22.10 Preliminary Engineering Studies

22.10.1 Preliminary Design of Port Facilities

(1) Design Vessel

The proposed container berth is designed to accommodate container ship with maximum capacity of about 5,000 DWT .The proposed design ship has the following dimensions:

Container Ship: 5,000 DWT, Overall Length: 110 m
Breadth: 15.7 m, Full loaded Draft: 5.5 m

As for the wharf depth, an additional depth is required for the keel clearance of the ship (10% of the full loaded draft). Then the wharf depth is calculated in the following equation; 5.5 m x 0.1+5.5m-0.2m(LWL) = 6.0m.

(2) Design Conditions and Design Criteria

1) Codes and Standard

The design criteria of marine and civil works conform to the following design standards and references.

- "Standard Design Criteria for Ports in Indonesia, 1984"
- "Technical Standards for Port and Harbour Facilities in Japan, 1999"

2) Design Criteria

The details of major design criteria for Master Plan are summarized in Table 22.10.1

Table 22.10.1 General Design Criteria

	Talang Duku	Muara Sabak	
		Container Berth	General Cargo Berth
Seismic coefficient	0.05	0.05	0.05
Load on berth	3t/m^2	3t/m^2	3t/m^2
Load on yard	4t/m^2	4t/m^2	4t/m^2
Truck	T-20	T-20	T-20
RTG on yard	Max.32t/wheel	Max.32t/wheel	-
Gantry Crane on berth	Max 45t/wheel	Max 45t/wheel	-
Berth top elevation	+1.5 to +8.5	+5.6	+5.6
Berthing velocity of ship	15cm/sec	15cm/sec	15cm/sec
Subsoil condition	SPT 25-53	Sandy silt	Sandy silt
Assuming depth of hard strata	-	-20m	-20m

3) Tide

The water level fluctuations including tide and floodwater at both sites are as follows:

Talang Duku: HWL = +7.0m , LWL = +0.2m
Muara Sabak: HWL = +3.8m, LWL = +0.2 m

(3) Layout

1) Talang Duku

As explained in the master plan, new floating pontoons are proposed in addition to the existing pontoon to complement the berthing facility for container vessels. The new pontoon will be of the same size as the existing one, connected by new movable access bridge between pontoon and land. The existing container-handling yard will be extended to the southern area near the existing IPC II office building. With this extension, the existing Warehouse will be demolished and a new workshop for the terminal will be constructed.

A pontoon with two movable access bridges and the yard extension with the related facilities is to be installed in the first development phase. Another pontoon with an access bridge is to be installed in the third development phase.

The major facilities and container handling equipment in the master plan for Talang Duke are summarized in Table 22.10.2. The general layout is shown in Figure 22.10.1.

Table 22.10.2 Facilities and equipment for Talang Duku

Facility	Descriptions	Phase I	Phase II	Phase III
Pontoon	Steel, 60m x 17m	1 unit		1unit
Access Bridge	Steel,	2 units		1unit
Yard Pavement	T-20	31,200m^2		
RTG Lane	1.5m width, RC beam	2,300 m^2		
Container Sleeper	1.5m width, RC beam	2,600 m^2		
CFS	54m x 30m	1,600 m^2		
Workshop	40m x 30m	1,200 m^2		
Utilities	Power, Water, Drainage	L.S		
Equipment	Capacity	Phase I	Phase II	Phase III
RTG	6 lanes, 1 over 4		2 units	2 units
Mobile Crane	50 t		1 units	1 units
Yard Tractors	20" , 40"		4 units	4 units

2) Muara Sabak

The development of new container and general cargo terminal is planned at both sides of the existing concrete pier in Muara Sabak. Two alternatives are studied for the development: base case and high public case.

In the base case, three (3) container berths and one (1) general cargo berth are planned in the first four (4) construction phases. The container berths will be 375 m of the total length with 28 m width. The general cargo berth will be 125 m length with 17 m width. The western area of these berths is allocated for the container and open storage yard with related facilities. Each berth will be connected to the yard by an access bridge.

In the high public case, one(1) container berth of 125m long with an access bridge and connected container yard are planned in the fifth construction phase at the northern side along with the previous construction phase.

The major facilities and container handling equipment in the master plan for Muara

Sabak are summarized in Table 22.10.3. The general layout is shown in Figure 22.10.2.

Table 22.10.3 Facilities and equipment for Muara Sabak

Facility	Descriptions	Phase I	Phase II	Phase III	Phase IV	Phase V
Container Berth	125m x 28m	1 unit		1 unit	1 unit	1unit
Cargo Berth	125m x 17m	-	1 unit	-	-	-
Access Bridge	10m x 50m to 60m	2 units	2 units	1 units	1 unit	1unit
Yard Pavement	T-20	22,650m^2	21,600 m^2	25,550 m^2	22,650 m^2	25,550 m^2
RTG Lane	1.5m width, RC beam	1,200 m^2	-	1,200 m^2	1,200 m^2	1,200 m^2
Container sleeper	1.5m width, RC beam	1,150 m^2	-	1,150 m^2	1,150 m^2	1,150 m^2
CFS	56m x 40m	2,240 m^2	-	-	2,240 m^2	-
Warehouse	90m x 40m	-	3,600 m^2	-	-	-
Workshop	R.C	1,200 m^2	1,200 m^2	-	-	-
Terminal Office	R.C	600 m^2	600 m^2	-	600 m^2	-
Access Road	Terminal Access	5,520 m^2	480 m^2	2,000 m^2	2,000 m^2	2,000 m^2
Utilities	Power, Water, Drainage, Sewerage	L.S	L.S	L.S	L.S	L.S
Equipment	Capacity	Phase I	Phase II	Phase III	Phase IV	Phase V
Quay Gantry Crane	12m-span, 20m-reach, 17m-height, 44-ton	1 unit	-	1unit	1unit	1unit
RTG	6 lanes, 1 over 4, 35-ton	2 units	-	2 units	2 units	2 units
Mobile Crane	25-ton	2 units	1 unit	-	-	-
Reach Stacker	40-ton	1 unit				
Yard Tractors	20" , 40"	4 sets	-	4 sets	4 sets	4 sets
Forklift	3 t Diesel	5 units	5 units	-	-	-

(3) Design of Port Facilities

1) Floating Berth (Pontoon) and Access Bridge for Talang Duku Port

The pontoon is proposed as the berthing facility in order to avoid the high initial cost of berth construction with quay handling equipment, taking it into consideration the future demand of the container and cargo handling volume. With respect to the large difference of annual water level (0m to +7m), the floating berth with ship gear is more economical than the fixed berth structure with handling equipment.

A floating berth (pontoon) made of a steel structure of approx. 62 m length and 17 m width is determined, which is the similar scale and structure with that of the existing pontoon. The access bridge between the terminal yard and pontoon is also a steel structure as same as the existing movable bridges. The typical section of the pontoon and access bridge is shown in Figure 22.10.3

2) Container and General Cargo Berth for Muara Sabak Port

A detached pier type RC deck structure supported by the steel pile piles was proposed for the container berth. Steel pipe piles will be driven into sand stone layer (N value > 50). Vertical piles and coupled batter piles of the same diameter will be used for the foundation of the deck structure. Crane rails will be installed just above the concrete deck to support the gantry crane. The general cargo berth and the access bridges are also of the similar structure as the container berth, however, the diameter of the piles and scale of the RC deck are smaller than the container berth.

The typical section of the berths and Access Bridge are shown in Figure 22.10.4

3) Pavement (Road, container yard and general cargo open storage)
Roads and areas subject to paving works are listed as follows:
- Container storage areas and general cargo open storage
- RTG runway beam (RTG Lane)
- Container Sleeper
- Roads and Other area of Container Terminal

Depending on the facilities and their uses, different pavement types are applied to suit to their function as described as follows:
- Container storage areas and general cargo open storage
  80 mm thick of rectangular interlocking blocks, 50 mm of sand, 200 mm thick of cement bound material, a crushed aggregate sub base (300 mm) are layered on top of the compacted sub grade.
- RTG runway beams
  Rubber Tired Gantry Crane (RTG) requires a long span passage with 1.5 m width, in order to stand its loading weight of more than 38 tons per wheel. The lanes are generally made of the reinforcing concrete slab (RC slab) having 300 mm thickness with sub- base (300 mm) on top of the compacted sub grade. The joint of the spans will be provided on the RC base in order to avoid unequal settlement and to allow for the smooth operation of the RTG.
- Container Sleeper
  Since containers will be generally stacked and arranged in fixed positions in the yard slots, a base named Container Sleeper to bear the containers' concentration load will be provided. The Container Sleeper is 1.5 m width and similar structure as RTG lane.
- Roads and Other area of Container Terminal
  The vehicle traffic lanes run parallel to the container stacking areas and access road to the terminal are planned to be paved with concrete. The pavement consists of concrete slab of 250 mm thick, on top of a crushed aggregate sub-base (300 mm) over the compacted sub-grade.

4) Buildings
The proposed port buildings are determined in accordance with the following principles.
- Rational and functional design for efficient port management and operation.
- Smooth flow line planning
- Flexibility to the future port expansion
- Utilization of local construction methods and materials
- Economical design

The proposed buildings are basically planned as RC column structure.

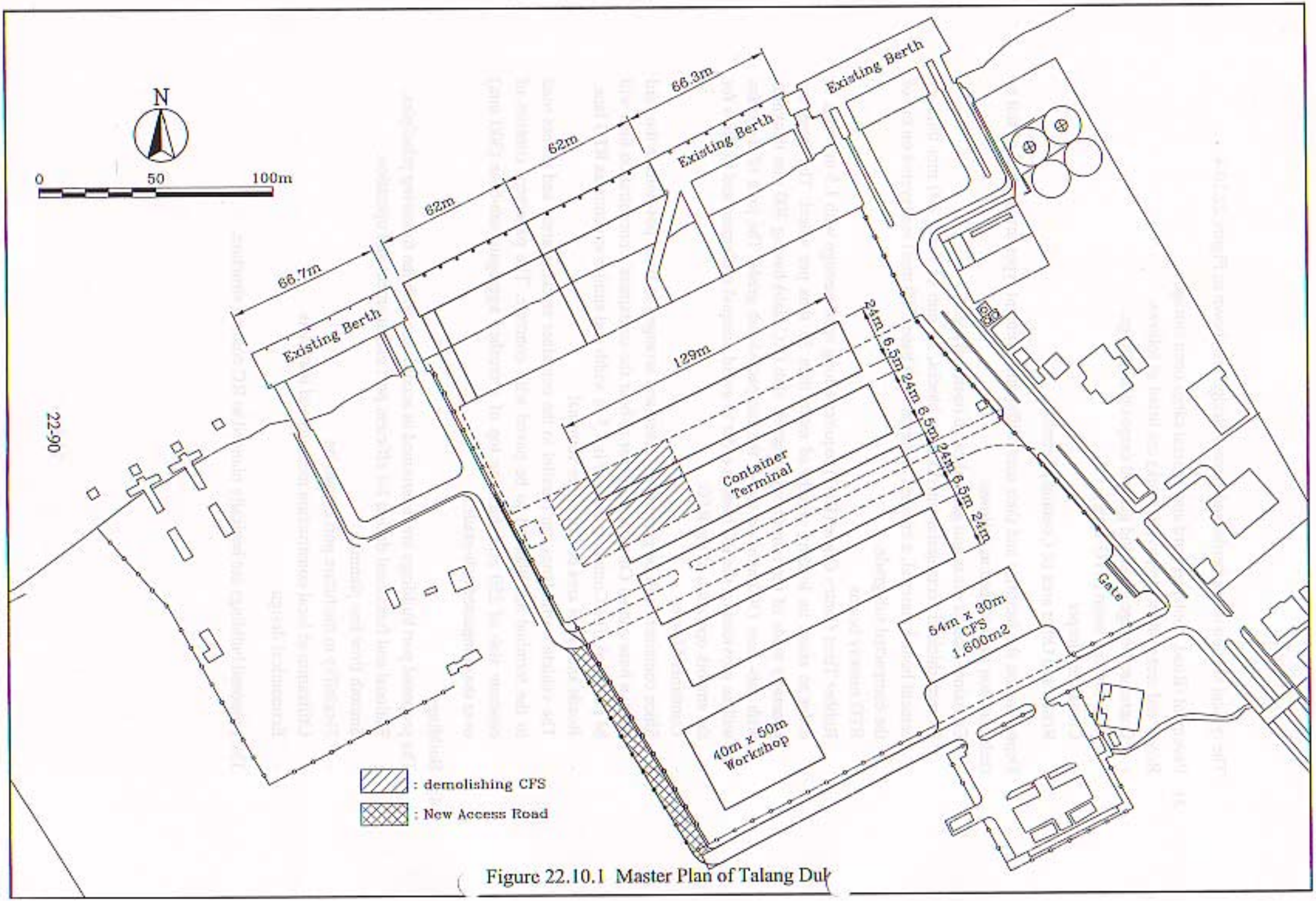


Figure 22.10.1 Master Plan of Talang Duk

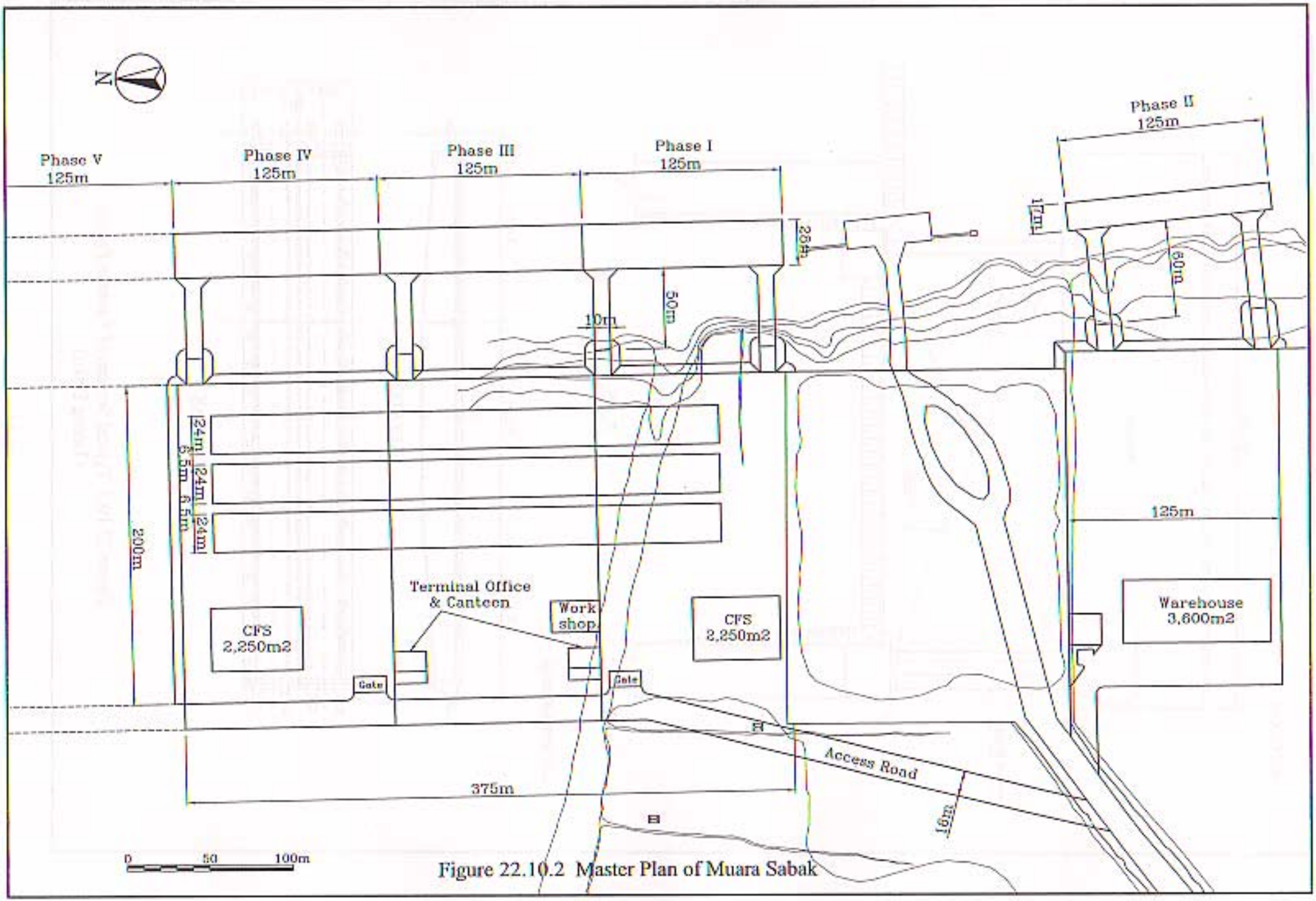
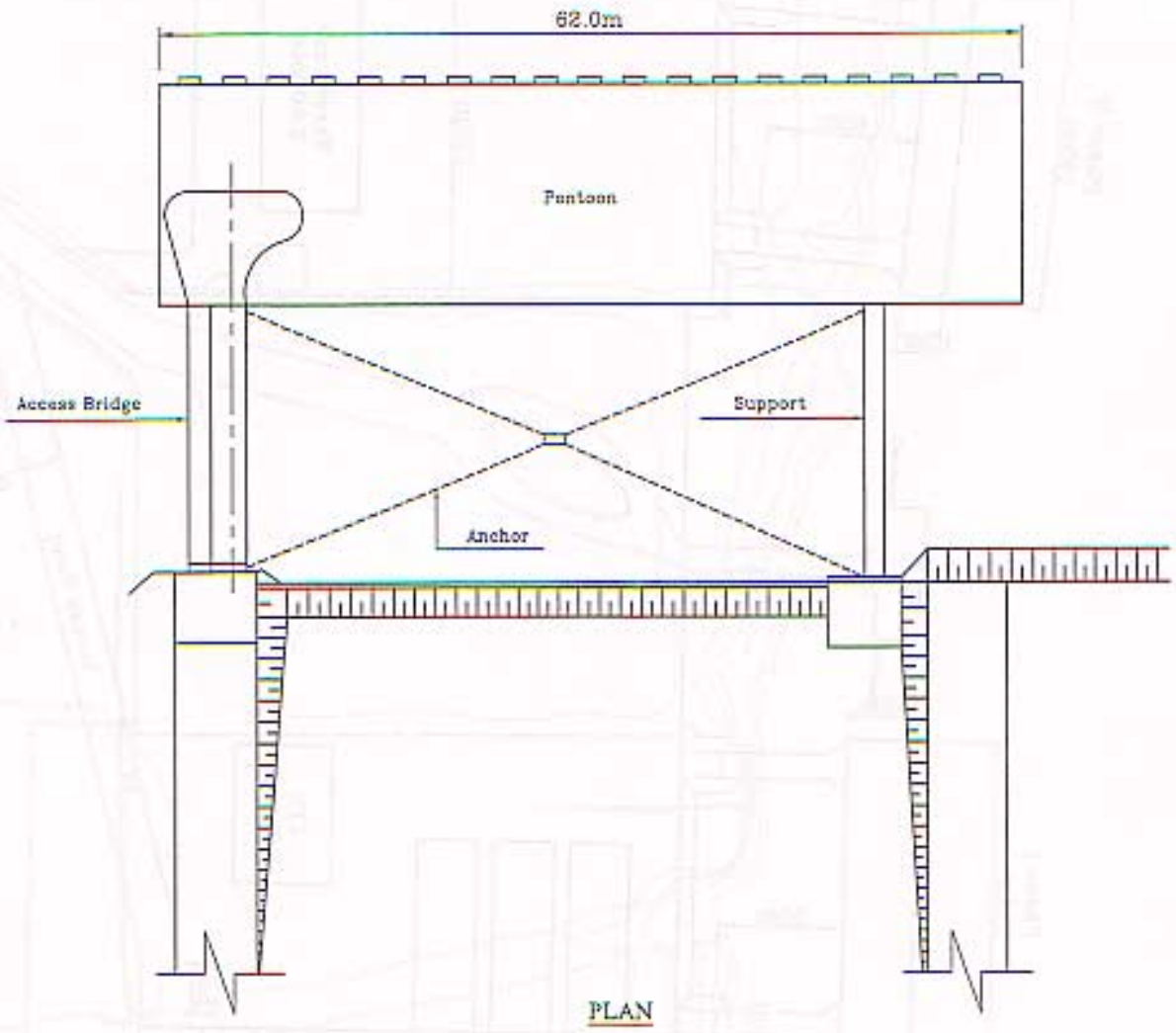


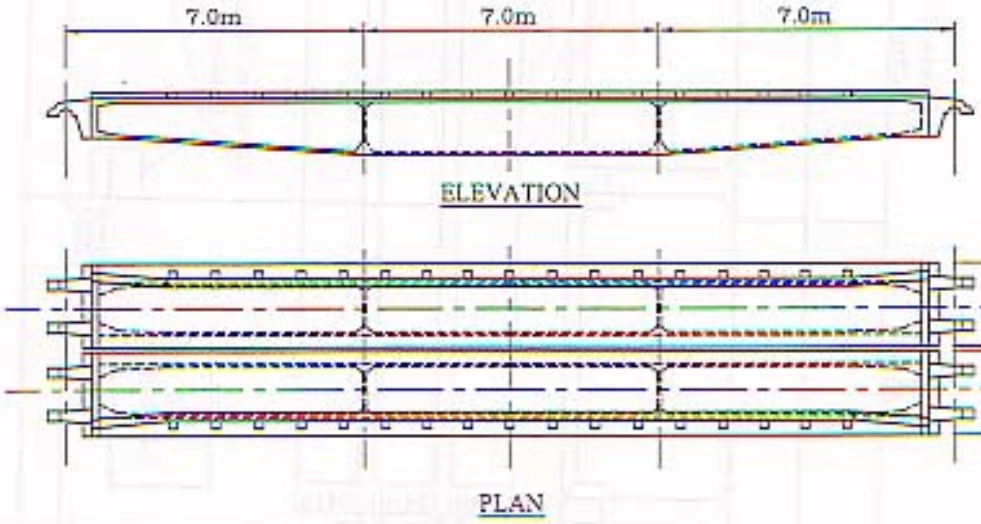
Figure 22.10.2 Master Plan of Muara Sabak

PONTOON



PLAN

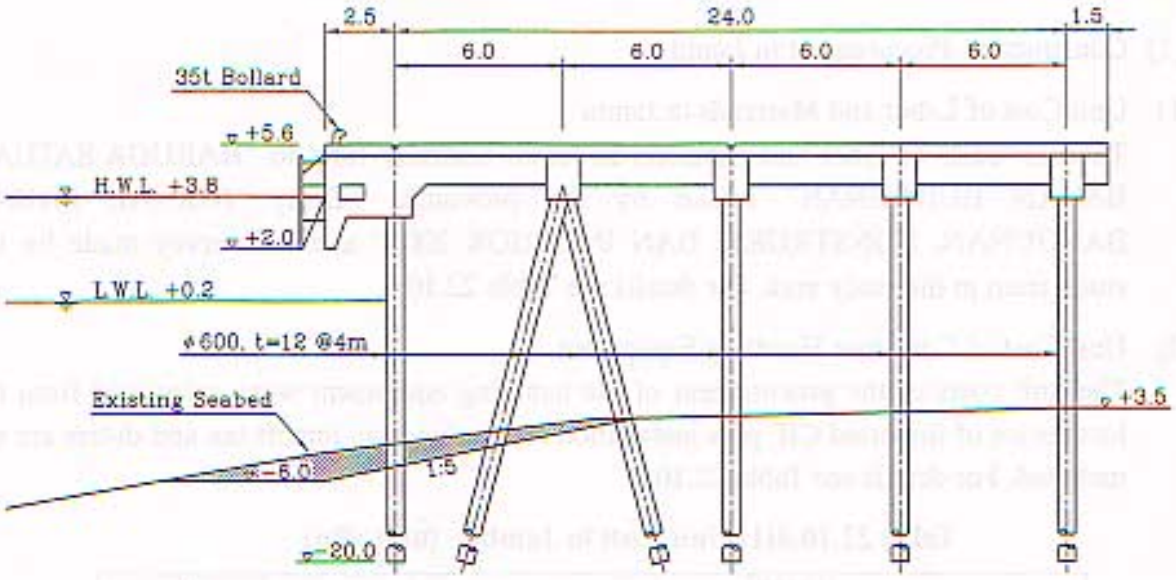
ACCESS BRIDGE



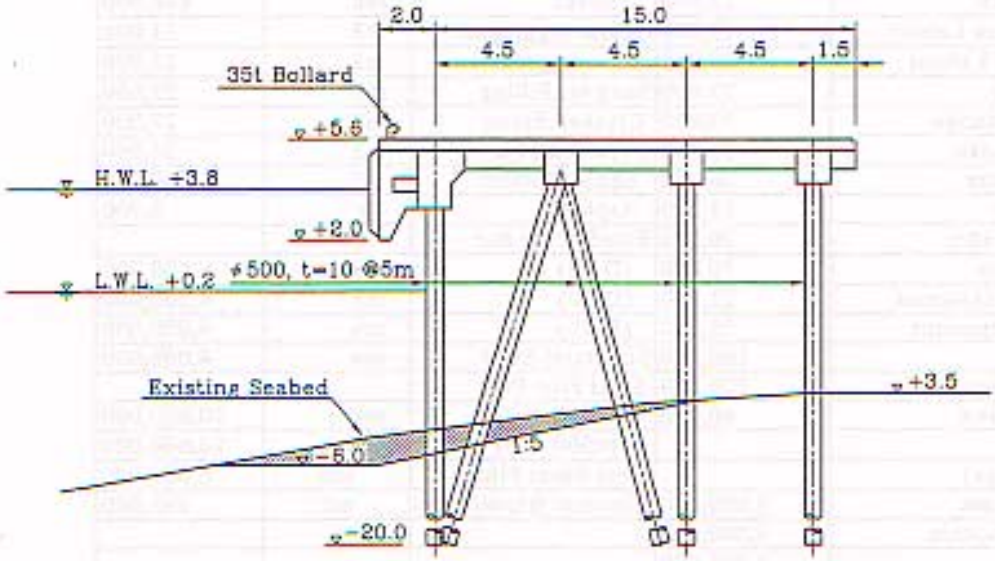
ELEVATION

PLAN

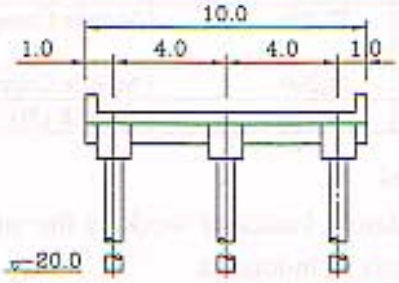
Figure 22.10.3 Typical Section of Pontoon Facility
(Talang Duku)



Muara Sabak Container Terminal



Muara Sabak General Cargo Berth



Muara Sabak Access Bridge

Figure 22.10.4 Typical Section of Berth Facility

22.10.2 Cost Estimation

(1) Construction Procurement in Jambi

1) Unit Cost of Labor and Materials in Jambi

The unit costs of labor and materials in Jambi basically refer to "HARUGA SATUAN BAHAN BUNGUNAN" issued by the provincial office, "JURNAL BAHAN BANGUNAN, KONSTRUKSI DAN INTERIOR 2001" and the survey made by the study team in the study area. For details see Table 22.10.4.

2) Unit Cost of Container Handling Equipment

The unit costs of the procurement of the handling equipment were calculated from the local price of imported CIF plus installation fee. Indonesian import tax and duties are not included. For details see Table 22.10.5

Table 22.10.4(1) Unit Cost in Jambi (unit :Rp)

Description	JAMBI (Rp/day)	Description	Unit	JAMBI
(Local)		Gasoline	Lit	1450
Superintendant	50,000	Diesel Fuel	Lit	900
Foreman	25,000	Cement	ton	440,000
Common Labour	15,000	Coarse Aggregate	m3	31,000
Skilled Labour	20,000	Fine Aggregate	m3	32,000
Welder	25,000	Sand for Filling	m3	25,000
Mechanician	25,000	Crushed Stone	m3	29,000
Electrician	25,000	Plywood 1cm	m2	30,000
Carpenter	20,000	Square Timber	m3	400,000
Painter	15,000	Asphalt	kg	3,700
Bar Bender	20,000	Reinforcing Bar		
Masonry	20,000	(D-10)	ton	4,500,000
Equip. Operator	25,000	(D-16)	ton	4,200,000
Plant Operator	25,000	(D-25)	ton	4,000,000
Diver	100,000	Structural Steel	ton	4,000,000
Ship Captain	100,000	Steel Pipe Pile		
Ship Crew	60,000	(D=600 x12)	ton	10,600,000
		(D=500 x10)	ton	10,600,000
(Foreign)		Steel Sheet Pile	ton	8,000,000
Expatriate	3,000,000	Concrete Block(paver	m2	195,000
Ship Captain	3,500,000			
Diver	3,500,000			

Table 22.10.4(2) Unit Cost of Equipment

Description	Cost (Million Rp)	Description	Cost (Million Rp)
Quay Gantry Crane Span 12m, Reach 22m	32,000	Mobile Crane (50t)	3,700
RTG 6Lane, 1 over 4	11,200	Mobile Crane (25t)	1,900
Tractor & Chassis	1,100	Forklift (3t)	350

3) Construction Firms in Jambi

The construction firms in Jambi basically work as the sub-contractors under the foreign or major domestic contractors in Indonesia.

(2) Assumptions for Cost Estimation

1) Basic Price and Exchange Rate

The basic prices are as of 2001 and the foreign exchange rate of;

1 US$ = 9,500 Rupiah (Rp) = 118 Yen

2) Currency Component

The each unit price was split into foreign currency and local currency portions, both indicated in Rupiah, estimated in the following classifications.

The foreign currency component consists of:

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

The local currency component consists of:

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

3) Maintenance Cost (Facility, Equipment, Dredging)

The maintenance cost for facilities is set out as 2% of the construction cost based on the annual maintenance fee of the facilities. Also, 3% of the equipment cost is adopted as the maintenance cost for the equipment. The maintenance dredging cost is determined from the unit prices proposed by RUKINDO.

Unit Price of Maintenance dredging in navigation channel: Rp.13,000/m^3

(3) Basic Cost of Construction Works

The combined cost for major construction works is estimated from the costs of labor, required materials, required construction equipment, and the site expense of labor and equipment. The estimation was verified by referring to the data of local construction cost data collected in the survey. The combined cost of major works is shown in Table 22.10.5.

(4) Construction Cost and Procurement Cost

The construction cost is estimated based on the combined cost of the construction works. The utilities cost of such as water, electric power and drainage, refers to the other projects in the equivalent scale. In addition to the construction cost and procurement cost, the engineering fee for the detail design and supervision, physical contingency and VAT are estimated in this study. The engineering fee for construction is about 10% to 15% for the construction cost, 3% for the equipment cost. The physical contingency is 8% for the construction cost, VAT is 10% of the whole cost.

The project cost for Talang Duku is shown in Tables 22.10.6 and 22.10.7. The equipment cost for Muara Sabak for is shown in Table 22.10.8. The construction cost for Muara Sabak is shown in Tables 22.10.9 and 22.10.10.

Table 22.10.5 Combined Cost for Major Works

Work Item	Unit	JAMBI	Currency(%)		Local Currency (%)		
			Foreign	Local	Goods	Skilled labour	Unskilied la
Excavation	m3	2,580	61	39	12	68	20
Back Filling	m3	5,239	59	41	10	67	23
Soil Disposal	m3	3,440	62	38	9	69	22
Blinding Stone	m3	43,081	33	67	45	34	21
Base Course	m3	45,738	39	61	44	35	21
Sub- Base Course	m3	47,939	39	61	44	35	21
Con.Block Paving	m2	162,727	59	39	32	44	23
Concrete Form Work	m2	97,529	46	54	32	46	22
Re-Bar Work	ton	5,099,050	60	40	17	62	21
Mix- Concrete 270kg/cm2	m3	240,305	43	57	56	26	18
Mix- Concrete 210kg/cm2	m3	231,405	43	57	56	26	18
Mix- Concrete 150kg/cm2	m3	220,314	43	57	56	26	18
Concrete Placing(Included T ding Transportation)							
by Man Power	m3	106,883	39	61	6	64	30
by Truck Crane	m3	77,018	70	30	8	65	27
As-Con Hot-Mix	ton	399,654	76	24	17	56	27
As-Con Placing	ton	64,827	72	28	29	49	22
Steel Pile Driving							
D-500mm	m	1,198,546	94	6	2	70	28
D-600mm	m	1,899,052	94	6	2	70	28
Sheet Pile Driving	m	477,647	95	5	1	70	29
Dredging & Disposal by Cutter Suction	m3	33,000	78	22	6	76	18
Dredging & Disposal by Barge & Grab	m3	63,000	76	24	8	75	17
Paper Drain driving	m	18,686	94	6	9	60	31
Stone Placing	m2	205,967	58	42	44	37	19
Manufacturing Steel Structure							
Super Structure	ton	9,000,000	72	28	15	68	17
Supporting Structure	ton	6,000,000	74	26	11	72	17
Office Building	m2	2,150,000	62	38	32	55	13
Warehouse or Shed	m2	1,420,000	61	39	27	56	17

Table 22.10.6 Equipment Cost for Talan Duku

Phase		Description	Quantity	Unit Price (Million	Amount (Million Rp)
II	1	Mobile Crane (50t)	1	3,700	3,700
	2	RTG	2	11,200	22,400
	3	Tractor & Trailer	4	1,100	4,400
	4	Engineer Fee	%	3	783
	5	VAT	%	10	3,128
			Total		**34,411**
III	1	Mobile Crane (50t)	1	3,700	3,700
	2	RTG	2	11,200	22,400
	3	Tractor & Trailer	4	1,100	4,400
	4	Engineer Fee	%	3	783
	5	VAT	%	10	3,128
			Total		**34,411**
Grand Total					**68,823**

Table 22.10.7 Construction Cost for Talang Duku Port

				Description	Unit	Quantity	Unit Price(Rp)	Amount (Million Rp)	
								Phase I	Phase III
1	Direct Construction Cost								
	(1)			Mobilization and Demobilization	L.S	1	2,500,000,000	2,000	500
	(2)			Dredging & Reclamation					
		1)		Dredging	m3	0	63,000	0	0
		2)		Reclamation	m3	33,000	32,200	1,063	0
	(3)			Pontoon Construction					
		1)		Pontoon (62 x 17)	Unit	2	5,400,000,000	5,400	5,400
		2)		Barge Connection	Unit	1	81,000,000	0	81
		3)		Access Bridge	Unit	4	350,000,000	700	700
		4)		Relating Facilities	set	2	540,000,000	540	432
	(4)			Yard Pavement					
		1)		Block Paving	m2	10,700	162,727	1,741	0
		2)		RTG Lane	m2	2,300	446,052	1,026	0
		3)		Container Sleeper	m2	2,600	391,770	1,019	0
		4)		Concrete Paving	m2	20,500	171,370	3,513	0
	(5)			Access Road					
		1)		Concrete Paving	m2	1,300	171,370	223	0
	(6)			Buildings					
		1)		Demolishing Existing Shed	L.S	1	250,000,000	250	
		2)		CFS (1 Units)	m2	1,600	1,420,000	2,272	0
		3)		Gate	m2	300	2,150,000	645	0
		4)		Work Shop	m2	1,200	1,420,000	1,704	0
		5)		Canteen	m2	150	1,420,000	213	0
	(7)			Yard Fence	m	320	456,000	146	0
	(8)			Drainage System	L.S	1	706,000,000	706	0
	(9)			Power Supply & Yard Lighting	L.S	1	1,250,000,000	1,250	250
	(10			Water Supply System	L.S	1	1,550,000,000	1,550	310
	(11			Sewerage System	L.S	1	550,000,000	550	0
	(12			Other Utilities	L.S	1	200,000,000	200	0
	Total Direct Cost							**26,710**	**7,673**
3	Indirect Construction Cost								
	(1)			Common Temporary Work	%	8,(4)	D.C	2,137	307
	(2)			Site Expenses	%	13, (5)	D.C	3,472	384
	(3)			Overhead	%	8	D.C	2,137	614
	Total Indirect Cost							7,746	1,304
Total Construction Cost								**34,456**	**8,977**
				Physical Contingency	%	8	T.C	**2,756**	**718**
				Engineering Fee	%	12	T.C	**4,135**	**628**
				VAT	%	10	T.C,P.C,E.F	**4,135**	**1,032**
Total Project Cost								**45,482**	**11,356**
Total Project Cost (Phase I + Phase II)									**56,838**

Table 22.10.8 Equipment Cost for Muara Sabak

Phase		Description	Quantity	Unit Price (Million Rupiah)	Amount (Million Rupiah)
I	1	Gantry Crane	1	32,000	32,000
	2	RTG	2	11,200	22,400
	3	Tractor and Trailor	4	1,100	4,400
	4	Mobile Crane (25 t)	2	1,900	3,800
	5	Reach Stacker	1	3,650	3,650
	6	Forklift (3T)	5	350	1,750
	7	Engineering Fee	3 %		2,040
	8	VAT	10 %		7,004
		Total			**77,044**
II	1	Mobile Crane (25 t)	1	1,900	1,900
	2	Forklift (3T)	5	350	1,750
	3	Engineering Fee	3 %		110
	4	VAT	10 %		376
		Total			**4,135**
III	1	Gantry Crane	1	32,000	32,000
	2	RTG	2	11,200	22,400
	3	Tractor and Trailor	4	1,100	4,400
	4	Engineering Fee	3 %		1,764
	5	VAT	10 %		6,056
		Total			**66,620**
IV	1	Gantry Crane	1	32,000	32,000
	2	RTG	2	11,200	22,400
	3	Tractor and Trailor	4	1,100	4,400
	4	Engineering Fee	3 %		1,764
	5	VAT	10 %		6,056
		Total			**66,620**
V	1	Gantry Crane	1	32,000	32,000
	2	RTG	2	11,200	22,400
	3	Tractor and Trailor	4	1,100	4,400
	4	Engineering Fee	3 %		1,764
	5	VAT	10 %		6,056
		Total			**66,620**
	Grand Total				**281,041**

Table 22.10.9 Construction Cost of Container Terminal in Muara Sabak

	Description	Unit	Quantity	Unit Price(Rp)	Amount (Million Rp)			
					Phase I	Phase III	Phase IV	Phase V
1	Direct Construction Cost for Container Terminal							
(1)	Mobilization and Demobilization	L.S	1	16,000,000,000	4,000	4,000	4,000	4,000
(2)	Dredging & Reclamation							
1)	Dredging	m3	2,000	63,000	32	32	32	32
2)	Reclamation	m3	200,000	32,200	1,610	1,610	1,610	1,610
(3)	Berth Construction							
1)	Steel Pipe Piling Work (D=600)	m	19,200	1,899,052	9,115	9,115	9,115	9,115
2)	Concrete Deck							
	Concrete Placing	m3	10,500	601,900	1,580	1,580	1,580	1,580
	Re-bar Work	ton	1,155	5,099,050	1,472	1,472	1,472	1,472
3)	Trestle				(2 sets)			
	Steel Pipe Piling Work (D=500)	m	4,375	1,198,546	2,097	1,049	1,049	1,049
	Concrete Deck	m3	2,000	601,900	482	241	241	241
	Re-bar Work	ton	220	5,099,050	449	224	224	224
4)	Retaining Stone Bank	m3	8,000	205,967	412	412	412	412
5)	Wharf Fittings							
	Fender & Bollard	set	44	144,000,000	1,584	1,584	1,584	1,584
	Crane Rail Fittings	m	1,000	1,315,000	329	329	329	329
6)	Corrosion Protection	m2	7,200	1,280,000	2,304	2,304	2,304	2,304
(4)	Yard Pavement							
1)	Block Paving	m2	13,400	162,727	545	545	545	545
2)	RTG Lane	m2	4,800	446,052	535	535	535	535
3)	Container Sleeper	m2	4,600	391,770	451	451	451	451
4)	Concrete Paving	m2	77,200	171,370	3,307	3,307	3,307	3,307
(5)	Access Road							
1)	Filling & Grading	m3	30,800	32,200	460	177	177	177
2)	Concrete Paving	m2	11,200	171,370	480	480	480	480
3)	Utilities	L.S	1	250,000,000	100	50	50	50
(6)	Buildings							
1)	CFS (1 Units)	m2	4,500	1,420,000	3,195	0	3,195	0
2)	Gate	m2	600	2,150,000	645	0	645	0
3)	Terminal Office Building	m2	1,200	2,150,000	1,290	0	1,290	0
4)	Work Shop	m2	1,200	1,420,000	1,704	0	0	0
5)	Canteen	m2	300	1,420,000	213	0	213	0
(7)	Yard Fence	m	1,300	456,000	148	148	148	148
(8)	Drainage System	L.S	1	2,536,800,000	906	544	544	544
(9)	Power Supply & Yard Lighting	L.S	1	7,583,333,333	3,250	1,083	2,167	1,083
(10)	Water Supply System	L.S	1	3,700,000,000	1,850	617	617	617
(11)	Sewerage System	L.S	1	1,487,500,000	850	213	213	213
(12)	Other Utilities	L.S	1	600,000,000	200	100	200	100
Total Direct Cost					**45,596**	**32,201**	**38,728**	**32,201**
3	Indirect Construction Cost							
(1)	Common Temporary Work	%	8	D.C	3,648	1,932	2,324	1,932
(2)	Site Expenses	%	15	D.C	6,839	4,830	5,809	4,830
(3)	Overhead	%	8	D.C	3,648	2,576	3,098	2,576
Total Indirect Cost					14,135	9,338	11,231	9,338
Total Construction Cost					**59,730**	**41,540**	**49,959**	**41,540**
	Physical Contingency	%	8	T.C	4,778	3,323	3,997	3,323
	Engineering Fee	%	12	T.C	7,168	4,985	5,995	4,985
	VAT	%	10	T.C,P.C,E.F	7,168	4,985	5,995	4,985
Total Project Cost					**78,844**	**54,833**	**65,946**	**54,833**
Total Project Cost (Phase I + III + IV)							**199,622**	
Total Project Cost (Phase I + III + IV +V)								**254,455**

Table 22.10.10 Construction Cost for General Cargo Terminal in Muara Sabak

			Description	Unit	Quantity	Unit Price(Rp)	Amount (Million Rp) (Phase II)
1	Direct Construction Cost for General Cargo Terminal						
	(1)		Mobilization and Demobilization	L.S	1	3,800,000,000	3,800
	(2)		Dredging & Reclamation				
		1)	Dredging	m3	400	63,000	25
		2)	Reclamation	m3	55,000	32,200	1,771
	(3)		Berth Construction				
		1)	Steel Pipe Piling Work (D=500)	m	3,125	1,198,546	3,745
		2)	Concrete Deck				
			Concrete Placing	m3	1,490	601,900	897
			Re-bar Work	ton	164	5,099,050	836
		3)	Trestle				(2 sets)
			Steel Pipe Piling Work (D=500)	m	2,050	1,198,546	2,457
			Concrete Deck	m3	840	601,900	506
			Re-bar Work	m3	92	5,099,050	469
		4)	Retaining Stone Bank	m3	2,540	205,967	523
		5)	Wharf Fittings				
			Fender & Bollard	set	13	144,000,000	1,872
		6)	Corrosion Protection	m2	1,495	1,280,000	2,220
	(4)		Yard Pavement				
		1)	Block Paving	m2	21,600	162,727	3,515
	(5)		Access Road				
		1)	Filling & Grading	m3	480	32,200	15
		2)	Concrete Paving	m2	480	171,370	82
		3)	Utilities	L.S	1	100,000,000	100
	(6)		Buildings				
		2)	Warehouse (1 Units)	m2	3,600	1,420,000	5,112
		3)	Gate	m2	80	2,150,000	172
		4)	Terminal Office Building	m2	400	2,150,000	860
		5)	Work Shop	m2	400	1,420,000	568
		6)	Canteen	m2	150	1,420,000	213
	(7)		Yard Fence	m	325	456,000	148
	(8)		Drainage System	L.S	1	706,000,000	706
	(9)		Power Supply & Yard Lighting	L.S	1	1,250,000,000	1,250
	(10)		Water Supply System	L.S	1	1,850,000,000	1,850
	(11)		Sewerage System	L.S	1	450,000,000	450
	(12)		Other Utilities	L.S	1	100,000,000	100
	(13)		Water Resources	L.S	1	3,432,000,000	3,432
	Total Direct Cost						**37,695**
3	Indirect Construction Cost						
	(1)		Common Temporary Work	%	8	D.C	3,016
	(2)		Site Expenses	%	15	D.C	5,654
	(3)		Overhead	%	8	D.C	3,016
	Total Indirect Cost						11,686
Total Construction Cost							**49,381**
			Physical Contingency	%	8	T.C	3,950
			Engineering Fee	%	13	T.C	6,419
			VAT	%	10	T.C,P.C,E.F	5,975
Total Project Cost							**65,726**

(5) Project Cost

The total project cost for Jambi is **Rp 751,720 million** for the base case and **Rp 873,173 million** for high public case.

In addition to the above project costs, the initial dredging for the Batanghari River is required. The volume of the initial dredging is estimated as about 5,190,000 m^3. The initial cost is calculated as follows.

First Stage Dredging

Outer Bar: 890,000 m^3 (Not included in this project)

Inner Channel: 570,000 m^3 x Rp 25,000/ m^3 = Rp 14,250 million

Second Stage Dredging

Outer Bar: 2,690,000 m^3 x Rp 25,000/ m^3	= Rp 67,250 million
Inner Channel: 1,930,000 m^3 x Rp 25,000/ m^3	= Rp 48,250 million
Engineering Fee: 2.5% of Dredging fee	= Rp 3,244 million
VAT : 10% of Dredging and Engineering fee	= Rp 13,299million
Total	**= Rp 146,293 million**

The summary of the project cost is indicated in Table 22.10.11 and Table 22.10.12. For the economic analysis, the depreciation period of the constructed facilities and the procured equipment are determined as following Table 22.10.13.

Table 22.10.12 Summary of Project Cost for Jambi (2) (Unit in Million Rp.)

	Civil Work		**Equipment**		**Total**	
	Foreign	Local	Foreign	Local	Foreign	Local
Talang Duku	36,261	20,577	61,194	7,628	97,455	28,205
Muara Sabak - Base Case	173,362	91,986	190,267	24,152	363,629	116,138
Muara Sabak - High Case	209,727	110,453	249,346	31,693	459,073	142,146
Initial Dredging	86,446	59,847			86,446	59,847
Total - Base Case	296,069	172,410	251,461	31,780	547,530	204,190
Total - High Case	332,434	190,877	310,540	39,321	642,974	230,198

Table 22.10.13 Depreciation Period of the Facilities and Equipment

Facility	Depreciation Period	Remarks
Berth , Retaining Wall	50 years	
Warehouse, CFS	50 years	
Pontoon , Movable Bridge	40 years	In River
Yard Pavement	35 years	
Road Pavement	35 years	
Buildings	40 years	
Equipment	**Depreciation Period**	**Remarks**
Quay gantry Crane	25 years	
RTG	20 years	
Mobile Crane	15 years	
Reach Stacker	15 years	
Tractor & Chassis	10 years	
Forklift	10 years	

Table 22.10.11 Summary of Project Cost for Jambi (1) (Unit in Million Rp.)

	Description	Phase I			Phase II			Phase III									Total	
1.	**Talang Duku**	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total							Base Case	High Case
1.1	Civil Works	Container						Container										
1.1.1	Construction Cost	23,688	10,768	34,456			0	7,020	1,957	8,977							43,433	43,433
1.1.2	Physical Contingency	1,895	861	2,756			0	562	157	719							3,475	3,475
1.1.3	Enginering Fee	2,688	1,447	4,135			0	408	220	628							4,763	4,763
1.1.4	VAT	0	4,135	4,135			0	0	1,032	1,032							5,167	5,167
	Sub- total (1.1)	28,271	17,211	45,482			0	7,990	3,366	11,356							56,838	56,838
1.2	Equipment						0			0							0	0
1.2.1	Equipment				29,971	529	30,500	29,971	529	30,500							61,000	61,000
1.2.2	Enginering Fee				626	157	783	626	157	783							1,566	1,566
1.2.3	VAT				0	3,128	3,128	0	3,128	3,128							6,256	6,256
	Sub- total (1.2)				30,597	3,814	34,411	30,597	3,814	34,411							68,822	68,822
	Total (1.1 + 1.2)	28,271	17,211	**45,482**	30,597	3,814	**34,411**	38,587	7,180	**45,767**							**125,660**	**125,660**
		Phase I			Phase II			Phase III			Phase IV			Phase V			Total	
2.	**Munra Sabak**	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Base Case	High Case
2.1	Civil Works	Container			General Cargo			Container			Container			Container				
2.1.1	Construction Cost	44,292	15,438	59,730	33,822	15,559	49,381	30,672	10,868	41,540	36,949	13,009	49,958	30,671	10,868	41,539	200,609	242,148
2.1.2	Physical Contingency	3,543	1,235	4,778	2,706	1,245	3,951	2,454	869	3,323	2,956	1,041	3,997	2,454	869	3,323	16,049	19,372
2.1.3	Enginering Fee	4,659	2,509	7,168	4,173	2,247	6,420	3,240	1,745	4,985	3,897	2,098	5,995	3,240	1,745	4,985	24,568	29,553
2.1.4	VAT	0	7,168	7,168	0	5,975	5,975	0	4,985	4,985	0	5,995	5,995	0	4,985	4,985	24,123	29,108
	Sub- total (2.1)	52,494	26,350	78,844	40,700	25,025	65,726	36,366	18,467	54,833	43,802	22,144	65,946	36,365	18,467	54,833	265,349	320,182
2.2	Equipment																	
2.2.1	Equipment	66,777	1,225	68,002	3,614	37	3,651	57,668	1,132	58,800	57,668	1,132	58,800	57,668	1,132	58,800	189,253	248,053
2.2.2	Enginering Fee	1,632	408	2,040	88	22	110	1,411	353	1,764	1,411	353	1,764	1,411	353	1,764	5,678	7,442
2.2.3	VAT	0	7,004	7,004	0	376	376	0	6,056	6,056	0	6,056	6,056	0	6,056	6,056	19,492	25,548
	Sub- total (2.2)	68,408	8,636	77,044	3,701	434	4,135	59,079	7,541	66,620	59,079	7,541	66,620	59,079	7,541	66,620	214,419	281,039
	Total (2.1 + 2.2)	120,902	34,986	**155,888**	44,401	25,459	**69,861**	95,445	26,008	**121,453**	102,881	29,685	**132,566**	95,444	26,008	**121,453**	**479,768**	**601,221**
		Stage I			Stage II												Total	
3.	**Initial Dredging**	Foreign	Local	Total	Foreign	Local	Total										Base Case	High Case
3.1	Initial Dredging	9,263	4,988	14,250	75,075	40,425	115,500										129,750	129,750
3.2	Engineering Fee	231	125	356	1,877	1,011	2,888										3,244	3,244
3.3	VAT	0	1,461	1,461	0	11,838	11,838										13,299	13,299
	Sub- total (3)	9,494	6,573	**16,067**	76,952	53,274	**130,226**										**146,293**	**146,293**

22.11 Phased Planning

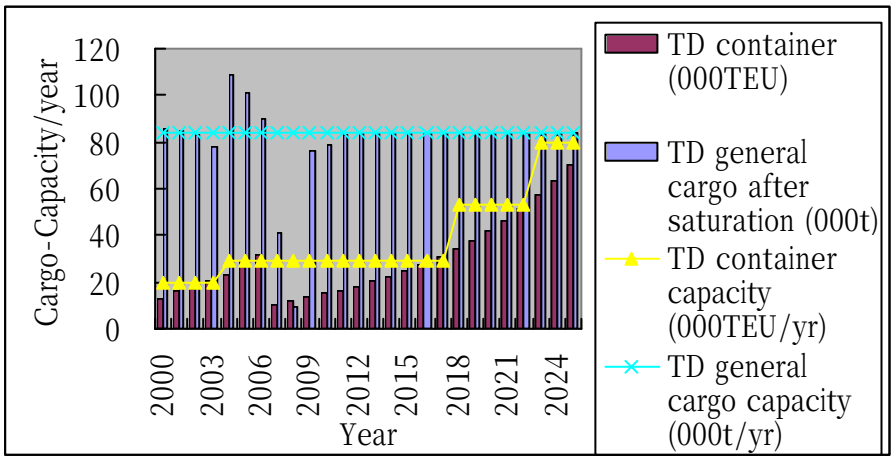
22.11.1 Base Case

(1) Talang Duku

The measures to be taken at Talang Duku up to 2025 are summarized below (Table 22.11.1). Talang Duku can deal with the projected cargo volume with these measures (Figure 22.11.1). In order to deal with the temporary increase of containers, port users will be requested to observe the ship schedule. The Team assumed a reduction of the berthing time by 30 % from 2004 on.

Table 22.11. 1 Milestone at Talang Duku

Year	Milestone	Procurement	Construction
2017			1 Pontoon, CFS, Shed and Open Storage Demolition of the Existing Warehouse
2018	1Container Berth becomes operational	1 Mobile Cranes, 4 Yard Tractors, 2 RTGs	
2022		1 Mobile Crane, 4 Yard Tractors, 2 RTGs	1 Pontoon
2023	1Container Berth becomes operational		



Note: TD stands for Talang Duku

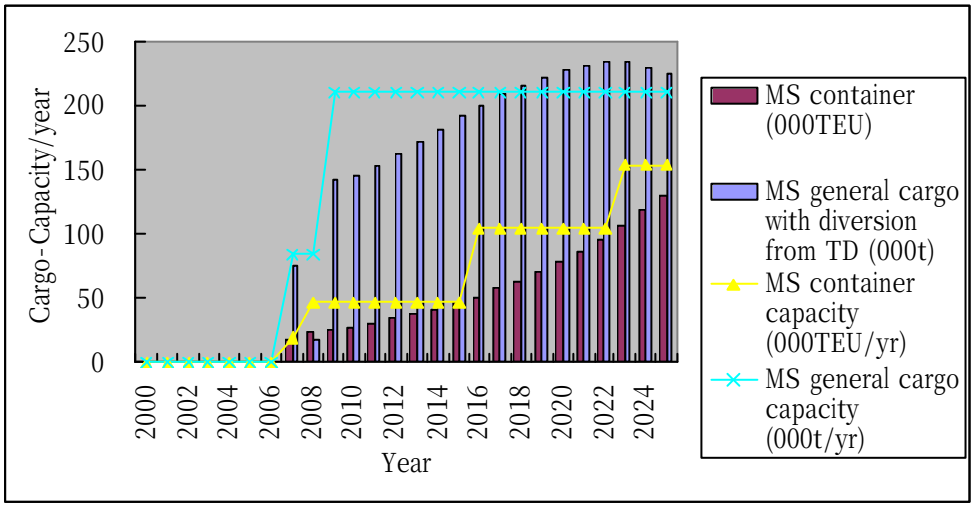
Figure 22.11.1 Demand and Capacity at Talang Duku

(2) Muara Sabak

The measures to be taken at Muara Sabak up to 2025 are summarized below (Table 22.11.2). Muara Sabak can deal with the projected cargo volume with these measures (Figure 22.11.2).

Table 22.11. 2 Milestone at Muara Sabak

Year	Milestone	Procurement	Construction
2007		1 Gantry, 2 RTG, 4 Yard Tractors, 2 Mobile cranes, 5 Forklifts	1 Container Wharf, CFS
2008	1 Container Wharf becomes operational, The Existing Jetty dedicated to General Cargo	1 Mobile Cranes, 5 Forklifts	1 General Cargo Wharf, Shed
2009	1 General Cargo Wharf becomes operational		
2015		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf
2016	1 Container Wharf becomes operational		
2022		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf, CFS
2023	1 Container Wharf becomes operational		



Note: MS stands for Muara Sabak. TD stands for Talang Duku.

Figure 22.11.2 Demand and Capacity at Muara Sabak

22.11.2 High Public Case

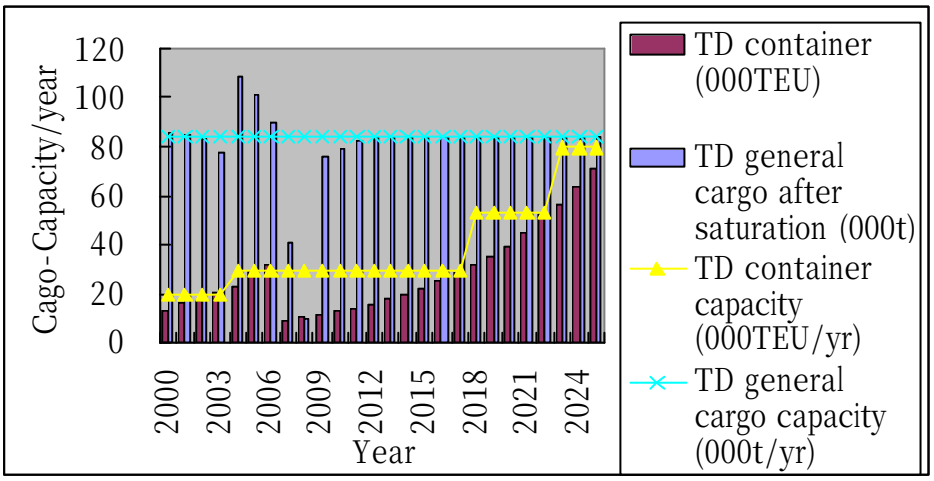
(1) Talang Duku

The measures to be taken at Talang Duku up to 2025 are summarized below (Table 22.11.3). Talang

Duku can deal with the projected cargo volume with these measures (Figure 22.11.3). In order to deal with the temporary increase of containers, port users will be requested to observe the ship schedule. The Team assumed a reduction of the berthing time by 30 % from 2004 on.

Table 22.11. 3 Milestone at Talang Duku

Year	Milestone	Procurement	Construction
2017			1 Pontoon, CFS, Shed, and Open Storage Demolition of Existing Warehouse
2018	1 Container Berth becomes operational	1 Mobile Cranes, 4 Yard Tractors, 2 RTGs	
2022		1 Mobile Crane, 4 Yard Tractors, 2 RTGs	1 Pontoon
2023	1 Container Berth becomes operational		



Note: TD stands for Talang Duku

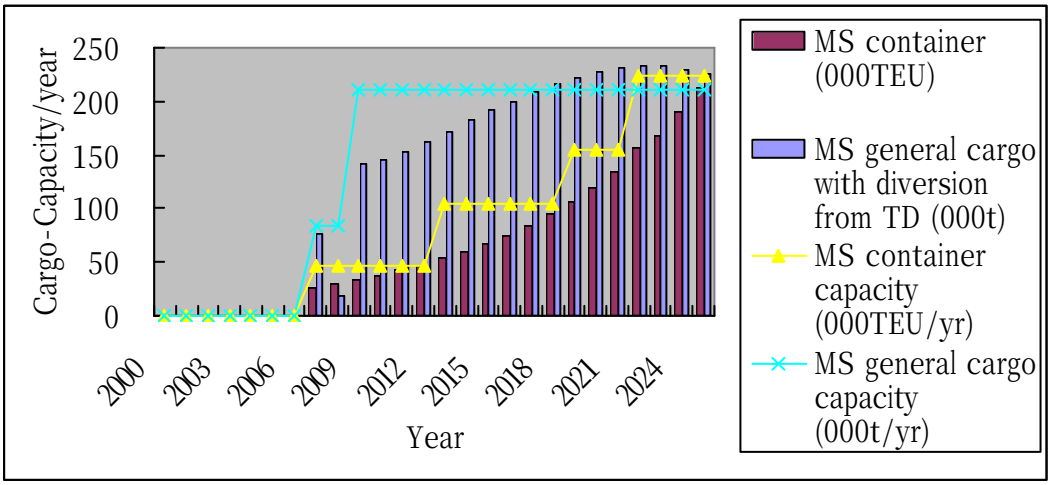
Figure 22.11.3 Demand and Capacity at Talang Duku

(2) Muara Sabak

The measures to be taken at Muara Sabak up to 2025 are summarized below (Table 22.11.4). Muara Sabak can deal with the projected cargo volume with these measures (Figure 22.11.4).

Table 22.11.4 Milestone at Muara Sabak

Year	Milestone	Procurement	Construction
2006		1 Gantry, 2 RTG, 4 Tractors, 2 Mobile Cranes, 5 Forklifts	1 Container Wharf, CFS
2007	1 Container Wharf becomes operational, Existing Jetty dedicated to General Cargo		
2008		1 Mobile Cranes, 5 Forklifts	1 General Cargo Wharf, Shed
2009	1 General Cargo Wharf becomes operational		
2012		1 Gantry, 2 RTG, 4 Tractors	1 Container Wharf
2013	Another Container Wharf becomes operational		
2017		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf, CFS
2018	Additional Container Wharf becomes operational		
2021		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf
2022	Additional Container Wharf becomes operational		



Note: MS stands for Muara Sabak, TD stands for Talang Duku

Figure 22.11.4 Demand and Capacity at Muara Sabak

22.12 Capacity Evaluation

22.12.1 Simulation Model

Two scenarios have been drawn up for the Short Term Plan (target year 2007) and the Master Plan (target year 2025) of Jambi.

The purpose of this chapter is to carry out the "Vessel Traffic Simulation" for both scenarios and to examine their results.

A numerical simulation model "WITNESS 2000" was employed to evaluate whether the port capacity and the channel capacity would be sufficient to cope with the increasing cargo and vessel traffic throughout the planning period of this study.

The list of the data to be used in the simulation is shown in Table 22.12.1. The volume of cargoes and the number of calling vessels are in line with the traffic demand forecast for 2007 and 2025. The scenarios are "Case 1 (Base Case Scenario)" and "Case 2 (High Public Case Scenario)". Table 22.12.2 and Table 22.12.3 show the numbers of berths, berth productivity and working hours for Case 1 and Case 2.

The navigation conditions of Batang Hari River such as the river sailing route are shown in Table 22.12.4. These conditions are based on the interview with IPC II offices and the documents issued by IPC II Jambi office.

Figure 22.12.1 exemplifies a simulation model.

Table 22.12.1 Cargo Volume and Vessel Call Condition (2007 & 2025)

Berth	Cargo Type	(Year)	Cargo Volume (for one year)		Vessel Calls (for one year)	
Public Berth (Talang Duku)	General Cargo	2007	29,000 tons		60	
		2025	77,000 tons		120	
	Container	2007	8,900 TEUs		73	
		2025	71,000 TEUs		552	
	CPO	2007	319,000 ton		238	
		2025	767,000 ton		597	
	Coal	2007	400,000 tons		274	
		2025	600,000 tons		374	
Other Private Berth (Jambi)	General Cargo & Container	2007	Base	540,000 tons	Base	346
			High	453,000 tons	High	290
		2025	Base	2,289,000 tons	Base	1,041
			High	1,482,000 tons	High	674
	CPO	2007	319,000 tons		238	
		2025	767,000 tons		597	
	Coal	2007	100,000 tons		55	
		2025	200,000 tons		125	
Public Berth (Muara Sabak)	General Cargo	2007	88,000 tons		85	
		2025	232,000 tons		48	
	Container	2007	Base	18,000 TEUs	Base	134
			High	26,700 TEUs	High	200
		2025	Base	132,000 TEUs	Base	294
			High	213,000 TEUs	High	474
Private Berth (Muara Sabak)	General Cargo	2007	2,109,000 tons		945	
		2025	3,113,000 tons		284	
	Coal	2007	100,000 tons		50	
		2025	1,200,000 tons		217	

Source: JICA Study Team

Table 22.12.2 Case 1 (Base Case Scenario) Berth Conditions (2007 & 2025)

Public Berth		(year)	No. of Berth	Productivity	Working Hours
Talang Duku	General Cargo	2007	1 no.	45 tons/hour	16 hours
		2025	1 no.	45 tons/hour	16 hours
	Container	2007	1.5 nos.	10 TEUs/hour	16 hours
		2025	3.5 nos.	10 TEUs/hour	16 hours
	CPO	2007	0.5 nos.	400 ton/hour	16 hours
		2025	0.5 nos.	800 ton/hour	16 hours
	Coal	2007	In the channel		
		2025	In the channel		
Muara Sabak	General Cargo	2007	0.5 nos.	45 tons/hour	16 hours
		2025	2 nos.	45 tons/hour	16 hours
	Container	2007	0.5 nos.	10 TEUs/hour	16 hours
		2025	3 nos.	20 TEUs/hour	16 hours

Source: JICA Study Team

Table 22.12.3 Case 2 (High Public Scenario) Berth Conditions (2007 & 2025)

Public Berth		(year)	No. of Berth	Productivity	Working Hours
Talang Duku	General Cargo	2007	1 no.	45 tons/hour	16 hours
		2025	1 no.	45 tons/hour	16 hours
	Container	2007	1.5 nos.	10 TEUs/hour	16 hours
		2025	3.5 nos.	10 TEUs/hour	16 hours
	CPO	2007	0.5 nos.	400 ton/hour	16 hours
		2025	0.5 nos.	800 ton/hour	16 hours
	Coal	2007	In the channel		
		2025	In the channel		
Muara Sabak	General Cargo	2007	1 no.	45 tons/hour	16 hours
		2025	2 nos.	45 tons/hour	16 hours
	Container	2007	1 no.	20 TEUs/hour	16 hours
		2025	4 nos.	20 TEUs/hour	16 hours

Source: JICA Study Team

Table 22.12.4 Navigation Conditions of Batang Hari River

No.	Navigation Conditions		
1.	Maximum Vessel Size	to Muara Sabak	LOA = 115.0m, Draft = 6.50m
		to Jambi	LOA = 75.0m, Draft = 5.0m (Rainy Season)
			LOA = 75.0m, Draft = 3.5m (Dry Season)
2.	Vessels of over 3.0 draft, when passing the Kelamak Channel, is requested to wait until about 3 – 5 hours after the high tide at the following places : 1) Vessels going into the Talang Duku should berth at the Muara Sabak/Sabak Indah. 2) Vessels going out from Talang Duku should berth at the Simpang Tua/Keramat Orang Kayo Itam.		

Source: IPC II Jambi Office

22.12.2 Capacity Evaluation of Jambi Short Term Plan (2007)

Below is the result output of the simulation over a span of one year (2007).
The average BOR is given in Table 22.12.5. The BOR of Muara Sabak in the Base Case shows high value. The average numbers of berth waiting time for each case are given in Table 22.12.6. The berth waiting time of Muara Sabak in the Base Case general cargo and container both shows high value also.

Table 22.12.5 Berth Occupancy Rate (BOR on 2007)

Public Berth	Scenario Berth Type	Case 1 (Base Case)		Case 2 (High Public Case)	
		No. of Berth	Ave. BOR	No. of Berth	Ave. BOR
Talang Duku	General Cargo	1 no.	13.9 %	1 no.	13.9 %
	Container	1.5 nos.	21.8 %	1.5 nos.	22.5 %
	CPO	0.5 nos.	26.5 %	0.5 nos.	27.3 %
Muara Sabak	General Cargo	0.5 nos.	77.5 %	1 no.	36.3 %
	Container	0.5 nos.	77.5 %	1 no.	30.9 %

Source: by “WITNESS 2000” Simulation Result
Note: 0.5 nos. of berth means one berth is shared with two kinds of cargoes.

Table 22.12.6 Berth Waiting Time (2007)

Public Berth	Scenario Berth Type	Case 1 (Base Case)		Case 2 (High Public Case)	
		No. of Berth	Average Berth Waiting Time	No. of Berth	Average Berth Waiting Time
Talang Duku	General Cargo	1 no.	188 min.	1 no.	188 min.
	Container	1.5 nos.	143 min.	1.5 nos.	131 min.
	CPO	0.5 nos.	254 min.	0.5 nos.	239 min.
Muara Sabak	General Cargo	0.5 nos.	2,621 min.	1 no.	757 min.
	Container	0.5 nos.	4,683 min.	1 no.	321 min.

Source: by "WITNESS 2000" Simulation Result

Note: 0.5 nos. of berth means one berth is shared with two kinds of cargoes.

22.12.3 Capacity Evaluation of Jambi Master Plan (2025)

The output of the simulation over a span of one year is shown below.

The average BOR is given in Table 22.12.7. The average berth waiting times are given in Table 22.12.8.

The values of BOR in each case can be considered reasonable.

In case of the berth waiting time, the values of general cargo shows a little high.

Table 22.12.7 Berth Occupancy Rate (BOR on 2025)

Public Berth	Scenario Berth Type	Case 1 (Base Case)		Case 2 (High Public Case)	
		No. of Berth	Ave. BOR	No. of Berth	Ave. BOR
Talang Duku	General Cargo	1 no.	38.7 %	1 no.	38.7 %
	Container	3.5 nos.	47.1 %	3.5 nos.	47.5 %
	CPO	0.5 nos.	54.9 %	0.5 nos.	55.4 %
Muara Sabak	General Cargo	2 nos.	49.8 %	2 nos.	49.8 %
	Container	3 nos.	40.3 %	4 nos.	49.3 %

Source: by "WITNESS 2000" Simulation Result

Note: 0.5 nos. of berth means one berth is shared with two kinds of cargo vessels.

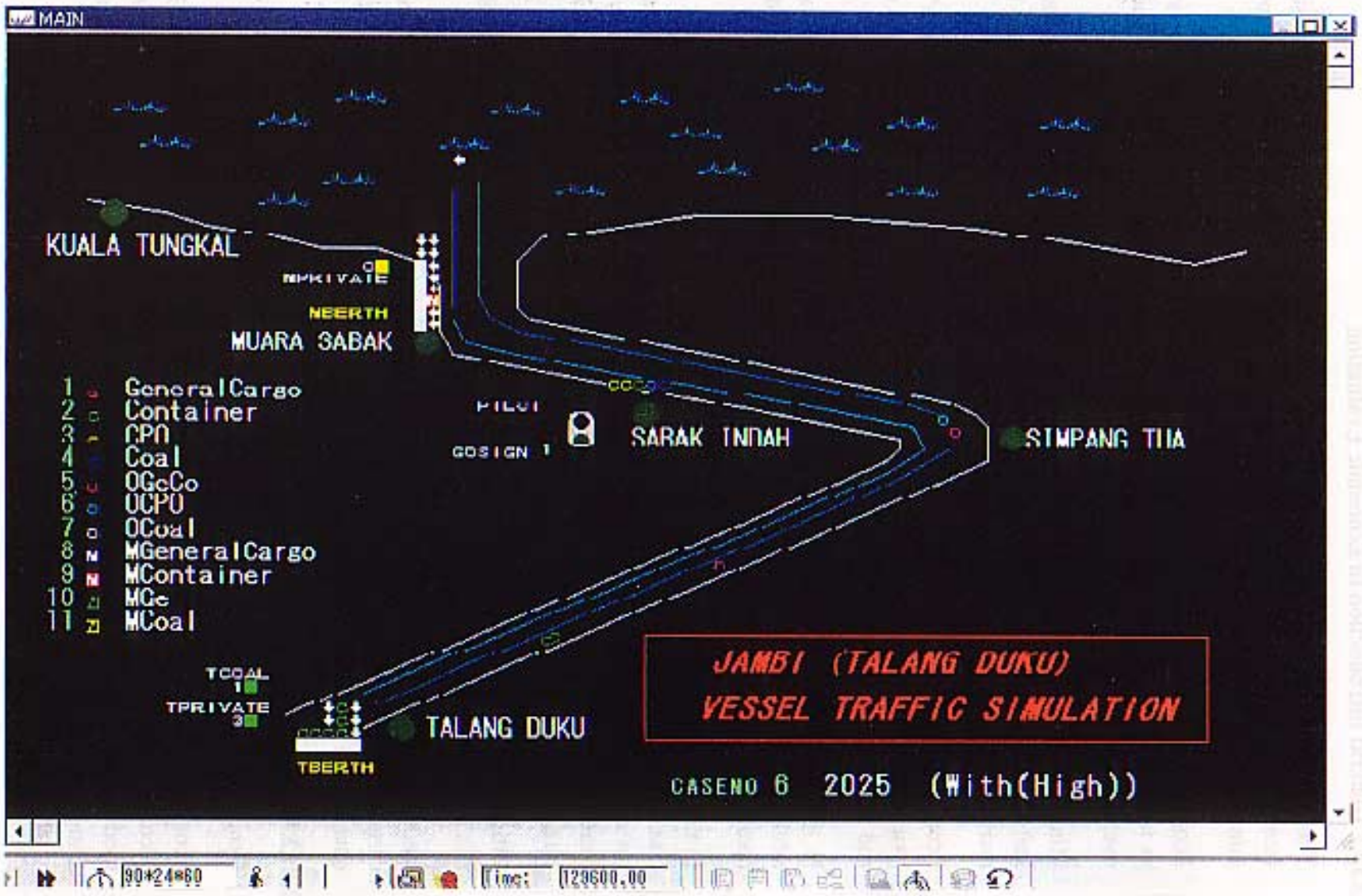
Table 22.12.8 Berth Waiting Time (2025)

Public Berth	Scenario Berth Type	Case 1 (Base Case)		Case 2 (High Public Case)	
		No. of Berth	Average Berth Waiting Time	No. of Berth	Average Berth Waiting Time
Talang Duku	General Cargo	1 no.	664 min.	1 no.	664 min.
	Container	3.5 nos.	189 min.	3.5 nos.	180 min.
	CPO	0.5 nos.	551 min.	0.5 nos.	507 min.
Muara Sabak	General Cargo	2 nos.	1,678 min.	2 nos.	1,678 min.
	Container	3 nos.	218 min.	4 nos.	228 min.

Source: by "WITNESS 2000" Simulation Result

Note: 0.5 nos. of berth means one berth is shared with two kinds of cargo vessels.

Fig. 22.12.1 Jambi Simulation Model "WITNESS 2000"



22.13 Economics of Master Plan Port Development at Jambi

22.13.1 General Introduction to Economic Evaluation

The purpose of economic evaluation is to provide a view of the feasibility of investment from the national, resource viewpoint. It differs from financial analysis, which provides information on the direct financial implications of investment including profitability.

Economic evaluation, therefore, considers only resource costs and excludes transfers such as taxes. It also takes into account the price of local (non-traded) inputs which may be overpriced or underpriced relative to market conditions.

Minimum wages may overprice labour relative to its market value and subsidies, say for fuel or water, may underprice inputs. Shadow pricing is the mechanism to overcome these market defects.

Economic evaluation also differs from financial analysis as it is based on 'with' and 'without' project scenarios and the costs and benefits quantified are the incremental costs and benefits (i.e., the difference between the two scenarios).

In this project, the 'without' scenario is defined as the existing port at Jambi having minimal development and very little change occurring in infrastructure, equipment and operational procedures.

In this project, under the 'without' case, the existing port facilities will be used to their maximum capacity with an increasing degree of congestion and delay at the berths and in the terminals. This would result in increased waiting time, lower port efficiency and increased transport costs. Container traffic would also be handled at the existing general cargo berths at lower handling rates than would be anticipated at specialized berths.

Ultimately, traffic would be increasingly diverted to other ports such as Palembang and this is already happening and sometimes to ports even further distant.

Under the 'with' project scenario the specialized and additional facilities will enable cargo to be handled more efficiently and cost effectively with ships experiencing less queuing and faster on berth turnaround times.

22.13.2 Methodology

(1) General

Economic analysis is carried out by means of well-developed techniques and the EIRR (Economic Internal Rate of Return) and NPV (Net Present Value) are the two most often used. Both use discounting or discount rates (i.e., money has a time value and the same amount of money is worth more today than in any future year).

EIRR calculates the discount rate internally, hence its name and is the most widely used for the reason that one does not need to input a discount rate. The rate estimated within this procedure provides a proxy for the economic return on investment and is then compared to the target discount rate (15 % in Indonesia).

To calculate the NPV of a project, the discount rate is input and a discounted project value (i.e., the value of the project in today's values) is the output. If the output is greater than zero, the project is economically feasible.

In Indonesia, in recent years, the minimum rate required for projects has been 15 percent for non-social projects and 12 percent for social projects such as housing.

In undertaking the economic analysis, the project period is determined, and the costs and benefits of the investment, in each year of disbursement or receipt, are calculated.

Both local costs and all benefits are shadow priced. The foreign portion is regarded as already at market prices so no adjustment is made for imported (traded) inputs.

All costs and benefits are expressed in real terms (i.e., there is no allowance for inflation) although costs and benefits may be increased if there is expected to be an increase in real terms (i.e., above the general level of inflation). Costs and benefits are expressed in real or constant values in the base year of study which for this project is 2001.

The exchange rate used throughout is US$1.0=Rp.9,500.

Clearly, economic analysis depends on quantification of costs and benefits. All projects have clearly quantifiable elements but also elements that are difficult or impossible to quantify.

(2) Specific Aspects of Jambi Development

At this stage of the project, the ToR specify that the Master Plan as a whole is to be evaluated (i.e., the total costs and benefits of all the Jambi port sub projects are to be compared together) to assess in broad terms the feasibility of the Master Plan.

This section relates to the economic evaluation of the Master Plan. The short term project, which forms the first set of sub-projects for implementation within the master plan framework, is evaluated in section 24.5.

This section deals with both the 'Base' and 'High' development scenarios as defined above.

Usually, the principal quantified benefits of each such project are reduction in ship time in port and/or queuing and avoided land transport and /or transshipment costs between the without and with scenarios. In this case, we have one existing small port and a proposed port, which are both complementary and competitive. Unlike Samarinda, the existing port is very small and is not handling many containers per year.

22.13.3 Project Period

Infrastructure projects are expensive but have long economic and physical lives. Hence, the evaluation period is usually at least 20 years, excluding construction, and often 30 years. Thirty years has been chosen for this project. Costs and benefits are specified for each of the project years. Discounting means that costs and benefits after about 20 years usually have relatively small impacts on the economic feasibility.

This means that if there is expenditure in 2004, as in the High scenario, the last year is 2036. However, if expenditure starts in 2005 as in the Base scenario, the last year is 2037.

22.13.4 Project Costs

Costs for each scenario are divided into capital costs and annual costs. Capital costs are incurred both for the initial investment, and any subsequent, phase and for replacement of fully depreciated assets within the 30 year period (usually equipment has an economic life of less than 30 years).

Dredging at Jambi will be required on capital and annual basis.

The economic costs of implementing the projects have been estimated based on the financial cost including physical contingency. Price contingency, interest during construction and taxes and duties are then all excluded from the financial cost.

In order to shadow price the projects costs and benefits, a standard conversion factor (SCF) of 0.924 has been generally applied to non-traded (local portion) costs and benefits and a specific factor of 0.75 has been applied to unskilled labour. These factors are currently being applied in other Indonesian project evaluations.

Annual costs (i.e., operating and maintenance costs) are assumed to have a reasonably high local content and a SCF of 0.85 has been applied.

All traded costs (foreign portion) have been valued at their border price (i.e., the SCF is assumed as 1.0).

(1) Capital Costs and Maintenance Costs

These have been specified by year in Section 13.9.2 and the assumptions made detailed therein. The without scenario envisages minimal development and so the capital and maintenance costs are the incremental costs. Current maintenance expenditure is minimal.

(2) Operating Costs

These have been projected originally for the Jambi port branch based on 1999 and 2000 data and then converted to incremental costs for the project, based on incremental cargo volumes for each scenario.

These have been projected originally for the branch based on 1999 and 2000 data and then converted to incremental costs based on incremental cargo volumes for each scenario. The estimates involve a two-stage process. First a realistic assessment of the base year data is needed to establish the reliability of the data and then the future year costs must be estimated taking into account that some costs will directly vary with cargo growth and other costs are fixed or semi-fixed.

Base year costs were reviewed in relation to other Indonesian ports including on an IPC wide basis for the 4 IPCs. Secondly, cost data was disaggregated and an estimate made of the likely proportion of fixed sub-costs and variable sub-costs. Based upon a weighted average of these two, an estimate could be made of the link between cargo growth and operating cost growth. So for example, at Jambi, as cargo growth increases by 10 %, operating costs were estimated to increase by 4 % per year on the basis that per tonne throughput, Jambi operating costs are already high. Thus we can expect economies of scale.

Table 22.13.1 show the estimated incremental operating costs for the Base and High Scenarios.

(3) Dredging Costs

Dredging costs are subsidised in the RUKINDO contracts and we have allowed a substantially increased price. However, it is unclear as to whether any subsidy still remains in our estimates. Hence, we have not shadow priced dredging costs.

Table 22.13.5 at the end provides a summary of capital and annual costs, in economic prices, that are used in the analyses in this report.

Table 22.13.1 Jambi Base Scenario - Incremental Operating Costs

Year	Cost Per tonne (000 Rp)	Annual Operating Costs (with-in Rp m)	Cargo (000 tonnes)	Cargo Growth Rate (% pa)	Costs without (Rp m.)	Incremental Costs
2000	29.8	4,802	161		4,802	0
2001	28.3	4,976	176	9%	4,976	0
2002	26.9	5,154	192	9%	5,154	0
2003	25.5	5,344	209	9%	5,344	0
2004	22.2	5,941	268	28%	5,941	0
2005	21.1	6,156	292	9%	6,156	0
2006	20.0	6,388	319	9%	6,388	0
2007	17.7	6,987	394	23%	6,987	0
2008	15.9	7,558	475	20%	6,987	571
2009	14.4	8,125	564	19%	6,987	1,138
2010	13.7	8,396	611	8%	6,987	1,409
2011	13.1	8,701	666	9%	6,987	1,714
2012	12.4	9,019	727	9%	6,987	2,032
2013	11.8	9,348	794	9%	6,987	2,361
2014	11.2	9,690	866	9%	6,987	2,703
2015	10.6	10,047	946	9%	6,987	3,060
2016	10.1	10,418	1,033	9%	6,987	3,431
2017	9.6	10,804	1,129	9%	6,987	3,817
2018	9.1	11,207	1,234	9%	6,987	4,220
2019	8.6	11,627	1,350	9%	6,987	4,640
2020	8.2	12,065	1,477	9%	6,987	5,078
2021	7.7	12,522	1,617	9%	6,987	5,535
2022	7.3	12,999	1,771	10%	6,987	6,012
2023	7.0	13,497	1,941	10%	6,987	6,510
2024	6.6	14,019	2,128	10%	6,987	7,032
2025	6.2	14,564	2,335	10%	6,987	7,577

Note: Because of high existing costs, growth in costs=40% of growth in Cargo

Base Year actual

These are for Master Plan; FS costs are constant after capacity year, estimated as 2015 Base, 2013 High

Capacity 397,000 tonnes

22.13.5 Benefits-Quantifiable

(1) Ship Queuing and Savings to Ships

Ship waiting time with and without the project are estimated with a simulation model and this was described in section 20.11. The resulting time savings are then costed by applying the daily cost of the average vessel in key years, and interpolating between these years. We have established vessel cost per day by surveys with ship operators and charterers. These costs are increased in real terms in line with the increased size of vessel projected over time.

There is considerable competition in shipping rates at present with the economic recession in Indonesia and elsewhere but the possible increase in real costs is difficult to estimate.

The three types of vessels handled at Jambi public port are container, general cargo and bulk/CPO vessels. Passenger vessels are not handled at Talang Duku nor proposed at Muara Sabak.

Table 22.13.2 Estimated Ship Costs per Day, 2007 and 2025

Type of Vessel	GRT, Tonne (t) or TEU	Year	Cost per Day(Rp.m.)
Container	75 teu	In 2007	8.0
	125 teu	By 2025	19.0
General Cargo	300 t	In 2007	6.7
	650 t	By 2025	10.9
Bulk CPO Cargo	927 grt	In 2007	8.8
	1210 grt	By 2025	10.3

Notes: Conversion of tonnes to GRT or v.v. based on Indonesian fleet data and load factors

Sources: Research in Indonesia with shipping companies and charterers.

(2) Ship Service Time on Berth and Savings to Ships

Benefits are also generated by faster turnaround of vessels. The simulation model gives time on berth with and without project and annual savings are calculated and costed as in a) above.

Other benefits, albeit small in total, are generated because ships can save up to 36 hours per round trip by calling at Muara Sabak rather than Talang Duku. The saved time is valued as in a) above.

(3) Avoided Transport Costs

At the point at which the 'without' project capacity is reached, overflow cargo is assumed to be handled elsewhere. In accordance with this likely situation, the Consultants have assumed 100% will be handled at Palembang some 265 km. from Jambi. The avoided

costs (benefits) are based on the economic cost and truck transport data used in Indonesia for highway planning. While these rates could vary from actual freight rates they represent a more realistic resource cost.

Road transport costs are based on cost models currently in use in Indonesia. These models are based on the World Bank Highway Development Manual and adapted over many years to Indonesian conditions. The main inputs are vehicle type, speed and road surface. We have assumed that these conditions will not be as favourable as in East Kalimantan (a new road or toll road is planned to link Samarinda the capital with Balikpapan the oil centre) and therefore, truck costs are somewhat more expensive in Sumatra than Kalimantan.

Heavy truck costs are estimated to amount to Rp 3,688 per truck/km assuming that each truck will carry 10 tonnes payload. As traffic will be imbalanced a load factor of 80% has been assumed within that figure bearing in mind probable overloads.

It is quite possible that in a regional port study, there would be justification of including some additional capital costs for 'overflow' ports and other infrastructure. In this study, we are assessing a specific Master Plan and we have not considered in detail the regional infrastructure requirements.

Therefore, as this benefit is quite substantial and there could be justification for assessing the impact of not including all of this benefit assessed in the sensitivity analysis.

(4) Transport Disbenefits

Muara Sabak is some 105 km from the existing Jambi port and there will be some disbenefit from the additional distance. However, companies are likely to move in the longer term nearer the port and industrial development areas are already planned in the Muara Sabak area at Parit Culum. Further, Jambi city will become increasingly congested and impose penalties on port users.

The disbenefit is assumed to be on the same cost basis as the avoided costs above.

However, for the reasons above, we have assumed that in year 1 of operation the disbenefit will be 100 % of the maximum. By 2025 this percentage is assumed to fall to 10 % with relocation of business.

Traffic is forecast only up to 2025 and therefore, by convention, all benefits are kept constant thereafter to avoid overestimation.

(5) Shadow Pricing of Benefits

The net benefits are shadow priced at a SCF of 0.923. Conventionally, only benefits to Indonesian shippers and other Indonesian parties are included. In Jambi, as in most river ports, this is made complex by the fact that say plywood is exported from Indonesia in

foreign ships but is barged to the sea in Indonesian vessels. Container exports often travel in Indonesian ships to the export port where they are exported in foreign ships.

This is further complicated by the fact that Indonesia is taking steps to carry more goods in Indonesian ships so that by 2025 the situation could be different.

In this case, unlike Samarinda, we have, therefore, assumed no benefits accrue directly to foreign entities.

22.13.6 Unquantified Costs and Benefits

Environmental and social impacts are usually impossible or very difficult to quantify in monetary terms. The loss of mangrove areas and the destruction of landscapes and cultures cannot be measured in these terms. Project screening at an early stage attempts to sieve out the most sensitive areas.

Similarly, the generation of employment and employment opportunities, development of the economy and the facilitation of agriculture, trade and industry are all aspects which this project will help develop in a very important manner. However, their quantification is rarely attempted. This is because either no data exists to help quantify the impact of improved transport, and even where some data does exist, its further translation into monetary terms depends on often-speculative assumptions. However, this is not to say that the economic development aspects are not important. On the contrary, while we attempt to quantify benefits through cost savings, the goal is expansion of the regional economy, more and better quality employment opportunities and economic and social development in its wider sense.

The basis of the provincial economy and its maritime transport constraints were discussed in section 9, on demand forecasts.

However, it is worth emphasizing again, albeit briefly, that Jambi province is poorly served by river/sea transport with Talang Duku a long way upstream and providing public services through only small vessels on a semi-scheduled basis. The current difficulties and limitations of the existing services are described above.

Conversely, as described in the sections above, Jambi province is resource rich and, while possibly not on the same level as Riau or East Kalimantan, urgently requires improved river/sea transport to provide much needed support to exploit these resources. The Jambi Port Master plan sets out to significantly support economic development through the phased implementation of infrastructure and equipment, together with associated operational and related improvements.

22.13.7 Residual Values

Land values have not been included as no expenditure has been made on land in the cost estimates.

Infrastructure implemented after 2020 has been valued at 50 percent of its initial cost and all equipment is assumed fully depreciated by 2036. After 30 years, the impact of residual values is very small.

22.13.8 Results of the Economic Evaluation

The EIRR for the proposed Master Plan was estimated as shown in Table 22.13.3 which also shows the sensitivity analysis.

Table 22.13.3 EIRR Analysis for Jambi Port Master Plan-Base Scenario

JAMBI Port Master Plan	Base Scenario	Cost Plus 10%	Benefits Minus 10%	Combining (2) and (3)
	(1)	(2)	(3)	(4)
EIRR (%)	19.2	17.3	17.1	15.3

The EIRR analysis shows that the Master Plan is economically viable. Even with two unfavourable factors combined the EIRR falls to about 15 percent.

At 15 % discount rate, the Net Present Value (NPV) is Rp. 70,468 million. Any positive value of NPV means the project is viable.

Table 22.13.4 EIRR Analysis for Jambi Port Master Plan-High Scenario

JAMBI Port Master Plan	High Scenario	Cost Plus 10%	Benefits Minus 10%	Combining (2) and (3)
	(1)	(2)	(3)	(4)
EIRR (%)	18.1	16.4	16.6	15.0

The EIRR analysis shows that the Master Plan is economically viable. If either costs or benefits change by 10 percent the project is still approximately viable. However, with two unfavourable factors combined the EIRR falls to 15 percent.

At 15 % discount rate, the Net Present Value (NPV) is Rp. 70,465 million. Any positive value of NPV means the project is viable.

Table 22.13.5 Cost Summaries for Input to EIRR for Jambi Port

Master Plans

Jambi Base Case			
Item	Financial Cost	Economic Cost	Ratio Economic/Financial
	in Million Rupiah (except where ststed)		
Capital Costs	916,006	809,512	88%
in Million USD	96.4	85.2	
Annual Costs	773,808	699,412	90%
Total Costs	1,689,814	1,508,924	89%

* All items over 30 years

Jambi High Scenario			
Item	Financial Cost	Economic Cost	Ratio Economic/Financial
	in Million Rupiah (except where ststed)		
Capital Costs	1,033,388	913,594	88%
in Million USD	108.8	96.2	
Annual Costs	915,051	826,988	90%
Total Costs	1,948,439	1,740,582	89%

* All items over 30 years

Feasibility Studies

Jambi Base Case			
Item	Financial Cost	Economic Cost	Ratio Economic/Financial
	in Million Rupiah (except where ststed)		
Capital Costs	916,006	809,512	88%
in Million USD	96.4	85.2	
Annual Costs	773,808	699,412	90%
Total Costs	1,689,814	1,508,924	89%

* All items over 30 years

Jambi High Scenario			
Item	Financial Cost	Economic Cost	Ratio Economic/Financial
	in Million Rupiah (except where ststed)		
Capital Costs	1,033,388	913,594	88%
in Million USD	108.8	96.2	
Annual Costs	915,051	826,988	90%
Total Costs	1,948,439	1,740,582	89%

* All items over 30 years

Note: All annual costs includes incremental branch port operating costs per year.

Table 22.13.6 Summary Results of the Economic Evaluation of Jambi Ports Master Plan (Base Scenario)

Base Scenario	Benefits to Shipping	Land Transport Costs* and Benefits	NET BENEFIT	Capital Costs	Maintenance including dredging	NET COST / BENEFITS
2005				-3,447	0	(3,447)
2006				-35,635	0	(35,635)
2007	-	4,697	4,697	-141,605	0	(136,908)
2008	14,396	14,129	28,525	-32,447	-6,071	(9,993)
2009	14,744	21,953	36,697	0	-7,159	29,538
2010	15,088	27,034	42,122	0	-7,404	34,719
2011	15,422	32,963	48,385	0	-7,678	40,707
2012	15,739	39,486	55,225	0	-7,964	47,261
2013	16,032	46,602	62,634	0	-8,260	54,373
2014	16,293	54,350	70,643	-82,155	-6,489	(18,001)
2015	16,510	62,764	79,274	-138,016	-6,810	(65,551)
2016	16,673	71,863	88,536	-13,887	-22,538	52,110
2017	17,310	81,713	99,023	-32,378	-22,886	43,759
2018	17,957	92,329	110,286	-32,090	-23,918	54,278
2019	18,639	103,798	122,437	0	-25,120	97,317
2020	19,338	116,161	135,499	-29,794	-25,514	80,191
2021	20,104	129,486	149,590	-29,932	-25,925	93,733
2022	20,906	143,852	164,758	-105,859	-27,326	31,573
2023	21,747	159,303	181,050	-1,875	-30,360	148,815
2024	22,627	175,999	198,626	0	-30,829	167,796
2025	22,356	193,979	216,335	-4,343	-31,320	180,672
2026			216,335	0	-31,320	185,015
2027			216,335	-28,181	-31,320	156,835
2028			216,335	-6,070	-31,320	178,945
2029			216,335	0	-31,320	185,015
2030			216,335	0	-31,320	185,015
2031			216,335	-4,343	-31,320	180,672
2032			216,335	-40,272	-31,320	144,743
2033			216,335	-3,652	-31,320	181,363
2034			216,335	0	-31,320	185,015
2035			216,335	-26,453	-31,320	158,562
2036			216,335	0	-31,320	185,015
2036			216,335	-17,076	-31,320	339,182
						171,243
						Residual Value
						Land
						13,200
						36,061
						Infrastructure
						270,364
						135,182

* Note in the earlier years diversion costs to Muara Sabak are greater than diversion benefits to Palemabng

EIRR=	19.2%
NPV=	70,468
Total Cpaital and annual Costs=	1,508,924 Million Rupiah

Table 22.13.7 Summary Results of the Economic Evaluation of Jambi Ports Master Plan (High Scenario)

High Scenario	NET BENEFIT	Capital Costs	Maintenance including dredging	NET COSTS / BENEFITS
2004		-3,454	0	(3,454)
2005		-34,091	0	(34,091)
2006		-102,598	0	(102,598)
2007	28,006	-41,580	-3,646	(17,220)
2008	30,638	-31,418	-6,253	(7,033)
2009	25,560	0	-7,839	17,721
2010	33,783	0	-8,129	25,654
2011	42,614	-82,155	-19,371	(58,912)
2012	52,941	-138,015	-19,708	(104,782)
2013	64,607	0	-22,453	42,154
2014	77,589	0	-22,820	54,769
2015	91,858	0	-23,203	68,654
2016	106,382	-50,913	-23,604	31,865
2017	124,113	-112,799	-24,023	(12,709)
2018	143,011	-32,090	-27,690	83,231
2019	163,175	0	-28,973	134,202
2020	186,037	-25,934	-29,455	130,649
2021	212,154	-90,047	-29,959	92,148
2022	250,360	-44,229	-32,883	173,249
2023	271,114	-1,875	-34,435	234,803
2024	306,028	0	-35,017	271,011
2025	344,120	0	-35,627	308,493
2026	344,120	-28,181	-35,627	280,312
2027	344,120	-4,343	-35,627	304,150
2028	344,120	-6,070	-35,627	302,423
2029	344,120	0	-35,627	308,493
2030	344,120	0	-35,627	308,493
2031	344,120	-35,929	-35,627	272,564
2032	344,120	-30,796	-35,627	277,697
2033	344,120	-3,652	-35,627	304,841
2034	344,120	0	-35,627	308,493
2035	344,120	0	-35,627	308,493
2036	344,120	-13,424	-35,627	551,569
				256,500
				Residual Value
			Land	
			Bought	-
			Balance in 2036	-
			Infrastructure	
			Spent after 2020	513000
			Remaining Value	256500

EIRR=	18.1%	
NPV=	70,645	
Total Costs	1,740,582	Rp. Million

22.14 Preliminary Financial Analysis

22.14.1 Objective and Methodology of the Financial Analysis

(1) Objective

The purpose of the financial analysis is to evaluate the financial feasibility of the project. The analysis focuses on the viability of the project itself and the financial soundness of the new terminal management entity during the project life.

(2) Methodology

1) Viability of the Project

The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the Financial Internal Rate of Return (FIRR). The FIRR is the discount rate that makes the discounted costs and revenues over the project life equal, i.e., the rate "r" that satisfies the following formula:

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

Where, n : Project life,
Bi : Revenue in the i-th year : the first year is the base year,
Ci : Cost in the i-th year
r : Discount rate.

The revenues and costs which are taken into account for the FIRR calculation are summarized in Table 22.14.1.

Table 22.14.1 Revenues and Costs Employed in FIRR Calculation

Revenues	Costs
1) Operating Revenues by the Project	1) Investment for the Project (Installation of Handling Equipment and Replacement/Overhaul of Equipment) 2) Operating Expenses such as Maintenance, Repair, Rental, Personnel and Other Cost

The revenue and cost items excluded from the FIRR calculation are summarized in Table 22.14.2.

Table 22.14.2 Revenues and Costs Exempted from FIRR Calculation

Revenues	Costs
1) Fund Management Income	1) Depreciation Cost 2) Repayment of the Loan Principal 3) Interest on Loan

When the FIRR exceeds a certain threshold, the project is assessed to be financially feasible: the weighted average of the interest rates of various funds generated for the project is used as the threshold.

22.14.2 Assumption for Financial Analysis

(1) Scope of Analysis

The viability of the project was assessed using the revenues and costs related to the project.

1) Base Year

Price as of year 2001 is used in this financial analysis. Price escalation due to inflation for the future is not considered.

2) Project Life

Taking account of conditions of the long-term loans and service lives of port facilities, the project life for the financial analysis is determined as 33 years including 3-year design and construction period.

3) Revenues and Port Tariff

The Study Team took the following assumptions for the container wharves of Jambi Port.

a. Talang Duku will remain a conventional terminal throughout the study period.
b. Talang Duku will raise the tariff by 20 % in 2005 to become on a par with other conventional terminals. The tariff in Talang Duku will be raised in 2018 again to pay for the new investment.
c. Muara Sabak will be declared as a container terminal in 2007/2008. Most of the containers handled at Muara Sabak will be destined for Singapore. Accordingly, Muara Sabak will charge the tariff for a FCT.
d. As for general cargo handling and marine charge, the existing tariff will be applied.
e. To avoid a drastic increase of the container tariff, an exchange rate of US$1= Rp.6, 000 is applied (This rate of convenience is adopted at Palembang).

Table 22.14.3 Future Container Tariff at Jambi Port

Terminal	Type of Container	-2004	2005-2017	2018-
Talang Duku	FCL	Rp.94,800(20') Rp.142,200 (40')	Rp.120,000 (20') Rp.180,000 (40')	Rp.200,000 (20') Rp.300,000 (40')
	LCL	Rp.195,600 (20') Rp.293,400 (40')	Rp.240,000 (20') Rp.360,000 (40')	Rp.400,000 (20') Rp.600,000 (40')
	Empty	Rp.85,320 (20') Rp.127,980 (40')	Rp.110,000 (20') Rp.165,000 (40')	Rp.180,000 (20') Rp.270,000 (40')
Muara Sabak	FCL	-	US$ 81 (20') US$121 (40')	US$ 81 (20') US$121 (40')
	LCL	-	US$135 (20') US$ 203 (40')	US$135 (20') US$ 203 (40')
	Empty	-	US$ 73 (20') US$109 (40')	US$ 73 (20') US$109 (40')

4) Costs

Capital cost and annual cost for the project are summarized in Table 22.14.4 and Table 22.14.5. Capital dredging costs were divided to two parts, inside the river and outside the river. Since IPC2 is responsible for the dredging inside the river, the capital dredging cost for the channel inside the river was counted as the project cost. The Study Team also assumed IPC2 would pay a half of the maintenance dredging costs outside the river mouth. The dredging costs born by IPC 2 are included in the financial analysis.

Table 22.14.6 Proposed Dredging Cost Sharing

Area	Capital Dredging	Maintenance Dredging
Inside the River Mouth	IPC 2	IPC 2
Outside the River Mouth	Central Government	Central Government (50%) IPC2 (50%)

5) Fund Raising

It is assumed that 85 % of the total project cost is financed by foreign funds. The remaining 15 % of the total cost is assumed to be raised by domestic funds. The following conditions are employed for each fund in this financial analysis.

a. Foreign Fund

The foreign loan conditions are assumed as follows:

- Loan period : 30 years
- Grace period : 10 years
- Interest rate : 1.0 % per annum
- Repayment : Fixed amount repayment of principal
- Ratio of investment : Less than 85 % of the project cost

b. Domestic Fund

Table 22.14.4 Jambi FIRR Base Case

Year	Expenditure								Revenue	Balance
	Capital cost	MS Facility Maintenance	MS Equipment Maintenance	TD Facility Maintenance	TD Equipment Maintenance	Maintenance Dredging	Incremental operation costs	Total		
2004	0							0		0
2005	4,672							4,672		-4,672
2006	40,712							40,712		-40,712
2007	144,096	0	0				571	144,667		-144,667
2008	36,997	1,823	2,040			2,288	1,138	44,286	13,550	-30,735
2009	0	2,357	2,150			2,288	1,409	8,204	15,397	7,193
2010	0	2,357	2,150			2,288	1,714	8,509	18,207	9,698
2011	0	2,357	2,150			2,288	2,032	8,827	20,473	11,646
2012	0	2,357	2,150			2,288	2,361	9,156	23,286	14,130
2013	0	2,357	2,150			2,288	2,703	9,498	26,646	17,148
2014	56,766	2,357	2,150			0	3,060	64,333	30,006	-34,327
2015	118,971	2,357	2,150			0	3,431	126,909	33,914	-92,995
2016	15,918	3,254	3,914			12,155	3,817	39,058	38,368	-690
2017	36,903	3,254	3,914			12,155	4,219	60,445	43,370	-17,075
2018	35,762	3,254	3,914	744		12,155	4,639	60,469	52,717	-7,752
2019	0	3,254	3,914	744	915	12,155	5,077	26,060	59,305	33,245
2020	34,073	3,254	3,914	744	915	12,155	5,535	60,590	66,486	5,896
2021	34,181	3,254	3,914	744	915	12,155	6,012	61,175	74,257	13,081
2022	118,274	4,333	3,914	744	915	12,155	6,510	146,845	82,619	-64,226
2023	2,090	4,333	5,678	938	1,830	12,155	7,032	34,056	92,758	58,702
2024	0	4,333	5,678	938	1,830	12,155	7,577	32,511	103,486	70,975
2025	4,840	4,333	5,678	938	1,830	12,155	7,577	37,351	114,806	77,455
2026	0	4,333	5,678	938	1,830	12,155	7,577	32,511	114,806	82,295
2027	31,405	4,333	5,678	938	1,830	12,155	7,577	63,916	114,806	50,890
2028	6,765	4,333	5,678	938	1,830	12,155	7,577	39,276	114,806	75,530
2029	0	4,333	5,678	938	1,830	12,155	7,577	32,511	114,806	82,295
2030	0	4,333	5,678	938	1,830	12,155	7,577	32,511	114,806	82,295
2031	4,840	4,333	5,678	938	1,830	12,155	7,577	37,351	114,806	77,455
2032	44,880	4,333	5,678	938	1,830	12,155	7,577	77,391	114,806	37,415
2033	4,070	4,333	5,678	938	1,830	12,155	7,577	36,581	114,806	78,225
2034	0	4,333	5,678	938	1,830	12,155	7,577	32,511	114,806	82,295
2035	29,480	4,333	5,678	938	1,830	12,155	7,577	61,991	114,806	52,815
2036	0	4,333	5,678	938	1,830	12,155	7,577	32,511	114,806	82,295

Exchange rate for the dollar base tariff

US1$= Rp.	6,000

FIRR	6.0%

Table 22.14.5 Jambi FIRR High Case

	Expenditure								Revenue	Balance
	Capital cost	MS Facility Maintenance	MS Equipment Maintenance	TD Facility Maintenance	TD Equipment Maintenance	Maintenance Dredging	Incremental operation	Total		
2004	3,943							3,943		-3,943
2005	38,947							38,947		-38,947
2006	115,353							115,353		-115,353
2007	47,753	1,290	2,040				721	51,804	15,455	-36,349
2008	35,820	1,290	2,040			2,288	1,307	42,745	17,894	-24,850
2009	0	2,357	2,150			2,288	1,893	8,688	21,136	12,448
2010	0	2,357	2,150			2,288	2,215	9,010	24,245	15,235
2011	56,765	2,357	2,150			0	2,573	63,845	27,960	-35,885
2012	118,970	2,357	2,150			0	2,947	126,424	32,276	-94,148
2013	0	3,254	3,914			12,155	3,336	22,659	37,194	14,535
2014	0	3,254	3,914			12,155	3,744	23,067	42,714	19,648
2015	0	3,254	3,914			12,155	4,169	23,492	48,837	25,344
2016	58,049	3,254	3,914			12,155	4,614	81,986	54,957	-27,029
2017	127,338	3,254	3,914			12,155	5,080	151,741	62,885	-88,857
2018	35,762	4,333	5,678	744		12,155	5,568	64,240	75,477	11,237
2019	0	4,333	5,678	744	915	12,155	6,078	29,903	85,086	55,182
2020	29,624	4,333	5,678	744	915	12,155	6,613	60,062	95,963	35,901
2021	101,038	4,333	5,678	744	915	12,155	7,173	132,037	108,740	-23,296
2022	49,592	5,230	7,442	744	915	12,155	7,761	83,839	128,491	44,651
2023	2,090	5,230	7,442	938	1,830	12,155	8,377	38,062	138,096	100,034
2024	0	5,230	7,442	938	1,830	12,155	9,023	36,618	155,940	119,322
2025	0	5,230	7,442	938	1,830	12,155	9,701	37,296	175,686	138,390
2026	31,405	5,230	7,442	938	1,830	12,155	9,701	68,701	175,686	106,985
2027	4,840	5,230	7,442	938	1,830	12,155	9,701	42,136	175,686	133,550
2028	6,765	5,230	7,442	938	1,830	12,155	9,701	44,061	175,686	131,625
2029	0	5,230	7,442	938	1,830	12,155	9,701	37,296	175,686	138,390
2030	0	5,230	7,442	938	1,830	12,155	9,701	37,296	175,686	138,390
2031	40,040	5,230	7,442	938	1,830	12,155	9,701	77,336	175,686	98,350
2032	34,320	5,230	7,442	938	1,830	12,155	9,701	71,616	175,686	104,070
2033	4,070	5,230	7,442	938	1,830	12,155	9,701	41,366	175,686	134,320
2034	0	5,230	7,442	938	1,830	12,155	9,701	37,296	175,686	138,390
2035	0	5,230	7,442	938	1,830	12,155	9,701	37,296	175,686	138,390
2036	14,960	5,230	7,442	938	1,830	12,155	9,701	52,256	175,686	123,430

Exchange rate for the dollar base tariff

US1$=Rp.	6,000

FIRR	8.7%

The domestic loan conditions are assumed as follows:

- Loan period : 10 years
- Interest rate : 18.0 % per annum
  (The real interest rate excluding inflation rate)
- Repayment : Fixed amount repayment of principal

c. Weighted Average Interest Rate

The weighted average interest rate of the funds for investments is 3.55 % per annum under the loan conditions stated above. (1.0 x 0.85 + 18.0 x 0.15 = 3.55)

22.14.3 Evaluation of Project

(1) Viability

FIRR of the project is shown in Table 22.14.5 and Table 22.14.6 FIIRR of each project is exceeding the weighted average interest rate of loan of 3.55 %.

(2) Sensitivity Analysis

Sensitivity analysis is carried out to examine the impact of unexpected future changes such as cargo volume, construction cost, inflation or exchange rate. The following cases were analyzed.

- Case 1 : Investment costs increase by 10 %.
- Case 2 : Revenues decrease by 10 %.
- Case 3 : Investment costs increase by 10 %, and revenues decrease by 10 %.

Results of the sensitivity analysis is shown in Table 22.14.7. In all cases except Case 3 of the base case, FIRR exceeds the weighted average interest rate of loan (3.55 % per annum). For this case, the exchange rate of convenience should be Rp. 6,500, which results in a FIRR of 4.5%.

Table 22.14.7 Results of Sensitivity Analysis

(Exchange rate of convenience at US1$=Rp6, 000)

Case	Jambi Base Case	Jambi High Public Case
Original case	6.0%	8.7%
Case 1	5.1%	7.8%
Case 2	4.4%	7.3%
Case 3	3.4% (4.5%)	6.4%

Judging from the above analysis, the project is regarded as financially feasible.