Breakwater Relocation (Dam Timur, Dam Tengah) 1,605m

Description		Speed (m/day)	Duration (Month)	Year 2007									Year 2008											Year 2009			Remarks
				4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
Breakwater Relocation			9.3																								
a.	Remove concrete block	10.8	6.2							S.1,2			S.3,4,5														Temporaly Store
b.	Demolish crown and cover concrete	10.0	6.7								S.1,2		S.3,4,5														Reuse
c.	Remove Rubble Stone down to	17.6	3.8									S.1,2			S.3,4,5												Reuse
	elevation -5.00 m																										
d.	Dredge under -5.0m to -14.0m	13.6	4.9										S.1,2			S.3,4,5											**Dump**
																											as Disposal

Note: Except Dam Barat

Figure 6.2.10 Tentative Relocation Schedule and Work Period

6.3 Dredging and Dumping

6.3.1 Volume of Dredging Materials

Dredging works should be executed without interfering and disturbing the normal operation of Tanjung Priok Port activity especially daily calling ship navigation. From the view point of earlier effectiveness for ship navigation, a priority should be given to the widening works of inner harbour channel through dredges in the left side of inner channel. And consecutive areas to be dredged are curvature parts of channel and followed by turning basins. Paying attention to the early effectiveness of areas dredged, dredging work areas can be divided as shown in Figure 6.3.1. Dredging volume up to –14.0m has been calculated based on the bathymetric survey map done by JICA Team recently.

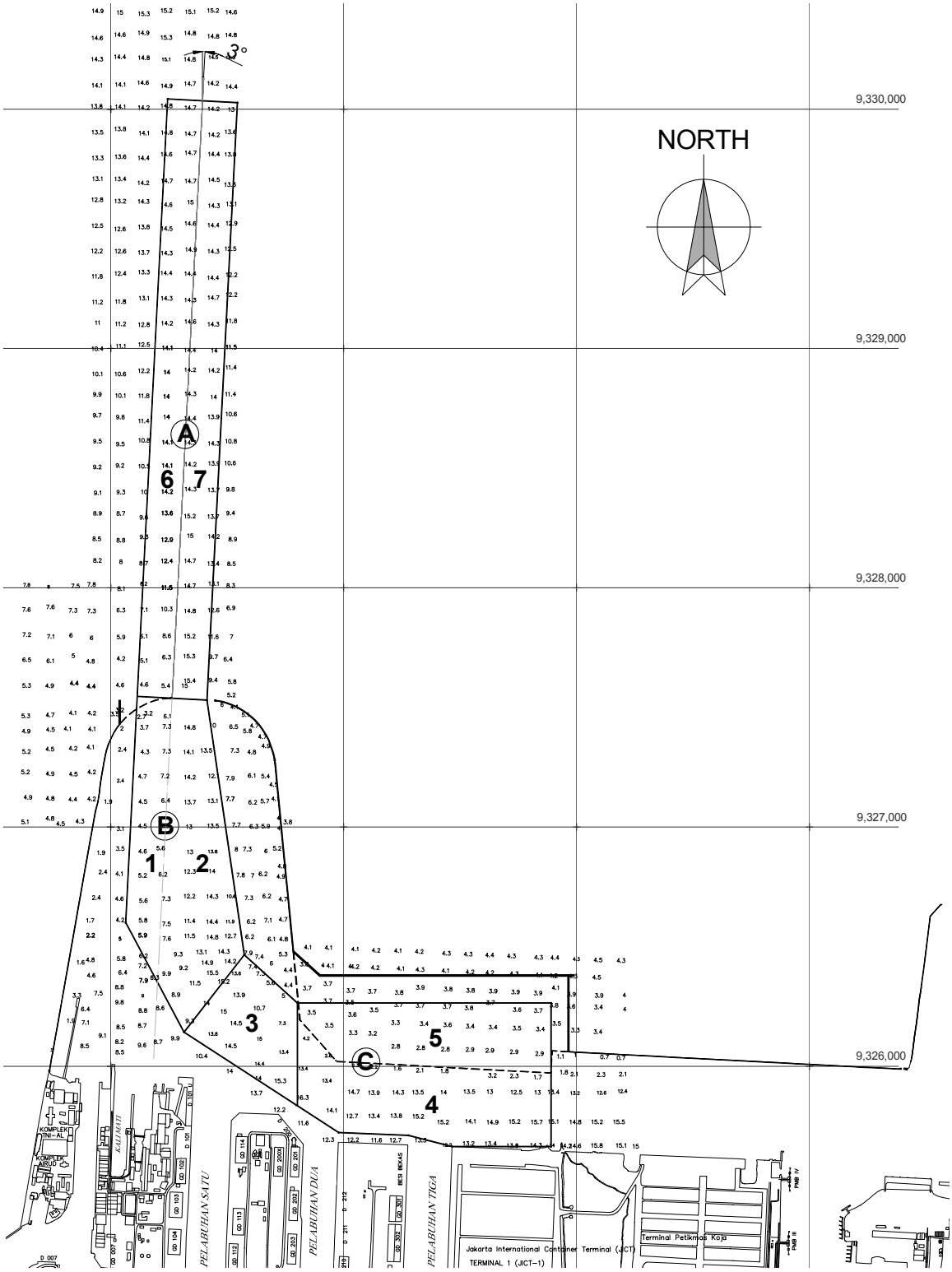


Figure 6.3.1 Dredging Areas

The calculated volume is summarized in Table 6.3.1. This volume is included over dredging volume and tolerance to the slope and bottom.

Dredging works for the channel and basin can commence apart from the relocation works of breakwaters because almost of all work vessels fleets for relocation works don't pass through present west channel and basin.

Table 6.3.1 Dredging Volume by Area (unit m3)

No.	Purpose	Place	Volume
Area 1	Cannel	Inner Harbour Left Side	1,895,500
Area 2	Cannel	Inner Harbour Right Side	855,270
Area 3	Turning Basin	Inner Harbour	603,300
Area 4	Turning Basin	Inner Harbour	1,030,880
Area 5	Turning Basin	Inner Harbour	3,568,440
Area 6	Cannel	Outer Harbour Left Side	1,416,920
Area 7	Cannel	Outer Harbour Right Side	170,760
Total	--	--	9,541,070

Source: JICA D/D Team Note: volume includes over dredging and tolerance

6.3.2 Dredging Fleet

(1) Soil Condition and Dredging Slope

JICA Team carried out soil borings in the panned dredging areas, that were BS2~BS8 in outer harbor channel, BS9 in inner harbour and BS12, BS13 in the planned turning basin. (cf. Volume-2 Appendices G and Volume-3 Drawings GEOLOGICAL PROFILE (Section A-A, Section B-B and Section C-C))

Almost of all soils dredged up to the elevation of –14.0m are classified as Ac1 layer, which is clay/silt soil average N-value 0.4. Table 6.3.2 shows soil characteristics of these layers.

Table 6.3.2 Soil Characteristics of Layers Dredged

Layer			Section A-A Ac1	BS9 Ac1	Section C-C Ac1
N-Value			0.4	0.4	0.5
Gradation	Gravel	%	2.7	0.0	0.3
	Sand	%	7.0	18.5	9.3
	Silt	%	26.7	24.7	31.5
	Clay	%	63.7	56.8	58.9
Natural Water Content	Wn	%	114.3	122.7	110.2
Specific Gravity	Gs	%	2.647	2.612	2.643
Liquid Limit	LL	%	105.9	96.6	98.9
Plastic Limit	PL	%	38.8	38.5	38.8
Plasticity Index	Ip		66.8	58.1	60.2
Thickness (Bore Hole Elevation)			5.6 (-10.6)	10.5 (-3.9)	10.0 (-2.8)

Source JICA D/D Team Note: 1.Number is average value 2. Number of Section C-C includes BS14

The slope dredged should be stable especially when dredging next row area to proceed dredging equipment. Therefore, the dredging section should be planned with a gentle slope for the un-dredged soil not to fall into the dredged areas. The softer or looser is the soil dredged, the gentler slope is needed. Table 6.3.3 shows a standard gradient of slope dredged by soil characteristics.

Table 6.3.3 Normal Gradient of Dredged Slope

Soil Characteristics		Gradient	Remarks
Classification	Condition		
Clayey Soil	Soft Mud	**3.0 ~5.0**	N-Value Under 4
	Soft Soil	2.0~3.0	N-Value 4~8
	Medium Stiff Soil	1.5~2.0	N-Value 8~20
	Stiff Soil	1.0=1.5	N-Value 20~40
Sandy Soil	Loose	2.0~4.0	N-Value Under 10
	Medium	1.5~2.0	N-Value 10~30
	Hard	1.0~1.5	N-Value 30~50
Gravel		1.0~1.5	-
Rock		1.0	-

Source: Komao Higuchi "Design and construction of Water Area Facilities" [Work Vessel] Vol.146、Work Vessel Association in Japan, March1983

According to this standard, the planned dredging soil is classified clayey soil of soft mud. Considering this standard and the experience of Semarang Port Project case, the planned slope of dredging is decided 1:5.

Proper over-dredging and tolerance volume should be considered. Considering Semarang Port Project case and referring Japanese cost estimate criteria, allowance for the required dredging depth (-14.0m) will be as specified below.

Seabed: Within 50cm of the design dredging level

Side slope: Within 2.0m perpendicularly of the design dredging slope

(2) Kind of Dredger and Its Selection

No other dredger is selected except of trailing suction hopper dredger (TSHD) utilized for the dredging work. Dredging soils are almost all soft clay that is very suitable for suction pumping method. In this project, there is no reclamation works. It means that there is no way but dumping somewhere. Further more except area 5, dredging areas overlap navigation area. It makes difficult to occupy a definitively large area for dredging fleet. Conveniently, dredging areas have a certain length, for example, Area 1 has nearly 1,100m long in average. This length is suitable for TSHD which can dredge with navigation speed 3~4knot.

Table 6.3.4 shows actual maintenance dredging in Tanjung Priok Port. RUKINDO carries out large part of dredging by his TSHD. Grab bucket dredgers engage dredging in front of quay walls or narrow slips where are not suitable by TSHD.

Table 6.3.4 Maintenance Dredging Volume in Tanjung Priok Port

Unit (m^3)

Dredger	2000	2001	2002	2003	2004	2005
T.S.H.D	646,057	638,956	425,000	184,625	195,440	298,690
G.B.D.	123,256	393,556	200,000	253,288	119,365	320,607
Total	769,313	884,246	625,000	437,913	314,806	619,297

Note: 1. T.S.H.D. Trailing Suction Hopper Dredger, G.B.D. Grab Bucket Dredger 2.Year2005planned
Source: IPC-II. Tanjung Priok Port

Table 6.3.5 shows active dredger list owned by RUKINDO. RUKINDO has 11 TSHD with hopper capacity of 1,000m^3~5,000m^3. In actual SULAWESI Ⅱ with hopper capacity 3,000m^3, loaded draft of 7.33m and empty draft of 4.0m conducted maintenance dredging in 2003. She dredged 184,625m^3 in the channel adjacent Koja container terminal and behind East entrance water areas.

Minimum present natural depth is different by Area 1 to Area 7 but TSHD with empty-draft of –3.0m can dredge all areas. In case of Area 5, natural depth would be –3.5m~4.0m so that the size of TSHD in early stage might be limited to 1,000m^3 ~2,000m^3. For eastward area of Area5 with depth of around -4.0m~-5.0m deep TSHD has difficulty to navigate with full loaded. Therefore, a TSHD for Area 5 also must navigate through west entrance.

Table 6.3.5 RUKINDO Dredger List

1.TRAILING SUCTION HOPPER DREGER

No.	Name of Vessel	Length Overall (m)	Moulded Breadth (m)	Moulded Depth (m)	Laoded Draught (m)	Gross Tonnage (ton)	Net Tonnage (ton)	Output of Propulsion Machinery (HP)	Power of Dreger-Pumps (HP)	Dreging Depth (m)	Hopper Capacity (m3)	Ship Yard	Speed (Knot)	Drag Posi-tion
1	BALI Ⅱ	124.40	18.00	10.30	7.90	6,603.00	1,981.00	3000kw	-	30.0	5,000	STRALSUND GERMANY/1993	12-13	ng
2	ARU Ⅱ	124.40	18.00	10.30	7.90	6,603.00	1,981.00	3000kw	-	30.0	5,000	STRALSUND GERMANY/1994	12-13	ng
3	IRIAN JAYA	109.88	18.02	8.13	6.33	5,179.20	2,645.00	2×1,795	2×898	20.0	4,000	O&X/K.GERMANY/1981	12-13	BS
4	KALIMANTAN Ⅱ	109.88	18.02	8.13	6.33	5,097.52	2,645.00	2×1,795	2×898	20.0	4,000	O&X/K.GERMANY/1981	12-13	BS
5	SULAWESI Ⅱ	92.50	16.00	8.00	7.33	4,179.00	1,170.00	2×1,900	2×900	20.0	3,000	IHC/Holland/1975	11	BS
6	BETUAH	92.00	16.00	8.00	7.30	4,940.00	-	-	-	20.0	3,000	-	-	-
7	SERAM	92.00	16.05	7.81	5.30	3,700.00	1,719.00	2×2,100	2×900	20.0	3,000	IHC/Holland/1981	12-13	BS
8	HALMAHERA	92.50	16.00	8.00	5.30	3,932.00	1,179.00	2×2,200	2×900	20.0	3,000	IHC/Holland/1983	12-13	BS
9	TIMOR	95.00	18.43	7.27	5.00	3,867.00	1,821.00	2×2,100	2×550	20.0	2,000	IHI/JAPAN/1980	12-13	BS
10	BANDA	71.10	14.02	4.90	4.05	1,512.00	671.00	2×846	1×438	14.0	1,000	IHC/Holland/1982	10.7	SS
11	NATUNA	71.10	14.02	4.90	4.05	1,512.00	671.00	2×846	1×438	14.0	1,000	IHC/Holland/1982	10.7	SS

2.CUTTER SUCTION DREDGER

No.	Name of Vessel	Length Overall (m)	Moulded Breadth (m)	Moulded Depth (m)	Draught Max (m)	Gross Tonnage (ton)	Net Tonnage (ton)	Diameter of Suction Pipe(Inch)	Power of Drege-Pumps (HP)	Dreging Depth (m)	Capacity (m3/h)	Ship Yard	Speed (Knot)
1	BATANG ANAI	80.00	18.50	7.00	4.986	2,550	765	30	2×2,650kv	24.0	-	VLKSWERFT GMBH STRALSUND GERMANY/1994	12
2	KAPUAS	41.45	13.17	2.90				30		17.7	-		

3.SAND PUMP DREGER

No.	Name of Vessel	Length Overall (m)	Moulded Breadth (m)	Moulded Depth (m)	Draught Max (m)	Gross Tonnage (ton)	Net Tonnage (ton)	Diameter of Suction Pipe(Inch)	Power of Drege-Pumps (HP)	Dreging Depth (m)	Capacity (m3/h)	Ship Yard	Speed (Knot)
1	Agung	48.1	14.66	4.1	-	515	-	16	926	40	700	1981	

4.GRAB DREGER

No.	Name of Vessel	Length Overall (m)	Moulded Breadth (m)	Moulded Depth (m)	Draught Max (m)	Gross Tonnage (ton)	Net Tonnage (ton)	Grab Capacity (m3)		Dreging Depth (m)	Capacity (m3/h)	Ship Yard	Speed (Knot)
1	Tondano	28.0	-	-	-	333	-	5.5	455	20	300	1985	-
2	Ranua	28.0	-	-	-	333	-	5.5	455	20	300	1985	-
3	Poso	28.0	-	-	-	333	-	5.5	455	20	300	1985	-
4	Batur	28.0	13.0	2.6		333	-	5.5	455	20	300	1985	-
5	Danau Laut Tawar	54.0	23.0	4.5	-	1,964	-	20.0	1,139	25	1,500	1990	-

Source: RUKINDO, June 2005

(3) Dredging Productivity and Work Period

Dredging capacity of TSHD per year can figure out by following formula.

$C=Vh \times Es \times Cd \times Dy$

Here:

C: Capacity---------- (m^3/year)

Vh: Hopper Capacity---------- (m^3)

Es: Concentration ratio of dredged materials----- (0.45)

Cd: Daily operation cycle time----------6times

(Cd= Effective Working time per day /Dredging time +sailing time to dumping site + dumping time +return time)

Adopting practical data from RUKINDO and others; =21hour/(1.0h+27km/(10knot=18.5)+0.1h+27/(12knot=22.2km/hour) =21/3.77=5.6 times =6times

Dy: Operation day per year----------288days(24days×12month)

TSHD 3,000m^3 C=3,000 × 0.45 × 6 × 288=2,332,800m^3/year
TSHD 4,000m^3 C=4,000 × 0.45 × 6 × 288=3,110,400m^3/year
TSHD 5,000m^3 C=5,000 × 0.45 × 6 × 288=3,888,000m^3/year

Assuming 4,000m^3 class TSHD operation in average, work period would be as follows.

Area1 ------2,154,520/3,110,400=0.69year=8.3month

Area2------ --894,460/3,110,400=0.29year=3.5month

Area3------ --965,190/3,110,400=0.31year=3.7month

Area4 --------227,160/3,110,400=0.073year=0.9month

Area5------ 4,313,910/3,110,400=1.39year=16.6month

Area6 --------894,900/3,110,400=0.29year=3.5month

Area7 --------262,700/3,110,400=0.08year=1.0month

Considering traffic condition and dredging volume by area, Area 1 should be widened first then followed by Area 2, Area 3 and Area 4. Area 5 has the largest volume of nearly 44% of total. Therefore, it is necessary to engage 2TSHDs from the time when Area 4 is going to start.

Regarding of the dredging work schedule described in Figure 6.3.3, One TSHD usually operates in inner harbour. It is desirable for preventing sea traffic congestion in the inner harbour.

Considering relation between construction works of breakwaters and dredging works, the construction schedule is prepared in Figure 6.3.3. As a tentative draft, construction schedule might be modified more details.

6.3.3 Dumping Location

Proposed dumping site for this project is shown in Figure 6.3.2. Total dumping site area is 8.53km^2 (about 2km×4km). Assumes dumping soil spread with 1.0m thick, the total soil volume will be 8,000,0000m^3. Water depth at the dumping site is around –30m which is enough for accommodating soft soil disposal.

Distance to the new proposed dumping site from the construction site is approximately 27km. It is a rather long distance comparing to the other cases, thus, causing the longer dredging work period. Usual cycle time of TSDH in Indonesia project is reported more than 9 times per day according to “Study on Reinforcement of Dredging Capacity in Indonesia March 2003 by PT. TOMO & SON, Jakarta, Indonesia. As already mentioned, due to the long distance to the

dumping site, even if working time takes 21hours per day, cycle time of TSHD is scarcely 6 times per day.

Coordinates of Proposed New Dumping Area

Dumping Area No.	Coordinates				Remarks
	Longitude (E)	Latitude (S)	X (m)	Y (m)	
DA-1	106 58 47.00	5 52 52.00	719184.726	9349549.520	
DA-2	106 58 24.00	5 51 54.00	718483.388	9351334.013	
DA-3	107 0 40.00	5 51 4.00	722673.249	9352855.373	
DA-4	107 1 9.00	5 51 56.00	723559.786	9351254.482	

Coordinates of the Existing Dumping Area

Dumping Area No.	Coordinates				Remarks
	Longitude (E)	Latitude (S)	X (m)	Y (m)	
A	106 57 50.00	5 56 09.00	717409.697	9343503.110	
B	106 58 50.00	5 56 09.00	719255.479	9343496.537	
C	106 57 50.00	6 00 00.00	717384.394	9336405.889	
D	106 58 50.00	6 00 00.00	719229.961	9336399.246	

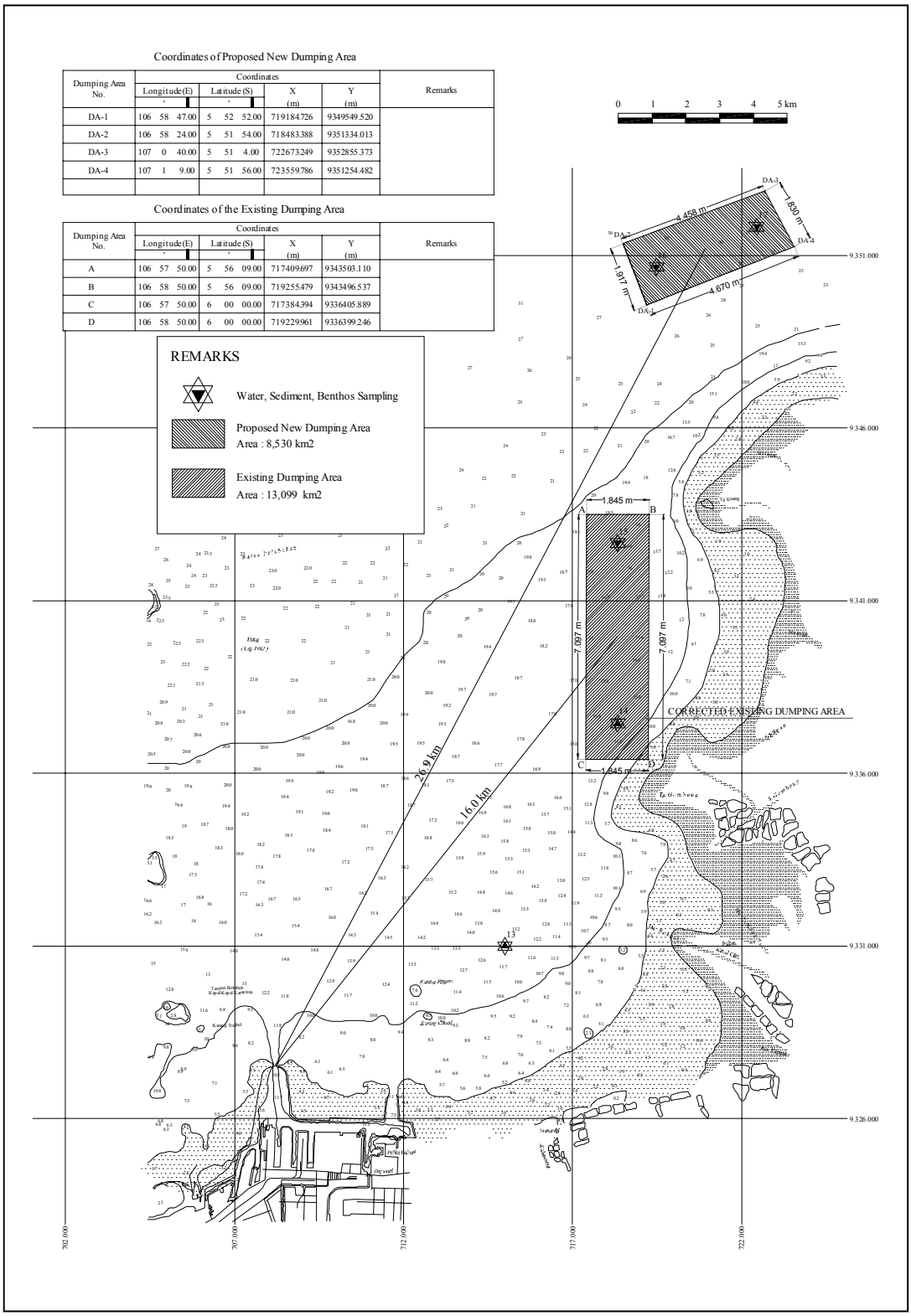
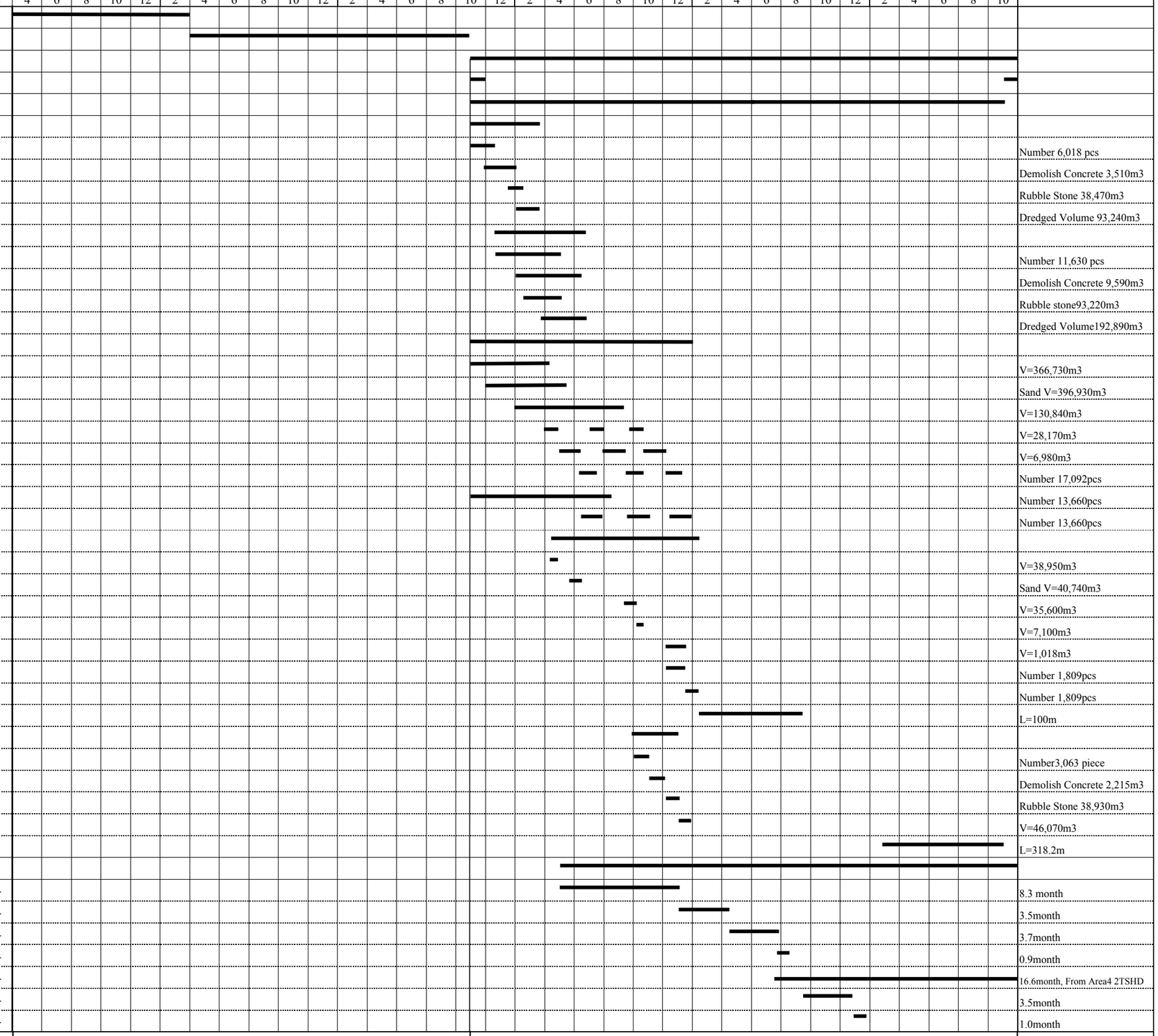


Figure 6.3.2 Propose New Dumping Area

Figure 6.3.3 Tentative Construction Schedule

	Description	Quantity	Speed/ day	Month	Remarks
1	**Engineering service (incl. Survey)**	JICA D.D			
2	**Tender Process and Selection of Contractor**				
3	**Supervision**				
4	**Mobilization and Demobilazation**				
5	**Breakwater**			37.0	
1)	East Breakwater Relocation (Segment 1, 2)	L=523 m	-	4.6	
	Remove Concrete Block	L=523 m	10.0m	1.7	Number 6,018 pcs
	Demolish Crown and Covered Concrete	L=523 m	10.0m	2.2	Demolish Concrete 3,510m3
	Remove Rubble Stone down to -5.0m	L=523 m	19.9m	1.1	Rubble Stone 38,470m3
	Dredge under -5.0m to -14.0m	L=523 m	19.9m	1.6	Dredged Volume 93,240m3
2)	Central Breakwater Relocation(Segment3,4,5)	L=1,082 m	-	7.2	
	Remove Concrete Block	L=1,082 m	10.0m	4.5	Number 11,630 pcs
	Demolish Crown and Covered Concrete	L=1,082 m	10.0m	4.5	Demolish Concrete 9,590m3
	Remove Rubble Stone down to -5.0m	L=1,082 m	16.9m	2.7	Rubble stone93,220m3
	Dredge under -5.0m to -14.0m	L=1,082 m	13.5m	3.3	Dredged Volume192,890m3
3)	New Central Breakwater(Segment B) N.D.T.-1	L=1,092 m	-	15.0	
	Excavation for Replacement	L=1,092 m	8.3m	5.5	V=366,730m3
	Replacement as Removal Material or Sand	L=1,092 m	6.2m	7.3	Sand V=396,930m3
	Rubble Stone Mound	L=1,092 m	6.0m	7.6	V=130,840m3
	Armor Stone	L=1,092 m	13.8m	3.3	V=28,170m3
	Crown Concrete	L=1,092 m	9.8m	4.6	V=6,980m3
	Concrete Block (Inner Harbour)	L=1,092 m	12.3m	3.7	Number 17,092pcs
	Concrete Block Manufacture (Outer Harbour)	L=1,092 m	4.7m	9.7	Number 13,660pcs
	Concrete Block Placing (Outer Harbour)	L=1,092 m	9.6m	4.7	Number 13,660pcs
4)	New Central Breakwater (Segment A) N.D.T.-1	L=151m m	-	10.0	
	Excavation for Replacement	L=151m m	10.8m	0.6	V=38,950m3
	Replacement as Removal Material or Sand	L=151m m	8.4m	0.8	Sand V=40,740m3
	Rubble Stone Mound	L=151m m	7.0m	0.9	V=35,600m3
	Armor Rubble Stone	L=151m m	13.8m	0.8	V=7,100m3
	Crown Concrete	L=151m m	4.0m	1.6	V=1,018m3
	Concrete Block Manufacture (Outer Harbour)	L=151m m	4.3m	1.5	Number 1,809pcs
	Concrete Block Placing (Outer Harbour)	L=151m m	9.6m	0.6	Number 1,809pcs
5)	New West Breakwater N.D.B.	L=100.0 m	0.6m	7.5	L=100m
6)	Remove West Breakwater (Segment 6)	L=258.4 m	-	3.2	
	Remove Concrete Block	L=258.4 m	10.0m	1.1	Number3,063 piece
	Demolish Crown and Covered Concrete	L=258.4 m	10.0m	1.1	Demolish Concrete 2,215m3
	Remove Rubble Stone down to -5.0m	L=258.4 m	9.7m	1.1	Rubble Stone 38,930m3
	Dredge under -5.0m to -14.0m	L=258.4 m	9.7m	0.8	V=46,070m3
7)	New Central Breakwater (Segment C) N.D.T.-2	L=318.2m m	1.6m	8.3	L=318.2m
6	**Dredging**	V=9,712,840 m3	-	31.0	
1)	Area1 (Inner Harbour)	2,154,520 m3	3,110.4thou.m3/year		8.3 month
2)	Area2 (Inner Harbour)	894,460 m3	3,110.4thou.m3/year		3.5month
3)	Area3 (Inner harbour)	965,190 m3	3,110.4thou.m3/year		3.7month
4)	Area4 (Inner Harbour)	227,160 m3	3,110.4thou.m3/year		0.9month
5)	Area5 (Inner Harbour)	4,313,910 m3	3,110.4thou.m3/year		16.6month, From Area4 2TSHD
6)	Area6(Outer Harbour)	894,900 m3	3,110.4thou.m3/year		3.5month
7)	Area7(Outer Harbour)	262,700 m3	3,110.4thou.m3/year		1.0month



Note:Monthly Working Day 24, Dredging Volume include over dredging and tolerance

February 2005. Commencement of Engineering

October 2007. Commencement of Construction

Note: N.D.T; New dam Tengah N.D.B; New Dam Barat

October 2010 Complete of Works

6.4 Port Traffic Control during Construction Period

6.4.1 General Information on Sea Traffic Safety

As already mentioned in the previous chapter, construction work plan is prepared based on the principle of no interfering nor disturbing the sea traffic of Tanjung Priok Port as much as possible.

To carry out the works, the Contractor should have an effective traffic control plan for their work vessels or fleets. At present, ADPEL (Port Administration Office of Tanjung Priok Port) is the most important and responsible body that has initiative function to control and keep the sea traffic safely. The Contractor should inform their work plans to ADPEL and gets permission from ADPEL for conducting their surveys and works around Tangjung Priok Port.

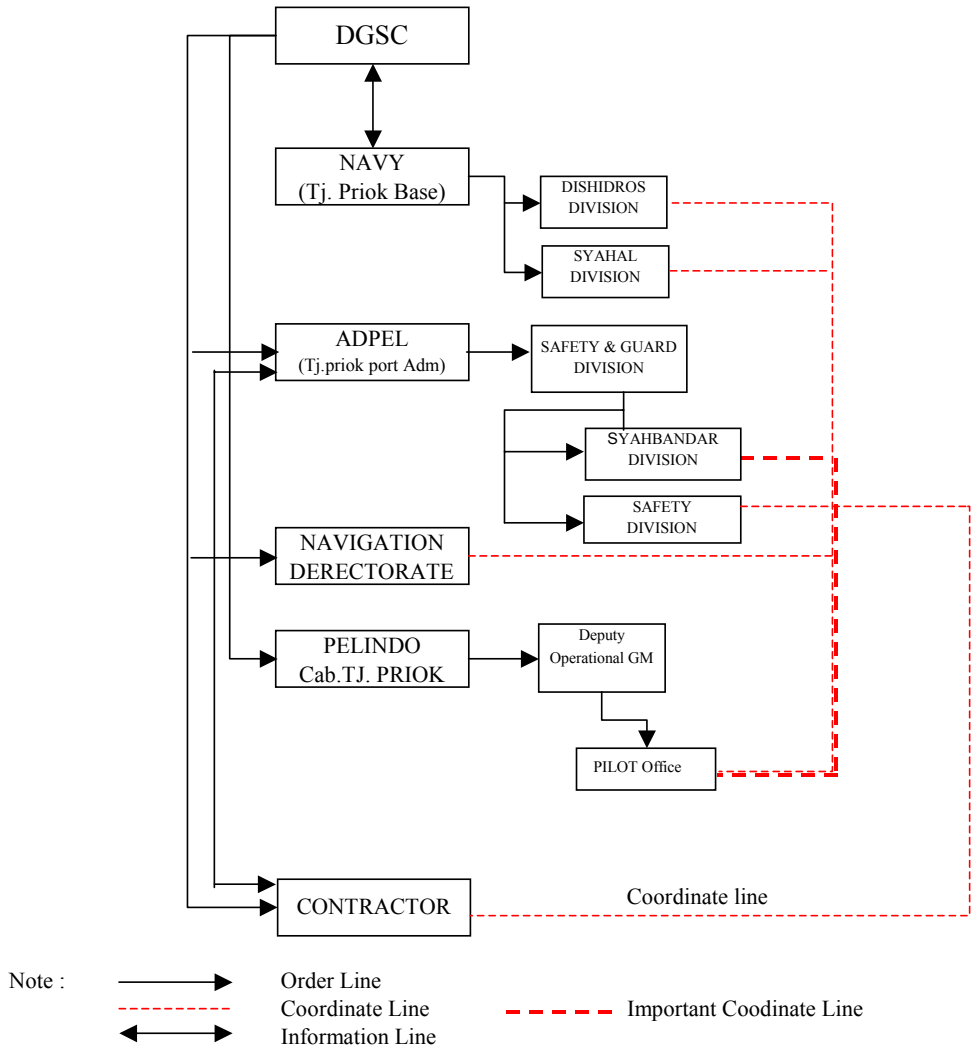


Figure 6.4.1 Information and Control Procedure among Concerned Organization

There are many organizations concerned to fulfill safety of sea traffic. Therefore, the information and coordinate system by organization to organization is already established as show in Figure 6.4.1. The important coordinate line is established ADPEL 'section and the pilot office of Tanjung Priok Port.

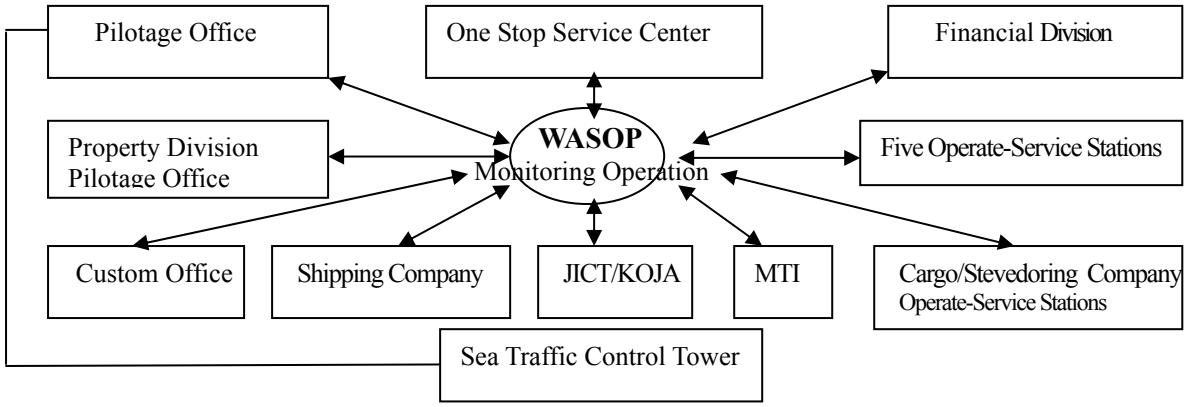
Preventing sea accidents during construction period shall be discussed. Here, as a reference the trial monitoring system of IPC-II Tanjung Priok Port office (WASOP) is introduced.

WASOP (operational monitoring system) is a trial program being carried out by IPC-II for internal purpose of operation monitoring on ship traffics especially on administration matters. As a program trial, WASOP just has started two months ago, and the staffs in charge of WASOP are belong to various a permanent divisions or sections of IPC-II organization. However, IPC-II through Deputy General Manager of Operation will evaluate WASOP as a trial program.

WASOP coordinates all concerned units of IPC-II in their activities or services relating with the ship traffic or transferring documents. If a problem arisen related with their services, WASOP checks in which part of IPC-II or other unit the problem is occurred. Then WASOP asks the concerned unit to speed up to solve problems. Services rendered to be monitored are anchoring, towing, mooring, water and oil supply, sewage disposal, and cargo handling etc.

The most expected outcome of WASOP in this trial now is that payment notes can be delivered within only one day to shipping companies. It means that shipping companies can settle their payment due soon. IPC-II needs to reduce their claims or credits period to shipping companies through the Coordination Link of WASOP Operation.

So far this trial doesn't touch traffic safety matters. However, this system will be useful to introduce VTIS (Vessel Traffic Information System) in the very near future to promote sea traffic safety, because of the existing link to the Pilotage Office, which presently operates traffic control to going vessels around Tanjung Priok Port.



Note: 1. One Stop Service Center is under Assistant Manger of Ship and Cargo Service, Manager of Planning and Operation Control
2. Operate - Service Stations are under Assistant Manger of Operation
Source: Interview from WASOP Operators July 04, 2005

Figure 6.4.2 Operational Monitoring System

6.4.2 Work Area Occupied by Work Vessels and Fleet

(1) Working Area of Vessels and Fleets for Demolishing Existing Breakwater

Demolition works of existing breakwaters, Dam Timur, Dam Tengah and Dam Citra will start from the outside of the harbour by selected work vessels and equipments as discussed and prepared in the previous section 6.2.4. The works will progress in the following 4 steps, removing concrete blocks, demolishing crown and covered concrete, removing rubble stones down to –5.0m, then, dredging under –5.0m to –14.0m.

Out of these 4 steps, dredging works under –5.0m to –14.0m needs the most wide water area toward inner harbour. Other steps of the works don not use inner harbour water area basically but work vessels or fleets approach from the outer harbour side only.

Figure 6.4.3 shows the working area of a 20m3 grab bucket dredger engaging excavation work under –5.0m to –14.0m in the existing breakwater area. Anchor wires at bow and stern side stretch into seawater occupying approximately 50m from the centerline of the existing breakwaters including breadth of the grab bucket dredger. A hopper barge is alongside of the grab bucket dredger in outer or inner harbour side, which does not interfere navigating ships in inner harbour.

Sometimes a small anchor/work boat enters into inner harbour in a short time. It takes usually for an anchor/work boat 15 mines to lift up and sift anchors to the progressive position. During the moving time of the anchor/work boat, it should take attention not to disturb maneuvering ships coming into this water area.

In case of Dam Barat demolition works will be divided as same steps as Dam Timur, Dam Tengah and Dam Citra, even though excavated reusable materials need not place for improvement works of new breakwater foundation. However, a smaller grab bucket dredger can carry out dredging work under –5.0m to –14.0m in stead of 20m3 grab bucket dredger because this work is not critical work. If a smaller grab bucket dredger utilized, the working area is smaller too.

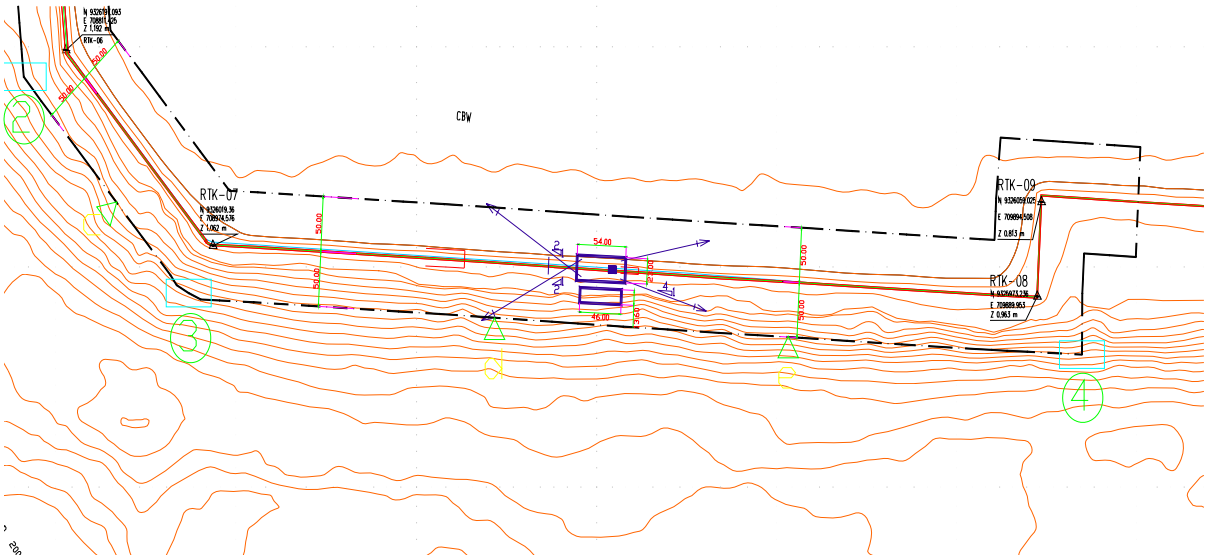
Figure 6.4.4 shows a draft plan of working area. Buoys with flash light shall be installed along the end line of occupied water areas for preventing collision accidents between other vessels entering into working areas and work vessels staying in all day long.

These buoys can be like the drawing ones shown in the Figure 6.4.4, which should be installed before starting construction works.

Advertising and giving notice of working water areas or work period to organizations related with sea affairs beforehand of beginning of the works is the indispensable issue for the responsible administrator to keep navigation safely. .

(2) Working Area of Vessels and Fleets for Construction of New Breakwater

Construction of new breakwaters is executed in the outer harbour area so that there doesn't happen interfering action nor disturbing navigating ships in inner harbour.



Note: 50m inside and outside from the centerline of existing breakwater is planned for working areas.

Figure 6.4.3 Occupied Water Area for Grab Bucket Dredger (Dam Tengah)

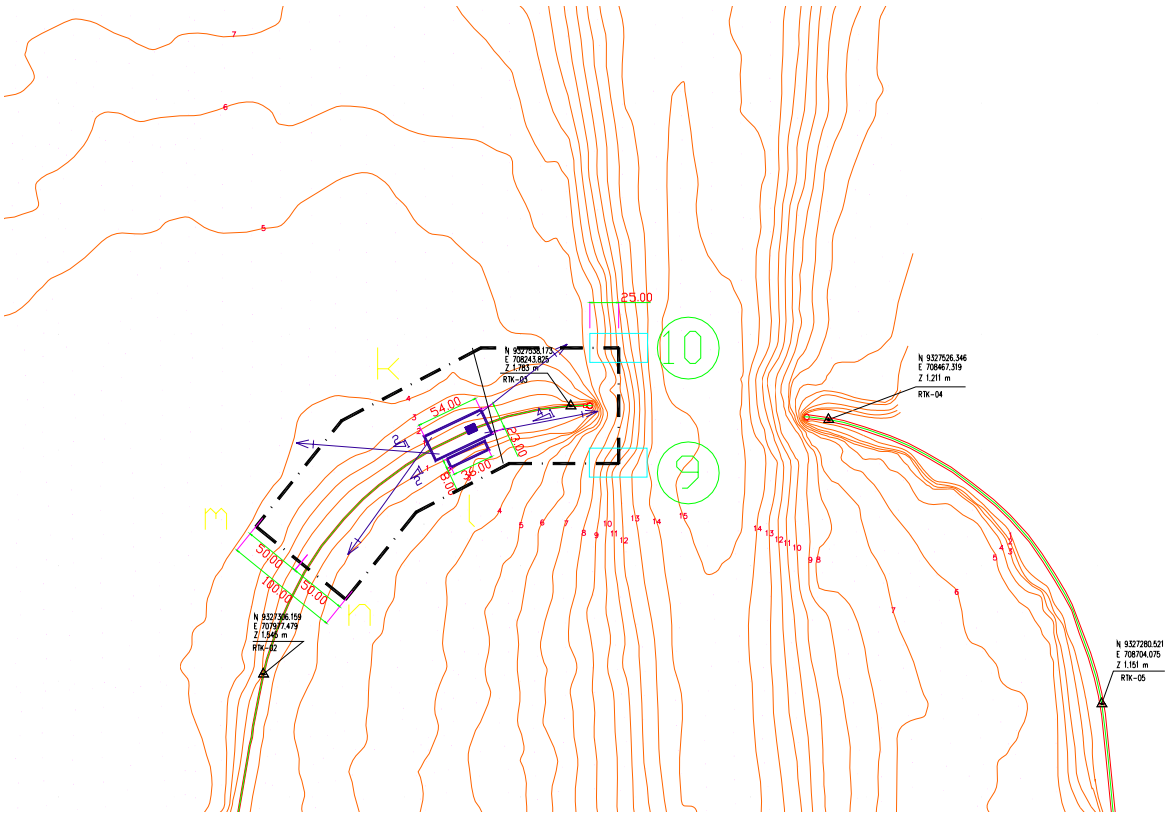


Figure 6.4.4 Occupied Water Area for Grab Bucket Dredger (Dam Barat)

6.4.3 Mooring Buoy Sifting Plan

(1) Existing Mooring Buoy in Inner Harbour

As shown in Figure 6.4.5 there are 15 mooring buoys (Buoy Barat) in the west side of the channel of which 10 buoys have to be shifted before the dredging work by a TSHD. The sinkers of the buoys differ as shown in Table 6.4.1. The biggest one is estimated 100 ton of a concrete block and tied with two chains. According to a staff of Tangjung Priok Port Office,

these buoys were installed about twenty-five years ago. There are also 6 mooring buoys (Buoy Timur) in the east side of the channel, but they are not need to shift for the dredging works except BT-18.

Table 6.4.1 Mooring Buoys in Inner Harbour

No.	Code Name	Location	Weight of Sinker	Connection Type	Remarks
1	BB-03	West Side	100 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
2	BB-05	West Side	100 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
3	BB-07	West Side	100 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
4	BB-11	West Side	30 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
5	BB-13	West Side	30 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
6	BB-15	West Side	30 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
7	BB-17	West Side	30 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
8	BB-19	West Side	30 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
9	BB-09	West Side	30 ton	Double Chain Ø 2,5 ~ 2¾	Need to shift
10	BB-21	West Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
11	BB-23	West Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
12	BB-27	West Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
13	BB-29	West Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
14	BB-31	West Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
15	BB-33	West Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
16	BT-02	East Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
17	BT-08	East Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
18	BT-12	East Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
19	BT-14	East Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
20	BT-16	East Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
21	BT-18	East Side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	Need to shift
22	PT-03	Pertamina side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
23	PT-05	Pertamina side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift
24	PT-07	Pertamina side	5 ~ 15 ton	Single Chain Ø 2,5 ~ 2¾	No Need to sift

Source: JICA D/D Team compiled based on the data by IPC-II, Tangjung Priok Port Office

Data related with the dimension of existing buoys e.g. floater or sinker could not be obtained. However, according to information of Tanjung Priok Port Office, sinkers were made of concrete and a 100t concrete block sinker lifted up and sets on the land near Nusantara slip. By this information a brief site survey has been carried out. Photo 6.4.1 shows the shape of lifted concrete block sinker. The concrete block sinker is approximately 4.5m long, 4.5m wide and 3.3m high. On the top of the block there attached 6 steel fucks of 120mm in diameter.

A floater part is painted with whiteColor and likely made of steel. The shape is cylindrical with about 2.0m long and 1.0m in diameter. On the center top of cylindrical floater there is a fuck with shackles for mooring ropes.

(Cf. Photo 6.4.1)

Photo 6.4.1 100t Concrete Block Sinker (10^{th} October 2005)

(2) Relocation Plan of Buoys During the Dredging Work

BB-03, BB-05 and BB-07 are daily used by ships under 10,000DWT. Usually one ship moors with BB-03 by her bow rope and with BB-05 by her stern rope. In case of BB-05 and BB-07, as the same way as BB-03 and BB-05, another ship moors. Therefore, 2 ships moor with these buys at the same time as shown in Photo 6.4.2.

Photo 6.4.2 Two Ships Moors with BB-07, BB-05 and BB-03 (10th October 2005)

Other buoys located in Dam Barat side are used by barges, work vessels and cargo ship. 9 buoys located in Dam Barat side as shown in Figure 6.4.5 should be shifted during dredging work in Area 1. Buoys in Dam Timur side need not to relocate except BT-18. BT-18 shall be moved before dredging work in Area 3. Under this condition, the relocation plans of 10 buoys are drafted as shown in Figure 6.4.6.

BB-03, BB-05 and BB-07 will be shifted to the east side water area of Dam Timur, 5 buoys (BB-11, BB-13, BB-15, BB-17, BB19) will be moved to the inner harbour of east gate entrance and one buoy (BB-09) will shift to near Dam Barat between BB-23 and BB-24.

Necessary work vessels or fleet for BB-03, BB-05 and BB-07 which have a 100t concrete block sinker respectively can be planed using a floating crane with a lifting capacity 200t, a 1,500t flat barge, a 1,000 PS tugboat and a 250 PS anchor/work boat with divers.

It is expected that the sinkers bury into soft seabed mud and have some resistant force caused by mostly cohesion when lifting up. Then, survey and investigation by diver is necessary before lifting works.

Workdays to be required including survey and investigation will be 4 days for lifting BB-03, BB-05 and BB-07, 3days for lifting BB-11, BB-13, BB-15, BB-17 and 2days for relocating (lifting and placing) BB-09 and BT-18. As for placing BB-03, BB-05, BB-07 and BB-11, BB-13, BB-15, BB-17, BB19, it will take 3 days, then, totally 12 days will be required.

According to Tanjung Priok Port Pilot Office, they don't need to relocate sifted mooring buoys to the original position nor other position in inner harbour at moment. However, they expressed their opinion that considering future traffic conditions after completion of this project, BB-03, BB-05 and BB-07 will be relocated to proper places in inner harbour.

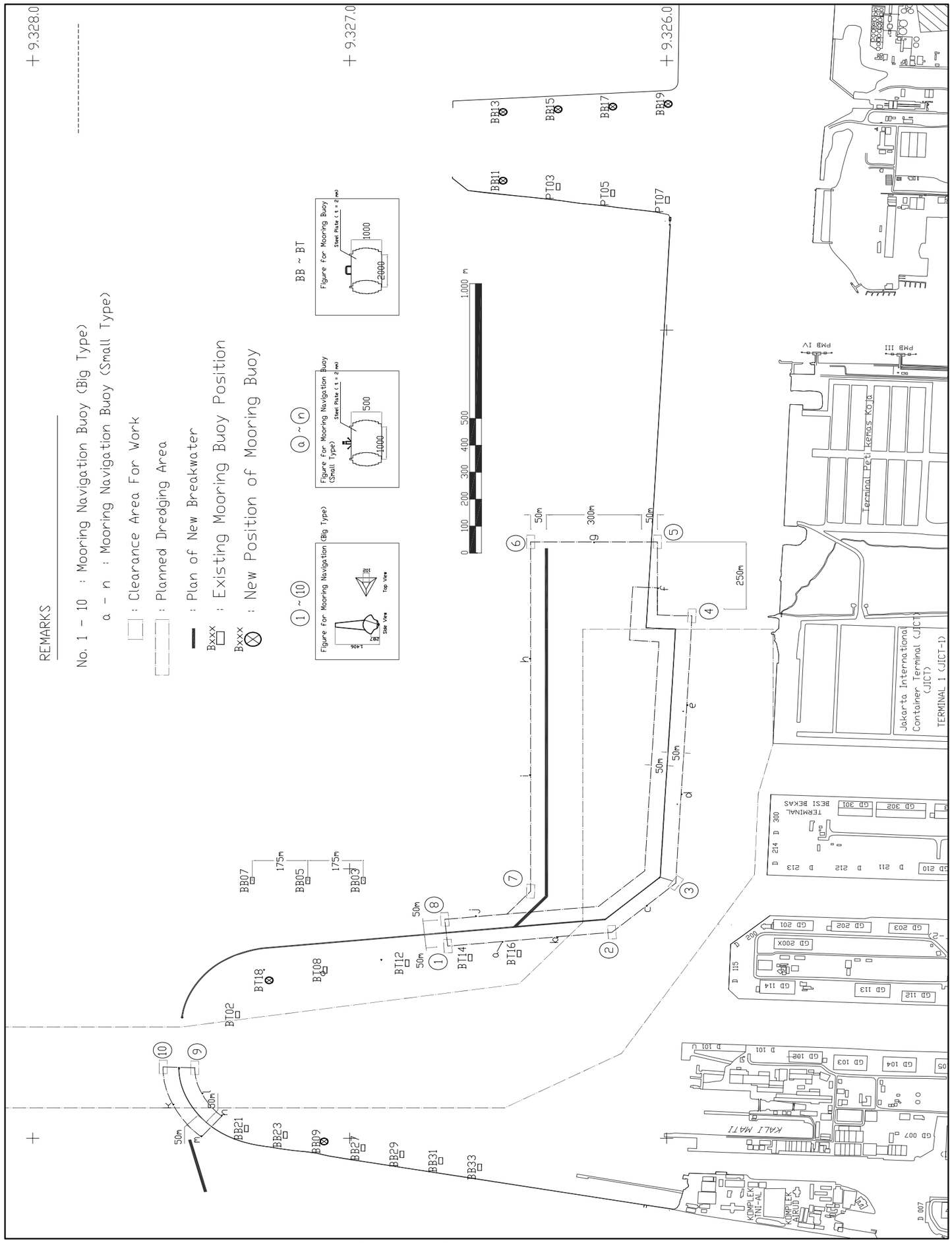


Figure 6.4.5 Relocation Draft Plan of Existing Mooring Buoys in Inner Harbour

CHAPTER 7 IMPROVEMENT PLAN OF PORT INNER ROAD AND FLYOVER

7. IMPROVEMENT PLAN OF PORT INNER ROAD AND FLYOVER

7.1 Existing Port Traffic

7.1.1 General

The Tanjung Priok Port is serving not only for the freight transport but also for the passenger transport. In Pier-I, PELNI berth is providing passenger transport for national sea transport using passenger vessels. Pier-II, III and Pier Nusantara are mostly used for freight transport. There are port inner roads inside the port area and the access to the roads are controlled by the port gates (Gate-1, 3, 8 and 9). The Project area is shown in Figure 7.1.1.

Figure 7.1.1 Location Map of the Project Road

The land access transportation to/from the port area is using by several arterial roads. Their traffic characteristics are summarized below.

Traffic from the Western Regions - Jl.Laks.RE.Martadinata connects the port area to business centers in the western part of Jakarta such as Jakarta Kota, Pluit, Grogol and further to the industrial area of Tangerang, Serang and Cilegon. The port related traffic from the western regions mainly enters in and exit from the port area through Gate-1 or Gate-3.

Traffic from the Southern/Eastern Regions - Jl.Yos Soedarso (and Jl.Sulawesi) connects the port to the eastern and southern parts of Jakarta such as Jatinegara, Cawang and further to Bogor (southern part of Jakarta), Bekasi, Karawang, Cikampek and Ciregon (eastern part of Jakarta).

Also Jl.Jampea-Jl.Cilincing connects the port area to the eastern regions such as Bekasi, Karawang, Cikampek, Ciregon and many industrial areas.

The port related traffic from the eastern and the southern regions mainly enters in the port area through Gate-9. The traffic to the eastern and the southern regions exits through Gate-9, while a part of the traffic to the southern regions exits through Gate-8. A bus terminal is located in front of Gate-3 and traffic congestion was observed due to bus terminal traffic, Jl.Martadinata traffic and port traffic through Gate-3.

7.1.2 Present Condition of Port Inner Road

In the port area, the eastern part of the road network is currently one-way controlled (e.g. Jl.Raya Pelabuhan, Jl.Bangka and Jl.Pasoso), while the western part of the network is operated in two-ways (e.g. Jl.Pulau Payung, Jl.Penjalai and Jl.Padamarang).

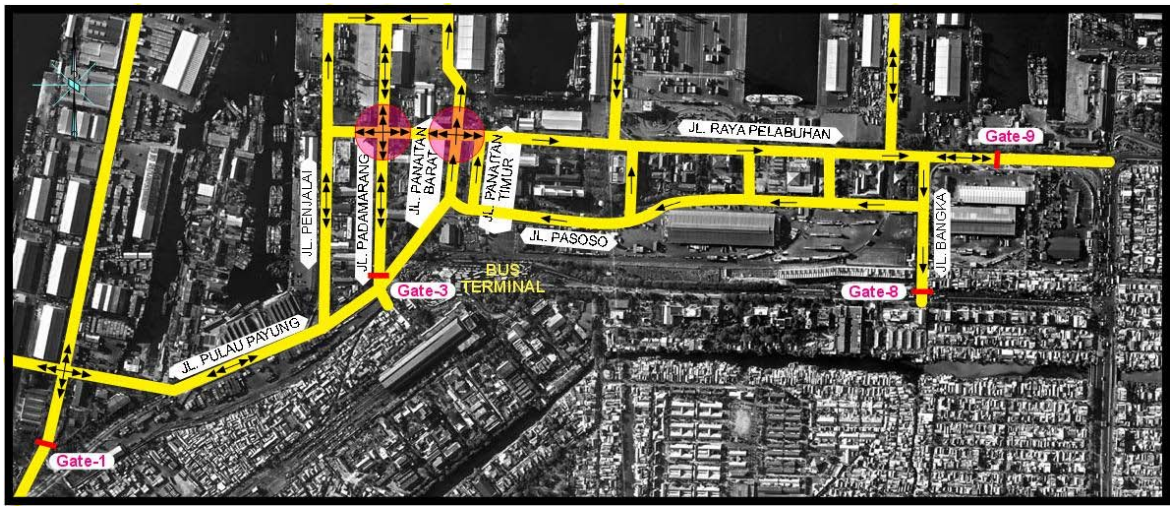


Figure 7.1.2 Present Traffic Flow of Port Inner Road

Main road users inside the port area are heavy loaded vehicles such as trucks and trailers, but the port area is also open to public vehicles with an entrance charge (1,000Rp). Access to and exit from the port area is controlled by port gates.

Though the carriageway of the port inner roads is asphalt/cement concrete paved, many deformations such as cracks, pot holes. are observed on the pavement. Also it has no lane markings so that the number of lanes of each port inner road has been assumed according to the site investigation on actual road use. The actual number of lanes and the width of the carriageway are summarized in Table 7.1.1.

Table 7.1.1 Number of Lanes and Carriageway Width

Road Name	Carriageway Width (m)	Number of Lanes (Actual Use)
Jl.Pulau Payung	7.5 - 9.0	2-lane, 2-way
Jl.Penjalai	17.5 - 22.5	2-lane, 2-way
Jl.Padamarang	12.0	2-lane, 2-way
Jl.Palmas	14.0	2-lane, 2-way
Jl.Raya Pelabuhan	12.5 - 15.5	3-lane, 1-way
Jl.Bangka	16.5 - 19.0	2-lane, 1-way
Jl.Banda-Pasoso	8.5 - 12.0	2-lane, 1-way
Jl.Panaitan (Barat)	14.0	2-lane, 1-way

Source: JICA Study Team

(1) Traffic Survey

Traffic survey has been conducted in order to obtain necessary data and information to estimate the traffic demand forecast. The location of the survey station is shown in Figure 7.1.3.

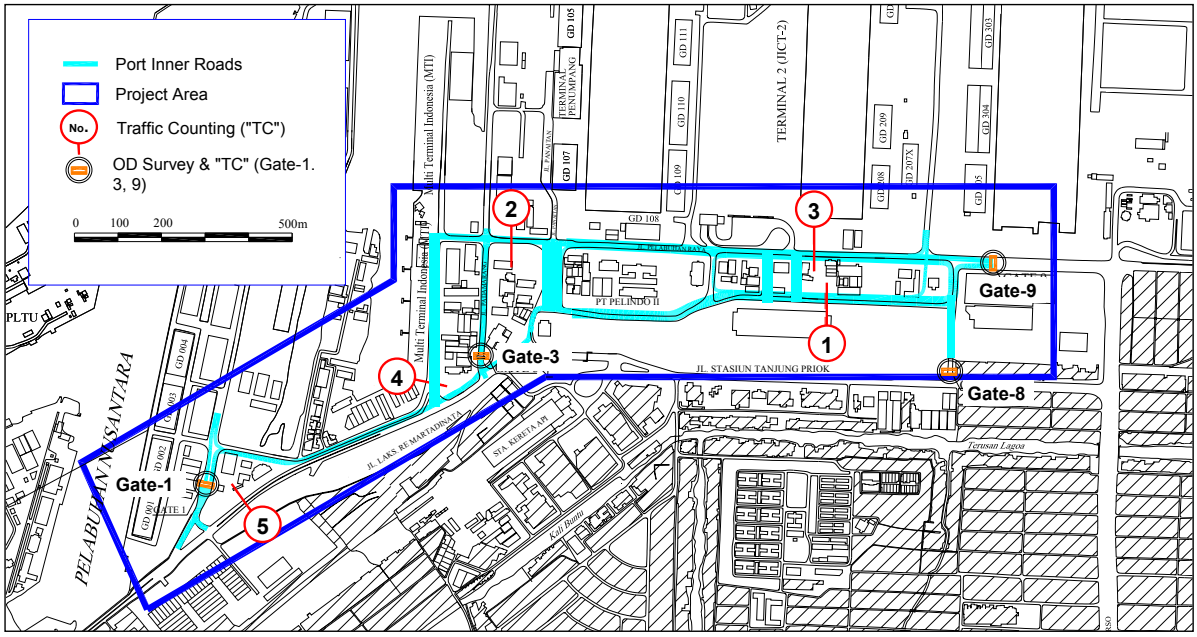


Figure 7.1.3 Location Map of Traffic Survey

	Survey Item	Survey Location
1.	Traffic Counting (24 hours, 7 days)	(Jl.Banda-Pasoso) (Jl.Palmas) (Jl.Raya Pelabuhan) (Jl.Penjalai) (Jl.Laks.RE.Martadinata)
2.	Traffic Counting (24 hours, 3 days)	(Gate-1, Gate-3, Gate-8, Gate-9)
3.	OD Interview Survey (24 hours, 1 day)	(Gate-1, Gate-3, Gate-9)

1) Traffic Counting Survey

The traffic counting survey has been carried out by manual counting method. The survey has been conducted by following schedule.

Traffic Counting (24 hours, 7 days)	April 14 to April 21, 2005
Traffic Counting (24 hours, 3 days)	April 18 to April 20, 2005

The results of traffic counting survey are summarized in Table 7.1.2.

Table 7.1.2 Summary of Traffic Counting Survey

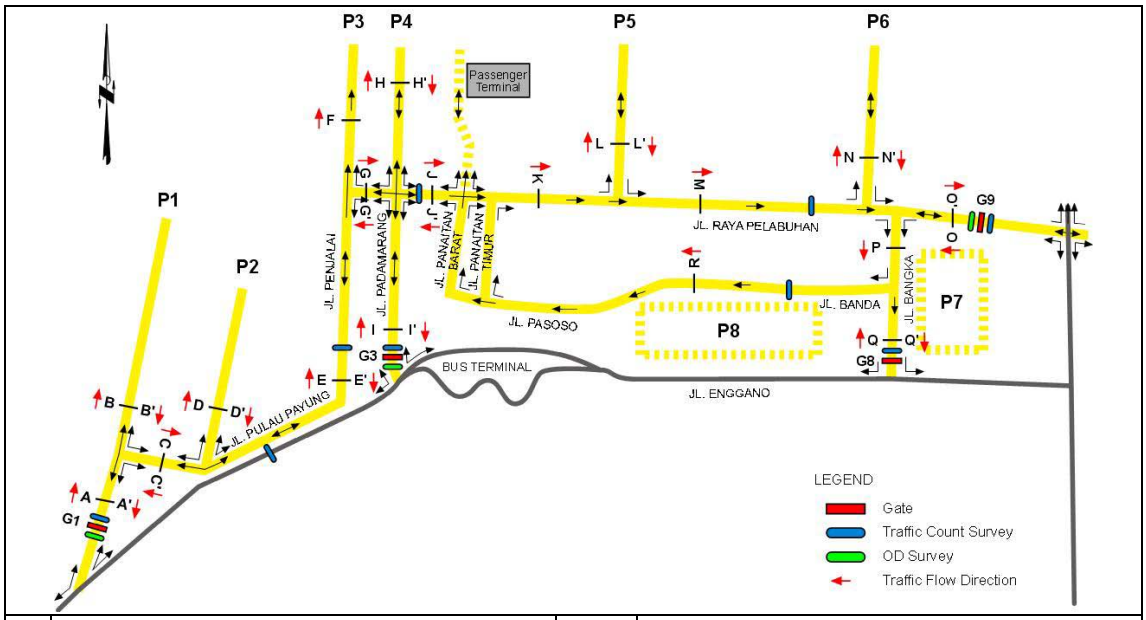
Sta.	Road Name	Direction	Average Daily Traffic Volume (veh./24hous)										Total
			Motor-cycle	Sedan, Jeep, Wagon	Van, Minibus	Mikrolet, Bajaj	Medium / Large-size bus	Pick up	Truck 2axles	Truck 3axles	Truck Articulated	Trailer	
1	Jl.Banda	westbound	14,010	3,618	203	20	46	501	929	933	144	5,324	25,729
2	Jl.Palmas	eastbound	11,967	3,271	501	5	35	400	599	937	120	5,627	23,463
3	Jl.Raya Pelabuhan	eastbound	11,440	2,238	274	26	10	382	718	467	11	2,489	18,056
		westbound	8,204	2,282	177	3	13	278	733	398	12	2,569	14,669
4	Jl.Penjalai	northbound	6,271	1,096	251	11	7	331	608	458	17	2,116	11,165
		southbound	6,783	1,732	320	9	13	318	799	408	14	1,874	12,270
5	Jl.RE.Martadinata	westbound	15,461	6,199	256	2,284	824	598	914	597	2	1,031	28,166
		eastbound	17,180	5,543	236	2,193	825	688	735	452	30	815	28,696
G1	Gate-1	northbound	6,073	1,659	472	15	36	201	477	197	58	1,053	10,242
		southbound	7,927	1,811	778	2	10	265	538	204	13	968	12,516
G3	Gate-3	northbound	10,058	1,406	237	4	3	271	256	244	53	572	13,104
		southbound	11,209	1,412	178	11	7	225	298	234	9	460	14,043
G8	Gate-8	northbound	13,706	0	0	0	0	0	0	0	0	0	13,706
		southbound	6,712	1,688	23	10	8	259	300	242	55	557	9,854
G9	Gate-9	westbound	33	4,346	556	18	30	542	1,122	1,139	128	4,637	12,550
		eastbound	6,782	1,902	54	6	17	209	420	678	33	5,070	15,170

Note: Detailed results of traffic counting survey are provided in Appendix 7A.
Source: JICA Study Team

2) OD Interview Survey

OD interview survey has been conducted at 3 port gates (Gate-1, 3, 9) only for the inbound truck/trailer traffic, for 24 hours (6:00am-6:00am) for one day on April 19, 2005.

The objective of OD interview survey is to identify traffic flow inside the port area. The survey was not conducted at Gate-8 because it was only provided for vehicles leaving the port area. Applied codes for the survey are shown in Figure 7.1.4.



Code	Description	Code	Description
P1	Nusantara I Pier	G1	Gate-1
P2	Nusantara II Pier	G3	Gate-3
P3	Lapangan Multi Terminal	G8	Gate-8
P4	Pier I	G9	Gate-9
P5	Pier II (JICT-II: Jakarta International Container Terminal-II)	A-R	Sections for distribution of OD results
P6	Pier III		
P7	Container Yard (PT.Masaji Tatanan, PT.Dwipa Manunggal and PT.Agung Raya)		
P8	PT.Multi Terminal Indonesia		
P9	Only through the port		

Figure 7.1.4 Coding for OD Interview Survey

3) Distributed Traffic based on the Survey Result

The result of traffic counting survey has been distributed into each section (coding as shown in Figure 7.1.4) of the port inner roads and the distributed traffic volume has been converted into Passenger Car Unit (pcu) volume as shown in Table 7.1.3. The equivalent factors to convert into pcu are presented in Appendix 7A.

Table 7.1.3 Summary of Distributed Traffic Volume (pcu/day)

Location	Motorcycle	Sedan Jeep Wagon	Van Minibus	Mikrolet bajaj	Medium/ Large-size bus	Pick up	Truck 2axles	Truck 3axles	Truck Articulated	Trailer	Total
A	927	874	115	5	10	145	1,096	452	232	4,215	8,072
A'	831	783	103	4	9	130	729	517	151	3,975	7,231
B	1,442	1,359	179	8	16	226	1,234	940	265	6,885	12,552
B'	1,442	1,359	179	8	16	226	1,234	940	265	6,885	12,552
C	1,585	1,494	197	9	17	249	1,491	970	320	7,468	13,799
C'	1,488	1,403	185	8	16	233	1,123	1,035	239	7,228	12,958
D	115	108	14	1	1	18	93	74	19	555	998
D'	115	108	14	1	1	18	93	74	19	555	998
E	1,649	1,555	205	9	18	259	1,530	1,018	328	7,790	14,360
E'	1,553	1,464	193	8	17	244	1,163	1,082	246	7,551	13,520
F	448	422	56	2	5	70	350	302	73	2,172	3,900
G	1,576	1,486	195	8	17	247	1,444	982	309	7,458	13,723
G'	1,928	1,817	239	10	21	302	1,426	1,348	301	9,390	16,783
H	594	560	74	3	6	93	510	463	136	2,731	5,168
H'	1,041	982	129	6	11	163	859	764	209	4,903	9,068
I	564	531	70	3	6	88	589	561	211	2,285	4,909
I'	613	578	76	3	7	96	562	472	152	2,778	5,337
J	2,324	2,191	288	12	25	365	2,045	1,617	483	10,884	20,235
J'	2,277	2,146	282	12	25	357	1,651	1,593	343	11,137	19,823
K	4,259	4,015	528	23	46	668	3,386	2,965	749	20,440	37,079
L	1,550	1,461	192	8	17	243	1,203	1,087	264	7,467	13,492
L'	1,550	1,461	192	8	17	243	1,203	1,087	264	7,467	13,492
M	4,259	4,015	528	23	46	668	3,386	2,965	749	20,440	37,079
N	670	631	83	4	7	105	539	472	122	3,198	5,831
N'	670	631	83	4	7	105	539	472	122	3,198	5,831
O	3,751	3,536	465	20	41	588	2,581	2,619	511	18,545	32,656
O'	3,268	3,081	405	18	36	513	2,542	2,275	553	15,764	28,455
P	4,741	4,469	588	25	52	744	3,425	3,309	706	23,221	41,281
Q	0	0	0	0	0	0	0	0	0	0	0
Q'	530	499	66	3	6	83	432	369	97	2,528	4,613
R	4,211	3,970	522	23	46	661	2,992	2,940	609	20,693	36,667

Note: Calculation details are presented in Appendix 7A.
Source: JICA Study Team

4) Future Traffic Volume Forecast

In the feasibility study of the Project (F/S), 2003, the daily traffic volume of port vehicles in 2012 and 2025 was estimated based on the actual traffic counting data and the forecast of cargo throughput.

For this Project, the future vehicle growth rates was retrieved from the future traffic volume data in F/S as shown in Table 7.1.4. The estimated future traffic volume is shown in Table 7.1.5.

Table 7.1.4 Future Traffic Growth Rates

Vehicle Type	Daily Traffic Volume			Vehicle Growth Ratio	
	2002	2012	2025	2002-2012	2012-2025
Passenger Car					
Sedan	13,715	22,538	30,665	5.09%	2.40%
Van	4,139	7,242	9,791	5.75%	2.35%
Small Bus	78	148	198	6.60%	2.25%
Medium/Large Bus	194	469	615	9.24%	2.11%
Truck for Cargo					
Pickup	2,363	2,490	3,634	0.53%	2.95%
Medium Truck	3,040	3,374	4,615	1.05%	2.44%
Large Truck	17,286	26,516	33,580	4.37%	1.83%

Source: Retrieved from F/S, 2003, Main Report Vol.2, P73

Table 7.1.5 Future Traffic Volume Forecast (pcu/day)

Section	2005 YEAR	2015 YEAR	2020 YEAR	2025 YEAR
A	8,072	11,365	13,292	15,358
A'	7,231	10,195	11,931	13,797
B	12,552	17,699	20,713	23,954
B'	12,552	17,699	20,713	23,954
C	13,799	19,449	22,757	26,313
C'	12,958	18,280	21,397	24,752
D	998	1,407	1,647	1,905
D'	998	1,407	1,647	1,905
E	14,360	20,241	23,685	27,386
E'	13,520	19,072	22,324	25,825
F	3,900	5,501	6,438	7,447
G	13,723	19,345	22,637	26,175
G'	16,783	23,676	27,714	32,061
H	5,168	7,287	8,528	9,862
H'	9,068	12,788	14,966	17,310
I	4,909	6,916	8,090	9,352
I'	5,337	7,524	8,804	10,180
J	20,235	28,528	33,385	38,606
J'	19,823	27,967	32,738	37,874
K	37,079	52,297	61,209	70,799
L	13,492	19,031	22,275	25,766
L'	13,492	19,031	22,275	25,766
M	37,079	52,297	61,209	70,799
N	5,831	8,224	9,626	11,133
N'	5,831	8,224	9,626	11,133
O	32,656	46,081	53,945	62,414
O'	28,455	40,136	46,977	54,340
P	41,281	58,241	68,177	78,873
Q	0	0	0	0
Q'	4,613	6,506	7,615	8,807
R	36,667	51,735	60,562	70,066

Source: JICA Study Team

(2) Degree of Saturation ("DS") of Present Traffic

To find out the problem of the existing port inner roads, the JICA Study Team has estimated the Degree of Saturation ("DS") of the present traffic as given in detail in Appendix 7A.

The value of "DS" is applied to find out the level of congestion at a particular road. It is the comparison between the value of traffic volume and the traffic capacity and the estimated "DS" value indicates the traffic conditions as described below.

1.00-1.25	Traffic service level is uncomfortable mainly during peak hours.
1.25-1.75	Traffic service level is going to be worse at an accelerating rate.
more than 1.75	Road is seriously congested throughout the day.

The estimated "DS" of each port inner road is summarised in Table 7.1.6.

Table 7.1.6 Degree of Saturation of Port Inner Roads

Section	Road Name	Capacity (pcu/hour) (C)	2005 YEAR		2015 YEAR		2020 YEAR		2025 YEAR	
			Q (pcu/hour) (Q)	Degree of Saturation (Q/C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)
A A'	Jl.Nusantara2 (Jl.Gate-1)	6,409	1,377	0.21	1,940	0.30	2,270	0.35	2,624	0.41
B B'	Jl.Nusantara2	3,554	2,259	0.64	3,186	0.90	3,728	**1.05**	4,312	**1.21**
C C'	Jl.Pulau Payung	2,494	2,408	0.97	3,396	**1.36**	3,974	**1.59**	4,596	**1.84**
D D'	Jl.Paliat	2,494	180	0.07	253	0.10	296	0.12	343	0.14
E E'	Jl.Penjalai	3,554	2,509	0.71	3,538	**1.00**	4,141	**1.17**	4,789	**1.35**
F	Jl.ke. Lapangan Multi Terminal	4,044	351	0.09	495	0.12	579	0.14	670	0.17
G G'	Jl.Palmas (1)	3,046	2,746	0.90	3,872	**1.27**	4,532	**1.49**	5,241	**1.72**
H H'	Jl.ke Pelabuhan I	3,470	1,281	0.37	1,807	0.52	2,114	0.61	2,445	0.70
I I'	Jl.Padamarang	3,692	922	0.25	1,300	0.35	1,520	0.41	1,758	0.48
J J'	Jl.Palmas (2)	3,554	3,605	**1.01**	5,085	**1.43**	5,951	**1.67**	6,883	**1.94**
K	Jl.Panaitan Utara	3,135	3,337	**1.06**	4,707	**1.50**	5,509	**1.76**	6,372	**2.03**
L L'	Jl.ke Pelabuhan II	3,692	2,429	0.66	3,426	0.93	4,009	**1.09**	4,638	**1.26**
M	Jl.Raya Pelabuhan	3,574	3,337	0.93	4,707	**1.32**	5,509	**1.54**	6,372	**1.78**
N N'	Jl.ke Pelabuhan III	3,141	1,050	0.33	1,480	0.47	1,733	0.55	2,004	0.64
O O'	Jl. Gate-9	6,213	5,500	0.89	7,759	**1.25**	9,083	**1.46**	10,508	**1.69**
P	Jl.Bangka (1)	6,270	3,715	0.59	5,242	0.84	6,136	0.98	7,099	**1.13**
Q Q'	Jl.Bangka (2)-Jl.Gate-8	3,135	415	0.13	586	0.19	685	0.22	793	0.25
R	Jl.Banda-Pasoso	2,970	3,300	**1.11**	4,656	**1.57**	5,451	**1.84**	6,306	**2.12**

Note: Calculation details are presented in Appendix.
Source: JICA Study Team

(3) Necessity of Port Inner Road Improvement

The degree of saturation ("DS") revealed that most of the port inner roads are going to be saturated during peak hours and the "DS" of these roads are going to be worse at an accelerating rate in near future. The JICA Study Team has assumed that actual "DS" would be further worse than the value shown in Table 7.1.6 because the following site situations have not been taken into account in the estimated "DS".

- Uncontrolled traffic at the intersections inside the port area causing serious traffic congestion on the port inner road network

- Uncontrolled traffic at the intersection in front of Gate-3, i.e. through traffic on Jl.Laks.RE.Martadinata, right-turn truck/trailer traffic from Gate-3 and right-turn traffic (e.g. heavy motorcycle traffic) to Gate-3 are interlocking, causing serious traffic congestion. The bus terminal traffic further worsens the situation. Jl.Laks.RE.Martadinata is often clogged up by the bus terminal traffic, causing serious disturbance to the through traffic on Jl.Laks.RE.Martadinata, and also the exit traffic from the port area through Gate-3.

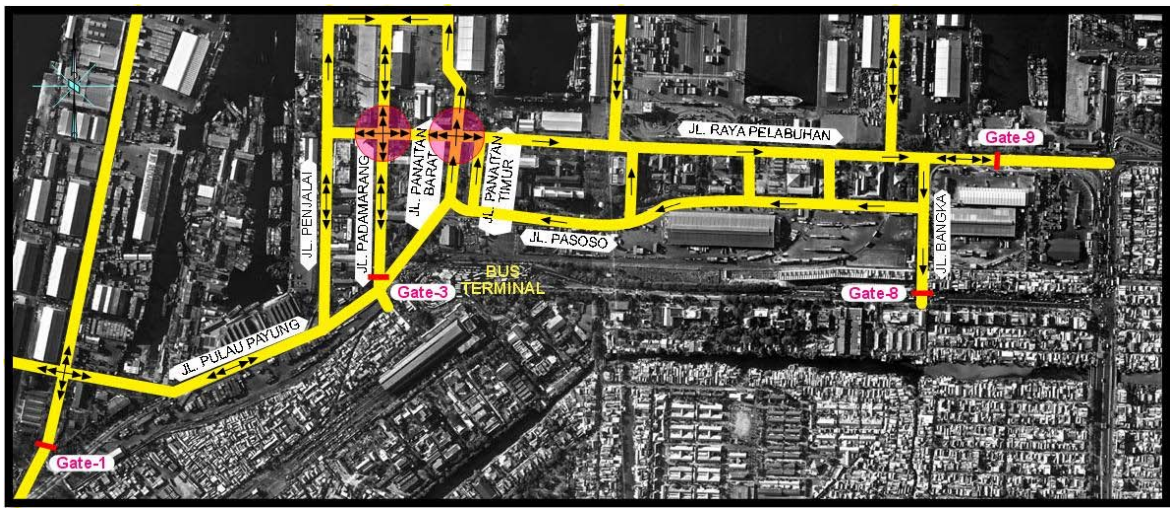
7.2 Proposed Road Improvement

7.2.1 Review of Road Network Proposed in F/S

In the Feasibility Study, 2003, the scope of works for the Project was proposed as follows:

- to improve the road network (traffic flow) including a new road construction and a flyover (refer to Figure 7.2.1.),
- to upgrade the existing pavement by overlay.

Present Network



Proposed Network in F/S

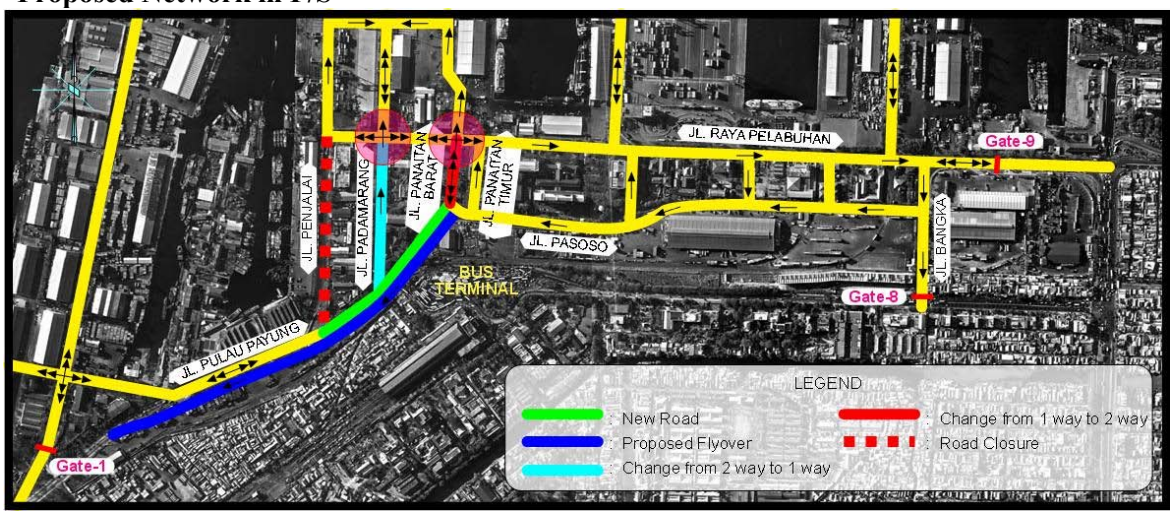


Figure 7.2.1 Proposed Road Network in F/S

Through the analysis of the present traffic based on the traffic survey and site observations, the JICA Study Team has reviewed the scope of works which was proposed in F/S of the Project and the scope has been considered reasonable except the following.

1) Jl.Penjalai

The previous F/S proposed to abandon Jl.Penjalai and utilize Jl.Penjalai for container yard of MTI Terminal. Also Jl.Padamarang was proposed to be used as a main port inner road instead of Jl.Penjalai. This proposal was reviewed in this Study and the following problems have been revealed.

- The traffic to MTI Terminal will make queue on the main port inner road (Jl.Padamarang, Jl.Palmas) and disturb the main traffic flow inside the port area because the existing MTI gate is closer to the main port inner roads. In order to resolve this issue, the existing MTI gate is expected to be relocated far from the main port traffic flow (inside MTI wharf). However any definitive plan (implementation plan, budgetary plan) regarding the above has not been prepared yet.

- If Jl.Padamarang is used as a main port inner road instead of Jl.Penjalai, the horizontal alignment of Jl.Padamarang around the mosque (near the existing Gate-3) shall be improved with a modest radius to avoid sharp turning of heavy vehicles. It will require a demolition of a part of the mosque property.

Through several meetings between IPC-II officials and the JICA Study Team, IPC-II has concluded that Jl.Penjalai will be used as a main port inner road as it is.

2) Additional Lane along Jl.Raya Pelabuhan

It is observed that the traffic toward Pier III and JICT-1 is making a long queue along Jl.Raya Pelabuhan mostly at night time. This waiting queue is not caused by the lack of capacity of the port inner road itself. The JICA Study Team considers that it can be resolved by improving the facilities inside Pier III and JICT-1, such as automatic tariff system at the gate and/or providing space for waiting vehicles inside Pier III and JICT-I.

It was found that there is some available space on the northern side of Jl.Raya Pelabuhan for further widening. Therefore one additional lane has been proposed mainly for accommodating the waiting queue on Jl.Raya Pelabuhan.

3) Traffic Inter-blocking at the Intersections

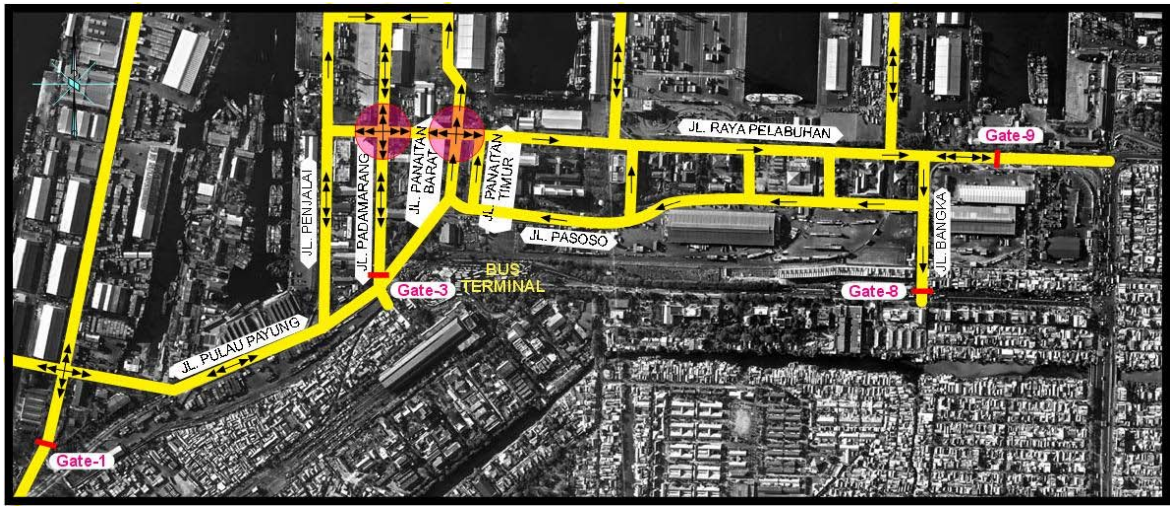
In the proposed road network in F/S, there are intersections which still have traffic inter-blocking. Therefore the proposed network in this study has been designed to eliminate the inter-blocking applying one-way traffic flow.

7.2.2 Proposed Road Network

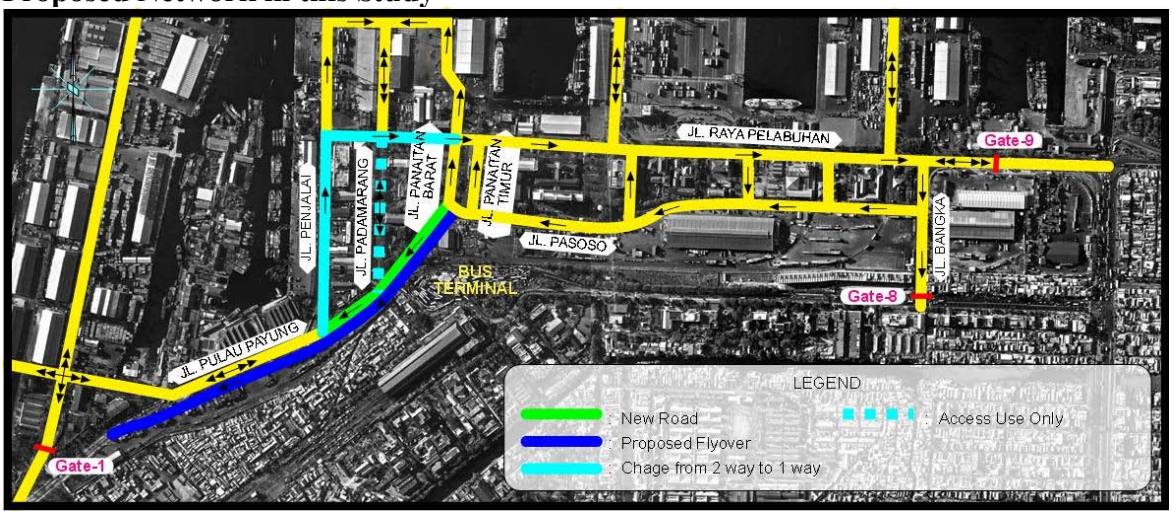
(1) Proposed Road Network

Based on the design strategy, the JICA Study Team has proposed the new road network as shown in Figure 7.2.2.

Present Network



Proposed Network in this Study

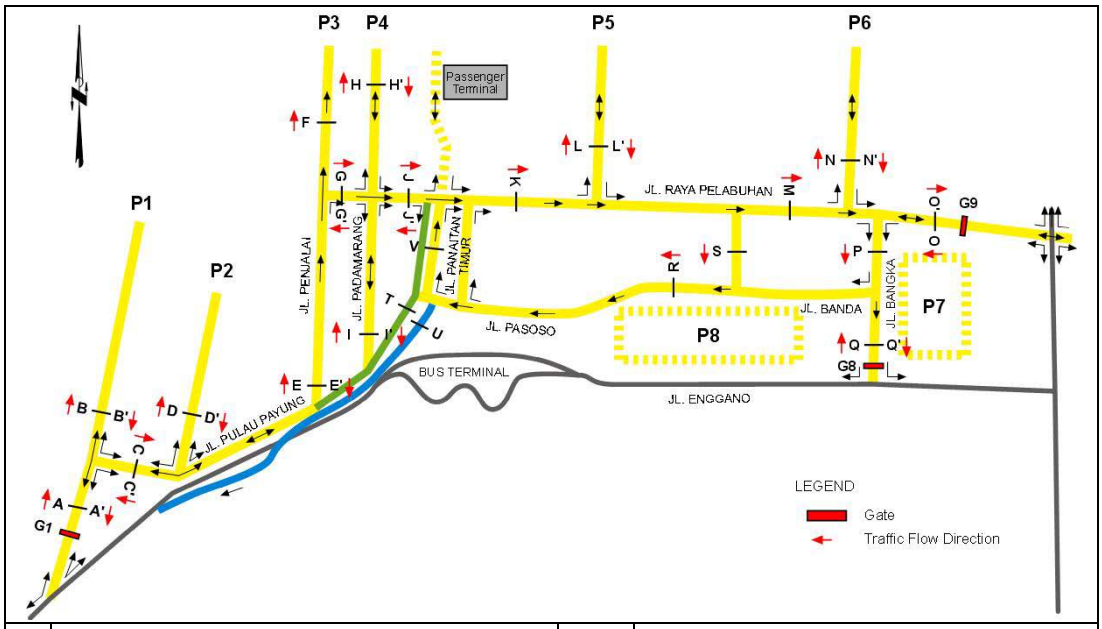


(Proposed Network in D/D)
- One-way control applying most of the port inner roads
- New flyover to allow one-way exit to J1. Laks. RE. Martadinata
- Elimination of inter-blocking traffic flow at intersections

Figure 7.2.2 Proposed Road Network

(2) Estimate of Present Traffic Volume on the Proposed Road Network

A coding map has been prepared to estimate the traffic volume on the proposed road network (Figure 7.2.3). Vehicle movement patterns from each entrance gate (code: G1, 9) to the exit gate (code: G1, 8, 9) through the destination area inside the port (code: P1-P9) can be categorized into 105 patterns (Vehicle Movement Patterns) as shown in Appendix 7A. Based on the result of traffic survey and the Vehicle Movement Patterns, a traffic volume on the proposed road network has been estimated as shown in Table 7.2.1.



Code	Description	Code	Description
P1	Nusantara I Pier	G1	Gate-1
P2	Nusantara II Pier	G3	Gate-3 (to be closed)
P3	Lapangan Multi Terminal	G8	Gate-8
P4	Pier I	G9	Gate-9
P5	Pier II (JICT-II: Jakarta International Container Terminal-II)	A-V	Location for distribution of OD results
P6	Pier III		
P7	Container Yard (PT.Masaji Tatanan, PT.Dwipa Manunggal and PT.Agung Raya)		
P8	PT.Multi Terminal Indonesia		
P9	Only through the port		

Figure 7.2.3 Coding for the Proposed Road Network

Table 7.2.1 Estimated Present Traffic Volume on the New Road Network (pcu/day)

Section	Motor-cycle	Sedan Jeep Wagon	Van Minibus	Mikrolet bajaj	Medium/ Large-size bus	Pick up	Truck 2axles	Truck 3axles	Truck Articulated	Trailer	Total
A	1,491	1,405	185	8	16	234	1,685	1,014	443	6,500	12,981
A'	499	470	62	3	5	78	456	304	95	2,372	4,345
B	1,442	1,359	179	8	16	226	1,234	939	264	6,885	12,551
B'	1,442	1,359	179	8	16	226	1,234	939	264	6,885	12,551
C	1,995	1,881	247	11	22	313	1,946	1,401	491	9,067	17,374
C'	1,004	946	124	5	11	157	717	692	144	4,939	8,739
D	115	108	14	1	1	18	93	74	19	555	998
D'	115	108	14	1	1	18	93	74	19	555	998
E	2,744	2,587	340	15	30	430	2,456	1,926	592	12,773	23,893
E'	0	0	0	0	0	0	0	0	0	0	0
F	448	422	56	2	5	70	350	302	73	2,172	3,900
G	2,296	2,165	285	12	25	360	2,106	1,624	519	10,601	19,993
G'	0	0	0	0	0	0	0	0	0	0	0
H	593	559	74	3	6	93	509	462	136	2,730	5,165
H'	1,041	981	129	6	11	163	859	764	208	4,902	9,065
I	0	0	0	0	0	0	0	0	0	0	0
I'	0	0	0	0	0	0	0	0	0	0	0
J	2,744	2,587	340	15	30	430	2,456	1,926	592	12,773	23,893
J'	0	0	0	0	0	0	0	0	0	0	0
K	4,634	4,368	575	25	50	727	3,744	3,249	846	22,126	40,344
L	1,549	1,461	192	8	17	243	1,203	1,087	264	7,466	13,490
L'	1,549	1,461	192	8	17	243	1,203	1,087	264	7,466	13,490
M	3,938	3,712	488	21	43	618	3,113	2,738	685	18,930	34,284
N	670	631	83	4	7	105	539	472	122	3,197	5,830
N'	670	631	83	4	7	105	539	472	122	3,197	5,830
O	3,751	3,536	465	20	41	588	2,581	2,619	511	18,545	32,656
O'	3,268	3,080	405	18	36	513	2,542	2,274	553	15,763	28,451
P	4,421	4,167	548	24	48	693	3,151	3,083	642	21,712	38,490
Q	0	0	0	0	0	0	0	0	0	0	0
Q'	530	499	66	3	6	83	432	368	97	2,528	4,613
R	4,587	4,324	569	25	50	719	3,351	3,226	706	22,381	39,937
S	741	699	92	4	8	116	684	536	173	3,399	6,453
T	1,752	1,652	217	9	19	275	1,227	1,216	244	8,644	15,257
U	945	891	117	5	10	148	835	686	207	4,383	8,228
V	1,914	1,804	237	10	21	300	1,317	1,336	261	9,463	16,664

Note: Traffic volume at E',G' and J' are zero due to the change of direction (1 way) in the proposed road network. Also traffic volume at I and I' are zero due to the closure of Gate-3 in the proposed road network. Calculation details are presented in Appendix 7A.

Source: JICA Study Team

(3) Future Traffic Volume on the Proposed Road Network

The future traffic distributed on the proposed road network has been estimated based on the present distributed traffic volume (Table 7.2.1) and the future vehicle growth rate (Table 7.1.4).

The estimated traffic volumes in 2005 (present), 2015, 2020 and 2025 are presented in Table 7.2.2.

Table 7.2.2 Future Traffic Volume distributed on Proposed Road Network

Section	Estimated Traffic Volume (pcu/24 hours)			
	2005 YEAR	2015 YEAR	2020 YEAR	2025 YEAR
A	12,981	17,989	19,826	21,854
A'	4,345	6,051	6,664	7,341
B	12,551	17,500	19,271	21,225
B'	12,551	17,500	19,271	21,225
C	17,374	24,162	26,615	29,325
C'	8,739	12,223	13,454	14,812
D	998	1,392	1,533	1,688
D'	998	1,392	1,533	1,688
E	23,893	33,285	36,657	40,378
E'	0	0	0	0
F	3,900	5,446	5,996	6,602
G	19,993	27,839	30,661	33,776
G'	0	0	0	0
H	5,165	7,202	7,930	8,734
H'	9,065	12,648	13,926	15,337
I	0	0	0	0
I'	0	0	0	0
J	23,893	33,285	36,657	40,378
J'	0	0	0	0
K	40,344	56,312	62,000	68,276
L	13,490	18,842	20,743	22,841
L'	13,490	18,842	20,743	22,841
M	34,284	47,872	52,705	58,037
N	5,830	8,138	8,960	9,867
N'	5,830	8,138	8,960	9,867
O	32,656	45,702	50,300	55,372
O'	28,451	39,738	43,748	48,172
P	38,490	53,836	59,257	65,237
Q	0	0	0	0
Q'	4,613	6,437	7,087	7,805
R	39,937	55,839	61,465	67,671
S	6,453	8,984	9,895	10,900
T	15,257	21,347	23,495	25,865
U	8,228	11,466	12,627	13,908
V	16,664	23,321	25,668	28,256

Note: Calculation details are presented in Appendix 7A.
Source: JICA Study Team

(4) Forecast of Degree of Saturation and Proposed Number of Lanes

In accordance with the results of the estimated future traffic volume, the Degree of Saturation ("DS") of each port inner road has been calculated as shown in Table 7.2.3. The capacity of the proposed roads and necessary factors to calculate "DS" are provided in Appendix 7A.

Table 7.2.3 Proposed Lane Number and Estimated Degree of Saturation

				2005 YEAR		2015 YEAR		2020 YEAR		2025 YEAR	
Section	Road Name	Proposed Lane Number	Capacity (pcu/hour) (C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)	Q (pcu/hour) (Q)	Degree of Saturation (Q/C)
A	Jl.Nusantara2 (Jl.Gate-1)	2	6,409	1,559	0.24	2,164	0.34	2,384	0.37	2,628	0.41
A'		2									
B	Jl.Nusantara2	1	3,554	2,259	0.64	3,150	0.89	3,469	0.98	3,820	1.07
B'		1									
C	Jl.Pulau Payung	2	3,579	2,350	0.66	3,275	0.91	3,606	1.01	3,972	1.11
C'		1									
D	Jl.Paliat	1	2,494	180	0.07	251	0.10	276	0.11	304	0.12
D'		1									
E	Jl.Penjalai	3	4,059	2,150	0.53	2,996	0.74	3,299	0.81	3,634	0.90
E'		0									
F	Jl.ke. Lapangan Multi Terminal	2	4,044	351	0.09	490	0.12	540	0.13	594	0.15
G	Jl.Palmas (1)	3	4,059	1,799	0.44	2,506	0.62	2,759	0.68	3,040	0.75
G'		0									
H	Jl.ke Pelabuhan I	1	3,470	1,281	0.37	1,786	0.51	1,967	0.57	2,166	0.62
H'		1									
I	Jl.Padamarang	1	3,692	0	0.00	0	0.00	0	0.00	0	0.00
I'		1									
J	Jl.Palmas (2)	3	4,703	2,150	0.46	2,996	0.64	3,299	0.70	3,634	0.77
J'		0									
K	Jl.Panaitan Utara	4	6,270	3,631	0.58	5,068	0.81	5,580	0.89	6,145	0.98
L	Jl.ke Pelabuhan II	1	3,692	2,428	0.66	3,392	0.92	3,734	1.01	4,111	1.11
L'		1									
M	Jl.Pelabuhan Raya	4	6,270	3,086	0.49	4,308	0.69	4,743	0.76	5,223	0.83
N	Jl.ke Pelabuhan III	1	3,141	1,049	0.33	1,465	0.47	1,613	0.51	1,776	0.57
N'		1									
O	Jl. Gate-9	3	9,470	5,500	0.58	7,690	0.81	8,464	0.89	9,319	0.98
O'		3									
P	Jl.Bangka (1)	3	5,361	3,464	0.65	4,845	0.90	5,333	0.99	5,871	1.10
Q	Jl.Bangka (2)-Jl.Gate-8	1	3,135	415	0.13	579	0.18	638	0.20	702	0.22
Q'		1									
R	Jl.Banda-Pasoso	4	6,270	3,594	0.57	5,026	0.80	5,532	0.88	6,090	0.97
S	Jl. Ayung	1	1,568	581	0.37	809	0.52	891	0.57	981	0.63
T	New Road	2	2,970	1,373	0.46	1,921	0.65	2,115	0.71	2,328	0.78
U	Flyover	1	1,485	741	0.50	1,032	0.69	1,136	0.77	1,252	0.84
V		2	2,970	1,500	0.50	2,099	0.71	2,310	0.78	2,543	0.86

Source: JICA Study Team

Note: Calculation details are presented in Appendix 7A.

Degree of Saturation

1.00-1.25	Traffic service level is uncomfortable mainly during peak hours.
1.25-1.75	Traffic service level is going to be worse at an accelerating rate.
more than 1.75	Road is seriously congested throughout the day.

According to the estimated "DS" shown in Table 7.2.3, the value of "DS" more than 1.0 appear only on Jl.Pulau Payung (C-C'), Jl.ke Pelabuhan II (L-L') and Jl.Bangka (P), and this value is still less than 1.25. It means that traffic congestion will occur mainly only during peak hours. Thus the target year of road capacity improvement can be set up as 2025.

Table 7.2.4 shows the comparison of "DS" between the present road network and the proposed network.

Table 7.2.4 Forecast of Degree of Saturation (Present and Proposed Road Network)

Section	Road Name	Degree of Saturation							
		Present Road Network				Proposed Road Network			
		2005	2015	2020	2025	2005	2015	2020	2025
A A'	Jl.Nusantara2 (Jl.Gate-1)	0.21	0.30	0.35	0.41	0.24	0.34	0.37	0.41
B B'	Jl.Nusantara2	0.64	0.90	1.05	1.21	0.64	0.89	0.98	1.07
C C'	Jl.Pulau Payung	0.97	**1.36**	**1.59**	**1.84**	0.66	0.91	1.01	1.11
D D'	Jl.Paliat	0.07	0.10	0.12	0.14	0.07	0.10	0.11	0.12
E E'	Jl.Penjalai	0.71	1.00	1.17	**1.35**	0.53	0.74	0.81	0.90
F	Jl.ke. Lapangan Multi Terminal	0.09	0.12	0.14	0.17	0.09	0.12	0.13	0.15
G G'	Jl.Palmas (1)	0.90	**1.27**	**1.49**	**1.72**	0.44	0.62	0.68	0.75
H H'	Jl.ke Pelabuhan I	0.37	0.52	0.61	0.70	0.37	0.51	0.57	0.62
I I'	Jl.Padamarang	0.25	0.35	0.41	0.48	0.00	0.00	0.00	0.00
J J'	Jl.Palmas (2)	1.01	**1.43**	**1.67**	**1.94**	0.46	0.64	0.70	0.77
K	Jl.Panaitan Utara	1.06	**1.50**	**1.76**	**2.03**	0.58	0.81	0.89	0.98
L L'	Jl.ke Pelabuhan II	0.66	0.93	1.09	**1.26**	0.66	0.92	1.01	1.11
M	Jl.Pelabuhan Raya	0.93	**1.32**	**1.54**	**1.78**	0.49	0.69	0.76	0.83
N N'	Jl.ke Pelabuhan III	0.33	0.47	0.55	0.64	0.33	0.47	0.51	0.57
O O'	Jl. Gate-9	0.89	**1.25**	**1.46**	**1.69**	0.58	0.81	0.89	0.98
P	Jl.Bangka (1)	0.59	0.84	0.98	1.13	0.65	0.90	0.99	1.10
Q Q'	Jl.Bangka (2)-Jl.Gate-8	0.13	0.19	0.22	0.25	0.13	0.18	0.20	0.22
R	Jl.Banda-Pasoso	1.11	**1.57**	**1.84**	**2.12**	0.57	0.80	0.88	0.97
S	Jl. Ayung					0.37	0.52	0.57	0.63
T	New Road					0.46	0.65	0.71	0.78
U	Flyover					0.50	0.69	0.77	0.84
V	Jl.Panatitan					0.50	0.71	0.78	0.86

Source: JICA Study Team

Note: Degree of Saturation

1.00-1.25	Traffic service level is uncomfortable mainly during peak hours.
1.25-1.75	Traffic service level is going to be worse at an accelerating rate.
more than 1.75	Road is seriously congested throughout the day.

It has been confirmed that "DS" of port inner roads on the proposed network will be much more improved than the present network.

7.3 Proposed Scope of Improvement Works

7.3.1 Port Inner Road

(1) Road Network and Number of Lanes

In accordance with the results of the traffic analysis, the new road network has been finally proposed as shown in Figure 7.3.1.

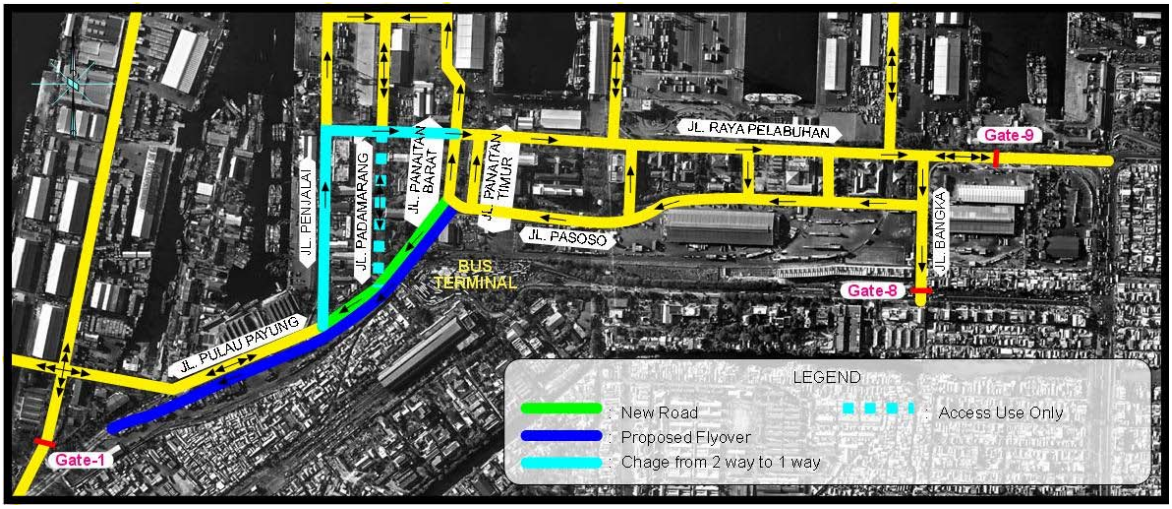


Figure 7.3.1 Proposed Road Network

Also widening of the existing carriageway will be implemented based on the proposed number of lanes shown in Table 7.3.1.

Table 7.3.1 Proposed Number of Lanes

Road Name	Actual Number of Lanes	Proposed Number of Lanes	
Jl. Pulau Payung	2 lane	3 lane	2 way: 2 lanes (eastbound) + 1 lane (westbound)
Jl. Penjalai	2 lane	3 lane	1 way: northbound
Jl. Palmas	2 lane	3-lane	1 way: eastbound
Jl. Raya Pelabuhan	3 lane	5 lane	1 way: eastbound, 1 additional lane for gate queue
Jl. Bangka	3 lane	3 lane	1 way: southbound
Jl. Banda-Pasoso	2 lane	4 lane	1 way: westbound
Jl. Panaitan Timur	2 lane	2 lane	1 way: northbound
Jl. Panaitan Barat	-	1 lane	1 way: southbound
New Road 1	-	1 lane	1 way: westbound
New Road 2	-	2 lane	1 way: westbound
New Road 3	-	1 lane	1 way: westbound
New Road 4	-	1 lane	1 way: westbound
Jl. Ayung	1 lane	1 lane	1 way: southbound
Pasoso Flyover	-	1 lane	1 way: westbound

Source: JICA Study Team

(2) Pavement

Through the site reconnaissance, it was observed that the existing pavement is partially damaged such as rutting and crack, and its improvement shall be required.

Considering the unit price of pavement works in the Loan Agreement (L/A) for the Project, the JICA Study Team initially proposed asphalt pavement. However IPC-II strongly requested to apply cement concrete pavement following the development policy of IPC-II. When estimating the cost in the Basic Design stage, it was confirmed that the additional cost due to cement concrete pavement would be negligible compared to the total cost of the Project. Thus the application of cement concrete pavement was mutually agreed between IPC-II and the JICA Study Team.

7.3.2 Pasoso Flyover

Construction of a flyover (Pasoso Flyover) was proposed in F/S and its necessity has been confirmed by the JICA Study Team also as described below:

- Gate-3 is planning to be abandoned to ease the traffic congestion outside Gate-3 (near Bus Terminal). Then the Pasoso Flyover was proposed to handle a part of the exit traffic from the port area to the western regions instead of Gate-3. Table 7.3.2 shows the estimated traffic volume on the Pasoso Flyover which is derived from Table 7.2.2 ("U" section in the Table).

Table 7.3.2 Estimated Traffic Volume on Pasoso Flyover

Estimated Traffic Volume (pcu/24 hours)			
2005 (present)	2015	2020	2025
8,228	11,466	12,627	13,908

Source: JICA Study Team

- Also the road network **without the flyover** has been studied, and the additional number of lanes **without the flyover** is estimated as shown below.

Road Name	Length	**With** Flyover	**Without** Flyover
Jl.Pulau Payung	470m	3-lane	4-lane
New Road	440m	2-lane	3-lane

In the case the Pasoso Flyover is not implemented, it will be necessary to add the number of lanes as mentioned above. However further widening is not recommended especially on Jl.Pulau Payung due to land constraint by the existence of Army properties along the road.

Also it will be difficult to implement further widening of New Road because of the land constraint by the existence of Mosque property and future implementation of Tanjung Priok Access Road (JORR).

The design of the flyover was required to ensure cost saving to cover cost increment due to applying of cement concrete pavement for the port inner road improvement.