

2.5 Design and Cost Estimates

2.5.1 Design of Facilities

In the Short-Term Plan, the following existing facilities shown in "A : Demolishing Works" are going to be demolished and the new facilities shown in "B : New Construction Works" will be constructed and the existing facilities shown in "C : Modification Works" are required to be improved.

A : Demolishing Works

1. West Quay

- 1) Checking Post No.1
- 2) Police Station
- 3) Harbor Service Sec.
- 4) Craft service Sec.
- 5) Import Control & Immigration Office
- 6) Export Inspection Office
- 7) Vehicle Section
- 8) Supplementary Sheds No.1, 4, 5, 6, 7 & 9
- 9) Bonded warehouse
- 10) Bangkok Port Head Office
- 11) PAT O.B. Building
- 12) Quay Side Cranes No.1 to No.12

2. East Quay

- 1) Repair Shop for Handling Equipment
- 2) Gas Station
- 3) Cargo Warehouse (Budget is already allocated by PAT)
- 4) Transit Sheds No.11 & 12
- 5) Reefer Container Storage Yard
- 6) Railway

B : New Construction Works

1. West Quay

- 1) 2 Import CFS Sheds (Budget is already allocated by PAT)
- 2) Maintenance Shop
- 3) Container Cleaning Area
- 4) Gates & Fence of CFS & Empty Container Storage Yards
- 5) Container Handling Equipment & Vehicle Area
- 6) Port Office Building
- 7) Gas Station

- 8) Canteen
- 9) Fire Station
- 10) Main Port Road
- 11) Open Storages
- 12) Checking Post No.1
- 13) Railway Yard
- 14) Parking Lots
- 15) Repair Shop and Office for Container Handling Equipment
- 16) Utilities

2. East Quay

- 1) Container Marshaling Yard
 - Existing Building Area
 - Surrounding Area
- 2) Reefer Container Storage Yard
- 3) 4 Transtainer Repair Areas
- 4) Terminal Office Building
- 5) Gates & Fence of Container Terminals
- 6) Gas Station
- 7) Utilities

C : Modification Works

1. West Quay

- 1) Transit Sheds No.13 & 14
- 2) Transit Sheds No.1 to 9

2. East Quay

- 1) Bridge

The outline of new facilities are summarized in Table 2-5-1.

Table 2-5-1 Outline of New Facilities (1)

Name of Facilities	Area	Capacity	Description
1) Maintenance Shop			
-Shop	1,500m ²	3.0t/m ²	Steel frame, Concrete block wall, RC slab, Pile foundation Work Shop: 1,260m ² Spare Parts Store: 120m ² Battery Room: 40m ² Office: 40m ² Locker Room: 40m ²
-Maintenance Open Area	3,750m ²	3.0t/m ²	Concrete pavement (25cm) 1 Grease trap
2) Container Cleaning Area	3,430m ²	3.0t/m ²	Concrete pavement (25cm) 1 Grease trap
3) Gates for Export CFS & Empty Container Yard			
No.1			2 Incoming, 2 Outgoing
No.2			1 Incoming, 1 Outgoing lanes
No.3			1 Incoming, 1 Outgoing lanes RC canopy of 4.2m high Checking room: 25m ² each Pile foundation
4) Container Marshaling Yard			
-Existing Building Area	26,260m ²	3.0t/m ²	RC slab and beams on existing PC pile foundation
-Other Area	70,400m ²	3.0t/m ²	Concrete pavement (35cm)
5) RTG Repair Area			
-RTG Small	3x300m ²	3.0t/m ²	Concrete pavement (35cm) 3 Grease traps
-RTG Large	1x375m ²	3.0t/m ²	Concrete pavement 1 Grease trap
6) Container Terminal Office	600m ²	0.25t/m ²	3 Story RC structure, Pile foundation Operator's room: 116m ² Customs room: 50m ² Worker's room: 50m ² Documentation room: 50m ²

Table 2-5-1 Outline of New Facilities (2)

Name of Facilities	Area	Capacity	Description
7) Container Terminal Gates			
-No. 1			4 Incoming, 3 Outgoing lanes. 3 Check rooms: 7.5m ² each 2 Check rooms: 21.0m ² each 2 Truck scales
-No. 2			4 Incoming, 3 Outgoing lanes. 5 Check rooms: 7.5m ² each 2 Check rooms: 21.0m ² each 3 Truck scales
-No. 3			4 Incoming, 3 Outgoing lanes. 5 Check rooms: 7.5m ² each 2 Check rooms: 21.0m ² each 2 Truck scales
8) Bridge (Modification)	252m		PC Girder Bridge 30m x 3 Span=90m long 81m long approaches on both side, with RC deck. Modify from 4 lanes to 5 lanes by reducing width of sidewalks.
9) Gas Station			
-East Quay	1,200m ²		Underground storage tanks: Diesel: 2 x 2.1m D x 6.0m L Gasoline: 2 x 1.5m D x 3.0m L
-West Quay	600m ²		Underground storage tanks: Diesel: 3 x 1.5m D x 3.0m L Gasoline: 1 x 2.1m D x 6.0m L 3 x 1.5m D x 3.0m L
10) Main Port Road	1,500m		21m wide, Concrete pavement (25cm) Traffic Lane: 4 x 3.5m Temporary Stoppage Lane: 2 x 2.5m Side Walk: 1 x 2m
11) Checking Post No. 1			2 Incoming, 3 Outgoing lanes 1 Emergency Passage 4 Check rooms: 30m ² RC canopy 5.3m high Pile foundation
12) Port Office Building and Canteen			
-Port Office	2,300m ²	0.25t/m ²	3 Story RC structure. Pile foundation Customs office: 880m ² Vehicle section: 150 m ² Harbor service div.: 350m ² Craft service sec.: 230m ² Others: 790m ²
-Canteen	150m ²	0.25t/m ²	1-story RC structure

Table 2-5-1 Outline of New Facilities (3)

Name of Facilities	Area	Capacity	Description
13) Repair Shop and Office			
-Repair shop	750m ²	3.0t/m ²	Steel frame. Concrete block wall. RC slab. Pile foundation Work Shop: 620m ² Spare Parts Store: 60m ² Battery Room: 30m ² Office: 30m ² Locker room: 40m ²
-Office	900m ²	0.25t/m ²	2-story RC structure. Pile foundation
14) Railway Yard	5,500m ²	3.0t/m ²	New railway siding of approx. 200m long diverges from the existing line. Concrete pavement (25cm)
15) Fence			
-Customs Fence	1,325m		Concrete block. 2.8m high RC foundation
-Container Terminal Fence	2,250m		Steel Netting. 1.5m high Steel post
16) Parking Lot No.1	19,000m ²	1.0t/m ²	Asphalt pavement(5cm) Passenger cars: 1,060 units
17) Transit Shed No.13 & 14	2x5,060m ²	1.5t/m ²	6m wide RC platforms with foundation piles are added on both sides of these sheds. 7 shutter doors are installed on all walls of these sheds
18) Transit Sheds No.1~No.9	4,680m ² ~6,000m ²	1.5t/m ²	Middle ridge between sheds No.1 and No.2. No.3 and No.4, No.5 and No.6. No.8 and No.9 are demolished part . Part of floor deck at middle ridge shall be demolished and constructed again with suitable elevation.

2.5.2 Design of Cargo Handling Equipment

Judging from the existing cargo handling equipment owned by PAT and the cargo handling equipment that will be procured within a few years, there are sufficient numbers and types of cargo handling equipment for the container cargoes and general cargoes in the Bangkok Port. In order to utilize available limited yard space efficiently, the only equipment recommended for the project is the large size container transfer crane which can work on the six row and four high stacked containers in lieu of the existing type container transfer crane for the four row and three high stacked containers.

The recommendable technical specification for the container transfer crane is as follows;

- | | |
|-----------------------|--------------------------------------|
| 1) Type | : Tire Mounted Gantry Type |
| 2) Procurement Number | : 9 units |
| 3) Rated Load | : 40 ton |
| 4) Main Dimension | |
| Lift | : 15.24 m (4 tiers + 1 Over) |
| Span | : 23.47 m (6 rows + 1 chassis lane) |
| Traversing distance | : 19.07 m |
| 5) Speed | |
| Hoist (40 ton) | : 20 m / min. |
| (No load) | : 50 m / min. |
| Traverse | : 80 m / min. |
| Travel | : 120 m / min. |
| 6) Spreader Type | : 20' / 40' / 45' Telescopic Type |
| 7) Power Source | : Diesel Engine Generator |

2.5.3 Construction Planning

The project implementation schedule must be established so as to not stop or effect port operations. The construction period of the project implementation is estimated as 43 months including works for the CFS and demolishing of the warehouse in the east quay.

The summary of the construction schedule is prepared as shown in Fig. 2-5-1.

Description		Year	1994	1995	1996	1997	Remarks
East Quay	unit	Quantity	2 4 6 8 10	2 4 6 8 10	2 4 6 8 10	2 4 6 8 10	
Container Yard	m2	83470		*****	*****	*****	
Container Yard on Existing Sheds	m2	26620		*****		*****	
RTG Repair Area & Passing Way	LS	1		*****		*****	
Terminal Office	m2	600			*****		
Terminal Gates 1,2 & 3	LS	1	*****	*****			
Road Improvement & Fence	LS	1			*****		
Gas Station	LS	1	*****				
Demolishing work	LS		*****	*****	*****	*****	
Utilities	LS	1	***	***	*****	***	
West Quay							
Import CFS & Yard (2 Sheds by PAT)	LS	1	*****	*****			
Empty Container Yard & Gate 1,2 & 3	LS	1	*****	*****			
Checking Post 1	Unit	1			***	***	
Main Port Road	m2	29340			*****		
Parking Lot 1 & 3	m2	18700	***	***			
Maintenance Shop & Cleaning Yard	LS	1	*****				
Demolishing Building & Yard Paving	LS	1	*****	*****	*****		
Buildings & Facilities	LS	1	***	*****	***		
Utilities	LS	1		*****	*****		
Modification Transit Shed No1-No9	LS	1		*****			
Modification Transit Shed No.13 &14	LS	1			*****		
Modification Bridge	LS	1	***				

Note: *****: The budget allocation for items has been completed by PAT

Fig. 2-5-1 Construction Schedule

2.5.4 Cost Estimation

The budget allocation for the CFS, the demolishing warehouse in the east quay, the parking lot No.2 and the 2 (two) lighting towers in the east quay has been completed by PAT. Therefore, these works are not included in this project cost. The contingency for price escalation is not included in the project cost. The project cost is estimated at 1199 million baht in total, including VAT, as presented in Table 2-5-2 and the annual disbursement schedule is presented in Table 2-5-3.

Table 2-5-2 Summary of Project Cost

Construction Cost			COST	Remarks
East Quay	unit	Quantity	Million Baht	
Container Yard	m2	83470	88.47	
Container Yard on Existing Sheds	m2	26620	58.03	
RTG Repair Area & Passing Way	LS	1	19.59	
Terminal Office	m2	600	8.63	
Terminal Gates 1,2 & 3	LS	1	12.81	
Road Improvement & Fence	LS	1	2.47	
Gas Station	LS	1	5.50	
Demolishing work	LS	1	5.22	
Utilities	LS	1	26.26	
Sub-Total			226.98	
West Quay				
Empty Container Yard & Gate 1,2 & 3	LS	1	5.24	
Checking Post 1	Unit	1	7.45	
Main Port Road	m2	29340	23.08	
Parking Lot 1 & 3	m2	18700	16.88	
Maintenance Shop & Cleaning Yard	LS	1	24.64	
Demolishing Building & Yard Paving	LS	1	46.31	
Buildings & Facilities	LS	1	45.60	
Utilities	LS	1	16.81	
Modification Transit Shed Nol-No9	LS	1	3.99	
Modification Transit Shed No.13 &14	LS	1	22.50	
Modification Bridge	LS	1	1.49	
Sub-Total			213.99	
Construction Cost Sub-Total			440.97	
Engineering Fee	%	10	44.10	
Physical Contingency	%	10	44.10	
Construction Cost Total			529.17	
Procurement Cost	unit	Quantity	COST Million Baht	
Rubber Tyred Gantry Crane (6+1)	Unit	9	549.90	
Computer (terminal)	Set	31	7.44	
Package Soft-ware	LS	1	16.50	
Procurement Cost Sub-Total			573.84	
Engineering Fee	%	3	17.22	
Physical Contingency	%	0	0.00	
Procurement Cost Total			591.06	
Total Cost (Construction & Procurement)			1120.23	
VAT	%	7	78.42	
Project Cost			1198.64	

Table 2-5-3 Annual Disbursement Schedule

Unit: Million Baht

Description	Currency		1994			1995			1996			1997			Total	
	F	L	F	L	Total	F	L	Total	F	L	Total	F	L	Total	F	L
Construction Cost (East)	46%	54%	5.3	4.3	9.6	32.23	38.1	70.3	27.6	33.7	61.3	39.59	46.3	85.8	104.7	122.4
Construction Cost (West)	48%	52%	25.6	25.2	50.8	41.9	42.2	84.1	22.4	28.7	51.1	0	0	0	89.9	96.1
Improvement Cost																0
Transit Shed No. 1-No. 9	48%	52%	0	0	0	1.9	2.1	4	0	0	0	0	0	0	1.9	2.1
Transit Shed No. 13 & 14	45%	55%	0	0	0	0	0	0	10.1	12.4	22.5	0	0	0	10.1	12.4
Bridge	46%	54%	0.7	0.8	1.5	0	0	0	0	0	0	0	0	0	0.7	0.8
Sub-Total	47%	53%	31.6	30.3	61.9	76.03	82.4	158.4	60.1	74.8	134.9	39.59	46.3	85.8	207.3	233.8
Engineering Fee	50%	50%	13.2	13.2	26.4	3	2.9	5.9	3	2.4	5.9	3	2.9	5.9	22.2	21.4
Physical Contingency	47%	53%	2.9	3.3	6.2	7.5	8.4	15.9	6.3	7.1	13.4	4	4.6	8.6	20.7	23.4
VAT	0	100%		6.6	6.6		12.6	12.6		10.8	10.8		7	7	0	37
Total (Construction)	44%	56%	47.7	53.4	101.1	86.53	106.3	192.8	69.4	95.1	165	46.59	60.8	107.3	250.2	315.6
																0
Procurement Cost	77%	23%							134	38	172	312.9	88.9	410.8	446.9	126.9
Engineering Fee	90%	10%							4.7	0.5	5.2	10.9	1.2	12.1	15.6	1.7
VAT	0	100%							0	12.4	12.4	0	29	29	0	41.4
Total (Procurement)	73%	27%							138.7	50.9	189.6	323.8	119.1	451.9	462.5	170
Project Cost	59%	41%	47.7	53.4	101.1	86.53	106.3	192.8	208.1	146	354.6	370.3	179.9	559.2	712.7	485.6

Note; F=Foreign Portion
L=Local Portion

2.6 Economic Analysis

2.6.1 Purpose and Methodology of Economic Analysis

The purpose and methodology of the economic analysis is to evaluate whether the project is justifiable from the economic viewpoint by investigating the economic benefits as well as costs which will arise from the project and assessing its contribution to the national economy.

An economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project.

2.6.2 Benefits of the Project

The following benefits are considered to be brought about by the Short-Term Plan for modernization of Bangkok Port:

- (i) Savings in ships staying costs
- (ii) Savings in administration and operation costs
- (iii) Improvement of cargo handling safety and reduction of cargo damage
- (iv) Reduction of traffic congestion in the port area
- (v) Reduction of robbery of container cargo
- (vi) Contribution to the national economic development through upgrading international status of Bangkok Port

Among the above benefit items, (i) and (ii) are evaluated monetarily as benefits from the project.

This results in safe side evaluation in the economic analysis.

2.6.3 "Without" Case

In this study, following conditions are adopted for the "without" case.

- (i) The cargo volume loaded/discharged on/from conventional vessels and container vessels is the same as that of "with" case.
- (ii) Number of container boxes at Klong Toei Wharf will be one million TEUs both in "with" and "without" cases.
- (iii) Number of personnel will be kept unchanged from the present number.

2.6.4 Results of Economic Analysis

The resulting EIRR of this project is estimated as 12.4% (see Table 2-6-1) and it exceeds the criterion of 10% which is generally adopted to assess the economic justifiability of a project.

Table 2-6-1 Cost/Benefit Analysis

Unit: Million Baht										
	Benefits			Costs			Benefits -Costs	Net Present Value (NPV)		
	Total	Savings in Ship Staying Cost	Savings in Admi. & Op Cost	Total	Construction Cost	Maintenance Cost		Benefit	Cost	Benefit -Cost
1 1994					84.4		84.4	-84.4	0.0	-84.4
2 1995					159.1		159.1	-159.1	0.0	-159.1
3 1996					585.0		585.0	-585.0	0.0	-585.0
4 1997	124.1	5.4	129.5			23.0	106.5	91.2	16.2	75.0
5 1998	124.1	11.0	135.1			23.0	112.1	84.6	14.4	70.2
6 1999	124.1	16.8	140.9			23.0	117.9	78.5	12.8	65.7
7 2000	124.1	22.7	146.8			23.0	123.8	72.8	11.4	61.4
8 2001	124.1	28.8	152.9	16.5		23.0	139.5	67.4	17.4	50.0
9 2002	124.1	35.0	159.1			23.0	136.1	62.4	9.0	53.4
10 2003	124.1	41.5	165.5	5.7		23.0	136.8	57.8	10.0	47.8
11 2004	124.1	48.1	172.1			23.0	149.1	53.5	7.1	46.3
12 2005	124.1	54.9	178.9			23.0	155.9	49.4	5.4	43.1
13 2006	124.1	61.9	185.9	456.4		23.0	479.4	-293.5	45.7	117.8
14 2007	124.1	69.0	193.1			23.0	170.1	42.2	5.0	37.2
15 2008	124.1	76.4	200.5			23.0	177.5	39.0	4.5	34.5
16 2009	124.1	84.0	208.1			23.0	185.1	36.0	4.0	32.0
17 2010	124.1	91.8	215.9	5.7		23.0	187.2	33.2	4.4	28.8
18 2011	124.1	99.8	223.9	16.5		23.0	184.4	30.7	5.4	25.3
19 2012	124.1	108.1	232.1			23.0	209.1	28.3	2.8	25.5
20 2013	124.1	116.5	240.6			23.0	217.6	26.1	2.5	23.6
21 2014	124.1	125.2	249.3			23.0	226.3	24.0	2.2	21.8
22 2015	124.1	134.2	258.2			23.0	235.2	22.2	2.0	20.2
23 2016	124.1	143.4	267.4	456.4		23.0	479.4	-212.0	20.4	36.6
24 2017	124.1	152.8	276.9	5.7		23.0	248.2	18.8	1.9	16.9
25 2018	124.1	162.6	286.6			23.0	263.6	17.3	1.4	15.9
26 2019	124.1	172.6	296.6			23.0	273.6	15.9	1.2	14.7
27 2020	124.1	182.8	306.9			23.0	283.9	14.7	1.1	13.6
28 2021	124.1	193.4	317.5	456.6		23.0	491.6	-174.1	13.5	20.9
29 2022	124.1	204.3	328.3			23.0	305.3	12.4	0.9	11.6
30 2023	124.1	215.4	339.5	-558.6		23.0	-535.6	875.1	11.4	-18.0
Total	3349.6	2658.5	6008.1	1801.4		621.0	2422.4	3585.7	1069.5	1069.5

EIRR= 0.12405

2.7 Financial Analysis

2.7.1 Purpose and Methodology of the Financial Analysis

The purpose of the financial analysis is to appraise the financial feasibility of the projects proposed in the Short-Term Plan. The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the FIRR. At the same time, the financial soundness of the port management body is appraised from the viewpoints of profitability and operational efficiency etc. based on its projected financial statements (Profit and Loss Statement, Cash Flow Statement and Balance Sheet).

2.7.2 Analysis of Viability of the Project

(1) Prerequisites

1) "With" Case and "Without" Case:

- a) Benefits and costs in a cost-benefit analysis are calculated based on the difference between the "With" and "Without" investment cases.
- b) Number of container boxes handled at Klong Toei Wharf will be one million TEUs both for "With" and "Without" cases.
- c) Project costs will not include the cost of on-going projects such as procurement of some RTGs.

2) Project Life: 30 years

3) Base Year: 1993

4) Revenues from the Projects

The Short-Term Plan covers both the container handling and the general cargo handling. However, since most of the modernization works are related to the container cargo handling, revenues which are only concerned with the container operations are to be counted as revenues earned from the project in the FIRR calculation. The following items can be considered affecting revenues from the project.

- a) Reduction of revenues of berth hire through less berthing time of container vessels
- b) Increase of revenues from the land rent
- c) Increase of revenues from container repair and cleaning which are new businesses in the Short-Term Plan
- d) Increase of revenues by increase of the port tariff related to containers

5) Costs

Costs of investment, reinvestment, personnel, administration, maintenance, repair and fuel are taken into account.

- a) The personnel cost is calculated based on the assumption that PAT would recruit a less number of personnel than that of retirees by 50 persons per year for a period of thirty years as an effect of the Short-Term Plan.

(2) Evaluation

1) Result of FIRR Calculation: 9.3%

This figure is taken as acceptable for PAT to spend its own funds because it exceeds the range of the recent interest rates of bank deposits (6%-9%).

2) Sensitivity Analysis

Sensitivity analysis is made for the following three cases.

Case I: The revenues decrease by 10%.

Case II: The project costs increase by 10%.

Case III: The revenues decrease by 10% and the project costs increase by 10%.

Table 2-7-1 FIRR Sensitivity Analysis

	Base Case	Case I	Case II	Case III
FIRR	9.3%	8.4%	8.5%	7.7%
Range of Interest Rate	6.0%-9.0%			

The FIRR of each case is as shown in Table 2-7-1. The ratio of each case keeps a favorable level judging from the range of investing interest rates like those of bank deposits.

2.7.3 Analysis of Financial Soundness of the Port Management Body

(1) Prerequisites

1) Project Life and Base Year: The same as those in section 2.7.2

2) Cargo Handling Volume

The annual cargo handling volume is determined based on the cargo handling volume forecast.

3) Port Charges and Revenues

Revenue from the port activities are calculated based on the new tariff. The rates of the new tariff would be the same as those in section 2.7.2, namely, the charges related only to container operations would be increased.

4) Costs

Costs of investment, reinvestment, personnel, administration, depreciation, maintenance, repair and fuel etc. are taken into account.

- a) Maintenance, repair and fuel cost are calculated from the estimated future cargo handling volume by analyzing the relation between the past maintenance, repair and fuel costs and the past cargo handling volume.
- b) The future depreciation costs are estimated by adding those of the newly proposed port facilities and equipment calculated by the straight line method to the depreciation cost in the fiscal year 1993 which is supposed as the base year.

(2) Evaluation

At the same time, the financial soundness of the port management body is appraised based on the projected financial statements (Profit and Loss Statement, Cash Flow Statement and Balance Sheet).

1) Profitability

The rate of return on net fixed assets shows the profitability of the investment. It

sufficiently maintains a favorable level.

2) Operational Efficiency

The operating ratio shows the operational efficiency of the organization as an enterprise, and the working ratio shows the efficiency of the routine operations of the port. Both of them maintain favorable levels.

2.7.4 Conclusion

Judging from the above analysis, this project is financially feasible in the base case.

2.8 Proposals on Measures to Implement the Project

It is proposed to take the following measures to implement the project of the Short-Term Plan:

- a. Both restructuring of management and operations systems and investment in necessary physical facilities in Bangkok Port shall be put emphasis on and be implemented simultaneously.
- b. The purpose of modernization of Bangkok Port is not to increase cargo throughput but to upgrade service levels of port services for its port users. The required amount of the investment is moderate judging from an average income level of PAT. Those points shall be well acquainted to the authorities concerned.
- c. The port tariff is proposed to be raised slightly to cover some portion of the capital investment. In other words, the proposed increase rate is considered to be conservative compared with the benefits for the port users generated from the project. That point shall be understood by the port users.
- d. Knowhow to control the container terminal under the closed terminal system shall be obtained by PAT through employment of competent yard planners along with cooperation with private companies as port users. Even in the transitional period when PAT will operate a part of the marshaling yard, it is essential that PAT take full responsibility of container-handling at that terminal.

JICA

