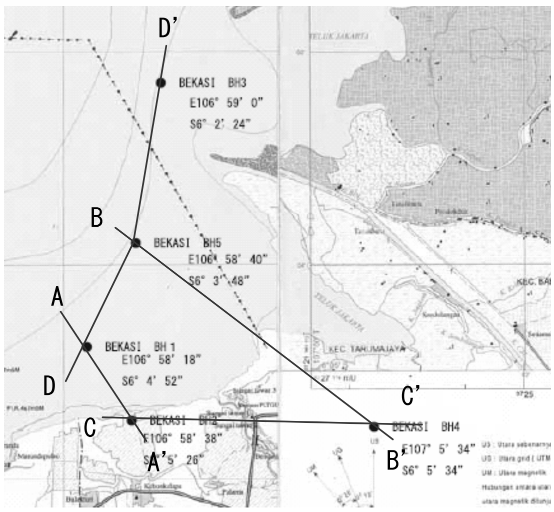
Item		BH01	BH02	BH03	BH04	BH05
Unit Weight	γt (g/cm^3)	1.517	1.504	1.474	1.489	1.484
Unconfined Compression Test	qu (kg/cm^2)	0.41	0.56	0.25	0.45	0.37
Consolidation Test	Cv (cm2/sec)	5.272 ×10-4	5.022 ×10-4	2.260 ×10-4	3.453 ×10-4	4.262 ×10-4
	Cc	0.58	0.36	2.24	1.47	0.92
	Pc (kg/cm^2)	1.5	1.5	0.68	0.765	0.76
Effective Pressure at Sampling depth	Pe (kg/cm^2)	0.84	4.90	0.92	0.36	1.11
Over Consolidated Ratio	OCR	1.79	0.31	0.74	2.13	0.68

Source: JICA Study Team

4) Subsoil Profile

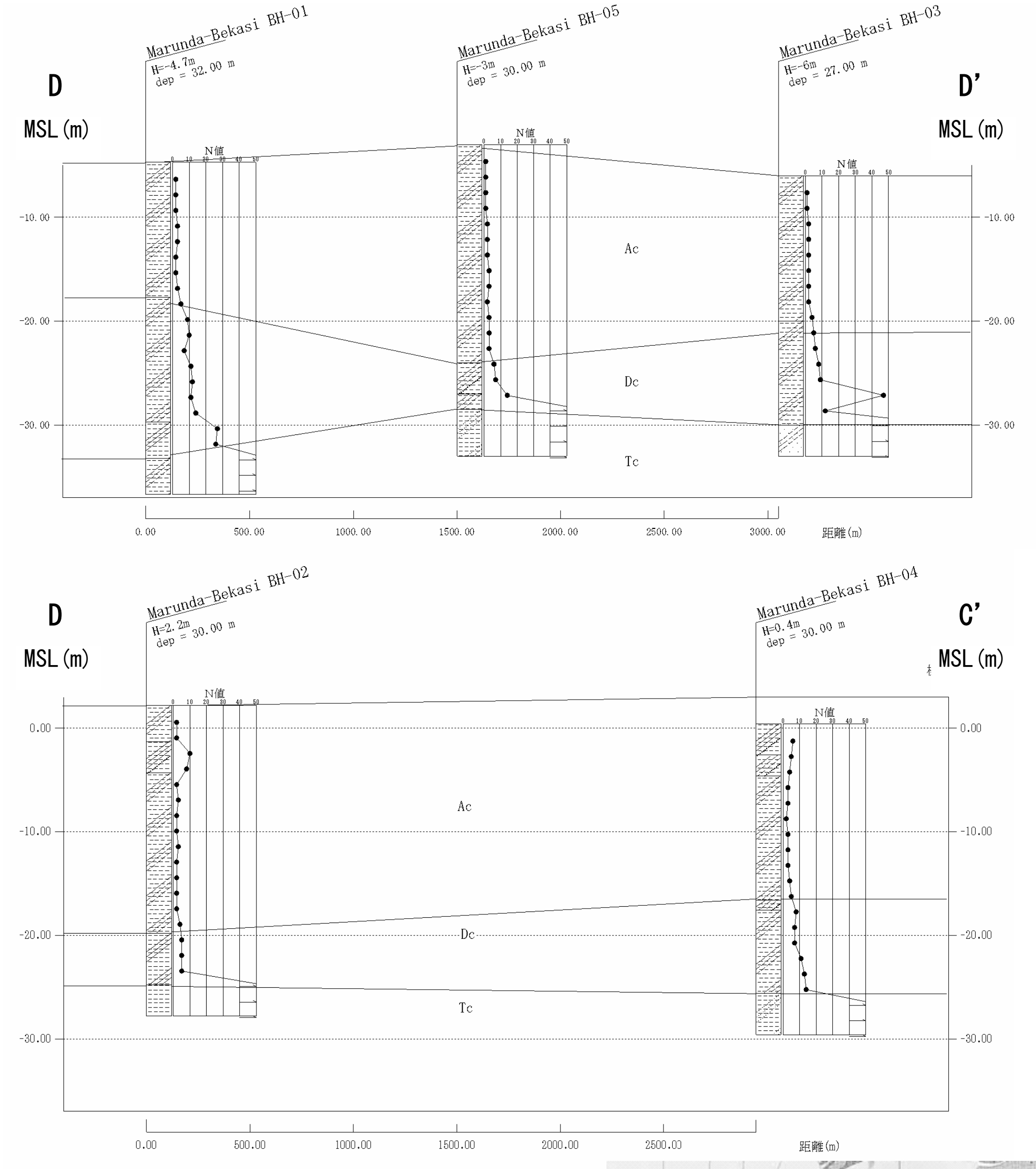


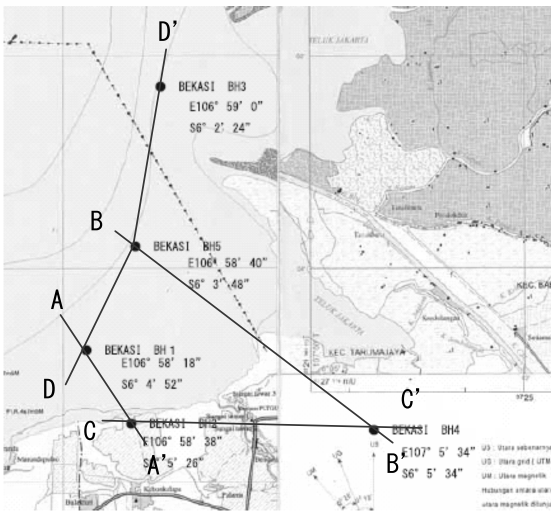




Source: JICA Study Team

Figure 3.5-11 Subsoil Profile in Marunda-Bekasi





Source: JICA Study Team

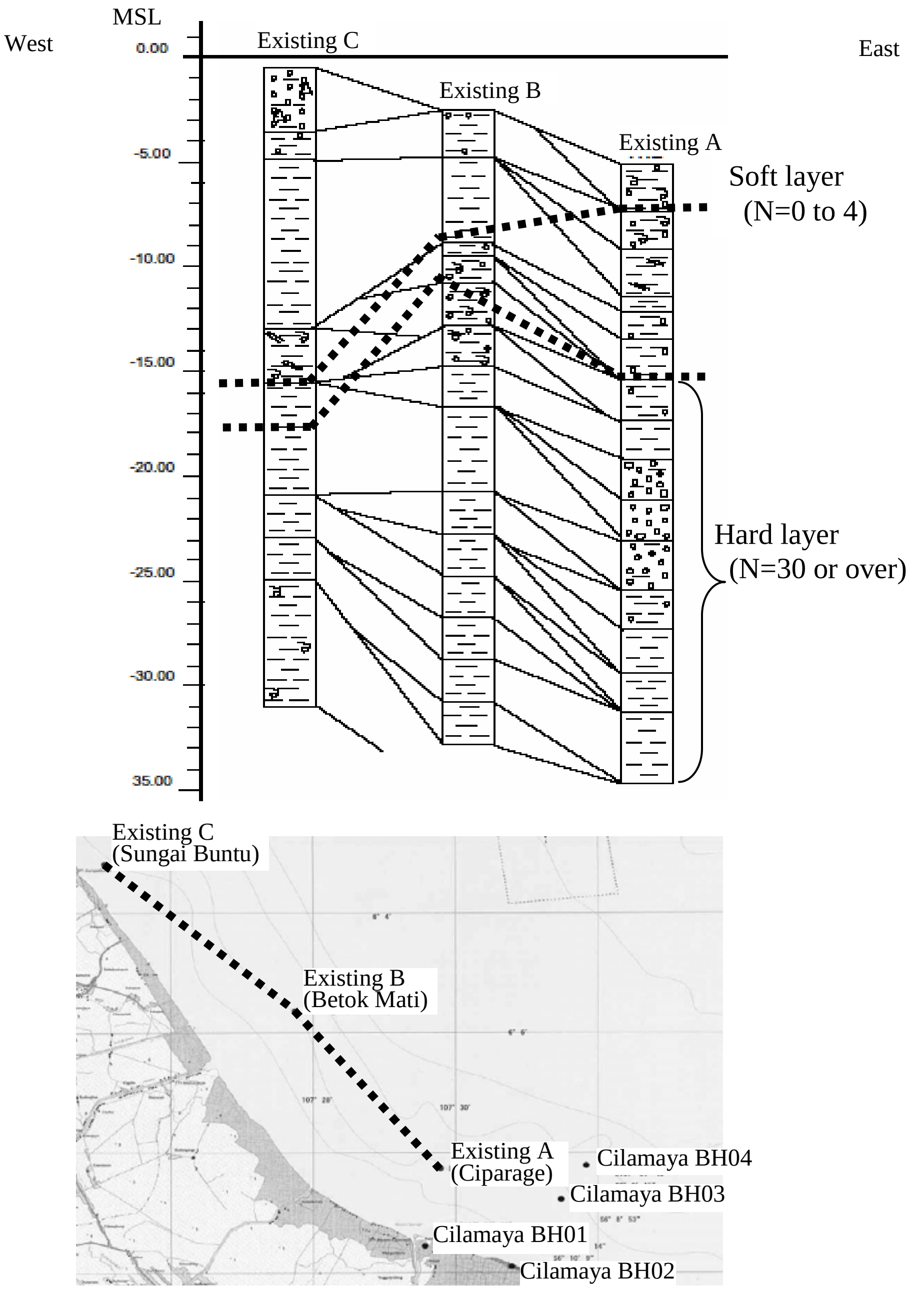
Figure 3.5-12 Subsoil Profile in Marunda-Bekasi

(3) Cilamaya

1) Existing borehole data

Soil investigations were carried out on the west side of the candidate study area by a local consultant in 2005. As for the location of the boreholes, reference is made to Figure 3.5-2. The subsoil profile drawn by the local consultant is shown in Figure 3.5-13.

The thickness of the soft layer decreases towards east and appearance elevation of the hard layer (N=30 or over) varies from -11m at Existing B to -18m at Existing C.



Source: Soil Investigation Report-Kegiatan Feasibility Study Pelabuhan Cilamaya-2005" by PT. Rayasurverindo Tirtasarana

Figure 3.5-13 Subsoil Profile of existing data in Cilamaya

2) Outline of boring logs

Boring results are summarized in the below tables. According to the results, the thickness of soft layer (i.e. N=4 or less) in this area ranges from 0m at BH04 to 12m at BH01, and is especially thinner in off shore area than onshore area.

Hard layer (i.e. N=30 or over) appears at MSL-17m, -18m at BH03, 04 while it appears at -31m at BH02. At BH01, the hard layer appears below -57.59m. The difference of its appearance elevation between BH01 and other boreholes was assumed to be due to the river erosion during the glacial era in the past.

Table 3.5-11 Result of Boring log at BH01

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
0.41~-8.59	Silty clay	0 to 3	Very soft consistency and grey in color, alluvial layer
-8.59~-12.09	Clayey Silt	3 to 5	Medium stiff consistency and grey in color, Pleistocene layer
-12.09~-27.59	Clayey silt	12 to 24	Stiff or very stiff consistency and grey in color, early Pleistocene or late Neogene layer
-27.59~-27.99	Cemented silt	-	Very stiff
-27.99~-59.59	Clayey silt	20 to 60over	Sometimes cemented, Very stiff to hard consistency and grey in color

Source: JICA Study Team

Table 3.5-12 Result of Boring log at BH02

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
0.21~-6.79	Silty clay	1 to 2	Very soft consistency, grey in color
-6.79~-7.79	Sandy silt	10	Medium stiff consistency , grey in color
-7.79~-19.29	Silty clay	11 to 22	Stiff to very stiff consistency, brownish grey in color
-19.29~-24.79	Clay silt	15 to 16	Stiff consistency, brownish grey in color
-24.79~-32.79	Cemented clay silt	45 to 60 over	Hard consistency, grey in color

Source: JICA Study Team

Table 3.5-13 Result of Boring log at BH03

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-4.00~-5.00	Clayey silt with fragmental shell	-	Soft consistency and grey in color
-5.00~-8.00	Clayey silt	3	Soft consistency, grey in color
-8.00~-10.00	Clayey silt	26	Very stiff consistency, brown in color
-10.00~-17.00	Clayey silt	9 to 23	Stiff to very stiff consistency and brown to brownish in color
-17.00~-24.00	Cemented sandy silt to cemented silt	45 to 60	Hard consistency, grey in color

Source: JICA Study Team

Table 3.5-14 Result of Boring log at BH01

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-7.00~-9.00	Clayey silt	12	Stiff consistency, grey in color
-9.00~-12.00	Cemented sandy silt	60 over	Hard consistency, brown in color
-12.00~-18.00	Clay silt	23 to 28	Very stiff consistency, light brown to brownish grey in color
-18.00~-20.00	Cemented clayey silt	33	Hard consistency, grey in color
-20.00~-21.50	Silty sand mixed with gravel	47	Dense condition, grey in color
-21.50~-25.00	Cemented clayey silt	37 to 60over	Hard consistency, brown in color

Source: JICA Study Team

3) Laboratory test

Both disturbed samples and undisturbed samples of thin-wall sampling were subjected to physical testing in laboratory to obtain information on the physical characteristics of the soils. The results of physical tests are shown in Table 3.5-15 and Table 3.5-16.

Water content of Ac layer tends to be close to Liquid Limit (L.L) while the one of Dc and Tc tends to be in the middle between L.L. and Plastic Limit (P.L.) or close to P.L. Ac and Dc are mostly occupied by Silt and Clay. The strengths of unconfined compression test (qu) are 0.08 to 0.13 kg/cm2. OCR calculated from Pre-consolidation stress (Pc) and Effective Pressure at a sampling depth (Pe) vary from 1.67 to 10.8. However, Pc of BH02 is not obvious enough to be identified according to e-logP curve, so OCR should be considered as 1.67 to 2.73.

Table 3.5-15 Summary of Average for Each Layer (Physical test)

Layer	Specific Gravity	Water Content (%)	Atterberg Limit (%)		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	2.579	93.04	101.64	36.09	0	5.27	36.66	58.07
Dc	2.619	42.26	73.20	33.94	0	11.16	35.61	53.99
Tc	2.650	32.81	77.83	34.51	0	20.43	33.03	46.58

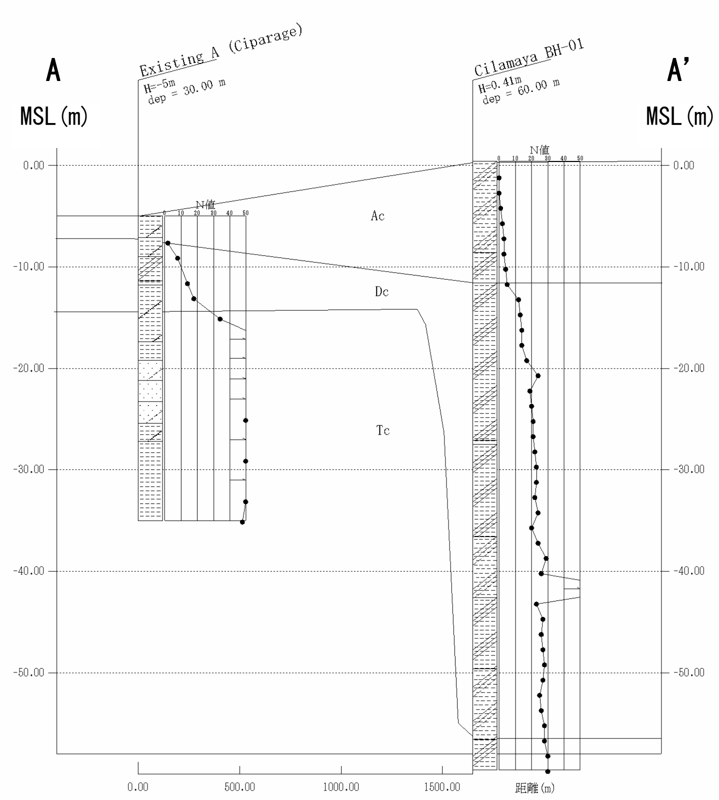
Source: JICA Study Team

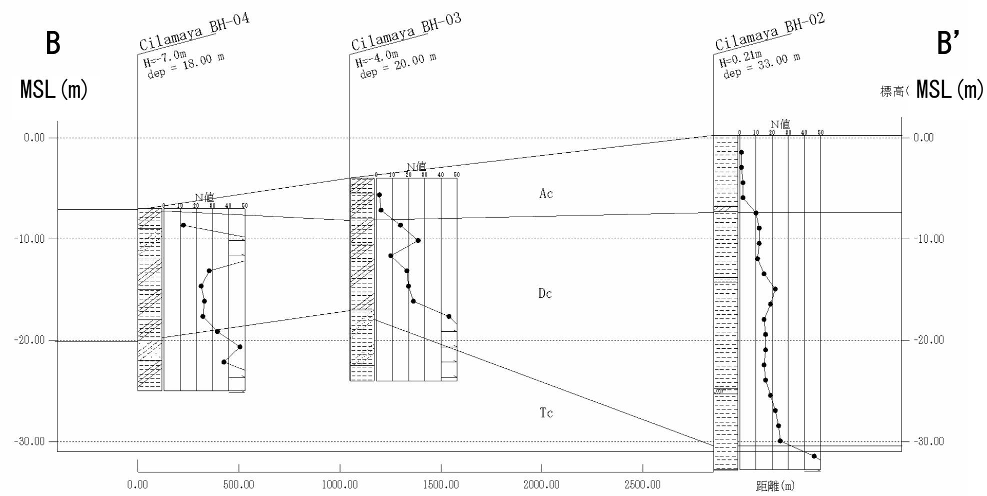
Table 3.5-16 Summary of Average for Each Layer (Mechanical test)

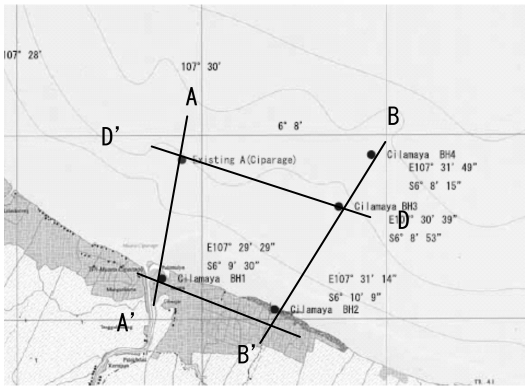
Item		BH01	BH02	BH03
Unit Weight	γt (g/cm^3)	1.229	1.354	1.39
Unconfined Compression Test	qu (kg/cm^2)	0.08	0.1	0.13
Consolidation Test	Cv (cm^2/sec)	4.251×10-4	4.021×10-4	3.027×10-4
	Cc	1.9	0.81	0.5
	Pc (kg/cm^2)	0.5	2.6	1.39
Effective Pressure at Sampling depth	Pe (kg/cm^2)	0.30	0.24	0.51
Over Consolidated Ratio	OCR	1.67	10.8	2.73

Source: JICA Study Team

4) Subsoil Profile

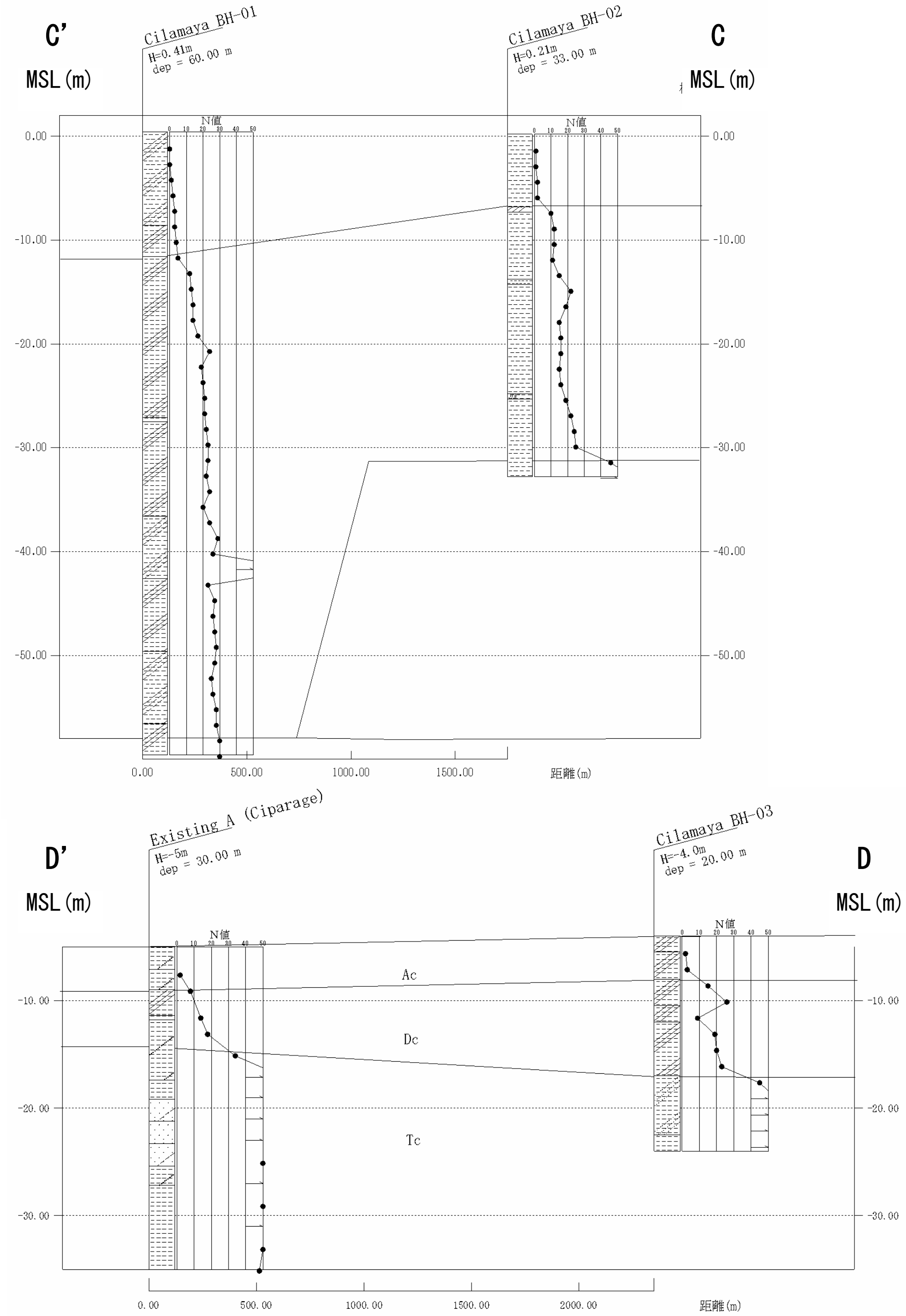


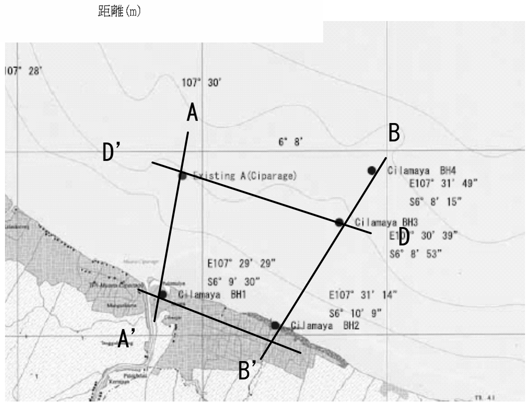




Source: JICA Study Team

Figure 3.5-14 Subsoil Profile in Cilamaya





Source: JICA Study Team

Figure 3.5-15 Subsoil Profile in Cilamaya

(4) Ciasem

1) Outline of boring logs

Boring results are summarized in the below tables. According to the results, the thickness of soft layer (i.e. N=4 or less) is thin, from 2m at BH02 to 5m at BH01.

Hard layer (i.e. N=30 or over) appears at -21.40 m, -31 m at BH01, 02.

Table 3.5-17 Summary of Boring log at BH01

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
0.60~-4.40	Sandy silty clay with fragmental shell	1 to 4	Soft consistency, grey in color
-4.40~-11.60	Silty clay	10 to 15	Stiff consistency , brown in color
-11.60~-21.40	Silty clay	15 to 24	Very stiff consistency, brown in color
-21.40~-25.40	Cemented clayey silt	60 over	Hard consistency, grey in color
-25.40~-28.40	Silty sand mixed with gravel	60 over	Very dense condition, grey in color

Source: JICA Study Team

Table 3.5-18 Summary of Boring log at BH02

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-7.00~-9.00	Sandy silt	1	Very soft, grey in color
-9.00~-20.00	Clayey silt	9 to 17	Stiff consistency , grayish brown in color
-20.00~-24.00	Clayey silt	17 to 21	Very stiff consistency, grey in color
-24.00~-27.00	Cemented clayey silt	36 to 40	Hard consistency, grey in color
-27.00~-31.00	Silty clay	21 to 22	Very stiff consistency, grayish brown in color
-31.00~-33.00	Cemented silty clay	57 to 60	Hard in consistency, grey in color
-33.00~-34.00	Sand mixed with gravel	60 over	Very dense, grey in color

Source: JICA Study Team

2) Laboratory test

Both disturbed samples and undisturbed samples of thin-wall sampling were subjected to physical testing in laboratory to obtain information on the physical characteristics of the soils. The results of physical tests are shown in Table 3.5-19 and Table 3.5-20.

Average of water content of Ac layer is beyond Liquid Limit (L.L) while the one of Dc and Tc tend to be in the middle between L.L. and Plastic Limit (P.L.). All the layers are mostly composed of Silt and Clay.

The strengths of unconfined compression test (qu) are 0.17 to 0.2 kg/cm2. OCR calculated from Pre-consolidation stress (Pc) and Effective Pressure at a sampling depth (Pe) vary from 1.61 to 1.73.

Table 3.5-19 Summary of Average for Each Layer (Physical test)

Layer	Specific Gravity	Water Content (%)	Atterberg Limit (%)		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	2.522	71.29	62.10	31.37	0	4.91	38.59	56.50
Dc	2.611	45.67	63.55	31.76	0	3.90	42.78	53.33
Tc	2.618	43.90	65.06	32.17	0	3.69	48.56	47.75

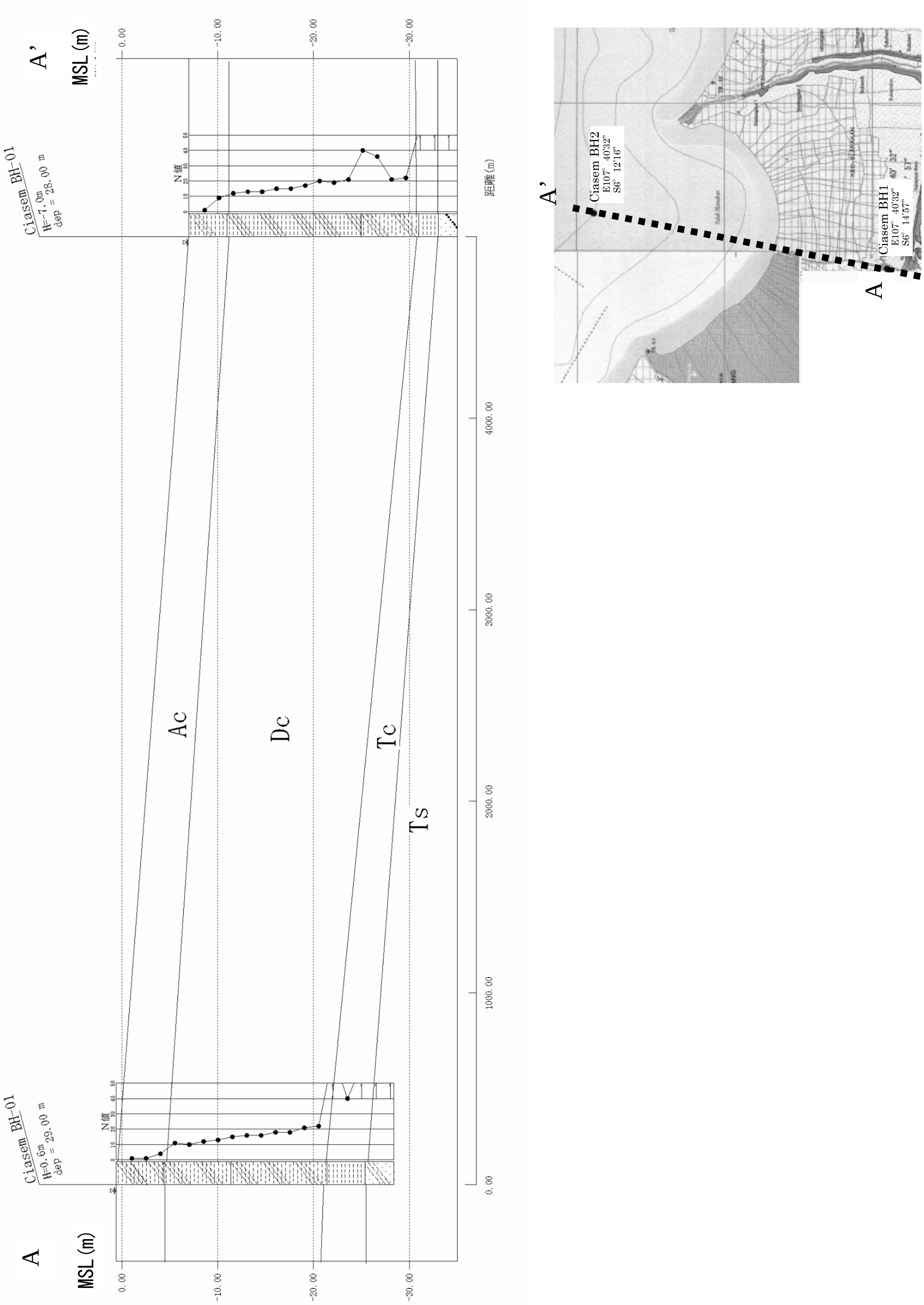
Source: JICA Study Team

Table 3.5-20 Summary of Average for Each Layer (Mechanical test)

Item		BH01	BH04
Unit Weight	γt (g/cm^3)	1.518	1.618
Unconfined Compression Test	qu (kg/cm^2)	0.2	0.17
Consolidation Test	Cv (cm^2/sec)	4.134×10-4	3.622×10-4
	Cc	1.08	0.29
	Pc (kg/cm^2)	0.52	1.4
Effective Pressure at Sampling depth	Pe (kg/cm^2)	0.30	0.87
Over Consolidated Ratio	OCR	1.73	1.61

Source: JICA Study Team

3) Subsoil Profile



Source: JICA Study

Figure 3.5-16 Subsoil Profile in Ciasem

(5) Tangerang

1) Outline of boring logs

Boring results are summarized in the below tables. According to the results, the thickness of soft layer (i.e. N=4 or less) in this area ranges from 5 m at BH01 to 13 ~ 17 m at BH02, 03 and 04.

Hard layer (i.e. N=30 or over) appears at -39.5m, -32.4m at BH03, 04 while it appears at -32.5 m, -15.2 m depth at BH01, 02. Soft layer thickness is thicker and hard layer is deeper in the west side area than in the east side area.

Table 3.5-21 Result of Boring log at BH01

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-8.00~-13.00	Silty clay	0	Very soft consistency, dark grey in color
-13.00~-29.50	Silty clay	13 to 25	Very stiff consistency , light grey or reddish brown in color
-29.50~-33.50	Clayey Silt	22 to 33	Very stiff consistency, light grey in color
-33.50~-38.00	Silty sand with gravel	60over	Very dense, dark grey in color

Source: JICA Study Team

Table 3.5-22 Result of Boring log at BH02

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
0.80~0.20	Silty fine sand	-	Loose, dark grey in color
0.20~-12.20	Silty clay	0	Very soft consistency , dark grey in color
-12.20~-15.20	Silty clay	13, 19	Medium stiff to very stiff consistency, dark grey in color
-15.20~-20.70	Sandy silt or Silty Sand	41 to 60over	Hard consistency or very dense condition, dark grey in color
-20.70~-29.20	Silty clay or Sandy clay	11 to 38	Stiff to very stiff consistency, dark grey in color

Source: JICA Study Team

Table 3.5-23 Result of Boring log at BH03

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-8.00~-25.00	Silty clay or clayey silt	0 to 4	Very soft or soft consistency and dark grey in color, alluvium sediment
-25.00~-36.00	Silty clay with organic	0 to 8	Very soft or very stiff consistency, dark grey in color
-36.00~-43.00	Sandy silty clay	21 to 41	Very stiff consistency, dark brown in color, early Pleistocene or Neogene
-43.00~-47.00	Sandy clayey silt	48 to 60	Hard consistency and dark grey in color

Source: JICA Study Team

Table 3.5-24 Result of Boring log at BH04

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
0.60~-14.40	Silty clay	0 to 3	Very soft or soft consistency, dark grey in color
-14.40~-18.90	Silty Clay	4 to 6	Medium stiff consistency, light grey in color
-18.90~-32.40	Silty Clay	14 to 26	Very stiff consistency, light brown in color
-32.40~-38.40	Silty Clay or Sandy clayey silt	33 to 60	Very stiff to hard consistency, light brownish grey in color

Source: JICA Study Team

2) Laboratory test

Both disturbed samples and undisturbed samples of thin-wall sampling were subjected to physical testing in laboratory to obtain information on the physical characteristics of the soils. The results of physical tests are presented in Table 3.5-25 and Table 3.5-26.

Water content of Ac layer is close to Liquid Limit (L.L) while the one of Dc is in the middle between L.L. and Plastic Limit (P.L.). Water content of Tc is close to P.L. relatively. Ac and Dc are mostly occupied by Silt and Clay.

The strengths of unconfined compression test (qu) are 0.16 to 0.33 kg/cm^2. OCR calculated from Pre-consolidation stress (Pc) and Effective Pressure at a sampling depth (Pe) vary from 0.88 to 1.36.

Table 3.5-25 Summary of Average for Each Layer (Physical test)

Layer	Specific Gravity	Water Content (%)	Atterberg Limit (%)		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	2.566	79.41	95.69	36.57	0	4.58	34.22	61.31
Ds	2.601	51.94	80.83	34.27	0	14.84	28.16	57.00
Dc	2.610	37.45	65.30	32.22	0	2.60	37.15	60.25
Tc	2.675	28.02	68.30	34.56	0	19.34	43.02	37.67

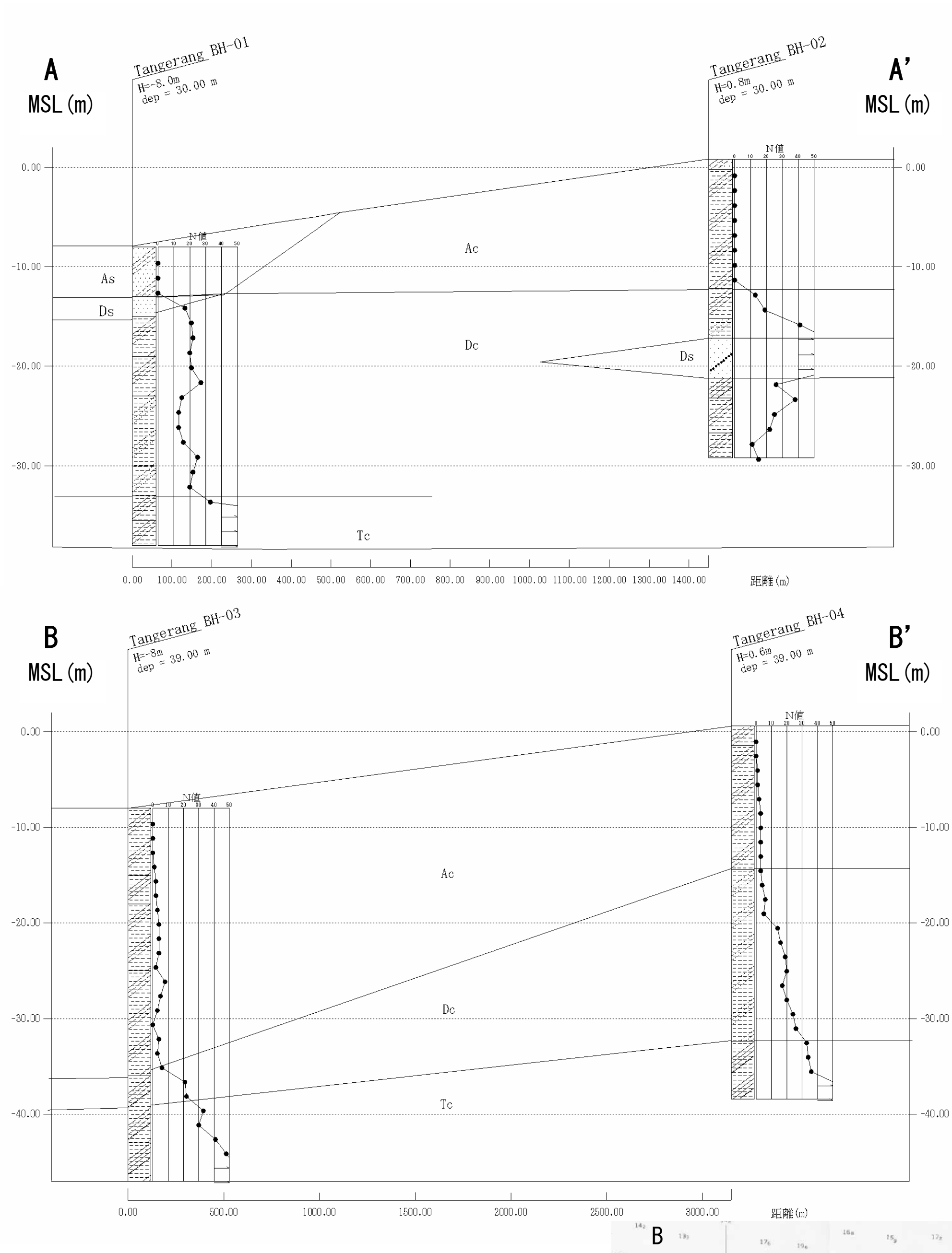
Source: JICA Study Team

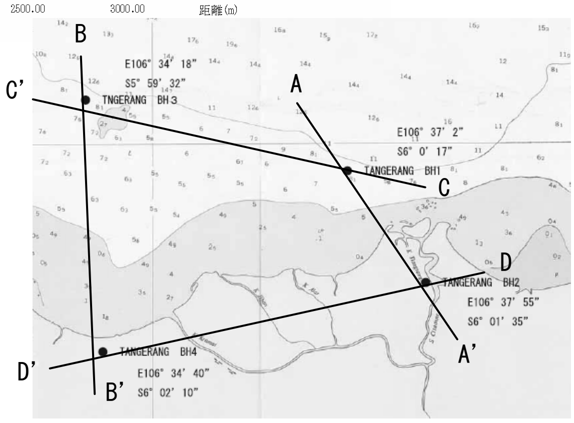
Table 3.5-26 Summary of Average for Each Layer (Mechanical test)

Item		BH01	BH02	BH03	BH04
Unit Weight	γt (g/cm^3)	1.621	1.608	1.445	1.481
Unconfined Compression Test	qu (kg/cm^2)	0.31	0.33	0.16	0.21
Consolidation Test	Cv (cm^2/sec)	6.442×10-4	7.856×10-4	3.963×10-4	5.781×10-4
	Cc	0.67	0.22	1.56	0.92
	Pc (kg/cm^2)	1.5	0.9	1.16	0.82
Effective Pressure at Sampling depth	Pe (kg/cm^2)	1.10	0.94	1.32	0.62
Over Consolidated Ratio	OCR	1.36	0.96	0.88	1.32

Source: JICA Study Team

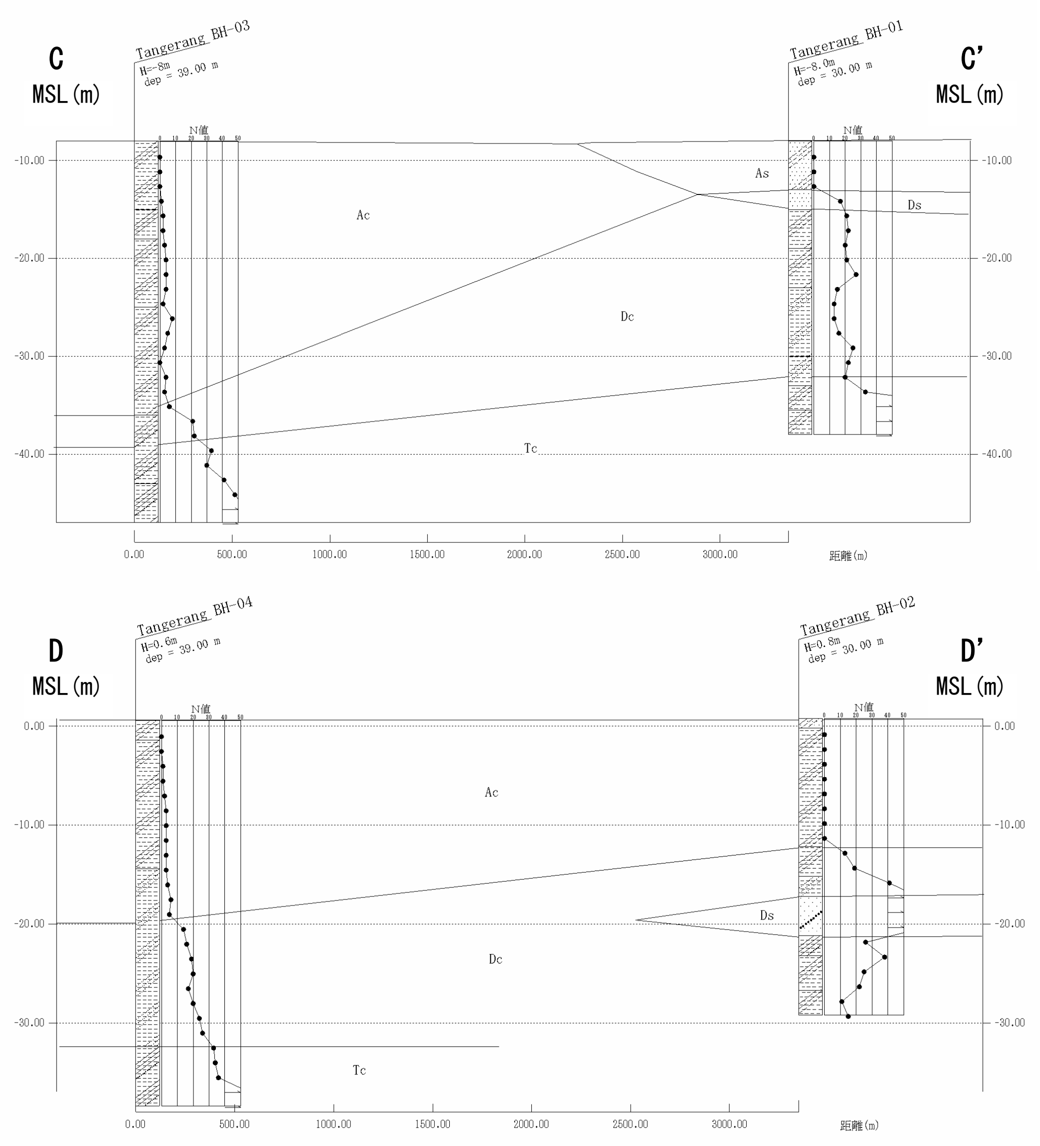
3) Subsoil Profile

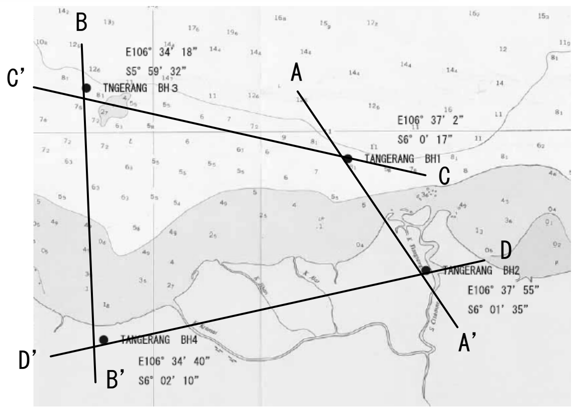




Source: JICA Study Team

Figure 3.5-17 Subsoil Profile in Tangerang





Source: JICA Study Team

Figure 3.5-18 Subsoil Profile in Tangerang

3.5.3 North Kalibaru

(1) Subsoil conditions survey

In response to the request for a further examination of subsoil at North Kalibaru, an additional subsoil investigation was planned to get the actual soil condition at offshore Tanjung Priok Port. The additional borehole locations were decided by considering the planned port area. BH01 was within the proposed navigation dredging area. BH02 was on the periphery of the proposed reclamation area. BH03 was in the proposed reclamation area and located on the same longitude of BH01 and closer to the landside.

Site works were executed during the northwest monsoon season, and high waves and rainfall disturbed the works frequently, especially in the afternoon. Attention also had to be paid to securing site safety.

Each boring location was decided by the portable GPS induction. After the confirmation of locations, bamboo platform was assembled and boring machine was installed properly on it. Offshore boring was conducted at MSL-5.1 m (BH01), -7.1 m (BH02) and -9.2 m (BH03).

The summary of soil investigation is shown in Table 3.5-27. The coordinates and the elevation of boreholes are shown in Table 3.5-28.

Laboratory tests were carried out based on the standards shown in Table 3.5-29.

Table 3.5-27 Summary of Soil Investigation

Area	Bore hole No.	Onshore /Offshore	Drilling Length	SPT	Undisturbed Sampling	Laboratory Test	
						Physical Test	Mechanical Test
North Kalibaru	BH01	Off Shore	30 m	20	1	11	1
	BH02	Off Shore	30 m	20	1	11	1
	BH03	Off Shore	30 m	20	1	11	1
TOTAL			90 m	60	3	33	3

Source: JICA Study Team

Table 3.5-28 Location and Elevation of Boreholes

Area	Borehole No.	Coordinate		Elevation
		Latitude	Longitude	
North Kalibaru	BH01	S 06o 04’ 25.0”	E 106o 54’ 00.0”	-9.2m
	BH02	S 06o 04’ 51.3”	E 106o 54’ 46.2”	-7.1m
	BH03	S 06o 05’ 17.7”	E 106o 53’ 59.4”	-5.1m

Source: JICA Study Team

Table 3.5-29 Standards for Laboratory Tests

Physical tests		Mechanical Tests	
Items	Standard	Items	Standard
Grain Size	ASTM D422-63	Unit Weight	ASTM D7263
Specific Gravity	ASTM D854-10	Unconfined Compression Test	ASTM D2166
Water Content	ASTM D2216	Consolidation Test	ASTM D2435
Atterberg Limit Test (Liquid Limit/Plastic Limit)	ASTM D4318		

Source: JICA Study Team

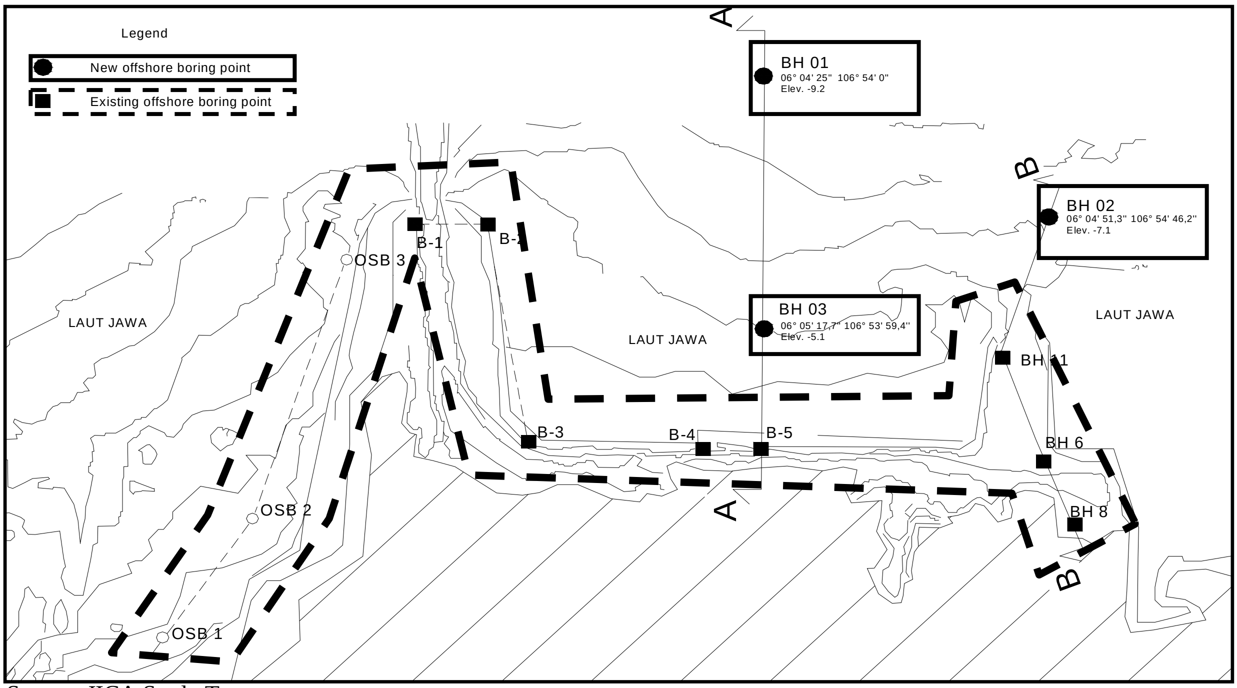
Outline of Soil Conditions

JICA Study Team (2002) carried out a soil investigation in Tanjung Priok Port with exploratory borings and laboratory tests at 3 points. Many of other soil investigations and laboratory tests were also executed by PELINDO II, and JICA Study Team acquired those data in 2002 (location of the investigations are shown in Figure 3.5-19).

The seabed soils (from the seabed to approximately -35m) in front of Tanjung Priok Port from existing bore holes (B-1, 2, 3, 4, 5, 6 and 11) and in the west area of the port from JICA Study in 2002 (OSB-1, 2 and 3) are classified into mainly three layers as follows;

- The first layer is a soft layer, its thickness is approximately 5m to 13m, and its N-value is approximately 0.
- The second layer is a deposit consisting of volcanic ash in the elevation range of approximately -10m to -25m, with N-value of approximately 6.
- The third layer is a deposit consisting of volcanic ash, sand and silts in the elevation range of approximately -20m to -25m below, with a N-value of approximately 50 or more than 50.

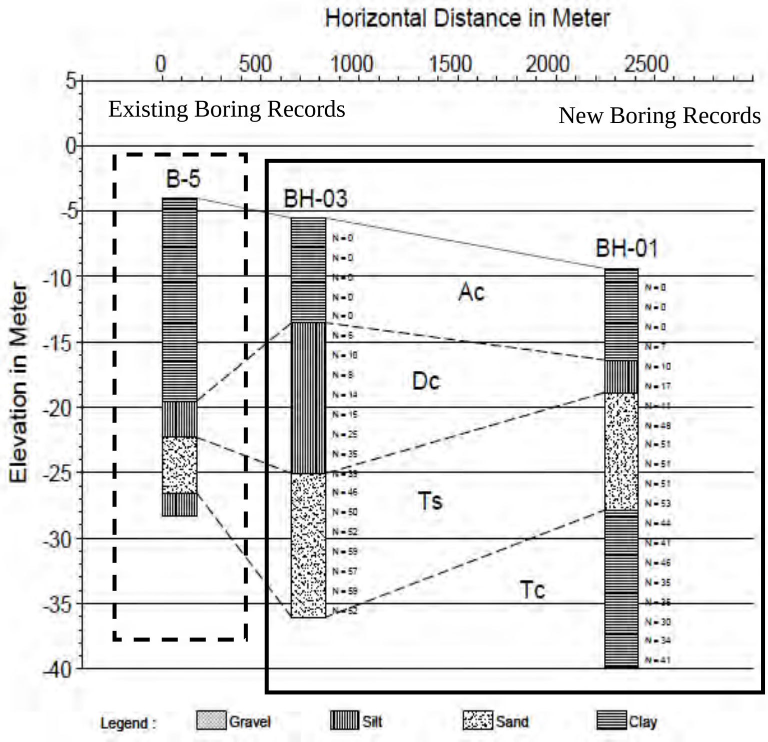
In this study, the records from the newly executed three (3) boring tests and the some of the above-mentioned previous records are examined comprehensively.



Source: JICA Study Team

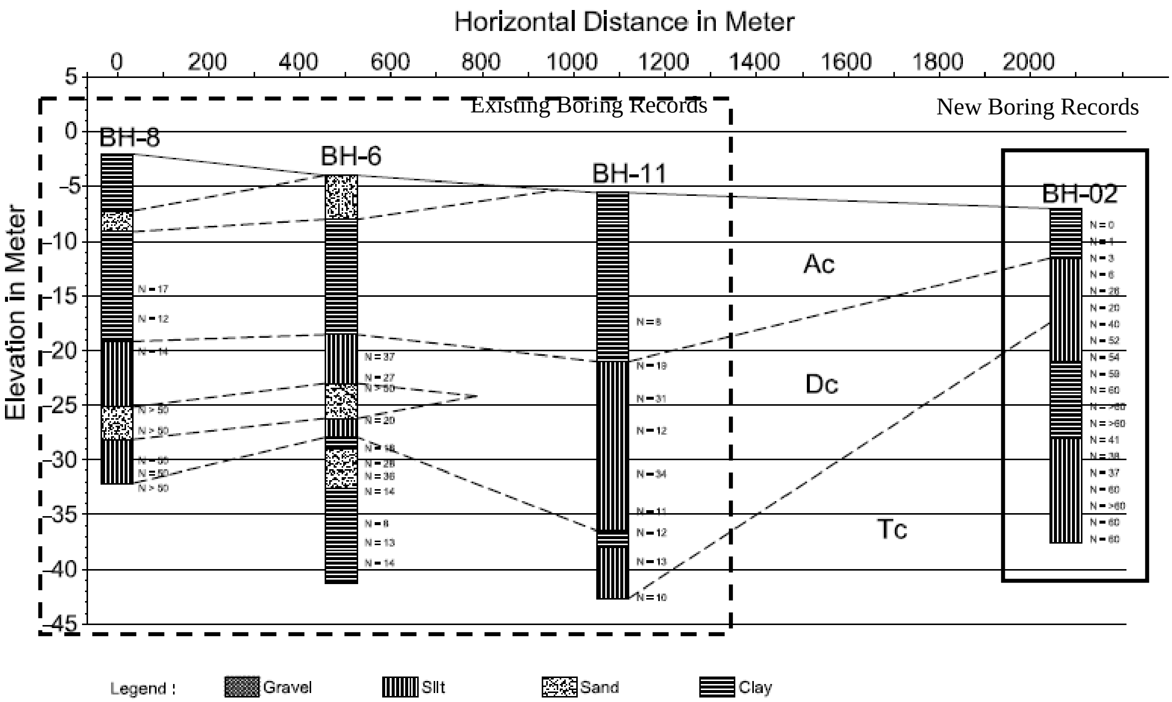
Figure 3.5-19 Borehole locations in Tanjung Priok Port and North Kalibaru

Subsoil profiles of A-A section and B-B section indicated in the above Figure are presented in the following Figure 3.5-20 and Figure 3.5-21.



Source: JICA Study Team

Figure 3.5-20 Subsoil Profile in front of Tanjung Priok Port (A-A section)



Source: JICA Study Team

Figure 3.5-21 Subsoil Profile in front of Tanjung Priok Port (B-B section)

(2) Investigation Results

1) Outline of boring logs

Three (3) offshore borings were carried out in North Kalibaru in this study. The boring results are summarized in the below tables. According to the results, the thickness of soft layer (i.e. N=4 or less) in this area varies in the range 6m to 9m.

Hard layer (i.e. N=30 or over) appears at 10m depth at BH01, at 10m at BH02, and at 18m at BH03.

Table 3.5-30 The Result of Boring log at BH01

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-9.2 ~ -16.2	Silty clay or Clayed silt	0 - 10	Very soft consistency, dark grey in colour
-16.2 ~ -18.7	Sandy Silt	10 to 17	Medium to stiff consistency , light brown in colour
-18.7 ~ -27.7	Sand	17 to 53	very dense consistency, black in colour
-27.7 ~ -33.7	Silty Clay or Clayed silt	53 to 35	Very stiff consistency, black in colour
-33.7 ~ -39.7	Silty Clay or Clayed silt	35 to 41	Very stiff consistency, dark grey in colour

Source: JICA Study Team

Table 3.5-31 The Result of Boring log at BH02

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-7.1 ~ -11.6	Silty clay or Clayed silt	0 - 1	Very soft consistency, dark grey in colour
-11.6 ~ -21.1	Sandy Silt	1 to 54	Medium to very stiff consistency , light and dark brown in colour
-21.1 ~ -28.1	Silty clay	54 to 60	Very stiff consistency, dark grey in colour
-28.1 ~ -33.1	Sandy silt	41 to 60	Stiff consistency, dark grey in colour
-33.1 ~ -37.6	Sandy silt	> 60	Very stiff consistency, dark grey in colour

Source: JICA Study Team

Table 3.5-32 The Result of Boring log at BH03

Elevation (MSL m)	Outline of Soil type	N-Value	Characteristics
-5.1 ~ -13.1	Silty clay or Clayed silt	0	Very soft consistency, dark grey in colour
-13.1 ~ -24.6	Sandy silt	6 to 38	Medium to very stiff consistency, light and dark brown in colour
-24.6 ~ -30.1	Silty clay	38 to 52	very stiff consistency, dark grey in colour
-30.1 ~ -35.6	Medium sand	52 to 59	Very dense consistency, black in colour

Source: JICA Study Team

2) Laboratory test

Both disturbed and undisturbed samples extracted from thin-wall sampling were subjected to physical and mechanical testing in laboratory to obtain information on the characteristics of the soils. The results of physical and mechanical tests are shown in Table 3.5-33, Table 3.5-34, Table 3.5-35 and Table 3.5-36.

According to the test results, unconfined compression strength (qu) range from 0.20 to 0.94 kg/cm2. OCR, which is calculated from pre-consolidation stress (Pc) and effective pressure at a sampling depth (Pe), vary from 0.82 to 1.67.

Table 3.5-33 Summary of Average at BH01 (Physical Test)

Layer	Specific Gravity	Plastic Index	Atterberg Limit		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	2.49	15.28	50.08	42.80	0	5.98	83.60	0
Dc	2.32	10.91	55.75	44.84	0	3.56	96.44	0
Ts	2.47	7.47	50.53	43.06	0	54.18	45.82	0
Tc	2.55	9.72	46.79	43.90	0	0.80	97.54	1.66

Abbreviations: A_c: Alluvial clay, D_c: Diluvium clay, T_s: Tertiary sand, T_c: Tertiary clay
Source: JICA Study Team

Table 3.5-34 Summary of Average at BH02 (Physical Test)

Layer	Specific Gravity	Plastic Index	Atterberg Limit		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	3.08	16.11	46.92	30.81	0	5.10	94.90	0
Dc	2.48	13.65	57.90	28.99	0	22.84	77.16	0
Tc	2.35	15.98	54.98	39.01	0	27.52	72.48	0

Source: JICA Study Team

Table 3.5-35 Summary of Average at BH03 (Physical Test)

Layer	Specific Gravity	Plastic Index	Atterberg Limit		Grain Size Distribution (%)			
			Liquid Limit	Plastic Limit	Gravel	Sand	Silt	Clay
Ac	2.40	12.83	55.17	42.34	0	6.03	93.97	0
Dc	2.43	12.31	50.47	NP	0	31.24	68.77	0
Ts	2.63	NP	NP	NP	0	54.41	44.82	0.78

Source: JICA Study Team

Table 3.5-36 Summary of Average (Mechanical Test)

Item		BH01	BH02	BH03
Unit Weight	γt (g/cm³)	1.69	1.77	1.53
Unconfined Compression Test	qu (kg/cm²)	0.94	0.39	0.20
Consolidation Test	Cv (cm²/sec)	7.35×10-4	5.24×10-4	6.18×10-4
	Cc	0.52	0.32	0.72
	Pc (kg/cm²)	0.40	0.65	0.95
Effective Pressure at Sampling depth	Pe (kg/cm²)	0.49	0.39	0.60
Over Consolidated Ratio	OCR	0.82	1.67	1.58

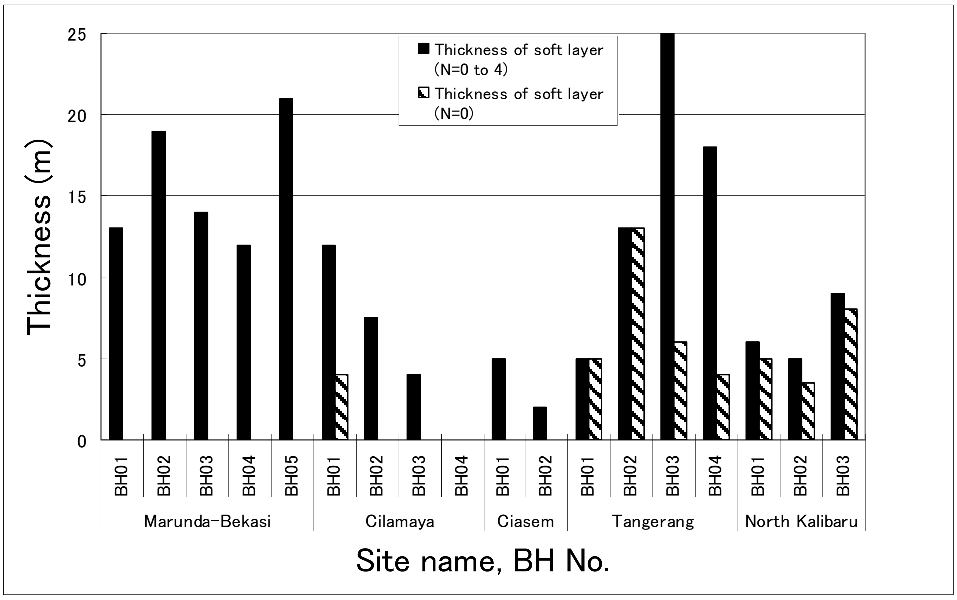
Source: JICA Study Team

3.5.4 Summary of Subsoil Condition

(1) Soft Layer Thickness

The thicknesses of soft layer at each site are shown in Figure 3.5-22.

Main soft layers consist of silty clay or clayey silt at Marunda/Bekasi, Cilamaya, Ciasem and Tangerang while mainly silty clay or sandy silt in North Kalibaru. While the soft layer's thickness at Cilamaya is 6m on average, the ones at Tangerang and Marunda are 15m to 16m on average. BH04 in Cilamaya, the soft layer is less than 50cm thickness. The soft layer is also less than 5m in Ciasem. In North Kalibaru, the average thickness of soft layer is 7m.



Source: JICA Study Team

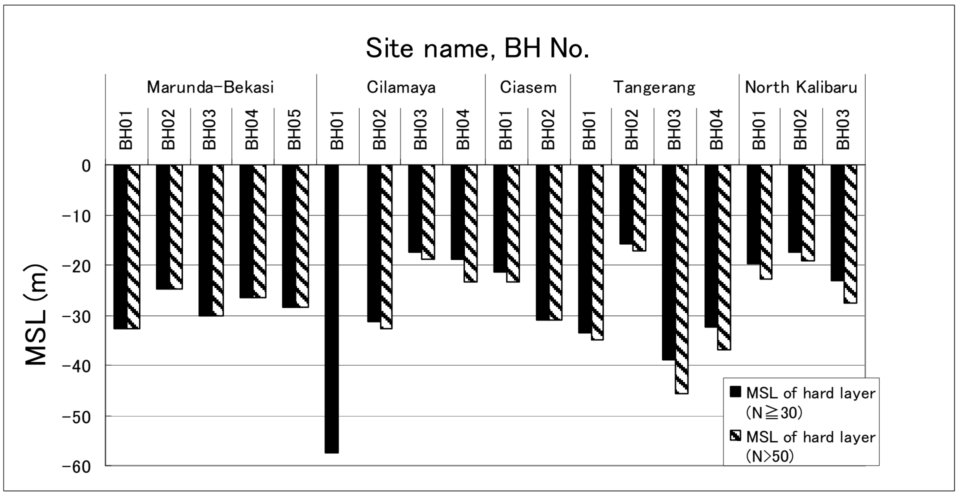
Figure 3.5-22 Soft Layer Thickness at Candidate Terminal Sites

(2) Elevation of Hard Layer Encountered at Each Site

In the case of the three (3) additional boring tests in North Kalibaru, it can be said that the appearance of hard layer (SPT-N=30 and/ or over) is from around -20m and it consists of clay or silt and fine sand. The hard layer (N>50) appears 2.0 to 5.0m deeper than hard layer (N=30 or over).

Figure 3.5-23 shows the encountering elevations of hard layer (SPT-N=30 and over N>50) of not only the additional three (3) additional boring results in North Kalibaru but also past survey results in Marunda-Bekasi, Cilamaya, Chiasem and Tangerang executed in July 2010. Comparing the additional results in North Kalibaru to others, the appearance of hard layer in North Kalibaru is shallower than other four (4) sites.

The layer (N=30 and/ or over) can be considered as a bearing layer for shallow footing. It is also possible to be considered as a bearing layer by applying friction piling due to the required load. The layer (N>50) is recommended as a bearing layer for piling foundation of structure requiring heavy load.



Source: JICA Study Team

Figure 3.5-23 Elevation of Hard Layer encountered at each site

(3) Subsoil Condition at Tangerang

In Tangerang, soft layer of the west region (BH03 &04) is thicker than that of the east region (BH01 &02). In Marunda, the range of thickness of soft layer is varied and relatively thinner than the other sites. In North Kalibaru, the thickness at BH03, which is located closer to the landside, is thicker than other two (2) results from BH01 and BH02.

The consolidation test results show that the soft layer in all of the sites seems to be normally-consolidated (OCR≒1) or slightly over-consolidated clay (OCR<2) except some samples, which are assumed to be disturbed before the test. Therefore, final settlement by reclamation work can be small if the effective overburden stress including reclamation work does not exceed Pc.

(4) Subsoil Condition at Cilamaya

In Cilamaya offshore, “Soil Replacement” of the soft layer is applicable because the layer is less than 5 m thick. However, Soil Replacement method, which is to replace superficial soft material with fine sand, does not seem to be applicable in other sites. The main reason to disallow this method is that the existing soft layer is too thick, more than 5m in thickness, to remove. In addition, considering the assumed huge dredging volume and the scale of work that would be required, it is not a viable method from financial and work-period management aspects.

On the other hand, “Preloading” seems to be effective in Cilamaya onshore, Marunda-Bekasi, Tangerang and North Kalibaru. In particular, the surface layer of Tangerang is so soft, SPT-N=0, that it will take more time to be consolidated than the other sites. Therefore, “Vertical drain” with “Preloading” should be considered to enhance the consolidation process and to reduce the consolidation time up to certain degree of consolidation, ex 90%.

(5) Subsoil Condition at North Kalibaru

In the case of three (3) additional boring tests in North Kalibaru, it can be said that soft layer consists of mainly silty clay or sandy silt. According to the survey results, the soft layer at BH03, which is located closer to the landside, is thicker than other two (2) results from BH01 and BH02.

Figure 3.5-22 shows the thickness of soft layers of not only the additional three (3) boring results in North Kalibaru but also past survey results in Marunda-Bekasi, Cilamaya, Chiasem and

Tangerang executed in July 2010. Comparing the additional results in North Kalibaru to others, the thickness of soft layer in North Kalibaru is thinner than the sites at Marunda-Bekashi and Tangerang.

The consolidation test results show that the soft layer at BH01, 02 and 03 seem to be normally-consolidated (OCR≒1) or slightly over-consolidated clay (OCR< 2) similar to previous results at Marunda-Bekasi, Cilamaya, Ciasem and Tangerang. Therefore, it can be assumed that final settlement by reclamation work can be relatively small if the effective overburden stress including reclamation work does not exceed the value of Pc.

(6) Improvement of Existing Poor Soil Condition

As a result of comprehensive examination on reclamation work based on the test results from the additional three (3) boring tests in North Kalibaru, Soil Replacement method, which is to replace superficial soft material with fine sand, does not seem to be applicable. The main reason to disallow this method is that the existing soft layer is too thick, more than 5m in thickness, to remove. In addition, considering the assumed huge dredging volume and the scale of work that would be required, it is not a viable method from financial and work-period management aspects.

On the other hand, considering the soil characteristics, Preloading method seems to be effective. If Vertical Drain method is adopted in addition to Preloading method, it might be more effective to enhance the consolidation process, and to reduce the consolidation time up to certain degree of consolidation, ex 90%.

For the construction of breakwater and revetment, Sand Compaction Pile method or Deep Soil Mixing method should be examined to adapt to the foundation. In case of applying Sand Compaction method, a huge amount of fine sand is required. However, considering environmental aspects and the surroundings in/around the North Kalibaru area, it might be difficult to acquire such a volume sand of the necessary quality. In case of the Deep Soil Mixing method, cement as the main material seems to be easily procured and work quality can be controlled easier because residual settlement is minimal if improvement work is done by bearing layer. However, it must be noted that the cost of this method is relatively higher and that such an advanced method has never been applied before in the republic of Indonesia.

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

The improvement methods of the existing poor soil conditions at Cilamaya and North kalibaru area can be summarized as follows.

Table 3.5-37 Applicable Ground Improvement Method for Civil Works Structures

Purpose	Method	
• Increase resistance to liquefaction • Reduce movements	• Vibrocompaction, vibrorod • Stone columns • Deep dynamic compaction • Explosive compaction • Gravel drains	• Deep soil mixing • Penetration grouting • Jet grouting • Compaction grouting • Sand and gravel compaction piles
• Stabilize structures that have undergone differential settlement	• Compaction grouting • Penetration grouting	• Jet grouting • Mini-piles
• Increase resistance to cracking, deformation and/or differential settlement	• Compaction grouting • Penetration grouting	• Jet grouting • Mini-piles
• Reduce immediate settlement	• Vibrocompaction, vibrorod • Deep dynamic compaction • Explosive compaction • Compaction grouting	• Deep soil mixing • Jet grouting • Sand and gravel compaction piles
• Reduce consolidation settlement	• Precompression • Jet grouting • Compaction grouting	• Stone columns • Deep soil mixing • Electro-osmosis
• Increase rate of consolidation settlement	• Vertical drains, with or without surcharge fills • Sand and gravel compaction piles	
• Improve stability of slopes	• Buttress fills • Gravel drains • Penetration grouting • Compaction grouting	• Jet grouting • Deep soil mixing • Soil nailing • Sand and gravel compaction piles
• Improve seepage barriers	• Jet grouting • Deep soil mixing	• Penetration grouting • Slurry trenches
• Strengthen and/or seal interfaces between embankments/abutments/foundations	• Penetration grouting	• Jet grouting

Source: Guidelines on Ground Improvement for Structures and Facilities, U.S. Army engineer technical letter, 1999

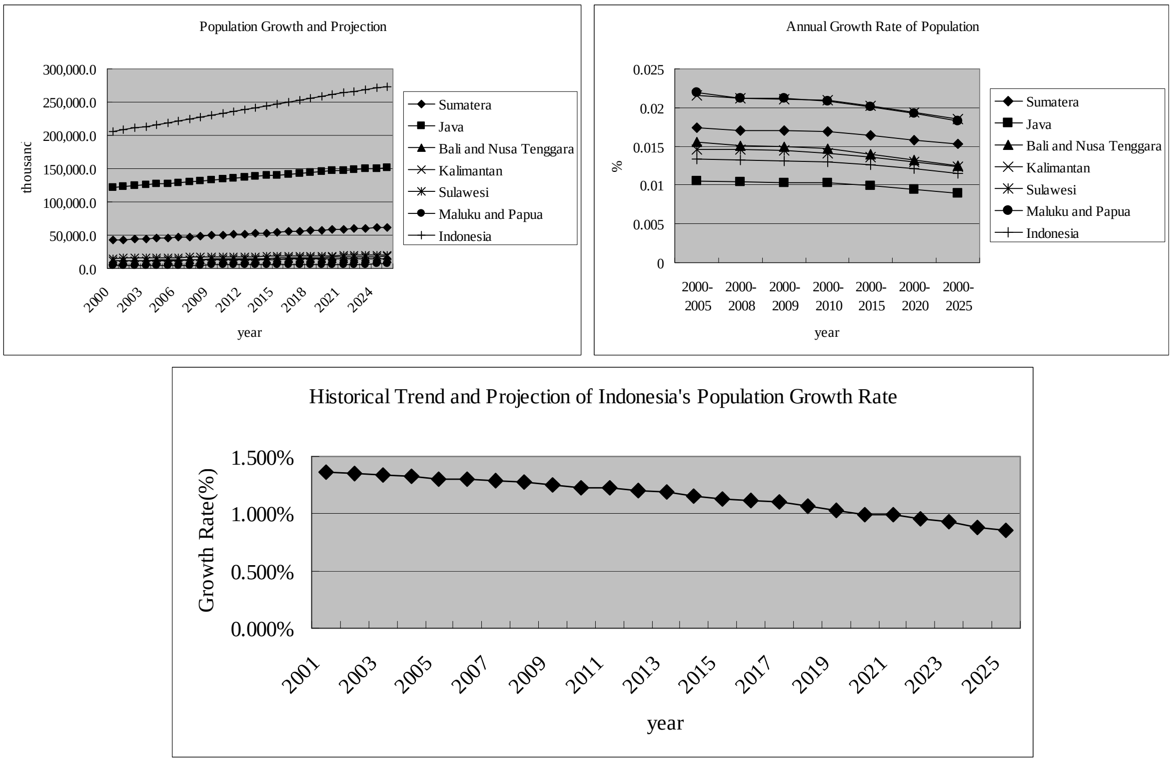
CHAPTER 4 MASTER PLAN FOR PORT DEVELOPMENT AND LOGISTICS IN AND AROUND GREATER JAKARTA METROPOLITAN AREA

4.1 Socio-economic Framework

4.1.1 Population

In 2005, BPS, Bappenas with the support of UNFPA conducted Indonesian Population Projection 2000-2025 primarily based on the SP2000.

According to the projection, the population of Indonesia during the next twenty-five years will increase from 205.1 million in 2000 to 273.2 million in 2025. Average growth per year over the period 2000-2025 shows a tendency to decline continuously. In the decade 1990-2000, the population of Indonesia increased at the rate of 1.49 percent per year, then between the periods 2000-2005 and 2020-2025 fell to 1.34 percent and 0.92 percent per year (See Figure 4.1-1)



Source: Indonesia Population Projection, BPS, 2005

Figure 4.1-1 Historical Trend and Projection of Indonesia's Population Growth Rate

4.1.2 GDP (Gross Domestic Product)

(1) Indonesia

During the Asian economic crisis, Indonesian's GDP growth rate sharply dropped to -13.1% per annum in 1998 and only 0.79 % in 1999. Indonesian economy, however, got back on track in 2000 with the healthy growth rate of 5.35%. Since then, the national economy has showed steady growth with annual growth rates of about 5 %. In 2008 it registered 6.007% (See Table 4.1-1).

Table 4.1-1 Growth Rates of Indonesia

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
GDP Growth (annual %)	5.350	3.643	4.499	4.780	5.031	5.693	5.501	6.345	6.007

Source: International Monetary Fund, World Economic Outlook Database, April 2010

Indonesia's recent GDP growth rates are still less than the 7.2 % average GDP growth the country experienced during the period of 1990-1996, however, during the 2nd quarter of 2010, economists as well as the Indonesian Government expressed that GDP would grow steadily in the range of 6.0% to 7.0%. Furthermore, the Indonesian Government announced a growth rate of 7.7% in 2014 as the Governments Policy Target.

In the Greater Jakarta Metropolitan Ports Study in 2003, the JICA study team assumed that Indonesia's GDP growth rate in 2003 will be nearly same as that in 2002, and that a 6 % growth rate will be realized in 2006. It is also assumed that the 6 % growth rate will be maintained afterwards through 2012, and then will slightly decline because the population growth rate has been continuously decreasing as shown earlier.

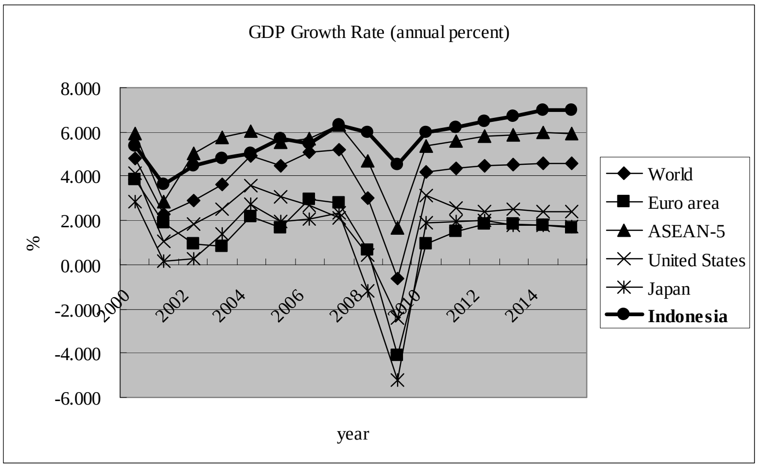
(2) Major Trade Partners

Formulating future economic frameworks of trade partners is also one of the important works of the demand forecast.

Japan, the United States, Singapore, Malaysia and China have been the major trade partners with Indonesia in recent decades. In addition to these individual countries, Asia and Europe as regional economic compounds are also important trade partners.

GDP growth rates of these countries and regions after 1990 are shown in Figure 4.1-2. Economies of East Asia and Pacific region had shown the highest growth rates of more than 8 % before the year 1997 when the region's economic prosperity collapsed due to the financial crisis.

United States has shown steady economic growth for the last decade, with growth rates in the range of 2 – 4 %. On the contrary, Japan as well as Euro area has been in an economic slump since 1998, and annual growth rates have been around 1 or 2 % recently.



Source: IMF World Economic Outlook Database April 2010

Figure 4.1-2 Growth Rate in Major Trade Partners

Future GDP growth rates of the trade partners were taken and extrapolated from the International Monetary Fund (IMF), World Economic Outlook Database April 2010 and official announcement of the Indonesian Government.

(3) GDP Growth Rate

In the fall of 2008, global economy faced a severe challenge generated from the collapse of the housing market. Economic slump was not limited to US; the European market and Japan were affected as well. Developing economies including Indonesia were also not immune to the world financial crisis.

The 2010 – 2014 National Medium-Term Development Plan (RPJMN 2010-2014) is the second phase of the 2005-2025 National Long-Term Development Plan promulgated through Law 17/2007. The RPJMN 2010-2014 contains the national development strategy, general policies, programs of ministries/agencies and cross-ministries/agencies, regional and cross-regional programs, as well as the macroeconomic framework.

RPJMN 2010-2014 states that a sustainable macroeconomic position will be maintained during the 2010-2014 period. Indonesian economy is expected to gradually grow from 5.5-5.6% in 2010 to 7.0-7.7% in 2014, at an average growth rate of 6.3-6.8% per year over the next five years (See Table 4.1-2).

Table 4.1-2 Estimated Economic Growth 2010-2014 (%)

	2010	2011	2012	2013	2014	average 2010-2014
Economic Growth	5.5 - 5.6	6.0 - 6.3	6.4 - 6.9	6.7 - 7.4	7.0 - 7.7	6.3 - 6.8
Expenditure Side						
Private Consumption	5.2 - 5.2	5.2 - 5.3	5.3 - 5.4	5.3 - 5.4	5.3 - 5.4	5.3 - 5.4
Governement Consumption	10.8 - 10.9	10.9 - 11.2	12.9 - 13.2	10.2 - 13.5	8.1 - 9.8	10.6 - 11.7
Investment	7.2 - 7.3	7.9 - 10.9	8.4 - 11.5	10.2 - 12.0	11.7 - 12.1	9.1 - 10.8
Exports of Goods and Services	6.4 - 6.5	9.7 - 10.6	11.4 - 12.0	12.3 - 13.4	13.5 - 15.6	10.7 - 11.6
Imports of Goods and Services	9.2 - 9.3	12.7 - 15.2	14.3 - 15.9	15.0 - 16.5	16.0 - 17.4	13.4 - 14.9
Production Side						
Agriculture, Plantation, Livestock, Forestry, and Fisheries	3.3 - 3.4	3.4 - 3.5	3.5 - 3.7	3.6 - 3.8	3.7 - 3.9	3.6 - 3.7
Mining and Quarrying	2.0 - 2.1	2.1 - 2.3	2.3 - 2.4	2.4 - 2.5	2.5 - 2.6	2.2 - 2.4
Manufacturing Industry	4.2 - 4.3	5.0 - 5.4	5.7 - 6.5	6. 2 - 6.8	6.5 - 7.3	5.5 - 6.0
Non-Oil and Gas Industry	4.8 - 4.9	5.6 - 6.1	6.3 - 7.0	6.8 - 7.5	7.1 - 7.8	6.1 - 6.7
Electricity, Gas and Water	13.4 - 13.5	13.7 - 13.8	13.8 - 13.9	13.9 - 14.0	14.1 - 14.2	13.8 - 13.9
Construction	7.1 - 7.2	8.4 - 8.5	8.8 - 9.3	8.9 - 10.1	9.1 - 11.1	8.4 - 9.2
Trade, Hotels, and Restaurants	4.0 - 4.1	4.2 - 4.8	4.4 - 5.2	4.5 - 6.4	4.6 - 6.6	4.3 - 5.4
Transaportatio and Telecommunication	14.3 - 14.8	14.5 - 15.2	14.7 - 15.4	14.9 - 15.6	15.1 - 16.1	14.7 - 15.4
Finance, Real Estates, and Corporate Services	6.5 - 6.6	6.6 - 6.7	6.8 - 7.0	6.9 - 7.0	7.2 - 7.3	6.8 - 6.9
Services	6.7 - 6.9	6.9 - 7.0	7.0 - 7.1	7.1 - 7.2	7.2 - 7.4	6.9 - 7.1

Source: The 2010 – 2014 National Medium-Term Development Plan

IMF regularly updates "The World Economic Outlook" and its latest version as of April 2010 forecasts the state of the global economy until 2015.The following is an excerpt:

The global recovery has evolved better than expected, with activity recovering at varying speeds— tepidly in many advanced economies but solidly in most emerging and developing economies.

The world economy is poised for further recovery but at varying speeds across and within regions. Global growth is projected to reach 4¼ percent in 2010 and 2011. It is true that future economic framework is quite uncertain, but released outlook by IMF is the most reliable one so far. The outlook for activity remains unusually uncertain, even though a variety of risks have receded.

The assumed GDP growth rates of Indonesia and trade partners by case are shown in Table 4.1-3. The growth rates of the high case are set at 0.5 percentage point higher, and those of the low case are 0.5 percentage point lower than those of the basic case, respectively, in the same manner as executed by the JICA Study Team in 2002.

As for the base case, each growth rate is based on the following:

2000 - 2009: The IMF World Economic Outllook April 2010,
2010 - 2013: ditto
2014 - 2015: The Indonesian Government Policy Target, April 2010,
2016 - 2020: Assumed 7.0%
2021 - 2030: Assumed 6.0%

Figure 4.1-3 shows historical and development scenario of Indonesia's GDP in conformity with conditions as above mentioned

Table 4.1-3 GDP Growth Rates by Case

Indonesia	2008	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2030
Base	6.007	4.546	6.004	6.200	6.500	6.700	7.700	7.700	7.000	6.000

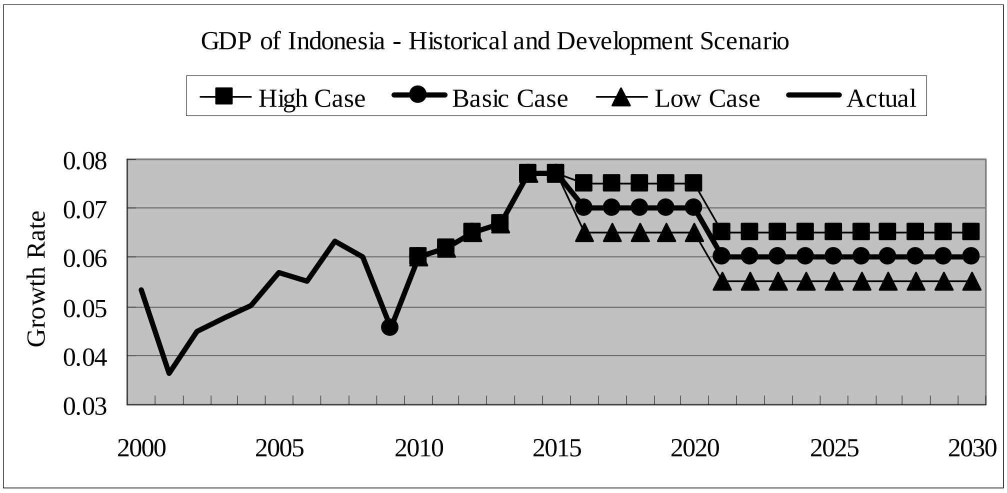
	2008	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2030
World	3.021	-0.604	4.217	4.340	4.461	4.531	4.577	4.586	4.500	4.500
Euro area	0.648	-4.085	0.960	1.493	1.814	1.842	1.775	1.682	1.700	1.700
ASEAN 5	4.708	1.694	5.395	5.611	5.816	5.884	5.992	5.947	6.000	6.000
United States	0.439	-2.440	3.101	2.550	2.398	2.504	2.393	2.390	2.400	2.400
Japan	-1.193	-5.197	1.896	1.965	2.035	1.788	1.808	1.730	1.700	1.700

Indonesia	2008	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2030
High	6.007	4.546	6.004	6.200	6.500	6.700	7.700	7.700	7.500	6.500

	2008	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2030
World	3.021	-0.604	4.217	4.340	4.461	4.531	4.577	4.586	5.000	5.000
Euro area	0.648	-4.085	0.960	1.493	1.814	1.842	1.775	1.682	2.200	2.200
ASEAN 5	4.708	1.694	5.395	5.611	5.816	5.884	5.992	5.947	6.500	6.500
United States	0.439	-2.440	3.101	2.550	2.398	2.504	2.393	2.390	2.900	2.900
Japan	-1.193	-5.197	1.896	1.965	2.035	1.788	1.808	1.730	2.200	2.200

Indonesia	2008	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2030
Low	6.007	4.546	6.004	6.200	6.500	6.700	7.700	7.700	6.500	5.500

	2008	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2030
World	3.021	-0.604	4.217	4.340	4.461	4.531	4.577	4.586	4.000	4.000
Euro area	0.648	-4.085	0.960	1.493	1.814	1.842	1.775	1.682	1.200	1.200
ASEAN 5	4.708	1.694	5.395	5.611	5.816	5.884	5.992	5.947	5.500	5.500
United States	0.439	-2.440	3.101	2.550	2.398	2.504	2.393	2.390	1.900	1.900
Japan	-1.193	-5.197	1.896	1.965	2.035	1.788	1.808	1.730	1.200	1.200



Source: IMF World Economic Outlook Update on April 2010, JICA Study Team

Figure 4.1-3 Development Scenario and Historical Growth Rates of GDP

4.1.3 Regional Socio-economic framework

(1) Population

Population (2004 – 2008) of DKI, Banten and West Java are shown in Table 4.1-4, Table 4.1-5 and Table 4.1-6 respectively and historical trend of population 2004-2008 is shown in Figure 4.1-4.

Table 4.1-4 Population of DKI Jakarta (2004 – 2008)

Population of DKI

DKI	2004	2005	2006	2007	2008
DKI	8,636,100	8,699,600	8,755,700	8,814,000	8,872,900

Source: Statistical Yearbook of Indonesia 2009

Table 4.1-5 Population of Banten (2004 – 2008)

Population of Banten

Regencies/Municipalities	2004	2005	2006	2007	2008
Kab. Pandeglang	1,100,911	1,116,000	1,074,762	1,085,042	1,092,527
Kab. Lebak	1,132,899	1,153,300	1,183,184	1,210,149	1,234,459
Kab. Tangerang	3,194,282	3,346,800	3,366,423	3,473,271	3,574,048
Kab. Serang	1,834,514	1,868,400	1,786,223	1,808,464	1,826,146
Kota Tangerang	1,488,666	1,531,300	1,481,591	1,508,414	1,531,666
Kota Cilegon	331,872	336,500	331,667	338,027	343,599
Total	9,083,144	9,352,300	9,223,850	9,423,367	9,602,445

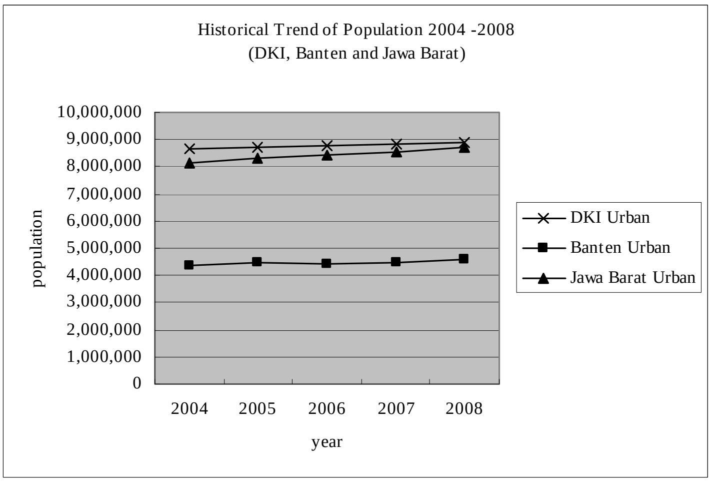
Source: Statistical Yearbook of Indonesia 2009

Table 4.1-6 Population of West Java (2004 – 2008)

Population of Jawa Barat

Regencies/Municipalities	2004	2005	2006	2007	2008
Kab. Bogor	3,945,411	4,100,934	4,216,186	4,316,236	4,402,026
Kab. Sukabumi	2,210,091	2,224,993	2,240,901	2,258,253	2,277,020
Kab. Cianjur	2,079,306	2,098,644	2,125,023	2,149,121	2,169,984
Kab. Bandung (incl Bandung Barat)	4,002,290	4,263,934	4,399,128	4,531,263	4,647,128
Kab. Garut	2,260,478	2,321,070	2,375,725	2,429,167	2,481,471
Kab. Tasikmalaya	1,569,292	1,693,479	1,743,324	1,792,092	1,839,682
Kab. Ciamis	1,522,928	1,542,661	1,565,121	1,586,076	1,605,891
Kab. Kuningan	1,073,172	1,096,848	1,118,776	1,140,777	1,163,159
Kab. Cirebon	2,084,572	2,107,918	2,134,656	2,162,644	2,192,492
Kab. Majelengka	1,184,760	1,191,490	1,197,994	1,204,379	1,210,811
Kab. Sumedang	1,043,340	1,067,361	1,089,889	1,112,336	1,134,288
Kab. Indramayu	1,749,170	1,760,286	1,778,396	1,795,372	1,811,764
Kab. Subang	1,406,976	1,421,973	1,441,191	1,459,077	1,476,418
Kab. Purawakarta	760,220	770,660	784,797	798,272	809,962
Kab. Karawang	1,939,674	1,985,574	2,031,128	2,073,356	2,112,433
Kab. Bekasi	1,917,248	1,953,380	1,991,230	2,032,008	2,076,146
Kota Bogor	833,523	844,778	855,846	866,034	876,292
Kota Sukabumi	278,418	287,760	294,646	300,694	305,800
Kota Bandung	2,290,464	2,315,895	2,340,624	2,364,312	2,390,120
Kota Cirebon	276,912	281,089	285,363	290,450	298,995
Kota Bekasi	1,931,976	1,994,850	2,040,258	2,084,831	2,128,384
Kota Depok	1,353,249	1,373,860	1,393,568	1,412,772	1,430,829
Kota Cimahi	482,763	493,698	506,250	518,985	532,114
Kota Tasikmalaya	579,128	594,158	610,456	624,478	637,083
Kota Banjar	166,868	173,576	177,118	180,744	184,577
Total	38,942,229	39,960,869	40,737,594	41,483,729	42,194,869

Source: Statistical Yearbook of Indonesia 2009



Source: Statistical Yearbook of Indonesia 2009, Jawa Barat in Figure2009, Banten in Figures in 2009

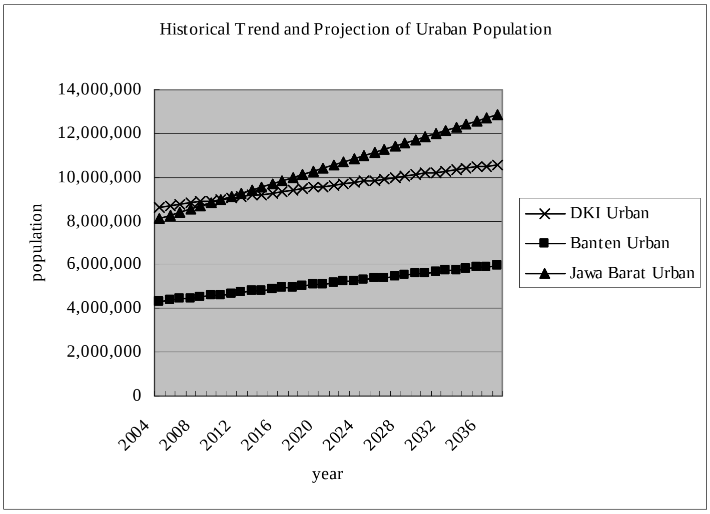
Figure 4.1-4 Historical Trend of Urban Population 2004 – 2008 (DKI, Banten and West Java)

Based on the above data, population of each province is projected by grouped regency/municipality level as urban area in order to identify population trends within the province.

Urban areas are defined as cities and areas alongside the TOLL ROAD where the population is dense. Those areas defined as urban areas other than cities are Kab. Tangerang, Kab. Serang in Banten province, Kab. Karawang and 50% of that population are considered for calculation.

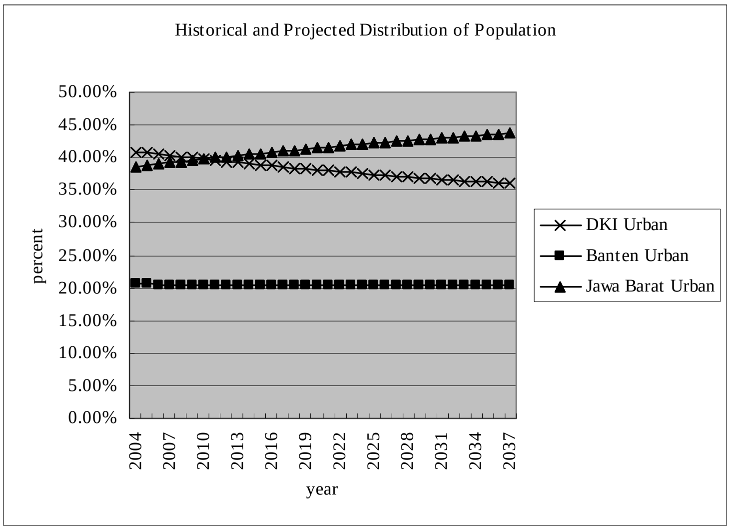
Furthermore, those areas situated away from the toll road are excluded from the calculation in order to accentuate the trend of the distribution among those three provinces. Areas neglected from the calculation are Kota Sukabumi, Kota Tashikmalaya and Kota Banjar.

The method of the projection is based on the approximation formula. Projection of population is shown in Figure 4.1-5 and distribution trend of population is shown in Figure 4.1-6.



Source: Statistical Yearbook of Indonesia 2009, Jawa Barat in Figure2009, Banten in Figures in 2009

Figure 4.1-5 Historical Trend and Projection of Population in DKI, Banten and West Java



Source: Statistical Yearbook of Indonesia 2009, Jawa Barat in Figure2009, Banten in Figures in 2009

Figure 4.1-6 Historical Trend and Projection of Population Distribution in DKI, Banten and West Java

In the area of DKI, Banten and West Java, trend of distribution of population in urban areas clearly shows that West Java is constantly increasing while DKI is decreasing. Suburban area in West Java may become a densely populated area.

(2) GRDP of Manufacturing

Current situation of Gross Regional Domestic Product (GRDP) by manufacturing Industry without oil & gas of DKI, Banten and West Java are shown in Table 4.1-7.

Distribution of the Manufacturing GRDP in the area shows that West Java has been constantly increasing since 2004 while GRDP elsewhere has been decreasing especially DKI (See Figure 4.1-7).

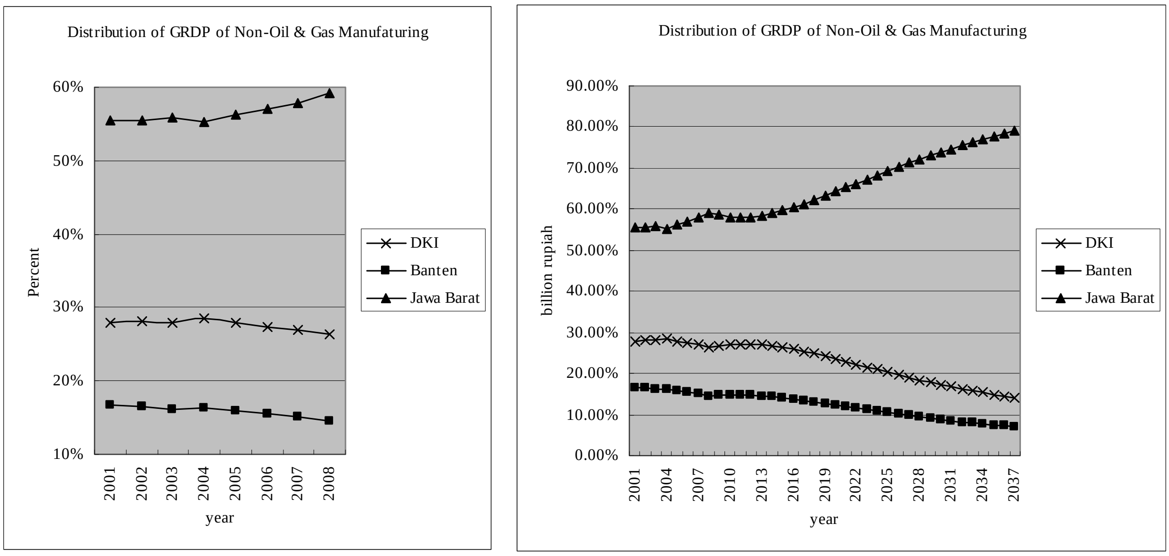
Further to this data, it also may be said that this trend will continue for the coming decades according to the results of interview surveys with major consignees/consignors as well as shipping companies. One of the reasons of the tendency is investment of manufacturing companies to West Java Province rather than the others.

Table 4.1-7 GRDP of Manufacturing without Oil & Gas (DKI, Banten and West Java)

GRDP of DKI, Banten and Jawa Barat at 2000 Constant Market Prices of Non-Oil & Gas Manufacturing, 2004 - 2008 (Billion Rupiahs)

	2001	2002	2003	2004	2005	2006	2007	2008
DKI	41,925	43,847	46,063	48,707	51,178	53,722	56,195	58,367
Banten	25,029	25,705	26,581	27,749	28,976	30,549	31,497	32,225
Jawa Barat	83,469	86,630	92,023	94,367	103,037	111,977	120,458	131,557
Total	150,423	156,183	164,667	170,823	183,191	196,248	208,150	222,149

Source: BPS, Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin 2004 – 2008, and Raw data prepared by BPS



Source: BPS, Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin 2004 – 2008, and Raw data prepared by BPS

Figure 4.1-7 Current Share and Projection of GRDP of Non Oil & Gas Manufacturing

4.2 Cargo Demand Forecast

4.2.1 Container Cargoes

(1) International Container

A total of 28.6 million tons of international cargo were handled at Tanjung Priok Port in 2009 in the form of containers, which was equivalent to 2.74 million TEU. There used to be three dedicated container terminals: JICT I & II and KOJA terminal while JICT II is not operational at present because of customs practice reasons. These dedicated container terminals handle international containers. Conventional berths are also used for handling international containers, which account for 14.2% of the total international containers at the port in 2009.

A regression model was developed and applied to forecast future port demand taking into consideration the correlation between cargo volume (ton) and magnitude of economic activities in the hinterland.

$Y = a + bX$

Where, X: Independent Variable
Y: Dependent Variable
a, b: Constants

Firstly, future cargo tonnage transported by containers was forecast using the regression model. This work is implemented for export and import cargo individually. Trade partners' weighted GDP was applied as an independent variable for export cargo, and GRDP of the hinterland of Tanjung Priok Port for import cargo. Correlation coefficient (R) of the model is 0.984 for export and 0.932 for import cargo.

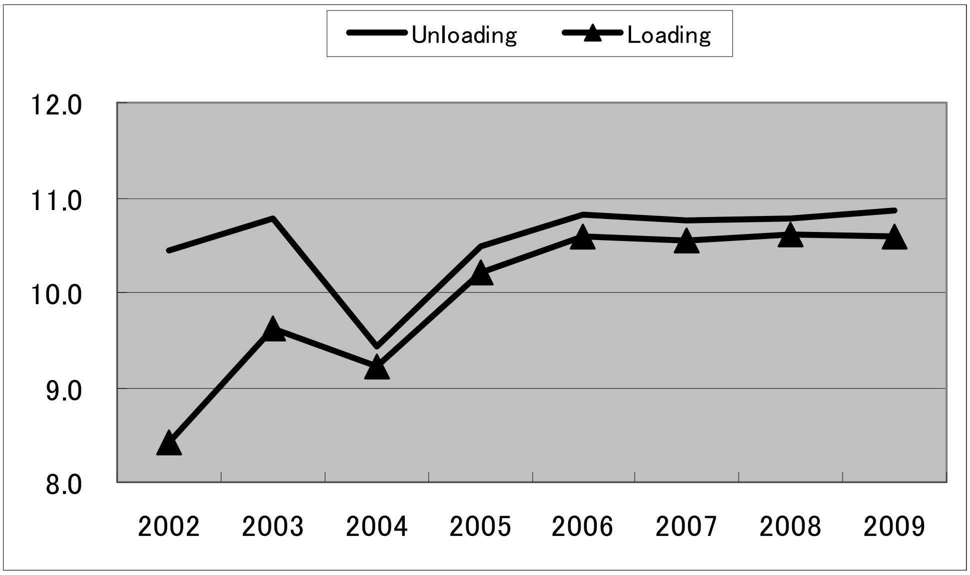
Secondly, the number of containers is estimated as follows;

$N = V/W \times 1/(1 - E)$

Where, N: Number of containers (TEUs/year)
V: Cargo tonnage in containers (tons/year)
W: Cargo weight per loaded 20 ft container

(tons/TEU)
E: Percentage of empty container

The average cargo weight per loaded 20 ft container (W) is set as 10.5 ton for export containers and 11.0 ton for import containers based on the actual past records at JICT (see Figure 4.2-1). Although average tonnages per loaded TEU are quite similar for both import container and export one, the total cargo tonnage of imported containers is larger than that of exported. Therefore, import container cargoes need a larger number of laden container boxes (TEUs) than export container cargoes. Percentage of empty container among import container is set as 5 %, taking into consideration the actual records of JICT and prospect of container operation.

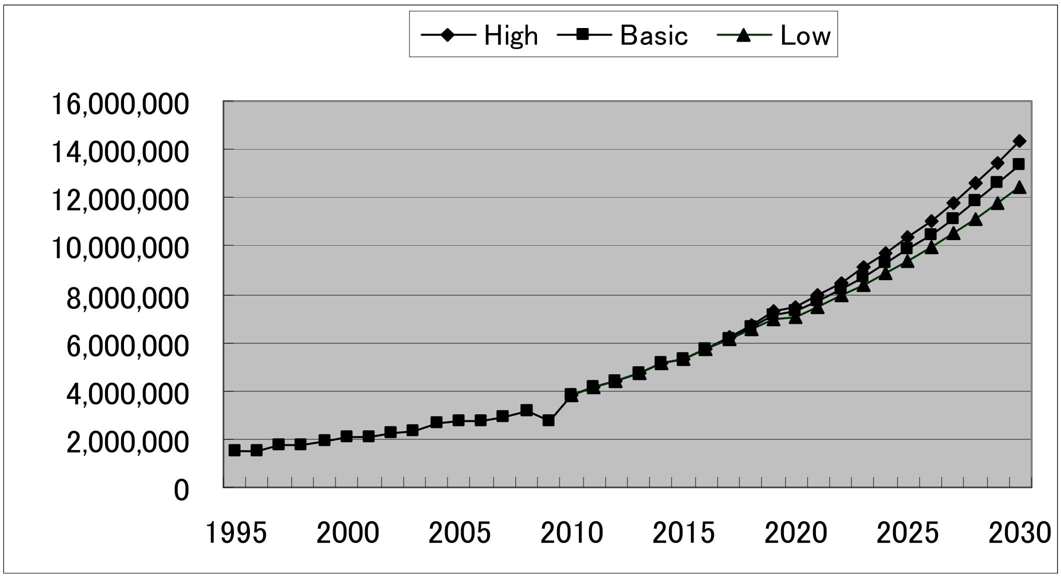


Source: JICT

Figure 4.2-1 Average Tonnage Per Laden TEU at JICT

Considering the fact that a highway network system in Java Island is under development, and that Tanjung Priok Port is by far the largest container port in Indonesia, it is reasonable to assume that the number of exported containers is the same as those of imported containers in the long run. The difference between the number of imported container and that of exported containers calculated from the cargo tonnage will be the number of exported empty containers.

Under the three socioeconomic frameworks, container throughputs were forecast. Total tonnage and the number of containers of international trade in the target years for the basic case are calculated at 61.2 million tons, 7.3 million TEU in 2020, and 106.2 million tons and 13.4 million TEU in 2030. Resulting TEU in the high case is 7.5% higher and that in the low case is 7.1% lower than the basic case in 2030, as shown in Figure 4.2-2 and Table 4.2-1.



Source: Forecast by JICA Study Team

Figure 4.2-2 Forecast of International Container Throughput by Case at Tg. Priok.

Table 4.2-1 Forecast of International Container Throughput by Case at Tanjung Priok

High Case

	Import		Export		Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	15,616	1,445	12,980	1,291	28,596	2,736
2015	26,341	2,661	18,345	2,661	44,685	5,321
2020	38,860	3,719	24,140	3,719	63,000	7,437
2025	54,129	5,180	31,274	5,180	85,403	10,360
2030	75,050	7,182	40,130	7,182	115,180	14,364

Basic Case

	Import		Export		Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	15,616	1,445	12,980	1,291	28,596	2,736
2015	26,341	2,661	18,345	2,661	44,685	5,321
2020	37,909	3,628	23,244	3,628	61,153	7,255
2025	51,543	4,932	29,169	4,932	80,711	9,865
2030	69,787	6,678	36,396	6,678	106,183	13,356

Low Case

	Import		Export		Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	15,616	1,445	12,980	1,291	28,596	2,736
2015	26,341	2,661	18,345	2,661	44,685	5,321
2020	36,976	3,538	22,365	3,538	59,342	7,077
2025	49,063	4,695	27,153	4,695	76,216	9,390
2030	64,860	6,207	32,906	6,207	97,765	12,413

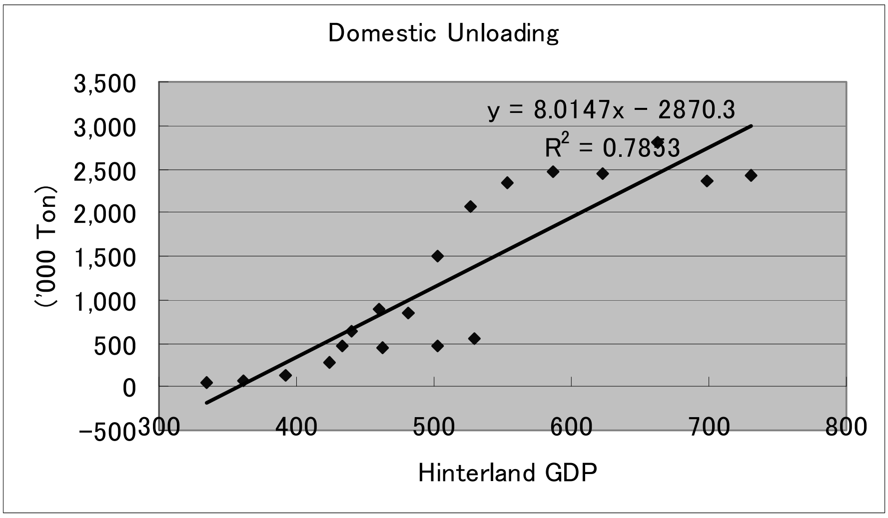
Source: Forecast by JICA Study Team

(2) Domestic Container

A total of 7.7 million tons or 1.07 million TEU of domestic containers were handled at Tanjung Priok Port in 2009. These domestic containers are loaded and unloaded at conventional berths. Although dedicated container terminals such as JICT are also used for loading/unloading containers coming from/going to remote islands, the volume is minimal.

Future demand for domestic containers is also forecast basically in the same manner as the international containers. However, a multiple regression analysis with a Dummy variable is employed instead of a single regression analysis.

In the case of the relationship between container cargo tonnage and GRDP in the port hinterland, a high correlation is not found for the period of 1991-2009 because of the discontinuity during the economic crisis (see Figure 4.2-3). Unloading container tonnage at Tanjung Priok Port is shown on the Y-axis, and port hinterland GRDP is on the X-axis. The corresponding plots make two groups, revealing a poor correlation between the two variables during this period. Coefficient of determination (R2) of the simple regression analysis during 1991-2009 is calculated at 0.7853, which is not sufficient for forecasting the future port demand.



Source: JICA Study Team

Figure 4.2-3 Simple Regression Analysis between Container Tonnage and GRDP

Another method to examine how one variable is related to other variables is Multiple Regression. Multiple Regression is the extension of simple regression, to take account of more than one independent variable. It is obviously the appropriate technique when we want to examine the effect on Y of several X variables simultaneously.

Now we introduce Dummy Variable (D) into the Multiple Regression Model in the following form;

$$Y = a + bX + cD$$

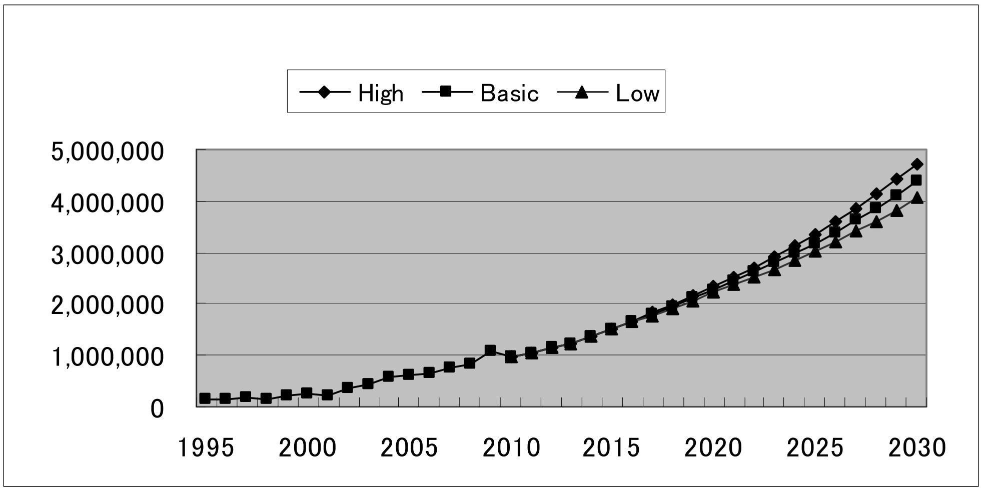
D is a 0-1 variable that clearly distinguishes between the two groups.

It is assumed that observed data of a dependent variable can be classified into two groups; initial stage on containerization in the interisland shipping (D=0), and afer 2002 (D=1). Then relative to the reference line where D=0, the line where D= 1 is parallel and c units higher.

The Multiple Regression Model with a dummy variable was evaluated using the same data on cargo tonnage and GDP shown in the above figure so as to check whether this model was suitable enough to forecast future port demand. Coefficient of determination (R2) was significantly improved from the simple regression model and turned out to be 0.947 for unloading case and 0.962 for loading case. JICA study team will apply the multiple regression model with dummy variable in order to forecast the future port demand whenever appropriate.

The average cargo weight per laden 20 ft container is set as 12.0 tons for both loading and unloading containers taking into consideration the actual working records at conventional wharves. Percentage of empty container is set as 5% for loading containers based on the actual records and future prospects.

Resulting volumes of inter-island containers handled at Tanjung Priok Port are estimated at about 18.5 million tons or 2.3 million TEU in 2020, and about 34.7 million tons or 4.4 million TEU in 2030. Loading and unloading volumes in the target years are found in Table 4.2-2. Future demands under the different economic frameworks are also forecast. Resulting volumes in the target years are summarized in Figure 4.2-4 and Table 4.2-2. Estimated demands (TEU) of the high case and low case are 7.9 % larger or 7.4% less respectively than that of the basic case in 2030.



Source: JICA Study Team

Figure 4.2-4 Historical Trend and Forecast of Domestic Container Throughput at Tg. Priok Port

Table 4.2-2 Forecast of Domestic Container Throughput by Case at Tanjung Priok Port

High Case

	Unloading		Loading		Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	2,417	524	5,244	544	7,662	1,068
2015	3,868	761	8,824	761	12,692	1,523
2020	5,430	1,173	13,599	1,173	19,030	2,347
2025	7,335	1,676	19,424	1,676	26,759	3,352
2030	9,945	2,364	27,404	2,364	37,349	4,728

Basic Case

	Unloading		Loading		Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	2,417	524	5,244	544	7,662	1,068
2015	3,868	761	8,824	761	12,692	1,523
2020	5,312	1,142	13,237	1,142	18,549	2,284
2025	7,013	1,591	18,437	1,591	25,450	3,181
2030	9,289	2,191	25,396	2,191	34,685	4,382

Low Case

	Unloading		Loading		Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	2,417	524	5,244	544	7,662	1,068
2015	3,868	761	8,824	761	12,692	1,523
2020	5,195	1,111	12,881	1,111	18,076	2,223
2025	6,703	1,509	17,491	1,509	24,194	3,018
2030	8,674	2,029	23,517	2,029	32,191	4,058

Source: Forecast by JICA Study Team

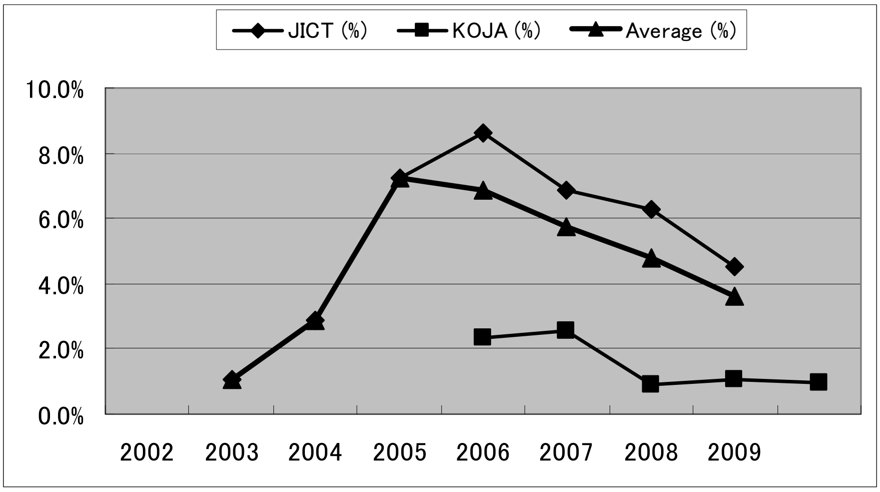
(3) Transshipment Container

According to container throughput statistics, a total of 90,221 TEU of containers (unloading / loading total) were transshipped at JICT in 2008. This volume was equivalent to 4.52% of the total throughput at JICT. On the other hand, it is reported that transshipped volume at KOJA was 7,680 TEU in 2008, which corresponded to 1.09% of the total throughput at the terminal (see Table 4.2-3).

Transshipment ratio of both JICT and KOJA terminals for the latest several years are shown in Figure 4.2-5. During 2002–2006 transshipment ratio showed an increasing tendency and reached over eight percent, but has since been gradually decreasing. By terminals, JICT has a higher transshipment ratio than KOJA, and currently in the neighborhood of 5 percent. Transshipment ratio at KOJA has been one percent for the last three years.

According to information given by a local shipping line, JICT offers a special tariff for transshipment containers in order to attract customers. Other shippers suggested that they select a port depending upon service level which terminal operators and shipping lines offer. It is useful to transfer the following remarks which a local shipping operator made to the JICA Study Team: “Tanjung Priok Port has already served as a transshipment port for Banjarmasin, Pontianak, and Panjang even if currently at a small scale. This can be jacked up if infrastructure and institutional arrangements at Tanjung Priok Port are improved and better than those at Singapore so as to do this business.”

Presently transshipment ratio at Tg. Priok Port is not significant from the view point of terminal throughput level and will not affect the result of demand forecast substantially. Throughput of the transshipment containers is included in the international throughput in this study.



Source: JICT and KOJA, Compiled by JICA Study Team

Figure 4.2-5 Transshipment Ratio by Terminal (%)

Table 4.2-3 Transshipment Ratio by Terminal （%）

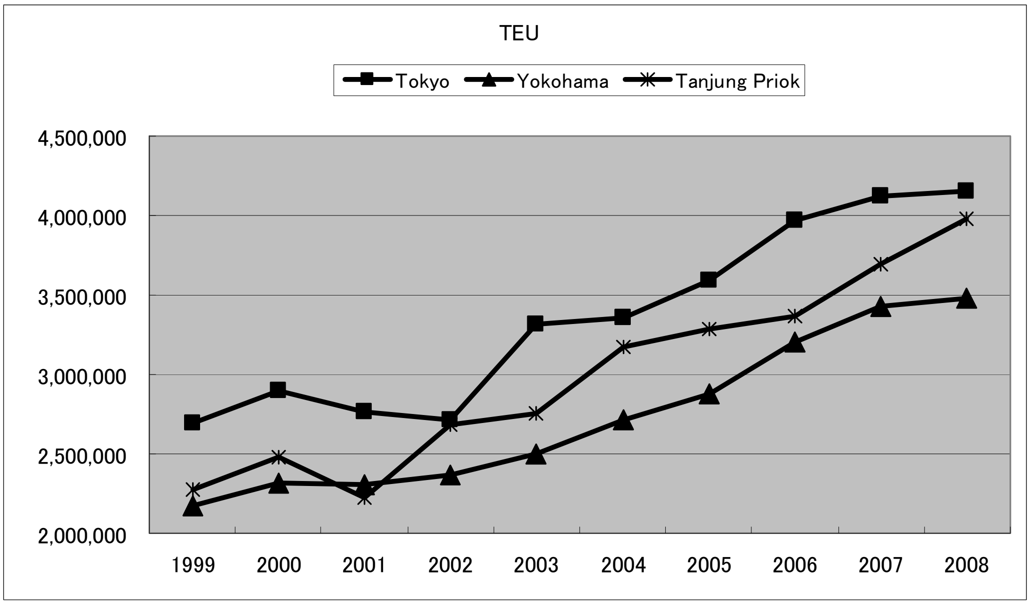
Year	JICT			KOJA			JICT + KOJA		
	Total TEUs	Transship TEUs	JICT (%)	Total TEUS	Transship TEUs	KOJA (%)	Total TEUS	Transship TEUs	Average (%)
2002	1,532,436	16,039	1.05%				1,532,436	16,039	1.05%
2003	1,502,883	43,429	2.89%				1,502,883	43,429	2.89%
2004	1,623,735	117,322	7.23%				1,623,735	117,322	7.23%
2005	1,470,467	126,982	8.64%	573,827	13,578	2.37%	2,044,294	140,560	6.88%
2006	1,623,916	111,758	6.88%	582,995	14,962	2.57%	2,206,911	126,720	5.74%
2007	1,821,326	114,793	6.30%	702,861	6,496	0.92%	2,524,187	121,289	4.81%
2008	1,995,782	90,221	4.52%	704,618	7,680	1.09%	2,700,400	97,901	3.63%
2009	1,675,395	N.A.		620,172	5,933	0.96%	2,295,567		

Source: JICT and KOJA, Compiled by JICA Study Team

(4) Demand Elasticity

As discussed and explained earlier, JICA Study Team developed and applied regression models for forecasting future cargo demand. This methodology is based on an assumption that the past relationship between cargo volumes and independent variables such as GDP will be kept in the same manner even in the future. Unit change of independent variable will always result in the same amount of change of dependent variable such as cargo volume.

On the other hand, it is widely believed that growth rate of cargo demand will not be unchanged for a long run, but will gradually decline as socioeconomic indices such as per capita income come to be matured. It is important to cross check from various points of view whether results of demand forecasting are sufficiently reliable and realistic. One of the useful general tools to examine the results of forecasting is to compare throughput of similar ports in the world.



Source: JICA Study Team

Figure 4.2-6 Historical Trend of Container Throughput at Tg. Priok, Tokyo, and Yokohama

Figure 4.2-6 illustrates container throughputs of Tg. Priok Port, Tokyo Port, and Yokohama Port. Tokyo and Yokohama ports are situated in the metropolitan area in Japan and these two ports jointly support socioeconomic activities in the greater capital area where about 30 million people reside while Tg. Priok Port is the single gateway port in the greater Jakarta metropolitan area where more than 50 million people live. Each of those three ports handles almost the same volume of containers, i.e. nearly four million TEU yearly. As seen from Figure 4.2-6, annual growth rates of these three ports are also identical while per capita GDP of Japan is much larger than that of Indonesia.

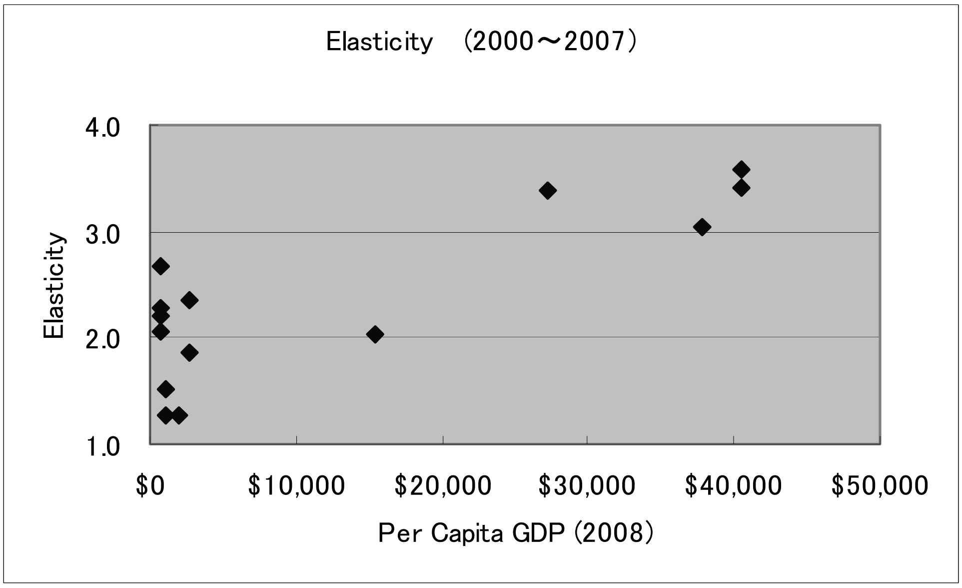
Elasticity is another useful tool to examine the forecast results. Elasticity is the ratio of the percent change in one variable to the percent change in another variable. It is a tool for measuring the responsiveness of a function to changes in parameters in a unit-less way. In empirical work elasticity is the estimated coefficient in a linear regression equation where both the dependent variable and the independent variable are in natural logs.

In general, the "x-elasticity of y" is expressed as follows;

$$E_{y,x} = \left|\frac{\partial \ln y}{\partial \ln x}\right| = \left|\frac{\partial y}{\partial x} \cdot \frac{x}{y}\right| = \left|\frac{\%\Delta y}{\%\Delta x}\right|$$

JICA Study Team obtained country-wise container throughput data through “International Containerisation” magazine, and used “World Development Indicator” of World Bank as sources for GDP and population data. Container throughput elasticity with respect to GDP is examined. This analysis aims at whether throughput elasticity to GDP will decline as per capita GDP grows.

Resulting elasticity of selected countries including both developing and developed countries is shown in Table 4.2-4. Contrary to the prediction, what is found is that nations with high per capita GDP have higher elasticity; Japan, USA and Netherlands are among this class. Elasticity of ports in Indonesia including the Tg. Priok port is not necessarily high, but Indonesian ports belong to a class of rather low elasticity. In other words, Indonesian ports have good potential to increase container volume elasticity with respect to GDP in coming years.



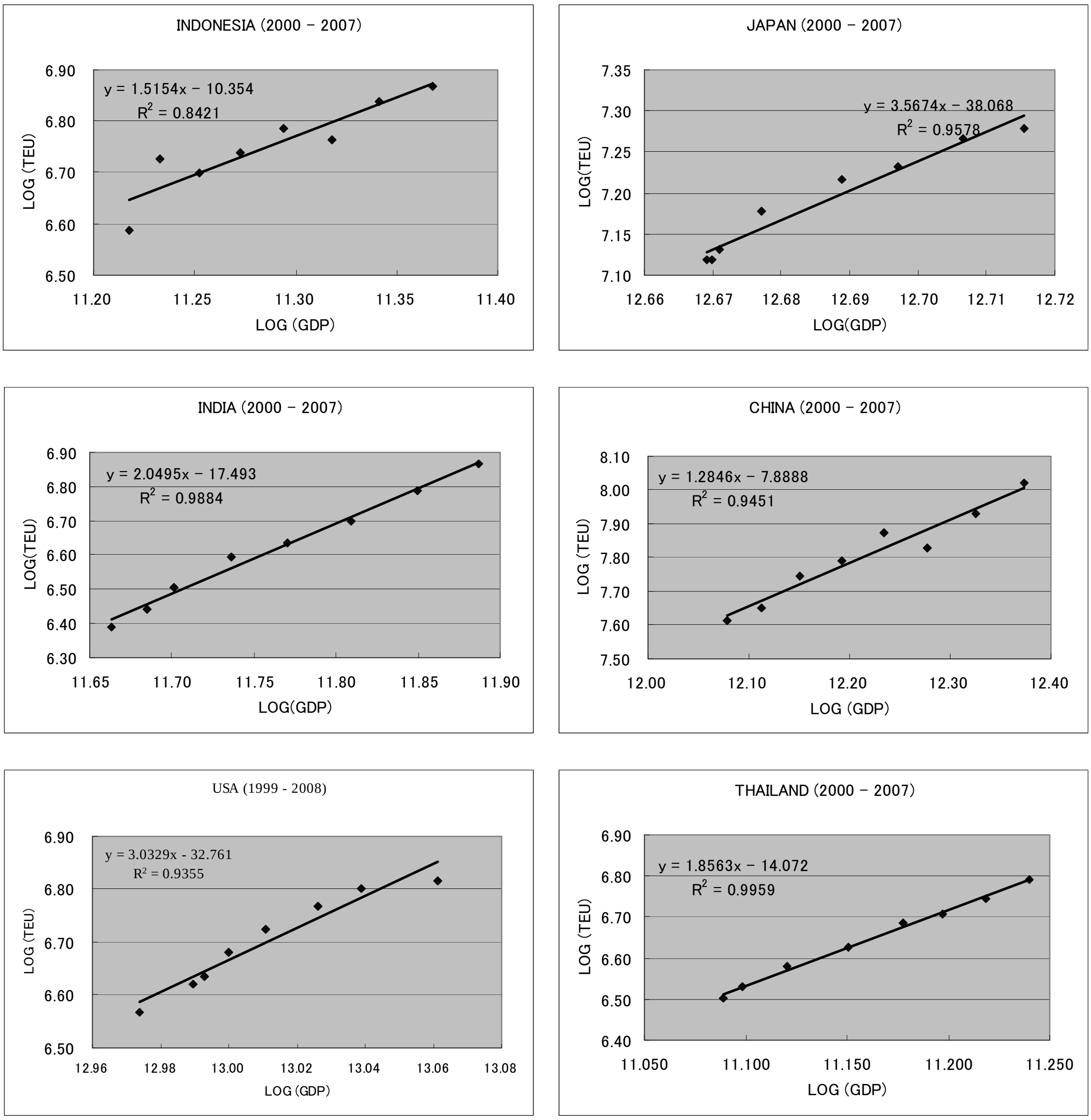
Source: JICA Study Team

Figure 4.2-7 Relationship Throughput Elasticity and Per Capita GDP

Table 4.2-4 Throughput Elasticity to GDP

	Elasticity (2000～2007)	Per Capita GDP (2008)		Elasticity (2000～2007)	Per Capita GDP (2008)
Japan	3.57	40,455	Jawaharlal Nehru	2.28	718
Tokyo	3.42	40,455	Vietnam	2.20	647
Korea	2.04	15,447	Pakistan	2.68	650
China	1.28	1,965	Indonesia	1.52	1,087
Thailand	1.86	2,640	Tg. Priok	1.28	1,087
Laem Chabang	2.36	2,640	USA	3.03	37,867
India	2.05	718	Rotterdam	3.38	27,307

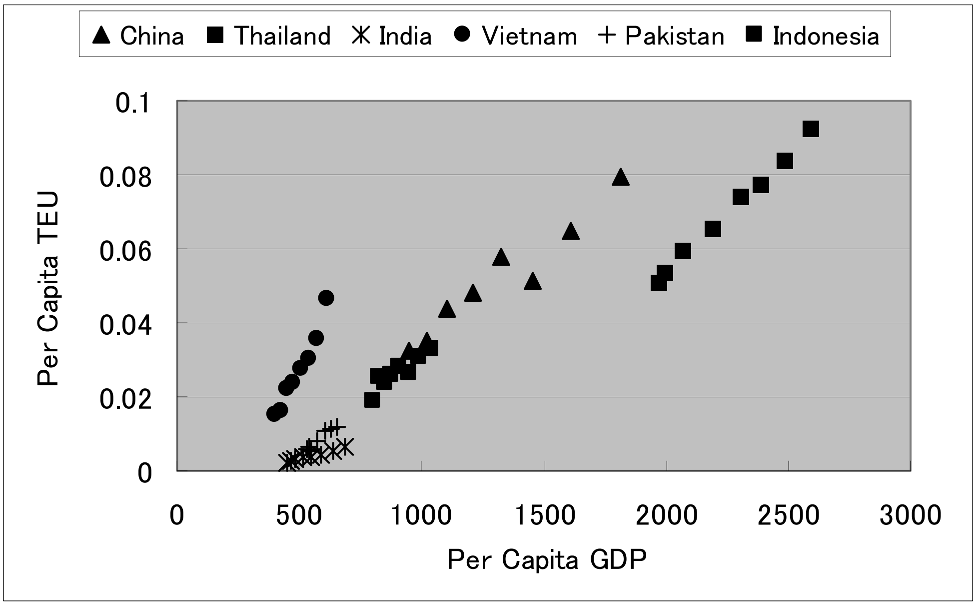
Source: JICA Study Team



Source: JICA Study Team

Figure 4.2-8 Container Volume (TEU) Elasticity To GDP of Selected Countries

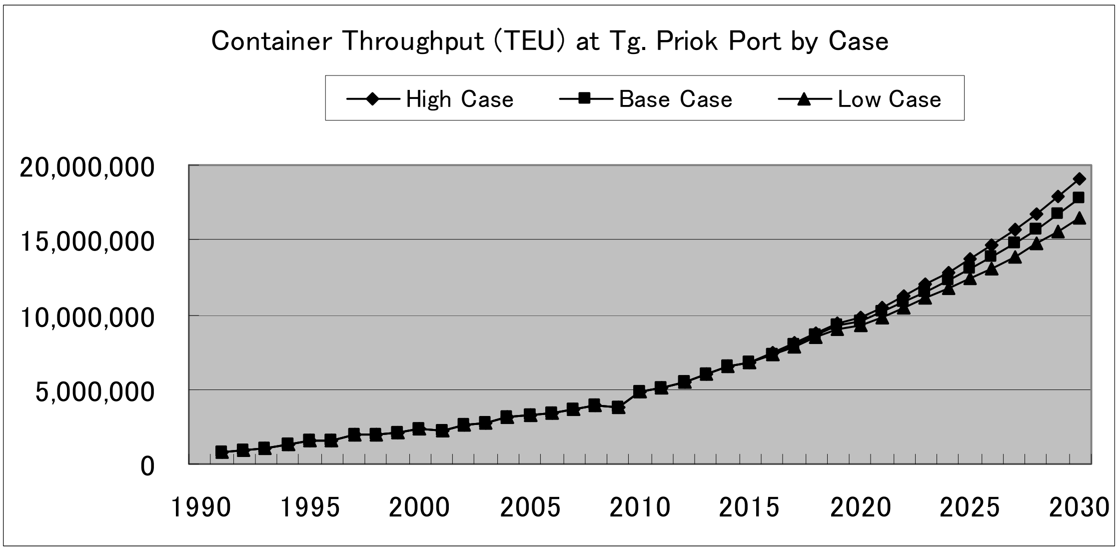
Figure 4.2-9 shows the relationship between per capita GDP and per capita TEU. Indonesia's plots lies to the southwest corner of the Figure, and is likely to follow China as the per capita GDP increases. Even if per capita GDP of Indonesia grows four times larger than the present level, per capita TEU will become in the neighborhood of the present level of Thailand, thus it can be said that Indonesia has good potential to continuously expand its container throughput in the foreseeable future.



Source: JICA Study Team

Figure 4.2-9 Relationship between Per Capita GDP and Per Capita TEU

(5) Summary of Container Throughput



Source: JICA Study TEam

Figure 4.2-10 Total Container Throughput, Tanjung Priok

Total container throughputs at Tanjung Priok Port, which consist of international containers and domestic containers, are summarized in Table 4.2-5. .

Table 4.2-5 Total Container Throughput at Tanjung Priok

High Case

	International Total		Domestic Total		Grand Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	28,596	2,736	7,662	1,068	36,258	3,804
2015	44,685	5,321	12,692	1,523	57,377	6,844
2020	63,000	7,437	19,030	2,347	82,029	9,784
2025	85,403	10,360	26,759	3,352	112,162	13,711
2030	115,180	14,364	37,349	4,728	152,529	19,092

Basic Case

	International Total		Domestic Total		Grand Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	28,596	2,736	7,662	1,068	36,258	3,804
2015	44,685	5,321	12,692	1,523	57,378	6,844
2020	61,153	7,255	18,549	2,284	79,702	9,539
2025	80,711	9,865	25,450	3,181	106,161	13,046
2030	106,183	13,356	34,685	4,382	140,868	17,738

Low Case

	International Total		Domestic Total		Grand Total	
	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)	Ton ('000)	TEU ('000)
2009	28,596	2,736	7,662	1,068	36,258	3,804
2015	44,685	5,321	12,692	1,523	57,377	6,844
2020	59,342	7,077	18,076	2,223	77,418	9,299
2025	76,216	9,390	24,194	3,018	100,411	12,408
2030	97,765	12,413	32,191	4,058	129,956	16,471

Source: Forecast by JICA Study Team

4.2.2 Non-Container Cargoes

(1) Major Non-container Cargoes

Indonesia Port Corporation II (ICPII) provided the JICA Study Team with commodity-wise information on cargo tonnage during the period 2000-2009 although classification of cargo is not necessarily consistent throughout the years.

According to the commodity-wise cargo tonnage statistics in 2009, commodities with more than one million tons can be listed in Table 4.2-6. Petroleum Product, Iron and Steel、and Coal are among the largest commodity group at Tg. Priok Port.

Table 4.2-6 Commodities with more than one million tons

(Unit: ton)

No.	Commodity Category	Unit	Import	Export	Unloading	Loading	Total
2	Cement and Clinker	Ton	14,643	1,943,484	722,102	352,767	3,032,996
3	Wheat	Ton	1,814,400	22,500	104,721	0	1,941,621
4	Crude Palm Oil		15,895	26,150	1,465,354	18,989	1,526,388
5	Iron & Steel	Ton	2,670,899	396,583	78,997	125,864	3,272,343
6	Coal	Ton	133,638	0	2,946,000	8,745	3,088,383
7	Sand	Ton	124,300	4,000	1,883,309	39,984	2,051,593
8	Forest Product	Ton	214,561	771	769,591	81,734	1,066,657
9	Petroleum Product	Ton	3,205,411	58,073	1,912,028	10,848	5,186,360

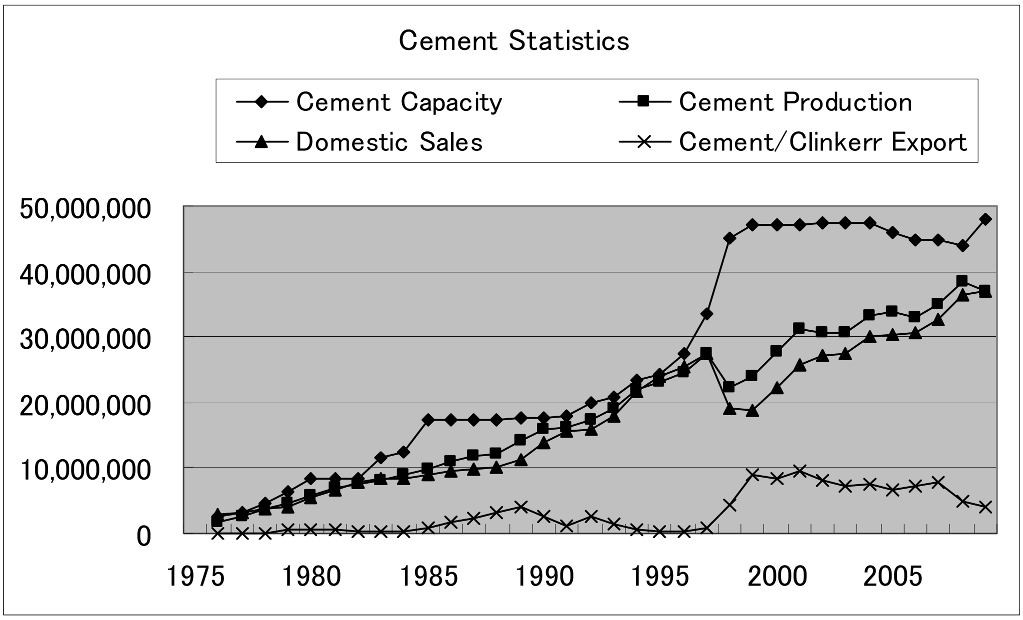
Source: TG. Priok Port Office, Pelindo II

Volume of cargoes listed in Table 4.2-6 covers more than ninety percent of the non-container cargo handled at the Tg. Priok port. Methodologies employed for demand forecasting and resulting demand of each cargo category at the target years shall be explained and presented as follows;

(2) Cement and Clinker

The Indonesian cement industry consists of nine companies, five of which are Government-owned or majority share held. According to Indonesia Cement Statistic 2009, total cement design capacity is 47,975 million tons, about 41% of which is controlled by the Government. The cement industry has historically been dominated by three companies: PT Indocement Tunggal Prakarsa Tbk.(ITP), Semen Gresik Group and PT Holcim Indonesia, Tbk. (HI),, which together control over 90 % of domestic production capacity.

In 2009, Indonesian cement factories produced 37 million tons of cement, and 37 million tons were sold on the domestic market, and 4 million tons of cement/clinker were sold in the overseas market. As shown in Figure 4.2-11, the production capacity was expanded just before the economic crisis in 1998 and many cement companies suffered from the overcapacity. However, average utilization ratio of the cement manufacturing plants in Indonesia has improved since then and registered 82 % in 2009. According to the operation report of Tanjung Priok Port, a total of 4 million tones of cement and clinker were loaded and unloaded at the port in 2009.



Source: Indonesia Cement Statistic 2009, Indonesia Cement Association

Figure 4.2-11 Cement Industry in Indonesia

Among the nine cement companies, two companies have manufacturing plants in West Java: at Citeureup and Palimanan for PT Indocement Tunggal Prakarsa Tbk, and at Narogong for PT Holcim Indonesia

Limestone and clay make up 90 % of raw material requirements, and they are usually quarried at the manufacturing sites. The raw materials are dried, ground, proportioned and homogenized before being transferred to rotary kilns to be burned. The resulting material is called clinker, and crushed with gypsum at the cement grinding mil to make Portland cement. Gypsum typically makes up 3 to 5 % of the finished product. Cement production requires energy to heat kilns and electricity to run other machinery and equipment. Coals are usually used as energy resources in Indonesia, and transported from Kalimantan and Sumatera. Most of them are unloaded at Tg. Priok Port, Banten Port and Cirebon Port.

According to Indonesia Cement Association, domestic cement sales will reach 4.9 million tons in 2015. For forecasting the domestic sales during 2016-2030, JICA Study Team developed a regression model with independent variables of the construction sector’s GDP and Dummy. Future growth rates of the construction sector’s GDP is assumed same as those of the National GDP.

Resulting domestic cement sales are estimated at 113 million tons in 2030, i.e., 398.5 kg per capita. Cement consumptions per capita in ASEAN Countries in 2008 are summarized in Table 4.2-7; 1,020 kg per capita for Singapore, 612 kg for Malaysia, and 461 kg for Vietnam, respectively. Indonesia only consumed 168 kg of cement per capita in 2008, hence has a good potential for expansion.

Table 4.2-7 Cement Consumption in ASEAN Countries - 2008

	Population	Cement Consumption	Per Capita Consumption
	Million	'000 Ton	kg/capita
Singapore	4.8	4,900	1,021
Brunei	0.4	246	615
Malaysia	27.7	16,962	612
Thailand	63.4	23,921	377
Vietnam	86.5	39,846	461
Philippines	90.4	13,217	146
Indonesia	226	38,072	168

Source: Indonesia Cement Association, 2010

In order to increase the utilization rate of the manufacturing plants, Indonesian cement companies expanded overseas markets after the economic crisis in 1998 and about 7 to 9 million tons of cement/clinker, which was nearly 20% of the production capacity, were annually exported to overseas market. With the increase of the domestic demand, export volume decreased significantly, and in 2009 export volume of cement/clinker dropped to 4 million tons, which was equivalent to 8.4% of the total production capacity. Considering these situations surrounding the Indonesian cement market, the JICA study team assumes that 5 percent of the cement production capacity will be sold to overseas markets in the form of cement and clinker. It is also assumed that Tanjung Priok Port will handle 50 % of the total Indonesian exported volume of cement and clinker based on the actual cargo tonnage and market shares.

Indonesia Cement Association revealed the capacity projection of each cement company up to 2015 as shown in Table 4.2-8. JICA Study Team follows the Association’s capacity projection up to 2015, and assumes that cement industries will expand their production capacities to meet the market demand even afterward.

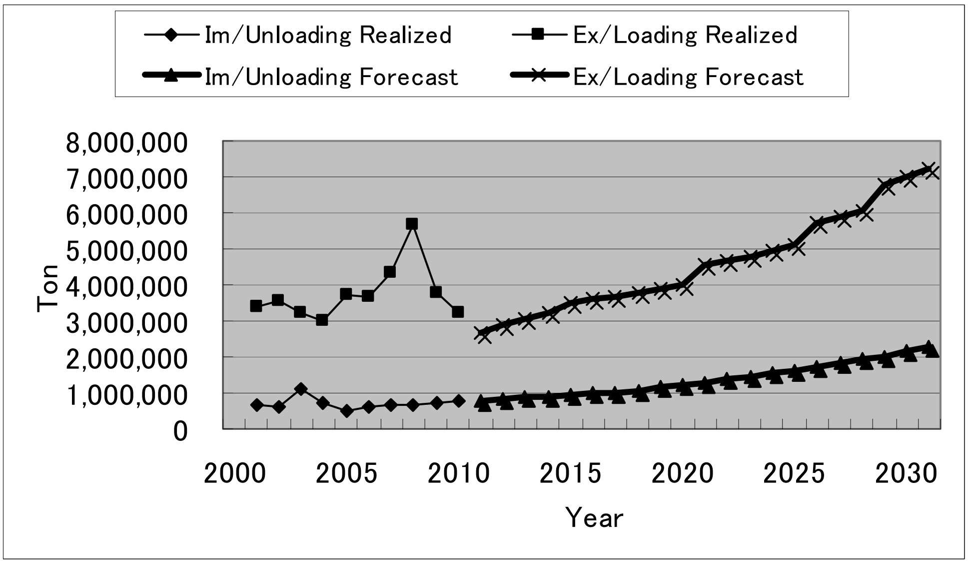
Table 4.2-8 Cement Production Capacity Projection

(Unit: ton)

Company		2009	2010	2011	2012	2013	2014	2015
PT. SAI	Clinker	0	600	1,200	1,200	1,200	2,400	2,400
	Cement	0	800	1,600	1,600	1,600	3,200	3,200
PT. SP	Clinker	4,952	5,577	5,609	5,609	5,625	6,855	8,216
	Cement	5,410	6,300	6,300	6,400	6,620	8,160	9,257
PT. SB	Clinker	1,200	1,200	1,200	1,200	1,200	2,225	2,300
	Cement	1,200	1,200	1,200	1,350	1,500	2,600	2,700
PT. ITP	Clinker	15,600	15,600	15,600	15,600	15,600	18,100	18,100
	Cement	17,100	18,600	21,100	21,100	21,100	23,100	23,100
PT. HI	Clinker	6,391	6,391	6,391	6,391	7,632	7,632	7,632
	Cement	8,700	8,700	8,700	8,700	8,700	10,700	10,700
PT. SG	Clinker	7,161	7,568	7,879	9,109	10,495	10,495	10,495
	Cement	8,530	9,100	9,724	11,300	13,120	13,120	13,120
PT. ST	Clinker	3,528	3,612	3,675	6,266	6,331	6,331	6,331
	Cement	3,900	4,290	4,602	6,549	7,147	7,147	7,147
PT. SBM	Clinker	1,800	1,800	1,800	1,800	4,300	4,300	4,300
	Cement	3,000	3,000	3,000	3,000	5,500	5,500	5,500
PT. SK	Clinker	300	300	300	300	300	300	300
	Cement	570	570	570	570	570	570	570
Total	Clinker	40,932	42,648	43,654	47,475	52,683	58,638	60,074
	Cement	48,410	52,560	56,796	60,569	65,857	74,097	75,294

Source: Indonesia Cement Association, 2010

It is assumed that domestic cement consumption will be supplied by the domestic production. Volumes of cement and clinker in the inter-island trade are forecast in consideration of actual ratios against the volumes of the domestic sales. Demand of cement and clinker can be summarized in Figure 4.2-12 and Table 4.2-9.



Source: IPC II for 2000 – 2009 realized throughput and forecast by JICA Study Team

Figure 4.2-12 Historical Trend and Future Demand of Cement and Clinker at Tg. Priok Port

Table 4.2-9 Cement and Clinker Throughput at Tg. Priok Port

(Cement & Clinker) (Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Unloading Total	691	635	719	795	983	1,304	1,716	2,266
Loading Total	3,373	3,647	3,763	3,215	3,602	4,541	5,713	7,218
Grand Total	4,064	4,282	4,482	4,009	4,584	5,845	7,428	9,484

Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

(3) Wheat

Wheat and flour are important foods in Indonesia after rice. The largest users of flour are the small-scale enterprises such as the wet & dry noodle industry, market share of which is about 30 %. Bakery and biscuit industry consume about 25 % and 15 % respectively. Instant noodle industry consumes about 20 %, and fried snack and general household consume about 10 %.

Basic material of flour is wheat. Nearly all of the consumed wheat in Indonesia is supplied by foreign producers. Main import origins are Australia, Argentina, the United States, and Canada.

There are currently four flour companies in Indonesia; PT ISM Bogasari Flour Mills in Jakarta and Surabaya, PT Sriboga Raturaya in Semarang, PT Panganmas Inti Persada in Cilacap, and PT Berdikari Sari Utama Flour Mills in Makassar. According to APTINDO, combined share of Bogasari Jakarta and Surabaya in Indonesian wheat flour market was 69% in 2004, followed by Berdikari of 12%.

Bogasari has a wheat flour production capacity of 3.6 million tons per year, the largest in the world in a single location. Bogasari Jakarta has 140 wheat silos with a total capacity of 4,000,000 mt, pellet silos with a capacity of 69,000 mt and warehouses for the storage of goods with a capacity of 65,000 mt.

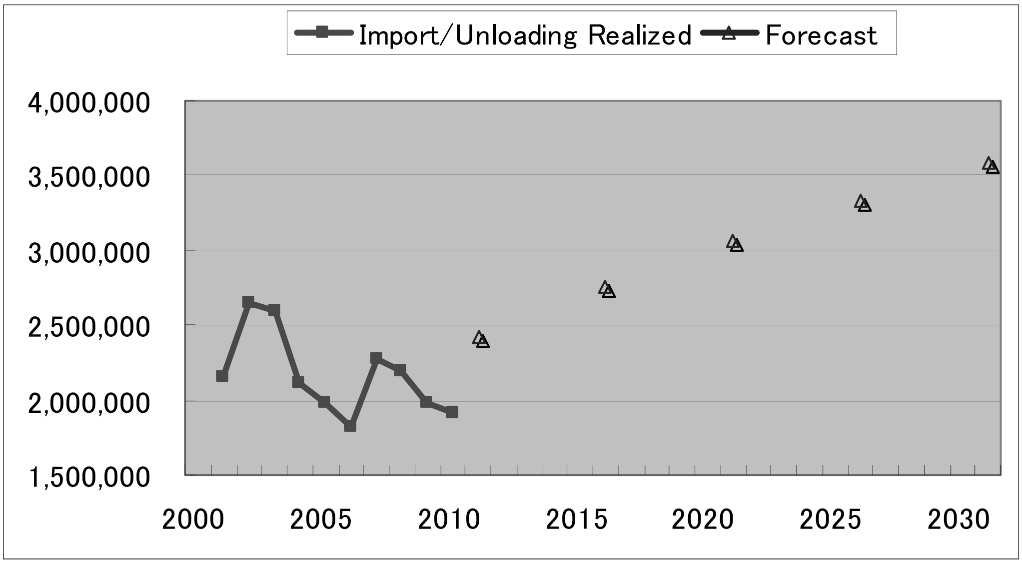
Bogasari Jakarta has two piers, 185 m and 200 m in length and 9 m and 14 m deep, and equipped with a pneumatic unloading equipment of 3,800 mt per hour. One of these piers, Pier B, can accommodate the Panamax class size vessels. Marine Division of this company operates three wheat transport vessels capable of carrying 100,000 mt and three barges with a capacity of 8,000 mt.

Presently Indonesia imports a total of about four and a half million tons of wheat annually, and more than half are passing through Tanjung Priok Port. Consequently this port handles over two million tons of grain. About 90 %, however, of the total tonnage handled at Tanjung Priok Port are import cargoes.

Historical trend of Indonesian import of wheat can be obtained from the FAO statistics, and its future volume was forecast by a regression model, in which total population in Indonesia was used as a regressor (R=0.90). It is forecast that Indonesia will import a total of about 7 million tons of wheat in 2030 as both population and per capita GDP increase. Currently Indonesia's per capita wheat flour consumption is around 15kg/capita, and the above forecast results in around 20 kg/capita in 2030 whereas it is 71 kg per capita in Singapore and 40 kg per capita in Malaysia in 2002. Therefore, continuous growth of wheat flour industry is still possible in Indonesia.

It is set based on the actual records that 50 % of the Indonesian import of wheat is equal to the total wheat tonnage handled at the Tanjung Priok Port.

Historical trend and forecast of wheat volumes of the target years are shown in Figure 4.2-13 and Table 4.2-10.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-13 Historical Trend and Demand of Wheat at Tg. Priok Port

Table 4.2-10 Wheat Throughput at Tg. Priok Port

(Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Unloading Total	2,155	1,823	1,980	1,919	2,756	3,058	3,333	3,589
Loading Total	301	-	13	23	-	-	-	-
Grand Total	2,457	1,823	1,993	1,942	2,756	3,058	3,333	3,589

Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

(4) Crude Palm Oil（CPO）

Crude Palm Oil (CPO) is mainly used to produce refined, bleached and deodorized palm oil (RBDPO). RBDPO is further fractionated to produce RBD olein and RBD stearine. RBD olein is used mainly in the manufacture of cooking oil and margarine. RBD stearine is primarily used in the manufacturing of soaps and detergent. The CPO-derived cooking oil industry has experienced continuous growth in the last 10 years, along with the growth of the country's palm oil industry.

Indonesia produced about 17 million tones of CPO in 2007 (11 million tons of large estates and 6 million tons of small holders estates), and ranked as the largest CPO producer in the world, surpassing Malaysia. As shown in Table 4.2-11, annual growth rates of palm oil in Indonesia have been more than ten percent during the last decade. According to a local newspaper, CPO output was registered at 20.3 million tons in 2009.

Table 4.2-11 Palm Oil Production of Indonesia

(Unit: '000 ton)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Production (MT)	6,855	7,775	9,370	10,600	12,380	14,100	15,881	16,900
Growth Rate (%)		13.42%	20.51%	13.13%	16.79%	13.89%	12.63%	6.42%

Source: FAO

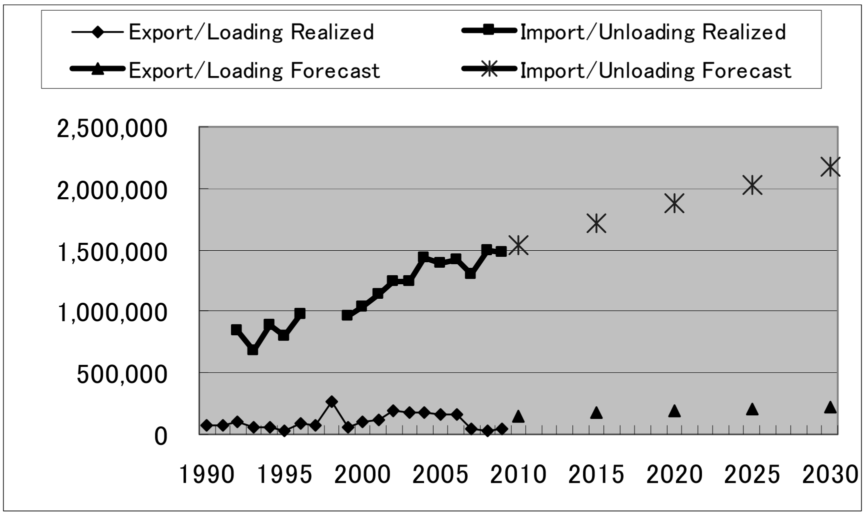
Currently, about forty percent of CPO is consumed domestically. It is reported that the government plans to cap crude palm oil exports at 50 percent of output by 2015 and 30 percent by

2020 in a bid to boost the downstream processing sector. Total domestic output of CPO is expected to reach 40 million tons by 2020.

North Sumatra has been the center of the cooking oil industry, and Jakarta the sub-center of this industry in Indonesia. Many CPO-based cooking oil factories are located in this capital city and construction of a CPO refinery in Tanjung Priok will be finished soon.

Tanjung Priok Port has been utilized as an unloading point for CPO, which is primarily produced in Sumatra. As products of CPO are mostly consumed domestically, volume of CPO unloaded at Tanjung Priok Port is correlated with hinterland population (R=0.958). Therefore, if based on a conservative scenario, future CPO volume handled at the port can be estimated by giving the population in the target year. Export/Loading volume of CPO has been around ten percent of the Import/Unloading volume at Tg. Priok port.

Historical trend and future volume of CPO in the target years are shown in Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team
Figure 4.2-14 and Table 4.2-12.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-14 Historical Trend and Demand of CPO at Tg. Priok Port

Table 4.2-12 CPO Throughput at Tg. Priok Port

(Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Im/Unloading Total	1,041	1,397	1,489	1,481	1,713	1,877	2,032	2,176
Ex/Loading Total	105	168	37	45	171	188	203	218
Grand Total	1,146	1,565	1,526	1,526	1,884	2,065	2,235	2,393

Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

(5) Iron and Steel

In the past, Indonesia was the largest steel producer in ASEAN. By 1996, the steel production in Indonesia accounted for 35 percent of the total production in ASEAN region. On the other hand, steel consumption in Indonesia during this period of time overweighed production, resulting in significant inflow of steel and steel products from foreign countries.

The steel industry in Indonesia is essentially comprised of one integrated mill, PT Krakatau Steel, that makes steel from iron ore and many mini-mills that use scrap metal as their raw material. The principal products made in Indonesia include hot rolled sheets, cold rolled sheets, wire rods, and galvanized steel.

Since 2005, the domestic steel industry has faced marketing problem with large imports of steel products at cheaper prices especially from China. The trade pact between ASEAN and China will see import duties scrapped or reduced on numerous products including steel. The tariffs are zero to 5 percent. In 2008, domestic producers supplied only half of Indonesia's demand of nine million tons.

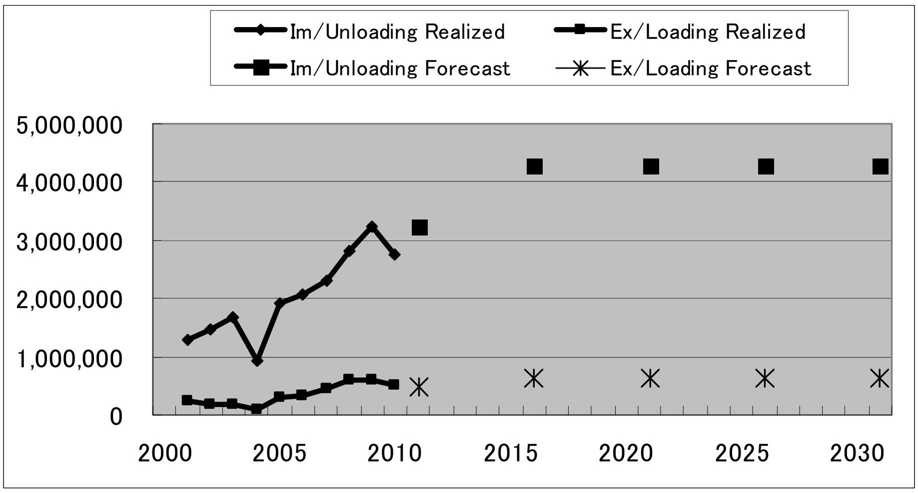
Indonesia's steel industry has not expanded significantly in the past 10 years. The production capacity for various types of steel products has been almost unchanged. Increase has been recorded only in the capacity of a few types of products, but there is also a decline in the production capacity of certain products.

Recently, there has been speculation in the media that an integrated steel mill in Indonesia will be established. According to one source, Indonesian state-owned steel maker PT Krakatau Steel hopes to set up a joint venture company with South Korea's Steel Maker POSCO in July. A joint venture agreement is to be signed in May 2010 for the construction of a factory producing steel plates in Cilegon, Banten. The factory will have an annual production capacity of 3 million tons of steel plates. POSCO wants the first phase of the project to be completed in 2013 or early 2014 producing with annual production slated for 1 million tons.

Tanjung Priok Port handled 2.2 million tons of steel and steel product in 1996, and 2.5 million tons in 1997. Indonesian economy was hampered by the economic crisis in 1997/98, and cargo tonnage dropped to 1.4 million tons. Since then the cargo volume has been gradually increasing again and reached 4.4 million tons in 2008.

The government has set up an aggressive economic development policy targeting 2014. Under this circumstance, it is difficult to foresee prevailing huge inflow of foreign steel products will continue for long term, but it is more likely that another integrated steel mill with advanced technology will be established in the nation to meet the domestic needs in near future. JICA Study Team presents results of time series analysis up to 2015, and assumes the throughput remains unchanged at the level afterwards. It is highly recommended to pay close attention to the deal between the domestic steel maker and international investors regarding the establishment of steel mills. When such deal is realized, trading pattern at Tg. Priok Port will significantly change.

Historical trend of cargo tonnage and forecast volumes of steel and steel products at the target years' are summarized and shown in Figure 4.2-15 and Table 4.2-13.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-15 Historical Trend and Demand of Iron and Steel at Tg. Priok Port

Table 4.2-13 Iron and Steel Throughput at Tg. Priok Port

(Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Im/Unloading Total	1,505	2,399	3,810	3,272	4,291	4,291	4,291	4,291
Ex/Loading Total	226	335	591	522	644	644	644	644
Grand Total	1,731	2,734	4,402	3,795	4,935	4,935	4,935	4,935

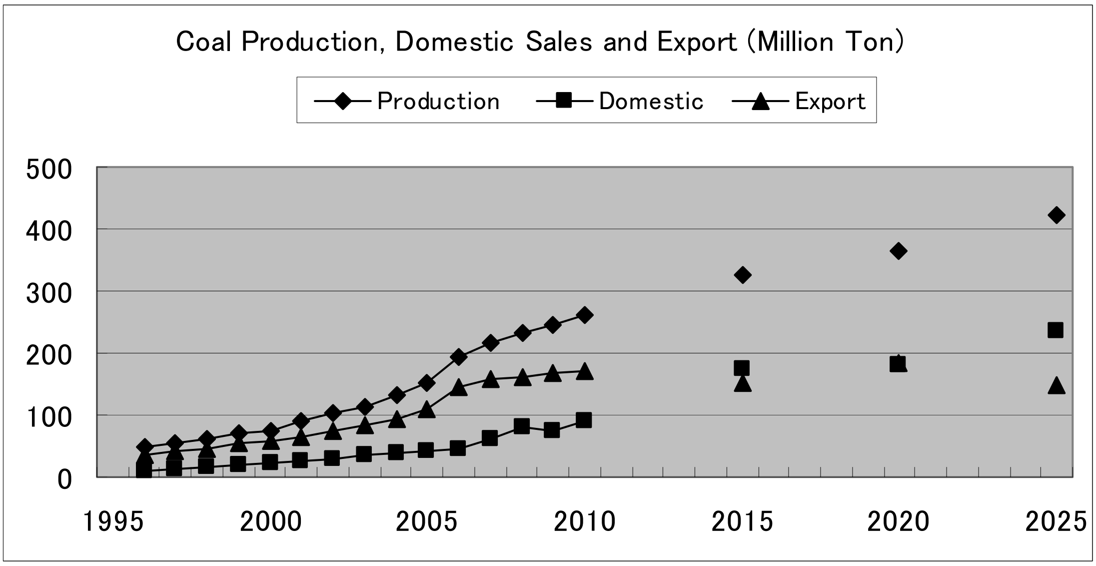
Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

(6) Coal

Coal is an energy alternative to petroleum because of relatively low cost. Coal is used for many purposes in Indonesia, particularly electric power (about 65%), cement industries (15%), metallurgy and paper (10%), and also power source for some other industries (10%).

Indonesia's coal production has increased in recent years, and today the country is one of the world's chief coal exporters. The country's coal reserves mainly are located in Sumatra and Kalimantan. In Kalimantan, East Kalimantan Province and South Kalimantan Province are main coal producers in Indonesia.

Indonesia adopted National Coal Policy in January 2004, which seeks to promote the development of the country's coal resources to meet domestic requirements and to increase coal exports in the long-run. In 2008, 65 million tons of coal were consumed domestically while 160 million tons were exported. Directorate General of Mineral, Coal and Geothermal forecast that export volume of coal will remain at the level of 150 million tons per year and domestic consumption will increase rapidly and reach 220 million tons in 2025. However, the price gap between export and domestic market will have to be addressed.



Source: Directorate of Mineral and Coal Enterprise-"Indonesia Mineral and Coal Statistic 2005

Figure 4.2-16 Indonesia Coal Production, Domestic Sales and Export (Million tons)

Tanjung Priok port has not substantially been handling coal for many years. In 2002, this port unloaded 375, 000 tons of coal. Since then, volume of coal unloaded at the Tanjung Priok port has been increasing rapidly in reflection of the New Coal Policy. It is certain that the demand for coal will continue to grow unless other alternative energy resource comes into existence.

In 2009 the Tanjung Priok port unloaded about three million tons of coal, which were mainly used as fuel for cement manufacturing plants in West Java. Indonesia Cement Association revealed the required volume of coal for cement industry up to 2015 (see Table 4.2-14). Compound annual growth rate of required volume of coal during 2009 – 2015 for Indonesia cement industry total is 8.9 percent while that for Holcim cement and Indocement, which have cement manufacturing plants in West Java, is 3.1 percent.

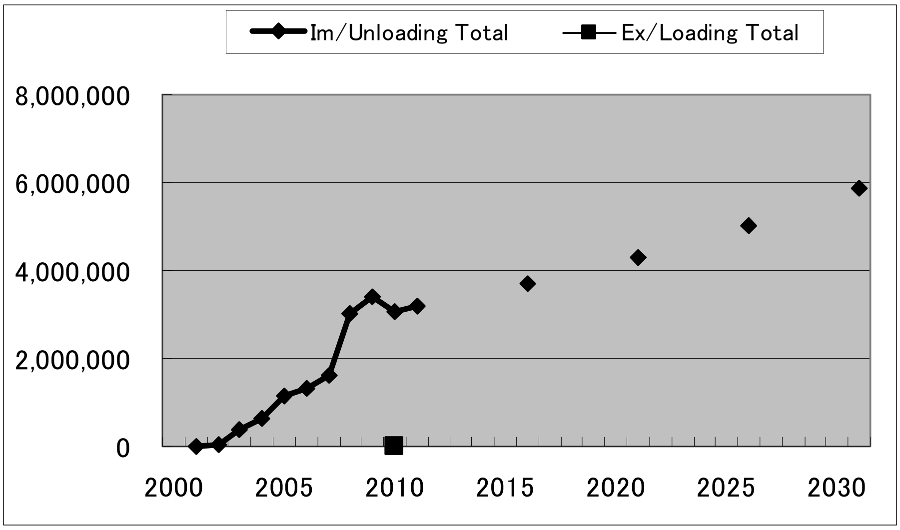
Table 4.2-14 Coal Type in Cement Industry

Cement Company	Calory	2009	2010	2011	2012	2013	2014	2015
PT Semen Gresik	> 6,000 cal	367,359	367,359	149,701	173,071	0	0	0
	5,500-6,000 cal	612,266	612,266	748,505	865,355	692,670	692,670	692,670
	< 5,500 cal	244,906	244,906	598,804	692,284	1,616,230	1,616,230	1,616,230
PT Semen Padang	> 6,000 cal	211,644	211,644					
	5,500-6,000 cal			403,725	406,042	406,042	496,241	594,765
	< 5,500 cal	57,725	57,725	609,062	609,062	610,800	744,361	892,148
PT Semen Tonasa	> 6,000 cal	207,054	207,054	215,676	244,841	247,368	247,368	247,368
	5,500-6,000 cal	483,126	483,126	503,243	856,942	865,787	865,787	865,787
	< 5,500 cal	0	0	0	122,420	123,684	123,684	123,684
PT Holcim Indonesia	> 6,000 cal	0	0	0	0	0	0	0
	5,500-6,000 cal	0	0	0	0	0	0	0
	< 5,500 cal	955,856	955,856	948,855	981,654	1,231,654	1,231,654	1,231,654
PT Indocement Tunggal Prakarsa Tbk	> 6,000 cal	304,200	304,200	304,200	304,200	304,200	352,950	352,950
	5,500-6,000 cal	1,419,600	1,419,600	1,419,600	1,419,600	1,419,600	1,647,100	1,647,100
	< 5,500 cal	304,200	304,200	304,200	304,200	304,200	352,950	352,950
PT Semen Baturaja	> 6,000 cal	179	179	204	204	204	204	204
	5,500-6,000 cal	0	0	0	0	0	222	222
	< 5,500 cal	0	0	0	0	0	0	0
PT Sement Andalas Indonesia	> 6,000 cal	0	0	0	0	0	0	0
	5,500-6,000 cal	0	0	320	320	320	640	640
	< 5,500 cal	0	0	0	0	0	0	0
PT Semen Bosowa Maros	> 6,000 cal	0	0	0	0	0	0	0
	5,500-6,000 cal	360	360	360	360	1,200	1,200	1,200
	< 5,500 cal		0	0	0	0	0	0
Total		5,168,475	5,168,475	6,206,455	6,980,555	7,823,959	8,373,261	8,619,572

Source: Indonesia Cement Association, 2010

Future coal demand is forecast assuming the same annual growth rate as the cement industry because main consignees of this commodity at the Tg. Priok port are cement manufacturing companies. Decision of locations where huge volume of coal should be handled involves policy judgment taking into consideration the economy, space planning, and environment and social matters.

Historical trend and future volume of coal in the target years are shown in Figure 4.2-17 and Table 4.2-15.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-17 Historical Trend and Demand of Coal at Tg. Priok Port

Table 4.2-15 Coal Throughput at Tg. Priok Port

(Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Im/Unloading Total	6	1,334	3,405	3,080	3,700	4,311	5,023	5,853
Ex/Loading Total	0	0	0	9	0	0	0	0
Grand Total	6	1,334	3,405	3,088	3,700	4,311	5,023	5,853

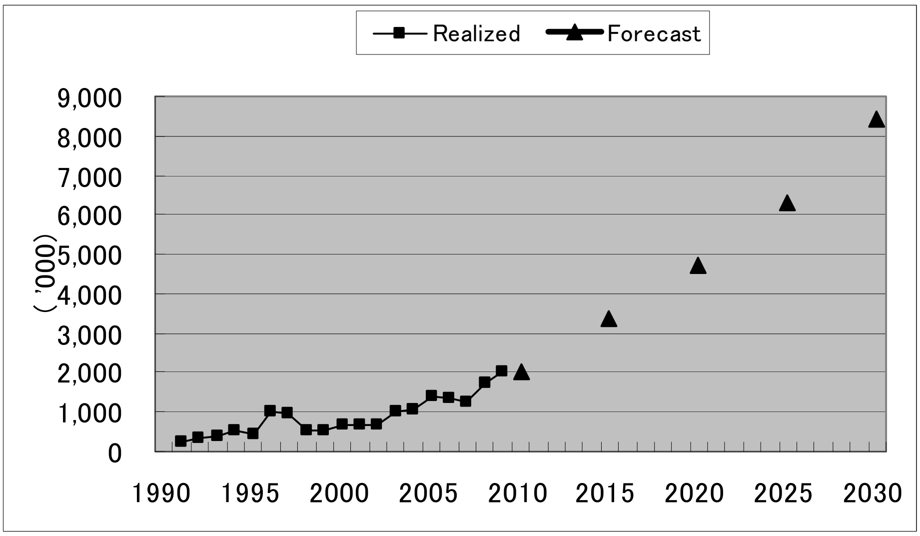
Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

(7) Sand

Sands are mostly unloaded at Wali Jaya (Kali Mati) Berth, Pier I. Cargo volume of this category registered 697,000 tons in 2000. After the economic crisis in Indonesia and other Asian countries, demand for sands has shown remarkable growth with 1,725,000 tons being unloaded at Tanjung Priok port in 2008 and 2,008,000 tons in 2009.

Cargo throughput of sand has a high correlation with GRDP of the hinterland (R=0.965). It is estimated that about 4.7 million tons of cargo of this category will be handled at Tanjung Priok port in 2020 and 8.4 million tons in 2030. It is worth noting that the Port of Tokyo unloaded 5,685, 380 tons of sand in 2008.

Historical trend and future volume of sand in the target years are shown in Figure 4.2-18 and Table 4.2-16.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-18 Historical Trend and Demand of Sand at Tg. Priok Port

Table 4.2-16 Sand Throughput at Tg. Priok Port

(Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Im/Unloading Total	697	1,413	1,725	2,008	3,351	4,700	6,290	8,417
Ex/Loading Total	-	-	-	44	-	-	-	-
Grand Total	697	1,413	1,725	2,052	3,351	4,700	6,290	8,417

(Remarks; Port of Tokyo unloaded 5,685,380 tons of sand in 2008.)
Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

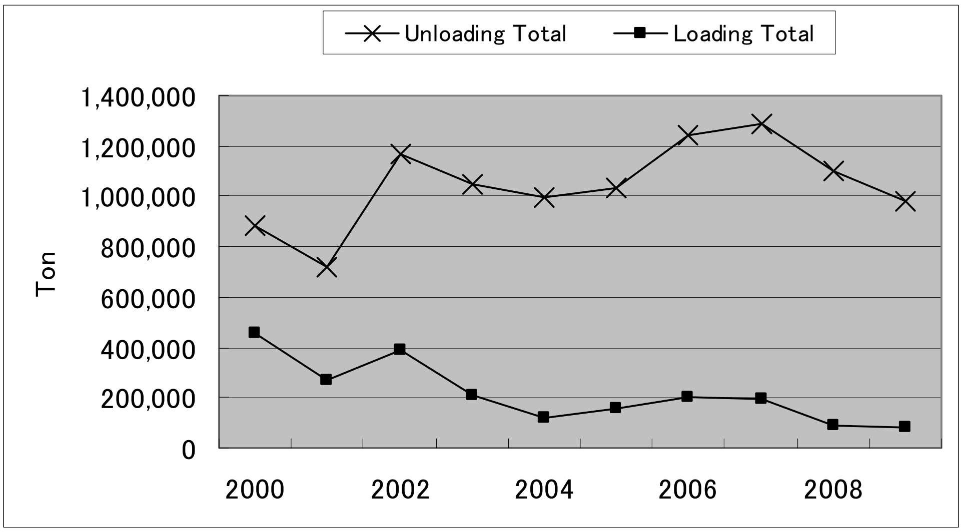
(8) Forest Product

"Forest Product" is, in these cargo statistics, a generic name of a class of port cargo, and consists of log, lumber, timber, plywood, fire board, pulp, and even paper and roll tissue are included in this category. Therefore, "Forest Product" includes not only raw materials, but also manufactured goods.

Percentage of "paper" in this category has been declining for the past years. During 1990 to 2002, more than 200,000 tons of paper was loaded and unloaded at Tanjung Priok port per year, but presently cargo volume of paper is only 10,000 tons.

On the contrary, pulp is the leading commodity of this class and amounts to nearly one million tons. About three quarters of the total throughput of the pulp are coming through interisland trade, and its manufactured products are mostly consumed domestically.

Figure 4.2-19 shows historical trend of "Forest Product" throughput at the Tg. Priok port, and reveals that volume of cargo has not significantly changed but has been rather stable by remaining in the range of between 1.0 and 1.5 million ton. It is likely that cargo volume will remain in the same range unless manufacturing capacity is increased.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-19 Historical Trend and Demand of Forest Product at Tg. Priok Port

Table 4.2-17 Forest Product Throughput at Tg. Priok Port

(Unit: '000 Ton)

Year	2000	2005	2008	2009	2015	2020	2025	2030
Im/Unloading	884	1,031	1,102	984	1,300	1,300	1,300	1,300
Ex/Loading	457	158	93	83	200	200	200	200
Total	1,341	1,189	1,195	1,067	1,500	1,500	1,500	1,500

Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

(9) Petroleum Product

Volume of cargo classified as “Petroleum Product” amounted to 5.1 million tons in Tanjung Priok Port in 2009. In the past nearly 100 % of the total cargo tonnage was domestic unloading cargo. Recently however, cargo volume from foreign countries has been increasing and surpassed that of domestic trade. For example, import volume of this commodity category was 3.2 million and domestic unloading volume was 1.9 million tons in 2009.

Historical trend of “Petroleum Product” throughput is shown in Figure 4.2.20. Cargo volume reached 8.4 million tons in 2004. Since then cargo tonnage of this class continues to decrease.

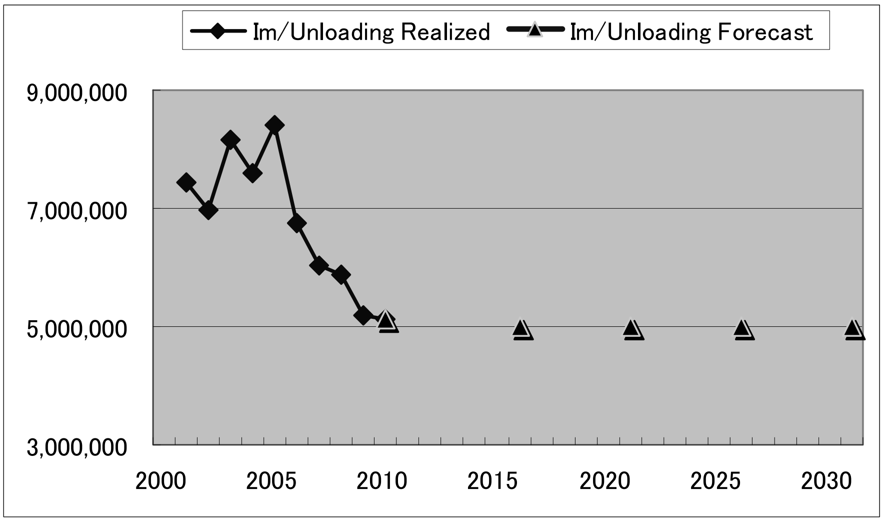
Indonesian government announced a basic policy on energy through the presidential decree No. 05 of Year 2006 and Blue Print: National Energy Policy 2006 – 2025. According to the government policies, share of petroleum shall decrease from 54.5% in 2005 to 20% in 2025 while that of coal shall increase to 33% from 16.8% at present. Sales of petroleum in the domestic market and import volume of petroleum product have been decreasing since 2004.

Table 4.2-18 National Energy Policy

Year	2006	2025
Oil	51.7%	20%
Gas	28.6%	30%
Coal	15.3%	33%
Biofuel		5%
Geothermal	1.3%	5%
Other new & renewable energy	3.1%	5%
Liquified coal		2%
Total	100%	100%

Source: Presidential Regulation No.5/2006

Therefore, it is likely that tonnage of "Petroleum Product" at Tg. Priok Port will not increase in the foreseeable future. Five (5) million tons would be the maximum. Historical trend and future volume of "Petroleum Product" in the target years are shown in Figure 4.2-20 and Table 4.2-19.



Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

Figure 4.2-20 Historical Trend and Demand of Petroleum Product at Tg. Priok Port

Table 4.2-19 Petroleum Product Throughput at Tg. Priok Port

(Unit: '000 Ton)

	2000	2005	2008	2009	2015	2020	2025	2030
Im/Unloading Total	7,450	6,757	5,197	5,117	5,000	5,000	5,000	5,000
Ex/Loading Total	-	-	-	69	-	-	-	-
Grand Total	7,450	6,757	5,197	5,186	5,000	5,000	5,000	5,000

Source: IPC II for 2000-2009 realized throughput and forecast by JICA Study Team

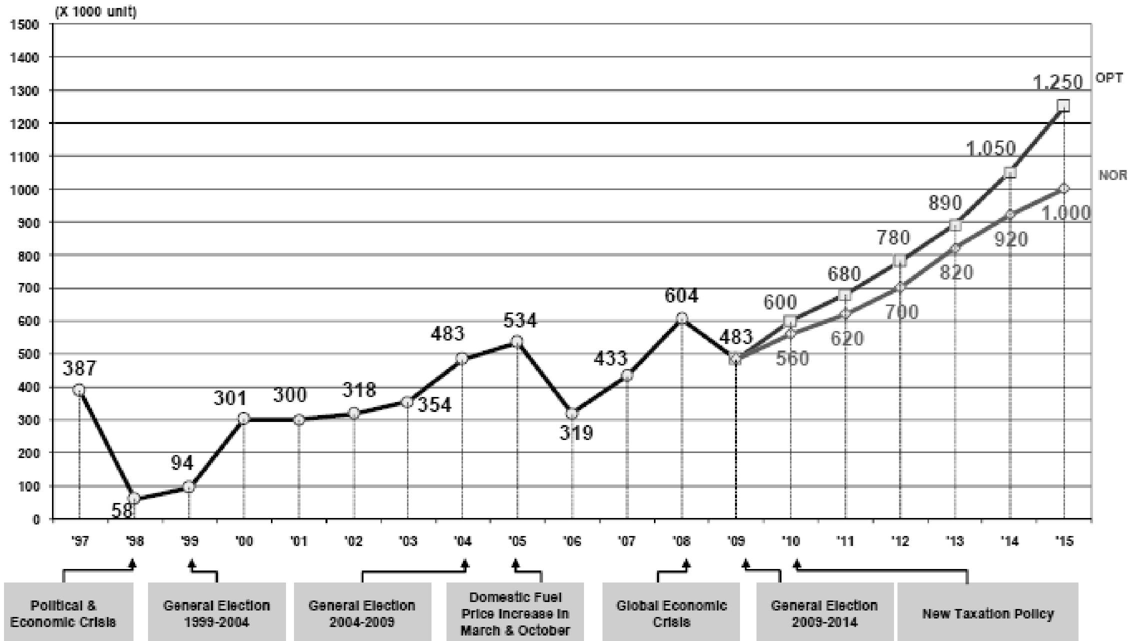
(10) CBU (Tg. Priok Car Terminal)

Indonesia Port Corporation II started construction works for a new car terminal at the eastern part of the port on 30 August 2006 and commenced official operation of the terminal on 28 November 2007. This project was planned and implemented to meet the ever increasing demand of both domestic and international vehicle throughput at Tanjung Priok Port. International groundswell on free trade also necessitated the development of a dedicated car terminal because the number of

Complete-Built-Unit cars (CBU) was expected to increase as import duties on CBU are getting reduced under common effective preferential tariffs within the ASEAN free trade area (CEPT/AFTA).

Jakarta Car Terminal has a marginal quay of 308 m in length and water depth of 10 m, and back up area of the terminal is 7.3 ha. The terminal has a car park building which can be expanded to a five story building so as to add 900 vehicle slots to its currently installed capacity. An area of 22 ha west of the existing terminal is a potential space for future expansion.

Association of Indonesian Automotive Industries (GAIKINDO) is composed of sole agents, distributers and manufactures of cars in Indonesia, and at the moment it has 37 members in total. GAIKINDO publishes several kinds of car statistics on an annual basis. According to the GAIKINDO's statistics, throughput of export and import CBU (Unit) has jumped up since the commencement of operation of the car terminal, and registered over 100,000 units for CBU Export and more than 70,000 units for CBU Import in 2008. Although statistics for 2010 are not available, total Export & Import CBU for 2010 has likely recovered from the world financial crisis (see Table 4.2-20).



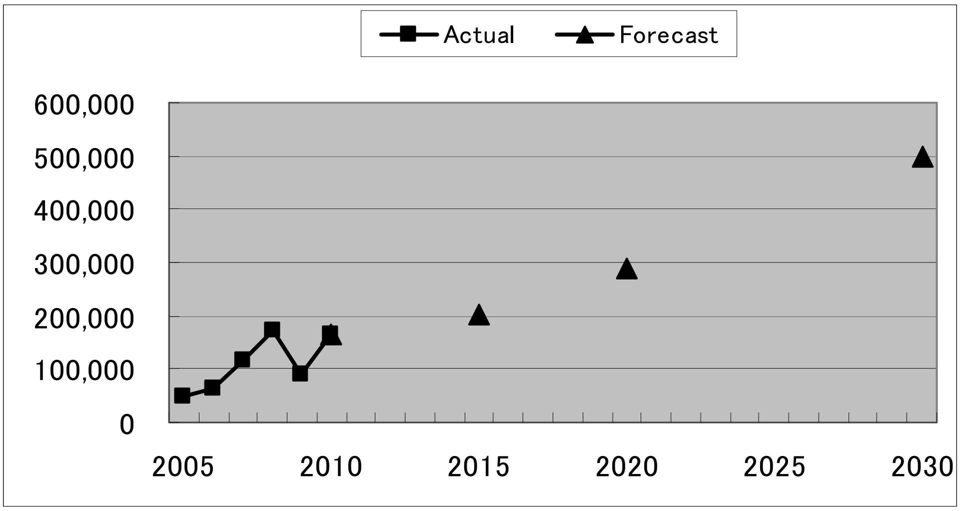
(Source: GAIKINDO)

Figure 4.2-21 Indonesia Automotive Market & Forecast 1997 - 2015

It has been observed that CBU Import (unit) is a fraction of the Indonesian automotive market volume. Empirical data between 2005 and 2010 show that CBU Import (Unit) was 10.4% of the total Indonesian market volume. Therefore, future CBU Import (Unit) is assumed at 10% of the total Indonesian automotive market, which is, in turn, forecast by building a regression model with independent variable of Indonesian GDP.

CBU Export (Unit) has been larger than the CBU Import (Unit) in recent several years. CBU cars manufactured or assembled in Indonesian firms are exporting abroad to meet the consumers' demand worldwide. It would be reasonable to assume that CBU Export (Unit) will grow if the world economy grows. In this study, it is assumed that CBU Export (Unit) growth rate is same as the Wold economic growth rate.

Based on assumptions explained above, future CBU export and Import (Unit) is forecast and shown in Table 4.2-20 and Figure 4.2-22 Historical Trend and Forecast of CBU (Unit) at Tg. Priok Car Terminal. In 2030, a total of nearly half a million CBU (Unit) are expected to be Rolled-on/Rolled-off at the car terminal.



Source; 2005-2009 is derived from GAIKINDO Statistics. 2010* is an tentative figure estimated by JICA Study Team based on January - November GAIKINDO's statistics. After 2010 is forecast by JICA Study Team.

Figure 4.2-22 Historical Trend and Forecast of CBU (Unit) at Tg. Priok Car Terminal

Table 4.2-20 Historical Trend and Forecast of CBU (Unit) at Tg. Priok Car Terminal

Year	2005	2006	2007	2008	2009	2010*	2015	2020	2030
CBU Export (Units)	17,805	30,974	60,267	100,982	56,669	83,942	103,908	130,000	185,000
CBU Import (Units)	31,760	33,663	55,112	72,646	32,678	79,716	100,000	159,000	314,000
Export & Import	49,565	64,637	115,379	173,628	89,347	163,658	203,908	289,000	499,000

Source; 2005-2009 is derived from GAIKINDO Statistics. 2010* is an tentative figure estimated by JICA Study Team based on January - November GAIKINDO's statistics. After 2010 is forecast by JICA Study Team.

(11) Summary of Forecast

Methodologies applied for demand forecasting are summarized in Table 4.2-21, varying according to the commodity type. Statistical data sources for forecasting have not been limited to Indonesian sources but databases of International institutions such as the World Bank, IMF, and FAO have been reviewed for reference. Outcomes of the future demands are also crosschecked with Asian and international standpoints.

Table 4.2-21 Methodology Employed for Commodity-wise Demand Forecasting

Commodity	Methodology
Cement and Clinker	Domestic sales up to 2015 is based on Indonesia Cement Association's forecast. For 2016-2-30, regressed against construction sector’s GDP and Dummy variable. Cement production capacity projection is based on Indonesia Cement Association's forecast. Export of cement/clinker is assumed at 5% of the production capacity. Tg Priok Port will handle 50% of national export. Inter-island trade is forecast in cosideration of actual ratio against the volume of domestic sales.
Wheat	Indonesian wheat import volume is regressed against total population in Indonesia. It is set that total wheat tonnage handled at the Tanjung Priok Port is equal to 50 % of the Indonesian import of wheat.
Crude Palm Oil	Regressed against hinterland population. 10% of Im/Unloading will be Ex/Loading volume.
Iron and Steel	Time series analysis until 2015, and assume the throughput remains unchanged at the 2015 level afterwards.
Coal	Coals fired at cement industries in the hinterland are expected to grow at 3.1% per year.
Sand	Regressed against Hinterland GRDP.
Forest Product	Largest volume in the past
Petroleum Product	Tonnage has been decreasing since 2004. Five million tons will be at most.
CBU (Car)	CBU import is set at 10% of Indonesia automotive market volume, which is regressed by domestic GDP. Growth rate of CBU export is same as that of World's GDP.

(Source: JICA Study Team)

Results of the demand forecast for Non-container major cargoes, which correspond to the basic case, are summarized in Table 4.2-22.

Table 4.2-22 Summary of Demand Forecast by Major Commodity

(Unit: ' 000 Ton)

Commodity	Trade Type	2009	2015	2020	2025	2030
Cement & Clinker	Im/Unloading Total	795	983	1,304	1,716	2,266
	Ex/Loading Total	3,215	3,602	4,541	5,713	7,218
	Grand Total	4,009	4,584	5,845	7,428	9,484
Wheat	Im/Unloading Total	1,919	2,756	3,058	3,333	3,589
	Ex/Loading Total	23	0	0	0	0
	Grand Total	1,942	2,756	3,058	3,333	3,589
Crude Palm Oil	Im/Unloading Total	1,481	1,713	1,877	2,032	2,176
	Ex/Loading Total	45	171	188	203	218
	Grand Total	1,526	1,884	2,065	2,235	2,393
Iron and Steel	Im/Unloading Total	3,272	4,291	4,291	4,291	4,291
	Ex/Loading Total	522	644	644	644	644
	Grand Total	3,795	4,935	4,935	4,935	4,935
Coal	Im/Unloading Total	3,080	3,700	4,311	5,023	5,853
	Ex/Loading Total	9	0	0	0	0
	Grand Total	3,088	3,700	4,311	5,023	5,853
Sand	Im/Unloading Total	2,008	3,351	4,700	6,290	8,417
	Ex/Loading Total	44	0	0	0	0
	Grand Total	2,052	3,351	4,700	6,290	8,417
Forest Product	Im/Unloading Total	984	1,300	1,300	1,300	1,300
	Ex/Loading Total	83	200	200	200	200
	Grand Total	1,067	1,500	1,500	1,500	1,500
Petroleum Product	Im/Unloading Total	5,117	5,000	5,000	5,000	5,000
	Ex/Loading Total	69	0	0	0	0
	Grand Total	5,186	5,000	5,000	5,000	5,000
CBU (Car)	CBU Import (Unit)	32,678	100,000	159,000	235,000	314,000
	CBU Export (Unit)	56,669	103,908	130,000	155,000	185,000
	Grand Total	89,347	203,908	289,000	390,000	499,000

(Source: JICA Study Team)

4.3 Estimate of Cargo Handling Capacity of Tanjung Priok Port

4.3.1 General

The capacity of the existing port facilities for container-handling at Tanjung Priok Port has been estimated so as to plan the new container terminal which will receive the excess once current capacity at the existing facilities is reached.

The estimation has been divided into two steps. Firstly, the capacity for handling international containers at JCT has been estimated. Then, the capacity for handling domestic containers at conventional wharf areas containing the island wharf, the first wharf, the second wharf and the third wharf has been estimated.

In this estimation, according to Pelindo II plan, it is assumed that JICT II and MTI will be converted from international container terminals into domestic container terminals.

4.3.2 International Containers

(1) Berthing Capacity

JCT comprising JICT I-North, JICT I-West, KOJA and MAL has 9 berths in total. According to the berthing records in 2009, the following conditions have been assumed:

JICT I-North, KOJA and MAL (6B)

Gross container handling productivity	63 boxes/hr/vessel
Average lot per vessel	1,270 boxes/vessel

Average berthing time	20 hr/vessel
Weekly service	5 services/week
Total Capacity	2,971,000 TEUs/year

JICT I-West (3B)

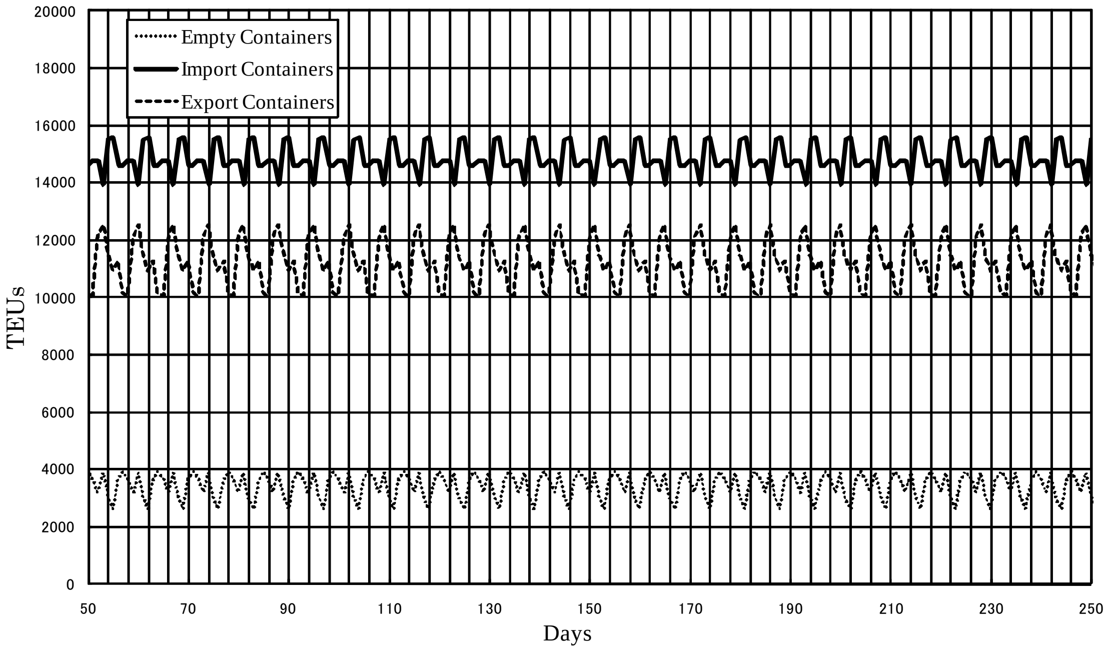
Gross container handling productivity	42 boxes/hr/vessel
Average lot per vessel	840 boxes/vessel
Average berthing time	20 hr/vessel
Weekly service	5 services/week
Total Capacity	983,000 TEUs/year

From the above, their total capacity has been estimated as 4 million TEUs per annum.

In addition, the capacity of JICT II and MTI has been estimated as 900,000 TEUs in total before the conversion from international containers to domestic container terminals. Thus total capacity has been estimated as 4.9 million According to the demand forecast, capacity will be reached in 2014.

(2) Storage Capacity

Container dwelling conditions of JCT have been identified using a computer simulation model assuming the above-mentioned 4 million TEU containers are handled in a year and assuming weekly services are provided (see Figure 4.3-1)



Source: JICA Study Team

Figure 4.3-1 Container Dwelling at Container Yard

According to the result shown in Figure 4.3-1, the total container storage capacity corresponding to 4 million TEUs handled in a year is as follows:

- Import containers: 18,000 TEUs
- Export containers: 12,000 TEUs
- Empty containers: 4,000 TEUs

Thus, required storage capacity has been estimated as 34,000 TEUs.

On the other hand, the ground slots of the existing container yards including the yard under expansion are as follows:

- JICT: 10,000 ground slots
- KOJA: 6,200 ground slots
- MAL: 1,000 ground slots

Thus, the total ground slots of JCT are 17,200. Assuming 4 high stacking and operational factor of 0.75, the total storage capacity has been estimated as 52,000 TEUs, and exceeds the required capacity mentioned above. Hence, the required capacity has been determined by the berthing capacity.

4.3.3 Domestic Containers

Domestic containers are handled at the conventional berths where conventional cargoes such as cement, CPO and steel products are also handled. Hence, the analysis of seaside capacity for handling both domestic containers and conventional cargoes at the existing Tanjung Priok Port has been conducted by using a computer simulation model. The seaside capacity is determined by the combination of the capacities of access channel and berths themselves. The shortage of capacity at berths with high berth occupancy rate causes offshore waiting for certain ships. Additionally, the shortage of access channel capacity also causes offshore waiting for all calling ships.

As to the seaside capacity covering simultaneously both access channel and berths, there are two categories. One is adequate capacity to keep a service level for a calling vessel at a port (hereinafter referred to as “the adequate seaside capacity”). The service level is expressed as the percentage of an offshore waiting time to the turnaround time from arrival to departure of a vessel at a port excluding ship off-shore waiting time. The figure of around 10% is generally used as the adequate service level, and is adopted in this study.

The other is the capacity that enables the number of vessels receivable at berths to be maximized during a certain period (one year), in which offshore ship waiting is on the verge of sharply increasing (hereinafter referred to as “the absolute seaside capacity”).

- Berths

The berth conditions as shown in Table 4.3.1 have been used. JICT II and MTI have been assumed to be converted to domestic containers

- Cargo-handling Productivities

Actual cargo-handling productivities have been applied.

- Vessel arrival pattern

Both a random arrival pattern for conventional cargoes and regular arrival schedules for container cargoes have been applied.

- Breakwater and basins

It has been assumed that the on-going project to move the breakwater and to dredge in front of JCT will be completed in terms of navigational conditions.

- Access Channel

It has been assumed that the access channel will be widened to two-way channel according to Pelindo II Plan. Inside the port, access channel is used for turning basins, and hence, when a vessel is turning, the other vessel cannot navigate. Those navigational and maneuvering conditions have been considered in the simulation.

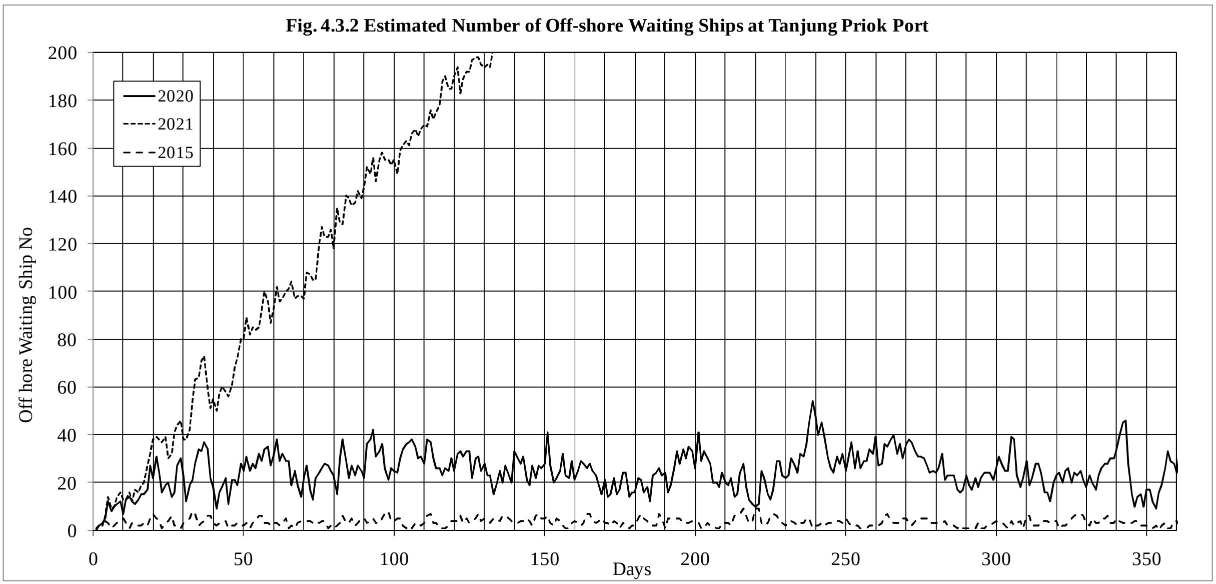
According to the results of the simulation, in 2019 the service level will be 20% with an average off-shore waiting of 8 hours per vessel which satisfies the adequate service level. Then in the next year, 2020, the service level will jump to 113% with an average off-shore waiting of 45 hours per vessel which does not satisfy the adequate service level.

Hence, it has been judged that the saturation year will be 2019 and consequently the adequate capacity has been estimated as the volume in 2019, viz. 2.1 million TEUs of containers.

Table 4.3-1 Berth Allocation Plan

No		CHP	Lot	Berth No.																								
1	Vehicle-D	8	119	7	8	9	10	15	21	22	23	27	28	29	30	31	32	33	38	39	40	41						
2	Cattle-I	124	3,090	22	23	31	32	36	37	38	39	40	41															
3	flour-D	36	2,552	6	7	8	12	15	36	37	38	44	49															
4	Sand-I	191	4,048	31	32	34	35	47	54	55	56																	
5	Sand-D	60	1,845	1	2	3	16	19																				
6	Cement in bag-I	91	14,500	33	34	36	37																					
7	Cement in bag-U-D	58	3,769	36	37	44	49																					
8	Cement in bag-L-D	54	2,867	3	6	7	8	12	15	16	21	22	23	24	30	31	32	34	35	38	39	44	47	48	49	51	53	54
9	Iron and steel product-U-I	244	6,308	31	32	33	34	35	36	37	38	39	40	41	45	46	47	48	49	51	53	54	55	56				
10	Iron and steel product-L-I	99	3,698	22	30	31	34	35	36	37	38	39	40	41	44	45	46	47	48	49	51	54	55					
11	Iron and steel product-D	30	1,169	4	6	7	8	11	12	14	15	16	20	23	32	33	34	35	39	40	41	44	49	51				
12	Aluminium-I	112	6,105	21	40	48	49	51																				
13	Aluminium-D	51	3,281	12	16																							
14	Pulp-I	310	10,121	31	39	40	41	55																				
15	Pulp-D	52	3,021	6	7	8	12	14	15	16	36	37	39	41	44	45	46	49										
16	GC-I	77	2,394	14	34	35	36	37	41	46	47	48	51	54	55	56												
17	GC-D	23	1,318	4	5	6	7	8	11	12	14	15	16	23	31	32	33	34	44	49								
18	GC + CNT-I	138	6,551	39	46	47	51	54	55	56																		
19	GC + CNT-D	34	1,771	4	12	15	16																					
20	GC + cement	38	2,901	6	7	12	15	16	33	34	36	37	49															
21	Project material	38	1,377	4	33	34	47	51																				
22	Plywood and particleboard	38	1,290	4	6	7	8	12	14	15	16	31	33	34	45	46	54	55	56									
23	Textile	64	1,944	7	8	23																						
24	miscellaneous-D	59	1,677	12	6	7	20	21	22	31	32	34	44	45	46	51	55	56										
25	Vehicle-I	98	773	72																								
26	Wheat-I	456	35,956	70																								
27	rice-I	73	4,672	39	40	41	47	48	51																			
28	rice bran-I	63	6,286	71																								
29	Cement in bulk-I	181	19,545	36	37	38	49																					
30	Cement in bulk-U-D	186	8,960	36	37	38																						
31	Cement in bulk-L-D	131	4,623	16	36	37	44	48	49	53	54																	
32	Clinker-I	301	28,290	21	35	36	37	38	49	51	53	54																
33	Gypsum-I	239	8,327	6	7	14	16	47	48	49	51																	
34	Gypsum-D	175	6,254	6	7	8																						
35	Sulfur-L-I	413	8,964	73																								
36	Sulfur-S-I	60	3,273	14	36	37	47	49																				
37	Coal	146	7,108	4	5	6	7	8	14	16	19																	
38	Mineral-I	87	5,607	49																								
39	Mineral-D	54	1,878	1	14	16	19	36	37	44																		
40	Quartz sand-I	35	1,058	3	16	19																						
41	Slag-I	220	7,948	6	19																							
42	Salt-I	185	8,820	36	37	49																						
43	Fertilizer-L-I	62	2,300	49																								
44	Fertilizer-D	31	2,060	4	7	8	36	37	38	44	49																	
45	Maize-I	194	8,250	49																								
46	Petroleum products-U-I	475	22,499	67	68																							
47	Petroleum products-L-I	99	4,761	39	40	41	67																					
48	Petroleum products-U-D	457	12,658	66	67	68																						
49	Petroleum products-L-D	64	528	38	39	40	68																					
50	LPG	152	6,556	69																								
51	Lubricant oil	74	3,004	66	67																							
52	High Speed Diesel-I	130	8,585	74																								
53	High Speed Diesel-D	78	1,729	74																								
54	Chemical product-I	162	10,257	6	14	36	37	39	40	41	45	48	49															
55	Chemical DKP-I	149	1,840	73																								
56	Chemical DKP-D	98	1,667	73																								
57	Vegetable oil-I	125	4,470	39	40																							
58	Vegetable oil-D	47	2,194	4	6	7	11	19	20	21	22	23	30	31	32	33	34	35	36	39	40	41						
59	Vegetable fats-L-I	105	4,563	23	39	53	54																					
60	Vegetable fats-U-D	50	1,156	6	7	19																						
61	Vegetable fats-L-D	66	2,723	6	7	21	31	40																				
62	Bo-diesel	153	5,173	68																								
63	Scrap	63	5,814	36	37	38	41	47	48	49	51	54	55															

Note: Berth No. correspond to the berths shown in Table 2.6-1
Source: Vessel berthing records provided by Pelindo II



Source: JICA Study Team

Figure 4.3-2 Estimated Number of Off-shore Waiting Ships at Tanjung Priok Port

4.4 Estimate of Traffic Capacities of the Existing Roads and Railway

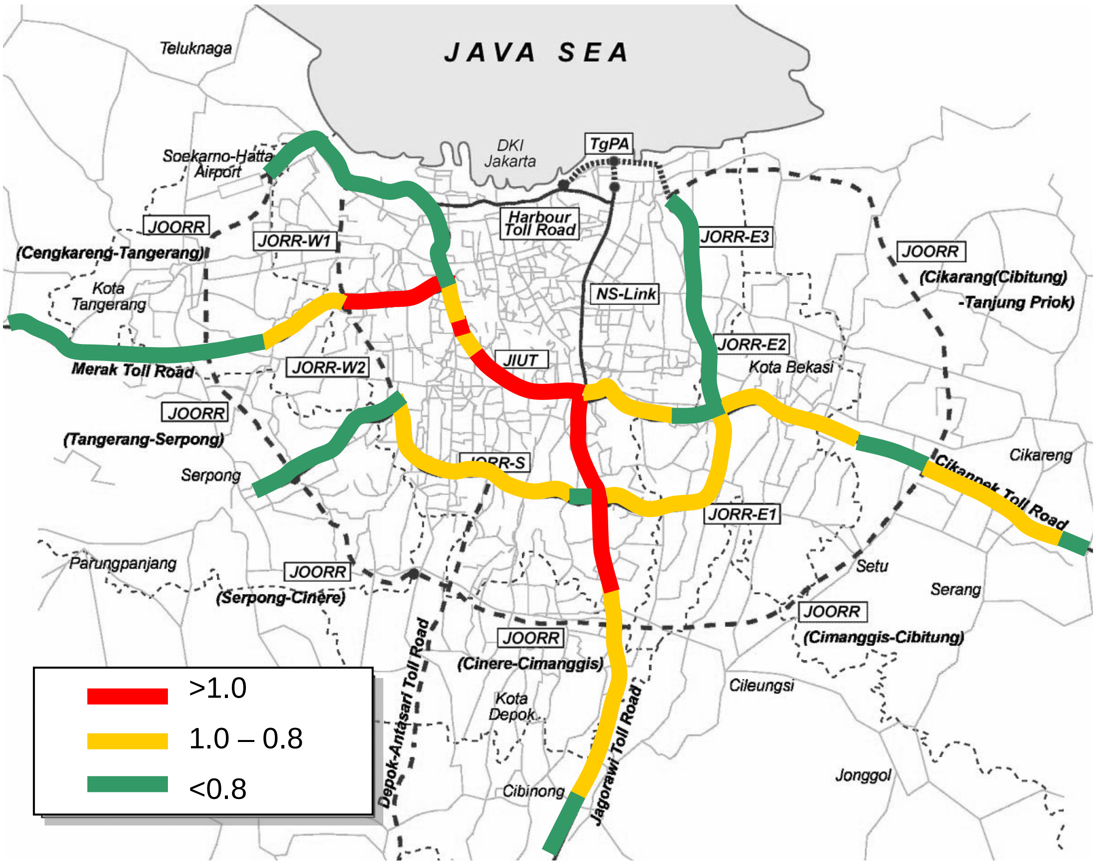
4.4.1 Traffic condition on toll road

(1) Current condition

1) Jakarta Metropolitan Area

The transportation system in Jakarta Metropolitan Area is facing a serious traffic congestion problem. Despite being 6 lanes on JIUT and JORR, the vehicle/capacity ratio as of April 2010 is beyond 0.8 in most sections. In addition, there are bottleneck points in which the queue from the on and off ramp prevent the smooth flow of traffic on the main carriageway.

The vehicle/capacity ratio of each section on the toll road is as follows.



Source: Jasa Marga

Figure 4.4-1 V/C ratio on toll road in April 2010

Table 4.4-1 V/C ratio on toll road in April 2010

No	TOL ROAD LINK	Length (Km)	Number of lane		V/C Ratio	
			From JKT	To JKT	From JKT	To JKT
I	**JAGORAWI**					
1	Cililitan –TMII	5.00	4	4	**1.08**	**1.02**
2	TMII – Pasar Rebo	1.80	3	3	**1.19**	**1.17**
3	Pasar Rebo – Cibubur	6.70	3	3	**1.00**	**1.34**
4	Cibubur – Cimanggis	5.50	3	3	**0.88**	**0.93**
5	Cimanggis – Gunung Putri	4.50	3	3	**0.80**	**0.84**
6	Gunung Putri – Cibinong	3.00	3	3	0.79	**0.83**
7	Cibinong – Sentul Utara	6.00	3	3	0.70	0.73
8	Sentul Utara – Sentul Selatan	4.00	3	3	0.66	0.66
9	Sentul Selatan – Bogor IC	3.50	3	3	0.56	0.55
10	Bogor IC – Ciawi	7.00	2	2	0.53	0.57
11	Bogor IC – Bogor	3.00	2	2	0.55	0.55
II	**JAKARTA – CIKAMPEK**					
1	Cawang – Pd Gede Barat	4.50	4	4	**0.99**	**0.94**
2	Pd Gede Barat – Pd Gede Timur	4.00	4	4	**0.83**	**0.81**
3	Pd Gede Timur – Cikunir IC	1.50	4	4	0.67	0.65
4	Cikunir IC – Bekasi Barat	4.00	4	4	**0.95**	**0.96**
5	Bekasi Barat – Bekasi Timur	3.00	4	4	**0.85**	**0.85**
6	Bekasi Timur – Tambun	4.70	4	4	0.79	0.79
7	Tambun – Cibitung	2.30	4	4	0.74	0.74
8	Cibitung – Cikarang	6.00	3	3	**0.84**	**0.84**
9	Cikarang – Cikarang Timur	5.50	3	3	0.62	0.62
10	Cikarang Timur – Karawang Barat	10.50	3	3	0.60	0.60
11	Karawang Barat – Karawang Timur	7.70	3	3	0.67	0.66
12	Karawang Timur – Dawuan IC	12.30	3	3	0.59	0.58
13	Dawuan IC – Kalihurip	1.00	2	2	0.38	0.41
14	Kalihurip – Cikampek	5.50	2	2	0.29	0.31
III	**JAKARTA – TANGERANG Link**					
1	Tomang – Kebon Jeruk	3.60	3	3	**1.20**	0.79
2	Kebon Jeruk – Meruya	2.50	3	3	0.72	**0.81**
3	Meruya – Kembangan	3.00	3	3	0.73	0.63
4	Kembangan – Tangerang	10.00	3	3	0.73	0.74
5	Tangerang – Karawaci	2.00	3	3	0.65	0.67
6	Karawaci – Tangerang Barat	5.70	3	3	0.45	0.47
	Ruas ULUJAMI – SERPONG					
1	IC Ulujami – Bintaro	3.00	3	3	0.47	0.54
2	Bintaro – Pondok Ranji	2.50	3	3	0.65	0.67
IV	**CAWANG TOMANG CENGKARENG**					
1	Cawang IC – Ciliwung	2.00	3	3	**1.07**	**1.07**
2	Ciliwung – Tebet	1.10	3	3	**1.18**	**1.18**
3	Tebet – Pancoran	1.10	3	3	**1.11**	**1.08**
4	Pancoran – Kuningan2	0.60	3	3	**1.21**	**1.20**
5	Kuningan2 – Kuningan 1	1.50	3	3	**1.04**	**1.04**
6	Kuningan 1 – Semanggi	1.45	3	3	**1.10**	**1.04**
7	Semanggi – Senayan	1.25	3	3	**0.86**	**0.85**
8	Senayan – Pejompongan	0.70	3	3	**1.01**	**1.03**
9	Pejompongan – Slipi 1	1.30	3	3	**0.84**	**0.95**
10	Slipi 1 – Slipi 2	0.10	3	3	**0.98**	**0.95**
11	Slipi 2 – Tomang IC	0.90	3	3	**0.87**	**0.98**
12	Tomang IC – Grogol	1.50	3	3	0.52	0.58
13	Grogol – Jelambar	2.40	3	3	0.34	0.74
14	Jelambar – Angke	2.10	3	3	0.48	0.68
15	Angke – Pluit IC	1.00	3	3	0.55	0.67
16	Pluit IC – Pluit	1.20	3	3	0.40	0.70
17	Pluit – Kapuk	1.80	3	3	0.39	0.70
18	Kapuk – Cengkareng Junction	3.60	4	4	0.38	0.38
19	Cengkareng Junction – Bandara	5.60	2	2	0.55	0.55

No	TOL ROAD LINK	Length (Km)	Number of lane		V/C Ratio	
			From JKT	To JKT	From JKT	To JKT
V	**JORR**					
1.	Ulujami – Veteran	2.80	3	3	0.47	0.54
2.	Veteran – Ciputat Raya	2.40	3	3	0.47	0.58
3.	Ciputat Raya – Pondok Pinang Barat	1.10	3	3	0.47	0.54
4.	P. Pinang Barat – P. Pinang Timur	1.30	3	3	0.58	0.65
5.	P. Pinang Timur – Fatmawati Barat	1.20	3	3	0.72	0.83
6.	Fatmawati Barat – Fatmawati Timur	0.60	3	3	0.69	**0.80**
7.	Fatmawati Timur – Ampera Barat	1.70	3	3	**0.83**	**0.94**
8.	Ampera Barat – Ampera Timur	0.60	3	3	**0.76**	**0.83**
9.	Ampera Timur – Lenteng Agung Barat	2.10	3	3	**0.87**	**0.98**
10	Lenteng Agung Barat – Lt Agung Timur	1.30	3	3	**0.80**	**0.83**
11	Lt. Agung Timur – Gedong Barat	1.90	3	3	**0.94**	**0.98**
12	Gedong Barat – Gedong Timur	0.50	3	3	**0.87**	**0.90**
13	Gedong Timur – Kampung Rambutan	0.80	3	3	**0.94**	**0.94**
14	Kampung Rambutan – Pasar Rebo	1.10	3	3	**0.90**	**0.90**
15	Pasar Rebo – Ramp TMII	1.00	3	3	0.54	0.58
16	Intc. TMII – Bambu Apus	0.70	3	3	**0.83**	**0.83**
17	Bambu Apus – Setu	1.70	3	3	**0.92**	**0.88**
18	Setu – Jati Warna	1.20	3	3	**0.92**	**0.88**
19	Jati Warna – Jati Asih	3.50	3	3	**0.88**	**0.80**
20	Jati Asih – Cikunir	5.45	3	3	**0.84**	**0.73**
21	Cikunir – Kali Malang	1.00	3	3	0.42	0.42
22	Kali Malang – Bintara	3.00	3	3	0.38	0.35
23	Bintara – Cakung Selatan	3.50	3	3	0.35	0.27
24	Cakung Selatan – Cakung Utara	1.50	3	3	0.23	0.15
25	Cakung Utara – Rorotan	3.25	3	3	0.19	0.14

Source: Jasa Marga

2) West Java Area

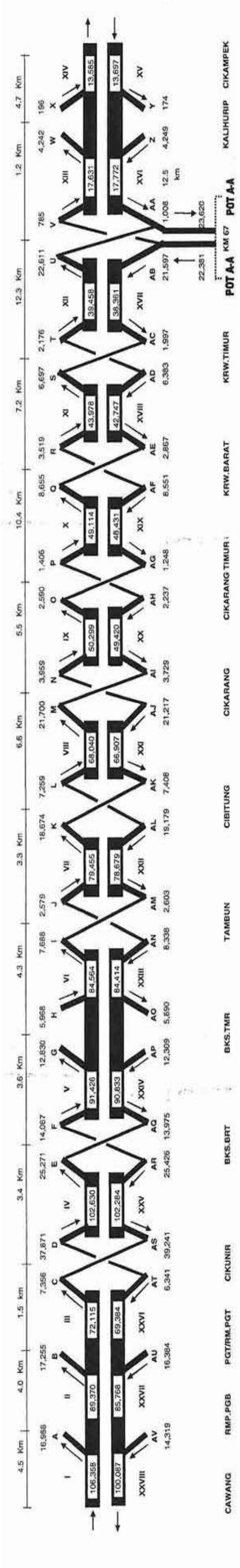
Jakarta-Cikampek Road

The industrial area has been developed around Cibitung and Cikarang, the east outskirt of Jakarta due to the congestion in urban areas and the restriction of land use. According to this movement, the traffic related to the cargo between Tanjung Priok Port and industrial area has increased which contributes to the traffic congestion on Jakarta – Cikampek toll road.

Figure 4.4.2 shows the annual average daily traffic on Jakarta – Cikampek toll road in 2009. The traffic volume around Bekasi accounts for over 200,000 vehicle/day on main road, which is largely beyond the capacity that is 126,000 vehicle/day for 6 lanes. In addition, the traffic on the ramp bound for Jakarta on Cibitung and Cikaran IC exceeds 20,000 vehicles/day.

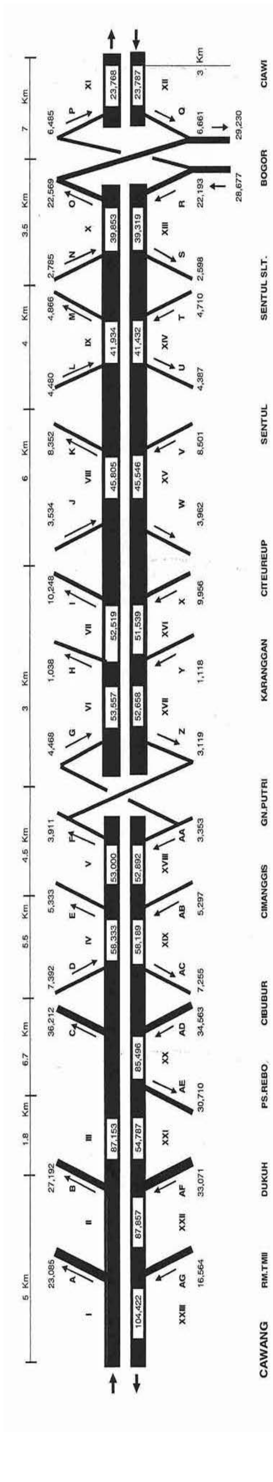
Jagorawi Toll Road

The traffic volume for both directions between Cawang and Citeureup on Jagorawi Road exceeds 100,000 vehicles/day. Especially around Cawang, the traffic volume only for one direction is over 100,000. The traffic volume on Jagorawi road is shown in Figure 4.4.3.



Source: Jasa

Figure 4.4 -.2 Traffic volume on Jakarta-Cikampek toll road



Source: Jasa

Figure 4.4 - .3 Traffic volume on Jagorawi toll road in 2009

Figure 4.4-2 Traffic volume on Jakarta-Cikampek toll road in 2009

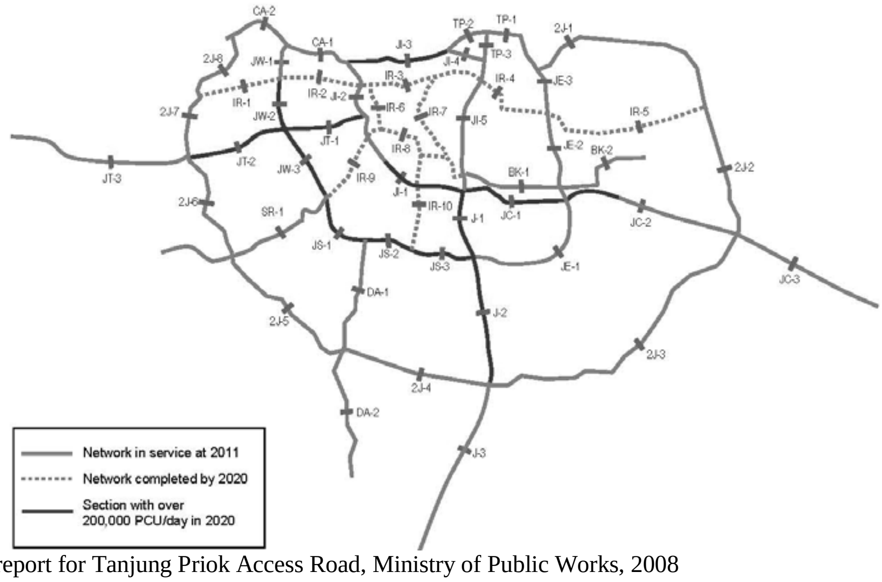
Figure 4.4-3 Traffic volume on Jagorawi toll road in 2009

(2) Future forecast of traffic demands in Jakarta Metropolitan Area

The future traffic volume around JABODETABEK area in 2011 and 2020 was forecasted in "The Study on Integrated Transportation Master Plan for JABODETABEK (PHASEII)" in 2004 and reviewed and updated it in "The Detailed Design for Tanjung Priok Access Road" conducted in 2007. According to the result, by the opening of JORR and JORR2, the traffic volume is expected to decrease temporarily on Jagowawi, Jakarta-Cikampek and JIUT in 2011. However, it will continue to increase and the Vehicle Capacity ratio (VCR) is beyond 1.0 on most of the roads at 2020. It is obvious that the traffic volume will be overflowed in the near future by not only the cargo but also ordinary vehicles, so reducing the traffic is the one of most important issues in JABODETABEK.

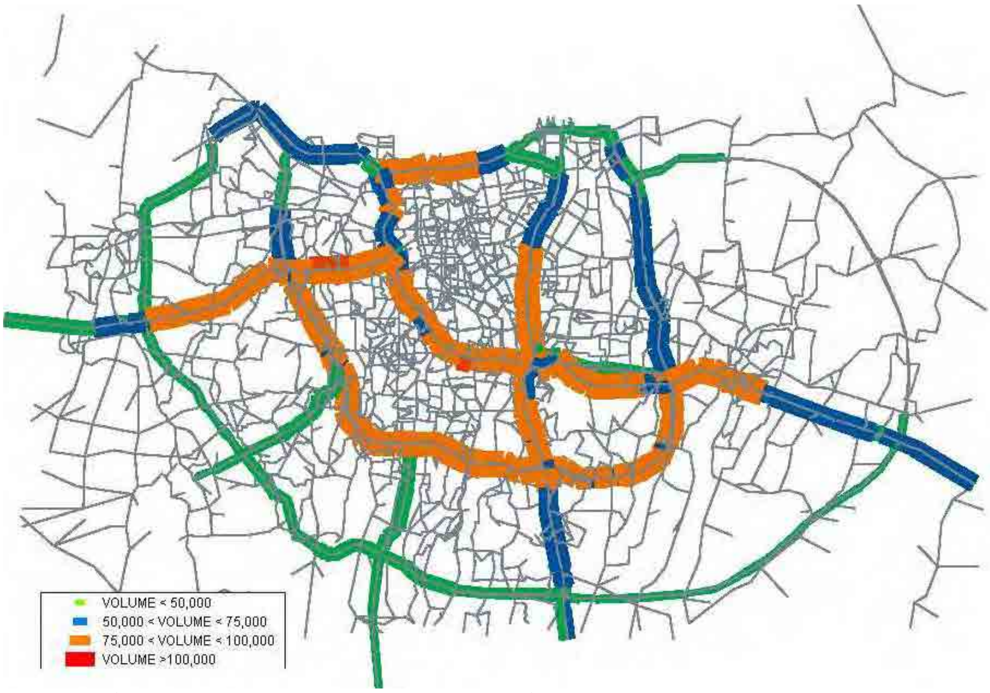
Too Road	Section	2011	2020	V/C
Jogorawi	J-1	171,700	211,200	1.8
	J-2	139,700	201,100	1.7
	J-3	114,400	154,700	1.0
Jakarta-Cikampek	JC-1	174,600	244,600	2.0
	JC-2	118,500	170,400	1.4
	JC-3	93,800	118,800	1.0
Jakarta-Tangerang	JT-1	202,500	249,900	2.1
	JT-2	167,100	214,600	1.8
	JT-3	97,900	138,500	1.2
Cengkareng Access	CA-1	134,200	158,900	1.3
	CA-2	111,700	141,600	1.2
JIUT	JI-1	168,300	201,000	1.7
	JI-2	121,900	156,300	1.3
	JI-3	171,100	206,600	1.7
	JI-4	86,600	98,600	0.8
	JI-5	155,900	191,700	1.6
Jakarta-Serpong	SR-1	75,900	138,800	1.2
JORR W1	JW-1	78,800	134,600	1.1
	JW-2	142,000	200,100	1.7
	JW-3	163,500	206,900	1.7
JORR-S	JS-1	169,900	204,200	1.7
	JS-2	183,700	232,000	1.9
	JS-3	170,300	218,100	1.8
JORR-E	JE-1	140,100	192,500	1.6
	JE-2	120,100	196,400	1.6
	JE-3		176,600	1.5

Too Road	Section	2011	2020	V/C
TgPA	TP-1	77,000	114,000	1.0
	TP-2	33,100	55,400	0.5
	TP-3	8,400	24,000	0.2
Becakayu	BK-1	82,000	189,800	1.6
	BK-2	35,900	110,900	0.9
Depok Antasari	DA-1	89,300	177,900	1.5
	DA-2	23,700	72,000	0.6
2nd JORR	2J-1	6,300	19,000	0.2
	2J-2	4,300	43,400	0.4
	2J-3	18,800	59,700	0.5
	2J-4	56,400	130,300	1.1
	2J-5	58,100	161,100	1.3
	2J-6	45,100	132,900	1.1
	2J-7	62,300	122,100	1.0
	2J-8	61,400	117,600	1.0
DKI Inner Ring Road	IR-1		128,600	1.1
	IR-2		158,600	1.3
	IR-3		149,100	1.2
	IR-4		103,300	0.9
	IR-5		50,100	0.4
	IR-6		144,700	1.2
	IR-7		100,800	0.8
	IR-8		117,400	1.0
	IR-9		158,100	1.3
	IR-10		124,200	1.0



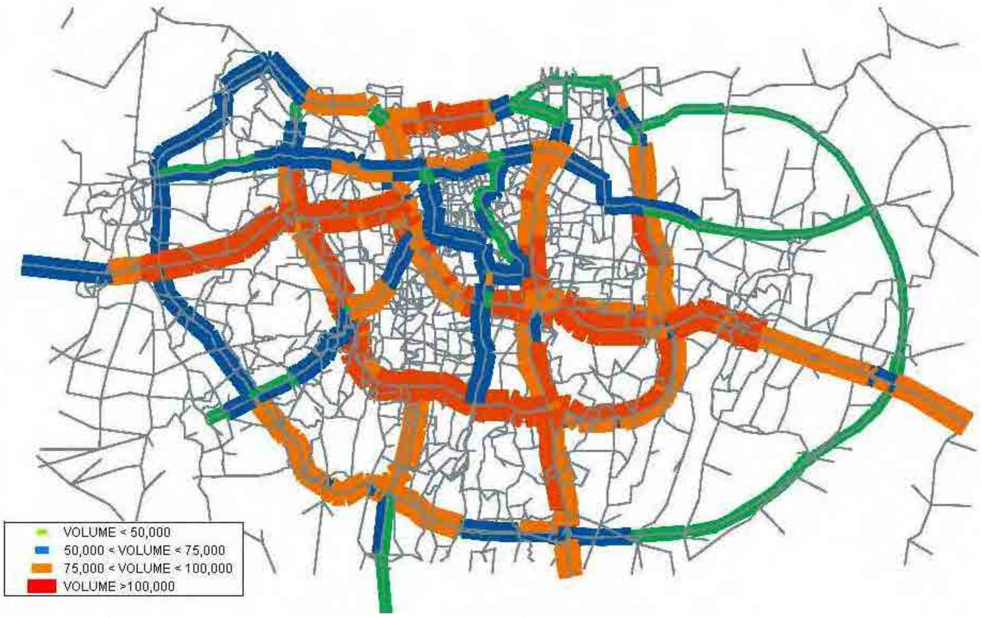
Source: Design report for Tanjung Priok Access Road, Ministry of Public Works, 2008

Figure 4.4-4 Future traffic volume in 2020



Source: Design report for Tanjung Priok Access Road, Ministry of Public Works, 2008

Figure 4.4-5 Future traffic volume in 2011



Source: Design report for Tanjung Priok Access Road, Ministry of Public Works, 2008

Figure 4.4-6 Future traffic volume in 2020

4.4.2 Daily Traffic Volume Related to Port Cargoes

According to cargo allocation to terminals of so-called Jakarta Metropolitan Port towards 2030 based on demand forecast in Section 4.2 and Capacity Analysis in Section 4.3, daily traffic volume from/to port terminals at Tanjung Priok Port has been estimated as shown in Table 4.4-2 (see Table 4.7-10).

Table 4.4-2 Estimated Daily Traffic from/to Port Terminals

Unit: Trucks per day

Year	International Containers					Domestic containers and conventional cargoes	Total (1)
	JCT		New Terminal		Total		
2010	5,100	100%			5,100	7,030	12,130
2011	5,604	100%			5,604	7,312	12,916
2012	6,108	100%			6,108	7,594	13,702
2013	6,612	100%			6,612	7,876	14,488
2014	7,116	100%			7,116	8,158	15,274
2015	7,620	100%			7,620	8,440	16,060
2016	8,416	100%			8,416	8,602	17,018
2017	9,212	100%			9,212	8,764	17,976
2018	10,008	100%			10,008	8,926	18,934
2019	8,768	81%	2,036	19%	10,804	9,088	19,892
2020	8,899	77%	2,701	23%	11,600	9,250	20,850
2021	8,931	72%	3,509	28%	12,440	9,820	22,260
2022	8,960	67%	4,320	33%	13,280	10,390	23,670
2023	8,985	64%	5,135	36%	14,120	10,960	25,080
2024	9,008	60%	5,952	40%	14,960	11,530	26,490
2025	8,937	57%	6,863	43%	15,800	12,100	27,900
2026	8,939	53%	7,981	47%	16,920	12,620	29,540
2027	8,940	50%	9,100	50%	18,040	13,140	31,180
2028	8,941	47%	10,219	53%	19,160	13,660	32,820
2029	8,942	44%	11,338	56%	20,280	14,180	34,460
2030	8,943	42%	12,457	58%	21,400	14,700	36,100
			35%				100%

Note (1): Total traffic is that per one way and not converted to pcu (passenger car unit)
Note (2): Percentage is the traffic of New Terminal to the total international containers.
Source: Estimated by the Study Team

Daily truck volume of port cargoes by area as origin and destinations has been estimated based on estimated daily traffic from/to the port terminal in Table 4.4-3 with the following assumption.

Daily truck volume for transporting annual international container volume (TEU) is worked out by dividing demands of cargo volume by 365 days and 1.5 considering combined number of containers 40 ft and 20 ft containers by one truck. Daily truck volume of domestic container is also worked out in a similar manner, namely, divided by 365 days per year and 1.25 considering combined number of 20 ft and 40 ft. containers.

The regional share of truck volume (veh/day) by commodities in 2030 based on the cargo demands is estimated considering regional socio-economic indicators such as regional GDP (GRDP), regional population, and consumption level (see Section 4.1), and OD survey (see section 2.10). The result of regional share of truck traffic volume is shown in Table 4.4-3.

Table 4.4-3 Truck Traffic by area as origins and destinations of port cargoes

Unit: vehicle per day

Type of cargo transported by truck	Banten Province		DKI Jakarta		North east area of West Java Province		South West area of West Java Province		Total Traffic	
Consumer goods	4,076	20.3%	7,376	36.8%	6,886	34.3%	1,712	8.5%	20,050	100%
Cargoes related to manufacturing industries	1,409	8.8%	2,777	17.3%	9,975	62.1%	1,886	11.8%	16,050	100%
Total	5,485		10,153		16,861		3,598		36,100	

Source: The Study Team

In case required magnitude of new terminal facilities are developed at respective candidate sites, the volume of trucks (veh/day) using toll roads within JABODETABEK area for transporting port cargo is estimated and shown in matrix format of OD (Origin and Destination) traffic related to port cargoes based on the estimated annual truck traffic by terminals and regional truck traffic forecast in Table 4.4-3 and Table 4.4-3 respectively.

Table 4.4-4 shows the findings of truck traffic distribution by OD in the matrix format by using the toll roads within JABODETABEK area. The truck volume is indicated by unit of veh/day. The figures are converted to PCU (passenger car unit) for assessing the balance of demands and capacity of the planned lanes of the toll roads and by calculating percentage of truck traffic occupancy on the toll roads. The veh/day of truck traffic is converted to PCU by multiplying PCU factor of design standard in Indonesia.

According to the past traffic survey by JICA Study in 2002, the percentage of truck for transporting port cargo to the total traffic volume including passenger cars, buses etc without converting pcu basis was around 20% on the roads around Tanjung Priok Port, equivalent to 50 % in term of pcu unit. In the case of traffic counting survey by Directorate General of Highways Ministry of Public Works in 2009, the ratio of truck traffic in the toll roads on some section of Jakarta – Cikanpec Toll Road has been around 10%, equivalent to 30% in terms of pcu unit.

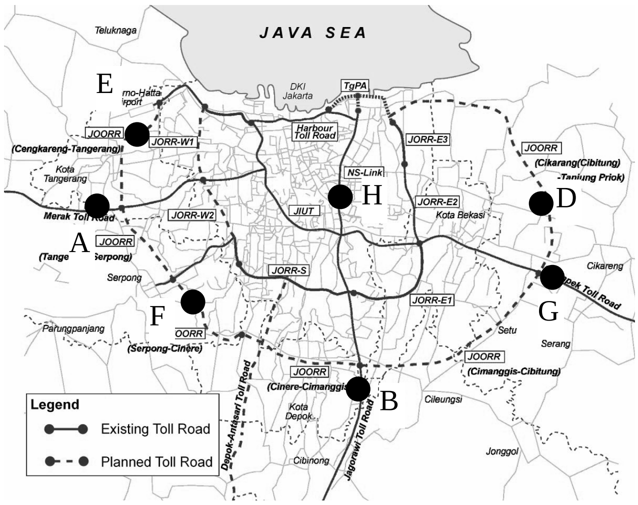
It is considered that this ratio of occupancy of trucks in the city traffic indicates the saturated capacity of the arterial city road. Beyond this ratio heavy congestion will occur and road service level will decline.

The results of the estimation of the occupancy ratio of port-related truck traffic to road capacities on toll roads on the basis of PCU in 2030 are shown in Table 4.4-4. Note that PCU factor for the heavy truck is “3” according to the design standard in Indonesia.

Table 4.4-4 Truck volume related to port cargo and truck occupancy

	Route	Nos. of Lane	Capacity (pcu/day)	Tanjung Priok		Cilamaya		Tangerang	
				Truck Volume (veh/day)	Truck occupancy	Truck Volume (veh/day)	Truck occupancy	Truck Volume (veh/day)	Truck occupancy
A	JKT~Merek	3	60,000	5,485	27%	5,485	27%	-	0%
B	JKT~Bogor	3	60,000	3,598	18%	3,598	18%	3,598	18%
C	2nd JORR(NE)	3	60,000	16,861	**84%**	8,003	40%	13,488	**67%**
D	2nd JORR(SE)	3	60,000	-	0%	3,598	18%	3,373	17%
E	2nd JORR(NW)	3	60,000	5,485	27%	5,485	27%	6,970	35%
F	2nd JORR(SW)	3	60,000	-	0%	-	0%	6,970	35%
G	JKT~Cikampek	4	80,000	16,861	**63%**	4,405	17%	16,861	**63%**
H	JIUT (NS)	3	60,000	13,751	**69%**	10,153	**51%**	10,153	**51%**

Source: JICA Study Team



In the case of full concentration to Tanjung Priok Port, the truck occupancy on 2nd Outer Ring Road (NE), Jakarta Cikampek Toll Road and the JIUT (NS) show extraordinarily high ratios, viz. 84%, 63% and 69%, which are far exceeding the above mentioned figures of 30 ~ 50% obtained from the actual traffic survey data. This suggests that full concentration to Tanjung Priok Port would contribute to the overcapacity of those accessible toll roads.

Alternatively in the case of developing a new terminal at Cilamaya area, the occupancy ratio of truck traffic through the toll roads concerned to a new terminal will be less than 50 % in most sections, which will relieve the heavy traffic congestion in the metropolitan area and maintain the required service level of toll roads. On the other hand, developing a new terminal at Tangerang would result in similar high burden percentages by truck traffic occupancy in the accessible toll roads.

4.4.3 Railway transportation line capacity between Tanjung Priok – Jatinegara – Bekasi – Cikarang – Cikampek

The line capacity of the existing railway facilities between Tanjung Priok and Bekasi stations is shown in the following tables:

Table 4.4-5 Line Capacity between Tanjung Priok and Bekasi Line

	KRL							
EASTERN LINE	TPK - KMO	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (TPK>KPB)	0	1	4	0	3	0	8
	DN(KPB>TPK)	0	1	4	1	2	0	8
								16
	KRL + OTHERS							42
	LINE CAPACITY							108
	KRL							
	KPB - KMO	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (KPB>KMO)	0	7	11	9	8	1	36
	DN(KMO>KPB)	0	3	9	9	8	0	29
								65
	KRL + OTHERS							128
	LINE CAPACITY							288
	KRL							
	KMO - PSE	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (KMO>PSE)	0	7	15	9	12	1	44
	DN(PSE>KMO)	0	4	13	9	10	0	36
								80
	KRL + OTHERS							166
	LINE CAPACITY							288
	KRL							
	PSE - JNG	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (PSE>JNG)	0	7	15	9	12	1	44
	DN(JNG>PSE)	0	4	13	10	9	0	36
								80
	KRL + OTHERS							205
	LINE CAPACITY							288
BEKASI LINE	KRL							
	JNG - BKS	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (JNG>BKS)	0	9	16	11	14	3	53
	DN(BKS>JNG)	0	11	14	14	13	1	53
								106
	KRL + OTHERS							234
	LINE CAPACITY							288

	OTHERS (NOT INCLUDE FACLUTATIVE)							
EASTERN LINE	TPK - KMO	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (TPK>KPB)	2	1	2	2	4	2	13
	DN(KPB>TPK)	2	3	0	4	2	2	13
								26
	KRL + OTHERS							42
	LINE CAPACITY							108
	OTHERS (NOT INCLUDE FACLUTATIVE)							
	KPB - KMO	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (KPB>KMO)	3	4	5	7	6	6	31
	DN(KMO>KPB)	2	7	6	2	10	5	32
								63
	KRL + OTHERS							128
	LINE CAPACITY							288
	OTHERS (NOT INCLUDE FACLUTATIVE)							
	KMO - PSE	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (KMO>PSE)	5	6	6	8	10	9	44
	DN(PSE>KMO)	4	9	6	6	10	7	42
								86
	KRL + OTHERS							166
	LINE CAPACITY							288
	OTHERS (NOT INCLUDE FACLUTATIVE)							
	PSE - JNG	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (PSE>JNG)	7	11	8	11	15	10	62
	DN(JNG>PSE)	9	16	4	12	14	8	63
								125
	KRL + OTHERS							205
	LINE CAPACITY							288
BEKASI LINE	OTHERS (NOT INCLUDE FACLUTATIVE)							
	JNG - BKS	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (JNG>BKS)	1	11	14	9	16	14	65
	DN(BKS>JNG)	13	13	11	9	12	5	63
								128
	KRL + OTHERS							234
	LINE CAPACITY							288

Referring to the above table, the busiest section is between Jatinegara and Bekasi where capacity is more than 80% as passenger and freight trains run on the same tracks. Additional electric rail car operation on this line is planned to extend to Cikarang station once the Electrification and Double-double Tracking of Java Main Line Project is completed.

In this connection, room for additional freight car operation from/to Tanjung Priok/East Jakarta and Gedebage Dryport through Bekasi line will be extremely limited. It is anticipated that freight volume by railway on this line cannot be increased, even if freight volume in Tanjung Priok Port shows remarkable growth. Identifying the new container terminal and freight corridor is essential to promote modal shift from road to railway.

Table 4.4-6 Line Capacity between Bekasi and Cikampek Line

		OTHERS (NOT INCLUDE FACLUTATIVE)						
CIKAMPEKLINE	BKS -KW	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (BKS>KW)	3	8	15	8	17	14	65
	DN(KW>BKS)	15	16	10	9	12	3	65
								130
	LINE CAPACITY							216
		OTHERS (NOT INCLUDE FACLUTATIVE)						
	KW - CKP	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	TOTAL
	UP (KW>CKP)	2	7	15	6	16	18	64
	DN(CKP>KW)	17	14	10	10	10	3	64
								128
	LINE CAPACITY							216

This problem is not applicable if the new port and freight terminal is located in Cilamaya area. Unlike other alternatives, railway approaching and connection to the existing line in the vicinity of Klari station will not interfere with passenger train operations between Jakarta and Bekasi area. Line capacity between Bekasi and Cikampek will be enough to add freight cars operation.

4.4.4 Railway transportation line capacity between Cikampek – Purwakarta – Padalaran – Bandung – Gedebage

The line capacity on the existing railway facilities between Cikampek and Gedebage stations is shown in the following table:

Table 4.4-7 Line Capacity between Cikampek and Gedebage

BANDUNG LINE		OTHERS (NOT INCLUDE FACLUTATIVE)			
	CKP - PDL	0 - 8	8 - 16	16 - 24	TOTAL
	UP (CKP>PDL)	5	8	6	19
	DN(PDL>CKP)	6	6	6	18
					37
	LINE CAPACITY				96
		OTHERS (NOT INCLUDE FACLUTATIVE)			
	PDL - BD	0 - 8	8 - 16	16 - 24	TOTAL
	UP (PDL>BD)	7	16	10	33
	DN(BD>PDL)	9	13	13	35
					68
	LINE CAPACITY				216
		OTHERS (NOT INCLUDE FACLUTATIVE)			
	BD - GDB	0 - 8	8 - 16	16 - 24	TOTAL
	UP (BD>GDB)	11	13	14	38
	DN(GDB>BD)	10	16	12	38
					76
	LINE CAPACITY				216

Within the whole Bandung line, line capacity is still sufficient for the operation of additional freight cars, except the short distance between Kiaracondon and Gedebage. To secure the operational efficiency, not only capacity increase in this short section, but also bottlenecks of railway infrastructure such as gradient, curve, and effective length in station yard shall be improved.

4.4.5 All factors of railway transportation capability between Tanjung Priok and Gedebage

Physical constraints of railway infrastructure in Tanjung Priok - Gedebage Corridor are summarized below:

- Maximum gradient 16‰ (Between Purwakarta and Padalarang)
- Minimum curve 150 meter (Between Puwakarta and Cisomang)
- Minimum effective length 168 meter (Cikadondong)
- Minimum Line Capacity 96 (Between Purwakarta and Padalarang)

Other constraints, as already mentioned in Chapter 2, are summarized below:

- Transportation time and tariff are unable to compete with truck transportation. This is largely due to highway road between Jakarta and Bandung and to chronic traffic jam between Tanjung Priok Port and Pasoso Station.

4.5 Basic Concept of Port Development Plan in Greater Jakarta Metropolitan Area

The purpose of the Master Plan for the port development in Greater Jakarta Metropolitan Area (target year 2030) is to serve as a target and guideline for phase plans including the Phase I Project urgently required.

Prior to making the Master Plan, the objectives of the development of the Port have been recognized as follows:

- To set up a New Container Terminal to receive containers overflowing from the existing container terminals (JCT) at Tanjung Priok Terminal which has limited expandable space within the existing port area and is anticipated to be soon saturated for ever increasing container-handling demand.

- To redevelop conventional wharves at Tanjung Priok Terminal so as to meet increasing domestic containers and conventional cargoes.
- To set up a New Petroleum Terminal through transferring the existing terminal in the vicinity of urban area at Tanjung Priok Terminal
- To set up a New Dry Bulk Terminal through transferring cargoes currently handled at berths in the vicinity of urban area at Tanjung Priok Terminal

The following current bottlenecks and disadvantages have been recognized at Tanjung Priok Terminal.

Excessive congestion on port access roads

Port users such as forwarders, trucking companies and consignors/consignees are suffering from excessive road traffic congestion in the hinterland of the port especially within JABODETABEK (Jakarta, Bogor, Depok, Tangeran and Bekesi) area.

Congestion within the port

There is a shortage of the port facilities including the number of berths and yard space, resulting in the congestion within the port. Even container ships scheduled for regular services are occasionally forced to wait off-shore. In addition, due to the shortage of yard space, container dwelling time is restricted and containers are often shifted to off-dock yards without notice to consignees generating additional expenses.

Insufficient water depth and space of turning basins to receive larger container ships

As to container ships, as shown in Fig. 4.7.8 below, it is anticipated that in 2014 the total container capacity of Post-Panamax Type ships will exceed the sum of capacities of Panamax Type and Handy-size in a clear trend that the sizes of container ships are getting larger and larger.

Despite the trend, shipping lines hesitate to bring even Panamax Type container ships with only 3,000 TEU capacities due to shallowness in the access channel and alongside berths as well as the narrowness of turning basins.

On the other hand, the water depth of the existing petroleum berths at Tanjung Priok Terminal is insufficient to receive larger petroleum product tankers importing petroleum to Indonesia from the Middle East, and larger tankers are forced to tranship oils to smaller tankers in deep sea waters.

Environmental burden on urban areas in the vicinity of the existing Tanjung Priok Terminal by port activities

Petroleum tank farms connected with the existing petroleum jetties are surrounded by the urban area of Jakarta Metropolis. In addition dust cargoes such as coal and sand are handled at the west side of the terminal adjacent to the urban area. Massive traffic of heavy vehicles is generated from the port activities at the existing terminal and is mixed with city traffic.

Taking the above aspects into account, the Master Plan for the port development in Greater Jakarta Metropolitan Area has been made according to the following principles:

- To propose a new terminal so as to receive increasing international containers to be overflowed from JCT at Tanjung Priok Terminal with a target year of 2030
- To propose redevelopment plan of the existing conventional wharves at Tanjung Priok Terminal so as to receive both increasing domestic containers and conventional cargoes
- To propose a transfer of the existing petroleum jetties and the tank farms connected with them to a new location off the existing facilities so as to ensure safety in urban areas adjacent to the existing petroleum terminal
- To propose a transfer of the current handling of dust cargoes to new location so as

to reduce scattering of dust to urban areas adjacent to the existing berths handling them

- To propose a port access road having the linkage with a road network in the port hinterland so as to enable smooth distribution of port cargoes to/from consignors/consignees of port cargoes and simultaneously alleviate further burden by port traffic to city traffic within JABODETABEK area
- To propose recommendations on the improvement of railway access to Tanjung Priok Terminal for port cargoe traffic for the purpose of converting the traffic from the excessively congested road to railway
- To pay due attention to environmental issues through conducting SEA (Strategic Environmental Assessment) prior to finalizing the Master Plan, especially focusing on the harmonization with the spatial plans of the central, provincial and regent governments and other related activities at a planned port location
- To take into consideration the potential shallow sea terminals extending off from Marunda to Tarumajaya by pursuing possible linkage with Tanjung Priok Terminal as a deep-sea terminal through barge transport
- To propose adequate functional allotment among the existing and potential terminals which are under the umbrella of Tanjung Priok Port aiming at making the most of limited resources including waters, land and funds

Based on the above principles, the Master Plan has been made according to the following steps:

First step (Screening the potential candidate sites)

Through the capacity analysis, it has been judged that the demand for international containers in the target year exceeds the potential capacity of JCT at Tanjung Priok Terminal and hence a new terminal is required to receive excess containers from JCT.

The nine potential candidate sites for the above new international container terminal, have been listed and then screened based on various criteria so as to narrow down into several sites and proceed to more detailed comparison based on estimated costs, economic viability, social and environmental considerations and so on.

According to the above screening in the first step, the nine listed candidate sites have been narrowed down into the following three sites:

- North Kalibaru,
- Cilamaya,
- Tangerang

Second step (Drafting development options for international containers)

Taking account of the forecast demand, capacity analyses and the three candidate sites, the following three options for the development of international container terminals have been drafted and compared with each other:

<u>Option 1</u>: Full concentration on Tanjung Priok Terminal
<u>Option 2</u>: Split to Tanjung Priok Terminal and Cilamaya
<u>Option 3</u>: Split to Tanjung Priok Terminal and Tangerang

Third step (Making the respective terminal development plans corresponding to the three options and the selection of the optimum plan)

The three options mentioned in “the second step” mentioned above have been proposed solely focusing on the development of international container terminals.

Those three options have been compared and then the optimum plan has been selected solely focusing on the services for international containers.

Forth step (Comparison of the three Alternatives of the selected optimum Option Plan and the selection of the Optimum Alternative Plan)

Fifth step (Making the development plan for domestic containers and conventional cargoes)

Sixth step (Drafting the Master Plan of Tanjung Priok Port)

The Master Plan of Tanjung Priok Port has been drafted by integrating the development plan for international containers and the development plan for domestic containers and conventional cargoes.

4.6 Screening of Potential Candidate Sites for a New International Container Terminal

4.6.1 List of Potential Candidate Sites

As shown in Section 2.2, the following ten conceptual port development plans have been proposed by various organizations including West Java Provincial Government, DKI Jakarta, Bekesi Regent, Tangeran Regent, Pelindo II and private developers. The sites of their plans have been listed as potential candidate sites for a new container terminal in this Study.

DKI Jakarta

1) North Kalibaru
2) Off Marunda Area between the existing Kalibaru Port and the border to Regent Bekesi

West Java Province

3) Off Marunda Center in Regent Bekesi (Kabupaten Bekesi)
4) Left Bank of Karang River (Ci Karang) in Regent Bekesi (Kabupaten Bekesi)
5) Muara Gembong Area in Regent Bekesi (Kabupaten Bekesi)
6) Cilamaya Coast in Regent Karawan (Kabupaten Karawan)
7) Ciasem Bay Coast in Regent Subong (Kabupaten Subong)

Banten Province

8) Tangeran Coast in Regent Tangeran (Kabupaten Tangeran)
9) Bojonegara Port

4.6.2 Criteria for Screening Potential Candidate Sites

In this study, in the first step, those nine plans have been reviewed as potential candidate sites. Then, in the second step, screening has been done to select candidate sites for the new container terminals out of those potential candidate sites. When screening, the following criteria have been applied:

1) Designation of protected forest (Hutan Lindun) by the Ministry of Forestry
2) Conformance with the Spatial Plan of the Provincial Governments
3) Conformance with the Spatial Plan of the Regent Governments (Kabupaten)
4) Ecological importance
5) Coastal line changes
6) JAPODETABEK traffic congestion

7) Distance from the major consumption area (Jakarta) in view of economical land transport
8) Distance from the major industrial areas (area along Jakarta – Cikampec Toll Road) in view of economical land transport
9) Sustainable maintenance dredging along deepwater access channel

4.6.3 Individual Evaluations for International Container Terminal

(1) North Kalibaru

Even if the second outer ring road (JORR2) is completed, it is predicted that JORR" will not be able to afford to accommodate port related vehicles to and from the New Terminal at North Kalibaru.

To alleviate the congestion forecast at JORR2, it is necessary to construct a new access road to the major industrial estates in Bekesi~Karawan areas along Jakarta – Cikampec Toll Road.

If the new access road to the above industrial estates is realized, the new road could afford to accommodate the port. If that is the case, it is predicted that the congestion within JABODETABEK toll road will be accelerated due to further concentration of international containers to Tanjung Priok Terminal. That means a negative factor to ABODETABEK toll road congestion

(2) Marunda (Jakarta)

Negative factors are acceleration to JABODETABEK toll road congestion and infeasibility of maintaining deep-water access channel for an international container terminal. Those sites will be usable for local terminals with shallow-water berths.

(3) Off Marunda Center

ditto

(4) Tarumajaya in Bekesi

Taking account of an excessive extension of the coast line due to sedimentation from Karan River (Ci Karan), it seems to be difficult to develop this site for either a shallow or deep-water container terminal.

(5) Muara Gembong in Bekesi

Taking account of many negative factors including natural and ecological conditions, it seems to be difficult to justify developing this site for an international container terminal.

(6) Cilamaya in Karawan

This site has no specific negative factor for constructing a deep-sea international container terminal.

A new access road toward Karawan industrial area must be constructed.

(7) Ciasem in Subang

Taking account of regulated forest areas designated by the Ministry of Forest as well as spatial plans of local government, it would be difficult to develop this site for a international container terminal.

(8) Tangerang

Negative factor is acceleration of JABODETABEK toll road congestion even if the second ring road is completed.

If a new terminal aims to attract containers from the West Java Province beyond DKI Jakarta, it seems to be difficult to alleviate the above negative factor in terms of traffic congestion.

Taking account that Tangerang has good natural conditions, the site has the potential to be developed as a deep-sea marine terminal to serve for local hinterland in the vicinity of the site in Banten Province without passing through DKI Jakarta.

(9) Bojonegara

Negative factor is the long distance from both major industrial and consumption areas. There is a plan to develop the port as a petroleum port as well as a conventional cargo port rather than an international container port.

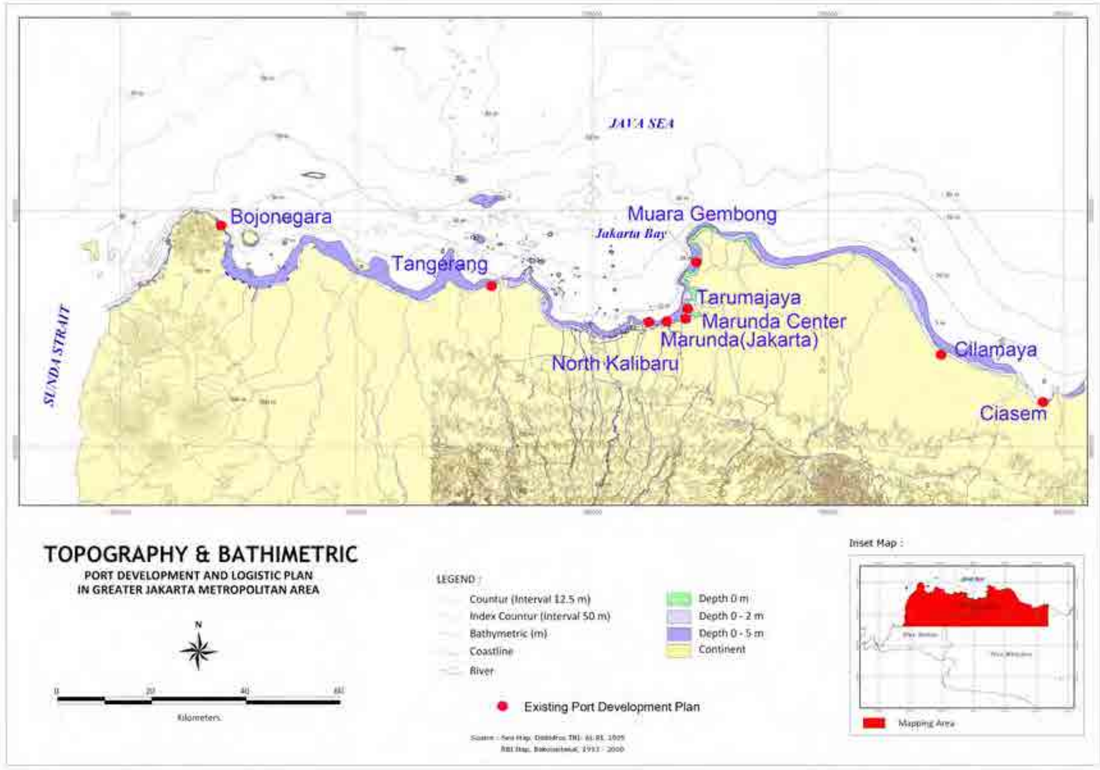
4.6.4 Result of the Screening

According to the basic concept of the New Container Terminal mentioned in Section 4.5 and the criteria mentioned in Section 4.6.2, screening of the above nine potential sites has been conducted and it has been narrowed down into the three sites, viz. North Kalibaru, Cilamaya and Tangerang. The remaining six potential sites have been ruled out due to having fatal negative factors for the construction of a deep sea marine terminal for international containers as summarized in Table 4.6-1 (see Figure 4.6-1)

Table 4.6-1 Screening of Potential Sites for a New Container Terminal

	Place	Regulated Forest Area (Hutan Lindung)			Ecological Importance	Coastal Line Changes	JABODETABEK traffic congestion	Land Transport Distances (km) to a new terminal		Maintenance dredging
		The Ministery of Forestry	Provincial Government	Government of Regent				Major industrial areas	Major consump-tion area	
1	North Kalibaru						Accelaration	60	7	
2	Marunda (Jakarta)						Accelaration	57	10	Infeasible
3	Marunda Center						Acceleration	55	12	Infeasible
4	Tarumajaya (Bekesi)	Disobedience				Excessive	Accelaration	53	32	Infeasible
5	Muara Gembong (Bekesi)	Disobedience	Disobedience	Disobedience	Important	Unstable	Accelaration	60	40	
6	Cilamaya						Alleviation	30	80	
7	Ciasem	Disobedience	Disobedience	Disobedience			Alleviation	55	100	
8	Tangerang						Accelaration	100	50	
9	Bojonegara						Accelaration	180 > 100	120 > 100	

Note: [dotted box] Negative factor
Source: Study Team



Source: Made by the Study Team based on the data from Fairplay

Figure 4.6-1 Potential Candidate Sites for International Container Terminal in the Jakarta Metropolitan Area

Taking account of the forecast demand, capacity analyses and the three sites, viz. North Kalibaru, Cilamaya and Tangerang, the following three options for the development of international container terminals have been drafted.

<u>Option 1:</u>	Fully concentration to Tanjung Priok Terminal			
	JCT:		4.0	
	North Kalibaru Phase I:		1.9	million TEUs
	North Kalibaru Phases II~ III:		7.5	million TEUs
		Total:	13.4	million TEUs
<u>Option 2:</u>	Split to Tanjung Priok Terminal and Cilamaya			
	JCT:		4.0	
	North Kalibaru Phase I:		1.9	million TEUs
	Cilamaya Phases II~III:		7.5	million TEUs
		Total:	13.4	million TEUs
<u>Option 3</u>	Split to Tanjung Priok Terminal and Tangerang			
	JCT:		4.0	
	North Kalibaru Phase I:		1.9	
	North Kalibaru Phases II~ III:		5.5	million TEUs
	Tangerang:		2.0	million TEUs
		Total:	13.4	million TEUs

4.7 Three Options for a New International Container Terminal

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

In this section, long-term development plan for Tanjung Priok Terminal has been studied corresponding to "the Third Step" mentioned in the previous section "4.5". In this study the area off North Kalibaru is considered the only space for further expansion for Tanjung Priok Terminal so as to meet increasing demand of international containers towards the target year 2030.

(1) Required Access Channel Dimensions

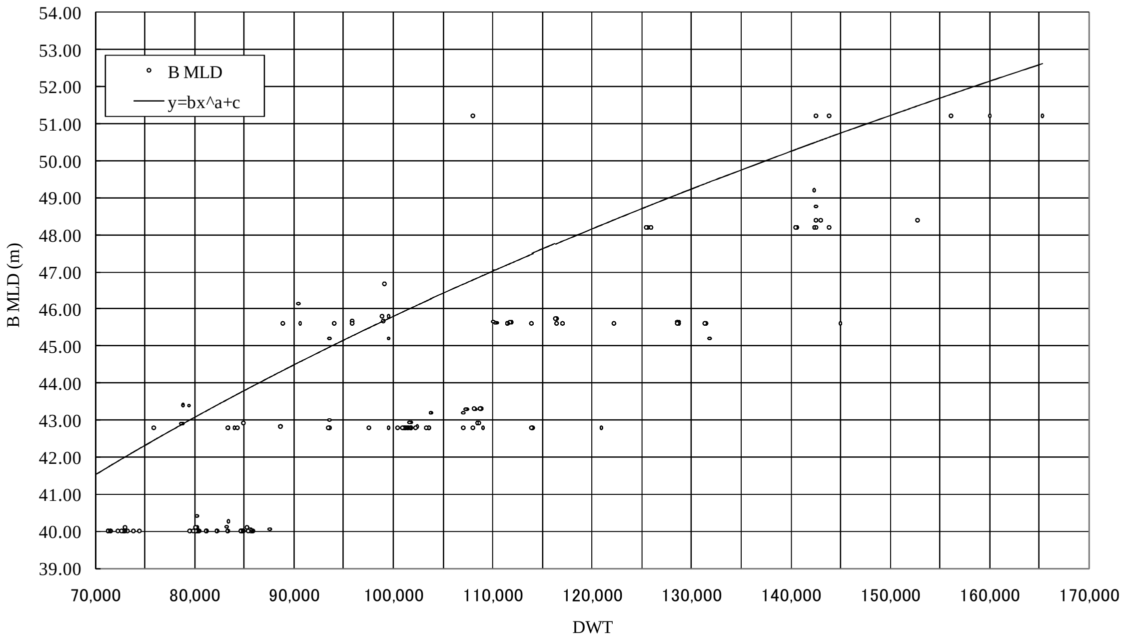
In the first step of the access channel planning, the representative principal dimensions of large container vessels which have a possibility of calling at new berths to be developed off North Kalibaru have been taken into account.

In the second step of the channel planning, the required dimensions of the access channel comprising width and water depth which accommodate so-called design vessels, the maximum vessel dimensions have been determined.

1) Representative Principal Dimensions of Container Vessels

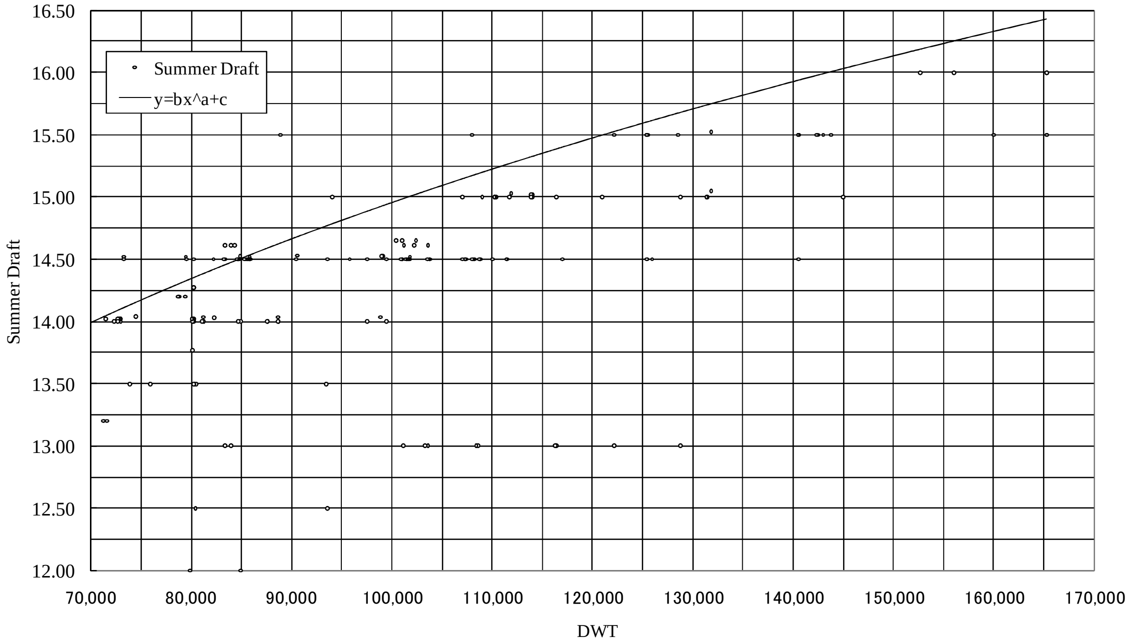
Representative principal dimensions of large container vessels potentially calling at the new container terminal to be allocated on candidate sites along northern coastal areas extending from in West Java Province, through DKI Jakarta to Banten Province have been analyzed and shown below.

Correlation between DWT and principal dimensions of Post-Panamax and Panamax container ships are shown in Figure 4.7-1 ~ Figure 4.7-7. In those figures, all the ships currently in operations worldwide are covered.



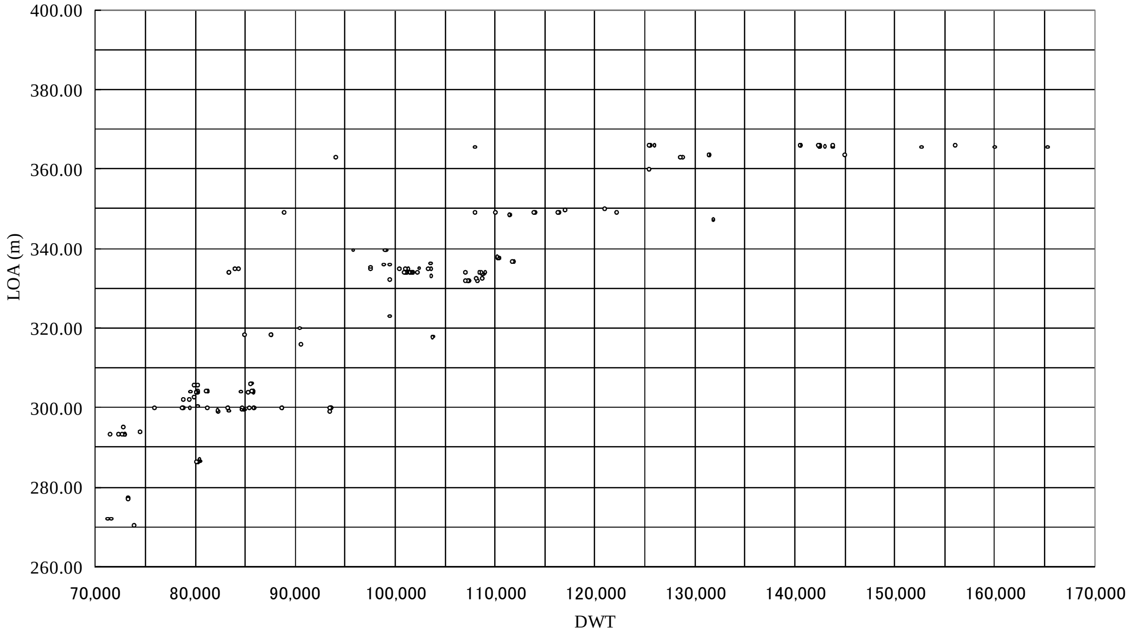
Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-1 Correlation between DWT-Beam Length in Post-Panamax Container Ships



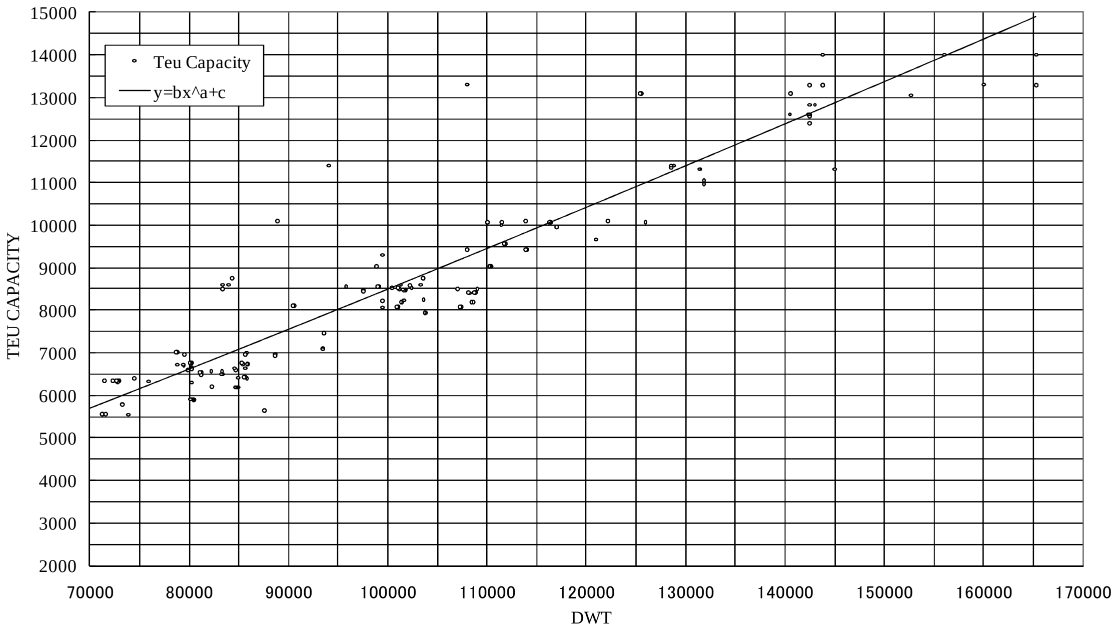
Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-2 Correlation between DWT-Summer Draft in Post-Panamax Container Ships



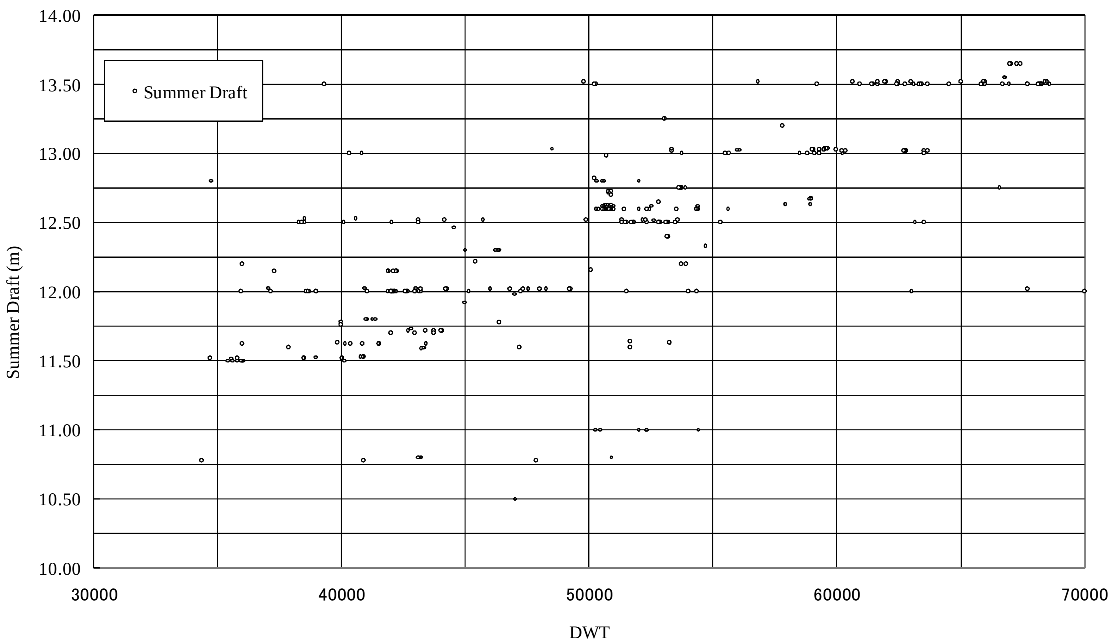
Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-3 Correlation between DWT-LOA in Post-Panamax Container Ships



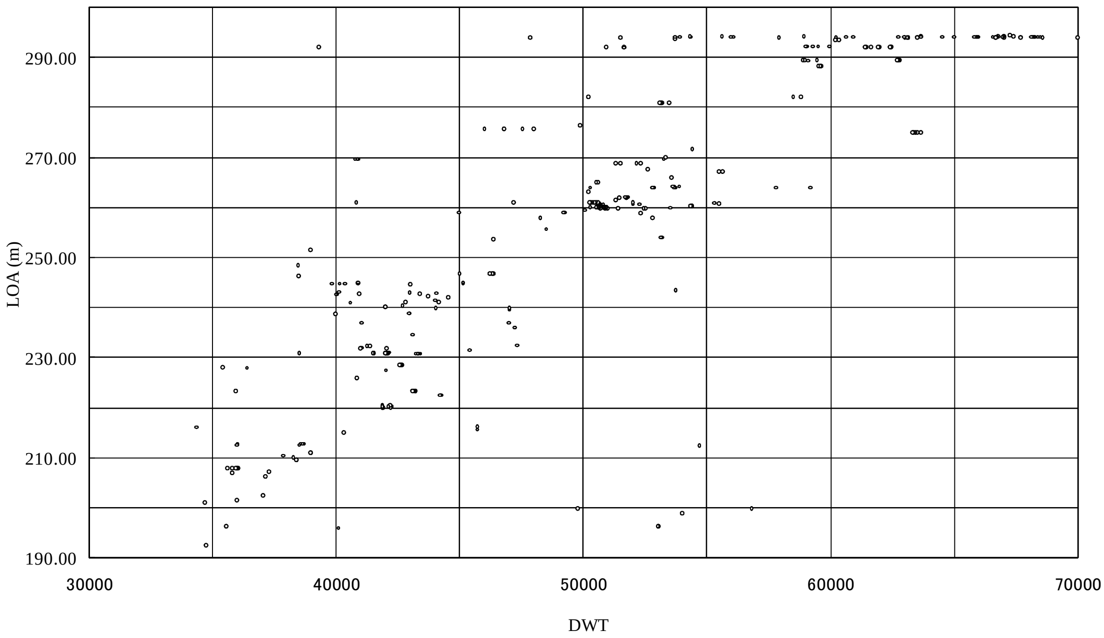
Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-4　Correlation between DWT-TEU Capacity in Post-Panamax Container Ships



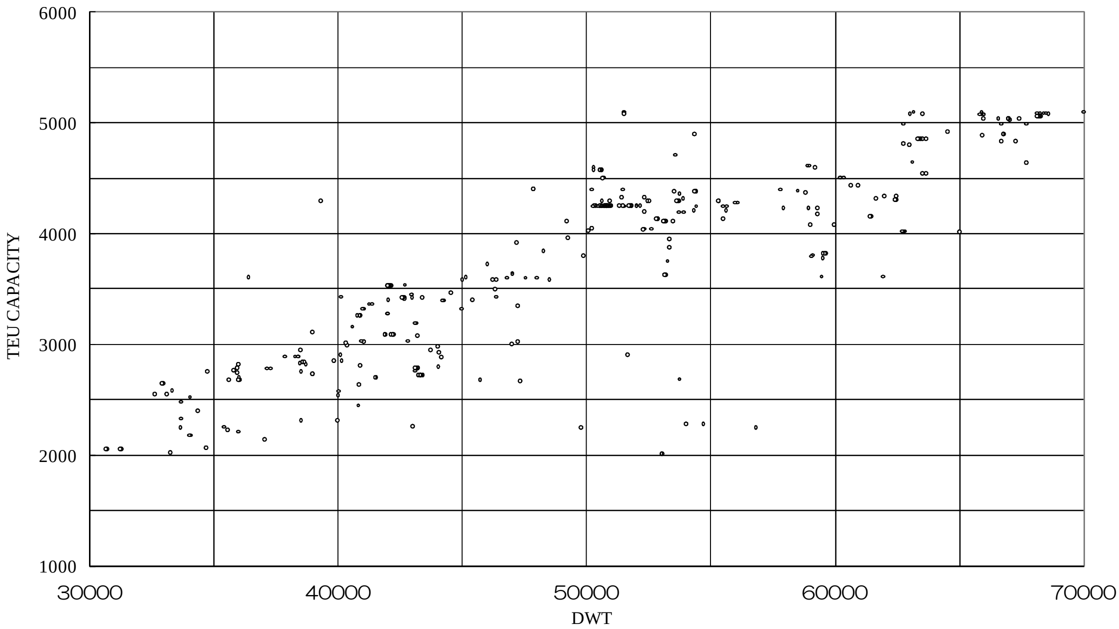
Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-5　Correlation between DWT-Summer Draft in Panamax Container Ships



Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-6 Correlation between DWT-LOA in Panamax Container Ships

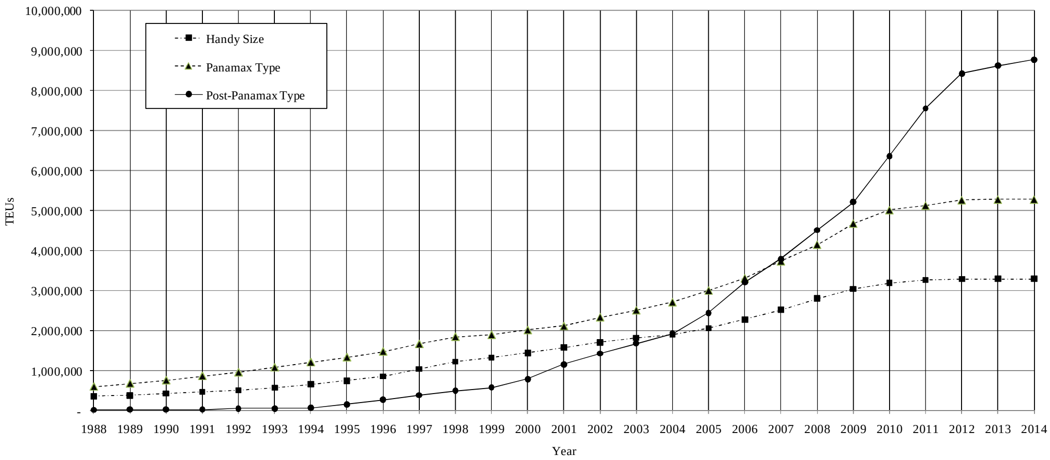


Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-7 Correlation between DWT-TEU in Panamax Container Ships

As to container ship size, there is a clear trend that container ship sizes are getting larger year by year. In the year of 2007, container ships of Post-Panamax Type exceeded those of Panamax Type in terms of the total amount of TEU capacity. Since then, the gap has been getting wider (see Figure 4.7-8). Taking account of due deliveries, in 2014, it is forecast that the percentage of Post-Panamax Type will reach 51%, whereas Panamax Type and Handy-Size will be 30% and 19%, respectively.

Among Post-Panamax Type container ships, ship sizes are getting larger towards Super-Post Panamax and ULC S (Ultra Large Container Ship).



Source: Compiled by the Study Team based on the data from Fairplay

Figure 4.7-8 TEU Capacities of Container Ships Currently in Operations Including Due Deliveries Accumulated in Years of Built

In 2009, the maximum type of container ships was Post-Panamax Type which called at KOJA Terminal presumably due to the existence of the comparatively large turning basin adjacent the terminal (see Table 4.7-1). The remaining two large vessels berthed at KOJA. Thus, sufficient turning basin is crucial at the existing Tanjung Priok Terminal as well as deeper water depth. By contrast, vessel sizes calling at JICT are comparatively smaller.

Table 4.7-1 The Maximum Container Vessel Sizes Calling at Tanjung Priok Terminal in 2009

Ship Name	DWT	TEUs	LOA	Beam (m)	Summer Draft (m)	Enter Draft (m)
BUNGA PELANGI DUA. MV	61,428	4,469	276.00	37.19	13.62	11.1.
MSC MALAYSIA. MV	59,283	4,230	292.15	32.23	13.03	11.20
MSC TOBA. MV	53,765	3,876	269.79	32.26	13.00	12.00

Source: Pelindo II

Using Figure 4.7-1 ~ Figure 4.7-7, representative container ship sizes and corresponding dimensions of required port facilities by type have been summarized in Table 4.7-2.

Table 4.7-2 The Representative Sizes Container Ships and Corresponding Dimensions of Port

Representative Vessel Dimensions						Berth Dimension		Turning Basin
Type	DWT	TEUs	LOA	Beam (m)	Draft (m)	Depth (m)	Length (m)	Diameter(m)
Small size	18,300	1,270	169	27.30	8.4	9.0	200	340
Midium size	33,750	2,550	207	29.84	11.4	12.5	240	420
Panamax	59,283	4,230	292	32.23	13.0	14.5	320	580
Post-Panamax	87,545	5,648	318	40.06	14.0	15.5	360	640
Super Post-Panamax	101,000	8,073	334	42.80	15.0	16.5	380	670
ULCS	142,500	12,400	366	48.40	16.0	18.0	410	730

Note; ULCS : Ultra Large Container Ship (Suez-max)
Source: Compiled by the Study Team using Fairplay's Data

2) Required Dimensions of New Access Channel off North Kalibaru

The bottom width of the planned two-way access channel has been designed through applying the prevailing guidelines including PIANC. According to the PIANC Guidelines, the required channel width has been estimated as 7.8 B (breadth of design vessel). Its breakdown is shown as follows:

- Basic Maneuvering lane	1.5B X 2
- Bank Clearance	0.5B x 2
- Vessel Speed	0.1B x 2
- Cross current	0.1B x 2
- Aids to navigation	0.1B x 2
- Bottom surface	0.1B x 2
- Depth of waterway	0.4B x 2
- Hazardous	0.5B x 2
- Passing lane	1.2B
total	7.8B

In addition to PIANC guidelines, the deviation angle method has also been applied assuming the angle of 15°. Required channel widths for ULCS (Ultra-Large Container Ships) according to PIANC Guidelines and the Deviation Angle Method are shown in Table 4.7-3. The required water depth for ULCS has been estimated to be 18 meters.

Table 4.7-3 Dimensions of Planned New Navigational Channel in the New Terminal

Maximum design vessel: Ultra Large Container Ship

Number of Lanes	PIANC Guideline			Deviation Angle Method		
	Channel Width (D) m	Beam (B) m	LOA (A) m	Channel Width (D) m	Beam (B) m	LOA (A) m
		48.40	366		48.4	366
		D/B	D/L		D/B	D/L
One-way	190	3.8	0.5	190	3.8	0.5
Two-way	380	7.8	1.0	380	7.8	1.0

Source: Made by the Study Team

Required channel widths for Super Post-Panamax Container Ships according to PIANC Guidelines and the Deviation Angle Method are shown in Table 4.7-4. The required water depth for the ships has been estimated to be 16.5 meters.

Table 4.7-4 Dimensions of Planned New Navigational Channel in the New Terminal

Maximum design vessel: Super Post-Panamax

Number of Lanes	PIANC Guideline			Deviation Angle Method		
	Channel Width (D) m	Beam (B) m	LOA (A) m	Channel Width (D)	Beam (B) m	LOA (A) m
		42.80	338		42.8	338
		D/B	D/L		D/B	D/L
One-way	160	3.8	0.5	170	4.0	0.5
Two-way	330	7.8	1.0	340	7.9	1.0

Source: Made by the Study Team

Required channel widths for Post-Panamax Container Ships are shown in Table 4.7-5. The required water depth for the ships has been estimated to be 15.5 meters.

Table 4.7-5 Dimensions of Planned New Navigational Channel in the New Terminal

Maximum design vessel: Post-Panamax

Number of Lanes	PIANC Guideline			Deviation Angle Method		
	Channel Width (D) m	Beam (B) m	LOA (A) m	Channel Width (D)	Beam (B) m	LOA (A) m
		40.06	318		40.06	318
		D/B	D/L		D/B	D/L
One-way	150	3.8	0.5	160	4.0	0.5
Two-way	310	7.8	1.0	320	8.0	1.0

Source: Made by the Study Team

(2) Require Dimensions of New Berths off North Kalibaru

1) Vessel Size

The potentiality of direct services to Europe from the new terminal has been examined based on a cost analysis. The conditions and result of the analysis have been summarized in Table 4.7-6. As shown in the table, direct services by mother vessel and feeder services through transshipment at Singapore have been compared. In the case of direct services, three types of mother vessels, viz. Post-Panamax, Super-Post Panamax and ULCS have been used for comparison. In addition, their laden container numbers between Singapore and the new terminal have been assumed the same by taking account that larger type has a disadvantage compared to smaller types in terms of collectability of containers from the container market.

As indicated in “Transport Cost Index”, direct services are more economical than transshipment services regardless of the lower laden percentage due to high transshipment cost. Furthermore, larger vessels are more economical among Post-Panamax ships. However, there is no decisive difference among the four cases shown in the table.

If that is the case, direct services should be promoted rather than feeder services so as to avoid possible cargo damage by stevedoring at a transshipment port and to achieve shorter transport time for a destination port.

On the other hand, as to the selection of the design vessel size among larger container ships, larger ones have a disadvantage compared to smaller types in terms of collectability of containers as mentioned above.

From the above, in this study, ordinary Post-Panamax type container ship with the capacity of around 6,000 TEUs has been selected as the maximum ship size for port facility planning.

Table 4.7-6 Container Transport Cost Comparison among various Ship Sizes on the Route between Jakarta Metropolitan Area and Europe via Singapore

TEU Capacity	Ship Type	Laden Percentage between Jakarta and Singapore	Transshipment/ Direct	Transport Cost Index between Jakarta and Europe
1,270	Feeder Ship/Post Panamax	100% (800 boxes)	Transshipment	106
5,650	Post-Panamax	30% (1000 boxes)	Direct	100
8,000	Super Post-Panamax	21% (1000 boxes)	Direct	100
10,000	Ultra Large Container Ship	17% (1000 boxes)	Direct	95

Source: Estimated by the Study Team

Principal dimensions of the design vessel of Post-Panamax Type are shown below:

- DWT: 88,000 tons
- TEU Capacity: 5,600 TEUs
- LOA: 320 m
- Beam: 40 m
- Summer draft: 14 m

2) Berth Dimensions:

To accommodate the design vessel mentioned in the former Clause “a.”, the following berth dimensions are required:

- Berth length: 360 m
- Water depth: -15.5 m

(3) Berth Allocation Plan at Tanjung Priok Terminal

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

According to the result of cargo demand forecast indicated in Section 4.2.1, the total volume of international containers in the target year of 2030 has been estimated as 13.4 million TEUs. As shown in Section 4, the capacity of the existing facilities of Tanjung Priok Terminal has been estimated as 4.9 million TEUs and this capacity is forecast to be reached by 2014.

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 as computed as follows (see Table 4.7-10):

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

2) Container Vessel Sizes Used for Berth Allocation Plan

Although Post-Panamax container ship has been selected as the maximum sized ship for the facility planning, she is not the only ship to call the new terminal. In other words, various ship sizes need to be considered to make an economical plan as shown in Table 4.7-7.

Table 4.7-7 Vessel Sizes Used for Berth Allocation Plan

Type	DWT	TEUs	LOA	Beam (m)	Draft (m)	Depth (m)	Length (m)
Small size	18,300	1,270	169	27.30	8.4	9.0	200
Midium size	33,750	2,550	207	29.84	11.4	12.5	240
Panamax	59,283	4,230	292	32.23	13.0	14.5	320
Post-Panamax	87,545	5,648	318	40.06	14.0	15.5	360

Source: The Study Team

3) Allocation of Containers by Ship Type

Containers to be handled at the new terminal in 2030 have been allocated as indicated in Table 4.7-8 by taking into account that direct calls will be promoted more than at present as mentioned in Section 4.5.2 (1).

Table 4.7-8 Allocation of Containers by Ship Type at a New Terminal in 2030

Unit: '000TEUs/year

Direct/Transshipment		Total	Allocation			
			Small size	Medium size	Panamax	Post-Panamax
Eastbound Direct	60%	5,640		2,820	2,820	
Westbound Direct	10%	940				940
Transshipment	30%	2,820	1,410	1,410		
Total	100%	9,400	1,410	4,230	2,820	940

Source: Estimated by the Study Team

4) Required Berth Length

Taking into account the possible configuration of North Kalibaru container berth and phased implementation, the berth has been proposed as a so-called continuous berth with the same water depth in the condition that various types of container ships as shown in Table 4.7.1 will berth at various places rather than fixed places according to their various LOAs.

To simplify the calculation of required berth length, actual unit productivity per unit berth length achieved by JICT North in 2009, viz. 1,600 TEUs/m/year, has been applied (see Section 4.3.2 (1)). 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

The above result has been crosschecked by using berth-wise productivity intuitionally understandable as follows:

- Calling ship types : Solely Panamax-type container ships
- Container-handling productivity: 25 boxes /hr/Gantry crane
- TEU-box ratio = 1.5
- Berthing hours: 20 hrs
- Gantry crane units per berth: 3 units
- Berth length: 320 m
- Number of weekly service per berth: 7 services x 0.65
- Yearly calls per berth: 237 calls (actual record of JCT in Dec. 2009)

- Yearly productivity: 532,000 TEUs
- Productivity per berth length: 532,000 TEUs/year/320m = 1,660 TEUs/m/year

From the above crosschecking, it has been verified that the unit of 1,600 TEUs per m per annum is a reasonable figure.

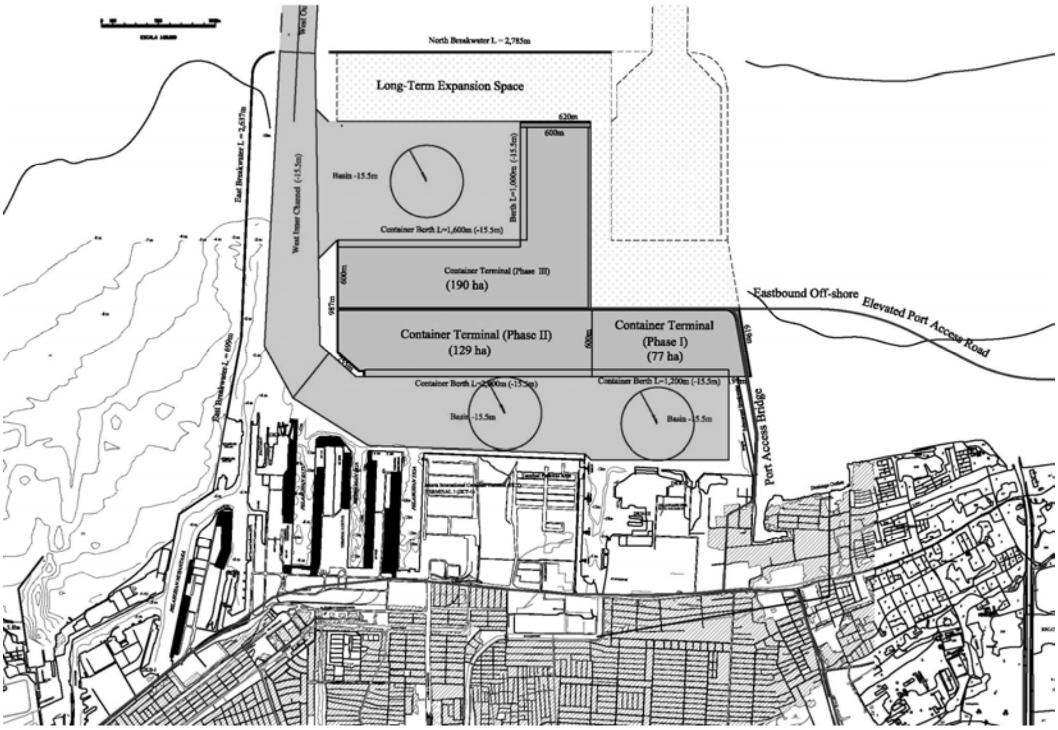
(4) Facility Components and Layout Plans of North Kalibaru Terminal of Option-1

The three alternative layout plans satisfying facility requirements to the new terminal off North Kalibaru in the stage of the Master Plan mentioned in this Section 4.7.1 Paragraphs (1) ~(3) have been made (see Figure 4.7-9~ Figure 4.7-12). The main components of each alternative are shown in Table 4.7-9.

Table 4.7-9 Facility Components of Alternative Plans at North Kalibaru (Option-1)

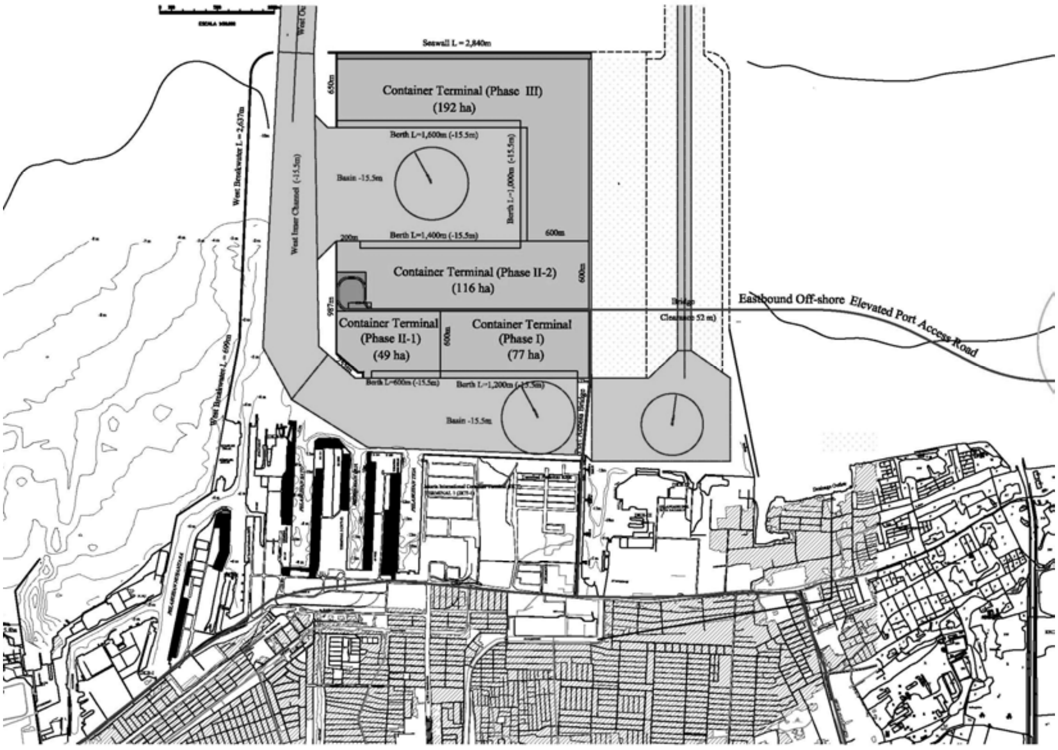
Component			Alternative-1	Alternative-2	Alternative-3
Access Channels	West	Bottom width (m)	310	310	310
		Water depth (m)	15.5	15.5	15.5
Basins	Northwest	Water depth (m)	15.5	15.5	15.5
	South	Water depth (m)	15.5	15.5	15.5
New Breakwaters	West	Length (m)	2,640	2,640	2,640
	North	Length (m)	2,790	70	2,300
Seawalls (Open Sea)		Length (m)	620	2,840	1,420
Revetment		Length (m)	2,050	2,210	2,670
Container Terminal	Phase I	Berth length (m)	1,200	1,200	800
		Water depth (m)	15.5	15.5	15.5
		Container yard (ha)	77	77	50
	Phase II	Berth length (m)	2,000	2,000	2,400
		Water depth (m)	15.5	15.5	15.5
		Container yard (ha)	130	170	180
	Phase III	Berth length (m)	2,600	2,600	2,600
		Water depth (m)	15.5	15.5	15.5
		Container yard (ha)	190	190	220
	Master Plan (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



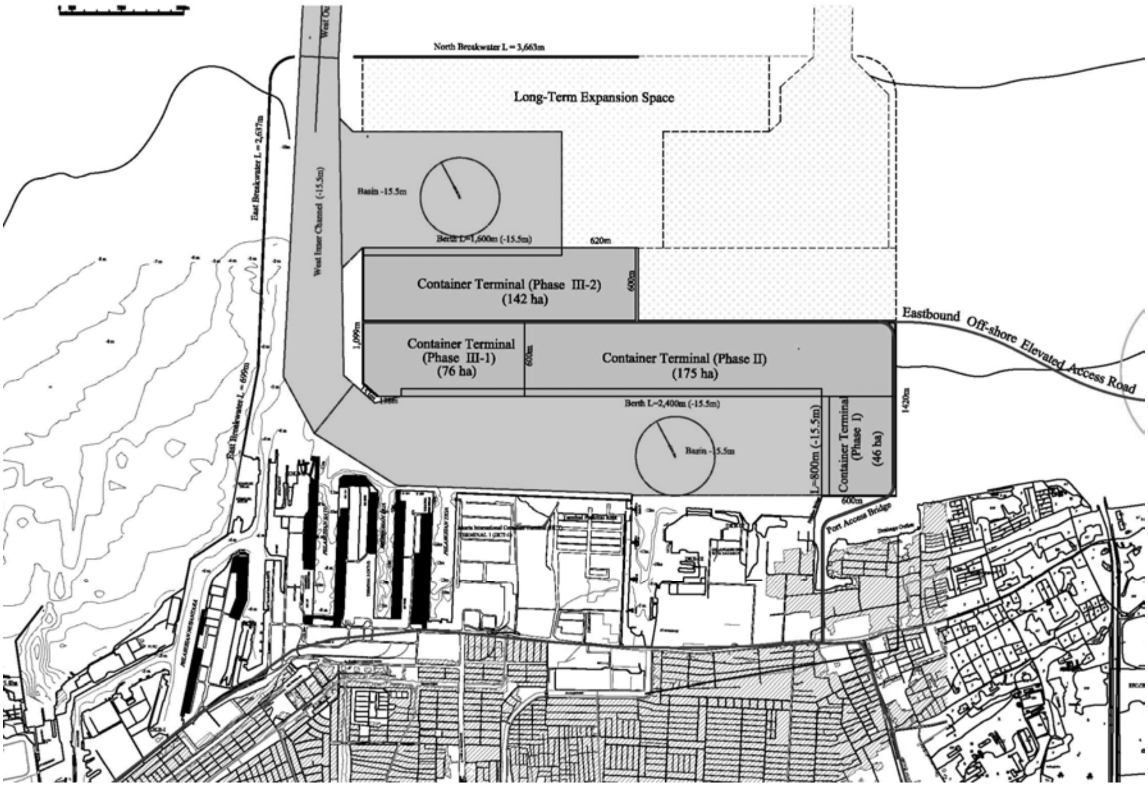
Source: Made by the Study Team

Figure 4.7-9 Facility Layout Plan of North Kalibaru Expansion in 2030 (Alternative-1)



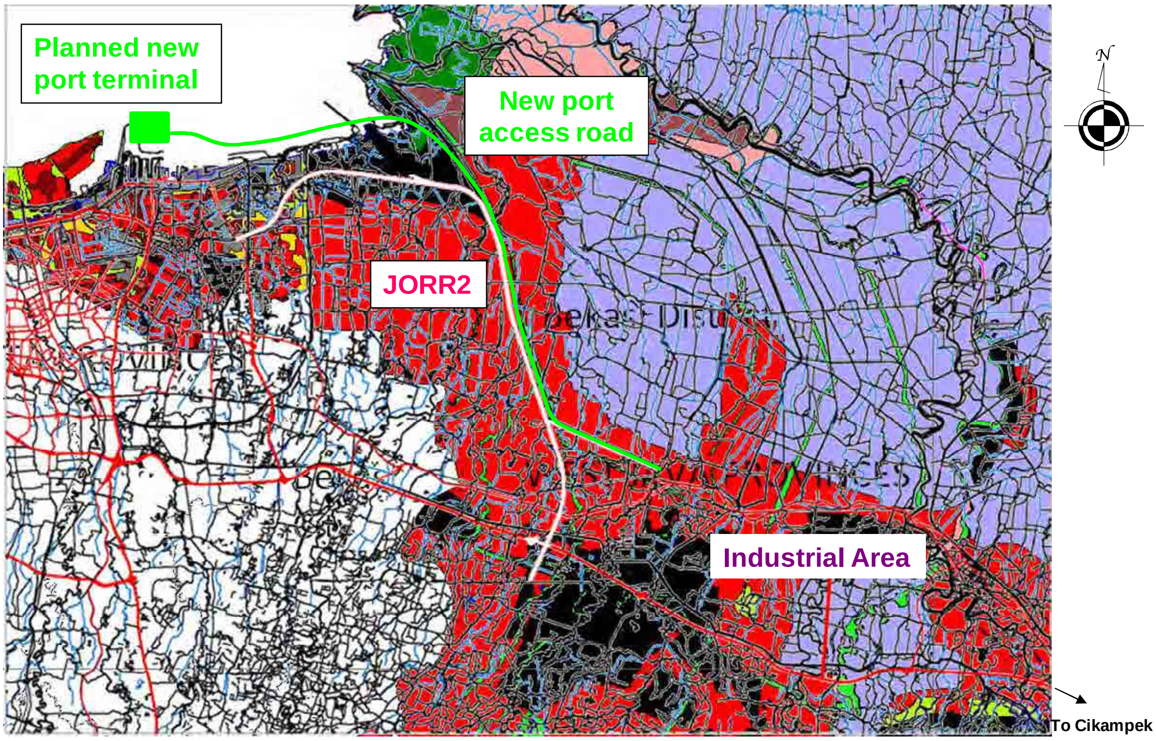
Source: Made by the Study Team

Figure 4.7-10 Facility Layout Plan of North Kalibaru Expansion in 2030 (Alternative-2)



Source: Made by the Study Team

Figure 4.7-11 Facility Layout Plan of North Kalibaru Expansion in 2030 (Alternative-3)



Source: Made by the Study Team

Figure 4.7-12 Access Road to North Kalibaru (Option-1)