PART III

GREATER SURABAYA METROPOLITAN PORTS DEVELOPMENT PLAN

9 SHORT-TERM IMPROVEMENT PLAN

The study works out a short-term improvement plan to meet shipping and related transport demand in the coming eight-year period or between 2008 and 2015. In the period, existing problems should be clearly addressed since increased seaborne traffic with larger fleets is anticipated.

For short-term improvement planning, the study put the highest priority on the existing West Surabaya Access Channel since it is the biggest bottleneck in the regional port system. The study also identified the urgent rehabilitation need of Jamrud Terminal, Tg. Perak. Lastly, there is some urgent improvement/development needs for the land access network in relation with Suramadu Bridge and others. It should be noted that the Lamong Bay Container Port Project which would be the largest capital investment during the period is out of the study's scope, particularly for project preparation.

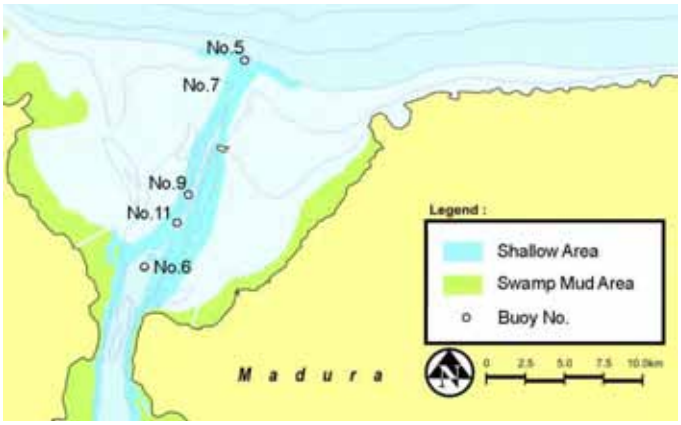
9.1 Seaborne Traffic and Capacity at Madura Strait

The access channel in Madura Strait is an indispensable access to Tg.Perak and Gresik port. This channel has contributed to the regional socio-economic development for a long time. However, recently the maritime activity is developing and it has manifested an inherent disadvantage. It is difficult for the large ships to pass through the access channel, and these ships sometime are waiting in front of the access channel. Therefore, this channel will not be able to meet the requirement of competitive maritime activities.

a. Existing Situation in the Access Channel

The existing access channel is narrow and shallow, especially, from buoy No.5 to No.6 (approximately 16km) as shown in the following figure, the water depth is around 10.5m and the width is around 100m. In this section, the large ships guided by pilot services have to carefully pass, and the travel speed is only 5-6 knots. Some ships with drafts more than 10m have to wait for the high tide. Nowadays, approximately 25-30 large ships (actual draft around 10m) per day are coming to this channel. It means that 62-74% of the ship calls in Surabaya port are affected by the channel's limitations. Although this section is narrow, the large ships can pass through both directions by pilot navigation. For this reason, traffic congestion apparently is not so serious, but this section doesn't have the capacity for both directions, and it will be a bottle neck for passing seaborne traffic in the near future.

Figure 9.1.1 Existing Situation in the Access Channel



b. Trend of Seaborne Traffic Volume

The following table shows the estimated seaborne traffic volumes passing through this access channel. The traditional ships are not passing through the deeper part between buoy No.5 and No.6, and this table is excludes them. These traffic volumes will increase approximately 1.3 times from 2005 to 2015, and two times from 2005 to 2030. Particularly, the number of container ships will account for around 30% of all traffic, and the size of container ships is increasing nowadays. Therefore, it is necessary to improve the capacity (depth and width) of this channel in the near future.

Table 9.1.1 Seaborne Traffic Volume Passing through the Access Channel

	Shipcalls	Traffic Volume*		
	Present (2005)	Present (2005)	2015	2030
Container	4,018	8,036	12,600	20,300
Non-Container	Tg.Perak: 4,514 Gresik: 3,094	15,216	18,200	27,400
Passenger	1,506	3,012	2,020	2,000
Tanker	1,557	3,114	5,800	8,200
Ships to/from Private Jetties**	90	180	180	180
Total	14,779	29,558	38,800	58,080

*: "Traffic Volume" is twice volume of shipcalls, for counting incoming and outgoing.
These data does not including traditional ships which are to/from Gresik port and Kalimas.
**: The ship sizes to/from private jetties are 30,000 ton based on the interview with related company. And, the total cargo throughputs of these private jetties were 1.8 million tons.
Source: JICA Study Team

c. Required Access Channel Depth

To understand the required access channel depth, the study compared the calling container ship's sizes in Surabaya port with the actual draft of container ships in surrounding countries as shown in the following table. As projected in Table 7.3.10, the ship calls of estimated large scale container ship (4,000 – 5,999 TEU) will be 147 in 2015. In the case of full loading, it will be necessary to prepare 14m water depth. On the other hand, the actual drafts of a 3,700 TEU ship as shown in the following table are less than 12m. 6,200 TEU ship can call the access channel with 12 m draft. There will therefore be a necessity for the access channel to prepare 12m water depth, at least.

Further, according to the interview with the pilot, some large ships which have an actual draft 10m have to wait for tidal currents in present situation. In the viewpoint of the pilot, the water depth also should be improved a minimum of 12m.

Table 9.1.2 Actual Draft of Container Ship in Foreign Countries

Port	Actual Draft	
	3,700 TEU	6,200 TEU
Tokyo	10.70m	10.75m
Kobe	9.28m	10.95m
Nagoya	9.66m	-
Sizuoka	-	12.08m
Shanghai	8.70m	-
Hong Kong	10.50m	-
Singapore	11.15m	12.08m
Rotterdam	11.82m	12.04m

Source: JICA Report "The Study for Development of the Greater Jakarta Metropolitan Ports in the Republic of Indonesia"

d. Required Access Channel Width

For determining adequate access channel width, two internationally recognized standards, i.e., PIANC Guidelines and Japan's Standards are analyzed in this section.

PIANC Guidelines: The Permanent International Association of Navigation Congresses (PIANC) has defined a concept design method for approach channels. In addition, an analysis has been made of existing navigation channels in the world and their performance with regard to safety. PIANC provides guidelines for the width of such two-way access channels, based on the maximum beam of the width of the design ship. The bottom width (W) of the two-way approach channel is defined by:

$$W = 2w_{bm} + 2\sum_{1}^{n} w_i + w_{br} + w_{bg} + w_p$$

W_{bm} : basic maneuvering lane

W_i : additional width dependent on local conditions

W_{br} : additional width for bank clearance port side

W_{bg} : additional width for bank clearance starboard side

W_p : additional width for passing distance for two-way traffic

The parameter for the local condition and factors was assumed 7.4*B (B is the width of design ship) in the Detec Study[1]. The shipcalls of Panamax size (2,500 – 3,999 TEU) and Post-Panamax size (4,000 – 5,999 TEU) will be 589 and 147 in 2015, respectively. Based on the parameter of Detec Study, the required channel widths are estimated as below.

[Panamax Type] : 7.4 * 32.3 = approximately 239 (m)

[Post –Panamax Type] : 7.4 * 39.4 = approximately 292 (m)

In the case of general cargo (30,000 DWT Class), the required channel width is reduced to:

[General Cargo] : 7.4 * 27.8 = approximately 204 (m)

[1] The DETEC Study aimed for a solution regarding the necessary upgrading of the western access channel to Surabaya port. This study was commissioned by PELINDO III and was partly funded by the Dutch Ministry of Economic Affairs in 2001.

The DETEC Study recommended that the channel be improved by a width of 200m and a water depth of more than 12m.

Technical Standard of Japan: In the technical standard of Japan, the minimum requirement for channel width will be the maximum ship length (Loa) when the channel distance is not so long. Therefore, the required channel width in 2015 is around 275 – 294m in the case of Panamax type and Post-Panamaxt type. In addition, this standard recommends a margin width (0.5 loa or more) when the access channel is congested with seaborne traffics such as the Surabaya west channel.

Although the existing channel is managed with the width of 100m, the average Loa (132m) to/from Tg.Perak is already longer the standard, meanwhile the ship size of container is rapidly increasing in recently. Consequently, it seems that the management of both direction crossing will be serious in the near future.

Required Channel Width: As mentioned above, in the case that the design ship size set is Panamax-Type or Post Panamax Type, the channel width will be required to be around 300m desirably. However, the container ship calls of these size will be approximately 2 (shipcall / day) only in 2015. Therefore, it seems that the channel expansion to 200m will be able to accommodate most of the channel traffic in the near future.

e. Access Channel Capacity

Ship Interval: Ships should have their blockage area around themselves from a traffic management viewpoint. The blockage length is said to be 8 to 10 times longer than ship length (L) at the minimum, and the study assumes 10 L as the minimum ship interval distance in this channel. Ship interval distance should be 20L for night navigation from the viewpoint of safety. The interval times are assumed as shown in the following table.

Table 9.1.3 Interval Time of Ship in Access Channel

	Interval Length		Interval Time*	Ships/day**
Daytime	10L	1,320m	6.1 Min	108 Unit
Nighttime	20L	2,640m	12.2 Min	60 Unit
Total				168 Unit

*: Estimated using average Loa (total GT / shipcalls in Tg. Perak) and ship speed (7 knot).
**: Daytime and nighttime are assumed 12 hours each. This value means one direction.
Source: JICA Study Team

Channel Capacity in Present Situation: From the viewpoint of technical standard, the existing channel has capacity for one way traffic only. Under this case, the cannel capacities for the year are estimated based on the interval time and safety factors of 1.5 for bad weather and accidents as below.

[Existing Capacity]: 168* 365 / (1.5 * 1.5) = approximately 27,000 (ships / year)

It clearly indicates that the existing seaborne traffic volume (29,558 in 2005) already exceeds the capacity (27,000). In fact, this channel is deliberately managed by the pilot, allowing both directional traffics in the case of small ships. Their service is critical because the channel is considered a black spot with more than 20 sunken ships and some shallow shoals nearby the routes. Even at present, the access channel suffers from traffic capacity and navigation safety problems.

f. Required Access Channel Condition

The seaborne traffic demand and the access channel capacity are shown in the following table. In the case of the water depth 12.0m and width 200m, this capacity will be able to accept the seaborne traffic volume in 2015. However, this case will not satisfy the seaborne traffic in 2030. Even the case of the depth 14.0m and width 300m, the channel capacity will not be able to meet demands in 2030 despite of providing better services to larger container vessels like Panamax-type and more.

To relieve this channel capacity issue, therefore, it is rational that a new container port will be constructed outside the access channel and accommodate considerable container traffic particularly large sized. In this case, the channel condition of the water depth 12.0m and width 200m is sufficient during the planning period towards 2030 while some thousand ship calls at a new container port.

Table 9.1.4 Seaborne Traffic Demand and Cannel Capacity

	Channel Condition		Access Cannel Capacity (ships / year)			Seaborne Traffic Volume (ships / year)		
	Depth	Width	2005	2015	2030	2005	2015	2030
Existing Condition	10.5m	100m	27,000	-	-	29,558	38,800	58,080
Required Condition	12.0m	200m	54,000	48,400*	47,100*			
	14.0m	300m	54,000					

*: When Panamax-Type and Post Panamax Type ships are passing through the channel, one way operation must be adopted, resulting in some reduction in channel capacity. Such capacity reduction is estimated by 10% in 2015 and 13% in 2030, respectively.
Source: JICA Study Team

9.2 Appreciation of the Access Channel

1) Natural Conditions from the Survey

In order to understand the natural conditions in Surabaya port area, the following surveys were performed:

In-situ survey:

i) Tidal Level measurement at three locations in the Madura Strait,

ii) Bathymetric surveys at the Access Channel from Buoy No. 5 to Buoy No.6, the Madura Strait section and the shallow area near Buoy No.8,

iii) Current measurement at Buoy No.6 and Buoy No.8,

iv) Sea bottom material survey, and

v) SS density measurement at the Sembayat Bridge in the Solo River.

Other survey:

vi) Collection and analysis of wave data for the recent 5 years.

The above surveys enabled the following analyses:

- Discussion on general improvement plans of the Surabaya West Access Channel
- Calculation of the capital dredging volume related to the channel improvement plans.

- Calculation of the capital dredging volume to remove the shoals near Buoy No. 8.
- Simulation on sedimentation phenomena around the Channel and assessment of sedimentation quantity, or maintenance dredging volume.
- Verification of the tidal condition for the above simulation.

The results of above planning, simulations, calculations and verification are presented hereinafter in the relevant sections.

a. Bathymetric condition

General features of bathymetric conditions along the Surabaya West Access Channel are summarized as follows:

- According to the results of bathymetric survey of this time, the depths of the Outer Channel are mostly CDL -10 m to -12 m. Some areas are surveyed at about -9.3 m due to sedimentation. Periodical maintenance dredging secured the water depth of -10.5 m and the width of 100m and thus some sedimentation is observed.
- Channel width at water depth of -10 m is around 100 m.
- Gradient of side slope is around 1 on 50 to 100.

b. Soil condition

Soil condition survey was not performed around the Surabaya Access channel in this study.

However, from the past reports and the known soil conditions at the surrounding areas, objective soils for dredging can be presumed as follows:

- At the Outer Channel approximately from Buoy No.5 to Buoy no.6, most of bottom soils up to a certain depth (say -15m) consists of soft silt or clay except southern small part where bed rock exists under a few meter of soft silt or clay layer.
- At the Inner Channel approximately between Socah and Gresik, soils up to a certain depth (say -15m) will be bed rock covered by a few meters of soft silt or clay layer.

c. Tidal condition

The primary features of tidal conditions at P. Kg. Jamuang are shown already in Table 2.1.3. The tide has characteristics of *diurnal tide*, or K1, O1 and P1 components are dominant in the Java Sea.

The tidal components at three points, which are measured in this survey, are as shown in Table 9.2.1. It indicates that the *semi-diurnel* effect, or M2 and S2 components, increases at Sukolilo near the Suramado Bridge in the East Channel.

d. Tidal current condition

Current velocities are measured at two points in the Channel, namely at Buoys No.6 and No.8, locations of which are shown in Figure 9.2.1. At each point of measurement, current speed and direction are measured at two depths, namely 2m below the seawater surface and 2m above the seabed. The result of measurement is presented in Table 9.2.2.

Table 9.2.1 Tidal Components Measured at the Madura Strait

Location	MSL (cm)	Tidal Components (cm) and Phase (degree)								
	Z0	M2	S2	N2	K2	K1	O1	P1	M4	MS4
Tg. Bulpandan	116.7	**1.0** 238	**8.9** 337	1.5 161	2.1 337	**79.6** 308	**27.2** 266	26.3 308	0.8 234	1.2 294
Socah	133.6	**15.4** 328	**16.5** 334	0.4 367	3.8 334	**70.1** 313	**18.3** 266	23.1 313	1.5 242	4.0 289
Sukolilo	161.6	**42.4** 318	**24.5** 346	12.6 301	5.6 346	**70.4** 304	**24.3** 268	23.3 304	1.0 208	3.5 234

Note: $Z_0=M_2+S_2+K_1+O_1$
Source: JICA Study Team

Figure 9.2.1 Locations of Current Measurements, Bottom Material Survey, and SS Density Measurement

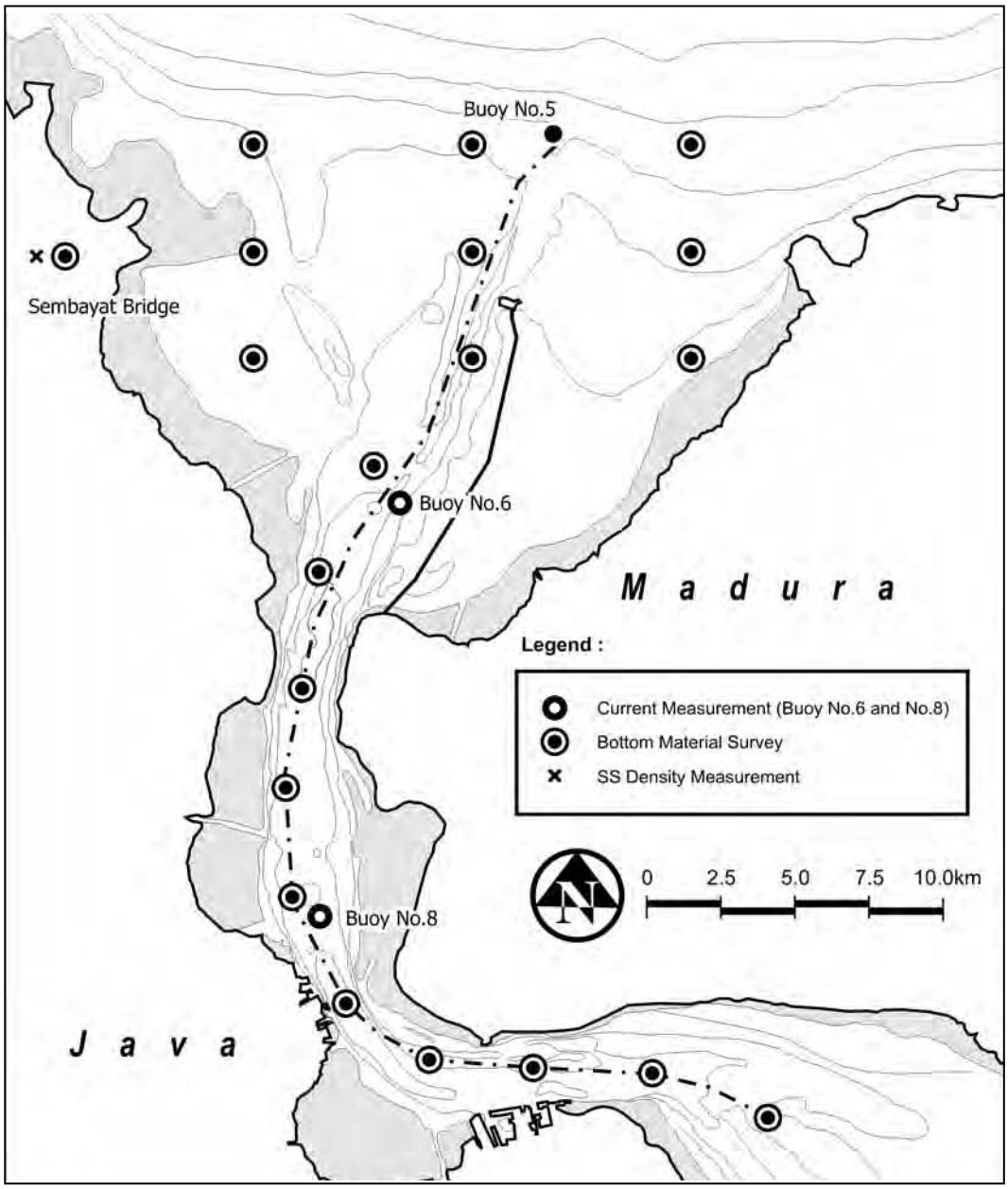


Table 9.2.2 Current in the Outer and Inner Channel of the Surabaya West Channel

Location	Frequency of Speeds (cm/s) in %				Remarks
	0–70	70-140	140-210	210-	Direction & Max. Speed(cm/s)
Buoy No.6 Upper	99%	1%	0	0	N/NE , S/SW 93.9
Lower	99%	1%	0	0	N/NE , S/SW 82.9
Buoy No.8 Upper	43%	26%	23%	8%	NW , NE 279.1
Lower	58%	19%	16%	7%	NW , NE 271.3

Source: JICA Study Team

The above current measurement revealed the following important facts:

- At Buoy No.6 in the Outer Channel, where the width of the Strait is relatively wide, the current speed reaches at a maximum speed of 1.9 knots. This figure is considered to be rather high and careful operation of ships is required for their safe navigation in the narrow channel. It is fortunate that the direction of the current is almost parallel to the orientation of the channel.
- On the other hand, at Buoy No.8 in the Inner Channel, where the width of the Strait is narrow, the current speed becomes very high, reaching a maximum speed of about 5.6 knots (271.3 - 279.1cm/s) both on the surface and bottom. This speed is perilous for navigation of ships. The ships at anchor may be drifted due to action of this treacherous current.

e. Wave Condition

First, wave data are collected for the past 5 years at the point of Latitude 5.0 degrees South and Longitude 112.5 degrees East, which are computed by means of "*the Global Wave Hindcast Method*" from the Japan Meteorological Agency. The result is already presented in the section 2.1, 3), b.

Next, these offshore deep water waves are converted to waves at a water depth of CDL -15m, utilizing the conversion method in "Technical Standards and Commentaries for Port and Harbor Facilities in Japan." These data are applied to siltation simulations and design calculations of port facilities.

Wave distribution at the mouth of the Surabaya West Access Channel is shown in Table 9.2.3 below.

Table 9.2.3 Wave Height Distribution off Surabaya West Channel (at -15m depth for 5 years from 2001 to 2006)

Item	Wave Height Class							Wave Direction
Wave Height (m)	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	West to north-west in the rainy season (November to April) East in the dry season (May to October)
Occurrence Probability (%)	58.2	25.1	11.8	3.9	1.0	0.1	0.01	

Source: JICA Study Team

The highest wave calculated at the entrance area of the Channel is 3.5m in height with wave period of 6 seconds during the five years.

Those coastal waves are attenuated gradually as they proceed on the delta southward along the Channel. In the Inner Channel, most of the waves can be considered smaller than 0.5 m, and the effect of the waves on ship operation would be small at the Gresik, Socah and Tg. Perak areas.

f. Bottom Materials

For this study sea bottom materials are sampled at 23 locations as shown in Figure 9.2.1. Among those samples 10 samples are taken from the Surabaya West Access Channel. Those samples are classified by the results of laboratory tests as shown in Table 9.2.4. In general, bottom materials can be mainly classified as mud (very soft cay and silt).

Table 9.2.4 Sea Bottom Materials in Surabaya West Channel

Location	No.	X (deg West)	Y (deg South)	Depth (m)	Kind of Soil
Mouth of the entrance Channel	1	112.71436	6.87686	8.2	Muddy sand
	2	112.71344	6.91033	7.1	Mud
	3	112.71675	6.94541	4.5	Fine sand
	4	112.68673	6.98423	11.3	Mud
	5	112.66814	7.01104	16.0	Mud
Socah	6	112.66050	7.04932	23.0	Muddy sand
Socah	7	112.65986	7.08789	17.5	Mud
Gresik	8	112.66529	7.12700	10.0	Solid clay
Gresik	9	112.67932	7.16163	24.0	Mud
Tg. Perak Port	10	112.70905	7.17839	12.4	Medium sand

Source: JICA Study Team

g. Suspended Solid Density

To estimate the quantity of suspended material carried by the Solo River into the Madura Strait which subsequently causes sedimentation in the West Channel, water samples are taken at the Sembayat Bridge of the Solo River during the rainy season (February 2007) and the dry season (June 2007). Eight water samples in each season are taken at 4 points X 2 depths and measured Suspended Solid (SS) density in laboratory.

The result of the measurement is shown in Table 9.2.5 below. These figures coincide with the past understanding that the SS is between 500ppm and 2,000ppm during the rainy season and 0 and 40ppm during the dry season.

Table 9.2.5 Suspended Solid Density Measured in the Solo River

Season	Date	SS Density (mg/l)	Average SS (mg/l)
Rainy season	16 Feb. 2007	893 1,247 1,066 836 951 1,085 929 1,418	1,053
Dry season	22 Jun. 2007	23 20 15 22 16 28 10 20	19

Source: JICA Study Team

2) Estimated Dredging Volumes by Alternative Plans

a. Capital Dredging at West Channel

The present West Channel has a length of about 16km with a planned depth of 10.5m and width of 100m. In order to exploit the present channel, considerable volume of capital dredging is required as shown in Table 9.2.6. For example, the channel with a depth of 12.0m and a width of 200m requires the capital dredging volume of 6.9 million cubic meters. For

maximum Panamax ships with a channel depth of 14.0m and a width of 300m, the required volume becomes 23.0 million cubic meters. For Post-Panamax ships with a channel size of 16.0m deep and 350m wide, the capital dredging volume is 40.2 million cubic meters.

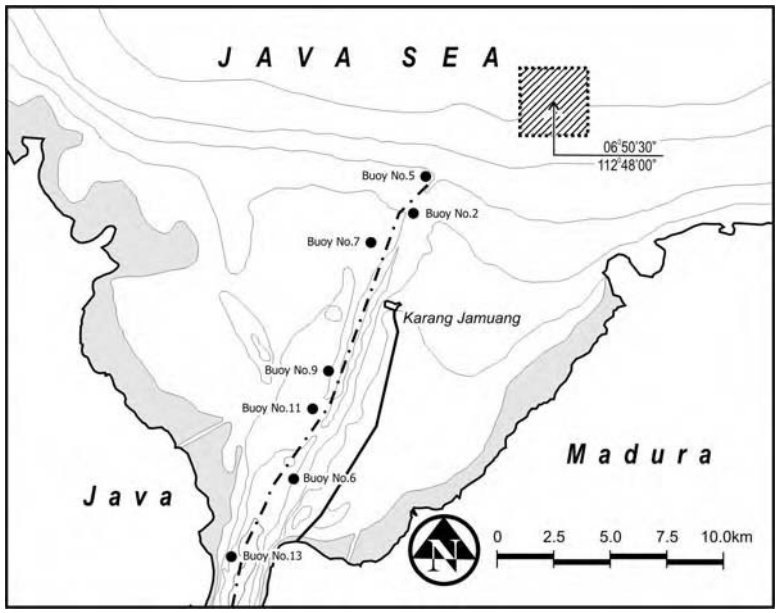
In order to carry out dredging works in the channel while allowing vessel traffic, TSHD is the only dredger suitable to such condition. The dumping site of dredged soils is the designated offshore area, the center of which is located 15 km from the center of the Outer Channel of the West Channel as shown in Figure 9.2.2 below. The dredging work takes about one year, if a TSHD of 8,000 m^3 is introduced from abroad. This size is judged most suitable to the site conditions from technical viewpoints such as dredging depth, and is rather popular in Asia.

Table 9.2.6 Necessary Capital Dredging Volume at Outer and Inner Channels

Case No.	Condition / Design Ship	Necessary Channel Dimensions		Capital Dredging Volume (million m^3)		Remarks
		Depth	Width	Outer Channel *	Inner Channel	
1.	Present Channel before Maintenance Dredging	9.5-12.2	<100m	-	-	Base case (Sept 2005)
2	30,000 DWT	12.0m	200m	6.9	0.011	Panamax ships
3	50,000 DWT	14.0m	300m	23.0	0.93	Max. Panamax ships
4	80,000 DWT	16.0m	350m	40.2	4.9	Post-Panamax ships

Note: "Outer Channel" is from Buoy No. 5 to Buoy No. 6 with a length of 16.22 km.
"Inner Channel" is from Buoy 6 to Buoy Pisang with a length of 21.56 km.
Side slope is designed to be 1:5. No over-dredging is counted.

Figure 9.2.2 Designated Dumping Site of Dredged Soils



Source: JICA Study Team

b. Capital Dredging to Remove Shoals

There are two shoals just beside the channel in front of Gresik Port, which constitute a hindrance for safe and efficient navigation of ships. The volume of the shoals to be dredged up to CDL -12 is about 2 million cubic meters as shown in Table 9.2.7. It is not practical to cut these shoals to a deeper depth, e.g. CDL – 14m or -16m, because the depth of the skirt areas or periphery of the shoals is about -12m.

As the material of the shoals is expected to be stiff, a CSD with a pump capacity of 3,200 PS may be most suitable and economic type of dredger for the job. It takes about 11 months to complete the dredging works. The dredged materials shall be dumped at nearby shallow waters by barges. The dredging work will take about one year.

Table 9.2.7 Necessary Dredging Volume to Remove Shoals beside Inner Channel

Case No.	Condition / Design Ship	Depth		Necessary Dredging Volume (mil m^3)		Remarks
		Shoal A	Shoal B	Shoal A	Shoal B	
5.	Present Shoal	4.3m*	7.8m**	-	-	* Base Case (June 2007) ** Base Case (Sept 1987)
6	15,000 DWT	10m		0.85	0.042	Panamax ships
7	30,000 DWT	12.0m		2.01	0.093	Ditto
8	50,000 DWT	14.0m		NP 2.01	NP 0.093	Max. Panamax ships
9	80,000 DWT	16.0m		NP 2.01	NP 0.093	Post-Panamax ships

Notes: * The bell-shaped Sunken Shoal A is located on the left bank of the Inner Channel at 200 m north of Buoy No. 8 in front of PT Petro Kimia Jetty at Gresik Port.
NP implies that the skirt of the shoal is shallower than the depth, or dredging area/volume becomes very large and impractical.
** The bell-shaped Sunken Shoal B is located on the right bank of the Inner Channel at about 1 km south of Buoy No. 8 in front of PT Smelting Jetty at Gresik Port.

Figure 9.2.3 Dredger Types adopted in the Plan

Trailer Suction Hopper Dredger (TSHD)

Cutter Suction Dredger (CSD)

c. Maintenance Dredging

Sedimentation volume has been assessed by means of computer simulations. The model employed is "*PHRI-JPC Model,*" accounting for "siltation" by suspension, dispersion and settling of sediment particles and mud. Siltation volume has been calculated for two seasons, i.e. the rainy season (November to April) and dry season (May to October). Conditions are divided into two, i.e. usual and unusual conditions. Detail of the simulation method is described in Appendix 3.

The results of assessment of siltation, or required volumes of maintenance dredging, in the West Channel are summarized in the Table 9.2.8 below. It should be noted that these assessment are made for average sea conditions in the past 5 years with the usual condition (energy wave height < 1m) as the basic conditions and the unusual condition (wave height : 2m) for 10 days in a year.

For Case No.2b, the required annual maintenance dredging is estimated to be 2.4 million cubic meters. If a local TSHD of 5,000 cm^3 hopper capacity is introduce, it would take about 7 months to remove this volume. It is noted that a TSHD of this size is owned and operated by P.T. PENGERUKAN INDONESIA (RUKINDO) at Surabaya. Case No.4 takes quite longer period of more than one year, or 18 months, by the same dredger, which implies that the case is not practical to be adopted as regular maintenance works.

Case No.5 is the hypthetical result of simulations in which a new trailing wall is erected on the west side of the channel. The planned new trailing wall has the alignment shown in Figure 9.2.4. Distances between the existing and new trailing walls are between 3.5km and 4.5km. The length of the new trailing wall is 15.3km in total, including a 3.0km-long wing to the North-west direction. Another new wing of 3.0km long is extended to the north-east direction from P. Karang Jamuang. According to the result of simulations, the training wall has an effect to decrease works by a volume of about 400,000 m^3 per year in this case.

Table 9.2.8 Anticipated Siltation Volume at Surabaya West Channel

Case No.	Condition / Design Ship	Necessary Channel Dimensions		Anticipated Siltation Vol. (mil m^3/yr)		Duration of Dredging	Remarks
		Depth	Width	Detec	JPC	(month)	
1a	Present Actual Condition without Maintenance	9.5m	80m	NA	0.1	0.5	Panamax ships
1b	Present with Maintenance 20,000DWT	10.5m	100m	0.35	0.3	1	Ditto
2a	**30,000 DWT**	**12m**	**100m**	NA	**1.3**	**4**	Ditto (one way)
2b			**200m**	2.3	**2.4**	**7**	Ditto (two ways)
3	50,000 DWT	14m	300m	3.0+a	4.2	12	Maximum Panamax ships
4	80,000 DWT	16m	350m	4.2+a	6.2	18	Post-Panamax ships
5	New Training Wall	**12m.**	**200m**	**NA**	**2.0**	**6**	Tentative plan
6		14m	300m	NA	3.3	10	
7		16m	350m	NA	5.4	16	

Source: JICA Study Team

Among these cases, the study concludes that Case 2b is the most appropriate from the viewpoint of periodical maintenance dredging. The annual volume of 2.4 million m^3 is almost equivalent to that of Banjarmasin Port along the Barito River. Thus, this magnitude of maintenance dredging is not easy, but is feasible in Indonesia.

Column 9.1 Similar Experience (Barito River)

In Indonesia there are some important commercial ports which have been suffering from serious sedimentation in their access channels such as Belawan, Dumai, Bengkulu and Palembang Ports in Sumatra, and Banjarmasin and Pontianak Ports in Kalimantan.

One of the typical ports which have critical channel maintenance issue is Banjarmasin Port. Banjarmasin Port itself is the hub port at central Kalimantan, located about 26km upstream from the mouth of the Barito River. The river is one of the largest rivers in Indonesia with a total length of about 600km, a width of 4km at the mouth, and a depth of 5m to 15m. In the river, water depth is sufficient for navigation of large vessels up to about 20,000 DWT.

Figure C9.1 Banjarmasin Access Channel at Barito River Delta

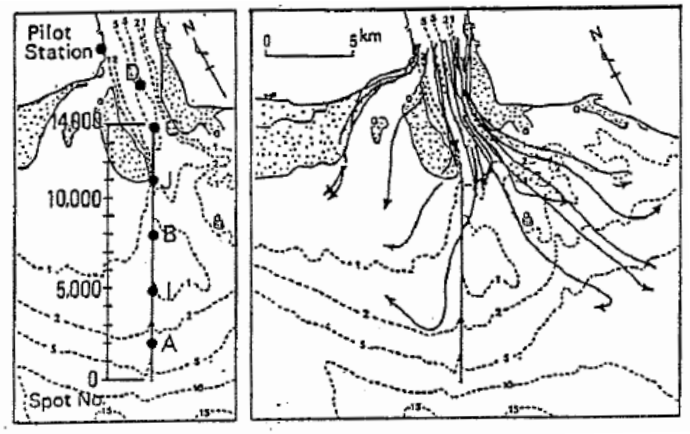
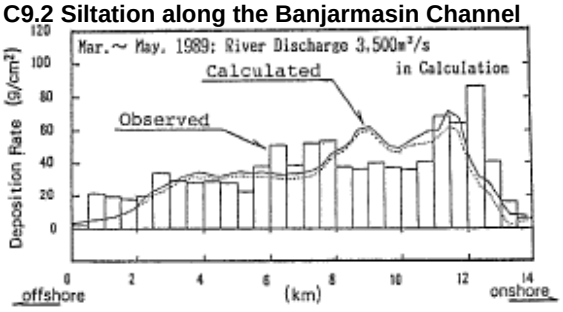


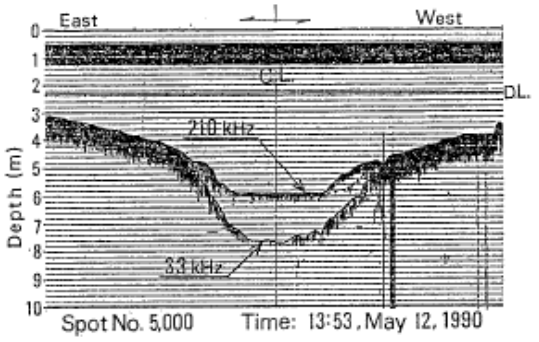
Figure C9.2 Siltation along the Banjarmasin Channel



The access channel of Banjarmasin Port is located on the shallow fan-shaped delta which is formed outside of the river mouth as shown in Figure 9.3.1. The channel has a length of 14km from the river mouth to the edge of the delta. In this channel, heavy sedimentation takes place due to the fact that the river brings about an enormous volume of sediments every year especially during the rainy season. Another phenomenon is sediment transportation by tidal currents and waves which cause suspension, dispersion and settlement of the sediment particles. There are two phenomena observed in the channel, i.e. “sedimentation of sandy materials” near the river mouth, forming a submerged dam in the channel, which in turn stimulates “siltation” of silty / clayey materials, or accumulation of “fluid mud,” at its down stream portion.

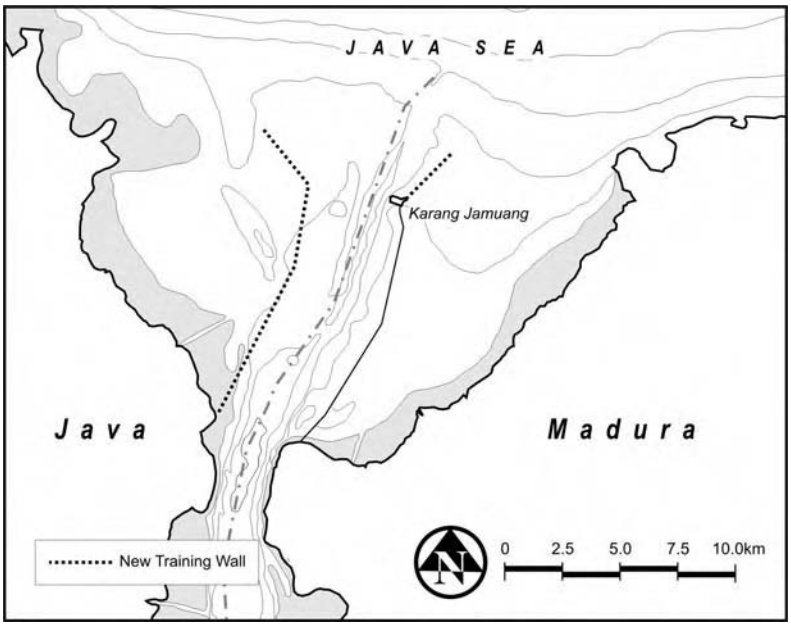
The natural depth of the channel can be only a few meters, or 2.5m to 3.0m, with agitation of ships’ propellers. In order to artificially maintain a depth of LWS - 5m and a width of 60m, for example, regular maintenance dredging of 2.0 to 2.5 million cubic meters by TSHD becomes necessary every year as shown in Figure 9.3.2. It is to be noted that the volume calculation depends on definition of seabed soil, or density of the soil to be dredged. Fluid mud, detected by a 30kHz and 200 kHz dual-frequency echo sounder as shown in Figure 9.3.3, shall not be dealt as the substantial soil to be dredged.

Figure C9.3 Fluid Mud in Banjarmasin Channel



Source: Okabe, et al. “Characteristics of Siltation at Banjarmasin Channel,” CEJ, Vol.38, JSCE, 1991, pp.491-495

Figure 9.2.4 Alignment of New Training Wall on the West Side of the Channel (Tentative Plan)



Source: JICA Study Team

9.3 Access Channel Improvement and Maintenance Plan

1) Implementation Scheme Plan

The initial and maintenance dredging works of West Surabaya Access Channel are planned to be implemented as follows:

a. Planned Channel Dimensions

Outer Channel:

Distance:	16 km
Depth:	Deeper than CDL -12.0m
Bottom width:	200m
Side slope:	1/5

Inner Channel:

Depth:	Deeper than CDL -12.0m
Bottom width:	Variable and wider than 200m
Side Slope:	Variable

b. Implementing Body

The implementation body of the Access Channel Improvement Plan should be DGST for the Outer and Inner Channels in consideration of demarcation of services between DGST and Pelindo III, past understandings among the parties concerned, and the public nature of the channels. Meanwhile, Pelindo III would be responsible for the basins in Tg. Perak and Gresik Ports.

c. Necessary Dredgers

Necessary dredgers for implementation of dredging works are as follows:

(1) Capital dredging of access channels:	TSHD with 8,000m^3 hopper capacity
(2) Maintenance dredging of access channels:	TSHD with 5,000m^3 hopper capacity
(3) Capital dredging of shoals:	CSD with 3,200 PS pump capacity

d. Disposal Points of Dredged Materials

(1) Channel dredging:	Designated offshore dumping site
(2) Capital dredging of shoals:	Nearby shallow water areas with enclosure

2) Channel Operation Plan

The operations of Outer and Inner Channels and management of ship movements are to be done by DGST, or actually ADPEL in Tg. Perak, by utilizing the VTS System.

a. VTS

A new VTS system is to be introduced, combining with the existing AIS system. The VTS system should have the following principal specifications:

i) Location: Radar site at the roof of the light house at Sembilangan (Height: 55m)

ii) Control room in ADPEL office at Jamrud Wharf in Tg. Perak Port as conceptualized in Figure 9.3.1.

iii) Radar: Wide range (coverage: 30km) and high resolution

iv) Control room: Consoles, displays, emergency generators, UPS, and other devices

v) Radio: VHF radio communication devices

vi) Network: Microwave transmission/receiving antennas between Sembilangan and Tg. Perak

In order to operate and manage the VTS system smoothly and efficiently, the following institutional and technical measures should be considered:

i) Organizational set up and manpower arrangement in ADPEL,

ii) Preparation of “Operation and Maintenance Manual,”

iii) Training of officers and operators,

iv) Establishment of “Committee for Safe Ship Operations in Surabaya Port” among the related organizations in Surabaya, and

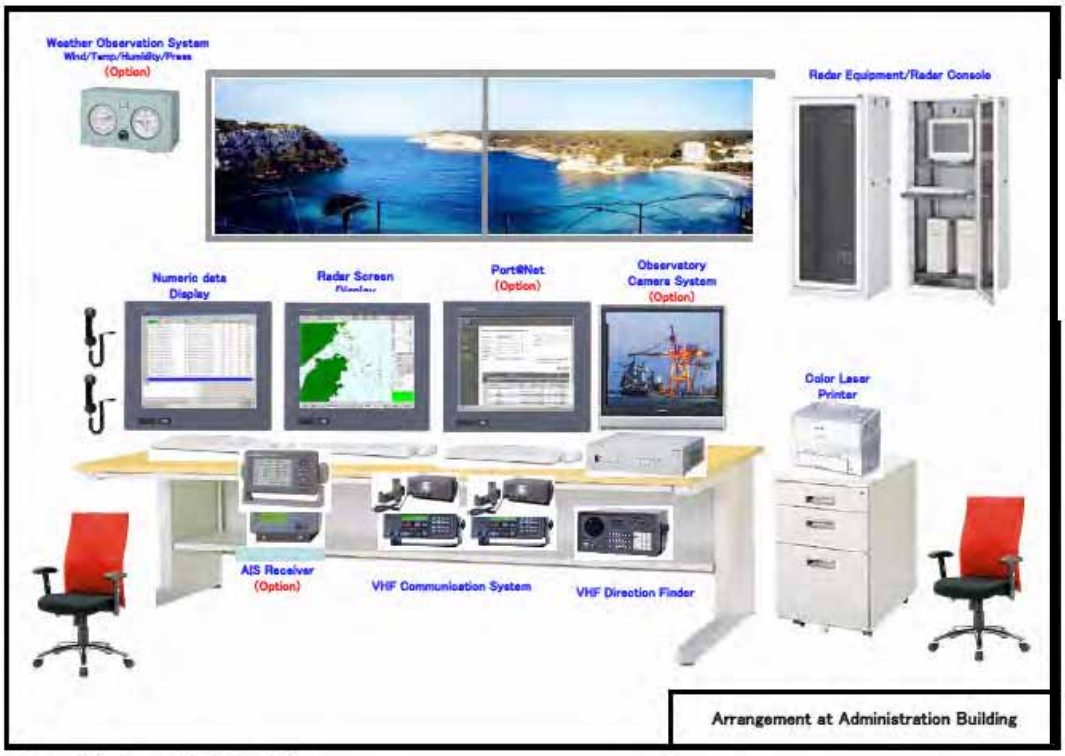
v) Others.

b. Navigation aids

In order to improve safety of ship navigation in the channels, rehabilitation of the following navigation aids is required:

(1) Light houses:	Karang Jamuang and Sembilangan
(2) Light beacons:	Ug. Piring and others

Figure 9.3.1 Concept of VTS



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3) Implementation Scheme Plan

The implementation schedule of the Access Channel Improvement and Maintenance Plan is as shown in Table 9.3.1. The duration of the dredging works is one year, say, in 2011.

Table 9.3.1 Table of the Access Channel Improvement and Maintenance Plan

	Volume (Million m^3)			Estimated Cost (US$ million)			
	Channel		Shoal Removal	Channel		Shoal Removal	Total
	Out*	In*		Out*	In*		
Initial Dredging	6.9	0.01	2.1	39.7	0	24.3	64.0
Maintenance Dredging	2.4			5.5			5.5
Installation of VTS							3.3

Work Item	2008	2009	2010	2011	2012	2013	2014	2015
L/A	▲							
D/D & Tender Document		▬						
Bidding & Selection		▲	▬					
Contract			▲					
Implementation				▬				
Maintenance						▬	▬	▬

*Out: Area of Outer Channel is from Bouy No. 5 to No.6.
**In: Area of Inner Channel is from Bouy No.6 to No.8.
Source: JICA Study Team

4) Economic and Financial Analysis

a. Economic Analysis

Methodology and Assumptions: A cost-benefit analysis was conducted on the access channel improvement project which was planned as an urgent project. Accoriding to the project, the channel is to be widened to 200m and deepened to -12m.

Annual maintenance dredging volume is estimated at about 2.4 million cubic meters, while initial dredging is about 6.9 million cubic meters. This means the initial investment becomes in vain if maintenance dredging is neglected only for three years and there is no reason to consider continued maintenance dredging. In addition, significance of the project will be affected by opening a new deep sea port located outside the channel. By these reasons, the project life was set as short as 20 years for economic evaluation.

Main assumptions and input are as follows:

- This analysis is done for the channel improvement project while, the capacity of the port is not considered. Enough capacity for future demand is assumed by the construction of the Lamong Bay Port or expansion of other ports.
- Operation and management cost of the channel other than the maintenance dredging cost are ignored because the channel improvement will reduce such costs.
- In Surabaya Port, most of large vessels are international container ships. General cargo ships, bulk carriers and passenger ships have shallow draft and can through the -10.5m channel. Apparently, they will share the benefit of safety improvement and both way operation. However, this is omitted due to unavailability of data. This exclusion in evaluation will result on estimates on the lower side.
- The discount rate is 12% which is generally used in Indonesia.

Economic Cost: Table 9.3.2 and Table 9.3.3 show unit cost of dredging used in this study and the resultant project costs, respectively. Direct cost of dredging is US$ 5.0 for channel and US$ 7.0 for the shoal. Maintenance dredging is much cheaper because new sediment is still soft. By deducting import duties and taxes levied on the foreign portion taxes, VAT and price contingency which was regarded as 50% of contingency from financial cost of the project, the economic cost was estimated to be Rp. 529 billion (US$ 57.5 million) at 2007 price, or 85% of the financial cost. In the same way, annual maintenance cost was Rp. 42.9 billion (US$ 4.7 million).

The shadow wage rate and shadow exchange rate are not applied in this analysis because Indonesian Rupiah is regarded as a hard currency and dredging work does not employ many unskilled workers.

Table 9.3.2 Financial and Economic Unit Cost of Dredging

(1) Financial Cost

Type of Dredging	Capital		Mainte-Nance
	Channel	Shoal	Channel
Direct Cost	5.00	7.00	1.66
Engineering	0.40	0.56	0.13
Contingency	0.54	0.76	0.18
Import Duty	0.09	0.12	0.03
VAT	0.65	0.91	0.22
Admin.	0.18	0.25	0.06
Total	6.86	9.60	2.28

(2) Economic Cost

(US$/m^3)

Type of Dredging	Capital		Mainte-nance
	Channel	Shoal	Channel
Direct Cost	5.00	7.00	1.66
Engineering	0.40	0.56	0.13
Contingency	0.27	0.38	0.09
Import Duty	-	-	-
VAT	-	-	-
Admin.	0.17	0.24	0.06
Total	5.84	8.18	1.94

Table 9.3.3 Economic Cost of Channel Improvement Project

F/E	Dredge	Volume (m^3)			Cost (US$ million)			
		Channel	Shoal	Total	Channel	Shoal	VTA	Total
Financial Cost	Capital Dredge	6.91	2.10	9.01	47.41	20.17	3.30	67.58
	Maintenance Dredge	2.40	-	2.40	2.40	-	-	2.40
Economic Cost	Capital Dredge	6.91	2.10	9.01	40.31	17.17	2.40	57.48
	Maintenance Dredge	2.40	-	2.40	4.66	-	-	4.66

Economic Benefit: Economic benefit accruing from the project were estimated by "with and without" comparison. The following three direct benefits were quantitatively measured:

i) Reduction of sea transportation cost by larger vessels

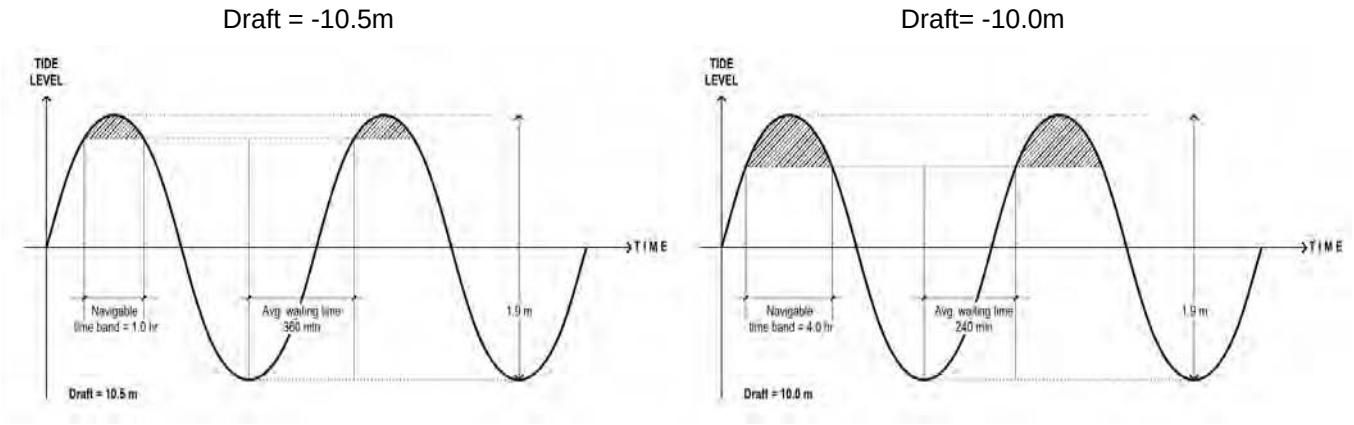
ii) Savings of time passing the channel with higher speed than present, and

iii) Savings in staying cost of vessels and cargoes waiting for high tide and channel clearance of large vessels coming from the opposite direction

Besides these benefit, improvement of safety should be accounted. Collisions occurs sometimes resulting in submergence or stranding every year and many minor accidents such as keel touching. With such accidents, not only repair cost is spent, but business opportunity is lost. However, enough accident data to estimate the cost is not available and the benefit due to accident reduction was excluded.

The 16km project section between Buoy No.5 and No.6 of the Madura Strait is narrow and shallow. Among others, the section between No.7 and No.11 with 8 km long is most dangerous and large ships with -9.0 to -9.5m draft run the section at a low speed of 7.0 to 9.0 knot. Container ships of more than -10.0 to -10.5m have to wait for high tide. Average wait time is about 6 hours for -10.5m ship and 4 hours for -10m ship. (Figure 9.3.2)

Figure 9.3.2 Ship Size and Waiting Time for High Tide



The economic benefit attributed to the project was estimated as shown in Table 9.3.4. The method of estimation is stated in item 1) of Section 10.5. Main source of the benefit is improvement of running speed in the canal, followed by the savings in sea transportation cost by larger sized ships.

Table 9.3.4 Economic Benefit of Access Channel Improvement

(US$ million)

	Benefit Item	2011	2020	2030
a)	Savings in sea transport cost	4.25	5.14	9.57
b)	Savings in channel passing time	8.93	10.00	15.36
c) -1	Reduction of waiting (Ship)	0.44	0.51	0.89
c) -2	Reduction of waiting (Container)	1.83	2.17	3.84
	Total	15.45	17.82	29.66

Economic Evaluation: By comparing the economic cost and benefit, E- IRR was estimated at 23.2% and the project is judged highly feasible from the economic point of view. The most part of benefits are derived from savings of sea transport cost and only with such benefits, the project is feasible with E-IRR of 13.8%. Therefore, further research will be needed before making decision, whether the project will result in enlargement of size of container ships.

Table 9.3.5 shows the change of E-IRR against increase of cost and decrease of benefit. E-IRR will become less than 12.0% if the cost becomes 1.6 times of the original estimate or the benefit becomes less than 62% of the estimate. Thus, feasibility of the project is very robust. It is more important for securing the high economic return to establish a system for implementation of maintenance dredging without fail.

Figure 9.3.3 Flow of Economic Cost and Benefit

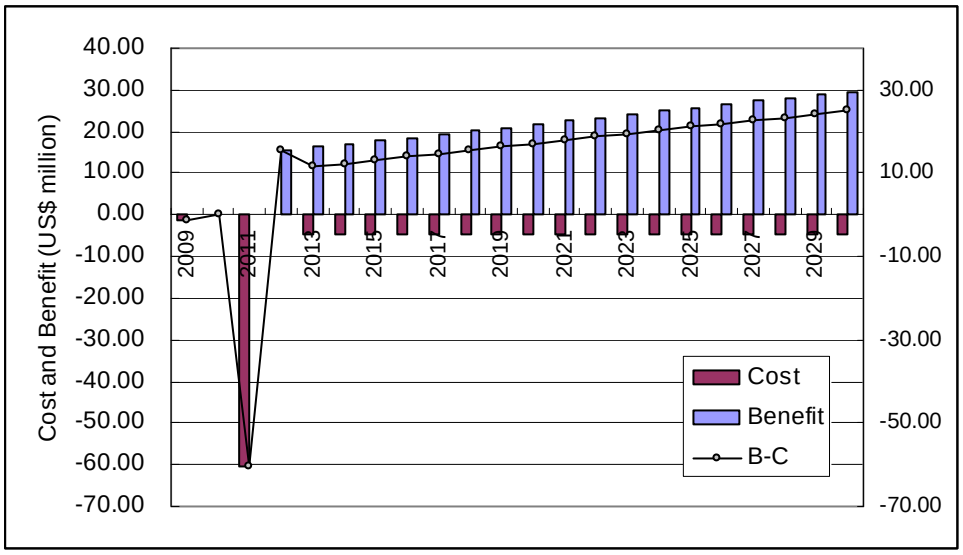


Table 9.3.5 Cash Flow of Economic Cost and Benefit

Year	Economic Cost		Benefit	Net Cash Flow
	Initial Dredging	Maintenance Dredging		
2009	1.45			-1.45
2010	0.00			0.00
2011	60.39			-60.39
2012		0.00	15.45	15.45
2013		4.66	16.24	11.57
2014		4.66	17.03	12.36
2015		4.66	17.82	13.15
2016		4.66	18.61	13.94
2017		4.66	19.39	14.73
2018		4.66	20.18	15.52
2019		4.66	20.97	16.31
2020		4.66	21.76	17.10
2021		4.66	22.55	17.89
2022		4.66	23.34	18.68
2023		4.66	24.13	19.47
2024		4.66	24.92	20.26
2025		4.66	25.71	21.05
2026		4.66	26.50	21.84
2027		4.66	27.29	22.63
2028		4.66	28.08	23.42
2029		4.66	28.87	24.21
2030		4.66	29.66	25.00

EIRR	(%)	23.2
NPV	US$ million	44.1
B/C	-	1.60

Table 9.3.6 Sensitivity Analysis of Channel Improvement Project

(E-IRR: %)

Change of B&C		Cost up			
		Base Case	10% up	20% up	Cost 30% up
Benefit down	Base Case	23.2	20.6	18.5	16.6
	10%	20.4	18.0	16.0	14.2
	20%	17.5	15.3	13.4	11.7
	30%	14.4	12.4	10.6	8.9

b. Financial Analysis

Since the project is undertaken by the government without profit making, FIRR calculation is not required in this case. In project implementation, however, a stable and sustainable resource for maintenance dredging is crucial. In order to secure costs for operation and maintenance of the new channel, including those for O/M of VTS and maintenance dredging, a new tariff system should be introduced to charge the channel users, i.e. vessels calling ports in the Madura Strait.

If this cost could be transferred to port users, an adequate tariff would be US$ 0.08 per registered ton, which covers maintenance dredging cost plus administration cost for this charge (30% of the dredging cost). It would be charged at the ports located at the Surabya West Access Channel.

It is a sensitive issue whether this new charge would discourage a shipper to use Surabaya ports or not. In the case of international container, a shipping company collects THC inclusive all port related charges from a shipper, i.e., $ 95 per 20-foot container. Provided that the average 20-foot container weighs 16 tons including container frame itself, the amount of new charge per 20-foot container would be $1.28 ($0.08 x 16 tons) or 1.3% of the present THC. It is marginal but it is difficult to say that a shipping company might absorb this additional cost without revising the present THC. Domestic containers enjoy more reasonable port tariff setting and bulk shipping loads and unloads bulk cargo at lower port charges per ton. Thus, a new charge will give larger impact on them.

Column 9-2 New Channel Fee at Barito River

It is now in progress to establish a new PFI system which enables maintenance of the channel commercially feasible. The South Kalimantan Province authorizes, based on Provincial Regulation No.18 in 2006 dated 14 December 2006, a management body of the Barito River channel to collect a channel fee of US$ 30.0 3 per ton or m3 of cargo, or wood, coal and other mining products, from these channel users in return tofor maintenance of the channel.

It should be noted that this regulation stipulates the required contribution to the local government as 6% of total income for the first 10 years and 10% from 11th to 50th years

If we assume a unit rate of maintenance dredging by a TSHD of 3,000m3 capacity to be Rp. 21,000/m3 = $2.4/m3, costs for the capital dredging of 8 to 9 million m3 and the maintenance dredging of 2.0 to 2.5 million m3 become $19 to 22 million and $ 5 to 6 million, respectively. On the other hand, an income of more than US$ 11 million p.a. can be expected, because coal only was handled by was 36 million ton in 2006.

A company named PT. Ambang barito Nusapersada is now in preparation of the legal procedures to beof the channel management body. If this system could work, the navigational channel maintenance policy in Indonesia might allow wider choices and be applied at other ports.

c. Analysis on Deeper and Wider Dredging

For reference, lager scale improvement of the channel was additionally analyzed for two cases: -14m deep and 300m wide, and -15m deep and 350m wide in the same way as the case of -12m deep and 200m wide. The followings were assumed for the analysis

i) **Deep Sea Port:** Lamong Bay Port with -14m wharf shall open in 2012 before completion of the channel improvement because no wharf exists in the Surabaya Port currently.

ii) **Phasing:** The improvement shall be done in one time from present -10.5m to -14m, instead of stepwise improvement from -10.5m to -12m and finally to -14m.

iii) **Scope of Dredging:** Dredging is limited to the 16km section between buoy No.5 and No.16 of main channel. The cost of the Lamong Bay Port estimated in 2006 (Information Memorandum—Digest**)** does not include any dredging cost, regarding it as public sector's obligation. Making a crude cost estimation for dredging in the berth area and a branch channel from the main channel to the wharf, it will cost US$ 216 to dredge some 30 million cubic meter, In addition, annual maintenance will cost much due to its location at the estuary of the River Lamong. Such dredging cost relating to Lamong Bay Port development is not included in this analysis.

Economic cost of capital cost and maintenance for cost each were estimated as shown in Table 9.3.7. Table 9.3.8 shows annual investment for two cases.

In the same way as the base case (d = -12m, w=200 m), economic benefit was estimated as shown in Table 9.3.9. By comparing the benefit against the cost, the E-IRRs are estimated at 22.6% for -14m case and 15.6% which are lower than the base case but show that both case s are still economically feasible. (Table 9.3.10)

A series of economic analysis works conclude that the base case (d = -12m, w=200 m) has the highest E-IRR (23.2%). However, the difference with the case (d = -14m, w = 300m) is not so large. All the kinds of economic benefit are derived from large ships. The case (d = -14m, w = 300m) enables almost no restricted channel operation for such large ships. It implies that, if a new container port located outside the channel would not be successfully constructed, a stage improvement where the channel is improved to 12m deep and then to 14m deep with a wider section must be seriously considered as an alternative.

Table 9.3.7 Project Cost by Channel Depth and Width

A. Capital Cost

(1) Financial Cost

	Depth	Width	Channel		Shoal
			Outer	Inner	
Volume (Million m^3)	12	200	6.90	0.01	2.10
	14	300	23.00	0.93	NP
	15	350	33.50	2.40	NP
	16	350	40.20	4.90	NP
Cost (US$ million)	12	200	47.34	0.08	20.17
	14	300	157.80	6.38	NP
	15	350	229.83	16.47	NP
	16	350	275.80	33.62	NP

Stepwise Cost		Total	Outer	Inner	Shoal
Present ==> -12m		67.58	47.34	0.08	20.17
-12m ==> -14m		116.76	110.46	6.30	-
-14m ==> -15m		82.12	72.04	10.09	-

(2) Economic Cost

	Depth	Width	Channel		Shoal
			Outer	Inner	
Volume (Million m^3)	12	200	6.90	0.01	2.10
	14	300	23.00	0.93	NP
	15	350	33.50	2.40	NP
	16	350	40.20	4.90	NP
Cost (US$ million)	12	200	40.30	0.06	17.17
	14	300	134.32	5.43	NP
	15	350	195.64	14.02	NP
	16	350	234.77	28.62	NP

Stepwise Cost		Total	Outer	Inner	Shoal
Present ==> -12m		57.53	40.30	0.06	17.17
-12m ==> -14m		99.39	94.03	5.37	-
-14m ==> -15m		69.91	61.32	8.58	-

Note: NP: Not Practical because of huge amount

B. Annual Maintenance

(1) Financial Cost

	Depth	Width	Channel		Total
			Channel	Wharf Front	
Volume (Million m^3)	12	200	2.40	-	2.40
	14	300	4.20	0.15	4.35
	15	350	5.20	0.15	5.35
	16	350	6.20	0.15	6.35
Cost (US$ million)	12	200	5.48	-	5.48
	14	300	9.59	0.34	9.93
	15	350	11.87	0.34	12.21
	16	350	14.15	0.34	14.49

(2) Economic Cost

	Depth	Width	Channel		Total
			Channel	Wharf Front	
Volume (Million m^3)	12	200	2.40	-	2.40
	14	300	4.20	0.15	4.35
	15	350	5.20	0.15	5.35
	16	350	6.20	0.15	6.35
Cost (US$ million)	12	200	4.66	-	4.66
	14	300	8.16	0.29	8.45
	15	350	10.10	0.29	10.40
	16	350	12.05	0.29	12.34

Table 9.3.8 Annual Investment Schedule

Year	D = -14m, W = 200m		D = -15m, W = 350m	
	Financial	Economic	Financial	Economic
2009	2.77	2.10		
2010				
2011	184.35	139.75	266.47	226.83
2012				
2013	9.59	8.16	11.87	10.10
2014	9.59	8.16	11.87	10.10
	:	:	:	:
	:	:	:	:
2030	9.59	8.16	11.87	10.10

Table 9.3.9 Economic Benefit of Access Channel Improvement

In case of -14m depth (US$ million)

	Benefit Item	2011	2020	2030
a)	Savings in sea transport cost	9.13	10.98	20.22
b)-1	Savings in channel passing time	8.98	10.06	15.47
b)-2	Reduction of waiting (Ship)	1.05	1.20	1.96
c)	Reduction of waiting (Container)	14.91	16.80	26.24
	Total	34.07	39.04	63.89

In case of -15m depth (US$ million)

	Benefit Item	2011	2020	2030
a)	Savings in sea transport cost	8.85	10.98	21.60
b)-1	Savings in channel passing time	8.98	10.06	15.47
b)-2	Reduction of waiting (Ship)	1.10	1.27	2.09
c)	Reduction of waiting (Container)	16.62	18.88	30.21
	Total	35.55	41.19	69.37

Table 9.3.10 Economic Evaluation for Larger Scale Improvement

Index	Unit	Case	
		-14m & d=300m	-15m & d=350m
EIRR	(%)	22.6	15.6
NPV	US$ million	97.6	46.5
B/C	-	1.61	1.21

5) Environmental and Social Consideration

It is to be noted that this study is still at the preliminary stage of project planning, for further environmental and social impacts examination of the proposed channel improvement plan, a full-scale EIA (AMDAL) based on State Ministry of Environmental Decree No. 11/2006, is strongly required under the responsibly of the executing body of the project. According to State Ministry of Environmental Degree No.11/2006, i) capital dredging with a volume ≧ 500,000m3 and ii) volume of dredged material to be disposed at dumping site ≧500,000m3 are subject to full-scale EIA.

Among the anticipated impacts, special attention needs to be addressed in carrying out the environment assessment in relation to the following points;

- **Hydrology:** Although further studies are required for detailed analysis, potential effects of the large volume of dredging activities may lead to: i) increased turbidity during construction; ii) impact on sediment transport, current pattern, physical disturbance of the seabed, etc. Such impacts should be carefully examined and necessary mitigation measures should be considered to minimize the possible impacts.

- **Dumping Site of Dredged Materials:** The dredged materials are currently disposed at the designated offshore area, about 15km from the centre of the outer channel of the west channel. Considering the significant volume of capital and maintenance dredging, the associated and cumulative impacts of the disposal of dredged materials should be carefully examined including the levels of suspended solids, change in seabed conditions, wave and tidal actions and residual current movements and the biological consequences of these physical impacts.

- **Impacts on Biological Environment:** According to secondary data (Technical and Environmental Study against Channel, Sedimentation and Reclamation Phases Performance in Madura, 2001), corals reefs were identified through visual observation around Karang Jamuang area with a live coral coverage between 30 % and 60%. Current coverage of coral reefs and possible impacts on them should be carefully considered in the EIA.

- **Impacts on Social Environment:** Some local fishermen using the channel dredging area as fishing grounds may be affected during construction phase. Impacts on fisheries and fisheries resources during operational phase should also be considered.

Considering other possible environmental impacts, the overall environmental and social impacts and mitigation measures are assumed and summarized in the following table.

Table 9.3.11 Summary of Impacts and Mitigation Measures

Environmental Item	Anticipated Impact	Proposed Mitigation Measures
Overall Plan		
Mitigation and monitoring implementation plan		Mitigation measures executing and monitoring plan will be prepared based on ANDAL. The plan will contain all mitigation measures and monitoring program. Roles and responsibilities will be allocated to each task.
Environmental issues		
Dredging and disposal	Impacts on hydrodynamic environment (physical disturbance o the seabed, increased turbidity, dispersal dredging sediments, change in current pattern etc.)	• A good dredging practices will be adopted by selecting the right equipment (TSHD), which shall have less impacts on physical disturbance on turbidity, seabeds. Adoption pf selecting the right dredging, loading methods are required. • Hydrodynamic modeling study should be carried out to analyze the predicted change in current movement. • Comprehensive monitoring is required for hydrodynamic affects.
	Impacts on deep sea-disposal	• Disposal of dredged materials should be put in place to prevent distribution of suspended solids in the waters outside of disposal sites. • Contents of spoiled materials should be analyzed regularly before dumping to make sure they do contain toxic components. • Conduct sampling and seawater quality analysis in the dumping area.
	Impact on marine environment	Adopt best dredging practice and disposal of dredged materials by following appropriate engineering design and monitoring and feedback system to limit any possible disruption of ecological processes.
Social issues		
Socio-economic impacts	Impacts on fisheries activities and fisheries resources	• Fisheries activities taking place in the project area shall be further examined. • In case, loss of fishing grounds and income of fisheries are not able to be mirigated, proper compensation and assistance should be provided to the affected fishermen.
Accidents	Fewer accidents with wider passage for vessels and improved sea traffic control with an installation of VTS.	Installation of navigation aids (VTS) will ensure safe transit inside the port.
	Installed pipelines along the channel posse high risk of maritime accidents.	Further enforcement of maritime security and safety measures.

9.4 Jamrud Terminal Rehabilitation Plan

1) Planning

This old terminal requires urgent rehabilitation. In line with the access channel improvement project, if terminal rehabilitation is done, a synergy effect can be expected to accommodate larger ships. Therefore, the study has analyzed Jamrud Terminal as part of the short-term improvement plan.

The rehabilitation and improvement needs of Jamrud Terminal are identified and justified as follows:

- The old structure built in the 1910s is seriously damaged, thus it must be urgently rehabilitated.
- The layout is not suitable for modern shipping. For example, the apron width of 12m is narrow for cargo handling.
- The berths of North Jamrud Pier are allocated for international dry bulk and general cargo vessels except the berth in front of the passenger terminal. If the berths could be made deeper, larger international vessels would call at this port.
- The passenger terminal located at the east edge of Jamrud is obsolete. PELINDO III intends to replace it with a new one which meets not only domestic passengers but also international cruisers. Five large warehouses are also operational, but they are old and not popular nowadays. Therefore, any superstructures on Jamrud can be demolished and replaced.

Since the study proposes the access channel improvement project at -12m depth, the same water depth will be provided at Jamrud North Pier. The new north pier layout has five berths. They are lined as 250m (length) x 12m (depth), 250m x 12m, 250 m x 12m, 250m x 11m and 200m x 11m from the west edge.

The apron will be widened from 12m to 20m, which is suitable for modern dry bulk and general cargo shipping, using open hopper bin or directly loaded/unloaded by truck. Currently 20m width is the standard apron width for ordinary wharves of 7.5m water depth or more. Berths dimensions are summarized in Table 9.4.1.

Table 9.4.1 Berths Dimensions of Rehabilitation Plan at North Jamrud

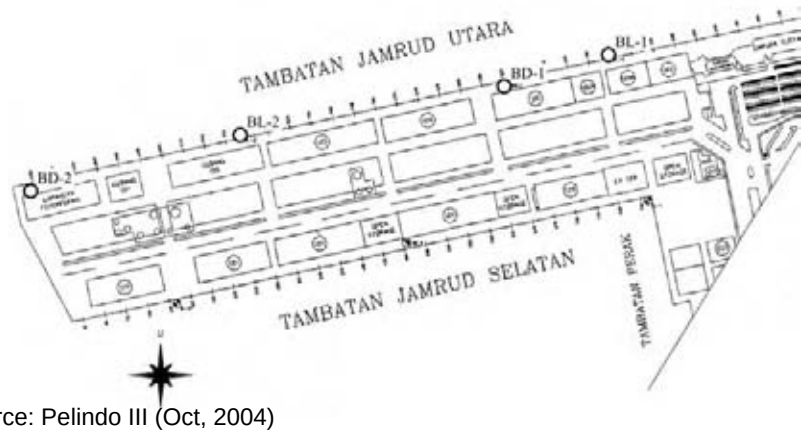
	Apron Width	Length of Berth	Water Depth	Type of Berth
1	20m	250m	-12m	General / Bulk Cargo
2	20m	250m	-12m	
3	20m	250m	-12m	
4	20m	250m	-11m	Passenger Ship
5	20m	200m	-11m	

2) Preliminary Design and Cost Estimates

The locations of soil investigations and soil stratigraphy at North Jamrud Terminal are shown in Figures 9.4.1 and 9.4.2 respectively. Borings at BL 1 and BL 2 were carried out for wharf designing. From the survey data, the soil profile can be interpreted as follows:

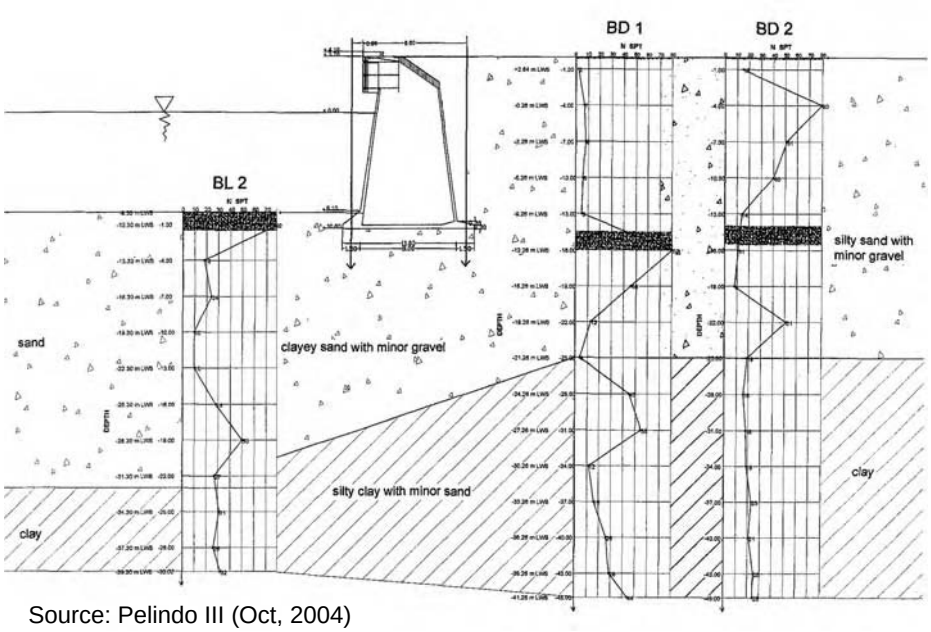
- The uppermost 1m - thick alluvium is a layer of stones, which are placed as a foundation of concrete caisson. N-values are more than 80.
- The second layer of thickness 19m – 22m consists of clayey sand with minor gravel. N-values generally ranged from 10 to 30. Higher N-values exceeding 50 are encountered at 19m depth of both BL1 and BL 2.
- The third layer below 20m -23m depth consists of silty clay with minor sand. N-values range from 22 to 32.

Figure 9.4.1 Locations of Soil Investigation at North Jamrud Terminal



Source: Pelindo III (Oct, 2004)

Figure 9.4.2 Soil Stratigraphy at North Jamrud Terminal



Source: Pelindo III (Oct, 2004)

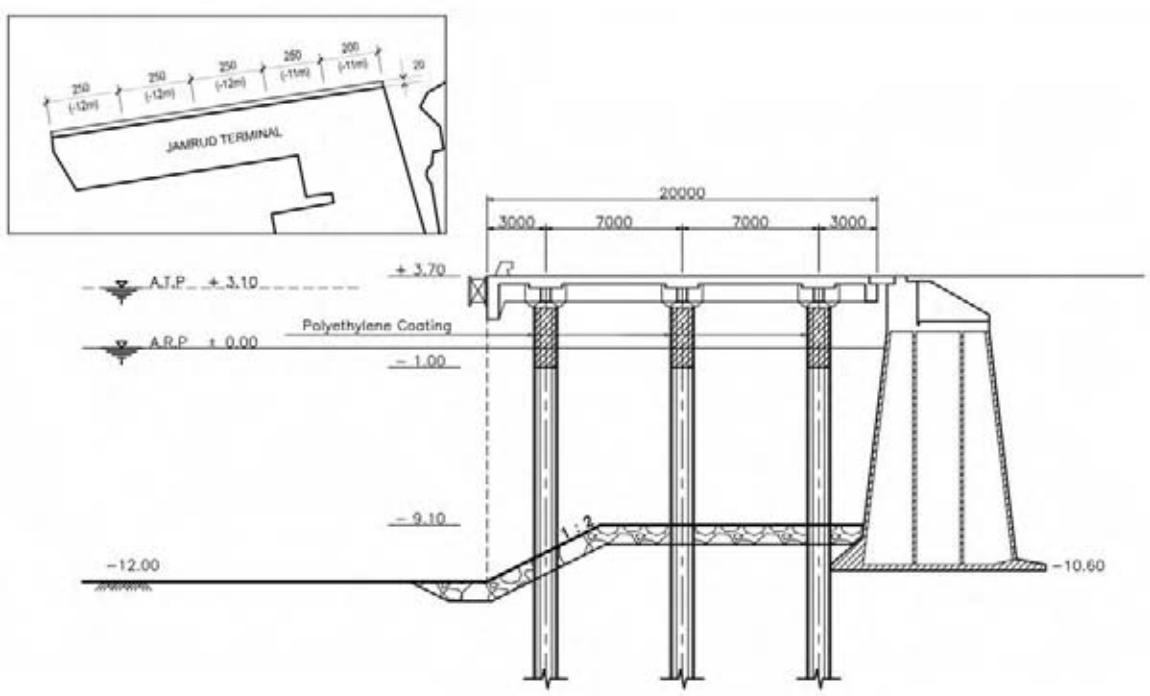
Considering such soil condition and existing structure, concrete caisson type and steel pipe pile pier types have been compared as alternatives of berth foundation in the study as follows:

- When the project adopts steel pile pier type, the construction will be simple and sufficient in terms of cost, construction method and work period. It is fairly economic in cost. Reclamation works is not necessary.

- Caisson type is the method to construct the existing wharves in 1910, when the gravity type deep wharves constructed by concrete caisson or concrete block type were popular. However, in constructing concrete caissons, dry dock, caisson yard with slipway or floating dock is required for fabrication. Reclamation works and construction of revetments for both west and east end of the wharves are necessary. It results in complicated and longer works.

Thus, in this study, the steel pipe type structure is selected considering above conditions at the planned site. Typical cross section is shown in Figure 9.4.3.

Figure 9.4.3 Typical Cross Section of the Wharf at North Jamrud Terminal



The preliminarily estimated project cost is summarized in Table 9.4.2. In addition to the construction cost, the engineering fee for the detailed design and supervision (consulting services), physical contingency, tax and duties, VAT, and administration cost are roughly estimated in this study. The physical contingency is counted as 10 % of the construction cost and consulting services, tax and duties is 3% of the foreign portion, VAT and administration cost is 3% of the whole costs are 11% and 3% of the whole cost, respectively.

Table 9.4.2 Summary of Project Cost

Item	Quantity	Cost (million Rp)
Wharf (-11m)	450m	92,000
Wharf (-12m)	750m	160,000
(a) Direct Construction Cost		252,000
Consulting Services		20,000
Contingency		41,000
(b) Total Direct Project Cost		313,000
TAX and Duties		6,000
VAT (Value Added Tax)		34,000
Administration Cost		9,000
Sub Total		50,000
(c) Total Project Cost		363,000

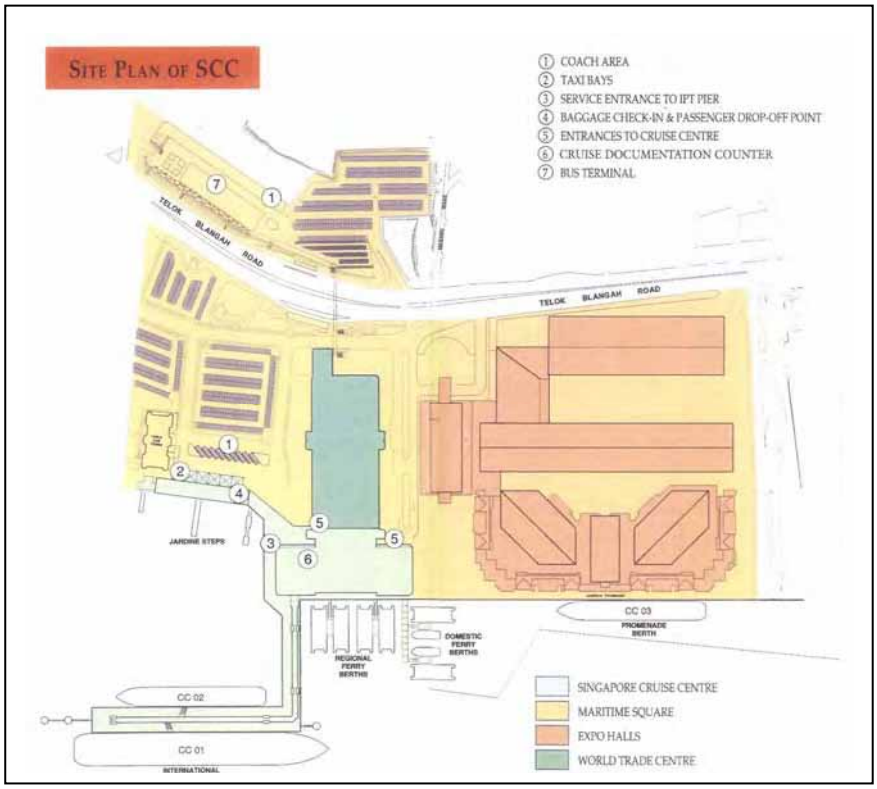
3) Some Suggestions for Terminal Superstructures

Existing warehouses will be re-arranged due to low utilization. Some of them will be partially demolished for efficient lift-on/lift-off operations and hopper bin usage.

For accommodating international cruise ships, a new passenger terminal is required to add CIQS (customs, immigration, quarantine and security) related facilities, tourism desk, bank (for money exchange), post office, international telecommunication services, and so on. Singapore Cruise Centre is a good example where international cruise terminal is located in the same building with regional/domestic ferry terminals.

Column 9.2

SINGAPORE CRUISE CENTRE (SCC)



SPECIFICATIONS OF INTERNATIONAL CRUISE SHIP BERTHS

Berth No.	CCO1	CCO2	CCO3
Depth Alongside	12.0 m	11.0 m	10.0 m
Approach Channel Width / Depth (min)	160 m / 10.0 m	100 m / 10.0 m	160 m / 9.8 m
Height of Tide (max)	3.5 m	3.5 m	3.5 m
Vessel Length / Width Restriction (max)	245 m / 50 m	190 m / 30 m	150 m / 50 m
Vessel Height Restriction (max)	52 m	52 m	52 m

Source: ASEAN Cruise Development Study, 2002

9.5 Land Access Network Improvement Plan

a. Improvement of Access Road to the Ports

The improvement and reinforcement of access road to the ports in GKS is imperative to ensure the smooth and effective flow of cargo to and from the ports. The major toll road network of GKS connected with the ports has been planned and most of those planned toll roads has been already tendered. Therefore, the toll road developers have been already selected or determined and ready for their implementation subject to the completion of land acquisition and funding. Those planned toll road ready for their implementation is listed with the priority of timing of expected completion is as shown in Table 9.5.1.

Other toll roads that have been already tendered and ready for their implementation as well as the toll roads under planning are suggested to be constructed as soon as possible depending on the progress and completion of necessary land acquisition for their implementation.

Table 9.5.1 Priority Toll Road Development as Port Access

	Ref.	Name of Toll Road Proposed	Length	Remarks
1		New Sidoarjo – Gempol Toll Road	10.0 km	The section of Surabaya – Gempol Toll Road by-passing Sidoarjo Mudflow Disaster Area. Urgent rectification works.
2		Tg. Perak – Suramadu Bride (Surabaya Side)	14.0 km	The first portion to be completed of Aloha – Waru – Tg. Perak Toll Road or a part of Surabaya East Ring Road. Ensure smooth traffic to and from Suramadu Bridge.
3		Suramadu Bridge (Kamal-Madura Side) – Bruneh (Madura Side)	11.0 km	The right-of-way has been secured and graded. Accelerate IZ development in Madura Island
4	R-T4	Gempol – Pasuruan Toll Road	34.5 km	Support PIER and IZ in Probolinggo
5	R-T3	Waru – Mojokerto Toll Road	36.5 km	Support IZ in Mojokerto
6	P-T1	Surabaya Eastern Ring Road	18.0 km	Ensure by-passing Surabaya City center to and from Tg. Perak Port and southern area (Sidoarjo, Mojokerto, Pasuruan, etc.)
7		Surabaya Western Ring Road	20.0 km	Ensure smooth transport between New Port in Lamong Bay and Mojokerto and other areas in south.

b. Improvement of Access Railway System

Tg. Perak Port Branch Railway Line: The branch line connected with Tg. Perak port and marshal yard located at eastern side of Tg. Perak Timur have been under rehabilitation and extension works to modify the old single track system to double track system aiming at enhancement of container freight train operation. The improvement and modification of Kalimas Station to make it function as a container freight service marshal yard is imperative to utilize effectively century old asset that is the right-of-way and land owned and managed by PT. KAI or railway-corporation.

Surabaya Regional Rail Transport System (SRRTS): The master plan and feasibility study (still preliminary level) of SRRT has been completed in March 2007. It should be studied carefully again in consideration of possible freight train service using the same track being provided for the commuter train service in Surabaya City as its major influencing zone for passenger transport. The designing and plans on physical structure needed for development of modern and new urban as well as regional railway system should be coordinated with the toll road development plans especially in Surabaya City portion.

Because most of the tracks of SRRTS in Surabaya City is planned to be elevated and they would cross over the toll road alignments or toll road's interchange sections since some part of toll road is planned to be elevated as well. The elevated segment of SRRTS's track should also be carefully studied and designed taking into consideration of operation of container freight train composed of 20 heavy loaded cars or more in view of structural design. Some section of SRRT may be suggested to run through tunnel.

Lamong Bay New Container Terminal Branch Railway Line: To the west of TPS, the new container terminal in Lamong Bay is planned to be developed. If the container freight train operation system has been developed and become operative prior to the completion of this new container terminal, the railway branch line can be introduced to this new Lamong Bay Container Terminal as well.

c. Development of Access Road between Suramadu Bridge and Tanjung Perak Port

The completion of Suramadu Bridge is expected by the end of 2008. Therefore, the access road connecting Tg. Perak and the base of Suramadu Bridge at Surabaya City side should be given the first priority for its implementation taking into consideration of its symbolic status of the Suramadu Bridge and need to develop the area being provided for the industrial development along the access road connecting Bangkalan and the base of Suramadu Bridge at Madura side.

As the cargo demand would increase to and from Mojokerto and Tg. Perak as well as Pasuruan and Tg. Perak in the future assuming that an effective and smooth detour is secured by constructing new toll road by-passing the Sidoarjo Mudflow Disaster area and Surabaya – Gempol Toll Road will fully revived. Therefore, the realization of toll road as well as an improvement of primary collector road to deal with such increased road cargo traffic beyond south from Waru to Mojokerto and Pasuruan should be drawn more attention and development priority is to be given to these two toll road.

However, if these two major collector road which are connected to Surabaya – Gempol Toll Road that is the major trunk road passing through Surabaya City from south to north then up to Tg. Perak Port, the traffic volume would surpass the transport capacity of this toll road especially in the part of Surabaya City. Therefore, the road by-passing such crowded Surabaya City to the Tg. Perak or Madura through Suramadu Bridge that is Surabaya East Ring Toll Road should be realized subsequently to the completion of the toll road connecting Waru and Mojokerto as well as Gempol and Pasuruan.

d. Utilization of Direct Backyard of Tg. Perak Port

At present, the area for fuel storage tanks is the single largest facility occupying land area of direct backyard of Tg. Perak Port, which is operated and managed by Pertamina. However, this area has been used as the fuel storage area since almost 90 years ago. Pertamina has already started the construction of pipeline for transportation of petroleum products from Tuban to Tg. Perak of which total length is around 138 km. The reason why the fuel storage tanks of Pertamina is installed at present location is that all petroleum products is unloaded at Tg. Perak Port. However, the volume of petroleum products being unloaded at Tg. Perak Port will be minimized when the subject pipeline is completed. Thus, there will be no reason to maintain the fuel storage tanks just behind the Tg. Perak Port. Figure 9.5.1 illustrates the location and area of Pertamina's fuel depot installations.

Figure 9.5.1 Area of Pertamina's Fuel Depot Installations

Note: Area cycled by white line is leased out to Pertamina for their fuel depot.

This area is quite congested area by heavy loaded trucks in Surabaya City. Hundreds of heavy tank-lorries of 6 – 16 tons class gather here to load the petroleum products every day throughout a day. If the new fuel storage installation is planned taking into consideration of delivery of petroleum products from Tuban by pipeline, it can be suggested to be located a bit far from the present location and the center of Surabaya City but more open area which is strategically proper location in view of urban development strategy eying to the future and ensure the safety.

If and when this area will be opened for other use, this area can be used as the freight transport center with truck depot or as the transfer station between international and domestic container transport because this area or immediate backyard of the port is the most ideal place to conduct such kind of operation.

e. Detouring of Road at Sidoarjo Mudflow Disaster Area

At this moment, almost all cargo freight or container cargo is transported by road. Therefore, the relocation of road by-passing the Sidoarjo Mudflow Disaster Area should be completed as soon as possible. Especially in view point of the manufactures operated either fully or in the form of joint venture by foreign interest, the detour or urgent relocation of this segment of Surabaya – Gempol Toll Road is imperative. It is to be noted almost 60% of manufactures falling under category of foreign invested corporation is located beyond Gempol to the south.

10 LONG-TERM DEVELOPMENT PLAN

Two sites, Tg. Bulupandan and Socah, have been selected for further detailed comparison as a gateway container port. A long-term development plan is formulated to pave the way for effective gateway port development under the regional development context, through comparison of the two candidate sites factoring in port design and construction method, sea and land port access, associated direct hinterland development, initial environmental examination and economic and financial analysis and seawaters and spacious hinterlands.

10.1 New Infrastructure Need

1) New Infrastructure Need for Container Shipping

a. Projected Port Traffic

Based on the demand forecast, the expected future cargo throughput (Scenario 2) and ship calls for containers in the GKS region as a whole can be summarized as shown in Table 10.1.1. The demand forecast implies that the number of containers will increase 3.6 times from 2005 to 2030. The ship calls will grow approximately twice as large during the same period of time.

Table 10.1.1 Projected Port Traffic and Ship Calls for Container in the GKS Region

	Present (2005)	2015	2020	2025	2030
Container Cargo ('000 TEU)	1,953	3,346	4,229	5,230	6,356
-Ocean going	1,031	1,767	2,229	2,756	3,356
-Inter-island	922	1,579	2,000	2,474	3,000
Container Ship call (Unit)	4,018	6,300	7,900	8,700	10,100
- Ocean going	1,291	2,000	2,000	2,400	2,500
- Inter-island	2,727	4,300	5,900	6,300	7,600

Source: JICA Study Team

As for containers, it is expected that the capacity of existing facilities at Tg. Perak and that of planned Lamong Bay Port can absorb the demand until around 2017. The required capacity for the remaining demand should be served by the development of a new container port, i.e. approximately 500,000 TEU, 1,600,000 TEU and 2,700,000 TEU in 2020, 2025, and 2030, respectively. The main target of a new port assumes oceangoing container ships.

b. Future Infrastructure Requirements

Berth Dimension: Berth dimension (depth and length) is closely related to ship size to be accommodated. The previous section "7.3.Future Shipping Needs" envisages that the maximum container ship sizes will be more than 4,000 TEU class in 2015. It is assumed that the maximum container ship sizes are Panamax type in 2020, and Largest Panamax in 2025 and 2030.

In accordance with the Technical Standard of Port and Harbor Facilities in Japan, necessary berth dimension is analyzed (refer to Figure 10.1.1 and Table 10.1.2). For this planning exercise, the study puts one assumption which is no significant physical limitation for new port development. Thus, a very deep berth over 15m could be constructed if there would be sufficient demand.

Figure 10.1.1 Flow Chart for Estimation of Required Berth Dimension

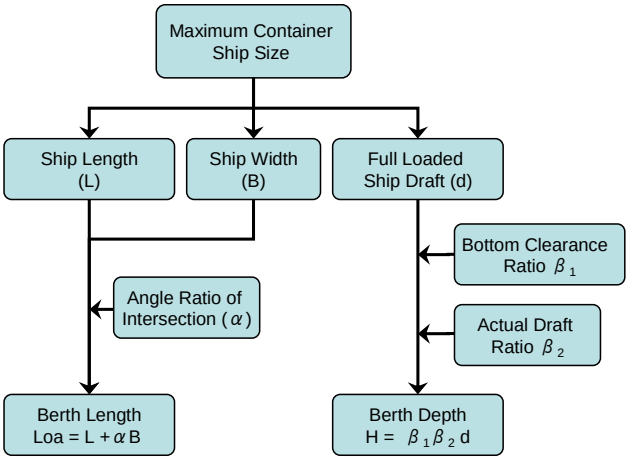


Table 10.1.2 Size of Container Ship and Berth for Port Planning

Container Ship Type	Ship Size (DWT)	Ship Capacity V (TEU)	Ship Draft D (m)	Ship Length Loa (m)	Berth Depth H (m)	Berth Length L (m)
Under Panamax	30,000	2,150	11.1	218	12.0	250
	40,000	3,000	12.2	244	13.0	300
Panamax	50,000	4,000	13.0	266	14.0	330
Largest Panamax	60,000	4,600	13.8	286	15.0	350
Post-Panamax	80,000	6,200	14.0	304	16.0	370

Source: Technical Standards for Port and Harbor Facilities in Japan

Number of Berth: For estimation, the study considered both plausible largest ship size and crane productivity, and then calculated the required number of cranes and berths. In the case of 2030, it is assumed that total 8 berths will be necessary to meet future container demand.

Table 10.1.3 Required Number of Berth

Factor		2020	2025	2030
No. of Berth	a	2	6	8
No. of Crane	b	4	12	19
Required Capacity (000 TEU)	c	500	1,600	2,700
Container Volume in Box (000)	d	357	1,143	1,929
Average TEU per Ship call	e	535	601	629
No. of Ship call	f	934	2662	4290
Crane Factor	g	1.80	1.80	2.10
Crane Productivity (Box/Day) per Berth	h	1,890	1,890	2,618
Ship Loading& unloading hours	I	8.8	9.6	7.8
Berth-Day Requirement	j	342	1068	1389
Berth-Day Requirement per Berth	k	171	178	174
Berth Utilization Ratio	l	0.52	0.54	0.53

* Working Hours per Day: 21 hours, Crane Handling Rate per Hour: 25 boxes
TEUs / Box Ratio (TPS Data): 1.4

Table 10.1.4 Required Container Berths

Year	Required Capacity (TEU)	Accumulated Berth Length (m)	Berth Depth (m)	Remarks
2020	500,000	300m x 2 berths = 600m Total 600m	14m	Panamax
2025	1,600,000	300m x 5 berths = 1,500m 350m x 1 berths = 350m Total 1,850m	14m 15m	Panamax Largest Panamax
2030	2,700,000	300m x 5 berths = 1,500m 350m x 3 berths = 1,050m Total 2,550m	14m 15m	Panamax Largest Panamax

Source: JICA Study Team

Apron Area: In a new container port, the width of apron area for container terminal is assumed to be 64.5m which is the aggregated length of pier face, rail space and vehicular traffic space. Detailed calculation is indicated as follows:

(Width of Apron for Container Terminal) = $a_1 + a_2 + a_3$

i) a_1 (Pier Face & Rail. Distance): It is set 3.0m that consider the facilities for moorings such as a mooring pole or a stairway.

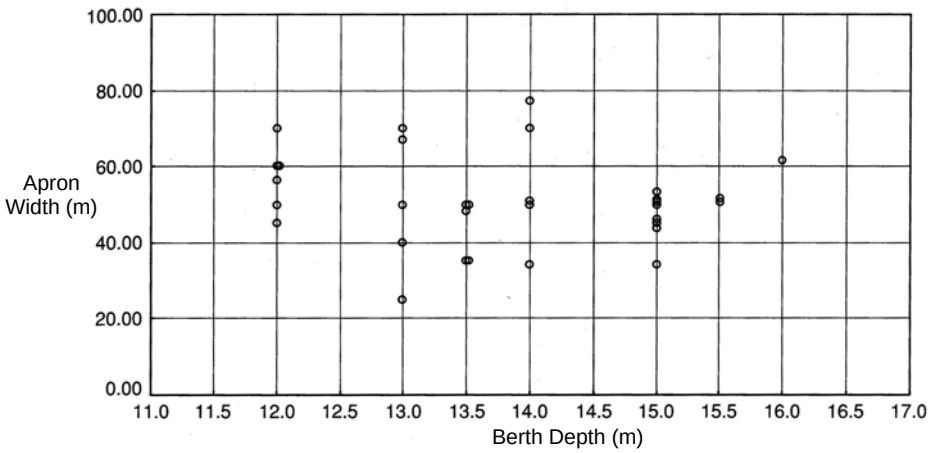
ii) a_2 (Rail Span Width): It is assumed that a ship use 2 cranes, and sets it to 24.5m.

= (2+1(Spare Crane) * 5.5m/lane (Straddle Carrier) + 8m (Margin)

iii) a_3 (Width for Vehicle passing Space): It is set 37m that consider the turn space for straddle carrier (22m) and margin area (15m).

In the case of Japan, apron width mostly ranges from 50m to 80m as illustrated below.

Figure 10.1.2 Width of Apron for Container Terminal in Japan



Source: TAKAHASHI Hironao, Container Transport and Container Port, 2004

Marshalling Yard: To estimate marshalling yard space, the study collected and analyzed some important date, i.e., weekly peak coefficient and doweling time in port based on TPS data and the result of shipping company's interview survey. Explanatory factors are extracted from those actual data (refer to Table 10.1.5) and necessary marshalling yard dimension is estimated (refer to Table 10.1.6). As result, the necessary width of marshalling yard is estimated at approximately 94m in 2020.

Table 10.1.5 Factor of Marshalling Yard

Factor		Unit		Remarks
Width for Marshalling Yard	b	= (B/La)	m	
Berth Length	La		m	Refer to Berth Dimension
Marshalling Yard Area	B	= (Gy*j)	m^2	
Marshalling Yard Area Coefficient	j	= 2.5*		
Target Container Volume	V_1	= (f*Vo/e)	TEU	
Weekly Peak Coefficient	f	= 1.19		TPS in 2006
Required Capacity (TEU)	Vo		TEU	Refer to Berth Dimension
Turnover	e	= (365/DT)		
Doweling Time	DT	= 2.7	day	Interview Survey Result
No. of Grand Slot	V_2	= (V1/(g_1*0.75))*		
Ave. Container Heap	g_1	= 4*		
Grand Slot Area	Gy	= (V_3*i_1+V_4*i_2)	m^2	
No. of Grand Slot for Container	V_3	= (V_2(1-h))	Unit	
No. of Grand Slot for Refrigerated Container	V_4	= (V_2*h)	Unit	
Refrigerated Container Ratio	h	= 0.1		Generally 0.05 - 0.15*
Floor Space for Container	i_1	= 14.87	m^2	8 feet * 20 feet

Source: * TAKAHASHI Hironao, Container Transport and Container Port, 2004

Table 10.1.6 Required Marshalling Yard Dimension

Year	Required Capacity (TEU)	Accumulated Berth Length	Marshalling Yard Area	Marshalling Yard Width
2020	500,000	600m	56,200m^2	94m
2025	1,600,000	1,850m	180,000m^2	97m
2030	2,700,000	2,550m	303,700m^2	119m

Source: JICA Study Team

Backyard Area: Lastly, the study estimated the required space of back yard for container terminal regarded as a container freight station (CFS), maintenance facilities, office and gate. Since there is no acceptable formula in this regard, only the empirical relation between marshalling yard and backyard was adopted.

Table 10.1.7 Required Back Yard Dimension

Year	Marshalling Yard Area	Back Yard Space	Accumulated Berth Length
2020	56,200m^2	7,500m^2	600m
2025	180,000m^2	9,000m^2	1,600m
2030	303,700m^2	9,000m^2	2,900m

Source: JICA Study Team

2) New Infrastructure Need for Non-Container Shipping

a. Projected Port Traffic

The demand forecast result in Section 7.2 in this report is re-arranged to give a snapshot of non-container port traffic in Table 10.1.8. It indicates that non-container cargos will steadily increase by 2.1 times from 2005 to 2030 unlike a sharp increase of container cargo. The number of ship calls will grow during the same period accordingly.

Table 10.1.8 Projected Port Traffic for Non-Container in the GKS Region

	2005	2015	2030
Non-Container Cargo ('000 Ton)	23,093	30,774	45,131
Petroleum	5,980	9,774	13,717
Liquid Bulk Cargo	2,057	3,614	5,394
Dry Bulk Cargo	7,350	10,149	13,317
General Cargo	7,706	7,237	12,702
Non-Container Ship call (Unit)	11,238	13,800	20,500
Petroleum	1,158	1,900	2,700
Liquid Bulk Cargo	399	700	1,000
Dry Bulk Cargo	4,726	6,500	8,600
General Cargo	4,955	4,700	8,200

Source: JICA Study Team

b. Estimation of Port Capacity

Non-container port facilities handle a variety of cargo. One capacity measurement is BOR (berth occupancy rate). In general case of port planning, BOR is assumed from 70% to 80% as a benchmark of full operation. In this sense, it may be said that Gresik port already reaches their capacity, exceeding 70%. Similarly, the capacity of Tg. Perak has a little space to accommodate additional ship calls.

Table 10.1.9 Berthing Capacity in the Existing Port

		Main Ship Type	Actual Berthing Point**	BOR (%)	Existing Ship calls	Berthing Capacity*** (Ship calls)
Tg. Perak	Jamrud*	General Cargo & Bulk	12	58	4,584	5,300 – 6,000
	Nilan Timur		7	65		
	Berlian Timur & Mirah	Tanker	8	65	1,697	1,800 – 2,100
Gresik Port		General Cargo & Bulk	16	72	3,094	3,000 – 3,400

*: Including Jumrud Utara, Selatan and Barat
**: It is assumed from the berth length and the average ship length by each port.
***: Their BOR are assumed from 70 – 80%.

c. Future Infrastructure Requirements

Table 10.1.10 shows the estimated existing capacity and the future demand. The ship calls in 2015 will exceed the existing capacity. Such port infrastructure shortage for non-container shipping will be gradually exaggerated towards the year 2030. Therefore, the issue of new port infrastructure for non-container must be addressed in a long-term regional port development plan.

The study estimated necessary additional berth length for non-container shipping. Provided that the existing non-container port facilities would be operated at the same efficiency in the future, only new port infrastructure could meet surplus ship calls overflowed from the existing

ports. At the year 2015 situation, for instance, the number of 'overflowed' or 'straying' ship calls for non-container cargo will be around 3,700 and the berth length to meet this demand segment will be approximately 1,920m.

Now, Gresik port plans berth expansion by 640m for multipurpose. Tanjung Perak Port has an idea to expand bulk handling capability at Nilam Terminal. Such improvement efforts are critically important to meet the year 2015 demand. Even with such efforts, however, new non-container port infrastructure must be necessary after 2015.

Table 10.1.10 Existing Port Capacity and Future Demand (Ship calls)

Ship Type	Existing Port Capacity	Demand				
		Existing	2015	2020	2025	2030
General Cargo & Dry Bulk	8,300 - 9,400	7,678	11,200	12,900	14,700	16,800
Tanker	1,800 - 2,100	1,697	2,600	3,000	3,300	3,700

Source: JICA Study Team

Table 10.1.11 Required Berth Length by Cargo Type

Year	Ship call				Required Berth Length (m)			
	General Cargo	Bulk	Tanker	Total	General Cargo	Bulk	Tanker	Total
2015	1,200	1,700	800	3,700	600	840	480	1,920
2020	2,000	2,600	1,200	5,800	1,080	1,320	600	3,000
2025	3,000	3,400	1,500	7,900	1,560	1,680	840	4,080
2030	4,100	4,400	1,900	10,400	2,040	2,280	960	5,280

Source: JICA Study Team

10.2 New Port Development at Tg. Bulupandan

1) Natural Conditions from the Survey

With regard to Tg. Bulupandan area the following site surveys are performed:

i) Bathymetric survey,

ii) Tide measurement,

iii) Soil investigation, and

iv) Bottom material sampling.

The results of the surveys suggest the following technical perspectives on the construction plan of the new port at this place:

- Natural condition data to prepare a preliminary new port development plan are obtained.
- Breakwaters will be necessary of the almost same level as those at Jakarta and Semarang ports.
- For economical dredging a cutter suction dredger with cutter power of more than 1,500 ps will be needed. Dredged material will be dumped at closed dumping (reclamation) area.

- Although sub-soil layers are expected to be rather hard, construction of wharves of pile structure will be possible, if auxiliary measures such as usage of a rock auger are adopted for pile driving.
- Sandy materials, or coral debris, for reclamation may be obtained with high possibility from the seabed reasonably adjacent to the Tg. Bulupandan area.
- Soil improvement will not be necessary for reclaimed ground, since in-situ soft cohesive soil layers are expected to be thin (some 1 to 5 m).

a. Bathymetric condition

The bathymetric chart is shown in Figure 10.2.1. General features of bathymetric conditions around Tg. Bulupandan area are ;

- Coastal areas near the land consist of coral debris with a width of about 300m to 500m perpendicular to the seashore. The gradient of ground surface slope is about 1 on 40.
- The slope of shallow seabed continuing thereof is gentle up to a point deeper than – 50 m. The gradient of the gentle seabed is about 1 on 130.
- Bathymetry is rather uniform in this area. The contours are generally parallel, except one shoal of MSL -13m deep at the surrounding water depth of about MSL -21m. This shoal is located 3.7km off Tg. Modung, which is most possibly a sunken ship.
- The seabed slope becomes gentler toward the Madura Strait direction and steeper toward the east direction.

b. Soil condition

Soil borings at Tg. Bulupandan were planned to be carried out at two points shown in Figure 10.2.2. The boring works, however, could not be conducted at the planned offshore locations due to continuous strong east wind and rough seas. Several trials were made to build a platform for boring at the originally designated places in the open sea. It was failed due to difficulties to work under high waves and to penetrate platform piles into the seabed which is probably consisted of coral or clay rock. Therefore, the locations shall be changed to two points at the near-shore area.

The results of borings are shown in Figure 10.2.2. The feature of the sub-bottom soil layers are summarized in Table 10.2.1.

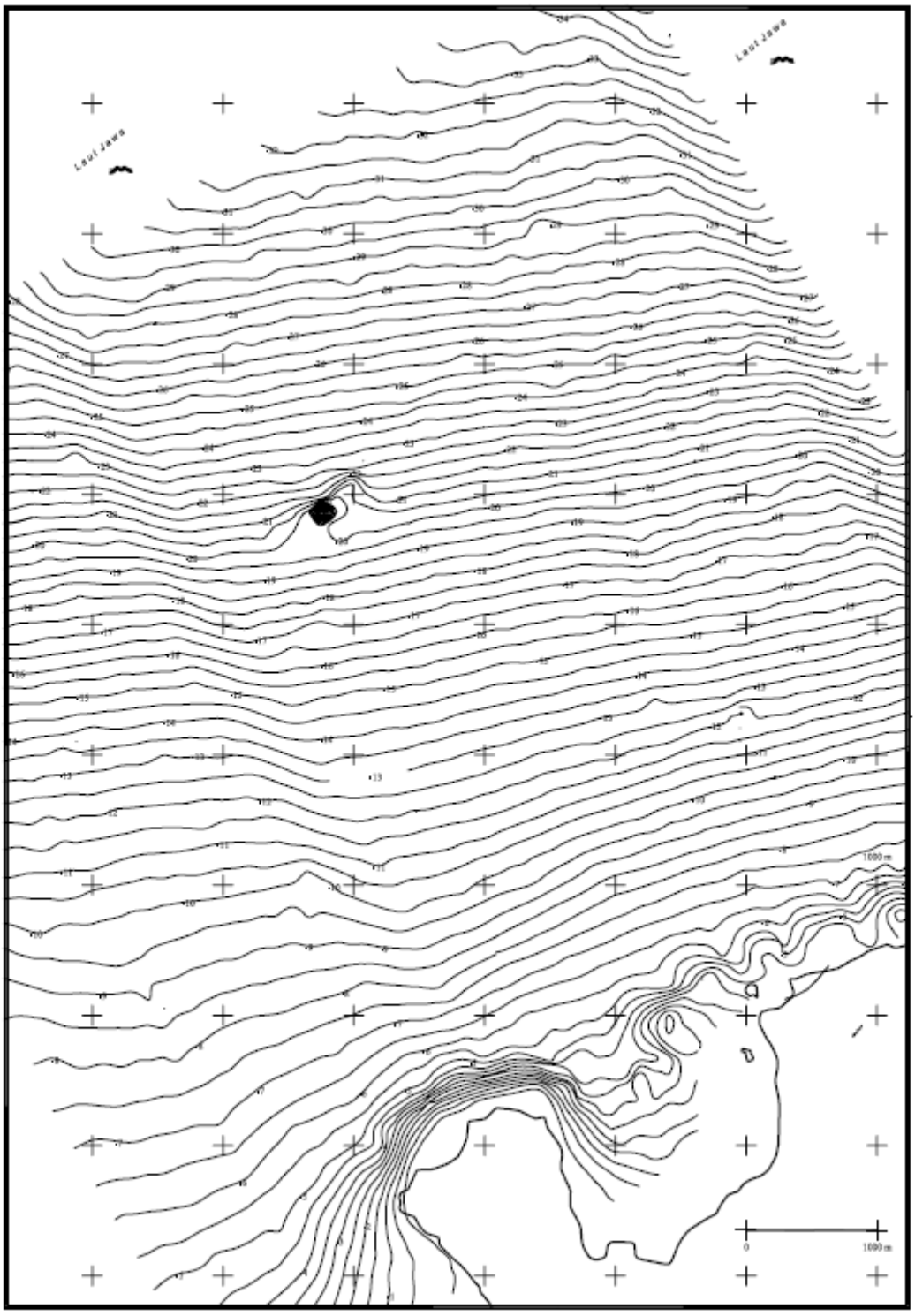
In Tg. Bulupandan area, there are in total 6 borings on the land areas, which were executed in the past by the Jawa Timur Province Government. The above result of Boring No.2 has similar characteristics to those of the soil layers identified in the past borings. There exist very hard coral rock layers under a few meter of soft surface layer.

The soil layers of Boring No.1, however, have somewhat different characteristics from the others in the point that there exist intermediate hard layers of about 20m thickness. This implies that soil strata variation is rather large around this coastal area.

c. Tidal Conditions

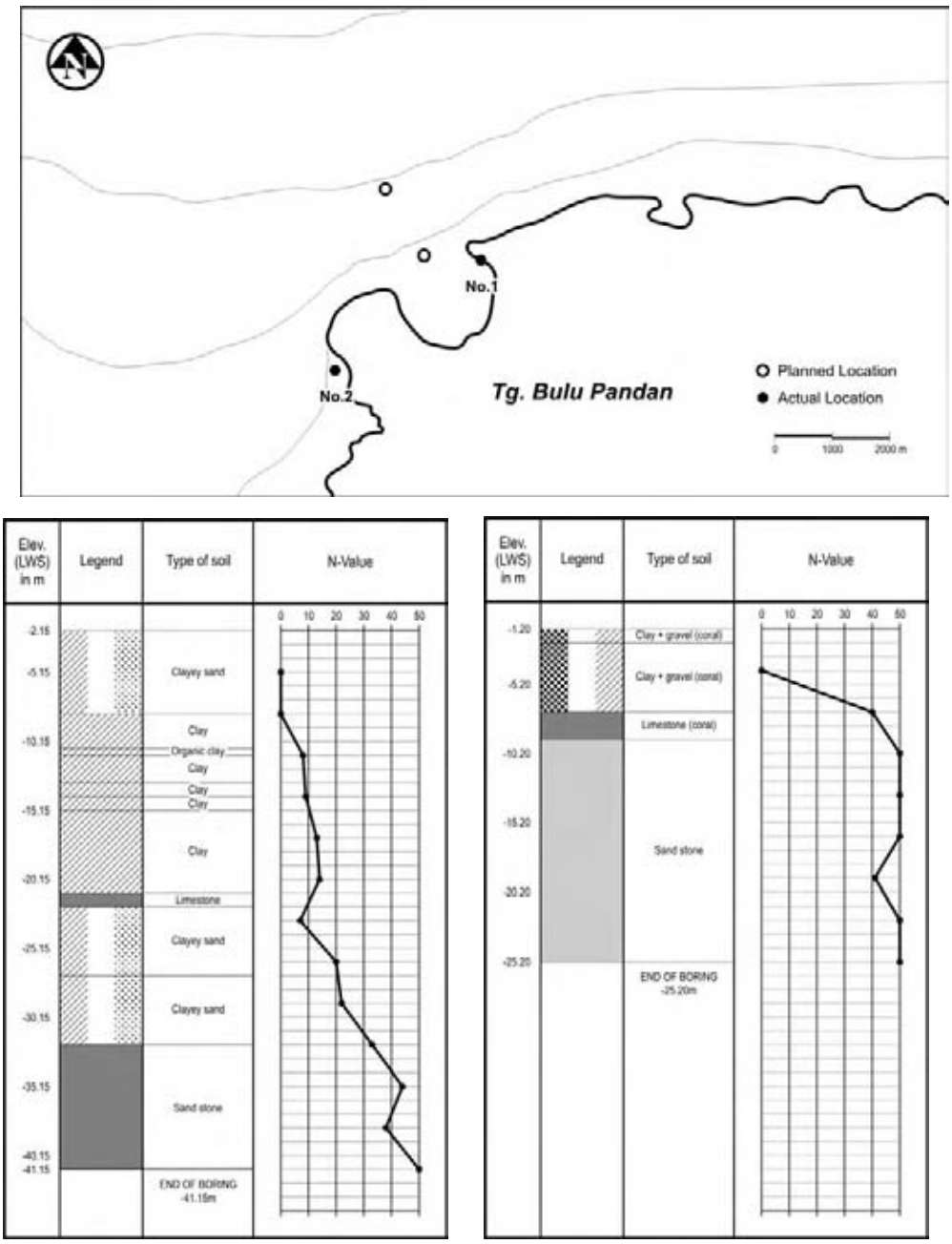
In this survey tidal level is observed at the northern end of Tg. Modung at intervals of every 1 hour for continuous 15 days. The primary figures of tidal components calculated from the result of this tidal observation are already shown in Table 9.2.1. It indicates stronger diurnal character than P. Kg. Jamuang.

Figure 10.2.1 Bathymetric Chart at Tg. Bulupandan



Source: JICA Study Team

Figure 10.2.2 Soil Borings in Tg. Bulupandan



Source: JICA Study Team

Table 10.2.1 Soil Characteristics at Tg. Bulupandan

Borehole No.	Depth (m below MSL)	Type of Soil	SPT (N-Value)
1. Tg. Bulupandan (at west side of Tg. Bulupandan)	- 3.2 to - 9	Clayey sand	1
	- 9 to - 12	Soft clay	1
	-12 to - 22	Hard clay	10 to 15
	- 22 to - 33	Clayey sand	10 to 30
	- 33 to - 42	sand stone	30 to 100
2. Tg. Modung (at west side of Tg. Modung)	- 3.2 to - 9	Clay & coral	1
	- 9 to - 11	Coral	40
	-11 to - 27	Coral	40 to 150

Source: JICA Study Team

d. Ocean Current Condition

According to "TNI-IL: Peta Arus Perairan, Indonesian Kawasan Barat, 1997, " the surface ocean current off the Madura Island in the Jawa Sea is completely alternate, from the west in November to March and from the east in May to September. April and October are transition months. The maximum velocity is about 0.5 knots for both east current in February and west current in August. Such velocity can be considered very slow for safety navigation of ships.

e. Wave Condition

Wave condition at Tg. Bulupandan can be considered equivalent or similar to those at the entrance of Surabaya West Access Channel. As to detailed wave condition, please refer to 9. 2, 1), e. Wave Condition.

f. Bottom Materials

In this study seabed materials are sampled at 23 locations in the Madura Strait. Among those samples, three samples are taken from the area of about 4km to the west of Tg. Bulupandan as shown in Figure 9.2.2. Those samples were classified by laboratory tests as shown in Table 10.2.2 below. The surface soil is mud at offshore area and rock at near-shore area.

Table 10.2.2 Sea Bottom Materials in West Bulupandan Area

Location	No.	X (deg West)	Y (deg South)	Depth (in m)	Type of Soil
Tg. Bulupandan north	1	112.79050	6.87372	19.4	Mud
middle	2	112.79142	6.91133	7.7	Mud
south	3	112.79250	6.94700	3.1	Rock

Source: JICA Study Team

It is noted that, according to the results of 2 borings and 1 trial boring made in the Bulupandan area in this study, it is found that surface soils are rather coarse and can consist of thin coral or sand which is supported by underneath very soft clay or silt. This fact is important to discuss sedimentation in the channel and basin of new Tg. Bulupandan Port whether it can be caused by siltation of mud or littoral drift of sand.

2) Port Development Plan

a. Basic Concepts and Planning Features

Planning Targets: The new Tg. Bulupandan Port is planned for the design ships of *Panamax container ships* as Phase 1 (target year: 2025) and *Largest Panamax container ships* as Phase 2 (target year: 2030). The major planning indicators are characterized by the combination of a target berth occupancy rate (BOR) of approximately 50% (less than 55%) and required berth number and length as shown in Table 10.2.3. International competitiveness deserves the top priority in the planning targets.

Table 10.2.3 Required Berths at New Port

Ship Size	Depth of Berth	Length per Berth	Number of Berth			Berth Length
			Phase 1	Phase 2	Total	
Panamax	14m	300m	5		5	1,500m
Largest Panamax	15m	350m	1	2	3	1,050m
Total			6	2	8	2,550m

Source: JICA Study Team

Location: The new port will be constructed at the bay area in the sea between Tg. Modung and Tg. Bulupandan by reclamation for yards and dredging for channel and basins.

This is the second port development plan since PUSTRAL, Gajah Mada University, conducted the first port development study in 2005 (refer to Figure 10.2.3). Our plan will reclaim the Ko'ol Bay totally by the dredging materials. This is the largest difference between the first and second plans. The reason why the port area is located offshore in the sea is that, according to previous geological investigations at the bay area, very hard soil layers of sand and gravel with coral are anticipated to exist on the shallow surface of the seabed in the bay. Cost for dredging can be saved by moving the basins and the channel toward offshore area. The alignment of the port facilities are shown in Figure 10.2.4.

It is noted that, if further development becomes necessary in the future, the eastern part of the port can be used as the expansion area.

b. Berthing Facilities

Berths are arranged to form a rectangular shape. An allowance length of 50m each is considered at the two corners.

At one of the corners on the right hand side a small basin is allocated for official boats and work vessels such as pilot boats, tug boats, crane ships, etc. The small basin has a water depth of CDL -4.5m and a basin area of 100m x 200m with an entrance of 150m wide.

c. Container Yards

Yard Space: The container yards is planned to have enough areas for modern cargo handling methods such as Transfer Crane (RTG) method. The width of the yard is planned to be 550m, including spaces for the apron, marshaling yards, administration area, and the access/inner road. If a width of 50m is excluded for the road, the area for one berth is (300m or 350m) x 500m, which enables to secure a total ground slot (TGS) of 3,500 TEU to 3,900 TEU per berth with transfer cranes of 6 rows.

The total land area is 203 ha for the yard and inner road areas in the new Bulupandan Port.

Container Handling Equipment: The following equipment is planned to be arranged for the container yards:

1. Ship to Shore Gantry Crane (SSG): 2 units each for Panamax berth
   3 units each for Largest Panamax berth
2. Transfer Crane (RTG): 6 units for each berth
3. Tractor Trailer (Chasses): 15 units for each berth

Figure 10.2.3 Previous Port Development Plan *(right)*

Source: PUSTRAL, Gajah Mada University, 2005

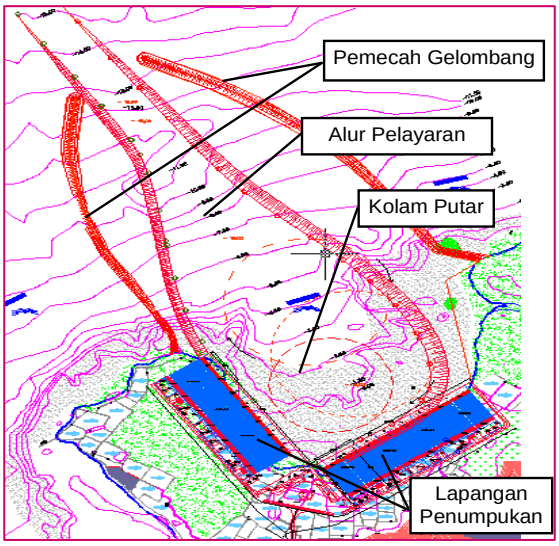
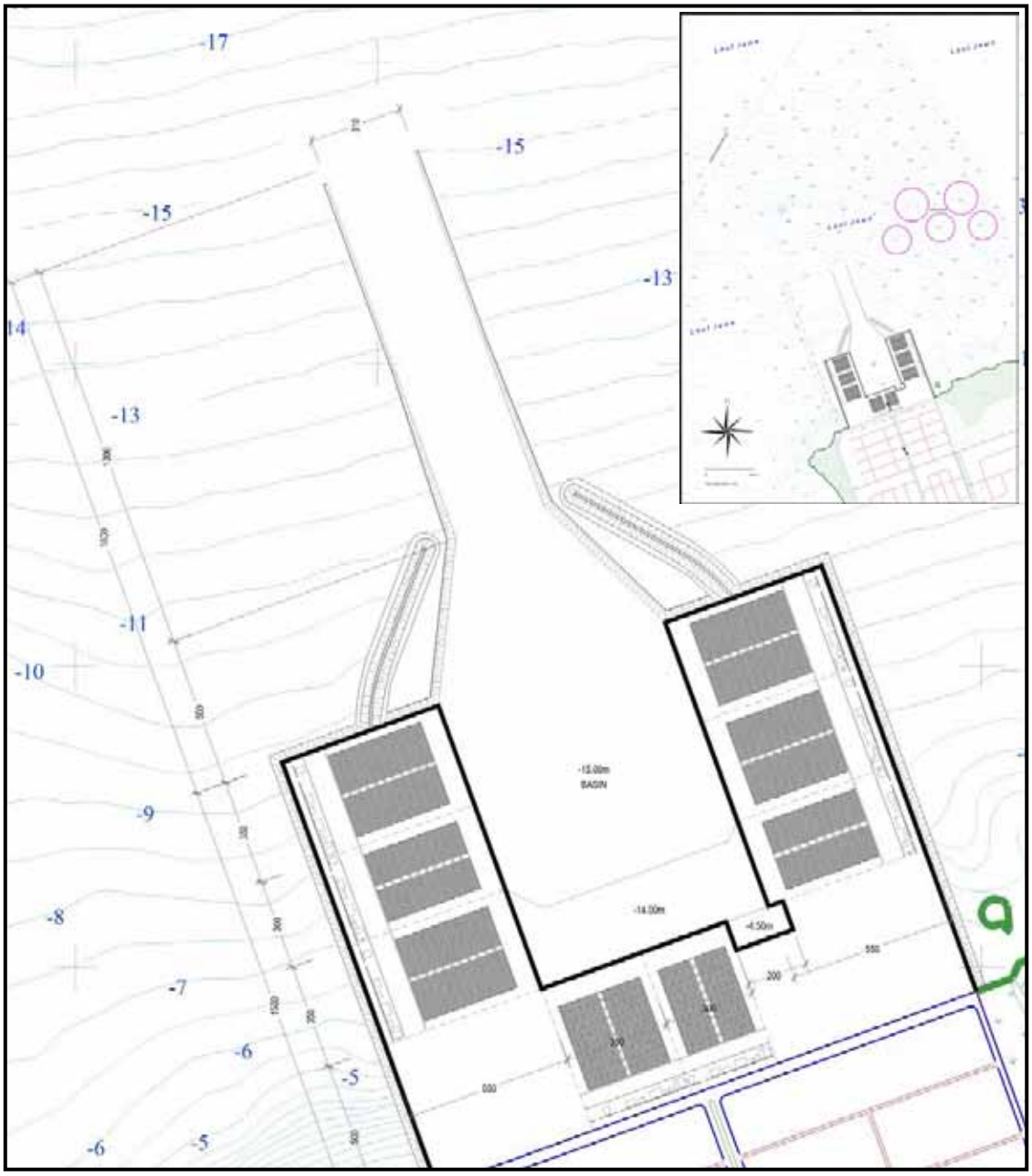


Figure 10.2.4 Layout Plan of Tg. Bulupandan Port *(below)*

Source: JICA Study Team



d. Channel and Sedimentation

Access Channel: The access channel dimensions are planned to have a depth of CDL-15.0m (Phase 2) and width of 310m. The depth and width are decided in consideration of the size of the design ship (Size: 50,000 DWT, Breadth: 32.2m) base on the PIANC Guidelines (1997):

Channel width = 9.6 x B = 9.6 x 32.2m = 309.1m = 310m (10.2-1)

The orientation of the channel is N 20 degrees W (20 degrees from the north to the west, counter-clock wise), which is decided with consideration of the direction of the depth contours and the position of a sunken ship at a depth of about 21m in front of the port.

Sedimentation in the Channel: In this coastal area, considerable sedimentation of sand and coral debris is observed in the basins of existing ports. This phenomenon is called “sand drift” which is caused by waves. Under the action of 10 % cumulative unusual offshore waves with a wave height of 2.0m and a wave period of 5.0 sec, the movable limit of seabed fine sand (diameter: 0.1mm) is at the water depth of 5.6m. This means that substantial sand drift takes place at shallow waters of less than 10m.

It is therefore theoretically not necessary to take account of serious sedimentation in the channel due to sand drift. It may be necessary, however, to consider a certain amount of maintenance dredging at intervals of a few years.

e. Breakwaters

The breakwaters are extended to a depth of CDL -10m to protect the basins from incident waves and the channel from drifted sand. As the waves come mostly from both east and west directions by season, the mouth of the breakwaters should not be overlapped to one direction.

The diffraction coefficient of perpendicular incidence waves is about 0.4 at the wharf face lines in the port. In consideration of distribution of incident waves in height, period and direction, the exceeding probability of waves at the berths being higher than the threshold wave height of 0.5m for cargo handling is assessed to be less than 2.5%, which satisfies the requirement in the Japanese Technical Standards.

f. Basins and Anchorages

Basins in the port are planned to have a diameter of 2 x Loa for turning of the design vessels, where Loa is the length overall of the design ship. Adding an allowance, a, for berthing ships on both sides of the basin, the distance can be calculated as:

Basin width = 2 x (Loa + a) = 2 x (350m + 50m) = 800m (10.2-2)

Anchorage for ships’ waiting for berthing is not necessary theoretically. This is because, according to the Queuing Theory, the average number of waiting ships, Lq, is less than 0.25 ships per day for the planned berth utilization condition of BOR to be 0.52 to 0.54 in Phase 1, 2 and 3. It is, however, better to plan a space for some ships to anchor at outside of the port, which is shown as five single point mooring (SPM) in Figure 10.2.4.

g. Navigation Aids

The following NAV AIDS are planned in the Port:

1. Leading markers on the land: Two light beacons on towers aligned on the centerline of the channel,

2. Breakwater lights: Two light beacons (red and green) at the tips of the breakwaters, and

3. Marker Buoys: Two light buoys on the both sides of the channel, and

One light buoy to show the location of a sunken ship.

3) Preliminary Port Design and Cost Estimates

The major port structures to be planned and designed are mooring facilities such as quay walls, protective facilities such as a breakwater, and a channel and basins. As the new port at Tg. Bulupandan faces to the Java Sea, breakwaters are necessary to keep the water calm inside the harbor.

a. Quay wall Structure

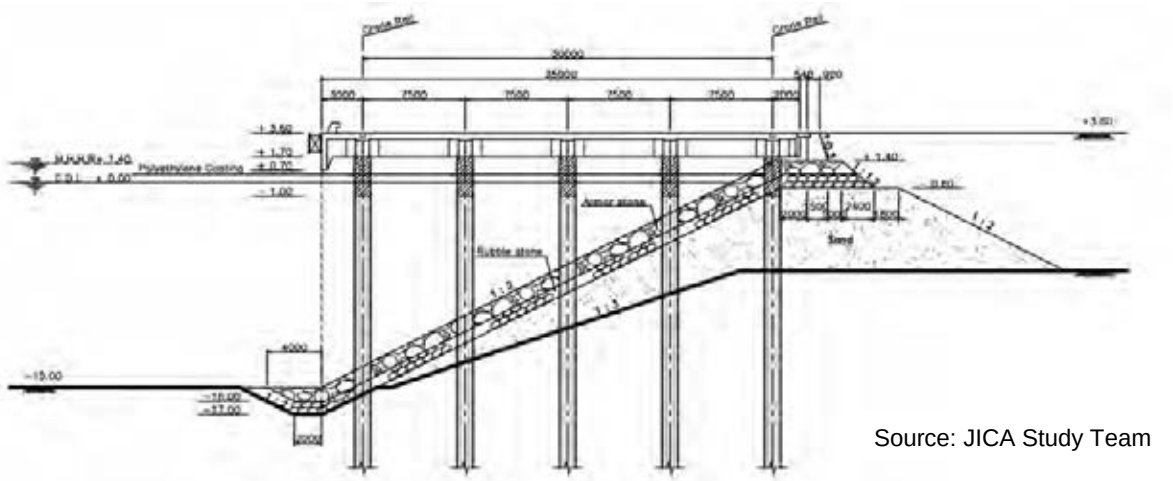
According to the sub-soil data, there exist hard coral rock layers under a few meters of soft surface. Considering such soil condition and gentle slope of seabed topography, concrete caisson type, steel pipe pile and steel pipe sheet pile types are considered as alternatives of berth foundation.

As for caisson type, dry dock, caisson yard with slipway or floating dock is required for fabrication. But, there is no adequate site for mooring a floating dock in the vicinity of the project site. Constructing caisson yard makes construction works complicated and longer.

As for steel pipe sheet pile type, more pile driving works are necessary than that of steel pipe pile type, since not only sheet pipe piles and anchor piles works, but also foundation pile works for container crane foundation is required on applying steel pipe sheet pile type for container terminal berth foundation. It may result in higher construction cost compared to steel pipe pile type.

For the planned new container terminal berths, considering above conditions at the planned area, the steel pipe pile type foundation will be sufficient in terms of cost, construction method and work period. The pile should be driven up to -33m into the sand stone, which is very dense layer. This type of the foundation is adopted for the adjacent berth structure at Tg. Bulpandan new port. Typical cross section of the wharf is shown in Figure 10.2.5.

Figure 10.2.5 Typical Cross Section of the Wharf at Tg. Bulupandan

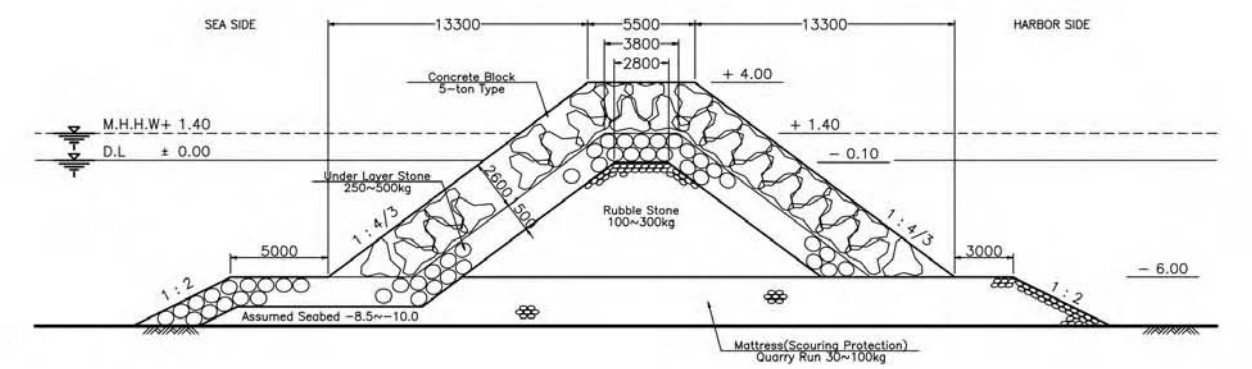


Source: JICA Study Team

b. Breakwater Structure

The breakwater is planned to secure the calmness of the container handling quay wall during rough weather season. The breakwater is designed by placing gravel and riprap stones on the seabed, and concrete cups are placed on top of the gravel stone mounded. The large concrete blocks around 5 ton units are placed on the seaside slope as amour stone protection. Typical cross section of the breakwater is shown in Figure 10.2.6.

Figure 10.2.5 Typical Cross Section of the Breakwater at Tg. Bulupandan



Source: JICA Study Team

c. Dredging and Reclamation Works

The existing seabed where berthing area, entrance channel and basin are planned has various water depth ranging from -4m to -15m. It is necessary to deepen the channel and basin areas to obtain the required water depth -14 to -15m. Considering the results of soil investigation, the dredging works is planned to be carried out by cutter suction dredgers.

d. Estimate of Project Cost

The project cost is estimated in line with the stage development plan of the new port at Tg. Bulupandan. The project cost is summarized in Table 10.2.4. In this table Office/Gate/Workshop/ Others means superstructures such as administration buildings, gates, maintenance shops, electric sub stations, water towers, and utility facilities of electric supply and water supply works.

e. Schedule

Table 10.2.5 shows Investment schedule for the project. The scope of wharf construction works in the Phased Development up to 2025 is as follows,

Phase 1 ; 5 berths x 300m (-14m), 1 berth x 350m (-14m)

Phase 2 ; 2 berths x 350m (-15m) ; new additional construction

1 berth x 350m (-15m) ; deepening of 1m for 1 berth x 350m (-14m)

Total ; 5 berths x 300m (-14m), 3 berth x 350m (-15m)

Table 10.2.4 Summary of Project Cost Estimates

Tg. Bulupandan		Cost (1,000 USD)	
		Phase 1	Phase 2
Wharf		77,400	29,400
Container Yard		64,000	19,700
Office/Gate/Workshop/Others		34,600	11,700
Breakwater		41,300	24,500
Revetment		15,300	3,400
Dredging		66,000	9,300
Reclamation		24,100	13,100
Access Road		10,000	0
Container Handling Equipment		121,500	59,300
(a) Direct Construction Cost		**454,200**	**170,400**
Consulting Services		36,300	13,700
Contingency	10% of Const+Coslt Services	49,000	18,500
(b) Total Direct Project Cost		**539,500**	**202,600**
TAX and Duties	5% of Foreign Portion	8,100	3,000
VAT (Value Added Tax)	11% of Foreign Portion and Local portion	59,300	22,300
Administration Cost	3% of (b)	16,200	6,100
Sub Total		83,600	31,400
(c) Total Project Cost		**623,100**	**234,000**

Source: JICA Study Team

Table 10.2.5 Investment Schedule of New Port

Work Item	2010	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
MP/FS																
L/A																
Select Conslt.																
D/D																
Bidding																
Implementation	Phase I															
	Phase II															

Source: JICA Study Team

f. Port Maintenance

The maintenance cost for facilities is set out as percentage of the facility construction cost based on the annual maintenance fee of the facilities. Table 10.2.6 shows percentage of the construction/installation cost for annual maintenance cost.

Table 10.2.6 Percentage of Construction/Installation Cost for Annual Maintenance Cost

Item	%
Wharf	2.0
Container Yard	2.5
Administration Building	3.0
Warehouse/Others terminal facilities	2.0
Revetment	1.0
Breakwater	0.5
Channel	0.5
Access road	2.5
Container Handling Machine	3.0

Source: JICA Study Team

4) Initial Environmental Examination

a. Objectives and the Scope of the Study

Objectives of the IEE Study[1]: The main objectives of the IEE Study are to collect fundamental environmental information of the study area, identify and assess potential impacts on social/natural environment caused by the proposed projects at different phases (i.e. pre-construction. construction and operational phases) in the Master Plan Study. IEE itself is not subject to approval of the EIA (AMDAL) in Indonesia, however with regards to the project, IEE Study aimed to cover the requirements of the JICA Guidelines for Environmental and Social Considerations (2004) as well as Environmental Impact Assessment system in Indonesia.

Scope of the IEE Study: Major basic environmental and social baseline information was collected based on comprehensive literature reviews and existing secondary information. Socio-economic survey (in form of both public consultation and interviews) was carried out at three potentially project-affected villages (Ko'ol, Tolbuk and Klampis).

b. Current State of Environmental and Social Conditions at the Study Area[2]

[Physical Environment]

(i) Water

Water Quality in Tg. Bulupandan has been analyzed at two different locations (Figure A.1.1.1 of Appendix 1). Sampling point L1 is located at the cape near the old brake-water, while L2 is located inside the bay (Table A.1.1.1). Heavy metals such as Copper, Zinc, Cadmium and Lead level were found to be rather high at sampling points. The marine phytoplankton inhabitant conditions in the water indicate that the water is productive enough for the marine habitats at present (Table A.1.1.5 to A1.1.13).

(ii) Sediment and Tide

The related primary data can be referred in the previous section 10.2,1) Natural Conditions from the Survey.

(iii) Air/Noise

Secondary data indicates that air quality in good at present. Although no secondary data is available for noise, the field inspection results show that noise is not a problem with little traffic at present.

[Biological Environment]

i) Fauna and Flora

Mangroves: The coastline along the bay is fringed with mangrove habitats with a thickness varying between about 5 and 30 meters. The field survey result indicates that mangrove forests identified in the area are in good condition. A total of 27 species of mangroves are identified (Table A.1.1.2 to A1.1.3).

Water Birds: 29 bird species are found in the area. Among them 8 species are protected species under Indonesian Government Regulation Republic Indonesia Number 7 Year 1999,

[1] IEE Study was entrusted to Surabaya Institute of Technology under the responsibility of JICA Study team.

[2] Tables and supportive information regarding IEE are given in Appendix1.1.

10 species identified that are listed in IUCN Red list. Two species identified are on the verge of extinction (Table A1.1.4).

[Social Environment[3]]

i) Population and Land Use

Population: The Klampis sub-district, comprising 22 villages, occupies a land area of 67.1km2 with a population of 50,416 (or 16,467 households) / population density of 2,292 persons per village or 7.51person/ha (Table A.1.12). Population of Klampis sub-district by sex groups is as follows: 22,601 males and 27,815 females, with sex ratio of 0.81. 67% of the population belongs to economically active age group (Table A.1.13).

Land Use: In the study area, the predominant use of land is agriculture, fishpond and residential area (Table A.1.15).

ii) Economic Activities /Labor

Labor: 43% of the respondents are engage in farming, followed by fisheries by 33% and trading by 8% and 7% are unemployed (Table A.1.16). Although there are no official figures, there are quite a number of migrant workers (including a small number women), who either goes overseas or to other islands within the country.

Economic Activities: *Farming:* The major crops grown in the farming area of the surveyed villages are rice, corn, cassava, sweet potatoes, and green beans. Their productivities are relatively low (Table A.1.17).

Fisheries[4]: Fishermen in Klampis are mostly engaged in either marine fisheries or fishpond aquaculture (*tambak*) in the area. Klampis has the largest marine fisherman population in the regency. There is a fisheries port in Klampis village, and the port is being used to beach their fishing crafts to go off shore- fishing. The bay area in Tg. Bulupandan is used for gill net fishing by fishermen from Klampis village and also some from other sub-districts (such as Bangkalan etc.). The major local fish caught in the bay are: *Banden, kerapu, tengiri, kakap merah, kembung,lajur,udang etc.*

Marine Fishery production: Klampis has the second largest marine fishery production of 3,694ton/year after Sepulu (4,987ton/year) Productivity per fisherman is 875,000 Rp/ year (or Rp72,916 /month).

Fishpond aquaculture production: Klampis has the 6th largest fishpond production of 141 ton (Socah has the largest production of 445 ton). Productivity per fishpond is relatively low with 581,309 Rp/year (or Rp.48,442/month).

Industries: Most of the industries in operation in the sub-district are of small-scale. According to statistical data (Bangkalan in Figure, 2006), there are 188 home industries with 504 employees (average number of employment is 2.7) and a production rate of Rp.1,052,000 /year (or Rp.87,666/month). Major industries include: shrimp paste (*terasi*), wood cutting, rice husk etc.

iii) Income Level

Income: Based on the field survey, monthly income ranges between below Rp 0.5million to over Rp2.5million. The largest tier of income level was between below Rp. 0.5million (58%) and

[3] Baseline information is based on secondary information as well as primary information through social survey (62 respondents) carried out at Ko'ol, Tolbok and Klampis Barat village.

[4] Fisheries statistical data are referred from Bangkalan in figure 2006

second largest was Rp 0.5million – 1million(16%), followed by Rp 1million –2million(7%). (Table A.1.18).

Poverty Indicator[5]:

In Klampis sub-district, 20% are categorized as "very poor" and 43% as "poor" based on BKKBN statistics (Table A.1.19).

iv) Housing and Social Services

House Type and Housing Area: Survey result shows that 90 % of the houses are permanent and 10% temporary. All the respondents have certified ownership of the house.

v) Social Infrastructure and Public Utilities

Education: The survey results shows that 60% of the respondents are elementary graduates, 14% graduates from middle school and 10% from high school, and 2 % from Islamic high school and 14% has no education at all (Table A.1.1.21).

Public Health: There is only one decent size clinic in the area. According to social survey, some of the respondents have recently suffered from respiratory problems, fever diarrhea, rheumatism, and dengue fever etc.

Water: Villagers in the Ko'ol and Tolbuk are using only well water and not tapped water (around 23% are using tapped water in the Klampis Barat) (Table A.1.1.22).

Electricity: Although electricity is available in over 50% of the households in the area, many households are still dependent on wood/coal and kerosene for cooking and for lighting (Table A.1.1.23).

vi) Culture, Life Style and Values

Religion: Based on Bangkalan in Figures 2006, 100% of Klampis Sub district residents are Moslem.

Social values: 93% of respondents stated that the social solidarity was respected in the village, and they lived in peace within the community. Head of Village and Informal Islamic leader (*Kepala desa* and *Ulama*) are the most respected and valued people by the citizens. Regarding social acceptability towards the outsiders, 48% of respondents would welcome them with open arms, while 16% would not welcome, but rather reject them.

vii) Land Tenure

In Madura, there are mainly two types of land use rights, of which one is the formal land use certificate based on a written law, and the other, which is mostly dominant in the area, is so called "*Petok D',* a land claim that comes from the customary law. Not only in Madura Island but In Indonesia, the current system of the land titles should be understood in the context of how land rights have been established previously, especially in the areas, where customary law is still respected. Evidence of ownership can come in different forms. The most formal of these informal rights to land is said to be "land deed" or "*akte*" [6]. A less formal but perhaps locally stronger right is the "*petok"*, which is a claim on land that comes from a customary law. Documents known as "*Petok C (Letter C)*" or "*Petok D (Letter D)*", are guaranteed by the village heads can be inherited. As for in Madura including the study area, *"Petok D"* is the most

[5] Calculation method for poverty index is referred in Appendix1.1

[6] It is a document that represents the purchase of a piece of land and is officially stamped and notarized.

common land certificate applied. Among the respondents, 81% of them either have *"PetokD"* or posses formal land certificate.

viii) Cultural Heritage

A special attention should be paid to graves that are believed as "a tomb of a holy person" by villagers.

ix) Local Perceptions

Perception towards the Project: 90 % of respondents agreed with the future port development planning in the area. However, 10% of the respondents did not disagree, but expressed their concerns over the impact that development may bring, such as involuntary resettlement, disturbance in their fisheries activities in the bay during the construction etc.

Perceived Benefits of the Project: Although 10% of the respondents expressed their concerns over the project development, all the respondents assessed the significance of the project stated that the project would contribute to: i) provision of new job opportunities (44%); ii) improved infrastructure and transportation system (29%); iii) contribute to the mobilization of the community (14%); iv) Increased community's social welfares (13%).

c. Environmental and Social Impact Assessment of the Project

[Physical Environment]

i) Hydrology

Pre-Construction/Construction and Operational Stage:

The hydrodynamic simulation on a qualitative level was carried out based on the "with" and "without" the project scenario to analyze the current flow, sediment concentration, seabed etc. The methodology of the simulation and their results are shown in (Appendix1.1 2)). The simulation result indicates that hydrological changes by reclamation activities will induce changes in current flow/sediment /seabed condition.

ii) Water Quality

Construction Stage: Although the water productivity level is currently good for marine habitats, some heavy metals values were found to be high during the field survey. Water quality may be further deteriorated during construction due to dredging and reclamation activities. Dredging of the basin could stir up the sediments and increase the turbidity due to suspended particles, resulting in a reduction in the amount of light penetrated into the water column. This leads to a reduction in the rate of photosynthesis of marine organism, thus, leading to a deterioration of the water productivity.

Operational Stage: Reclaimed land may block the water circulation and induce water quality degradation. Water quality may also be deteriorated due to pollution from oil& hydrocarbons, pollution caused by maintenance dredging activities, sewage effluent, pollution form cargo processing and handling, etc. Possible industrial development in the future will induce increased amount of wastewater from the industries and increased human activities.

iii) Air

Pre-Construction/Construction Stage: Although the air quality is good at present with few vehicles, the construction work with increased vehicles may lead to increase in pollutant in the air during the construction period, particularly, due to activities such as transport of quarry materials, vehicle gas emissions etc.

Operational Stage: During operation stage, indirect impacts on air quality may result from increased traffic due to development of the area. Pollutant emission from the industrial estates, increased human activities due to influx of workers may further deteriorate the air conditions. Such impacts may not be negligible.

iv) Noise and Vibration

Pre-Construction/Construction Stage: Although noise not a problem at present, the port development activities may result in increased noise levels around the construction site during the construction period due to drilling, trucks transporting construction materials from the quarry sites to the port etc, however presumed to be on a manageable level.

Operational Stage: During operation stage, indirect impacts on noise and vibration would result from increased traffic due to better access and possible industrial development of the area.

v) Impacts on dredging

Pre-Construction/Construction Stage: According to the planning, dredged materials are to be directly diverted to the reclamation areas of the harbor.

Operational Stage: Existing marine habitats at the dumping sites can be disrupted by the disposal of dredged materials. Wave and current environment in dumping sites will change as a result of the bottom bathymetry. If the dredged materials during the operational stage contain toxic substances, they will disperse in the surrounding areas of the disposal site thus polluting neighboring waters. Impacts are considered to be negative and significant.

[Biological Environment]

Pre-Construction/Construction and Operational Stage: Under the current plan, the reclamation area will cover up all along the bay (approx. 2km), and this will directly affect all fringing mangroves along the bay. The dredging activities will increase the turbidity level of the shore area, therefore, reducing the penetration of sunlight into the water area. This will lead to decrease in the photosynthesis of the marine ecologies, resulting in a reduction in a primary productivity in the coastal marine environment.

Operational/Maintenance Stage: Activities during operational stage will continue to have adverse impacts on the ecological habitats, fauna and flora of the area. Further, the existing fringing mangroves and swamps will also be affected form oil spills and also, in long turn due to oil leakage from ships and vessels. The impacts are continued to be adversely significant and extensive.

[Social Environment]

i) Land Use

Pre-Construction/Construction and Operational Stage: Area subject to land acquisition is mainly fishpond, farming and bare land. Change in land use pattern is anticipated to a certain extent. Tg. Bulupandan, its untamed and rural aesthetic feature, consisting of fishponds and farming land will be altered due to change in land use pattern.

ii) Economic Activities /Labor

Pre-Construction/Construction Stage:

Most of the people are engaged in small-scale farming and fisheries activities. Port related construction work is expected to bring increased temporal works and income for those local

residents. Social baseline information on population and current labor pattern of the area also indicates that sufficient labor force is available. The project will require people with different skills (educated, unskilled, technical or professional etc.). There will also be an influx of labor outside the area.

Operational/Maintenance Stage: The operation of the port, together with improved road condition, will trigger more business opportunities in different areas, such as port related activities, and formal/informal commercial and service activities (such as restaurants, food stands, transportation etc.). Number of influx of labor will continue to grow because of new job opportunities in newly established industries and businesses. Since most of the local people in the area only have primary education, some of the skill-required jobs opportunities are given priority to those outsiders.

iii) Resettlement

Pre-Construction/Construction Stage: In case of port development, proposed plan does not require large scale resettlement since most of land area required for port / port related activities /access road construction will be fishponds/farming and bare land. Small-scale resettlement may take place due to construction of access roads[7].

However, the project is anticipated to induce non-resettlement impacts on a significant level. Livelihood of fishermen and farmers engaged in fishpond aquaculture and farming will be affected due to decreased area of fishpond and farming area. Fishermen, who are engaged in fisheries activities in the bay area, are not able have access to the bay areas for anchoring their crafts and arranging seine nets and fishing equipments during construction period. It is also anticipated by some of the fishermen that they would face problems such as changing fishing route due to port construction related activities.

Operational Stage: Livelihood of fishermen engaged in fishpond aquaculture will be affected due to decreased area of fishponds. Fishermen engaged in net-fishing in the bay will lose their fishing grounds. The non-resettlement impact of the fishermen and the farmers will continue to be significant.

As referred in the following chapter, the future integrated port hinterland development induced by the port development activities may lead to involuntary resettlement, where around 12 thousand local villagers will be affected due to large land area (approx.1, 600 ha) to be developed. The scale of resettlement impact shall be significant and extensive in such case.

iv) Public Health

Pre-Construction/Construction Stage: There are not sufficient medical services available in Klampis sub-district at present. An increase in population including influx of labor outside the area may lead to impacts such as i) risk for contracting and spreading diseases; ii) insufficient public heath facilities to deal with such increased health problems iii) deterioration of sanitary conditions in the construction area.

Operational Stage: Increase in labor population may continue to induce risks of contracting and spreading diseases and deterioration of sanitary conditions due to increase in wastes produced by human daily activities. Better road condition will enable better access to medical services in the urban area, but may be deteriorated in the rural area. The impact may not be negligible.

[7] The possible losses may include: loss of land (fishpond, farming area, residential area, and commercial land area), Impacts on loss of structures (houses, secondary structures etc.), public facilities, crops, and other economic and income generating activities etc.

v) Women and Vulnerable Groups

Pre-Construction/Construction/ Operational Stage: Women's main role is to support the family livelihood and may be engaged in second jobs to support the family. They may go shell picking in the tidelands during the day and go looking for forage for the livestock. Their small scale but economic activities may be affected. Women may face dangers and risk in a socially disadvantaged position. Massive flow of construction workers might increase a risk of chronic problems such as prostitution and spread of HIV/AIDS for women.

Around 67% of the population in Klampis sub-district is considered "poor". Their livelihood may be affected due to loss of access to natural resources and income generating activities.

vi) Culture and Interaction /Conflicts of interest

Pre-Construction/Construction and Operational Stage: In general, people have positive perception towards port development and villagers have anticipation that the port development will bring new and better employment opportunities. However, limited employment opportunities in the port development activities may induce negative perceptions among the locals within the community (i.e. horizontal conflict) in competing one another for the employment opportunities offered.

vii) Safety

Pre-Construction/Construction and Operational Stage: Gas pipeline built/to be built near Tg. Bulupandan possesses a high risk of maritime accidents. Number of accidents may be increase, due to increased traffic with better road condition.

The summary of impact assessed on Initial Environmental Examination (IEE) is as follows;

Table10.2.7 Summary of Anticipated Environmental and Social Impacts

Environmental Impact Items	Pre / construction stage	Operation stage	Remarks
A. Physical Environment			
1. Land	C	C	• Land reclamation may cause surface water runoff. • Reclamation will change the current flow/ sediment concentration / sea bed conditions
2. Water	A	A	• Reclamation activities may induce changes in oceanographic conditions, such as current flow/ sediment transport, sea bed conditions. • Dredging activities may deteriorate the water quality.
3. Air	B	B	• Deterioration of ambient air quality may occur by using construction machineries during construction period. • Offensive odor during the construction. • Air quality degradation may occur due to polluted gas emission from new industrial development estates.
4. Noise and Vibration	B	B	• Increase of noise level by using construction machinery during the construction. • Increase in traffic volume due to port and industrial /urban development.
5. Bottom sediment	A	A	• Adverse impacts on sediments may occur due to dredging • Contamination of sediments by discharge or dumping of materials
B. Biological Environment			
1. Terrestrial	A	A	• Reclamation activities will adversely affect the existing ecological cycle and diversity. Especially fringed mangroves along the bay will be directly affected due to change in hydrological condition. • Water birds, of which several are under protection, are identified around the mangrove area
2. Marine	A	A	

Environmental Impact Items	Pre / construction stage	Operation stage	Remarks
C. Land Use			
1. Land Use and Zoning	B	B	• Most of the land area subject to land acquisition is mainly fishpond, farming and bare land. Some proportion of the army owed fishpond land is leased to local fishermen.
2. Aesthetics and Visual Effects	B	A	• Change of the landscape will take place due to port development.
3. Archaeological and Historical Sites	B	B	• Existence of remains and cultural assets should be confirmed before construction. • A special attention should be paid to graves.
D. Socio-Cultural Economic			
1. Resettlement	B	B	• Resettlement impact is minimized under present planning for ports and access roads. • Non-resettlement impacts of the PAP should be considered as well.
2 Economic Activities	A	A	(Adverse impacts) • Fishermen/farmers may lose access to existing land/natural resources/ income generating activities (Positive impacts) • New port related activities may bring new and diversified local job opportunities for the local people.
3. Labor and Employment	A	A	
4. Housing and Social Services	C	C	• Lack of social services may hurt the vulnerables. • Temporal houses may increase during construction phase due to infulx of labor outside.
5. Infrastructure and Public Utilities	C	C	• Existing social infrastructure may be affected due to project development.
6. Public Health and Safety	C	C	• Deterioration of the sanitary condition in and around the project area may occur due to construction of labor camps for the project. • Influx of the labors may induce spread of the epidemic /contagious s diseases such as HIV/AIDS in and around the project area.
7. Culture, Lifestyle and Values	B	B	• Disruption/ loss of established social system and networks • Influx of population introducing new customs, culture etc.
8. Women and Vulnerable Groups	B	B	• Over 60% of the population of the sub-district is considered “poor”. They may be affected to a larger extent by loss of income generating activities. • Massive flow of construction workers might increase a risk of chronic problems such as prostitution and spread of HIV/AIDS for women.
9. Conflict of interests	B	B	• Conflicts of interest stemming from land dispute/economic reasons/social reasons may occur. • Limited employment opportunities in the port development activities will induce social disparity and insecurity.
10. Equity of benefits and losses	B	B	• Increased disparity in income/assets/accessibility among the locals • Regional divide may occur due to development of new port / access road.
11. Safety	B	A	• Installed sub sea pipeline or offshore oil/gas station may incur risk for maritime insecurity in the port area. • Due to increase in traffic volume may induce increased traffic accident risks.

Note: Evaluation categories are as follows

A: Significant environmental and social impact is expected.
B: Environmental and social impact is expected to some extent.
C: environmental and social impact is minimum.
D: Environmental and social impact is less significant.
U: Environmental impact Unknown

d. Impact Mitigation Measures and Recommendations

Proposed measures based on the possible impacts predicted in the previous section are examined below. For mitigation measures that correspond to each impact items are also summarized in the low below table including location and timetable (refer to Appendix 1.1.3) .

It is to be noted that this study is still at the preliminary stage of project development planning, and for further environmental and social impacts examination, a full-scale EIA (AMDAL) is required under the responsibly of the executing body of the project at the feasibility study stage. The IEE study result shall be utilized as a basis for the preparation and in carrying out the full-scale EIA.

[Physical Environment]

i) Hydrology

The reclaimed land will alter the flow of wave and current that moves parallel to the coastline. Such change will induce alternation of sediment transportation and seabed condition. The impact may be minimized by decreasing the reclamation area, enabling the seawater to flow into the bay. The impacts of dredging on water in the outer harbor will also affect the turbidity level.

It is recommended to numerically model wave and tide induced currents and associated sediment distribution in the harbor basin and in the entrance channels. Such study would enable to identify critical areas of the design, which requires further investigation.

ii) Water

Reclamation work may lead to run off of surface water in the surrounding area. Impacts may be minimized by decreasing the reclamation area and accommodate with the proper drainage facility. During the opetational stage, the sources of pollutant such as sewerage outfalls, litter disposal, etc. should be restricted. Measures should be taken to prevent pollutants spreading into neighboring area.

In the next stage, the water testing at the bay at the top and bottom of the water column during high/low tide as well as water quality of point sources of surface water discharging into the bay should be analized.

iii) Air Quality

Precaution should be taken to minimize the dust emanation from the vehicles delivering construction materials by wetting the surface, and using the vehicle that meet the exhaust standards.

iv) Noise Level

The noise level could be reduced by using equipment and vehicles that emanates less noise. Proper traffic management practices and maintenance of access roads during the transport will help to reduce the traffic noise.

v) Dredging

Dredging work methodology should be considered carefully to prevent sudden increase in turbidity in the water, which may lead to a stressful condition for the aquatic ecology. For maintenance dredging, careful selection of a site at an adequate distance from the harbor

based on the standard is required[8], to ensure that the disposed materials will not return to the nearby shore areas or re-enter the harbor basin[9]. In the next stage, sediment quality of the seabed materials should be analyzed (ex. such as level of heavy metals) to verify if the dredged materials are suitable for reclamation purposes. Impacts are considered to be negative and significant.

vi) Reclamation

Reclamation material to be obtained should be analyzed to verify its conformity. In Tg. Bulupandan, the dredged materials are planned to use for reclamation purposes. In such case, sediment quality of the seabed should be analyzed.

[Biological Environment]

The lack of saltwater supply and increased sediments will affect the existing mangroves around the reclamation area. A number of protected water birds are identified in the mangrove area. In order to minimize the impacts of the ecological function of the mangroves, rehabilitation or remedial action should at least be taken.

[Social Environment]

i) Economic Activities/Labor

Almost 80% of the villagers engage in farming/fisheries in Tg. Bulupandan area. The current farming and fishpond area are not fertile enough and their land productivities are relatively low. However, the locals stake their livelihoods on them and deprivation of such economic activities may further increase their socio-economic and even food insecurity. On the other hand, change in land use pattern due to the development of port and new industrial and urban development may bring long-term growth with new type of economic activities in the local community. In this respect, the port development will possibly induce two side impacts. One of the key successes to achieve this objective is how to accommodate the local intentions and aspirations into project planning. Local human resource should not be undermined, and priorities should be given to them for port construction related activities. Provision of proper training for the required jobs both for short and long term perspectives, and, improved social awareness programs may be given as part of community development programs.

Below are possible assistances that could be provided that will contribute to community empowerment:

- Project related job training
- Skills training
- Agricultural and Fisheries extension
- Credit scheme specific to the project
- Social awareness programs for the community to be integrated into the new development planning
- Socio-economic support for the vulnerable

In the next stage, further social studies are required to identify the detailed socio-economic conditions of the local communities and their needs to be fully integrated into the planned development. Individual study on fisheries communities may be carried out since they are one

[8] According to State Minister of Environmental Decree No.11/2006, maintenance dredging over 500,000 m^3 is subject to full EIA.

[9] Currently, the dumping site for dredged materials from the maintenance dredging in the channel is located around 8km northwest of Kool bay (06°50'30", 112° 48'00") within 1km^2 where there is a water depth of around 30m.

of the most possibly affected people. Detailed baseline information on fisheries conditions (their fishing grounds, technologies used, type of fish catch, production level, willingness to acquire proper fisheries technologies (including processing technologies), willingness to be engaged in other economic activities etc.) shall be considered

ii) Resettlement

No large-scale resettlement is anticipated in the present project planning. However, in case small scale resettlement may not be avoidable for access road construction etc., proper compensation planning should be carried out based on such principles: i) compensation for the lost assets, livelihood, and income; ii) assistance for relocation iii) assistance for rehabilitation, to achieve at lest the pre-project level of well-being.

As referred in the following chapter, future integrated port hinterland development may induce voluntary resettlement which involves around 12 thousand affected local villagers due to large land area to be developed (approx.1,600 ha). The scale of resettlement impact shall be significant and extensive in such case. Resettlement planning should be fully incorporated into socio-economic framework of the regional integrated plan.

Involuntary resettlement can be regarded as a “development opportunity” and allows planners to manage impoverishment risks and turn displaced people into project beneficiaries.

Involuntary resettlement for large-scale infrastructure is not new in Indonesia. There are many lessons learnt in implementation of the large -scale project, some of which are the followings;

- Adequate consultation and information dissemination on impacts and entitlements with the affected people throughout planning, design, and implementation stage;
- Timely proceeding of compensation planning. Payment at replacement cost for compensation for the lost assets in one instance instead of in installments;
- Timely identification of the resettlement sites and its development handling over the sites on time to affected people.
- Adequate timing of income restoration measures with the compensation payment of loss of assets so that the time lag between its payment and restoration implementation is not too long. This is to ensure effective implementation of livelihood and income restoration allowing affected people to re-establish their livelihood in time.
- Adequate institutional arrangements, training staff, grievance and redress mechanism to be in place from the beginning of the project.

Previous studies show that compensation related to non-land acquisition matters has not been commonly practiced in the country. There is no specific land acquisition and resettlement related laws for the compensation for such losses. However, considering the possible impacts induced to such small-scale fishermen, restoration methods should be carefully examined and also construction method to be considered to minimize such impacts.

At the same time, efforts should be made to translate and register current customary land titles “petok” into official land titles through provision of “land registry promotion programs”.

As a next step, with regards to resettlement planning, once the land acquisition areas are specified, studies should be carried out on: i) identification on types of loss of lands and their land ownership, ii) identification of the project affected people (PAP)/socio-economic conditions of the PAP, iii) survey on preliminary inventory of losses (loss of lands, assets, crops, income generating activities etc). Based on those information, Land Acquisition and Resettlement Action Plan (LARAP) should prepared based on the following principles: a) to minimize the impacts from the project, b) to provide fair compensation and assistance, c) to provide

compensation based on replacement cost and market value, c) to consult stakeholders, including communities and ensure theirs participation, d) to provide possible income restoration support programs etc. Compensation preferences and necessary training should be discussed with the local stakeholders during the consultation.

iii) Women and Venerable Groups

Women are economically low-paid, unskilled and are in vulnerable position. Their small-scale, secondary economic activities (such as collecting shells etc.) may be affected due to port development. Influx of construction workers might increase a risk of chronic problems such as prostitution and spread of HIV/AIDS for women. Restoration program of livelihood activities for women should be considered.

Around 67% of the population in Klampis sub-district is considered “poor”. Special consideration should be addressed to vulnerable groups, whose livelihood may be affected due to loss of access to natural resources/income generating activities.

iv) Culture and Interaction/Social Conflicts

The survey shows that the social solidarity is well maintained in the present community. A good co-ordination with the project authority and the local community leaders shall induce less conflict among the locals. The local knowledge should not be undermined but be respected and to utilized in the project planning. Continuous consultation with the community is also required for the better understating about the project and their possible impacts and also to keep them up to date about the planning, so as to allay the social anxieties of the locals regarding the project.

v) Safety

Improved enforcement of maritime security and safety measures shall prevent from maritime accidents. Construction of gas pipelines near the harbor area possesses a high risk in port operation, particularly when vessels access to the harbor area. These risks should be incorporated into port planning. Traffic Safety enhancement for increased traffic in roads should be considered as well.

10.3 New Port Development at Socah

1) Natural Conditions from the Survey

In the study, the following site surveys were carried out to understand the Socah site located at the middle of the access channel:

1. Bathymetric survey,
2. Tidal level measurement, and
3. Soil investigation.

As results, the study has obtained necessary data and the following findings to make a preliminary port development plan:

- Breakwater is not necessary since the peripheral sea is calm enough.
- A platform-type wharf parallel to the channel centerline is deemed the most suitable berthing facility in view of hydraulic characteristics in this area.
- Although foundation soil layers are rather hard, the construction of wharves and trestles with a pile structure is possible. It may be necessary at some locations to use a rock auger for pile driving through a lime stone (coral) layer.
- In front of the wharf it is necessary to dredge the seabed to secure basin depth of -14m for Phase 1 and -15m for Phase 2. For economical dredging, cutter suction dredger(s) of cutter power more than 1,500ps is adequate.
- A dumping site is necessary. To convert a dumping site into a container yard through reclamation, soil improvement works may not be necessary, since the foundation consists of a thin soft layer on the surface, thickness of which is only about 5m, and a sandy non-consolidation layer of 30m thick beneath it on the lime stone bearing stratum.
- It might be difficult to obtain suitable sandy materials enough for reclamation from the sea reasonably adjacent to the Socah area. Additional sandy materials can be obtained from the coastal area of Madura Island.

a. Bathymetric condition

The bathymetric chart in front of Socah area is shown in Figure 10.3.1. General features of the bathymetric condition in this area are;

1. The maximum water depth at the channel center portion is deeper than 20m.

2. At the northern part of the area where width of the Channel is narrow, or about 2.2km, the seabed slopes are relatively steep toward the channel center. The gradients of slope are about 1 on 30 to 40.

3. At the southern part of the area where width of the Madura Strait is wider, the seabed slopes are relatively gentle toward the channel center. The gradients of slope are around 1 on 80 to 100. The near-shore sea is very shallow.

4. Along the coastline in the area there are small dikes for fish ponds continuously with mangrove plantation.

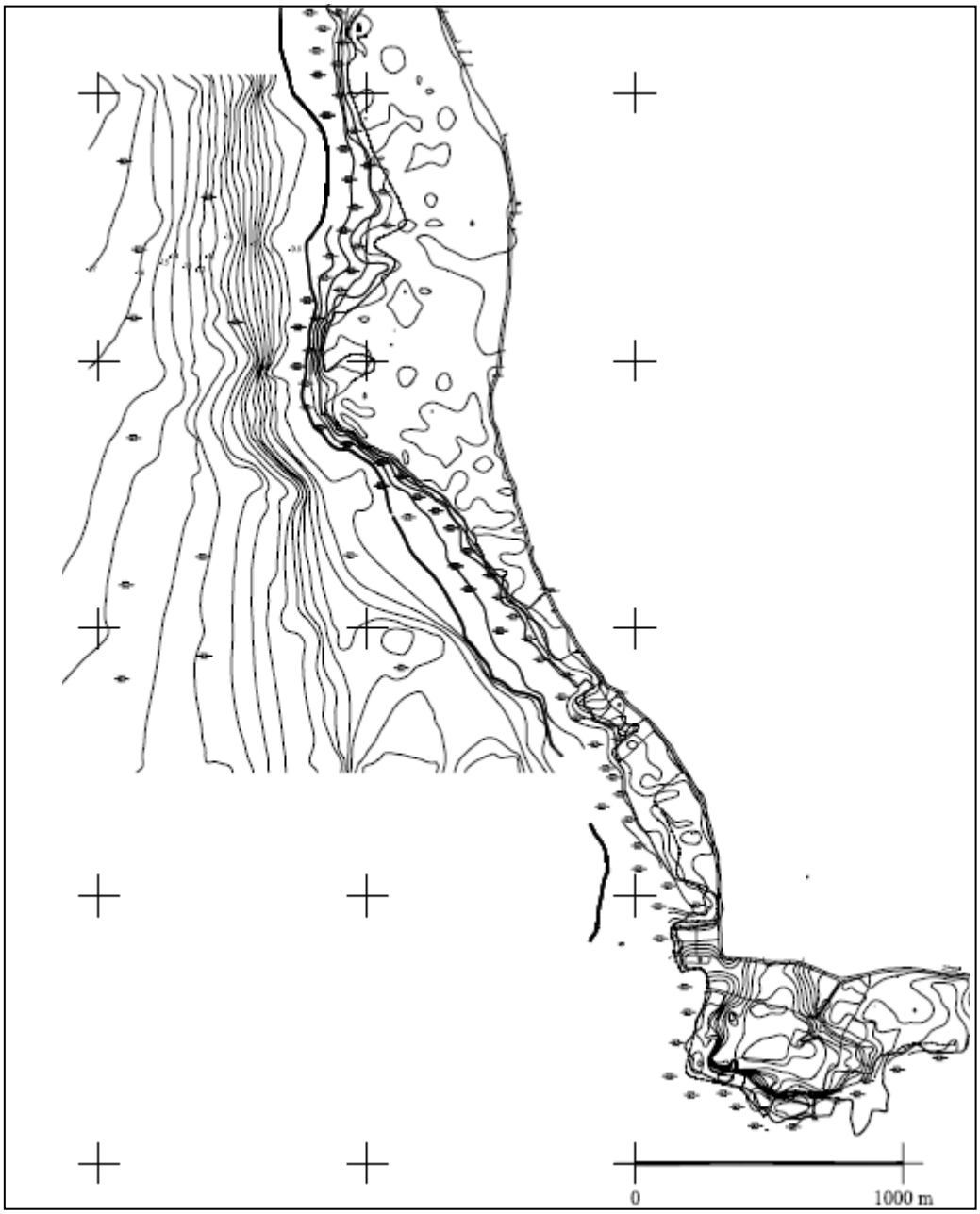
b. Topographic Condition

There is only one road running along the shoreline. The distance between the road and the shore varies from about 100m to 500 m. Topographic survey is performed at this strip between the road and the shoreline. The result is shown in Figure 10.3.1.

Most of this area is occupied by fish ponds, compartmentalized by small string-like dykes except village areas. The crown levels of the dykes are about +2.0m to +2.5m above LWS (CDL). The depths of fish pond are about CDL 0 to +1.0 m, which is inundated most of the time.

Thus, this area can be considered rather flat in general.

Figure 10.3.1 Bathymetric and Topographic Chart at Near-shore Socah Area

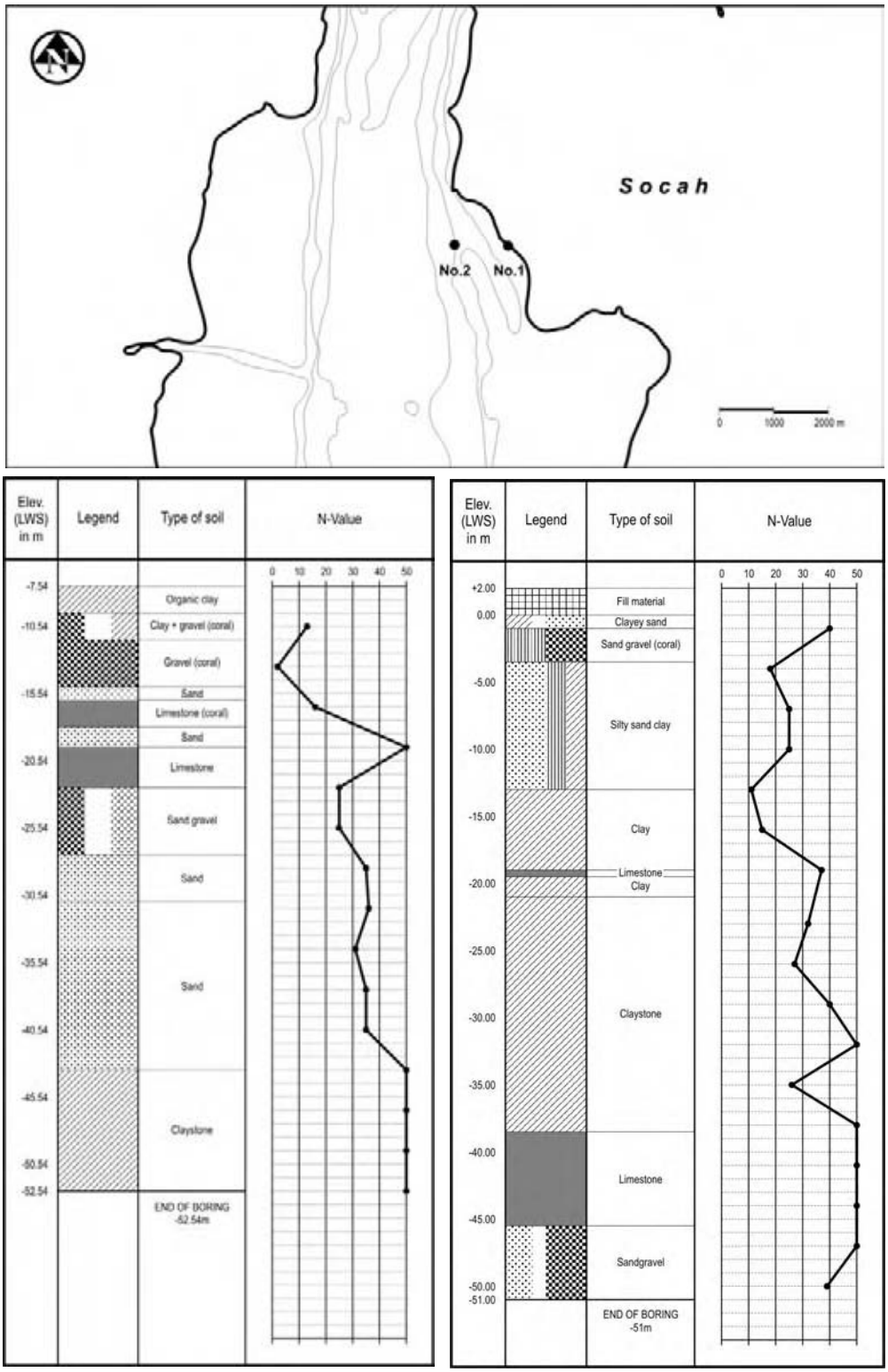


Source: JICA Study Team

c. Soil Condition

Soil borings are performed at 2 points on the shore as shown in Figure 10.3.2. The results of the borings are also shown in Figure 10.3.2. The features of the soil layers are as summarized in Table 10.3.1 below.

Figure 10.3.2 Soil Borings at Socah Coast



Source: JICA Study Team

Table 10.3.1 Soil Characteristics at Socah Coast

Borehole No.	Depth (m above MSL)	Kind of Soil	N-value
1. On the Shoreline (on bank at seashore)	+1.4 to - 0.5	Reclaimed layer	N/A
	-0.5 to -1.5	Clayey sand	0
	-1.5 to -13.5	Clayey sand	20 to 40
	-13.5 to -39	Hard clay	10 to 50
	- 39 to -46	Limestone	150 to 200
	- 46 to -51.5	Sand gravel	40 to 50
2. In the Sea (in the sea about 1 km from the land)	-7.5 to -9.5	Soft clay	0
	-9.5 to -15	Clay & coral	2 to 15
	-15 to -23	Sand & limestone	15 to 70
	-23 to -44	Sand	25 to 35
	-44 to -53	Very hard clay	50 to 100

Source: JICA Study Team

Adjacent to this area towards the south direction along Madura Island, there are 3 borings in the sea which were executed by Pelindo III. Comparing the above results with these boring results, there are some similarities. The first layer on the surface consists of very soft clay and silt (N-value: 0) with a few meters in thickness. The second layer is rather hard layer of sand, clay, or limestone (N-value: 20 to 40). The bottom layer is very hard coral (N-value more than 50).

There is a difference, however, as to the 3 boring holes executed in the past, in which the very hard bottom layers were not encountered although drillings were made up to -50m. Therefore, it is understood that the limestone belt is running on the newly surveyed area.

Generally speaking, thickness of very soft surface layer becomes thinner, coming closer to the seashore. The depth of very hard bottom layer becomes shallower as getting northward.

Thickness of the soft soil layer at Socah area in Madura Island is thinner than those at the opposite side area along Java Island. The reason might be that the thick soft layer with a maximum depth of about 50m on the Java Island side is formed by siltation of small particles carried by rivers such as the Solo River, the Wangen (Miring) River and the Lamong River. On the other hand, there are no large rivers carrying such large quantity of sediment materials on the Madura side.

d. Tidal Condition

The tidal level is observed at every one hour intervals for 15 days continuously. The nine primary tidal components are presented in Table 9.2.1. The pattern of the tide is predominantly diurnal. The Mean Sea Level (MSL) is 1.16m above the Low Water Spring (LWS) which is larger than the value at Pulau Kg. Jamuang and smaller than that at Tg. Perak.

e. Current Condition

As to the current conditions around the Channel in front of Socah area, please refer to the data at Buoy No. 8 shown in Table 9.2.2 described in 9.2, 1).

d. Wave Condition

Socah area can be considered well sheltered in the Strait, and consequently waves are considered to be smaller than 0.5 m throughout a year.

g. Bottom Materials

In this study 2 samples are taken from the seabed in front of the Socah area. These samples are classified by laboratory tests as shown in Table 10.3.2 below. According to the results of thieve and hydraulic tests of the two samples, surface soils are very soft clay and silt, which are scoured, floated, settled or accrued, depending on the degree of acting tidal currents.

Table 10.3.2 Seabed Materials at the Channel in front of Socah

Location	No.	X (deg West)	Y (deg South)	Depth (m)	Type of Soil
Socah North	6	112.66050	7.04932	23.0	Muddy sand
Socah South	7	112.65986	7.08789	17.5	Mud

Source: JICA Study Team

2) Port Development Plan

a. Basic Concepts and Planning Features

Planning Targets: The new Socah Port is planned for the design ships of *Panamax container ships* as *Phase 1* (target year: 2025) and *Largest Panamax container ships* as *Phase 2* (target year: 2030). The major planning indicators are characterized by the combination of a target berth occupancy rate (BOR) of approximately 50% (less than 55%) and required berth number and length as same as Tg. Bulupandan New Port shown in Table 10.2.3. International competitiveness also deserves the top priority in the planning targets.

Development Principle and Location: The new Socah Port will be constructed on the eastern shore of the narrow path at Tg. Sawa - Lighthouse Sembilangan section in the Surabaya West Channel. The root of the port facility is located at Tg. Bulu on Madura Island. The berth is planned to be in the deep water, which is as much as closer to Tg. Bulu, so that costs for dredging can be decreased and hindrance to other ships is minimized.

Originally there were three basic alternative plans, i.e.

Plan-1 Detached platform plus bridges and the port area on the land,

Plan-2 Detached platform plus trestles and the reclaimed port area in the sea, and

Plan-3 Port areas on the coast with dredged basins.

According to the result of geological investigation, it is confirmed that the foundation soils on this coastal area are stiff except the thin surface layer of mud. Hence, large-scale settlement of the reclaimed land is not anticipated. Long bridges of Plan-1 are very expensive. In addition, site surveys proved that natural conditions at the shore should be preserved from environmental viewpoint of view, i.e. the swampy ground for fishing activities and ponds for aquaculture. Plan-3 has serious deficiency from the hydraulic point of view, or the plan is against the Conservation Law of Hydraulic Section. Thus, Plan-2 is considered most suitable. The alignment of the port facilities are shown in Figure 10.3.3.

The front line of the reclaimed land for the port area is originated at the tip of the cape at Tg. Bulu and extended to southward parallel to the channel orientation so that impact to tidal current can be minimized. The berth and the reclaimed land for container yards are connected by trestles.

It is noted that, if further development becomes necessary in the future, the berth and yards can be extended further toward the south. If the planning conditions are changed to smaller scale with shallower depth, the face line of the berth can be set back to shallower water.

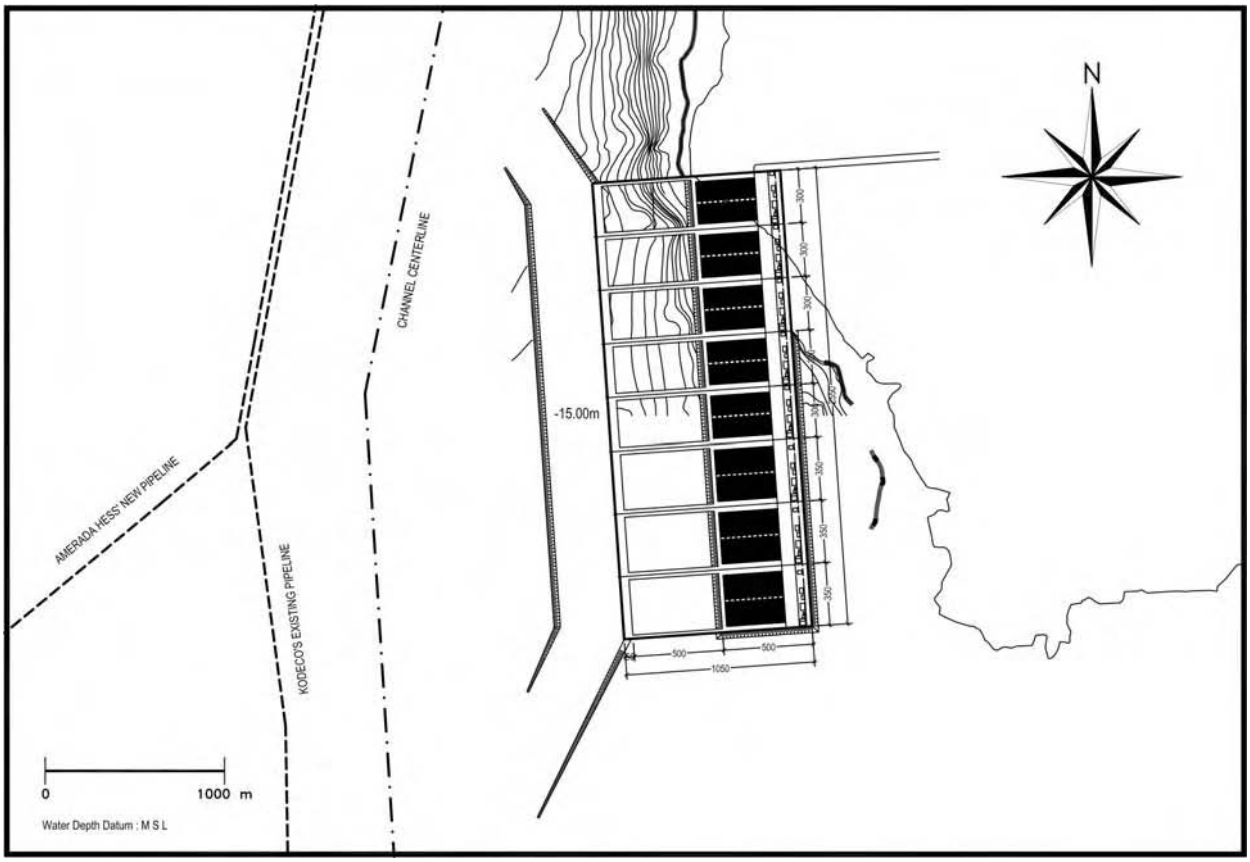
b. Berthing Facilities and Trestles

Berths are arranged to form a rectangular shape. The width of the platform is 50m, forming a space for equipment installation, aprons for vehicle operations, and hatch cover placing.

There are nine trestles with a length of 500m. Seven trestles have widths of 40m and the two at the both ends have 20m in width.

The side of the wharf at the southern end of the platform is allocated as the basin for official boats and work vessels such as pilot boats, tug boats, crane ships, etc.

Figure 10.3.3 Alignment of Port Facilities of New Socah Port



Source: JICA Study Team

c. Container Yards

Yard Space: The container yard is planned to have enough space for a modern container handling yards such as Transfer Crane (RTG) method. The width of the yard is planned to be 500m, most of which is to be reclaimed in the sea. There is a total ground slot (TGS) of more than 3,500 TEU per berth with transfer cranes of 6 rows in the yards.

The area to be reclaimed in the sea is 107 ha among the total yard area of 128 ha.

Container Handling Equipment: The following equipment is planned on the berth and yards:

1. Ship to Shore Gantry Crane (SSG):	2 units each for Panamax berth
	3 units each for Largest Panamax berth
2. Transfer Crane (RTG):	6 units for each berth
3. Tractor Trailer (Chasses):	15 units for each berth

d. Channel and Sedimentation

Access Channel - Surabaya West Channel : The location of the new Socah Port is at the entrance of the Inner Channel of the Surabaya West Channel. The function of the Port is therefore restrained by the capacity of the Outer Channel of the West Channel. As described in 9.2, 2), the access channel dimensions are planned to be maintained at a depth of CDL-15.0m and a width of 350m.

Sedimentation at the Channel and Basin: Sedimentation in the West Channel is expected by siltation and thus maintenance dredging shall be carried out as planned in 9.2, 2). In the basins in front of the berths, capital dredging as well as maintenance dredging is required to deepen the seabed to CDL-15m. The magnitude of those dredging works at the basin, however, should be minimal to make the project compatible with the “Hydraulic Rule of the Madura Strait” recommended in Section 6.3.

e. Anchorages

Anchorage for ships’ waiting for berthing is not necessary theoretically based on the Queuing Theory. A minimum number of anchorages is, however, necessary in practical operations of the Port. The anchorage can be considered at two places, one is off the Outer Channel of the West Channel, and the other is at the downstream water on the east side of the Inner Channel.

f. Navigation Aids

Other than the NAV AIDS at the Access Channel, light beacons are necessary at the corners of the berth to mark the location of the quay structure.

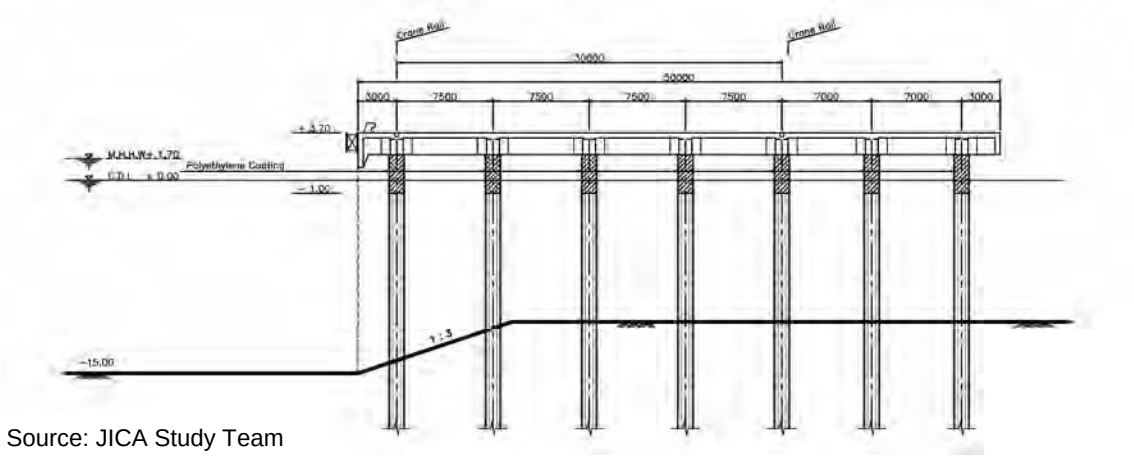
3) Preliminary Port Design and Cost Estimates

The major port structures to be planned and designed are mooring facilities such as quay walls, protective facilities such as a breakwater, and a channel and basins. Since the new port at Socah faces to the West Madura Channel and in the shade of Madura Island, which protects high waves coming from Java Sea, a breakwater is not necessary.

a. Quay wall Structure

The wharf constructs at the deep water area to make dredging cost low, while container yard construct at the shallow area to make reclamation cost low. The wharf and container yard is connected by trestle. As backyard of the wharf is not reclaimed area, the steel pipe pile type foundation is adopted to the adjacent berth structure at the Socah new port. Typical cross section of the wharf is shown in Figure 10.3.4.

Figure 10.3.4 Typical Cross Section of the Wharf at Socah



Source: JICA Study Team

b. Dredging and Reclamation Works

The existing seabed depth of the planned berthing area and entrance channel and basin is -12m to -15m. It is necessary to deepen the channel and basin areas to obtain the required water depth -14 to -15m. The dredging area is close to existing channel, the dredger, which requires anchoring is not adequate to dredge this area for safety of channel passing vessels. It is considering that the dredging works is planned to be carried out by trailer suction dredgers.

c. Estimate of Project Cost

The project cost is estimated in line with the stage development plan of the new port at Socah. The project cost is summarized in Table 10.3.3. In this table Office/Gate/Workshop/ Others means superstructures such as administration buildings, gates, maintenance shops, electric sub stations, water towers, and utility facilities of electric supply and water supply works.

Table 10.3.3 Summary of Project Cost

Socah		**Cost (1,000 USD)**	
		Phase 1	**Phase 2**
Wharf		89,400	33,900
Trestle		90,900	30,300
Container Yard		34,600	61,200
Office/Gate/Workshop/Others		33,800	12,200
Revetment		7,700	3,800
Dredging		23,000	0
Reclamation		9,500	12,000
Access Road		7,000	0
Container Handling Equipment		121,500	59,300
(a) Direct Construction Cost		**444,000**	**171,200**
Consulting Services		35,500	13,700
Contingency	10% of Const+Coslt Services	48,000	18,400
(b) Total Direct Project Cost		**527,500**	**203,300**
TAX and Duties	5% of Foreign Portion	7,900	3,100
VAT (Value Added Tax)	11% of Foreign Portion and Local portion	58,100	22,300
Administration Cost	3% of (b)	15,800	6,100
Sub Total		81,800	31,500
(c) Total Project Cost		**609,300**	**234,800**

Source: JICA Study Team

d. Schedule

Table 10.3.4 shows the investment schedule for the project. The scope of wharf construction works in the Phased Development up to 2025 is as follows,

Phase 1 ; 5 berths x 300m (-14m), 1 berth x 350m (-14m)

Phase 2 ; 2 berths x 350m (-15m) ; new additional construction

1 berth x 350m (-15m) ; deepening of 1m for 1 berth x 350m (-14m)

Total ; 5 berths x 300m (-14m), 3 berth x 350m (-15m)

Table 10.3.4 Investment Schedule of New Port

Work Item	2010	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
MP/FS																
L/A																
Select Conslt.																
D/D																
Bidding																
Implementation	Phase I															
	Phase II															

Source: JICA Study Team

e. Port Maintenance

The maintenance cost for facilities is set out as percentage of the facility construction cost based on the annual maintenance fee of the facilities. Table 10.3.5 shows percentage of the construction/installation cost for annual maintenance cost.

Table 10.3.5 Percentage of Construction/Installation Cost for Annual Maintenance Cost

Item	%
Wharf	2.0
Trestle	2.0
Container Yard	2.5
Administration Building	3.0
Warehouse/Others terminal facilities	2.0
Revetment	1.0
Channel	1.0
Access road	2.5
Container Handling Machine	3.0

Source: JICA Study Team

4) Initial Environmental Examination

a. Objectives and the Scope of the Study

The objectives of the IEE study at Socah, conducted by ITS under the supervision of JICA Study Team, are the same as the IEE study for Tg. Bulupandan. Socio-economic survey (in form of both public consultation and interviews) was carried out at three potentially project-affected villages (Da'iring and Junganyar and Socah).

b. Current State of Environmental and Social Conditions at the Study Area[10]

[Physical Environment]

(i) Water

For water, suspended solid, wastes, detergent, cadmium were above standards (Table A.1.2.1) in sampling points (Da'iring and Junganyar). Water analysis on plankton (phytoplankton, zooplankton, benthos) condition indicates that the water is still good and productive enough for marine inhabitants (Table A.1.2.6 to Table A.1.2.12).

(ii) Sediment and Tide

The related primary data can be referred in the previous section 10.2 1) Natural Conditions from the Survey.

(iii) Air/Noise

Secondary data for air indicates that air conditions are in a good condition (Table A.1.2.2). Although no secondary data is available for noise, field survey result has identified that noise is not a problem with little traffic volume at present.

[Biological Environment]

i) Fauna and Flora

Mangroves: The coastline along the bay area consists of fringing mangrove habitats with a thickness varying between around 5 - 25 meters. The field survey result indicates that mangrove forests identified in the area are in good condition. A total of 23 species of mangroves are identified (Table A.1.2.3 to Table A.1.2.4).

Water Birds: 15 bird species are found in the area. Among them 5species are protected species under Indonesian Government Regulation Republic Indonesia Number 7 Year 1999, and there are also five species identified that are listed in IUCN Red list (Table A.1.2.5).

[Social Environment[11]]

i) Population and Land Use

Population: The Socah sub-district, comprising 11 villages, occupies a land area of 53.8km^2 with a population of 55,493 (or 12,196 households) / population density of 5,944 persons per village or 10.3 person/ha (Table A.1.2.13). Population of Klampis sub-district by sex groups is as follows: 26,031 males and 29,462 females, with sex ratio of 0.88. 64% of the population belongs to economically active age group (Table A.1.2.14).

Land Use: The land use pattern of the three coastal villages that may be affected by the port development activities, are presented in Table A.1.2.16. In all villages, the predominant use of land is agriculture, fishpond and residential area.

ii) Economic Activities /Labor

Labor: 56% of the respondents are engaged in farming / fisheries and trading by 20% (trade and service, packaging etc). 18% are unemployed or only have secondary job. Although there

[10] Tables and supportive information regarding IEE are given in Appendix1.2.

[11] Baseline information is based on secondary information as well as primary information through social survey (62 respondents) carried out at Da'iring, Junganyar and Socah village.

are no official figures, there are quite a number of migrant workers (including a small number women), who either go overseas or to other islands within the country (Table A.1.2.17).

Economic Activities:

Farming: The major crops grown in the farming area of the surveyed villages are rice, corn, cassava, sweet potatoes, and green beans. Their productivities are relatively low (Table A.1.2.18).

Fisheries[12]: Fishermen in Socah are engaged in marine fisheries and fishpond aquaculture (*tambak*). In some parts, semi-intensive fishpond aquaculture is practiced. Socah has a highest productivity for fishpond aquaculture within the regency.

Marine fishery: Socah has a production of 1,615 ton/year. Productivity per fishermen is Rp504,347/year (or Rp42,028/month).

Socah has the fishpond aquaculture production of 445million ton/year. Productivity per fishpond is Rp 1,811,400/year (or Rp 150,950 /month).

Industries: Most of the industries in operation in the sub-district are of small to medium-scale. According to statistical data (Bangkalan in Figure, 2006), there are 565 home industries with 1,714 employees (average number of employment is 3).

iii) Income Level

Income: Based on the field survey, monthly income ranges between Rp. 1million to Rp.10million. The largest tier of income level was between below Rp. 1million–Rp. 2 million (47%) and between Rp. 2.5 million –Rp. 5milllion (45%), followed by Rp. 5 million –Rp. 10 million (8%) (Table A.1.2.19).

Poverty Indicator[13]: In Klampis sub-district, 15% are categorized as “very poor” and 40% as “poor” based on BKKBN statistics (Table A.1.2.20).

iv) Housing and Social Services

House Type and Housing Area: Survey result shows that 66 % of people live in permanent houses, 21% in a semi-permanent and 13% in temporary houses. Around 43% of the people have a house with a total area of $70m^2$-$90m^2$, 57% with a total area of $90m^2$-$120m^2$. All the respondents have certified ownership of the house.

v) Social Infrastructure and Public Utilities

Education/Public Health/Water: The survey results shows that 50% of the respondents are primary school graduate, 24 % middle school, 16% high school and 10% university graduates (Table A.1.2.22). There are only four clinics (of which three are small-scale) available on a sub-district level. Most of the people are using only well water.

vi) Culture, Life Style and Values

Religion: Based on Bangkalan in Figures 2006, 100% of Klampis Sub district residents are Moslem.

Social values: 91% of respondents stated that the social solidarity was respected in the village, and they lived in peace within the community. Head of Village and Informal Islamic leader (*Kepala desa* and *Ulama*) are the most respected and valued people by the citizens. Regarding

[12] Fisheries statistical data are referred from Bangkalan in figure 2006

[13] Poverty criteria index is referred in Appendix 1.1.

social acceptability towards the outsiders, only 16% responded that they would welcome them without any suspicion, and 25% would not accept or rather reject those new comers.

vii) Land Tenure

Land tenure system can be referred in IEE on Tg Bulupandan (10.1).

Cultural Heritage

Some historic inscription sites have been found in Socah village. Although its historical value is yet unknown, they are valued by the villagers. A special attention should be paid to graves that are believed as "a tomb of a holy person" by villagers.

viii) Local Perceptions

Perception towards the Project: Local community perceives the port development planning with both expectation and suspicion. A strong anti-port project sentiment has been prevailing in Socah among some villagers and such perception was clearly indicated by some of the respondents during the consultation meeting[14]. Several other project development plans are underway in the area, but absence of proper information disclosure, locals' inclusion to the planning process had lead to villagers' distrust and dissatisfactory feelings towards such development planning. Among the attendants, 10% of the respondents had responded that they would prefer to maintain their current livelihood activities and they did not wish the planning to proceed. However, it is to be noted that 90% of the attendants had positive perceptions towards port development at the same time (based on the survey response).

Perceived Benefits of the Project: Of those who agreed to assess the significance of the project stated that the project would contribute to: i) better livelihood for the local community (35%); ii) increased employment opportunities (30%); iii) long term benefit to the island (23%); iv) give an opportunity who wants to change for the better (11%) etc. However, even though they basically agreed to the project planning, some concerns were expressed or did agree but with certain conditions, among which were; i) enabling the fishermen to continue fishing (29%); ii) thorough discussions within the local community and co-ordination with the other stakeholders (27%); iii) construction method should be considered to co-exist with the marine-ecosystem (27%); iv) the project should avoid resettlement (16%).

Perceived disadvantages of the Project:

Of those who disagreed with the project planning gave their reasons as follows: i) the project will adversely affect the fisheries community (24%); ii) the project may bring benefits to few group of people but will cause negative impacts to the local community as a whole (38%); iii) loss of current job (14%); iv) Increasing income disparity (13%); v) the local community may be left out from the project benefits (8%).

c. Environmental and Social Impact Assessment of the Project

[Alternative project layouts]

Four alternative layouts were conceptualized. Firstly three alternatives were considered: i) existing condition (without the project), ii) option 1: construction of pier (length: 3km) with trestles, ii) Option 2: reclamation and pier construction, iii) option 3: dredging (water depth: 14m) and construction of port area with reclamation of existing land area. In order to assess the hydrological impacts among those alternatives, hydrodynamic simulation was carried based on

[14] In particular, strong negative opinions and views were expressed by the people in Junganyar, where most densely populated residential area is located along the coastline.

"with" and "without" the project scenario (Appendix1.2 4)). In summary, hydrological changes made by excavation and reclamation activities are anticipated to induce change in the current flow/sedimentation/seabed condition. In this respect, option 1 had the least impact, enabling the current to flow through the trestles, where as option 2 and 3 (or option 3 in particular) are anticipated to have considerable impact on current flow. In considering the socio-environmental and financial aspects, another alternative layout: trestle with reclamation work (but not attached to the land) was considered, which is the alternative selected for the present planning. As a consequence the resettlement impact is minimized.

[Physical Environment]

i) Hydrology

Pre-Construction/Construction and Operational Stage: Current in front of reclamation area is able to flow through in between the trestles, however the seawater flow inside the reclamation area is blocked and not able to flow into the other side. Such blockage of water may aggravate the water circulation and induce water quality degradation of the seawater.

ii) Water Quality

Construction Stage: Although the water is productive enough for the marine habitats at present, some levels of water quality parameters indicate that industrial development, as well as increased human activities across the channel may be inducing water quality degradation. Water quality may be further deteriorated during construction due to dredging.

Operational Stage: Reclaimed land may block the water circulation of the seawater inside the reclamation area. Water quality may also be deteriorated due to pollution from oil& hydrocarbons, pollution caused by maintenance dredging activities, sewage effluent, pollution form cargo processing and handling, etc. Possible industrial development in the future will induce increased amount of wastewater from the industries and increased human economic activities.

iii) Air

Pre-Construction/Construction Stage: Although the air quality is good at present, the construction work with increased vehicles may lead to increase in pollutant in the air during the construction period, particularly, due to activities such as transport of quarry materials, vehicle gas emissions etc.

Operational Stage:

During operation stage, indirect impacts on air quality will result from increased traffic due to better access of roads and possible port related activities and industrial development of the area. Pollutant emission from the industrial estates, increased human activities due to influx of workers is expected to further deteriorate the air conditions.

iv) Noise and Vibration

Pre-Construction/Construction: The port development activities would result in increased noise levels around the construction site during the construction period due to drilling, trucks transporting construction materials from the quarry sites to the port etc.

Operational Stage: During operation stage, indirect impacts on noise and vibration would result from increased traffic due to better access and possible industrial development in the area.

v) Impacts on dredging

Pre-Construction/Construction Stage: Dredging may disturb sea bottom and particle suspension.

Operational Stage:. Wave and current environment in dumping sites may alter as a result of the change in bottom bathymetry. If the dredged materials during the operational stage contain toxic substances, they will disperse in the surrounding areas of the disposal site thus polluting neighboring waters.

[Biological Environment]

Pre-Construction/Construction and Operational Stage: Certain area of mangrove woods will be directly damaged due to reclamation work. Reduced mangrove forest areas due to reclamation will have adverse impacts on other marine and terrestrial fauna and flora, such as water birds and aquatic animals that are dependent on mangroves. The decrease in seawater quality/productivity due to reclamation will also have an impact on existing mangrove ecosystem.

Operational/Maintenance Stage: Existing fringing mangroves and swamps will also be affected form oil spills and also, in long turn due to oil leakage from ships and vessels.

[Social Environment]

i) Land Use

Pre-Construction/Construction and Operational Stage: The port development will bring change in the land use pattern to a certain extent. Some of the fishponds/farming land area will decrease due to possible land acquisition. Certain proportion of fishponds and farming land areas are under private ownership, therefore, proper land acquisition and compensation plan should be prepared and implemented.

ii) Economic Activities /Labor

Pre-Construction/Construction Stage: Farming and fisheries are their dominant economic activities. Semi-intensive fishpond aquaculture is practiced in some parts of fishpond area. Socah has the largest fishpond aquaculture productivity in the regency. Decreased in fish production level is expected due to decrease in fishpond area. Construction work is expected to bring increased temporal works and income for the local residents. Social baseline information on population and current labor pattern of the area also indicates that sufficient labor force is available. The project will require people with different skills (educated, unskilled, technical or professional etc.). There will also be an influx of labor outside the area.

Operational/Maintenance Stage: The operation of the port, together with improved road condition, will trigger more business opportunities in different areas, such as port related activities, and formal/informal commercial and service activities (such as restaurants, food stands, transportation etc.). Number of influx of labor will continuously grow because of new job opportunities in newly established port operation related activities, businesses and industries.

iii) Resettlement

Pre-Construction/Construction Stage: Resettlement impacts are anticipated to be at a minimum under planned design for port development. Small-scale resettlement may be

required for access road development[15]. On the other hand, livelihoods and income of fishermen fishing in the project area will be affected. Such non-resettlement impacts should be considered as Decreased area of fishponds due to land acquisition will lead to decrease in fish catch. Fishermen, who are engaged in net fishing in the mud flats in the project surrounding area, will have difficulties to operate during construction stage because their fishing grounds are disturb due to construction work. It is also anticipated by some fishermen that they may face delay in coming back to the shore after fishing due to changing of fishing route.

Operational Stage: Livelihood of fishermen engaged in fishpond aquaculture will be affected due to decreased area of fishponds. Fishermen engaged in net-fishing in the mud-flats may also find difficulties to continue their fisheries activities due to decreased water quality, marine pollution during operation.

As referred in the following chapter, the future integral port hinterland development including access roads, logistic functions (approx.200 ha) may induce large-scale involuntary resettlement, where more or less than 2,000 local villagers may be affected.

iv) Social Services

Pre-Construction/Construction Stage: There are currently only four small clinics in Socah sub-district. An increase in population including influx of labor outside the area may lead to impacts such as: i) risk for contracting and spreading diseases; ii) insufficient public heath facilities to deal with such increased health problems; iii) deterioration of sanitary conditions in the construction area.

Operational Stage: Increase in labor population may continue to induce risks of contracting and spreading diseases and deterioration of sanitary conditions due to increase in wastes produced by human daily activities. Improvement of accessibility to social services may take place in the urban area, but be aggravated in the rural areas. The impact may not be negligible.

v) Women and Venerable Groups

Construction and Operational Stage: Women are economically low-paid, unskilled and are in vulnerable position. Massive flow of construction workers might increase a risk of chronic problems such as prostitution and spread of HIV/AIDS for women.

Income disparity in Socah is relatively high. Although 30% of the people are categorized as “privileged group”, 55% are under “poor”. Their livelihood may be affected due to loss of access to natural resources and income generating activities.

vi) Conflicts of interest/Equity of benefits and losses

Pre-Construction/Construction and Operational Stage: Anti-development sentiment prevailing in the village may lead to further conflicts among the villagers who are “for” and “against” the project. Limited employment opportunities in the port development activities may induce social conflicts among the locals (i.e. horizontal conflict) in competing one another for the employment opportunities offered. Non-local participatory process in proceeding with the resettlement and land acquisition could induce a conflict with the project authorities (i.e. vertical conflict). Well-maintained social solidarity may be disturbed due to such possible conflicts.

[15] The possible losses may include: loss of land (fishpond, farming area, residential area, commercial land area), Impacts on loss of structures (houses, secondary structures etc.), public facilities, economic and income generating activities etc.

vii) Safety

Pre-Construction/Construction and Operational Stage: Gas pipeline running parallel to the channel will induce extremely high risk of maritime accidents.

The summary of impact assessed on Initial Environmental Evaluation (IEE) is as follows;

Table10.3.6 Summary of Anticipated Environmental and Social Impacts

Environmental Impact Items	Pre/Construction stage	Operation stage	Remarks
A. Physical Environment			
1. Land	C	C	• The new reclamation area may lead to surface water run off.
2. Water	A	A	• The new reclamation area will block water flow along the coastline, therefore affecting the water circulation. • Dredging activities may deteriorate the water quality. • Adequate wastewater disposal during the construction and adequate drainage have to be planned.
3. Air	B	B	• Deterioration of ambient air quality may occur by using construction machineries during construction period. • Offensive odor during the construction.
4. Noise and Vibration	B	B	• Increase of noise level by using construction machinery during the construction. • Increase in traffic volume due to port and industrial /urban development.
5. Bottom sediment	B	B	• Sediment from the river may lead to further sedimentation, affecting the hydrological condition of the area. • Adverse impacts on sediments may occur due to dredging. • Contamination of sediments by discharge or dumping of materials.
B. Biological Environment			
1. Terrestrial	B	B	• The reclaimed land will block the water flow, aggravating the water circulation of the area. This will cause adverse impacts on the marine ecology. • Water birds, of which several are under protection, are identified around the mangrove area.
2. Marine	A	A	
C. Land Use			
1. Land Use and Zoning	B	B	• Parts of the agricultural and fishpond area will be altered due to the port development and construction of access roads. • Most of the fishpond and farming land area as well as small-scale settlement area subject to land acquisition are under private ownership (based on customary law).
2. Aesthetics and Visual Effects	B	B	• Change of the landscape will take place to a certain extent.
3. Archaeological and Historical Sites	B	B	• Existing remains and cultural assets should be confirmed before construction. • A special attention should be paid to graves.
D. Socio-Cultural Economic			
1. Resettlement	B	B	• No-large scale resettlement is anticipated to take place under present project design. However, non-resettlement impacts such as loss of livelihood /income for fishermen during construction /post construction stage will take place.
2 Economic Activities	A	A	(Adverse impacts)

Environmental Impact Items	Pre/Construction stage	Operation stage	Remarks
3. Labor and Employment	A	A	• They may lose access to existing land (crops) /natural resources/ income generating activities. (Positive impacts) • New port related activities may bring new and diversified local job opportunities for the local people.
4. Housing and Social Services	C	C	• Lack of social services may deterioate the livihoods for the vulnerables. • Temporal houses may increase during construction phase due to infulx of labor outside.
5. Infrastructure and Public Utilities	C	C	• Existing social infrastructure may be affected due to project development.
6. Public Health and Safety	C	C	• Deterioration of the sanitary condition in and around the project area may occur due to construction of labor camps for the project. • Influx of the labors may cause the spread of the contiguous diseases such as HIV/AIDS around the project area.
7. Culture, Lifestyle and Values	B	B	• Influx of population may introduce new customs, culture etc. • Disruption/ loss of established social system and networks may increase due to development
8. Women and Vulnerable Groups	B	B	• Massive flow of construction workers might increase a risk of chronic problems such as prostitution and spread of HIV/AIDS for women.
9. Conflict of interests	A	A	• Due to prevailing anti- development sentiment among the part of the villagers, conflicts of interests among pro-project and anti-project villagers may occur. • Limited employment opportunities in the port development activities will induce social insecurity with winners and losers.
10. Equity of benefits and losses	B	B	• Enlargement of disparity of income/accessibility may occur between the locals
11. Accident	B	A	• Sub sea pipelines built / under planning in Madura channel will have a high risk in port operation. • Due to increase in traffic volume may induce increased traffic accident risks.

Note: Evaluation categories are as follows
A: Significant environmental and social impact is expected.
B: Environmental and social impact is expected in some extent.
C: environmental and social impact is minimum.
D: Environmental and social impact is less significant.
U: Environmental impact Unknown

d. Impact Mitigation Measures

Proposed measures based on the possible impacts predicted in the previous section are examined below. For mitigation measures that correspond to each impact items are also summarized in the low below table including location and timetable (refer to Appendix 1.2. 3)) .

[Physical Environment]

i) Hydrology

The reclaimed sea-area may block the water flow in between the coastal land and the reclamation area. Such blockage of water flow will aggravate water circulation, affecting the fishpond/net fishing activities in the area. Reclamation methodology should be considered to minimize such impacts.

A current distribution study should be considered at the next planning stage to investigate whether adequate water circulation exits in the seawater inside the harbor structure.

ii) Water

As mentioned above, mitigation measures should be taken to ensure the water circulation in the seawater area inside the harbor structure. During the opetational stage, the sources of pollutant such as sewerage outfalls, litter disposal, etc. should be restricted. Measures should be taken to prevent pollutants spreading into neighboring area.

In the next stage, the water testing at the bay at the top and bottom of the water column during high/low tide as well as water quality of point sources of surface water discharging into the bay (ex. Solo river) should be analized.

iii) Air Quality

Precaution should be taken to minimize the dust emanation from the vehicles delivering construction materials by wetting the surface, and using the vehicle that meet the exhaust standards.

iv) Noise Level

The noise level could be reduced by using equipment and vehicles that emanates less noise. Proper traffic management practices and maintenance of access roads during the transport will help to reduce the traffic noise.

v) Dredging

Dredging work methodology should be considered carefully to prevent sudden increase in turbidity in the water, which may lead to a stressful condition for the aquatic ecology. For maintenance dredging, careful selection of a site at an adequate distance from the harbor based on the standard required[16], to ensure that the disposed materials will not return to the nearby shore areas or re-enter the harbor basin.

vi) Reclamation

Reclamation material to be obtained should be analyzed to verify its conformity. The material comprises both hard and soft materials, therefore special care should be taken to prevent the hard material findings to be used as reclamation purposes.

[Biological Environment]

Degradation of seawater quality due to reclamation and dredging activities will affect the existing mangroves along the coastline. Several protected water birds are identified around the mangrove area. In order to minimize the impacts of the ecological function of the mangroves rehabilitation or remedial action should be taken.

[Social Environment]

i) Economic Activities/Labor

The port development will possibly bring both negative and positive impacts. The loss of current livelihood activities on one hand and new employment opportunity in the port related activities on the other. One of the key successes to achieve this objective is how to

[16] According to State Minister of Environmental Decree No.11/2006, disposal of dredged materials at dumping site with a volume 500,000 m^3 is subject to full-scale EIA.

accommodate the local intentions and aspirations into project planning. Local human resource should not be undermined, and priorities should be given to them for port construction related activities. Provision of proper training for the required jobs both for short and long term perspectives, and, improved social awareness programs may be given as part of community development programs.

Below are possible assistances that could be provided that will contribute to community empowerment:

- Project related job training
- Skills training
- Agricultural and Fisheries extension
- Credit scheme specific to the project
- Social awareness programs for the community to be integrated into the new development planning
- Socio-economic support for the vulnerable

In the next stage, further social studies are required to identify the detailed socio-economic conditions of the local communities and their needs to be fully integrated into the planned development. Individual study on fisheries communities may be carried out since they are one of the most possibly affected people. Detailed baseline information on fisheries conditions (their fishing grounds, technologies used, type of fish catch, production level, willingness to acquire proper fisheries technologies (including processing technologies), willingness to be engaged in other economic activities etc.) shall be considered.

ii) Resettlement

Under present project design, most of the project affected area is either fishpond or farming land or bare land, therefore the resettlement impact is minimized. However, in case small-scale resettlement may take place due to construction of access roads, resettlement should be carried out based on the following principals: i) compensation for the lost assets, livelihood, and income; ii) assistance for relocation iii) assistance for rehabilitation, to achieve at lest the pre-project level of well-being.

As referred in the following chapter, the future integral port hinterland development including access roads, logistic functions (approx.200 ha) may induce large-scale involuntary resettlement, where around 2,000 local villagers may be affected. Resettlement planning should be fully incorporated into socio-economic framework of the regional integrated plan.

Involuntary resettlement can be regarded as a “development opportunity” and allows planners to manage impoverishment risks and turn displaced people into project beneficiaries.

Previous studies show that compensation related to non-land acquisition matters has not been commonly practiced in the country. There is no specific land acquisition and resettlement related laws for the compensation for such losses. However, considering the possible impacts that could be induced to such small-scale fishermen, restoration methods should be carefully examined and also construction method to be considered to minimize such impacts. At the same time, efforts should be made to translate and register current customary land titles “petok” into official land titles.

As a next step, with regards to resettlement planning, once the land acquisition areas are specified, social studies should be carried out on: i) identification on types of loss of lands and their land ownership, ii) identification of the project affected people (PAP)/socio-economic conditions of the PAP, iii) survey on preliminary inventory of losses (loss of lands, assets, crops,

income generating activities etc). Based on those information, Land Acquisition and Resettlement Action Plan (LARAP) should prepared based on the following principles: a) to minimize the impacts from the project, b) to provide fair compensation and assistance, c) to provide compensation based on replacement cost and market value, c) to consult stakeholders, including communities and ensure theirs participation, d) to provide possible income restoration support programs etc. Compensation preferences and necessary training should be discussed with the local stakeholders during the consultation.

iii) Women and Vulnerable Groups

Women may face dangers and risk in a socially disadvantaged position. Massive flow of construction workers might increase a risk of chronic problems such as prostitution and spread of HIV/AIDS for women. Restoration program of livelihood activities for women should be considered. Special consideration should be addressed to vulnerable groups, whose livelihood may be affected due to loss of access to natural resources/income generating activities

iv) Culture and Interaction/Social Conflicts

Local community perceives the port development planning with both expectation and suspicion. An anti-project sentiment prevailing in parts of Socah is a consequence of absence of local participation in the process for various developments planning taking place in the area. A good co-ordination with the project authority and the local community leaders is necessary and also to keep up to date to the locals about the project planning. The local knowledge should not be undermined but be respected and to be incorporated in the project planning. On-going consultation with the local stakeholders and to ensure theirs participation in the process is essential in proceeding with the project planning.

v) Safety

Improved enforcement of maritime security and safety measures shall prevent from maritime accidents. Construction of gas pipelines near the harbor area possesses a high risk in port operation, particularly when vessels access to the harbor area. These risks should be incorporated into port planning. Traffic Safety enhancement for increased traffic in roads should be considered as well.

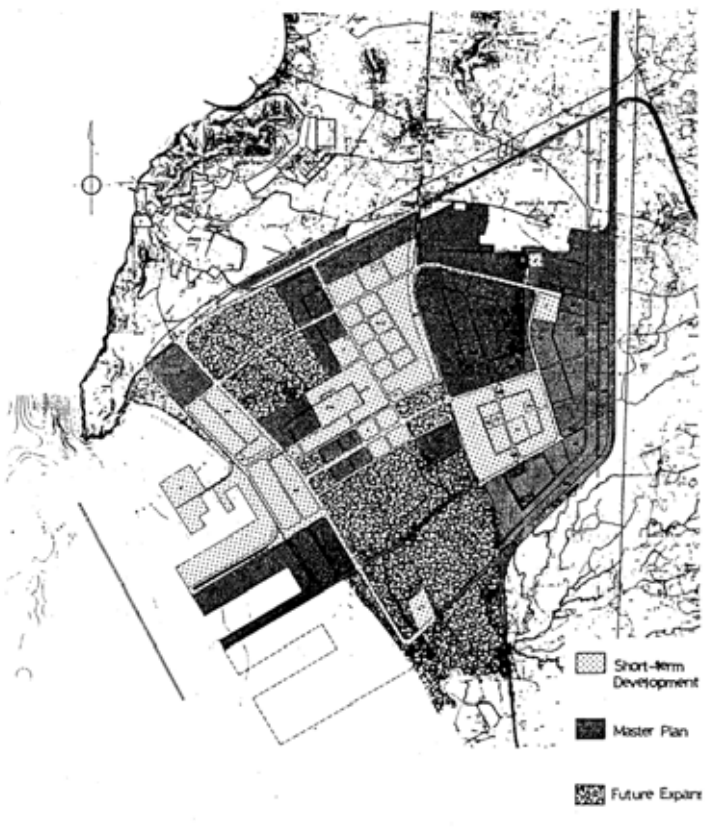
10.4 Integrated Port Hinterland Development

1) Planning Rationale

Gateway port development may have a profound impact on regional development. Particularly, when a gateway port is developed at underdeveloped area and direct hinterland development is associated, greater synergy can be expected than individual developments. Such synergy effect has being demonstrated in Laem Chabang in Thailand, Busan in Korea and other port cities. One of the reasons why the study selected two candidate sites for a gateway port is spaciousness not only for port but also direct hinterland development.

As already stated, Tg. Bulupandan and Socah have different characteristics in many aspects such as dependence on the access channel, local socio-economic conditions and natural environments. Regarding area-wide development project like new town and industrial estate, no commitment has been done so far at Tg. Bulupandan but one large-scale development project developer has already obtained development permit from Bangkalan Regency in Socah, i.e., Madura Integrated Seaport City (MISI).

The study has conceptualized an integrated port hinterland development plan adjoining the proposed Tg. Bulupandan port, creating a self-containing port city. In the case of Socah, however, only a logistics center has been allocated near the proposed Socah port. This is because the MISI project and thus the study do not need to draw a whole picture of area-wise development. But one of port competitiveness points is considered to be the availability of supporting logistics lands near a port.

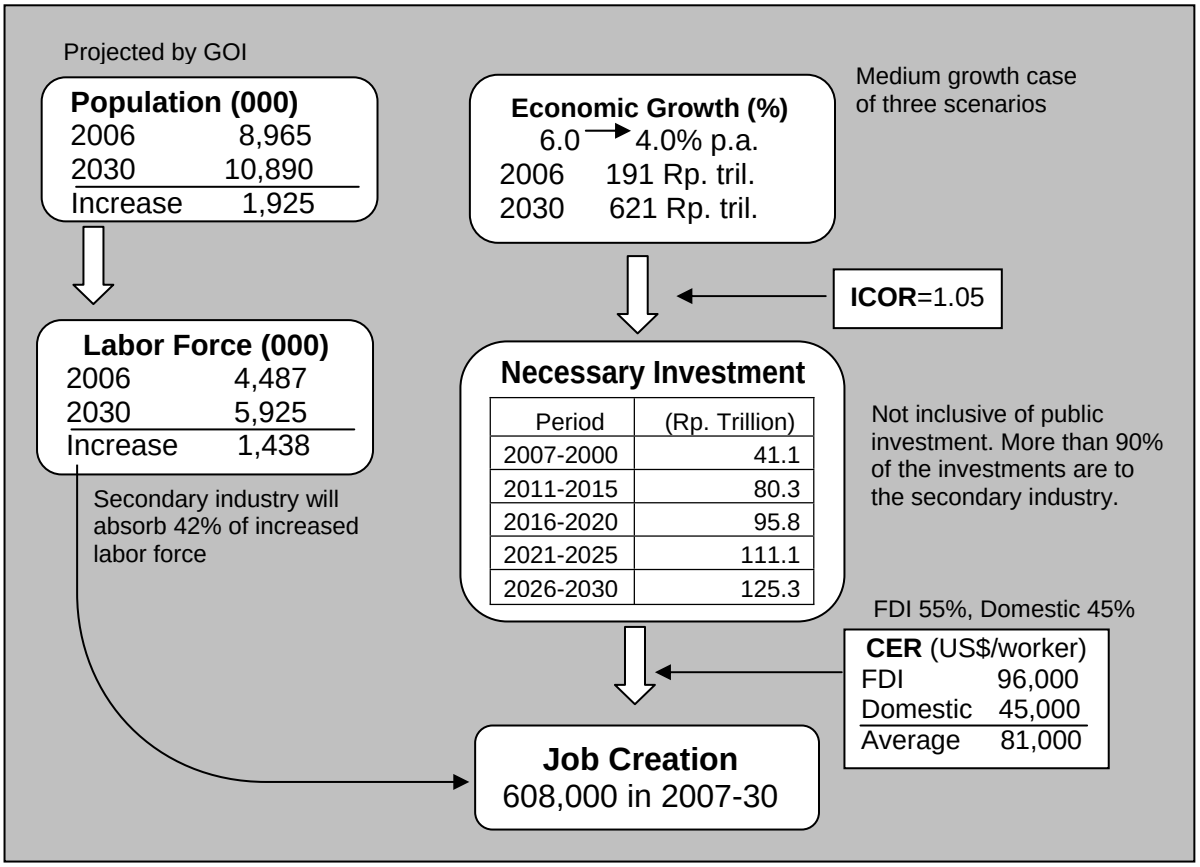
Column 10.1	**Laem Chabang Port Development, Thailand**
History A new gateway seaport of Thailand on the eastern seaboard of the Siam Gulf was conceptualized in the late 1970s. A series of JICA development studies concretize the plan until 1983. Subsequently JBIC loan finance supported the initial port development during 1984 – 1990 or 22.9 billion Yen in total. In 2004, Laem Chabang Port is ranked at the 19th largest container port in the world, handling 3.6 million TEU.	
Initial Land Use Plan	
Port Wharf Area 260 (ha) Port Service Area 500 Industrial Estate 450 New Town 930 Total 2,140	

2) Industrial Land Development Need

In section 1-4) of Chapter 7, future economic growth of the Study Area was projected at 4-6 % per annum until year 2030, as the medium growth case. By this, GRDP of the Study Area will reach Rp.621 trillion, 3.3 times of the present. In order to attain this medium growth, the secondary sector, especially manufacturing sector should lead the growth, sustained by an enormous private investment.

The regional economy in recent six years of 2000-2005 showed Rp.4.18 trillion of GRDP increase at 2006 price, while the private investment was Rp. 4.40 trillion in the same period. Therefore, the incremental capital output ratio (ICOR = Investment / GRDP increase) is estimated at 1.05. Assuming the same value of ICOR in the future, the medium growth case will require Rp. 453 trillion (US$ 49.2 billion) of private investment by the year 2030. (Figure 10.4.1)

Figure 10.4.1 Expected Job Creation by Private Investment



Source: JICA Study Team

Table 2.2.7 shows past private investment in the East Java Province and employment created by the investment. According to the data, the capital equipment ratio (CER: investment per worker) of the foreign direct investment (FDI) is high at US$ 9,600, which is a level of capital intensive industries, while domestic investment shows US$ 45,000. Their weighted average is US$ 8100 Rp. 74.5 million). If applying the same CER to the said Rp.453 trillion of investment, about 0.6 million of employment will be created by the investment by year 2030. As stated in the future framework, labor force of the Study Area will increase by 1.44 million in the same period, 42% of which corresponds to the 0.6 million employment to be created by the private sector investment.

It should be noted, however, the huge amount of investment of Rp. 453 trillion is not a forecast but a target to be attained for the planned economic growth. Without any effort of the public sector and stakeholders, this intensive investment will never take place in the Study Area.

As a nature of the private investment, more than 90% of the amount will focus on the manufacturing sector and the majority will be FDI. In order to call such investments, the Central and Local Governments have to undertake every effort to create an attractive environment for investors, by developing industrial areas, infrastructure of transportation, power and water supply, and livable residential areas. It is also important to foster labor force with good quality, improve sanitary and medical care and maintain good securities.

Institutional and legislative arrangement are the most direct and vital measures to investors. A variety of tax incentives is commonly taken in every industrial park. As the basic laws and regulations are enacted by the Central Government, local measures which can be determined with discretion of the Local Governments should be looked for in order to win the competition of inviting the private capital.

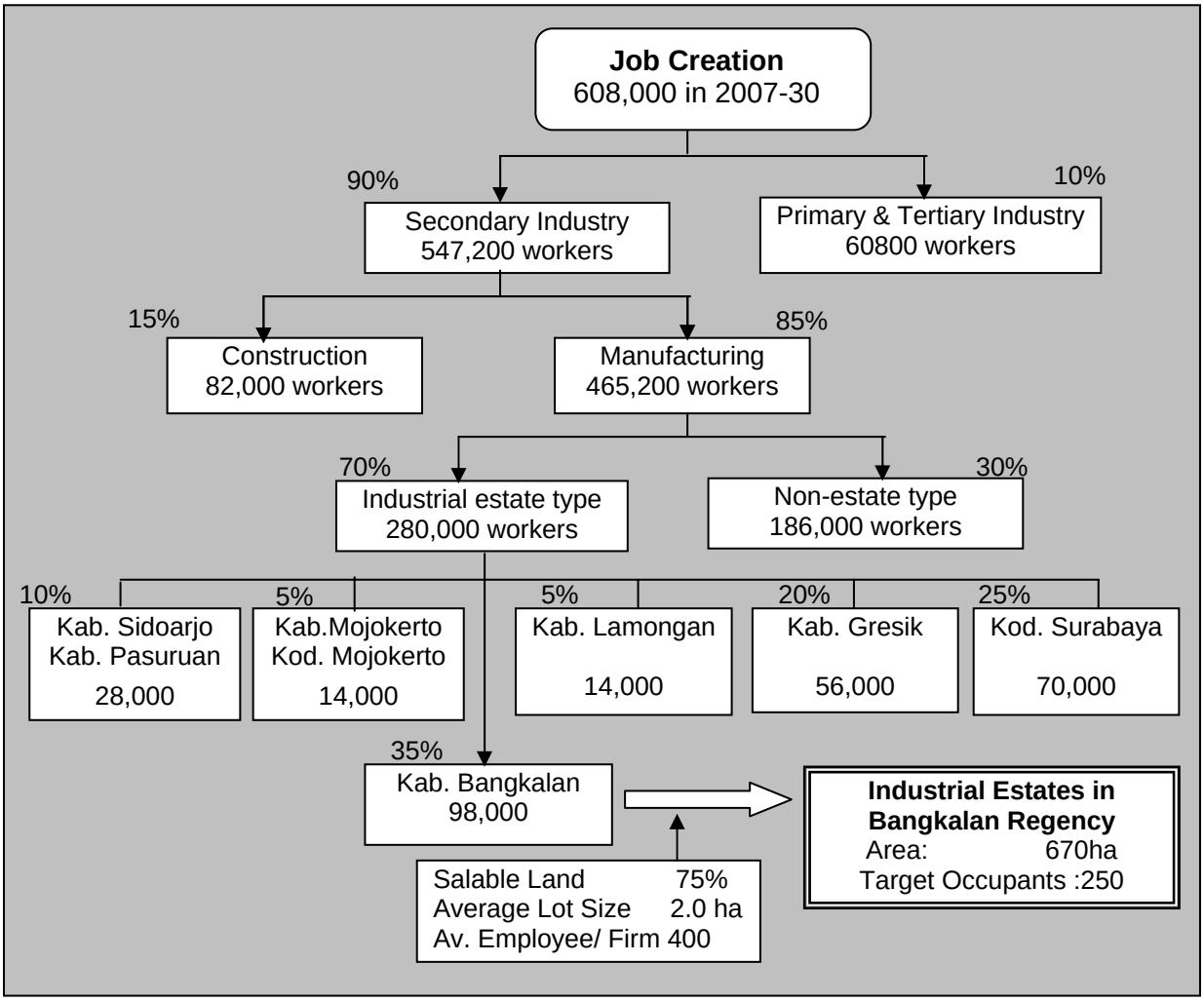
Figure 10.4.2 shows an allocation of newly created employment among industrial sectors and provinces based on the existing employment and its past trend. Out of 465,200 workers in manufacturing sector, 70% are assumed to work in industrial estates where most FDI enterprises will locate.

The new port in Madura will significantly raise the industrial development potential of the hinterland area. The Government should fully utilize this opportunity to activate regional economy and alleviate regional disparity. In this context, one third of the total new employment in industrial estates was allocated to Kab. Bangkalan and the rest were distributed to other areas. Thus, the industrial estates developed in the hinterland have to be planned to employ 98,000 workers in 2030.

Even in the same estate, number of workers and lot size per occupants remarkably vary by capital scale, manufacturing products and era of establishment. Table 10.4.1 shows the number of occupants, area and number of workers in the industrial estates developed in the Study Area. Average site area is in the range of 1.6 – 3.1 hectares except Maspion Industrial Estate, where heavy industries such as steel, steel pipe, stainless steel and industrial gas are mainly located.

As of workers per company, the average of 150 – 300 seems rather small. Large-scale industries such as oil refinery, iron and steel, chemical and electrical apparatus sometimes employ 3000 – 5000 workers per one company. An IT-related industry which has capital-labor intensive nature, also employs 2000 – 3000 workers.

Figure 10.4.2 Geographical Distribution of New Employment



Source: JICA Study Team

Table10.4.1 Area and Workers of Industrial Estate in Study Area, as of August 2007

Name of Estate	Total Area (ha)	Occupancy			Per Company	
		Number of Company	Occupied Area (ha)	Workers	Area (ha)	Workers
Surabaya Industrial Estate (SIER)	476	290	472	50000	1.6	172
Maspion Industrial Estate	341	14	156	4200	11.1*	300
Pasuruan Industrial Estate (PIER)	250	60	184	13000	3.1	217
Gresik Industrial Estate	135	54	133	N.A.	2.5	N.A.-
Ngoro Industrial Estate (NIP)	220	57	104	8700	1.8	152

Note:* Excluding PT. The Master Steel (52.5ha), Average area is 7.7ha
Source: Hearing from each estate

Industrial estates to be developed near the Bulupandan Port or the Socah Port will mainly attract port-oriented industries, which will be medium to large scale industries. From this viewpoint, average employment of 400 workers and average lot size of 2.0 ha are assumed for the industrial estates. Accordingly, total area of industrial estates developed in the hinterland of the port should span at about 670 hectares. The estates are not necessarily developed in one place but split into several sites. In any case, however, they have to be planned to have a good access to the port.

3) Hinterland Development in the case of Tg. Bulupandan

Associated industrial development is a trend when a new gateway port is developed at underdeveloped area. One typical example is Laem Chabang Port, Thailand (refer to Column 10.1). The port was designed to meet two kinds of development needs, i.e., industrial development in the Bangkok Capital Region and new gateway port development from old and congested Bangkok Port.

The section aims at proposing direct hinterland development surrounding Tanjung Bulupandan Port site including access road in order to maximize new port impact in regional development.

Land Use Plan: In the area, main land uses will be logistics, industrial and residential. Arterial roads and open space is an important tool to allocate different land uses in a district in an orderly manner. Each area is determined with the following planning considerations:

- Industrial land: This area attracts gateway port's related industries. The location is attractive for export processing and part of international division of works because of good accessibility to the international markets. The previous section estimates an industrial estate demand of 670 ha in Bangkalan Regency. The study allocates 320 ha for the direct hinterland development.

- Logistics and Business Land: This area absorbs shipping companies, shipping agents, forwarders and other shipping and trading related businesses. Possible development types are office buildings, container depots, warehouses and private terminals. One of the strengths of Tanjung Perak lies in its large direct control area of 517.6ha under PELINDO III. The PELINDO III's Tanjung Perak land is divided into port terminal (43%) and other port related lands (57%) such as port related industries, maritime business complex and private cargo depot and distribution centers. Without such a face-to-face port village configuration, Tanjung Perak might not have kept its competitiveness against other rivalry ports. Similarly, a port complex area of 200 ha will be allocated just behind the port.

- Residential Land: A total of 800 ha lands are allocated for residential use. This is a compound for a population of 96,000 or 120 persons per ha. Near or within residential lands, living services areas such as public, social and commercial facilities are allocated taking accessibility at a community level into account.

- Arterial Roads: It consists of port access road, arterial roads and prime collectors. The port access road has a 6-lane width connecting with Suramadu Bridge in the shortest way (33 km). The port-end section of 4.5km is included within the direct hinterland development plan. The artery and prime collector has 4 lanes to connect the direct hinterland with the surrounding areas and collect internally generated/attracted traffic.

- Open Space: This gateway city is functionally a sleepless city where the port and most of factories operate in a 24x7 system. In order to secure safe and calm living environments and protect ordinary living activities from logistics works, open space and green buffer is allocated. In addition. Two massive greeneries or reserved forests and one spacious recreational field are allocated. A historical site of Tg. Modung will be partly preserved. On the opposite side, Tg. Bulumodung will be also preserved because of a strategic reason. There is a possibility in far future that this area will be the site for port expansion.

Table 10.4.2 Area and Land Use of Integrated Port Hinterland

Land Use	Area (ha)	Composition (%)
Industrial Land	320	20
Logistics and Business Land	200	13
Residential Land	800	50
Public, Social and Commercial Facilities	50	3
Port Access, Artery and Primary Collector Roads	80	5
Open Space (Reserved Forest, Recreational Field, Park)	150	9
Total	1,600	100

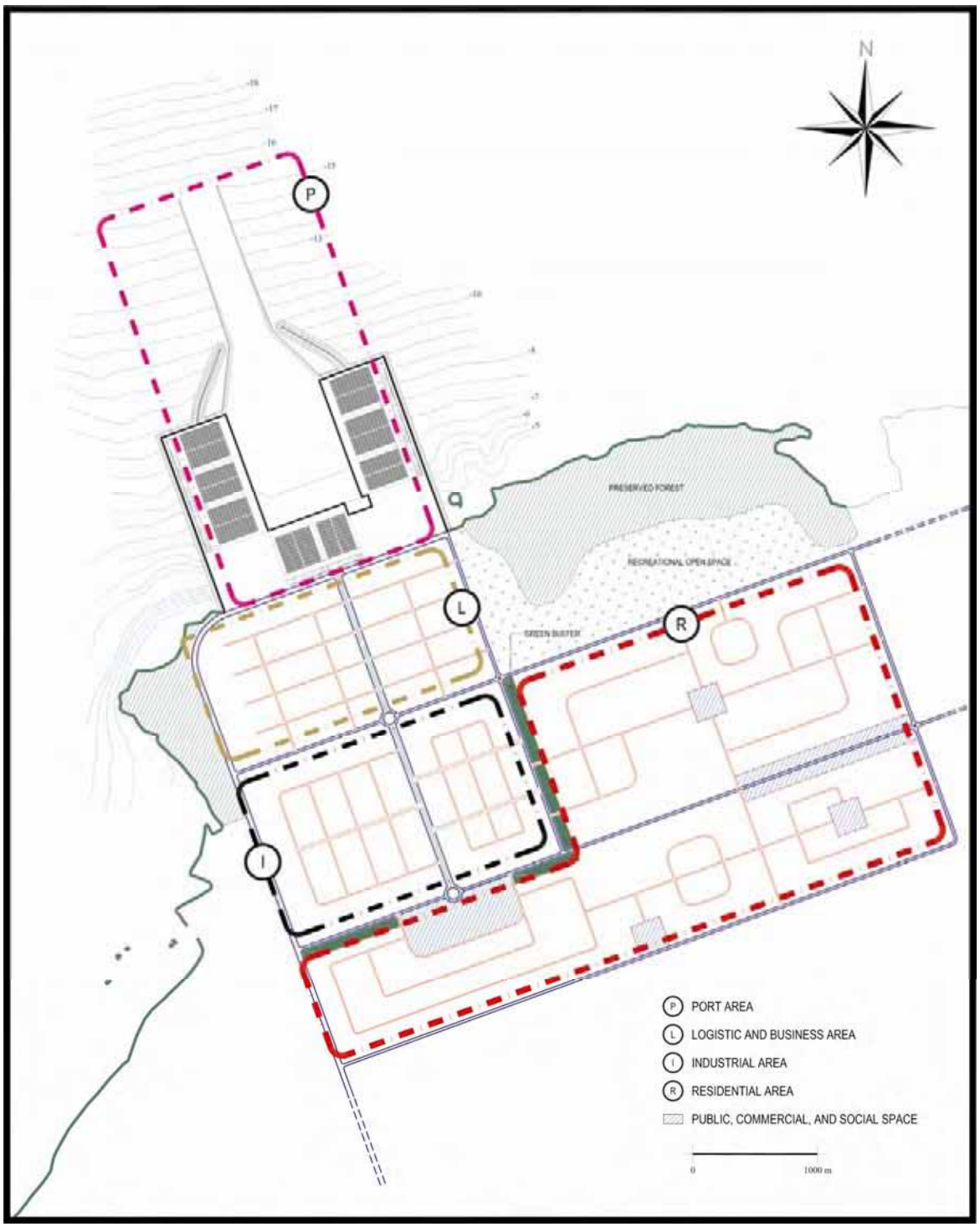
Source: JICA Study Team

Population Plan: The integrated hinterland development requires creating an efficient local economy with a livable community. Daytime and night-time population should be adequately planned. However, it does not mean to plan a self-contain city or totally balanced between day and night populations. In Madura, good job opportunities are insufficient. Many people are forced to work abroad or bear a hand-to-mouth life. On the other hand, to realize an efficient 24-hour city, the residential area is desirably located near the working places. Taking those understandings into account, daytime and night-time populations are planed as follows:

- Daytime population: It consists of working and non-working population. When the district is fully developed, a working population of 70,000 is predicted including port workers (3,000), shipping and logistics related workers (4,000), factory workers (49,000) and other service workers and others (14,000 or 20% of the all workers).

- Night-time population: The residents are divided into two types, the indigenous people (11,000 persons estimated at present since the existing population density is as low as 7.5 persons per ha) and the new comers who will mostly work within the district and their families. Provided that an average family size is 4 persons and most of the indigenous workers get job opportunities within the district, around 30% of the daytime workers will reside in the same district. The rest will commute from other Bangkalan areas mostly and some from Surabaya City, particularly manager-class.

Figure 10.4.3 Land Use Concept Plan for Integrated Port Hinterland Development at Tg. Bulupandan

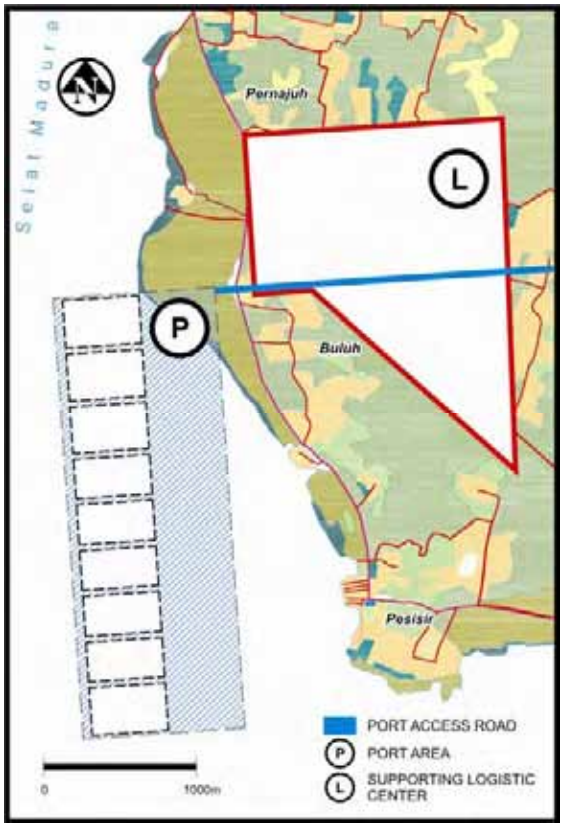


Source: JICA Study Team

4) Other Port Supporting Plans

Socah Zoning Plan: The proposed Socah Port is mostly located on water because of a combined trestle and reclamation structure. Although the committed project – MISI – plans to develop industrial and residential area, a logistics supporting area is desirably located next to a port. Taking account of the existing habitation pattern along the coastlines and port access road, a logistics center site of 200 ha is delineated to locate inland.

Figure 10.4.4 Location of the Proposed Supporting Logistics Center

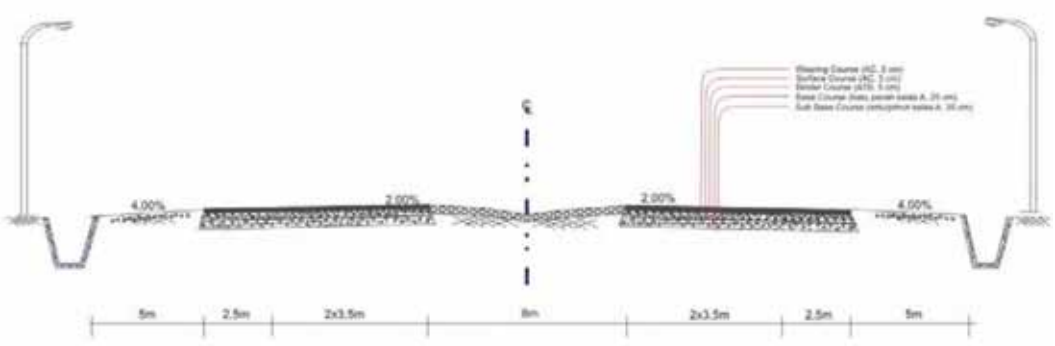


Port Access Plan: For ensuring port vehicular traffic, the Suramadu Bridge access road (6-lane width) up to Burneh will be extended to Tg. Bulupandan by 22 km while a short-cut road to the access road will be constructed from Socah by 9 km.

To serve heavy loaded vehicles, the road should have thick pavement, composing favorably surface course (15 mm), sub-base course (30 mm) and base course (55 mm) with a 6-lane width.

It is suggested that the port access road be constructed and managed by the provincial government. The road is important for not only port operation but also construction but the existing road is not enough to receive construction generated vehicular traffic. The port access road will have to be constructed before the commencement of port construction.

Figure 10.4.5 Cross Section of the Planned Access Road to the Port



Source: Study on Port Supporting Infrastructure Development, East Java Province, 2006

Electricity Supply Plan: Electricity system in East Java and Madura is part of the JAMALI (Java, Madura and Bali) interconnected electricity system. Electric current is transmitted by inter city/main electrical station with 500 kv and 1000 kv. From existing electrical station, power will be distributed to users with low electricity current, use for industrial, household, and others activity.

The interconnected system from Java Island to Madura Island is maintained by marine cable between Gresik and Tg. Tanjungan, Bangkalan. After the completion of Suramadu Bridge construction, the role of the existing marine cable will be transferred to a new bridge cable. But the existing one will remain for a backup power supply. There are 5 main electrical stations in Madura: Sumenep, Pamekasan, Sampang Bangkalan, and East Gili, connected by 20kV.

To supply sufficient electricity to a new port in Bangkalan, it is important to increase electricity up to 20 kV between port location and the main electricity station of Bangkalan. Power demand for port activity is estimated 10 to 15 MWe (megawatt electrical), depend on type and quantity of port supporting facility. Usually use for these activities:

a) Machine and mechanical equipment operation, i.e., heavy crane.
b) Clean water, fuel, waste treatment facility
c) Office lights, air conditioning, and warehouse lights
d) Stack yard lights
e) Port ICT system
f) Public facility related to port activity (hotel, supermarket, transportation services)

Telecommunication Supply Plan: Internal telecommunication is a port operator's authority. Those infrastructures have to support conversation communication and data communication. The problem is on technology choice and facility quantity. Technology should be used at least for 10 years, it is important to install LAN/WLAN system for data communication, and PABX for conversation telecommunication. Facility quantity is hard to figure out before port design is completed in detail. Port's basic requirements are a unit of E1 (2 Mbps) and broadband internet connection. Nowadays, port EDI has been networking among a port operator, port users, customs, and more. High-capacity and dedicated telecommunication services are desirable.

At the outside of a port, PT. Telkom Bangkalan Regency has 4 (four) STO units (Bangkalan, Kamal, Arosbaya, and Tanjungbumi) with total capacity 22,206 SST. If Bangkalan total residents assumed 959,451 persons, teledensity (excluding mobile phone) is 2.31%. To reach 3%, need 6,578 additional SST. For example 30% (1,974 SST) of wire-line technology and

70% (4.604 SST) wireless technology. Port operation will affect the telecommunication traffic in Bangkalan. It is so far at a low teledensity with low traffic per line. Due to increasing teledensity and further internet population, public telecommunication infrastructure should be strengthened.

Water Supply Plan: Clean water is necessary for many kinds of port activities such as office use and water supply to ships. An hourly demand of 243 m^3 is estimated for a new port. According to Bangkalan Regency, water consumption in Bangkalan for domestic, agriculture, and industry is only 16% of the area-wide water potential volume. Water resource is enough but its supply infrastructure is limited. So that, it is recommended to diverse water sources which could be from rain water, soil water, and river in addition to piped water.

Drainage System Plan: Developing drainage system in port will be advantageous for the environment itself, sanitation, convenience for port area and its surroundings. The suitable drainage system technique for such port area is Polder System. This system is synergized by river normalization, development of river dike, water stock basin, pump and water gate. Drainage system, especially in coastal area is a basic vital infrastructure to prevent flood caused by tide and rain water. In particular, at Tg. Bulupandan, the existing natural drainage system, small rivers flowing into Ko'ol Bay, must be changed into a well developed roadside drain and small canal system since Ko'ol Bay is supposed to be reclaimed totally. Without an efficient drainage system, the port hinterland would suffer from floods.

Waste Water Disposal Plan: Waste water in port should be treated within port. Waste water quantity depends on total clean water consumption and use characteristic. Total water waste is about 40-80% of total clean water demand. According to a waste water study in Indonesia, average waste water is about 70% of total clean water demand. Total clean water produced by a new port is:

$$\text{Average Waster Water} \times \text{Average Water Consumption} = 70\% \times 243\ m^3/\text{hour}$$
$$= 170\ m^3/\text{day}$$

Other Waste Disposal Plan: Waste from Bangkalan container port might come from office, maintenance workshop, warehouse, washing station, fuel station, container yard, and canteen. Waste coming from port activity is usually paper, plastics and leftover food/beverage. Waste treatment is important, inorganic and organic waste must be separated. Reuse and recycle paper/plastic is effective because that materials have high economical value.

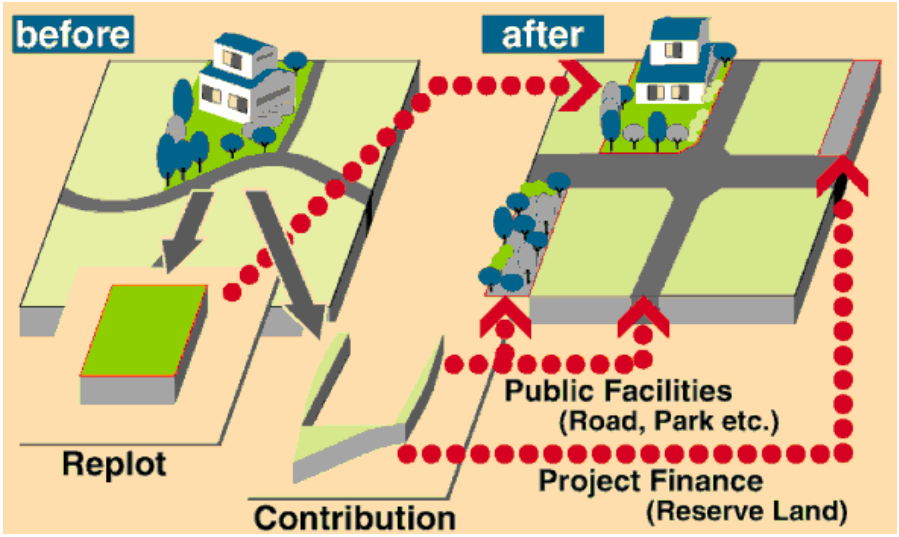
5) Development Scheme

The IEE survey at Tg. Bulupandan reported that almost respondents positively assessed the port development project which will contribute to (i) provision of new job opportunities (44%), (ii) improved transport system – meaning port access road (29%), (iii) modernization of the communities (14%) and increased community social welfare (13%). Their perception as a whole implies that they would get better job opportunities and stay in the community which would be modernized and well-off.

However, usual land acquisition method eventually forces them out of the project site. It is difficult to meet the villagers' perception. On the other hand, land readjustment method can make the port and its hinterland development and their perception compatible because the method does not require land acquisition. In a land readjustment scheme, land right holders may stay in the same district on the condition that they provide contribution to the project. The contribution has two types: contribution to public facilities such as roads and open space, and

contribution to reserved land which will be sold for covering project costs. Their individual lands will be re-plotted with adequate contribution.

Figure 10.4.6 Concept of Land Readjustment



Source: Ministry of Land, Infrastructure and Transport of Japan

In Indonesia, land readjustment has been applied only to farm lands, so-called land consolidation or *"tanah consolidasi"*, mainly for confirming land rights with allocating minimum public space in the corresponding cadastral map without development. .It is applicable to the project with some modifications for urbanization and industrialization. If the local land right holders organized a cooperative and leased their reserved land as logistics center/industrial estate lands to tenants, they could live in the same district through minimum re-plotting, work in the same district and earn rent. To facilitate such port related development with public participation, current traditional land titles, namely "petok", must be translated and registered as official land titles and a cooperative of land right holders be established.

Public participation in development means the involvement of local people in planning and development authorization procedure. Merits and demerits of development schemes such as land acquisition and land readjustment should be compared and discussed in such procedure.

10.5 Comparative Assessment for a New Gateway Port

1) Economic Analysis

a. Methodology

The new port to be developed at Bulupandan or at Socah in Madura after saturation of Lamong Bay port was evaluated from the viewpoint of regional economy. The economic cost and benefit were measured by comparison of "with" and "without" project. It is apparent, however, that the economy of the Study Area can hardly survive without development of a new port. Consequently, if some extreme assumption is adopted in "Without Project" case, the E-IRR tends to be overestimated. To avoid this, this study assumed almost no demand exceeding the present port capacity would not realize without a new port development.

Main assumptions and input are as follows:

- The channel improvement project at the Madura Strait, i.e., 12m deep by 200m wide, will be completed before starting the new port project.
- Lamong Bay Port will start its operation by 2012
- The new port will exclusively receive container ships, and.
- Without the new port, container demand will exceed the capacity of existing port and Lamong Bay Port around 2020 and after the saturation, merely one percent of the excess demand will convert to other alternative ports such as Tg. Priok at Jakarta and Tg Emas at Semarang.

b. Economic Cost

The financial cost of the project was converted into economic cost by deducting transfer cost (import duties and VAT) and price contingency (50% of total contingency). By this, economic cost corresponds to about 86% of the financial cost. The maintenance cost to be incurred by the operation of Socah Port includes annual dredging cost of the berth area and an appropriate share of main channel dredging cost.

Table 10.5.1 Economic Cost of New Port Project

(US$ million)

Alternative Port	Initial Cost			Channel Dredging Cost			Maintenance Cost	
	Phase I	Phase II	Total	Phase I	Phase II	Total	2020-2005	2006-
Tg. Bulupandan	533.7	199.3	733.0	-	-	-	9.3	13.0
Socah	521.7	166.6	688.3	31.3	55.4	86.7	18.3	24.4

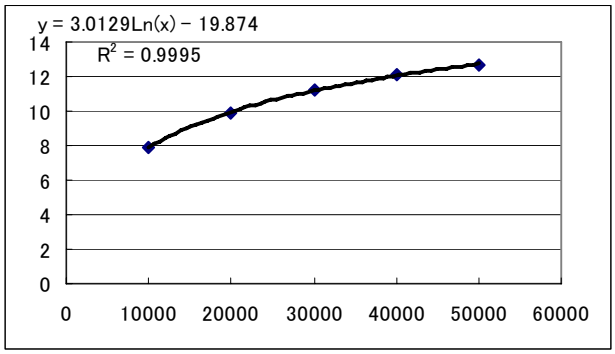
c. Input to Economic Benefit Estimation

New port development will generate various kinds of economic benefit. Consequently, data and information to estimate them have to cover a wide area. Main data used in this analysis were as follows.

DWT and Maximum Draft: The following equation was obtained using the data of representative container ships in STRAMINDO (Study on the Development of Domestic Sea Transportation and Maritime Industry in the Republic of INDONESIA, 2004 March, JICA).

Draft (m) = 3.0129 x Ln (DWT) -19.874

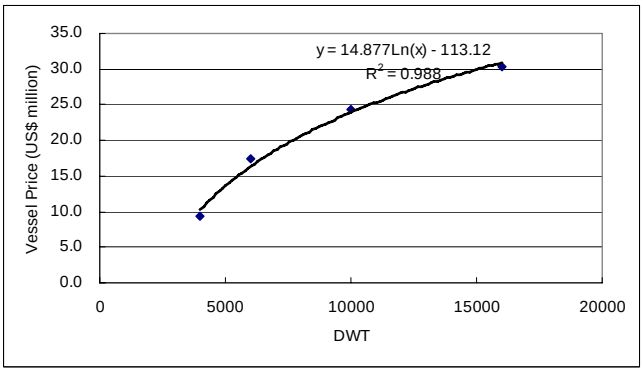
Figure 10.5.1 DWT and Draft



Price of Container Ship and Capital Opportunity Cost: Using the data in the same source as above, the relation between container ship price and size (DWT) was expressed with the following equation.

Ship Price = 14.877 x Ln(DWT) - 113.12

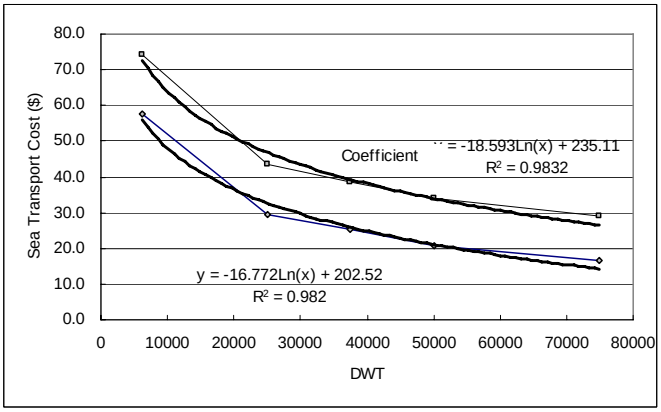
Figure 10.5.2 Ship Price and Ship Size (DWT)



Unit Cost of Sea Transportation for Container: Unit sea transportation cost of a container was expressed by the following equation, using data in the Manual for the Cost-Benefit Analysis on Port Development Project, 2000, ex-Ministry of Transport of Japan.

Ship Price = a * (Day of Voyage) - b
a = -18.593 x Ln(DWT) + 235.112
b = - 16.772 x Ln(DWT) + 202.52

Figure 10.5.3 Sea Transportation Cost of Container



Time Cost of Container: Average time cost of one container was assumed at US$ 4.5 per hour, according to an estimation made in the Study on ASEAN Logistic Development Study, September 2007, ASEAN, where three following data sources were referred to, in order to estimate the time value of a container.

1) Interest cost while in transit – based on regulation-standard value of freight for truck (8.33 SDR/kg) and 15% p.a. interest

2) Stated Preference Survey conducted in the Study of Development of PPP Technique for Metro Manila Urban Expressway Network, JICA, 2003

3) Revealed Preference Analysis on Thailand – Malaysia corridor in 2005, where data collected from various sources.

The study states that all sources above resulted in a similar value at around US$ 4.5 per TEU-hour.

In 1997, the then Ministry of Transport of Japan estimated the time value of a container to/from Japan and reported in the Manual of Cost-Benefit Analysis for Port Development Project,1998. The time value of container was estimated at US$ 22.5 per TEU-hour for an exported container and US$ 11.7 for an imported container. Those values are much higher than US$ 4.5, because of difference in average value of cargoes inside.

Waiting Time in Port Congestion: Average waiting time is expressed as a function of utilization (berth occupancy rate) and in case of container port it is estimated as shown in Table 10.5.2, according to the queuing theory. In this study, the utilization rate will rise up to 0.85 when the demand reached to the capacity and used 0.22 hours as the average waiting time for all of container ships calling at Surabaya Port.

Table 10.5.2 Average Waiting Time at Congested Port

(Unit: Average Service Time in Day)

Utilization	Number of Berthing Point											
	1	2	3	4	5	6	7	8	9	10	11	12
0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.15	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.20	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.09	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.30	0.13	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.17	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.40	0.24	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.30	0.09	0.04	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.50	0.39	0.12	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.55	0.49	0.16	0.07	0.04	0.02	0.02	0.02	0.01	0.00	0.00	0.00	0.00
0.60	0.63	0.22	0.11	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
0.65	0.80	0.30	0.16	0.09	0.06	0.05	0.03	0.02	0.01	0.01	0.00	0.00
0.70	1.04	0.41	0.23	0.14	0.10	0.07	0.05	0.04	0.03	0.02	0.00	0.00
0.75	1.38	0.58	0.32	0.21	0.14	0.11	0.08	0.07	0.05	0.03	0.01	0.00
0.80	1.87	0.83	0.46	0.33	0.23	0.19	0.14	0.12	0.09	0.07	0.03	0.01
0.85	2.80	1.30	0.75	0.55	0.39	0.34	0.26	0.22	0.20	0.13	0.08	0.05
0.90	4.36	2.00	1.20	0.92	0.65	0.57	0.44	0.40	0.34	0.25	0.18	0.12
0.95	5.00	3.40	2.80	2.10	2.00	1.75	1.35	0.95	1.02	0.62	0.32	0.30
1.00	6.60	6.00	4.30	3.20	3.10	2.60	2.10	1.80	1.60	1.40	1.10	0.95

Source: E. Page, Queuing Theory in OR (London, Butterworths, 1972) p. 155

Road Transport Cost of Container: In order to estimate road transport cost of a container, IRMS (Indonesia Road Management System) of BINAMARGA was used, which was expressed by the following equation.

$$VOC = K1 + K2/V + K3*V^2 + K4 * IRI + K5*IRI^2$$

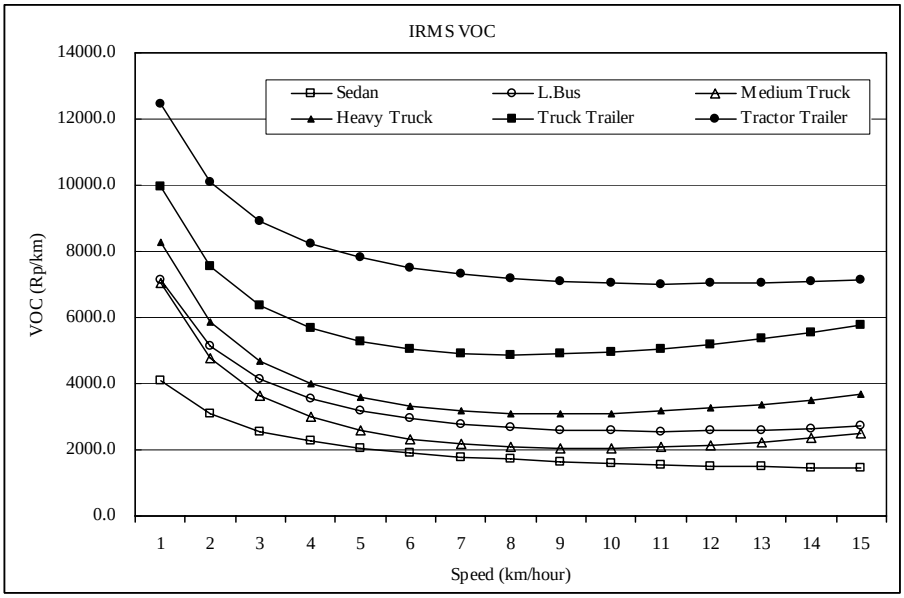
Parameter values of the model are shown in Table 10.5.3. IRI (International Roughness Index) was assumed at 3. According to the Model, VOC (Vehicle Operating Cost) by Vehicle Type is shown as Figure 10.5.4.

Table 10.5.3 Parameters of IRMS Model

	Vehicle Type		K1	K2	K3	K4	K5	Base VOC	TTC
	This Study	IRMS			(x 10^{-6})	(x 10^{-3})	(x 10^{-3})	(Rp/km)	(Rp/veh./hr)
1	Sedan	Sedan	0.66707	22.23983	6.808	12.937	0.139	1,396.10	15,038.32
2		Util. Pass	0.57932	20.34176	18.379	14.087	0.093	1,186.77	14,762.62
3		Util. Freight	0.58382	20.30049	18.278	13.313	0.079	1,141.64	2,729.61
4	Mini Bus	Light Bus	0.32475	21.93222	28.582	68.937	-0.007	1,724.67	29,525.24
5	Large Bus	Large Bus	0.32985	22.26215	53.281	12.930	0.069	2,735.78	59,050.49
6	Pickup	Light Truck	0.42258	20.52269	27.740	44.006	-0.006	1,592.41	2,729.61
7	Truck	Medium Truck	-0.17257	28.62223	100.534	61.250	0.016	2,444.33	2,729.61
8		Heavy Truck	0.11065	21.20004	85.612	44.117	0.041	3,481.37	2,729.61
9		Truck Trailer	0.29038	13.69068	68.153	53.472	0.027	5,447.68	2,729.61
10		Tractor Trailer	0.59807	10.02214	21.525	44.723	0.009	7,180.32	2,729.61
11	Motor cycle	Motor cycle	1.05130	13.71763	-9.124	9.024	0.052	201.90	3,609.20

(Source) BINAMARGA

Figure 10.5.4 Vehicle Operating Cost by Type of Vehicles



d. Economic Benefit

The following items were taken into account as the economic benefit of new port project:

- savings in sea transport cost by larger vessels
- reduction in staying cost of vessels and cargoes due to port congestion
- reduction in land transport cost by using alternative port under “without” case

The sea depth of the new port will be -14m after the phase I construction and -15m after the phase II. In order to measure the economic benefit, the calling ship distribution by size for each case of current -10.5m, -12m, -14m and -15m was assumed as shown in Table10.5.4.

Table 10.5.4 Ship Size Distribution of Container Ships Calling at Surabaya Port

	DWT			Av. TEU	Av. DWT	Draft	Do Nothing (-10.5m, 100m)			Base Case -12m, 200m)		
				(unit)	(ton)	(m)	2005	2015	2030	2005	2015	2030
1	0	-	6250	250	3125	-8	99	39	50	99	39	10
2	6250	-	12500	750	9375	-9	239	108	139	239	108	33
3	12500	-	24000	1750	21875	-9.5	446.5	540	695.5	447	540	730
4	24000	-	31250	2210	27625	-11	267.9	324	417.3	281	472	700
5	31250	-	50000	3000	37500	-12	178.6	216	278.2	188	325	562
6	50000	-	75000	3750	46875	-13	209	589	759	218	687	1066
7	75000	-	100000	5000	62500	-14	0	147	189	0	0	0
8	100000	-	0	7000	87500	-15	0	0	0	0	0	0
9	0	0	0	9000	112500	-16	0	0	0	0	0	0

	DWT			Av. TEU	Av. DWT	Draft	Phase I (14m, 300m)			Phase II (-15m, 350m)		
				(unit)	(ton)	(m)	2005	2015	2030	2005	2015	2030
1	0	-	6250	250	3125	-8	99	39	10	99	39	10
2	6250	-	12500	750	9375	-9	239	108	33	239	108	33
3	12500	-	24000	1750	21875	-9.5	447	540	730	447	540	730
4	24000	-	31250	2210	27625	-11	268	324	437	268	324	437
5	31250	-	50000	3000	37500	-12	179	216	368	179	216	368
6	50000	-	75000	3750	46875	-13	209	589	892	209	589	857
7	75000	-	100000	5000	62500	-14	0	147	275	0	147	249
8	100000	-	0	7000	87500	-15	0	0	0	0	0	37
9	0	0	0	9000	112500	-16	0	0	0	0	0	0

Economic benefits were estimated as shown in Table 10.5.5. There is almost no difference between two alternative ports except a slight change in benefit (C). Annual total benefit corresponds to approximately 20% of total economic cost.

Table 10.5.5 Economic Benefit of New Deep Sea Port

(US$ million)

	Benefit Item	Tg Bulupandan		Socah	
		2020	2030	2020	2030
a)	Savings in sea Transport Cost	25.0	29.3	25.0	29.3
b)	Reduction of Staying Cost of Vessels	4.3	4.3	4.3	4.3
c)	Reduction of Staying Cost of Cargoes	87.9	87.9	87.9	87.9
d)	Reduction of Land Transport Cost	1.5	14.5	1.5	14.8
	Total	118.6	136.0	118.6	136.4

e. Evaluation Results

E-IRR was estimated to be 17.2% for Tg. Bulupandan Port and 15.4% for Socha Port. (Table 10.5.6) The E-IRR of the former is slightly higher than the latter mainly due to the necessity of maintenance dredging in Socah Port. Both of them are marginally feasible because the threshold is considered at 15% in Indonesia. Annual flow of cost and benefit is shown in Table 10.5.8.

The results of sensitivity analysis against changes of cost and benefit are shown in Table 10.5.7. The shaded area in the Table shows the area of E-IRR lower than 15% and the project will become economically unfeasible under such changes of cost and benefit.

The E-IRR is more sensitive to the change of benefit than a change of cost. In case of Tg. Bulupandan Port, the E-IRR becomes lower than 15% to 45% cost increase or 32% benefit decrease while Socah Port becomes unfeasible to 28% cost increase or 20% benefit decrease. The feasibility of Tg. Bulpandan is more robust than Socah Port.

In this analysis, excess cargoes over the port capacity in "without" case were mostly disregarded because no other realistic alternative way to load to or unload from ships after saturation of present facilities. In the analysis, only 1% of them were assumed to divert to other ports such as Tg. Priok and Semarang Port and transported by truck between the port and Surabaya and the difference of truck transport cost and sea transport cost was regarded as economic benefit. If the conversion rate is 2%, E-IRR will rise up to 20.5% for Tg. Bulupandan Port and 16.7% for Socah Port. Thus, how to treat the excess demand will significantly affect on the evaluation results. In this point, 1% conversion is rather conservative assumption.

Table 10.5.6 Results of Economic Evaluation of New Port Project

Evaluation Index		Tg Bulpandan	Socah
E-IRR	%	17.2%	15.4%
NPV	US$ million	148.0	86.2
B/C	-	1.44	1.25

Table 10.5.7 Sensitivity Analysis of E-IRR of Port Development Project

Sensitivity			Cost up (%)			
			Base	10	20	30
Tg. Bulupandan	Benefit down (%)	Base	17.2%	15.7%	14.5%	13.4%
		10	15.6%	14.2%	13.0%	12.0%
		20	13.9%	12.6%	11.5%	10.5%
		30	12.1%	10.9%	9.8%	8.9%
Socah	Benefit down (%)	Base	15.4%	13.9%	12.6%	11.4%
		10	13.7%	12.3%	11.1%	10.0%
		20	12.0%	10.6%	9.5%	8.4%
		30	10.1%	8.9%	7.8%	6.8%

f. Impact of New Port Project on Regional Economy

As stated, it was assumed that the excess demand for container transport over the current port capacity would not be realized without the new port, except some marginal conversion to road transport.

This suppression of transport demand will severely deteriorate the regional economy and high economic growth will never occurred. If this diseconomy is taken into account as a benefit of the new port, E-IRR is much higher.

In addition, the analysis assumed that one third of the targeted investment until 2030 will locate at the new industrial estate near the port. If this target is attained, total investment amount in the new estate will reach US$ 16.4 billion (Rp. 151trillion) and almost same amount of GRDP will be increased by the investment every year. Moreover, as the multiplier coefficient of manufacturing industry is about 2.0 (Table 10.5.9), the GRDP increase will be double of the said amount as a whole, inclusive of ripple effect to other industrial sectors.

All the economic effect cannot be attributed to the new port. On the other hand, however, it is also true that such enormous investment including FDI would hardly be attained.

Table 10.5.8 Cost and Benefit Flow of New Port Development Project

(1) Tg. Bulpandan Port (US$ Million ay 2007 price)

Year	Economic Cost				Economic Benefit					Benefit-Cost
	Phase 1	Phase 2	Maintenance	Total Cost	Savings in Sea Transp. Cost	Reduction of waiting time of		Savings of Detour Cost	Total	
						Vessels	Cargoes			
2011	1.2			1.2					0.0	-1.2
2012	1.2			1.2					0.0	-1.2
2013	2.3			2.3					0.0	-2.3
2014	9.2			9.2					0.0	-9.2
2015	0.0			0.0					0.0	0.0
2016	116.1			116.1					0.0	-116.1
2017	126.4			126.4					0.0	-126.4
2018	91.9			91.9					0.0	-91.9
2019	185.4			185.4					0.0	-185.4
2020			9.3	9.3	33.1	4.3	87.9	6.7	132.0	122.7
2021			9.3	9.3	25.4	4.3	87.9	7.5	134.2	124.9
2022		0.9	9.3	10.2	25.8	4.3	87.9	8.3	136.4	126.3
2023		3.4	9.3	12.7	26.3	4.3	87.9	9.1	138.6	125.9
2024		107.7	9.3	117.0	26.7	4.3	87.9	9.8	140.8	23.8
2025		87.3	9.3	96.6	27.2	4.3	87.9	10.6	143.1	46.4
2026			9.3	9.3	27.6	4.3	87.9	11.4	145.3	136.0
2027			13.0	13.0	28.0	4.3	87.9	12.1	147.5	134.5
2028			13.0	13.0	28.5	4.3	87.9	12.9	149.7	136.7
2029			13.0	13.0	28.9	4.3	87.9	13.7	151.9	138.9
2030			13.0	13.0	29.3	4.3	87.9	14.4	154.1	141.1
2031			13.0	13.0	29.8	4.3	87.9	15.2	156.3	143.3
2032			13.0	13.0	30.2	4.3	87.9	16.0	158.5	145.5
2033			13.0	13.0	30.6	4.3	87.9	16.8	160.7	147.7
2034			13.0	13.0	31.1	4.3	87.9	17.5	162.9	150.0
2035			13.0	13.0	31.5	4.3	87.9	18.3	165.1	152.2
2036			13.0	13.0	31.5	4.3	87.9	19.1	167.3	154.4
2037			13.0	13.0	31.5	4.3	87.9	19.8	169.5	156.6
2038			13.0	13.0	31.5	4.3	87.9	20.6	171.7	158.8
2039			13.0	13.0	31.5	4.3	87.9	21.4	174.0	161.0
2040			13.0	13.0	31.5	4.3	87.9	22.2	176.2	163.2
2041			13.0	13.0	31.5	4.3	87.9	22.9	178.4	165.4
2042			13.0	13.0	31.5	4.3	87.9	23.7	180.6	167.6
2043			13.0	13.0	31.5	4.3	87.9	24.5	182.8	169.8
2044			13.0	13.0	31.5	4.3	87.9	25.2	185.0	172.0
2045			13.0	13.0	31.5	4.3	87.9	26.0	187.2	174.2
2046			13.0	13.0	31.5	4.3	87.9	26.8	189.4	176.4
2047			13.0	13.0	31.5	4.3	87.9	27.5	191.6	178.6
2048			13.0	13.0	31.5	4.3	87.9	28.3	193.8	180.9
2049			13.0	13.0	31.5	4.3	87.9	29.1	196.0	183.1
2050			13.0	13.0	31.5	4.3	87.9	29.9	198.2	185.3
Total	533.7	199.3	376.4	1109.4	932.8	132.7	2725.3	567.3	5118.9	4009.5

(2) Socah Port (US$ million at 2007 price)

Year	Economic Cost				Economic Benefit					Benefit -Cost
	Phase 1	Phase 2	Mainte-nance	Total Cost	Savings in Sea Transp. Cost	Reduction of waiting time of		Savings of Detour Cost	Total	
						Vessels	Cargoes			
2011	1.2			1.2					0.0	-1.2
2012	1.2			1.2					0.0	-1.2
2013	2.2			2.2					0.0	-2.2
2014	9.0			9.0					0.0	-9.0
2015	0.0			0.0					0.0	0.0
2016	78.6			78.6					0.0	-78.6
2017	113.0			113.0					0.0	-113.0
2018	145.4			145.4					0.0	-145.4
2019	196.6			196.6					0.0	-196.6
2020	0.0		12.8	12.8	33.1	4.3	87.9	6.6	131.9	119.0
2021			12.8	12.8	25.4	4.3	87.9	7.3	124.9	112.1
2022		1.1	12.8	13.9	25.8	4.3	87.9	8.1	126.1	112.2
2023		3.7	12.8	16.5	26.3	4.3	87.9	8.8	127.3	110.8
2024		83.1	12.8	96.0	26.7	4.3	87.9	9.6	128.5	32.5
2025		96.5	12.8	109.3	27.2	4.3	87.9	10.4	129.7	20.4
2026			18.3	18.3	27.6	4.3	87.9	11.1	130.9	112.6
2027			18.3	18.3	28.0	4.3	87.9	11.9	132.1	113.7
2028			18.3	18.3	28.5	4.3	87.9	12.6	133.3	114.9
2029			18.3	18.3	28.9	4.3	87.9	13.4	134.5	116.1
2030			18.3	18.3	29.3	4.3	87.9	14.1	135.6	117.3
2031			18.3	18.3	29.8	4.3	87.9	14.9	136.8	118.5
2032			18.3	18.3	30.2	4.3	87.9	15.6	138.0	119.7
2033			18.3	18.3	30.6	4.3	87.9	16.4	139.2	120.9
2034			18.3	18.3	31.1	4.3	87.9	17.1	140.4	122.1
2035			18.3	18.3	31.5	4.3	87.9	17.9	141.6	123.3
2036			18.3	18.3	31.5	4.3	87.9	18.6	142.3	124.0
2037			18.3	18.3	31.5	4.3	87.9	19.4	143.1	124.8
2038			18.3	18.3	31.5	4.3	87.9	20.1	143.8	125.5
2039			18.3	18.3	31.5	4.3	87.9	20.9	144.6	126.3
2040			18.3	18.3	31.5	4.3	87.9	21.6	145.4	127.0
2041			18.3	18.3	31.5	4.3	87.9	22.4	146.1	127.8
2042			18.3	18.3	31.5	4.3	87.9	23.1	146.9	128.5
2043			18.3	18.3	31.5	4.3	87.9	23.9	147.6	129.3
2044			18.3	18.3	31.5	4.3	87.9	24.7	148.4	130.0
2045			18.3	18.3	31.5	4.3	87.9	25.4	149.1	130.8
2046			18.3	18.3	31.5	4.3	87.9	26.2	149.9	131.5
2047			18.3	18.3	31.5	4.3	87.9	26.9	150.6	132.3
2048			18.3	18.3	31.5	4.3	87.9	26.9	150.6	132.3
2049			18.3	18.3	31.5	4.3	87.9	26.9	150.6	132.3
2050			18.3	18.3	31.5	4.3	87.9	26.9	150.6	132.3
Total	547.2	184.3	535.3	1266.9	932.8	132.7	2725.3	549.7	4340.5	3073.6

Table 10.5.9 Multiplier Coefficient by Integrated Industrial Sector in Indonesia

Output / Input		Primary Industry	Secondary Industry			Tertiary Industry	Total
			Manufac-turing	Utility	Const-ruction		
Primary Industry		1.131908	0.310849	0.025224	0.006678	0.092106	1.566765
Secondary Industry	Manufacturing	0.182961	1.539380	0.009150	0.034993	0.255337	2.021821
	Utility	0.107210	0.676190	1.171360	0.026320	1.459940	3.441020
	Construction	0.190440	0.160490	0.011780	1.007670	1.448950	2.819330
Tertiary Industry		0.242368	0.513723	0.012191	0.027709	1.473598	2.269588
Total		1.854886	3.200633	1.229705	1.103370	4.729930	12.118524

Source: Collaborated by JICA Study Team based on IO Table of Indonesia in 2003

g. Road Transport Cost between Port and Industrial Estate

Table 10.5.10 shows the economic cost of one 20ft container transport by truck from each port to some existing industrial estates. Ports include alternative new ports of Tg. Bulpandan and Socah. Here, toll rate of Suramadu Bridge is assumed at US$ 1.36 (Rp.12500) for a container trailer of class V.

Apparently, new ports are disadvantageous compared with the existing ports as for the port access and egress. Economic transport cost of the new ports is several times of the exiting ports.

To solve or alleviate the disadvantage, it is recommended to develop a new industrial estate near the new port and to charge a cheaper toll of the bridge although the toll is less than 5% of the total cost.

Table 10.5.10 Road Transport Cost of Container from Port to Industrial Estate

(US$/TEU)

Port	Industrial Estate	Distance	Travel Time	Transport Cost / TEU			Container Time Cost	Total
		(Km)	(Minutes)	VOC	Time Cost	Toll		
Tg. Perak	SIER	24.3	22	11.2	45.5	1.6	2.5	60.8
	GIE	19.8	30	9.0	61.3	1.6	3.4	75.3
	PIER	74.7	53	34.7	107.9	1.6	5.9	150.1
	Tandes IE	12.3	19	5.6	38.0	1.6	2.1	47.3
Lamong Bay	SIER	24.6	23	11.4	46.5	2.7	2.6	63.2
	GIE	85.0	13	3.9	26.4	1.1	1.4	32.8
	PIER	75.0	53	34.9	108.9	2.7	5.9	152.4
	Tandes IE	0.3	5	0.5	3.1	0.0	0.2	3.8
Tg. Bulupandan	SIER	70.4	79	32.5	162.0	16.3	8.9	219.7
	GIE	67.1	98	30.7	200.1	17.9	11.0	259.7
	PIER	120.8	109	56.0	224.4	16.3	12.3	309.0
	Tandes IE	59.6	86	27.3	176.9	17.9	9.7	231.8
Socah	SIER	60.2	64	27.8	130.4	16.3	7.2	181.7
	GIE	56.9	82	26.0	168.6	17.9	9.2	221.7
	PIER	110.6	94	51.3	192.8	17.4	10.6	272.1
	Tandes IE	49.4	71	22.6	145.4	17.9	8.0	193.9

Source JICA Study Team

2) Financial Analysis

a. Bulupandan Development

In order to examine the feasibility of the project as a whole, regardless of composition of financial contribution, overall return on project is examined in order to obtain the basic nature of the project. The return on investment needs to be reasonably high so that attract private investment. If the rate is more than 15% it will be possible to make the project for PPP, and if the rate of return is lower, it would be reasonable to consider the combination of long term soft loan from G to G Development loan such as JBIC for public investment such as breakwater and development of supporting infrastructures.

The key assumptions of cargo forecast used in this preliminary feasibility studies are based on the data collected by the JICA Study Team in its recent survey with the historical traits of TPS and the Port of Surabaya. The newly planned port of Bulupandan will derive revenues from the future volumes of container cargo as a source of financial return on the investment.

Investment schedule: Based on the engineering study discussed in Chapter 10.2, the construction cost of the Project was calculated and distributed annually according to the construction schedule. Fund requirements are summarized in two phases for the start of operation in 2020 and 2026.

Table 10.5.11 Investment Schedule

	Investment		Total
	PH-1(Mil $)	PH-2(Mil $)	(Mil Rp)
2010	0.0		0
2011	1.1		10,470
2012	1.1		10,470
2013	2.7		24,431
2014	10.6		97,723
2015	0.0		0
2016	136.1		1,252,497
2017	148.3		1,364,403
2018	107.6		989,599
2019	215.6		1,983,127
2020			0
2021			0
2022		0.9	8,725
2023		3.8	34,901
2024		126.4	1,163,096
2025		102.8	945,760
2026			0
2027			0
2028			0
2029			0
2030			0
Total	**623.1**	**234.0**	**7,885,202**

Financial Return on Investment as a Whole: The basic financial return on the project investment is nearly 7% as is seen in the table below.

Table 10.5.12 Return on Investment as a whole

	Case 1-JICA Forecast	**Case 2-Pelindo-III**
Assumption of forecast	4% increase of Economy in Surabaya Greater Metropolitan Area	10% increase of Container Cargo
Tg. Bulupandan IRR	**6.9%**	**7.3%**

It is observed that the return is less than 15% and development scheme should follow the style of development by the public side first for the infrastructure and private operator will invest in the buildings and cargo handling machines.

Financial Returns for Public and Private Investment: Infrastructure such as wharf and breakwater are constructed by Public Investment including Pelindo III as a owner of the development project. After the infrastructures are laid out, tender process will determine a terminal operator with concession agreement. Division of investment and schedules are assumed in the following table.

Table 10.5.13 Direct Cost Division between Private and Public for the Development of Tg. Bulupandan

	Private (Mil $)		**Public** (Mil $)	
	Phase1	Phase 2	Phase 1	Phase 2
Wharf			77,400	29,400
Container Yard	64,000	19,700		
Office/Gate/Workshop/Others	34,600	11,700		
Breakwater			41,300	24,500
Revetment			15,300	3,400
Channel Dredging			66,000	9,300
Reclamation			24,100	13,100
Access Road			10,000	0
Container Handling Equipment	121,500	59,300		
Direct Construction Cost	**220,100**	**90,700**	**234,100**	**79,700**

Table 10.5.14 Investment Schedule by Private and Public

	Private Investment		**Total**	**Public Investment**		**Total**
	PH-1(Mil $)	PH-2(Mil $)	(Mil Rp)	PH-1(Mil $)	PH-2(Mil $)	(Mil Rp)
2011	0.0		0	1.1	0	10,470.
2012	0.0		0	1.1	0	10,470
2013	0.0		0	2.7	0	24,430.
2014	0.0		0	10.6	0	97,723.
2015	0.0		0	0	0	0
2016	0.0		0	136.1	0	1,252,496.
2017	16.2		149,040	132.1	0	1,215,362.
2018	62.2		572,240	45.4	0	417,358.
2019	148.5		1,366,200	67.1	0	616,927
2020			0	0	0	0
2021			0	0	0	0
2022		0.0	0	0	0.9	8,725.
2023		0.0	0	0	3.8	34,901.
2024		66.6	612,720	0	59.8	550,376.
2025		54.7	503,395	0	48.1	442,365.
2026			0	0	0	0
2027			0	0	0	0
2028			0	0	0	0
2029			0	0	0	0
2030			0	0	0	0
Total	226.9	121.3	3,203,595	396.222	112.649	4,681,607

It is expected that, for the construction of infrastructure, the project will be financed by long-term soft loans from international lending institutions such as JBIC so that public sector will be able to complete the responsibility to start the project.

The annual fixed fee is assumed to cover the interest payment of JIBC loan in the beginning of operation, which is 15.3 million USD per year equivalent to 3% of interest rate on the

investment from the public side. Then as cargo volume grows and goes over 100,000 TEU per year, additional concession fee will be charged by 20 USD/TEU for the surplus over 100,000. This additional portion will cover the repayment of principal of loan.

Concession fee will be determined in terms of US dollar because tariff for international cargo is set by US dollar and the loan repayment should be secured by the international currency. By this consideration public side is assured by the payment equivalent to the agreed amount in US dollar.

Private concessionaire will receive large profit when cargo volume increase and expected to realize the return more than 10%, this condition will satisfy the private terminal operator. Considering that the TPS return on investment is approximately 7%, expected return above has good possibility to satisfy the international terminal operator to invest on this project.

Table 10.5.15 Assumptions of Concession Fee

Concession Fee 1(Fixed Annual Fee)	15.3	Mil $/ year	140,760	Mil Rp/ year
Concession Fee 2 (Volume Related)	20	$/TEU	184	Thou Rp/TEU
Base Cargo volume over which Fee-2 will be due by Private Concessionaire			100,000	TEU/year

Table 10.5.16 Return on investment by Public and Private

	Case 1-JICA Forecast 4% increase of Economy in Surabaya Greater Metropolitan Area	**Case 2-Pelindo-III** 10% increase of Cargo
Private Investor's Return	**10.2%**	**8.6%**
Public Side IRR	**4.3%**	**6.3%**

In addition to the basic assumption, sensitivity simulation indicates the impact to rate of return by changes in condition of investment and operation. If the construction cost increases over the range of contingency allowance and become 10% more than the estimated total investment, the return will become lower by 0.9 points. If operating cost increases by 10 % the return will decrease by 0.6 points and if tariff is raised by 10%, the rate of return increases 1.3 points. If both increase of operation cost and increase of tariff happen together, the rate will increase by 0.8 points. Therefore it can be said that tariff rate is important to control in response to the changes of operational cost.

Table 10.5.17 Sensitivity in the Case of Tg. Bulupandan

	IRR by Case 1 JICA Forecast	IRR by Case 2 Pelindo III Forecast
Base Assumption	**6.9%**	**7.3%**
Cost overrun by 10%	6.0%	6.4%
Operating Cost 10% up	6.3%	6.7%
Tariff increase 10%	8.2%	8.6%
Op Cost 10% up and Tariff increase 10%	**7.7%**	**8.1%**

Figure 10.5.5 Feasibility Calculation of Tg Bulupandan Case-1

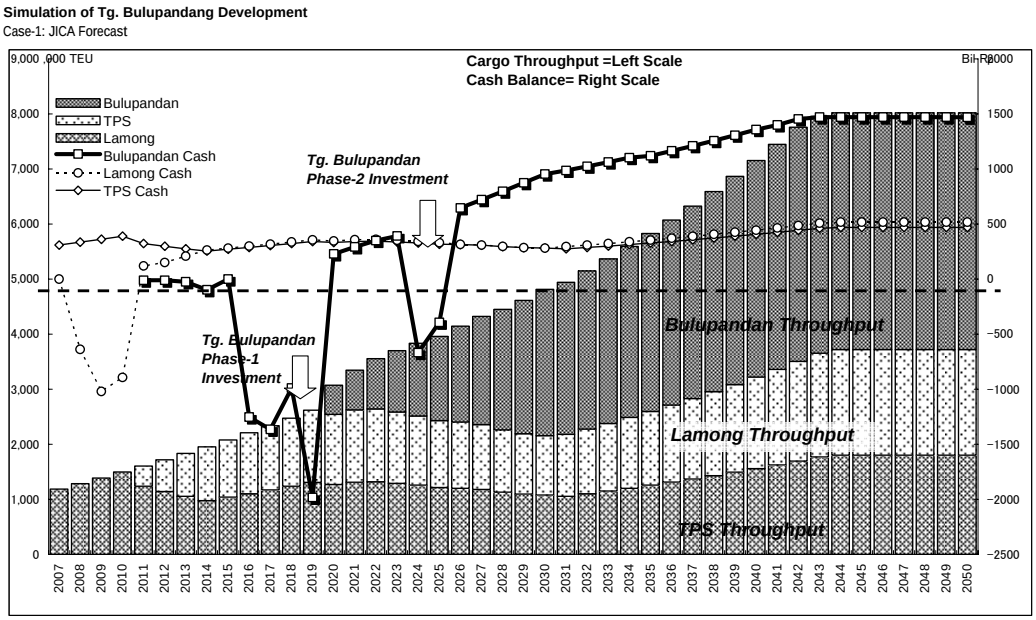
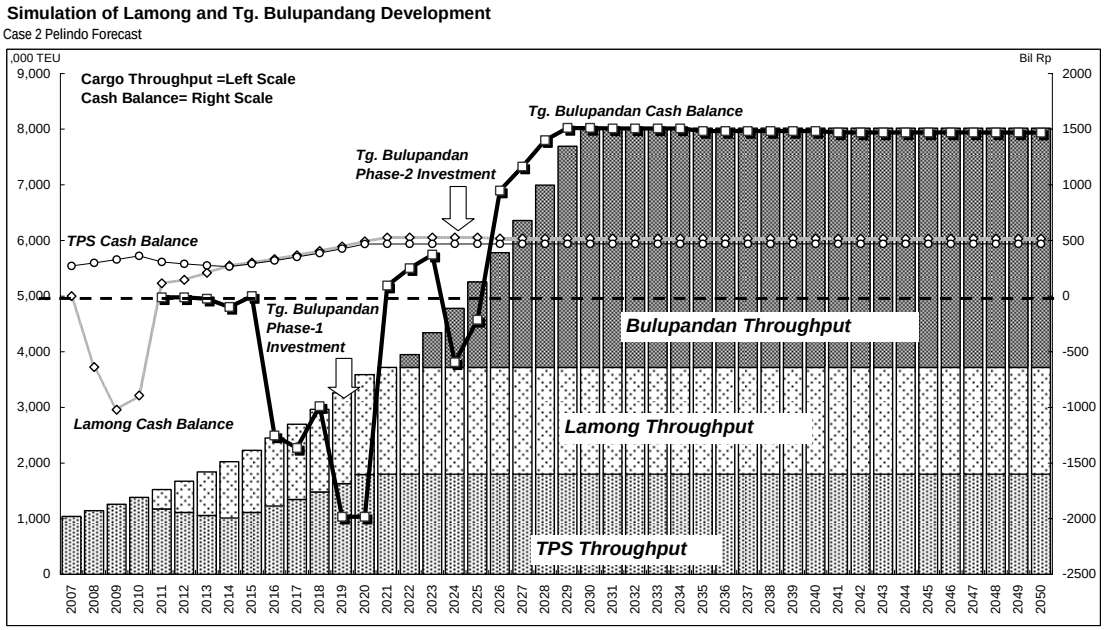


Figure 10.5.6 Feasibility Calculation of Tg Bulupandan Case-2



b. Socah Development

In order to examine the feasibility of the project as a whole, regardless of composition of financial contribution, overall return on project is examined in order to obtain the basic nature of the project. The return on investment needs to be reasonably high so that attract private investment. If the rate is more than 15% it will be possible to make the project for PPP, and if the rate of return is lower, it would be reasonable to consider the combination of long term soft loan from G to G Development loan such as JBIC for public investment such as breakwater and development of supporting infrastructures.

The key assumptions of cargo forecast used in this preliminary feasibility studies are based on the data collected by the JICA Study Team in its recent survey with the historical traits of TPS

and the Port of Surabaya. The newly planned port of Socah will derive revenues from the future volumes of container cargo as a source of financial return on the investment.

Investment schedule: Based on the engineering study discussed in Chapter 11.2, the construction cost of the Project was calculated and distributed annually according to the construction schedule. Fund requirements are summarized in two phases for the start of operation in 2020 and 2026.

Table 10.5.18 Investment Schedule

	Investment on Construction			Capital Dredging		
	PH-1(Mil $)	PH-2(Mil $)	Total in Mil Rp	PH-1(Mil $)	PH-2(Mil $)	Total in Mil Rp
2010						
2011	1		10,471			0
2012	1		10,471			0
2013	3		24,273			0
2014	11		97,094			0
2015	0		0			0
2016	92		843,152	1.1		10,474
2017	132		1,215,821	1.1		10,474
2018	156		1,435,020	67.3		619,266
2019	214		1,969,201	67.3		619,266
2020			0			0
2021			0			0
2022		1	8,731		0.6	5,665
2023		4	34,926		0.6	5,665
2024		127	1,168,446		33.6	308,975
2025		103	948,132		33.6	308,975
2026			0			0
2027			0			0
2028			0			0
2029			0			0
2030			0			0
Total	**609.3**	**234.8**	**7,765,739**	**136.9**	**68.4**	**1,888,760**

Financial Return on Investment as a Whole: The basic financial return on the project investment is nearly 7% as is seen in the table below.

Table 10.5.19 Return on Investment as a whole

	Case 1-JICA Forecast	Case 2-Pelindo-III
Assumption of forecast	4% increase of Economy in Surabaya Greater Metropolitan Area	10% increase of Container Cargo
Socah IRR	**6.5%**	**8.8%**

It is observed that the return is less than 15% and development scheme should follow the style of development by using international development fund for the infrastructure construction first, then private operator will prepare the buildings and cargo handling machines.

Financial Returns for Public and Private Cooperation: Infrastructure such as wharf, trestle and capital dredging are conducted by Pelindo-III as the owner of the development project. After the infrastructures are laid out, tender process will determine the terminal operators with concession agreements. Winner tender will invest on the cargo handling machines, container yard pavement and buildings based on the concession agreements.

Table 10.5.20 Direct Cost Division between Private and PELINDO-III for the Development of Socah

	Private Operator (Mil $)		**PELINDO-III** (Mil $)	
	Phase1	Phase 2	Phase 1	Phase 2
Wharf			89,400	33,900
Container Yard	34,600	61,200		
Office/Gate/Workshop/Others	33,800	12,200		
Trestle			90,900	30,300
Revetment			7,700	3,800
Channel Dredging			23,000	0
Reclamation			9,500	12,000
Access Road			7,000	0
Container Handling Equipment	121,500	59,300		
Direct Construction Cost	189,900	132,700	227,500	80,000

Table 10.5.21 Investment Schedule by Private and PELINDO-III

	Private Operator		**Total**	**PELINDO-III**		**Capital Dredging**	**Total**
	PH-1(Mil $)	PH-2(Mil $)	(Mil Rp)	PH-1(Mil $)	PH-2(Mil $)	(Mil $)	(Mil Rp)
2011	0.0		0	1.1	0.0	0.0	9,791
2012	0.0		0	1.1	0.0	0.0	9,791
2013	0.0		0	2.5	0.0	0.0	22,847
2014	0.0		0	9.9	0.0	0.0	91,387
2015	0.0		0	0.0	0.0	0.0	0
2016	0.0		0	127.3	0.0	1.1	1,181,762
2017	18.6		171,176	120.1	0.0	1.1	1,115,237
2018	71.4		657,231	29.2	0.0	67.3	887,471
2019	170.6		1,569,113	31.0	0.0	67.3	904,700
2020			0	0.0	0.0	0.0	0
2021			0	0.0	0.0	0.0	0
2022		0.0	0	0.0	1.1	0.6	15,968
2023		0.0	0	0.0	4.5	0.6	46,875
2024		99.9	919,333	0.0	49.3	33.6	762,991
2025		82.1	755,300	0.0	39.3	33.6	670,399
2026			0	0.0	0.0	0.0	0
2027			0	0.0	0.0	0.0	0
2028			0	0.0	0.0	0.0	0
2029			0	0.0	0.0	0.0	0
2030			0	0.0	0.0	0.0	0
Total	260.6	182.0	4,072,152	322.1	94.2	205.3	4,681,607

For the case of Socah, access channel is deepened as capital dredging which will contribute for both Lamong and Socah terminal. Therefore the cost is apportioned according to the length of wharf. It is expected that, for the construction of infrastructure, the project will be financed by long-term soft loans from international lending institutions such as JBIC so that public sector, in this case PELINDO-III, will be able to complete the responsibility to start the project.

The annual fixed fee from the concessionaire is assumed to cover the interest payment of JIBC loan in the beginning of operation, which is 12.7 million USD per year equivalent to 3% of interest rate on the investment. Then as cargo volume grows and goes over 100,000 TEU per year, additional concession fee will be charged by 22 USD/TEU for the surplus portion. This additional portion will cover the repayment of principal of loan.

Concession fee will be determined in terms of US dollar because tariff for international cargo is set by US dollar and the loan repayment should be secured by the international currency. By this consideration PELINDO-III is assured by the payment equivalent to the agreed amount in US dollar.

Private concessionaire will receive large profit when cargo volume increase and expected to realize the return of 7.3% based on the cargo forecast by JICA and 10.5% based on the

PELINDO forecast. This situation will be a marginal level because TPS realizes return on investment at approximately 7%. Expected return here would be just as good to satisfy the international terminal operator to invest on this project.

Table 10.5.22 Assumptions of Concession Fee

Concession Fee 1(Fixed Annual Fee)	12.7	Mil $/ year	116,840	Mil Rp/ year
Concession Fee 2 (Volume Related)	22	$/TEU	202	Thou. Rp/TEU
Base Cargo volume over which Fee-2 will be due by Private Concessionaire			100,000	TEU/year

Table 10.5.23 Return on Investment by Public and Private

	Case 1 – JICA Forecast	Case 2 - Pelindo-III
	4% increase of Economy in Surabaya Greater Metropolitan Area	10% increase of Cargo
Private Operator's Return	7.3%	10.5%
Public (PELINDO-III) IRR	3.3%	5.3%

Figure 10.5.7 Feasibility Calculation of Socah Case-1

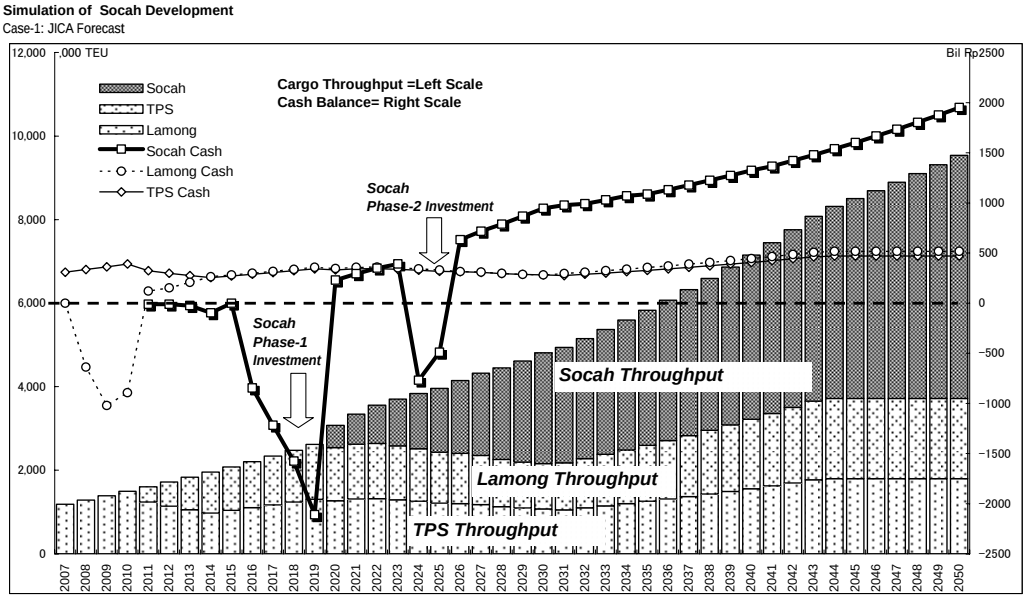
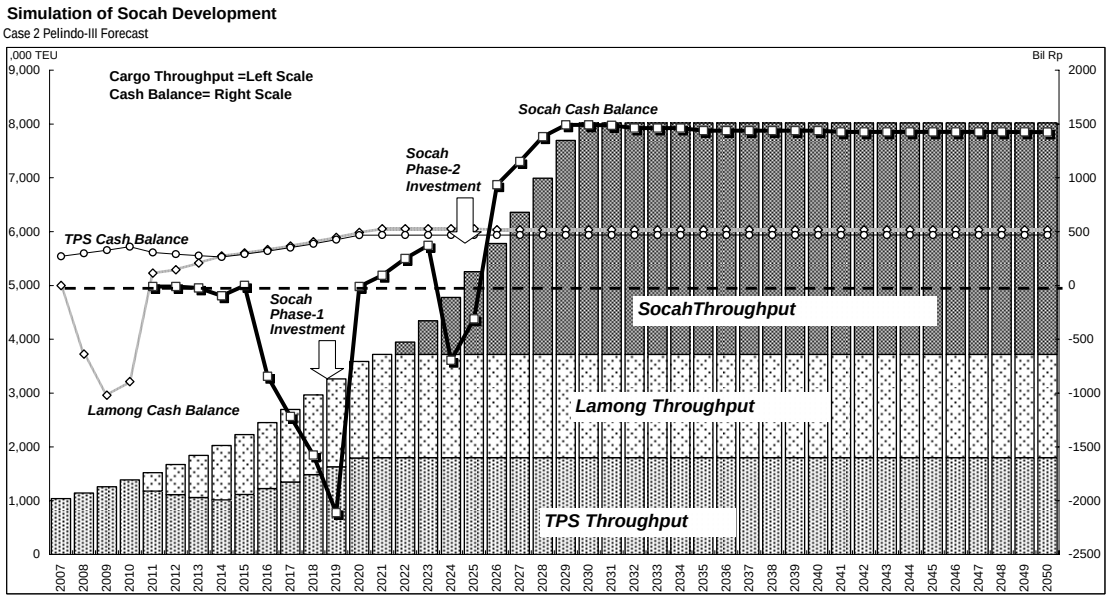


Figure 10.5.8 Feasibility Calculation of Socah Case-2



3) Site Selection and Possible Functional Linkage

Two candidate sites are compared in a comprehensive manner in Table 10.5.24. In conclusion, Tg. Bulupandan is a more suitable site for a regional gateway port judging mainly qualitative assessment. If an attractive PPP scheme is offered to a private investor, Tg. Bulupandan Port would become an economically and financially feasible project, while it develops its own breakwater and approach channel instead of depending on the Surabaya West Access Channel.

In the region, however, Socah has also good potential to develop into a seaport. Taking account of role sharing between the two sites, the study suggests that a Socah new port deal with non-container cargo such as general cargo with a berth depth up to 12m be considered.

Table 10.5.24 Comparative Assessment of the Two Candidate Sites

	Tg. Bulupandan	**Socah**
Qualitative Indicator		
Provincial Spatial Plan	The same location as specified	No site endorsement in the plan
Regional Development Impact	Expected considerable impact together with Suramadu Bridge Inducement of synergy effect by associated direct hinterland development	(the same as left)
Future Expansion Potential	The adjoining coastline can be used for capacity expansion	Difficulty in further quay extension
Sea Access	Favorable	Not easy due to fast tide flow and too near to the access channel
Land Access	49 km from Tg. Perak through bridge	31 km from Tg. Perak through bridge
Natural Environmental Considerations	Great impact by port reclamation to Kool Bay and coastal land	Great impact by port reclamation to Socah Bay and limited impact to land
Social Environmental Considerations	More supportive and cooperative attitude towards port development due to economic difficulty by mostly farming and fishing and the local government' propaganda	A mixture of positive and suspicious attitude during the IEE survey
Quantitative Indicator		
Direct Construction Cost	Phase I – US$ 454 million Phase II – US$ 170 million	Phase I – US$ 454 million Phase II – US$ 171 million
Burden on Access Channel Usage	Negligible	US$ 49 million for initial dredging (-14m) US$ 3 – 3.8 million for annual dredging
EIRR	17.2%	15.4%
FIRR	6.9%	6.5%

Source: JICA Study Team

11 CONSOLIDATED GSMP DEVELOPMENT PLAN

11.1 GSMP Blueprint

1) Spatial Framework

The most urgent critical issue does not lie in ports in the case of Surabaya. The key issue is the access channel along the Madura Strait. After a series of civil engineering and transport planning works, the study has obtained the following conclusions:

- The access channel shall be improved to be 12m deep and 200m wide in the short-term. Further improvement is not realistic due to difficult maintenance dredging.
- In the long-term, there is a possibility to further improve the access channel because of increased capability and affordability of maintenance dredging, say, 14m deep and 300m wide. Even with such further improvement, the channel traffic capacity will not be able to expand over 54,000 ships per year. But seaborne traffic will exceed the maximum capacity in 2025. Therefore, new port(s) being located free from the access channel is necessary.

Nowadays, the role of container shipping has ever been increasing for regional development at the both scopes of international and domestic trading in Indonesia. In order to strengthen regional competitiveness, the new Lamong Bay project has already been put on the implementation track. The study was requested to identify a new port project next to the Lamong Bay project. In response, the study has formulated a new container port project at Tg. Bulupandan, Bangkalan Regency, facing the Java Sea.

During the study, it is increasingly recognized that Madura Island gathers momentum in regional development in conjunction with the construction of the Suramadu bridge project which is scheduled to start its operation by the end of 2008. The bridge project is designed to accelerate island development including residential and industrial uses with necessary infrastructure and public utilities. It means that the bridge project is quite developmental, addressing urban land scarcity at the Surabaya side, rather than merely converting the present ferry demand. Under such regional development context, Tg. Bulupandan new port will become another core infrastructure development because of benefiting container shipping and users at a wider scope than ever and stimulating direct hinterland development.

2) Timeframe

The study proposes a comprehensive picture of the Greater Surabaya Metropolitan Ports. There are mainly two conductors to guide such planning works: port demand forecast and port accessibility from land and sea.

In the short-term or during the period 2008-2015: Some additional non-container port infrastructure will be necessary. Provided that the Lamong Bay project could be implemented, no other substantial container port investment would be required. (Refer to Table 10.1.11)

The study has formulated the following short-term projects:

- The access channel improvement project;

- The Jamrud Terminal rehabilitation project (terminal modernization to accommodate dry bulk carriers, inter-island passenger ships and international cruise ships for optimizing synergy with the access channel improvement project); and
- Some land access network improvements

The study reported and analyzed some on-going plans and efforts to meet various shipping needs. They are:

- Improvement of Tanjung Perak such as Kali Mas revitalization and Nilai Terminal;
- Expansion of Gresik Port for dry bulk; and
- A couple of additional private jetties for dry bulk along the coastline of Gresik.

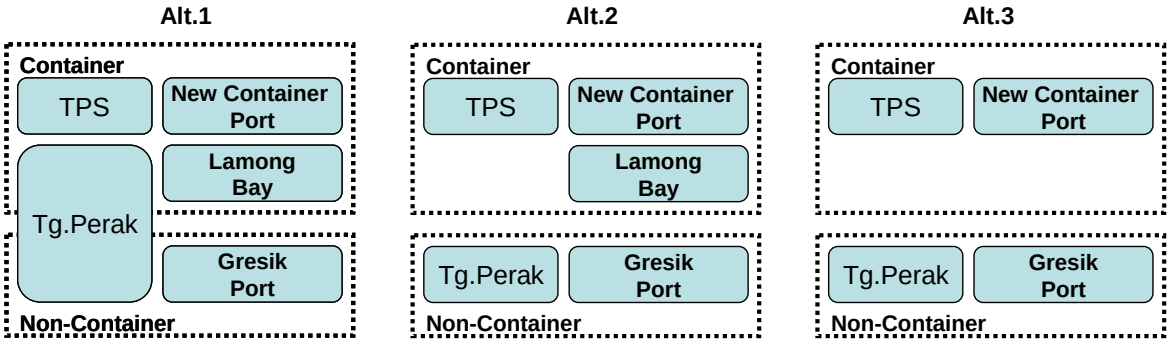
With the above-mentioned, we consider that metropolitan port traffic demand until 2015 will be supported.

In the long-term or during the period 2016-2030: The study proposes the Tg. Bulupandan container port project in the long-term. This is the most important port investment project for the metropolitan economy and thus investment timing becomes critical. Under different situations from the study's assumption, the Tg. Bulupandan project would have to appear in an early turn under the GSMP development. The plausible differences are (i) introduction of full container fleet totally in the domestic shipping, and (ii) cancellation of the Lamong Bay project. Under the (i) situation, historical terminals at Tg. Perak may not keep pace with full-scale container shipping and thus container traffic would be handled at TPS, Lamong Bay and Tg. Bulupandan. If the situation (i) occurred, Tg. Bulupandan Port would have to be constructed 5 years in advance or the target opening year of 2015 and furthermore if situation (ii) happened, the project needs to be accelerated by 10 years' earlier from the original schedule or the target opening year of 2010 or at least the early 2010s. Therefore the project implementation should be determined adequately taking account of such factors. (Figure 11.1.1 and Table 11.1.2)

To meet non-container demand, any ports having non-container infrastructure will need to adjust (mainly expand) their operation capacity in the long term. Although available coastline at the Madura Strait would be densely used for ports and shipping around the year 2015, one coastal site would be left behind, i.e., Socah in Madura Island. It is recommended that Socah site be developed as a non-container port, handling general cargo and others, with up to 12m depth. Currently, the private initiated MISI project has a development permission of specialized port. It is important to incorporate such a privately owned port into the GSMP development plan with necessary policy guidelines.

In addition, the associated hinterland development with Tg. Bulupandan Port and the port access roads to the two sites in Madura Island are conceptualized in the GSMP development plan.

Figure 11.1.1 Alternatives of GSMP Development – Allocated Port Roles



Note: Tg. Perak means Tg. Perak Branch of PELINDO III consisting of Jamrud, Berlian, Nilam and Mirah.

Table 11.1.1 Alternatives of GSMP Development – Required Berth Length

Year	Required Berth Length (m) To the New Container Port			Required Berth Length (m) for General Cargo		
	Alt.1	Alt.2	Alt.3	Alt.1	Alt.2	Alt.3
2015	-	900	1,800	600	-	-
2020	600	1,500	2,700	1,080	360	600
2025	1,850	2,450	3,650	1,560	840	1,500
2030	2,550	3,750	4,650	2,040	1,320	2,600

Source: JICA Study Team

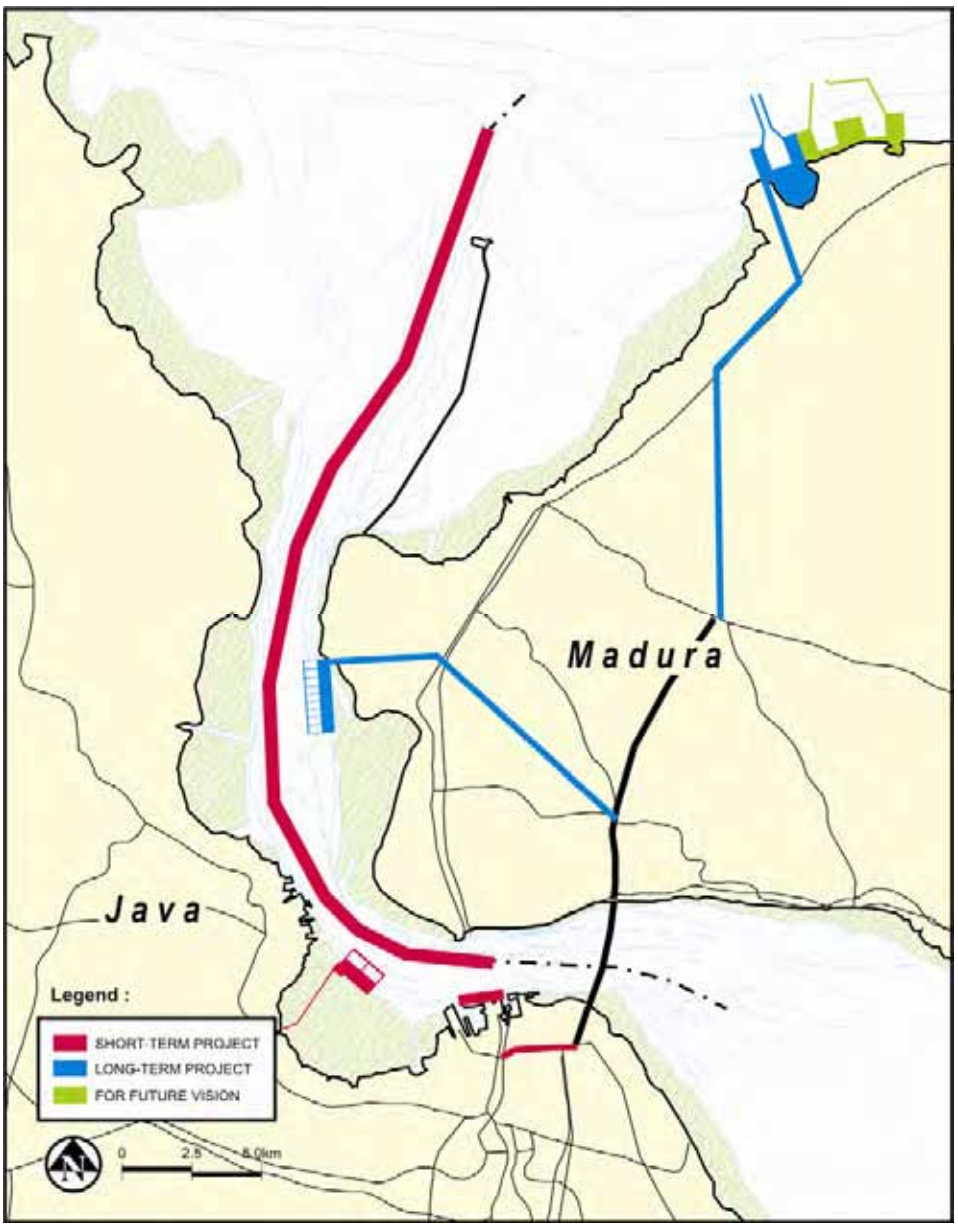
3) Far Future Vision

The study team learned most of essential infrastructure for GSMP were constructed in the late 19th century like Ujung Piring Lighthouse (in 1876) and the early 20th century like Tg. Perak (in 1910) and the training wall (unknown construction year but it was recorded on the map surveyed in 1937. Thus, major infrastructure must work and be of service over centuries with adequate rehabilitation and prolongation measures. As the final part of the GSMP blueprint, far future vision beyond the target year of 2030 is presented.

Although the proposed project can't meet far future demand (i.e. beyond 2030), Tg. Bulupandan Port will be able to serve for the region as a gateway port beyond 2030 by way of expansion. Expansion site should be preserved when port hinterland is developed.

An extreme solution to increase the capacity of the access channel at the Madura Strait is to construct a training wall at the opposite side. Thus, it enables hydraulic engineering to totally control the channel dimensions. However, it is a prohibitive investment during the planning period though economic development will overcome this constraint in the future.

Figure 11.1.2 Consolidated GSMP Development Plan (Blueprint)



11.2 PPP Approach in Port Development

1) Various PPP Schemes

Nowadays public private partnership is very common on the construction and management of transportation field, because relevant public bodies sometimes have not enough construction budgets and efficient management know-how, but private sectors have good opportunity to enter the transportation business. As for port management, port authority is public sector and used to manage port by itself (public service port). But port operation by public sector was claimed to be not efficient and expensive by port users like shipping companies and freight forwarders. Some of the operation like cargo handling was commissioned to private sectors (tool port). Some of dry bulk cargo like grains, ores and cements and some of liquid bulk cargo like crude oil and petroleum products are handled with specific facilities by huge amount volume at a time. Those berthing facilities are not used for public, but for specific industries exclusively. Those facilities are commonly constructed and managed by the specific bodies (private port). There are various types of public private partnership in the field of port activities like that. While the containerization has been progressing, it has become common that private sector participate with container terminal management. Recently port management body tends to be just landowners and the management of a container terminal is commissioned to private sectors. And private involvement into container terminal operation is progressing more. There are several types of private participation in the field of terminal operations, as showed on Table 11.2.1. The most important subject of private participation is how to balance between public interests and fair competition.

Table 11.2.1 Type of Private Participation in the Field of Port

Content of Private Participation		Management Type
Public	Public Management and Operation	Public Service Port
↑	Outsourcing	Tool Port
	Management Contract	
	Lease and Rent Contract	Tool Port/Landlord Port
Concession	Full Concession including BOT etc.	Landlord Port
	BOO (Build, Operate and Own)	
↓	Divesture by License	Relinquishment of Public Interest
	Divesture by Sale	
Private	Private Supply & Operation	Private Port

Notes: Additionally revised the original one of Oversea Costal Development Institute in Japan

Figure 11.2.1 shows the various cases of private participation of port management for a New Gateway Port. As for ownership of assets, water area is definitely owned by the government and land is also owned by public sector in case of public port. The ownership of terminal infrastructures is determined on a case by case basis. But even if private sector has its ownership, it is generally transferred to public sector after expiring contracts or concessions. Superstructures are constructed and procured by private sectors, if the terminal is newly constructed. Based on these assumptions, the following cases are considered for public private participation in case of a New Gateway Port.

Case 1 shows the case of an entire private port. The port is owned by private sector. The public sector can control its business only through supervising the port tariffs and having authority to give permission for further expansion. But the public sector exercise its authority strongly, private sectors will go back their intention to participate the project. Furthermore private sector

must bear the huge initial investment costs. It is very risky for private sectors to participate in the project. And there is no private port for public cargo handling in Indonesia. International main ports are the most basic national infrastructure for the country. They should be owned by public sector. So case 1 is not feasible.

The others show the cases of various types of PFI. Management & operation should be private business. Procurement of equipment, pavement of yard and construction of operation building are generally done by private sectors. And the ownership of the port is in the public sector or will be transferred to be public sector after finishing the concession contract. Assuming those things, 4 cases of PFI scheme are considered.

Case 5 is a typical one, the same type as the case of TPS. All of terminal infrastructures such as the land, the quays and the access bridge are provided by PELINDO III. Those land and facilities were not newly constructed ones. PELINDO III just leased their properties to TPS. It was not necessary for TPS to bear a lot of initial investment costs. If the port is newly constructed, the public sector must bear a big initial cost. It is very risky for the public sector, but private sectors feel a favorable impression on the project.

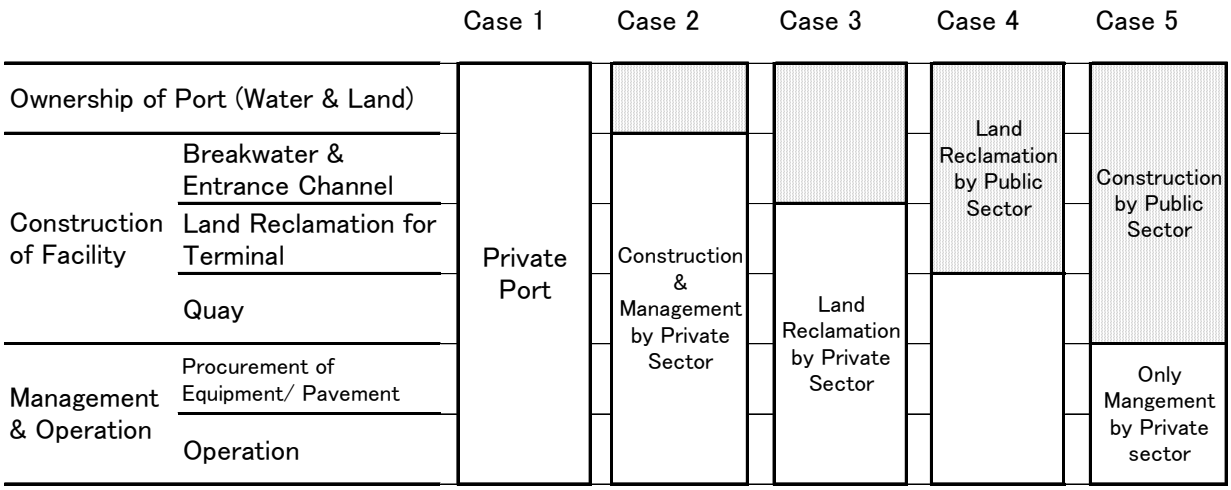
Case 2 is a completely opposite side of case 5. Private sectors must construct all of infrastructures. The construction of a new port needs a huge amount of initial cost. It takes several years or more to open for the service after starting the construction. It might be possible for private sectors to participate in the project if they can estimate enough future traffic volume and expect its certain return of investment. Considering the situation around Surabaya, it is very risky and almost impossible in case of the development of Tanjung Burpandan. Because the construction of breakwater and the channel are must. Furthermore the land reclamation is considered to be necessary. Public sector should prepare the initial cost. On the contrary, it is possible in case of the development of Socha, because there is no cost-consumed infrastructure such as breakwater and channel.

Case 3 and 4 are possible ones. There are no advantage and disadvantage between them. It depends on the magnitude of private involvement and the flexibility of business.

The conclusion is as follows.

- The ownership of the port should be on public sector.
- Public sector should bear the initial cost such as the construction cost of breakwater and entrance channel
- Management and Operation should be entirely on private sector.
- The ownership of terminal infrastructures will be decided based on the negotiation. But public sector should own those assets after expiring the contract

Figure 11.2.1 Various Patterns of Private Participation on Port Management



Source: Study Team
Note: ▒ public sector ☐ private sector

2) Port Finance and Management

Standard Loan Schemes: There are several schemes to procure fund for development of port. The most common method is to get government loan either by bilateral agreement or by international financial institutions. This method has been conducted very popularly in the past. TPS development was a typical successful case utilizing ADB loan for the development of container terminal. TPS now brings approximately 45% of total income of PELINDO-III after paying due tax to the government.

But there are several drawbacks conspicuous in recent years as listed below.

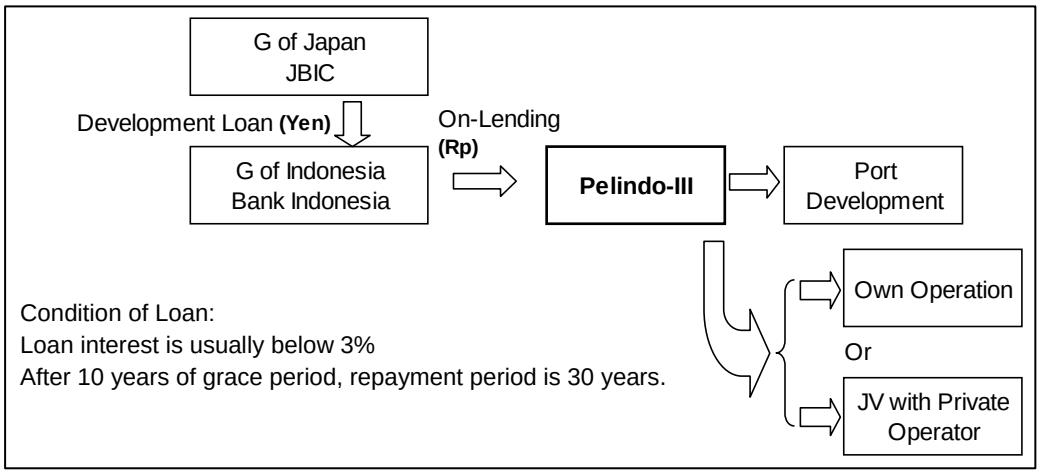
i) International funds are in terms of foreign currency and therefore subject to exchange risk. In case of the development of infrastructure, such as port, contract term is long and exchange risk tends to be large.

ii) Process of fund release is often complicated and takes long time to fulfill the requirement, and therefore the project cannot respond to the changing needs quickly.

iii) Design and Contractor are sometimes tied to the donor country and the construction cost and price is not competitive compared to other private open tender projects

iv) Lending term is very long and officers related to the project cannot be responsible for the result.

Figure 11.2.2 Standard Loan Scheme Utilizing G to G Soft Loan for Development



Source: JICA Study Team

Private Participation Scheme: In contrast, there is a tendency to invite private investors as partners from the beginning of the project including funding so that the feasibility and responsibility of the project will be improved. Several legal situations are in preparation in recent years as listed below.

i) "Perpres 67/2005"concerning the cooperation between the government and business entities for the provision of infrastructure

ii) "Perpres 36/2005" for the Land Procurement with amendment by "Perpres 65/2006"

iii) "38/PMK.01/2006" for the control and management of risk related to the project to provide infrastructure.

Even though these regulations are the basics of public-private partnership, Shipping Law No. 21/1992 stipulates basic port management. It is reported that the revised law will allow the private sector to join in the provision of infrastructure including public port development by PPP scheme. In other words, PILINDO will not be the only authorized organization to develop public port but also other private entities with central or local governments will have chance to develop .

As a prerequisite, based on the Perpres 67/2005, following points should be considered in the development of a PPP project.

i) Comply with medium term of national/regional development planning and strategic planning of infrastructure sector.

ii) Comply with spatial planning

iii) Interconnection among infrastructure sectors and among regions.

iv) Cost analysis and social benefit.

In the same regulation, projects are supposed to take the following steps:

i) feasibility study

ii) preparation of partnership type

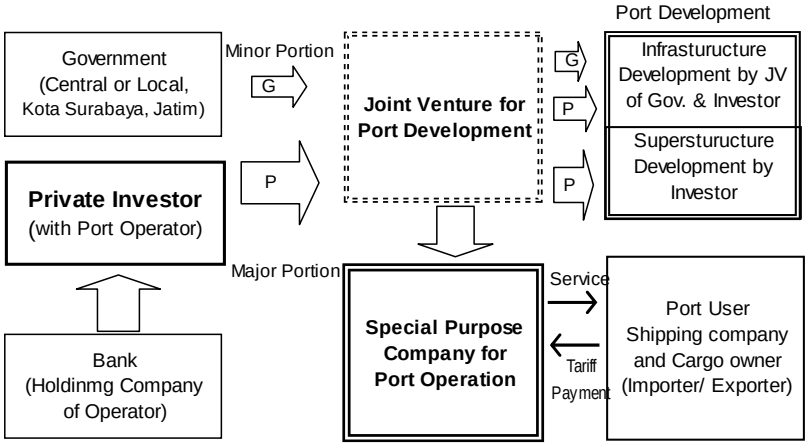
iii) planning of project financing and funding resource

iv) preparation of proposal of partnership covering schedule, process and method of evaluation

Port Financing and Management Plan for Tg. Bulupandan: The Lamong Bay project scheme is applicable to Tg. Bulupandan if PELINDO III were appointed as a port management body as it is now (refer to Column 11-1). There will be another possibility that Private Terminal Operator will set up a JV-company with Local government so that DBOF (Design Build Operate Finance) will be realized in the port development. If there will be a government organization such as the proposed Sumaradu Bridge District Development Acceleration Board (B3PWS) which plans infrastructure for full-set industrial development, port would be very important as a gateway to the new industrial zone. In order to concretize this new scheme, there are some options to be adequately arranged as follows:

- Involvement of local government at either provincial or kabupaten level or both;
- Involvement of local community as stakeholders or a more influential form such as a land right holders cooperative;
- Participation of the private sector in compliance with the Perpres 67/2005.

Future 11.2.3 Port Development and Management Structure



Source: JICA Study Team

A project financial plan shall be worked out to be financially robust and absorb all concerned parties' interests based on reliable project preparation documents such as feasibility study and investment study. In principal, major 3 parties, i.e., the government, the landlord (under the non-PELINDO case) and SPC for port operation, have different resources or negotiable items in making a project financial plan as follows:

The Government: has 2 revenue sources: i) corporate tax to central and local government (likely to be exempted) and ii) revenue sharing by investment ratio (likely to be waived).

The land lord has 3 types of sources of revenue (possibility if involved in the development): i) concession fee by contract (fixed payment), ii) revenue sharing by contract of concession (variable by cargo volume), and iii) profit sharing by equity capital participation (based on the investment ratio).

Finally, JV Operator, as SPC has right to request following management decisions: i) duty to provide service to port users and authority to collect port tariff, ii) making fund reserve for maintenance and future development, and iii) profit sharing by equity capital participation (investment ratio).

Column 11-1	PPP Application Example – Lamong Bay Port Project

Investment amount for the construction of the terminal is estimated at 2.5 trillion Rupiah or 267.58 million US dollars. Among the total investment, 75% is on infrastructure such as quay wall and reclamation of container yard, and the rest is on cranes and other cargo handling machines.

The financial scheme is to invite local government funds and a private operator capital in addition to the finances of PELINDO III. The local government portion is a combination of East Java Province and Surabaya City and the private operator will be selected by open tender based on the regulation introduced above.

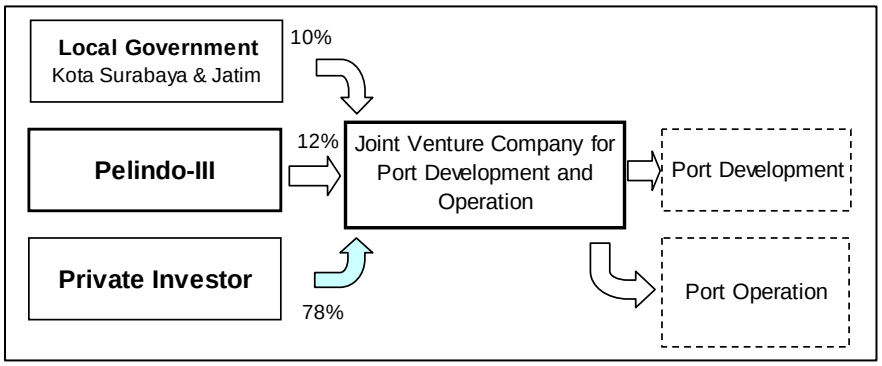
PELINDO III intends to develop Lamong Bay Port by a scheme similar to BOT but the detail is not yet settled. It is likely that a JV-company will be set up for the management of the construction and operation. Based on the scheme of joint venture effort, the tasks of PELINDO III include i) Preparing the land for construction, ii) Design and Environmental review, iii) Capital Dredging to -14m at quayside and approach channel, iv) Construction of Infrastructure: Access road, Causeway, Bridge and Trestle.

The partner of private sector will be decided through tender process and concession agreement to build and operate will cover the following duties: i) Construction of Infrastructure such as Quay-wall, CY, CFS, office and other utilities, ii) Prepare superstructure such as quayside crane, RTG, trailers, etc., iii) Maintenance dredging, iv) Operation and maintenance of the Terminal, v) Provide guarantee to Minimum amount of container throughput, and vi) Collect operational revenue and transfer share revenue to Pelindo-III.

Concession term for the operation will be 30 years with revenue sharing scheme based on a BOT concept. At the end of the concession term, the asset will be transferred to PELINDO III.

Revenue is assumed to be coming from terminal operation services and mooring service. The terminal operator will pay the concession fee and transfer the share of revenue to PELINDO III including the share of local government. At the end of the concession period the local government will be given the sum of revenue share from PELINDO III. Ratio of profit sharing will be decided among the parties concerned

Project Diagram for Lamong Bay Port Development



Note: The diagram here is a sample trial graphic presentation of the project composition. There are many uncertainties, however, concerning the development scheme including JV company and Private Investors. Private investors may be for investment only and concession to operator may be different. Or the investor is likely to be the operator so that the design of terminal and investment will be managed by the private partner. There is no concrete idea, nor document concerning the detail of business structure for the development and operation.

Column 11-2	PPP Application Example – Trans Java Toll Road Project

For a port PPP project, a case study in the road sector gives some important insights since toll road development is comparatively advanced in PPP application than port development in Indonesia.

The Original PPP scheme was that the government made initial upfront subsidy to start procurement of land and construction. After the completion of road, toll revenue would cover the repayment and maintenance cost. In addition, annual service payment from the government over the life of the road to a PPP Company would reduce financing requirements for operation to a level supportable by tolls.

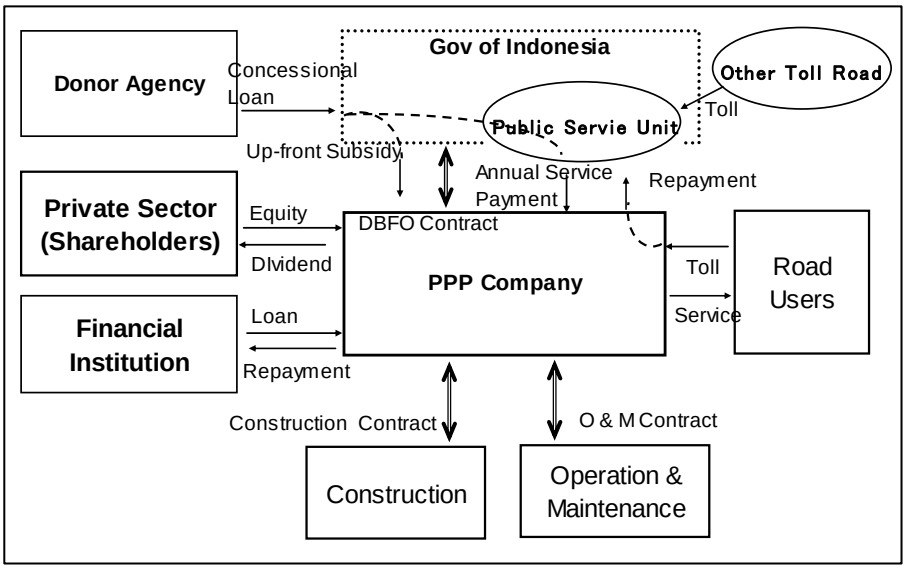
During the tender process to determine private operator and negotiation on investment conditions, upfront subsidy seems to be in the construction of a certain substantial portion of road itself and operator will receive to operate as a whole. After the operation starts there will be no service payment expected to be paid to operator.

When the overall project is financially viable, private participation with DBOF scheme (Design-Build-Operate-Finance) would be available. But for this Trans-Java Toll Road : Solo-Kertosono section EIRR was 24.5% but FIRR was 13.1%, which is lower than marginal financial viability level of 18-19%. The gap is supposed to be filled by government subsidy.

The key for the scheme is to allocate potential risks to the party best able to manage, and therefore minimize the cost of risks. The idea is to make full utilization of management expertise from the private sector for both construction and operation. At the same time, the government is also responsible for securing the public service quality.

The international experience also suggests that the optimal risk allocation and strong political commitment are two key factors making good PPP projects. In other words government role is important for the establishment of schemes, and even after the contract especially since the infrastructure are closely related to the economic growth. However, PPP projects sometimes suffer from a poor coordination of related agencies including land acquisition and access road preparation.

PPP Scheme for Toll Road Development

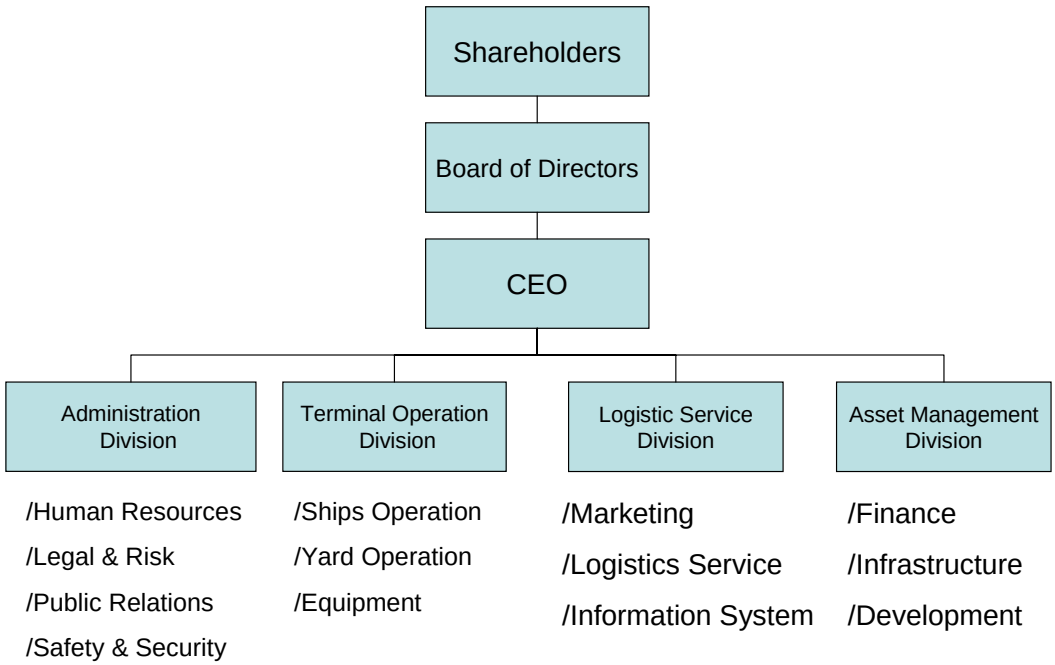


Source: Modified by JICA Study Team based on the JICA Study on Public-Private Partnership Scheme for Trans Java Toll Road

3) Management and Operation Body

Structure of management & operation body: It depends on the range of its work. TPS is in the region of Port of Tanjung Perak. It is supervised by various port administrative agencies, but its management is totally independent from other bodies except for pilot and tug services. A New Gateway Port is a container terminal like TPS. Its management and operation style is considered to be the same as Those of TPS. Figure 11.2.4 shows an example of imaginable organization structure of management & operation body. CEO manages all jobs under board of directors. There are 4 divisions like Administration Division, Terminal Operation one, Logistics service/Information one and Asset Management one. Most of employees are under Terminal Operation Division. Because terminal operation is done for 24 hours and those employees must work in 4 shifts a day. Those jobs are ships operation, yard operation and equipment maintenance. Administration Division has jobs for human resources, Legal and risk matters, public relations and safety and security matters. Logistic Service Division has an important role for management. There are main purposes of the management. The first one is to perform the highly efficient operation at the terminal. The second one is to realize the high collection of cargos. Not only shipping companies but also cargo owners have powers to select ports. Marketing section should have a close relationship with those users. Some cargo owners may have the intention of processing their cargos like packing and sorting at the terminal. Terminal business is not limited on terminal operation. There are various value added services there. Logistics Service Division has jobs for marketing, logistics service and information system to do those things. Asset Management Division has jobs for finance, infrastructure maintenance and future development.

Figure 11.2.4 Organization Chart of Port Management & Operation



Personnel size of the organization: Table 11.2.2 shows the personnel size of the port management body. Plan1 is the case of starting the business. Plan2 is the case of final stage of the project. The organization structure is assumed to be the same as that of TPS where Operation Division and Engineering Division have around 80% shares altogether of the total personnel. Engineering Division is supposed to be under Terminal Operation Division in the imaginable management body. Other divisions are considered to be almost same, even if the operation business increases.

The number of the personnel in the operation division depends on the number of equipments at the terminal. The drivers of quay gantry cranes, RTGs and forklifts are its regular staffs in the case of TPS. 3 drivers are necessary for 2 equipments respectively. Supervisors and planners are also its regular staffs. One supervisor per ship, one supervisor for quay side machines, one planner for working vessel and one yard planner are posted at the terminal. And supervisors at the gatehouse and CFS and document service staffs are posted for 24 hours. Considering those conditions, total number of regular shift workers is estimated as follows.

Regular shift workers = (Number of berths x 6 persons + Number of (QGCs + RTGs + Forklifts) x 1.5 persons) x 4 shifts

Equipment maintenance are done by Engineering Division. The number of regular staffs in Engineering Division is estimated by multiplying TPS's staffs by increasing ratio of equipments.

Tally clerks, stevedore workers, chassis track drivers, cleaners and security staffs are outsourcing workers. They are estimated as follows:

- Tally clerk: (2 persons for each QGC + 1 person for each RTG and Forklift + 5 person for others (empty container, reefer container and gatehouse)) x 4 shifts
- Stevedore: 6 persons x QGC *4 shifts
- Truck driver: 4 persons x Trailer x 4 shifts (5 trailers are used for each QGC at TPS because of the long access bridge. 4 trailers are enough for cargo handling at a New Gateway Port.)
- Maintenance staff: Estimation is based on actual personnel placement at TPS and increasing ratio by equipment at a New gateway Port.
- Cleaner and security staff: Estimation is based on the number of berths comparing to TPS.

Based on these assumptions and calculations, total regular staffs are about 700 for Plan 1 and 1000 persons for Plan 2. On-site outsourcing staffs are respectively about 1200 and 2000 persons.

Table 11.2.2 Personnel Size of the Port Management Body

	TPS	BJTI	Plan 1	Plan 2	Note
Facilities & Equipment Condition					
Quay (berths)	6	1625m	6	10	
Quay Gantry Crane (Units	10	(Mobile) 19	12	20	2 units/berth
RTG (Units)	23	7	36	60	3 units/GC
Forklift (Units)	5	2(35t)	7	12	1 units/5RTG
Trailer (Units)	54	38	48	80	4 units/GC
Regular Staff					
Administration Division	45	43	50	50	Almost same as TPS
Finance Division	64		70	70	
Engineering Division	73	151	82	136	TPS's Number*Equipment increase rate
Operation Division (1)	10		10	10	Shift employee is estimated as follows. (Berth Number*6 persons +(GC+RTG+Forklift)* 1.5 person) *4 shifts
(shift employee) (2)	408		474	792	
Sub Total	600	194	686	1058	
Outsourcing Staff					
Tally	212	75	289	468	(GC*2+RTG+Forklift+5)*4 shifts
Stevedors & CFS Staff	244	948	288	480	GC *6 persons*4shift
Truck Driver	216		192	320	GC*4 Units*4 shifts
Maintenance	227		248	414	(GC*2.25+(RTG+Forklift+Trailer)*0 .385)*4 shifts
Cleaners	111	40	111	185	TPS's Number*berth increase rate
Security Guard	100	55	100	167	
Sub Total	1110	1118	1276	2034	
Total Staff	1710	1312	1962	3092	

Source: Study Team except for TPS & BJTI data which is from TPS & BJTI respectively.

Note: Data of BJTI shows all equipment and staff including conventional terminals.

d. Other Issues

4) Anticipated Management and Operation Issues

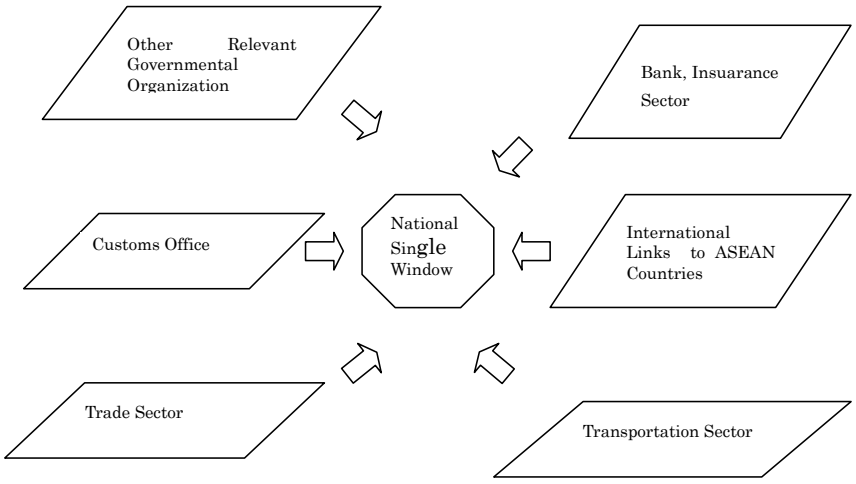
There are several issues about port management and operation tackled hard in future.

- Attraction of Mega Carrier,
- Introduction of Single Window One-Stop Service
- Introduction of Non-Stop Gate System

Attraction of Mega Carrier: In order to change from a feeder port to a direct-call port, it is essential to attract one of mega carriers. Mega carriers are introducing larger ships because of driving economies of scale. The terminals of a New Gateway Port must have enough facilities to accommodate such large vessels, of course. It is, however, much more important to have enough cargos to be handled there. Port of Surabaya is now main domestic hub port in the east of Indonesia. This function should be strengthened more. And original import/export cargo should be produced in Surabaya area by means of industrial development. Even if enough cargos are anticipated there, carriers may feel some risk without big cargo users. So industrial development plan should include such larger shippers or large factory investment, with giving priority to such large container cargo users. And it is useful for the realization of the project to get the intention and expectation of mega carriers continually.

Introduction of Single Window One-Stop Service: There is one-stop service at Port of Tanjung Perak. Users can request pilot and tug service, berthing and mooring allocation and water supply for ship at one place. Shipping users of TPS can request by the internet. Most of users appreciate that those are rather good systems. However many countries try to introduce single window one-stop service to make international trade smooth and accelerate more. There are many administrative procedure at port, such as ship call declaration, customs clearance, quarantine control and crew shore leave procedure. Single window one stop service is to be able to input the necessary data for import/export at one time and to complete all of the relevant procedures. The introduction of the system is in order to enhance security measuer against terrorisms and shorten the lead time on cargo distribution by exchange electrical cargo data with customs each others. Figure 11.2.3 shows the image of Single Window One Point Service which has been tackled together among ASEAN 10 countries[1]. This will be an international standard for export/import related activity including port activity.

Figure 11.2.3 Image of Single Window One Point Service



Introduction of Non-Stop Gate System: Non-stop gate system is now introducing to some advanced container terminals. IC tag are put on outside of containers. Every container can be checked automatically through a gate with IC tag reading equipment. It is useful not only to control containers for security but also to trace containers in and out of the terminal. It may make a big contribution to efficiency of logistics for cargo owners.

[1] The Agreement to Establish and Implement the ASEAN Single Window was made among 10 ASEAN Member Countries in 2005. Indonesia commits the operationalization of their national single windows by year 2008.

11.3 Recommendations for Effective Implementation

1) Infrastructure Development

It is recommended that the proposed access channel improvement project be implemented urgently. The study has confirmed the project's importance from both traffic management and shipping operators' view. The proposed project is doable in the implementation scheme and a high economic return to the regional economy is anticipated.

The study has identified the Jamrud Terminal rehabilitation project which has a good synergy effect with the access channel improvement project, by reconstructing the existing obsolete terminal with wider apron and deeper berth. The possibility of joint implementation should be pursued.

The study recommends the Tg. Bulupandan port project to be constructed as a regional gateway port in the long run, which is to be transferred from the Tg. Perak ports group. As a next step, a feasibility study is necessary. Since the port project has a great opportunity for regional development, the next study should not be limited to port area. It is suggested to encompass related regional development issues such as associated direct hinterland development.

Siltation assessment is one of the most difficult subjects in port and coastal engineering. When the proposed access channel improvement project is implemented, there is a need to review and verify the results of the study particularly on the channel maintenance issue for the sake of better understanding of the access channel and technology improvement in the field of port and coastal engineering. In addition, the study highlights the necessity of R&D to control the access channel by innovative ways such as training wall and dyke with reclamation.

2) Institutional Development

The study has further observed that the Madura Strait is at peril in terms of endowed maritime infrastructure because of uncoordinated port development, uncoordinated pipeline installation and poor access channel maintenance and operation. There is a strong need to synergize among the relevant agencies to keep its essential multi functions for the regional development. For a coordination body, the establishment of a "Madura Strait Management Committee" is recommended, consisting of related line agencies such as transport and energy, local governments, port operators and other users. As one of coordination principles, the study recommends to use the "hydraulic rule of the Madura Strait" identified by the study, to avoid negative coastline development which affects ports and shipping.

At the level of access channel operation, some measures are necessary including, among others, installation of VTS with personnel training and introduction of navigation fee which is charged over access channel users based on a beneficiaries' pay principle.

Regarding the Tg. Bulupandan port project, the study showed that the project have enough economic viability. However, financial IRR is not sufficient to attract private investors. With the Tg. Bulupandan project, the public sector will not need to undertake further access channel improvement. In this sense, a PPP scheme where the public sector is responsible for non-earning asset construction such as breakwater, approach channel, etc. should be further elaborated. It should be noted that PPP sounds attractive to governments but often it delays the schedule of development and thereby causes a slowdown of economy. Such pitfalls must be carefully avoided.

In Indonesia, not only port PPP scheme but also land acquisition and social and environmental management often meet difficulties under ineffective institutional arrangements. It is reported that the Bojonegara port project experiences land acquisition problem due to land price hike although the project envisions an associated industrial development. In the Tg. Bulupandan port project, it is important to involve the local stakeholders in the planning process. Thanks to the local governments' campaign about port development, the majority of residents showed supportive attitude to the study. They definitely wish for better job opportunities and to continue to reside in the area. A more socially acceptable land development method like short-distance displacement without land acquisition such as land readjustment method should be studied through public participation.