10-D. PROJECT COMPONENTS FOR BOJONEGARA

93. In accordance with development concept for Bojonegara new port, the Study team has selected the following projects in 2025: Basic port facilities development, Container terminal development, Unitized and other cargo handling facilities development and Port access development.

10-D-1 Container Terminal Development

1) Concept

- ✓ *Establishment of high grade, world standard international container terminal to meet the rapid increase of import/export container demand in Western Java area as well as to function as a complementary port of Tanjung Priok*

2) Requirements of the Terminal

a) Berth Dimension

94. Target maximum ship size are set as 50,000GT based on the analysis of world wide ship size distribution. The depth of berth is set as -14m basically (=12.7m*1.1=14m), while two of those developed in the first stage are set initially as -12m considering bed rock existence at the site and effective investment. The decision on the depth of first stage terminal should be made based on detailed field survey on bed rock situation. Length of a berth is set as 300m considering the berth alignment is sequential. (Basically, calculated as follows: = LOA + Beam = 280m + 33m = 313m, however, can be reduced in case of sequential berths)

b) Berth Handling Capacity

95. The capacity of a newly developed berth in Bojonegara is set as 380,000 TEU/berth in the same manner in section III-A based on the following conditions:

- Target BOR (Berth Occupancy Ratio) = 60%
- Ship size distribution, number of loaded/unloaded boxes per ship and number of cranes used per ship are set as follows:

	Ship Size Distribution	Loaded/Unloaded Boxes per Ship	Number of Crane Used			
			LOA	m/crane	No.crane	Setting
0-4999	10%	300	120	100	1.2	1.5
5000-9999	20%	500	150	100	1.5	2.0
10000-14999	15%	600	170	100	1.7	2.0
15000-19999	20%	800	200	100	2.0	2.0
20000-29999	20%	1000	220	100	2.2	2.5
>30000	15%	1000	280	100	2.8	3.0

96. Ship size distribution was set based on the world data and ship record data at Tanjung Priok port. Number of boxes were set based on the actual figures at Tanjung Priok.

- Crane productivity (BCH) = 25 boxes/Crane/Hour
- Idling time = 2hr
- Operation ratio = 95% (considering non-operating time due to weather condition and other factor)

c) Required Number of Berths

97. Required number of berths in each year is calculated as follows based on the demand and the above conditions:

Table 10-D-1 Berth Planning (Container Terminal)

	No. of Berths	L (m)	Ship Calls			T'put ('000TEU)	'000TEU /berth	No. of Cranes	Newly Developed Quays
			Int'l	Dom	Total				
2010	2	600	153	32	185	162	81	3	CT1,CT2(-12m, 600m)
2011	2	600	326	74	400	349	175	3	
2012	2	600	522	125	647	563	282	5	
2013	2	600	727	183	909	790	395	5	
2014	4	1200	844	253	1,097	1,035	259	10	CT3, CT4 (-14m, 600m)
2015	4	1200	970	276	1,246	1,190	298	10	
2016	4	1200	1,098	298	1,396	1,345	336	10	
2017	4	1200	1,224	321	1,545	1,500	375	10	
2018	4	1800	1,349	346	1,695	1,655	414	10	
2019	6	1800	1,474	372	1,846	1,811	302	15	CT5, CT6 (-14m, 600m)
2020	6	1800	1,599	394	1,993	1,966	328	15	
2021	6	1800	1,723	420	2,142	2,122	354	15	
2022	6	1800	1,845	446	2,290	2,277	380	15	
2023	6	1800	1,967	471	2,439	2,433	406	15	
2024	8	2400	2,089	500	2,589	2,589	324	20	CT7, CT8 (-14m, 600m)
2025	8	2400	2,210	526	2,735	2,745	343	20	

3) Container Yard

98. With regard to container yard, the 450m width of the terminal including apron is sufficient on the following condition.

- RTG system
- Maximum stacking height: 3, Average stacking height ratio: 0.7 (In case of applying UNCTAD standard)
- Peak ratio = 1.3 (In case of applying Japanese standard)
- Average dwelling time: 5 days (Export - 3days, Import - 7days)
- Marshalling yard ratio: 70% to total terminal area

Table 10-D-2 Necessary Terminal and Yard Area per Berth

Yard Capacity (‘000TEU)	UNCTAD	966
	Japanese Standard	796
Quay side Capacity (‘000TEU)		760 (380*2berth)

10-D-2 Multi Purpose Terminal and General Cargo Berth Development

1) Concept

- ✓ *Establishment of multi purpose berths to meet the cargo demand generated from regional development*

2) Requirements of the Terminal

99. As target ships may transport general cargo and/or unitized cargo such as inter-island container, Ro-Ro cargo, the dimensions of a multi purpose berth depends on the target vessels as follows:

Table 10-D-3 Dimensions of an Multi Purpose Berth and General Cargo Berth

	Length of Berth (*)	Depth of Berths (**)	Terminal Width
General Cargo (20,000GT)	210m	-12m	around 300m for multi purpose use around 150m for general cargo
General Cargo (10,000GT)	170m	-10m	
Inter-island Container (10,000GT)	170m	-9~10m	
Ro-Ro Vessel (20,000GT)	220m	-10m	

* Length of ship (L) + Allowance (B)
** Draft of ship (D) + Allowance (D*10%)
*** 181m + 40m =221m ≈ 220m (As the same way for a car carrier vessel)

100. For the initial development of multi purpose terminal, the depth of berth is set as -10m with 10% allowance of the above target ship draft excluding 20,000GT class of general cargo vessel. Berth length is basically set as 220m considering Ro-Ro vessel use. As for the terminal width, 300m is sufficient even if considering container handling, or Ro-Ro cargo. The maximum diameter of turning basin for the proposed multi purpose terminal is set as 400m (= 2*180m = 360m ≈ 400m), which can be located in front of the container terminal.

101. For the long term development, general cargo berth will be planned based on the above target ship of 20,000GT class. Berth length is set as 210m, and depth as -12m. With regard to the terminal width 150m is sufficient for handling general cargo.

102. Assuming ship size distribution, handling productivity, cargo lot per ship, berth occupancy ratio etc., required number of berths in each year is calculated as follows: The details of calculation are shown in Appendix–A.

Table 10-D-4 Berth Planning (Multi Purpose Terminal, General Cargo Berth)

	No. of Berths	Length of Berth (m)	T'put (ton)	Ship Calls	Newly Developed Quays
2008	1	220	92000	41	MPT1 (-10m, 220m)
2009	1	220	208000	93	
2010	1	220	353,000	157	
2011	1	220	533,000	238	
2012	1	220	753,000	336	
2013	2	430	818,000	365	Q1 (-10m, 210m)
2014	2	430	884,000	395	
2015	2	430	948,000	423	
2016	2	430	1,014,000	452	
2017	2	430	1,079,000	482	
2018	2	430	1,144,000	511	
2019	2	430	1,210,000	540	
2020	3	640	1,275,000	569	Q2 (-10m, 210m)
2021	3	640	1,340,000	598	
2022	3	640	1,405,000	627	
2023	3	640	1,470,000	656	
2024	3	640	1,536,000	685	
2025	3	640	1,601,000	715	

10-D-3 Ro-Ro Terminal Development

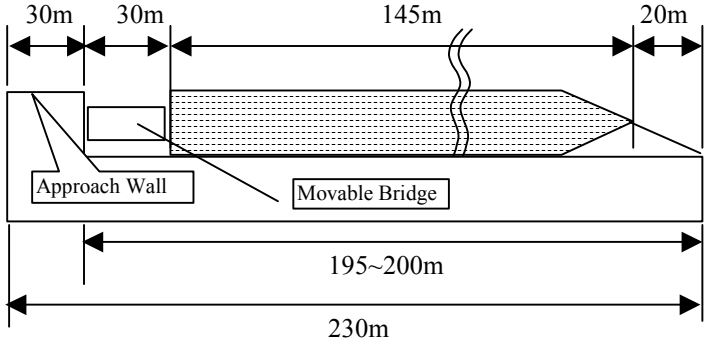
103. It is forecasted that the capacity of the current ferry port, Merak port, will be in shortage around 2012 and there will be a possibility to establish a Ro-Ro terminal in Bojonegara instead of expanding Merak port. In that case, the above multi purpose terminal will not be sufficient to

accommodate Ro-Ro calls. For that reason, potential space for Ro-Ro cargo will be reserved in the development plan with the following dimensions:

Table 10-D-5 Dimensions of an Ro-Ro Terminal

	Length of Berth (*)	Depth of Berths (**)	Terminal Width
Ro-Ro Vessel (10,000GT)	200m	-8m	around 200m

* Length of berth is set as follow:



** Draft of ship (D) + Allowance (D*10%)

10-D-4 Special Wharf

104. Special wharf development should be considered based on another study, however, offshore area of the island will be available for the development with enough depth (more than -15m).

10-D-5 Breakwater, Channel and Basin, and Other Port Facilities

105. There are two small islands offshore in the Bojonegara new port site, however, appropriate breakwater will be necessary because the protected water area with these islands is too narrow to develop several berths along the coast line. The standard of calmness for berth operation is set at 97.5% according to the Japanese standard, which means that number of days with less than or equal to 0.5m wave height in front of quays covers more than or equal to 97.5% of 365 days. Alignment of breakwater should be set to satisfy this standard of calmness.

106. As for breakwater alignment, the Study team examined the following two alternatives.

- Alternative-A: Set the access channel toward to the north (N10W) direction
- Alternative-B: Set the access channel toward to the South-east (S45E) direction)

107. Based on the evaluation on the alternatives shown in Table 10-D-6, the Study team proposes **Alternative-A** considering phased development. Tranquility analysis is described in the "Supporting Report of Engineering Study".

108. Breakwater alignment should be examined from the viewpoint of securing calmness of the basin inside the port. According to the computer simulation, it was confirmed that the proposed alignment of breakwater satisfied the standard which stimulates that excessive probability beyond 0.5m wave height in front of quay should be under 2.5% throughout the year. Detailed simulation results are shown in the "Supporting Report of Engineering Study".

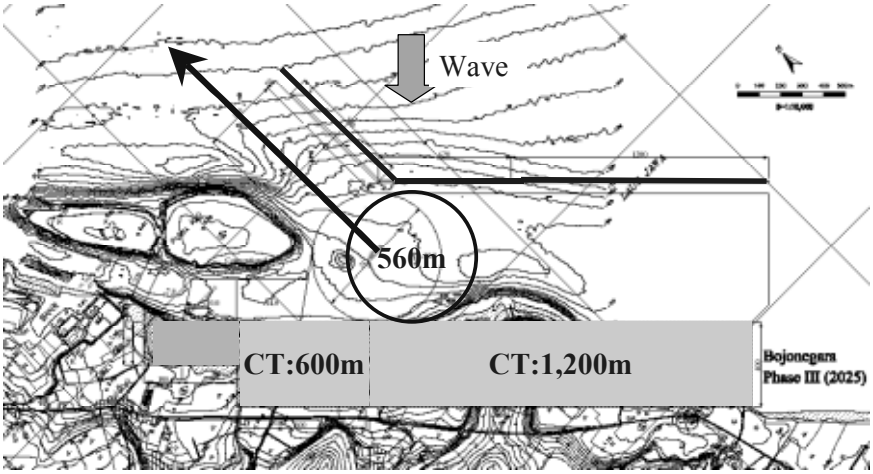


Figure 10-D-1 Alternatives for Breakwater Alignment (Alternative-A)

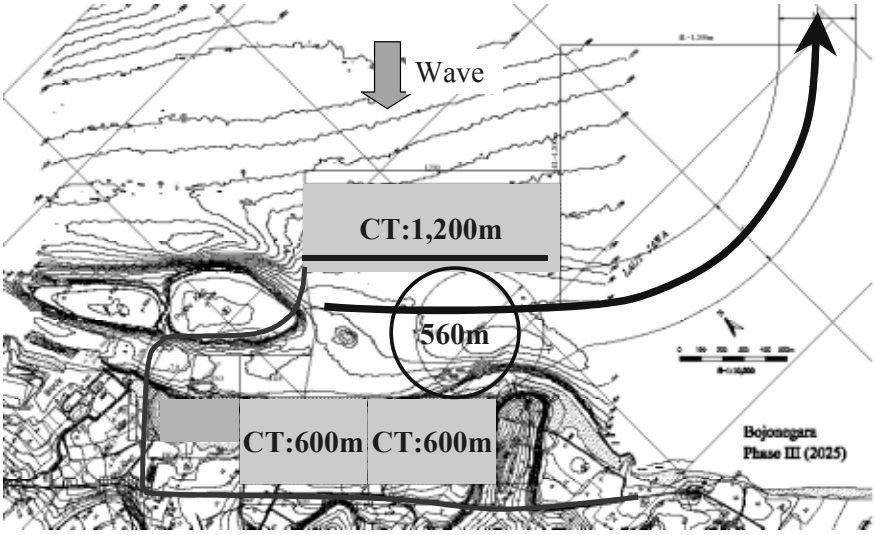


Figure 10-D-2 Alternatives for Breakwater Alignment (Alternative-B)

Table 10-D-6 Evaluation on the Alternatives of Breakwater Alignment

	Alternative-A	Alternative-B
Calmness	Satisfies criteria (Number of days with less than 0.5m wave height in front of quays is 97.5% or more.)	Same as in the left.
Navigation	Easy access from the north direction.	Access channel should be curved sharply at the entrance of the port.
Project Cost	Almost same in the initial stage. Cost is lower than Alternative-B in the long term.	Almost same in the initial stage, however, the total cost of container terminal development is expected to be higher than Alternative-A in the long term.
Easiness of the phased development	Easy (Additional berths can be developed sequentially along the coast line according to the demand and no need to modify the access channel alignment. Construction work will be separated from the port operation.)	Not easy (Need to develop offshore terminals in the long term or need to modify the channel alignment according to the expansion work along the coast line. Furthermore, the port operation would be interfered by construction work.)

109. Original development plan is as shown in Figure 10-D-3. It is easily understood that there will be a problem in the plan from calmness of the basin.

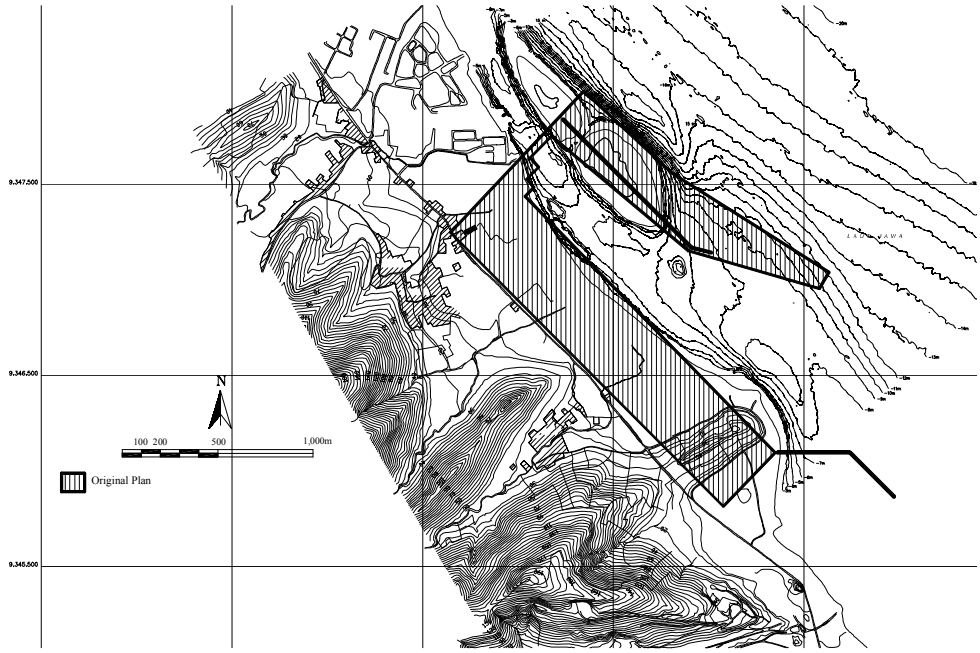


Figure 10-D-3 Original Bojonegara Development Plan

110. Access channel and turning basin should be provided properly in compliance with the alignment of breakwater. Their requirements are set as the same in Tanjung Priok, 300m width for access channel and 560m diameter for turning basin for container vessels. The depth of channel and basin are set as -14m basically based on the target ship size, while the depth of initial stage are set as -12m in accordance with the container terminal development.

111. Other port facilities such as mooring space for tug boats and other port service ships are planned properly.

10-D-6 Port Access Development

a) Access Road Development

112. Completion of a high standard access road by the time of port operation is an essential condition for Bojonegara operation. The Study team proposes a new highway road should be developed linking the existing toll road with the port. Furthermore, completion of JORR (Jakarta Outer Ring Road) is also a must to attract container cargo to Bojonegara because the road network situation around Jakarta DKI has a great influence on the hinterland. The detailed road improvement projects/programs are described in Chapter-11.

b) Railway Development

113. To upgrade the container handling services as well as to attract container cargo, the possibility of introducing a railway system should be also examined. In this case, new railway linking with the existing Merak-Jakarta line is necessary. In addition, a new inland container distribution center (inland container deposit terminal) alongside of the railway should be established at a suitable place somewhere around Jakarta DKI in order to prevent traffic congestion inside the city. Serpong is thought be one of the alternative sites. (See Figure 10-D-4.)

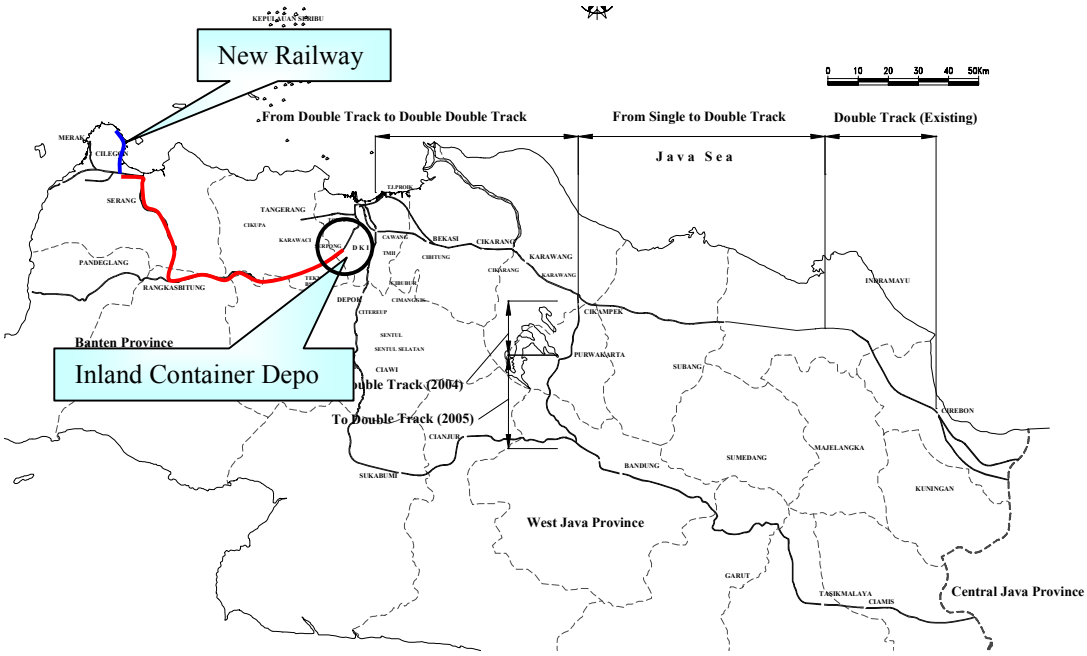


Figure 10-D-4 An Idea of Railway Access to Bojonegara New Port

10-D-7 Summary of Project Components

114. Long-term project components are summarized in Table 10-C-9 including road components. Road components will be discussed in Chapter-10 though, here, it should be just pointed out that the improvement/development of port access road is dispensable to start operation of Bojonegara new port.

Table 10-D-7 Long-term Project Components for Bojonegara

Project	Contents
Basic port facilities development	- Breakwater, access channel, basin and necessary port service facilities
Container terminal development (2 berths (600m) in the short term, 8 berths (2,400m) in the long term)	
Unitized and other cargo handling facilities development	- Multi purpose terminal - General cargo berth - Ro-Ro terminal - Special cargo handling
Port access development	- High-standard access road connecting the existing Jakarta-Merak toll road - Railway service linking with an inland container distribution center/terminal (In addition to the above access road, JORR (Jakarta Outer Ring Road) is indispensable for the new port operation.)

10-D-8 Layout of Port Facility

115. Proposed layout plan of Bojonegara for 2025 is shown in Figure 10-D-5. For reference, Figure 10-D-6 shows the comparison with the original development plan.

Figure 10-D-5 Layout Plan of Bojonegara for 2025

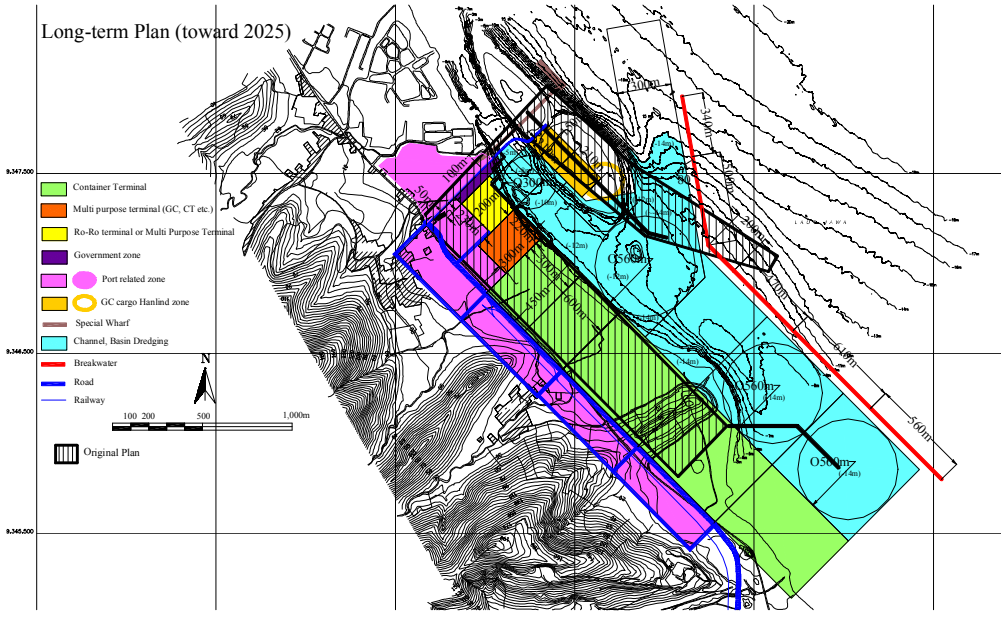
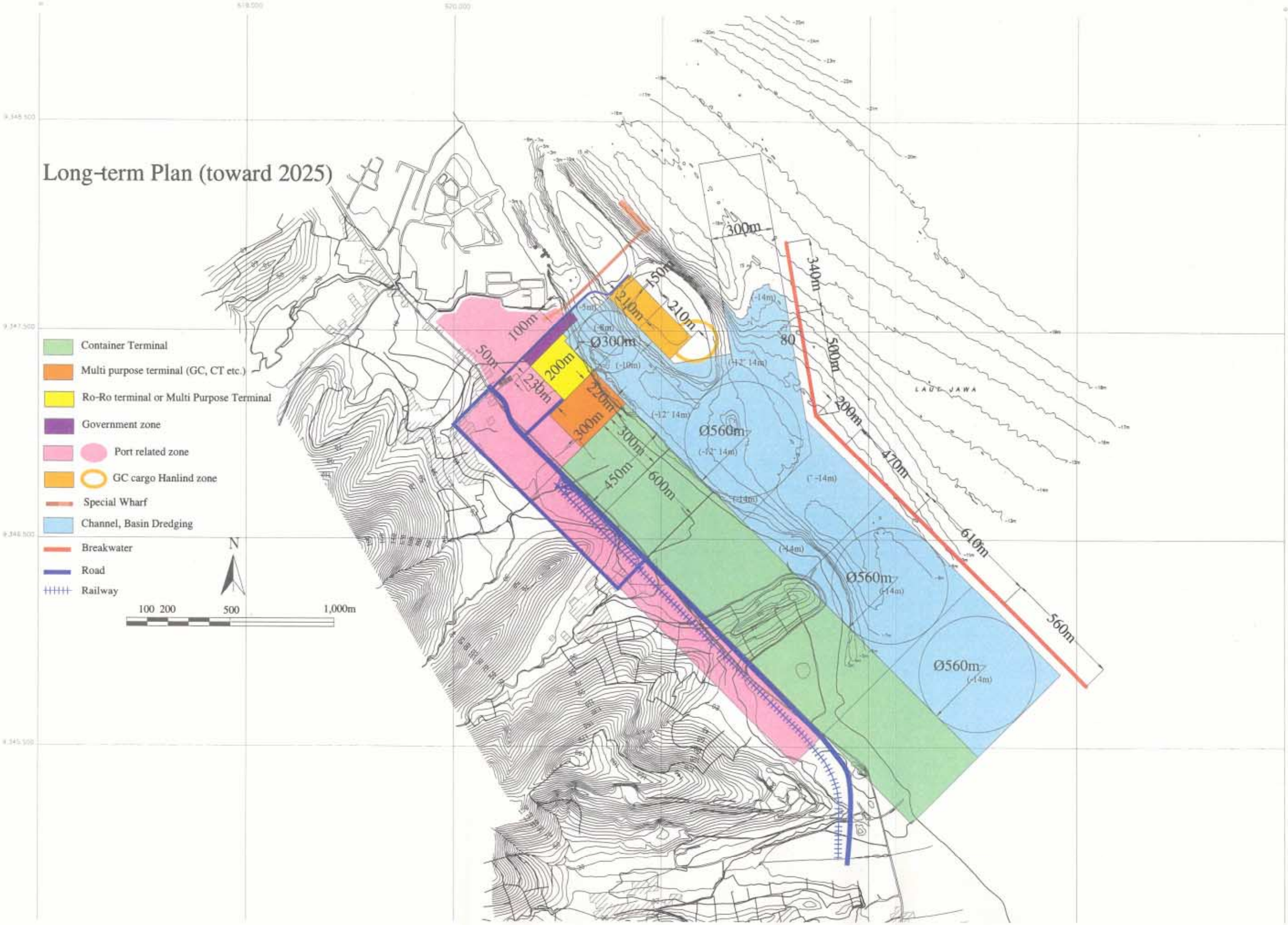


Figure 10-D-6 Comparison with the Original Development Plan

Long-term Plan (toward 2025)



10-E. PRELIMINARY IMPLEMENTATION PROGRAM

116. Considering urgency of each project components planned for the long term development target year of 2025 of the Tanjung Priok Port and Bojonegara New Port and step by step development thereof, the Study team prepares an implementation program of phased development of required facilities for both ports as shown in Table 10-E-1.

Table 10-E-1 Implementation Program of Long Term Development (2025) of Project Ports

117. From the urgency and phased planning/construction points of view, priority should be put on the following points in examining the implementation schedule of the proposed projects:

- To expedite development of an automobile terminal in order to accommodate urgent need of export/import automobiles in AFTA, which should be realized by around 2006
- To expedite improvement of navigational conditions at Tanjung Priok in order to increase the port capacity as well as port safety
- To alleviate traffic congestion in/around the port in order to secure smooth cargo distribution
- To reorganize disorderly land-use of the port making use of Ancol new port area in order to improve the port productivity and capacity
- To commence the operation of a new container terminal in Bojonegara by around 2010 in order to reduce heavy burden on Tanjung Priok and to encourage industrial location/investment in Banten area

118. Based on the above points, the project period of each phase development at the Tanjung Priok and Bojonegara New Port is planned as follows.

Phased Development	Tanjung Priok Port	Bojonegara New Port
Urgent Rehabilitation	Total length: 5 years including project preparation and 30 months of construction works. The car terminal facility should be operational in 2006. The other facility should be operational in 2008.	Total length: 5 years including project preparation and 30 months of construction. The port facility should be operational in 2008. Container terminal should be operational by 2010.
Short Term Development	The length: 5 years including project preparation, construction 36 months. The facility should be operational by 2012.	Total length: 5 years including project preparation, construction of 36 months. The facility should be operational by 2012.
Long Term Development	The length: 8years including project preparation, 48 months of construction. The facility should be operational in 2025.	Total length: 8 years including project preparation, 48 months of construction. The facility should be operational in 2025.

Table 10-G-1 Preliminary Implementation Schedule of the Long Term Development Projects of the Tanjung Priok Port Devewlopment and Bojonegara New Port Development up to 2025

Description	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I. Tanjung Priok Port Development																							
A) Navigation Facility Improvement																							
Widenning Main Channel																							
Widenning Turning Basin																							
Opening the Eastern Channel																							
B) A Car Terminal Development																							
C) Road Development /Improvement Around Existing Port																							
Port Inner Road Improvement																							
Eastern Access Port Highway to link with JORR																							
Access Road to/from JIUT																							
Improvement of Existing Road in Urban Area																							
D) Ancol East Area Development																							
Breakwater Development																							
Access Channel and Basin Development																							
New Passenger Terminal Development																							
Multi purpose Terminal Development																							
Government Area Development																							
Port Amenity Park Development																							
Port Access Road Development																							
E) Reorganizing Land Use of the Existing Port Facility																							
CPO Consolidation																							
Sand Berth Relocation																							
Berth No 100 and 101 U Relocation																							
Redevelopment of Existing Passenger Terminal																							
Reorganization of Existing Land use of Pier III																							
MITI Expansion including New/Access Channel																							
Reclamation of Part of Nusantara Basin																							
Relocation of Pertamina Oil Jetty for Container Terminal																							
JICT II Terminal Consolidation																							
Consolidation of Ship Dock Yard (DKB)																							
Relocation of Military Facility																							
Improvement of Urban Area near the Port																							
Kali Baru Special Cargo Terminal Development																							
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
II. Bojonegara New Port Development																							
F) Basic Port Facilities Development																							
Breakwater Development																							
Access Channel Dredging																							
Channel and B asin Dredging																							
G) Terminal Facility Development																							
Container Terminal																							
Multi purpose Terminal																							
General Cargo Berth Development																							
Government Area Development																							
Ro-Ro Terminal Development																							
Special Cargo Terminal Development																							
Port Inner Road Development																							
H) Port Access																							
Access Road Development from the Existing Tollway																							
Railway Connection Development																							

10-F. PRELIMINARY ENGINEERING DESIGN AND COST ESTIMATE

10-F-1 Code and standards

119. The design criteria of marine and civil works conform to the following design standards and reference:

- Indonesian Standard PBI (Peraturan Beton Indonesia 90-91) 80, Indonesian Concrete Design
- Standards National Indonesia 1991-63 Design Standards of Concrete Structure
- Standards Design Criteria for Ports in Indonesia, 1984
- Technical Standards and Commentaries for Port and Harbor Facilities in Japan, 2002
- Indonesia Highway Capacity Manual in 1997 Ministry of Highway and Public Works,

10-F-2 Design Criteria

1) Objective Ships

120. As described in the previous chapters, the dimensions of the ships used for the design of new port facilities are summarized in the table below.

Table 10-F-1 Objective Ship Size of the Project Ports for 2012 to 2025

Project Port	Type of Vessel	DWT (GRT)	LOA (m)	Water Depth (m)
Tanjung Priok Port	Container ship			
	International	50,000 GT	280	13.0
	Domestic	10,000 GT	144	8.4
	Cargo ship			
	International	20,000 GT	180	10.6
	Domestic	10,000 GT	145	9.0
	Passenger ship	15,000 GRT	150	6.5
	Pure Car Carrier	50,000 GRT	200	10.0
New Bojonegara Port	Container ship			
	International	50,000 GT	280	13.0
	Domestic	10,000 GT	144	8.4
	Middle Ro-Ro Ferry	10,000 GRT	145	7.0
	Cargo ship			
	International	20,000 GT	180	10.6
	Domestic	10,000 GT	145	9.0
	Bulk Carrier Ships	30,000 GRT	190	12.0

2) Natural Conditions for Preliminary Design of Project Facilities

121. The criteria and parameters for the preliminary design are determined based on the results of the field surveys, the natural conditions of the West Jawa province and the project area as described in Chapter 8 and other references such as Design Manual For Port and Harbor Facilities of the Design Standards and Commentaries of Port Facilities in Japan. The summary is shown below.

a) Tide, Current and Wave Conditions

Table 10-F-2 Tide, Current and Wave Conditions of Project Ports

	Tanjung Priok Port	Bojonegara Port
Tide (cm)[1]		
High Water Level (HWL)	+91.00	+103.0
Mean Sea Level (MSL)	+48.00	+58.00
Design Low Tide Level (DLT)	0.0	0.0
Current (m/sec)[2]		
Maximum velocity	0.50	0.50
Wave at Berth,		
Significant Wave Height $H_{1/3(m)}$	0.50	0.50
Significant Wave Period $T_{1/3}$	Less than 2 sec	Less than 2 sec
Wave at Breakwater		
Significant Wave Height $H_{1/3}$ (m)	3.00	2.0 to 2.5
Significant Wave Period $T_{1/3}$	Around 8 sec	Around 4 sec

Source 1, 2: Dinas Hidro-Oseanografi, Indonesia

b) Wind

Table 10-F-3 Design Wind

Item	Design Value	Remarks
Wind Velocity	V = 49 m/s	West Jawa area, 20 m/sec Max. for last 30 years
Wind Pressure	p = 245 kg/m^2	h > 30m
	p = 196 kg/m^2	9 m < h < 30m
	p = 147 kg/m^2	0 m < h < 9m

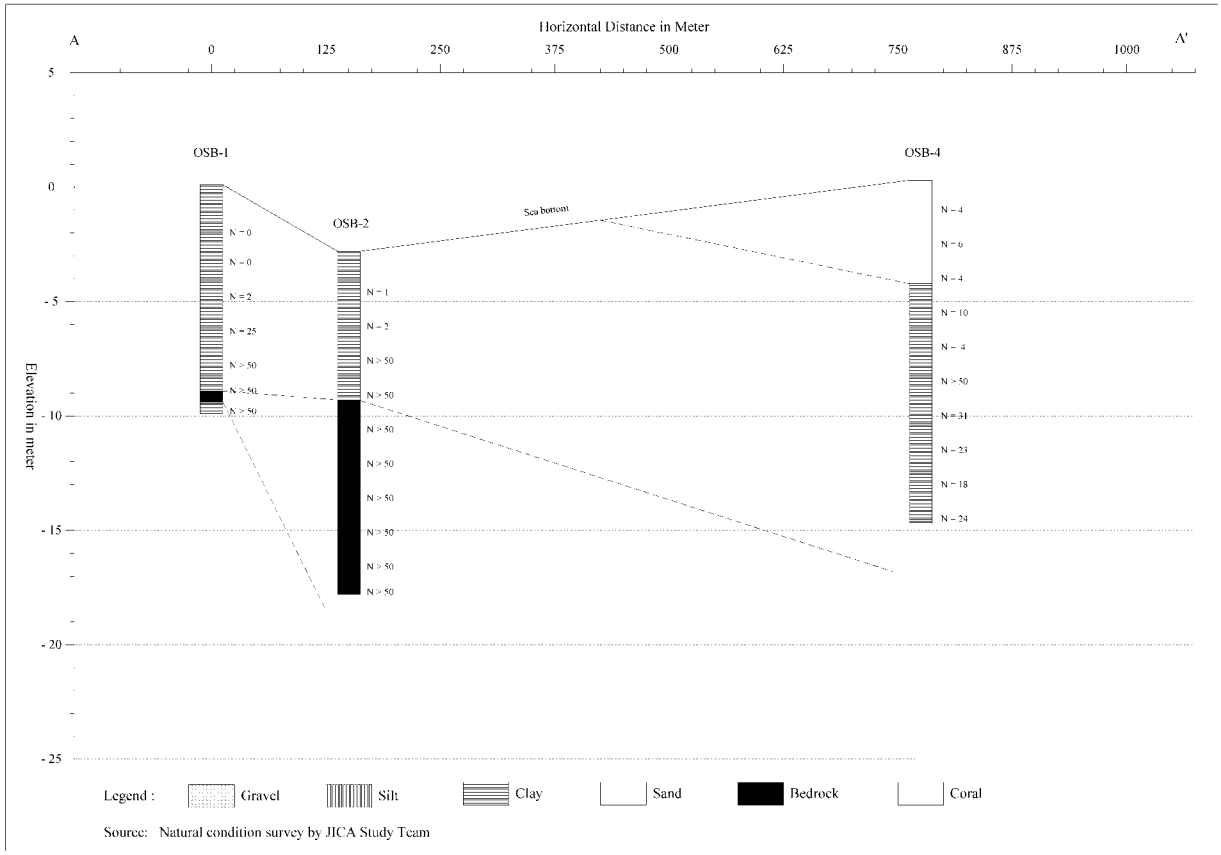
c) Subsoil Condition

i) Bojonegara Area

122. According to the geotechnical investigation in the new Bojonegara port area, the following parameters are used for the preliminary design for the new Bojonegara port facilities.

	Deep Area		Shallow Area
-10.0 m	Sandy clay N = around 10 or more	0 m	Silty clay N= 1-3
-15.0 m	Sand clay N = around 10-28 c = 30 kPa, ϕ = 25°, γ' = 0.9 tf/m^3	-5 m	Silty Clay, N = 12 on average c = 30 kPa, ϕ = 25°, γ' = 0.9 tf/m^3
-20.0 m	Bedrock and Clay (Dense to very dense) N = more than 50 c = 0 kPa, ϕ = 35°, γ' = 1.0 tf/m^3	-10 m	Gravel and Bedrock N = around 30 and more than 50 c = 0 kPa, ϕ = 35°, γ' = 1.0 tf/m^3

123. The Soil Profile of new Bojonegara port area is shown in Figure 10-F-1.



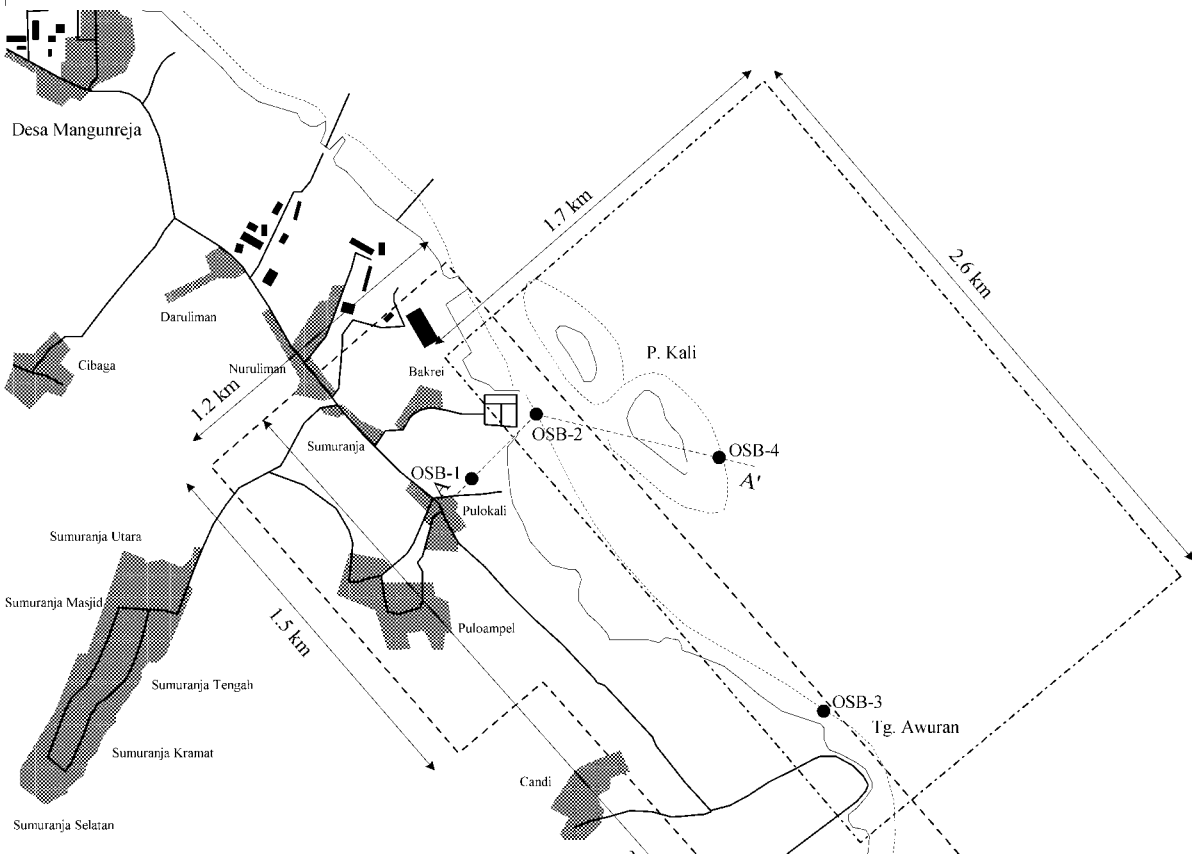


Figure 10-F-1 Subsoil Profile of Development Site at Bojonegara

ii) Tanjung Priok Port Area

124. According to the geotechnical investigation in the west side of the Tanjung Priok port area, the following parameters are used for the preliminary design for the new port facilities.

West side Area		Inside Basin Area	
-17.0 m	Clay N = around 10 or less	-15.0 m	Clay N= 0 - 20
-25.0 m	Sand clay N = around 50 or more c = 30 kPa, ϕ = 30°, γ' = 0.9 tf/m^3	-22.0 m	Silty Clay, N = 24 - 30 c = 30 kPa, ϕ = 30°, γ' = 0.9 tf/m^3
-34.0 m	Dense to very dense sand N = around 45 to 50 or more c = 0 kPa, ϕ = 35°, γ' = 1.5 tf/m^3	-30.0 m	Dense to very dense sand N = more than 50 c = 0 kPa, ϕ = 35°, γ' = 1.5 tf/m^3

125. The Soil Profile of west side of the Tanjung Priok port and inside of the basin area is shown in Figure 10-F-2.

d) Earthquake and Seismic Coefficient

126. The seismic coefficient is calculated by the following formula of the Indonesian Standard "Pedoman Perencanaan Ketahanan Gempa untuk Rumah dan Gedung":

$$K_h = K_{h1} \times C_1 \times C_2$$

Where :
K_h = Seismic Coefficient
K_{h1} = Regional Seismic Coefficient (= 0.1)
C_1 = Factor for Subsoil Condition
C_2 = Coefficient of Importance

127. The regional seismic coefficient (K_{h1}) of the Indonesia is shown in Figure 10-F-3.

128. The project site of Bojonegara port and Tanjung Priok are located in the boundary of zone 3 and 4 of the classification of seismic zone. The seismic coefficients of stiff soil range from 0.05 to 0.03.

Table 10-F-4 Factor for Subsoil Condition C1 under the zone 3 and 4

Subsoil Class	Zone 3		Zone 4	
	Stiff Soil	Soft Soil	Stiff Soil	Soft Soil
Factor C1	0.05	0.07	0.03	0.05

Source: Design Manual For Port and Harbor Facilities in the Indonesia Ports Authority (1995)

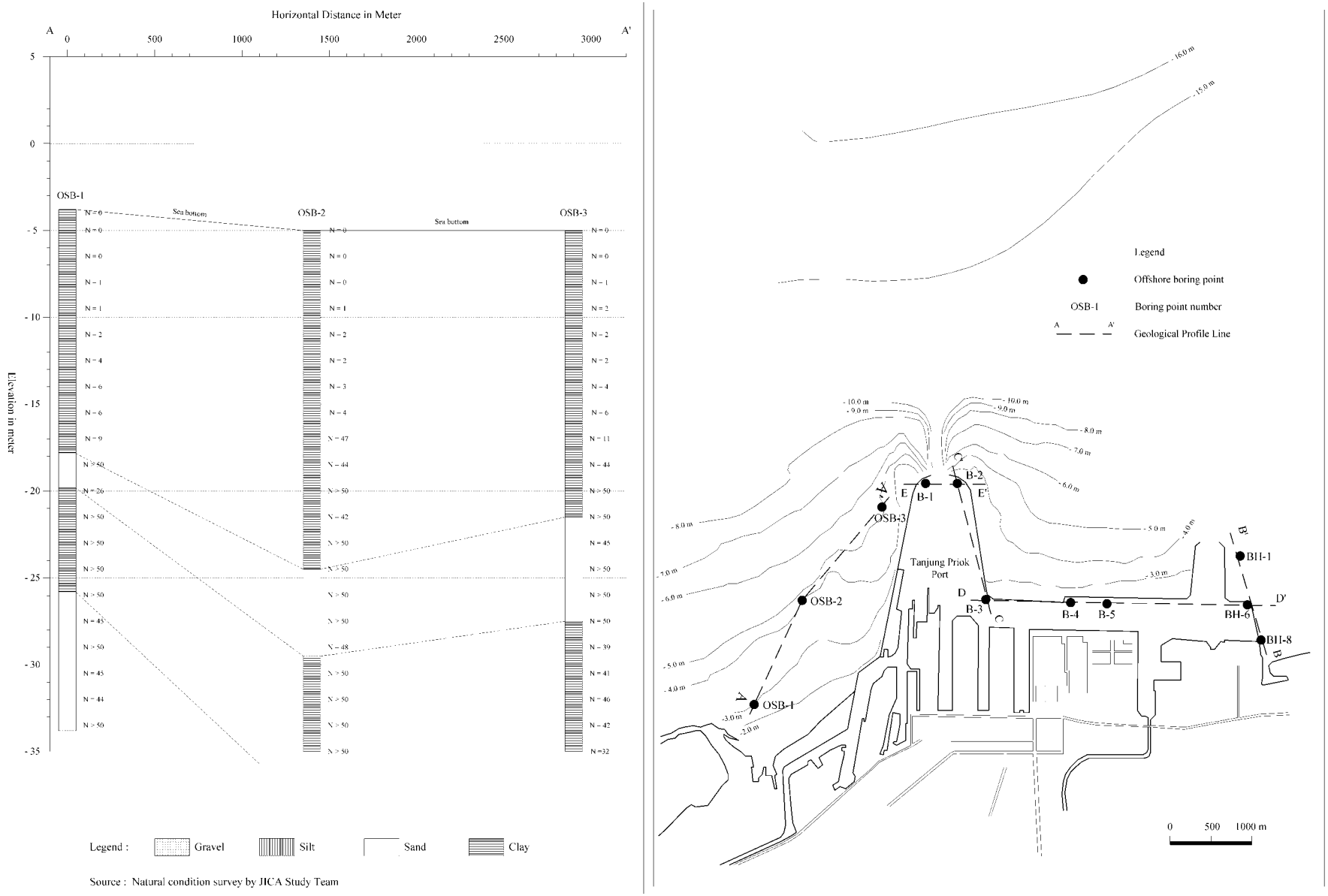


Figure 10-F-2 Subsoil Profile of Development Site at Tanjung Priok

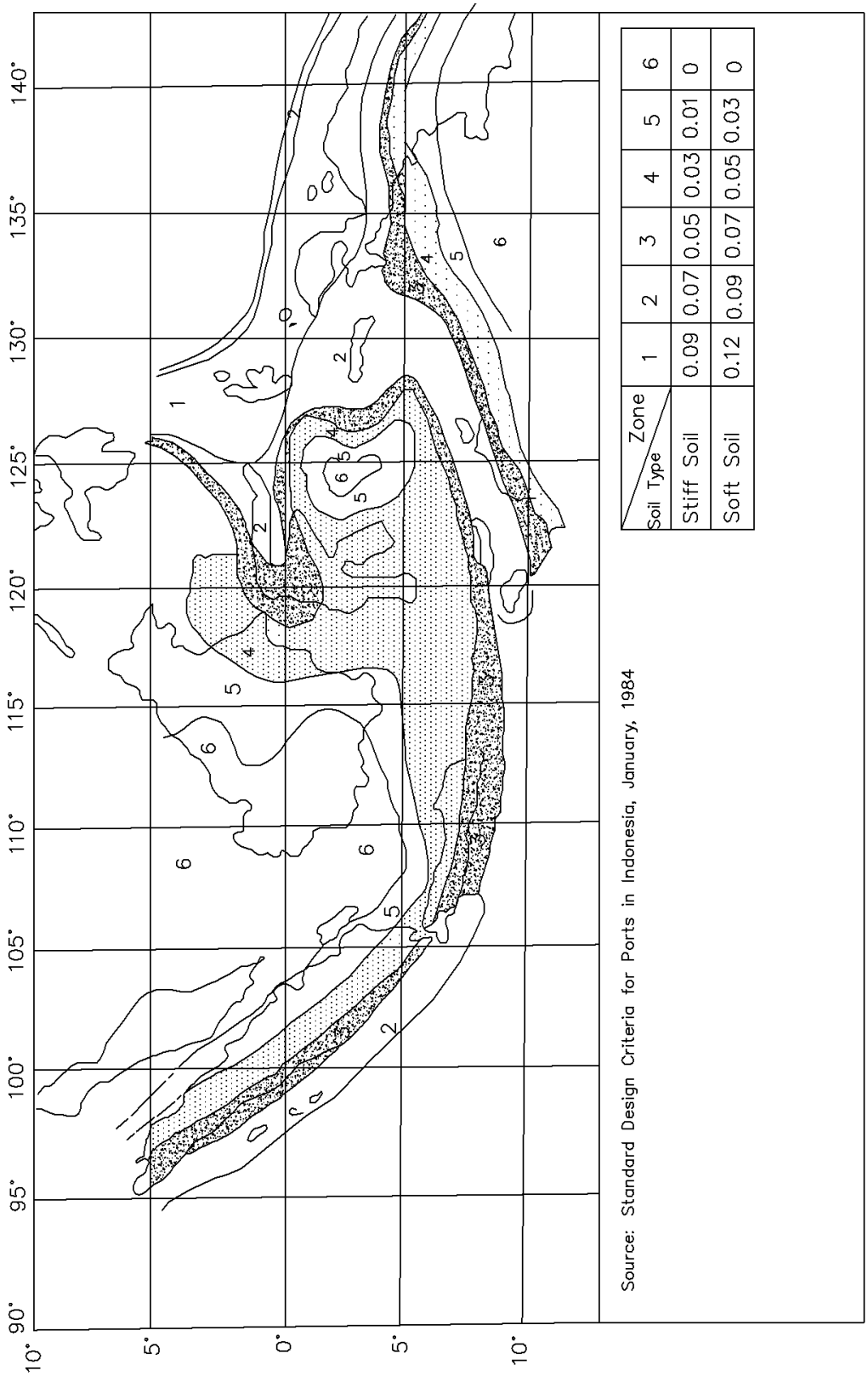


Figure 10-F-3 Regional Area and Seismic Coefficients in Indonesia

Table 10-F-5 Structure factor, K for each structure type of building

Structure Type	Building material of component which spreading the seismic energy	Structure factor
Ductile frame	Reinforced concrete Pre-stressed concrete Steel Wood	1.0 1.4 1.0 1.7
Ductile chained shear wall	Reinforced concrete	1.0
Ductile cantilever shear wall	Reinforced concrete Reinforced hollow wall Wood	1.2 2.5 2.0
Limited ductile cantilever shear wall	Reinforced concrete Reinforced hollow wall Wood	1.5 3.0 2.5
Braced frame	Reinforced concrete Steel Wood	2.5 2.5 3.0
Cantilever structure of one story	Reinforced concrete Steel	2.5 2.5

Source: Pedoman Perencanaan Ketahanan Gempa untuk Rumah dan Gedung

Table 10-F-6 Coefficient of Importance

Classification of Structure	Character of Structure	Coefficient of Importance
(a)	Monumental Building	1.5
(b)	Important Facilities which shall be still in function after earthquake, for example of these buildings; Hospital, Food warehouse School, Rescue Center for emergency situation Power Station, Water supply building Radio and Television Building For people gathering place, Public Service infrastructures	1.5
(c)	Gas and Fuel distribution facilities in urban area	2.0
(d)	Buildings used to store the danger materials such as acid, poison material, etc	2.0
(e)	Other Building	1.0

Source: Pedoman Perencanaan Ketahanan Gempa untuk Rumah dan Gedung

129. The seismic coefficient for the proposed port facility and access road structure are computed by applying the above factors as follows:

The West Jawa Province is located in the zone 3 of the regional seismic coefficient under stiff soil, C = 0.05
Stiffness Factor of structures; K = 1.0
Importance Factor; I = 1.5
K_h = K x C x I = 1.0 x 0.05 x 1.5
= 0.075 (for the Bojonegara and Tanjung Priok port facility)
K_v = not considered = 0

i) For the Bojonegara Port facilities,

In case of Merak Ferry Terminal K_h is 0.1 (Earthquake coefficient 0.05, Importance factor 2.0, Structure type factor 1.0) and

Merak Mas (IKPP Container Terminal) K_h is 0.18 (Earthquak coefficient 0.09, Importance factor 2.0, Structure factor 1.0).

130. It is therefore recommended to adopt 0.1 for K_h at the Bojonegara Port facilities.

ii) For the Tanjung Priok Port facilities,

In case of Koja container terminal extension project K_h is 0.18 for sea wall design (Earthquake coefficient 0.09, Importance factor 2.0, Structure factor 1.0)

131. It is therefore recommended to adopt 0.1 for K_h at the Tanjung Priok.

e) Materials

132. The strength and quality requirement of construction materials shall conform to Japan Industrial Standard (JIS) and other applicable standards used in the Indonesia.

i) Concrete

133. Concrete shall be classified into the following on the basis of cylinder sample compressive strength @ 28 days (Equivalent PBI 71 Concrete class).

Table 10-F-7 Concrete Strength of Class for Use

Class	Strength (kgf/cm^2)	Use
A	250 (K300)	All marine structures
B	210 (K250)	Structural Reinforced Concrete
C	180 (K225)	Non-stress structures of fence, curb concrete
D	Less 180	Leveling concrete and lean concrete

ii) Reinforcing Bar

134. Standard strength of reinforcement bar shall confirm to the following requirement;

Table 10-F-8 Strength of Reinforcing Bar

Description	Round Br	Deformed Bar
Characteristic yield strength σ au (kgf/cm2)	2,400	4,000
Equivalent products based on the SNI. 07-2052	BJTP-24	BJTD-40
Ditto but for JIS(G3112)	SR 235	SD 390

SNI: Standard National Indonesia

iii) Steel Pile and Sheet Pile

135. Steel pile sheet piles shall conform to the following requirements.

Table 10-F-9 Steel Pile Specifications

Pile	Kind of Steel	Specification
Steel Pipe Pile	SKK 400	JIS A5525 / ASTM A161
Steel H Pile	SHK 400	JIS A5526
Steel Sheet Pile	SY 390	JIS A5528
Steel Pipe Sheet Pile	SKY 400	JIS A5530

f) Corrosion Rate of Steel Members

Table 10-F-10 Corrosion Rate of Steel Members

Corrosion Environment		Corrosion Rate (mm/yr.)
Sea Side	Above H.W.L.	0.30
	H.W.L. ~ (L.W.L. -1.0 m)	0.25
	(L.W.L. - 1.0 m) ~ Seabed	0.20
Land Side	In marine atmosphere	0.10
	In soil above the residual water table	0.03
	In soil below the residual water table	0.02

g) Unit Weight of the Materials

136. Unit weight of the materials as listed below is assumed in the design except otherwise specified.

Table 10-F-11 Unit Weight of Material

Materials	Unit Weight γ (tf/m³)
Reinforced Concrete	2.4
Plain Concrete	2.4
Mortar	2.0
Asphalt	2.3
Structure Steel	7.85

h) Unit Weight and Strength Parameters of the Fill Materials

137. Unit weight and strength parameter of the filling materials is assumed in the design as listed below except otherwise specified.

Table 10-F-12 Unit Weight and Strength of Fill Materials

Materials	Unit Weight in Air γ (tf/m³)	Effective Unit Weight γ' (tf/m²)	Angle of Shearing Resistance φ (deg.)
Sand	1.8	1.0	30
Rock / Stone	1.8	1.0	35
Gravel	1.8	1.0	35

i) Other Considerations

Increase in the Allowable Stress

138. For each type of structure, appropriate loading combinations are considered in order to design safer structures against possible loading conditions. The combination of loading will be explicitly indicated in the design process.

139. In some extreme cases of loading, a certain increase of the allowable stresses is permitted in the working stress design method. In principle, the allowable stresses of each structural component can be increased 50% during storm and seismic conditions.

Surcharge Loads during Earthquakes

140. In the design of quay wall structures against earthquakes, the surcharge loads on the apron are considered as half of those used in the normal case.

Safety Factors for Earthworks and Foundations

141. The following safety factors are considered in design of earthworks and foundation for their bearing capacity, slope stability of circular arc slips and earth-pressure induced moment balance used for sheet pile walls.

Table 10-F-13 Safety Factor of Earthworks and Foundation Works

Conditions	S.F. (Normal)	S.F. (Extreme)
Circular Arc Slip (Slope Stability)	1.3	1.0 ~ 1.1
Stability of Gravity Type Structures		
Sliding	1.2	1.0
Over-Turning	1.2	1.1
Sheet Pile Embedment		
Moment Balance due to Earth-Pressure	1.5	1.2
Anchor Block Stability	1.5	1.2
Bearing Capacity		
Shallow Foundation	2.5	1.5
Gravity Type Structure (Circular Arc Slip)	1.2	1.0
Bearing Capacity of Piles		
Bearing Capacity	2.5	1.5
Pullout	3.0	2.5

3) Design Conditions of Berthing Structure

a) Crown Height

142. The crown height of the berth is normally determined by the following formula:

H = HWL + (1.0 to 2.0 m);
(large berth with tidal range smaller than 3.0m)
H = HWL + (0.5 to 1.5 m);
(large berth with tidal range smaller than 3.0m)

143. The crown height affects greatly the construction cost of the port. The strength of the quay wall structure and reclamation volume are proportional to the crown height. On the other hand, as it becomes lower, the chance of the berth being flooded by high waves becomes larger. Therefore, this must be studied carefully in consideration of wave conditions.

144. As a preliminary design of the container wharf structure at Tanjung Priok port and Bojonegara new port, the crown height is fixed at 3.5m from MLLW considering the ship size and required efficiency of cargo handling operation.

$$HWL + 2.0\ m + H_{1/3} = +3.5\ m$$

145. The crown height of multipurpose berth and passenger terminal wharf of both ports is set + 2.50 m from MLLW considering ship size and required efficiency of cargo handling and passenger loading/unloading operation.

146. The crown height of car terminal berth in the Tanjung Priok Port is set at + 2.50 m and Ro-Ro terminal berth in Bojonegara new port is set at + 2.50 m considering ship size and loading/unloading operation.

b) Water Depth along side the Berth and Berth Length

147. Water depth is determined by the following formula:

Water Depth = LWL - (ship max draft + 10% of ship draft)
Berth Length = LOA + Ship Beams as allowance

148. The required water depth and Berth Length for each berth are set as follows:

149. The water depth along side berth is measured from MLLW.

Table 10-F-14 Design Water Depth and Berth Length

Project Port	Berth	Water Depth	Berth Length
For Tanjung Priok	For Container Terminal Berth	-14 m from MLLW	
	For Inter-Island Container berth	-10 m from MLLW	170 m
	For Multipurpose Berth	-10 m from MLLW	210 to 170 m
	For Car Terminal Berth	-10 m to -11 m from MLLW	250 m
	For Passenger Terminal Berth	-7.5 m from MLLW	350 m
For Bojonegara	For Multipurpose Berth	- 10 m from MLLW	210 to 170 m
	For Container Terminal	- 12 m to -14 m from MLLW	300 m
	For Bulk Cargo Berth:	- 12 m from MLLW	300 m
	For Ro-Ro Berth	- 8 m from MLLW	200 m

4) Loading Conditions

a) Surcharge Loads and Live Loads on the Apron

i) Surcharge Loads

150. On the apron of the berths of the port, the following surcharge is considered as a dead load by assuming temporary stack of containers;

- Normal condition: 2.5 tf/m²
- Seismic Condition: 1.0 tf/m². (50% of the normal condition)

ii) Live Loads

151. Quay wall structures of container berth is designed to sustain the following container cranes with the provisions of their foundation:

- Rail Gauge : 30 m
- Overall Weight : approximately 750 tf/unit;
- Nominal rated capacity : 41 tf under spreader.

152. In the design of the apron, only trailer trucks and standard trucks with full loaded containers are considered as handling equipment.

153. The following wheel loads are considered:

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

Table 10-F-15 Loading Conditions of the Container Wharf at Bojonegara New Port

Uniform Distributed Load	2.50 t / m^2 (without QGC)
Uniform Distributed Load	1.35 t/ m^2 (with QGC)
The worst possible combination of Live Load generated by cargo handling equipment and transporting equipment.	Loads of equipment is shown in Table 10-H-15 (Impact factor shall be considered)
Gantry Crane Load	40.0 t rated load x30m span x 36 to 38 m outreach.

154. The live load for Quay Gantry Crane (QGC) is adopted as shown in the figure and table below.

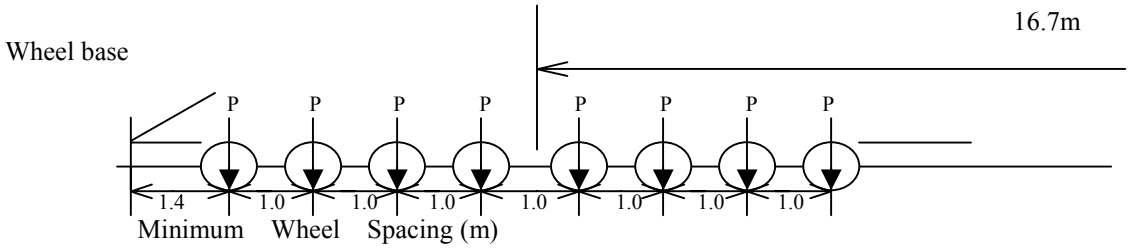


Figure 10-F-4 Live Load of QGC

Table 10-F-16 Load Condition of Quay Gantry Crane

Conditions	Direction		Wheel Loads (P) on Sea-side Rail	Wheel Loads (P) on Land-side Rail	Remarks
Operating (wind =16m/s)	Vertical		Pv max= 38 t	Pv max= 34 t	Dynamic coefficient 1.25
Stormy (wind) (V=55m/s)	V	Wind from sea side	Pve max= 44 t	Pve max= 63 t	
	V	Wind from land side	Pve max= 54 t	Pve max= 44 t	
	V	Wind from Gantry side	Pve max=33 t	Pve max=42 t	
	Horizontal		Phe max=4.7 t	Phe max.=4.7 t	
Seismic (Kh=0.15)	Horizontal		Phe max= 3.8 t	Phe max=3.8 t	Perpendicular to load at Crane Rail

155. Typical Sections of Quay Gantry Crane are shown in Figure 10-F-5.

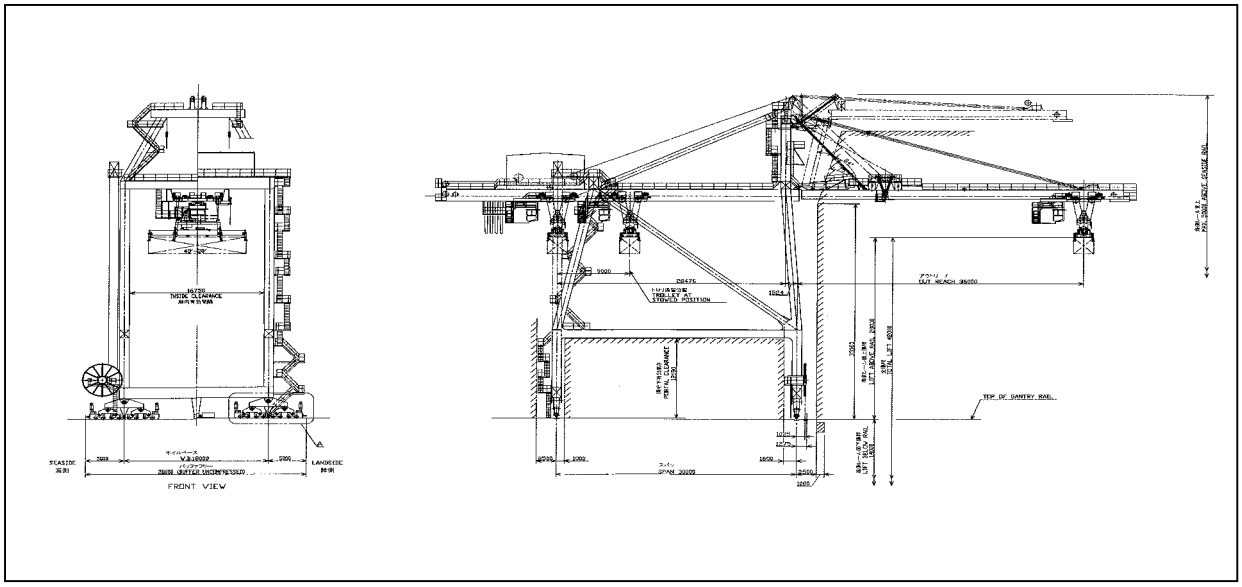


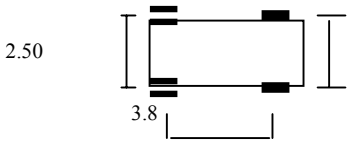
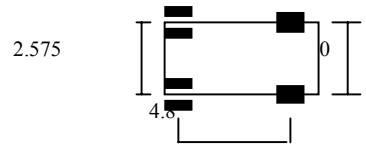
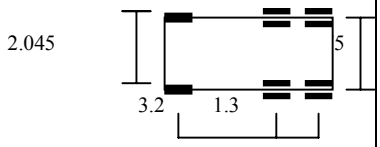
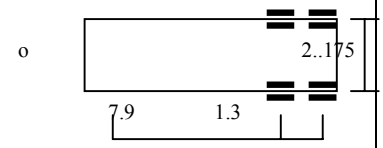
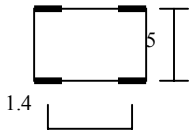
Figure 10-F-5 Typical Sections of Quay Gantry Crane

b) Live load on Container Yard and Road

i) Load of Container Handling Equipment

156. Equipment Loads in the pavement at the Container yard and Roads as shown in Table 10-F-17 are adopted in the design of pavements. In operation condition, the load dynamic coefficient are considered for dynamic effect (1.2.)

Table 10-F-17 Cargo handling Equipment Loads

Equipment	Description	Outline of Wheel	Load Condition	Front Wheels	Rear Wheels
Top Lifter (Reach Stacker) for Empty Container	4.5t under Spreader		With Load Without Load	8.6t x4 wheels 5.4t x4 wheels	3.1 t x 2 wheels 7.5 t x 2 wheels
Top Lifter (Reach Stacker) For loaded Container	4 tiers, 30.5t under Spreader		With Load Without Load	21.2 t x4 wheels 9.7 t x4 wheels	7.5 t x 2 wheels 12.9 t x 2 wheels
Tractor Head for Container Transport	40.5 t Container Chassis Towing		With Load Without Load	3.2 t x2 wheels 2.0 t x2 wheels	2.5t x 8 wheels 0.6 t x 8 wheels
Chassis for Container Transport	2 x 20ft or 1 x 40/45 ft		With Load Without Load	Load on The Tractor Head	3.8 t x 8 wheels 0.4 t x 8 wheels
Fork Lift Track for General Use	2.5 t		With Load Without Load	2.9t x2 wheels 1.3t x2 wheels	0.6 t x 2 wheels 0.9 t x 2 wheels

ii) Load of RTG (Rubber Tired Gantry Crane)

157. The Proposed RTG (Rubber Tired Gantry Crane) is 40 tons rated capacity under the spreader, having 23.47 m of gauge span. Live Load of the RTG is shown in Figure 10-F-6 and Table 10-B-18.

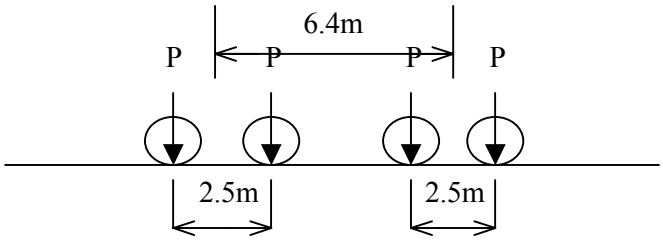


Figure 10-F-6 Live Load of RTG

Table 10-F-18 Load of RTG

Conditions		Wheel Load (P)
With Rated Load (wind 15m/s condition)	Static	Pv max=26t
	During Acceleration	Pv max =32 t
With No Load	Static	Pv max=18t
	Acceleration	Pv max=21t

158. Dynamic Coefficient = 1.2 shall be multiplied to the static load

iii) Load of Container (Container Yard)

159. The weight of the containers in the following figure, will be taken as 4 stacking containers weight which is also the height of the RTG. The empty container will be stacked less than 8 tiers height.

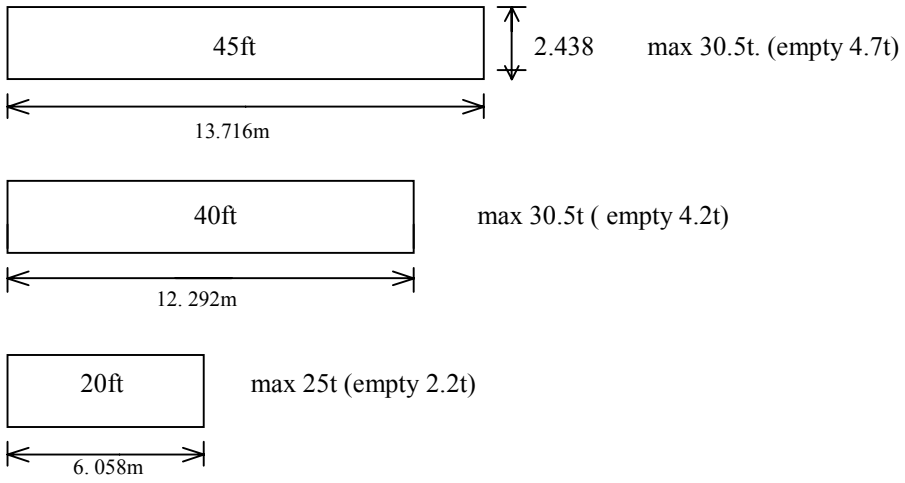


Figure 10-F-7 Load of Container Boxes

c) Tractive Force and Berthing Force

i) Mooring

160. Tractive force acting on mooring bitts are 100 tf per unit for the vessels from 10,000 to 50,000 DWT which are spaced at 35 m. Regarding the tractive force acting on mooring bitts by cargo ships of 10,000 –20,000 DWT and Middle Ro-Ro ships of 10,000 GRT at Bojonegara is 35 ton per unit which are spaced at 20 m.

ii) Fender System

161. In design of the fender system to absorb the shock of ship berthing energy, berthing speed of vessels to be adopted is as follows:

- 5,000 ~ 10,000 DWT 0.30 m/sec.
- 10,000 ~ 20,000 DWT 0.15 m/sec.
- 20,000 ~ 50,000 DWT 0.10 m/sec.

162. Maximum berthing angle is 10 degrees. Spacing of rubber fenders is installed from 10 to 15.0 m. Fender frame is attached as parts of fender system.

d) Design of Yard and Pavement

i) Pavement

163. Based on the operation planning inside the container terminal of the new West Jawa port and selection of the pavement type to be adopted, the following wheel loads are the critical condition for each type and area of the pavements, on which the design will be conducted:

164. Special provision of pre-stressed concrete block slab pavement is adopted for the track of rubber transfer cranes (RTG), whose wheel loads exceed well enough 40 tf/wheel.

165. The pavement of the parking lots on the reclaimed land for passenger terminal, car Terminal and container terminal of both ports will be by interlocking concrete blocks.

Table 10-F-19 Critical Wheel Load for Pavement Design

Area Particulars	Access / Service Road	Container Terminal Area		Stock Yard		Multipurpose Berth	
		Berth / Apron	Road way	RTG passage way	Stock yard	Berth/ Apron	Yard Area
Critical Wheel Load Type	Standard Truck (H20-44)	Standard Truck (H20-44)	Forklift Truck (25 tf)	RTG (40ft)	Reach stacker (4.5 tf)	Standard Truck (H20-44)	Forklift Truck (25 tf)
Critical Wheel Load (ton)	8.0	8.0	12.8	40	8.1	8.0	12.8
Pavement Type	Concrete	Concrete	Concrete	PC slab	Inter-lock block	Concrete	Concrete

PC slab: pre-stressed concrete block slab

ii) Required Backup Area of the Berth for the Project

166. The proposed terminal is planned to have the following backup area for cargo handling and vehicle parking and others purpose for the Project.

Terminal	Planned Backup Area (sq.m)	
	Tanjung Priok Port	Bojonegara New Port
Multipurpose Berth		
For 20,000 GT	210 x 300 m (63,000)	210 x 300 m (63,000)
For 10,000 GT	170 x 300 m (51,000)	170 x 300 m (51,000)
Inter Island Container Terminal	170 x 300 m (51,000)	170 x 300 m (51,000)
International Container Terminal		760 x 450 m (342,000)
Ro-Ro Terminal		
For 15,000 GT	220 x 300 m (66,000)	
For 10,000 GT		200 x 200 m (40,000)
Car Carrier Terminal	7 ha	
Passenger Terminal	4 ha	

iii) Drainage

167. Selection of the drainage type and relevant coefficient for drainage design of the container terminal are summarized in the following table:

Table 10-F-20 Drainage Design

	Service Road	Container Yard	Container Stock Yard	Open Stock Yard
Drain Type	L-Type Curb with Catch Basin - Concrete Pipe	U-Type Ditch - Concrete Pipe	Gutter with Catch Basin - Concrete Pipe	Gutter with Catch Basin - Concrete Pipe
Concentration time for Surface Water: Tc (min)	5	5	5	5
Coefficient of Runoff : C	0.95	0.9	0.9	0.9

e) Buildings

168. All the buildings inside the container terminal, car terminal, passenger terminal and multipurpose berth will be designed in conformity with relevant national codes and standards, such as National Structural Code for Buildings, National Plumbing Code of the Indonesia, Indonesia Electrical Code, Fire Code of the Indonesia, etc. Requirements of the floor area for each building and other criteria are described here.

i) Required Area of Buildings for the Project

169. The required floor area of buildings is summarized in the following table.

Table 10-F-21 Office and Building Floor Area Requirement (m^2)

Terminals	Buildings	Floor Area
Container Terminal	IPC management office	1,500
	Container Terminal Building	1,500/2 berths
	Container Freight Station	2,800/2 berths
	Maintenance Shop	1,500/2 berth
	Power Generator House	300/ 2 berths
	Water Supply Reservoir	400/2 berths
Multipurpose Berth	Multipurpose Berth Cargo Shed	18,500
Car Terminal	Terminal office	900 x 2 floors
	Maintenance Works Shop	1,500
	Power Station, Lighting Tower	300
	Fuel Station, Washing Station	400 x 2
Passenger Terminal	Passenger Waiting Hall and Office Space	10,000 x 2 floors

f) Utilities

i) Water Supply

170. The following volume of water demand for the passenger terminal at Tanjung Priok port and Container terminal at Bojonegara will be required. Water supply system included in the Project will consist of water reservoir, pump house, elevated water tank and distribution system for general purpose of the office, ship, hydrant, and fire fighting inside of the port area. The water source should be from the main supply line of the public water of the Water Supply Works Department of the province and of the Local Unit Water Authority (LUWA) for the Bojonegara regency. The water supply pits and pipeline along the berth of the Bojonegara new port will be provided to supply the water to ships.

Table 10-F-22 Requirement of Water Supply for New Port Facility Area

Demand	Design
1) Domestic Consumption	
1-1) Average Domestic Consumption per Capita	100 l/day
1-2) Maximum Daily Consumption	+ 30 %
1-3) Losses	10 %
2) Ship Supply	
2-1) 2% of Full Tank for average 10,000 GWT Vessel	200 tons/call
3) Fire Fighting	
3-1) Maximum Reserve	200 tons/day

171. Minimum pressure at the farthest supply point should be 50 psi for the domestic demand and ship supply, while much higher pressure of 65 psi should be provided for the fire fighting.

ii) Power Supply

172. Electric power demand for the container terminal of Bojonegara is summarized in Table 10-F-23.

173. The electric power requirement of the Tanjung Priok port will be supplied from the National Electric Cooperation (PLN) and of Bojonegara ports is assumed to get from the National Power Corporation (PLN regional office). A standby generator set for emergency purpose of the office use in the port will be installed.

Table 10-F-23Requirement of Power Supply at New Port Facility Area

Demand Source	Design Values
Gantry Cranes per Unit	1,000 KVA (demand) 4.16 KV, 3 Φ
Reefer Container per Unit	6 KW 440 V, 3 Φ
Lighting	230 V, 3 Φ
Others	230 V, 3 Φ
TOTAL DEMAND	15 MVA

g) Environmental Treatment Facilities

174. The following environmental treatment facilities will be provided for the Tanjung Priok port and Bojonegara new port area respectively.

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

i) Drainage/sewage outfall facilities

175. The septic tanks as sewerage facilities will be provided at each building and water thereof will flows out through the drainage pipes. Drainage facilities are provided together with the pavement works.

ii) Solid waste management facilities

176. For the solid wastes management facilities, necessary number of garbage bins are provided and installed inside the port area and the port management office will make an arrangement with garbage collection companies to collect such garbage to take to the specified garbage dumping site.

177. Ballast Bilge Waste Treatment System

178. In November 1967 "International Agreement for the Prevention of the Sea Water Pollution with Oil came into the Oil of Ship" was enforced in 1990, as the domestic law.

179. This oil treatment plant accepts wasted oil (mainly ballast water and bilge water) directly from the smaller coastal service tanker or oil barge, should be the oceanic environment.

180. The proposed ballast and bilge water treatment plant by this master plan is aimed at mitigation potential ship related oil pollution due to indiscriminate disposal of ship based oily waste into the port waters. It is noted that the port water is visibly polluted with floating oil, which is an aesthetic nuisance in addition to a water pollution issue.

181. This is considered as the very first step in controlling potential pollution due activities directly concerned to the operation of the port. Moreover, the provision of ballast and bilge waste treatment by the port is to meet its legal obligation as mandated by the DENR Administration Order No.34 (Water Quality Criteria Amendment Section 68 and 69 issued in 1990).

182. A bilge water disposal plant, if established, will employ a biological processing where activated sludge by mechanical aeration will accelerate the digestion of organic substances in the bilge water. A bilge water (sewage) disposal plant, effluent from which must comply with the decree put down by Indonesia national laws, will be considered..

10-F-3 Preliminary Design Concept of Quay Wall Structure

183. Based on the above design criteria, and berth requirement, the type of berth foundation is determined considering the site, topographic, hydrographic and soil conditions as follows:

1) Preliminary Design of Quay Wall Structure of the Tanjung Priok port

a) Berth Structure for Car Terminal, Passenger Terminal and Multipurpose Berth

i) Soil Conditions

184. The berth structure is considered for multipurpose berth to handle general cargo, passenger terminal berth and other for exclusive car terminal berth. The same type of berth structure is adopted for the new multipurpose berths and passenger terminal berth planned in the expansion of the Ancol west side area considering the continuation of longer berth utilization for berthing by number of cargo ships and passenger ships at the same time, and the following soil conditions.

185. According to the sub-soil data, the alluvium composed of underlain is mainly of cohesive granular material consisting of sand, gravel and gravel-size broken corals. The typical soil profile is described as follows:

- The uppermost 11.0 m average thick of alluvium consists of layers of cohesive

fines (clays) and non-plastic granular material (sand, corals and gravel). N-value generally ranged from 2 to 3, with higher N-values ranging from 5 to 10. It is composed generally of soft, gray, silty clay, with appreciable amount of coral fragments and broken shells. It consists of sand and broken corals mixture. Thickness of this layer vary from around 7.0 to 10.0 meter. It would indicate that this layer is normally consolidated. Therefore, relatively large consolidation settlement is expected should there be high embankment or fill.

- The second granular layer (below 11.0 - 30 m) consists mainly of sand with large amount or coarse gravel-size broken corals. Very stiff to hard, yellowish brown clay with varying thickness was also observed embedded within the layer at varying depths. N-values generally ranged from 10 to 30. Higher N-blows exceeding 50 were frequently encountered between 20 to 25 meter depth in the boreholes. The substantial increased in the N-value was probably due to the large amount of coarse, gravel-size, broken corals that was hit during the conduct of SPT.
- The percentage of gravel-size broken corals (25 mm max. size) ranged from a low of 20% to a high of 80%. The amount of sand (including sand-size shell and coral fragments) ranged from 20% to 45%, while the amount of clay varies from 20% to a high of 60%.
- The soil below 30.0 m is the last granular layer described as dense to very dense, yellowish to grayish brown silty, gravely sand, with gravel-size corals. N-values generally ranged between 30 to 50. The granular layer found below 28.0 to 32.0 meter depth (average 30 m), described as dense to very dense, silty or gravelly sand may be regarded as bearing layer. N-values generally ranged from 40 to50.

ii) Berth Structure Design

186. Considering such soil conditions and gentle slope of seabed topography, the following alternatives types of berth foundation are considered. The comparison of advantage and disadvantage of each type is shown in Table 10-F-24.

Table 10-F-24Comparison of Quaywall Structure Type

	Steel Pipe Sheet Pile (SPSP)	Caisson Type	Steel Pipe Pile (SPP)
Evaluation	Simple in works and Good. Typical cross section is shown in Figure 10-F-8.	Complicated in works and longer period of works. Typical cross section is shown in Figure 10-F-9.	Simple and Fair in cost and construction period Typical cross section is shown in Figure 10-F-10.
Advantage	• The construction period may be the shortest among the alternatives • Large apron and backup area by backfill can be provided • Volume of dredging and reclamation will be minimal • Sheet piling works and dredging/reclamation works can be conducted at the same time • SPSP structure is flexible to cope with strength by the change of soil conditions and sea bed topography.	• Material locally available can intensively be used, thus economically be superior. • Relatively suitable to deeper water depth • Maintenance is easy and structure is relatively durable	• Volume of reclamation works will be minimal. • Sheet Pile driving works and reclamation works can be progressed separately at the same time.
Disadvantage	• Corrosion of SPSP should be considered. • SPSP and tie wires have to be imported • The construction cost may be almost same as caisson type	• Caisson yard or floating dock is required for fabrication. • Large floating equipment is required during installation. • The construction works is complicated to make level of mound for caisson installation and to set exact position for installation. • Construction period may be the longest.	• Corrosion of SPP should be considered. • SPP have to be imported. • Dredging works should be progressed before pile driving works. • Large offshore pile driving equipment may be required. • SPP is not easy to adjust its length by changes of soil and sea bed topography • Additional retaining wall is required for reclamation works • Construction period will be longer than SPSP type structure.

187. For the planned new multipurpose berths, passenger terminal berth and car terminal berth, considering soil conditions at the planned area the steel pipe pile foundation will be sufficient in cost, construction method and work period. The pile should be driven up to around -30m of the sandy layer. This type of foundation of the berth is adopted to the adjacent berth structures in the Tanjung Priok port.

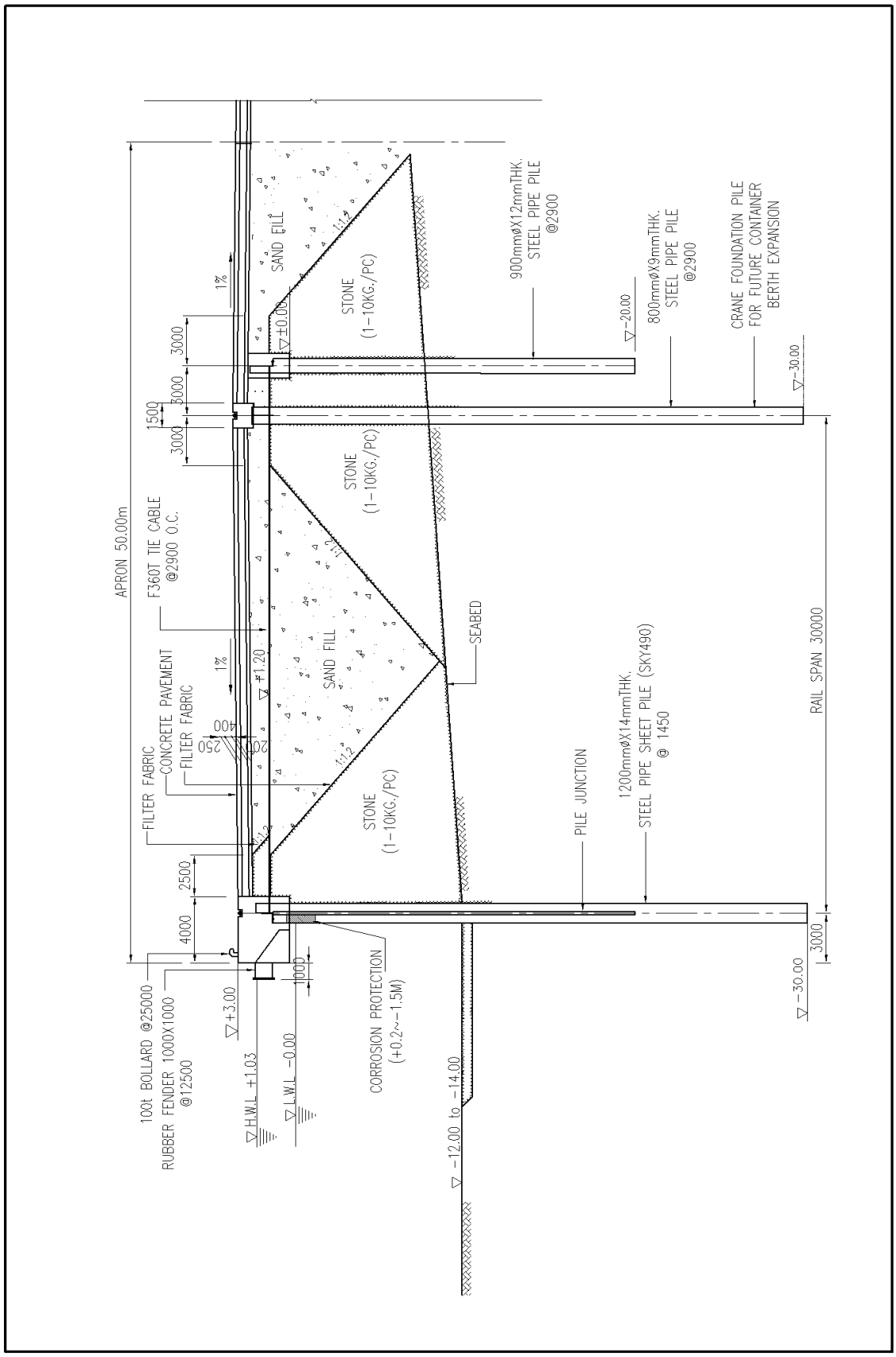


Figure 10-F-8 Steel Pipe Sheet Pile (SPSP) Type Quaywall

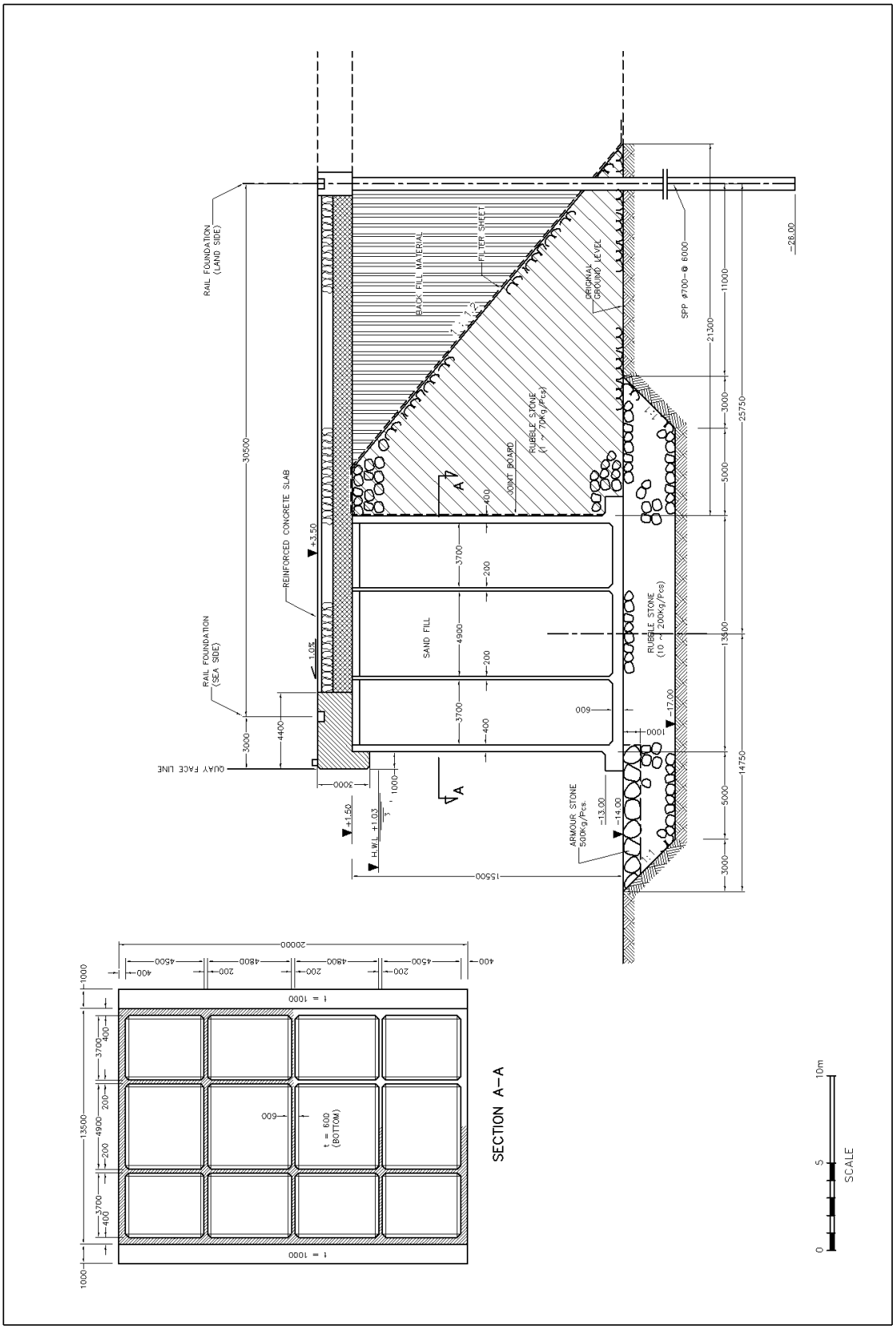


Figure 10-F-9 Typical Section of Concrete Caisson Type Quaywall

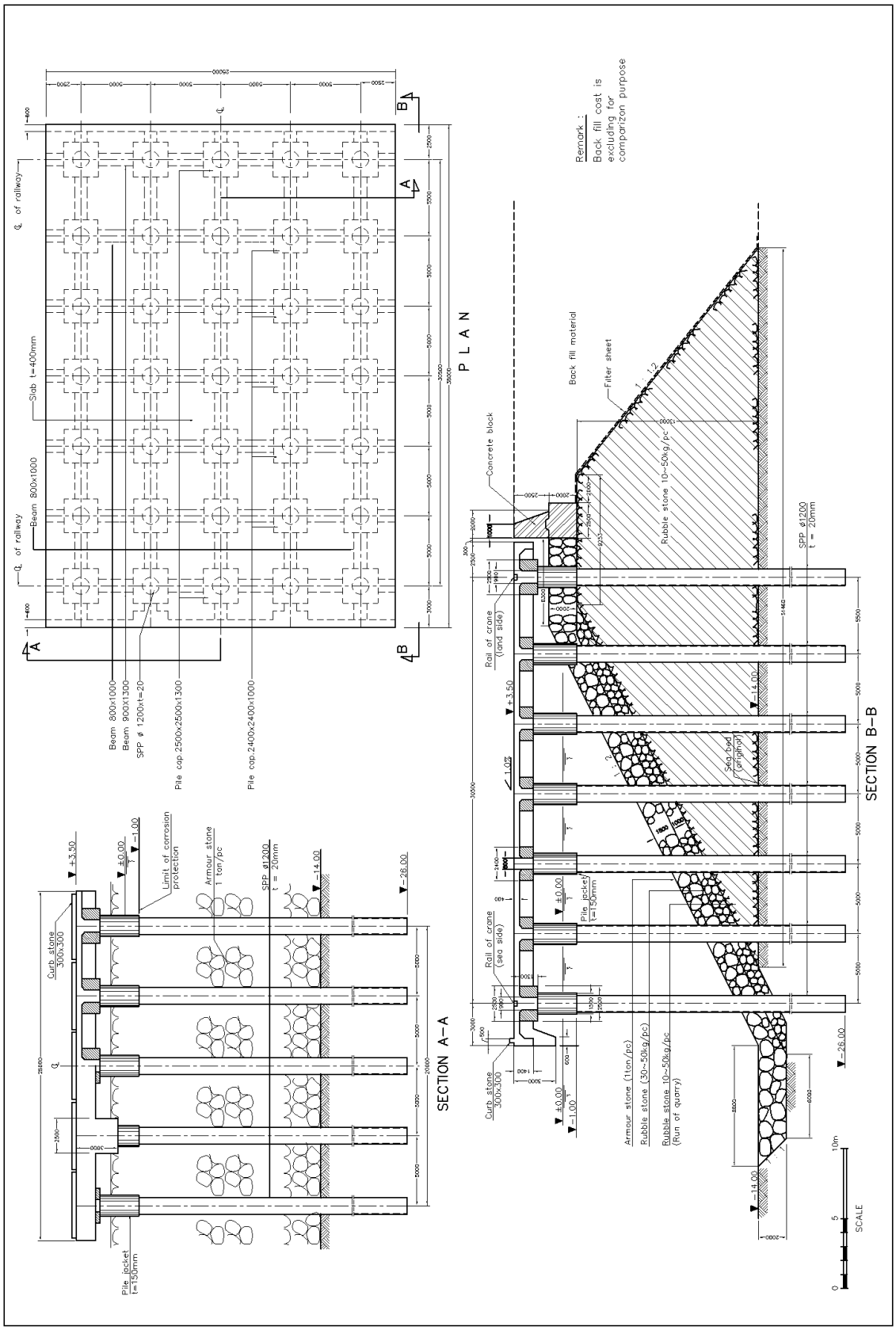


Figure 10-F-10 Typical Section of Steel Pipe Pile (SPP)Type Quaywall Retaining Wall Design for Redevelopment of Existing Port Facilities Area

188. The retaining wall for development of the backup area by reclamation for the multipurpose berth and passenger terminal berth in the expansion area will be designed with steel sheet pile (SSP) Type II or III according to the depth to be driven. The SSP will be anchored from the anchor wall to be constructed about 10 m behind from the front wall.

189. The retaining wall for redevelopment of the existing port facilities will be constructed with SSP driven to -20 to -25 m with anchor piles along the water front area to keep the land facilities from sliding and corrupting. Typical cross section of retaining wall is shown in Figure 10-F-11 and Figure 10-F-12.

b) Design of New Breakwater by Re-Construction

190. The existing breakwater is planned to be relocated for widening the existing inner port channel and turning basin in front of the container terminal and a new breakwater will be constructed off-shore about 350-450 m away from the existing location.

191. The breakwater functions to protect against waves and sediment material transported by current flow. The crown height of a new breakwater is set at around 2.0 to 2.5 m from HWL considering designed wave height of 2.5 to 3.0 m, design wave period of 8 to 9 sec and dominating direction of North.

192. The new breakwater is constructed on the upper layer of clay at depth of -5.0m. This clay material on the surface of sea bed is planned to be replaced with fine sandy material as soil improvement. The new breakwater structure will be constructed with rubble stones piled up and armour stones to be covered thereon. The concrete blocks (3 ton type) will be placed on the slope of the off-shore side and layer of armor stones (250 to 500 kg) on the slope of harbor side.

193. It is planned to recycle existing concrete block (around 1 ton size) and rubble stones used in the existing breakwater for construction of a new facilities. For identifying the durability of the existing material for recycling, it is recommended the detailed soil investigation of the existing breakwater area. The typical cross section of new breakwater is shown in Section 14-C.

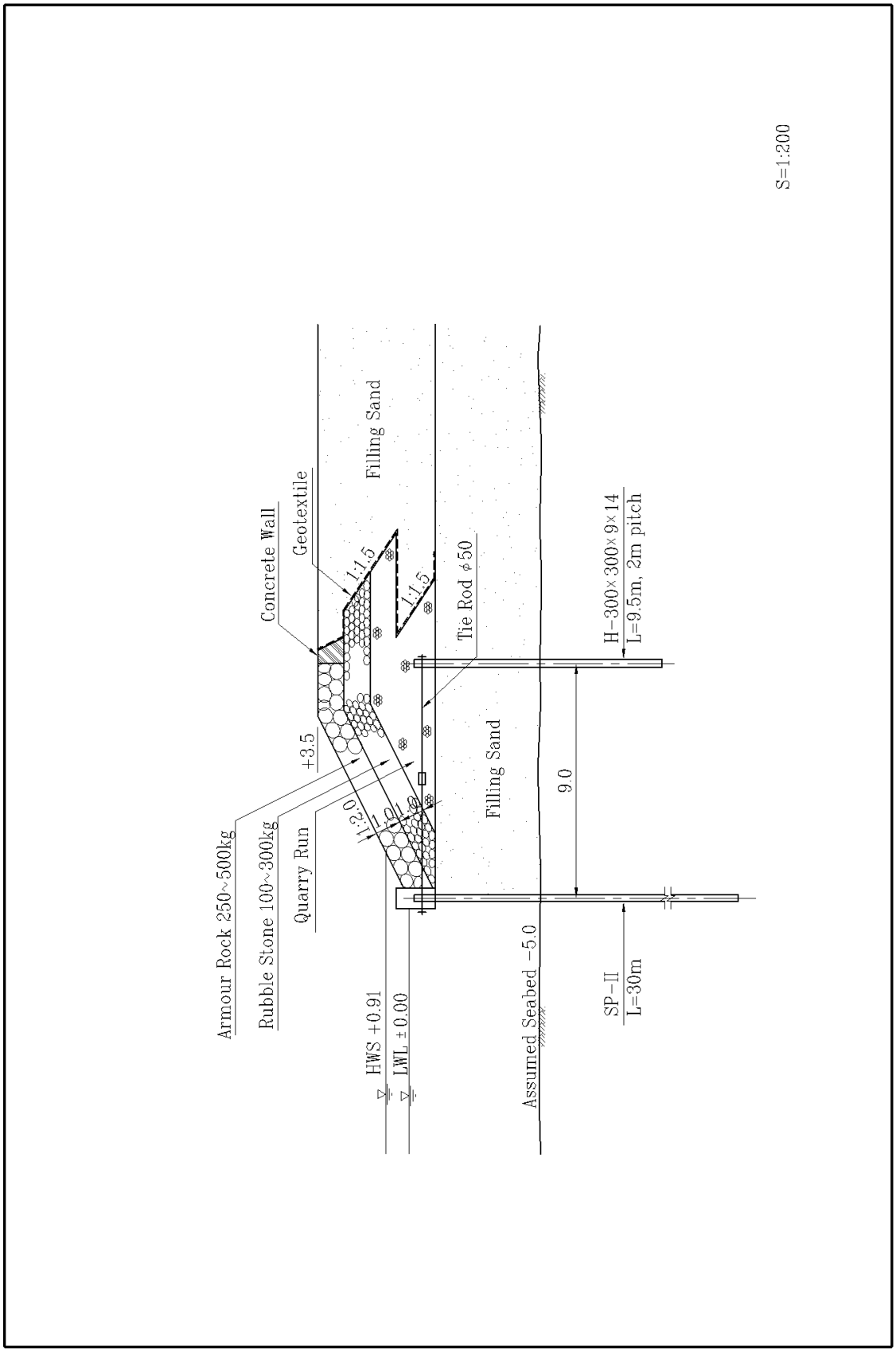


Figure 10-F-11 Typical Section of Revetment of Reclamation at Tanjung Priok

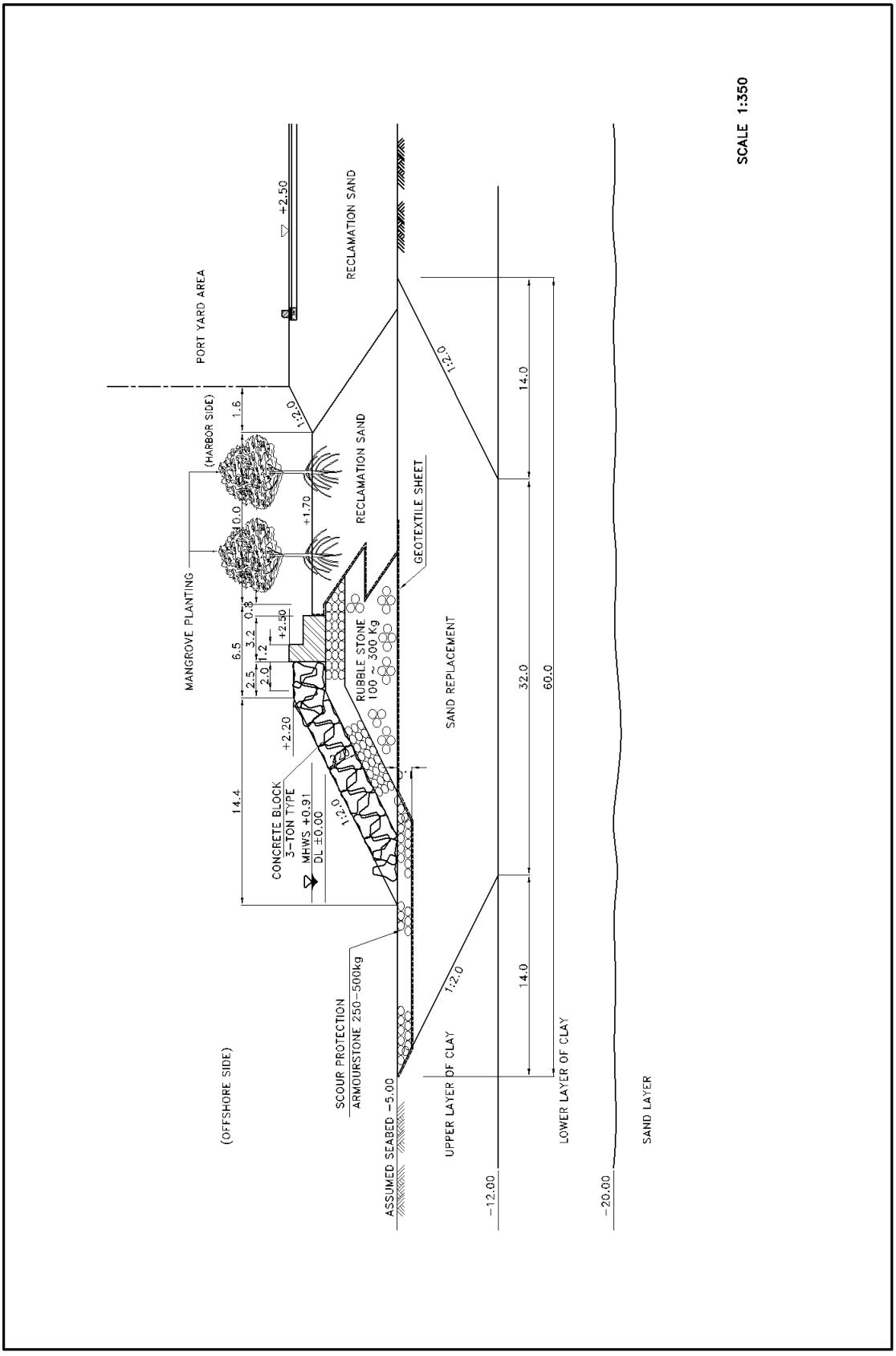


Figure 10-F-12 Typical Section of Revetment for Ancol Reclamation (Offshore side; with Mangrove Planting)

2) Preliminary Design of Quay Wall Structure of Bojonegara New Port

a) Berth Structure Design for Container Berth and Multipurpose Berth

194. The same type of berth structure is adopted for the new multipurpose berth and container terminal berth planned in the Bojonegara new port area considering the continuation of longer berth utilization for berthing by number of cargo ships and container ships at the same time and the following soil conditions.

i) Soil Conditions

195. According to the sub-soil data, the alluvium composed of underlain is mainly of cohesive fine sandy clay and Andesite rocky material consisting of dense sand, antesite grey hard sandy clay. The typical soil profile is described as follows:

- The uppermost 5.0 m average thick of alluvium consists of layers of fine sandy clay, brown soft clay and coarse sand and shell fragment. N-value generally ranged from 1 to 3, with higher N-values ranging from 4 to 10.
- The thickness of this layer vary from around 5.0 to 9.0 meter. It would indicate that this layer is normally consolidated. Therefore, relatively large consolidation settlement is expected should there be high embankment or fill.
- The second granular layer (below 5.0 – 15.0 m) consists mainly of sandy clay with grey medium to hard clay. The medium to hard, grey sandy clay with varying thickness of 4.0 m to 10.0m was also observed. N-values generally ranged from 23 to more than 50. Higher N-blows exceeding 50 were frequently encountered between 8 to 12 meter depth in the boreholes. The substantial increased in the N-value was probably due to the large amount of gravelly fine sand that was hit during the conduct of SPT. There is no indication of gravel-size broken coral.
- The soil below 9.0 m along the existing coastal shore line is the andesite rock, grey, hard and sandy clay, grey, and hard. There is no indication of gravel-size corals. N-values generally ranged beyond 60 as dense to very dense, may be regarded as bearing layer.

ii) Berth Structure Design

196. Considering such soil conditions and gentle slope of seabed topography, the two alternatives types of berth foundation i.e. Caisson type and Steel Pipe Sheet Pile (SPSP) type are considered. The SSP type will be expensive by longer time of works required for pile driving and by larger diameter of piles required to protect from bulking of pile during driving through hard rock layer. The comparison of advantage and disadvantage of each type is explained below.

	Steel Pipe Sheet Pile (SPSP)	Caisson Type
Evaluation	Simple in works method and fair in cost and period.	Complicated in works method and cheaper in cost and fair in period of works. Typical cross section is shown in Figure 10-F-13
Advantage	• The construction period may be the shorter than caisson type. • Large apron and backup area by backfill can be provided • Volume of dredging and reclamation will be minimal • Sheet piling works and dredging/reclamation works can be conducted at the same time • SPSP structure is flexible to cope with strength by the change of soil conditions and sea bed topography.	• Material locally available can intensively be used, thus economically be superior. • Relatively suitable to deeper water depth • Maintenance is easy and structure is relatively durable
Disadvantage	• Corrosion of SPSP should be considered. • SPSP and tie wires have to be imported • The construction cost will be more than caisson type	• Caisson yard or floating dock is required for fabrication. • Large floating equipment is required during installation. • The construction works is complicated to make level of mound for caisson installation and to set exact position for installation. • Construction period may be the longer. • The large volume of rock material required for dredging before caisson installation.

197. The caisson type structure is considered more economic and suitable from the other alternative and adopted for the preliminary design of the container berth and multipurpose berth foundation.

b) Ro-Ro Terminal Berth Structure and Bulk Cargo Handling Facility

198. The berth structure of Ro-Ro ships and bulk cargo berth are designed with pile support trestle and dolphin type.

i) The Ro-Ro terminal facilities:

199. The Roll-on/Roll-off ships berth is planned with breasting dolphins and mooring dolphins for berthing and movable bridge deck for loading /unloading vehicles.

200. The car parking area of 6-8 ha with concrete blocks pavement will be required. The area is developed behind the retaining wall by reclamation. The Ro-Ro berth is constructed off-shore from the retaining wall. The dolphin structure is designed with pile support concrete deck on pile.

201. The hydraulic operational steel movable bridge will be installed on the deck pile supported structure. The typical plan and cross section of Ro-Ro berth facility is shown in Figure 10-F-15 to Figure 10-F-17.

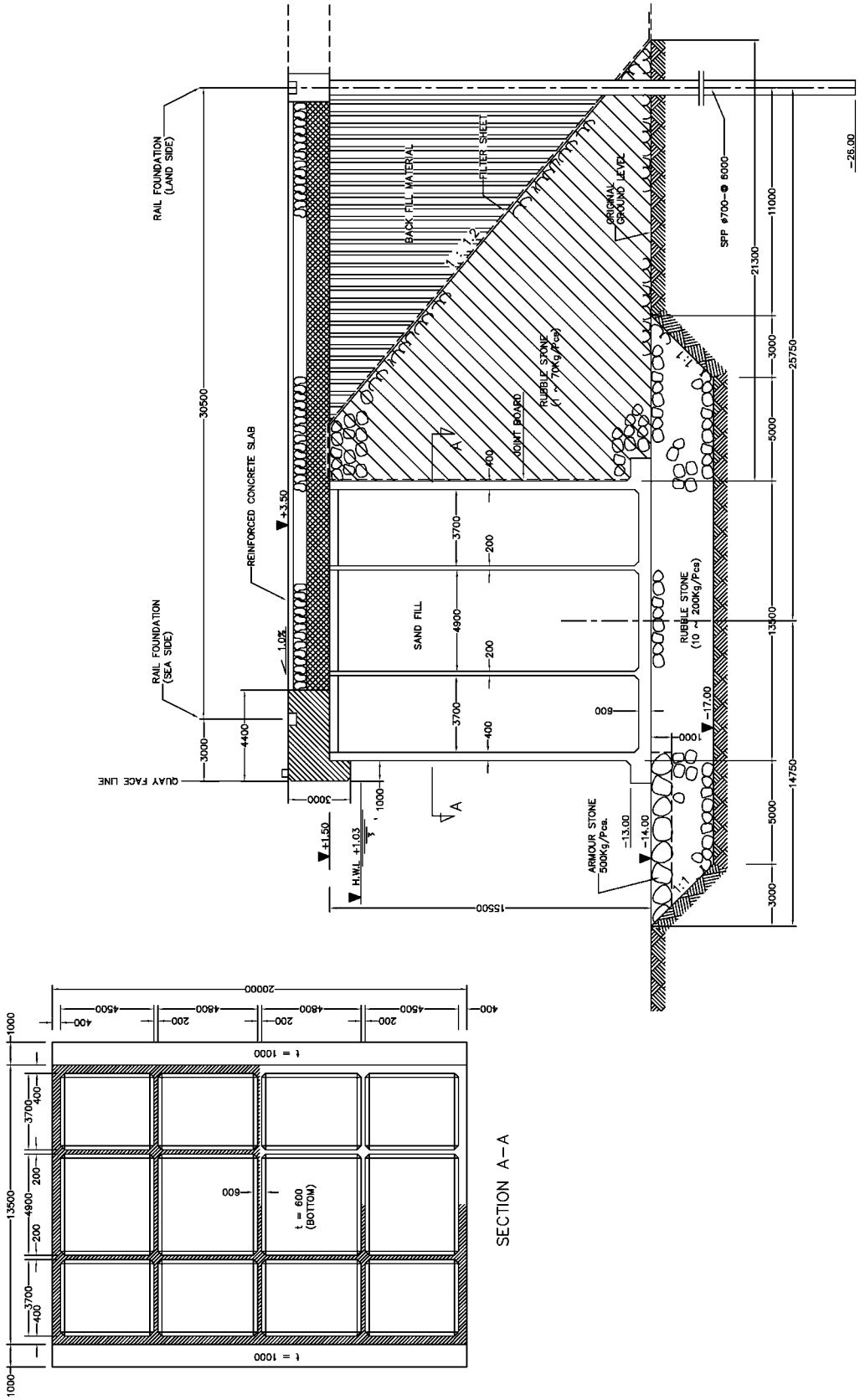


Figure 10-F-13 Typical Section of Caisson Type Container Berth of Bojonegara Port

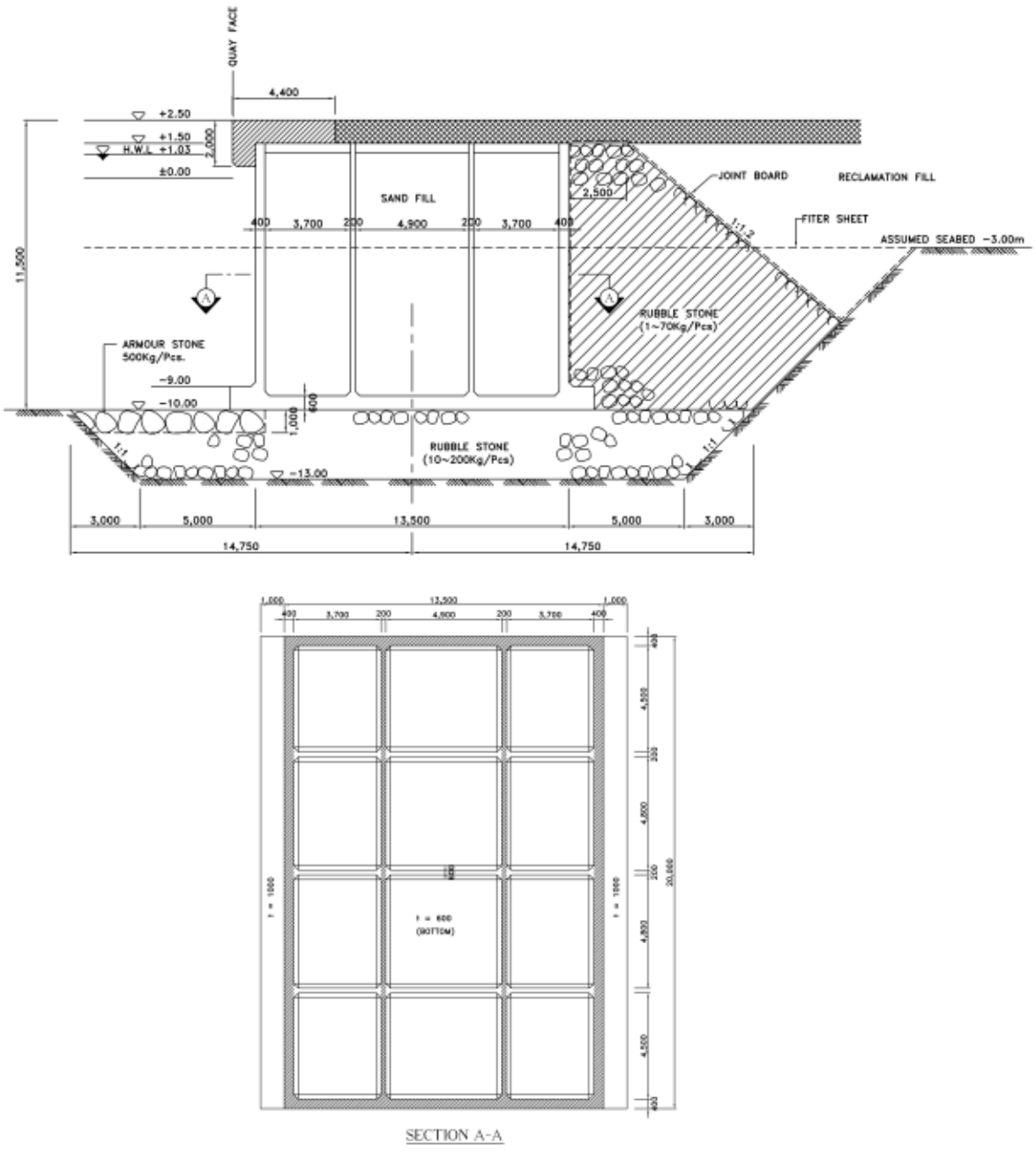


Figure 10-F-14 Typical Section of Caisson Type Multipurpose Berth of Bojonegara Port (Concrete Caisson, -10 m)

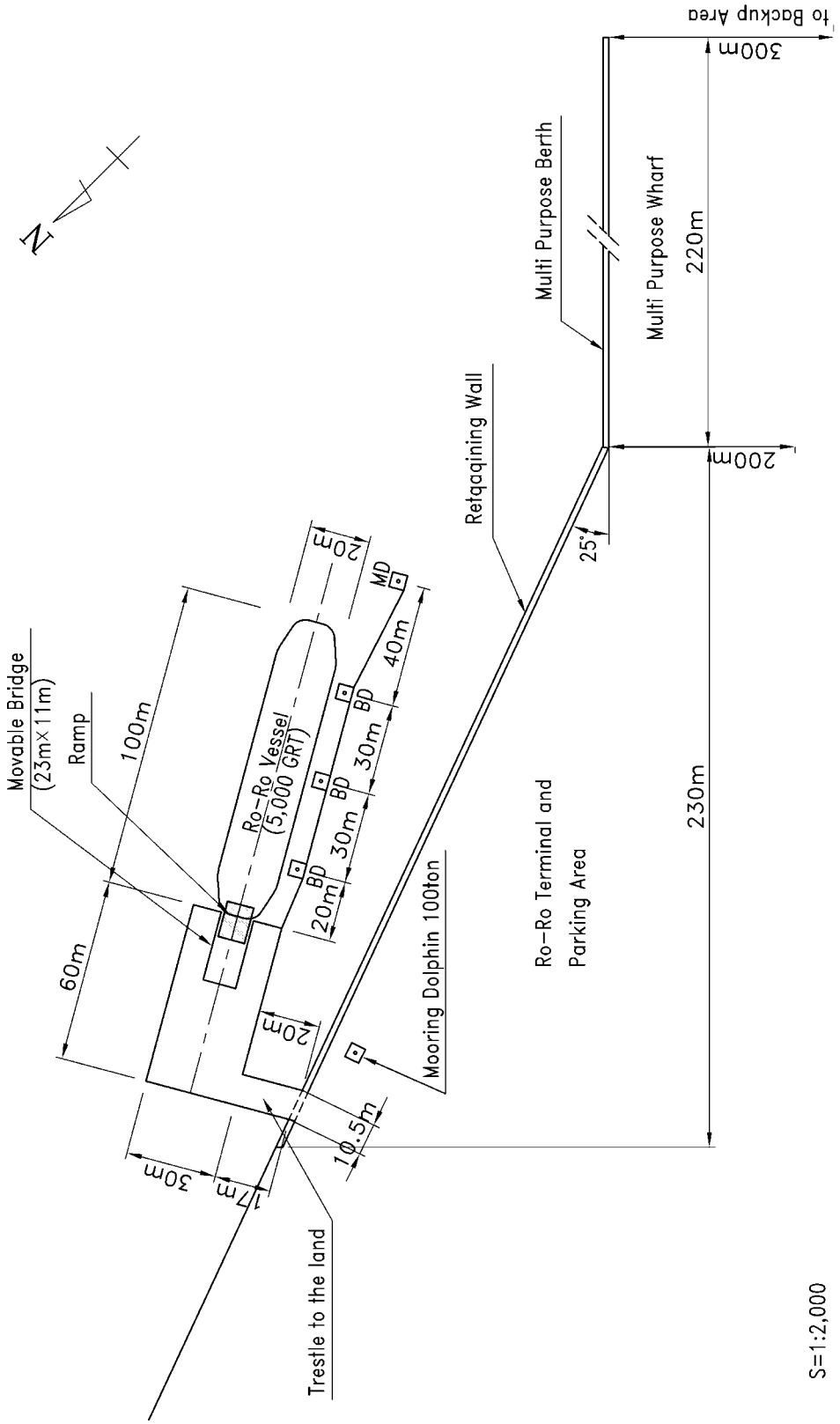


Figure 10-F-15 Typical Plan of Ro-Ro Terminal Berth at Bojonegara Port

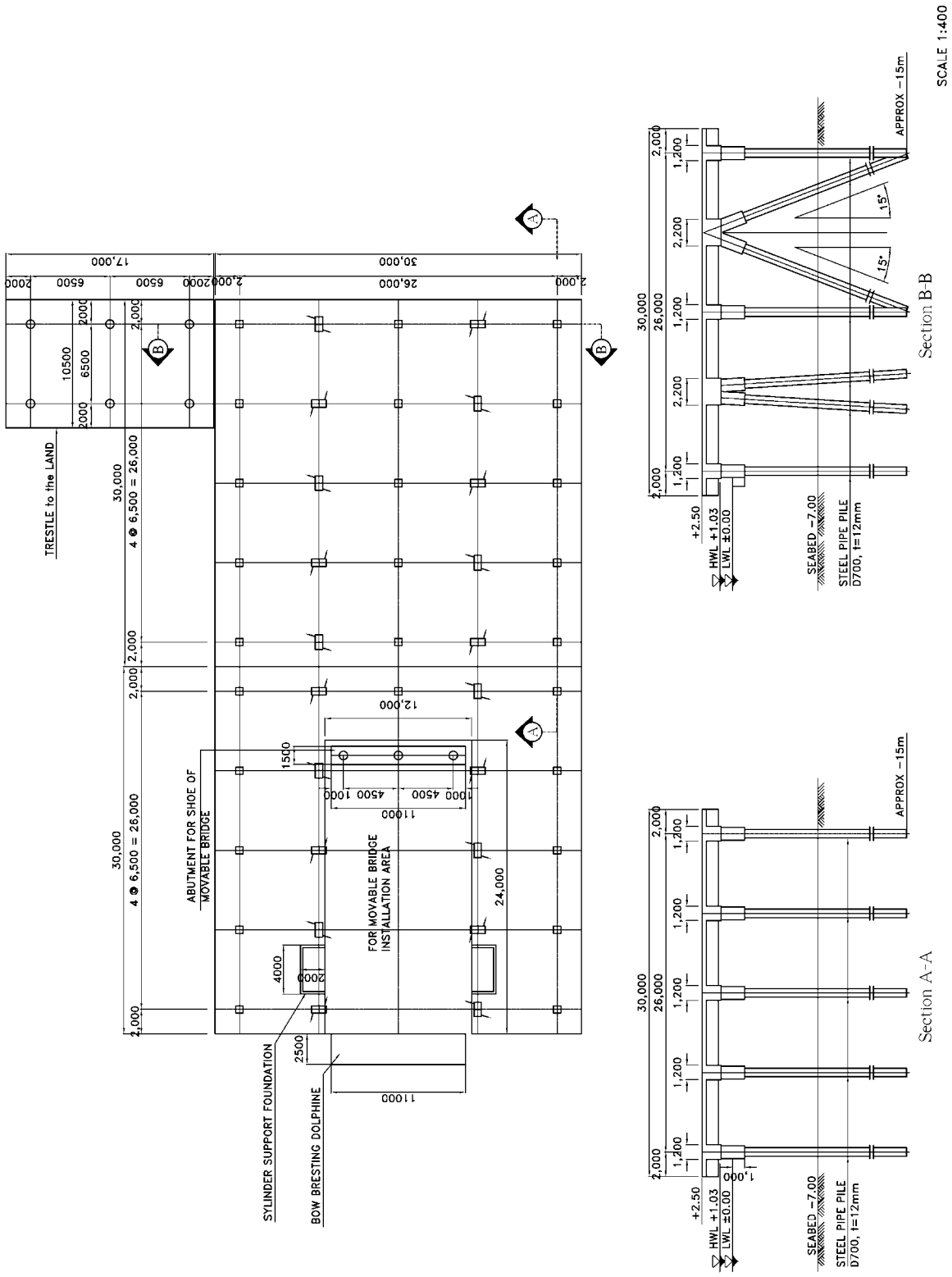


Figure 10-F-16 Unit Module of Landing Deck of Ro-Ro Terminal at Bojonegara Port

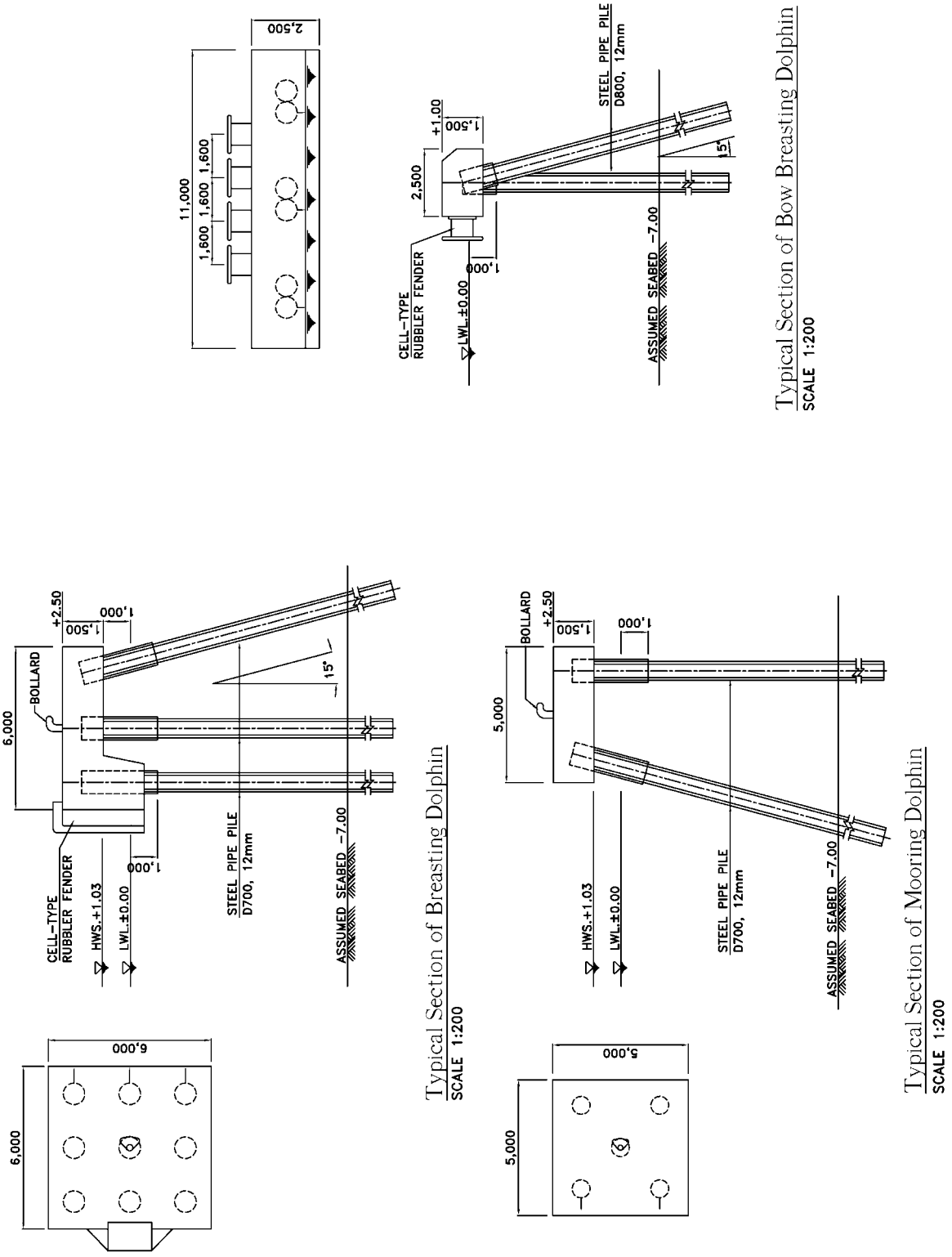


Figure 10-F-17 Typical Section of Mooring Dolphin of Ro-Ro Terminal at Bojonegara Port

ii) The bulk cargo terminal facilities:

202. The bulk cargo (wheat, animal feed, etc) berth is planned off- shore from the island at the depth of -12.0 m or deeper area. The berth is designed with pile supported deck type and its length is set about 300m to accommodate 30,000 GRT bulk carriers. The silo storage facilities will constructed on land area. The off-shore berth and silo storage will be connected by belt conveyor.

c) Quay Crane Foundation for Container Berth

203. The rear container crane rail foundation piles are installed at 30 m away for the crane wheel gauge from the sea side foundation piles separately from caisson foundation for crane installation.

d) Pavement of Container Yard and Port Road

204. The surface of the reclaimed area for container storage yard and car parking of Ro-Ro terminal will be paved with interlock concrete block on the cemented treated sand fill. The runway of rubber tired gantry cranes and container trucks in the container stock yard area are paved with pre stress concrete blocks. The port road area is paved with concrete.

e) Design of Breakwater Structure

205. The breakwater is planned to obtain the required calmness of the specified period of container handling under the wave height of 50 cm during rough weather season. The detailed study of calmness of basin and channel and of determining the direction, length and height of breakwater is described in Appendix C.

206. The breakwater is planned to make the entrance channel from the north direction and to extend in parallel to the future container terminal development. The breakwater is planned to extend along with the expansion of the container terminal by phased development.

207. The breakwater is designed by using the plastic sheet to be placed on the dredged sea bed at the designed depth, then gravel and riprap stones are placed thereon, and concrete cups are placed on top of the gravel stone mounded. The large concrete blocks around 1 ton unit are placed on the slope of the sea side as amour stone for protection. The typical section is shown in Figure 10-F-18.

f) Channel dredging of the rocky hard soil and reclamation material

208. The existing sea bed depth of the planned berthing area and entrance channel and basin is –6.0m to –10.0 m, where is required to be deepen to obtain the required water depth of – 8 to –14 m. The results by detailed soil investigation and marine geophysical survey are carefully studied to determine the suitable type of dredging equipment and methods. The finding thereof is described in the Appendix C, the dredging works is planned to carry out by grab dredgers with hopper barge.

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

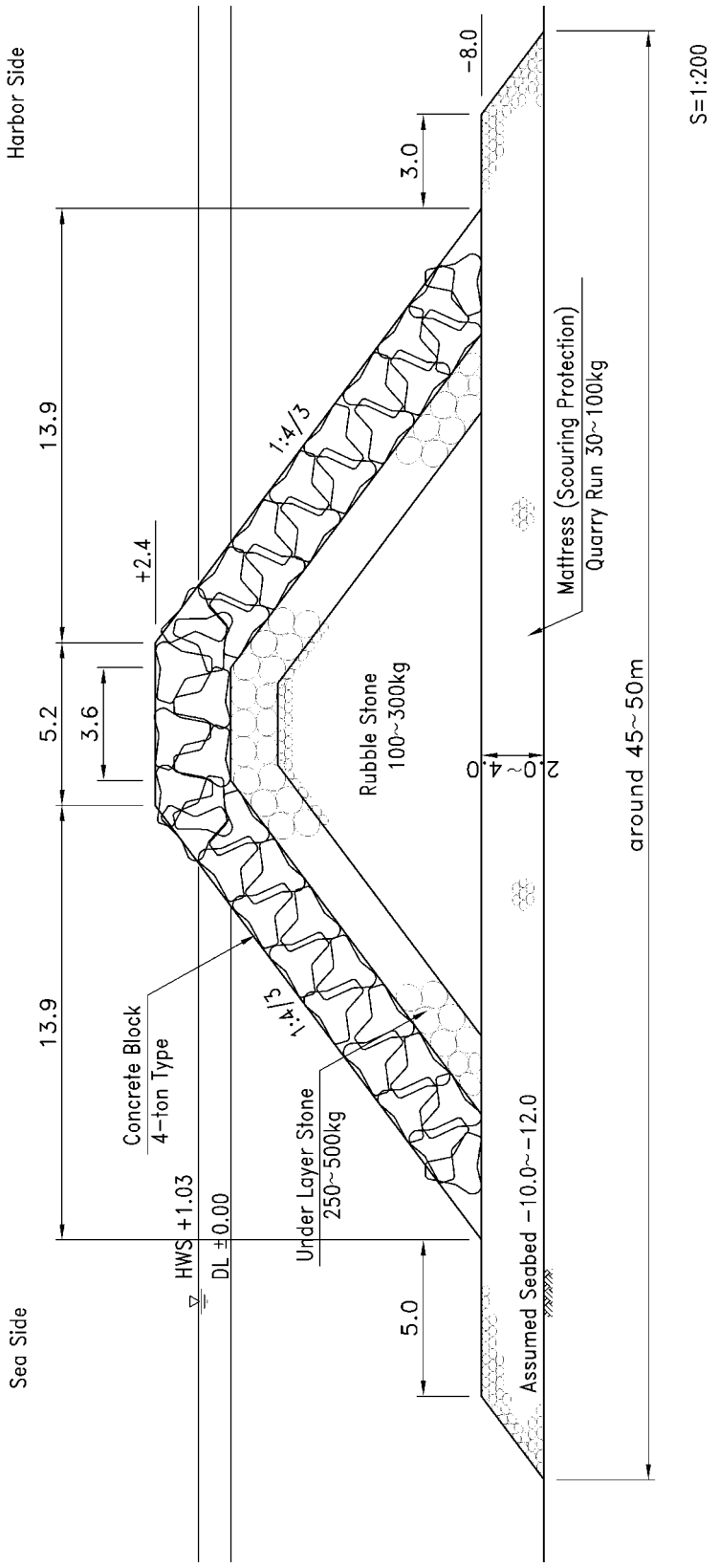


Figure 10-F-18 Typical Section of Breakwater (Rubble Mound Sloping Type) at Bojonegara Port

10-F-4 Study of Calmness of Channel and Basin of Tanjung Priok and Bojonegara Port

1) Tanjung Priok Port

210. Technical Standards for Port and Harbour Facilities in Japan (2002) stipulates that for basins used for accommodating or mooring vessels shall achieve the calmness for 97.5 % or more of the days of a year (Operational Cover Ratio) under the excessive probability beyond 0.5m wave height in front of quay. The detailed assessment of wave hindercast and tranquility calculation of calmness at each development stage are described in the Appendix D and G in Supporting Report of Engineering Study.

a) Wave Characteristic of Tanjung Priok Port Area

211. Westerly incident waves are most frequent in the table with about 11 % occurrence due to the wind of northwest monsoon and transitional seasons. N - NNE - NE incident waves are also frequent accounting for about 10 % of the frequency.

b) Design Wave Conditions for Calmness Study

212. Wave conditions at the off-Tanjung Priok Port was prepared with Wave Hindcast by SMB method using the 5-year wind records at Cengkareng (1997～2001). The details are described in the Appendix .

213. According to the occurrence probability of wave height, the cumulative occurrence of the incident waves lower than 0.5 m is about 93.5 % at off-Tanjung Priok port. This wave characteristic indicates that the construction of breakwater is necessary to secure the targeted calmness (0.5 m) and the operational days of cargo handling (97.5 %) in Tanjung Priok Port.

214. Incidence directions of the waves with wave height over 0.25 m and higher wave energy show higher occurrence probability in the direction of NNE, NE, ENE. And wave occurrence is mainly concentrated in the zone of wave period of 2 - 4 seconds.

215. Wave Occurrence Probability at offshore Tanjung Priok by the wave hindcast is shown in Table D.3 in the Appendix D. Wave condition is generally calm in the western portion of Java Sea and the cumulative frequency of wave height less than 0.5 m is about 87 %.

216. Out of the statistic analysis of these wave characteristics, the representative wave is defined as follows;

Wave height: H_m = 1.0 m (root-mean-square wave height), wave period: T_m = 3.5 sec.

217. Based on the tranquility analysis for the port facilities in accordance with the staged development plans, the wave height distribution is extracted at the specified output points (4 points) along wharves and container berth, and 4 points along fairway channel and harbor basin.

c) Results of Calmness Study

218. The operational cover ratio at each point for the 5 cases of staged development plans is given in Table 10-F-25.

Table 10-F-25 Results of Calmness Study at Tanjung Priok Port

Target Wave Height: H≦0.5m

Location	Urgent Development (2008)		Short Term (2012)		Long Term (2025)	
	Occurrence	Cover Ratio	Occurrence	Cover Ratio	Occurrence	Cover Ratio
Fairway and Inner channel	0.8	99.2	0.8	99.2	0.7	99.3
JICT 1	0.0	100	0.0	100	0.0	100
Car Terminal	0.0	100	0.0	100	0.6	99.4
Multipurpose			0.0	100	0.0	100
Passenger berth					0.2	99.8

219. The results of calmness study show that the planned alignment and relocation program of breakwaters and port facilities at different development stages will provide the cover ratio over 99 % under the target wave height 0.5 m at every point in Tanjung Priok Port.

2) Bojonegara New Port

220. The detailed assessment of wave hindcast and tranquility calculation of calmness at each development stage is described in the Appendix D and F in Supporting Report of Engineering Study.

a) Wave Characteristics at Bojonegara Port Area

221. Technical Standards for Port and Harbour Facilities in Japan (2002) stipulates that for basins used for accommodating or mooring vessels shall achieve the calmness for 97.5 % or more of the days of a year (Operational Cover Ratio). The threshold wave height ($H_{1/3}$) in front of mooring facilities for container handling is defined generally as 0.5 m.

222. Westerly incident waves are most frequent in the table with about 11 % occurrence due to the wind of northwest monsoon and transitional seasons. N - NNE - NE incident waves are also frequent accounting for about 14 % of the frequency.

b) Design Wave Conditions for Calmness Study

223. Wave conditions for the study of Bojonegara Port Development was prepared by the method of Wave Hindcast using the 5-year wind records at Cengkareng (1997～2001) and the combined occurrences of wave height, wave period and wave incidence direction in front of the assumed breakwater at the Bojonegara Development site are derived as follows:

224. Under 30 years return period, from North to North East and North West direction, wave height will be 3.19 to 3.03 m with period of 8.69 to 8.23 second.

225. According to the occurrence probability of wave height, the cumulative occurrence of the incident waves lower than 0.5 m is about 93 % at Bojonegara. This wave characteristic indicates that the construction of breakwater is necessary to secure the targeted calmness (0.5 m) for more than the operational days of 97.5 % per year for cargo handling in the Bojonegara Port development.

226. Wave Occurrence Probability at offshore Bojonegara by the wave hindcast is shown in Table D.4 in the Appendix D. The cumulative occurrence of wave height is less than 0.5 m is about 87 %.

c) Alignment and Length of Breakwater for Required Calmness

227. The alignment and length of the breakwater to be studied has three phases of development, i.e. Urgent Development stage as Phase I, Short Term Development as Phase II and Long Term Development as Phase III; refer to the attached Figures. Alignment plan of the breakwater has the features in offshore breakwater and approach channel at north entrance of the harbor. Future expansion of container berths is planned alongshore.

- Phase I: Multipurpose Berth (-10.0 m) and Container Wharf (-12.0 m; CT1 and CT2) without breakwater
- Phase II: Expansion of Container Berth (CT3 and CT4, water depth -14.0m) and extension of Breakwater as the Short Term Development for 2012
- Phase III: Offshore development of container terminal (CT5, CT6, CT7 and CT8 water depth -14.0m) as the Long Term Development for 2025

Table 10-F-26 Results of Calmness Study at Bojonegara New Port

Target Wave Height: H≦0.5m

Location	Phase II Short Term (2012)		Phase III Long Term (2025)	
	Occurrence	Cover Ratio	Occurrence	Cover Ratio
Multi Berth	0.4	99.6	0.2	99.8
Multi Berth	0.6	99.4	0.2	99.8
Container CT1	1.1	98.9	0.2	99.8
CT2	2.0	98.0	0.5	99.5
CT3	6.2	93.8	2.2	97.8
CT4			1.7	98.3
CT5			1.5	98.5
CT6			1.5	98.5
CT7			2.5	97.5
	With B/W of 1,040 m length		With B/W of 2440 m length (With B/W of around 2,700m cover ratio will be over 97.5% in front of CT8.)	

10-F-5 Project Cost

1) Basis of Cost Estimation and Exchange Rate

a) Unit Prices of Labor / Material / Equipment

228. Unit price of each element of labor, construction material and construction equipment for estimate of costs of works are determined on the basis of the information collected from the latest similar projects in the Jakarta Metropolitan region and market surveys of major construction companies and suppliers of material during the year of 2002. The unit prices are summarized in Table 10-F-27.

Table 10-F-27 Unit Prices of Labor/Material/Equipment for Construction in West Java Area

Construction Labour			
No.	Item	Time Unit	Basic Wage (Rupiah)
L- 1	Supervisor	day	65,000
L- 2	Foreman	day	65,000
L- 3	Skilled Labour	day	45,000
L- 4	Common Labour	day	30,000
L- 5	Scaffolding Man	day	35,000
L- 6	Carpenter	day	45,000
L- 7	Mechanic	day	55,000
L- 8	Electrician	day	55,000
L- 9	Operator (heavy)	day	70,000
L- 10	Operator (light)	day	50,000
L- 11	Truck Driver	day	50,000
L- 12	Welder	day	55,000
L- 13	Steel Fixer	day	40,000
L- 14	Mason	day	40,000
L- 15	Painter	day	40,000
L- 16	Plumber	day	40,000
L- 17	Surveyor	day	100,000
L- 18	Assistant Surveyor	day	50,000
L- 19	Captain (Tug Boat)		100,000
L- 20	Crew		80,000
L- 21	Diver		200,000
L- 22	Engineer (Expatriate)	mon	3,500,000
L- 23	Engineer (Local)	mon	2,500,000
L- 24	Assistant Engineer	mon	2,000,000
L- 25	Secretary	mon	1,000,000
L- 26	Assistant Secretary	mon	800,000
L- 27	Typist	mon	800,000
L- 28	Guardsman	mon	800,000
L- 29	Janitor	mon	800,000

Construction Material			
No.	Item	Unit	Unit Price* (Rupiah)
M- 1	Steel Bar (D16)	kg	2,700
M- 2	Steel Bar (D22)	kg	2,700
M- 3	Steel Bar (D29)	kg	2,700
M- 4	Structural Steel	kg	6,000
M- 5	Steel Sheet Pile; SP-	kg	5,400
	SP-III	kg	5,700
	SP-IV	kg	5,850
M- 6	Steel Pipe Pile	kg	4,500
M- 7	RC Pile; dia 500 - 600 m	m	200,000
M- 8	Portland Cement	ton	500,000
M- 9	Ready-mixed Concrete		
	Strength: 210 kg/cm^2	m^3	270,000
	Strength: 280 kg/cm^2	m^3	300,000
M- 10	Form Material; t=12 mm	m^2	43,500
	Form Material; t=15 mm	m^2	52,000
M- 11	Admixture	litre	15,000
M- 12	Fine Aggregate	m^3	60,000
M- 13	Coarse Aggregate	m^3	115,000
M- 14	Local Sand	m^3	45,000
M- 15	Import Sand	m^3	60,000
M- 16	Cobble Stone	m^3	75,000
M- 17	Crushed Stone	m^3	115,000
M- 18	Rock for Rubble Mound	m^3	75,000
M- 19	Sod	m^2	37,500
M- 20	Gasoline	litre	1,810
M- 21	Diesel Oil	litre	1,800
M- 22	Geotextile Filter Sheet	m^2	12,000
M- 23	Aspahlt concrete mix	ton	300,000
M- 24			
M- 25			

b) Basic Price and Exchange Rate

229. The basic prices are as of December 2002 and the following foreign exchange rate is applied for estimating the project cost considering the current trend in the market as of June 2003.

1 USD = 8,500 Rupiah = 120 Yen (1 Yen = 70.83 Rupiah)

c) Maintenance Cost of Facility, Equipment and Dredging

230. The maintenance cost for facilities is set out as 1 % of the facility construction cost based on the annual maintenance fee of the facilities. Also, 5 % of the equipment cost is adopted as the maintenance cost for the equipment.

231. Access channels and basins of Tanjung Priok Port are maintained by the periodical maintenance dredging, which is financed by IPC2 and carried out by P.T PENGERUKAN INDONESIA (RUKINDO). The average annual volume of maintenance dredging of the inner port channel is about 330,000 m^3/year based on the recent years experiences.

232. The unit price of maintenance dredging is given as Rp13,000/m^3 based on the latest JICA Study (River Port Development, 2001 - 2002).

d) Depreciation Periods of Port Facilities

233. For the economic and financial analysis, the depreciation period of the constructed facilities and the procured equipment are determined based on the report "Taksiran Umur Ekonomis Tetap" (source: IPC2, 1995) as shown in Table 10-F-28 below.

Table 10-F-28 Depreciation Period of Port Facilities

Port Facilities	Year	Remarks
Revetment and Quay	50	
Cargo Handling Equipment	20	
Building	50	Permanent
Navigation Aids	10	
Fender System	10	

2) Composition of Cost

a) Currency Component

234. The each unit price consists of the foreign currency and local currency portions, both indicated in Rupiah, and estimated in the following classifications;

i) The foreign currency component consists of:

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

ii) The local currency component consists of:

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

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

236. While, the cost of the works such as building works, fabrication of cargo handling equipment, supply of utilities and demolition works are to be hindcast on the basis of the empirical prices collected from the major contractors which have experiences in the fields.

237. Price of imported products such as cargo handling equipment, fender systems, bollard and navigation aids are to be estimated based on the CIF Jakarta price and adjusted considering import tax and some mobilization fee to the construction site.

b) Combined Cost for Major Construction Works

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

Table 10-F-29 Combined Cost for Major Construction Works

(Direct Construction Cost)

Item	Description	Unit	Unit Cost (1,000 Rupiah)
Tanjung Priok Development			
Breakwater	Rubble Mound Type, -5 m	m	83,557
Quay Wall (-10 m)	RC Deck-on-Pile	m	174,060
Revetment	Wave-breaking with Mangrove	m	70,167
Dredging	Soft Clay	m^3	27.1
Reclamation	Local Sand	m^3	52.1
Bojonegara Development			
Breakwater (-10 m)	Rubble Mound Type, -10 m	m	135,794
Quay Wall (-14 m)	Concrete Caisson	m	214,387
Quay Wall (-8 m)	Concrete Block	m	75,839
Dredging	Weathered Rock	m^3	123.3
Dredging	Soft Clay	m^3	27.1
Reclamation-on-land	including Rock Excavation	m^3	63.0

c) Indirect Cost to the Construction Works

239. The indirect costs such as general temporary works, overheads profit and site expenses are estimated in this study and included as parts of the Project Cost.

240. The temporary works, site expenses and overhead are assumed as about 8%, 15% and 8% respectively of the direct construction cost of the works.

241. In addition to the construction cost and procurement cost, the engineering fee for the detail design and supervision, physical contingency and VAT are estimated in this study.

242. The engineering fee for construction is assumed as about 8 % of the construction cost for Tanjung Priok and Bojonegara Port project and 3.5 % for the procurement cost of equipment.

243. The physical contingency is 10 % for the construction cost, VAT is 10% of the whole cost.

d) Unit Cost of Container Handling Equipment

244. The unit cost of cargo handling equipment will include the costs of design, manufacturing, workshop tests, delivery and installation. Procurement Cost of the major equipment is given as follows for the preliminary engineering study (as of August 2002).

Table 10-F-30Unit Prices of Cargo Handling Equipment

Item	Description	Unit Price
Wharf Gantry Crane	Out-reach: 36 m	45 Billion
Rubber Tyred Gantry Crane	6-lane, 1 over 4	10 Billion
Stacker		4 Billion
Tractor/Chassis		1 Billion
Forklift		0.2 Billion

245. Price of imported products such as cargo handling equipment, fender systems, bollard and navigation aids are to be estimated based on the CIF Jakarta price and adjusted considering import tax and some mobilization fee to the construction site.

3) Estimate of Project Cost

246. The project cost is estimated in line with the staged development plan of the Tanjung Priok Port and Bojonegara Port.

a) Project Cost Estimate of Tanjung Priok Port up to 2025

i) Scope of Major Works in the Phased Development up to 2025

247. Scope of Major Works in the Phased Development up to 2025 is shown in Table 10-F-31.

Table 10-F-31 Scope of Works of the Tanjung Priok Port Development up to 2025

Tanjung Priok Port Development	Quantity	Remarks
1. Urgent Rehabilitation Project (2008)		
1.1 Breakwater (Dam Tengah)	1450 m	
1.2 Breakwater (Dam Barat)	200 m	
1.3 Western Channel Improvement	8,758,000 m^3	
(1) Basin	- 10 m	For car terminal
(2) Widening of Channel	- 14 m	300 m width
(3) Deepening of Basin	- 14 m	540 m dia circle
1.4 Car Terminal Development	250 m	7 ha backup area
1.5 Port Inner Road Improvement with viaduct	4,150 m	including Pasoso Flyover 610 m
1.6 Eastern Access Port Highway	3,500 m	Elevated
1.7 Environmental Treatment Facilities	1 set	3 different type
2. Short Term Development Project (2012)		
2.1 Breakwater (Dam Tengah)	907 m	
2.2 Breakwater for Ancol Development	980 m	
2.3 Western Channel Improvement, Central Basin	300,000 m^3	- 14 m depth
2.4 New Access Channel for Ancol Development		
(1) Access Channel	1,205,000 m^3	-10m, 120m
(2) New Basin	1,271,000 m^3	-10m, 400m
(3) New Basin	494,000 m^3	-7.5m 300m
(4) Deepening channel (from -6 to -9 m)	1,243,000 m^3	
2.5 Multipurpose Terminal 1st berth by 2010	440 m	- 10 m
Expansion by 2012	350 m	- 10 m
2.6 Passenger Terminal	350 m	
2.7 Redevelopment of existing port area (DKB II areas)	58,000 m^2	
Redevelopment of Existing port area (Wharf 101 area)	22,000 m^2	
Redevelopment of Multi Terminal	179,000 m^2	Upto 2012
Redevelopment of Pelabuhan Nusantara Area	51,000 m^2	Upto 2012
2.8 Ancol Access Road from the existing road by 2010	3,310 m	Elevated
Extension by 2012	490 m	
2.9 Demolishing Navy Facilities	98,000 m^2	
2.10 Environmental Treatment Facilities	1 set	3 different types
3 Long Term Development Project (upto 2025)		
3.1 Development of Breakwater (East Entrance)	1,100 m	
3.2 Dredging East Channel	4,248,000 m^3	
3.3 Improvement of Channel and Basin		
(1) Widening of Channel (-14m)	4,493,000 m^3	
(2) Deepening of Basin (-14m)	1,157,000 m^3	
(3) Deepening of Basin (-12m)	187,000 m^3	
3.4 Expansion of Car Terminal	250 m	
3.5 Demolishing Breakwater of west channel Ancol side	540 m	
3.6 Deepening of Channel and Basin	4,217,000 m^3	
3.7 Expansion of Multipurpose Terminal	1,700 m	- 12m
3.8 Extension of Ancol Access Road	1,500 m	
3.9 Expansion of Passenger Terminal	175 m	- 7.5m
3.10 Redevelopment of DKB –I area	131,500 m^2	
Redevelopment of DKB –II area	214,500 m^2	
Redevelopment of bulk berth area	18,000 m^2	
3.11 Bus Terminal Redevelopment in front of Gate No 3	12,000 m^2	
3.12 Western Access Port Highway Development	3,450 m	
3.13 Future Expansion for Special cargo at Kali Baru area	337,000 m^2	

3.14 Future Expansion for a New Dock Area	226,000 m^2	
3.15 Kali Baru Reclamation	166,000 m^2	
3.16 Kali Baru Access Road	2,500 m	2,100 m on reclamation, 400 m on shore
3.17 Relocation of Oil Jetty	4 units	- 14 m

ii) Summary of Total Project Cost Estimate

248. The total project cost estimate is summarized at around 11,000 billion Rp as follows: (It should be noted that these figures include access road and other urban-side development project costs and exclude handling equipment such as gantry crane.)

Table 10-F-32 Summary of Capital Cost (Million Rp) of Tanjung Priok Port up to 2025

(million Rp)

Description		Local	Foreign	Total
Port Development Projects				
	Urgent Plan (~2008)	315,444	483,514	798,958
	Short Term Plan (~2012)	1,375,779	836,494	2,212,273
	Long Term Plan (~2025)	2,940,228	1,732,775	4,673,003
	小計	4,631,451	3,052,783	7,684,234
	Contingency	463,145	305,278	768,423
	Engineering Service	370,318	242,441	612,759
	VAT (10 %)	546,491	360,050	906,542
	Administration Expenses	121,842		121,842
Total		6,133,248	3,960,552	10,093,800
Related Projects				0
	Urgent Plan (~2008)	326,246	102,222	428,468
	Short Term Plan (~2012)	0	0	0
	Long Term Plan (~2025)	201,911	111,298	313,209
	小計	528,156	213,521	741,677
	Contingency	52,816	21,352	74,168
	Engineering Service	42,253	17,082	59,334
	VAT (10 %)	62,322	25,195	87,518
	Administration Expenses	7,417		7,417
Total		692,964	277,150	970,114
Grand Total		6,826,212	4,237,702	11,063,914

Note-1) "Port Development Projects" includes port inner road improvement (including gate improvement) and procurement of cargo handling equipment.

Note-2) "Port Development Project" includes investment of an Ancol developer (private sector).

Note-3) "Administration Expenses" includes compensation.

Note-4) Related Projects are development of Eastern and Western Port Access Highway and redevelopment around the Tanjung Priok eailway station.

b) Project Cost of Bojonegara New Port

i) Scope of Major Works in the Phased Development up to 2025

Table 10-F-33Scope of Works of Bojonegara New Port Development up to 2025

Bojonegara New Port Development	Quantity	
1. Urgent Rehabilitation Project (2008)		
1.1 Dredging of Channel and Basin	2,320,000 m^3	-12m
1.2 Development of Multipurpose Berth	220 m	- 10m
1.3 Jetty for Government service boats Zone	50 m	- 5 m
1.4 Land development for Port Related Zone	80,800m^2	
1.5 Port Related Road	33,150 m^2	
1.6 Development of Access Road	12,400 m	2 lanes
1.7 Diversion of Canal for flood from hill	93,000 m^3	
2, Short Term Development Project (upto 2012)		
2.1 Breakwater Construction	1,040 m	
2.2 Dredging of Channel and Basin	1,388,000 m^3	-10 m to -12m
2.3 Ro-Ro Terminal	230 m	- 8 m
2.4 Container Terminal Berth B1, B2	600 m	- 12 m
2.5 Procurement of Container Handling Equipment	5 units of Gantry cranes and RTG 18 units.	To be procured by operator
2.6 Procurement of general cargo handling equipment	2 units of Mobil crane, 1 unit reach stacker, 7 units of forklift	To be procured by operator
2.7 Port Related Zone	275,000 m^2	
3. Long Term Development Project		
3.1 Breakwater Extension	1,640 m	
3.2 Dredging Channel and Basin	6,338,325 m^3	-14 m
3.3 Container Terminal Berth Expansion B3, B4	600 m	-14 m
3.4 Container Terminal Berth Expansion of B5 to B8	1,200 m	- 14 m
3.5 General Cargo handling Zone Development	630 m	- 10 m
3.6 Container Handling Equipment	5 units of Gantry Cranes	To be procured by operator
3.7 Railway Construction	16,500 m	
3.8 Port Related Zone Development	300,000 m^2	

ii) Summary of Total Project Cost Estimate

249. The total project cost estimate is summarized at around 6,700 billion Rp as follows: (It should be noted that these figures include access road and other urban-side development project costs and exclude handling equipment such as gantry crane.)

Table 10-F-34 Summary of Capital Cost of Bojonegara New Port up to 2025 (mil Rp)

(million Rp)

Description		Local	Foreign	Total
Port Development Projects				
	Urgent Plan (~2010)	492,272	554,439	1,046,710
	Short Term Plan (~2012)	39,243	26,572	65,814
	Long Term Plan (~2025)	1,141,936	1,133,039	2,274,975
	Sub Total	1,673,451	1,714,049	3,387,500
	Physical Contingency	167,345	171,405	338,750
	Engineering Service	133,678	135,342	269,020
	VAT (10%)	197,447	202,080	399,527
	Administration Expenses	61,811		61,811
Total		2,233,732	2,222,876	4,456,607
Related Projects				0
	Urgent Plan (~2010)	52,508	122,519	175,027
	Short Term Plan (~2012)	0	0	0
	Long Term Plan (~2025)	14,130	127,170	141,300
	Sub Total	66,638	249,689	316,327
	Physical Contingency	6,664	24,969	31,633
	Engineering Service	5,331	19,975	25,306
	VAT (10%)	7,863	29,463	37,327
	Administration Expenses	29,778		29,778
Total		116,274	324,096	440,370
Procurement of Cargo Handling Equipment				0
	Urgent Plan (~2010)	37,047	333,422	370,468
	Short Term Plan (~2012)	0	0	0
	Long Term Plan (~2025)	108,039	972,347	1,080,385
	Sub Total	145,085	1,305,768	1,450,854
	Physical Contingency	14,509	130,577	145,085
	Engineering Service	5,078	45,702	50,780
	VAT (10%)	16,467	148,205	164,672
	Administration Expenses	14,509		14,509
Total		195,648	1,630,252	1,825,900
Grand Total		2,545,654	4,177,223	6,722,877

Note-1) "Port Development Projects" includes superstructure except cargo handling equipment.
Note-2) "Port Development Projects" of Short Term Plan is development of Ro-Ro terminal.
Note-3) "Administration Expenses" includes compensation.
Note-4) "Related Projects" of urgent plan is access road development, while that of long term plan is railway (infrastructure) development.

10-G. PRELIMINARY ECONOMIC ANALYSIS

10-G-1 General

1) Purpose

250. A preliminary economic analysis is conducted to appraise the economic feasibility of the Master Plan for the Greater Jakarta Metropolitan Ports before conducting a feasibility study of the Short-term Development Plan. The preliminary economic evaluation of a project should show whether the project is justifiable from the viewpoint of the national economy by assessing its contribution to the national economy.

2) Methodology

251. Preliminary economic analysis will be carried out according to the following method. The Master Plan will be defined and it will be compared to the "Without the project" case (hereinafter referred to as the "Without" case). All benefits and costs in market price of the difference between "With the project" case (hereinafter referred to as the "With" case) and "Without" case will be calculated and evaluated.

252. In this study, the economic internal rate of return (EIRR) and the benefit/cost ratio (B/C ratio) based on a cost-benefit analysis are used to appraise the feasibility of the project. The EIRR is a discount rate which makes the costs and the benefits of the project during the project life and is compared to the target discount rate(15% for non-social project in Indonesia). The benefit/cost ratio is obtained by dividing the benefits by costs based on the present value.

3) Base Year

253. The "Base Year" here means the standard year in the estimation of costs and benefits. In this study, 2002 is set as the "Base Year".

254. The target year of the Master Plan is 2025 and starting year of construction is assumed to start prior to the target year.

4) Project Life

255. The period of calculation (project life) in the preliminary economic analysis is assumed to be 34 years from the commencing year of the project.

5) Foreign Exchange Rate

256. The exchange rate adopted for this analysis is US$ 1.00 = Rupiah 8500 (average of the later half of the year 2002), the same rate as used in the cost estimation.

6) Economic Price

257. Estimated costs of the projects are counted by market price and those are converted into economic price using conversion factor 0f 0.85% at the preliminary economic analysis.

10-G-2 Projects of the Port of Tanjung Priok

1) "With" Case

258. As a cost-benefit analysis is conducted on the difference between the "With" case and the "Without" case, it is important to define the "With" case and the "Without" case.

259. In the preliminary economic analysis, the six projects, Navigational Improvement Project, Domestic Container Terminal Development Project, Car Terminal Development Project, Re-organizing and Developing Conventional Wharves Project, Passenger Terminal Relocation Project and Land Transport Improvement Project are assessed totally.

260. In an preliminary economic analysis, benefits are mainly brought about by improvement and expansion in traffic capacity.

2) "Without" Case

261. No investment is made for the Master Plan. But operation of three container berths at JICT and KOJA is assumed to commence in 2005. In the "Without" case scenario, when handling volume reaches the maximum volume of handling capacity of the port, the excess cargoes are assumed to be handled by Mid-Stream operation through the East Channel. Following conditions are adopted as the "Without" case for each project.

a) Navigational Improvement Project

- No investment is made for the navigational improvement.
- The volume of cargo is the same as the "With" case
- Foreign Container cargo exceeding current capacity shall be transshipped to smaller ship for conducting a midstream operation
- Foreign container ship and passenger ship have a priority to enter the port up to the same number as the present.

b) Domestic Container Terminal Development Project

- No investment is made for the port.
- The working efficiency of cargo handling is not the same as the "With" case.
- Container berths equipped with a gantry crane as of January 2003 are applied to foreign container ship. Therefore, domestic container is handling by ship crane or mobile one at conventional berths.

c) Car Terminal Development Project

- Two general cargo berths are applied for this operation in the "Without" case
- The size of vessels is the same as the "With" case.

d) Re-organizing and Developing Conventional Wharves Project

- No investment is made for the port.
- A conventional cargo ship calls at present general cargo berth.

e) Passenger Terminal Relocation Project

- No investment is made for the port.
- A passenger boat calls at present berth.

f) Land Transport Improvement Project

- No investment is made for the road.
- The time required for the land transportation is longer than that of the "With" case.

3) Benefits of the Projects

a) Benefit Items

262. As benefits brought about by the master plan of the study port, the following items are identified.

- a-1 Saving in ship staying cost for cargo handling
- a-2 Saving in sea transportation costs
- a-3 Saving in handling costs by Midstream operation for the excess cargoes
- a-4 Saving in land transportation costs
- a-5 Reduction of cargo damage and accidents at the port
- a-6 Promotion of regional economic development
- a-7 Increase in employment opportunities and income
- a-8 Reduction of the traffic congestion in the port area

263. Item a-1, a-2, a-3 and a-4 are considered countable in this study and the monetary benefits of those items are counted.

b) Calculation of Benefits

i) Saving in ship staying costs for cargo handling

264. In the "With" case, total ship staying cost at berths is less than that of the "Without" case owing to the implementing of the Navigational Improvement Project and the Domestic Container Terminal Development Project. The difference of ship costs between the "With" case and the "Without" case is counted as a benefit of the projects. Saving in ship staying costs at berths is shown in Table 10-G-1.

Table 10-G-1 Saving in Ship Staying Costs by Type of Cargo

(Unit: billion Rp)

Item / Year No.	Delay Operation on Container	Delay Operation on General Cargo and Bags	Delay Operation on Car
1-9	607	451	147
10-19	1,718	2,065	328
20-29	2,754	3,738	481
30-34	1,561	2,546	248
Total of 1 to 34	6,641	8,802	1,206

ii) Saving in sea transportation costs

265. Generally speaking, if the loading capacity of a vessel increases, the vessel can transport cargo at lower cost. But container ship planned to be accommodated at the New Terminal is too large for midstream operation, therefore smaller ship equipped with ship crane shall be applied to "Without" case after transshipment. The transshipment cost shall be counted as the benefit of this item.

266. Saving in sea transportation costs is shown in Table 10-G-2.

Table 10-G-2 Saving in Sea Transportation Costs

(Unit: billion Rp)

Item / Year No.	Transshipment Cost On Cargo Stay	Transshipment Cost On Cargo Handling
1-9	50	374
10-19	117	866
20-29	154	1,136
30-34	78	580
Total of 1 to 34	401	2,956

iii) Saving in handling costs of Midstream operation for the excess cargoes

267. In the "Without" case of the Navigational Improvement Project, as the volume of cargo exceeds the handling capacity of the Tanjung Priok Port, Midstream operation shall be applied to the excess cargoes. Saving in handling costs as a result of the Navigational Improvement Project is counted as a benefit of the project (See Table 10-G-3).

Table 10-G-3 Saving in Handling Cost of Midstream Operation

(Unit: billion Rp)

Item / Year No.	Container	General Cargo and Bags
1-9	68	239
10-19	686	1,094
20-29	2,931	1,981
30-34	2,773	1,349
Total of 1 to 34	6,460	4,664

iv) Saving in land transportation costs

268. In the "Without" case of the Land Transportation Improvement Project, as the volume of traffic exceeds the capacity of the road, the lower traffic speed results in a large economic loss in terms of time cost. Also, transport cost of vehicle increases by the lower speed. Those additional costs are shown in .

Table 10-G-4 Saving in Land Transport Costs

(Unit: billion Rp)

Item / Year No.	Time Cost of Vehicle	Time Cost of Cargo	Vehicle Transport Cost
1-9	190	104	165
10-19	970	557	831
20-29	2,440	1,375	1,878
30-34	2,350	1,319	1,694
Total of 1 to 34	5,950	3,355	4,568

4) Costs of the Projects

a) Construction Costs

269. The following items are identified as costs of the master plan.

- Construction and dredging costs
- Maintenance and renewal costs

270. Construction costs consist of Direct Construction Cost, Indirect Construction Cost, Project Related Cost, Administration Cost and VAT. Total Project Cost is estimated at 7,528 billion Rp by market price. Details are shown in the Table bellow.

Table 10-G-5 Project and Direct Construction Cost of Master Plan (billion Rp)

Item	Urgent	Short	Long	Total
a. Channel and Basin Improvement Project	403	372	534	1,310
a.1 Breakwater(Dam Tengah)	144	93	0	234
a.2 Breakwater(Dam Barat)	22	0	0	22
a.3 Western Channel Improvement by Dredging	171	0	0	171
a.4 Basin Improvement by Dredging	66	8	156	232
a.5 Access Channel	0	104	0	104
a.6 Dredging of Channel and Basin	0	0	123	123
a.7 Breakwater for Ancol Development	0	87	0	87
a.8 New Access Western Channel by Dredging	0	80	0	80
a.9 Breakwater(East Entrance)	0	0	138	138
a.10 Dredging for East Entrance Channel	0	0	115	115
b. Domestic Container Terminal Development Project	0	269	819	1,088
b.1 Multi Purpose Terminal	0	269	819	1,088
c. Automobile Terminal Development Project	88	0	93	181
c.1 Car Carrier Terminal	86	0	93	179
c.2 Access to Car Terminal	2	0	0	2
d. Re-organizing and Developing Conventional Wharves Project	0	181	0	181
d.1 Port Re-development(Demaga)	0	21	0	21
d.2 Port Re-development(Lapangan)	0	160	0	160
e. Passenger Terminal Relocation Project	0	111	64	175
e.1 Passenger Terminal	0	111	64	175
f. Land Transport Improvement Project	432	0	0	432
f.1 Improvement of Port Related Road	69	0	0	69
f.2 Eastern Access Port Highway	363	0	0	363
g. Other Cost	61	662	326	1,048
g.1 Mobilization and Demobilization	25	79	150	254
g.2 Port-related Zone	0	130	26	156
g.3 Ancol Access Road	0	122	0	122
g.4 Access Road (offshore island) extension	0	128	150	277
g.5 Access Road (bridge over sea)	0	203	0	203
g.6 Gate Improvement	36	0	0	36
Total a. to g.	984	1,594	1,836	4,414

Table 10-G-6 Construction Cost of Master Plan (billion Rp)

Items	Urgent	Short	Long	Total
I. Direct Construction Cost	984	1,594	1,836	4,414
II. Indirect Construction Cost	244	494	569	1,307
III. Project Related Expense	221	376	433	1,030
IV. Administration Cost and Compensation	57	21	24	102
V. Total I to IV	1,506	2,486	2,862	6,853
VI. VAT	145	246	284	675
VII. Construction Cost	1,651	2,732	3,145	7,528

271. Maintenance cost is estimated at 1% of civil cost and 5% of mechanical cost.

272. Above costs are converting to economic price as same method as an economic analysis in the feasibility study.

Table 10-G-7 Construction Costs for Structure and Equipment (billion Rp)

Project / Year No.	Master Plan up to 2037 Construction Cost	Master Plan up to 2037 Maintenance Cost	Total Master Plan Project
1-9	3,823	10	3,833
10-19	1,304	35	1,340
20-29	1,518	72	1,590
30-34	0	36	35
Total of 1 to 34	6,646	155	6,801

5) Evaluation of Projects

a) Calculation of the EIRR

273. The economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the economic feasibility of the project. The EIRR is a discount rate which makes the costs and benefits of a project during the project life equal.

274. It is calculated by using the following formula.

$$\sum_{i=1}^{n} \frac{Bi - Ci}{(1+r)^{i-1}} = 0$$

where,

n:	Period of economic calculation (project life = 35 years)
Bi:	Benefits in i-th year
Ci:	Costs in i-th year
r:	Discount rate

275. The EIRR is calculated at 16.6 %, and indicates that the project is feasibleness.

EIRR = 16.6 %

b) Calculation of the Benefit/Cost (B/C) Ratio and Net Present Value(NPV)

276. The benefit/cost ratio is obtained by dividing the benefit by the cost. The results of the B/C and NPV are shown in Table 10-G-8. The discount rate adopted for calculation of B/C is 15% in this study.

277. B/C is larger than 1.0 and NPV is positive, therefore the project is deemed to be feasible.

Table 10-G-8 Result of B/C and NPV Calculation

Benefit (billion Rps)	Cost (billion Rps)	B/C	NPV (billion Rps)
2,186	1,971	1.11	215

Table 10-G-9 Cost, Benefit and NET Values of the Project (million Rp)

Year	Cost	Benefit	Net
2004	21,600	0	-21,600
2005	58,400	0	-58,400
2006	557,000	49,400	-507,600
2007	640,800	104,800	-536,000
2008	319,800	205,300	-114,500
2009	443,600	310,800	-132,800
2010	975,800	364,600	-611,200
2011	763,400	415,600	-347,800
2012	53,500	489,200	435,700
2013	3,400	501,500	498,100
2014	3,400	508,200	504,800
2015	3,400	547,700	544,300
2016	3,400	588,900	585,500
2017	3,400	642,300	638,900
2018	3,400	697,500	694,100
2019	3,400	755,400	752,000
2020	3,400	815,400	812,000
2021	480,500	878,100	397,600
2022	832,500	942,800	110,300
2023	1,149,500	1,010,000	-139,500
2024	332,700	1,079,300	746,600
2025	7,300	1,151,400	1,144,100
2026	7,300	1,226,000	1,218,700
2027	7,300	1,288,100	1,280,800
2028	7,300	1,350,400	1,343,100
2029	7,300	1,415,300	1,408,000
2030	27,400	1,482,400	1,455,000
2031	37,500	1,551,600	1,514,100
2032	7,300	1,623,100	1,615,800
2033	7,300	1,696,600	1,689,300
2034	7,300	1,761,600	1,754,300
2035	7,300	1,827,000	1,819,700
2036	7,300	1,893,000	1,885,700
2037	7,300	1,959,500	1,952,200
Total	6,801,500	31,132,800	24,331,300

10-G-3 Projects of the Port of Bojonegara

1) "With" Case

278. As a cost-benefit analysis is conducted on the difference between the "With" case and the "Without" case, it is important to define the "With" case and the "Without" case.

279. In the preliminary economic analysis, the three projects, Container Terminal Development Project, Multipurpose Terminal Development Project and Land Transport Improvement Project are assessed totally.

280. In the preliminary economic analysis, benefits are mainly brought about by the development of container terminal.

2) "Without" Case

281. No investment is made for the Master Plan. In the "Without" case scenario, the excess volume among the cargoes assigned to Banten ports are assumed to be handled by Mid-Stream operation. Following conditions are adopted as the "Without" case for each project.

a) Container Terminal Development Project

- No investment is made for the port.
- Handling equipment of ports in Banten Province is assigned for cargoes of each port. Therefore, projected cargoes of Bojonegara Port shall be handled by midstream operation at the coast of Banten Province.
- Foreign container cargo will be transshipped to smaller sized ship on the maritime route.

b) Multipurpose Terminal Development Project

- No investment is made for the port
- General cargo and bag cargo are also handled by the midstream operation.
- The size of vessels is the same as the "With" case.

c) Land Transport Improvement Project

- No investment is made for the road and railway.

3) Benefits of the Projects

a) Benefit Items

282. As benefits brought about by the master plan of the study port, the following items are identified.

- a-1 Saving in ship and cargo staying costs
- a-2 Saving in sea transportation costs
- a-3 Saving in cargo handling costs by the midstream operation
- a-4 Saving in land transportation costs
- a-5 Reduction of cargo damage and accidents at the port
- a-6 Promotion of regional economic development
- a-7 Increase in employment opportunities and income
- a-8 Reduction of the traffic congestion in the Greater Jakarta Region

283. Item a-1, a-2 and a-3 are considered countable in this study and the monetary benefits of those items are counted.

b) Calculation of Benefits

i) Saving in ship and cargo staying costs

284. In the "With" case, total ship staying cost at berths and total ship waiting cost at offshore anchorages are less than that of the "Without" case owing to the implementation of the Container Terminal Development Project and the Multipurpose Terminal Development Project. The difference of ship costs between the "With" case and the "Without" case is counted as a benefit of the projects. Saving in ship staying costs is shown in Table 10-G-10.

Table 10-G-10 Saving in Ship and Cargo Staying Costs (billion Rp)

Item / Year No.	Foreign Container Operation	Domestic Container Operation	General Cargo Operation
1-9	208	4	79
10-19	3,040	70	454
20-29	6,115	127	720
30-34	4,176	86	459
Total of 1 to 34	13,540	290	1,714

ii) Saving in sea transportation costs

285. Generally speaking, if the loading capacity of a vessel increases, the vessel can transport cargo at lower cost. But container ship planned to be accommodated at the New Port is too large for midstream operation, therefore smaller ship equipped with ship crane shall be applied to Without case after a transshipment. The transshipment cost shall be counted as the benefit of this item.

286. Saving in sea transportation costs is shown in Table 10-G-11.

Table 10-G-11 Saving in Sea Transportation Costs (billion Rp)

Item / Year No.	Container Terminal Development
1-9	127
10-19	1,863
20-29	3,748
30-34	2,560
Total of 1 to 34	8,300

iii) Saving in cargo handling costs by the midstream operation

287. Necessary number of barge and small pier will be prepared according to the increased traffic volume. The cost of midstream operation is counted as a benefit of the project. Saving in cargo handling cost is shown in Table 10-G-12.

Table 10-G-12 Saving in cargo handling costs by the midstream operation (billion Rp)

Item / Year No.	Container Terminal Development	Multipurpose Terminal Development
1-9	118	96
10-19	1,267	445
20-29	2,428	688
30-34	1,636	434
Total of 1 to 34	5,449	1,664

4) Costs of the Projects

a) Construction Costs

288. The following items are identified as costs of the master plan.

- Construction and dredging costs

- Maintenance and renewal costs
- Administration cost

289. Construction costs consist of Direct Construction Cost, Indirect Construction Cost, Project Related Cost, Administration Cost and VAT. Total Project Cost is estimated at 6,736 billion Rp by market price. Details are shown in the Table bellow.

290. Above costs are shown in Table below after converting to economic price from marketing price.

Table 10-G-13 Maintenance Costs for Structure and Equipment (billion Rp)

	Port	Road	Equipment	Total
I. Direct Construction Cost	2,620	316	1,451	4,388
I.a Container Terminal	1,085	0	1,441	2,526
I.b Multipurpose Terminal	193	0	10	204
I.c Land Transportation	0	175	0	175
I.d Others	1,341	141	0	1,483
II. Indirect Construction Cost	812	0	0	812
III. Project Related Cost	623	57	196	876
IV. Administration Cost	34	3	15	52
V. Total Project Cost	4,090	376	1,661	6,128
VI. VAT	406	37	165	608
VII. Construction Cost	4,496	414	1,826	6,736

291. Maintenance cost are estimated at 1% of civil cost and 5% of mechanical cost. Refer financial analysis on administration cost.

292. Above costs are converted to economic price from marketing price.

Table 10-G-14 Maintenance Costs for Structure and Equipment (billion Rp)

Project / Year No.	Construction Cost(incl. Residual Value)	Maintenance Cost	Administration Cost	Total Master Plan Project
1-9	1,872	52	10	1,935
10-19	2,628	413	97	3,138
20-29	1,300	672	160	2,133
30-34	-336	342	82	89
Total of 1 to 34	5,464	1,482	351	7,297

5) Evaluation of Projects

a) Calculation of the EIRR

293. The EIRR is calculated at 16.6 %, and indicates that the project is feasible.

EIRR = 16.6 %

b) Calculation of the Benefit/Cost (B/C) Ratio and Net Present Value(NPV)

294. The benefit/cost ratio is obtained by dividing the benefit by the cost. The results of the B/C and NPV are shown in Table 10-G-15. The discount rate adopted for calculation of B/C is 15% in this study.

295. B/C is larger than 1.0 and NPV is positive. Those indicate feasibleness of the project.

Table 10-G-15 Result of B/C and NPV Calculation

Benefit (billion Rps)	Cost (billion Rps)	B/C	NPV (billion Rps)
1,685	1,481	1.14	204

Table 10-G-16 Cost, Benefit and NET Values of the Project (million Rp)

Year	Cost	Benefit	Net
2004	19,903	0	-19,903
2005	86,773	0	-86,773
2006	125,446	0	-125,446
2007	280,870	3,500	-277,370
2008	441,001	7,680	-433,322
2009	484,935	26,840	-458,095
2010	69,992	108,090	38,098
2011	195,328	198,070	2,741
2012	231,741	290,499	58,758
2013	447,362	390,379	-56,984
2014	575,133	482,741	-92,392
2015	44,289	550,765	506,475
2016	51,104	618,296	567,192
2017	380,729	683,127	302,397
2018	636,028	747,691	111,663
2019	550,464	823,131	272,667
2020	64,678	884,461	819,784
2021	70,775	945,020	874,246
2022	318,117	1,016,585	698,468
2023	508,236	1,081,064	572,828
2024	566,295	1,149,503	583,209
2025	85,066	1,218,056	1,132,991
2026	85,226	1,285,349	1,200,123
2027	87,258	1,346,482	1,259,224
2028	138,988	1,418,115	1,279,127
2029	258,214	1,482,328	1,224,114
2030	115,597	1,550,461	1,434,864
2031	200,498	1,611,174	1,410,676
2032	88,412	1,686,307	1,597,895
2033	159,163	1,747,439	1,588,277
2034	372,531	1,815,152	1,442,622
2035	85,066	1,883,285	1,798,219
2036	85,066	1,947,918	1,862,852
2037	-612,558	1,960,644	2,573,202
Total	7,297,727	30,960,153	23,662,426

10-H. INITIAL ENVIRONMENTAL EVALUATION

296. According to the system of EIA in Indonesia, *AMDAL* does not have Initial Environmental Examination (IEE) process because of simplification of *AMDAL* Procedures. However, as the IEE Study will pick up the environmental impact to be necessary to evaluate in the EIA study, IEE was carried out based on the Master Plan toward 2025.

10-H-1 Tanjung Priok

297. The contents of the Master Plan for Tanjung Priok are shown in earlier section. Results of IEE is shown in Table 10-H-1.

Table 10-H-1 Results of IEE (Tanjung Priok)

Type of major Activities / Environmental Factors		Overall Evaluation	Construction Phase		Operation Phase		
			Reclamation /Spatial Occupancy	Operation of Construction Equipment	Spatial Occupancy	Operation of Vehicles /Ships	Operation of Port Facilities
1. Social Environment							
1	Resettlement	-B		○			
2	Economic Activities	+-B		○		○	
3	Traffic and Public Facilities	+-B		○		○	
4	Split of Communities	D					
5	Cultural Property	D					
6	Water Rights and Rights of Common	D					
7	Public Health Condition	-C		○		○	○
8	Waste and garbage	-C	○				○
9	Hazards (Risk)	-C		○		○	○
2. Natural Environment							
10	Topography and Geology	D					
11	Soil Erosion	D					
12	Groundwater	D					
13	Hydrological Situation	D					
14	Coastal Zone	-C			○		
15	Fauna and Flora	-C	○		○		
16	Meteorology	D					
17	Landscape	D					
3. Pollution							
18	Air Pollution	-B		○		○	
19	Water Pollution	-B	○		○	○	○
20	Soil Contamination	-B	○		○		
21	Noise and Vibration	-B		○		○	
22	Land Subsidence	D					
23	Offensive Odor	D					

Note:
A: Serious impact B: Medium impact C: Small impact D: No impact
+: Positive impact – : Negative impact

1) Social Environment

a) Resettlement

298. Population density of the project site is extremely high; lack of dwelling will be predicted. As project area is located close DKI Jakarta, it will be not so difficult for workers to procure the dwelling. Concerning road project, road rehabilitation of existing road will be closed to residential or business zones. Even though land acquisition process is not necessary, road rehabilitation will temporarily affect the resident/business zones such as temporal removal of the service industries along the existing roadside.

b) Economic Activity

299. The port project will provide job opportunity; and the residents expect it. However port working in resent year needs high skills and experiences. People of productive age, especially young ages, will be difficult to get the skillful port work because of lack of education.

300. Many types of work around the project area are dependent on the port activity regardless of direct/indirect. For example many workers in construction/operation phase need many type of services industries, food services, transportation services e.g. Hence the project can lead to accelerate business chance.

c) Traffic and Public Facilities

301. Serious traffic jam still occurs. According to the traffic volume survey by the JICA Study Team, Much of traffic volume is caused by trucks, which are involved the port activities. The traffic jam affects serious damage to air quality and noise disturbance. Construction/Rehabilitation of existing road, which is included in the Master Plan, will improve the road condition.

d) Public Health Condition

302. Project Site has 2 Hospitals, 2 Public Health Centers and 17 Health Units (*Pos Kesehatan*), additionally, DKI Jakarta has many facilities. Hence the public condition is enough to cover the Project.

303. Water supply system at the project Site is supplied by PAM, few people uses shallow well. On the other hand, existing sanitation system is not good condition. Population growth will affect negative impact to the health environment. Improvement of management for the sanitation will be necessary.

e) Waste and Garbage

304. Waste and garbage systems are supplied by DKI Jakarta Government. Drainage system is poor and unplanned in comparison with necessary capacity. Hence flood problems occasionally occur in rainy season.

305. Many garbage and wastewater inflow from DKI Jakarta, these cause serious pollution to water area in Tanjung Priok. In addition, drainage carries soil; it brings sedimentation problem.

306. Port facilities should have sewage treatment system such as septic tank; however, some of these septic tanks are still poor management. As a result, sewage water overflows into the port water area in rainy season or high tide.

307. Increasing population and port workers will oppress sanitary condition not only in residential area but also in port activity; and lead to aggravation of water quality. Additionally speaking, traditional services industry, such as mobile food services, *Warung*, Bike Transportation Service, will be increase in conjunction with increasing port activity. Hence improvement of sanitation and waste/garbage system is necessary for appropriate port management

f) Hazards (Risk)

308. Increasing ship volume lead to ship accident; on the other hand relocation of breakwater improves navigation system. Similarly road rehabilitation can improve road condition; it decreases risk.

309. It is necessary to create the safety manual for construction/operation phase. Also controlling and regulating illegal/unacceptable activity such as pleasure fishing are necessary to manage appropriate port activity.

2) Natural Environment

a) Coastal Zone

310. Small sand beach exists in the west of the project site. Development of East-Ancol area may change coastal landform.

b) Fauna and Flora

311. Dominant species of terrestrial fauna and flora are domestic and plantation. Concerning aquatic biota, though land reclamation and dredging decrease habitat for the benthos, however, these are mainly common species.

3) Pollution

a) Air Pollution

312. There is still serious air pollution around the Port. Especially Jl. Enggano, Jl Sulawesi, Jl. Perabuhan Raya and Jl Cilincing. It is caused by heavy traffic volume. Increasing port activity will affect damage to air quality. However road rehabilitation is expected improvement of traffic condition, the project will not affect much damage to air quality.

b) Water Pollution

313. Current water condition at the Project Site is still bad. Especially organic pollution such as COD and Nutrients showed high concentrations. This pollutant is mainly dependent on domestic sewage. Human activity of DKI Jakarta may affect aggravation of water quality.

314. Water quality inside breakwater was extremely high level, exceeded environmental standard. Existing port layout shows semi-closed water area. Relocation of breakwaters will improve water changing.

315. On the other hand, reclamation at Ancol will build semi-closed area. Thermal power station (*PLTU*) discharges thermal discharge water. New land reclamation has possibility to interrupt the diffusion of thermal discharge water.

316. To sum up the cause of negative impact to water quality, water pollution will be caused by the following factors;

- Drainage of domestic wastewater from DKI Jakarta;
- Low activity of water exchange caused by existing closed water area; and
- Poor wastewater management.

c) Soil Contamination

317. Aggravation of water quality leads to soil pollution. Tanjung Priok port needs maintenance dredging because of siltation. As mentioned before, bottom sediment condition showed high contamination of heavy metals and organic parameters at some points. According to the Indonesian government, they are examining the way for treatment of contaminated dredged soil.

d) Noise and Vibration

318. Current condition of noise and vibration showed similar to that of air quality, that is to say, surrounding area of the Project Site showed noise disturbance.

10-H-2 Bojonegara

319. The contents of the Master Plan for Bojonegara are shown in earlier section. Results of IEE is shown in Table 10-H-2.

Table 10-H-2 Results of IEE (Bojonegara)

Type of major Activities / Environmental Factors		Overall Evaluation	Construction Phase		Operation Phase		
			Reclamation /Spatial Occupancy	Operation of Construction Equipment	Spatial Occupancy	Operation of Vehicles/ Ships	Operation of Port Facilities
1. Social Environment							
1	Resettlement	-A	○				
2	Economic Activities	+B		○			○
3	Traffic and Public Facilities	-C		○		○	
4	Split of Communities	-C					○
5	Cultural Property	D					
6	Water Rights and Rights of Common	-C	○		○		
7	Public Health Condition	D					
8	Waste and garbage	-C	○				○
9	Hazards (Risk)	-C		○		○	○
2. Natural Environment							
10	Topography and Geology	D					
11	Soil Erosion	D					
12	Groundwater	D					
13	Hydrological Situation	D					
14	Coastal Zone	-C	○		○		
15	Fauna and Flora	-B	○		○		
16	Meteorology	D					
17	Landscape	D					
3. Pollution							
18	Air Pollution	-C		○		○	○
19	Water Pollution	-C	○		○		○
20	Soil Contamination	D					
21	Noise and Vibration	-C		○		○	○
22	Land Subsidence	D					
23	Offensive Odor	D					

Note:
A: Serious impact B: Medium impact C: Small impact D: No impact
+: Positive impact – : Negative impact

1) Social Environment

a) Resettlement

320. According to the information from IPC2, they has already purchased 445 ha, land acquisition is still on going. Dominant problems are as follows;

- IPC2 purchased different area as the Project; and
- Some residents complain of the proposed relocation site because it is far from the Port Area.

321. The project requires much number and many type of workers. Many newcomers will come to the Project Site to look for job opportunity during construction, operation and maintenance phase. Hence resettlement zone should be provided.

b) Economic Activity

322. The port project will provide job opportunity, and the residents expect it. However port working in resent year needs high skills and experiences.

323. Many types of work in the project area are dependent on the port activity regardless of direct/indirect. For example many workers in construction/operation phase need many type of services industries, food services, transportation services e.g.. Hence the project can lead to more job opportunities.

c) Traffic and Public Facilities

324. Existing road from/to the Project Site is too poor to carry passengers and baggage; however there is no space for rehabilitation. Hence construction of access road is necessary. Road construction should consider on impact to the following factors;

- to interrupt water canal;
- to split communities;
- to increase aggravation of air quality and noise disturbance; and
- to purchase necessary land.

d) Split of Communities

325. The Project Site is close to *Desa* Puloampel, Sumuranja and Margasari. Some residents in the Project Site will be relocated the proposed area where is connected existing road with pathway.

326. Construction of access road has possibility to split communities. Hence Layout of access road and land use plan of port related zone should be designed lest these interrupt communication of residents.

e) Water Right and Right of Common

327. According to the interview survey, there is little fishing activity, however, small marine cultivation exists around Tanjung Awran. It is necessary to estimate compensation of these activity.

f) Waste and Garbage

328. According to the interview survey with regional government, waste and garbage management system is mainly individually carried out by each household. The Project needs many workers, so number of newcomers will increase; and lead to increase waste and garbage. Also construction/operation phase of port development bear much waste and garbage. Poor waste/garbage management can not cover increasing of waste materials. Increasing wastewater from residential area affect serious damage to water quality.

329. Concerning appropriate wastewater treatment management and waste/garbage collection system should be required to create.

g) Hazards (Risk)

330. Increasing ship volume lead to ship accident; also oil accident affect serious damage not only to ecosystem but also to human activity. It is necessary to create the safety manual for construction/operation phase.

2) Natural Environment

a) Coastal Zone

331. Natural coastal line exists in the Project Site; also mangrove forest exists. According to the Coastal Management Plan in Serang Zone, the Project Site is located in port and industry zone. The project site can be developed in consideration of minimizing negative impact.

b) Fauna and Flora

332. Terrestrial fauna and flora at the Project Site were mainly domestic; there are no protected, endangered species.

333. On the other hand, mangrove forest exists shorefront and around Pulo kali island. Also coral reef exists offshore of Pulo Kali Island. As mentioned above, the Project Site can be used for port and industrial zone. However, to conserve coral reef and mangrove forest is effective for marine ecosystem and amenity for residents and workers.

3) Pollution

a) Air Pollution

334. In the current condition, air quality is good condition. Concentrations were below the environmental standard. However, it is necessary to examine the future conditions caused by increasing traffic volume.

b) Water Pollution

335. Current condition is still good; concentrations of water quality were below the standard.

336. However, construction of breakwater and reclamation has possibility to change water current condition, which may affects water quality. And also port activity, related industrial activity and residential activity will damage water quality.

337. Dredging and reclamation activity have possibility to lead to turbidity and siltation; diffusion of soil materials affects impact to surrounding water area.

c) Noise and Vibration

338. At the moment, there is little noise disturbance, however increasing traffic volume will affect damage to the residents.

10-H-3 Access Road Development for Bojonegara New Port

1) Existing Environmental Condition around the Planned Access Road Development Area.

339. The JICA Study Team carried out the environmental field survey on June 2003.

340. The objectives of the environmental survey are:

- To identify the present condition of access road from Cilegon Timur Exit Toll Road to Planned Bojonegara Port.
- To show the present environmental condition to enable the Access Road Detail Design considered with the environmental aspect, that it will not have negative

impact a disadvantage to environmental aspect in protection.

- To minimize and to make efficient the operational cost for environment management due to the port design application.

341. The Access Road will be planned by using the existing Provincial Road in maximum possible way, therefore construction activities will include widening, pavement and short-cut in order that large vehicles can move smoothly.

342. The contents of field survey are summarized as follows:

Table 10-H-3 Contents of Field Survey

Type of Environment	Content	Method
Air Quality	CO	CO Analyzer
	SO2	Absorption Spectrometry
	NO2	Absorption Spectrometry
	TSP	Gravimetric Method
	Wind Direction/Velocity	Direct Measuring
Noise and Vibration	Noise	Noise Meter
	Vibration	Vibration Meter
Social Environment	Socio Economy	Secondary Data, Interview
	Social Cultura	Secondary Data, Interview
	Land Use	Secondary Data, Interview

343. Location of field survey is shown in Figure 10-H-1.

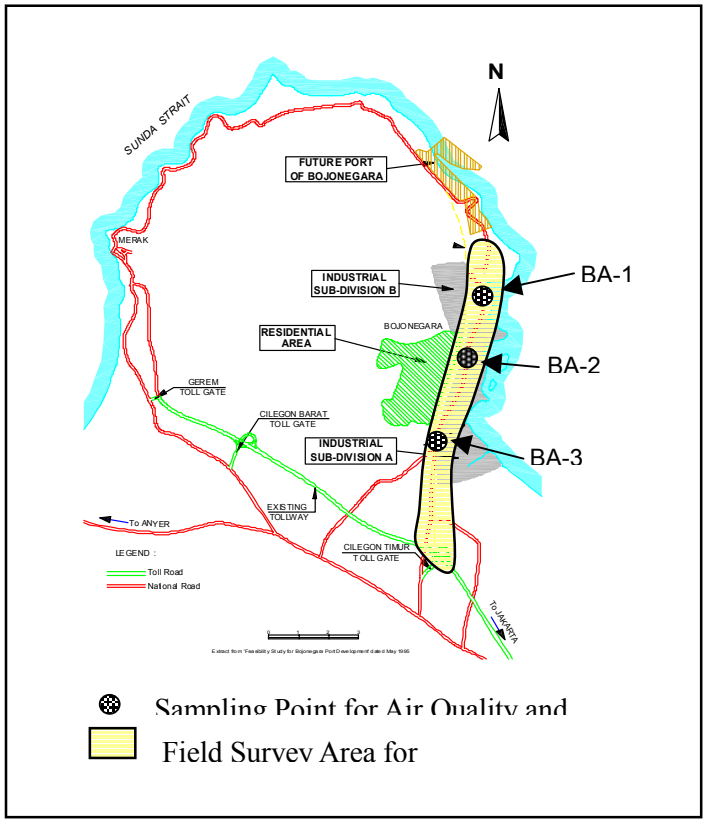


Figure 10-H-1 Location of Field Survey

a) Natural Environment

i) Physical Environment

344. According to ANDAL Bojonegara Port Report, 1997, and IWACO - WASECO studies 1990, the geological condition in Bojonegara and along the planned access road from East Cilegon Exit Toll Road to Bojonegara Port area can be classified according Physical Characteristic as:

- Alluvial Sediment

  The formation consists of Clay, Mud, Sand, Gravel and Coarse like Andesit, Pumice Stone mixed with Organic component. It spread in beach, low tide swamp and a part of estuary or river.

- Tufan Stone

  Based on sedimentation process, consists of Upper Banten Tufan and Lower Banten Tufan. Lower Banten Tufan settles first and compact, spread around Rawa Danau, Rangkong Mountain and Anyer River Valley (south study area). Upper Banten Tufan spread at Serang, Cilegon until Bojonegara include Kaki Gunung Gede Valley as study area.

- Old Volcanic Rock

  This Rock is made from Gunung Api Gede eruption, consists of Lava, Breksi, Volcanic, and Tufan. Physical characteristic are compact and solid.

345. Surface water resources limited caused by big river flow and estuary along access road to Bojonegara Port location. Ground water along the planned access road is very rare. The area near beach included productive aquifer with flow under 5L/sec, meanwhile part of them has flow 5 –10L/sec (data from DGTL, IWACO–WASECO, 1990). The potential of ground water is related with geological structure, morphology shape, land use and climate especially rainfall intensity.

ii) Air Quality

346. The results of air quality are summarized in Table 10-H-4.

Table 10-H-4 Summarized Result of Air Quality

Location		CO (ppm)	SO_2 (ug/m^3)	NO_2 (ug/m^3)	SPM (ug/m^3)
BA-1 (Grenyang, *Desa* Argawana)	Min-Max (Avg)	0.2 – 1.2 (0.64)	1.5 - 6.4 (3.3)	4.6 – 12.6 (8.4)	48 – 305 (144)
BA-2 (*Desa* Bojonegara)		0.8 – 1.7 (1.2)	2.4 – 8.4 (4.8)	6.3 – 18.8 (11.2)	757 – 2455 (1248)
BA-3 (*Desa* Terate)		0.7 – 1.4 (0.94)	1.4 – 7.0 (4.0)	4.2 – 14.7 (8.1)	60 – 327 (212)
Environmental Standard		8.75	365	150	230

Source: JICA Study Team

347. Generally air quality at Bojonegara area is classified good condition, Concentration of CO, SO_2 and NO_2 are still below the standard. Meanwhile concentration of SPM

348. Compared among three locations, generally air pollution in BA-2 (Desa Bojonegara, near the public facilities) was more serious than other locations. Concentration of SPM sometimes exceeded Environmental Standard, especially during daytime (see Figure 10-H-2).

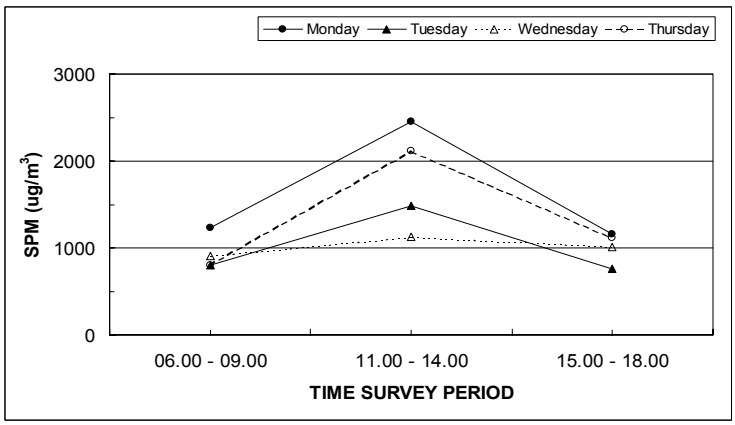


Figure 10-H-2 Distribution of SPM at BA-2

Simulation of Air Quality

349. The Ambient Air Quality Model was prepared using Line Track Source Type Gaussian Basis Model.

350. The air quality model simulation used the following data and assumptions:

- Emission Factor

The emission factors for the simulation were adopted from ADB Jakarta Air Quality Impact (2002).

Generally vehicles are divided into four groups: motor cycles, personal cars, light vehicles and heavy vehicles. Also vehicle type can be divided into diesel fueled and gasoline fueled.

Emission factor in 2002 can be categorized as "uncontrolled", which means emission gas cannot be controlled in this time in Indonesia. Now Indonesia has a strategy to control emission gas in order to follow Euro Standard. Euro 4 standard was used as a emission factor in 2012 assuming that controlling emission gas improves under the government management.

- Traffic Volume

Traffic volume was predicted as follows:
Year 2002 7,433 pcu/day
Year 2012 13,383 pcu/day

- Meteorology

The model simulation used wind direction/speed from data of Cengkareng Meteorology Station. Meteorological condition in year 2012 was assumed to be same as that in 2002.

- Road Condition

We assumed road condition does not change between 2002 and 2012, so vehicle speed is assumed not to change.

- Topography

The surrounding location was assumed fairly flat, so the vehicle speed pattern was assumed uniform.

351. Simulation carried out for two scenarios, year 2002 and 2012. The main difference is traffic volume and emission factor. Traffic volume in 2012 is predicted to be larger than 2002, meanwhile emission factor will be decline.

352. The result of model simulation can be described in following figures and summarized as follows:

- Generally growth of traffic volume leads increasing air pollution.
- As shown in Figures, NO_2, CO and THC (Total Hydro Carbon) may be easy to spread. Meanwhile PM10 (which chemical behavior is similar to SPM) and SOx may affect near the source point.
- Concentration of THC was simulated to exceed Environmental Standard (160 μ g/Nm^3) within 20m from the road.
- Concentrations of NO_2 and CO were simulated below the Standards.
- Generally speaking, impact by road traffic can affect within around 100m from the road.

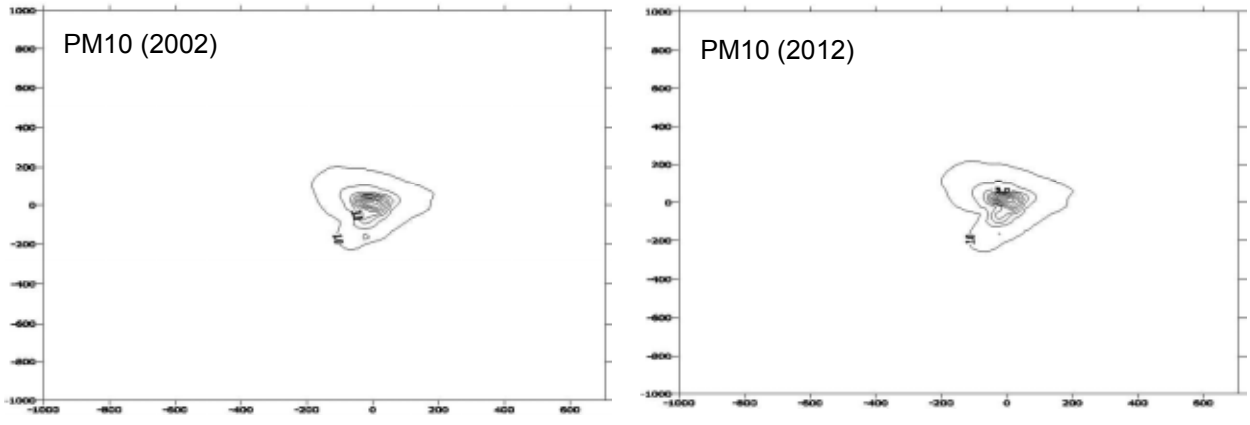


Figure 10-H-3 Distribution of Simulation Result (PM10)

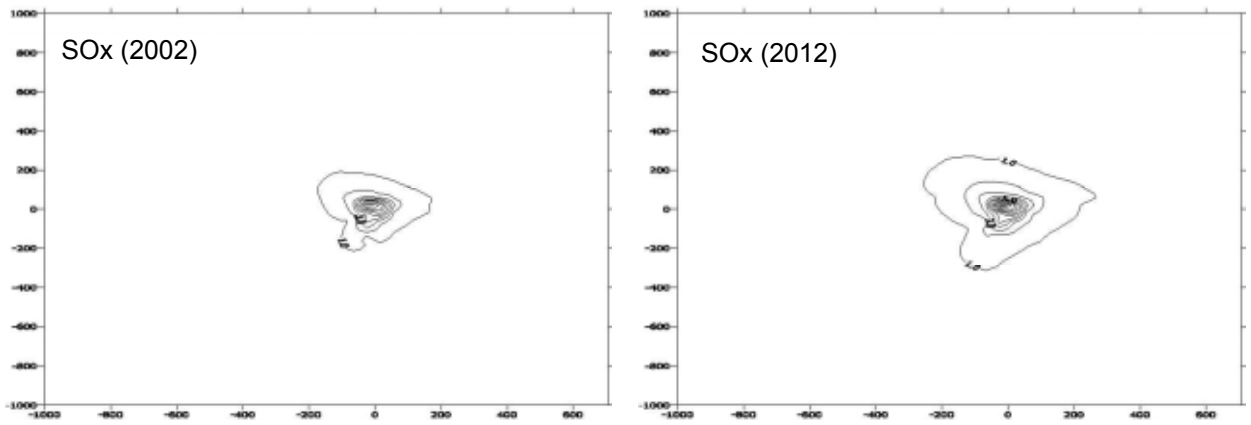


Figure 10-H-4 Distribution of Simulation Result (SOx)

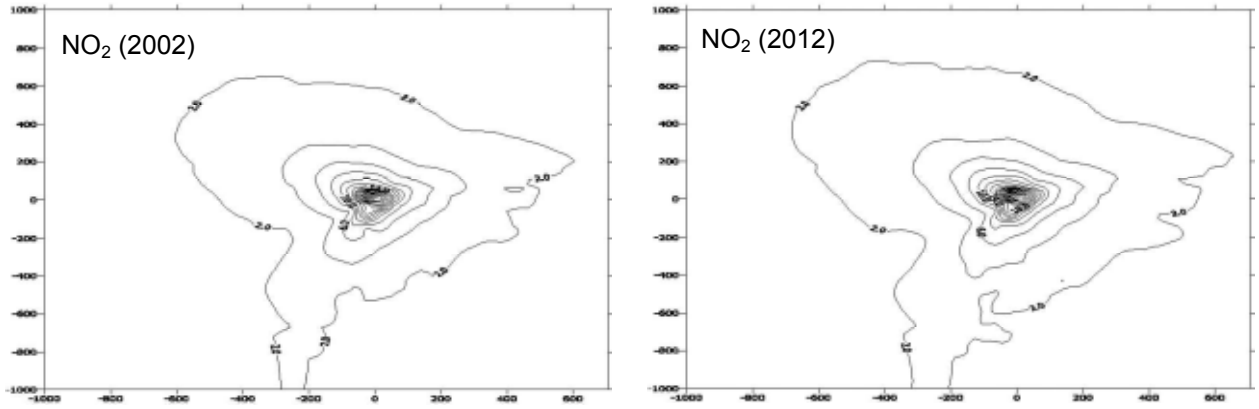


Figure 10-H-5 Distribution of Simulation Result (NO_2)

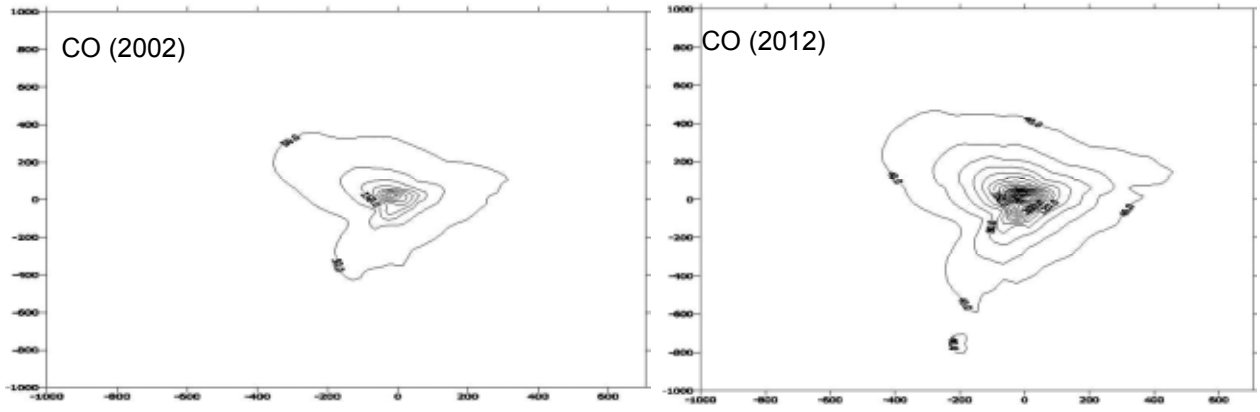


Figure 10-H-6 Distribution of Simulation Result (CO)

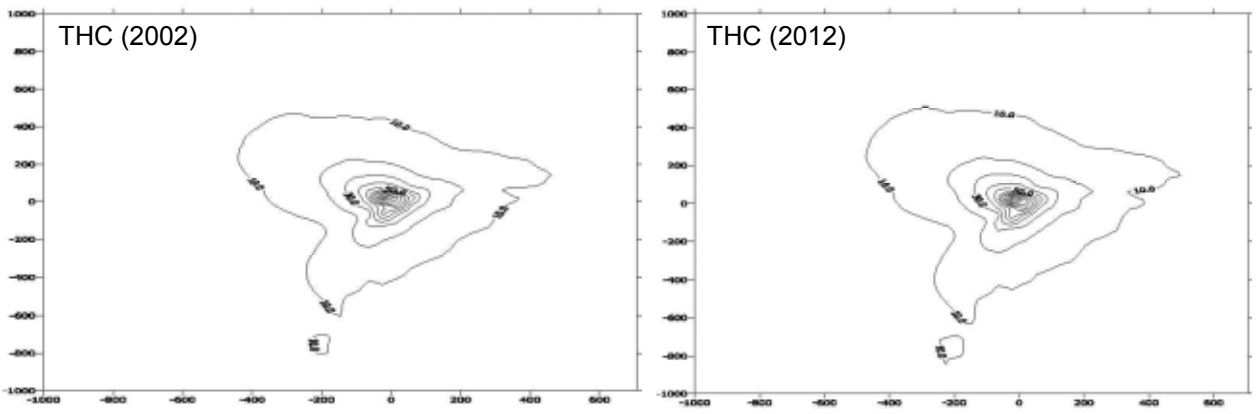


Figure 10-H-7 Distribution of Simulation Result (THC)

iii) Noise and Vibration

353. Noise and vibration survey was carried out at the same location of air quality sampling.

354. Summarized result of Noise survey is shown in Table 10-H-5.

Table 10-H-5 Summarized Result of Noise level

Location		Noise Level (dBA)
BA-1 (Grenyang, *Desa* Argawana)	Min-Max (Avg)	46.8 – 69.1 (60.4)
BA-2 (*Desa* Bojonegara)		63.1 – 79.4 (68.3)
BA-3 (*Desa* Terate)		51.8 – 75.3 (65.2)
Environmental Standard		70

Source: Field Survey by the JICA Study Team in 2003

355. Compared among three locations, generally noise level in BA-2 (Desa Bojonegara, near the public facilities) was higher than other locations. This aspect was similar to that of air quality.

356. Noise level was simulated using Line Track Type Source Model. Noise level model simulation used the following data and assumptions:

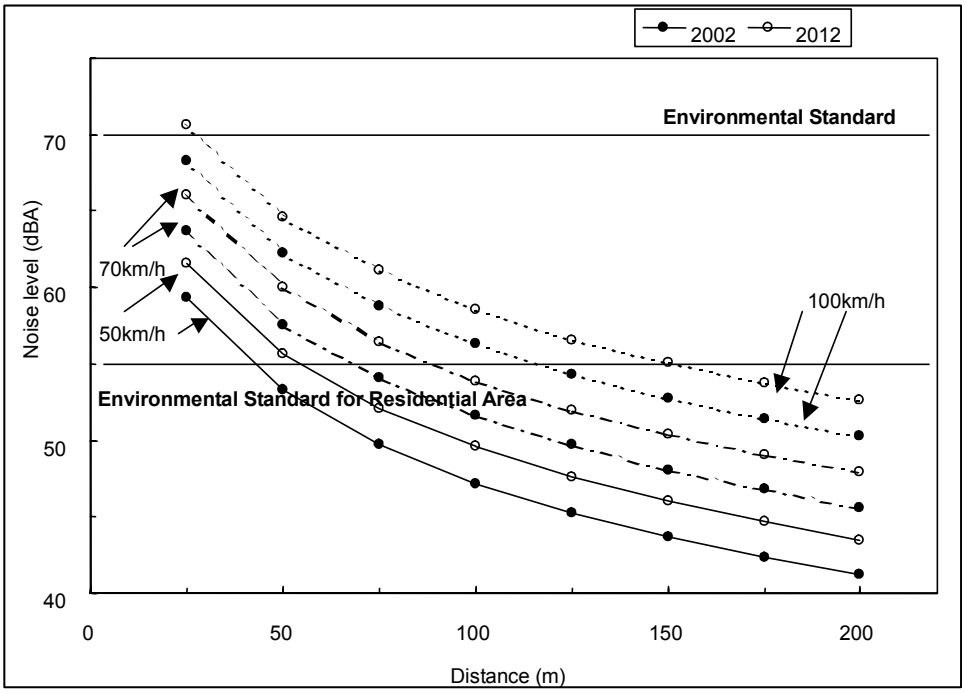
- Traffic Volume

Condition of traffic volume was assumed same as air quality simulation.

- Vehicle Speed

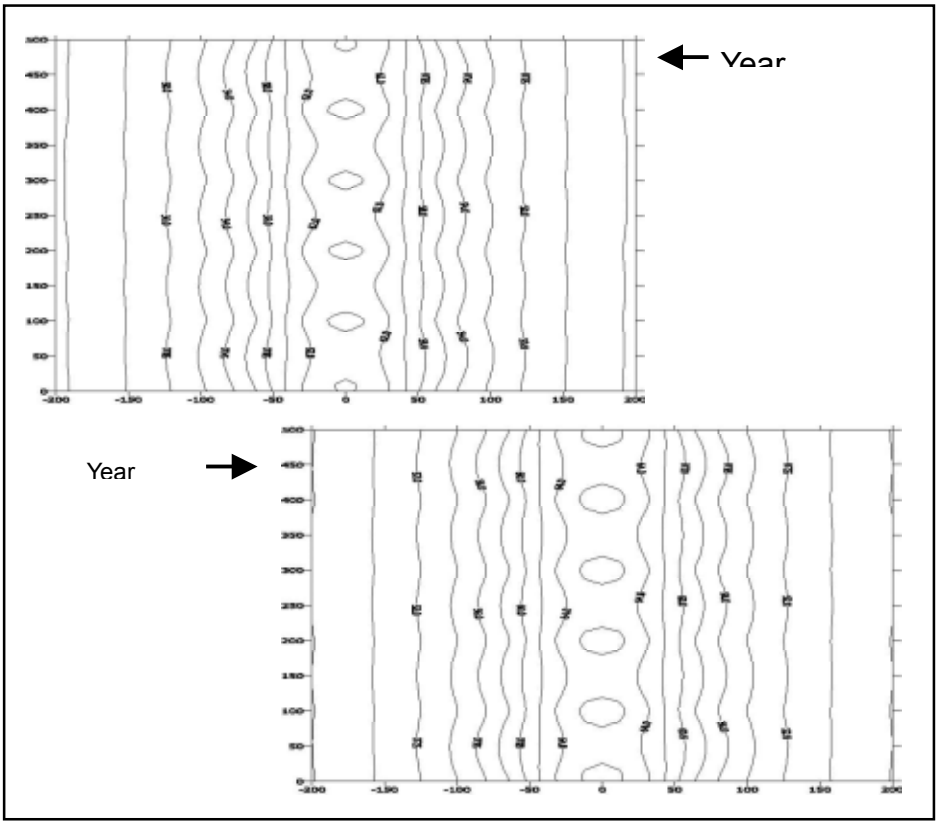
Noise level was simulated with making vehicle speed change to several level, from 50km/h to 100km/h.

357. Figure 10-H-8 shows difference of noise level caused by the distance from road based on the simulation. And Figure 15-11 shows the distribution of result of simulation in case that vehicle speed was 70km/h.



Source: Field Survey by the JICA Study Team in 2003

Figure 10-H-8 Simulated Noise Level in Case Several Speed



Source: Field Survey by the JICA Study Team in 2003

Figure 10-H-9 Distribution of noise level in Case of 70km/h of Vehicle

358. The results of simulation for noise level can be summarized as follows:

- Noise level is depend on traffic volume and vehicle speed.
- Compassion with Environmental Standard (< 70dBA), noise level over 25m from road was simulated below the Standard. How ever, noise level close the road side within 50m will exceed the Standard for Residential zone (< 55dBA).
- Noise level in year 2012 was predicted around 3dBA higher than that in 2002.
- Noise level was simulated below the Standard (< 55dBA) further from 80m, if vehicle speed is kept below 70km/h.

iv) Natural Environment

359. Existing Flora and Fauna are summarized in Table 10-H-6 and Table 10-H-7.

360. Briefly speaking, flora and fauna can be categorized as common species, protected, rare also endangered species do not exist. Dominant flora can be categorized as plantation such as Rice, Mango, Fauna is mainly domestic animals such as Cow.

Table 10-H-6 Existing Flora at Bojonegara District and Kramatwatu District

Local Name	English Name	Scientific Name
Swamp/Beach Ecosystem		
Daun Katang-Katang	-	*Ipomoea pescaprae*
Beluntas	-	*Plucea indica*
Jeunjing	-	*Albazia falcata*
Melinjo	-	*Gnetum gnemon*
Akasia	-	*Acacia auriculiformis*
Angsana	-	*Pterocarpus indica*
Duranta	-	*Durant erecta*
Hanjuang	-	*Cordyline fructicosa*
Plantation Ecosystem		
Padi	Paddy	*Oryza sativa*
Mangga	Mango	*Mangifera indica*
Asam	-	*Tamarindus indica*
Lamtoro	-	*Leucaena glauca*
Kelapa	Coconut	*Cocos sp*
Nangka	Jack Fruit	*Arthocarpus integra*
Pepaya	Papaya	*Carica papaya*
Randu	-	*Ceiba petandra*
Jati	Teak Tree	*Tectona grandis*
Singkong	Casava	*Manihot esculenta crantz – utilissima*
Alpukat	Avocado	*Persea Americana*
Bambu	Bamboo	*Bambusa sp*
Pisang	Banana	*Musa paradisiaca*
Rambutan	-	*Nepelium lapaceum*
Srikaya	-	*Sanga muricata*
Jambu Batu	Guava	P*sidium guajava*
Kacang Tanah	Peanut	*Phaseolus sp*
Kacang Panjang	Long Beans	*Vigna sinensis*
Kacang Hijau	Green Beans	-
Jagung	Corn	*Zea mays*
Terung	Eggplant	*Solamun sp*

Cabe	Chilli	*Capsicum* anuum
Cabe Rawit	Small Chilli	*Capsicum frutescen*
Jambu Air	Rose Apple	*Syzygium aqueum*
Ubi Jalar	Sweet Potato	*Ipomoea batatas poir*
Jeruk	Orange	*Citrus sp.*
Durian	Durian	*Durio zibethius*
Sawo	-	*Achras zapota*
Nanas	Pineapple	*Nanas variegata*
Salak	-	*Salacca edulis reinw*
Duku	Buff-skinned fruit	-
Jambu Mete	-	*Anacardium occidentale*
Kopi	Coffee	-
Kapuk	Cotton	

Source: Field Survey by the JICA Study Team in 2003

Table 10-H-7 Existing Fauna at Bojonegara District and Kramatwatu District

Local Name	English Name	Scientific Name
Mammal		
Sapi	Cow	*Bos taurus*
Kerbau	Buffalo	*Bubalos bubalis*
Kambing	Goat	*Capra sp*
Kucing	Cat	*Felis sp*
Kalong	Bat	*Pteropus vampyrus*
Bird/ Aves/Iinsect		
Ayam	Chicken	*Galusnb galus*
Angsa	Goose	*Nefopus sp*
Itik	Duck	*Anas sp*
Burung Gereja	-	*Passer montanus*
Kutilang	Thrush	*Pycnonotus aurigaster*
Perkutut	Turtle Dove	*Geopelia striata*
Kuntul	Egret, Heron	*Bubulcus Ibis*
Walet	Swallow	Colocalia esculenta
Layang-layang	-	*Hiruda tahitica*
Kupu-kupu	Butterfly	*Eurema sp. Papilio sp*
Capung	Dragon fly	*Otherium*

Source: Field Survey by the JICA Study Team in 2003

v) Social Environment

361. The access road from/to planned Bojonegara new Port and Ciregon Interchange occupies of around 16km, and consists of 2 districts, 5 villages:

- Kramatwatu District, consist of: *Desa* Terate
- Bojonegara District, consist of: *Desa* Margagiri, *Desa* Argawana, *Desa* Bojonegara, *Desa* Mangkunegara

362. Demographical condition of each village is shown in Table 10-H-8.

Table 10-H-8 Number of Area, Population Household and Population Density

Name of Village	Area (ha)	Number of People	Number of House	Population Density (Person/ha)
Terate	953.2	4,967	1,084	5
Margagiri	370.5	4,968	1,162	13
Argawana	426.5	5,325	1,321	13
Bojonegara	387.0	4,077 (*)	1,079	11
Mangkunegara	162.0	2,877 (*)	1,120 (*)	18

Source: Monographic Data from each Village, 2000
(*) : Data 2003

363. Average of population density was around 10 persons, this value was almost same as Bojonegara Port project Site like *Desa* Pulo Ampel, Margasari.

364. According to the population structure based on education age, the ratio of education age upper 19 years in Terate was 34.2%, 58.0% in Margagiri, 55.7% in Argawana, 50.2% in Bojonegara and 10.7% in Mangkunegara.

365. Population structure of Desa Terate showed difference from other villages. Number of child age in Terate may bigger than others, and sex ration is lower. It means labor force of Terate is low in comparison with other village.

366. Table 10-H-9 shows people structure based on livelihood. Dominant work type in *Desa* Terate and Argawana was farmer, 62.5% of labors in Terate and 50.1% in Argawana occupied farmers. Meanwhile, Desa Margagiri and Mangkunera occupied as Fishermen.

Table 10-H-9 People Structure Based on Livelihood

TYPE OF LIVELIHOOD	TERATE		MARGA GIRI		ARGAWANA		BOJONEGARA		MANGKUNEGARA	
	PEOPLE	%	PEOPLE	%	PEOPLE	%	PEOPLE	%	PEOPLE	%
1. Civil Government Worker	25	1.40	93	8.09	12	0.50	77	3.38	1	0.10
2. Military	-	-	1	0.09	1	0.04	1	0.04	1	0.10
3. Freelancer/ Private worker	-	-	101	8.79	262	10.84	293	12.86	10	0.95
4. Entrepreneur/ Trader	95	5.30	53	4.61	-	-	562	24.66	225	21.47
5. Farmer	1,120	62.50	-	-	1,211	50.12	317	13.91	172	16.41
6. Skilled Worker	216	12.05	53	4.61	209	8.65	547	24.00	32	3.05
7. Retired	6	0.33	31	2.70	11	0.46	15	0.66	-	-
8. Fisheries	315	17.58	817	71.11	695	28.77	467	20.49	597	56.97
9. Services	15	0.84	-	-	15	0.62	-	-	10	0.95
TOTAL	1,792	100.00	1,149	100.00	2,416	100.00	2279	100.00	1,048	100.00

Source: Monographic Data from each Village, 2000

367. The education level is important indicator to evaluate local social condition. Greater parts of educational level was Primary School Graduates, senior high school level occupied 0.8 to 6.3%.

368. There are total 32 educational institutions, half of them were religious private school like *Madrasah*.

369. Most of the people in the Study Area are Moslems, they are very devout. As shown above, they have many religious schools, and also have 51 Mosque/Mushola.

370. Most of them were born in the Study Area, they are Bantenese. Few people moved in the area for opening new business or working for nearby factories.

371. One clinic exists in *Desa* Margagiri, one pharmacy exists in *Desa* Bojonegara.

372. Land use can be distributed in Table 10-H-10.

Table 10-H-10 Distribution of Land Use

No.	Type of Land Use	TERATE	MARGA GIRI	ARGAWANA	BOJONEGARA	MANGKUNEGARA
1	Road/ Street (Km)	0.30	3.50	5.20	3.00	4.00
2	Cultivated Area (Ha)	708.36	219.10	102.00	275.00	2.23
3	General Structrure (Ha)	-	-	-	11.00	9.00
4	Pond (Ha)	191.25	17.65	-	62.00	-
5	Residential Area (Ha)	29.69	30.87	56.00	32.00	45.42
6	Green Area (Ha)	-	-	12.00	4.00	-
7	Cemetery/ Grave Yard (Ha)	3.82	8.00	5.00	1.51	5.00
8	Others (Ha)	-	-	6.00	-	-

Source: Monographic Data from each Village, 2000

373. The above table shows that the cultivated area occupies most part of *Desa* Terate, Margagiri, Argawana and Bojonegara. Meanwhile, the residential area occupies the most part of *Desa* Mangkunegara.

2) Initial Environmental Examination (IEE)

374. The results of IEE can be summarized in the following Table.

Table 10-H-11 Results of IEE (Bojonegara Access Road)

Type of major Activities / Environmental Factors		Overall Evaluation	Construction Phase		Operation Phase		
			Land Acquisition/ Preparation	Operation of Construction Equipment	Spatial Occupancy	Operation of Vehicles	Accumulation of People/Goods
1. Social Environment							
1	Resettlement	-B	○				
2	Economic Activities	+C		○			○
3	Traffic and Public Facilities	-C		○		○	
4	Split of Communities	D					
5	Cultural Property	D					
6	Water Rights and Rights of Common	D					
7	Public Health Condition	D					
8	Waste and garbage	-C	○				○
9	Hazards (Risk)	-C				○	
2. Natural Environment							
10	Topography and Geology	D					
11	Soil Erosion	D					
12	Groundwater	D					
13	Hydrological Situation	D					
14	Coastal Zone	D					
15	Fauna and Flora	D					
16	Meteorology	D					
17	Landscape	D					
3. Pollution							
18	Air Pollution	-C		○		○	
19	Water Pollution	-C	○				
20	Soil Contamination	D					
21	Noise and Vibration	-C		○		○	
22	Land Subsidence	D					
23	Offensive Odor	D					

Note:
A: Serious impact is predicted.
B: Some impact is predicted.
C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).
D: No impact is predicted.
+: Positive impact -: Negative impact

a) Social Environment

i) Resettlement

375. Basically Access road is planned to use existing road, so scale of land acquisition can be kept to a minimum.

376. Existing road is located along the farmland, however, some area adjoins residential zone. Hence, even dominant construction work is widening, some residents may be oppressed or required to move out.

377. Also many public facilities, such as school or Mosque, exist along the roadside. These facilities shall be relocated appropriate location by the developer.

ii) Economic Activities

378. If farmers shave to release their land, it may affect negative impact. Meanwhile construction activity may bring job opportunities. And road construction lead to improve physical distribution, to accelerate business activity. As a result, positive impact caused by accelerating business activity will be expected.

iii) Traffic and Public Facilities

379. Access road construction is planned to use existing road where many public facilities exist. Widening road has possibility to bear down on these facilities and people during construction phase. Appropriate design to protect people crossing the road may be required.

iv) Waste and Garbage

380. Waste and garbage management is individually carried out by each household, public management is poor system. Much construction/demolition waste may generate during construction phase. Growth of business activity may also generate waste. Hence Strengthening waste/garbage management will be one of first priority. And recycling construction waste is important to consider environment.

v) Hazards (Risk)

381. Increasing traffic volume may cause traffic accident. Especially some school, Mosque and other facilities are located close to the roadside so that appropriate design to protect people crossing the road may be required.

b) Pollution

i) Air Pollution

382. In the current condition, air quality is good, concentrations of CO, NO_2 and SO_2 were below the Environmental Standard. According to the result of simulation, additional air pollution did not predicted, negative impact of future traffic condition caused by Access Road Project may not be big.

383. However close to the roadside, within 20m from there, emission gas from vehicles still damage to air quality. Especially emission gas can give serious damage to residents.

ii) Water Pollution

384. During construction phase, reclamation, filling and pavement activities may generate turbid water. If drainage is not controlled, discharge to the canal directly, turbid water may damage to the residential zone and farmland.

iii) Noise and Vibration

385. Existing noise disturbance can be explained that noise level exceeds sometimes, when heavy vehicles pass. Generally speaking, serious noise disturbance does not occur.

386. Even though traffic volume increase as shown in the simulation toward year 2012, predicted increase of noise level will around 3dBA. However boundary of roadside, within 25m, noise level will exceed Environmental Standard for residential zone (< 55dBA).

387. If planned vehicle speed can be kept below 70km, noise disturbance can not spread 80m further from the road.