16.12 Economic Analysis

16.12.1 Methodology

The method of analysis is the same as that of Latakia Port mentioned in Chapter 15.13.1.

16.12.2 Prerequisites of Analysis

In order to estimate the costs and benefits, the following requisites are assumed for the analysis.

(1) Base Year

1995 is set as the "Base Year" for this study.

(2) Project Life

Taking into consideration the depreciation period of the main facilities of 30 years and the construction period of 4 years, the period of calculation (project life) in the economic analysis is assumed to be 34 years from the beginning of construction.

(3) Foreign Exchange Rate

The exchange rate adopted for this analysis is US$ 1.00 = 42 S.P., the same rate as used in the cost estimation.

(4) "With"case and "Without"case

If the new port is not constructed, it is the most reasonable to assume that the cargoes which are planned to be handled in the New Port would have to be handled in Tartus Port because most those cargoes are handled there now. But only the cargoes which are planned to be handled in Tartus port in the future are set as objects of economic analysis in order to calculate the substantial benefits of the project in tartus port.

1) "With"case

The "With"case scenario includes all improvements in productivity and all expansions of port facilities for the short-term plan. In this study, the following conditions are assumed for the capacity of cargo handling.

i) Handling capacity of the container terminal planned in the short-term plan is estimated to be about 150,000 TEUs (handled in 2008). The excess container cargo will be dealt with in the next phase project.
ii) Handling capacity of the existing general cargo berth is estimated to be about

4.5 million tons (handled in 2009). The excess general cargo will be dealt with in the next phase project.

2) "Without"case

In this study, the following conditions are adopted as the "Without" case.

i) No investment is made for the port
ii) As for the container, the working efficiency of cargo handling are not the same as "With" case.
iii) Handling capacity of the general cargo berth is estimated to be about 3.2 (handled in 2004).

The results of forecast on the handling volume by categories of berth are shown in Table 16.12.2-1
As for the container and the general cargo terminal project, the working efficiency of cargo handling in the "With" and "Without" cases are shown in Table 16.12.2-2.

Table 16.12.2-1 Handling Cargo Volume by Categories of Berth in Tartus Port

(Unit: thousand ton)

Classification of Berth		1994	2003	2004	2005	2006	2007	2008	2009
Phosphate Terminal		777	0	0	0	0	0	0	0
Container Terminal		170	528	619	720	830	950	1,083	1,226
Grain Terminal: Export		57	600	600	600	600	600	600	600
: Import		294	390	420	453	489	500	500	500
Grain	Export	0	0	0	0	0	0	0	0
	Import	0	0	0	0	0	27	68	112
General			907	941	978	1,017	1,057	1,099	1,142
Food			497	500	502	504	506	509	511
Animal			191	206	223	241	260	281	303
Steel		2,228	546	599	659	725	797	877	964
Wood			351	386	426	469	517	570	628
Machine			169	183	198	214	232	251	272
Chemical			290	312	335	360	386	415	446
Ro/Ro			68	77	86	97	109	123	138
General Berth Total		2,228	3,018	3,204	3,407	3,627	3,892	4,191	4,516
Total		3,526	4,536	4,843	5,180	5,546	5,942	6,374	6,842

Table 16.12.2-2 Working Efficiency of Cargo Handling in both Cases

			"Without"	"With"
Working Efficiency (ton/hr)	Container(TEU/hr)		13	48
	General	General	33.0	
		Foodstuff	44.0	
		Animal	12.0	
		Steel	80.0	
		Wood	22.2	
		Machine	39.0	
		Chemical	32.2	
		Ro/Ro	34.4	

16.12.3 Economic Prices

The method for converting to economic prices from market prices is the same as that of Latakia port mentioned in Chapter 15.13.3.

16.12.4 Costs of the Projects

(1) Construction Costs

Table 16.12.4-1 shows the economic prices of the construction costs including investment schedule.

Table 16.12.4-1 Construction Cost in Economic Prices by Year

(Unit: Million SP)

	1999	2000	2001	2002	Total
Container Terminal	339.9	339.9	0.0	0.0	679.8
General Cargo Terminal	140.3	287.9	379.8	193.3	1,001.3
Others	23.7	0.0	145.8	145.8	315.3
Total	503.9	627.8	525.6	339.1	1,996.4

(2) Maintenance and Operation Costs

1) Maintenance Costs

The costs of maintaining the port facilities are estimated as a fixed proportion (1 % for structures, 4 % for handling equipment) of the original construction costs excluding the costs of dredging and reclamation costs.

2) Operation Costs

Operation costs consist of personnel costs and material costs. Based on the estimation of operation costs in the following Chapter 16.13, operation costs are converted to economic prices by multiplying by the conversion factor for skilled labor and the conversion factor for unskilled labor respectively.

(3) Renewal Investment Costs

The renewal investment costs for facilities and equipment after their useful lifetimes are considered.

Table 16.12.4-2 Maintenance Costs in Economic Prices

(Unit: Million SP)

Items \ Projects		Container Terminal	General C. Terminal	Others	Total
Maintenance Costs		26.5	12.2	11.6	50.3
Operation Costs	Personnel Costs	12.8	20.8	0.0	33.6
	Material Costs	3.2	5.2	0.0	8.4
Sub Total		42.5	38.2	11.6	92.3
Renewal Investment	Every 7 Years	0.0	102.0	179.3	281.3
	Every 17 Years	662.8	0.0	106.0	768.8

Note: Renewal Investment
7 Years: Forklift, Trailer, Mobil Tower Crane
17 Years: Container Crane, Transfer Crane, Portal Jib Crane

16.12.5 Benefits of the Projects

(1) Benefit Items

As benefits brought about by the master plan of study port, the following items are identified.

1) Savings in waiting costs of ships
2) Savings in water transportation cost by enlargement of ship size
3) Savings in land transportation costs
4) Savings of cost in cargo handling
5) Savings in interest of cargo costs
6) Reduction of cargo damage and accidents at the port
7) Promotion of regional economic development
8) Increase in employment opportunities and incomes

Items 1), 2), 3), 4) and 5) are considered countable and in this study the monetary benefits of item 1) are calculated.

(2) Calculation of Benefits

1) Savings in waiting costs of ships

The method of calculation in the above benefit item is the same as that of Latakia Port mentioned in Section 15.13.5(2).

Tale 16.12.5-1 Benefits of the Projects

(Unit: Million SP)

Items	Year	2001	2002	2003	2004 & over
Container Terminal	Staying Cost	231.6	268.0	310.1	358.9
General C. Terminal	Waiting Cost	-	-	124.9	348.4
Total		-	-	435.0	707.3

16.12.6 Evaluation of the Projects

(1) Calculation of the EIRR

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

(2) Sensitivity Analysis

In order to determine whether the project is feasible when certain conditions change, a sensitivity analysis is made for three alternatives.

Case A: The costs increase by 10%
Case B: The benefits decrease by 10%
Case C: The costs increase by 10% and the Benefits decrease by 10%

The sensitivity analysis for three alternatives is calculated by using above formula as the base case and the results are shown in Table 16.12.6-1 (Refer to Table 16.12.6-2 - 16.12.6-4).

Table 16.12.6-1 Results of Sensitivity Analysis

Case	EIRR(%)		
	Project Total	Container Terminal	General C. Terminal
Base Case	19.8	32.8	20.2
Case A	18.1	30.0	18.6
Case B	17.9	29.7	18.4
Case C	16.3	27.0	16.8

(2) Evaluation

As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR exceeds 10 %. Therefore, this short-term plan development project is feasible from the viewpoint of the national economy.

Table 16.12.6-2 Cost/Benefit Analysis of All Projects

(Total-Base Case) (Unit: million S.P.)

	Year	Cost			Benefit		Net Present Value (NPV)		
		Construction	Maintenance	Total	Total	Benefit - Cost	Benefit	Cost	Benefit - Cost
1	1999	504	0	504	0	-504	0	504	-504
2	2000	628	0	628	0	-628	0	524	-524
3	2001	526	0	526	0	-526	0	366	-366
4	2002	339	0	339	0	-339	0	197	-197
5	2003	0	92	92	435	343	211	45	166
6	2004	0	92	92	707	615	286	37	249
7	2005	0	92	92	707	615	239	31	208
8	2006	0	92	92	707	615	199	26	173
9	2007	0	92	92	707	615	166	22	145
10	2008	0	92	92	707	615	139	18	121
11	2009	0	92	92	707	615	116	15	101
12	2010	0	374	374	707	334	97	51	46
13	2011	0	92	92	707	615	81	11	70
14	2012	0	92	92	707	615	67	9	58
15	2013	0	92	92	707	615	56	7	49
16	2014	0	92	92	707	615	47	6	41
17	2015	0	92	92	707	615	39	5	34
18	2016	0	92	92	707	615	33	4	28
19	2017	0	374	374	707	334	27	14	13
20	2018	0	92	92	707	615	23	3	20
21	2019	0	92	92	707	615	19	2	16
22	2020	0	861	861	707	-154	16	19	-3
23	2021	0	92	92	707	615	13	2	11
24	2022	0	92	92	707	615	11	1	10
25	2023	0	92	92	707	615	9	1	8
26	2024	0	374	374	707	334	8	4	4
27	2025	0	92	92	707	615	6	1	6
28	2026	0	92	92	707	615	5	1	5
29	2027	0	92	92	707	615	4	1	4
30	2028	0	92	92	707	615	4	0	3
31	2029	0	92	92	707	615	3	0	3
32	2030	0	92	92	707	615	3	0	2
33	2031	0	374	374	707	334	2	1	1
34	2032	0	92	92	707	615	2	0	2
	Total	1996	4663	6659	20947	14287	1930	1930	0

EIRR= 0.19840

Table 16.12.6-3 Cost/Benefit Analysis of Container Terminal Project

[Container - Base Case] (Unit: million S.P.)

	Year	Cost			Benefit		Net Present Value (NPV)		
		Construction	Maintenance	Total	Total	Benefit - Cost	Benefit	Cost	Benefit - Cost
1	1999	340	0	340	0	-340	0	340	-340
2	2000	340	0	340	0	-340	0	256	-256
3	2001	0	43	43	232	189	131	24	107
4	2002	0	43	43	268	226	114	18	96
5	2003	0	43	43	310	268	100	14	86
6	2004	0	43	43	359	316	87	10	77
7	2005	0	43	43	359	316	65	8	58
8	2006	0	43	43	359	316	49	6	43
9	2007	0	43	43	359	316	37	4	33
10	2008	0	43	43	359	316	28	3	25
11	2009	0	43	43	359	316	21	2	19
12	2010	0	43	43	359	316	16	2	14
13	2011	0	43	43	359	316	12	1	10
14	2012	0	43	43	359	316	9	1	8
15	2013	0	43	43	359	316	7	1	6
16	2014	0	43	43	359	316	5	1	4
17	2015	0	43	43	359	316	4	0	3
18	2016	0	43	43	359	316	3	0	3
19	2017	0	43	43	359	316	2	0	2
20	2018	0	705	705	359	-346	2	3	-2
21	2019	0	43	43	359	316	1	0	1
22	2020	0	43	43	359	316	1	0	1
23	2021	0	43	43	359	316	1	0	1
24	2022	0	43	43	359	316	1	0	0
25	2023	0	43	43	359	316	0	0	0
26	2024	0	43	43	359	316	0	0	0
27	2025	0	43	43	359	316	0	0	0
28	2026	0	43	43	359	316	0	0	0
29	2027	0	43	43	359	316	0	0	0
30	2028	0	43	43	359	316	0	0	0
31	2029	0	43	43	359	316	0	0	0
32	2030	0	43	43	359	316	0	0	0
	Total	680	1938	2618	10500	7882	696	696	0

EIRR= 0.32830

Table 16.12.6-4 Cost/Benefit Analysis of General Cargo Terminal Project

[General - Base Case] (Unit: million S.P.)

	Year	Cost			Benefit		Net Present Value (NPV)		
		Construc-tion	Maintenance	Total	Total	Benefit - Cost	Benefit	Cost	Benefit - Cost
1	1999	140	0	140	0	-140	0	140	-140
2	2000	288	0	288	0	-288	0	239	-239
3	2001	380	0	380	0	-380	0	263	-263
4	2002	193	0	193	0	-193	0	111	-111
5	2003	0	38	38	125	87	60	18	42
6	2004	0	38	38	348	310	139	15	124
7	2005	0	38	38	348	310	115	13	103
8	2006	0	38	38	348	310	96	11	85
9	2007	0	38	38	348	310	80	9	71
10	2008	0	38	38	348	310	66	7	59
11	2009	0	38	38	348	310	55	6	49
12	2010	0	140	140	348	208	46	18	27
13	2011	0	38	38	348	310	38	4	34
14	2012	0	38	38	348	310	32	3	28
15	2013	0	38	38	348	310	26	3	24
16	2014	0	38	38	348	310	22	2	20
17	2015	0	38	38	348	310	18	2	16
18	2016	0	38	38	348	310	15	2	14
19	2017	0	140	140	348	208	13	5	8
20	2018	0	38	38	348	310	11	1	9
21	2019	0	38	38	348	310	9	1	8
22	2020	0	38	38	348	310	7	1	6
23	2021	0	38	38	348	310	6	1	5
24	2022	0	38	38	348	310	5	1	4
25	2023	0	38	38	348	310	4	0	4
26	2024	0	140	140	348	208	3	1	2
27	2025	0	38	38	348	310	3	0	3
28	2026	0	38	38	348	310	2	0	2
29	2027	0	38	38	348	310	2	0	2
30	2028	0	38	38	348	310	2	0	1
31	2029	0	38	38	348	310	1	0	1
32	2030	0	38	38	348	310	1	0	1
33	2031	0	140	140	348	208	1	0	1
34	2032	0	38	38	348	310	1	0	1
	Total	1001	1554	2555	10229	7673	881	881	0

EIRR= 0.20223

16.13 Financial Analysis

16.13.1 Purpose of the Financial Analysis

Purpose of the financial analysis is to examine the viability of the project in the short-term plan and the financial soundness of the port management entity during the project life.

16.13.2 Methodology of the Financial Analysis

Figure 16.13.2-1 shows a flowchart of the financial analysis.

(1) Viability of the Project

The viability of the project is evaluated by the Financial Internal Rate of Return (FIRR). The FIRR is a discount rate in which revenue and costs during the project life are considered equal. It is obtained from the following formula:

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

n : Project Life
R_i : Revenue in the i-th year
C_i : Cost in the i-th year
r : Discount Rate

Here, the revenue and the cost in this analysis consist of the following items:

Revenue -Increase of operating revenues by the project
(Crane usage fee -- in case of conventional terminal)

Cost -(1) Initial and renewal investments for the project
-(2) Increase of maintenance, repair, personnel and administrative costs by the project
(Increase of maintenance and repari cost --- in case of conventional terminal)

Following revenue and expenditures are excluded from calculation of FIRR.

Revenue - Fund management income

Cost - Depreciation cost
- Repayment of the principal loan
- Interest on loan

When FIRR exceeds the weighted average interest rate of the total funds for investments of the project, the project is regarded as financially feasible.

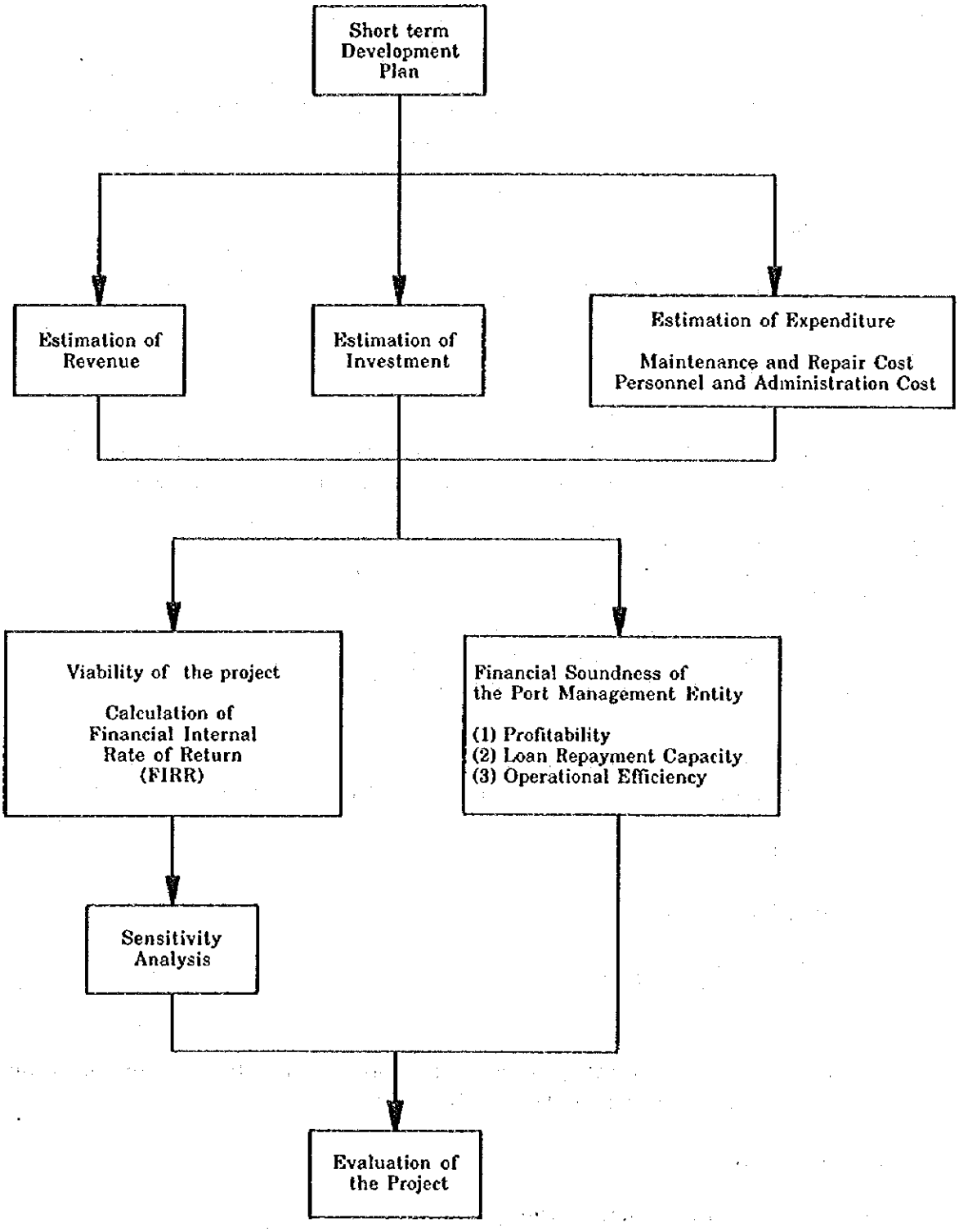


Figure 16.13.2-1 Flowchart of the Financial Analysis

(2) Financial Soundness of the Port Management Entity

Appraisal of financial soundness of the port management entity is based on its projected financial statements (Profit and Loss Statement, Cash Flow Statement and Balance Sheet). The appraisal is made from the viewpoint of profitability, loan repayment capacity and operational efficiency, using the following ratios:

1) Profitability

Rate of Return on Net Fixed Assets

$$\frac{Net\ Operation\ Income}{Total\ Fixed\ Assets} \times 100\%$$

Rate of Return on Net Fixed assets relates operating fixed assets. It is necessary to keep the rate above the average interest rate of the funds for investment.

2) Loan Repayment Capacity

Debt Service Coverage ratio

$$\frac{Net\ Operating\ Income\ before\ Depreciation}{Repayment\ of\ Principal\ and\ Interest\ on\ Longterm\ Loan} \times 100\%$$

Debt Service Coverage Ratio shows whether the operating income can cover the repayment and the interest on long-term loans. The ratio must be higher than 1.0.

3) Operational Efficiency

Operating Ratio

$$\frac{Operating\ Expenses}{Operating\ Revenue} \times 100\%$$

Operating Ratio shows the percentage of port revenue that is consumed by operating expenditure. It must be less than 75%.

Working Ratio

$$\frac{Operating\ Expenses - DepreciationExpenses}{Operating\ Revenue} \times 100\%$$

Working Ratio shows the efficiency of the routine operations of the port. It must be less than 60%.

16.13.3 Prerequisites of the Financial Analysis for the Multi-purpose Terminal and the Expanded Conventional Berth

(1) Scope of the Financial Analysis

Scope of this financial analysis is construction work of general terminal and procurement of cargo handling equipment in the multi-purpose terminal, general terminal and conventional terminal

(2) Prerequisites of the Financial Analysis for the Multi-purpose Terminal and the Expanded Conventional Berth

1) Project life

Project life is 34 years from the beginning of the project. It includes four years of detailed design and construction work of the port facilities.

2) Base Year

All costs, expenditures and revenues are indicated in prices as of 1995, when the price survey was conducted. Neither inflation nor an increase in nominal wages are considered during the project life.

3) Fund Raising

Fund raising is divided into two kinds, foreign and domestic funds. In the projects, all the costs of foreign procurement are assumed to be raised by foreign funds (soft loan) and the domestic procurement costs are assumed to be raised by domestic funds in principle. The required money for domestic funds is financed by the General Monetary Fund. Conditions of loans are as follows:

(Foreign Funds)
Loan period : 30 years
Grace period : 10 years
Interest rate : 2.7%
Repayment : Fixed amount repayment of principal

These conditions are OECF's in 1995. Its upper limit of finance is 75% of the total project or foreign procurement, whichever is higher.

(Domestic Funds)
Loan period : 40 years
Interest Rate : 9%
Repayment : Fixed amount repayment of principal

(Weighted Average Interest Rate)
4.28%

4) Cargo Handling Volume

The cargo volume of container that can be handled in the current conventional terminal will reach its limit (83,000 TEU) in 2004. The other cargoes' volume will reach their limit in 2009.

(3) Expenditure

1) Investment

Initial investment cost is shown in chapter 16.11. The depreciable facilities will be replaced after their service lives. This replacement cost is included in the investment cost of this financial analysis.

Summary of Investment (Unit : Thousand S.P.)

	Civil Works	Buildings	Utilities	Equip-ment	Others	Total	
Foreign	84,000	0	0	1,050,000	39,300	1,173,300	59.2%
Domestic	765,200	0	22,937	0	21,300	809,437	40.8%
Sub-Total	849,200	0	22,937	1,050,000	60,600	1,982,737	100.0%

Table 16.13.3-1 Scheduled Investment of Container (Multi) Terminal

(Machines and Equipment) (Unit : 1000S. P.)

	Crane	Transfer	Total
1999	239,400	91,980	331,380
2000	239,400	91,980	331,380
2001			0
2002			0
2003			0
2004			0
2005			0
2006			0
2007			0
2008			0
2009			0
2010			0
2011			0
2012			0
2013			0
2014			0
2015			0
2016	239,400	91,980	331,380
2017	239,400	91,980	331,380
2018			0
2019			0
2020			0
2021			0
2022			0
2023			0
2024			0
2025			0
2026			0
2027			0
2028			0
2029			0
2030			0
2031			0
2032	-42,246	-16,233	-58,479

Table 16.13.3-2 Scheduled Investment of General Terminal

(Machines and Equipment) (Unit : 1000S. P.)

	Mobil T. Crane	Total
1999		
2000		
2001	34,000	34,000
2002	68,000	68,000
2003		
2004		
2005		
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018	34,000	34,000
2019	68,000	68,000
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032	-22,000	-22,000

Table 16.13.3-3 Scheduled Investment of Conventional Terminal

(Machines and Equipment) (Unit : 1000S. P.)

	Mobil T. Crane	Portal Jib Crane	Forklift	Total
1999				0
2000				0
2001	68, 000	52, 980	38, 640	159, 620
2002	34, 000	52, 980	38, 640	125, 620
2003				0
2004				0
2005				0
2006				0
2007				0
2008			38, 640	38, 640
2009			38, 640	38, 640
2010				0
2011				0
2012				0
2013				0
2014				0
2015			38, 640	38, 640
2016			38, 640	38, 640
2017				0
2018	68, 000	52, 980		120, 980
2019	34, 000	52, 980		86, 980
2020				0
2021				0
2022			38, 640	38, 640
2023			38, 640	38, 640
2024				0
2025				0
2026				0
2027				0
2028				0
2029			38, 640	38, 640
2030			38, 640	38, 640
2031				0
2032	-20, 000	-21, 815	-49, 680	-91, 495

2) Maintenance and Repair Cost

The annual maintenance cost for the port facilities are calculated as follows:

Infrastructure	: 1% of the construction cost
Equipment	: 4% of the procurement cost

Operation of the planned facilities will start as follows:

Multi-purpose Terminal	: 2000
General Terminal	: 2003

Table 16.13.3-4 Maintenance and Repair Cost of Multi-purpose Terminal

(Unit : 1000S.P.)

Facilities	Procurement Cost	Ratio	Maintenance Cost(1999)	Maintenance Cost(2000-)
Handling Equipment	679,960	4%	13,599	27,198

Table 16.13.3-5 Maintenance and Repair Cost of General Terminal

(Unit : 1000S.P.)

Faclities	Procurement Cost	Ratio	Maintenance Cost
Wharf	378,000	1%	3,780
Revetment	81,800	1%	818
Handling Equipment	102,000	4%	4,080
Total	561,800		8,678

Table 16.13.3-6 Maintenance and Repair Cost of General Terminal by year (Unit: 1000S.P)

Facilities	1999	2000	2001	2002-
Wharf	1,160	2,320	3,780	3,780
Revetment	117	351	585	818
Handling Equipment			1,360	4,080
Total	1,277	2,671	5,725	8,678

Table 16.13.3-7 Maintenance and Repair Cost of Conventional Terminal by year

(Unit : 1000S.P.)

	Procurement Cost	Ratio	Maintenance Cost	2002	2003-
Mobile Tower Crane	102,000	4%	4,080	2,720	4,080
Portal Jib Crane	105,960	4%	4,238	2,119	4,238
Forklift	77,280	4%	3,091	1,546	3,091
Total	285,240		11,410	6,385	11,410

3) Personnel and Administration Cost

Estimation of annual personnel cost is based on the required number of workers and existing pay scales. Administration cost (material cost) is assumed as 25% of total personnel cost considering increase of administrative cost and modernized management system in the target year. The number of operation personnel of terminals is assumed as follows:

Number of Personnel of Multi-Purpose Terminal

Manager	1
Administration Department	9
Operating Department	116
Maintenance Department	10
CFS Department	14
Total	150

Number of Personnel of Expanded Conventional Terminal

Operation Department	244
Total	244

Average Personnel Cost of Tartous Port

Personnel cost per capita	88,268 S.P. / year (including social benefit)
Material cost per capita	22,072 S.P. / year
Total	110,358 S.P. / year

Table 16.13.3-8 Personnel and Administration Cost

Section	Number	Wage/Year	Total
Multi-purpose Terminal	150	110,358	16,553,700
General Terminal	244	110,358	26,927,352
Total	394		43,481,052

4) Depreciation

Annual depreciation costs are calculated by the straight line method. The annual depreciation costs are not retained inside the administrative body. The administrative body repays the amount of annual depreciation expenses with 9% interest to the General Monetary Fund as a rule.

Standard service lives are as follows:

Depreciable assets except cargo handling equipment	: 40 years Container
Crane, Mobile Tower Crane, Grain Loader / Unloader	: 17 years
Other cargo handling equipment	: 7 years

(4) Revenue

Calculation of revenues from port activities is based on the tariff system (issued on 24th Oct. 1995) and future cargo handling volume. Charges obtained from the operation of each terminal are as follows.

Loading / Unloading and Cargo Handling Fee
Storage Fee
Container Terminal 38.16 US$ / Box (20% up)
General Terminal 20% up of current tariff standard
Charges from Vessels
- Anchorage Fee 0.5344 S.P. / NRT
- Berthing Fee 0.7125 S.P. / NRT
- Pilotage & Towage Fee 2.316 S.P. / NRT*2times

Table 16.13.3-9 Charges from Container Terminal

Year		1999	2000	2001	2002	2003
Cargo Volume	(1000ton)	405	432	461	493	528
	(TEU)	55,227	58,909	62,864	67,227	72,000
	(Box)	38,620	41,195	43,961	47,012	50,350
Charge(1000S.P.)			66,024	70,457	75,347	80,697

Table 16.13.3-9 Charges from Container Terminal

Year		2004	2005	2006	2007	2008
Cargo Volume	(1000ton)	606	696	799	917	1,053
	(TEU)	82,636	94,909	108,955	125,045	143,591
	(Box)	57,788	66,370	76,192	87,444	100,413
Charge (1000S.P.)		92,618	106,373	122,114	140,148	160,934

Table 16.14.3-12 shows Charges from the renewed conventional berth. Calculation of crane usage fee is based on following formulas

Crane usage fee = Operation time of crane X Crane usage fee per hour (US $39)
Operation time of crane = Forecast Cargo volume by commoditiy
/ Cargo handling productivity by commodity (Chapter 15.2)

(5) Tax

The administration body pays 45% of the annual net income as income tax to the government.

Table 16.13.3-10 Charges from General Terminal

Year	2003	2004	2005	2006
Total Cargo Volume('000 Ton)	3,018	3,207	3,410	3,630
Cargo Volume of New Berths('000 Ton)	468	497	529	563
1st category Direct 94.35 SP/ton (0%)	0	0	0	0
Stowage 106.55 SP/ton (100%)	53	56	60	64
4th category Direct 82.1 SP/ton (15%)	34	36	38	40
Stowage 94.3 SP/ton (85%)	191	203	216	229
6th category Direct 106.55 SP/ton (15%)	29	31	33	35
Stowage131.4 SP/ton (85%)	162	172	183	195
Handling fees ('000 S.P.)	50,732	53,909	57,322	61,020
handling Fee 20% up	60,879	64,691	68,786	73,224
Storage total ton ('000ton)	405.6	431	458	488
Storage Fee (Ave. 8days) 4.9S.P./ton Storage Fee Total ('000 S.P.)	15,900	16,895	17,965	19,124
Ave.No.of Vsl. 2680ton/vsl. 7.3days	175	186	197	210
NRT=Ave.6300 x 3/4 ≒4725 NRT				
Anchorage Fee	3,219	3,420	3,637	3,872
Berthing Fee	4,292	4,560	4,849	5,162
Pilotage & Towage Fee	3,822	4,061	4,318	4,597
Total ('000 S.P.)	88,111	93,629	99,555	105,978

Year	2007	2008	2009-
Total Cargo Volume('000 Ton)	3,869	4,127	4,408
Cargo Volume of New Berths('000 Ton)	600	640	684
1st category Direct 94.35 SP/ton (0%)	0	0	0
Stowage 106.55 SP/ton (100%)	68	72	77
4th category Direct 82.1 SP/ton (15%)	43	46	49
Stowage 94.3 SP/ton (85%)	245	261	279
6th category Direct 106.55 SP/ton (15%)	37	39	42
Stowage131.4 SP/ton (85%)	208	222	237
Handling fees ('000 S.P.)	65,038	69,374	74,098
handling Fee 20% up	78,045	83,249	88,918
Storage total ton ('000ton)	520	555	592
Storage Fee (Ave. 8days) 4.9S.P./ton Storage Fee Total ('000 S.P.)	20,383	21,742	23,222
Ave.No.of Vsl. 2680ton/vsl. 7.3days	224	239	255
NRT=Ave.6300 x 3/4 ≒4725 NRT			
Anchorage Fee	4,126	4,402	4,701
Berthing Fee	5,502	5,869	6,268
Pilotage & Towage Fee	4,900	5,226	5,582
Total ('000 S.P.)	112,956	120,488	128,692

Table 16.13.3-11 Forecast of Future Cargo Volume (General Berth)

(Unit: 1000ton)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
General	846	907	943	980	1,018	1,059	1,100	1,144	1,189
Food	490	497	499	502	504	506	508	511	513
Animal	182	191	206	223	241	260	280	303	327
Steel	564	546	600	660	726	798	878	965	1,062
Wood	312	351	387	427	470	518	571	629	693
Machine	158	169	183	198	214	232	251	272	295
Chemical	266	290	312	335	360	387	415	446	479
Ro/Ro	63	68	77	86	97	109	123	138	155
Total	2,881	3,019	3,207	3,411	3,630	3,869	4,126	4,408	4,713

Table 16.13.3-12 Forecast of Future Cargo Volume (Conventional Berth)

(Unit: 1000ton)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
General	736	789	820	853	886	921	957	995	1,034
Food	426	432	434	437	438	440	442	445	446
Animal	158	166	179	194	210	226	244	264	284
Steel	491	475	522	574	632	694	764	840	924
Wood	271	305	337	371	409	451	497	547	603
Machine	137	147	159	172	186	202	218	237	257
Chemical	231	252	271	291	313	337	361	388	417
Ro/Ro	55	59	67	75	84	95	107	120	135
Total	2,506	2,627	2,790	2,968	3,158	3,366	3,590	3,835	4,100

Table 16.13.3-13 Operation Time of Cranes by Cargoes and Crane Usage Fee

(Unit:Hour, 1000 S.P.)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
General	22,304	23,912	24,861	25,836	26,838	27,919	29,000	30,160	31,346
Food	9,689	9,827	9,867	9,926	9,965	10,005	10,045	10,104	10,143
Animal	13,195	13,848	14,935	16,168	17,473	18,850	20,300	21,968	23,708
Steel	6,134	5,938	6,525	7,178	7,895	8,678	9,548	10,494	11,549
Wood	12,227	13,755	15,166	16,734	18,419	20,300	22,377	24,650	27,158
Machine	3,525	3,770	4,082	4,417	4,774	5,175	5,599	6,068	6,581
Chemical	7,187	7,835	8,430	9,051	9,727	10,456	11,213	12,050	12,942
Total	74,259	78,885	83,866	89,309	95,091	101,384	108,082	115,494	123,427
Charge	184,015	195,477	207,820	221,308	235,635	251,229	267,827	286,193	305,853
Replace	24,002	45,110	47,958	51,071	54,377	57,976	61,806	66,045	70,581

16.13.4 Appraisal of Project

16.13.4.1 Viability of Project

(1) Financial Internal Rate of Return (FIRR)

The calculation results of FIRR are as follows:

Multi-Purpose Terminal	General Terminal	Conventional Terminal(*)	Total
9.53%	5.95%	12.72%	7.76%

(*) Replacement of cargo handling equipment.

These exceed the weighted average interest rate of the funds.

(2) Sensitivity Analysis

Sensitivity analysis is conducted to examine the impacts of unexpected future changes. (For example, cargo volume or construction cost) Following cases are assumed.

Case 1 : Investment cost increase by 10%
Case 2 : Revenue decrease by 10%
Case 3 : Case 1 and 2

The results of sensitivity analysis are as follows:

	Multi-Purpose Terminal	General Terminal	Conventional Terminal(*)	Total
Base Case	9.53%	5.95%	12.72%	7.76%
Table	16.13.4-1	16.13.4-5	16.13.4-9	16.13.4-13
Case 1	8.46%	5.21%	11.10%	6.77%
Table	16.13.4-2	16.13.4-6	16.13.4-10	16.13.4-14
Case 2	7.70%	4.76%	10.50%	6.18%
Table	16.13.4-3	16.13.4-7	16.13.4-11	16.13.4-15
Case 3	6.70%	4.06%	8.97%	5.24%
Table	16.13.4-4	16.13.4-8	16.13.4-12	16.13.4-16

(*) Replacement of cargo handling equipment.

In all the cases except Case 3 of General terminal, FIRR exceeds the weighted average interest rate of the funds.

(3) Evaluation

Judging from the above results of analysis, this project is regarded as financially feasible on the conditions of proposed tariff.

16.13.4.2 Financial Soundness of the Port Management Entity

Table 16.13.4-17 shows the projected financial statements and financial indicators (the rate of return on net fixed assets, debt service coverage ratio, operating ratio and working ratio of the port management body) with regard to Short-term plan in Tartous Port.

(1) Profitability

The rate of return on net fixed assets exceeds the favorable level from 2005. This comes from relatively smaller annual revenues compared with larger initial investment.

(2) Loan Repayment Capacity

Throughout the project life, the debt service coverage ratio exceeds 1.0. This means that there will be no difficulty in repaying long-term loans from the annual operating revenues.

(3) Operational Efficiency

Working ratios maintain favorable level from beginning. Operating ratios exceed favorable level except in 2003. It shows that the operation will be efficient.

16.13.4.3 Conclusion

Judging from the above analysis, the base case project is regarded as financially feasible. However, it is advisable that the Tartous Port Company make continuous efforts to secure forecast cargo volume, improve cargo handling efficiency and reduce operating expenses.

FIRR Calculation of Container (Multi) Terminal

Table 16.13.4-1 Basic Case

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999		339,980	13,255	353,235	-353,235	0	353,235	-353,235
2000	66,024	339,980	27,198	367,178	-301,154	60,282	335,245	-274,963
2001	70,457		43,752	43,752	26,705	58,735	36,473	22,262
2002	75,347		43,752	43,752	31,595	57,349	33,301	24,048
2003	80,696		43,752	43,752	36,944	56,078	30,405	25,674
2004	92,617		43,752	43,752	48,865	58,765	27,760	31,005
2005	106,373		43,752	43,752	62,621	61,623	25,346	36,277
2006	122,114		43,752	43,752	78,362	64,590	23,142	41,448
2007	140,149		43,752	43,752	96,397	67,682	21,129	46,553
2008	160,934		43,752	43,752	117,182	70,961	19,292	51,669
2009	160,934		43,752	43,752	117,182	64,790	17,614	47,176
2010	160,934		43,752	43,752	117,182	59,155	16,082	43,073
2011	160,934		43,752	43,752	117,182	54,010	14,683	39,327
2012	160,934		43,752	43,752	117,182	49,313	13,406	35,907
2013	160,934		43,752	43,752	117,182	45,024	12,240	32,784
2014	160,934		43,752	43,752	117,182	41,109	11,176	29,933
2015	160,934		43,752	43,752	117,182	37,534	10,204	27,330
2016	160,934	331,380	43,752	375,132	-214,198	34,269	79,881	-45,611
2017	160,934	331,380	43,752	375,132	-214,198	31,289	72,934	-41,645
2018	160,934		43,752	43,752	117,182	28,568	7,767	20,801
2019	160,934		43,752	43,752	117,182	26,083	7,091	18,992
2020	160,934		43,752	43,752	117,182	23,815	6,474	17,340
2021	160,934		43,752	43,752	117,182	21,744	5,911	15,832
2022	160,934		43,752	43,752	117,182	19,853	5,397	14,455
2023	160,934		43,752	43,752	117,182	18,126	4,928	13,198
2024	160,934		43,752	43,752	117,182	16,550	4,499	12,050
2025	160,934		43,752	43,752	117,182	15,110	4,108	11,002
2026	160,934		43,752	43,752	117,182	13,796	3,751	10,046
2027	160,934		43,752	43,752	117,182	12,596	3,425	9,172
2028	160,934		43,752	43,752	117,182	11,501	3,127	8,374
2029	160,934		43,752	43,752	117,182	10,501	2,855	7,646
2030	160,934		43,752	43,752	117,182	9,588	2,606	6,981
2031	160,934		43,752	43,752	117,182	8,754	2,380	6,374
2032	160,934	-58,479	43,752	-14,727	175,661	7,992	-731	8,724
Total	4,777,127	1,284,241	1,440,517	2,724,758	2,052,369	1,217,135	1,217,135	-0

FIRR= 0.095253

FIRR Calculation of Container (Multi) Terminal

Table 16.13.4-2 Case I

< Investment 110% > (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2) Investment	Expense	Total	(1)-(2)	Discount Value Revenue	Cost	Difference
1999		373,978	13,255	387,233	-387,233	0	387,233	-387,233
2000	66,024	373,978	27,198	401,176	-335,152	60,872	369,872	-309,000
2001	70,457		43,752	43,752	26,705	59,890	37,190	22,700
2002	75,347		43,752	43,752	31,595	59,049	34,288	24,761
2003	80,696		43,752	43,752	36,944	58,307	31,613	26,694
2004	92,617		43,752	43,752	48,865	61,698	29,146	32,552
2005	106,373		43,752	43,752	62,621	65,333	26,872	38,461
2006	122,114		43,752	43,752	78,362	69,148	24,775	44,373
2007	140,149		43,752	43,752	96,397	73,168	22,842	50,326
2008	160,934		43,752	43,752	117,182	77,464	21,059	56,404
2009	160,934		43,752	43,752	117,182	71,419	19,416	52,003
2010	160,934		43,752	43,752	117,182	65,846	17,901	47,945
2011	160,934		43,752	43,752	117,182	60,708	16,504	44,204
2012	160,934		43,752	43,752	117,182	55,971	15,216	40,755
2013	160,934		43,752	43,752	117,182	51,604	14,029	37,575
2014	160,934		43,752	43,752	117,182	47,577	12,934	34,643
2015	160,934		43,752	43,752	117,182	43,865	11,925	31,939
2016	160,934	364,518	43,752	408,270	-247,336	40,442	102,596	-62,154
2017	160,934	364,518	43,752	408,270	-247,336	37,286	94,590	-57,304
2018	160,934		43,752	43,752	117,182	34,377	9,346	25,031
2019	160,934		43,752	43,752	117,182	31,694	8,616	23,078
2020	160,934		43,752	43,752	117,182	29,221	7,944	21,277
2021	160,934		43,752	43,752	117,182	26,941	7,324	19,617
2022	160,934		43,752	43,752	117,182	24,839	6,753	18,086
2023	160,934		43,752	43,752	117,182	22,901	6,226	16,675
2024	160,934		43,752	43,752	117,182	21,114	5,740	15,374
2025	160,934		43,752	43,752	117,182	19,466	5,292	14,174
2026	160,934		43,752	43,752	117,182	17,947	4,879	13,068
2027	160,934		43,752	43,752	117,182	16,547	4,498	12,048
2028	160,934		43,752	43,752	117,182	15,256	4,147	11,108
2029	160,934		43,752	43,752	117,182	14,065	3,824	10,241
2030	160,934		43,752	43,752	117,182	12,968	3,525	9,442
2031	160,934		43,752	43,752	117,182	11,956	3,250	8,705
2032	160,934	-64,327	43,752	-20,575	181,509	11,023	-1,409	12,432
Total	4,777,127	1,412,665	1,440,517	2,853,182	1,923,945	1,369,961	1,369,961	0

FIRR= 0.084634

FIRR Calculation of Container (Multi) Terminal

Table 16.13.4-3 Case II

< Revenue -10% > (Unit : (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999		339,980	13,255	353,235	-353,235	0	353,235	-353,235
2000	59,422	339,980	27,198	367,178	-307,756	55,174	340,931	-285,757
2001	63,411		43,752	43,752	19,659	54,670	37,721	16,949
2002	67,812		43,752	43,752	24,060	54,285	35,024	19,261
2003	72,626		43,752	43,752	28,874	53,983	32,521	21,462
2004	83,355		43,752	43,752	39,603	57,529	30,196	27,333
2005	95,736		43,752	43,752	51,984	61,350	28,038	33,313
2006	109,903		43,752	43,752	66,151	65,394	26,033	39,361
2007	126,134		43,752	43,752	82,382	69,687	24,172	45,515
2008	144,841		43,752	43,752	101,089	74,302	22,445	51,858
2009	144,841		43,752	43,752	101,089	68,991	20,840	48,151
2010	144,841		43,752	43,752	101,089	64,059	19,350	44,709
2011	144,841		43,752	43,752	101,089	59,480	17,967	41,513
2012	144,841		43,752	43,752	101,089	55,229	16,683	38,546
2013	144,841		43,752	43,752	101,089	51,281	15,490	35,790
2014	144,841		43,752	43,752	101,089	47,615	14,383	33,232
2015	144,841		43,752	43,752	101,089	44,211	13,355	30,856
2016	144,841	331,380	43,752	375,132	-230,291	41,051	106,321	-65,270
2017	144,841	331,380	43,752	375,132	-230,291	38,117	98,721	-60,604
2018	144,841		43,752	43,752	101,089	35,392	10,691	24,701
2019	144,841		43,752	43,752	101,089	32,862	9,927	22,935
2020	144,841		43,752	43,752	101,089	30,513	9,217	21,296
2021	144,841		43,752	43,752	101,089	28,332	8,558	19,774
2022	144,841		43,752	43,752	101,089	26,307	7,946	18,360
2023	144,841		43,752	43,752	101,089	24,426	7,378	17,048
2024	144,841		43,752	43,752	101,089	22,680	6,851	15,829
2025	144,841		43,752	43,752	101,089	21,059	6,361	14,698
2026	144,841		43,752	43,752	101,089	19,554	5,907	13,647
2027	144,841		43,752	43,752	101,089	18,156	5,484	12,672
2028	144,841		43,752	43,752	101,089	16,858	5,092	11,766
2029	144,841		43,752	43,752	101,089	15,653	4,728	10,925
2030	144,841		43,752	43,752	101,089	14,534	4,390	10,144
2031	144,841		43,752	43,752	101,089	13,495	4,076	9,419
2032	144,841	-58,479	43,752	-14,727	159,568	12,531	-1,274	13,805
Total	4,299,414	1,284,241	1,440,517	2,724,758	1,574,656	1,348,761	1,348,761	-0

FIRR= 0.076985

FIRR Calculation of Container (Multi) Terminal

Table 16.13.4-4 Case III

<Investment 110%, Revenue -10%> (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999	0	373,978	13,255	387,233	-387,233	0	387,233	-387,233
2000	59,422	373,978	27,198	401,176	-341,754	55,688	375,970	-320,282
2001	63,411		43,752	43,752	19,659	55,693	38,427	17,266
2002	67,812		43,752	43,752	24,060	55,816	36,012	19,804
2003	72,626		43,752	43,752	28,874	56,023	33,750	22,273
2004	83,355		43,752	43,752	39,603	60,259	31,629	28,630
2005	95,736		43,752	43,752	51,984	64,861	29,642	35,219
2006	109,903		43,752	43,752	66,151	69,780	27,779	42,001
2007	126,134		43,752	43,752	82,382	75,054	26,034	49,020
2008	144,841		43,752	43,752	101,089	80,770	24,398	56,372
2009	144,841		43,752	43,752	101,089	75,695	22,865	52,830
2010	144,841		43,752	43,752	101,089	70,939	21,429	49,511
2011	144,841		43,752	43,752	101,089	66,482	20,082	46,400
2012	144,841		43,752	43,752	101,089	62,305	18,821	43,485
2013	144,841		43,752	43,752	101,089	58,390	17,638	40,752
2014	144,841		43,752	43,752	101,089	54,722	16,530	38,192
2015	144,841		43,752	43,752	101,089	51,284	15,491	35,792
2016	144,841	364,518	43,752	408,270	-263,429	48,061	135,473	-87,412
2017	144,841	364,518	43,752	408,270	-263,429	45,042	126,961	-81,920
2018	144,841		43,752	43,752	101,089	42,212	12,751	29,461
2019	144,841		43,752	43,752	101,089	39,559	11,950	27,610
2020	144,841		43,752	43,752	101,089	37,074	11,199	25,875
2021	144,841		43,752	43,752	101,089	34,744	10,495	24,249
2022	144,841		43,752	43,752	101,089	32,561	9,836	22,726
2023	144,841		43,752	43,752	101,089	30,516	9,218	21,298
2024	144,841		43,752	43,752	101,089	28,598	8,639	19,960
2025	144,841		43,752	43,752	101,089	26,801	8,096	18,706
2026	144,841		43,752	43,752	101,089	25,117	7,587	17,530
2027	144,841		43,752	43,752	101,089	23,539	7,111	16,429
2028	144,841		43,752	43,752	101,089	22,060	6,664	15,397
2029	144,841		43,752	43,752	101,089	20,674	6,245	14,429
2030	144,841		43,752	43,752	101,089	19,375	5,853	13,523
2031	144,841		43,752	43,752	101,089	18,158	5,485	12,673
2032	144,841	-64,327	43,752	-20,575	165,416	17,017	-2,417	19,434
Total	4,299,414	1,412,665	1,440,517	2,853,182	1,446,232	1,524,874	1,524,874	-0

FIRR= 0.067043

FIRR Calculation of General Terminal (Tartous Port)

Table 16.13.4-5 Basic Case

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999		143,100	1,277	144,377	-144,377	0	144,377	-144,377
2000		294,000	2,671	296,671	-296,671	0	280,023	-280,023
2001		369,300	5,725	375,025	-375,025	0	334,116	-334,116
2002		213,437	8,678	222,115	-222,115	0	186,781	-186,781
2003	88,111		35,605	35,605	52,506	69,936	28,261	41,676
2004	93,629		35,605	35,605	58,024	70,146	26,675	43,471
2005	99,555		35,605	35,605	63,950	70,400	25,178	45,222
2006	105,978		35,605	35,605	70,373	70,737	23,765	46,972
2007	112,956		35,605	35,605	77,351	71,163	22,431	48,732
2008	120,488		35,605	35,605	84,883	71,649	21,173	50,476
2009	128,692		35,605	35,605	93,087	72,233	19,985	52,248
2010	128,692		35,605	35,605	93,087	68,180	18,863	49,316
2011	128,692		35,605	35,605	93,087	64,354	17,805	46,549
2012	128,692		35,605	35,605	93,087	60,742	16,805	43,937
2013	128,692		35,605	35,605	93,087	57,334	15,862	41,471
2014	128,692		35,605	35,605	93,087	54,116	14,972	39,144
2015	128,692		35,605	35,605	93,087	51,079	14,132	36,947
2016	128,692		35,605	35,605	93,087	48,213	13,339	34,874
2017	128,692		35,605	35,605	93,087	45,507	12,590	32,917
2018	128,692	34,000	35,605	69,605	59,087	42,954	23,232	19,722
2019	128,692	68,000	35,605	103,605	25,087	40,543	32,640	7,903
2020	128,692		35,605	35,605	93,087	38,268	10,588	27,681
2021	128,692		35,605	35,605	93,087	36,121	9,993	26,127
2022	128,692		35,605	35,605	93,087	34,094	9,433	24,661
2023	128,692		35,605	35,605	93,087	32,181	8,903	23,277
2024	128,692		35,605	35,605	93,087	30,375	8,404	21,971
2025	128,692		35,605	35,605	93,087	28,670	7,932	20,738
2026	128,692		35,605	35,605	93,087	27,061	7,487	19,574
2027	128,692		35,605	35,605	93,087	25,543	7,067	18,476
2028	128,692		35,605	35,605	93,087	24,109	6,670	17,439
2029	128,692		35,605	35,605	93,087	22,756	6,296	16,460
2030	128,692		35,605	35,605	93,087	21,479	5,943	15,537
2031	128,692		35,605	35,605	93,087	20,274	5,609	14,665
2032	128,692	-22,000	35,605	13,605	115,087	19,136	2,023	17,113
Total	3,709,325	1,099,837	1,086,501	2,186,338	1,522,987	1,389,354	1,389,354	-0

FIRR= 0.059453

FIRR Calculation of General Terminal (Tartous Port)

Table 16.13.4-6 Case I

< Investment 110% > (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999		157,410	1,277	158,687	-158,687	0	158,687	-158,687
2000		323,400	2,671	326,071	-326,071	0	309,927	-309,927
2001		406,230	5,725	411,955	-411,955	0	372,173	-372,173
2002		234,781	8,678	243,459	-243,459	0	209,059	-209,059
2003	88,111	0	35,605	35,605	52,506	71,915	29,060	42,855
2004	93,629	0	35,605	35,605	58,024	72,636	27,622	45,014
2005	99,555	0	35,605	35,605	63,950	73,409	26,254	47,155
2006	105,978	0	35,605	35,605	70,373	74,276	24,954	49,322
2007	112,956	0	35,605	35,605	77,351	75,247	23,719	51,529
2008	120,488	0	35,605	35,605	84,883	76,291	22,545	53,747
2009	128,692	0	35,605	35,605	93,087	77,451	21,428	56,023
2010	128,692	0	35,605	35,605	93,087	73,617	20,367	53,249
2011	128,692	0	35,605	35,605	93,087	69,972	19,359	50,613
2012	128,692	0	35,605	35,605	93,087	66,508	18,401	48,107
2013	128,692	0	35,605	35,605	93,087	63,215	17,490	45,726
2014	128,692	0	35,605	35,605	93,087	60,085	16,624	43,462
2015	128,692	0	35,605	35,605	93,087	57,111	15,801	41,310
2016	128,692	0	35,605	35,605	93,087	54,283	15,018	39,265
2017	128,692	0	35,605	35,605	93,087	51,596	14,275	37,321
2018	128,692	37,400	35,605	73,005	55,687	49,041	27,820	21,221
2019	128,692	74,800	35,605	110,405	18,287	46,613	39,989	6,624
2020	128,692	0	35,605	35,605	93,087	44,305	12,258	32,047
2021	128,692	0	35,605	35,605	93,087	42,112	11,651	30,461
2022	128,692	0	35,605	35,605	93,087	40,027	11,074	28,953
2023	128,692	0	35,605	35,605	93,087	38,045	10,526	27,519
2024	128,692	0	35,605	35,605	93,087	36,162	10,005	26,157
2025	128,692	0	35,605	35,605	93,087	34,371	9,509	24,862
2026	128,692	0	35,605	35,605	93,087	32,670	9,039	23,631
2027	128,692	0	35,605	35,605	93,087	31,052	8,591	22,461
2028	128,692	0	35,605	35,605	93,087	29,515	8,166	21,349
2029	128,692	0	35,605	35,605	93,087	28,053	7,762	20,292
2030	128,692	0	35,605	35,605	93,087	26,665	7,377	19,287
2031	128,692	0	35,605	35,605	93,087	25,344	7,012	18,332
2032	128,692	-24,200	35,605	11,405	117,287	24,090	2,135	21,955
Total	3,709,325	1,209,821	1,086,501	2,296,322	1,413,003	1,545,678	1,545,678	-0

FIRR= 0.052088

FIRR Calculation of General Terminal (Tartous Port)

Table 16.13.4-7 Case II

< Revenue -10% >

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999		143,100	1,277	144,377	-144,377	0	144,377	-144,377
2000		294,000	2,671	296,671	-296,671	0	280,023	-280,023
2001		369,300	5,725	375,025	-375,025	0	334,116	-334,116
2002		213,437	8,678	222,115	-222,115	0	186,781	-186,781
2003	79,300	0	35,605	35,605	43,695	62,943	28,261	34,682
2004	84,266	0	35,605	35,605	48,661	63,131	26,675	36,456
2005	89,600	0	35,605	35,605	53,995	63,360	25,178	38,182
2006	95,380	0	35,605	35,605	59,775	63,663	23,765	39,898
2007	101,660	0	35,605	35,605	66,055	64,047	22,431	41,616
2008	108,439	0	35,605	35,605	72,834	64,484	21,173	43,311
2009	115,823	0	35,605	35,605	80,218	65,010	19,985	45,025
2010	115,823	0	35,605	35,605	80,218	61,362	18,863	42,498
2011	115,823	0	35,605	35,605	80,218	57,918	17,805	40,114
2012	115,823	0	35,605	35,605	80,218	54,668	16,805	37,863
2013	115,823	0	35,605	35,605	80,218	51,600	15,862	35,738
2014	115,823	0	35,605	35,605	80,218	48,705	14,972	33,732
2015	115,823	0	35,605	35,605	80,218	45,971	14,132	31,839
2016	115,823	0	35,605	35,605	80,218	43,392	13,339	30,053
2017	115,823	0	35,605	35,605	80,218	40,957	12,590	28,366
2018	115,823	34,000	35,605	69,605	46,218	38,658	23,232	15,426
2019	115,823	68,000	35,605	103,605	12,218	36,489	32,640	3,849
2020	115,823	0	35,605	35,605	80,218	34,441	10,588	23,854
2021	115,823	0	35,605	35,605	80,218	32,509	9,993	22,515
2022	115,823	0	35,605	35,605	80,218	30,684	9,433	21,252
2023	115,823	0	35,605	35,605	80,218	28,962	8,903	20,059
2024	115,823	0	35,605	35,605	80,218	27,337	8,404	18,933
2025	115,823	0	35,605	35,605	80,218	25,803	7,932	17,871
2026	115,823	0	35,605	35,605	80,218	24,355	7,487	16,868
2027	115,823	0	35,605	35,605	80,218	22,988	7,067	15,922
2028	115,823	0	35,605	35,605	80,218	21,698	6,670	15,028
2029	115,823	0	35,605	35,605	80,218	20,481	6,296	14,185
2030	115,823	0	35,605	35,605	80,218	19,331	5,943	13,389
2031	115,823	0	35,605	35,605	80,218	18,247	5,609	12,637
2032	115,823	-22,000	35,605	13,605	102,218	17,223	2,023	15,200
Total	3,338,392	1,099,837	1,086,501	2,186,338	1,152,055	1,250,418	1,389,354	-138,935

FIRR= 0.047553

FIRR Calculation of General Terminal (Tartous Port)

Table 16.13.4-8 Case III

<Investment 110%, Revenue -10%> (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999		157,410	1,277	158,687	-158,687	0	158,687	-158,687
2000		323,400	2,671	326,071	-326,071	0	313,346	-313,346
2001		406,230	5,725	411,955	-411,955	0	380,428	-380,428
2002		234,781	8,678	243,459	-243,459	0	216,053	-216,053
2003	79,300	0	35,605	35,605	43,695	67,627	30,364	37,263
2004	84,266	0	35,605	35,605	48,661	69,057	29,179	39,878
2005	89,600	0	35,605	35,605	53,995	70,562	28,040	42,522
2006	95,380	0	35,605	35,605	59,775	72,183	26,946	45,238
2007	101,660	0	35,605	35,605	66,055	73,934	25,894	48,040
2008	108,439	0	35,605	35,605	72,834	75,786	24,884	50,902
2009	115,823	0	35,605	35,605	80,218	77,787	23,912	53,875
2010	115,823	0	35,605	35,605	80,218	74,751	22,979	51,772
2011	115,823	0	35,605	35,605	80,218	71,834	22,082	49,752
2012	115,823	0	35,605	35,605	80,218	69,031	21,221	47,810
2013	115,823	0	35,605	35,605	80,218	66,337	20,392	45,944
2014	115,823	0	35,605	35,605	80,218	63,748	19,597	44,151
2015	115,823	0	35,605	35,605	80,218	61,260	18,832	42,428
2016	115,823	0	35,605	35,605	80,218	58,869	18,097	40,772
2017	115,823	0	35,605	35,605	80,218	56,572	17,391	39,181
2018	115,823	37,400	35,605	73,005	42,818	54,364	34,266	20,097
2019	115,823	74,800	35,605	110,405	5,418	52,242	49,798	2,444
2020	115,823	0	35,605	35,605	80,218	50,203	15,433	34,770
2021	115,823	0	35,605	35,605	80,218	48,244	14,831	33,413
2022	115,823	0	35,605	35,605	80,218	46,361	14,252	32,109
2023	115,823	0	35,605	35,605	80,218	44,552	13,696	30,856
2024	115,823	0	35,605	35,605	80,218	42,813	13,161	29,652
2025	115,823	0	35,605	35,605	80,218	41,142	12,648	28,495
2026	115,823	0	35,605	35,605	80,218	39,537	12,154	27,383
2027	115,823	0	35,605	35,605	80,218	37,994	11,680	26,314
2028	115,823	0	35,605	35,605	80,218	36,511	11,224	25,287
2029	115,823	0	35,605	35,605	80,218	35,086	10,786	24,300
2030	115,823	0	35,605	35,605	80,218	33,717	10,365	23,352
2031	115,823	0	35,605	35,605	80,218	32,401	9,960	22,441
2032	115,823	-24,200	35,605	11,405	104,418	31,136	3,066	28,070
Total	3,338,392	1,209,821	1,086,501	2,296,322	1,042,071	1,655,642	1,655,642	-0

FIRR= 0.040612

FIRR Calculation of Conventional Terminal (Tartous Port)

Table 16.13.4-9 Basic Case

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discounted Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999				0	0	0	0	0
2000				0	0	0	0	0
2001		159,620	0	159,620	-159,620	0	125,617	-125,617
2002	24,002	125,620	6,385	132,005	-108,003	16,757	92,157	-75,401
2003	45,110		11,410	11,410	33,700	27,938	7,067	20,871
2004	47,958		11,410	11,410	36,548	26,349	6,269	20,080
2005	51,071		11,410	11,410	39,661	24,892	5,561	19,331
2006	54,377		11,410	11,410	42,967	23,511	4,933	18,578
2007	57,976		11,410	11,410	46,566	22,238	4,376	17,861
2008	61,806	38,640	11,410	50,050	11,756	21,031	17,030	4,000
2009	66,045	38,640	11,410	50,050	15,995	19,936	15,108	4,828
2010	70,581		11,410	11,410	59,171	18,900	3,055	15,845
2011	70,581		11,410	11,410	59,171	16,767	2,710	14,056
2012	70,581		11,410	11,410	59,171	14,874	2,405	12,470
2013	70,581		11,410	11,410	59,171	13,195	2,133	11,062
2014	70,581		11,410	11,410	59,171	11,705	1,892	9,813
2015	70,581	38,640	11,410	50,050	20,531	10,384	7,364	3,021
2016	70,581	38,640	11,410	50,050	20,531	9,212	6,532	2,680
2017	70,581		11,410	11,410	59,171	8,172	1,321	6,851
2018	70,581	120,980	11,410	132,390	-61,809	7,250	13,598	-6,349
2019	70,581	86,980	11,410	98,390	-27,809	6,431	8,965	-2,534
2020	70,581		11,410	11,410	59,171	5,705	922	4,783
2021	70,581		11,410	11,410	59,171	5,061	818	4,243
2022	70,581	38,640	11,410	50,050	20,531	4,490	3,184	1,306
2023	70,581	38,640	11,410	50,050	20,531	3,983	2,824	1,159
2024	70,581		11,410	11,410	59,171	3,533	571	2,962
2025	70,581		11,410	11,410	59,171	3,135	507	2,628
2026	70,581		11,410	11,410	59,171	2,781	450	2,331
2027	70,581		11,410	11,410	59,171	2,467	399	2,068
2028	70,581		11,410	11,410	59,171	2,188	354	1,835
2029	70,581	38,640	11,410	50,050	20,531	1,941	1,377	565
2030	70,581	38,640	11,410	50,050	20,531	1,722	1,221	501
2031	70,581		11,410	11,410	59,171	1,528	247	1,281
2032	70,581	-91,495	11,410	-80,085	150,666	1,355	-1,538	2,893
Total	2,031,708	710,825	348,685	1,059,510	972,198	339,430	339,430	-0

FIRR= 0.127249

FIRR Calculation of Conventional Terminal (Tartous Port)

Table 16.13.4-10 Case I

< Investment +10% >

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2) Investment	Expense	Total	(1)-(2)	Discounted Value Revenue	Cost	Difference
1999				0	0	0	0	0
2000				0	0	0	0	0
2001		175,582	0	175,582	-175,582	0	142,258	-142,258
2002	24,002	138,182	6,385	144,567	-120,565	17,504	105,430	-87,926
2003	45,110	0	11,410	11,410	33,700	29,612	7,490	22,122
2004	47,958	0	11,410	11,410	36,548	28,337	6,742	21,595
2005	51,071	0	11,410	11,410	39,661	27,162	6,068	21,094
2006	54,377	0	11,410	11,410	42,967	26,032	5,462	20,569
2007	57,976	0	11,410	11,410	46,566	24,982	4,917	20,066
2008	61,806	42,504	11,410	53,914	7,892	23,972	20,911	3,061
2009	66,045	42,504	11,410	53,914	12,131	23,058	18,823	4,235
2010	70,581	0	11,410	11,410	59,171	22,180	3,586	18,595
2011	70,581	0	11,410	11,410	59,171	19,965	3,227	16,737
2012	70,581	0	11,410	11,410	59,171	17,971	2,905	15,065
2013	70,581	0	11,410	11,410	59,171	16,176	2,615	13,561
2014	70,581	0	11,410	11,410	59,171	14,560	2,354	12,206
2015	70,581	42,504	11,410	53,914	16,667	13,106	10,011	3,095
2016	70,581	42,504	11,410	53,914	16,667	11,797	9,011	2,786
2017	70,581	0	11,410	11,410	59,171	10,618	1,717	8,902
2018	70,581	133,078	11,410	144,488	-73,907	9,558	19,566	-10,008
2019	70,581	95,678	11,410	107,088	-36,507	8,603	13,053	-4,450
2020	70,581	0	11,410	11,410	59,171	7,744	1,252	6,492
2021	70,581	0	11,410	11,410	59,171	6,970	1,127	5,843
2022	70,581	42,504	11,410	53,914	16,667	6,274	4,792	1,482
2023	70,581	42,504	11,410	53,914	16,667	5,647	4,314	1,334
2024	70,581	0	11,410	11,410	59,171	5,083	822	4,261
2025	70,581	0	11,410	11,410	59,171	4,575	740	3,836
2026	70,581	0	11,410	11,410	59,171	4,118	666	3,453
2027	70,581	0	11,410	11,410	59,171	3,707	599	3,108
2028	70,581	0	11,410	11,410	59,171	3,337	539	2,797
2029	70,581	42,504	11,410	53,914	16,667	3,004	2,294	709
2030	70,581	42,504	11,410	53,914	16,667	2,704	2,065	638
2031	70,581	0	11,410	11,410	59,171	2,433	393	2,040
2032	70,581	-100,645	11,410	-89,235	159,816	2,190	-2,769	4,960
Total	2,031,708	781,908	348,685	1,130,593	901,116	402,978	402,978	-0

FIRR= 0.110969

FIRR Calculation of Conventional Terminal (Tartous Port)

Table 16.13.4-11 Case II

(Revenue -10%)

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2) Investment	Expense	Total	(1)-(2)	Discounted Value Revenue	Cost	Difference
1999				0	0	0	0	0
2000				0	0	0	0	0
2001		159,620	0	159,620	-159,620	0	130,736	-130,736
2002	21,602	125,620	6,385	132,005	-110,403	16,012	97,848	-81,836
2003	40,599	0	11,410	11,410	29,189	27,235	7,654	19,581
2004	43,162	0	11,410	11,410	31,752	26,204	6,927	19,277
2005	45,964	0	11,410	11,410	34,554	25,254	6,269	18,985
2006	48,939	0	11,410	11,410	37,529	24,335	5,674	18,661
2007	52,178	0	11,410	11,410	40,768	23,481	5,135	18,346
2008	55,625	38,640	11,410	50,050	5,575	22,655	20,384	2,271
2009	59,441	38,640	11,410	50,050	9,391	21,909	18,448	3,461
2010	63,523	0	11,410	11,410	52,113	21,189	3,806	17,383
2011	63,523	0	11,410	11,410	52,113	19,177	3,445	15,732
2012	63,523	0	11,410	11,410	52,113	17,355	3,117	14,238
2013	63,523	0	11,410	11,410	52,113	15,707	2,821	12,885
2014	63,523	0	11,410	11,410	52,113	14,215	2,553	11,661
2015	63,523	38,640	11,410	50,050	13,473	12,864	10,136	2,728
2016	63,523	38,640	11,410	50,050	13,473	11,642	9,173	2,469
2017	63,523	0	11,410	11,410	52,113	10,536	1,893	8,644
2018	63,523	120,980	11,410	132,390	-68,867	9,536	19,873	-10,338
2019	63,523	86,980	11,410	98,390	-34,867	8,630	13,367	-4,737
2020	63,523	0	11,410	11,410	52,113	7,810	1,403	6,407
2021	63,523	0	11,410	11,410	52,113	7,068	1,270	5,799
2022	63,523	38,640	11,410	50,050	13,473	6,397	5,040	1,357
2023	63,523	38,640	11,410	50,050	13,473	5,789	4,561	1,228
2024	63,523	0	11,410	11,410	52,113	5,239	941	4,298
2025	63,523	0	11,410	11,410	52,113	4,742	852	3,890
2026	63,523	0	11,410	11,410	52,113	4,291	771	3,520
2027	63,523	0	11,410	11,410	52,113	3,884	698	3,186
2028	63,523	0	11,410	11,410	52,113	3,515	631	2,883
2029	63,523	38,640	11,410	50,050	13,473	3,181	2,506	675
2030	63,523	38,640	11,410	50,050	13,473	2,879	2,268	611
2031	63,523	0	11,410	11,410	52,113	2,605	468	2,137
2032	63,523	-91,495	11,410	-80,085	143,608	2,358	-2,972	5,330
Total	1,828,537	710,825	348,685	1,059,510	769,027	387,694	387,694	-0

FIRR= 0.104959

FIRR Calculation of Conventional Terminal (Tartous Port)

Table 16.13.4-12 Case III

<Investment +10%, Revenue -10%> (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2) Investment	Expense	Total	(1)-(2)	Discounted Value Revenue	Cost	Difference
1999				0	0	0	0	0
2000				0	0	0	0	0
2001		175,582	0	175,582	-175,582	0	147,878	-147,878
2002	21,602	138,182	6,385	144,567	-122,965	16,697	111,739	-95,043
2003	40,599	0	11,410	11,410	29,189	28,798	8,093	20,705
2004	43,162	0	11,410	11,410	31,752	28,097	7,428	20,670
2005	45,964	0	11,410	11,410	34,554	27,459	6,816	20,643
2006	48,939	0	11,410	11,410	37,529	26,831	6,256	20,576
2007	52,178	0	11,410	11,410	40,768	26,254	5,741	20,513
2008	55,625	42,504	11,410	53,914	1,711	25,685	24,895	790
2009	59,441	42,504	11,410	53,914	5,527	25,189	22,847	2,342
2010	63,523	0	11,410	11,410	52,113	24,704	4,437	20,267
2011	63,523	0	11,410	11,410	52,113	22,671	4,072	18,599
2012	63,523	0	11,410	11,410	52,113	20,806	3,737	17,069
2013	63,523	0	11,410	11,410	52,113	19,094	3,430	15,665
2014	63,523	0	11,410	11,410	52,113	17,523	3,148	14,376
2015	63,523	42,504	11,410	53,914	9,609	16,082	13,649	2,433
2016	63,523	42,504	11,410	53,914	9,609	14,758	12,526	2,232
2017	63,523	0	11,410	11,410	52,113	13,544	2,433	11,111
2018	63,523	133,078	11,410	144,488	-80,965	12,430	28,273	-15,843
2019	63,523	95,678	11,410	107,088	-43,565	11,407	19,230	-7,823
2020	63,523	0	11,410	11,410	52,113	10,469	1,880	8,588
2021	63,523	0	11,410	11,410	52,113	9,607	1,726	7,882
2022	63,523	42,504	11,410	53,914	9,609	8,817	7,483	1,334
2023	63,523	42,504	11,410	53,914	9,609	8,091	6,867	1,224
2024	63,523	0	11,410	11,410	52,113	7,426	1,334	6,092
2025	63,523	0	11,410	11,410	52,113	6,815	1,224	5,591
2026	63,523	0	11,410	11,410	52,113	6,254	1,123	5,131
2027	63,523	0	11,410	11,410	52,113	5,740	1,031	4,709
2028	63,523	0	11,410	11,410	52,113	5,267	946	4,321
2029	63,523	42,504	11,410	53,914	9,609	4,834	4,103	731
2030	63,523	42,504	11,410	53,914	9,609	4,436	3,765	671
2031	63,523	0	11,410	11,410	52,113	4,071	731	3,340
2032	63,523	-100,645	11,410	-89,235	152,757	3,736	-5,249	8,985
Total	1,828,537	781,908	348,685	1,130,593	697,945	463,594	463,594	-0

FIRR= 0.089652

Table 16.13.4-13 FIRR Calculation of Tartous Port (Basic Case)

(Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999	0	483,080	14,532	497,612	-497,612	0	497,612	-497,612
2000	66,024	633,980	29,869	663,849	-597,825	61,272	616,070	-554,798
2001	70,457	528,920	49,477	578,397	-507,940	60,680	498,135	-437,455
2002	99,349	339,057	58,815	397,872	-298,523	79,404	317,998	-238,594
2003	201,120		90,767	90,767	110,353	149,175	67,324	81,851
2004	234,204		90,767	90,767	143,437	161,212	62,478	98,733
2005	256,999		90,767	90,767	166,232	164,170	57,982	106,189
2006	282,469		90,767	90,767	191,702	167,453	53,809	113,645
2007	311,081		90,767	90,767	220,314	171,142	49,936	121,207
2008	343,228	72,640	90,767	163,407	179,821	175,238	83,429	91,809
2009	355,671	106,640	90,767	197,407	158,264	168,521	93,534	74,987
2010	360,207		90,767	90,767	269,440	158,386	39,911	118,475
2011	360,207		90,767	90,767	269,440	146,987	37,039	109,948
2012	360,207		90,767	90,767	269,440	136,408	34,373	102,035
2013	360,207		90,767	90,767	269,440	126,590	31,899	94,691
2014	360,207		90,767	90,767	269,440	117,479	29,603	87,876
2015	360,207	72,640	90,767	163,407	196,800	109,023	49,458	59,565
2016	360,207	438,020	90,767	528,787	-168,580	101,177	148,528	-47,352
2017	360,207	331,380	90,767	422,147	-61,940	93,895	110,040	-16,146
2018	360,207	120,980	90,767	211,747	148,460	87,137	51,223	35,914
2019	360,207	86,980	90,767	177,747	182,460	80,865	39,904	40,962
2020	360,207		90,767	90,767	269,440	75,045	18,910	56,135
2021	360,207		90,767	90,767	269,440	69,644	17,549	52,095
2022	360,207	72,640	90,767	163,407	196,800	64,631	29,320	35,312
2023	360,207	106,640	90,767	197,407	162,800	59,980	32,871	27,109
2024	360,207		90,767	90,767	269,440	55,663	14,026	41,637
2025	360,207		90,767	90,767	269,440	51,656	13,017	38,640
2026	360,207		90,767	90,767	269,440	47,939	12,080	35,859
2027	360,207		90,767	90,767	269,440	44,488	11,210	33,278
2028	360,207		90,767	90,767	269,440	41,286	10,404	30,883
2029	360,207	72,640	90,767	163,407	196,800	38,315	17,381	20,933
2030	360,207	106,640	90,767	197,407	162,800	35,557	19,487	16,071
2031	360,207		90,767	90,767	269,440	32,998	8,315	24,683
2032	360,207	-217,972	90,767	-127,205	487,412	30,623	-10,814	41,437
Total	10,505,363	3,354,905	2,875,703	6,230,608	4,274,755	3,164,040	3,164,040	-0

FIRR= 0.077555

Table 16.13.4-14 FIRR Calculation of Tartous Port

<Investment +10%> (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999	0	531,388	14,532	545,920	-545,920	0	545,920	-545,920
2000	66,024	697,378	29,869	727,247	-661,223	61,838	681,143	-619,304
2001	70,457	581,812	49,477	631,289	-560,832	61,807	553,784	-491,978
2002	99,349	372,963	58,815	431,778	-332,429	81,627	354,755	-273,129
2003	201,120	0	90,767	90,767	110,353	154,768	69,848	84,920
2004	234,204	0	90,767	90,767	143,437	168,801	65,420	103,381
2005	256,999	0	90,767	90,767	166,232	173,488	61,272	112,215
2006	282,469	0	90,767	90,767	191,702	178,593	57,388	121,205
2007	311,081	0	90,767	90,767	220,314	184,214	53,750	130,464
2008	343,228	79,904	90,767	170,671	172,557	190,366	94,660	95,706
2009	355,671	117,304	90,767	208,071	147,600	184,761	108,087	76,674
2010	360,207	0	90,767	90,767	269,440	175,255	44,162	131,093
2011	360,207	0	90,767	90,767	269,440	164,145	41,362	122,783
2012	360,207	0	90,767	90,767	269,440	153,739	38,740	114,999
2013	360,207	0	90,767	90,767	269,440	143,992	36,284	107,708
2014	360,207	0	90,767	90,767	269,440	134,864	33,984	100,880
2015	360,207	79,904	90,767	170,671	189,536	126,314	59,849	66,465
2016	360,207	481,822	90,767	572,589	-212,382	118,306	188,061	-69,755
2017	360,207	364,518	90,767	455,285	-95,078	110,806	140,054	-29,248
2018	360,207	133,078	90,767	223,845	136,362	103,782	64,493	39,288
2019	360,207	95,678	90,767	186,445	173,762	97,202	50,312	46,890
2020	360,207	0	90,767	90,767	269,440	91,040	22,941	68,099
2021	360,207	0	90,767	90,767	269,440	85,269	21,486	63,782
2022	360,207	79,904	90,767	170,671	189,536	79,863	37,840	42,023
2023	360,207	117,304	90,767	208,071	152,136	74,800	43,208	31,592
2024	360,207	0	90,767	90,767	269,440	70,058	17,654	52,404
2025	360,207	0	90,767	90,767	269,440	65,617	16,534	49,082
2026	360,207	0	90,767	90,767	269,440	61,457	15,486	45,971
2027	360,207	0	90,767	90,767	269,440	57,561	14,504	43,056
2028	360,207	0	90,767	90,767	269,440	53,912	13,585	40,327
2029	360,207	79,904	90,767	170,671	189,536	50,494	23,925	26,569
2030	360,207	117,304	90,767	208,071	152,136	47,293	27,318	19,974
2031	360,207	0	90,767	90,767	269,440	44,295	11,162	33,133
2032	360,207	-239,769	90,767	-149,002	509,209	41,487	-17,161	58,648
Total	10,505,363	3,690,396	2,875,703	6,566,099	3,939,265	3,591,812	3,591,812	-0

FIRR= 0.067687

Table 16.13.4-15 FIRR Calculation of Tartous Port

<Revenue -10%> (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2)			(1)-(2)	Discount Value		
		Investment	Expense	Total		Revenue	Cost	Difference
1999	0	483,080	14,532	497,612	-497,612	0	497,612	-497,612
2000	59,422	633,980	29,869	663,849	-604,427	55,964	625,226	-569,262
2001	63,411	528,920	49,477	578,397	-514,986	56,247	513,052	-456,805
2002	89,414	339,057	58,815	397,872	-308,458	74,698	332,389	-257,691
2003	181,008	0	90,767	90,767	90,241	142,419	71,417	71,003
2004	210,784	0	90,767	90,767	120,017	156,198	67,262	88,937
2005	231,299	0	90,767	90,767	140,532	161,429	63,348	98,081
2006	254,222	0	90,767	90,767	163,455	167,105	59,663	107,442
2007	279,973	0	90,767	90,767	189,206	173,324	56,192	117,133
2008	308,905	72,640	90,767	163,407	145,498	180,109	95,276	84,834
2009	320,104	106,640	90,767	197,407	122,697	175,780	108,403	67,377
2010	324,186	0	90,767	90,767	233,419	167,665	46,943	120,721
2011	324,186	0	90,767	90,767	233,419	157,910	44,212	113,698
2012	324,186	0	90,767	90,767	233,419	148,723	41,640	107,083
2013	324,186	0	90,767	90,767	233,419	140,070	39,217	100,853
2014	324,186	0	90,767	90,767	233,419	131,921	36,936	94,985
2015	324,186	72,640	90,767	163,407	160,779	124,245	62,626	61,619
2016	324,186	438,020	90,767	528,787	-204,601	117,017	190,869	-73,852
2017	324,186	331,380	90,767	422,147	-97,961	110,209	143,511	-33,302
2018	324,186	120,980	90,767	211,747	112,439	103,797	67,796	36,000
2019	324,186	86,980	90,767	177,747	146,439	97,758	53,599	44,159
2020	324,186	0	90,767	90,767	233,419	92,070	25,778	66,292
2021	324,186	0	90,767	90,767	233,419	86,714	24,278	62,435
2022	324,186	72,640	90,767	163,407	160,779	81,669	41,165	40,503
2023	324,186	106,640	90,767	197,407	126,779	76,917	46,837	30,080
2024	324,186	0	90,767	90,767	233,419	72,442	20,283	52,160
2025	324,186	0	90,767	90,767	233,419	68,227	19,103	49,125
2026	324,186	0	90,767	90,767	233,419	64,258	17,991	46,267
2027	324,186	0	90,767	90,767	233,419	60,519	16,944	43,575
2028	324,186	0	90,767	90,767	233,419	56,998	15,959	41,040
2029	324,186	72,640	90,767	163,407	160,779	53,682	27,059	26,624
2030	324,186	106,640	90,767	197,407	126,779	50,559	30,787	19,772
2031	324,186	0	90,767	90,767	233,419	47,617	13,332	34,285
2032	324,186	-217,972	90,767	-127,205	451,391	44,847	-17,597	62,444
Total	9,454,827	3,354,905	2,875,703	6,230,608	3,224,219	3,499,109	3,499,109	-0

FIRR= 0.061774

Table 16.13.4-16 FIRR Calculation of Tartous Port

<Investment +10%, Revenue -10%> (Unit : Thousand S.P.)

Year	Revenue (1)	Cost(2) Investment	Expense	Total	(1)-(2)	Discount Value Revenue	Cost	Difference
1999	0	531,388	14,532	545,920	-545,920	0	545,920	-545,920
2000	59,422	697,378	29,869	727,247	-667,825	56,461	691,011	-634,550
2001	63,411	581,812	49,477	631,289	-567,878	57,250	569,946	-512,697
2002	89,414	372,963	58,815	431,778	-342,364	76,703	370,398	-293,695
2003	181,008	0	90,767	90,767	90,241	147,540	73,984	73,556
2004	210,784	0	90,767	90,767	120,017	163,249	70,298	92,951
2005	231,299	0	90,767	90,767	140,532	170,212	66,795	103,417
2006	254,222	0	90,767	90,767	163,455	177,760	63,467	114,293
2007	279,973	0	90,767	90,767	189,206	186,011	60,305	125,706
2008	308,905	79,904	90,767	170,671	138,234	195,007	107,742	87,265
2009	320,104	117,304	90,767	208,071	112,033	192,008	124,807	67,201
2010	324,186	0	90,767	90,767	233,419	184,768	51,732	133,036
2011	324,186	0	90,767	90,767	233,419	175,561	49,154	126,407
2012	324,186	0	90,767	90,767	233,419	166,814	46,705	120,109
2013	324,186	0	90,767	90,767	233,419	158,502	44,378	114,124
2014	324,186	0	90,767	90,767	233,419	150,604	42,167	108,438
2015	324,186	79,904	90,767	170,671	153,515	143,100	75,337	67,764
2016	324,186	481,822	90,767	572,589	-248,403	135,970	240,155	-104,185
2017	324,186	364,518	90,767	455,285	-131,099	129,195	181,441	-52,246
2018	324,186	133,078	90,767	223,845	100,341	122,758	84,762	37,996
2019	324,186	95,678	90,767	186,445	137,741	116,641	67,082	49,559
2020	324,186	0	90,767	90,767	233,419	110,829	31,030	79,799
2021	324,186	0	90,767	90,767	233,419	105,307	29,484	75,823
2022	324,186	79,904	90,767	170,671	153,515	100,060	52,678	47,382
2023	324,186	117,304	90,767	208,071	116,115	95,074	61,021	34,053
2024	324,186	0	90,767	90,767	233,419	90,337	25,293	65,044
2025	324,186	0	90,767	90,767	233,419	85,836	24,033	61,803
2026	324,186	0	90,767	90,767	233,419	81,559	22,835	58,724
2027	324,186	0	90,767	90,767	233,419	77,495	21,697	55,798
2028	324,186	0	90,767	90,767	233,419	73,634	20,616	53,018
2029	324,186	79,904	90,767	170,671	153,515	69,965	36,834	33,131
2030	324,186	117,304	90,767	208,071	116,115	66,479	42,668	23,811
2031	324,186	0	90,767	90,767	233,419	63,166	17,686	45,481
2032	324,186	-239,769	90,767	-149,002	473,189	60,019	-27,586	87,605
Total	9,454,827	3,690,396	2,875,703	6,566,099	2,888,728	3,985,876	3,985,876	-0

FIRR= 0.05244

Table 16.13.4.2 Financial Statement

Income Statement

	1	2	3	4
Year	1999	2000	2001	2002
Operating Revenue	0	66,024	70,457	99,349
Operating Expenditure	14,532	49,362	88,463	112,437
Personnel & Administration	0	0	16,554	16,554
Maintenance	14,532	29,869	32,923	42,261
Depreciation	0	19,493	38,986	53,622
Net Operating Income	-14,532	16,662	-18,006	-13,088
Non-operating Revenue	0	0	0	0
Interest Income	-	-	-	-
Others				
Non-operating Expenditure	20,108	45,954	66,714	78,975
Interest on Long-term Loans	20,108	45,954	66,714	78,975
Others				
Net Income	-34,640	-29,292	-84,720	-92,064
Accumulated Earnings	-34,640	-63,932	-148,652	-240,716

Cash Flow

Year	1999	2000	2001	2002
Cash Beginning	0	-40,679	-64,441	-130,750
Cash Inflow	468,548	670,135	549,900	379,591
Net Operating Income	-14,532	16,662	-18,006	-13,088
Depreciation	0	19,493	38,986	53,622
Long-term Loans	483,080	633,980	528,920	339,057
Interest Income	-	-	-	-
Cash Outflow	509,227	693,897	616,209	442,845
Investment	483,080	633,980	528,920	339,057
Payment for Long-term Loans	6,039	13,963	20,575	24,813
Interest on Long-term Loans	20,108	45,954	66,714	78,975
Other Non-operating Expenditure	0	0	0	0
Cash Inflow - Outflow	-40,679	-23,762	-66,309	-63,254
Cash Ending	-40,679	-64,441	-130,750	-194,004
Cash Excess	0	0	0	0
Cash Shortage	-40,679	-64,441	-130,750	-194,004

Balance Sheet

Year	1999	2000	2001	2002
Current Assets	0	0	0	0
Cash & Deposit	0	0	0	0
Other Current Assets				
Fixed Assets	483,080	1,097,567	1,587,501	1,872,936
Depreciable Assets	483,080	1,117,060	1,645,980	1,985,037
Accumulated Depreciation	0	19,493	58,479	112,101
Total Assets	483,080	1,097,567	1,587,501	1,872,936
Liabilities	517,720	1,161,499	1,736,153	2,113,651
Current Liabilities	40,679	64,441	130,750	194,004
Fixed Liabilities(Long-term Loans)	477,042	1,097,058	1,605,404	1,919,648
Capital				
Accumulated Earnings	-34,640	-63,932	-148,652	-240,716
Total Liabilities & Capital	483,080	1,097,567	1,587,501	1,872,936
	0	-0	-0	-0

Financial Indicators	1999	2000	2001	2002
Rate of Return on Net Fixed Assets (%)				
Debt Service Coverage Ratio				
Operating Ratio (%)				
Working Ratio (%)				

5	6	7	8	9	10	11	12
2003	2004	2005	2006	2007	2008	2009	2010
201,120	234,204	256,999	282,469	311,081	343,228	355,671	360,207
169,733	169,733	169,733	169,733	169,733	169,733	169,733	169,733
43,481	43,481	43,481	43,481	43,481	43,481	43,481	43,481
47,286	47,286	47,286	47,286	47,286	47,286	47,286	47,286
78,966	78,966	78,966	78,966	78,966	78,966	78,966	78,966
31,387	64,471	87,266	112,736	141,348	173,495	185,938	190,474
0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-
76,742	74,509	72,276	70,043	67,809	65,576	62,854	59,490
76,742	74,509	72,276	70,043	67,809	65,576	62,854	59,490
-45,355	-10,038	14,990	42,693	73,538	107,918	123,084	130,984
-286,071	-296,109	-281,119	-238,426	-164,888	-56,970	66,114	197,098

2003	2004	2005	2006	2007	2008	2009	2010
-194,004	-185,206	-141,091	-71,948	24,899	152,590	242,022	294,504
110,353	143,437	166,232	191,702	220,314	252,461	264,904	269,440
31,387	64,471	87,266	112,736	141,348	173,495	185,938	190,474
78,966	78,966	78,966	78,966	78,966	78,966	78,966	78,966
0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-
101,555	99,322	97,089	94,856	92,622	163,029	212,422	126,193
			0	0	72,640	106,640	
24,813	24,813	24,813	24,813	24,813	24,813	42,928	66,703
76,742	74,509	72,276	70,043	67,809	65,576	62,854	59,490
0	0	0	0	0	0	0	0
8,798	44,115	69,143	96,846	127,692	89,432	52,482	143,247
-185,206	-141,091	-71,948	24,899	152,590	242,022	294,504	437,751
0	0	0	0	152,590	242,022	294,504	437,751
-185,206	-141,091	-71,948	24,899	0	0	0	0

2003	2004	2005	2006	2007	2008	2009	2010
-185,206	-141,091	-71,948	24,899	152,590	242,022	294,504	437,751
-185,206	-141,091	-71,948	24,899	152,590	242,022	294,504	437,751
1,793,970	1,715,003	1,636,037	1,557,071	1,478,104	1,471,778	1,499,452	1,420,485
1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037
191,068	270,034	349,000	427,966	506,933	513,259	485,585	564,552
1,608,764	1,573,912	1,564,089	1,581,969	1,630,695	1,713,800	1,793,955	1,858,236
1,894,835	1,870,022	1,845,209	1,820,396	1,795,583	1,770,770	1,727,841	1,661,139
-	-	-	-	-	-	-	-
1,894,835	1,870,022	1,845,209	1,820,396	1,795,583	1,770,770	1,727,841	1,661,139
-286,071	-296,109	-281,119	-238,426	-164,888	-56,970	66,114	197,098
1,608,764	1,573,912	1,564,089	1,581,969	1,630,695	1,713,800	1,793,955	1,858,236
-0	0	-0	-0	-0	-0	-0	-0

2003	2004	2005	2006	2007	2008	2009	2010
1.75	3.76	5.33	7.24	9.56	11.79	12.40	13.41
1.09	1.44	1.71	2.02	2.38	2.79	2.50	2.14
84.39	72.47	66.04	60.09	54.56	49.45	47.72	47.12
45.13	38.76	35.32	32.13	29.18	26.45	25.52	25.20

Table 16.13.4.2 Financial Statement

Income Statement	13	14	15	16
Year	2011	2012	2013	2014
Operating Revenue	360,207	360,207	360,207	360,207
Operating Expenditure	169,733	169,733	169,733	169,733
Personnel & Administration	43,481	43,481	43,481	43,481
Maintenance	47,286	47,286	47,286	47,286
Depreciation	78,966	78,966	78,966	78,966
Net Operating Income	190,474	190,474	190,474	190,474
Non-operating Revenue	0	0	0	0
Interest Income	-	-	-	-
Others				
Non-operating Expenditure	55,590	51,347	47,104	42,861
Interest on Long-term Loans	55,590	51,347	47,104	42,861
Others				
Net Income	134,884	139,127	143,370	147,613
Accumulated Earnings	331,981	471,108	614,478	762,090

Cash Flow

Year	2011	2012	2013	2014
Cash Beginning	437,751	565,064	683,905	806,989
Cash Inflow	269,440	269,440	269,440	269,440
Net Operating Income	190,474	190,474	190,474	190,474
Depreciation	78,966	78,966	78,966	78,966
Long-term Loans	0	0	0	0
Interest Income	-	-	-	-
Cash Outflow	142,127	150,599	146,356	142,113
Investment	0	0	0	0
Payment for Long-term Loans	86,537	99,252	99,252	99,252
Interest on Long-term Loans	55,590	51,347	47,104	42,861
Other Non-operating Expenditure			0	0
Cash Inflow - Outflow	127,313	118,841	123,084	127,327
Cash Ending	565,064	683,905	806,989	934,316
Cash Excess	565,064	683,905	806,989	934,316
Cash Shortage	0	0	0	0

Balance Sheet

Year	2011	2012	2013	2014
Current Assets	565,064	683,905	806,989	934,316
Cash & Deposit	565,064	683,905	806,989	934,316
Other Current Assets				
Fixed Assets	1,341,519	1,262,553	1,183,586	1,104,620
Depreciable Assets	1,985,037	1,985,037	1,985,037	1,985,037
Accumulated Depreciation	643,518	722,484	801,451	880,417
Total Assets	1,906,583	1,946,458	1,990,575	2,038,936
Liabilities	1,574,601	1,475,350	1,376,098	1,276,846
Current Liabilities	-	-	-	-
Fixed Liabilities(Long-term Loans)	1,574,601	1,475,350	1,376,098	1,276,846
Capital				
Accumulated Earnings	331,981	471,108	614,478	762,090
Total Liabilities & Capital	1,906,583	1,946,458	1,990,575	2,038,936
	-0	-0	-0	-0

Financial Indicators	2011	2012	2013	2014
Rate of Return on Net Fixed Assets (%)	14.20	15.09	16.09	17.24
Debt Service Coverage Ratio	1.90	1.79	1.84	1.90
Operating Ratio (%)	47.12	47.12	47.12	47.12
Working Ratio (%)	25.20	25.20	25.20	25.20

17	18	19	20	21	22	23	24
2015	2016	2017	2018	2019	2020	2021	2022
360,207	360,207	360,207	360,207	360,207	360,207	360,207	360,207
169,733	169,733	169,733	169,733	169,733	169,733	169,733	169,733
43,481	43,481	43,481	43,481	43,481	43,481	43,481	43,481
47,286	47,286	47,286	47,286	47,286	47,286	47,286	47,286
78,966	78,966	78,966	78,966	78,966	78,966	78,966	78,966
190,474	190,474	190,474	190,474	190,474	190,474	190,474	190,474
0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-
38,618	34,375	30,132	25,889	22,189	19,203	16,812	14,802
38,618	34,375	30,132	25,889	22,189	19,203	16,812	14,802
151,856	156,099	160,342	164,585	168,284	171,271	173,662	175,672
913,946	1,070,045	1,230,386	1,394,971	1,563,255	1,734,526	1,908,188	2,083,859

2015	2016	2017	2018	2019	2020	2021	2022
934,316	993,246	691,039	499,716	523,035	590,092	755,040	928,991
269,440	269,440	269,440	269,440	269,440	269,440	269,440	269,440
190,474	190,474	190,474	190,474	190,474	190,474	190,474	190,474
78,966	78,966	78,966	78,966	78,966	78,966	78,966	78,966
0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-
210,510	571,647	460,764	246,121	202,383	104,492	95,489	161,881
72,640	438,020	331,380	120,980	86,980	0	0	72,640
99,252	99,252	99,252	99,252	93,213	85,289	78,677	74,439
38,618	34,375	30,132	25,889	22,189	19,203	16,812	14,802
0	0	0	0	0	0	0	0
58,930	-302,207	-191,324	23,319	67,057	164,948	173,951	107,559
993,246	691,039	499,716	523,035	590,092	755,040	928,991	1,036,551
993,246	691,039	499,716	523,035	590,092	755,040	928,991	1,036,551
0	0	0	0	0	0	0	0

2015	2016	2017	2018	2019	2020	2021	2022
993,246	691,039	499,716	523,035	590,092	755,040	928,991	1,036,551
993,246	691,039	499,716	523,035	590,092	755,040	928,991	1,036,551
1,098,294	1,457,347	1,709,761	1,751,775	1,759,788	1,680,822	1,601,856	1,595,529
1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037
886,743	527,690	275,276	233,262	225,249	304,215	383,181	389,508
2,091,540	2,148,387	2,209,477	2,274,809	2,349,880	2,435,862	2,530,847	2,632,080
1,177,594	1,078,342	979,090	879,838	786,625	701,336	622,659	548,220
-	-	-	-	-	-	-	-
1,177,594	1,078,342	979,090	879,838	786,625	701,336	622,659	548,220
913,946	1,070,045	1,230,386	1,394,971	1,563,255	1,734,526	1,908,188	2,083,859
2,091,540	2,148,387	2,209,477	2,274,809	2,349,880	2,435,862	2,530,847	2,632,080
-0	0	0	0	0	0	0	0

2015	2016	2017	2018	2019	2020	2021	2022
17.34	13.07	11.14	10.87	10.82	11.33	11.89	11.94
1.95	2.02	2.08	2.15	2.33	2.58	2.82	3.02
47.12	47.12	47.12	47.12	47.12	47.12	47.12	47.12
25.20	25.20	25.20	25.20	25.20	25.20	25.20	25.20

Table 16.13.4.2 Financial Statement

Income Statement	25	26	27	28
Year	2023	2024	2025	2026
Operating Revenue	360,207	360,207	360,207	360,207
Operating Expenditure	169,733	169,733	169,733	169,733
Personnel & Administration	43,481	43,481	43,481	43,481
Maintenance	47,286	47,286	47,286	47,286
Depreciation	78,966	78,966	78,966	78,966
Net Operating Income	190,474	190,474	190,474	190,474
Non-operating Revenue	0	0	0	0
Interest Income	-	-	-	-
Others				
Non-operating Expenditure	12,792	10,782	8,772	6,763
Interest on Long-term Loans	12,792	10,782	8,772	6,763
Others				
Net Income	177,682	179,691	181,701	183,711
Accumulated Earnings	2,261,541	2,441,232	2,622,934	2,806,645

Cash Flow				
Year	2023	2024	2025	2026
Cash Beginning	1,036,551	1,112,120	1,296,338	1,482,567
Cash Inflow	269,440	269,440	269,440	269,440
Net Operating Income	190,474	190,474	190,474	190,474
Depreciation	78,966	78,966	78,966	78,966
Long-term Loans	0	0	0	0
Interest Income	-	-	-	-
Cash Outflow	193,871	85,221	83,211	81,201
Investment	106,640	0	0	0
Payment for Long-term Loans	74,439	74,439	74,439	74,439
Interest on Long-term Loans	12,792	10,782	8,772	6,763
Other Non-operating Expenditure	0	0	0	0
Cash Inflow - Outflow	75,569	184,219	186,229	188,239
Cash Ending	1,112,120	1,296,338	1,482,567	1,670,806
Cash Excess	1,112,120	1,296,338	1,482,567	1,670,806
Cash Shortage	0	0	0	0

Balance Sheet				
Year	2023	2024	2025	2026
Current Assets	1,112,120	1,296,338	1,482,567	1,670,806
Cash & Deposit	1,112,120	1,296,338	1,482,567	1,670,806
Other Current Assets				
Fixed Assets	1,623,203	1,544,237	1,465,270	1,386,304
Depreciable Assets	1,985,037	1,985,037	1,985,037	1,985,037
Accumulated Depreciation	361,834	440,800	519,767	598,733
Total Assets	2,735,323	2,840,575	2,947,838	3,057,110
Liabilities	473,782	399,343	324,904	250,465
Current Liabilities	-	-	-	-
Fixed Liabilities(Long-term Loans)	473,782	399,343	324,904	250,465
Capital				
Accumulated Earnings	2,261,541	2,441,232	2,622,934	2,806,645
Total Liabilities & Capital	2,735,323	2,840,575	2,947,838	3,057,110
	0	0	0	0

Financial Indicators	2023	2024	2025	2026
Rate of Return on Net Fixed Assets (%)	11.73	12.33	13.00	13.74
Debt Service Coverage Ratio	3.09	3.16	3.24	3.32
Operating Ratio (%)	47.12	47.12	47.12	47.12
Working Ratio (%)	25.20	25.20	25.20	25.20

29	30	31	32	33	34
2027	2028	2029	2030	2031	2032
360,207	360,207	360,207	360,207	360,207	360,207
169,733	169,733	169,733	169,733	169,733	169,733
43,481	43,481	43,481	43,481	43,481	43,481
47,286	47,286	47,286	47,286	47,286	47,286
78,966	78,966	78,966	78,966	78,966	78,966
190,474	190,474	190,474	190,474	190,474	190,474
0	0	0	0	0	0
-	-				
4,753	2,743	1,222	343	0	0
4,753	2,743	1,222	343	0	0
185,721	187,731	189,252	190,130	190,474	190,474
2,992,366	3,180,097	3,369,348	3,559,479	3,749,952	3,940,426

2027	2028	2029	2030	2031	2032
1,670,806	1,861,054	2,053,312	2,192,567	2,322,474	2,579,200
269,440	269,440	269,440	269,440	269,440	269,440
190,474	190,474	190,474	190,474	190,474	190,474
78,966	78,966	78,966	78,966	78,966	78,966
0	0	0	0	0	0
-	-	0	0	0	0
79,192	77,182	130,186	139,532	12,715	0
0	0	72640	106640	0	0
74,439	74,439	56,323	32,549	12,715	0
4,753	2,743	1,222	343	0	0
0	0	0	0	0	0
190,248	192,258	139,254	129,908	256,725	269,440
1,861,054	2,053,312	2,192,567	2,322,474	2,579,200	2,848,640
1,861,054	2,053,312	2,192,567	2,322,474	2,579,200	2,848,640
0	0	0	0	0	0

2027	2028	2029	2030	2031	2032
1,861,054	2,053,312	2,192,567	2,322,474	2,579,200	2,848,640
1,861,054	2,053,312	2,192,567	2,322,474	2,579,200	2,848,640
1,307,338	1,228,371	1,222,045	1,249,719	1,170,752	1,091,786
1,985,037	1,985,037	1,985,037	1,985,037	1,985,037	1,985,037
677,699	756,666	762,992	735,318	814,285	893,251
3,168,392	3,281,684	3,414,612	3,572,193	3,749,952	3,940,426
176,026	101,587	45,264	12,715	0	0
-	-				
176,026	101,587	45,264	12,715	0	0
2,992,366	3,180,097	3,369,348	3,559,479	3,749,952	3,940,426
3,168,392	3,281,684	3,414,612	3,572,193	3,749,952	3,940,426
0	0	0	0	0	0

2027	2028	2029	2030	2031	2032
14.57	15.51	15.59	15.24	16.27	17.45
3.40	3.49	4.68	8.19	21.19	-
47.12	47.12	47.12	47.12	47.12	47.12
25.20	25.20	25.20	25.20	25.20	25.20

16.14 Environmental Impact Analysis

a) Existing situation

The existing water quality, sediment quality, and air quality were assessed by the site survey.

The baseline data from the environmental survey has been reviewed. In general the water quality is acceptable and can be classed as good for a port where some polluting discharges are inevitable. Areas of concern are high COD and sulphides although the dissolved oxygen is acceptable. Phosphorus, phosphates and oil/grease are high but this also applies to water outside the harbour.

Monitoring for air quality was carried out at three locations around the port. This indicates that the levels in the port are in excess of the standards. The results indicates that the dust within the boundary of the site are within the port is arising from the phosphate loading operation and dust from traffic movements. Phosphate dust is an undesirable environmental pollutant but does not pose any particularly special threat to human health other than those normally associated with excessive dust levels.

The phosphate handling plant at Tartous port is operating in an unsatisfactory manner and would be considered to be outside the generally accepted limits for such a plant with respect to air pollution. Phosphate discharging into the marine environment is of concern. However in this case it in not considered to be a major issue.

b) Changes to Port Construction

The fundamental changes to the existing port construction will be removal of the existing phosphate handling pier and relocation to the new port. The existing sulphur pier will be used for steel and wood. An area adjacent to the old phosphate pier will be reclaimed to give a greater area for livestock handling. The general cargo area will be utilised for only container cargo. This will not require reclamation but some minor dredging will be required to increase the depth from 13 m to 14 m.

All dredged material will be used in the reclamation.

c) Environmental Impacts

The planned activities at Tartous will have no major adverse impacts, although the relocation of the phosphate pier will have a major beneficial impact by improving the situation. The activities that may have an impact are dredging. However the sediments are contaminated to a large degree with heavy metals and the intention to use the dredged material for reclamation purposes is supported. The degree of

this impact is classed as minor and a full EIA is not considered necessary.

The intended relocation of the phosphate handling pier will have a positive environmental impact in that an adverse impact will be removed.

d) Conclusions

There are no environmental reasons why the planned activities should not proceed and a full EIA and remedial measures are not considered necessary. Monitoring for heavy metals during dredging is recommended.

Chapter 17 Short-Term Plan of the New Port

17.1 The Basic Concept of the Port Development Plan

The Short-Term Plan is prepared as a first-phase plan with a target year of 2003 for the development of the New Port. The Short-Term Plan is made within the framework of the Master Plan described in Chapter 13 and whose project components are summarized as follows:

- Preparation of a phosphate terminal
- Preparation of a pellet terminal
- Preparation of a cement clinker terminal
- Preparation of a scrap terminal
- Preparation of a sulfur terminal
- Preparation of a fertilizer terminal
- Preparation of public berths
- Construction of a main breakwater and a sub-breakwater and preparation of an access channel and basins enclosed by the breakwaters

According to the results of the rough economic appraisal of the Master Plan of the New Port, it is judged that the projects listed above are economically viable as a whole (see Section 13.13). In the process of the above economic appraisal, it was revealed that it is economically viable to implement all the above projects as the short-term projects with the target year of 2003. According to the demand forecast of the New Port cargoes, there is not much difference in the forecast volumes of the respective bulk cargoes between the stages of the Short-Term Plan and the Master Plan except for phosphate rock. Even in case of phosphate rock, the volume of phosphate rock exported by sea is expected to exceed the phosphate-handling capacity of the existing facility at Tartous Port. In addition to the limitation of the existing phosphate-handling capacity, it is urgently required to shift the phosphate-handling from Tartous Port adjecent to densely-populated urban areas to the New Port to resolve the current dust emission problem at Tartous Port.

17.2 Terminal Plans

17.2.1 Phosphate Terminal

Number of berths necessary in the year 2003 is decided using computer simulation. The following premises are adopted based on the results described above.

- Total volume of cargoes unloaded from the vessels : 3.2 million tons
- Maximum cargo handling volume : 65,000 tons per vessel
- Number of calling vessels : 107
- Cargo handling productivity : 672 tons per hour

- Land transportation by train
- Number of berths : 2 berths

Cargo handling productivity is calculated as follows:

(400ton/hr) X 4 sets X 0.8(efficiency) X 0.7(operation ratio)

17.2.2 Pellet Terminal

The following premises are adopted based on the results described above.

- Total volume of cargoes unloaded from the vessels : 1.25 million tons
- Maximum cargo handling volume : 65,000 tons per vessel
- Number of calling vessels : 20
- Cargo handling productivity : 455 tons per hour
- Land transportation by train
- Number of berths : 1 berth

Since the premises are the same as that in the year 2010, the results are also the same.

17.2.3 Clinker Terminal

The following premises are adopted based on the results described above.

- Total volume of cargoes unloaded from the vessels : 1.1 million tons
- Maximum cargo handling volume : 65,000 tons per vessel
- Number of calling vessels : 28
- Cargo handling productivity : 392 tons per hour
- Land transportation by train
- Number of berths : 1 berth

Cargo handling productivity is calculated as follows:

300ton/hr X 2 sets X 0.8(efficiency) X 0.7(operation ratio)

17.2.4 Scrap Terminal

The following premises are adopted based on the results described above.

- Total volume of cargoes unloaded from the vessels : 200,000 tons
- Maximum cargo handling volume : 10,000 tons per vessel
- Number of calling vessels : 23
- Cargo handling productivity : 73 tons per hour
- Land transportation by truck
- Number of berths : 1 berth

Since the premises are the same as that in the year 2010, the results are also the same.

17.2.5 Fertilizer Terminal

The following premises are adopted based on the results described above.

- Total volume of cargoes loaded into the vessels : 510,000 ton
- Maximum cargo handling volume : 40,000 ton
- Number of calling vessels : 23
- Cargo handling productivity : 220 ton/hr
- Land transportation by railway
- Number of berths : 1

Cargo handling productivity:

15ton X 3units X 0.7(efficiency) X 0.7(operation)

17.2.6 Sulphur Terminal

Cargo volume of sulphur in 2003 is same as that in 2010. The premises of the simulation are as follows:

- Total volume of cargoes :500,000 tons
- Maximum cargo handling volume : 40,000 ton/vessel
- Number of calling vessels : 17
- Land transportation by railway
- Number of berths : 1

Since the terminal is used for fertilizer exclusively, the number of berth is also one.

17.2.7 Public Berths

(1) Public Berth for Steel Industry

Cargo volume of materials for steel industry such as furnace bricks excluding raw materials in 2003 is same as that in 2010. The premises of the simulation are as follows:

- Total volume of cargoes :150,000 tons
- Maximum cargo handling volume : 10,000 ton/vessel
- Number of calling vessels : 17
- Land transportation by truck
- Number of berths : 1

(2) Public Berth for Coke

The following premises are adopted.

- Total volume of cargo unloaded	:	100,000	ton
- Maximum cargo volume per vessel	:	15,000	ton
- Number of calling vessels	:	9	
- Cargo handling productivity	:	126	ton/hr
- Land transportation by truck			
- Number of berth	:	1	

Cargo handling productivity:

150ton X 3unit X 0.6 X 0.7 X 16hr/24hr

(3) Public Berth for Other Bagged Cargo

The following premises are adopted.

- Total volume of cargo unloaded	:	170,000	ton
- Maximum cargo volume per vessel	:	15,000	ton
- Number of calling vessels	:	15	
- Cargo handling productivity	:	67	ton/hr
- Land transportation by truck			
- Number of berth	:	2	

Cargo handling productivity:

2ton X 30rot. X 3gang X 0.7 X 0.8 X 16hr/24hr

(4) Small Vessel Terminal

Layout of the terminal is described in the Fig. 17.2-1.

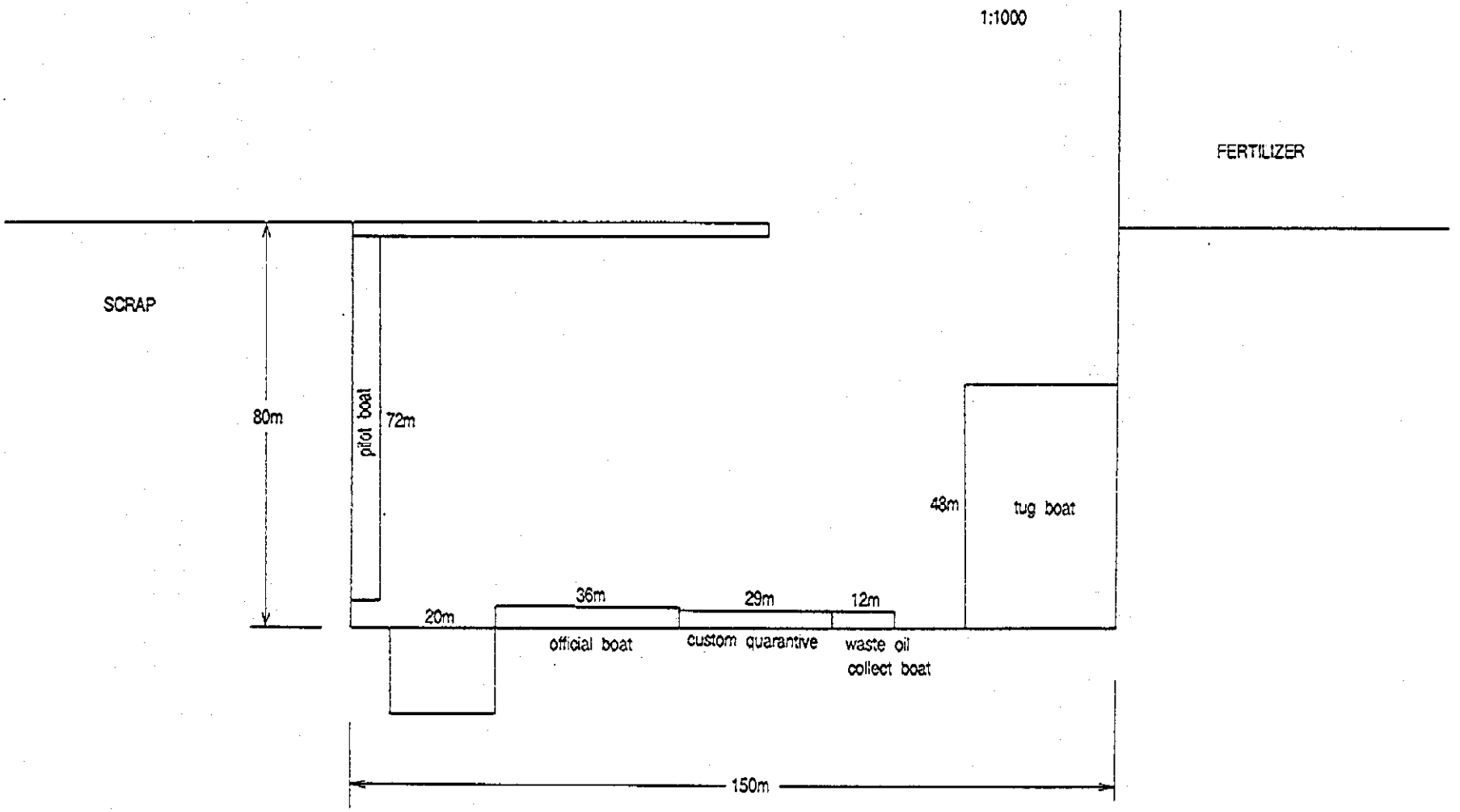


Figure 17.1.2 Small Vessel Terminal

17.2.8 The Required Number of Berths of Each Terminal

The above-mentioned terminals of phosphate, pellet, clinker, scrap, fertilizer in bulk and sulphur are planned to be terminals equipped with cargo-handling and storage facilities specialized to handle each cargo. Hence, those terminals are planned to be exclusive terminals which are separately allocated within the limits of the new port.

On the other hand, the public berth which is allocated between the pellet terminal and the scrap terminal is planned to handle mainly materials for iron and steel production inland including ferro-alloy and furnace bricks and excluding pellets and scraps. The yard behind its berth could be used as an additional storage yard for pellet to be discharged at the pellet berth west of the public berth.

The required number of the remaining public berths which are allocated north of the new port is determined so as not to induce undue long off-shore waiting times of vessels calling at the berths.

To reveal berth occupancy and off-shore waiting of vessels calling at the proposed layout plan, simulation was conducted. The results are as follows:

	Berth occupancy	Waiting time
- Phosphate terminal (2 berths)	31.9 %	2 hrs
- Pellet terminal (1 berth)	34.5 %	37 hrs
- Clinker terminal (1 berth)	32.1 %	9 hrs
- Scrap terminal (1 berth)	38.8 %	30 hrs
- Fertilizer terminal (1 berth)	38.9 %	38 hrs
- Sulphur terminal (1 berth)	38.5 %	22 hrs
- Public berth for iron/steel-making industry (1 berth)	32.1 %	19 hrs
- Public berths north of the port (2 berths)	27.5 %	16 hrs

Different from general cargo berths of the ports of Latakia and Tartous, berthing times of the vessels which will call the new bulk cargo port are estimated much longer than those of the existing ports. That results in much longer ship waiting times at the new port than those at the existing ports even when berth occupancy rate is the same. In addition, it has been theoretically proven that a small number of berths, one or tow at best, accelerate the tendency. Hence, in the new port, berth occupancy rates need to be kept under the moderate level of 50%; in case where the number of berth of the phosphate terminal or the north public berth is one, excessive ship waiting times are induced and the congestion will be exaggerated beyond the year 2003.

17.3 Cargo Handling System

Primary factors of deciding cargo handling system at a port in general are as follows:

1.Cargo style(or packing style of cargo).
2.Cargo handling volume at the port.
3.Transport mode.
4.Available area for handling and storing.
5.Environmental and natural condition around a port area.

In this section, the difference in the primary factors between the Master Plan and Short-Term plan is studied.

17.3.1 Comparison of Primary factors

(1) Cargo Style(or Packing Style) and Cargo Handling Volume

There is no difference in cargo style(or packing style) between the Master Plan and the Short-Term Plan.(Table 17.3.1)

Table 17.3.1 Cargo Handling Volume at New Port

(Unit:1,000 tons)

Commodity	Cargo Handling Volume	
	Short-Term Plan	Master Plan
Phosphate	3,200	4,100
Cement Clinker	1,100	1,000
Iron Pellet	1,250	1,250
Scrap	200	200
Oil Coke	100	200
Sulphur	500	500
Export Fertilizer	510	480
General Cargo(Fire Brick and Others)	150	150
General Cargo(Bagged Fertilizer)	170	270

There is not much difference in each volume of cargo to be handled in the New Port between the Master Plan and the Short-Term Plan. (Table 17.3.2)

Table 17.3.2 Cargo Style (or Packing Style) at New Port

Commodity	Cargo Style(or Packing Style)	
	Short-Term Plan	Master Plan
Phosphate	Bulk	Bulk
Cement Clinker	Bulk	Bulk
Iron Pellet	Bulk	Bulk
Scrap	Various(Break Bulk)	Various(Break Bulk)
Oil Coke	Bulk	Bulk
Sulphur	Bulk	Bulk
Export Fertilizer	Bulk	Bulk
General Cargo(Fire Brick and Others)	Various(Break Bulk)	Various(Break Bulk)
General Cargo(Bagged Fertilizer)	Bag	Bag

(2) Transport Mode

Transport mode, which comprises sea and land transport means, and cargo handling system in the marine terminal in the New Port for each commodity in the Short-Term Plan is basically the same as that in the Master Plan because the volume of cargo of each commodity and cargo style in the Short-Term Plan is almost the same as those of the Master Plan.

1) Phosphate

Phosphate in the Short-Term plan will be transported in Syria by rail way which is most economical transport mode for the following reasons:

1.Large volume of bulk cargo.
2.Long distance between the origin of the transportation and the New Port.

Phosphate will be transported for sea transport by bulk carriers.

2) Cement clinker

The cargo handling volume of cement clinker in the Short-Term Plan is larger than in the Master Plan. Therefore, the size of facilities is determined by the cargo handling volume in the Short-Term Plan.

The most economical transport mode for cement clinker is rail-way for the following reasons:

1.Large volume of bulk cargo.
2.Large bulk density.
3.The existing cement factories already have rail-way loading facilities.

The cement clinker will be transported from the New Port to unloading ports by bulk carriers.

The Master Plan adopts the same transport mode in the Short-Term Plan, namely,

rail-way for land and bulk carriers for sea.

3) Iron Pellet

The most economical transport mode of import iron pellet in Syria in the Short-Term Plan is rail-way for the following reasons:

1.Large volume of bulk cargo.
2.Large bulk density.
3.Long distance between the New Port and the inland destination.

Iron pellet will be transported between the loading ports and the New Port by bulk carriers.

The Master Plan adopts the same transport mode in the Short-Term Plan, namely, rail-way for land and bulk carriers for sea.

4) Scrap

The import iron scrap will be transported by train in Syria in the Short-Term Plan for the following reasons:

1.Same destination as iron pellet which is transported by rail-way.
2.There are many styles and sizes of iron scrap. Therefore, if iron scrap is transported by trucks, loading volume per truck would be very small.

Iron scrap will be transported between the loading ports and the New Port by general cargo ships.

The Master Plan adopts the same transport mode in the Short-Term Plan, namely, rail-way for land and general cargo ships for sea.

5) Oil coke

The most economical transport modes are rail-way for land in Syria and bulk carriers for sea from the New Port to unloading ports for the following reasons:

1.Existing oil refinery where oil coke originate has rail-way loading facilities.
2.Dirty water from the truck contaminates the road in case of rain, if oil coke is transported by truck.
3.The volume per ship for export oil coke is more than ten thousand tons.

The Master and the Short-Term Plan adopt the same transport mode, namely, rail-way for land and general cargo ships for sea.

6) Sulphur

Sulphur is transported between the New Port and unloading ports by bulk carriers. Land transportation of sulphur in Syria is performed by trains. The reason for adopting both transport modes is as follows:

1.Long distance from origin of land transportation to the New Port.
2.Large volume of bulk cargo

The same transport mode for sulphur is adopted in the Master Plan and the Short-Term Plan.

7) Import Fertilizer

The most economical transport modes for import fertilizer are trucks for land in Syria and general cargo ships for sea between the New Port and loading ports. The reason is as follows:

1.Annual cargo handling volume is not very large.
2.The packing style is bag.
3.The size and style of packing are the same.
4.Rail-way facilities are not established at all warehouses of consignee.

The same transport mode for import fertilizer is adopted in the Master Plan and the Short-Term Plan.

8) Export Fertilizer

The cargo handling volume of export fertilizer in the Short-Term Plan is larger than the Master Plan. Therefore, the size of facilities is determined by the cargo handling volume in the Short-Term Plan.

Rail-way is adopted as the cargo handling mode of land transportation in Syria for export fertilizer for the following reasons:

1.Large volume of bulk cargo.
2.Long distance between storage silos facilities at some field sides.
3.Almost all field silo facilities have loading facilities of rail-way.

Export fertilizer is transported between the loading ports and the New Port by bulk carriers.

The Master and the Short-Term Plan adopt the same transport mode, namely, rail-way for land and bulk carriers for sea.

9)General Cargo(Related cargo for steel company)

The most economical transport modes for import general cargo(related cargo for steel company) are rail-way for land in Syria and general cargo ships between the New Port and loading ports. The reason is as follows:

1.Large density cargoes
2.Size and style of cargoes are not the same.
3.Same destination(Steel company) as iron pellet which is transported from the New Port and Steel Company.

The same transport mode for the general cargo(related cargoes for steel company) is adopted in the Master Plan and the Short-Term Plan.

(3) Other Primary Factors

Other primary factors, namely available area for handling and storage and environmental and natural condition around the port area, are the same in the Master Plan.

17.4 Access Channel and Basins

The largest vessel that moors at the New Port in 2003 is pellet carrier, phosphate carrier and clinker carrier. The dimensions of the vessel are as follows:

- Capacity : 60,000 DWT
- Draft : 12.3 m
- LOA (Length Over All) : 235 m
- Breadth : 33.3 m

The width of the channel is determined as 250 m, (over 1 LOA of the vessel). In order to reduce the distance to the port, the channel access runs perpendicular to the coast line then curves around 30 degrees before the entrance of the port.

The depth of the channel is -15 m.

Turning basin has a diameter of 470 m (double the LOA) and a water depth of 14 m.

17.5 Breakwaters

Table 17.5-1 shows the distribution of calmness at point A, B and C which are situated at phosphate berth, pellet berth and turning basin respectively.
The following 3 cases of plan were examined.

Plan-1 Without breakwater
Plan-2 2,200m main breakwater and 700m sub-breakwater
Plan-3 1,950m main breakwater and 700m sub-breakwater

Table 17.5.1 Calmness in the Basin

Plan-1

Wave Height	Point A	Point B	Point C
0~0.3m	51.99%	51.99%	51.99%
0.3~0.6m	13.97%	13.97%	13.97%
0.6~1.0m	18.72%	18.72%	18.72%
1.0~2.0m	10.98%	10.98%	10.98%
2.0m~	4.31%	4.31%	4.31%

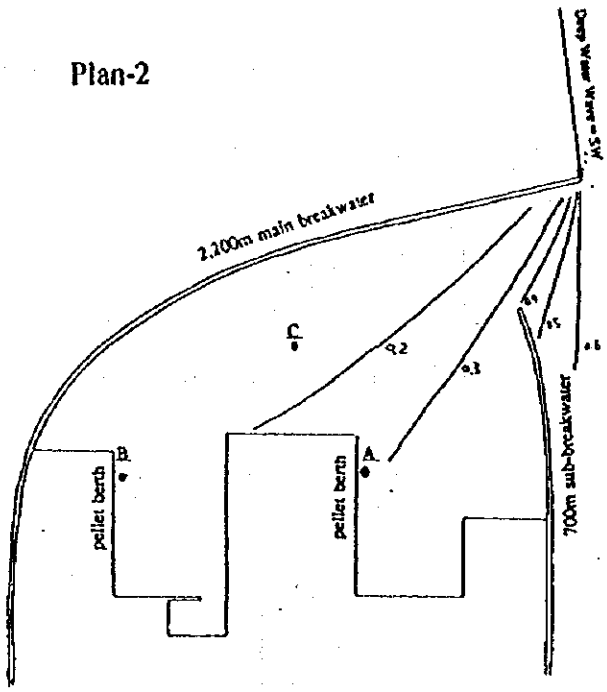
Plan-2

Wave Height	Point A	Point B	Point C
0~0.3m	86.08%	96.95%	94.53%
0.3~0.6m	9.21%	2.48%	4.11%
0.6~1.0m	3.35%	0.43%	1.10%
1.0~2.0m	1.21%	0.12%	0.24%
2.0m~	0.12%		

Plan-3

Wave Height	Point A	Point B	Point C
0~0.3m	84.30%	94.52%	93.34%
0.3~0.6m	11.52%	4.14%	4.76%
0.6~1.0m	3.22%	1.07%	1.41%
1.0~2.0m	0.88%	0.24%	0.46%
2.0m~	0.06%		

Calmness in case of Plan-2 is better than case Plan-3.
However, taking into account the construction cost, Plan-3 is recommendable.
Fig. 17.5-1 shows the example of wave diffraction from the SW deep water wave.



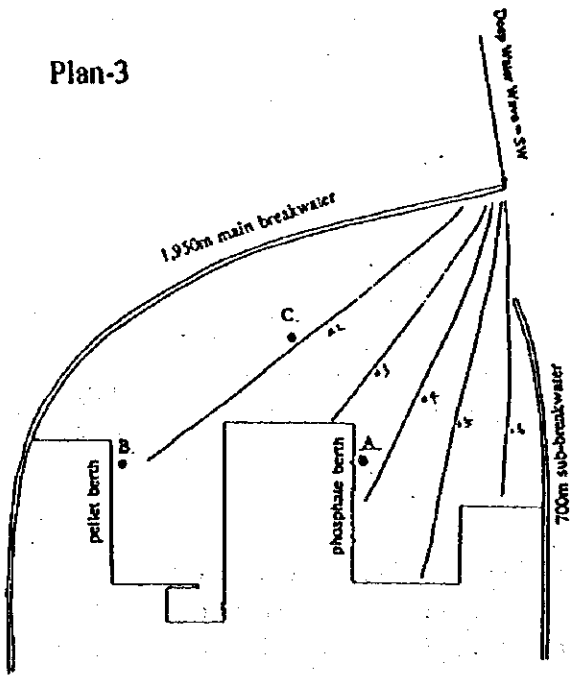


Figure 17.5.1 Wave Diffraction from the SW Deep Water Wave

17.6 Access Roads and Railways

The traffic volume of vehicles originating from or destined to the port in the year 2003 during peak time is estimated to be 331 vehicles per day and the hourly traffic corresponding to that daily traffic is estimated to be 42 vehicles. Even if the port related vehicles for operation and maintenance are included, two lane road is sufficient for the road transport. The access road overpasses the siding railway in front of the new port.

Port related vehicles are divided into two traffic flows. Trucks carrying steel materials, fertilizer, clinker, and other port related cars will use Gate No.1, which is situated in the south of the port. Trucks carrying dirty cargo - sulphur, phosphate, coke - enter through Gate No 2, which is situated at the north side of the port.

Since the construction of the railway takes a long time, the facility plan should consider the long-term cargo estimation. The cargo volumes carried by railway and the number of trains in the long-term are as follows:

Table 17.6.1 Railway Related Cargoes

Cargo Item	Volume (1000ton)	Railway Share%	Railway Volume	No of Train
Phosphate	4,100	100	4,100	2,929
Pellet	1,250	100	1,250	893
Clinker	1,000	80	800	571
Scrap	200	20	40	29
Bricks	150	20	30	21
Coke	200	100	200	143
Sulphur	500	100	500	357
Fertilizer(Exp.)	480	80	380	274

Number of trains are calculated using the maximum traction weight, 1400 tons/train. The average daily number of trains is 19. Considering monthly peak ratio and daily peak ratio, the maximum peak number is 35. Number of train for phosphate(19) is the largest among the cargoes.

The trains for phosphate, pellet, cement clinker, fertilizer and sulphur come to the port at least once a day. The length of loading/unloading yard for these cargoes is decided considering total length of each train. The length of the train to carry the maximum traction load, length and track of the loading/unloading yard are as follows:

	Length of Train	Length of Yard	No of Track
Phosphate:	415 m	450 m	3
Pellet:	400 m	450 m	2
Cement Clinker:	400 m	450 m	2
Sulphur:	450 m	500 m	2
Fertilizer:	400 m	450 m	2

Unloading yard used for scrap and other materials of steel factory is planned with the length of 250 m and two tracks. Loading yard for oil coke is planned with the length of 250m and two tracks. The length is sufficient for divided train.

Access railway approaches from the north between the existing road and the coast line. Since the branch line is used both for import and export cargoes, two tracks are recommendable.

17.7 Layout of the Main Facilities

(1) Required Scale for the Cargo

According to the cargo handling systems adopted for the new port, the necessary area for each type of cargo is as follows:

Phosphate : 50,000 m^2 (including silo, unloader, belt conveyers)
Pellet : 31,000 m^2 (including shed and office)
Clinker : 31,000 m^2 (including shed and office)
Scrap : 24,000 m^2 (including open yard and office building)
Clinker : 18,500 m^2 (including shed and office)
Fertilizer : 24,000 m^2 (including shed and office)
General(1) : 9,000 m^2 (cargo for steel factory)
General(2) : 18,000 m^2 (coke and others)
General(3) : 10,000 m^2 (bagged fertilizer)

In addition, area for land transportation(road, railway, parking), operation, utilities(electricity, sanitary, water supply) is necessary.

Since total reclamated area is over 150 ha, the area is sufficient for terminal, road, railway and other facilities.

Headquarter building is located in front of the port near the main gate. Maintenance shop is located in the middle of the small vessel yard and the headquarter building.

Waste oil receiving facility is planned behind the small vessel yard where oil collecting boat is berthing.

Layout of the facility is the same as that of the master plan.

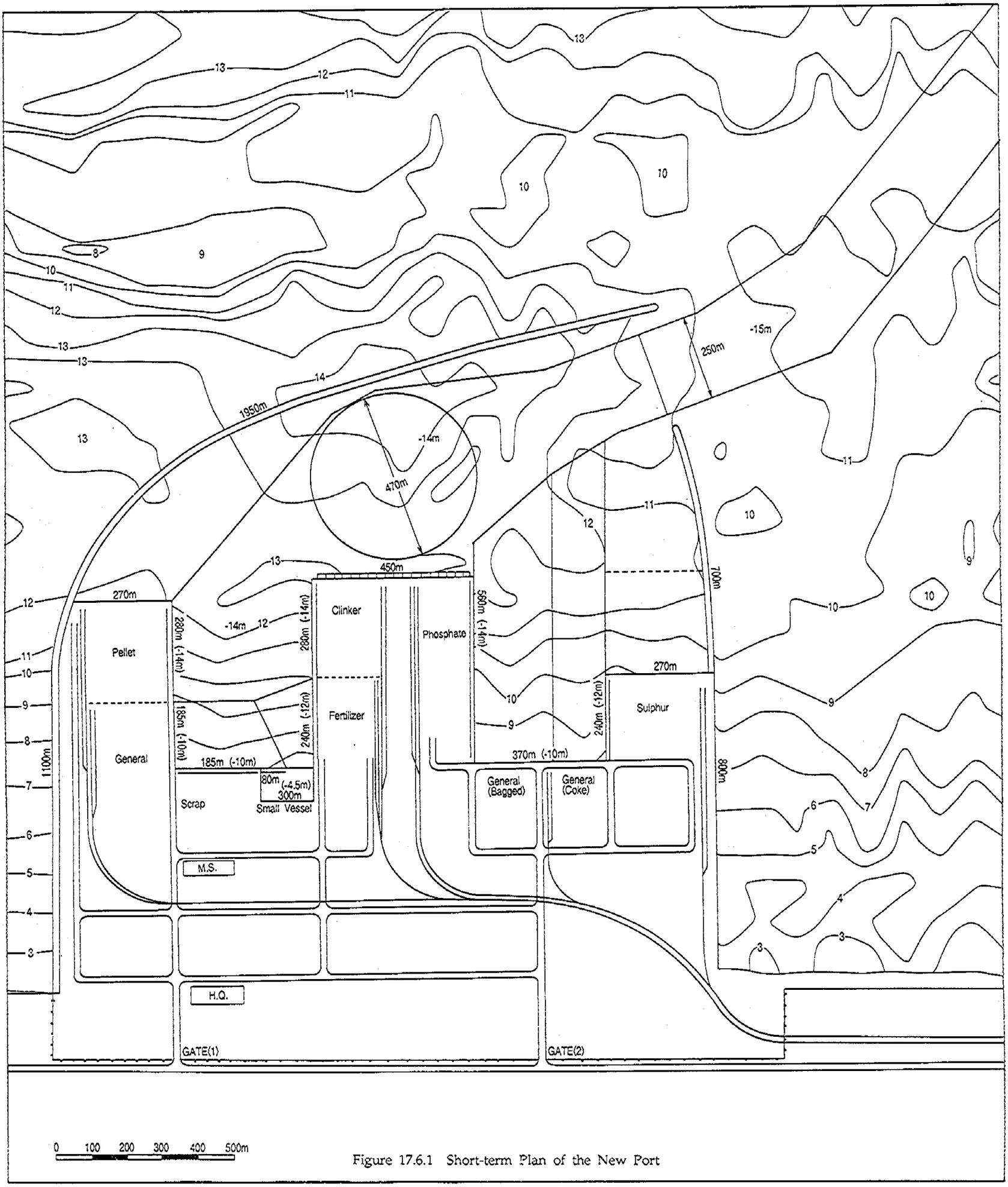


Figure 17.6.1 Short-term Plan of the New Port

17.8 Design of the Major Structure

The port facilities needed for the Master Plan of the new port are designed in the previous chapter. In this section, two alternatives of the breakwater are compared technically and economically.

(1) Breakwaters

The layout of the breakwaters and revetments is governed by the requirements of maximum protection of the water area of the new port. The overall length of the planned breakwaters will be around 2,650 m with maximum depth up to -13 m.
In this study, two alternatives of the breakwater, that is, rubble mound type and caisson type are proposed and investigated technically and economically. The existing breakwaters of Latakia and Tartous are of the rubble mound type with outer slopes armored by concrete blocks.
The rubble mound type needs the big amount of core stones (50-300 kg) and armor stones (1,000-3,200 kg) and these materials can be obtainable from the quarry at the hinterland of the new port. As core stones can be provided from the land side by end-on system ("forward" method), the rubble mound would be formed easily.
While, the caisson type breakwater is composed of the rubble mound and the caisson. Construction and setting of the caisson need the caisson yard and many kinds of working vessels,and the setting of the caisson should be done carefully at the right location on the sea. The construction method is complicated and the construction schedule should be controlled exactly. The caisson type is disadvantageous when its construction volume is not so large since ancillary works such as caisson yard cost much.
Nevertheless, sometimes the caisson type is cheaper than the rubble mound type depending on the site condition. Above all, in the case of deep water depth the caisson type tends to be cheaper due to the reduction of stone volume.

1) Determination of Cross Section

The breakwaters are designed by taking appropriate account of safety and broad economic implications.
In determining the cross sections of the breakwaters, the following premises are taken into consideration.

1. The crown height of the breakwater is determined to be about 0.6 times the design significant wave height above H.W.L. The maximum crown height is assumed to be +4.2 m. This crown height may allow overtopping to some extent, but this overtopping has little effect according to the experience.

2. In the rubble mound type, the gradients of the slopes are recommended to be 1:4/3 in the seaward side, and 1:1.5-2 in the harbor side. The gradients of the slopes of the rubble mound in the caisson type are designed to be 1:3 at the seaward side and 1:2 at the harbor side respectively considering the stability of the rubble mound.

3. In the rubble mound type, the crown width of the wave dissipating works using in situ concrete is determined to be equal to the equivalent width of two lanes of vehicle considering the construction method "forward method" and the maintenance after completion.

4. In the caisson type, breakwaters having the incident angle less than 15 degrees are designed with wave dissipating concrete blocks to prevent the increase of caisson weight.

5. An inspection platform shall be provided at the breakwater head for the turning of vehicles and mounting of navigational aids.

2) Weight of Armored Stones

The weight of concrete blocks covering the slope surface of the structure receiving the wave action is calculated using the following formula:

$$W = \frac{\gamma H3}{KD(Sr-1)3\cot\alpha} \quad *$$

where;

W :Minimum weight of rubbles or concrete blocks (tons)
γ :Unit weight of rubble or block in air (t/m3), 2.65
Sr :Specific gravity of rubble or block to sea water, 2.65/1.03
α :Angle of the slope to horizontal plane (degrees), 37
H :Significant wave height H1/3 at the water depth where the structure is constructed (m)
K_D :Constant determined by the armoring material and damage rate, 4

* :Hudson, R.Y, "Laboratory Investigation of Rubble-Mound Breakwater", proc. ASCE, Vol.85.

The weight of concrete blocks are calculated to be 2.5-29 tons depending on the sea depths.

3) Dimensions of Breakwater

The main dimensions of breakwater are summarized in the Table 17.8-1.
The standard cross sections of the breakwaters are shown in Fig.17.8-1,-9.

Table 17.8-1 Main Dimensions of Breakwater

Depth (m)	H1/3 (m)	Crown Height (m)	Weight of Armored Block (tons) Gradient of Slope 1:4/3
-15	6.1	+4.2	29
-12	5.8	+4.0	25
-10	5.4	+3.9	20
-8	4.7	+3.3*	13
-6	3.9	+2.8	8
-4	2.7	+2.1	2.5
-2	1.7	+1.5	0.6

Note: In the case of caisson type, crown height is decided to be +3.5m in order to keep the min. in situ concrete thickness.

4) Safety Factors of Caisson Type Breakwaters

The caisson of a breakwater must be designed to be safe against sliding and overturning. At the same time, the bearing capacity of the rubble mound foundation and the seabed should be examined to ascertain that they remain below the allowable limit. The safety factors against sliding and overturning of caisson under wave action are defined by the following:

Against sliding: $$S.F._1 = \frac{\mu(W-U)}{P}$$

Against overturning: $$S.F._2 = \frac{Wt - Mu}{M_P}$$

where;

W :Weight of caisson per unit extension in still water (tons)
U :Total uplift pressure (tons)
P :Total wave pressure (tons)
μ :Coefficient of friction between the caisson and the rubble mound
t :Horizontal distance between the center of gravity and the heel of the caisson (m)
Mu :Moment of uplift pressure (ton-m)
MP :Moment of wave pressure (ton-m)

According to the standard cross sections shown in Fig.17.8-6,-9, the safety factors for sliding (S.F.1), the safety factors for overturning (S.F.2) and the largest bearing pressures at the heel (p_e) result in the Table 17.8-2.
Usually, the coefficient of friction μ is assumed to be 0.6, and the breakwaters are to be designed with the safety factors over 1.2.
Therefore, above caissons have sufficient stability against sliding and overturning.
The bearing capacity of the rubble mound can be examined by comparing the allowable bearing capacity (q_{ta}) with the largest bearing pressure (p_e) caused by the resultant of dead weight and wave forces which is usually eccentric and inclined.
The allowable bearing limit of the rubble mound (q_{ta}) is to be kept below the value of 40 to 50 t/m2 based on the experience. As for the largest bearing pressure (p_e), it is assumed that a trapezoidal or triangular distribution of bearing pressure exists beneath the bottom of the caisson, and the largest bearing pressure at the heel is calculated as

$$p_e = \frac{2W_e}{3t_e} \qquad : t_e \le \frac{1}{3}B$$

or, $$p_e = \frac{2W_e}{B}\left(2 - 3\frac{t_e}{B}\right) \qquad : t_e > \frac{1}{3}B$$

where;

$$t_e = \frac{M_e}{W_e}, \quad M_e = Wt - Mu - M_P, \quad W_e = W - U$$

The largest bearing pressures shown in Table 17.8-2 are far less than the allowable bearing limit, and above cases are enough safe concerning the bearing capacity of the rubble mound.

Table 17.8-2 Safety Factors of Caisson Type Breakwaters

Depth (m)	Wave Dissipating Concrete Blocks	Max.Reaction (t/m2)	S.F.1 for Sliding	S.F.2 for Overturning
-15	w/	24.6	1.49	2.70
-12	w/	23.0	1.63	3.06
-10	w/o	17.3	1.95	4.47
-8	w/o	15.3	2.35	5.68

5) Comparison of Construction Costs of Breakwaters

Construction costs of breakwaters are compared by structural type as shown in Table 17.8-3.

Table 17.8-3 Comparison of Construction Costs of Breakwaters

Depth (m)	Rubble Mound Type	Caisson Type	
		w/o Concrete Blocks	w/ Concrete Blocks
-15	200	190	240
-12	150	140	190
-10	120	120	-
-8	100	100	-

6) Conclusion

Though the both structural types are feasible technically, the rubble mound type is chosen due to its easy construction.

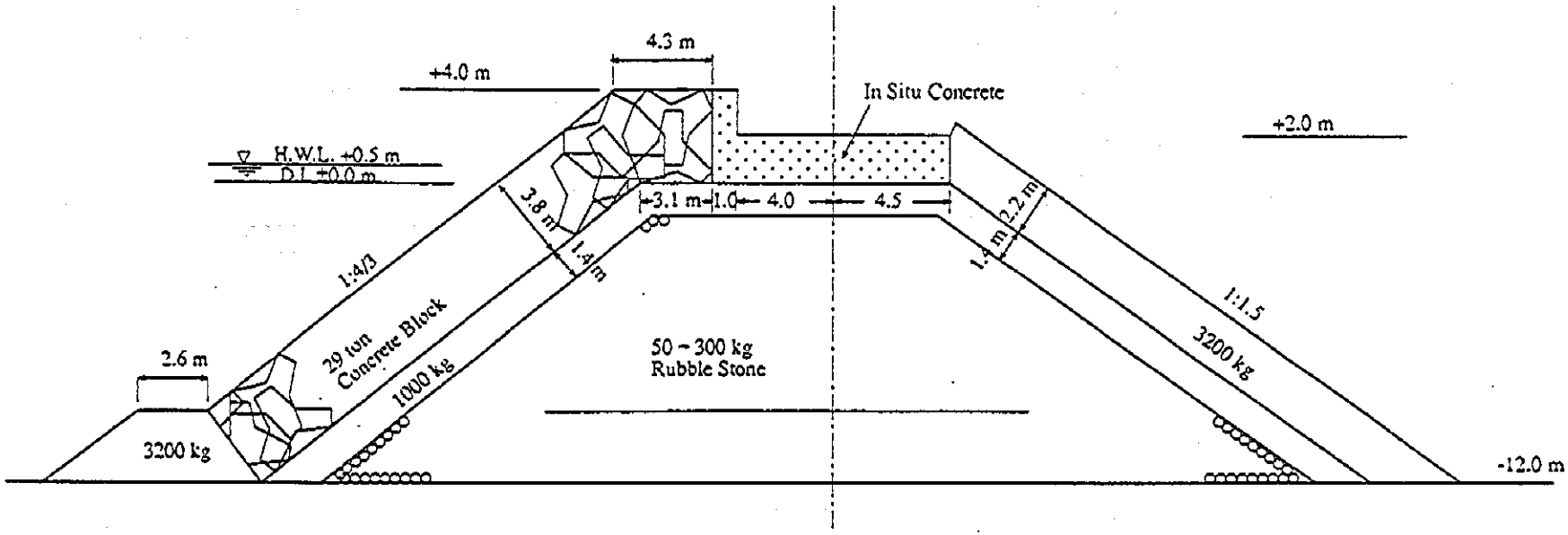


Fig. 17.8-1 Standard Cross Section of Breakwater (-12.0m)

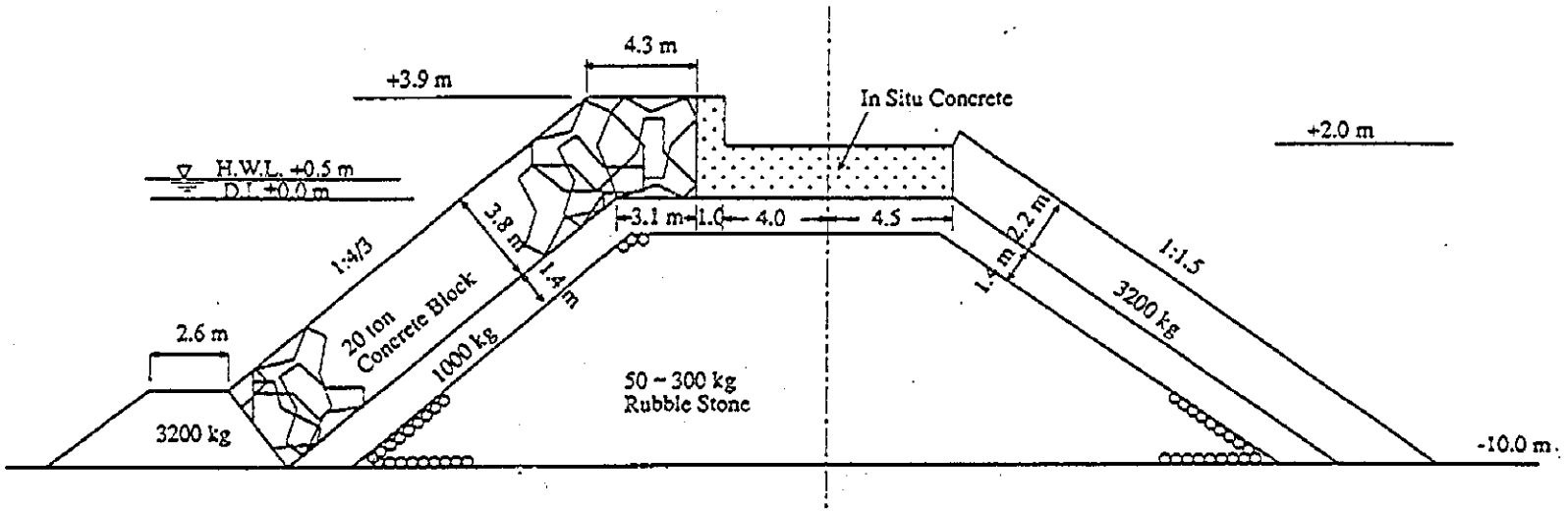


Fig. 17.8-2 Standard Cross Section of Breakwater (-10.0m)

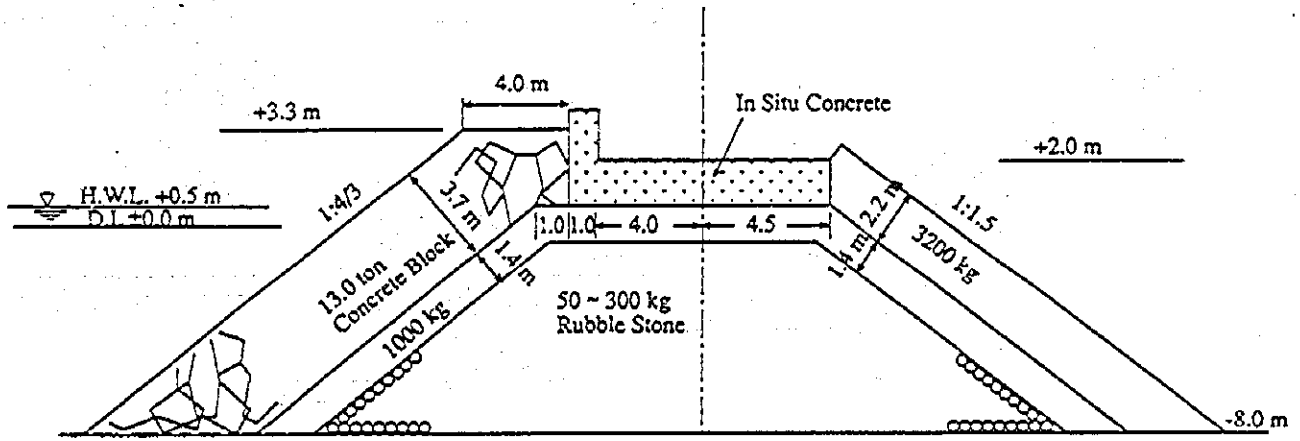


Fig. 17.8-3 Standard Cross Section of Breakwater (-8.0m)

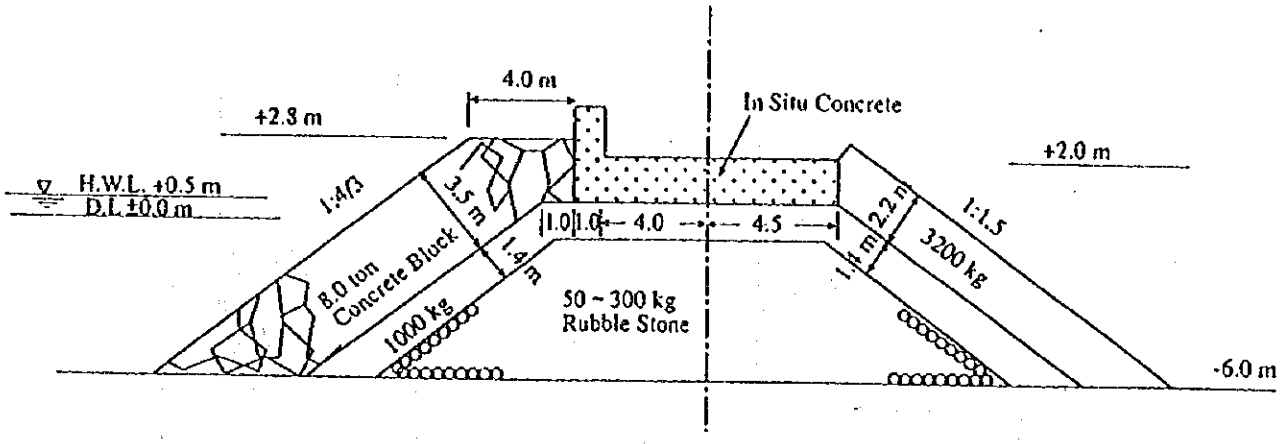


Fig. 17.8-4 Standard Cross Section of Breakwater (-6.0m)

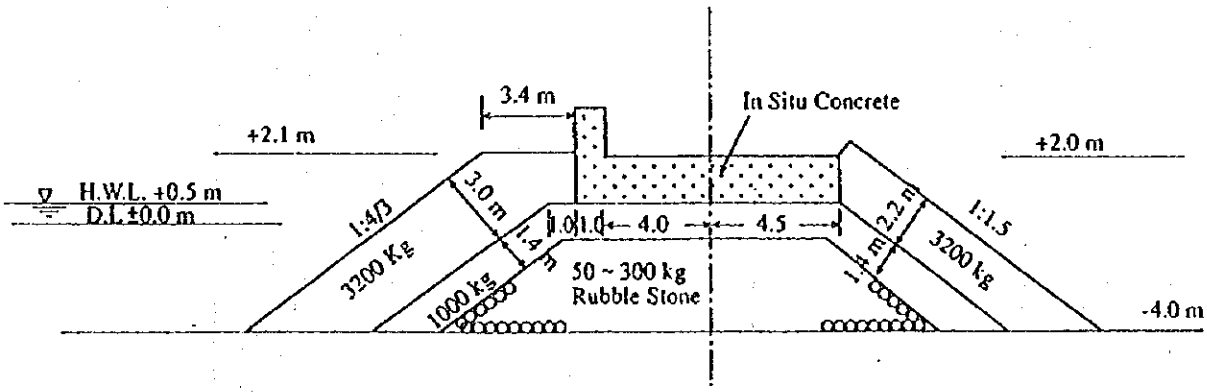


Fig. 17.8-5 Standard Cross Section of Breakwater (-4.0m)

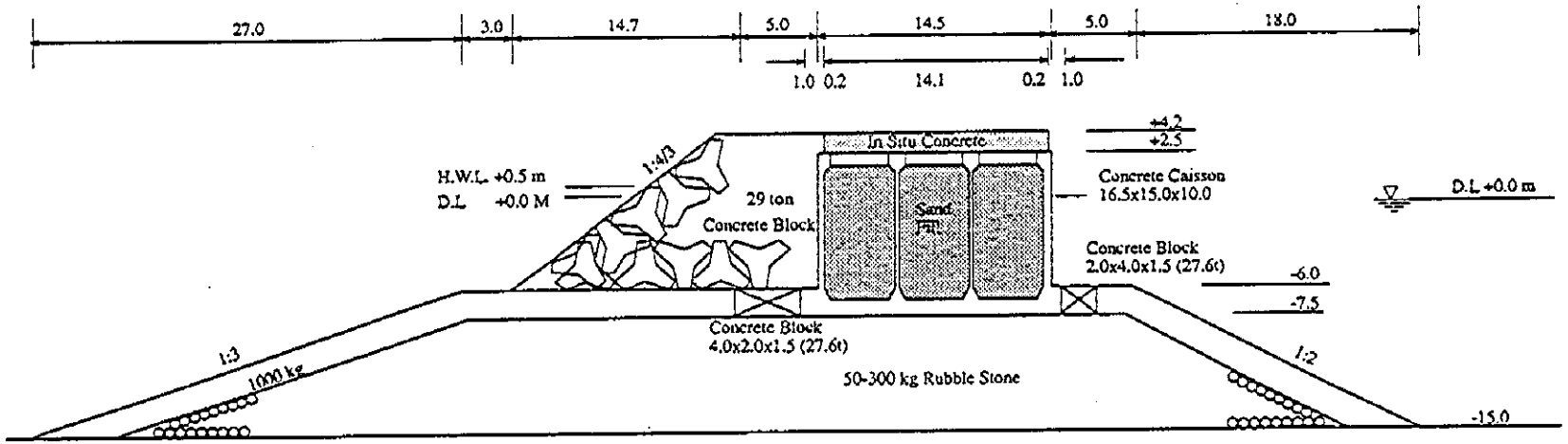


Fig. 17.8-6 Standard Cross Section of Breakwater Caisson Type (-15.0m)

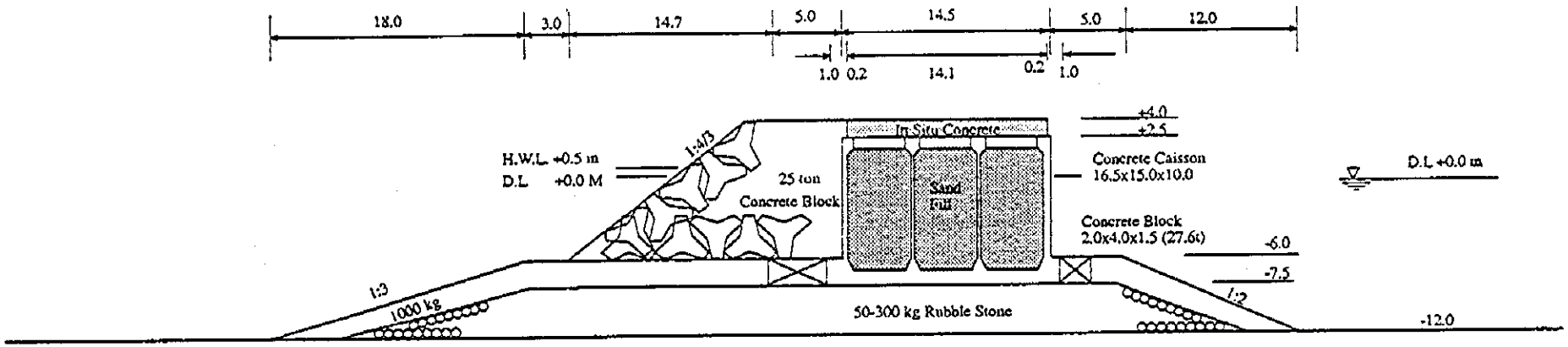


Fig. 17.8-7 Standard Cross Section of Breakwater Caisson Type (-12.0m)

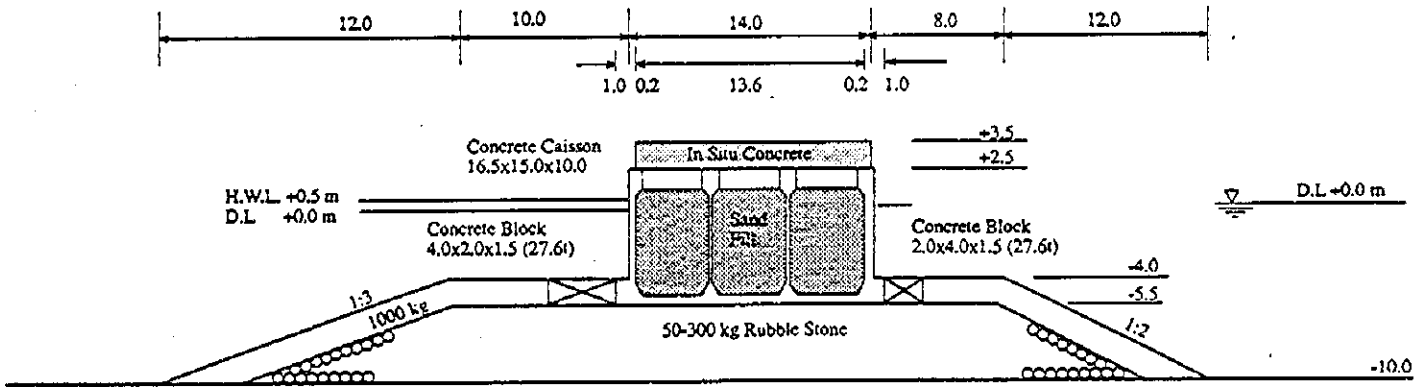


Fig. 17.8-8 Standard Cross Section of Breakwater Caisson Type (-10.0m)

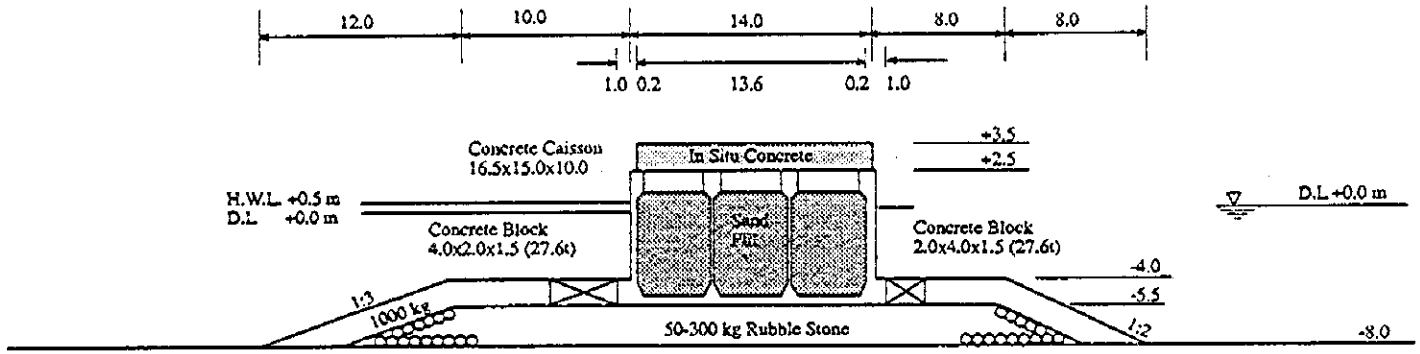


Fig. 17.8-9 Standard Cross Section of Breakwater Caisson Type (-8.0m)

17.9 Design of Cargo Handling Equipment

17.9.1 Phosphate Terminal

(1) Design conditions and outline of the terminal

Design conditions and outline of the terminal are shown on 13.2.1 Phosphate Terminal.
The general arrangement is shown on Fig 17-3-1.
In due consideration of enlargement for the silo capacity in future, the silo bins are not arranged symmetry.

(2) Handling equipment

1) Loader

Capacity and number	400 t/h x 4 units
Outreach(from seaside rail center to loading chute center)	Max. 28 m
	Min. 12 m
Span(gauge of span)	10 m
Loading chute with telescopic dustless	Each 1unit
Traveling distance	200 m

2) Silo

Capacity	Total 169,000
Type	Reinforced concrete
Number of silo bin	48 bins
Silo bin diameter(inner)	11 m

3) Receiving equipment from wagon and truck

a. Receiving underground conveyor	400 t/h x 4 lines
b. Number of receiving rail line	2 lines
c. Number of receiving truck lane	2 lanes

4) Conveyor

a. Take in conveyor	400 t/h x 4 lines
b. Take out conveyor	400 t/h x 8 lines
c. Loading conveyor from machinery tower to berth conveyor	400 t/h x 4 lines
d. Berth conveyor each berth	400 t/h x 2 lines

5) Others

a. Recycle line	400 t/h 1 line
b. Dust control equipment (cover for belt conveyor etc)	1 set
c. Dust collection equipment (Bag filter type)	1 set
d. Weighing equipment	1 set
e. Others	1 set

17.9.2 Cement clinker

(1) Design condition

1)	Cargo volume	Export 1,100,000 t/y			
2)	Max. ship	65,000 DWT			
3)	Character of cargo	Specific gravity	1.3(1.2-1.52)	Angle of repose	30-40
4)	Storage system	Shed			
5)	Minimum required storage capacity			87,000 t	
6)	Receiving	Wagon and Truck			

(2) Handling equipment

The general arrangement of the cement clinker is shown in Fig 17-3-2

1)	Loaders	
	Capacity and number	350 t/h x 2 units
	Outreach(from seaside rail center to loading chute center)	Max. 28m Min.12m
	Span(gauge of span)	10m
	Loading chute with telescopic dustless	Each 1 unit
	Travelling distance	180m
2)	Shed	
	Capacity	Total 100,000 t
	Size	50m x 230m x 2
3)	Receiving equipment from wagon and truck	
	a. Receiving underground conveyor	350 t/h x 2 lines
	b. Number of receiving rail line	1 line
	c. Number of receiving truck lane	2 lanes
4)	Conveyor	
	a. Receiving and direct loading conveyor	350 t/h x 2 lines
	b. Storage overhead conveyors	350 t/h x 4 lines
	c. Discharge under ground conveyor	350 t/h x 2 lines
5)	Minor handling equipment	
	a. Bulldozer	4 units
	b. Shovel loader	1 unit
6)	Others	
	a. Wagon and truck scale	
	b. Dust collection equipment	
	c. Others	

17.9.3 Pellet Terminal

(1) Design condition

1)	Cargo volume	Import 1,250,000 t/y
2)	Max ship	65,000 DWT
3)	Character of cargo	Specific gravity 2.3 Angle of repose 30-44 Pellet size Max 26 m/m Mean 20m/m
4)	Storage system	Open yard
5)	Minimum required yard storage capacity	135,000 t
6)	Discharge system	Wagon and truck

Remarks: Basic plan is shown in APPENDIX-5 Preliminary design of cargo handling equipment.

(2) Handling equipment

The general arrangement of the pellet terminal is shown on Fig 17-3-3

1) Unloaders

Capacity and number	500 t/h x 2 units
Type	Level luffing crane with double lever jib
Outreach (from seaside rail center)	29 m
Max. Slewing radius	41 m
Rail gauge	18 m
Traveling distance	180 m

2) Stacker cum reclaimers

Capacity and number	500 t/h x 3 units
Revolving radius x angle	for stacking 24m x (95 x 2) for reclaiming 32m x (150 x 2)
Rail gauge	5 m
Travelling distance	250 m

3) Belt conveyors

Capacity and number	500 t/h x 7 sets

4) Wagon and truck loading equipment

a. Wagon loading	800 t/h(400+400) 1 line
b. Truck loading	200 t/h 2 lanes

5) Minor handling equipment

a. Bulldozer	2 units
b. Shovel loader	2 units

6) Others

a. Wagon scale and truck scale

b. Dust collection equipment
c. Drainage treatment facility
d. Others

17.9.4 Scrap Terminal

(1) Design condition

1)	Cargo volume	250,000 t/y
2)	Max. ship	10,000 DWT
3)	Character of cargo	Specific gravity (assumed) 0.5
4)	Minimum required yard storage capacity	17,600 t

(2) Handling equipment

Basic plan is shown in APPENDIX-5 Preliminary design of cargo handling equipment. The general arrangement is shown on Fig 17-3-4

1)	Double link type Level luffing cranes	
	Hoisting capacity and number	11 t x 3 units
	Jib maximum radius	24m
	Jib minimum radius	12m
	Lift above rail	20m
	Travelling distance	90m
2)	Mobile crane	
	Capacity and number	65 t x 7 units
3)	Tractors	3 units
4)	Trailer	7 units

17.9.5 Sulphur Terminal

(1) Design condition

1)	Cargo volume		Export 500,000 t/y
2)	Max.ship size		40,000 DWT
3)	Character of cargo	Specific gravity	1.95-2.07
		Melting point	120 C
		Flashing point	200 C
		Ignition point	230 C
	A sulphur is highly inflammable cargo		
4)	Storage system		Shed
5)	Minimum require storage capacity		45,000 t

(2) Handling equipment

Basic plan is shown on APPENDIX-5 Preliminary design of cargo handling equipment. The general arrangement is shown on Fig 17-3-5
All handling equipment shall be anti-explosion type and dust control shall be done.

1)	Movable ship loader	
	Capacity and number	150 t/h x 3 units
2)	Wagon unloading line	1 line
3)	Conveyor	
	a. Receiving conveyor	150 t/h x 2 lines
	b. Storage overhead conveyors	150 t/h x 3 lines
4)	Minor handling equipment	
	a. Shovel loader 1.5 cu m	7 units
	b. Truck 10 t	9 units

(2) Shed

In due consideration of the fact that a sulphur is inflammable cargo,many small shed are prepared to keep large air ventilation in the shed which is to be handled. Furthermore, air ventilator which has enough capacity shall be installed in all shed.
Size and number 30 m x 70 m x 9

17.9.6 Oil cokes

(1) Design condition

1)	Cargo volume	Export 200,000 t
2)	Ship size	Max 15,000 DWT
3)	Minimum required yard	20,000 sq m

(2) Handling equipment

1)	Movable ship loaders	150 t/h x 3 units
2)	Shovel loaders	1.5 cu m 3 units
3)	Trucks	10 t 9 units

17.9.7 Fertilizer Terminal

Basic plan is shown on APPENDIX-5 Preliminary design of cargo handling equipment

(1) Design condition

1) Cargo volume Export in 2003 510,000 t/y in 2010 480,000 t/y

	Import in 2003	170,000 t/y	in 2010 210,000 t/y
2) Assumed type of packing	for export cargo	bulk	
	Imported cargo	bagged	
3) Ship size	50,000DWT		

4) Specific gravity of bulk

Caustic soda 1.4, Urea pills 0.7, Phosphate rock(pulverized) 0.96 assumed specific gravity of bulk fertilizer 0.8

5) Minimum required shed capacity 50,000 t

6) Others

Bulk fertilizer shall be handled at fertilizer terminal and bagged fertilizer shall be handled at the public berths. The general arrangement of the fertilizer terminal is shown on Fig 17-3-6

(2) Handling equipment

1) At fertilizer terminal

a. Wagon and truck receiving equipment	
b. Receiving conveyors	120 t/h x 2 lines
c. Storage overhead conveyors	120 t/h x 3 lines
d. Movable ship loaders	150 t/h x 3 units
e. Shed	40m x 230m x 2 and 40m x 200m
g. Minor handling equipment	
Shovel loader	1.5 cu m 3 units
Trucks	10 t 9 units

2) At general cargo berth

Mobile cranes	45 t 4 units
Forklift trucks	5 t 6 units

Remarks: All tire-mounted minor handling equipment at the scrap berth, sulphur terminal, oil cokes berth and fertilizer terminal will be used in common with another berth. Then the net procured number of equipment shall be decided on the cargo volume of each cargo.

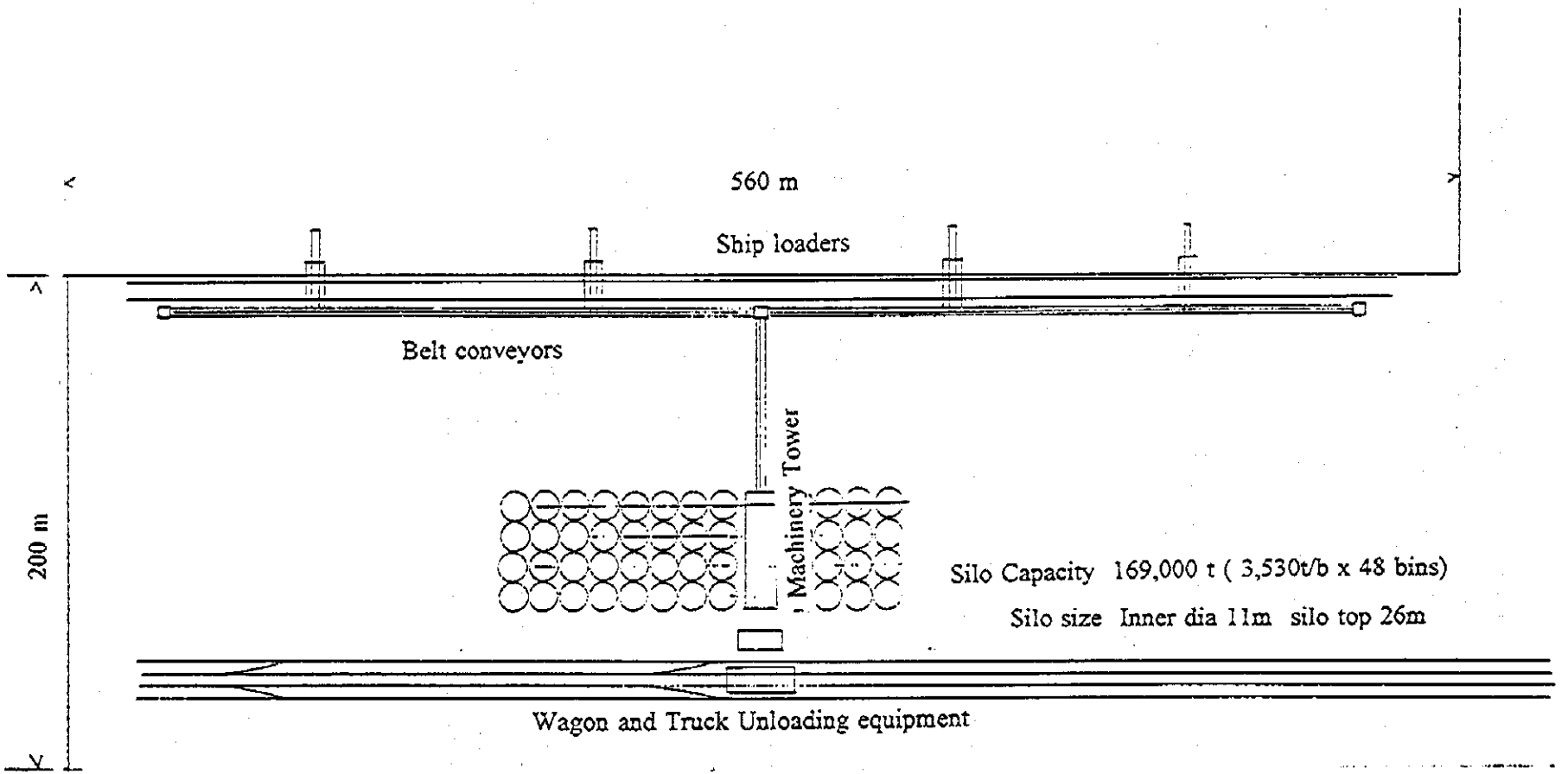
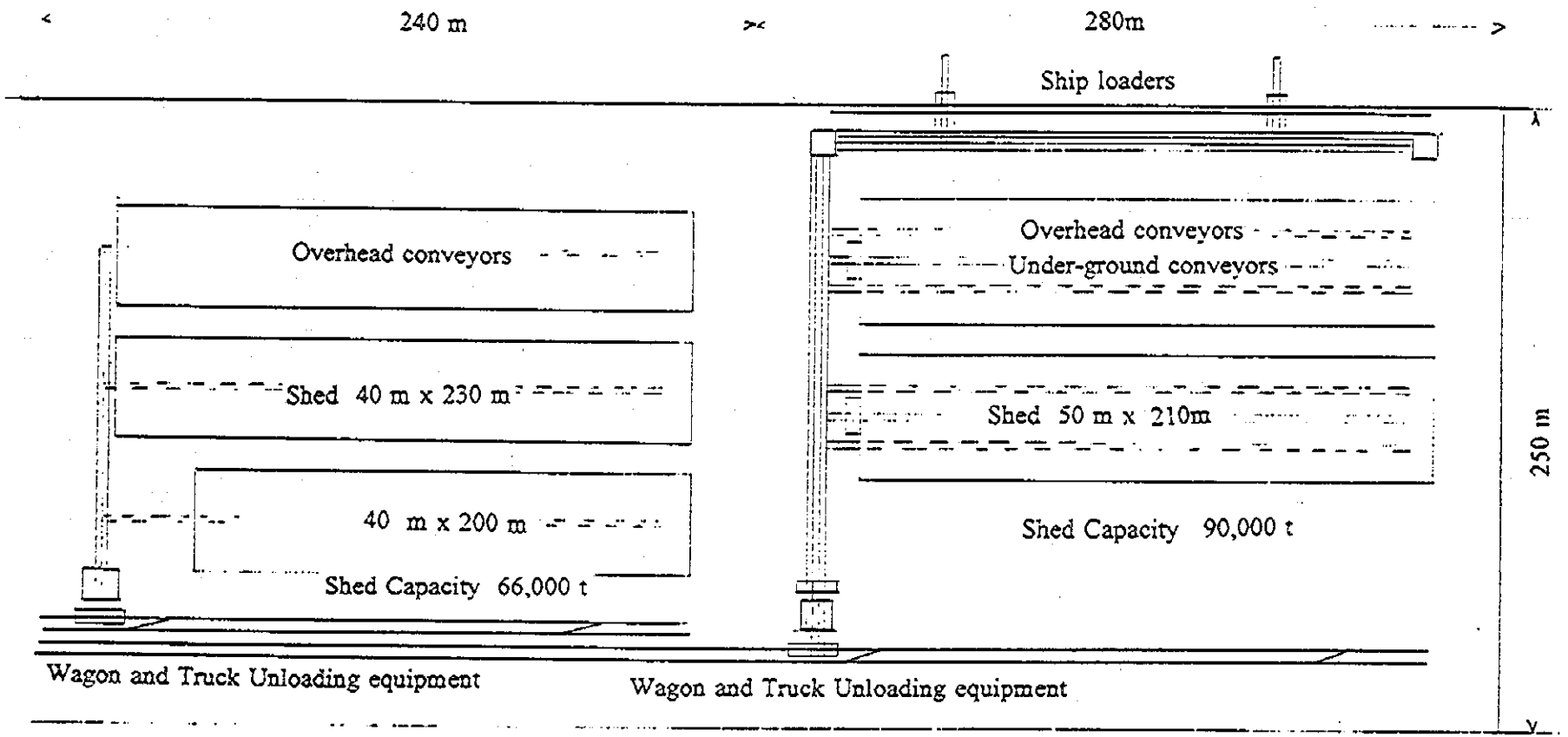


Figure 17.3.1 Phosphate Berth



Scale 1/2500

Figure 17.3.6 Fertilizer Berth

Figure 17.3.2 Cement Clinker Berth

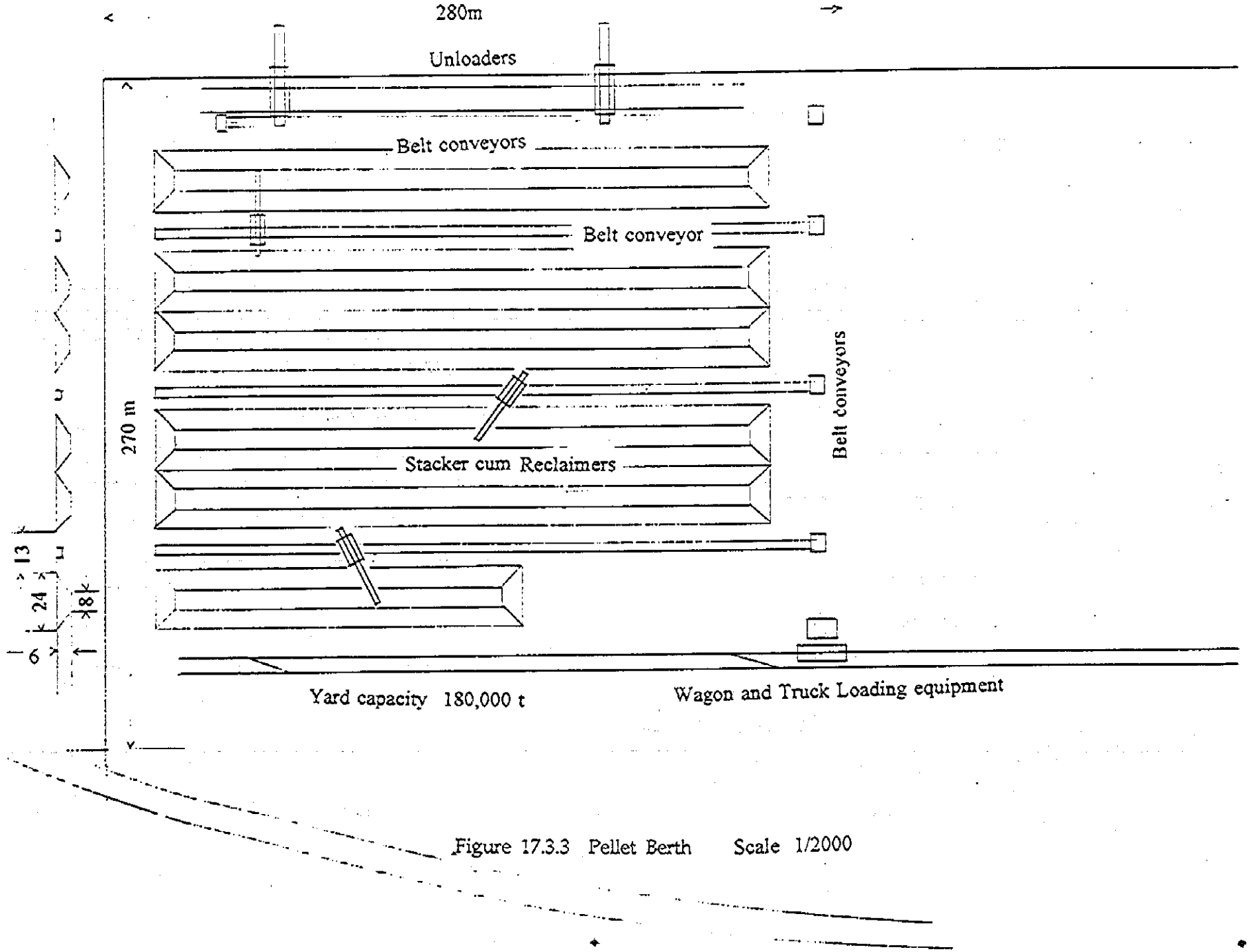


Figure 17.3.3 Pellet Berth Scale 1/2000

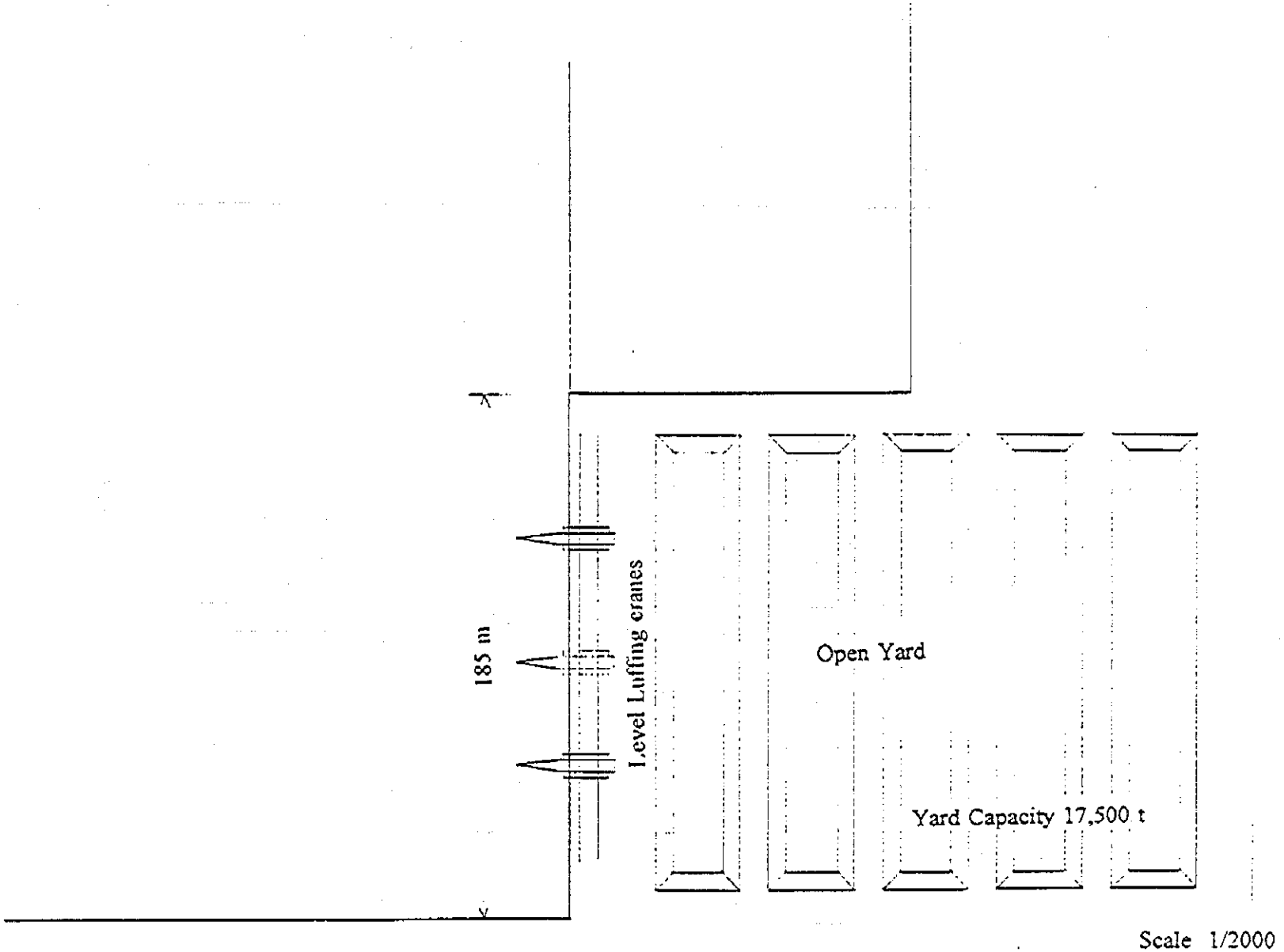


Figure 17.3.4 Scrap Berth

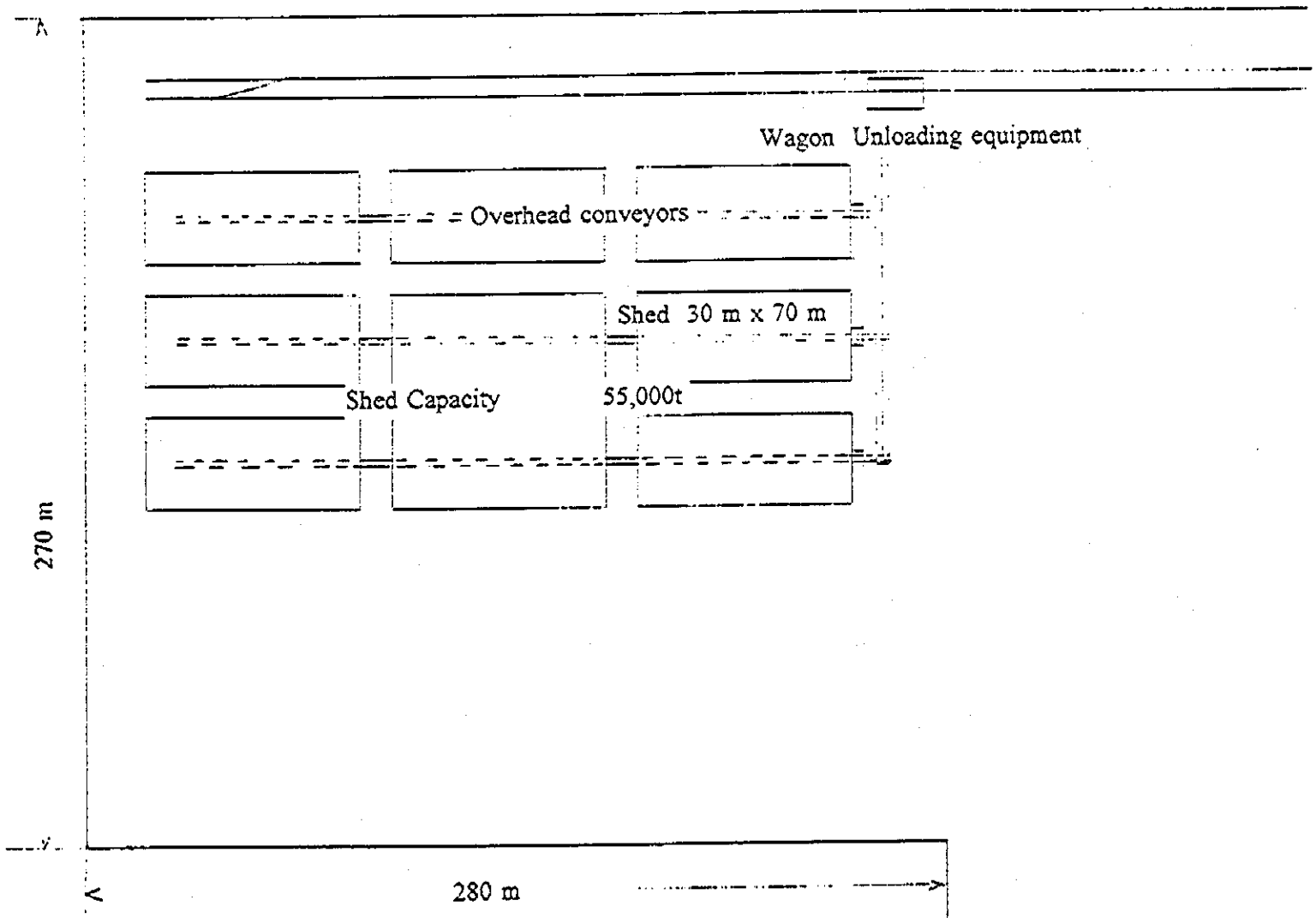


Figure 17.3.5 Sulphur Berth

Scale 1/2000

17.10 Implementation Program

The construction quantities for main facilities in the new port area are shown in Table 17.10-1.

Implementation schedule is largely restricted by the dredging and reclamation. Planned dredging areas consist of upper sand layer and lower rock layer. Rock dredging of around 2,111,000 m^3 and sand dredging of around 2,192,000 m^3 are planned.

Reclamation volume reaches up to 12,748,000 m^3. Although dredged materials are used for the reclamation, reclamation materials of around 8,445,000 m^3 are necessary furthermore. These materials are planned to be supplied from the neighboring water areas by using the pump cutter dredgers.

After the completion of the detailed design in 1998, the construction of the port facilities is to start in 1999 and be completed by the end of 2003.

The construction schedule is shown in Fig. 17.10-1.

Table 17.10-1 Construction Quantities

Facilities	Unit	Quantities
Breakwater:	m	2,730
Main Breakwater	m	1,950
Sub-Breakwater	m	780
Dredging:	m^3	4,302,950
Rock	m^3	2,111,105
Sand	m^3	2,191,845
Reclamation	m^3	12,748,000
Wharf:	m	2,640
-14m	m	1,120
-12m	m	480
-10m	m	740
-4.5m	m	300
Revetment	m	2,090
Pavement	m^2	2,153,050
Railway	m	12,550
Road	m	4,100
Utilities	L.S.	1

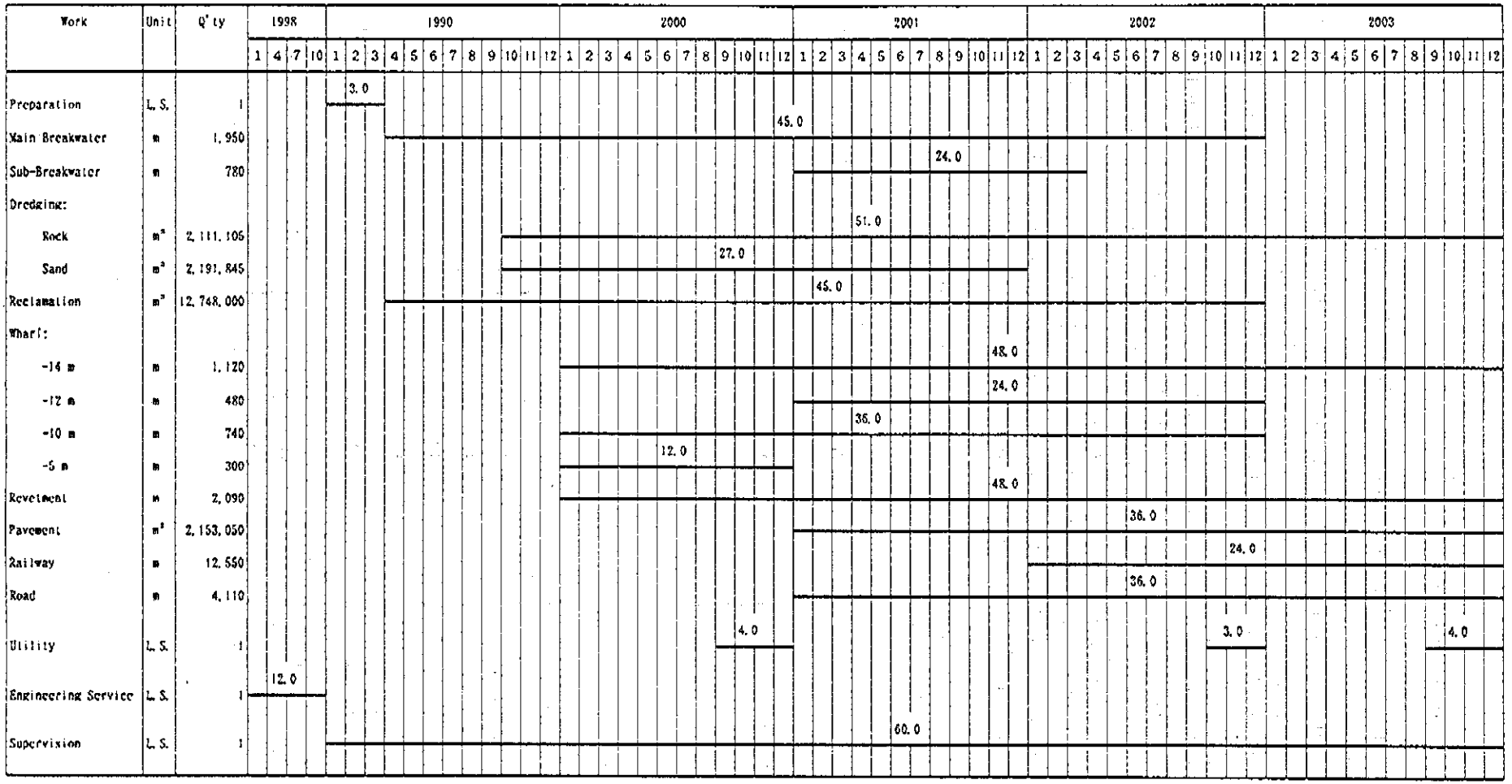


Figure 17.10-1 Construction Schedule for New Port

17.11 Cost Estimate

17.11.1 Scheme of Short-Term Plan

The scheme of Short-Term Plan is mentioned in Chapter 17.7, and all facilities should be constructed within Short-Term Period.

17.11.2 Unit Price of Main Facilities

The cost estimate is carried out, and the unit price of main facilities are shown as below:

Table 17.11.2-1 Unit Price of Main Facilities

Facilities		Unit	Unit Price		
			F.C	L.C	Total
Dredging (-14m) (Rock)		S.P/m^3	1,000	0	1,000
Wharf					
	Pellet (-14m)	S.P/m	350,000	898,000	1,248,000
	Fertilizer (-12m)	S.P/m	380,000	800,000	1,100,000
	General Cargo (-10m)	S.P/m	170,000	690,000	860,000
Loader					
	Phosphate (400t/h)	1,000 S.P/unit	54,600	0	54,600
	Pellet (500t/h)	1,000 S.P/unit	210,000	0	210,000
	Scrap (11t)	1,000 S.P/unit	117,600	0	117,600
Silo	Phosphate (Concrete)	1,000 S.P/Unit	0	420,000	420,000

17.11.3 Total Cost

The total cost of Short-Term Plan is estimated at around 19,595 Millions S.P, and is tabulated in Table 17.11.3-1.

The detail cost of the cargo handling equipment is shown in Table 17.11.3-2.

Table 17.11.3-1 Total Cost of New Port

NEW PORT

No.	Facilities	Unit	Q'ty	Unit Cost (S.P)			Cost (Unit: 1,000 S.P)		
				F.C	L.C	Total	F.C	L.C	Total
A	Civil Works				19,345,112				
1	Breakwater								
	Main Breakwater	m	1,950	0	1,225,000	1,225,000	0	2,388,750	2,388,750
	Sub Breakwater	m	700	0	980,000	980,000	0	686,000	686,000
	Breakwater (Small Vessel)	m	80	130,000	510,000	640,000	10,400	40,800	51,200
	Sub-Total						10,400	3,115,550	3,125,950
2	Dredging								
	(Rock)	m^3	2,111,105	1,000	0	1,000	2,111,105	0	2,111,105
	(Sand)	m^3	2,191,845	350	0	350	767,146	0	767,146
	Sub-Total						2,878,251	0	2,878,251
3	Reclamation								
	(Reclamation)	m^3	7,870,000	0	300	300	0	2,361,000	2,361,000
	(Add. Recla)	m^3	575,000	0	250	250	0	143,750	143,750
	Sub-Total							2,504,750	2,504,750
4	Wharf								
	Pellet(-14m)	m	280	350,000	898,000	1,248,000	98,000	251,440	349,440
	General Berth(-10m)	m	185	170,000	690,000	868,000	31,450	127,650	159,100
	Scrap(-10m)	m	185	170,000	690,000	868,000	31,450	127,650	159,100
	Clinker(-14m)	m	280	350,000	898,000	1,248,000	98,000	251,440	349,440
	Fertilizer(-12m)	m	240	380,000	800,000	1,180,000	91,200	192,000	283,200
	Phosphate(-14m)	m	560	350,000	898,000	1,248,000	196,000	502,888	698,888
	General/Coke(-10m)	m	370	170,000	690,000	860,000	62,900	255,300	318,200
	Sulphur(-12m)	m	240	380,000	800,000	1,180,000	91,200	192,000	283,200
	Small Vessel(-4.5m)	m	300	136,000	474,000	610,000	40,800	142,200	183,000
	Sub-Total						741,008	2,042,560	2,783,560
5	Revetment								
	(1)	m	650	0	800,000	800,000	0	520,000	520,000
	(2)	m	270	0	200,000	200,000	0	54,000	54,000
	(3)	m	450	350,000	898,000	1,248,000	157,500	404,100	561,6000
	(4)	m	270	0	160,000	160,000	0	43,200	43,2000
	(5)	m	450	0	128,000	128,000	0	57,600	57,6000
	Total of Revetment						157,500	1,078,900	1,236,4000
6	Apron/Yard/Open Space								
	(Pavement)	m^2	1,343,050	0	750	750	0	1,007,287	1,007,287
	(Add. Pave)	m^2	810,000	0	750	750	0	687,500	607,500
	Sub-Total						0	1,614,788	1,614,788
7	Railway	m	12,550	0	1,664	1,664	0	20,883	20,883
8	Road	m	4,100	0	1,200	1,200	0	4,920	4,920
9	Mobilization	LS	1	5,000,000	0	5,000,000	5,000	0	5,000
	Total of Civil Works						3,542,251	10,382,351	13,924,601
B	Building								
1	Storage	m^2	66,300	0	10,000	10,000	0	663,000	663,000
2	Phosphate Silo (Concrete)	LS	1	0	420,000,000	420,000,000	0	420,000	420,000
3	Machinery Tower	LS	1	0	115,500,000	115,500,000	0	115,500	1115,5000
	Total of Build						0	1,198,500	1,198,500
C	Utilities	LS	1				0	272,011	272,011
D	Cargo handling Equipment								
	Total of H.E	LS	1				3,200,000	0	3,200,000
E	Port Service Facilities	LS	1				130,000	20,000	150,000
F	Physical Conti/Engineering	LS	1				360,000	240,000	600,000
G	Grand Total						7,482,151	12,112,861	19,595,012

Table 17.11.3-2 Cargo Handling Equipment
New Port

Unit:1,000SP

Items	Capacity	Unit Price	Short Term Plan	
			Q'ty	Cost
1. Phosphate Terminal(Exclude Silo & M.T)				961,800
1-1 Loaders	400t/h	54,600	4	218,400
1-2 Handling Equipment		743,400	1	743,400
2. Cement Clinker Terminal				343,980
2-1 Loaders	350t/h	50,400	2	100,800
2-2 Handling Eqipment		240,912	1	240,912
2-3 Minor Handling Equipment		2,268	1	2,268
3. Pellet Terminal				817,366
3-1 Unloaders	500t/h	210,000	2	420,000
3-2 Stacker/reclaimer	500t/h	92,400	3	277,200
3-3 Handling Eqipment		118,108	1	118,108
3-4 Minor Handling Eqipment		2,058	1	2,058
4. Scrap				573,300
4-1 D.L level luffing Cranes	11t	117,600	3	352,800
4-2 Mobil Cranes	65t	31,500	7	220,500
5. Sulphur Terminal				84,000
5-1 Handling Eqipment		84,000	1	84,000
6. Oil Cokes				
All equipment are included in common equipment				
7. Fertilizer Terminal				63,000
7-1 Handling Equipment		63,000	1	63,000
8. Common Equipment				356,580
8-1 Movable Ship Loader	150t/h	18,900	7	132,300
8-2 Trucks		2,100	20	42,000
8-3 Shovel Loaders		3,780	14	52,920
8-4 Mobile Cranes	45t	23,100	4	92,400
8-5 Forklift Trucks	5t	2,100	6	12,600
8-6 Tractors		4,200	3	12,600
8-7 Trailers		1680	7	11,760
Total				3,200,000

17.11.4 Yearly Investment

The yearly investment based on the implementation program in Chapter 17.10 is shown Table 17.11.4-1.

Table 17.11.4-1 Yearly Investment Schedule

(Unit:1,000 S.P.)

Items	1998		1999		2000		2001		2002		2003		Total	
	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C
Civil Works			758,430	2,076,000	758,430	2,076,000	758,430	2,076,000	758,430	2,076,000	758,430	2,078,351	3,792,150	10,382,351
Buildings								399,500		399,500		399,500	0	1,198,500
Utilities										136,000		136,011	0	272,011
Port Service Facilities											130,000	20,000	130,000	20,000
Cargo Handling Equipment							494,600		1,000,900		1,704,500		3,200,000	0
Physical Contingency and Engineering Fee	60,000		60,000	48,000	60,000	48,000	60,000	48,000	60,000	48,000	60,000	48,000	360,000	240,000
Grand Total	60,000	0	818,430	2,124,000	818,430	2,124,000	1,313,030	2,523,500	1,819,330	2,659,500	2,652,930	2,681,862	7,482,150	12,112,862
Investment	60,000		2,942,430		2,942,430		3,836,530		4,478,830		5,334,792		19,595,012	

17.12 Economic Analysis

17.12.1 Methodology

The method of analysis is the same as that of Latakia Port mentioned in Chapter 15.13.1.

17.12.2 Prerequisites of Analysis

In order to estimate the costs and benefits, the following requisites are assumed for the analysis.

(1) Base Year

1995 is set as the "Base Year" for this study.

(2) Project Life

Taking into consideration the depreciation period of the main facilities of 30 years and the construction period of 5 years, the period of calculation (project life) in the economic analysis is assumed to be 35 years from the beginning of construction.

(3) Foreign Exchange Rate

The exchange rate adopted for this analysis is US$ 1.00 = 42 S.P., the same rate as used in the cost estimation.

(4) "With"case

The "With"case scenario includes all expansions of port facilities for the short-term plan.

(5) "Without"case

If the new port is not constructed, it is the most reasonable to assume that the cargoes which are planned to be handled in the New Port would have to be handled in Tartous Port because most those cargoes are handled there now. Therefore, in the "Without" case, the handling cargoes of Tartous Port combined with the cargoes handled in New Port are set as objects of economic analysis. After calculating the combined benefits, the benefits of New Port are estimated by subtracting the substantial benefits of Tartous Port from the combined benefits.
In this study, the following conditions are adopted as the "Without" case.

i) No investment is made for the port excluding the investment in the silo of phosphate rock. The silo with the capacity of 60,000 tons is set up more in order

to handled the cargo volume of 3,100,000 tons.

ii) The materials for an ironworks will be newly handled in Tartous Port from 2003.

iii) Transit cargoes in export are not handled.

iv) Bulk cargoes are given priority in the cargo handling. Therefore, the overflowed general cargoes are assumed to be handled in a foreign port and carried by truck between Tartous Port and a foreign port, if the handling volume will fill the maximum capacity.

v) As for the bulk terminal project, the ship size of vessels and the working efficiency of cargo handling are not the same as "With" case.

The results of forecast on the handling volume by categories of berth are shown in Table 17.12.2-1

As for the bulk terminal project, the size of ships and the working efficiency of cargo handling in the "With" and "Without" cases are shown in Table 17.12.2-2.

Table 17.12.2-1 Handling Cargo Volume by Categories of Berth in New Port

["Without"case: Handled in Tartus Port] (Unit: thousand ton)

Classification of Berth	2003	2004	2005	2006	2007	2008	2009	2010
Phosphate Terminal	2,200	2,267	2,391	2,521	2,657	2,799	2,949	3,100
Container Terminal	528	619	720	830	950	1,083	1,226	1,387
Grain Terminal: Export	600	600	600	600	600	600	600	600
: Import	390	420	453	489	500	500	500	500
Grain Export	0	0	0	0	0	0	0	200
Grain Import	0	0	0	0	27	68	112	160
General	907	941	978	1,017	1,057	1,098	1,142	1,187
Food	497	499	502	504	506	508	511	513
Animal	191	206	223	241	260	280	303	327
Steel	546	599	659	725	797	876	964	1,060
Wood	351	387	426	469	517	570	628	692
Machine	169	183	198	214	232	251	272	295
Chemical	290	312	335	360	387	415	446	479
Ro/Ro	68	77	86	97	109	123	138	155
Clinker	1,100	1,085	1,070	1,056	1,042	1,028	1,014	1,000
Oil Cokes	100	110	122	135	149	164	181	200
Fertilizer	680	727	721	714	708	702	696	690
Pellet	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Scrap	200	200	200	200	200	200	200	200
Materials for Iron	150	150	150	150	150	150	150	150
General Berth Total	6,498	6,726	6,919	7,131	7,390	7,685	8,007	8,558
Total	10,216	10,632	11,083	11,571	12,097	12,667	13,282	14,145

Table 17.12.2-2 Size of Ship and Working Efficiency of Cargo Handling in both Cases

		"Without"	"With"
Ship Size (DWT)	Phosphate	10,000	40,000-65,000
	Clinker	15,000	32,200-65,000
	Pellet	15,000	65,000
	Scrap	6,500	10,000
	Materials	6,500	10,000
	Fertilizer	10,000	10,000-40,000
	Oil Cokes	10,000	15,000
Working Efficiency (ton/hr)	Phosphate	250	672
	Clinker	128	448
	Pellet	146	455
	Scrap	9.6	73
	Materials	33	67
	Fertilizer	45	Ex:176/Im:67
	Oil Cokes	84	126

17.12.3 Economic Prices

The method for converting to economic prices from market prices is the same as that of Latakia port mentioned in Chapter 15.13.3.

17.12.4 Costs of the Projects

(1) Construction Costs

Table 17.12.4-1 shows the economic prices of the construction costs including investment schedule.

Table 17.12.4-1 Construction Cost in Economic Prices by Year

(Unit: Million SP)

	1999	2000	2001	2002	2003	Total
Civil Total	2,689.3	2,689.3	2,689.3	2,689.3	2,693.8	13,451.2
Building Total	0.0	0.0	381.9	381.9	381.9	1,145.8
Utilities	0.0	0.0	0.0	130.0	130.0	260.0
Handling Equipment	0.0	0.0	494.6	1,000.9	1,704.5	3,200.0
Port Service Facilit.	0.0	0.0	0.0	0.0	149.1	149.1
Physical Contingency & Engineering Fee	165.6	106.5	106.5	106.5	106.5	591.6
Total	2,855.0	2,795.8	3,672.4	4,308.7	5,165.8	18,797.7

(2) Maintenance and Operation Costs

Table 17.12.4-2 shows the economic prices of the maintenance and operation costs including investment schedule.

1) Maintenance Costs

The costs of maintaining the port facilities are estimated as a fixed proportion (1 % for structures, 4 % for handling equipments and port service facilities) of the original construction costs excluding the costs of dredging and reclamation costs.

2) Operation Costs

Operation costs consist of personnel costs and material costs. Based on the estimation of operation costs in the following Chapter 17.13, operation costs are converted to economic prices by multiplying by the conversion factor for skilled labor and the conversion factor for unskilled labor respectively.

(3) Renewal Investment Costs

The renewal investment costs for facilities and equipment after their useful lifetimes are considered.

Table 17.12.4-2 Maintenance Costs in Economic Prices

(Unit: Million SP)

Items		Cost
Maintenance Costs		231.7
Operation Costs	Personnel Costs	119.2
	Material Costs	29.8
Sub Total		380.7
Renewal Investment	Every 7 Years	728.4
	Every 17 Years	1518.3

Note: Renewal Investment
7 Years: Mobil Crane, Moval Ship Loader, Truck, Shovel Loader, Forklift
17 Years: Loader/Unloader, Stacker/Reclaimer, D.L Level Luffing Crane

17.12.5 Benefits of the Projects

(1) Benefit Items

As benefits brought about by the short-term plan of study port, the following items are identified.

1) Savings in waiting costs of ships
2) Savings in water transportation cost by enlargement of ship size
3) Savings in land transportation costs
4) Savings of cost in cargo handling
5) Savings in interest of cargo costs
6) Reduction of cargo damage and accidents at the port
7) Promotion of regional economic development

8) Increase in employment opportunities and incomes

Items 1), 2), 3), 4) and 5) are considered countable and in this study the monetary benefits of items 1) and 2) are calculated.

(2) Calculation of Benefits

1) Savings in waiting costs of ships

The methods of calculation in the above benefit items are the same as that of Latakia Port mentioned in Section 15.13.5(2).

2) Savings in water transportation cost by enlargement of ship size

When the size of calling ships becomes larger to capitalize on mass transportation, large ship can call at deep berths but can not at existing shallow berths. The water transportation cost per ton of cargo will become cheaper by enlargement of ship size. The benefit that will accrue to Syria from the projects can be calculated by the following formula.

Savings in water transportation cost by enlargement of ship size
= Difference in water transportation cost between "With" and "Without" cases (unit cost)
x Handling cargo volume
x Share of benefits accruing to Syria (= 0.5)

The results of above calculation are shown in Table 17.12.5-1.

Table 17.12.5-1 Benefits of the Projects

(Unit: Million SP)

Year / Items	2004	2005	2006	2007	2008	2009	2010
Staying Cost	2,334.6	2,347.9	2,363.3	2,380.1	2,397.3	2,416.8	2,436.6
Waiting Cost	950.2	950.2	950.2	950.2	950.2	950.2	950.2
Ship Size	701.9	713.8	726.5	739.9	753.9	768.9	784.1
Total	3,986.7	4,011.9	4,040.0	4,070.2	4,101.4	4,135.9	4,170.9

17.12.6 Evaluation of the Projects

(1) Calculation of the EIRR

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

(2) Sensitivity Analysis

In order to determine whether the project is feasible when certain conditions change, a sensitivity analysis is made for three alternatives.

Case A: The costs increase by 10%
Case B: The benefits decrease by 10%
Case C: The costs increase by 10% and the Benefits decrease by 10%

The sensitivity analysis for three alternatives is calculated by using above formula as the base case and the results are shown in Table 17.12.6-1 (Refer to Table 17.12.6-2).

Table 17.12.6-1 Results of Sensitivity Analysis

Case	EIRR(%)
	Project Total
Base Case	14.8
Case A	13.5
Case B	13.4
Case C	12.1

(2) Evaluation

As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR exceeds 10 %. Therefore, this short-term plan development project is feasible from the viewpoint of the national economy.

Table 17.12.6-2 Cost / Benefit Analysis of All Projects

[Total-Base Case] (Unit: million S.P.)

	Year	Cost			Benefit		Net Present Value (NPV)		
		Construction	Maintenance	Total	Total	Benefit - Cost	Benefit	Cost	Benefit - Cost
1	1999	2855	0	2855	0	-2855	0	2855	-2855
2	2000	2796	0	2796	0	-2796	0	2435	-2435
3	2001	3672	0	3672	0	-3672	0	2785	-2785
4	2002	4309	0	4309	0	-4309	0	2845	-2845
5	2003	5166	0	5166	0	-5166	0	2970	-2970
6	2004	0	381	381	3987	3606	1996	191	1805
7	2005	0	381	381	4012	3631	1749	166	1583
8	2006	0	381	381	4040	3659	1534	145	1389
9	2007	0	381	381	4070	3690	1345	126	1220
10	2008	0	381	381	4101	3721	1181	110	1071
11	2009	0	381	381	4136	3755	1037	95	941
12	2010	0	381	381	4171	3790	910	83	827
13	2011	0	1109	1109	4171	3062	793	211	582
14	2012	0	381	381	4171	3790	690	63	627
15	2013	0	381	381	4171	3790	601	55	546
16	2014	0	381	381	4171	3790	523	48	476
17	2015	0	381	381	4171	3790	456	42	414
18	2016	0	381	381	4171	3790	397	36	361
19	2017	0	381	381	4171	3790	346	32	314
20	2018	0	1109	1109	4171	3062	301	80	221
21	2019	0	381	381	4171	3790	262	24	238
22	2020	0	381	381	4171	3790	228	21	207
23	2021	0	1899	1899	4171	2272	199	90	108
24	2022	0	381	381	4171	3790	173	16	157
25	2023	0	381	381	4171	3790	151	14	137
26	2024	0	381	381	4171	3790	131	12	119
27	2025	0	1109	1109	4171	3062	114	30	84
28	2026	0	381	381	4171	3790	99	9	90
29	2027	0	381	381	4171	3790	87	8	79
30	2028	0	381	381	4171	3790	75	7	69
31	2029	0	381	381	4171	3790	66	6	60
32	2030	0	381	381	4171	3790	57	5	52
33	2031	0	381	381	4171	3790	50	5	45
34	2032	0	1109	1109	4171	3062	43	12	32
35	2033	0	381	381	4171	3790	38	3	34
	Total	18798	15853	34651	124448	89797	15632	15632	0

EIRR= 0.14840