A4.1.1 Seismic coefficient

1. Design seismic coefficients for each structures are defined by the following formula:

$$K_h = C \times I \times K$$

Where, K_h : Design seismic coefficient
C : Regional seismic coefficient (Refer to Figure A4.1.1)
I : Importance coefficient (Refer to Table A4.1.1)
K : Structural type coefficient (Refer to Table A4.1.2)

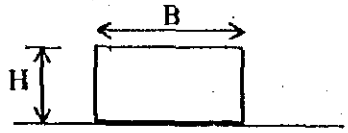
2. Indonesian archipelago is divided into six (6) areas according to the seismicity zone as indicated in Figure A4.1.1. Regional seismic coefficient C is adopted in accordance with the seismicity zone division.

3. Importance coefficient I and structural type coefficient K are adopted based on the Table A4.1.1 and Table A4.1.2.

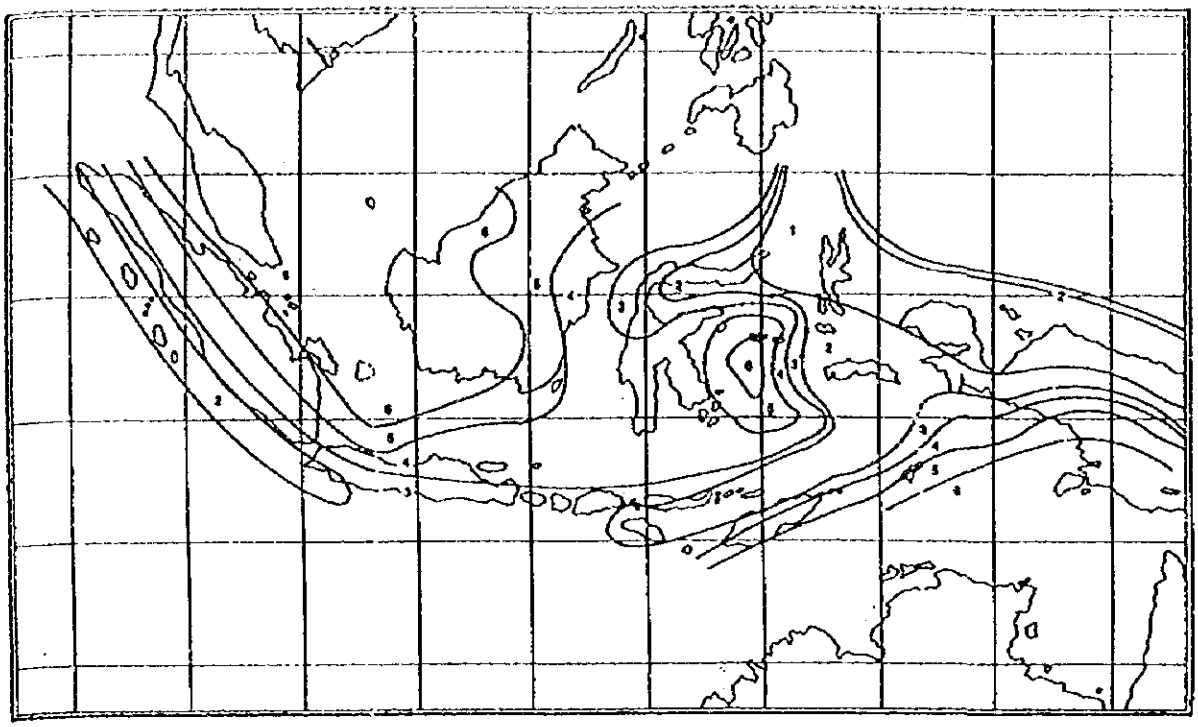
Table A4.1.1 Importance Coefficient, I

	Buildings	Main Factor : I
(a)	Monumental buildings	1.5
(b)	Important facility that have to keep function after the earthquake : The example facilities as follows : Hospital School building Storing food building Health centre in emergency Power station Reservoir building Radio and TV facilities Playground	1.5
(c)	Distribution facilities for gases and petroleum in down town	2.0
(d)	The building that keep the dangerous materials (such as acid, poisons, etc.)	2.0
(e)	The other buildings	1.0

Table A4.1.2 Structural Type and Factor K

Type of Structure	Material of Building	Structural Type Factor (K)
- Frame designed in ductile area	- Reinforced concrete	1.0
	- Pre-stressed concrete	1.4
	- Steel	1.0
	- Wood	1.7
- Ditto, but with shear wall	- Reinforced concrete	1.0
- Cantilever structure with shear wall (B/H>2.0 and Bmin>1.5m)	- Reinforced concrete	1.2
	- Hollowed RC wall	2.5
	- Wood	2.0
		
- Cantilever structure with shear wall but exceeding above limitation. Or other structures	- Reinforced concrete	1.5
	- Hollowed RC wall	3.0
	- Wood	2.5
- Frame with diagonal members	- Reinforced concrete	2.5
	- Steel	2.5
	- Wood	3.0
- One storied cantilever structure	- Reinforced concrete	2.5
	- Steel	2.5
	- Wood	3.0
- Two storied cantilever structure	- Reinforced concrete	2.5
	- Steel	2.5
- Chimney, small tank	- Reinforced concrete	3.0
	- Steel	3.0

Source : "Pedoman Perencanaan Ketahanan Gempa untuk Rumah dan Gedung"



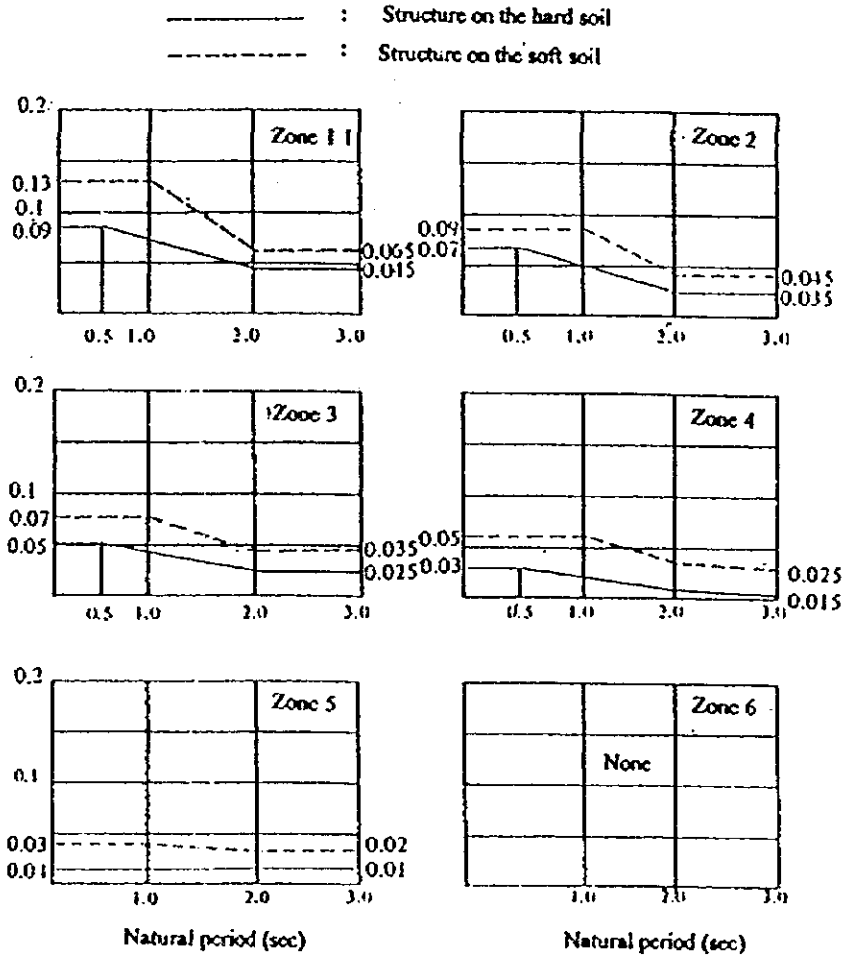


Figure A4.1.1 Seismicity Zones and Regional Coefficient
(Source: Standard Design Criteria for Ports in Indonesia, January 1994)

A4.1.2 Allowable Stress of Materials to be used for Construction Works

(1) Concrete

Class	Standard Design Strength (σ_{ck} : kg/m^2)	Allowable Compressive Stress (σ_{ck} : kg/cm^2)	
		Normal	Temporary
A	240	90	135
B	180	70	105
C	120	40	60

Usage of concrete by each class:
Class A: For all concrete including secondary concrete other than levelling concrete, curb and foundation of mortar masonry wall.
Class B: For curb and foundation of mortar masonry wall.
Class C: For levelling concrete.

(2) Reinforcing Bar

Steel Type :	Deformed Bar (U. 32)
Yield Strength (σ_y)	3,200 kg/cm^2
Normal Allowable Tensile Stress (σ_{sa})	1,850 kg/cm^2
Temporary Allowable Tensile Stress (σ_{sa})	2,650 kg/cm^2

(3) Structural Steel (SS 400 / BJ37)

Yield strength	σ_y = 2,400 kg/cm^2
Allowable axial tensile stress	σ_{ta} = 1,400 kg/cm^2
Allowable axial compressive stress	σ_{ca} = 1,400 kg/cm^2
Allowable bending stress	σ_{ca} = 1,400 kg/cm^2
Allowable shearing stress	σ_{sa} = 800 kg/cm^2

(4) Steel Pipe Pile (SKK 400 / SKY 400)

Yield strength	σ_y = 2,400 kg/cm^2
Allowable axial tensile stress	σ_{ta} = 1,400 kg/cm^2
Allowable compressive stress	
$l/r < 20$	σ_{ca} = 1,400 kg/cm^2
$20 < l/r < 93$	σ_{ca} = 1,400 - 8.4 (l/r-20)

l/r > 93 $\sigma_{ca} = 12{,}000{,}000/(6{,}700 + (l/r)^2)$

Where, l : Effective bucking length of the member (cm)

r: Radius of gyration of area for the cross sectional area of the member (cm)

Allowable bending stress $\sigma_{ca} = 1{,}400$ kg/cm^2

Allowable shearing stress $\sigma_{sa} = 800$ kg/cm^2

(5) Steel Pipe Pile (SKK 490 / SKY 490)

Yield strength $\sigma_y = 3{,}200$ kg/cm^2

Allowable axial tensile stress $\sigma_{ta} = 1{,}900$ kg/cm^2

Allowable compressive stress

l/r < 15 $\sigma_{ca} = 1{,}900$ kg/cm^2

15<l/r<80 $\sigma_{ca} = 1{,}900 - 13\ (l/r-15)$

l/r>80 $\sigma_{ca} = 12{,}000{,}000/(5{,}000+(l/r)^2)$

Allowable bending stress $\sigma_{ca} = 1{,}900$ kg/cm^2

Allowable shearing stress $\sigma_{sa} = 800$ kg/cm^2

(6) Prestressed Concrete Structure

Concrete for P. C. Structure

Standard design strength $\sigma_{ck} = 500$ kg/cm^2

Allowable compressive stress $\sigma_{ck} = 160$ kg/cm^2

Concrete for Cast-in situ

Standard design strength $\sigma_{ck} = 300$ kg/cm^2

Allowable compressive stress $\sigma_{ck} = 110$ kg/cm^2

Prestressed Wire

Tension Stress 190 kg/mm^2

Allowable tension stress 114 kg/mm^2

(7) Increase of Allowable Stress

When earthquake force of instantaneous forces are considered, the allowable stresses mentioned above can be multiplied by the followings, unless otherwise specified in respective items.

- Civil Structures 150%

A4.1.3 Corrosion Rate of Steel (one side)

	Corrosion environment	Corrosion rate (mm/year)
Sea side	Above LWL - 1.0 m	0.30
	Between LWL - 1.0 m and the sea bottom	0.10
	Below the sea bottom	0.03
Land Side	In marine atmosphere	0.10
	In soil (above the residual water level)	0.03
	In soil (below the residual water level)	0.02

Cathodic protection is not provided.

Service life of facilities is assumed 30 years.

A4.1.4 Safety Factors

The major important safety factors are summarised below as follows:

Condition	In normal condition	Abnormal condition
- Gravity structures Sliding	1.2	1.0
- Overturning	1.2	1.1
- Circular slip	1.3	-
- Circular slip (Bishop Method)	1.2	1.0
Pile foundation		
- Bearing capacity	2.5	1.5
- Pulling capacity	3.0	2.5

A4.1.5 Characteristics of Soil Material

Sand Fill Material for Reclamation

Unit weight in air	$\gamma = 1.8$ ton/m^3
Unit weight in water	$\gamma = 1.0$ ton/m^3
Angle of internal friction	$\phi = 30$ degree

Rock Fill Material

Unit weight in air	$\gamma = 1.8$ ton/m^3
Unit weight in water	$\gamma = 1.0$ ton/m^3
Angle of internal friction	$\phi = 40$ degree

Table A4.2.1 Estimation of Construction Cost (Surabaya)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking	Shuttle Bus Park	Land Area (m2)	Design Conditions (Datum Level: LWS)
Surabaya	max: 5000; min: 1000	1	6,400	5,000	4,000	3,300	38,000	HWS: +2.74 m; Design Water Depth: -6.0 m; Design Height of Berth: +4.50 m; Bearing Strata: -57 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		5,516,859		3,964,467	110,337	165,506	3 % of Total of the Direct Construction Cost.
Offshore Detached Pier	Steel Pipe Pile Works	m	4,880	672.9	3,283,745	944.1	4,607,107	9,760	4,880	D=500mm, t=12mm, 40 x 60m, 40 x 62m
	Corrosion Protection of Piles	no	80	4,620	369,600	1,980	158,400	5,914	6,653	
	Reinforced Concrete Works	m3	1,080	1,265	1,366,095	474	511,920	21,600	24,300	RC slabs and beams
	Fender System	unit	5	1,643	8,215	150,298	751,489	67	100	C800H(R1) 1 x 2 x 7 units
	Bollard	unit	5	10,184	50,922	0	0	40	150	35 ton Type; 5 units
Mooring Dolphin	Steel Pipe Pile Works (MD 1)	m	243	682	166,455	958	233,757	488	244	D=700mm, t=14mm, 2 x 60m, 2 x 62m
	Steel Pipe Pile Works (MD 2)	m	243	759	185,161	1,073	261,816	458	244	D=700mm, t=16mm, 2 x 60m, 2 x 62m
	Corrosion Protection of Piles	no	8	4,620	36,960	1,980	15,840	591	665	
	Reinforced Concrete Works	m3	75	1,265	94,868	474	35,555	1,500	1,688	
	Bollard	unit	2	10,184	20,369	0	0	16	60	35 ton Type
Cat Walk		m	35	840	29,400	360	12,600	470	529	
Off-Shore Platform	Steel Pipe Pile Works	m	30,741	672.9	20,687,595	944.1	29,024,777	61,488	30,744	D=800mm, t=12mm, 216 x 60m, 288 x 62m
	Corrosion Protection of Piles	no	504	4,630	2,328,480	1,980	997,920	37,256	41,913	
	Reinforced Concrete Works	m3	6,600	1,265	8,348,361	474	3,128,828	132,000	148,500	12 Unit x 30m x 35m
Offshore Terminal Building		m2	2,400	600	1,440,000	400	960,000	23,040	25,920	A1
Access Bridge for Passengers		m	120	4,200	504,000	1,800	216,000	8,064	9,072	Width 4 m x 120 m
Movable Bridge	Steel Works	m2	275	2,800	770,000	4,200	1,155,000	12,320	13,860	B: 11 m x 1; 25 m, Wheel Load: T-20, 1 Units
	Mechanical and Electrical Parts	LS	1		180,000		420,000	2,880	3,240	
	Control Room	m2	20	240	4,800	160	3,200	90	144	Control Room of 20 m2 of Floor Area
Abutment of Movable Bridge	Steel Pipe Pile Works	m	496	672.9	333,758	944.1	468,263	992	496	D=800mm, t=12mm, L=62m ; 8 piles
	Corrosion Protection of Piles	no	8	4,620	36,960	1,980	15,840	591	665	
	Reinforced Concrete Works	m3	147	1,265	185,941	474	69,688	2,940	3,308	12.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge	Steel Pipe Pile Works	m	616	672.9	414,506	944.1	581,553	1,232	616	D=800mm, t=12mm, 2 @(4 x 62m, 1 x 60m)
	Corrosion Protection of Piles	no	10	4,620	46,200	1,980	19,800	739	832	
	Reinforced Concrete Works	m3	105	1,265	132,815	474	49,737	2,100	2,363	2 Units @ (3.0 x 4.0 x 5.0 - Void)
Dredging for Works of Trestle and Causeway		m3	991,200	26	25,356,482	7	7,254,989	0	198,240	354.0 m3/m x 2.8 km
Access Bridge (L=2.0 km)	Steel Pipe Pile Works	m	28,748	672.9	19,344,489	944.1	27,140,395	57,496	28,748	D=800mm, t=12mm,
	Corrosion Protection of Piles	no	468	4,620	2,162,160	1,980	926,640	34,595	38,919	33x(4x60m + 10x62m) + (2x60m + 4x62m)
	RC Main Girder	m3	2,316	1,265	2,929,990	474	1,098,112	46,328	52,118	33 x (2.5x1.5x14.5) + 2 x 33 x (1.5x1.5x14.5)
	Superstructure (PC Beam)	spun	100	732,142	73,214,236	475,237	47,523,749	56,400	63,450	Span 20 m; 19 x Box type PC beam
	Pavement (Carriage Way)	m2	23,000	30	687,614	20	466,977	15,333	11,500	11.50 m2/m x 2 km
	Pavement (Walk Way)	m2	4,000	28	112,160	14	55,206	4,000	3,000	2.0 m2/m x 2 km
Causeway (L=0.8 km)	Sand Replacement of Foundation	m3	230,000	30.7	7,059,152	1.5	338,839	0	17,250	287.5 m3/m x 800 m
	Filling Works of Core	m3	54,320	30.7	1,667,188	1.5	80,025	0	4,074	67.9 m3/m x 800 m
	Quarry Run	m3	12,850	59.5	766,109	4.3	56,003	0	3,864	16.1 m3/m x 800 m
	Armour Rock (100 - 300 kg/unit)	m3	14,680	83.6	1,243,922	4.0	59,396	0	5,952	18.5 m3/m x 800 m
	Geotextile	m2	17,200	5	92,481	16	269,269	0	1,720	21.5 m2/m x 800 m
	Pavement (Carriage Way)	m2	9,200	30	275,045	20	186,791	6,133	4,600	11.50 m2/m x 800 m
	Pavement (Walk Way)	m2	1,600	28	44,864	14	22,682	1,600	1,200	2.0 m2/m x 800 m
Slope Protection (L=400 m)	Filling Works	m3	7,400	30.7	227,121	1.5	10,902	0	555	18.5 m3/m x 400 m
	Quarry Run	m3	3,240	59.5	192,717	4.3	14,088	0	972	8.1 m3/m x 400 m
	Armour Rock (100 - 300 kg/unit)	m3	3,720	83.6	310,981	4.0	14,849	0	1,488	9.3 m3/m x 400 m
	Geotextile	m2	4,320	5	23,228	16	67,630	0	432	10.8 m2/m x 400 m
Land Filling		m3	95,000	30.7	2,915,737	1.5	139,955	0	7,125	38,000 m2 x 2.50m
Terminal Building		m2	4,000	600	2,400,000	400	1,600,000	48,000	72,000	A1
Pavement (Parking Area)		m2	12,300	30	367,724	20	249,731	8,200	6,150	A2
Pavement (Passage)		m2	11,900	30	355,765	20	241,620	7,933	5,950	850 m x Width 14.0m
Drainage		m2	38,000	10.2	387,600	1.8	68,400	0	13,566	
Landscaping		m2	11,800	8.5	100,300	1.5	17,700	0	3,511	A0 - (A1+A2+A3)
Fence		m	760	170	129,200	30	22,800	0	4,522	2 x (150 + 125) meter
Water Supply		m2	6,400	15	96,000	10	64,000	1,920	2,880	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	18,700	20	374,000	10	187,000	7,480	11,220	
Truck Scale		LS	1		30,000		270,000	600	900	Capacity: 60 ton
Sewerage System		m2	6,400	0.6	3,840	0.4	2,560	77	115	
Total					189,412,166		136,113,365	733,104	1,034,111	

(Local + Foreign) 325,525,531 (1,000 Rupiah)

Table A4.2.2 Estimation of Construction Cost (Banjarmasin)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Banjarmasin	max: 5,000, min: 1,000	1	4,000	5,000	4,000		30,000	HWS: +2.97 m, Design Water Depth: -6.0 m, Design Height of Berth: +4.00 m, Bearing Strata: -36 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		931,209		806,816	46,560	27,936	5 % of Total of the Direct Constructing Cost
Side Breasting Dolphin	Steel Pipe Pile Works	m	1,093.5	555.7	607,656	689.2	753,610	2,187	1,094	D=700mm, t=12mm, 3 unit x (6x40m, 3x41.5m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,512	1,701	
	Reinforced Concrete Works	m3	216	1,537.5	332,094	625.7	135,147	4,320	4,860	
	Fender System	unit	3	1,208	3,625	151,550	454,649	40	60	C800H(R1) 1 x 2
	Bollard	unit	3	10,284	30,852	0	0	24	90	35 ton Type
Bow Breasting Dolphin	Steel Pipe Pile Works	m	244.5	616.9	150,843	781.0	190,965	489	245	D=800mm, t=12mm, 3 x 40m, 3 x 41.5m
	Corrosion Protection of Piles	no	6	3,500	21,000	1,500	9,000	336	378	
	Reinforced Concrete Works	m3	39.9	1,537.5	61,307	625.7	24,939	798	897	
	Fender System	unit	2	1,208	2,416	151,550	303,099	27	40	C800H(RE) 2 x (2 x 1)
Mooring Dolphin	Steel Pipe Pile Works	m	163	551	89,890	683	111,302	326	163	D=600mm, t=14mm, 2 x 40m, 2 x 41.5m
	Corrosion Protection of Piles	no	4	3,500	14,000	1,500	6,000	224	252	
	Reinforced Concrete Works	m3	37.5	1,537.5	57,655	625.7	23,463	750	844	
	Bollard	unit	1	10,284	10,284	0	0	8	30	35 ton Type
Cat Walk		m	100	1,050	105,000	450	45,000	1,680	1,890	
Landing Deck	Steel Pipe Pile Works	m	3,312	617	2,043,325	781	2,586,818	6,624	3,312	D=800mm, t=12mm, 33 x 40m, 48 x 41.5m
	Corrosion Protection of Piles	no	81	3,500	283,500	1,500	121,500	4,536	5,103	
	Reinforced Concrete Works	m3	470.0	1,537.5	722,681	625.7	294,070	9,400	10,575	2 Unit x 30m x 30m
	Bollard	unit	2	10,284	20,568	0	0	16	60	35 ton Type
Movable Bridge	Steel Works	m2	253	2,870	726,110	4,305	1,089,165	11,638	13,070	B: 11 m x 1: 23 m, Wheel Load: T-20, 1 Units
	Mechanical and Electrical Parts	LS	1		184,500		430,500	2,952	3,321	
	Control Room	m2	20	240	4,800	160	3,200	96	144	Control Room of 20 m2 of Floor Area
Abutment of Movable Bridge	Steel Pipe Pile Works	m	332	617	204,826	781	259,307	664	332	D=800mm, t=12mm, 8 x 41.5m
	Corrosion Protection of Piles	no	8	3,500	28,000	1,500	12,000	448	504	
	Reinforced Concrete Works	m3	147	1,537.5	226,008	625.7	91,975	2,940	3,308	12.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge	Steel Pipe Pile Works	m	412	617	254,382	781	321,790	824	412	D=800mm, t=12mm, 2 @(4 x 41.5m, 1 x 40m)
	Corrosion Protection of Piles	no	10	3,500	35,000	1,500	15,000	560	630	
	Reinforced Concrete Works	m3	105	1,537.5	161,434	625.7	65,696	2,100	2,363	2 Units @(3.0 x 4.0 x 5.0 - Void)
Dredging for Sand Replacement of Revetment		m3	14,950	33	495,570	9	141,838	2,990	0	65 m3/m x 230 m
Sand Replacement of Foundation of Revetment		m3	17,940	41	738,164	2	33,153	0	1,346	120% x (65 m3/m x 230 m)
Slope Protection (L=230 m)	Filling Works	m3	4,255	41	175,077	2	7,863	0	319	18.5 m3/m x 230 m
	Quarry Run	m3	1,863	62.7	116,779	5.8	10,790	0	0	8.1 m3/m x 230 m
	Armour Rock (100 - 300 kg/unit)	m3	2,139	79.0	169,021	5.3	11,329	0	642	9.3 m3/m x 230 m
	Geotextile	m2	2,484	6	15,236	16	39,740	0	248	10.8 m2/m x 230 m
	Sheet Piling	m	17,250	128	2,201,005	162	2,793,025	8,625	2,588	Sheet Pile (type II) x 30 m x (230 m / 0.4m)
	Tie-rod and Anchorage	set	230	1,334	306,712	1,215	279,502	2,300	1,725	1m pitch
Retaining Wall (L=170 m)	Sheet Piling	m	14,450	128	1,843,741	162	2,339,665	7,225	2,168	Sheet Pile (type II) x 34 m x (170 m / 0.4m)
	Tie-rod and Anchorage	set	170	1,334	226,700	1,215	206,588	1,700	1,275	1m pitch
Land Filling		m3	45,000	41.1	1,851,583	1.8	83,160	0	3,375	30,000 m2 x 1.50m
Terminal Building		m2	4,000	660	2,640,000	440	1,760,000	52,800	79,200	A1
Pavement (Parking Area)		m2	9,000	36	326,957	31	274,963	6,000	4,500	A2
Pavement (Passage)		m2	8,960	36	325,504	31	273,741	5,973	4,480	640 m x Width 14.0m
Drainage		m2	30,000	10.2	306,000	1.8	54,000	0	10,230	
Landscaping		m2	8,040	8.5	68,340	1.5	12,060	0	2,392	A0 - (A1+A2+A3)
Fence		m	620	170	105,400	30	18,600	0	3,689	2 x (150 + 125) meter.
Water Supply		m2	4,000	12	48,000	8	32,000	960	1,440	Including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	13,000	12	156,000	8	104,000	3,120	4,680	
Truck Scale		LS	1		30,000		270,000	600	900	Capacity: 60 ton
Sewerage System		m2	4,000	0.6	2,400	0.4	1,600	48	72	
Total					19,555,385		16,943,137	194,400	209,360	

(Local + Foreign) 36,498,522 (1,000 Rupiah)

Table A4.2.3 Estimation of Construction Cost (Patumbukan / Selayar)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Selayar	max: 1000, min: 500	1	2,000	2,500	2,500		19,500	HWS: +2.39 m; Design Water Depth: -4.5 m; Design Height of Berth: +3.50 m; Bearing Strata: -34 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		982,571		686,725	19,651	29,477	8 % of Total of the Direct Construction Cost
Side Breasting Dolphin	Steel Pipe Pile Works	m	1,008	670	675,814	811	817,851	1,512	672	D=700mm, t=14mm, 3 units(6x37.0m, 2x38.0m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,512	1,701	
	Reinforced Concrete Works	m3	216.0	1,540	332,592	643	138,853	3,240	3,240	
	Fender System	unit	3	1,630	4,889	153,815	461,444	30	40	C630H(R1) 1 x 2
	Bollard	unit	3	8,441	25,323	0	0	18	20	25 ton Type
Bow Breasting Dolphin	Steel Pipe Pile Works	m	225	662	148,950	799	179,705	338	150	D=800mm, t=12mm, 3 x 37.0m, 3 x 38.0m
	Corrosion Protection of Piles	no	6	3,500	21,000	1,500	9,000	336	378	
	Reinforced Concrete Works	m3	33	1,540	50,235	643	20,973	489	489	
	Fender System	unit	2	1,630	3,260	153,815	307,630	20	27	C630H(R0+5) 2 x (2 x 1)
Mooring Dolphin	Steel Pipe Pile Works	m	450	670	301,703	811	365,112	675	300	D=700mm, t=14mm, 3 units(2x37.0m, 2x38.0m)
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	115	1,540	177,075	643	73,927	1,725	1,725	
	Bollard	unit	3	8,441	25,323	0	0	18	60	25 ton Type
Cat Walk		m	95	1,050	99,750	450	42,750	1,596	1,796	
Movable Bridge	Steel Works	m2	162	2,912	471,744	4,368	707,616	7,548	8,491	W: 9.0 m x L: 18.0 m, Wheel Load: T-14, 1 Units
	Mechanical and Electrical Parts	LS	1		187,200		436,800	2,995	3,370	
	Control Room	LS	1	240	240	160	160	5	7	
Abutment of Movable Bridge	Steel Pipe Pile Works	m	304	662	201,249	799	242,801	456	203	D=800mm, t=12mm, 8 x 38.0m
	Corrosion Protection of Piles	no	8	3,500	28,000	1,500	12,000	448	504	
	Reinforced Concrete Works	m3	122.5	1,540	188,623	643	78,748	1,838	1,838	10.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge	Steel Pipe Pile Works	m	378.0	662	250,237	799	301,904	567	252	D=800mm, t=12mm, 2 @(4 x 38.0m, 1 x 37.0m)
	Corrosion Protection of Piles	no	10	3,500	35,000	1,500	15,000	560	630	
	Reinforced Concrete Works	m3	105	1,540	161,677	643	67,498	1,575	1,575	2 Units @(3.0 x 4.0 x 5.0 - Void)
Trestle (L=42m)	Steel Pipe Pile Works	m	414	537	238,603	612	271,629	666	296	D=600mm, t=12mm, 6 x 2 x 37.0m
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	453	1,540	743,714	643	310,492	7,245	7,245	
	Pavement (Carriage Way)	m2	294	46	13,482	45	13,367	147	98	7.0 m2/m x 42m
	Pavement (Walk Way)	m2	101	38	3,860	25	2,533	76	50	2 x 1.2 m2/m x 42m
Causeway (L=17.5m)	Filling Works	m3	761	38	29,293	2	1,688	0	38	Sandy Gravel; 43.5 m3/m
	Rubble Stone (20 - 40 kg/unit)	m3	184	58	10,608	7	1,332	0	37	10.5 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	236	83	19,668	14	3,228	0	47	13.5 m3/m
	Geotextile	m2	350	6	2,253	16	5,655	0	23	20.0 m2/m
	Pavement (Carriage Way)	m2	123	46	5,617	45	5,569	61	41	7.0 m2/m x 17.5m
	Pavement (Walk Way)	m2	42	38	1,608	25	1,056	32	21	2 x 1.2 m2/m x 17.5m
Dredging		m3	99,200	40	3,934,212	11	1,120,226	14,880	0	Turning Basin of vessels (LOA=70m)
Access Road (4.0 km)		m	4,000	27	108,000	18	72,000	2,160	3,240	
Slope Protection (L=230m)	Filling Works	m3	2,565	38.5	98,700	2.2	5,688	0	128	Sandy Gravel; 9.5 m3/m
	Rubble Stone (20 - 40 kg/unit)	m3	1,431	57.7	82,612	7.2	10,370	0	286	5.3 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	1,836	83.0	152,379	13.7	25,083	0	367	6.8 m3/m
	Geotextile	m2	2,700	6.4	17,380	16.2	43,623	0	180	10.0 m2/m
Terminal Building		m2	2,000	900	1,800,000	600	1,200,000	36,000	54,000	A1
Pavement (Parking Area)		m2	5,000	46	229,284	45	227,326	2,500	1,667	A2
Pavement (Passage)		m2	10,080	46	462,237	45	458,289	5,040	3,360	A3; Width 14.0m x 720m
Drainage		m2	19,500	8.5	165,750	1.5	29,250	3,315	4,923	
Landscaping		m2	2,420	8.5	20,570	1.5	3,630	413	617	A0 - (A1+A2+A3)
Fence		m	570	149	84,788	26	14,963	1,696	2,544	2 x (150 + 125) meter.
Water Supply		m2	2,000	80	160,000	24	48,000	3,200	4,800	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	7,000	40	280,000	20	140,000	5,600	8,400	including Generator and Housing
Truck Scale		LS	1		18,000		162,000	360	540	Capacity: 30 ton
Sewerage System		m2	2,000	0.6	1,200	0.4	800	24	36	
Navigation Aids		unit	5	6,000	30,000	10,000	50,000	600	900	
Total					**13,264,713**		**9,270,794**	**132,508**	**152,390**	

(Local + Foreign) **22,535,507** (1,000 Rupiah)

Table A4.2.4 Estimation of Construction Cost (Labuhan Bajo / Flores)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Labuhan Bajo	max: 1000, min: 500	1	1,500	2,500	2,500		20,000	HWS: +2.70 m, Design Water Depth: -4.5 m, Design Height of Berth: +3.50 m; Bearing Strata: -20 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		458,403		357,490	9,168	10,724	8 % of Total of the Direct Construction Cost
Demolition of Existing Breasting Dolphin		LS	1		15,806		9,000	316	270	
Rehabilitation of Existing Landing Jetty		LS	1		8,440		1,560	169	47	
Side Breasting Dolphin	Steel Pipe Pile Works	m	630	980	617,599	1,184	746,045	1,260	630	D=700mm, t=14mm, 3@(6x23.0m, 3x24.0m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,512	1,701	
	Reinforced Concrete Works	m3	216.0	2,217	478,849	932	201,362	4,320	4,860	
	Fender System	unit	3	1,892	5,675	153,203	459,610	40	60	(C-630Hx1x2) x 3 Dolphin
	Bollard	unit	3	8,417	25,250	0	0	24	90	25 ton Type
Mooring Dolphin	Steel Pipe Pile Works	m	282	786	221,573	892	251,631	564	282	D=600mm, t=12mm, 3 units(2x23.0m, 2x24.0m)
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	115	2,247	254,943	932	107,206	2,300	2,588	
	Bollard	no	3	8,417	25,250	0	0	60	68	25 ton Type
	Cat Walk	m	95	1,050	99,750	450	42,750	1,596	1,710	
Movable Bridge	Existing	---								
Slope Protection	Filling Works	m3	0							
	Rubble Stone (20 - 40 kg/unit)	m3	2,472	58.3	144,159	9.3	22,941	0	742	
	Armour Rock (100 - 300 kg/unit)	m3	1,600	82.6	132,163	14.8	23,755	0	480	
	Geotextile	m2	1,952	7.1	13,845	15.3	29,786	0	195	
Reclamation		m3	17,100	36.4	622,440	2.3	39,330	12,449	18,675	
Terminal Building		m2	1,500	900	1,350,000	600	900,000	27,000	40,500	A1
Pavement (Parking Area)		m2	5,000	54.2	271,052	72.6	362,961	3,333	2,500	A2
Pavement (Passage)		m2	10,360	54.2	561,619	72.6	752,055	6,907	5,180	A3; Width 14.0m x 740 m
Drainage		m2	20,000	12.8	255,000	2.3	45,000	5,100	7,650	
Landscaping		m2	3,140	8.5	26,690	1.5	4,710	534	801	A0 - (A1+A2+A3)
Fence		m	380	170	64,600	30	11,400	1,292	1,938	2 x (150 + 125) meter
Water Supply		m3	1,500	80	120,000	24	36,000	2,400	3,600	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	6,500	40	260,000	20	130,000	5,200	7,800	including Generator and Housing
Truck Scale		LS	1		18,000		162,000	360	540	Capacity: 30 ton
Sewerage System		m2	1,500	0.6	900	0.4	600	18	27	
Total					6,188,504		4,755,682	86,594	114,496	

(Local + Foreign) 10,944,186 (1,000 Rupiah)

Table A4.2.5 Estimation of Construction Cost (Wahai / Seram)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Wahai	max: 1000, min: 500	1	1,500	2,000	2,000		17,000	HWS: +1.92 m; Design Water Depth: -4.5 m; Design Height of Berth: +3.50 m; Bearing Strata: -30 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		698,435		746,364	13,969	20,953	8 % of Total of the Direct Construction Cost.
Side Breasting Dolphin	Steel Pipe Pile Works	m	922.5	611.5	564,132	723.0	666,942	1,384	615	D=700mm, t=12mm, 3 units(6x33.5m, 3x35.5m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,522	1,702	
	Reinforced Concrete Works	m3	216.0	1,656.9	357,897	661.3	142,845	3,240	3,240	
	Fender System	unit	3	1,630	4,889	153,111	459,334	30	40	C630H(RH) 1 x 2
	Bollard	unit	3	8,401	25,202	0	0	18	60	25 ton Type
Bow Breasting Dolphin	Steel Pipe Pile Works	m	207.0	674.3	139,581	817.1	169,148	311	138	D=800mm, t=12mm, 3 x 33.5m, 3 x 35.5m
	Corrosion Protection of Piles	no	6	3,500	21,000	1,500	9,000	336	378	
	Reinforced Concrete Works	m3	32.6	1,656.9	54,057	661.3	21,576	489	489	
	Fender System	unit	2	1,630	3,260	153,111	306,223	20	27	C630H(RH+S) 2 x (2 x 1)
Mooring Dolphin	Steel Pipe Pile Works	m	414.0	547	226,285	626	258,981	621	276	D=600mm, t=12mm, 3 units(2x33.5m, 2x35.5m)
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	112.5	1,656.9	186,405	661.3	74,399	1,688	1,688	
	Bollard	unit	3	8,401	25,202	0	0	18	60	25 ton Type
Cat Walk		m	95	1,050	99,750	450	42,750	1,596	1,796	
Landing Deck	Steel Pipe Pile Works	m	728	674	490,556	817	594,471	1,091	485	D=800mm, t=12mm, 9 x 33.5m, 12 x 35.5m
	Corrosion Protection of Piles	no	21	3,500	73,500	1,500	31,500	1,176	1,323	
	Reinforced Concrete Works	m3	97.5	1,656.9	161,551	661.3	64,479	1,463	1,463	30m x 15m
Movable Bridge	Steel Works	m2	335	2,870	387,450	4,305	581,175	6,199	6,974	B: 9 m x L: 15 m, Wheel Load: T-14; 1 Units.
	Mechanical and Electrical Parts	LS	1		186,300		434,200	2,981	3,353	
	Control Room	m2	20	240	4,800	160	3,200	96	144	Control Room of 20 m2 of Floor Area
Abutment of Movable Bridge	Steel Pipe Pile Works	m	284	674	191,502	817	232,068	426	189	D=800mm, t=12mm, 8 x 35.5m
	Corrosion Protection of Piles	no	8	3,500	28,000	1,500	12,000	448	504	
	Reinforced Concrete Works	m3	123	1,656.9	202,974	661.3	81,012	1,838	1,838	10.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge	Steel Pipe Pile Works	m	351	674	236,681	817	286,817	527	234	D=800mm, t=12mm, 2 @(4 x 35.5m, 1 x 33.5m)
	Corrosion Protection of Piles	no	10	3,500	35,000	1,500	15,000	560	630	
	Reinforced Concrete Works	m3	105	1,656.9	173,978	661.3	69,439	1,575	1,575	2 Units @(3.0 x 4.0 x 5.0 - Void)
Trestle (L=36m)	Steel Pipe Pile Works	m	201	547	109,863	626	125,737	302	134	D=600mm, t=12mm, 2 x 6 x 33.5m
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	414.0	1,656.9	685,969	661.3	273,786	6,210	6,210	
	Pavement (Carriage Way)	m2	252	46	11,573	26	6,429	126	84	7.0 m2/m x 36m
	Pavement (Walk Way)	m2	86	40	3,435	17	1,492	65	43	2 x 1.2 m2/m x 36m
Causeway (L = 115 m)	Filling Works	m3	5,003	36.4	182,124	2.3	11,477	0	250	Sandy Gravel; 43.5 m3/m
	Quarry Run	m3	1,208	58.0	70,026	1.8	2,188	0	60	10.5 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	1,553	82.2	127,620	6.5	10,144	0	311	13.5 m3/m
	Geotextile	m2	2,300	6.1	14,121	15.1	34,829	0	153	20.0 m2/m
	Pavement (Carriage Way)	m2	805	46	35,968	26	20,537	403	268	7.0 m2/m x 36m
	Pavement (Walk Way)	m2	276	40	10,971	17	4,767	207	138	2 x 1.2 m2/m x 36m
Land Filling		m3	25,500	36.4	928,366	2.3	58,504	0	1,275	Average Thickness: 1.5m
Slope Protection (L=170 m)	Filling Works	m3	1,615	36.4	58,797	2.3	3,705	0	81	Sandy Gravel; 9.5 m3/m
	Quarry Run	m3	901	58.0	52,251	1.8	1,632	0	45	5.3 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	1,156	82.2	95,027	6.5	7,553	0	231	6.8 m3/m
	Geotextile	m2	1,700	6.1	10,438	15.1	25,743	0	113	10.0 m2/m
Terminal Building		m2	1,500	900	1,350,000	600	900,000	27,000	40,500	A1
Pavement (Parking Area)		m2	4,000	46	183,691	26	102,045	2,000	1,333	A2
Pavement (Passage)		m2	7,140	46	327,859	26	182,150	3,570	2,380	A3; 510m x Width 14.0m
Drainage		m2	17,000	30.2	373,400	1.8	30,600	3,468	5,202	
Landscaping		m2	4,360	8.5	37,060	1.5	6,540	741	1,112	A0 - (A1+A2+A3)
Fence		m	300	170	51,000	30	9,000	1,020	1,530	
Water Supply		m2	1,500	15	22,500	10	15,000	450	675	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	5,500	20	110,000	10	55,000	2,200	3,300	
Truck Scale		LS	1		18,000		162,000	360	540	Capacity: 30 ton
Sewerage System		m2	1,500	0.6	900	0.4	600	18	27	
Total					9,428,874		7,431,380	93,093	117,680	

(Local + Foreign) 16,860,254 (1,000 Rupiah)

Table A4.2.6 Estimation of Construction Cost (Babang / Bacan)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Babang	max: 1000, min: 500	1	1,500	2,000	2,000		15,000	HWS: +1.35 m; Design Water Depth: -4.5 m; Design Height of Berth: +3.00 m; Bearing Strata: -32 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		229,971		305,352	4,599	6,899	7 % of Total of the Direct Construction Cost
Side Breasting Dolphin	Steel Pipe Pile Works	m	945	555.5	524,993	639.3	604,174	1,418	630	D=600mm, t=12mm, 3 units (6x34.5m, 3x36.0m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,512	1,701	
	Reinforced Concrete Works	m3	216	1,660.2	358,610	661.3	142,845	3,240	3,240	
	Fender System	no	6	1,630	9,779	153,815	922,889	60	80	C6301(RH) 1 x 2
	Bollard	no	3	8,441	25,323	0	0	18	60	25 ton Type
Bow Breasting Dolphin	Steel Pipe Pile Works	m	212	686.4	145,571	835.6	176,728	317	141	D=800mm, t=12mm, 3 x 34.5m, 3 x 36.0m
	Corrosion Protection of Piles	no	6	3,500	21,000	1,500	9,000	336	378	
	Reinforced Concrete Works	m3	33	1,660.2	54,165	661.3	21,576	489	489	
	Fender System	unit	2	1,630	3,260	153,815	307,630	20	27	C6301(R0+5) 2 x (2 x 1)
Mooring Dolphin	Steel Pipe Pile Works (D600, t=12)	m	138	556	76,666	639	88,229	207	92	4 x (D=600mm, t=12mm, 34.5m)
	Steel Pipe Pile Works (D700, t=12)	m	144	622	89,579	739	106,435	216	96	4 x (D=700mm, t=12mm, 36.0m)
	Steel Pipe Pile Works (D600, t=14)	m	69	618	42,617	732	50,541	104	46	2 x (D=600mm, t=14mm, 34.5m)
	Steel Pipe Pile Works (D700, t=14)	m	72	695	50,059	849	61,121	108	48	2 x (D=600mm, t=14mm, 36.0m)
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	115	1,660.2	190,926	661.3	76,052	1,725	1,725	
	Bollard	no	3	8,441	25,323	0	0	18	60	25 ton Type
Cat Walk		m	95	1,050	99,750	450	42,750	1,596	1,796	
Movable Bridge	Steel Works	m2	126	2,870	361,630	4,305	542,430	5,786	6,509	B: 9 m x L: 14 m, Wheel Load: T-14; 1 Units.
	Mechanical and Electrical Parts	LS	1		186,300		434,700	2,981	3,353	
	Control Room	LS	1	240	240	160	160	5	7	Control Room of 20 m2 of Floor Area
Abutment of Movable Bridge	Steel Pipe Pile Works	m	288	686	197,679	836	240,651	432	192	D=800mm, t=12mm, 8 x 36.0m
	Corrosion Protection of Piles	no	8	3,500	28,000	1,500	12,000	448	504	
	Reinforced Concrete Works	m3	122.5	1,660.2	203,378	661.3	81,012	1,838	1,838	10.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge	Steel Pipe Pile Works	m	357.0	686	245,040	836	298,307	536	238	D=800mm, t=12mm, 2 @(4 x 36.0m, 1 x 34.5m)
	Corrosion Protection of Piles	no	10	3,500	35,000	1,500	15,000	560	630	
	Reinforced Concrete Works	m3	105	1,660.2	174,324	661.3	69,439	1,575	1,575	2 Units @(3.0 x 4.0 x 5.0 - Void)
Trestle (L=16m)	Steel Pipe Pile Works	m	414	618	255,703	732	303,245	621	276	D=500mm, t=12mm, 2 x 6 x 34.5m
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	184	1,660.2	305,482	661.3	121,683	2,760	2,760	
	Pavement (Carriage Way)	m2	112	48	5,332	29	3,302	56	37	7.0 m2/m x 16m
	Pavement (Walk Way)	m2	38.4	40	1,554	19	728	29	19	2 x 1.2 m2/m x 16m
Slope Protection (L=150 m)	Filling Works	m3	1,425	40.6	57,838	2.3	3,269	0	71	Sandy Gravel, 9.5 m3/m
	Quarry Run	m3	795	65.6	52,166	7.2	5,761	0	159	5.3 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	1,020	82.2	83,813	6.5	6,665	0	204	6.8 m3/m
	Geotextile	m2	1,500	7.6	11,458	21.2	31,838	0	100	10.0 m2/m
Site Clearance and Grading		m3	7,500	4.6	34,378	3.2	24,102	0	375	A1
Access Road		m2	10,000	48	476,036	29	294,644	5,000	5,333	W:10 m x 1 Km
Terminal Building		m2	1,500	1,080	1,620,000	720	1,080,000	32,400	48,600	
Pavement (Parking Area)		m2	4,000	48	190,414	29	117,938	2,000	1,333	A2
Pavement (Passage)		m2	7,140	48	339,890	29	210,519	3,570	2,380	A3; 510m x Width 14.0m
Drainage		m2	15,000	10.2	153,000	1.8	27,000	3,060	4,590	
Landscaping		m2	2,360	8.5	20,060	1.5	3,540	401	602	A0 - (A1+A2+A3)
Fence		m	340	170	57,800	30	10,200	1,156	1,734	150 + 2 x 95 meter
Water Supply		m2	1,500	80	120,000	24	36,000	2,400	3,600	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	5,500	20	110,000	10	55,000	2,200	3,300	
Truck Scale		LS	1		18,000		162,000	360	540	Capacity: 30 ton
Sewerage System		m2	1,500	0.6	900	0.4	600	18	27	
Total					7,471,098		7,183,754	87,518	107,907	

(Local + Foreign) **14,654,852 (1,000 Rupiah)**

Table A4.2.7 Estimation of Construction Cost (Sowi / Manokwari)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Manokwari	max: 1000, min: 500	1	2,000	2,500	2,500		19,500	HWS: +2.22 m; Design Water Depth: -4.5 m; Design Height of Berth: +4.00 m; Bearing Strata: -14 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		692,646		512,338	13,853	20,779	8 % of Total of the Direct Construction Cost
Side Breasting Dolphin	Steel Pipe Pile Works	m	482	747	359,715	924	444,898	963	482	D=700mm, t=14mm, 3 units(6x17.5m, 3x18.5m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,512	1,701	
	Reinforced Concrete Works	m3	216	1,804	389,716	682	147,236	4,320	23	
	Fender System	unit	3	1,645	4,935	153,815	461,444	40	60	C630H,R4V 1 x 2
	Bollard	unit	3	8,458	25,375	0	0	24	90	25 ton Type
Mooring Dolphin	Steel Pipe Pile Works	m	216	747	161,367	924	199,580	432	216	D=700mm, t=14mm, 3 units(2x17.5m, 2x18.5m)
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	115	1,804	207,458	682	78,390	2,300	2,588	
	Bollard	unit	3	8,458	25,375	0	0	24	90	25 ton Type
Cat Walk		m	95	1,050	99,750	450	42,750	1,596	1,796	
Movable Bridge	Steel Works	m2	189	2,912	550,368	4,368	825,552	8,806	9,907	W: 9.0 m x L: 21.0 m, Wheel Load: T-14; 1 Units
	Mechanical and Electrical Parts	LS	1		187,200		436,800	2,995	3,370	
	Control Room	LS	1	240	240	160	160	5	7	
Abutment of Movable Bridge	Steel Pipe Pile Works	m	148	737	109,129	909	134,593	296	148	D=800mm, t=12mm, 8 x 18.5m
	Corrosion Protection of Piles	no	8	3,500	28,000	1,500	12,000	448	504	
	Reinforced Concrete Works	m3	1225	1,804	221,020	682	83,503	2,450	2,756	10.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge Trestle (L=42.0 m)	Steel Pipe Pile Works	m	183.0	737	134,936	909	166,422	366	183	D=800mm, t=12mm, 2 @(4 x 18.5m, 1 x 17.5m)
	Corrosion Protection of Piles	no	10	3,500	35,000	1,500	15,000	560	630	
	Reinforced Concrete Works	m3	105	1,804	189,445	682	71,573	2,100	2,363	2 Units @(3.0 x 4.0 x 5.0 - Void)
	Steel Pipe Pile Works	m	210	594	124,752	694	145,837	420	210	D=600mm, t=12mm, 6 x 2 x 17.5m
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	483	1,804	871,449	682	329,236	9,660	10,868	
	Pavement (Carriage Way)	m2	294	57	16,632	59	17,261	196	147	7.0 m2/m x 42m
	Pavement (Walk Way)	m2	101	47	4,716	32	3,241	101	76	2 x 1.2 m2/m x 42m
Causeway (L=50.0m)	Filling Works	m3	2,875	39	83,844	7	4,780	0	163	Sandy Gravel, 43.5 m3/m
	Rubble Stone (20 - 40 kg/unit)	m3	525	58	30,478	7	3,773	0	158	10.5 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	675	83	56,222	14	9,200	0	203	13.5 m3/m
	Geotextile	m2	1,000	8	8,404	24	23,760	0	100	20.0 m2/m
	Pavement (Carriage Way)	m2	350	57	19,800	59	20,548	233	175	7.0 m2/m x 17.5m
	Pavement (Walk Way)	m2	120	47	5,614	32	3,859	120	90	2 x 1.2 m2/m x 17.5m
Land Filling		m3	18,950	39	730,503	2	41,648	0	1,421	
Slope Protection (L=270m)	Filling Works	m3	2,565	39	98,878	2	5,637	0	192	Sandy Gravel, 9.5 m3/m
	Rubble Stone (20 - 40 kg/unit)	m3	1,431	58	83,075	7	10,265	0	429	5.3 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	1,836	83	152,924	14	25,023	0	551	6.8 m3/m
	Geotextile	m2	2,700	8	22,691	24	64,152	0	270	10.0 m2/m
Terminal Building		m2	2,000	900	1,800,000	600	1,200,000	36,000	54,000	A1
Pavement (Parking Area)		m2	5,000	57	287,854	59	293,546	3,333	2,500	A2
Pavement (Passage)		m2	10,080	57	570,234	59	591,789	6,720	5,040	A3, Width 14.0m x 720m
Drainage		m2	19,500	12.8	248,625	2.3	43,875	4,973	7,459	
Landscaping		m2	2,420	8.5	20,570	1.5	3,630	411	617	A0 - (A1+A2+A3)
Fence		m	385	170	65,450	30	11,550	1,309	1,964	2 x (150 + 125) meter.
Water Supply		m2	2,000	75	150,000	25	50,000	3,000	4,500	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	7,000	40	280,000	20	140,000	5,600	8,400	
Truck Scale		LS	1		18,000		162,000	360	540	Capacity: 30 ton
Sewerage System		m2	2,000	2.4	4,800	1.6	3,200	96	144	
Total					9,350,718		6,916,567	116,966	149,418	

(Local + Foreign) 16,267,286 (1,000 Rupiah)

Table A4.2.8 Estimation of Construction Cost (Mokmer / Biak)

Terminal	Size of Ferry Boat (GRT)	Berth	Building (m2)	Loading Parking	Waiting Parking		Land Area (m2)	Design Conditions (Datum Level: LWS)
Biak	max: 1000, min: 500	1	2,000	2,500	2,500		19,500	HWS: +1.55 m; Design Water Depth: -4.5 m; Design Height of Berth: +3.75 m; Bearing Strata: -18 m

Description		Unit	Quantity	Local Currency (1,000 Rupiah)		Foreign Currency (1,000 Rupiah)		Labour Cost (1,000 Rupiah)		Remarks
				Unit Price	Amount	Unit Price	Amount	Skilled	Unskilled	
Mobilization and Demobilization		LS	1		761,676		540,966	15,234	22,850	3 % of Total of the Direct Construction Cost.
Side Breasting Dolphin	Steel Pipe Pile Works	m	576	585	337,139	681	392,072	1,152	576	D=600mm, t=12mm, 3 units (6x22.0m, 3x22.0m)
	Corrosion Protection of Piles	no	27	3,500	94,500	1,500	40,500	1,512	1,701	
	Reinforced Concrete Works	m3	216	1,864	402,689	682	147,236	4,320	4,860	
	Fender System	no	3	1,645	4,935	153,815	461,444	40	60	C630H(R1f) 1 x 2
	Bollard	no	3	8,458	25,375	0	0	24	90	25 ton Type
Bow Breasting Dolphin	Steel Pipe Pile Works	m	129	585	75,505	681	87,808	258	129	D=600mm, t=12mm, 3 x 22.0m, 3 x 22.0m
	Corrosion Protection of Piles	no	6	3,500	21,000	681	4,084	336	378	
	Reinforced Concrete Works	m3	33	1,864	60,823	682	22,239	653	734	
	Fender System	unit	2	1,645	3,290	153,815	307,630	27	40	C630H(R0+5) 2 x (2 x 1)
Mooring Dolphin	Steel Pipe Pile Works	m	256	585	151,010	681	175,615	516	258	D=600mm, t=12mm, 3 units (2x21.0m, 2x22.0m)
	Corrosion Protection of Piles	no	12	3,500	42,000	1,500	18,000	672	756	
	Reinforced Concrete Works	m3	115	1,864	214,395	682	78,390	2,300	2,588	
	Bollard	no	3	8,458	25,375	0	0	24	90	25 ton Type
Cat Walk		m	95	1,050	99,750	450	42,750	1,596	1,796	
Movable Bridge	Steel Works	m2	162	2,912	471,744	4,368	707,616	7,548	8,491	W: 9.0 m x L: 18.0 m, Wheel Load: T-14; 1 Units
	Mechanical and Electrical Parts	LS	1		187,200		436,800	2,995	3,370	
	Control Room	LS	1	240	240	160	160	5	7	
Abutment of Movable Bridge	Steel Pipe Pile Works	m	176	585	103,015	681	119,800	352	176	D=600mm, t=12mm, 8 x 22.0m
	Corrosion Protection of Piles	no	8	3,500	28,000	1,500	12,000	448	504	
	Reinforced Concrete Works	m3	122.5	1,864	228,377	682	83,502	2,450	2,756	10.0 x 3.5 x 3.5
Post Gate Foundation of Movable Bridge	Steel Pipe Pile Works	m	218.0	585	127,598	681	148,388	436	218	D=600mm, t=12mm, 2 @ (4 x 22.0m, 1 x 21.0m)
	Corrosion Protection of Piles	no	10	3,500	35,000	1,500	15,000	560	630	
	Reinforced Concrete Works	m3	105	1,864	195,752	682	71,573	2,100	2,363	2 Units @(3.0 x 4.0 x 5.0 - Void)
Trestle (L=45m)	Steel Pipe Pile Works	m	294	585	172,081	681	200,120	588	294	D=600mm, t=12mm, 7 x 2 x 21.0m
	Corrosion Protection of Piles	no	14	3,500	49,000	1,500	21,000	784	882	
	Reinforced Concrete Works	m3	518	1,864	964,776	682	352,753	10,350	11,644	
	Pavement (Carriage Way)	m2	315	59	18,513	59	18,493	210	158	7.0 m2/m x 45m
	Pavement (Walk Way)	m2	108	49	5,252	33	3,516	108	81	2 x 1.2 m2/m x 45m
Land Filling		m3	36,500	39	1,409,024	2	80,942	0	2,738	
Slope Protection (L=300m)	Filling Works	m3	2,850	39	110,020	2	6,320	0	214	Sandy Gravel, 9.5 m3/m
	Rubble Stone (20 - 40 kg/unit)	m3	1,590	66	105,171	7	11,522	0	477	5.3 m3/m
	Armour Rock (100 - 300 kg/unit)	m3	2,040	91	184,861	14	29,486	0	612	6.8 m3/m
	Geotextile	m2	3,000	8	25,278	24	71,280	0	300	10.0 m2/m
Terminal Building		m2	2,000	900	1,800,000	600	1,200,000	36,000	54,000	A1
Pavement (Parking Area)		m2	5,000	59	293,854	59	293,546	3,333	2,500	A2
Pavement (Passage)		m2	10,050	59	592,410	59	591,789	6,720	5,040	A3; Width 14.0m x 720m
Drainage		m2	19,500	12.8	249,625	2.3	43,875	4,923	7,459	
Landscaping		m2	2,420	8.5	20,570	1.5	3,630	411	617	A0 - (A1+A2+A3)
Fence		m	400	170	68,000	30	12,000	1,360	2,040	2 x (150 + 125) meter
Water Supply		m2	2,000	108.0	216,000	72.0	144,000	4,320	6,480	including Deep Well and Water Reservoir Tank
Electric Power Supply		m2	7,000	40	280,000	20	140,000	5,600	8,400	including Generator and Housing
Truck Scale		LS	1		18,000		162,000	300	540	Capacity: 30 ton
Sewerage System		m2	2,000	2.4	4,800	1.6	3,200	96	144	
Total					10,282,621		7,303,045	120,770	160,039	

(Local + Foreign) 17,585,666 (1,000 Rupiah)

A5.1 Survey Data

5.1.1 Surabaya

(1) Seawater quality

1. The existing seawater quality is not good according to the laboratory analysis. The following three parameters have higher values than the government standards

- Oil and grease
- Coliform
- Transparency

2. The other parameters such as TSS, Total phosphate and Zinc are relatively high compared with other beach oceans. The presence of bacteria can be explained by the existence of the 6 rivers discharging to the shallow bay area. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

3. The existing seabed conditions are also not good according to laboratory analysis. The analysis result indicates contamination from both industrial sources and domestic sewage. Levels of heavy metal and other contaminants are relatively high compared with other project sites. The water characteristic allows the settling of the pollutant materials to seabed. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

4. At the project site, only seven (7) people work as fish pond workers. There are some fishermen living outside the project area and at the area along the Kalianak River. Fishermen conduct fishing operations with small fishing boats around the beach area and sell at the landing area. Fishing boats are mooring along the mouth of Kalianak River. Fishes are sold directly to consumers in the small market, to retailers or to collectors. Good quality fish from the collectors are being exported, while a part of milkfish are collected and delivered to Jakarta. Annual fish catch fluctuates according to the fishery data. Data from 1989 to 1996 show that the fish caught averages around 700ton/year. The data of fishing boats is shown in Table A5.1.1.

Table A5.1.1 Data of Fishing Boats

Year	Number of Boats
1989	184
1990	184
1991	168
1992	196
1993	160
1994	183
1995	183
1996	160

Source : Dinas Perikanan DT, with engine, less than 10 HP

(4) Fauna and flora

5. There are only few mangrove trees at the project site. Flora is common but there can not be observed specific fauna in the area of the port development and adjacent to the proposed project area .

(5) Benthic

6. Considering the number and species of benthic animal, where Polychaeta is dominant, the diversity index (1.423) and evenness (0.884) are relatively low. It is foreseen that the water quality at this bay area is low and the benthic condition is not good.

(6) Species listed in the data books/vulnerable ecological system

7. The area does not have any endangered and/or rare species listed in the Red Data Books of the International Union for Conservation of Nature and Natural Resources (ICUN).

5.1.2 Banjarmasin

(1) River water quality

8. The salinity of water is 0.2% and containes fresh water. Water quality is not good according to the survey result. Zn and Hg content are higher than the government standards. Compared with other locations of proposed ferry port, DO content is too low, while E.coli, TSS, Ni, Oil and grease are relatively high. The ignition loss content in this

area is higher than Surabaya, which means that water retains much organic materials. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Riverbed quality

9. The riverbed quality in the survey area is classified as bad. The value of ignition loss, COD, and phosphate indicate that the riverbed is polluted by organic substance. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

10. No fisherman lives in the proposed project area. However there is a local fish market near the project area. Fishing area is in the estuary of Barito River and along the shoreline of South Kalimantan Province. Only a few fishermen conduct fishing in the Barito River. The number of fishermen at Banjarmasin Fishing Port is shown in Table A5.1.2.

Table A5.1.2 Number of Fishermen (1993-1996)

Year	Open Sea	River
1993	2,027	63
1994	2,029	66
1995	2,031	70
1996	2,039	73
1997	2,035	77

Source : Banjarmasin Fishery Service

(4) Fauna and flora

11. At the proposed ferry port location, there is no specific flora and fauna. However, there are protected animals such as "Bekantan"(Proboscis Monkey) in the Kembang Island about 500 m from the project site.

(5) Species listed in the data books/vulnerable ecological system

12. The area does not have any endangered and/or rare species listed in the Red Data Books of the International Union for Conservation of Nature and Natural Resources (ICUN).

5.1.3 Selayar

(1) Seawater quality

13. The existing seawater quality is good enough according to the laboratory analysis. Most of the parameters are better than the environmental standards. These data indicate that so far, there is no pollution in this area or pollution is still lower than the carrying capacity of the environment. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

14. The seabed quality is still better than other project locations according to the laboratory analysis. There is no serious organic and heavy metal pollution at seabed of this area while sedimentation and organic matter decay in the area near the coast have occurred since a long time. It is observed that the quality of seabed tends to increase gradually in places far from the coastal line. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

15. In Selayar Island, the routine activities of fishery are concentrated at Benteng (Capital of the district) in the subdistrict of Bontoharu. There is no fishery activity at the project site as this location is new. This project planning therefore got no negative response from the fishermen. This is based on the following facts:

1) The location is not a fishing ground area, therefore the project will not disturb any line or fish catching area of the fishermen.
2) The planned ferry port area in Patubukan Bay is still unpopulated with private property ownership status only on a limited area.
3) The fishing activities in Selayar Island are concentrated at Benteng area, which has facilities for docking and fish processing.

(4) Coral

16. Coral reef is a specific ecosystem in tropical areas. The quality of the ecosystem is mainly determined by its component, that is, coral stone. According to survey result, it is observed that the environment on the proposed project area has the characteristic of

damaged coral reefs. Analysis of Ground Cover Ridge Rock Ecosystem is shown in Table A5.1.3.

Table A5.1.3 Analysis of Ground Cover Ridge Rock Ecosystem

No.	Type of Ground Cover	Station 1 (%)	Station 2 (%)	Average (%)
1	Dead coral	72.4	44.8	56.8
2	Break coral	-	7.5	3.75
3	Turf algae	-	1.9	0.95
4	Live coral	23.3	35.9	29.6
5	Sand	2.1	-	1.05
6	Algae	1.4	5.3	3.35
7	Other biota	0.8	4.6	2.70

Notes:
0-24 %	very damaged
25-49 %	damaged
50-74 %	average
75-89 %	good
>90 %	very good

17. With regard to ten (10) types of coral colony which were observed adjacent to project area, coral type variability index is in the range of 1.17-1.44. This value indicates that coral productivity in this area is categorized as low. Coral colony species is shown in Table A5.1.4.

Table A5.1.4 Coral Colony Species

No.	Coral Species	Station 1	Station 2
1	Porites lutea	3,218	6,515
2	Porites Sp	1,873	2,756
3	Platygyra Daedalea	334	526
4	Platygra sinensis	216	328
5	Favites abdita	402	108
6	Montastrea curta	42	268
7	Goniophora Sp	61	76
8	Goniastrea Sp	0	88
9	Fungia concinna	0	12
10	Acropora Humilis	418	91
	Total	6,564	10,768
	Index of Diversity	1.44	1.17

(5) Species listed in the data books/vulnerable ecological system

18. The area does not have any endangered and/or rare species listed in the Red Data Books of he International Union for Conservation of Nature and Natural Resources (ICUN).

5.1.4 Labhan Bajo

(1) Seawater quality

19. Based on laboratory analysis, the quality of seawater is good enough except for its oil and grease content. Most of the parameters are better than the environmental standards, though the oil and grease content is relatively high. It is supposed that this condition is caused by the location being very close to the existing port. However pollution does not occur at this area so far, or the pollution is still lower than the carrying capacity of the environment. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

20. The value of ignition loss content is higher than other ferry port locations. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

21. There are 12 fishermen living near the proposed project area. The total number of fishermen is 800 consisting of 500 full time fishermen and 300 part time fishermen in Kecamatan Komodo. The shore located at the north side of proposed ferry port serves as fish landing. From this place, a part of the fish caught are distributed directly to the consumers, fish market and other Kecamatan. In 1996, there are 100 boats of less than 5tons without engine and 97 boats with less than 10HP engine in Labuhan Bajo Village.

(4) Coral and coral fish

22. Corals were found at the depth of 1m to 5m. The low coral coverage (12.5%), shows that the coral condition is damaged. It is assumed that the environmental condition does not support the coral growth. From 28 families of coral fish that consist the 28 species, no one is protected or almost extinct. The existing coral species is the common one. The limited number of species is not caused by contamination or bad habitat, but that the environmental condition does not support the growth of coral fish. Abiotic component and algae are dominant in this area. This indicates that coral reef is in bad condition. The result of survey is shown in Table A5.1.5.

Table A5.1.5 Percent Cover of Benthic Life Form

Benthic Life Form	Total % Cover
Hard Coral (Acropora)	0.3
Hard Coral (Non Acropora)	12.5
Dead Coral	0.0
Algae	33.8
Other Fauna	7.1
Abiotic	46.2
Total	100%

(5) Species listed in the data books/vulnerable ecological system

23. The area does not have any endangered and/or rare species listed in the Red Data Books of the International Union for Conservation of Nature and Natural Resources (ICUN).

5.1.5 Manokwari

(1) Seawater quality

24. The condition of seawater is good except for the presence of heavy metal. The heavy metal content is higher than the government standards. Water quality is not so good for sea biota to live. The number of E.Coli bacteria in one station is almost at the threshold value, while at other stations the value is higher. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

25. The seabed condition is bad and the degree of pollutant is relatively high. The oil and grease content and COD are relatively low. PCB was not detected. The heavy metal content is higher than seawater. This means that heavy metal content is accumulated at the sediments of the sea. No sedimentation was found at Manokuwari location. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

26. There is no fisherman living at the proposed project site. However some inhabitants of Sowi village do some subsistence fishing. In Manokuwari coastal area

there are 10 platforms for catching fish at sea. The platforms are 20m to 30m long. These platforms are located at Wasi Bay, Wappi Island, and Masingan Island. The fish sent to the market is usually fresh. If there are excess fish in the market, some are kept at the platform area to be sent to the market the next day. Some of the fishery products of Regency Monokwari are being exported to Singapore, Hong kong, Japan, etc.

(4) Corals

27. Corals were found at a location approximately 50m from the coastal line at depths between 2- 7m. In this area stone corals with the growing massive form of Porites family and soft coral of Sinularia family are dominant. From 8 translocations, there are 2 lines with 51 –75% covered by live coral, 4 lines with a live coral coverage of 31-50 %, and 2 lines with the live coral coverage of 11-31%. The result of the survey is shown on Table A5.1.6.

Table A5.1.6 Percent Cover of Benthic Life Form

(Depth: 3 m)

Category	Total % Cover
Live Coral	73.62
Dead Coral	0
Algae	14
Other Fauna	11.21
Abiotic Component	1.17
Total	100%

(Depth : 10 m)

Category	Total % Cover
Live Coral	43.87
Dead Coral	0
Algae	7.6
Other Fauna	3.16
Abiotic Component	45.37
Total	100%

(5) Species listed in the data books/vulnerable ecological system

28. The area does not have any endangered and/or rare species listed in the Red Data Books of the International Union for Conservation of Nature and Natural Resources (ICUN).

5.1.6 Biak

(1) Seawater quality

29. The condition of seawater is good except for the presence of heavy metal. The heavy metal content is higher than the government standards. Water quality is not so good for sea biota to live. The number of E.Coli bacteria in one station is almost at the threshold value, while at other stations the value is higher. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

30. The seabed condition is bad and the degree of pollution is relatively high. The oil and grease content and COD are relatively low. PCB was not detected. The heavy metal content is higher than seawater. This means that heavy metal content is accumulated at the sediments of the sea. No sedimentation was found at Biak location. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

31. There is no fisherman living at the proposed project site. The residents of Kampung Ambroben carry out their fishing operation by wooden boat with/without engine. The fishing ground of fishermen from Mokmer and Parai is along the village's shoreline to Padaido Island or even Yapen Island. They are using fishhook and gill net for their fishing activities. There is no market in these villages, so the fish is sold to direct buyers. In case of excess, the fishermen sell them at the town market.

(4) Coral and coral fish

32. Corals are found at a location approximately 50m from coastal line at the depth of between 3-5m. However, the coral condition at Biak is bad as fishermen catch fish by using explosive materials. From 13 translocations, there is only 1 line with 31-50% covered by live coral, 5 lines with 11-30% coverage of live coral, while the remaining 7 lines have a coverage of 0-10%. The results of the survey are shown in Table A5.1.7.

(5) Species listed in the data books/vulnerable ecological system

33. The area does not have any endangered and/or rare species listed in the Red Data Books of the International Union for Conservation of Nature and Natural Resources

(ICUN).

Table A5.1.7 Percent Cover of Benthic Life Form

(Depth : 3 m)

Category	Total % Cover
Live Coral	41.64
Dead Coral	0
Algae	48.76
Other Fauna	8.43
Abiotic Component	1.17
Total	100%

(Depth : 5 m)

Category	Total % Cover
Live Coral	21.07
Dead Coral	0
Algae	51.98
Other Fauna	3.96
Abiotic Component	22.99
Total	100%

(Depth : 10 m)

Category	Total % Cover
Live Coral	4.54
Dead Coral	0
Algae	63.61
Other Fauna	0.01
Abiotic Component	31.84
Total	100%

5.1.7 Wahai

(1) Seawater quality

34. The transparency in the proposed project area is bad. It is caused by sediment transport from Air Besar River near the project area. However, the influence of the river flow on the seawater is only during the rainy season, since during the dry season no water flows from the river. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

35. Seabed quality in the survey area is classified as bad according to the laboratory analysis. The existing seabed is dominated by silt and clay. The value of Zn, Ni, Cr, Cd

and T-Hg indicates that the seabed is polluted by heavy metals. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13.

(3) Fisheries

36. There are only four part-time fishermen in kampung (Village) Air Besar, the proposed project area. Fishing ground is located in front of the proposed ferry port and it has a distance of 1000-3000m. Fishermen conduct their fishing operation by small boats with/without engine. All fish caught is only for local market because there is no land or sea transportation to other cities.

(4) Coral

37. In this location seabed is covered with 50cm thick mud, and translocations were conducted at the depth of 3m. At the left side near the existing port there exist coral of Porites family. According to the survey, the abiotic component is dominant in this coral area with the percentage of 50.73%. Hence, the condition of coral is bad. It is mainly caused by sediment from Air Besar River. The results of the survey are shown in Table A5.1.8.

Table A5.1.8 Percent Cover of Benthic Life Form

(Depth : 3 m)

Category	Total % Cover
Live Coral	30.05
Dead Coral	2.05
Algae	16.90
Other Fauna	0.27
Abiotic Component	50.73
Total	100%

(5) Fauna and flora

38. The types of flora found are mangrove, coastal vegetation, secondary forest and wet tropical forest. There are five types of mangroves and bushes around the proposed project area, but there is none of the protected type of flora. The diversity of fauna is high; some protected fauna were found in the hinterland area (See Table A5.1.9). Those fauna which have to be protected are based on the Government Law No. 5, Minister of Forestry Decree No 301Kpts- II/1991and Minister of Forestry Decree No. 822/Kpts - II/1992.

Table A5.1.9 List of Protected Fauna

Local Name	Scientific Name	English Name	Notes
(Mammal)			
Kus-kus	Phalanger orientalis	Cuscus	Vulnerable
(Reptile)			
Biawak Maluku	Varanus indica	Monitor lizart	Rare kind
Soa-soa	Hydrosaurus amboinensis		Rare kind
(Aves)			
Nuri Kepala Hitam	Lorius domicella	k.o.parrot	Rare kind
Bayan	Electus sp.	k.o.parrot	Vulnerable

Source : Field survey data

5.1.8 Babang

(1) Seawater quality

39. The existing seawater quality is good enough according to the laboratory analysis. Most of the parameters are better than the environmental standards. These data indicate that so far, there is no pollution in this area or pollution is still lower than the carrying capacity of the environment. The result of seawater quality analysis is shown in Table A5.1.12.

(2) Seabed quality

40. The physical appearances of both samples show almost no difference, an indication that there is no significant pollution so far, even if this area is near the existing port. The result of seabed chemical quality analysis conducted in the laboratory is shown in Table A5.1.13. The laboratory analysis results indicate that seabed quality is still better than the environmental standard. So far, there is no organic or heavy metal pollution at the seabed of this area.

(3) Fisheries

41. In Bacan Island, the routine fishery activities are concentrated at Labuha. The activities include fish collection and marketing. The fish product is directly marketed from collector to buyer in Ternate for export purpose. At the project site there is no fishery activity as this location is used only for transportation of people and commodities. This project planning therefore got no negative response from the fishermen. This is due

to the following facts:

1) The location is not a fishing ground area, hence the project will not disturb any line or fish catching area of the fishermen.
2) The fishing activities in the sub-district of Bacan are concentrated in Lubuha area, which has the facilities for docking and fish processing.

(4) Coral

42. Coral reef is a specific ecosystem in tropical areas. The quality of the ecosystem is mainly determined by its component, that is coral stone. According to survey result, it is observed that the environment at the proposed project area has the characteristic of damaged coral reefs. Analysis of Ground Cover Ridge Rock Ecosystem is shown in Table A5.1.10.

Table A5.1.10 Analysis of Ground Cover Ridge Rock Ecosystem

No.	Type of Ground Cover	Station 1 (%)	Station 2 (%)	Average (%)
1	Dead coral	17.42	15.9	16.66
2	Break coral	79.36	78.12	78.74
3	Turf algae	1.62	1.32	1.47
4	Live coral branching	0.05	0.00	0.025
5	Live coral massive	0.98	3.96	2.47
6	Sand	0.00	0.35	0.175
7	Algae	0.45	0.05	0.25
8	Other biota	0.11	0.31	0.21

Notes: 0-24 % : very damaged
25-49 % : damaged
50-74 % : average
75-89 % : good
>90 % : very good

43. With regard to seven (7) types of coral colonies that were observed adjacent to the project area, coral type variability index is in the range of 0.94-1.5. This value indicates that coral productivity in this area is categorized as low. Coral colony species is shown in Table A5.1.11.

Table A5.1.11 Coral Colony Species

Table	Coral Species	Station 1 (3m)	Station 2 (15m)
1	Porites lutea	104	733
2	Porites Sp	124	374
3	Platygyra Daedalea	14	16
4	Goniophora columna	28	24
5	Favia matthaii	12	26
6	Goniastrea pectinate	14	15
7	Acropora andai	15	0
	Total	311	1188
	Index of Diversity	1.5	0.94

(5) Species listed in the data books/vulnerable ecological system

44. The area does not have any endangered and/or rare species listed in the Red Data Books of the International Union for Conservation of Nature and Natural Resources (ICUN).

Table A5.1.12 Summary of Chemical Test Results of Seawater Samples (1/2)

TEST	TEST METHOD	Surabaya				Banjarmasin				Selavar				Labuhan Bajo			
		ST.1		ST.2		ST.3		ST.4		ST.5		ST.6		ST.7		ST.8	
		Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle
pH	APHA 4500	8.3	8.2	8.3	8.3	3.5	3.9	4	4.1	8.1	8.8	8.16	8.14	8.3	8.2	8.3	8.4
Total Suspended Solids (SS)	APHA 2540 D	38.6	53.8	54.2	51	32	78.6	33.2	60.6	118	124	108	128	15.5	18.8	16.4	16.3
Chemical Oxygen Demand (COD)	APHA 5520 D	4	8	4	12	4	12	20	4	21.08	20.474	21.484	21.282	8	12	8	4
Dissolved Oxygen (DO)	APHA 4500-OC	5.08	4.88	5.72	5.50	2.74	2.65	2.58	2.57	7.0	7.0	6.9	7.0	6.21	6.15	6.49	6.05
Oil & Grease (n-hexane soluble matter)	APHA 5520 B	6.5	-	7	-	3	-	1	-	>0.01	>0.01	>0.01	>0.01	4.5	-	3.5	-
Total Conliform at 35-C/ 24hrs	APHA 9222	3543	2943	4860	4517	1947	933	910	707	4	<3	4	4	270	337	197	117
Total Nitrogen (T-N)	APHA 4500 N,B	0.130	0.145	0.160	0.145	0.125	0.11	0.15	0.16	0.009	0.010	0.012	0.010	0.04	0.06	0.07	0.06
Total Phosphorus (T-P)	APHA 4500 P,C	0.204	0.207	0.271	0.303	0.006	0.005	0.01	0.005	0.002	0.019	0.006	0.017	0.01	0.02	0.006	0.009
Total Mercury (T-Hg)	EPA 7471	0.003	0.004	0.003	0.003	0.002	0.002	0.002	0.004	<0.001	<0.001	<0.001	<0.001	0.004	0.003	0.003	0.004
Cadmium (Cd)	EPA 6010	ND	ND	ND	ND	ND	ND	ND	ND	0.014	0.016	0.020	0.012	ND	ND	ND	ND
Cyanide (CN)	APHA 4500-CN,C	ND	ND	ND	ND	ND	ND	ND	ND	0.016	0.018	0.022	0.020	ND	ND	ND	ND
Or-P	APHA 4500 P,B/C	0.105	0.019	0.015	0.13	0.004	0.004	0.005	0.004	<0.001	<0.001	<0.001	<0.001	0.006	0.008	0.004	0.004
Lead (Pb)	EPA 6010	5E-04	ND	ND	ND	0.002	ND	ND	0.002	0.025	0.0246	0.182	0.165	ND	ND	ND	ND
Chromium (Cr)	EPA 6010	ND	ND	ND	ND	ND	ND	ND	ND	0.012	0.014	0.012	0.028	ND	ND	ND	ND
Arsenic (As)	EPA 6010	0.9	0.7	1.2	1.4	0.7	0.6	0.9	1.1	0.008	0.010	0.006	0.010	0.3	0.2	0.3	0.3
Zinc (Zn)	EPA 6010	0.029	0.031	0.034	0.034	0.053	0.068	0.049	0.076	0.0248	0.0255	0.0195	0.0198	ND	ND	ND	ND
Nickel (Ni)	APHA321A	ND	ND	ND	ND	0.028	0.031	0.032	0.03	0.162	0.184	0.18	0.156	ND	ND	ND	ND
Polychlorinated Biphenyls (PCB)	EPA 8080/8270	ND	ND	ND	ND	0.028	0.031	0.032	0.03	ND	ND	ND	ND	ND	ND	ND	ND

Table A5.1.12 Summary of Chemical Test Results of Seawater Samples (2/2)

TEST	TEST METHOD	Manokwari				Biak				Wahai				Babang			
		ST.9		ST.10		ST.11		ST.12		ST.13		ST.14		ST.15		ST.16	
		Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle	Surface	Middle
pH	APHA 4500	8.28	8.28	8.43	8.4	8.63	8.48	8.7	8.58	8.51	8.53	8.5	8.56	8.34	8.43	8.4	8.4
Total Suspended Solids (SS)	APHA 2540 D	0.075	0.11	0.066	0.107	0.077	0.102	0.061	0.103	0.222	0.236	0.231	0.244	144	144	118	146
Chemical Oxygen Demand (COD)	APHA 5520 D	36	35	34	35	45	43	43	44	64	65	63	64	210.8	202.71	206.76	190.6
Dissolved Oxygen (DO)	APHA 4500-OC	7.21	6.81	7.05	6.42	6.49	6.42	6.66	6.1	5.76	5.18	4.5	4.43	7.3	6.1	7.3	6.1
Oil & Grease (n-hexane soluble matter)	APHA 5520 B	0.004	0.002	0.002	0.001	0.002	0.002	0.003	0.001	0.005	0.007	0.004	0.008	<0.01	<0.01	<0.01	<0.01
Total Coliform at 35~C/ 24hrs	APHA 9222	900	-	1760	-	54	-	1650	-	1970	-	1176	-	4	4	4	<3
Total Nitrogen (T-N)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.004	0.004	0.004	0.012	0.013	0.012	0.013
Total Phosphorus (T-P)	APHA 4500 P,C	0.0009	0.0009	0.0008	0.0008	0.0008	0.0009	0.0008	0.0009	0.001	0.001	0.001	0.001	0.018	0.005	0.025	0.005
Total Mercury (T-Hg)	EPA 7471	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0007	ND	0.0007	<0.001	<0.001	<0.001	<0.001
Cadmium (Cd)	EPA 6010	0.030	0.040	0.030	0.040	0.026	0.030	0.050	0.020	0.034	0.037	0.025	0.029	0.012	0.018	0.024	0.021
Cyanide (CN)	APHA 4500-CN.C	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.018	0.020	0.020	0.025
Or-P	APHA 4500 P,B/C	0.0006	0.0006	0.0007	0.0007	0.0005	0.0006	0.0007	0.0007	0.0008	0.0009	0.0009	0.0009	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	EPA 6010	0.134	0.101	0.148	0.113	0.1550	0.120	0.115	0.0950	0.048	0.055	0.053	0.051	0.024	0.022	0.032	0.038
Chromium (Cr)	EPA 6010	1.000	0.410	0.740	0.100	0.513	0.600	0.670	0.820	0.795	1.051	0.513	0.18	0.015	0.012	0.018	0.024
Arsenic (As)	EPA 6010	0.001	0.0	0.0	0.001	0.002	0.002	0.0	0.0	0.018	0.018	0.018	0.018	0.008	0.006	0.008	0.014
Zinc (Zn)	EPA 6010	0.031	0.034	0.047	0.021	0.027	0.04	0.028	0.039	0.02	0.01	0.022	0.014	0.0289	0.0282	0.0238	0.0248
Nickel (Ni)	APHA321A	0.011	0.014	0.016	0.042	0.326	0.358	0.032	0.211	0.195	0.158	0.205	0.2	0.215	0.283	0.301	0.280
Polychlorinated Biphenyls (PCB)	EPA 8080/8270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table A5.1.13 Summary of Chemical Test Results of Seabed Samples

TEST	TEST METHOD	Surabaya		Banjarmasin		Selayar		Labuhan Bajo		Manokwari		Biak		Wahai		Babang	
		ST.1	ST.2	ST.3	ST.4	ST.5	ST.6	ST.7	ST.8	ST.9	ST.10	ST.11	ST.12	ST.13	ST.14	ST.15	ST.16
pH value (1:2.5) (Soil:Water Extract)	EPA9045	8.6	8.5	7.1	6.7	7.74	7.84	8.4	8.2	8.21	8.2	8.3	8.29	7.6	7.59	7.74	7.84
Ignition Loss at 900~C (% wt.)	Furnace method	15.76	13.04	16.85	17	2.46	5.07	36.58	36.75	0.23	0.29	0.58	0.55	1.56	1.21	0.54	0.4
Oil & Grease (n-hexane soluble matter)	EPA 9071	2260	180	120	80	<0.01	<0.01	40	140	0.19	0.216	0.173	0.161	0.211	0.225	<0.01	<0.01
Chemical Oxygen Demand (COD)	APHA 5220B	384	345	1.184	1.176	200	236.42	165	55	290	253	201	201	361	373	190.94	145.47
Total Sulphate (T-S)	EPA 9030	11.4	11	18.4	16.7	52	56.4	11	10.7	21.1	22	28.1	27.3	31.2	33.1	6.80	6.60
Total Nitrogen (T-N)	Kjeldahl method	0.65	0.627	0.415	0.43	0.186	0.342	0.125	0.13	0.7	0.5	0.9	0.7	0.1	0.12	0.072	0.042
Total Phosphorus (T-P)	APHA 4500-P	27.903	10.426	15.395	1.992	0.028	0.045	6.483	6.963	2.059	2.043	2.024	2.009	4.257	4.159	0.015	0.013
Total Mercury (T-Hg)	EPA 7471	0.0625	0.1499	0.2124	0.2124	0.007	0.004	0.1	0.199	ND	6.22	1.746	ND	9.586	13.69	0.008	0.002
Cadmium (Cd)	EPA 6010	0.0249	0.0125	0.0375	0.0125	0.018	0.027	0.1375	0.0999	6.120	7.540	2.580	3.580	3.380	3.430	0.009	0.007
Cyanide (CN)	EPA 9010	0.05	0.07	0.08	0.06	0.042	0.068	0.01	0.01	0.017	0.017	0.015	0.015	0.01	0.01	0.018	0.012
Or-P	APHA 505A	11.215	6.415	10.525	0.116	<0.001	<0.001	112.6	3.870	1.888	1.934	1.996	1.99	3.081	3.573	<0.001	<0.001
Lead (Pb)	EPA 6010	11.4	10.79	9.89	10.45	4.105	5.102	2.52	2.56	11.59	10.87	8.19	9.23	21.46	27.97	2.015	1.82
Chromium (Cr)	EPA 6010	12	8.87	12.01	12.42	0.0260	0.196	7.87	8.31	32.54	52.11	166.46	161.08	64.370	68.930	0.028	0.015
Arsenic (As)	EPA 6010	2.2	2.0	4.4	4.7	0.016	0.064	1.0	1.5	6.604	6.604	1.926	1.926	16.7	16.7	0.016	0.012
Polychlorinated Biphenyls (PCB)	EPA 8080/8270	0.0032	ND	0.0036	0.0008	ND	ND	0.0005	0.0005	ND	ND	ND	ND	ND	ND	ND	ND
Copper (Cu)	EPA 6010	22.32	20.84	11.61	11.94	0.063	0.096	1.65	7.14	1.021	1.022	1.069	2.38	1.036	1.019	0.043	0.057
Nickel (Ni)	APHA321A	7.1	5.9	20.2	19.5	0.92	0.825	1.3	1.9	118.16	145.02	143.28	152.57	129.99	106.23	0.682	0.203
Zinc (Zn)	EPA 6010	61.36	64.1	66.34	71.63	8.462	9.224	7	7.91	9.05	7.34	4.92	5.35	15.67	18.16	4.821	5.693

A5.2 Environmental Impact Monitoring Plan (RPL)

5.2.1 Objectives and Goal

1. The environmental impact monitoring plan (RPL) shall be based on the decree of Minister of Communication No. KM-75, 1994 which contains the technical guidelines for the environmental impact assessment process of the port affairs. The documents for environmental impact monitoring plan describes the environmental monitoring methodology to be done by the agency in charge of environmental monitoring function during the port development and operation.

5.2.2 Benefit

2. The RPL comprises the monitoring and evaluation program for RKL implementation during the design, construction, and operation of the proposed ferry port development project. Wherever applicable, implementation schedules for monitoring activities and a clear delineation of responsibilities are given.

5.2.3 Period of Environmental Monitoring Plan

3. The environmental monitoring plan for this port will be undertaken in the following three periods :

- Before the start of the detailed design
- During construction
- During operation

5.2.4 Procedures of the Environmental Monitoring Plan

4. The timing of environmental monitoring plan for the project will be carried out during the three phases as mentioned above and the post construction phase. Furthermore, the initial timing of the environmental monitoring shall commence after the RPL documents have been approved and signed by the concerned authority. The general approach to be applied to the environmental monitoring is focused and described on the following aspects :

- Technical approach
- Economic approach
- Institutional approach

(1) Technical approach

5. Prior to the implementation of the ferry port development project, an intrinsic knowledge of the environment is required. The environmental constraints to port facilities and an impact prediction/evaluation have been presented in Volume 1. These, together with a better understanding of the environmental situation of the port, will minimize environmental damage during the project execution. Technical approaches opted for should be appropriate considering the environmental conditions, and the level of education of the project staff in the field.

(2) Economic approach

6. In deciding the most appropriate measures to achieve the overall objective of minimizing environmental damage, cost/benefit considerations, communal aspirations and local conditions have been taken into account. The majority of RPL program activities would require funds from this port development project.
To effectuate a successful implementation of the Environmental Monitoring Plan, specific measures to prevent deterioration of current environmental parameters could be described in specifications and conditions of contract. These legal documents between project proponent and the contractors will identify permitted construction & operation method with enforceable penalties for non-compliance and violations.

(3) Institutional approach

7. Environmental monitoring activities should be in line with applicable legislations. Both the project executing body as well as the proponent should take joint responsibilities with regard to execution of the environmental management plan.

5.2.5 Implementing Agency

8. To ensure the effectiveness of Environmental Monitoring, it is necessary to have an Institution responsible for its implementation. This institution will be the coordinator for the implementation of the environmental monitoring . The institution responsible for the coordination of the environmental management plan shall be decided based on government laws and regulations.

5.2.6 Methodology of Environmental Impact Monitoring

9. To obtain the correct data for environment conditions, monitoring and data collection such as questionnaire, interview, survey, statistical data collection, inspection and observation shall be carried for the following items :

- Observation of air quality
- Observation of water quality
- Observation of ecology
- Observation of coastal hydrology
- Survey of local community
- Survey of fishing activity, etc.

10. The monitoring activity will be undertaken at the port area, and at places related to port activities and the town area. Monitoring will be carried out before the construction period, during the construction period and after the commencement of operations at the port area. The frequency of monitoring will vary depending on the frequency laid down for each parameter. Some parameters may have a frequency of monitoring daily, others are monthly or yearly. Some parameters may only require to be monitored once in a given period while some parameters may be monitored daily in a given period. Others may require monitoring as they become apparent.

5.2.7 Surabaya

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Social conflict due to resettlement

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- *Dust and noise pollution* due to mobilization of equipment and construction materials

Construction of port facilities :

- Traffic jam due to mobilization of equipment and construction
- *Damage to marine ecology due to reclamation, dredging, piling, etc.*

- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(3) Operation stage

- Damage to marine ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of traffic
- Increase of local employment
- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition

5.2.8 Banjarmasin

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Conflict due to resettlement

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, dredging, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment

(3) Operation stage

- Damage to river ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of traffic
- Increase of local employment
- Public health and sanitation
- River water pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

5.2.9 Selayar

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Social unrest due to field survey for detailed design
- Social conflict due to resettlement

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, dredging, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(3) Operation stage

- Damage to marine ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of traffic
- Increase of local employment

- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

5.2.10 Labuhan Bajo

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Social unrest due to field survey for detailed design

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(3) Operation stage

- Damage to marine ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of the traffic
- Increase of local employment
- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

5.2.11 Manokwari

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Social conflict due to resettlement

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(3) Operation stage

- Damage to marine ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of traffic
- Increase of local employment
- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

5.2.12 Biak

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Social unrest due to field survey for detailed design

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(3) Operation stage

- Damage to marine ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of traffic
- Increase of local employment
- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

5.2.13 Wahai

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Conflict due to resettlement

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction

materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity increased by earthwork in coastal area.
- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(3) *Operation stage*

- Damage to marine ecology due to port operation
- *Air pollution and noise*
- Traffic jam by loading and unloading of traffic
- Increase of local employment
- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

5.2.14 Babang

Environmental Component Affected by Project

(1) Pre-construction stage

Field survey and land acquisition

- Social unrest due to field survey for detailed design
- Conflict due to resettlement

(2) Construction stage

Equipment and manpower mobilization

- Damage to road surface due to mobilization of heavy equipment
- Dust and noise pollution due to mobilization of equipment and construction materials

Construction of port facilities

- Traffic jam due to mobilization of equipment and construction
- Damage to marine ecology due to reclamation, piling, etc.
- Damage to aquatic habitats and human health due to siltation and turbidity

increased by earthwork in coastal area.

- Disturbance of fishing activity
- Temporary restraint on local traffic due to the transportation
- Increase of local employment
- Physical damage to coastal ecology

(2) Operation stage

- Damage to marine ecology due to port operation
- Air pollution and noise
- Traffic jam by loading and unloading of traffic
- Increase of local employment
- Public health and sanitation
- Seawater pollution due to oil spills, etc.
- Change of coastal hydrology due to deposition and erosion

Table A5.2.1 Environmental Assessment Summary Matrix : Surabaya

Proposed Project Activity	Environmental Component Affected	Prediction of Impact Type	Significance	Impact Mitigation Alternatives: Environmental Management Plan	Impact Mitigation Alternatives: Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	1	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	1	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1*	*Minimize the disturbance on regular* traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with *fishing activities* due to construction work	1	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	1	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.1 Environmental Assessment Summary Matrix : Surabaya

Proposed Project	Environmental Component	Prediction of Impact		Impact Mitigation Alternatives	
Activity	Affected	Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	1	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	1*	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3	1* The environmental impact to the existing traffic system will be resolved after widening plan of the existing road.
	Moderate negative impact	2	
	Minor (little) negative impact	1	
	Positive	0	
	No effect is expected	-	

Table A5.2.2 Environmental Assessment Summary Matrix : Banjarmasin

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	1	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	1	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1**	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	1	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.2 Environmental Assessment Summary Matrix : Banjarmasin

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	1	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	1**	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :		
	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-

1** The environmental impact to the existing traffic system will be resolved after completion of new highway project.

Table A5.2.3 Environmental Assessment Summary Matrix : Selayar

Proposed Project Activity	Environmental Component Affected	Prediction of Impact Type	Significance	Impact Mitigation Alternatives Environmental Management Plan	Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	1	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	-	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	-	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.3 Environmental Assessment Summary Matrix : Selayar

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	-	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	-	To minimize the disturbance on regular traffies: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-

Table A5.2.4 Environmental Assessment Summary Matrix : Labuhan Bajo

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	1	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	-	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	-	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.4 Environmental Assessment Summary Matrix : Labuhan Bajo

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	-	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	-	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-

Table A5.2.5 Environmental Assessment Summary Matrix : Manokwari

Proposed Project Activity	Environmental Component Affected	Prediction of Impact Type	Significance	Impact Mitigation Alternatives Environmental Management Plan	Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	-	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	-	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	-	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.5 Environmental Assessment Summary Matrix : Manokwari

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	-	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	-	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-

Table A5.2.6 Environmental Assessment Summary Matrix : Biak

Proposed Project Activity	Environmental Component Affected	Prediction of Impact Type	Significance	Impact Mitigation Alternatives: Environmental Management Plan	Impact Mitigation Alternatives: Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	-	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	-	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (*pH, SS, metal oxides, etc.* First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	-	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.6 Environmental Assessment Summary Matrix : Biak

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	-	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	-	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-

Table A5.2.7 Environmental Assessment Summary Matrix : Wahai

Proposed Project Activity	Environmental Component Affected	Prediction of Impact Type	Significance	Impact Mitigation Alternatives Environmental Management Plan	Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	-	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	-	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	-	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.7 Environmental Assessment Summary Matrix : Wahai

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	-	Proper air pollution control	Survey of number of vehicles. Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	-	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles.
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-

Table A5.2.8 Environmental Assessment Summary Matrix : Babang

Proposed Project Activity	Environmental Component Affected	Prediction of Impact Type	Significance	Impact Mitigation Alternatives: Environmental Management Plan	Impact Mitigation Alternatives: Environmental Monitoring Plan
Pre-construction Stage					
Land acquisition	Local community	Social unrest due to field survey	-	Dissemination of information about aims of project	Negative perception of the project among inhabitants
	Local community	Social conflict due to resettlement	-	Setting-up of relocation program, placing of signpost of restrictions to build facilities on the right of way	Negative response among inhabitants
Construction Stage					
Equipment and manpower mobilization	Transportation	Damage to road	-	Selection of lightest equipment where feasible	Comparison of equipment weight to specification of roads, required inspection of road conditions
Construction/mobilization	Local community	Dust and noise due to equipment mobilization	1	Signpost for speed limits of vehicles, Mobilization only during daytime	Number of over-speeding vehicles, Measurement of noise (dB)
Construction of port facilities	Local community	Traffic jam	1	Minimize the disturbance on regular traffic by proper planning, re-routing, scheduling of transportation to off peak hours, and if appropriate night hours.	Safety management, Length of temporary detours necessitated by construction work
	Soil toxicity and water quality	Damage to marine ecology	1	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	parameter (pH, SS, metal oxides, etc. First 4 month, weekly, then monthly at a net-work of strategic point on and off-schemes.
	Aquatic habitats and human health	Increase in siltation and turbidity of coastal area	-	Reclamation, dredging : countermeasures to reduce pollution and to prepare necessary construction procedures. Careful selection of disposal area.	Measurement of seawater turbidity
	Fishing activity	Interference with fishing activities due to construction work	-	One month prior notice and information to community	Negative response among fishermen.
	Transportation	Temporary restraint of local traffic	-	One month prior notice and information to community	Number of simultaneous traffic construction site, Length of temporary detours necessitated by construction activities. Negative response among inhabitants

Table A5.2.8 Environmental Assessment Summary Matrix : Babang

Proposed Project Activity	Environmental Component Affected	Prediction of Impact		Impact Mitigation Alternatives	
		Type	Significance	Environmental Management Plan	Environmental Monitoring Plan
Construction Stage					
Construction of port facilities	Employment	Local employment opportunity	0	Use skilled/unskilled manpower from project area	
	Ecology	Physical damage to coastal ecology	-	Careful project design and selection of construction methods.	Monitoring of fauna and flora in the coastal area
Operation Stage					
Ferry Port operation	Aquatic Life	Damage to marine ecology	-	Liquid waste from port facilities: provide water treatment/sewage disposal system in design	Measurement of water quality parameter (pH, SS, metal oxides, etc.)
	Air pollution and Noise	Damage to hygiene and health	-	Proper air pollution control	Survey of number of vehicles, Measurement of noise (dB)
	Seawater Quality	Damage to marine ecology	-	Oil spills/Leakage within port which escape port area: Strict management of vessels	Measurement of contents of oil in the port area. (Oil, monthly, at a net-work of strategic point)
	Local community	Traffic jam	-	To minimize the disturbance on regular traffics: proper planning , re-routing and scheduling of transports to off-peak hours are required	Survey of number of vehicles,
	Local community	Employment	0	Use skilled/unskilled manpower from project area	
	Local community	Public Health and Sanitation	-	Sanitation of solid waste, especially floatable including garbage: provide incineration system for the solid waste in design	Extraordinary attention to waste management from port facilities
	Coastal hydrology	Physical damage to coastal hydrology and facilities (deposition and erosion)	-	Careful project design with respect to hydrology ,plus protection facilities.	Monitoring of hydrological conditions at the project area and coastal area.

Level of Significance :	Serious negative impact	3
	Moderate negative impact	2
	Minor (little) negative impact	1
	Positive	0
	No effect is expected	-