CHAPTER 8 PRELIMINARY COST ESTIMATION FOR MASTER PLAN

8.1 General Description

8.1.1 Objectives of Cost Estimation

This chapter deals with cost estimation of the Master Plan based on the plan and design described in PART II Chapter 6 Master Plan and Chapter 7 Preliminary Design. The primary purposes of the project cost estimation are:

1) to compare various alternatives presented in the Master Plan,
2) to establish bases for Preliminary Economic Analysis and
3) to prepare the data to select the priority projects for the Short Term Development Plan

In addition to the cost data obtained from CPA, the data from the on-going Container Terminal Project in the South Port (Existing Pier S2, Phase 1) and other similar projects has been referred to.

8.1.2 Classification of Project

The cost estimated here will include the major costs incurred for construction and operation of components based on the Master Plan for the target year 2020. This means that the project components will be implemented before the target year 2020. Construction cost (or initial investment cost) will include civil and building works, utilities, cargo handling equipment and facilities necessary for environmental protection. The major facilities included in this cost estimation are:

Group A
A1) Container Terminal (Phase 2 and Phase 3)
A2) Grain Terminal (Phase 1 and Phase 2)

Group B
B1) Steel Product Terminal (Multipurpose General Cargo Terminal)
B2) Timber Terminal (Multipurpose General Cargo Terminal)
B3) Barge Terminal
B4) Inland Transport Facilities (Phase 1 and Phase 2)

Group C
C1) Edible Oil Terminal (Supplemental)
C2) Breakwater and Wet Basins
C3) Environmental Related Facilities

Group A consists of project components which impact revenues for the financial feasibility. Works classified in the Group B will collect moderate revenues or average revenues and do not impact feasible in financial terms comparing to those expected in Group A. Group C covers projects in which MOT is already scheduled to invest and other supplemental projects such as Edible Oil Terminal.

As indicated in Chapter 3, future cargo traffic demand is estimated for two cases: namely, Case 1: High Scenario and Case 2 : Medium Growth Scenario. Among these two, Case 1 in this Master Plan study is very similar to that of the Medium Case in the on-going S2 Container Terminal. Case 1 has been selected for the future traffic by which the project is analyzed. However the required costs are provided for both cases.

Except with regard to container cargoes and grain cargo, the existing port facilities have more than enough excess cargo handling capacity than the cargo demands in 2020. Thus all other facilities than these two terminals are required not by virtue of traffic increase but rather as improvement and integration of the existing port facilities for better management and higher efficiency.
Cost estimation of container terminal phase 2 & 3 is rather simple, since it locates beside the on-going phase 1 project.

Cost estimation for the grain terminal is however rather complicated due to the various possibilities in selecting the best location for the future grain terminal. This includes MOT's intention to compare the technical feasibility to built a new grain terminal at the north port areas including the existing Berths No.31 to 33. Refer to Section 7.4. To meet these requirements, the Study Team prepared three sites with cost alternatives; namely,

Alternative 1a: To construct a new terminal at the new South Pier S3. (Proposed)
Alternative 1b: To construct a new terminal at the existing South Pier S1.
Alternative 1c: To construct a new terminal at the existing Berth Nos. 31 to 33.

Phasing of project implementation was analyzed based on the future traffic demand and the capacity of existing cargo handling facilities.

Container Terminal:	Phase 1: On-going Project by JBIC finance.
	Phase 2: Item for cost estimation
	Phase 3: Item for cost estimation
Grain Terminal:	Phase 1: Item for cost estimation
	Phase 2: Item for cost estimation
Inland Transport Facilities:	Phase 1: Item for cost estimation
	Phase 2: Item for cost estimation

Among these, Phase 1 is included in the Master Plan and the Short Term Plan projects. Phase 2 and after are included in the Master Plan; the works belong to the Long Term Plan, in 2010.

8.1.3 Costing Criteria

The basic conditions and assumptions applied for cost estimation are as follows:

(a) Cost estimates are based on the market prices in September 1999 for container terminal project prices and December 2000 obtained by the study team for the prices of construction materials, labor rates and construction equipment rates prevailing in Constantza and other regions inside the country.

It is assumed that the fluctuation of prices converted to US dollars between September 1999 and December 2000 is negligible.

(b) In this cost estimate, the following average exchange rates are used:

December 2000: US$ 1.00 = 110 Yen = 26,000 lei

(c) The physical contingency is assumed to be **10%**.

8.1.4 Foreign Cost and Local Cost

In order to calculate economic price, the cost is roughly divided into Foreign Cost and Local Cost based on the experience in the similar projects.

In this estimate, a proportion of each component was also determined based on the previous experiences in the similar projects.

8.2 Cost Classification

The required costs were divided into four (4) categories, basic characteristics of which are shown in Table 8.2.1

Table 8.2.1 Basic Characteristics of Cost Categories

Cost Categories	Type			Note
	Civil Works	Equipment	Total	
(1) Capital Costs	X	X	X	
(2) Replacement Costs		X		Replacement of the equipment after its life time
(3) Maintenance Costs	X	X		Maintenance of civil facilities and equipment
(4) Operation Costs			X	

8.3 Master Schedule

The target years of each facility in the Master Plan are described in Chapter 6. Accordingly, the Master Schedule for the development is prepared for Case 1 Traffic as shown in Figures 8.3.1.

Among these project elements for the Master Plan, implementation schedule of the container terminal has a small delay due to the on-going S2 Container Terminal, which will be ready for operation in 2004.

Table 8.3.1 Master Schedule: Traffic Case 1, High Scenario

		Project Components	Present	Calendar Year															Notes
			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
A	**High Revenue Project Components**																			
	A1	Container Terminal: Phase I					Financed by JBIC													South Port S2
	1)	Detailed Design																		West Terminal
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	A1	Container Terminal: Phase II																		South Port S2
	1)	Detailed Design																		West Terminal
	2)	Tender and Contract																		& East Terminal
	3)	Construction and Procurement																		
	A1	Container Terminal: Phase III																		South Port S2
	1)	Detailed Design																		East Terminal
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	A2	Grain Terminal: Phase I																		South Port S3
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	A2	Grain Terminal: Phase II																		South Port S3
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
B	**Average Revenue Project Components**																			
	B1	Steel Product Terminal				Cargo Demand should be carefully monitored by 2010.														Privatization
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	B2	Timber Terminal				Cargo Demand should be carefully monitored by 2010.														Timber export
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	B3	Barge Terminal																		South Port
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	B4	Inland Transport Facilities: Phase I																		Port access
		: Road Access																		Gate 5 Access
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		
	B4	Inland Transport Facilities: Phase II																		Port Access
		: Road Access																		
	1)	Detailed Design																		
	2)	Tender and Contract																		
	3)	Construction and Procurement																		

8.4 Capital Costs

The capital costs comprise costs for contingency, engineering services, civil works, equipment procurement. Since these costs will be applied for the economic analysis, no tax was introduced.

8.4.1 Civil Works

Construction costs comprise Direct Construction Costs, Indirect Construction Costs and the Contractor's Indirect Costs as shown in Table 8.4.1.

Table 8.4.1 Composition of Construction Costs

Construction costs	- Direct construction costs	- Labor costs - Material Costs - Equipment Costs - Other component of the costs
	- Indirect construction costs	- Mobilization costs - Temporary facilities
	- Contractor's Indirect costs (Overhead)	- Site office expenses - Home office expenses - Profits

8.4.2 Equipment Procurement

Equipment procurement costs will comprise the equipment cost and spare part costs as shown in Table 8.4.2. The manufacturer's indirect cost, overhead and profit will be all included in the costs. Spare part costs are assumed as 5% of equipment costs.

Table 8.4.2 Composition of Equipment Procurement Costs

Equipment Procurement Costs	- Equipment Costs	- Material and Manufacturing costs - Transportation Costs - Installation Costs - Test and Commissioning - Manufacturer's Indirect Cost, Overhead and Profit
	-Spare Part Costs	- Material and Manufacturing costs - Transportation Costs - Manufacturer's Indirect Cost, Overhead and Profit

8.4.3 Engineering Fee

The engineering fees are assumed to be 6 % of the total construction cost; it will be allocated as 2 % for foreign costs and 4 % for local costs.

8.4.4 Cost Estimation

(1) Required Capital Cost for Case 1

The summary of capital cost for Case 1: High Scenario is shown in Tables 8.4.3 (a), (b), (c) and (d) and the breakdowns of them are shown in Tables 8.4.4 through 8.4.16.

Table 8.4.3a Summary of Capital Cost (1), Case 1

Unit: million USD

Terminal/Works	Phase	Capital Costs
Group A		
A1 Container Terminal	Phase 2*	56.6
	Phase 3*	22.0
	Subtotal	78.6
A2 Grain Terminal	Phase 1	78.3 /104.5
	Phase 2**	78.3 /104.5
	Subtotal	156.6 / 209.0
Group A Total		**235.2 / 287.6**
Group B		
B1 Steel Product Terminal		6.1
B2 Timber Terminal		6.1
B3 Barge Terminal		24.6
B4 Inland Transport Facilities: (Inner road access)		64.8
Group B Total		**101.6**
Group C		
C1 Edible Oil Terminal		9.3
C2 Breakwater and Wet Basin		176.1
C3 Environmental Related Facilities		18.3
Group C Total		**203.7**
Grand Total		**540.5 / 592.9**

Notes. 1. * Phasing of the container terminal starting from the on-going project at S2.
2. There are three alternatives regarding location of the new grain terminal.
3. ** Grain terminal will consist of unit terminal capacity in two-million tons in each phase development.

According to the summary of capital costs, the required total cost for Case 1 will amount to between **US$ 540.5 – 592.9** million and be divided as follows: Group A between US$ 235.2

287.6 million, Group B **US$ 101.6** million and Group C US$ 203.7million. Group A includes the terminals and facilities which are directly related to future cargo demand. However the facilities categorized into Groups B and C are those for the required improvement and integration for better and more efficient port operation.

(2) Required Capital Cost for Case 2

There is no significant difference in Group C between Case 1 and Case 2.
There is also little difference between container terminal of Case 1 and Case 2. Grain terminal cost in Case 2 amounts to only a half of Case 1. Only the scale of both container terminal and grain terminal will be affected by traffic demand. For example, major cost difference in the container terminal is due to the required number of quay gantry cranes.

Case 1: Seven units
Case 2: Six units

Grain terminal in Case 2 will consist of one unit terminal (two-million tons) and only Phase 1.

According to the summary of capital costs, the required total cost for Case 2 will amount to between **US$ 454.7 – 480.9** million and be divided as follows: Group A between US$ 149.4 - 175.5 million, Group B US$ 101.6 million and Group C US$203.7million.

Table 8.4.3a Summary of Capital Cost (2), Case 2

Unit: million USD

Terminal/Works	Phase	Capital Costs
Group A		
A1 Container Terminal	Phase 2*	49.1
	Phase 3*	22.0
	Subtotal	71.1
A2 Grain Terminal	Only Phase 1	78.3 /104.5
Group A Total		**149.4 / 175.6**
Group B		
B1 Steel Product Terminal		6.1
B2 Timber Terminal		6.1
B3 Barge Terminal		24.6
B4 Inland Transport Facilities		64.8
Group B Total		**101.6**
Group C		
C1 Edible Oil Terminal		9.3
C2 Breakwater and Wet Basin		176.1
C3 Environmental Related Facilities		18.3
Group C Total		**203.7**
Grand Total		**454.7 / 480.9**

Notes. 1. * Phasing of the container terminal starting from the on-going project at S2.
2. There are three alternatives regarding location of the new grain terminal.

(3) Short Term Development Plan

Among these facilities proposed for the Master Plan, certain ones should be implemented before 2010 under the Short Term Development Plan. The Short Term Plan will basically cover the following project components.

A1 Container Terminal Phase 2 following the present Phase 1 development.
A2 Grain terminal (Phase 1 development)

B3 Barge terminal
B4 Inland transport facilities (Phase 1 development)

It is assumed that part of the terminal and facilities shown above will be implemented as part of the Short Term Development Project subject to the results of individual feasibility study.

Refer to Part III Chapter 9.

Table 8.4.3 (b) Summary of Capital Cost (2) - Group A - (for Economic Analysis), Case 1

Description of work	Container Terminal, Phase 2 (2006 - 2009)			Container Terminal, Phase 3 (2011 - 2014)			Grain Terminal (2004 - 2007) , Phase 1, Alternative: S1 or Berth No. 31 to 33			Grain Terminal (2009 - 2011), Phas 2 , Alternative: S1 or Berfth No. 31 to 33			Grain Terminal (2004 - 2007) , Phase 1, Alternative: S3			Grain Terminal (2009 - 2011), Phas 2 , Alternative: S3		
	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)
1. Civil Construction	12,840	5,343	18,183	6,898	2,576	9,474	20,757	5,675	26,432	20,757	5,675	26,432	39,619	9,280	48,899	39,619	9,280	48,899
Subtotal (1)	12,840	5,343	18,183	6,898	2,576	9,474	20,757	5,675	26,432	20,757	5,675	26,432	39,619	9,280	48,899	39,619	9,280	48,899
2. Cargo Handling Equipment	23,826	7,942	31,769	7,385	2,462	9,846	3,500	39,120	42,620	3,500	39,120	42,620	3,500	39,120	42,620	3,500	39,120	42,620
Subtotal (1 - 2)	36,666	13,286	49,952	14,283	5,037	19,320	24,257	44,795	69,052	24,257	44,795	69,052	43,119	48,400	91,519	43,119	48,400	91,519
3. Physical Contingency (10% / 5%)	2,475	931	3,407	1,059	381	1,440	2,251	2,523	4,774	2,251	2,523	4,774	4,137	2,884	7,021	4,137	2,884	7,021
Subtotal (1 - 3)	39,141	14,217	53,358	15,342	5,418	20,760	26,508	47,318	73,826	26,508	47,318	73,826	47,256	51,284	98,540	47,256	51,284	98,540
4. Engineering Services	2,134	1,067	3,201	830	415	1,246	2,953	1,477	4,430	2,953	1,477	4,430	3,942	1,971	5,912	3,942	1,971	5,912
Grand Total (1 -5)	**41,276**	**15,284**	**56,560**	**16,172**	**5,833**	**22,005**	**29,461**	**48,794**	**78,255**	**29,461**	**48,794**	**78,255**	**51,198**	**53,254**	**104,452**	**51,198**	**53,254**	**104,452**

Note. 1. Required cost for the Grain Terminal will be one either alternative "S1" or ""Berth Nos. 31/33" or "S3".

Table 8.4.3 (c) Summary of Capital Cost (3) - Group A - (for Economic Analysis), Case 2

Description of work	Container Terminal, Phase 2 (2006 - 2009)			Container Terminal, Phase 3 (2011 - 2014)			Grain Terminal (2004 - 2007) , Alternative: S1 or Berth No. 31 to 33 Phase 1			Grain Terminal (2004 - 2007), Alternative: S3 Phase 1								
	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)
1. Civil Construction	12,840	5,343	18,183	6,898	2,576	9,474	20,757	5,675	26,432	39,619	9,280	48,899						
Subtotal (1)	12,840	5,343	18,183	6,898	2,576	9,474	20,757	5,675	26,432	39,619	9,280	48,899						
2. Cargo Handling Equipment	18,766	6,255	25,022	7,385	2,462	9,846	3,500	39,120	42,620	3,500	39,120	42,620						
Subtotal (1 - 2)	31,606	11,599	43,205	14,283	5,037	19,320	24,257	44,795	69,052	43,119	48,400	91,519						
3. Physical Contingency (10% / 5%)	2,222	847	3,069	1,059	381	1,440	2,251	2,523	4,774	4,137	2,884	7,021						
Subtotal (1 - 3)	33,828	12,446	46,274	15,342	5,418	20,760	26,508	47,318	73,826	47,256	51,284	98,540						
4. Engineering Services	1,851	925	2,776	830	415	1,246	2,953	1,477	4,430	3,942	1,971	5,912						
Grand Total (1 -5)	**35,679**	**13,371**	**49,050**	**16,172**	**5,833**	**22,005**	**29,461**	**48,794**	**78,255**	**51,198**	**53,254**	**104,452**						

Notes 1. Required cost for the Grain Terminal will be one alternative either "S1" or ""Berth Nos. 31/33" or "S3".

2. Grain terminal in Case 2 has Phase 1 only.

Table 8.4.3 (d) Summary of Capital Cost (4) - Group B and C- (for Economic Analysis), Case 1 and Case 2

	Steel Product Terminal (2004 - 2006) Group B			Timber Terminal (2004 - 2006) Group B			Barge Terminal (2004 - 2007) Group B			Inland Transport Facilities (2004 - 2007) Group B			Edible Oil Terminal (2004 - 2007) Group C			Breakwater and Wet Basin (2005 - 2009) Group C			Environmental Related Facilities (2005 - 2009) Group C
	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Local Cost (1000 USD)	Foreign Cost (1000 USD)	Total (1000 USD)	Total (1000 USD)
1. Civil Construction	3,830	1,420	5,250	3,780	1,420	5,200	9,500	11,600	21,100	24,291	31,311	55,602	2,570	952	3,522	82,800	68,200	151,000	-
Subtotal (1)	3,830	1,420	5,250	3,780	1,420	5,200	9,500	11,600	21,100	24,291	31,311	55,602	2,570	952	3,522	82,800	68,200	151,000	-
2. Cargo Handling Equipment	0	0	-	0	0	-	0	0	-	0	0	-	1,575	3,075	4,650	0	0	-	-
Subtotal (1 - 2)	3,830	1,420	5,250	3,780	1,420	5,200	9,500	11,600	21,100	24,291	31,311	55,602	4,145	4,027	8,172	82,800	68,200	151,000	-
3. Physical Contingency (10% / 5%)	383	142	525	378	142	520	950	1,160	2,110	2,429	3,131	5,560	336	249	585	8,280	6,820	15,100	-
Subtotal (1 - 3)	4,213	1,562	5,775	4,158	1,562	5,720	10,450	12,760	23,210	26,721	34,442	61,162	4,481	4,276	8,757	91,080	75,020	166,100	-
4. Engineering Services	231	116	347	229	114	343	928	464	1,393	2,446	1,223	3,670	350	175	525	6,644	3,322	9,966	-
Grand Total (1 -5)	**4,444**	**1,678**	**6,122**	**4,387**	**1,676**	**6,063**	**11,378**	**13,224**	**24,603**	**29,167**	**35,665**	**64,832**	**4,831**	**4,451**	**9,282**	**97,724**	**78,342**	**176,066**	**18,300**

Table 8.4.4 BREAKDOWN OF CONSTRUCTION COST, Case 1and Case 2 (Container Terminal, Phase 2; Between 2008 and 2009)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						**600**	**250**	**850**
2. CIVIL & BUILDING WORK										
2.1. Site Development										
(1) Land fill above +1,50 m level	180,000	m3	6	100	-	0	6.0	1,080	0	**1,080**
(2) Clear surface	50,000	m2	2	100	-	0	1.5	75	0	**75**
(3) Grading/Leveling	50,000	m2	1	100	-	0	1.0	50	0	**50**
Subtotal								**1,205**	**0**	**1,205**
2.2. Terminal Yard										
(1) Concrete Base for Stacking Yard	1,500	m3	245	70	105	30	350.0	368	158	**525**
(2) Modify Empty Yard to Stacking Yard	800	m3	280	70	120	30	400.0	224	96	**320**
(3) Pavement in the Stacking Area	9,000	m2	18	70	8	30	25.0	158	68	**225**
(4) Concrete Base for RTG Crane	1,500	m3	245	70	105	30	350.0	368	158	**525**
(5)Concrete Base in existing Empty Yard	1,100	m3	301	70	129	30	430.0	331	142	**473**
(6) Pavement for the Access Road, Main Gate, Trailer Parking & Yard Circulation	17,000	m2	25	70	11	30	35.0	417	179	**595**
(7) Pavement for the Apron Area Maintenance Area, Empty Container Area	15,000	m2	32	70	14	30	45.0	473	203	**675**
(8) Railway	700	m	420	70	180	30	600.0	294	126	**420**
(9) Reefer Container Platform	60	ton	3,750	75	1,250	25	5,000.0	225	75	**300**
Subtotal								**2,856**	**1,202**	**4,058**
2.3. Yard Utilities										
(1) Drainage and Sewer System	1	LS	240,000	80	60,000	20	300,000.0	240	60	**300**
(2) Water Supply System	1	LS	119,000	70	51,000	30	170,000.0	119	51	**170**
(3) Power Supply System	1	LS	490,000	70	210,000	30	700,000.0	490	210	**700**
(4) Lighting System	1	LS	630,000	70	270,000	30	900,000.0	630	270	**900**
Subtotal								**1,479**	**591**	**2,070**
2.4. Works outside Terminal										
(1) Road Access	1	L.S.	6,300,000	70	2,700,000	30	9,000,000.0	6,300	2,700	**9,000**
(2) Increase of PORT IV Station Capacity	1	LS	400,000	40	600,000	60	1,000,000.0	400	600	**1,000**
(3) Power Supply Cable		m	0	40	-	60	-	0	0	-
Subtotal								**6,700**	**3,300**	**10,000**
Total for Civil and Building Works								**12,840**	**5,343**	**18,183**

Note 1. Same amount shown above is used to both Case 1 & Case 2.

Table 8.4.5 BREAKDOWN OF CONSTRUCTION COST, Case 1 amd Case 2 (Container Terminal, Phase 3; Between 2013 and 2014)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						320	120	**440**
2. CIVIL & BUILDING WORK										
2.1. Site Development										
(1) Land fill above +1,50 m level	250,000	m3	6	100	-	0	6	1,500	0	**1,500**
(2) Clear surface	90,000	m2	2	100	-	0	2	135	0	**135**
(3) Grading/Leveling	90,000	m2	1	100	-	0	1	90	0	**90**
Subtotal								**1,725**	**0**	**1,725**
2.5. Terminal Yard										
(1) Concrete Base for Stacking Yard	3,000	m3	245	70	105.0	30	350	735	315	**1,050**
(2) Modify Empty Yard to Stacking Yard	700	m3	280	70	120.0	30	400	196	84	**280**
(3) Pavement in the Stacking Area	20,000	m2	18	70	7.5	30	25	350	150	**500**
(4) Concrete Base for RTG Crane	2,000	m3	245	70	105.0	30	350	490	210	**700**
(5)Concrete Base in existing Empty Yard	300	m3	301	70	129.0	30	430	90	39	**129**
(6) Pavement for the Access Road, Main Gate, Trailer Parking & Yard Circulation	30,000	m2	25	70	10.5	30	35	735	315	**1,050**
(7) Pavement for the Apron Area Maintenance Area, Empty Container Area	20,000	m2	32	70	13.5	30	45	630	270	**900**
(8) Railway		LS	420	70	180.0	30	600	0	0	-
(9) Reefer Container Platform		ton	3,750	75	1,250.0	25	5,000	0	0	-
Subtotal								**3,226**	**1,383**	**4,609**
2.6. Yard Utilities										
(1) Drainage and Sewer System	1	LS	296,000	80	74,000.0	20	370,000	296	74	**370**
(2) Water Supply System	1	LS	119,000	70	51,000.0	30	170,000	119	51	**170**
(3) Power Supply System	1	LS	595,000	70	255,000.0	30	850,000	595	255	**850**
(4) Lighting System	1	LS	217,000	70	93,000.0	30	310,000	217	93	**310**
Subtotal								**1,227**	**473**	**1,700**
(1) Road Access		m	0	100	-					
(2) Increase of PORT IV Station Capacity		LS	0	100	-			0	0	-
(3) Power Supply Cable	1	LS	400,000	40	600,000.0	60	1,000,000	400	600	**1,000**
Subtotal								**400**	**600**	**1,000**
Total for Civil and Building Works								**6,898**	**2,576**	**9,474**

Note 1. Same amount shown above is used to both Case 1 & Case 2.

1,071,216

Table 8.4.6a BREAKDOWN OF EQUIPMENT PROCUREMENT COST, Case 1 (Container Terminal, Phase 2, Between 2008 and 2009)

Type	Outline Spec	Quantity	Unit	Unit Price (USD)	Local Component (1,000 USD)	Foreign Component (1,000 USD)	Total (1,000 USD)
1. Quay Gantry Crane							
(1) Equipment	41t x 30.5m	3	Nos.	5,400,000	12,150	4,050	16,200
(2) Spare Parts	Post Panamax	3	Nos.	270,000	203	68	270
Subtotal					**12,353**	**4,118**	**16,470**
2. Rubber Tired Gantry Crane (RTG)							
(1) Equipment	41t x 23.5m	8	Nos.	1,200,000	7,200	2,400	9,600
(2) Spare Parts		8	Nos.	60,000	360	120	480
Subtotal					**7,560**	**2,520**	**10,080**
3. Rail Mounted Gantry Crane (RMG)							
(1) Equipment	41t x 32m, (2+1)	0	Nos.	2,700,000	-	-	-
(2) Spare Parts		0	Nos.	135,000	-	-	-
Subtotal					-	-	-
4. Tractor Head							
(1) Equipment		34	Nos.	90,000	2,295	765	3,060
(2) Spare Parts		34	Nos.	4,500	115	38	153
Subtotal					**2,410**	**803**	**3,213**
5. Chassis							
(1) Equipment	2 x 20ft / 1 x 40ft	34	Nos.	30,000	765	255	1,020
(2) Spare Parts		34	Nos.	1,500	38	13	51
Subtotal					**803**	**268**	**1,071**
6. Reach Stacker							
(1) Equipment	31t x 4m x 4 high	1	Nos.	450,000	338	113	450
(2) Spare Parts		1	Nos.	22,500	17	6	23
Subtotal					**354**	**118**	**473**
7. Sidelift Spreader Truck							
(1) Equipment	4.5 t x 5 high	2	Nos.	200,000	300	100	400
(2) Spare Parts		2	Nos.	10,000	15	5	20
Subtotal					**315**	**105**	**420**
8. Forklift Truck							
(1) Equipment	3t x 0.5m	2	Nos.	20,000	30	10	40
(2) Spare Parts		2	Nos.	1,000	2	1	2
Subtotal					**32**	**11**	**42**
9. Forklift Trucks for CFS							
(1) Equipment			Nos.		-	-	-
(2) Spare Parts			Nos.		-	-	-
Subtotal					-	-	-
Total for Equipment					**23,826**	**7,942**	**31,769**

Table 8.4.6b BREAKDOWN OF EQUIPMENT PROCUREMENT COST, Case 2 (Container Terminal, Phase 2, Between 2008 and 2009)

Type	Outline Spec	Quantity	Unit	Unit Price (USD)	Local Component (1,000 USD)	Foreign Component (1,000	Total (1,000 USD)
1. Quay Gantry Crane							
(1) Equipment	41t x 30.5m	2	Nos.	5,400,000	8,100	2,700	10,800
(2) Spare Parts	Post Panamax	2	Nos.	270,000	90	30	120
Subtotal					**8,190**	**2,730**	**10,920**
2. Rubber Tired Gantry Crane (RTG)							
(1) Equipment	41t x 23.5m	6	Nos.	1,200,000	5,400	1,800	7,200
(2) Spare Parts		6	Nos.	60,000	270	90	360
Subtotal					**5,670**	**1,890**	**7,560**
3. Rail Mounted Gantry Crane (RMG)							
(1) Equipment	41t x 32m, (2+1)	1	Nos.	2,700,000	2,025	675	2,700
(2) Spare Parts		1	Nos.	135,000	101	34	135
Subtotal					**2,126**	**709**	**2,835**
4. Tractor Head							
(1) Equipment		22	Nos.	90,000	1,485	495	1,980
(2) Spare Parts		22	Nos.	4,500	74	25	99
Subtotal					**1,559**	**520**	**2,079**
5. Chassis							
(1) Equipment	2 x 20ft / 1 x 40ft	22	Nos.	30,000	495	165	660
(2) Spare Parts		22	Nos.	1,500	25	8	33
Subtotal					**520**	**173**	**693**
6. Reach Stacker							
(1) Equipment	31t x 4m x 4 high	1	Nos.	450,000	338	113	450
(2) Spare Parts		1	Nos.	22,500	17	6	23
Subtotal					**354**	**118**	**473**
7. Sidelift Spreader Truck							
(1) Equipment	4.5 t x 5 high	2	Nos.	200,000	300	100	400
(2) Spare Parts		2	Nos.	10,000	15	5	20
Subtotal					**315**	**105**	**420**
8. Forklift Truck							
(1) Equipment	3t x 0.5m	2	Nos.	20,000	30	10	40
(2) Spare Parts		2	Nos.	1,000	2	1	2
Subtotal					**32**	**11**	**42**
9. Forklift Trucks for CFS							
(1) Equipment			Nos.		-	-	-
(2) Spare Parts			Nos.		-	-	-
Subtotal					-	-	-
Total for Equipment					**18,766**	**6,255**	**25,022**

Table 8.4.7 Breakdown of Equipment Procurement Cost, Case 1 and Case 2 (Container Terminal, Phase 3, Between 2013 and 2014)

Type	Outline Spec	Quantity	Unit	Unit Price (USD)	Local Component (1,000 USD)	Foreign Component (1,000 USD)	Total (1,000 USD)
1. Quay Gantry Crane							
(1) Equipment	41t x 30.5m	1	Nos.	5,400,000	4,050	1,350	5,400
(2) Spare Parts	Post Panamax	1	Nos.	270,000	405	135	540
Subtotal					**4,455**	**1,485**	**5,940**
2. Rubber Tired Gantry Crane (RTG)							
(1) Equipment	41t x 23.5m	2	Nos.	1,200,000	1,800	600	2,400
(2) Spare Parts		2	Nos.	60,000	90	30	120
Subtotal					**1,890**	**630**	**2,520**
3. Rail Mounted Gantry Crane (RMG)							
(1) Equipment	41t x 32m, (2+1)	0	Nos.	2,700,000	-	-	-
(2) Spare Parts		0	Nos.	135,000	-	-	-
Subtotal					**-**	**-**	**-**
4. Tractor Head							
(1) Equipment		11	Nos.	90,000	743	248	990
(2) Spare Parts		11	Nos.	4,500	37	12	50
Subtotal					**780**	**260**	**1,040**
5. Chassis							
(1) Equipment	2 x 20ft / 1 x 40ft	11	Nos.	30,000	248	83	330
(2) Spare Parts		11	Nos.	1,500	12	4	17
Subtotal					**260**	**87**	**347**
6. Reach Stacker							
(1) Equipment	31t x 4m x 4 high	0	Nos.	450,000	-	-	-
(2) Spare Parts		0	Nos.	22,500	-	-	-
Subtotal					-	-	-
7. Side-lift Spreader Lift Truck							
(1) Equipment	4.5 t x 5 high	0	Nos.	200,000	-	-	-
(2) Spare Parts		0	Nos.	10,000	-	-	-
Subtotal					-	-	-
8. Fork Lift Truck							
(1) Equipment	3t x 0.5m	0	Nos.	20,000	-	-	-
(2) Spare Parts		0	Nos.	1,000	-	-	-
Subtotal					-	-	-
9. Fork Lift Trucks for CFS							
(1) Equipment		0	Nos.		-	-	-
(2) Spare Parts		0	Nos.		-	-	-
Subtotal					-	-	-
Total for Equipment					**7,385**	**2,462**	**9,846**

Note 1. Same amount of those shown above is applied to both Case 1 & Case 2.

Table 8.4.8a Breakdown of Construction Cost
(Grain Terminal; Between 2006 and 2007)
To be applied for installation at Existing South Pier S1 or Existing North Berth No. 31 to 33
Case 1: Phase 1 & 2, Case 2: Phase 1

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc	5	%						**400**	**1,500**	**1,900**
2. CIVIL & BUILDING WORK										
2.1. Quay Construction										
(1) Dredging for Quay Construction	0	m3	5	70	2	30	7.7	0	0	-
(2) Rubble Mound	0	m3	33	70	14	30	47	0	0	-
(3) Precast Concrete Blocks	0	nr	3,150	70	1,350	30	4,500	0	0	-
(4) Concrete Caisson	0	nr	8,750	70	3,750	30	12,500	0	0	-
(5) Crushed stone to inside the caisson	0	m3	22	70	10	30	32	0	0	-
(6) Quarry Run	0	m3	17	70	7	30	24	0	0	-
(7) Crown Concrete	2,000	m2	175	70	75	30	250	350	150	**500**
(8) Bollard (75 ton)	14	nr	1,050	70	450	30	1,500	15	6	**21**
(9) Bollard (150 ton)	21	nr	2,170	70	930	30	3,100	46	20	**65**
(10) Fender	50	nr	4,900	70	2,100	30	7,000	245	105	**350**
(11) Fender	46	nr	1,120	70	480	30	1,600	52	22	**74**
Subtotal								**707**	**303**	**1,010**
2.2. Site Development										
(1) Land fill above +1,50 m level	100,000	m3	6	100	-	0	6	550	0	**550**
(2) Sand Mixing/Compaction	100,000	m3	8	70	4	30	12	840	360	**1,200**
(3) Grading/Leveling	150,000	m2	4	100	-	0	4	600	0	**600**
(4) Slope Protection	24,000	ton	25	100	-	0	25	600	0	**600**
Subtotal								**2,590**	**360**	**2,950**
2.3. Terminal Yard										
(1) Roads	2,000	m	385	70	165	30	550	770	330	**1,100**
(2) Marshaling Yard	1	sum	1,470,000	70	630,000	30	2,100,000	1,470	630	**2,100**
(3) Paving	40,000	m2	28	70	12	30	40	1,120	480	**1,600**
(4) Security Fencing	1,300	m	49	70	21	30	70	64	27	**91**
Subtotal								**3,424**	**1,467**	**4,891**
2.4. Yard Utilities										
(1) Sewer System	1	sum	184,000	80	46,000	20	230,000	184	46	**230**
(2) Water Supply System	1	sum	364,000	70	156,000	30	520,000	364	156	**520**
(3) Power Supply System	1	sum	182,000	70	78,000	30	260,000	182	78	**260**
(4) Communication	1	sum	21,000	70	9,000	30	30,000	21	9	**30**
Subtotal								**751**	**289**	**1,040**
2.5. Works outside Terminal										
(1) Road Access	1	sum	3,220,000	70	1,380,000	30	4,600,000	3,220	1,380	**4,600**
(2) Railway Access	1	sum	800,000	100	-	0	800,000	800	0	**800**
(3) Water Supply Connection	1	sum	100,000	100	-	0	100,000	100	0	**100**
(4) Sewer System Connection	1	sum	77,000	70	33,000	30	110,000	77	33	**110**
(5) Increase PORT IV Station Capacity	1	sum	44,000	40	66,000	60	110,000	44	66	**110**
(6) Power Supply Cable	1	sum	245,000	70	105,000	30	350,000	245	105	**350**
(7) Communication Connection	1	sum	49,700	70	21,300	30	71,000	50	21	**71**
Subtotal								**4,536**	**1,605**	**6,141**
2.6 Buildings										
(1) Administration Office	500	m2	700	70	300	30	1,000	350	150	**500**
(2) Grain Silo (100,000 ton)	1	sum	8,000,000	100	-	0	8,000,000	8,000	0	**8,000**
Subtotal								**8,350**	**150**	**8,500**
Total for Civil and Building Works								**20,757**	**5,675**	**26,432**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.8b Breakdown of Construction Cost
(Grain Terminal; Between 2006 and 2007)
To be applied for installation at New South Pier S3
Case 1: Phase 1 & 2, Case 2: Phase 1

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc	5	%						**400**	**1,500**	**1,900**
2. CIVIL & BUILDING WORK										
2.1. Quay Construction										
(1) Dredging for Quay Construction	16,000	m3	5	70	2	30	7.7	86	37	**123**
(2) Rubble Mound	3,400	m3	33	70	14	30	47	112	48	**160**
(3) Precast Concrete Blocks	50	nr	3,150	70	1,350	30	4,500	158	68	**225**
(4) Concrete Caisson	154	nr	8,750	70	3,750	30	12,500	1,348	578	**1,925**
(5) Crushed stone to inside the caisson	16,000	m3	22	70	10	30	32	358	154	**512**
(6) Quarry Run	83,000	m3	17	70	7	30	24	1,394	598	**1,992**
(7) Crown Concrete	14,000	m2	175	70	75	30	250	2,450	1,050	**3,500**
(8) Bollard (75 ton)	14	nr	1,050	70	450	30	1,500	15	6	**21**
(9) Bollard (150 ton)	21	nr	2,170	70	930	30	3,100	46	20	**65**
(10) Fender	50	nr	4,900	70	2,100	30	7,000	245	105	**350**
(11) Fender	46	nr	1,120	70	480	30	1,600	52	22	**74**
Subtotal								**6,263**	**2,684**	**8,947**
2.2. Site Development										
(1) Land fill above +1,50 m level	2,000,000	m3	6	100	-	0	6	11,000	0	**11,000**
(2) Sand Mixing/Compaction	440,000	m3	8	70	4	30	12	3,696	1,584	**5,280**
(3) Grading/Leveling	150,000	m2	4	100	-	0	4	600	0	**600**
(4) Slope Protection	24,000	ton	25	100	-	0	25	600	0	**600**
Subtotal								**15,896**	**1,584**	**17,480**
2.3. Terminal Yard										
(1) Roads	2,000	m	385	70	165	30	550	770	330	**1,100**
(2) Marshaling Yard	1	sum	1,470,000	70	630,000	30	2,100,000	1,470	630	**2,100**
(3) Paving	40,000	m2	28	70	12	30	40	1,120	480	**1,600**
(4) Security Fencing	1,300	m	49	70	21	30	70	64	27	**91**
Subtotal								**3,424**	**1,467**	**4,891**
2.4. Yard Utilities										
(1) Sewer System	1	sum	184,000	80	46,000	20	230,000	184	46	**230**
(2) Water Supply System	1	sum	364,000	70	156,000	30	520,000	364	156	**520**
(3) Power Supply System	1	sum	182,000	70	78,000	30	260,000	182	78	**260**
(4) Communication	1	sum	21,000	70	9,000	30	30,000	21	9	**30**
Subtotal								**751**	**289**	**1,040**
2.5. Works outside Terminal										
(1) Road Access	1	sum	3,220,000	70	1,380,000	30	4,600,000	3,220	1,380	**4,600**
(2) Railway Access	1	sum	800,000	100	-	0	800,000	800	0	**800**
(3) Water Supply Connection	1	sum	100,000	100	-	0	100,000	100	0	**100**
(4) Sewer System Connection	1	sum	77,000	70	33,000	30	110,000	77	33	**110**
(5) Increase PORT IV Station Capacity	1	sum	44,000	40	66,000	60	110,000	44	66	**110**
(6) Power Supply Cable	1	sum	245,000	70	105,000	30	350,000	245	105	**350**
(7) Communication Connection	1	sum	49,700	70	21,300	30	71,000	50	21	**71**
Subtotal								**4,536**	**1,605**	**6,141**
2.6 Buildings										
(1) Administration Office	500	m2	700	70	300	30	1,000	350	150	**500**
(2) Grain Silo (100,000 ton)	1	sum	8,000,000	100	-	0	8,000,000	8,000	0	**8,000**
Subtotal								**8,350**	**150**	**8,500**
Total for Civil and Building Works								**39,619**	**9,280**	**48,899**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.9 Breakdown of Equipment Procurement Cost
(Grain Terminal, Between 2006 and 2007)
Case 1 & 2, Phase 1 & 2

Type	Outline Spec	Quantity	Unit	Unit Price (USD)	Local Component (1000 USD)	Foreign Component (1000 USD)	Total (1,000 USD)
1. Grain Unloader							
(1) Equipment	400 t/h (Pneumatic)	2	nr	6,670,000	-	13,340	13,340
(2) Spare Parts		2	nr	330,000	-	660	660
Subtotal					**-**	**14,000**	**14,000**
2. Grain Loader							
(1) Equipment	800 t/h	2	nr	7,620,000	-	15,240	15,240
(2) Spare Parts		2	nr	380,000	-	760	760
Subtotal					**-**	**16,000**	**16,000**
3. Belt Conveyer		1000	m	3,000	1,500	1,500	3,000
Subtotal					**1,500**	**1,500**	**3,000**
4. Chain Conveyer		1000	m	2,000	1,000	1,000	2,000
Subtotal					**1,000**	**1,000**	**2,000**
5. Control System		1	sum	2,000,000	-	2,000	2,000
Subtotal					**-**	**2,000**	**2,000**
6. Bucket Elevator		9	nr	180,000	-	1,620	1,620
Subtotal					**-**	**1,620**	**1,620**
7. Other	15%	1	sum	4,000,000	1,000	3,000	4,000
Subtotal					**1,000**	**3,000**	**4,000**
Total for Equipment					**3,500**	**39,120**	**42,620**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.10 Breakdown of Construction Cost
(Edible Oil Terminal; Between 2006 and 2007)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc	5	%						**150**	**50**	**200**
2. CIVIL & BUILDING WORK										
2.1. Quay Construction										
(1) Modify Crown Concrete	150	m	14	70	6	30	20	2	1	**3**
(2) Bollard (50 ton)	21	nr	840	70	360	30	1,200	18	8	**25**
(3) Fender	30	nr	1,120	70	480	30	1,600	34	14	**48**
Subtotal								**53**	**23**	**76**
2.2. Site Development										
(1) Land fill above +1,50 m level	30,000	m3	6	100	-	0	6	165	0	**165**
(2) Sand Mixing/Compaction	15,000	m3	8	70	4	30	12	126	54	**180**
(3) Grading/Leveling	50,000	m2	4	100	-	0	4	200	0	**200**
(4) Slope Protection		ton	25	100	-	0	25	0	0	**-**
Subtotal								**491**	**54**	**545**
2.3. Terminal Yard										
(1) Roads	500	m	385	70	165	30	550	193	83	**275**
(2) Marshaling Yard	1	sum	140,000	70	60,000	30	200,000	140	60	**200**
(3) Paving	10,000	m2	28	70	12	30	40	280	120	**400**
(4) Security Fencing	200	m	2,100	70	900	30	3,000	420	180	**600**
Subtotal								**1,033**	**443**	**1,475**
2.4. Yard Utilities										
(1) Sewer System	1	sum	60,000	80	15,000	20	75,000	60	15	**75**
(2) Water Supply System	1	sum	52,500	70	22,500	30	75,000	53	23	**75**
(3) Power Supply System	1	sum	224,000	70	96,000	30	320,000	224	96	**320**
(4) Communication	1	sum	7,000	70	3,000	30	10,000	7	3	**10**
Subtotal								**344**	**137**	**480**
2.5. Works outside Terminal										
(1) Road Access	1	sum	0	70	-	30		0	0	**-**
(2) Railway Access	1	sum	0	100	-	0		0	0	**-**
(3) Water Supply Connection	1	sum	0	100	-	0		0	0	**-**
(4) Sewer System Connection	1	sum	0	70	-	30		0	0	**-**
(5) Increase PORT IV Station Capacity	1	sum	30,000	40	45,000	60	75,000	30	45	**75**
(6) Power Supply Cable	1	sum	245,000	70	105,000	30	350,000	245	105	**350**
(7) Communication Connection	1	sum	49,700	70	21,300	30	71,000	50	21	**71**
(8) Firefighting System										
Subtotal								**325**	**171**	**496**
2.6 Buildings										
(1) Administration Office	200	m2	700	70	300	30	1,000	140	60	**200**
(2) Others	1	sum	35,000	70	15,000	30	50,000	35	15	**50**
Subtotal								**175**	**75**	**250**
Total for Civil and Building Works								**2,570**	**952**	**3,522**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.11 Breakdown of Construction and Equipment Procurement Cost (Edible Oil Terminal, Between 2006 and 2007)

Type	Outline Spec	Quantity	Unit	Unit Price (USD)	Local Component (1000 USD)	Foreign Component (1000 USD)	Total (1,000 USD)
1. Loading/Unloading Arm							
(1) Equipment	2 x 100 t/h	2	nr	500,000	-	1,000	1,000
(2) Spare Parts		2	nr	50,000	-	100	100
Subtotal					**-**	**1,100**	**1,100**
2. Truck Receiving System							
Pipelines, etc	ϕ = 150 mm	1000	m	500	250	250	500
Subtotal					**250**	**250**	**500**
3. Railway Wagon Receiving System							
Pipelines, etc	ϕ = 150 mm	500	m	500	125	125	250
Subtotal					**125**	**125**	**250**
4. Storage System							
Tank	3,000 ton	4	nr	500,000	1,000	1,000	2,000
Subtotal					**1,000**	**1,000**	**2,000**
5. Others					-	-	-
Others	10%	1	sum	800,000	200	600	800
Subtotal					**200**	**600**	**800**
Total					**1,575**	**3,075**	**4,650**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.12 Breakdown of Construction Cost (Steel Product Terminal; 2006)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						**180**	**70**	**250**
2. CIVIL WORK										
2.1. Levelling and Relocation										
(1) Levelling and relocation	100,000	m2	5	100	-	0	5.0	500	0	**500**
Subtotal								**500**	**0**	**500**
2.2. Paving										
(1) Paving	100,000	m2	21	70	9	30	30	2,100	900	**3,000**
Subtotal								**2,100**	**900**	**3,000**
2.3. Others										
(1) Others	1	sum	1,050,000	70	450,000	30	1,500,000	1,050	450	**1,500**
Subtotal								**1,050**	**450**	**1,500**
Total for Civil Works								**3,830**	**1,420**	**5,250**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.13 Breakdown of Construction Cost (Timber Terminal; 2006)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						**180**	**70**	**250**
2. CIVIL WORK										
2.1. Levelling and Relocation										
(1) Levelling and relocation	200,000	m2	5	100	-	0	5.0	1,000	0	**1,000**
Subtotal								**1,000**	**0**	**1,000**
2.2. Paving										
(1) Paving	200,000	m2	21	70	9	30	30	4,200	1,800	**6,000**
Subtotal								**4,200**	**1,800**	**6,000**
2.3 Transit sheds										
(1)' Building works	0	m2	158	70	68	30	225	**0**	**0**	**-**
Subtotal								**0**	**0**	**-**
2.4. Others										
(1) Others	1	sum	1,050,000	70	450,000	30	1,500,000	1,050	450	**1,500**
Subtotal								**1,050**	**450**	**1,500**
Total for Civil Works								**6,430**	**2,320**	**8,750**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.14 Breakdown of Construction Cost (Barge Terminal; Between 2006 and 2007)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						**500**	**600**	**1,100**
2. CIVIL WORK										
2.1. Quaywall										
(1) Quaywall	2,000	m	1,500	30	3,500	70	5,000.0	3,000	7,000	**10,000**
Subtotal								**3,000**	**7,000**	**10,000**
2.2. Apron and Access										
(1) Apron and access	2,000	m	1,400	70	600	30	2,000	2,800	1,200	**4,000**
Subtotal								**2,800**	**1,200**	**4,000**
2.3. Utilities										
(1) Utilities	2,000	m	700	70	300	30	1,000	1,400	600	**2,000**
Subtotal								**1,400**	**600**	**2,000**
2.4. Pushar and Tugboat Basin										
(1) Quay wall	500	m	1,500	30	3,500	70	5,000	750	1750	**2,500**
(2) Apron and Access	500	m	1,400	70	600	30	2,000	700	300	**1,000**
(3) Utilities	500	m	700	70	300	30	1,000	350	150	**500**
Subtotal								**1800**	**2200**	**4,000**
Total for Civil Works								**9,500**	**11,600**	**21,100**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

Table 8.4.15 Breakdown of Construction Cost
(Inland Transport Facilities; Between 2006 and 2007)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						**400**	**500**	**900**
2. CIVIL WORK										
2.1. Road										
(1) Class A, (25m wide)	4,000	m	700	70	300	30	1,000.0	2,800	1,200	**4,000**
(2) Class B, (20m wide)	3,000	m	525	70	225	30	750.0	1,575	675	**2,250**
(3) Class C, (15m wide)	3,000	m	350	70	150	30	500.0	1,050	450	**1,500**
Subtotal								**5,425**	**2,325**	**7,750**
2.2. Bridge (Gate No. 5 Access)										
(1) Bridge	500	m	6,000	30	14,000	70	20,000	3,000	7,000	**10,000**
Subtotal								**3,000**	**7,000**	**10,000**
2.3 Road (South)										
(1) Class A (25 m wide)	5,000	m	1,050	70	450	30	1,500	5,250	2,250	**7,500**
(2) Class B (20 m wide)	4,000	m	604	70	259	30	863	2,416	1,036	**3,452**
Subtotal								**7,666**	**3,286**	**10,952**
Bridge (South)										
(1) Bridge (long span)	200	m	30,000	30	70,000	70	100,000	6,000	14,000	**20,000**
(2) Bridge (short span)	300	m	6,000	30	14,000	70	20,000	1,800	4,200	**6,000**
Subtotal								**7,800**	**18,200**	**26,000**
Total for Civil Works								**24,291**	**31,311**	**55,602**

Table 8.4.16 Breakdown of Construction Cost
(Breakwater and Wet Basin; Between 2008 and 2009)

(As of December 2000, $1.0 = 115 Yen = 26,000 Lei)

Description of work	Quantity	Unit	Unit Price					Total Amount		
			Local Component		Foreign Component		Total	Local Component	Foreign Component	Total
			(USD)	%	(USD)	%	(USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
1. INDIRECT CONSTRUCTION										
1.1. Mobilization, Temporary Facilities, etc.	5	%						**4,000**	**3,000**	**7,000**
2. CIVIL WORK										
2.1. Breakwater										
(1) Breakwater	1,000	m	70,000	70	30,000	30	100,000	70,000	30,000	**100,000**
Subtotal								**70,000**	**30,000**	**100,000**
2.2. Wet Basin										
(1) Dredging	1,100,000	m3	8	20	32	80	40	8,800	35,200	**44,000**
Subtotal								**8,800**	**35,200**	**44,000**
Total for Civil Works								**82,800**	**68,200**	**151,000**

Note 1. Same amount of those shown above is used for both Case 1 and Case 2.

8.5 Replacement Cost

In order to carry out the preliminary economic evaluation of project components, the required costs during operation stage should be estimated for each terminal. There are three basic cost items required for operation, namely.

- ✓ Replacement cost of cargo handling equipment
- ✓ Maintenance cost of provided facilities
- ✓ Operation cost of the terminal

This section deals with the replacement cost of equipment. Both container terminal and grain terminal have large investments in this regards.

The service life of equipment will be between 5 and 20 years, depending on the type of the equipment; the required replacement costs are estimated accordingly. At this stage to simplify the calculation, it is assumed that 2/3 of the equipment are replaced after 15 years.

8.6 Maintenance Cost

(1) Civil and Building Works

Civil and building works will require periodic maintenance and repair. Based on the Consultant's experiences in other similar projects, 0.3% of construction cost is assumed.

(2) Cargo Handling Equipment

The following rates of maintenance cost for equipment including new purchased and existing units are applied to this cost estimate.
Cargo Handling Equipment : 3 % of capital cost per year

8.7 Operation Cost

Operation costs for the project will cover costs for administration and operation staff, and fuel and power consumption cost in the port.
Based on the current operation cost and past experience, the operation cost per cargo throughput is estimated for each terminal. In case no data is available, it is assumed at USD 1.0 /ton for the Container Terminal and USD 0.62 /ton for the Grain terminal or Edible Oil Terminals.

8.8 Preliminary Disbursement Schedule

To verify the project characteristics, one of important assessments is looking on the financial requirement, namely the total amount, payment schedule and its contents. In order to outlook the financial requirements disbursement schedule of the two major master plan components was prepared.

- **Container Terminal Plan: Phase 2 & Phase 3**
- **Grain Terminal Plan: Phase 1 (mainly to export bulk grains)**

For the former, two schedules were prepared for both Case 1: High Traffic and Case:2 Medium Traffic. The required works for this are those for container terminal development in Phase 2 and Phase 3.

Note: Disbursement schedule of the Phase 1 development container terminal was excluded from study, since it was financed by JBIC and is on-going project, at the South Port Pier S2.

For the latter, two development alternatives by the construction site were taken in consideration namely,

- **Alternative S1 or Alternative Berth Nos. 31/33**
- **Alternative S3**

S1 is the South Port Pier 1 where an existing grain terminal is providing the port services.
It is concluded to study those of Case 1 (8.5 million tons including the net traffics o f6.5 million tons plus fluctuation in 2.0 million tons in 2020) only. Because the traffic of Case 2 (4 million tons including the net traffics of 2.5 million tons plus fluctuation in 1.5 million tons in 2020) is not enough to justify to install a new grain terminal considering to the existing bulk grain export capacity in 3,7milliom tons.

As a summary of the above, disbursement schedules for 30 years are presented in four sheets of Tables 8.8.1a through 8.8.2b.

Table 8.8.1a Disbursement Schedule for Container Terminal
Case 1: Phase 2 and Phase 3

1) Evaluation was carried out combining Phase 1 and Phase 2.
2) Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3) Total traffic demand is the total containerized general cargo as shown in Table 3.8.14 (Case 1) of Part II or Appendix IIA.

4) Existing capacity after Phase 1 container terminal development at S2: 3.13 million tons in containerized general cargo. Or 375,000 TEUs including empty containers.
5) Capacity of Phases 2 &3: 3.13 million tons in containerized general cargo.
6) Throughput of new terminal: Share in 50% after gradual increase in the first five years
7) Final disbursement schedule in cash flow base will be shown in Table 9.3.7 of Part II.

Table 8.8.1b Disbursement Schedule for Container Terminal
Case 2: Phase 2 and Phase 3

1) Evaluation was carried out combining Phase 1 and Phase 2.
2) Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3) Total traffic demand is the total containerized general cargo as shown in Table 3.8.15 (Case 2) of Part II or Appendix IIA.
4) Existing capacity after Phase 1 container terminal development at S2: 3.13 million tons in containerized general cargo. Or 375,000 TEUs including empty containers.
5) Capacity of Phases 2 &3: 3.13 million tons in containerized general cargo.
6) Throughput of new terminal: Share in 50% after gradual increase in the first five years
7) Final disbursement schedule in cash flow base will be shown in Table 9.3.8 of Part II.

Table 8.8.2a Disbursement Schedule for Grain Terminal
Case 1: Phase 1: Alternative S1 or Alternative Berth Nos. 31/33

1) Evaluation was carried out for only Phase 1.
2) Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3) Total traffic demand is the total containerized general cargo as shown in Table 3.8.3, Part II or Appendix IIA.
4) Existing capacity of grain terminals in the port: 3.70 million tons in bulk grain.
5) Capacity of Phase 1: 2.00 million tons in bulk grain exports.
6) Throughput of new terminal: Share in 35.1%.
7) Final disbursement schedule in cash flow base will be shown in Table 9.3.20 of Part II.

Table 8.8.2b Disbursement Schedule for Grain Terminal
Case 1: Phase 1: Alternative S3

1) Evaluation was carried out for only Phase 1.
2) Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3) Total traffic demand is the total containerized general cargo as shown in Table 3.8.3, Part II or Appendix IIA.
4) Existing capacity of grain terminals in the port: 3.70 million tons in bulk grain.
5) Capacity of Phase 1: 2.00 million tons in bulk grain exports.
6) Throughput of new terminal: Share in 35.1%.
7) Final disbursement schedule in cash flow base will be shown in Table 9.3.17 of Part II.

For all the tables, common conditions are applied as follows.

1) Physical contingency: Civil Works 10.0%, Equipment 5.0%
2) Engineering Fees: Six % to the total of civil cost and equipment cost.
3) Equipment replacement cost is set as two third of initial cost at every 15 years after operation.
4) Operation cost is tentative and should be verified by the operation experts.

Final disbursement schedule will be provided in Section 9.3 of Part II.

Table 8.8.1a Disbursement Schedule for Container Terminal

Case 1: Phase 2 and Phase 3

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Traffic Demand Forecast (1,000 ton)	938	1,052	1,172	####	####	####	####	2,286	2,544	2,868	3,181	3,428	####	3,979	4,287	####	4,990	5,370	5,755	6,142	####	####	####	####	####	####	####	####	####	####	####	####	####
Existing Capacity : Phase 1 (1,000t)	3,130	3,130	3,130	####	####	####	####	3,130	3,130	3,130	3,130	3,130	####	3,130	3,130	####	3,130	3,130	3,130	3,130	####	####	####	####	####	####	####	####	####	####	####	####	####
Share of New Terminal											10.0%	20%	30%	40%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Throughput of New Terminal;	0	0	0	0	0	0	0	0	0	0	318	686	####	1,592	2,143	####	2,495	2,685	2,878	3,071	####	####	####	####	####	####	####	####	####	####	####	####	####

Capital Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works									9.09	9.09				4.74	4.74																			
Equipment									15.88	15.88				4.92	4.92																		
Physical Contingency									1.70	1.70				0.72	0.72																		
Engineering Fee							1.60		0.80	0.80		0.62		0.31	0.31																		
Total				-	-	-	**1.60**		**27.48**	**27.48**	-	**0.62**	-	**10.69**	**10.69**	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Maintenance Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works, 0.3%										0.06	0.06	0.06	0.06	0.06	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Equipment, 3.0%										1.00	1.00	1.00	1.00	1.00	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Total				-	-	-	-	-		**1.06**	**1.06**	**1.06**	**1.06**	**1.06**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.40**	**1.4**

Replacement Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Equipment																									21.2					6.6			
Total																									**21.2**					**6.6**			

Operation Cost																																	
($1,000,000)																																	
Power Consumption	$0.07/ton			0	0	0	0	0	0	0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Fuel Consumption	$0.4/ton			0	0	0	0	0	0	0	0.1	0.3	0.4	0.6	0.9	0.9	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Adm. Expenses	$0.53/ton			0	0	0	0	0	0	0	0.2	0.4	0.6	0.8	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Total				0	0	0	0	0	0	0	**0.3**	**0.7**	**1.1**	**1.6**	**2.1**	**2.3**	**2.5**	**2.7**	**2.9**	**3.1**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**	**3.3**

Notes.
1 Evaluation was carried out combining Phase 1 and Phase 2.
2 Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3 Total traffic demand is the total containerized general cargo as shown in Table 3.8.14 (Case 1) of Part II or Appendix IIA.
4 Existing capacity after Phase 1 container terminal development at S2: 3.13 million tons in containerized general cargo. Or 375,000 TEUs including empty containers.
5 Capacity of Phases 2 &3: 3.13 million tons in containerized general cargo.
6 Throughput of new terminal: Share in 50% after gradual increas in the first five years
7 Physical contingency: Civil Works 10.0%, Equipment 5.0%
8 Engineering Fees: Six % to the total of civil cost and equipment cost.
9 Equipment replacement cost is set as two third of initial cost at every 15 years after operation.
10 Opetration cost is tentative and should be verified by the operation expart.
11 Final disbursement schedule in cash flow base will be shown in Table 9.3.7 of Part II.

Table 8.8.1b Disbursement Schedule for Container Terminal

Case 2: Phase 2 and Phase 3

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Traffic Demand Forecast (1,000 ton)	940	1,039	1,148	####	####	####	####	1,891	2,089	2,309	2,551	2,717	####	3,082	3,282	####	3,723	3,965	4,222	4,497	####	####	####	####	####	####	####	####	####	####	####	####	####	####
Existing Capacity : Phase 1 (1,000t)	3,130	3,130	3,130	####	####	####	####	3,130	3,130	3,130	3,130	3,130	####	3,130	3,130	####	3,130	3,130	3,130	3,130	####	####	####	####	####	####	####	####	####	####	####	####	####	####
Share of New Terminal																10%	20%	30%	40%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Throughput of New Terminal;	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	350	745	1,189	1,689	2,248	####	####	####	####	####	####	####	####	####	####	####	####	####	####

Capital Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works														9.09	9.09				4.74	4.74													
Equipment														12.51	12.51				4.92	4.92													
Physical Contingency														1.53	1.53				0.72	0.72													
Engineering Fee												1.39		0.69	0.69		0.62		0.31	0.31													
Total				-	-	-						**1.39**		**23.83**	**23.83**	**-**	**0.62**	**-**	**###**	**10.7**	0	0	0	0	0	0	0	0	0	0	0	0	0

Maintenance Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works, 0.3%										0.06	0.06	0.06	0.06	0.06	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Equipment, 3.0%										0.79	0.79	0.79	0.79	0.79	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.1
Total				-	-	-	-	-		**0.85**	**0.85**	**0.85**	**0.85**	**0.85**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**

Replacement Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Equipment																									16.7					6.6			
Total																									**16.7**					**6.6**			

Operation Cost																																	
($1,000,000)																																	
Power Consumption	$0.07/ton			0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Fuel Consumption	$0.4/ton			0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.7	0.9	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Adm. Expenses	$0.53/ton			0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.9	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Total				0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	**0.3**	**0.7**	**1.2**	**1.7**	**2.2**	**2.4**	**2.6**	**2.7**	**2.9**	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**

Notes. 1 Evaluation was carried out combining Phase 1 and Phase 2.
2 Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3 Total traffic demand is the total containerized general cargo as shown in Table 3.8.15 (Case 2) of Part II or Appenndix IIA.
4 Existing capacity after Phase 1 container terminal development at S2: 3.13 million tons in containerized general cargo. Or 375,000 TEUs including empty containers.
5 Capacity of Phases 2 &3: 3.13 million tons in containerized general cargo.
6 Throughput of new terminal: Share in 50% after gradual increas in the first five years
7 Physical contingency: Civil Works 10.0%, Equipment 5.0%
8 Engineering Fees: Six % to the total of civil cost and equipment cost.
9 Equipment replacement cost is set as two third of initial cost at every 15 years after operation.
10 Opetration cost is tentative and should be verified by the operation expart.
11 Time of investment in Case 2 should be carefully be evaluated including a choice to postpone investment delaying five years than Case 1.
12 Final disbursement schedule in cash flow base will be shown in Table 9.3.8 of Part II.

Table 8.8.2a Disbursement Schedule for Grain Terminal

Case ***Case 1, Phase 1: Alternative S1 or Alternative Berth Nos. 31/33***

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Traffic Demand Forecast (1,000t)	1.913	2.080	2.261	####	2.672	2.905	3.158	3.433	3.732	4.059	4.410	4.602	####	5.012	5.230	####	5.648	5.844	####	####	####	####	6.477	####	####	####	####	####	####	####	####	####	####
Existing Capacity before Phase 1 (1,000t)	2.500	2.500	3.000	####	3.700	3.700	3.700	3.700	3.700	3.700	3.700	3.700	####	3.700	3.700	####	3.700	3.700	####	####	####	####	3.700	####	####	####	####	####	####	####	####	####	####
Share of New Terminal 2.0/(3.7+2.0) = 0.351	0	0	0	0	0	0	0	0	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351
Throughput of New Termi	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.310**	**1.425**	**1.548**	**1.615**	**####**	**1.759**	**1.836**	**####**	**1.982**	**2.051**	**####**	**####**	**####**	**####**	**2.273**	**####**	**####**	**####**	**####**	**####**	**####**	**####**	**####**	**####**	**####**

Capital Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works							13.2	13.2																									
Equipment							21.3	21.3																									
Physical Contingency							2.39	2.39																									
Engineering Fee					2.21		1.11	1.11																									
Total				-	**2.21**	-	**38.02**	**38.02**			-					-	-	-	0	0	0	0	0	0	0	0	0	0	0				0
Maintenance Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works, 0.3%								0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Equipment, 3.0%								1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
Total				-	-	-	-	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**
Replacement Cost																																	
($1,000,000)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Equipment																							28.41										
Total																							28.41										
Operation Cost																																	
($1,000)																																	
Adm. Expenses	$0.62/ton			0.00	0.00	0.00	0.00	0.00	0.81	0.88	0.96	1.00	1.05	1.09	1.14	1.19	1.23	1.27	1.32	1.36	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Total				0.00	0.00	0.00	0.00	0.00	**0.81**	**0.88**	**0.96**	**1.00**	**1.05**	**1.09**	**1.14**	**1.19**	**1.23**	**1.27**	**1.32**	**1.36**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**

Notes. 1 Evaluation was carried out for only Phase 1.
2 Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3 Total traffic demand is the total containerized general cargo as shown in Table 3.8.3, Part II or Appendix IIA.
4 Existing capacity of grain terminals in the port: 3.70 million tons in bulk grain.
5 Capacity of Phase 1: 2.00 million tons in bulk grain exports.
6 Throughput of new terminal: Share in 35.1%.
7 Physical contingency: Civil Works 10.0%, Equipment 5.0%
8 Engineering Fees: Six % to the total of civil cost and equipment cost.
9 Equipment replacement cost is set as two third of initial cost at every 15 years after operation.
10 Opetration cost is tentative and should be verified by the operation expart.
11 Final disbursement schedule in cash flow base will be shown in Table 9.3.20 of Part II.

Table 8.8.2b Disbursement Schedule for Grain Terminal

Case ***Case 1, Phase 1: Alternative S3***

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Traffic Demand Forecast (1,000t)	1.913	2.080	2.261	####	2.672	2.905	3.158	3.433	3.732	4.059	4.410	4.602	####	5.012	5.230	####	5.648	5.844	####	####	####	####	6.477	####	####	####	####	####	####	####	####	####	####
Existing Capacity before Phase 1 (1,000t)	2.500	2.500	3.000	####	3.700	3.700	3.700	3.700	3.700	3.700	3.700	3.700	####	3.700	3.700	####	3.700	3.700	####	####	####	####	3.700	####	####	####	####	####	####	####	####	####	####
Share of New Terminal 2.0/(3.7+2.0) = 0.351	0	0	0	0	0	0	0	0	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351
Throughput of New Terminal									**1.310**	**1.425**	**1.548**	**1.615**	####	**1.759**	**1.836**	####	**1.982**	**2.051**	####	####	####	####	**2.273**	####	####	####	####	####	####	####	####	####	####

Capital Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works							24.4	24.4																									
Equipment							21.3	21.3																									
Physical Contingency							3.51	3.51																									
Engineering Fee					2.96		1.48	1.48																									
Total				-	**2.96**	-	**50.75**	**50.75**			-					-	-	-	0	0	0	0	0	0	0	0	0	0	0	0				0
Maintenance Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Civil Works, 0.3%								0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Equipment, 3.0%								1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
Total				-	-	-	-	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.5**
Replacement Cost																																	
($1,000,000)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Equipment																							28.41										
Total																							**28.41**										
Operation Cost																																	
($1,000,000)																																	
Adm. Expenses	$0.62/ton			0.00	0.00	0.00	0.00	0.00	0.81	0.88	0.96	1.00	1.05	1.09	1.14	1.19	1.23	1.27	1.32	1.36	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Total				0.00	0.00	0.00	0.00	0.00	**0.81**	**0.88**	**0.96**	**1.00**	**1.05**	**1.09**	**1.14**	**1.19**	**1.23**	**1.27**	**1.32**	**1.36**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**	**1.41**

Notes. 1 Evaluation was carried out for only Phase 1.
2 Throughput of new terminal might be determined taking both the capacity between the existing terminal and new terminal.
3 Total traffic demand is the total containerized general cargo as shown in Table 3.8.3, Part II or Appendix IIA.
4 Existing capacity of grain terminals in the port: 3.70 million tons in bulk grain.
5 Capacity of Phase 1: 2.00 million tons in bulk grain exports.
6 Throughput of new terminal: Share in 35.1%.
7 Physical contingency: Civil Works 10.0%, Equipment 5.0%
8 Engineering Fees: Six % to the total of civil cost and equipment cost.
9 Equipment replacement cost is set as two third of initial cost at every 15 years after operation.
10 Opetration cost is tentative and should be verified by the operation expart.
11 Final disbursement schedule in cash flow base will be shown in Table 9.3.17 of Part II.

CHAPTER 9 PRELIMINARY ECONOMIC EVALUATION

The purpose of preliminary economic analysis of the projects proposed in the Master Plan is to evaluate its economic viability by comparing alternatives. This evaluation will be conducted from the viewpoint of national economy. The viability of proposed project will be evaluated by an indicator, namely, using economic internal rate of return (EIRR) and benefit-cost ratio (B/C).

Individual evaluation will be carried out for selecting the projects to be nominated to the Short Term Development Plan.

9.1 Basic Methodology

9.1.1 Project Classification by Characteristics

As seen in the Chapter 6, Section 6.5, the New Master Plan is proposed with alternatives. In the Maser Plan, no priority scheme is confirmed yet, thus in this chapter no particular project component has been identified as the one for implementation. However project candidates are classified into two groups for this evaluation: namely,

- New Master Plan Project
- Existing project (including under consideration projects)

The former contains seven project components and the latter has eleven candidates.

9.1.2 Proposed Methodology

The preliminary economic evaluation of the project will summarize the impact of the project on the national economy of Romania in economic terms. It shows the benefits of port users and port-related activities and the cost of both project sponsors, which is MOT (CPA), and private investors (cargo terminal operators etc.).

Port development will consist of several stages. Stage 1 contains only the Master Plan development projects. Stage 2 may comprise a Short-term Plan. Only the selected priority projects from the Short-term Plan will be included in the scope of feasibility study.

The economic evaluation of the Port of Constantza will be conducted on the basis of **Cost-Benefit Analysis (CBA)** of the project. The methodology applied is basically in line with the international standard required for projects financed by IBRD, JBIC or other international financial agencies.

9.1.3 Cost Benefit Analysis: CBA

The cost estimates estimated in previous chapters (see Chapter 8) are based on market prices at site. For the economic analysis, the financial cost estimates will be divided into foreign currency portions and local currency portions in order to deduct import duties from foreign currency portion and indirect taxes from local currency portion.

The project's benefits are derived from a comparison between the anticipated situation "with" and "without" the project (i.e. with-the-project case and without-the-project case). The situation of without-the-project reflects the potential impacts of the case of not implementing the components of the Port of Constantza Project.

Project benefits include both quantifiable and non-quantifiable benefits, but benefits will be quantified as much as possible. Based on the comparison between "with-the-project" case versus "without-the-project" case, **the following benefits could be quantified**.

- Savings of waiting time for vessel at the Port of Constantza.
- Savings of interest on the value of the cargoes generating from waiting times vessels.
- Savings of ship lease cost for saved waiting time of vessel at the Port Constantza.
- Savings of ship lease cost for navigation by ship size scales of economy

The major **non-quantifiable benefits** of the Port of Constantza project are:

- Avoidance of traffic diversion to other ports and savings from higher transport cost
- Benefits from port generated investments at the Port of Constantza Free Zone
- Avoidance of negative factors influencing the national economy
- Other than these, there are possible benefits from cost saving from transportation of cargo on direct route services by larger mother vessels including Post-Panamax fleet without transshipment at other major ports. These benefits will dramatically increase in changing from "feeder port" to "call port". There will also undoubtedly be cost savings due to the use of larger (Post-Panamax) vessels.
- Such cost savings will accrue directly to the shipping companies operating such vessels. As most (if not all) of the shipping companies operating Post-Panamax vessels are based abroad, it is doubtful whether or not and to what extent they would transfer such cost savings as an indirect benefit to the Romanian economy (i.e. to exporters and importers), in form of freight tariff reductions. Freight tariffs are subject to market conditions, which are often determined and dominated by international shipping conferences formed by the large shipping companies.

In order to calculate benefit on the "safe side", this benefit which is difficult to quantify, will therefore, not be included as a quantifiable benefit but as a non-quantifiable one.

9.1.4 With-The-Project Case versus Without-The-Project Case

The definition of the without-the-project case is one of the crucial prerequisites for a practical economic evaluation of the project. The without-the-project case does not usually include any major investments for extension of existing infrastructure capacities. The without-the-project case is therefore usually a hypothetical case. It should nevertheless represent, as far as possible, a realistic simulation scenario of the hypothetical situation.

The basic assumptions of the without-the-project case for the Port of Constantza are as follows:

- The port infrastructure and facilities at the Port of Constantza will be used up to their capacity limits.
- Government and MOT(CPA)'s policies will be applied according to the objectives outlined and officially stated

Under these given constraints, the whole traffic volumes would be loaded and unloaded at existing facilities within area of the Port of Constantza with the following results.

- All remaining volumes of the cargo forecast for the Port of Constantza are assumed to be handled at the Port of Constantza
- Increasing congestion of the Port of Constantza will entail long ship waiting times.
- Large parts of the estimated cargo volumes will divert to other ports or modes with the consequence of higher transportation cost and longer transport times.

9.1.5 Economic Pricing

The project cost evaluated by financial prices will be converted into the economic prices in order to avoid distortion of the economy which is generated by the following factors:

- Controlled prices not reflecting real market prices (one example of which is the minimum wage regulation)
- 'Artificial' raising (or lowering) of prices of goods and services by compulsory charges on the existing value added portion of such goods and services (e.g. by indirect taxes on value added, customs duties, fees etc.) or by subsidies
- Inflationary trends.

Then the project costs have to satisfy the following conditions.

- Reflect the real economic value of a determined good or service
- Constant price (at 2000 prices) i.e. excluding expected inflationary trends in order to use only real terms.

- If prices do not reflect real market prices, **shadow prices** have to be used in economic evaluation instead of distorted prices. In the preliminary economic evaluation, the project cost in the financial price is not divided into the local currency portion and foreign currency portion. Then the project cost in the financial price is tentatively considered to be the local currency portion and the **standard conversion factor (SCF)** for shadow pricing, 0.986, for the local currency portion is applied to the economic pricing of the project cost. The SCF was derived by averaging the international trade statistics for five years from 1994 to 1998 in Romania.

The costs for unskilled labor (forming part of the construction cost and some part of the cargo handling cost which is subject to minimum wage regulations.) does not usually reflect real market prices. Thus, the shadow price is applied to the economic pricing cost for unskilled labor.

In this study, it is assumed that the basic minimum gross salary of Romania (1 million lei per month, or 30 thousand lei per day) is considered a realistic market price for unskilled labor. Thus, the wages of unskilled labor on construction works for the projects in this Study will be converted into realistic market price by the shadow price on the basis of the basic minimum gross salary mentioned above.

However, in the preliminary economic evaluation, the project costs are not divided into the labor cost and material cost respectively and the labor cost is not classified into the skilled and the unskilled. Thus the shadow prices for the unskilled labor are not applied in the preliminary study but will be applied in the Feasibility Study.

The economic versus financial cost calculations therefore focus on the two major items:

- Indirect taxes, VAT (tax on value added) of 19 %
- Deduction of customs duties for investment cost as far as imports are concerned.

Actually, the estimated project cost in the preliminary economic evaluation is not included the indirect taxes and custom duties. Thus these two items do not needed to be deducted for economic pricing.

9.1.6 Assumption

The “Base Year” in this Study means the starting year of the economic analysis and is set at the year of 2000.

The period of evaluation in the economic analysis is assumed to be thirty years after the implementation work of the projects.

The exchange rate adopted for this analysis will be US $ 1.00 = 25,300. Lei =110 Yen.
Most of the benefits from avoiding waiting times and savings of ship lease cost by ship size scales of economy will accrue to foreign shipping companies. On the contrary, the share of Romanian shipping companies in Romania's total sea transport is still comparatively low.

Usually benefits which accrue to foreign subjects and institutions are not included in economic analysis since only benefits accruing to the national economy are considered in the analysis. However, there is no doubt that the additional cost for waiting times to foreign shipping companies would be transferred to Romania's national economy in the form of higher than world market prices both for imported and exported goods. In the end, Romania's producers and consumers would have to pay for longer waiting times at the Port of Constantza. Furthermore, it is expected that Romania will acquire the membership of EU in the near future. After the Romania's EU membership, Romania will be socially and economically more closely related to other EU member countries and the attributability of the benefits to Romanian economy will be more strengthened. Thus in this Study, a hundred percent of the benefits are assumed to be included in the benefit of economic analysis.

9.1.7 Criteria of Project Evaluation

CBA, Cost Benefit Analysis aims at a realistic estimate of project benefits and costs. The key indicators of the result of CBA are:

- **NPV (Net Present Value)**
- **EIRR (Economic Internal Rate of Return)**
- **C/B Ratio (Cost Benefit Ratio)**

These criteria are related to the adopted economic discount rate which is also often referred to as **'cut-off ratio'** or 'target rate'. Although the economic discount rate is more or less clearly defined in economic theory (equal to the **Opportunity Cost of Capital** or alternatively to the social time preference), there is a wide range of definitions in practice. According to the sources obtained, the 'target rate' for public transport projects in Romania is assumed to be in the range of **12 to 15 %**.

9.2 Basic Criteria in Economic Feasibility Analysis

9.2.1 Costs

(1) Initial Cost, O/M Cost and Tax

The estimates of the economic costs of the project will be based on the Basic investment cost calculations as outlined in Chapter 8. These cost estimates are calculated on an on-site-basis. Therefore, they had to be converted to economic costs, if any.

The economic cost in this study will include:

- Investment cost of the Port of Constantza, general works to be funded by MOT(CPA)
- Investment cost of the Port of Constantza, structures and equipment to be funded by terminal operators (BOT or Lease Contract)
- Maintenance and operation cost related to the terminals to be developed.

In order to estimate the import duties, a split into foreign and local cost for all major cost components will be elaborated.

Based on the existing custom duties, the following item assumptions will be taken account of deduction from the financial cost for the economic evaluation.

- Cargo handling equipment
- Utilities, drainage and sewerage
- Other investment goods

Because financial costs are calculated at market prices, the VAT of 19% will be deducted from the total financial cost.

As a result of this calculation scheme, total economic cost over the whole study period (including reinvestment) for the Port of Constantza will be estimated.

As to the calculation of the economic maintenance cost, the same procedure as for the investment cost will be applied to economic pricing.

(2) Equipment Replacement Cost

Besides those cost mentioned above, equipment replacement cost will also be included. As discussed in Section 8.5, the replacement period of equipment is ten (10) years for the major equipment such as quay/wharf crane and yard crane, and five (5) years for supplemental equipment. Average life of equipment will be shorter than those of UNCTAD life, since UNCTAD recommends to give fifteen (15) years and eight (8) years respectively.

In this economic evaluation, shorter life of equipment is used based on the following reasons.

- Terminal operators in the Port of Constantza give estimates of equipment life.
- The enormous increase of cargo throughput, which has to be handled by the equipment, will certainly lead to higher “wear and tear” of the equipment than at current throughput levels. Equipment will be used “round the clock.” All this will lead in future to decreasing useful equipment life.

- Estimate of the future useful equipment life , seen from an economic point of view, lies "on the safe side". An extension of the useful equipment life would not have any significant impact on EIRR/NPV as initial investment costs, cargo throughput, productivity, revenues etc are much more important for EIRR than the useful life of these equipment parts. If the longer equipment life is given, the change on EIRR could only be seen in marginal figures

9.2.2 Estimation of Ship Waiting Time

(1) General Approach

Ship waiting times are directly related to the amount of economic benefits. Thus estimation of them should be carefully carried out on both theoretical mean and common value for actual experience. UNCTAD method is used for the former.

(2) UNCTAD Method

The procedure to estimate the ship waiting times by UNCTAD method in the without-the-project case starts from the following basic approach:

- A modified vessel call forecast will take into consideration that in the existing facilities (which defines port capacities and facilities of the without-project case) maximum vessel size will be limited.
- The waiting time calculation model published in the handbook for PORT DEVELOPMENT by the United Nations Conference on Trade and Development (UNCTAD) (Second Edition 1985) has been applied basically .

(3) Value of Cargoes

In this study, the value of the cargoes is considered to be the shipper's capital fund to be saved in bank during the period for the time they are waiting for berthing and earn the interests for short-term savings. The interest will be attributed to the "with-the-project" case as benefit.

The value per cargo unit is calculated according to the import-export statistics as outlined in previous chapter and then multiplied by the following:

- Cargo volume in tons
- Saving Time of ship waiting

The unit price of cargo and unit time value of cargo are shown in Table 9.3.1.

9.2.3 Benefits

(1) Quantifiable Benefits

The most important monetarily quantifiable benefits of the Port of Constantza ("with-the-project" case) against the "without-the-project" case" (port capacity of the existing Port of Constantza) are the waiting times of the ships calling at the Port of Constantza.

Table 9.3.1 Unit Price and Time Value of Traded Cargo of Romania

No	Cargo Classification	Unit Price		Time Value	
		Lei/ton	US$/ton	(Lei/ton/day)	(US$/ton/day)
1	Cereals	3,364,096	133	3,041.51	0.12
2	Fresh Fruits and Vegetables	11,039,371	436	9,980.80	0.39
4	Foods, Liquors, Tobacco	25,492,793	1,008	23,048.28	0.91
5	Seeds, oils, fats	9,905,356	392	8,955.53	0.35
6	Timber, fire wood	8,320,089	329	7,522.27	0.30
7	Natural, chemical fertilizers	2,672,939	106	2,416.63	0.10
8	Mineral rough products (quarry)	3,020,842	119	2,731.17	0.11
9	Iron Ore, scrap	637,277	25	576.17	0.02
10	Non metal ore	1,191,808	47	1,077.52	0.04
11	Textile, textile fiber and products	350,529	14	316.92	0.01
12	Paste, recycled paper	26,419,771	1,044	23,886.37	0.94
14	Crude Oil	2,803,413	111	2,534.59	0.10
15	Oil Products and gas	4,353,799	172	3,936.31	0.16
16	Coal and Natural Gas Tars	2,263,635	89	2,046.57	0.08
17	Chemical Products	10,244,835	405	9,262.45	0.37
18	Chalk, cement, construction materials	921,671	36	833.29	0.03
19	Glass, ceramic products	21,188,105	837	19,156.37	0.76
20	Iron / Non Iron Metals	11,531,358	456	10,425.61	0.41
22	Cars, transport materials	148,919,566	5,886	134,639.61	5.32
Container Cargo		395,214	16	357.32	0.01
General Cargo		395,214	16	357.32	0.01

Unit price was calculated on the basis of "Annual International Trade Statistics", National Commission of Statistics, Romania.
Timevalue was calculated on the basis of Interest rate for one month deposit (33%) of Bancpost in Dec. 2000.

As outlined in the traffic forecast, transshipment/transit is of major importance for the Port of Constantza. The predominant role of the Port of Constantza is to assure not only import and export flows of cargoes and goods but also transshipment/transit cargoes.

Beside the limited port capacities at other ports, the Port of Constantza is (and will be in the foreseeable future) the only deep sea port for cargoes and goods carried by mother vessels in Romania.

It is quite evident that in the "without-the-project" case long waiting times for ships calling at the Port of Constantza would very quickly occur after several years of saturation and cargo overflow. Despite long waiting times for ships, limited volumes of cargoes can be handled at the given design capacity of the existing Port of Constantza.

In addition to this, aged equipment facilities should be replaced by new ones. If not, long waiting times for ships calling at the Port of Constantza would also occur in the near future.

(2) Non Quantifiable Benefits

In addition to the quantifiable benefits, non-quantifiable benefits will arise for the with-project case against the without-the-project case in the form of the following:

- Contribution to the national economic development through upgrading of the industries to international standards.
- Improvement of cargo handling safety and reduction of cargo damage
- Project induced job-creation at the Industrial Zone and Export Processing Zone near the Port of Constantza.

All other cargo volumes exceeding this maximum handling capacity of the existing facilities would have to be diverted to other ports or modes of transport. Benefits from this diversion of traffic from the Port of Constantza are not quantifiable in this study.

9.3 Economic Evaluation of the Projects in the Master Plan: New Master Plan Projects

This section covers preliminary economic evaluation of the following seven:

1) Container Terminal Plan
2) Grain Terminal Plan
3) Steel Product Terminal Plan
4) Timber Terminal Plan
5) General Cargo Terminal Plan
6) Road Improvement Plan
7) Barge Terminal Plan

9.3.1 Container Terminal Plan, Phase 2 and Phase 3

Phase 1 container terminal plan project financed by JBIC is smoothly on-going expecting to complete in 2004 to add 375,000TEUs capacity to the port. Major target to the preliminary evaluation are next expansion, Phase 2 and Phase 3 of container terminal.

a. Benefit

Two benefits of Container Terminal Plan are considered to be quantifiable benefits: (i) savings of ship waiting time for cargo and (ii) savings of ship lease cost for saved waiting time.

Savings of Ship Waiting Time for Cargo

As the benefit of port users, the benefit by savings of ship waiting time is estimated on the basis of UNCTAD method mentioned above.

- Traffic Demand Forecast

  The savings of waiting time is estimated for two cases of traffic demand forecast for container cargo. Case-1 is the high growth case scenario and Case-2 is medium low growth scenario.

- No. of Container Boxes in TEU

  The traffic volume of container cargo is converted into the number of TEU by the following assumptions.
  (i) The tonnage of container box of 10f x 10f : 10 tons
  (ii) The tonnage of container box of 40f x 40f: 20 tons
  (ii) Ratio of container box of (10f x 10f): (20fx20f): 50% : 50%

- No. of Berths

  The numbers of existing berths in the without-the-project case are the two in use (berth no. 51 and 52) which are operated by SOCEP in the north port. However, in the future container cargo will be handled in S2 berth in the south port which is under construction and which will be completed in the year of 2004/2005. Thus, for without-the-project case, only two berths will be operated for container cargo handling. On the other hand, the number of berths will be four in total in the with-the-project case since two additional berths are to be newly constructed in the S2 terminal in the area of south port.

- Average Capacity Per Ship and Unit Load Per Ship

  The average capacities of ship and unit load per ship in TEU are set up as follows.

Table 9.3.2 Average Capacity and Unit Load per Ship

Period	(A) Average Capacity (TEU/ship)	(B) Unit Load (TEU/ship)	(C) Rate (B)/(A)
1999-2003	300	300	1.00
2004-2008	444	400	0.90
2009-2012	750	600	0.80
2013-2015	1,143	800	0.70
2016-2017	1,667	1,000	0.60
2018-2020	2,400	1,200	0.50

Source: Interview survey to Operators and JICA Study Team

- Cargo Handling Capacity for Crane

The cargo handling capacity of crane is set up by the following assumption.
(i) No. of cranes per berth : 1.5 (or 3 for two berths)
(ii) Crane capacity : 30TEU/crane･hour (20 boxes/hour x 1.5)

- Waiting Time

On the basis of these assumptions, the occupancy ratio is calculated. Waiting time factor is estimated according to the Queuing Table in UNCTAD handbook for port development (See Table 9.3.3). The waiting time is derived from multiplying waiting time factor by ship time at berth (hour/ship) and No. of ships per year.

- Saved Time of Ship Waiting

The saved time of ship waiting is assumed to be the difference between the waiting time of the without-the-project case and the with-the-project case after the traffic demand of container cargo has reached the handling capacity of existing container terminal. The handling capacity of the existing container terminal is set up at 370,000 TEU of containers which is attained in the year of 2011 in Case-1 and in 2015 in Case-2 respectively. Thus the saved time is calculated as the difference between the waiting time in the without-the-project case and the waiting time in the with-the-project case after these years on the condition that the waiting time for the with-the-project case after attainment of traffic demand of 370,000 TEU is considered to be negligible. Nevertheless once the physical handling capacity of the existing terminal has been attained; the waiting time will not increase. The physical capacity is set up at the waiting time per calling ship as five (120 hours) or seven days (148 hours). In this study, the waiting time per calling ship (which is the physical capacity) is assumed to be 5 days (120 hours) which will be attained in the year of 2022 in Case-1 and of 2026 in Case-2 respectively.

- Time Saving Benefit of Waiting Time

  The time saving benefit of ship waiting time is derived from multiplying the saved waiting time in days per annum by the traffic demand in tons and the unit time value of container cargo as 357.3 lei per day.

  The result of estimation of saved time and the benefit are shown in Tables 9.3.4 and 9.3.5.

Savings of Ship Lease Cost for Saved Waiting Time

As the supplier of port services, the shipping companies will get benefit as the savings of ship cost from the saved time of ship waiting time. The savings of ship cost is estimated on the basis of the ship lease fee.

- Ship Lease Cost

  The ship lease cost per day･ship is set up by type of container as follows:

Table 9.3.6 The Ship Lease Cost by Type of Container Ship

Period	Type of Container Ship (TEU/ship)	Unit Ship Lease Cost (US$/ship)
2013-2015	1,143	5,400
2016-2017	1,667	5,700
2018-2020	2,400	7,200

Source: Nihon Yusen Shipping Co. Ltd.

- Savings Benefit of Ship Lease Cost

  The cost savings benefit of ship lease cost is derived from multiplying the saved time in days per annum by the unit ship lease cost by type of container ship mentioned above. The result of savings of ship lease cost is shown in Tables 9.3.4 and 9.3.5.

b. Cost

Construction Cost

The construction cost as the initial cost for new container terminal is tentatively calculated as US$ 78.3million for Case 1 and US$ 70.8million for Case 2 which includes indirect contractor's indirect cost and physical contingency (10% of civil works) and engineering service fee (4% of local currency portion and 2% of foreign currency portion).

Operation and Maintenance Cost

The Operation is composed of power consumption (US$ 0.07 per ton), fuel consumption (0.4US$ per ton) and administrative expenses (US$ 0.53 per ton) for throughput container traffics of new terminal. The maintenance cost is 0.3% for civil works and 3% for equipment.

These costs do not include taxes such as VAT and are neither divided into local currency portion and foreign currency portion nor divided into materials cost and labor costs. Thus, for the purpose of economic pricing, the standard conversion factor (SCF) of 0.986 is adopted for the project cost as the shadow price for the local currency portion.

c. Economic Evaluation

The economic evaluation is carried out by preparing cash flow streams of economic cost and benefit during the evaluation period. (See Table 9.3.7 and 9.3.8). The result of indicators of economic evaluation such as EIRR, B/C and NPV by case of traffic demand forecast are as follows.

Table 9.3.9 The Result of Calculation of Indicators for Economic Evaluation

Case No. of Traffic Demand Forecast	EIRR (%)	B/C	NPV (1,000 US$)
Case-1: High	**23.57**	2.38	75,397
Case-2: Medium	25.64	3.16	99,120

Note: The discount rate for B/C and NPV is 15%.

The EIRRs of Case-1 and Case-2 are 23.57% and 25.64% respectively. Both of them are considerably higher than the cut-off-ratio of EIRR for judgment of feasibility. Thus the container terminal plan is considered to have high economic viability and it is recommended that the container terminal under construction as Phase-I is necessary to complete on schedule. The construction of new container terminal should be implemented as soon as possible in Phase-II.

9.3.2 Grain Terminal Plan, Phase 1

The Grain Terminal Plan, two alternatives are assumed as follows:

Alternative 1: With-the-Project Case

Alt. 1a Terminal at S3 Pier
Alt. 1b Terminal at S1 Pier
Alt. 1c Terminal at Berths No.31/ 33 in the North Port

Alternative 2: Without-the–Project Case

Alternative-1 is the case that most of facilities for cargo handling of grain except the facilities on Berth No.113 and 114 in the North Port area will close their operation and have their function relocated to the South Port area because most of the facilities are quite old and have not been renovated. Alternative-1 is divided into three Renovation Plans for "with-the-project" case. They are categorized by construction site of terminal: (a) S3 Pier, (b) at S1 Pier and (c) Berths No. 31/33.

a. Alternative-1a: Renovation Plan, At S3 Pier

a) Benefit

There are considered to be three quantifiable benefits of this Plan: (i) savings of ship waiting time for cargo, (ii) savings of ship lease cost for saved waiting time and (iii) savings of ship lease cost for navigation by ship size scales of economy.

Savings of Ship Waiting Time for Cargo

- Traffic Demand Forecast

  The savings of waiting time is estimated for two cases of traffic demand forecast for grain cargo (the same as for container cargo) as the Case-1 and the Case-2.

- No. of Berths

  The number of existing berth in the without-the-project case is assumed to be one (berth no. 114) which is in use and operated by SILOTRANS in the North Port. On the other hand, the number of berths will be two in total in the with-the-project case. The additional berth will be constructed in the area of South Port.

- Average Capacity Per Ship and Unit Load Per Ship

  The average capacity of ship and unit load per ship are set up as 7,500 ton/ship and 6,750 ton/ship (loading factor: 90%) from 2000 to 2036 for the "without-the-project" case and 7,500ton/ship (unit load: 6,750 ton/ship) from 2000 to 2009, 11,250ton/ship (10,125ton/ship) from 2010 to 2019 and 17,500 ton/ship (15,750 ton/ship) for the "with-the-project " case.

- Cargo handling capacity

  The cargo handling capacity is set up as 670 ton/ship･hour.

- Waiting Time

  On the basis of the assumptions mentioned above, the occupancy ratio is calculated. The waiting time factor is estimated according to the Queuing Table in UNCTAD handbook for port development (See Table 9.3.3). The waiting time is derived from multiplying waiting time factor by ship time at berth (hour/ship) and No. of ships per year.

- Saved Time of Ship Waiting

  The saved time of ship waiting is estimated in the same manner as of the container cargo mentioned above. The handling capacity of the existing grain terminal is set up as 2 million tons per year which is attained in 2004 in Case-1 and in 2007 in Case-2 respectively. Thus the saved time is calculated as the difference between the waiting time in the without-the-project case and the waiting time in with-the-project case after these years on the condition that the waiting time in the with-the-project case after attainment of traffic demand in 2 million tons is considered to be negligible.

- Time Saving Benefit of Waiting Time

  The time saving benefit of ship waiting time is derived from multiplying the saved waiting time in days per annum by the traffic demand in tons and the unit time value of container cargo as 3,041.5 lei per day.

The result of estimation of saved time and the benefit are shown in Tables 9.3.10 and 9.3.11.

Savings of Ship Lease Cost for Saved Waiting Time

- Ship Lease Cost

  The ship lease cost per day･ship is set up by type of container as US$ 4,800 /ship･hour for the type of ship with average capacity of 7,500 ton/ship.

- Saving Benefit of Ship Lease Cost

  The saving benefit of ship lease cost by saved waiting time is derived from multiplying the saved time in days per annum by the unit ship lease cost by type of container ship mentioned above. The result of savings of ship lease cost is shown in Tables 9.3.10 and 9.3.11.

Savings of Ship Lease Cost for Navigation by Ship Size Scales of Economy

This benefit is generated from transportation of cargo by the large scale ship.

- Ship Lease Cost

  The unit ship lease cost is set up by the average capacity per ship and unit load per Ship as shown in Table 9.3.12:

- Transport Distance

  The average navigated distance is estimated for the main routes of grain cargo transportation which are mostly between the Port of Constantza and the ports of the northern parts of Africa as 4,000 km (2,100 NM).

Table 9.3.12 Unit Ship Lease Cost

	Period	Average Capacity (ton/ship)	Unit Load (ton/ship)	Unit Ship Lease Cost (US$/ton･day)
Without	2000-2036	7,500	6,750	0.80
With	2000-2009	7,500	6,750	0.80
	2010-2019	11,250	10,125	0.58
	2020-2036	17,500	15,750	0.40

Source : JICA Study Team
Note : 1. Load factor of ship is assumed to be 90%
2. The average capacity is the average of two types of ship:
7,500 and 15,000 ton '2010-2019) and 7,500 ton and 27,500 ton.

- Transport Time

  The average transport time per ship is estimated as 175hours (7.3days) on the assumption of the average speed as 12 NM/hour and transport distance mentioned above as 2,100 NM.

- Saving Benefit of Ship Lease Cost

  The saved cost of ship lease cost for navigation is derived from difference of the with-the-project case and the without-the-project case with regard to the ship lease cost for navigation during the transport time.

  The result of savings of ship lease cost for navigation is shown in Tables 9.3.13 to 9.3.16

b) Cost

Construction Cost

The construction cost as the initial cost for new container terminal is tentatively calculated as US$ 72.6million which includes indirect contractor's indirect cost and physical contingency (10% of civil works) and engineering service fee (4% of local currency portion and 2% of foreign currency portion).

Operation and Maintenance Cost

The operation cost is assumed to be as US$ 0.62 per ton for throughput traffic volume and the maintenance cost is 0.3% for civil works and 3% for equipment.

These costs do not include taxes such as VAT and are not divided into local currency portion and foreign currency portion or materials cost and labor costs. Thus, for the purpose of economic pricing, the standard conversion factor (SCF) of 0.986 is adopted for the project cost as the shadow price for the local currency portion.

c) Economic Evaluation

The economic evaluation is carried out by preparing cashflow streams of economic cost and benefit during the evaluation period. (See Tables 9.3.17 and 9.3.18). The result of indicators of economic evaluation such as EIRR, B/C and NPV by case of traffic demand forecast is as follows:

Table 9.3.19 The Result of Calculation of Indicators for Economic Evaluation: Alternative-1a, Development at S3

Case No. of Traffic Demand Forecast	EIRR (%)	B/C	NPV (1,000 US$)
Case-1	12.6	0.82	-13,803
Case-2	9.2	0.55	-33,455

Note: The discount rate for B/C and NPV is 15%.

The EIRRs of Case-1 and Case-2 are 12.6% and 9.2% respectively. The EIRR of Case-1 is within the range of the cut-off-ratio (12%-15%) and higher than the minimum cut-off-ratio of EIRR as 12% for judgment of feasibility. Then the Alternative-1a Plan is considered to have fair economic viability for both high growth scenarios of traffic demand forecast.

b. Alternative-1b: Renovation Plan, At S1 Pier

a) Benefit

The benefits of this Plan are considered to be the same as the ones of the Alternative-1a but the project cost is different from Alternative-1a.

b) Cost

Construction Cost

The construction cost as the initial cost for new container terminal is about 75% of those for **Alternative-1a** and tentatively calculated as US$ 54.4 million which includes indirect contractor's indirect cost and physical contingency (10% of civil works) and engineering service fee (4% of local currency portion and 2% of foreign currency portion).

Operation and Maintenance Cost

The operation cost is assumed to be US$ 0.62 per ton for throughput traffic volume and the maintenance cost is 0.3% for civil works and 3% for equipment.

These costs do not include taxes such as VAT and are not divided into local currency portion and foreign currency portion or materials cost and labor costs. Thus, for the purpose of economic pricing, the standard conversion factor (SCF) of 0.986 is adopted for the project cost as the shadow price for the local currency portion.

c) Economic Evaluation

The economic evaluation is carried out by preparing cashflow streams of economic cost and benefit during the evaluation period. (See Tables 9.3.20 and 9.3.21). The result of indicators of economic evaluation such as EIRR, B/C and NPV by case of traffic demand forecast is as follows.

Table 9.3.22 The Result of Calculation of Indicators for Economic Evaluation, Alternative 1b at or Berth 31/33

Case No. of Traffic Demand Forecast	EIRR (%)	B/C	NPV (1,000 US$)
Case-1	15.7	1.05	3,086
Case-2	11.4	0.70	-17,266

Note: The discount rate for B/C and NPV is 15%.

The EIRRs of Case-1 and Case-2 are 15.7% and 11.4% respectively. Both of them are almost within the range of the cut-off-ratio (12%-15%). Thus the Alternative-1b Plan is considered to have fair economic viability for both low and high growth scenarios of traffic demand forecast.

c. Alternative-1c: Renovation Plan, At Berth No. 31/33

The project cost of this alternative is the same as Alternative-1b. Thus the benefit and the result of economic evaluation are also the same. Alternative-1c Plan is also considered to have fair economic viability for both low and high growth scenarios of traffic demand forecast.

d. Alternative-2: Conservative Plan, North Port

Alternative-2 is the case that all existing facilities for cargo handling of grain will remain in the North Port area. .

a) Benefit

There are three quantifiable benefits of this Plan: (i) savings of ship waiting time for cargo, (ii) savings of ship lease cost for saved waiting time and (iii) savings of ship lease cost for navigation by ship size scales of economy.

Savings of Ship Waiting Time for Cargo

- No. of Berths

  The number of existing berths in the without-the-project case is five and they are assumed to remain in use. These berths are 1 at berth No. 12, 2 at berth No. 31, 1 at berth No. 61 and 1 at berth No. 114 in the North Port.

- Average Capacity Per Ship and Unit Load Per Ship

  The average capacity of ship and unit load per ship are set up as 7,500 ton/ship and 6,750 ton/ship respectively for all ships to use these five berths.

- Cargo handling capacity

  The cargo handling capacity is set up as 670 ton/ship･hour.

- Waiting Time

  On the basis of the assumptions mentioned above, the occupancy ratio is calculated as far less than 30% and waiting time factor is estimated as mostly zero according to

the Queuing Table in UNCTAD handbook for port development (See Table 9.3.3). Because there is no waiting time factor for the occupancy ratio less than 30% in case of five berths, the waiting time is considered to be negligible or zero. Judging from this result, there is no saving benefit from ship waiting time in Alternative-2.

Savings of Ship Lease Cost for Saved Waiting Time

As the result of estimation for no ship waiting time, there is no benefit of ship lease cost for saved waiting time .

Savings of Ship Lease Cost for Navigation by Ship Scale Economy

The same assumptions are applied to the Alternative-2 for this benefit and the benefit is the same as Alternative-1.

The result of savings of ship lease cost for navigation is already shown in Tables 9. 3.13 and 9.3.16.

b) Cost

The project cost for Alternative-2 is assumed to be the same amount as of **Alternative-1b**, development at existing Berths Nos. 31 to 33.

c) Economic Evaluation

The economic evaluation is carried out by preparing cash flow streams of economic cost and benefit during the evaluation period. (See Tables 9.3.23 and 9.3.24). The result of indicators of economic evaluation such as EIRR, B/C and NPV by case of traffic demand forecast are as follows:

Table 9. 3.25 The Result of Calculation of Indicators for Economic Evaluation

Case No. of Traffic Demand Forecast	EIRR (%)	B/C	NPV (1,000 US$)
Case-1	1.75	0.17	-43,240
Case-2	2.75	0.24	-39,358

Note: The discount rate for B/C and NPV is 15%.

The EIRRs of Case-1 and Case-2 are 1.75% and 2.75% respectively. The higher EIRR value in Case-2 than that of the Case-1 is caused by the relatively earlier generation of benefit for Case-2 after the completion terminal construction as shown in Tables 9.3.14 to 9.3.16. The considerably lower figure of EIRR is because there is no benefit from saved ship waiting time or saved cost of ship lease cost.

Judging from the comparison of economic evaluation between two alternatives, Alternative-1 has high economic viability and is expected to contribute to the efficient utilization of port facilities. Thus it is definitely recommendable that Alternative-1 should be selected as the highly progressive development plan for grain terminal in the Port of Constantza.

9.3.3 Steel Product Terminal Plan (Multi Purpose General Cargo Terminal: M1)

The Pier S1 is now used exclusively by ROMTRANS on the basis of the Joint Venture on January 15, 1997 with C.N. A.P.M.C. S.A. till 2020. Furthermore, SIDEX Galati was privatized in 2001 and its property is owned by the private company.

By taking account of these recent situations with regard to Pier S1 mentioned above, it is not appropriate to plan to construct the new terminal for steel products in the area of Pier S1 at this moment because of the following reasons ;

(i) ROMTRANS's right to use Pier S1 given by the contract mentioned above will be disturbed.
(ii) The plan of production and the management strategy will change in the future. Then the traffic forecast will be necessary to be reviewed.
(iii) The private company might have the keen interests with regard to management the terminal of steel products. It is not appropriate to disregard the opinions of private sectors with regard to the future plan of the terminal for steel products.

Judging from these reasons, JICA Study Team concluded as follows: (1) the Steel Products Terminal Plan should not be included in the Short Term Development Plan but be included only in the Master Plan. (2) There is no necessity of economic study prior to the firm demand and precise development scheme of the terminal.

9.3.4 Timber Terminal Plan (Multi Purpose General Cargo Terminal: M2)

The traffic demand of timber was forecasted to increase until 2009 but to decrease after 2010. The main reasons for the result of this forecast are as follows;

(i) The rapid growth was recorded during the period from 1984 to 1999. Then this could sustain until 2009. But logging without reforestation will bring the serious environmental problem.
(ii) Romania's accession to the European Union imposes certain environmental criteria upon the country, and it is anticipated that the legislative framework will not allow for continued depletion of forest areas.
(iii) Romania does possess large, commercially exploitable forest areas, however, it is understood that access to these areas is limited due to the unavailability of adequate road infrastructure. Romania's accession to these areas is limited due to the unavailability of adequate road infrastructure.

On the basis of these reasons of traffic demand forecast, it is considerably risky to invest on the new Timber Terminal. It is better to wait for construction of new timber terminal until some private investors who have keen interests to invest on the new terminal.

Therefore, JICA Study Team concluded as follows: (1) The Timber Terminal Plan should not be included in the Short Term Development Plan but be included only in the Master Plan. (2) There is no necessity of economic study before the firm demand and precise development scheme of the terminal.

9.3.5 General Cargo Terminal

This plan aims to improve the efficiency of cargo handling by relocation the existing terminal to the area of the South Port. One of the major problems is how to maintain competition among the operators.

The economic benefits by this plan will be generated as follows:

(i) Improved efficiency of ship operation.
(ii) Improved efficiency of cargo handling
(iii) Improved distribution of cargo inland
(iv) Acceleration of harmonious competition and cooperation among operators

From these effects, two quantifiable benefits of the General Terminal Plan are considered to be: (i) savings of berthing time for cargo, and (ii) savings of berthing time for ship lease cost. The more detailed evaluation will be quantitatively carried out by comparison with the cost and benefit.

9.3.6 Road Improvement Plan

This plan aims to meet the increase of future traffic and to improve the traffic circulation safety of the road access. Among the total road arrangement plan prepared by IPTANA, those located near the gate No.5 and No.6 are selected for evaluation.

a. Benefit

There are considered to be two quantifiable benefits of this plan: (i) savings of cargo handling time and (ii) savings of transport time in the port area for inland transport.

b. Cost

Construction Cost

The construction cost as the initial cost for new road access is tentatively calculated as US$ 21.7million which includes indirect contractor's indirect cost and engineering service fee. The physical contingency is assumed to be 10% of construction.

Operation and Maintenance Cost

The operation and maintenance cost is assumed to be 0.3% of construction cost.

These costs do not include taxes such as VAT. Thus, for the purpose of economic pricing, the standard conversion factor (SCF) of 0.986 is adopted to the project cost as the shadow price for the local currency portion.

c. Economic Evaluation

Economic feasibility of this plan will be evaluated as a common facility which is used by all the terminals. The economic viability of this plan will be judged after figuring out the benefits to be generated from this plan.

9.3.7 Barge Terminal Plan

This plan aims to increase the terminal capacity by providing a new quay wall for stand-by empty barges and waiting laden barges for grouping.

a. Benefit

This plan is expected to improve the efficiency of barge movement in the basin of the Port of Constantza and the efficiency of cargo handling at the modernized barge terminal. Thus the following benefits could be quantified: (i) savings of navigation time for cargo and (ii) savings of navigation time for ship lease cost.

This plan is expected to improve the efficiency of the barge movement in the basin of the Port of Constantza and the cargo handling efficiency at the modernized barge terminal. Thus the following benefits could be quantified: (i) savings of cargo moving time, (ii) savings of moving time for lease cost of the barges and pusher, (iii) savings on forming up of a cargo convoy and (iv) savings on forming up of convoy for ship lease cost.

Savings of Moving Time for Cargo

- Traffic Demand Forecast

  The savings of moving time is estimated for traffic demand forecast for barge cargo (Case-1) as the high growth scenario.

- Average Capacity Per Ship and Unit Load Per Ship

  The average ship capacity and the unit load per ship are set up as 1,500/tons/ship and 1,050/ton/ship (loading factor : 70%) from 2000 to 2036 for the "without-the-project" and "with-the-project" cases respectively.

- Moving Time Saving

  The JICA Study Team estimated that the average dwelling time in Port of Constantza area is about eight days per barge. This eight days gap would include mainly: (i) waiting time for loading and unloading, (ii) time for forming up and disassembling up a convoy including the document procedures (4 - 6 hours on average), (iii) moving time from the waiting position to the berth for loading or unloading and (iv) moving time from the berth after loading and unloading, to the waiting basin as needed for forming a convoy. In this Study, there are two assumptions. The first assumption is that it takes about two days out of an eight days period for this type of movement except the time for forming a convoy which is period needed for this convoy to move in the area of Port of Constantza. The second assumption is that this moving time would increase in accordance with the traffic volume but decrease to 50% of all moving hours by this plan. The other six days are considered to consist mostly of waiting time which will change depending mainly on the traffic volume which will decrease as the traffic volume will increase. Thus the waiting time will change regardless of the with- or without-the-project cases and will not generate benefits.

- Time Saving Benefit of Moving

  The time saving benefit of barge moving time is derived from multiplying the saved moving time in days per annum by the traffic demand in tons and the unit time value of barge cargo (lei/day) as 2,866.5 in 1999, 3,071.9 in 2010 and 3,559.5 in 2020 respectively. The unit time value is estimated by the weighted average valuing on the basis of the traffic volume weight (%) by kinds of commodity transported by barge.

Savings of Moving Time for Ship Lease Cost

- Ship Lease Cost

  It is assumed that one convoy is composed of five barges and one pusher. Thus the lease cost per unit is set up by the average capacity per barge and pusher barge as follows:

Table 9.3.28 Unit Ship Lease Cost

(at 2000 price)

	Average Capacity (ton/ship)	Unit Load (ton/ship)	Unit Ship Lease Cost (Yen/ton･day)	Unit Ship Lease Cost (US$/ton･day)
Barge	1,500	1,000	16	0.15
Pusher Barge	(4,000PS)	(400GT)	87	0.80

Source: "Standard of Costing for Port Engineering Works by the Ministry of Transport", 1995, Foundation of Port Construction Technical

Saved Ship Lease Cost for Navigation

The saved cost on the ship lease amount, as needed for moving, is derived from the difference of the with-the-project and the without-the-project cases with regard to the ship lease cost for moving during the transport. However in this case, the navigation time in the with-the-project case is negligible, as mentioned above, and the benefit of the saved lease cost is the same as the one in the "without-the-project" case.

Savings of Forming of Convoy for Cargo

As already mentioned, it was assumed that the average time for forming a convoy is about 5 hours, whereas some 50% of the time, 2.5 hours, will be saved. The benefit of saved time for forming a cargo convoy is derived from multiplying the saved time by the traffic volume and the weighted average unit time value of commodity transported by barge .

Savings of Forming of Convoy for Ship Lease Cost

The benefit generated from the time saving for forming a convoy is estimated from multiplying the saved time by the unit lease cost of barge and pusher and the number of convoy, and the number of barges and pusher per convoy.

The results of estimation of saved time and the benefit are shown in Tables 9.3.26 and 9.3.27.

b. Cost

Construction Cost

The construction cost as the initial cost for new barge terminal is tentatively calculated as US$ 24.6million which includes indirect contractor's indirect cost and physical contingency (10% of civil works) and engineering service fee (4% of local currency portion and 2% of foreign currency portion).

Operation and Maintenance Cost

The operation cost is assumed for the barge as US$ 0.005 and US$ 0.05 per throughput traffic volume respectively and the maintenance cost is 0.3% for civil works and 3% for equipment.

These costs do not include taxes such as duties and VAT. Thus, for the purpose of economic pricing, the foreign currency portion does not need to be converted into economic cost. However, the standard conversion factor (SCF) of 0.986 is adapted to the financial project cost as the shadow price for the local currency portion.

c. Economic Evaluation

The economic evaluation is carried out by preparing cash flow streams of economic cost and benefit during the evaluation period. (See Tables 9.3.29 and 9.3.30). The result of indicators of economic evaluation such as EIRR, B/C and NPV by case of traffic demand forecast are as follows:

Table 9.3.31 The Result of Calculation of Indicators for Economic Evaluation

Case No. of Traffic Demand Forecast	EIRR (%)	B/C	NPV (1,000 US$)
Case-1	19.80	1.46	7,414
Case-2	17.72	1.22	35,66

Note: The discount rate for B/C and NPV is 15%.

The EIRRs of Case-1 and Case-2 are 19.80% and 17.72% respectively. Both of them are considerably higher than the cut-off-ratio of EIRR for judgment of feasibility. Thus the Barge Terminal Plan is considered to have high economic viability.

9.4 Economic Evaluation of the Project; Existing Project Including Under Consideration

This section deals with eleven project components which have been taken into consideration by MOT and others.

9.4.1 Edible Oil Terminal Plan

The object of this project is to relocate from the old North Port area, following to the relocation of existing grain terminal.

a. Benefit

The benefit of this project is difficult to specify because of the unknown scale of terminal but it is expected to supplement the other terminals planned by integrating with them. For example, if this terminal is operated with the grain terminal, the efficiency of cargo handling will be greater than single usage of the Edible Oil Terminal. Thus the benefit of this plan will be integrated with the Grain Terminal Plan.

However, there are many kinds of edible liquid cargo such as wine, tropical fruit juice, mineral water and etc. Thus if the integrated liquid edible terminal to handle these liquid cargoes would be constructed, the traffic demand will rapidly be induced and the benefit will be generated through providing the people ~~availability of~~ varieties of rich beverages.

b. Cost

The construction cost as the initial cost for new edible oil terminal is tentatively calculated as US$ 9.2million which includes indirect contractor's indirect cost and physical contingency (10% of civil works) and engineering service fee (4% of local currency portion and 2% of foreign currency portion).

These costs do not include taxes such as duties and VAT. Thus, for the purpose of economic pricing, the foreign currency portion is not necessary to be converted into economic cost. But the standard conversion factor (SCF) of 0.986 is adapted to the financial project cost as the shadow price for the local currency portion.

c. Economic Evaluation

The quantitative economic evaluation of this project is not possible at this moment because the benefits of these projects are not yet specified. But if the new edible terminal will be constructed near the grain terminal, the benefit of this plan will be integrated with the one of the Grain Terminal Plan. It is expected that this plan will be viable because the Grain Terminal Plan is assumed to be viable as already evaluated above.

9.4.2 Tropical Public Vegetable Terminal Plan

This terminal will be mainly used to handle imported cargo. If this terminal will be completed, the foods of Romanian will be enriched and bring nutritionally balanced diet to improve the health. Furthermore importing tropical vegetables will stimulate many kinds of industry such as commercial business (retail and wholesale) and manufacturing for processing the vegetables into other new products.

9.4.3 Car Transport Terminal Plan

This terminal will contribute to grow the production of car industries in Romania. If this terminal will be completed, the cars made in Romania will open the Romanian car industry to the world market such as South American and developing Asian countries through the sea transport with cheap transport cost. The prices of Romanian cars are relatively cheap supported by low labor cost under a good quality checking system.

9.4.4 Passenger Terminal Plan

The Passenger Terminal Plan is expected to contribute mainly to two kinds of traffic demand as follows:

(i) General passenger

These passengers are composed of tourists and businessmen coming from inland including other European countries by many kinds of transport means such as bus, private cars and train.

(ii) Cruise ship passenger

These passengers will make their trips only for tourism. The passenger terminal for cruise ships will sufficient water depth to cope with large-scale cruise ships and provide good and smooth linkage with inland transport for sightseeing inland scenic points.

The economic impact of this plan is expected to induce many kinds of industries such as (i) construction (e.g. hotels and restaurants), (ii) service industry (e.g. travel agents) and (iii) manufacturing for local products including souvenirs. The benefits from this plan are considered to be the income from industries mentioned above.

9.4.5 Business Center Complex Plan

The Plan comes from the viewpoint of effective utilization of the existing area of the North Port. This area could be used for maritime transport agents, trading companies and so on. This plan should be symbolic for the future roles of the Port of Constantza. It has become a common world phenomena that the port will contribute to not only as a physical transit point for cargoes and passengers but also to the center of business, tourism, communication and information for linking between inland areas and the sea. Thus it is needed to study in such a complex in detail with regard to economic impacts and benefits.

9.4.6 Railway Relocation Plan

This Plan is expected to contribute to the improvement of cargo transport efficiency within the Port area. The main quantifiable benefits are considered to be: (i) savings of transport time, (ii) savings of transport cost and (iii) induced income from industries to be established in the space after relocation of railway. More detailed study will be conducted in the following survey.

9.4.7 Breakwater and Wet Basin

The two main work items of this plan are the breakwater extension and deepening the water depth. The former is to maintain wave calmness, and the latter is for deepening design water depth of the turning basin.

a. Benefit

This plan is expected to improve safe port utilization and increase the size of calling vessels. Thus the following benefits could be quantified: (i) savings of ship lease cost for navigation and (ii) savings of cargo handling time by larger vessel.

b. Cost

The construction cost as the initial cost for this plan is tentatively calculated as US$ 176.1 million which includes indirect contractor's indirect cost and physical contingency (10% of civil works) and engineering service fee (4% of local currency portion and 2% of foreign currency portion).

c. Economic Evaluation

As with the breakwater, economic feasibility of this plan will be evaluated as a common facility which is used equally by all the terminals. The economic viability of this plan will be judged after figuring out the benefits to be generated from this plan.

9.4.8 Environmental Related Facilities

This plan is expected to protect the environment of the port area from additional loads and emissions based on the environmental regulations.

a. Benefit

The Netherlands Consultant, "Iwaco", quantified the benefits on the basis of the result of analysis with regard to the environmental impact analysis.

b. Cost

Construction Cost

The construction cost as the initial cost for new environmental improvement facilities are tentatively calculated as US$ 18.3million which includes indirect contractor's indirect cost engineering service fee. The physical contingency is assumed to be 10% of construction cost and 5% of plant.

Operation and Maintenance Cost

The operation and maintenance cost is assumed to be 0.3% of construction cost and 0.3% of plant.

These costs do not include taxes such as duties and VAT. Thus, for the purpose of economic pricing, the foreign currency portion is not necessary to be converted into economic cost. However, the standard conversion factor (SCF) of 0.986 is adapted to the financial project cost as the shadow price for the local currency portion.

c. Economic Evaluation

As with the breakwater, economic feasibility of this plan will be evaluated as common facilities which are beneficial to all the terminals. The economic viability of this plan will be judged after figuring out the benefits to be generated from this plan.

9.4.9 Port Management & Information System

This plan is already under study by the French Government as planned by MOT. The JICA Study Team will support this study by French assistance. Thus the economic evaluation will not be carried out. It is expected that the economic benefits will be generated mainly from the improvement of efficiency many kinds of procedures such as custom documentation, piloting ships, movement of cargoes in the land area of the Port and so on. A more qualitative analysis will be conducted by studying the contents of French assistance as necessary.

9.4.10 Initial Dredging Plan

This plan is expected to allow large-scale ships to approach the quay. The quantifiable benefits of this Plan are considered to be at least: (i) savings of ship lease cost for saved waiting time (if the handling capacity of the berth will be strengthened at the same time) and (ii) savings of ship lease cost for navigation by ship size scales of economy.

9.4.11 LPG Terminal Plan

This plan aims to cope with the increase of traffic demand in the future. The quantifiable benefits of this Plan are considered to be at least: (i) savings of transport time by short cut root, (ii) savings of ship lease cost for saved transport time and (iii) savings of ship lease cost for navigation by ship size scales of economy.

9.5 Integrated Evaluation

The economic evaluation of individual plans and project components is basic and essential for the judgment of their viability. However, the elements of each plan are not discrete but overlap. Thus if the individual plan will be effective and viable, there is no guarantee that all plans of the Port could effectively and simultaneously function with each other in the Port. Therefore, an integrated evaluation is necessary by taking account of the functions and benefits of the all plans for the purpose of determining urgency and priority.

9.5.1 Future Roles of the Port of Constantza

1) Base of Physical Distribution Linking the Inland and the Sea

The Port of Constantza is actually the only international seaport opening to world trade routes through a canal and a sea. This fact has considerable importance for Romania which is quite different from other island countries surrounded by sea such as Japan, UK, etc.

2) Maximization of Potentiality of Romanian Economy

The economic stagnation and saturation of traffic demand (except some cargo such as containers and bulk grain) can be considered to be just temporary. If the inland waterway through Romania will reopen completely and the EU will accept membership of Romania, the traffic demand will increase rapidly and the speed of economic growth will be accelerated by maximizing Romania's economic potentiality to Eastern Europe and Central Asia as discussed in previous chapters. However exports of some commodity to EU and/or competing with EU for export may be affected by political influence. Joining EU will affect the Romanian potentiality, in the form of advantages and/or impact of disadvantages.

3) Business Center Connecting the Western, Eastern Europe and Central Asia.

The vast area of the Port of Constantza should be effectively utilized. There is wide space in the area; thus it is so important to provide the port with an effective area utilization scheme and plan which should be satisfactorily realized.

Privatization of port will be pursued with maximum speed. This will welcome the aggressive participation of private sectors to all fields. Only a properly prepared master plan can indicate the proper places for such new private development.

The functions of the Port need to change from single function facilities for handling cargo and passenger movements from origins to destinations to diversified-function facilities. In this context, the function of a business center complex open to the world markets must be added and strengthened to connect and accelerate the relationship between Western and Eastern Europe and Central Asia.

On the basis of these major future roles to be played by the Port of Constantza, the individual Plans and project components presented in the Master Plan could be prioritized by means of acceptable criteria from the majority of concerns.

9.5.2 Priorities for Short-Term Development Plans

Firstly, Short Term Urgent Plans will be prioritized to meet the increase of traffic demand. From this viewpoint, the Plans for Container Terminal and Grain Terminal should be implemented in advance of other plans as first priority projects.

Secondary, urgent plans necessary to improve and accelerate ship operations such as the Plan for Barge Terminal should be implemented.

Thirdly, urgent plans necessary to contribute to diversification and accelerate the inter-modal traffic demand such as the Plan for Road Improvement.

Refer to Table 9.3.32 for the project evaluation.

9.5.3 Priorities for Long-Term Development Plans

The priority of the Long-term Development Plans for the Port of Constantza should be selected on the basis of efficiency improvement and accelerating to the modernization of port.

Firstly, the Long-term Plan necessary to contribute to diversification and accelerate the inter-modal traffic demand such as the Plans for Road Improvement, Passenger Terminal and Business Center Complex should be selected.

Secondly, the Plans for Railway Relocation, Breakwater Extension and Improvement and Initial Dredging Environment are the priority long-term development plans.

Thirdly, the Long-term Plan necessary to improve and accelerate ship operations and cargo handling such as the Plans for Steel Product Terminal, Timber Terminal, and General Cargo Terminal should be implemented.

Finally, it can be stressed that good organization and connection of each plan could expect the **"synergy effects"**.

Table 9.3.32 Summary Table of EIRR by Project Components

No.	Project Component	Case 1	Case 2
1.	Container Terminal	23.6%	25.6%
2.	Grain Terminal , S3	12.9%	9.6%
3.	Grain Terminal , S1 or 31/33	15.7%	11.4%
4.	Grain Terminal , North Port	1.8%	2.8%
5.	Barge Terminal	19.8%	17.7%

Table 9.3 3 Average Waiting Time of Ships in the Queue M/E2/n Expressed in Units of Average Service Time (Random Arrivals, Erling 2-Distributed Service Time)

Utilization	Number of Berthing Points							
	1	2	3	4	5	6	7	8
0.1000	0.150	0.048	-	-	-	-	-	-
0.1100	0.154	0.048	-	-	-	-	-	-
0.1200	0.158	0.049	-	-	-	-	-	-
0.1300	0.162	0.049	-	-	-	-	-	-
0.1400	0.166	0.050	-	-	-	-	-	-
0.1500	0.170	0.050	-	-	-	-	-	-
0.1600	0.178	0.051	-	-	-	-	-	-
0.1700	0.186	0.052	-	-	-	-	-	-
0.1800	0.194	0.053	-	-	-	-	-	-
0.1900	0.202	0.054	-	-	-	-	-	-
0.2000	0.210	0.055	-	-	-	-	-	-
0.2100	0.220	0.057	-	-	-	-	-	-
0.2200	0.230	0.059	-	-	-	-	-	-
0.2300	0.240	0.061	-	-	-	-	-	-
0.2400	0.250	0.063	-	-	-	-	-	-
0.2500	0.260	0.065	-	-	-	-	-	-
0.2600	0.272	0.068	-	-	-	-	-	-
0.2700	0.284	0.071	-	-	-	-	-	-
0.2800	0.296	0.074	-	-	-	-	-	-
0.2900	0.308	0.077	-	-	-	-	-	-
0.3000	0.320	0.080	0.030	0.020	0.010	-	-	-
0.3100	0.340	0.090	0.030	0.020	0.010	-	-	-
0.3200	0.350	0.090	0.030	0.020	0.010	-	-	-
0.3300	0.360	0.090	0.040	0.020	0.010	-	-	-
0.3400	0.370	0.100	0.040	0.020	0.010	0.010	-	-
0.3500	0.390	0.110	0.040	0.020	0.010	0.010	-	-
0.3600	0.410	0.110	0.040	0.030	0.020	0.010	-	-
0.3700	0.430	0.120	0.050	0.030	0.020	0.010	-	-
0.3800	0.440	0.130	0.050	0.030	0.020	0.010	0.010	-
0.3900	0.460	0.130	0.050	0.030	0.020	0.010	0.010	-
0.4000	0.480	0.140	0.060	0.030	0.020	0.010	0.010	-
0.4100	0.500	0.150	0.060	0.030	0.020	0.010	0.010	-
0.4200	0.520	0.160	0.060	0.040	0.020	0.010	0.010	0.010
0.4300	0.540	0.160	0.070	0.040	0.020	0.020	0.010	0.010
0.4400	0.560	0.170	0.070	0.040	0.030	0.020	0.010	0.010
0.4500	0.590	0.180	0.080	0.040	0.030	0.020	0.010	0.010
0.4600	0.610	0.190	0.080	0.050	0.030	0.020	0.020	0.010
0.4700	0.640	0.200	0.090	0.050	0.030	0.020	0.020	0.010
0.4800	0.660	0.210	0.090	0.050	0.040	0.030	0.020	0.010
0.4900	0.690	0.230	0.100	0.060	0.040	0.030	0.020	0.010
0.5000	0.720	0.240	0.110	0.060	0.040	0.030	0.020	0.010
0.5100	0.740	0.250	0.120	0.070	0.040	0.030	0.020	0.020
0.5200	0.780	0.260	0.130	0.070	0.050	0.030	0.020	0.020
0.5300	0.810	0.280	0.130	0.080	0.050	0.030	0.030	0.020
0.5400	0.840	0.290	0.140	0.080	0.050	0.040	0.030	0.020
0.5500	0.880	0.310	0.150	0.090	0.060	0.040	0.030	0.020
0.5600	0.910	0.330	0.160	0.100	0.060	0.050	0.030	0.020
0.5700	0.950	0.350	0.170	0.110	0.070	0.050	0.040	0.030
0.5800	1.000	0.370	0.180	0.110	0.070	0.050	0.040	0.030
0.5900	1.040	0.390	0.190	0.120	0.080	0.060	0.040	0.030
0.6000	1.080	0.420	0.200	0.130	0.080	0.060	0.050	0.040
0.6100	1.130	0.440	0.220	0.140	0.090	0.070	0.050	0.040
0.6200	1.180	0.470	0.230	0.150	0.100	0.070	0.060	0.040
0.6300	1.230	0.490	0.250	0.160	0.110	0.080	0.060	0.050
0.6400	1.290	0.510	0.270	0.170	0.120	0.080	0.070	0.050
0.6500	1.340	0.530	0.290	0.190	0.120	0.090	0.070	0.050
0.6600	1.400	0.600	0.310	0.200	0.130	0.100	0.080	0.060
0.6700	1.480	0.630	0.330	0.220	0.140	0.110	0.090	0.060
0.6800	1.550	0.660	0.360	0.230	0.160	0.120	0.090	0.070
0.6900	1.620	0.700	0.380	0.250	0.170	0.130	0.100	0.080
0.7000	1.700	0.720	0.420	0.270	0.190	0.140	0.110	0.090
0.7100	1.800	0.780	0.440	0.290	0.200	0.160	0.120	0.100
0.7200	1.900	0.830	0.480	0.310	0.220	0.170	0.130	0.110
0.7300	1.990	0.870	0.510	0.340	0.240	0.190	0.140	0.120
0.7400	2.080	0.930	0.540	0.360	0.260	0.200	0.160	0.130
0.7500	2.200	1.000	0.590	0.390	0.280	0.220	0.170	0.140
0.7600	2.310	1.080	0.630	0.420	0.300	0.240	0.190	0.150
0.7700	2.460	1.160	0.680	0.450	0.330	0.260	0.210	0.170
0.7800	2.590	1.230	0.730	0.490	0.360	0.280	0.230	0.190
0.7900	2.750	1.300	0.790	0.530	0.400	0.310	0.250	0.210
0.8000	2.950	1.400	0.840	0.570	0.430	0.340	0.270	0.220
0.8100	3.170	1.500	0.920	0.630	0.470	0.380	0.300	0.240
0.8200	3.450	1.700	0.980	0.680	0.520	0.420	0.340	0.270
0.8300	3.750	1.850	1.080	0.740	0.570	0.470	0.380	0.310
0.8400	4.100	1.900	1.160	0.810	0.640	0.500	0.420	0.340
0.8500	4.400	2.050	1.280	0.900	0.700	0.560	0.460	0.380
0.8600	4.750	2.200	1.400	0.980	0.760	0.610	0.510	0.420
0.8700	5.200	2.400	1.520	1.070	0.840	0.670	0.560	0.470
0.8800	5.600	2.600	1.680	1.160	0.920	0.750	0.630	0.520
0.8900	6.100	2.850	1.830	1.290	1.010	0.830	0.700	0.580
0.9000	6.600	3.200	2.000	1.430	1.120	0.920	0.760	0.640

Source : "Port Development", A handbook for planners in developing countries, Prepared by the secretariat of UNCTAD, UNITED NATIONS, New York, 1985

Table 9.3.4 Ship Waiting Time for Container Terminal Plan and Benefit Estimate(Traffic Demand Forecast:Case-1)

Year	Traffic Demand (ton)	Container (TEU/Year)	Average Capacity (TEU/ship)	Unit Load (TEU/ship)	No. of Ships (Ship/Year)	No. of Berth	Operator	Crane/Berth	Crane Capacity (TEU/crane*hour)	Crane Capacity (TEU/ship*hour)	Crane Capacity (TEU/terminal*hour)	Required Sta Terminal Hour/Year	Required Ship Days/Year	Days/Year	Occupancy Ratio	Waiting Time Factor	Ship Time at Berth (hour/ship)	Waiting Time (hour/ship)	Waiting Time (days/Year	Saved Waiting Time (days/Year	Waiting Time Savings Benefit for Cargo	Waiting Time Savings Benefit for Vessel	Time Value of Container Cargo (Lei/day)	Ship Lease Cost (Lei/day/ship)
	(A)	(AF	(B)	(C)	(D)	(E)		(F)	(G)	(H)	(I)	(P'	(P)	(Q)	(R)	(S)	(S)'	(T)'	(T)	(U)	(V)	(W)	(X)	(Y)
					(A')/(C)				Berthour (20-21)x1.6)	(FxG)	(ExH)	(A')/(I)	[(P')/24] x(E)	(E)x365	(P')/(Q)	Queueing Table (VBI)	(C')/(H)	(S)x(S)'	[(T)x(D)]/24	(T)-(waiting time(days) in Capacity)	[(A)x(U)x (X)]/1000000	[(U)x(Y)]/100000 0		
1999	767,233	88,232	300	300	294	2	SUCEP	1.5	32	48	96	919	76.6	730	0.1049	0.048	6.25	0.30	3.6					
2000	940,000	112,860	300	300	376	2		1.5	32	48	96	1,176	98.0	730	0.1342	0.049	6.25	0.31	4.8					
2001	1,050,000	127,204	300	300	424	2		1.5	32	48	96	1,325	110.4	730	0.1513	0.050	6.25	0.31	5.5					
2002	1,170,000	141,856	300	300	473	2		1.5	32	48	96	1,478	123.1	730	0.1687	0.051	6.25	0.32	6.3					
2003	1,330,000	160,160	300	300	534	2		1.5	32	48	96	1,668	139.0	730	0.1904	0.054	6.25	0.34	7.5					
2004	1,480,000	179,124	444	400	448	2		1.5	32	48	96	1,866	155.5	730	0.2130	0.057	8.33	0.48	8.9					
2005	1,810,000	217,602	444	400	544	2	S2	1.5	32	48	96	2,267	188.9	730	0.2588	0.065	8.33	0.54	12.3					
2006	2,020,000	243,936	444	400	610	2		1.5	32	48	96	2,541	211.8	730	0.2901	0.077	8.33	0.64	16.3					
2007	2,290,000	275,660	444	400	689	2		1.5	32	48	96	2,871	239.3	730	0.3278	0.090	8.33	0.75	21.5					
2008	2,540,000	306,746	444	400	767	2		1.5	32	48	96	3,195	266.3	730	0.3648	0.110	8.33	0.92	29.3					
2009	2,870,000	345,576	750	600	576	2		1.5	32	48	96	3,600	300.0	730	0.4109	0.150	12.50	1.88	45.0					
Capacity	3,260,870	375,000	750	600	625	2		1.5	32	48	96	3,906	325.5	730	0.4459	0.170	12.50	2.13	55.3					
2010	3,180,000	383,680	750	600	639	2		1.5	32	48	96	3,997	333.1	730	0.4562	0.180	12.50	2.25	60.0	4.6	3,743	525.0	255.2	113,850,000
2011	3,430,000	413,424	750	600	689	2		1.5	32	48	96	4,307	358.9	730	0.4916	0.230	12.50	2.88	82.5	27.2	23,814	3,097.0	255.2	113,850,000
2012	3,690,000	444,920	750	600	692	2		1.5	32	48	96	4,322	360.2	730	0.4934	0.230	12.50	2.88	82.8	27.5	25,900	3,131.0	255.2	113,850,000
2013	3,980,000	482,064	1,143	800	693	2		1.5	32	48	96	5,022	418.5	730	0.5732	0.350	16.67	5.83	146.5	91.1	92,562	12,449.1	255.2	136,620,000
2014	4,290,000	519,288	1,143	800	649	2		1.5	32	48	96	5,409	450.8	730	0.6175	0.440	16.67	7.33	198.3	143.0	156,574	19,536.7	255.2	136,620,000
2015	4,620,000	559,130	1,143	800	699	2		1.5	32	48	96	5,824	485.4	730	0.6649	0.600	16.67	10.00	291.2	235.9	278,131	32,235.2	255.2	136,620,000
2016	4,990,000	601,656	1,667	1,000	602	2		1.5	32	48	96	6,267	522.3	730	0.7154	0.780	20.83	16.25	407.4	352.0	448,341	50,766.6	255.2	144,210,000
2017	5,370,000	648,846	1,667	1,000	649	2		1.5	32	48	96	6,759	563.2	730	0.7716	1.160	20.83	24.17	653.4	598.0	819,616	80,239.5	255.2	144,210,000
2018	5,760,000	695,024	2,400	1,200	579	2		1.5	32	48	96	7,240	603.3	730	0.8265	1.700	25.00	42.50	1,025.6	970.3	1,426,447	176,750.7	255.2	182,160,000
2019	6,140,000	742,082	2,400	1,200	618	2		1.5	32	48	96	7,730	644.2	730	0.8824	2.600	25.00	65.00	1,674.8	970.3	1,520,553	176,750.7	255.2	182,160,000
2020	6,530,000	790,020	2,400	1,200	658	2		1.5	32	48	96	8,229	685.8	730	0.9394	3.419	25.00	85.46	2,344.4	970.3	1,617,136	176,750.7	255.2	182,160,000
2021	6,984,195	845,689	2,400	1,200	705	2		1.5	32	48	96	8,809	734.1	730	1.0056	3.996	25.00	99.89	2,933.2	970.3	1,729,616	176,750.7	255.2	182,160,000
2022	7,469,981	905,280	2,400	1,200	754	2		1.5	32	48	96	9,430	785.8	730	1.0765	4.720	25.00	118.01	3,709.3	970.3	1,849,919	176,750.7	255.2	182,160,000
2023	7,989,556	969,071	2,400	1,200	808	2		1.5	32	48	96	10,094	841.2	730	1.1523	5.692	25.00	142.31	4,788.3	970.3	1,978,591	176,750.7	255.2	182,160,000
2024	8,545,271	1,037,356	2,400	1,200	864	2		1.5	32	48	96	10,806	900.5	730	1.2335	6.852	25.00	171.30	6,170.2	970.3	2,116,212	176,750.7	255.2	182,160,000
2025	9,139,638	1,110,454	2,400	1,200	925	2		1.5	32	48	96	11,567	963.9	730	1.3205	8.353	25.00	208.83	8,052.1	970.3	2,263,405	176,750.7	255.2	182,160,000
2026	9,775,346	1,188,702	2,400	1,200	991	2		1.5	32	48	96	12,382	1031.9	730	1.4135	10.069	25.00	251.73	10,390.1	970.3	2,420,836	176,750.7	255.2	182,160,000
2027	10,455,271	1,272,463	2,400	1,200	1,060	2		1.5	32	48	96	13,255	1104.6	730	1.5131	12.234	25.00	305.85	13,513.2	970.3	2,589,218	176,750.7	255.2	182,160,000
2028	11,182,488	1,362,127	2,400	1,200	1,135	2		1.5	32	48	96	14,189	1182.4	730	1.6197	14.667	25.00	366.67	17,342.3	970.3	2,769,311	176,750.7	255.2	182,160,000
2029	11,960,287	1,458,110	2,400	1,200	1,215	2		1.5	32	48	96	15,189	1265.7	730	1.7339	17.944	25.00	448.59	22,711.7	970.3	2,961,931	176,750.7	255.2	182,160,000
2030	12,792,186	1,560,855	2,400	1,200	1,301	2		1.5	32	48	96	16,259	1354.9	730	1.8560	21.596	25.00	539.91	29,260.9	970.3	3,167,938	176,750.7	255.2	182,160,000
2031	13,681,948	1,670,841	2,400	1,200	1,392	2		1.5	32	48	96	17,405	1450.4	730	1.9868	26.006	25.00	650.15	37,718.8	970.3	3,388,295	176,750.7	255.2	182,160,000
2032	14,633,597	1,788,577	2,400	1,200	1,490	2		1.5	32	48	96	18,631	1552.6	730	2.1268	31.254	25.00	781.35	48,524.4	970.3	3,623,968	176,750.7	255.2	182,160,000
2033	15,651,438	1,914,609	2,400	1,200	1,596	2		1.5	32	48	96	19,944	1662.0	730	2.2767	37.460	25.00	936.51	62,258.8	970.3	3,876,034	176,750.7	255.2	182,160,000
2034	16,740,075	2,049,522	2,400	1,200	1,708	2		1.5	32	48	96	21,349	1779.1	730	2.4371	44.747	25.00	1118.66	79,608.5	970.3	4,145,631	176,750.7	255.2	182,160,000
2035	17,904,433	2,193,941	2,400	1,200	1,828	2		1.5	32	48	96	22,854	1904.5	730	2.6089	53.233	25.00	1330.82	101,380.1	970.3	4,433,981	176,750.7	255.2	182,160,000
2036	19,149,777	2,348,537	2,400	1,200	1,957	2		1.5	32	48	96	24,464	2038.7	730	2.7927	63.650	25.00	1591.25	129,760.9	970.3	4,742,387	176,750.7	255.2	182,160,000
2037	20,481,742	2,514,027	2,400	1,200	2,095	2		1.5	32	48	96	26,188	2182.3	730	2.9895	75.034	25.00	1875.84	163,747.1	970.3	5,072,244	176,750.7	255.2	182,160,000
2038	21,906,351	2,691,177	2,400	1,200	2,243	2		1.5	32	48	96	28,033	2336.1	730	3.2001	89.414	25.00	2235.36	208,879.8	970.3	5,425,045	176,750.7	255.2	182,160,000
2039	23,430,049	2,880,811	2,400	1,200	2,401	2		1.5	32	48	96	30,008	2500.7	730	3.4256	103.622	25.00	2590.56	259,128.5	970.3	5,802,384	176,750.7	255.2	182,160,000
2040	25,059,728	3,083,807	2,400	1,200	2,570	2		1.5	32	48	96	32,123	2676.9	730	3.6670	103.622	25.00	2590.56	277,388.0	970.3	6,205,969	176,750.7	255.2	182,160,000

Table 9.3.5 Ship Waiting Time for Container Terminal Plan and Benefit Estimate(Traffic Demand Forecast:Case-2)

Year	Traffic Demand (ton)	Container (TEU/Year)	Average Capacity (TEU/ship)	Unit Load (TEU/ship)	No. of Ships (Ship/Year)	No. of Berth	Operator	Crane/Berth	Crane Capacity (TEU/crane*hour)	Crane Capacity (TEU/ship*hour)	Crane Capacity (TEU/terminal*hour)	Required Stay Terminal Hour/Year	Required Ship Days/Year	Days/Year	Occupancy Ratio	Waiting Time Factor	Ship Time at Berth (hour/ship)	Waiting Time (hour/ship)	Waiting Time (days)/Year	Saved Waiting Time (days)/Year	Waiting Time Savings Benefit for Cargo	Waiting Time Savings Benefit for Vessel	Time Value of Container Cargo (Le/day)	Ship Lease Cost (Le/day/ship)
	(A)	(A)'	(B)	(C)	(D)	(E)		(F)	(G)	(H)	(I)	(P)'	(P)	(Q)	(R)	(S)	(S)'	(T)'	(T)	(U)	(V)	(W)	(X)	(Y)
		(A)x(1/10)x1.15			(A)/(C)				Box/hour (20-ft)	(FxG)	(ExH)	(A)/(I)	[(P)/24] x(E)	(Ex365	(P)/(Q)	Queueing Table (VIII)	(C)/(H)	(S)x(S)'	[(T)x(D)]/24	(T)-(Total Waiting Time of	[(A)x(U)x(X)]/1000000	[(U)x(Y)]/1000			
1999	767,233	88,232	300	300	294	2	SOCEP	1.5	32	48	96	919	76.6	730	0.105	0.048	6.25	0.30	3.6					
2000	940,000	112,860	300	300	376	2		1.5	32	48	96	1,176	98.0	730	0.134	0.049	6.25	0.31	4.8					
2001	1,050,000	127,204	300	300	424	2		1.5	32	48	96	1,325	110.4	730	0.151	0.050	6.25	0.31	5.5					
2002	1,140,000	138,424	300	300	461	2		1.5	32	48	96	1,442	120.2	730	0.165	0.051	6.25	0.32	6.1					
2003	1,260,000	152,768	300	300	509	2		1.5	32	48	96	1,591	132.6	730	0.182	0.053	6.25	0.33	7.0					
2004	1,370,000	164,846	444	400	412	2		1.5	32	48	96	1,717	143.1	730	0.196	0.054	8.33	0.45	7.7					
2005	1,630,000	196,812	444	400	492	2	S2	1.5	32	48	96	2,050	170.8	730	0.234	0.061	8.33	0.51	10.4					
2006	1,780,000	214,896	444	400	537	2		1.5	32	48	96	2,239	186.5	730	0.256	0.065	8.33	0.54	12.1					
2007	1,970,000	237,160	444	400	593	2		1.5	32	48	96	2,470	205.9	730	0.282	0.074	8.33	0.62	15.2					
2008	2,140,000	256,960	444	400	642	2		1.5	32	48	96	2,677	223.1	730	0.306	0.080	8.33	0.67	17.8					
2009	2,350,000	284,592	750	600	474	2		1.5	32	48	96	2,965	247.0	730	0.338	0.090	12.50	1.13	22.2					
2010	2,550,000	308,880	750	600	513	2		1.5	32	48	96	3,208	267.4	730	0.366	0.110	12.50	1.38	29.4					
2011	2,700,000	326,106	750	600	544	2		1.5	32	48	96	3,397	283.1	730	0.388	0.130	12.50	1.63	36.8					
2012	2,860,000	344,564	750	600	574	2		1.5	32	48	96	3,589	299.1	730	0.410	0.140	12.50	1.75	41.9					
2013	3,020,000	365,200	1,143	800	457	2		1.5	32	48	96	3,804	317.0	730	0.434	0.160	16.67	2.67	50.7					
Capacity	3,260,870	375,000	1,143	800	469	2		1.5	32	48	96	3,906	325.5	730	0.446	0.170	16.67	2.83	55.3					
2014	3,200,000	386,232	1,143	800	483	2		1.5	32	48	96	4,023	335.3	730	0.459	0.180	16.67	3.00	60.3	5.0	4,092	570	255.2	113,850,000
2015	3,380,000	409,530	1,143	800	512	2		1.5	32	48	96	4,266	355.5	730	0.487	0.210	16.67	3.50	74.7	19.3	16,663	2,199	255.2	113,850,000
2016	3,630,000	437,052	1,667	1,000	437	2		1.5	32	48	96	4,553	379.4	730	0.520	0.250	20.83	5.21	94.8	39.5	36,603	4,748	255.2	120,175,000
2017	3,890,000	470,844	1,667	1,000	471	2		1.5	32	48	96	4,905	408.7	730	0.560	0.310	20.83	6.46	126.7	71.4	70,853	8,576	255.2	120,175,000
2018	4,170,000	503,360	2,400	1,200	419	2		1.5	32	48	96	5,243	436.9	730	0.599	0.390	25.00	9.75	170.4	115.1	122,468	17,468	255.2	151,800,000
2019	4,470,000	540,408	2,400	1,200	450	2		1.5	32	48	96	5,629	469.1	730	0.643	0.510	25.00	12.75	239.2	183.9	209,810	27,917	255.2	151,800,000
2020	4,790,000	580,140	2,400	1,200	483	2		1.5	32	48	96	6,043	503.6	730	0.690	0.660	25.00	16.50	332.4	277.0	338,693	42,054	255.2	151,800,000
2021	5,133,845	622,706	2,400	1,200	519	2		1.5	32	48	96	6,487	540.5	730	0.740	0.930	25.00	23.25	502.7	447.4	586,181	67,910	255.2	151,800,000
2022	5,502,372	668,394	2,400	1,200	557	2		1.5	32	48	96	6,962	580.2	730	0.795	1.300	25.00	32.50	754.3	698.9	981,536	106,097	255.2	151,800,000
2023	5,897,354	717,435	2,400	1,200	598	2		1.5	32	48	96	7,473	622.8	730	0.853	2.050	25.00	51.25	1,276.7	1,221.3	1,838,322	185,400	255.2	151,800,000
2024	6,320,689	770,074	2,400	1,200	642	2		1.5	32	48	96	8,022	668.5	730	0.916	3.273	25.00	81.82	2,187.8	1,221.3	1,970,284	185,400	255.2	151,800,000
2025	6,774,412	826,575	2,400	1,200	689	2		1.5	32	48	96	8,610	717.5	730	0.983	3.823	25.00	95.58	2,743.1	1,221.3	2,111,718	185,400	255.2	151,800,000
2026	7,260,786	885,222	2,400	1,200	739	2		1.5	32	48	96	9,242	770.2	730	1.055	4.494	25.00	112.35	3,461.1	1,221.3	2,263,305	185,400	255.2	151,800,000
2027	7,781,908	952,319	2,400	1,200	794	2		1.5	32	48	96	9,928	826.7	730	1.132	5.439	25.00	135.98	4,496.4	1,221.3	2,425,774	185,400.5	255.2	151,800,000
2028	8,340,523	1,022,191	2,400	1,200	852	2		1.5	32	48	96	10,648	887.3	730	1.216	6.545	25.00	163.63	5,807.8	1,221.3	2,599,906	185,400.5	255.2	151,800,000
2029	8,939,238	1,097,191	2,400	1,200	914	2		1.5	32	48	96	11,429	952.4	730	1.305	7.993	25.00	199.82	7,612.6	1,221.3	2,786,537	185,400.5	255.2	151,800,000
2030	9,580,931	1,177,693	2,400	1,200	981	2		1.5	32	48	96	12,268	1022.3	730	1.400	9.862	25.00	246.56	10,082.2	1,221.3	2,986,566	185,400.5	255.2	151,800,000
2031	10,268,688	1,264,102	2,400	1,200	1,053	2		1.5	32	48	96	13,168	1097.3	730	1.503	12.000	25.00	300.00	13,167.7	1,221.3	3,200,953	185,400.5	255.2	151,800,000
2032	11,005,814	1,356,850	2,400	1,200	1,131	2		1.5	32	48	96	14,134	1177.8	730	1.613	14.667	25.00	366.67	17,275.1	1,221.3	3,430,730	185,400.5	255.2	151,800,000
2033	11,795,854	1,456,404	2,400	1,200	1,214	2		1.5	32	48	96	15,171	1264.2	730	1.732	17.944	25.00	448.59	22,685.1	1,221.3	3,677,001	185,400.5	255.2	151,800,000
2034	12,642,607	1,563,262	2,400	1,200	1,303	2		1.5	32	48	96	16,284	1357.0	730	1.859	21.596	25.00	539.91	29,306.0	1,221.3	3,940,950	185,400.5	255.2	151,800,000
2035	13,550,142	1,677,960	2,400	1,200	1,398	2		1.5	32	48	96	17,479	1456.6	730	1.995	26.361	25.00	659.02	38,396.2	1,221.3	4,223,847	185,400.5	255.2	151,800,000
2036	14,522,924	1,801,074	2,400	1,200	1,501	2		1.5	32	48	96	18,761	1563.4	730	2.142	32.044	25.00	801.10	50,098.5	1,221.3	4,527,051	185,400.5	255.2	151,800,000
2037	15,565,328	1,933,221	2,400	1,200	1,611	2		1.5	32	48	96	20,138	1678.1	730	2.299	38.331	25.00	958.27	64,324.9	1,221.3	4,852,020	185,400.5	255.2	151,800,000
2038	16,682,668	2,075,064	2,400	1,200	1,729	2		1.5	32	48	96	21,615	1801.3	730	2.467	46.186	25.00	1154.66	83,194.4	1,221.3	5,200,317	185,400.5	255.2	151,800,000
2039	17,880,215	2,227,314	2,400	1,200	1,856	2		1.5	32	48	96	23,201	1933.4	730	2.649	55.350	25.00	1383.74	107,014.9	1,221.3	5,573,616	185,400.5	255.2	151,800,000
2040	19,163,726	2,390,734	2,400	1,200	1,992	2		1.5	32	48	96	24,903	2075.3	730	2.843	66.551	25.00	1663.78	138,112.9	1,221.3	5,973,712	185,400.5	255.2	151,800,000
2041	20,539,373	2,566,145	2,400	1,200	2,138	2		1.5	32	48	96	26,731	2227.6	730	3.051	79.463	25.00	1986.57	177,008.1	1,221.3	6,402,528	185,400.5	255.2	151,800,000
2042	22,013,769	2,754,426	2,400	1,200	2,295	2		1.5	32	48	96	28,692	2391.0	730	3.275	94.273	25.00	2356.82	225,406.1	1,221.3	6,862,127	185,400.5	255.2	151,800,000
2043	23,594,003	2,956,522	2,400	1,200	2,464	2		1.5	32	48	96	30,797	2566.4	730	3.516	103.622	25.00	2590.56	265,938.7	1,221.3	7,354,717	185,400.5	255.2	151,800,000
2044	25,287,672	3,173,445	2,400	1,200	2,645	2		1.5	32	48	96	33,057	2754.7	730	3.774	103.622	25.00	2590.56	285,450.9	1,221.3	7,882,667	185,400.5	255.2	151,800,000

Table 9.3.7 Cash Flow of Economic Cost and Benefit for Container Terminal Plan (Traffic Demand Forecast : Case-1)

(Unit : 1,000 US$)

No.	Year	Cost				Benefit			Net Benefit
		Capital Cost	O&M Cost	Replacement Cost	Total	Waiting Time Savings for Cargo	Wsaiting Time Savings for Vessel	Total	
-4	2006	1,593.7			1,593.7			0.0	-1,593.7
-3	2007				0.0			0.0	0.0
-2	2008	27,372.3			27,372.3			0.0	-27,372.3
-1	2009	27,372.3	1,055.8		28,428.1			0.0	-28,428.1
1	2010		1,106.6		1,106.6	147.9	20.8	168.7	-938.0
2	2011	617.6	1,352.7		1,970.2	941.3	122.4	1,063.7	-906.6
3	2012		1,617.6		1,617.6	1,023.7	123.8	1,147.5	-470.1
4	2013	10,648.1	1,901.5		12,549.6	3,658.6	492.1	4,150.6	-8,399.0
5	2014	10,648.1	2,547.0		13,195.1	6,188.7	772.2	6,960.9	-6,234.2
6	2015		2,875.7		2,875.7	10,993.3	1,273.7	12,267.0	9,391.4
7	2016		3,247.2		3,247.2	17,721.0	2,006.6	19,727.6	16,480.4
8	2017		3,625.7		3,625.7	32,395.9	3,408.7	35,804.6	32,178.8
9	2018		4,009.2		4,009.2	56,381.3	6,986.2	63,367.5	59,358.3
10	2019		4,394.7		4,394.7	60,100.9	6,986.2	67,087.1	62,692.4
11	2020		4,780.2		4,780.2	63,918.4	6,986.2	70,904.6	66,124.4
12	2021		4,780.2		4,780.2	68,364.3	6,986.2	75,350.4	70,570.3
13	2022		4,780.2		4,780.2	73,119.3	6,986.2	80,105.5	75,325.3
14	2023		4,780.2		4,780.2	78,205.2	6,986.2	85,191.4	80,411.2
15	2024		4,780.2	21,116.9	25,897.1	83,644.7	6,986.2	90,630.9	64,733.8
16	2025		4,780.2		4,780.2	89,462.6	6,986.2	96,448.8	91,668.6
17	2026		4,780.2		4,780.2	95,685.2	6,986.2	102,671.4	97,891.2
18	2027		4,780.2		4,780.2	102,340.6	6,986.2	109,326.8	104,546.6
19	2028		4,780.2		4,780.2	109,458.9	6,986.2	116,445.1	111,664.9
20	2029		4,780.2	6,574.1	11,354.3	117,072.4	6,986.2	124,058.6	112,704.2
21	2030		4,780.2		4,780.2	125,215.3	6,986.2	132,201.5	127,421.3
22	2031		4,780.2		4,780.2	133,924.7	6,986.2	140,910.9	136,130.7
23	2032		4,780.2		4,780.2	143,239.8	6,986.2	150,226.0	145,445.8
24	2033		4,780.2		4,780.2	153,202.9	6,986.2	160,189.1	155,408.9
25	2034		4,780.2		4,780.2	163,858.9	6,986.2	170,845.1	166,065.0
26	2035		4,780.2		4,780.2	175,256.2	6,986.2	182,242.4	177,462.2
27	2036		4,780.2		4,780.2	187,446.1	6,986.2	194,432.3	189,652.1
28	2037		4,780.2		4,780.2	200,484.0	6,986.2	207,470.2	202,690.0
29	2038		4,780.2		4,780.2	214,428.6	6,986.2	221,414.8	216,634.6
30	2039		4,780.2		4,780.2	229,343.2	6,986.2	236,329.4	231,549.3
Total		78,252.0	123,337.6	27,691.0	229,280.7	2,797,224.2	161,916.4	2,959,140.6	2,729,859.9

EIRR = **23.57%**
(Discount Rate 15%)
B/C = **2.38**
NPV = **75,397**

Table 9.3.8 Cash Flow of Economic Cost and Benefit for Container Terminal Plan (Traffic Demand Forecast : Case-2)

(Unit : 1,000 US$)

No.	Year	Cost				Benefit			Net Benefit
		Construction Cost	O&M Cost	Replacement Cost	Total	Waiting Time Savings for Cargo	Wsaiting Time Savings for Vessel	Total	
-4	2006	1,384.6			1,384.6			0.0	-1,384.6
-3	2007				0.0			0.0	0.0
-2	2008	23,736.6			23,736.6			0.0	-23,736.6
-1	2009	23,736.6	1,055.8		24,792.4			0.0	-24,792.4
1	2010		1,055.8		1,055.8	161.7	22.5	184.3	-871.6
2	2011	617.6	1,055.8		1,673.4	658.6	86.9	745.5	-927.9
3	2012		1,055.8		1,055.8	1,446.8	187.7	1,634.4	578.6
4	2013	10,648.1	1,055.8		11,703.9	2,800.5	339.0	3,139.5	-8,564.5
5	2014	10,648.1	1,460.9		12,109.0	4,840.6	690.4	5,531.1	-6,577.9
6	2015		1,645.8		1,645.8	8,292.9	1,103.4	9,396.3	7,750.5
7	2016		1,889.0		1,889.0	13,386.7	1,662.2	15,048.9	13,159.8
8	2017		2,149.6		2,149.6	23,169.2	2,684.2	25,853.4	23,703.8
9	2018		2,428.6		2,428.6	38,795.9	4,193.6	42,989.4	40,560.8
10	2019		2,727.4		2,727.4	72,660.9	7,328.1	79,989.0	77,261.6
11	2020		3,047.4		3,047.4	77,876.8	7,328.1	85,204.9	82,157.5
12	2021		3,047.4		3,047.4	83,467.1	7,328.1	90,795.2	87,747.8
13	2022		3,047.4		3,047.4	89,458.7	7,328.1	96,786.8	93,739.4
14	2023		3,047.4		3,047.4	95,880.4	7,328.1	103,208.5	100,161.1
15	2024		3,047.4	16,634.5	19,681.9	102,763.1	7,328.1	110,091.2	90,409.3
16	2025		3,047.4		3,047.4	110,139.8	7,328.1	117,467.9	114,420.5
17	2026		3,047.4		3,047.4	118,046.1	7,328.1	125,374.2	122,326.8
18	2027		3,047.4		3,047.4	126,519.9	7,328.1	133,848.0	130,800.6
19	2028		3,047.4		3,047.4	135,602.0	7,328.1	142,930.0	139,882.7
20	2029		3,047.4	6,574.1	9,621.5	145,336.0	7,328.1	152,664.1	143,042.6
21	2030		3,047.4		3,047.4	155,768.8	7,328.1	163,096.9	160,049.5
22	2031		3,047.4		3,047.4	166,950.5	7,328.1	174,278.6	171,231.2
23	2032		3,047.4		3,047.4	178,934.8	7,328.1	186,262.9	183,215.5
24	2033		3,047.4		3,047.4	191,779.5	7,328.1	199,107.5	196,060.2
25	2034		3,047.4		3,047.4	205,546.1	7,328.1	212,874.2	209,826.9
26	2035		3,047.4		3,047.4	220,301.0	7,328.1	227,629.1	224,581.8
27	2036		3,047.4		3,047.4	236,115.1	7,328.1	243,443.2	240,395.8
28	2037		3,047.4		3,047.4	253,064.4	7,328.1	260,392.4	257,345.1
29	2038		3,047.4		3,047.4	271,230.3	7,328.1	278,558.4	275,511.0
30	2038		3,047.4		3,047.4	290,700.3	7,328.1	298,028.3	294,981.0
Total		70,771.5	78,527.8	23,208.7	172,507.9	3,421,694.3	164,859.6	3,586,554.0	3,414,046.0

EIRR = **25.64%**
(Discount Rate 15%)
B/C = **3.16**
NPV = **99,120**

Table 9.3.10 Ship Waiting Time for Grain Terminal Plan (Alternative-1a&b) and Benefit Estimate(Traffic Demand Forecast:Case-1)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Unit Load (ton/ship)	No. of Ships (Ship/Year)	No. of Berth	Operator	Capacity (ton/ship·hour)	Capacity (ton/terminal·hour)	Required Stay Terminal Hour/Year	Required Ship Days/Year	Days/Year	Occupancy Ratio	Waiting Time Factor	Ship Time at Berth (hour/ship)	Waiting Time (hour/ship)	Waiting Time (days)/Year	Saved Waiting Time (days)/Year	Waiting Time Savings Benefit for Cargo	Waiting Time Savings Benefit for Vessel	Time Value of Container Cargo (Lei/day)	Ship Lease Cost (Lei/day/ship)
	(A)	(B)	(C)	(D)	(E)		(H)	(I)	(P)'	(P)	(Q)	(R)	(S)	(S)'	(T)'	(T)	(U)	(V)	(W)	(X)	(Y)
			(B)x0.9	(A)/(C)				(E)x(H)	(A)/(I)	[(P)/24] x(E)	(E)x365	(P)/(Q)	Queueing Table (VIII)	(C)/(H)	(S)x(S)'	[(T')x(D)]/24	(T)-(Total Waiting Time of Capacity)	[(A)x(U)x (X)]/1000000	[(U)x(Y)]/1000000		
1999	1,760,000	7,500	6,750	261	1	SILOTRANS	670	670	2,627	109	365	0.300	0.462	10.07	4.65	50.567					
2000	1,817,062	7,500	6,750	269	1		670	670	2,712	113	365	0.310	0.480	10.07	4.84	54.241					
2001	1,875,974	7,500	6,750	278	1		670	670	2,800	117	365	0.320	0.510	10.07	5.14	59.499					
2002	1,936,795	7,500	6,750	287	1		670	670	2,891	120	365	0.330	0.525	10.07	5.29	63.235					
2003	1,999,589	7,500	6,750	296	1		670	670	2,984	124	365	0.341	0.555	10.07	5.59	69.016					
Capacity	2,000,000	7,500	6,750	296	1		670	670	2,985	124	365	0.341	0.555	10.07	5.59	69.030					
2004	2,064,419	7,500	6,750	306	1		670	670	3,081	128	365	0.352	0.585	10.07	5.89	75.105	6.075	45,773	922.2	3,649.8	151,800,000
2005	2,131,350	7,500	6,750	316	1		670	670	3,181	133	365	0.363	0.615	10.07	6.20	81.516	12.486	97,132	1,895.4	3,649.8	151,800,000
2006	2,200,452	7,500	6,750	326	1		670	670	3,284	137	365	0.375	0.645	10.07	6.50	88.264	19.235	154,477	2,919.8	3,649.8	151,800,000
2007	2,271,794	7,500	6,750	337	1		670	670	3,391	141	365	0.387	0.660	10.07	6.65	93.245	24.215	200,785	3,675.9	3,649.8	151,800,000
2008	2,345,449	7,500	6,750	347	1		670	670	3,501	146	365	0.400	0.690	10.07	6.95	100.644	31.614	270,634	4,799.1	3,649.8	151,800,000
2009	2,421,492	7,500	6,750	359	1		670	670	3,614	151	365	0.413	0.750	10.07	7.56	112.943	43.913	388,102	6,666.0	3,649.8	151,800,000
2010	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2011	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2012	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2013	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2014	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2015	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2016	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2017	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2018	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2019	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2020	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2021	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2022	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2023	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2024	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2025	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2026	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2027	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2028	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2029	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2030	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2031	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2032	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000
2033	2,500,000	7,500	6,750	370	1		670	670	3,731	155	365	0.426	0.780	10.07	7.86	121.269	52.239	476,655	7,929.9	3,649.8	151,800,000

Table 11.3.11 Ship Waiting Time for Grain Terminal Plan (Alternative-1a&b:) and Benefit Estimate(Traffic Demand Forecast:Case-1)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Unit Load (ton/ship)	No. of Ships (Ship/Year)	No. of Berth	Operator	Capacity (ton/ship-hour)	Capacity (ton/terminal -hour)	Required Stay Terminal Hour/Year	Required Ship Days/Year	Days/Year	Occupancy Ratio	Waiting Time Factor	Ship Time at Berth (hour/ship)	Waiting Time (hour/ship)	Waiting Time (days)/Year	Saved Waiting Time (days)/Year	Waiting Time Savings Benefit for Cargo	Waiting Time Savings Benefit for Vessel	Time Value of Container Cargo (Lei/day)	Ship Lease Cost (Lei/day/ship)
	(A)	(B)	(C)	(D)	(E)		(H)	(I)	(P)'	(P)	(Q)	(R)	(S)	(S)'	(T)'	(T)	(U)	(V)	(W)	(X)	(Y)
			(B)x0.9	(A)/(C)				(E)x(H)	(A)/(I)	[(P)/24] x(E)	(E)x365	(P)/(Q)	Queueing Table (VIII)	(C)/(H)	(S)x(S)'	[(T')x(D)]/24	(T)-(Total Waiting Time of Capacity)	[(A)x(U)x (X)/1000000	[(U)x(Y)]/10000 00		
1999	1,760,000	7,500	6,750	261	1	SILOTRANS	670	670	2.627	109	365	0.30	0.499	10.07	5.03	54.613					
2000	1,789,662	7,500	6,750	265	1		670	670	2.671	111	365	0.30	0.518	10.07	5.22	57.697					
2001	1,819,825	7,500	6,750	270	1		670	670	2.716	113	365	0.31	0.551	10.07	5.55	62.336					
2002	1,850,495	7,500	6,750	274	1		670	670	2.762	115	365	0.32	0.551	10.07	5.55	63.386					
2003	1,881,683	7,500	6,750	279	1		670	670	2.808	117	365	0.32	0.567	10.07	5.71	66.350					
2004	1,913,396	7,500	6,750	283	1		670	670	2.856	119	365	0.33	0.567	10.07	5.71	67.469					
2005	1,945,644	7,500	6,750	288	1		670	670	2.904	121	365	0.33	0.583	10.07	5.88	70.566					
2006	1,978,435	7,500	6,750	293	1		670	670	2.953	123	365	0.34	0.583	10.07	5.88	71.755					
Capacity	2,000,000	7,500	6,750	296	1		670	670	2.985	124	365	0.34	0.599	10.07	6.04	74.552					
2007	2,011,779	7,500	6,750	298	1		670	670	3.003	125	365	0.34	0.599	10.07	6.04	74.991	0.439	2,687	66.7	3,649.8	151,800,000
2008	2,045,685	7,500	6,750	303	1		670	670	3.053	127	365	0.35	0.599	10.07	6.04	76.255	1.703	10,596	258.5	3,041.5	151,800,000
2009	2,080,162	7,500	6,750	308	1		670	670	3.105	129	365	0.35	0.632	10.07	6.37	81.732	7.179	45,423	1,089.8	3,041.5	151,800,000
2010	2,115,220	7,500	6,750	313	1		670	670	3.157	132	365	0.36	0.664	10.07	6.69	87.371	12.819	82,470	1,945.9	3,041.5	151,800,000
2011	2,150,869	7,500	6,750	319	1		670	670	3.210	134	365	0.37	0.664	10.07	6.69	88.844	14.292	93,493	2,169.4	3,041.5	151,800,000
2012	2,187,119	7,500	6,750	324	1		670	670	3.264	136	365	0.37	0.697	10.07	7.02	94.748	20.196	134,345	3,065.7	3,041.5	151,800,000
2013	2,223,980	7,500	6,750	329	1		670	670	3.319	138	365	0.38	0.697	10.07	7.02	96.345	21.793	147,411	3,308.1	3,041.5	151,800,000
2014	2,261,462	7,500	6,750	335	1		670	670	3.375	141	365	0.39	0.713	10.07	7.18	100.247	25.695	176,735	3,900.5	3,041.5	151,800,000
2015	2,299,576	7,500	6,750	341	1		670	670	3.432	143	365	0.39	0.745	10.07	7.51	106.570	32.018	223,938	4,860.3	3,041.5	151,800,000
2016	2,338,332	7,500	6,750	346	1		670	670	3.490	145	365	0.40	0.745	10.07	7.51	108.366	33.814	240,486	5,132.9	3,041.5	151,800,000
2017	2,377,742	7,500	6,750	352	1		670	670	3.549	148	365	0.41	0.778	10.07	7.83	114.983	40.431	292,395	6,137.4	3,041.5	151,800,000
2018	2,417,815	7,500	6,750	358	1		670	670	3.609	150	365	0.41	0.810	10.07	8.16	121.793	47.241	347,399	7,171.1	3,041.5	151,800,000
2019	2,458,564	7,500	6,750	364	1		670	670	3.669	153	365	0.42	0.810	10.07	8.16	123.846	49.293	368,603	7,482.7	3,041.5	151,800,000
2020	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2021	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2022	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2023	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2024	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2025	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2026	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2027	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2028	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2029	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2030	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2031	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2032	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2033	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2034	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2035	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000
2036	2,500,000	7,500	6,750	370	1		670	670	3.731	155	365	0.43	0.842	10.07	8.49	130.970	56.418	428,989	8,564.2	3,041.5	151,800,000

Table 9.3.13 Ship Lease Cost for Navigation for Grain Terminal Plan (Alternative-1&2:Without-the-Project: Trazffic Demand Forfecast:Case-1)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Ship Lease Cost for Navigation by Ship Scale Economy (Million Lei)	Ship Lease Cost for Navigation (Lei/day/ton)
	(A)	(B)	(C)	(D)
			[(A)x(D)xTransportation Time(days:7.3)]/1000000	
1999	1,760,000	7,500	260,044	20,240.00
2000	1,817,062	7,500	268,475	20,240.00
2001	1,875,974	7,500	277,179	20,240.00
2002	1,936,795	7,500	286,165	20,240.00
2003	1,999,589	7,500	295,443	20,240.00
Capacity	2,000,000	7,500	295,504	20,240.00
2004	2,064,419	7,500	305,022	20,240.00
2005	2,131,350	7,500	314,911	20,240.00
2006	2,200,452	7,500	325,121	20,240.00
2007	2,271,794	7,500	335,662	20,240.00
2008	2,345,449	7,500	346,545	20,240.00
2009	2,421,492	7,500	357,780	20,240.00
2010	2,500,000	7,500	369,380	20,240.00
2011	2,500,000	7,500	369,380	20,240.00
2012	2,500,000	7,500	369,380	20,240.00
2013	2,500,000	7,500	369,380	20,240.00
2014	2,500,000	7,500	369,380	20,240.00
2015	2,500,000	7,500	369,380	20,240.00
2016	2,500,000	7,500	369,380	20,240.00
2017	2,500,000	7,500	369,380	20,240.00
2018	2,500,000	7,500	369,380	20,240.00
2019	2,500,000	7,500	369,380	20,240.00
2020	2,500,000	7,500	369,380	20,240.00
2021	2,500,000	7,500	369,380	20,240.00
2022	2,500,000	7,500	369,380	20,240.00
2023	2,500,000	7,500	369,380	20,240.00
2024	2,500,000	7,500	369,380	20,240.00
2025	2,500,000	7,500	369,380	20,240.00
2026	2,500,000	7,500	369,380	20,240.00
2027	2,500,000	7,500	369,380	20,240.00
2028	2,500,000	7,500	369,380	20,240.00
2029	2,500,000	7,500	369,380	20,240.00
2030	2,500,000	7,500	369,380	20,240.00
2031	2,500,000	7,500	369,380	20,240.00
2032	2,500,000	7,500	369,380	20,240.00
2033	2,500,000	7,500	369,380	20,240.00

Table 9.3.14 Ship Lease Cost for Navigationfor Grain Terminal Plan (Alternative-1&2:With-the-Project: Traffic Demand Forfecast:Case-1)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Ship Lease Cost for Navigation by Ship Scale Economy (Million Lei)	Ship Lease Cost for Navigation by Ship Scale Economy (Lei/day/ton)	Ship Lease Cost Savings for Navigation by Ship Scale Economy (Million Lei)
	(A)	(B)	(C)	(D)	(E)
			[(A)x(D)xTransportation Time(days:7.3)]/1000000		(Without)-(With)
1999	1,760,000	7,500	260,044	20,240.00	0
2000	1,817,062	7,500	268,475	20,240.00	0
2001	1,875,974	7,500	277,179	20,240.00	0
2002	1,936,795	7,500	286,165	20,240.00	0
2003	1,999,589	7,500	295,443	20,240.00	0
Capacity	2,000,000	7,500	295,504	20,240.00	0
2004	2,064,419	7,500	305,022	20,240.00	0
2005	2,131,350	7,500	314,911	20,240.00	0
2006	2,200,452	7,500	325,121	20,240.00	0
2007	2,271,794	7,500	335,662	20,240.00	0
2008	2,345,449	7,500	346,545	20,240.00	0
2009	2,421,492	7,500	357,780	20,240.00	0
2010	2,500,000	11,250	266,774	14,617.78	102,606
2011	2,500,000	11,250	266,774	14,617.78	102,606
2012	2,500,000	11,250	266,774	14,617.78	102,606
2013	2,500,000	11,250	266,774	14,617.78	102,606
2014	2,500,000	11,250	266,774	14,617.78	102,606
2015	2,500,000	11,250	266,774	14,617.78	102,606
2016	2,500,000	11,250	266,774	14,617.78	102,606
2017	2,500,000	11,250	266,774	14,617.78	102,606
2018	2,500,000	11,250	266,774	14,617.78	102,606
2019	2,500,000	11,250	266,774	14,617.78	102,606
2020	2,500,000	17,500	184,690	10,120.00	184,690
2021	2,500,000	17,500	184,690	10,120.00	184,690
2022	2,500,000	17,500	184,690	10,120.00	184,690
2023	2,500,000	17,500	184,690	10,120.00	184,690
2024	2,500,000	17,500	184,690	10,120.00	184,690
2025	2,500,000	17,500	184,690	10,120.00	184,690
2026	2,500,000	17,500	184,690	10,120.00	184,690
2027	2,500,000	17,500	184,690	10,120.00	184,690
2028	2,500,000	17,500	184,690	10,120.00	184,690
2029	2,500,000	17,500	184,690	10,120.00	184,690
2030	2,500,000	17,500	184,690	10,120.00	184,690
2031	2,500,000	17,500	184,690	10,120.00	184,690
2032	2,500,000	17,500	184,690	10,120.00	184,690
2033	2,500,000	17,500	184,690	10,120.00	184,690

Table 9.3.15 Ship Lease Cost for Navigation for Grain Terminal Plan (Alternative-1&2:Without-the-Project: Traffic Demand Forfecast:Case-2)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Ship Lease Cost for Navigation by Ship Scale Economy (Million Lei)	Ship Lease Cost for Navigation (Lei/day/ton)
	(A)	(B)	(C)	(D)
			[(A)x(D)xTransportation Time(days:7.3)]/1000000	
1999	1,760,000	7,500	260,044	20,240.00
2000	1,789,662	7,500	264,426	20,240.00
2001	1,819,825	7,500	268,883	20,240.00
2002	1,850,495	7,500	273,414	20,240.00
2003	1,881,683	7,500	278,022	20,240.00
2004	1,913,396	7,500	282,708	20,240.00
2005	1,945,644	7,500	287,473	20,240.00
2006	1,978,435	7,500	292,318	20,240.00
Capacity	2,000,000	7,500	295,504	20,240.00
2007	2,011,779	7,500	297,244	20,240.00
2008	2,045,685	7,500	302,254	20,240.00
2009	2,080,162	7,500	307,348	20,240.00
2010	2,115,220	7,500	312,528	20,240.00
2011	2,150,869	7,500	317,795	20,240.00
2012	2,187,119	7,500	323,151	20,240.00
2013	2,223,980	7,500	328,598	20,240.00
2014	2,261,462	7,500	334,136	20,240.00
2015	2,299,576	7,500	339,767	20,240.00
2016	2,338,332	7,500	345,493	20,240.00
2017	2,377,742	7,500	351,316	20,240.00
2018	2,417,815	7,500	357,237	20,240.00
2019	2,458,564	7,500	363,258	20,240.00
2020	2,500,000	7,500	369,380	20,240.00
2021	2,500,000	7,500	369,380	20,240.00
2022	2,500,000	7,500	369,380	20,240.00
2023	2,500,000	7,500	369,380	20,240.00
2024	2,500,000	7,500	369,380	20,240.00
2025	2,500,000	7,500	369,380	20,240.00
2026	2,500,000	7,500	369,380	20,240.00
2027	2,500,000	7,500	369,380	20,240.00
2028	2,500,000	7,500	369,380	20,240.00
2029	2,500,000	7,500	369,380	20,240.00
2030	2,500,000	7,500	369,380	20,240.00
2031	2,500,000	7,500	369,380	20,240.00
2032	2,500,000	7,500	369,380	20,240.00
2033	2,500,000	7,500	369,380	20,240.00
2034	2,500,000	7,500	369,380	20,240.00
2035	2,500,000	7,500	369,380	20,240.00
2036	2,500,000	7,500	369,380	20,240.00

Table9.3.16 Ship Lease Cost for Navigation for Grain Terminal Plan (Alternatgive-1&2:With-the-Project: Traffic Demand Forfecast:Case-2)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Ship Lease Cost for Navigation (Million Lei)	Ship Lease Cost for Navigation by Ship Scale Economy (Lei/day/ton)	Ship Lease Cost Savings for Navigation by Ship Scale Economy (Million Lei)
	(A)	(B)	(W)'	(Z)	(Z)1
			[(A)x(Z)xTransportation Time(days:7.3)]/1000000		(Without)-(With)
1999	1,760,000	7,500	260,044	20,240.00	0
2000	1,789,662	7,500	264,426	20,240.00	0
2001	1,819,825	7,500	268,883	20,240.00	0
2002	1,850,495	7,500	273,414	20,240.00	0
2003	1,881,683	7,500	278,022	20,240.00	0
2004	1,913,396	7,500	282,708	20,240.00	0
2005	1,945,644	7,500	287,473	20,240.00	0
2006	1,978,435	7,500	292,318	20,240.00	0
Capacity	2,000,000	7,500	295,504	20,240.00	0
2007	2,011,779	7,500	297,244	20,240.00	0
2008	2,045,685	7,500	302,254	20,240.00	0
2009	2,080,162	7,500	307,348	20,240.00	0
2010	2,115,220	11,250	225,715	14,617.78	86,813
2011	2,150,869	11,250	229,519	14,617.78	88,276
2012	2,187,119	11,250	233,387	14,617.78	89,764
2013	2,223,980	11,250	237,320	14,617.78	91,277
2014	2,261,462	11,250	241,320	14,617.78	92,815
2015	2,299,576	11,250	245,387	14,617.78	94,380
2016	2,338,332	11,250	249,523	14,617.78	95,970
2017	2,377,742	11,250	253,728	14,617.78	97,588
2018	2,417,815	11,250	258,005	14,617.78	99,233
2019	2,458,564	11,250	262,353	14,617.78	100,905
2020	2,500,000	17,500	184,690	10,120.00	184,690
2021	2,500,000	17,500	184,690	10,120.00	184,690
2022	2,500,000	17,500	184,690	10,120.00	184,690
2023	2,500,000	17,500	184,690	10,120.00	184,690
2024	2,500,000	17,500	184,690	10,120.00	184,690
2025	2,500,000	17,500	184,690	10,120.00	184,690
2026	2,500,000	17,500	184,690	10,120.00	184,690
2027	2,500,000	17,500	184,690	10,120.00	184,690
2028	2,500,000	17,500	184,690	10,120.00	184,690
2029	2,500,000	17,500	184,690	10,120.00	184,690
2030	2,500,000	17,500	184,690	10,120.00	184,690
2031	2,500,000	17,500	184,690	10,120.00	184,690
2032	2,500,000	17,500	184,690	10,120.00	184,690
2033	2,500,000	17,500	184,690	10,120.00	184,690
2034	2,500,000	17,500	184,690	10,120.00	184,690
2035	2,500,000	17,500	184,690	10,120.00	184,690
2036	2,500,000	17,500	184,690	10,120.00	184,690

Table 9.3.17 Cash Flow of Economic Cost and Benefit for Grain Terminal Plan (Alternative-1a) (Traffic Demand Forecast : Case-1) Development Alternative at New S3 Pier

(Unit : 1,000 US$)

No.	Year	Cost				Benefit				Net Benefit
		Capital Cost	O&M Cost	Replacement Cost	Total	Waiting Time Savings for Cargo	Wsaiting Time Savings for Vessel	Ship Lease Cost Savings for Ship Scale Economy	Total	
-4	2004	2,939.7			2,939.7				0.0	-2,939.7
-3	2005				0.0				0.0	0.0
-2	2006	50,401.9			50,401.9				0.0	-50,401.9
-1	2007	50,401.9	1,489.7		51,891.6	1,809.2	36.4	0.0	1,845.7	-50,045.9
1	2008		1,539.4		1,539.4	3,839.2	74.9	0.0	3,914.1	2,374.7
2	2009		1,747.9		1,747.9	6,105.8	115.4	0.0	6,221.2	4,473.3
3	2010		1,747.9		1,747.9	7,936.2	145.3	0.0	8,081.5	6,333.5
4	2011		1,747.9		1,747.9	10,697.0	189.7	0.0	10,886.7	9,138.7
5	2012		1,747.9		1,747.9	15,340.0	263.5	0.0	15,603.5	13,855.5
6	2013		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
7	2014		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
8	2015		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
9	2016		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
10	2017		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
11	2018		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
12	2019		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
13	2020		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
14	2021		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
15	2022		1,747.9	28,215.1	29,963.0	18,840.1	313.4	4,055.6	23,209.1	-6,753.9
16	2023		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
17	2024		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
18	2025		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
19	2026		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
20	2027		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
21	2028		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
22	2029		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
23	2030		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
24	2031		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
25	2032		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
26	2033		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
27	2034		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
28	2035		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
29	2036		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
30	2037		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
Total		103,743.4	53,718.9	28,215.1	185,677.5	516,730.1	8,661.1	150,055.6	675,446.7	489,769.3

EIRR = **12.6%**
(Discount Rate 15%)
B/C = **0.82**
NPV = **-13,103**

Table 9.3.18 Cash Flow of Economic Cost and Benefit for Grain Terminal Plan (Alternative-1a)(Traffic Demand Forecast : Case-2) Development Alternative at New S3 Pier

(Unit : 1,000 US$)

No.	Year	Cost				Benefit				Net Benefit
		Capital Cost	O&M Cost	Repalacement Cost	Total	Waiting Time Savings for Cargo	Wsaiting Time Savings for Vessel	Ship Lease Cost Savings for Ship Scale Economy	Total	
-4	2004	2,939.7			2,939.7				0.0	-2,939.7
-3	2005				0.0				0.0	0.0
-2	2006	50,401.9			50,401.9				0.0	-50,401.9
-1	2007	50,401.9	1,489.7		51,891.6	106.2	2.6	0.0	108.8	-51,782.7
1	2008		1,539.4		1,539.4	418.8	10.2	0.0	429.0	-1,110.3
2	2009		1,747.9		1,747.9	1,795.4	43.1	0.0	1,838.5	90.5
3	2010		1,747.9		1,747.9	3,259.7	76.9	3,431.4	6,768.0	5,020.0
4	2011		1,747.9		1,747.9	3,695.4	85.7	3,489.2	7,270.3	5,522.4
5	2012		1,747.9		1,747.9	5,310.1	121.2	3,548.0	8,979.2	7,231.3
6	2013		1,747.9		1,747.9	5,826.5	130.8	3,607.8	9,565.1	7,817.1
7	2014		1,747.9		1,747.9	6,985.6	154.2	3,668.6	10,808.3	9,060.4
8	2015		1,747.9		1,747.9	8,851.3	192.1	3,730.4	12,773.8	11,025.9
9	2016		1,747.9		1,747.9	9,505.4	202.9	3,793.3	13,501.5	11,753.6
10	2017		1,747.9		1,747.9	11,557.1	242.6	3,857.2	15,656.9	13,909.0
11	2018		1,747.9		1,747.9	13,731.2	283.4	3,922.2	17,936.9	16,188.9
12	2019		1,747.9		1,747.9	14,569.3	295.8	3,988.3	18,853.4	17,105.5
13	2020		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
14	2021		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
15	2022		1,747.9	28,215.1	29,963.0	16,956.1	338.5	7,300.0	24,594.6	-5,368.4
16	2023		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
17	2024		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
18	2025		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
19	2026		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
20	2027		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
21	2028		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
22	2029		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
23	2030		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
24	2031		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
25	2032		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
26	2033		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
27	2034		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
28	2035		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
29	2036		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
30	2037		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
Total		103,743.4	53,718.9	28,215.1	185,677.5	390,821.7	7,934.6	168,436.4	567,192.7	381,515.3

EIRR = **9.2%**
(Discount Rate 15%)
B/C = **0.55**
NPV = **-33,455**

Table 9.3.20 Cash Flow of Economic Cost and Benefit for Grain Terminal Plan (Alternative-1b) (Traffic Demand Forecast : Case-1) Development at Existing S1 Pier or Existing Berth Nos. 31 to 33

(Unit : 1,000 US$)

No.	Year	Cost				Benefit				Net Benefit
		Capital Cost	O&M Cost	Repalacement Cost	Total	Waiting Time Savings for Cargo	Wsaiting Time Savings for Vessel	Ship Lease Cost Savings for Ship Scale Economy	Total	
-4	2004	2,194.8			2,194.8				0.0	-2,194.8
-3	2005				0.0				0.0	0.0
-2	2006	37,759.2			37,759.2				0.0	-37,759.2
-1	2007	37,759.2	1,489.7		39,248.9	1,809.2	36.4	0.0	1,845.7	-37,403.2
1	2008		1,539.4		1,539.4	3,839.2	74.9	0.0	3,914.1	2,374.7
2	2009		1,747.9		1,747.9	6,105.8	115.4	0.0	6,221.2	4,473.3
3	2010		1,747.9		1,747.9	7,936.2	145.3	0.0	8,081.5	6,333.5
4	2011		1,747.9		1,747.9	10,697.0	189.7	0.0	10,886.7	9,138.7
5	2012		1,747.9		1,747.9	15,340.0	263.5	0.0	15,603.5	13,855.5
6	2013		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
7	2014		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
8	2015		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
9	2016		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
10	2017		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
11	2018		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
12	2019		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
13	2020		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
14	2021		1,747.9		1,747.9	18,840.1	313.4	4,055.6	23,209.1	21,461.2
15	2022		1,747.9	28,215.1	29,963.0	18,840.1	313.4	4,055.6	23,209.1	-6,753.9
16	2023		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
17	2024		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
18	2025		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
19	2026		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
20	2027		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
21	2028		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
22	2029		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
23	2030		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
24	2031		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
25	2032		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
26	2033		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
27	2034		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
28	2035		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
29	2036		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
30	2037		1,747.9		1,747.9	18,840.1	313.4	7,300.0	26,453.5	24,705.6
Total		77,713.2	53,718.9	28,215.1	159,647.3	516,730.1	8,661.1	150,055.6	675,446.7	515,799.5

EIRR = **15.7%**
(Discount Rate 15%)
B/C = **1.05**
NPV = **3,086**

Table 9.3.21 Cash Flow of Economic Cost and Benefit for Grain Terminal Plan (Alternative-1b) (Traffic Demand Forecast : Case-2) Development at Existing S1 Pier or Existing Berth Nos. 31 to 33

(Unit : 1,000 US$)

No.	Year	Cost				Benefit				Net Benefit
		Capital Cost	O&M Cost	Replacement Cost	Total	Waiting Time Savings for Cargo	Wsaiting Time Savings for Vessel	Ship Lease Cost Savings for Ship Scale Economy	Total	
-4	2004	2,194.8			2,194.8				0.0	-2,194.8
-3	2005				0.0				0.0	0.0
-2	2006	37,759.2			37,759.2				0.0	-37,759.2
-1	2007	37,759.2	1,489.7		39,248.9	106.2	2.6	0.0	108.8	-39,140.1
1	2008		1,539.4		1,539.4	418.8	10.2	0.0	429.0	-1,110.3
2	2009		1,747.9		1,747.9	1,795.4	43.1	0.0	1,838.5	90.5
3	2010		1,747.9		1,747.9	3,259.7	76.9	3,431.4	6,768.0	5,020.0
4	2011		1,747.9		1,747.9	3,695.4	85.7	3,489.2	7,270.3	5,522.4
5	2012		1,747.9		1,747.9	5,310.1	121.2	3,548.0	8,979.2	7,231.3
6	2013		1,747.9		1,747.9	5,826.5	130.8	3,607.8	9,565.1	7,817.1
7	2014		1,747.9		1,747.9	6,985.6	154.2	3,668.6	10,808.3	9,060.4
8	2015		1,747.9		1,747.9	8,851.3	192.1	3,730.4	12,773.8	11,025.9
9	2016		1,747.9		1,747.9	9,505.4	202.9	3,793.3	13,501.5	11,753.6
10	2017		1,747.9		1,747.9	11,557.1	242.6	3,857.2	15,656.9	13,909.0
11	2018		1,747.9		1,747.9	13,731.2	283.4	3,922.2	17,936.9	16,188.9
12	2019		1,747.9		1,747.9	14,569.3	295.8	3,988.3	18,853.4	17,105.5
13	2020		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
14	2021		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
15	2022		1,747.9	28,215.1	29,963.0	16,956.1	338.5	7,300.0	24,594.6	-5,368.4
16	2023		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
17	2024		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
18	2025		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
19	2026		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
20	2027		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
21	2028		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
22	2029		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
23	2030		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
24	2031		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
25	2032		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
26	2033		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
27	2034		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
28	2035		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
29	2036		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
30	2037		1,747.9		1,747.9	16,956.1	338.5	7,300.0	24,594.6	22,846.7
Total		77,713.2	53,718.9	28,215.1	159,647.3	390,821.7	7,934.6	168,436.4	567,192.7	407,545.4

EIRR = **11.4%**
(Discount Rate 15%)
B/C = **0.70**
NPV = **-17,266**

Table 9.3.23 Cash Flow of Economic Cost and Benefit for Grain Terminal Plan (Alternative-2) (Traffic Demand Forecast : Case-1) Development at Existing Terminal Area at North Port: "Without Project Case"

(Unit : 1,000 US$)

No.	Year	Cost				Benefit	Net Benefit
		Capital Cost	O&M Cost	Replacement Cost	Total	Ship Lease Cost Savings for Ship Scale Economy	
-4	2004	2,194.8			2,194.8	0.0	-2,194.8
-3	2005				0.0	0.0	0.0
-2	2006	37,759.2			37,759.2	0.0	-37,759.2
-1	2007	37,759.2	1,489.7		39,248.9	0.0	-39,248.9
1	2008		49.7		49.7	0.0	-49.7
2	2009		258.2		258.2	0.0	-258.2
3	2010		258.2		258.2	0.0	-258.2
4	2011		258.2		258.2	0.0	-258.2
5	2012		258.2		258.2	0.0	-258.2
6	2013		258.2		258.2	4,055.6	3,797.3
7	2014		258.2		258.2	4,055.6	3,797.3
8	2015		258.2		258.2	4,055.6	3,797.3
9	2016		258.2		258.2	4,055.6	3,797.3
10	2017		258.2		258.2	4,055.6	3,797.3
11	2018		258.2		258.2	4,055.6	3,797.3
12	2019		258.2		258.2	4,055.6	3,797.3
13	2020		258.2		258.2	4,055.6	3,797.3
14	2021		258.2		258.2	4,055.6	3,797.3
15	2022		258.2	28,215.1	28,473.3	4,055.6	-24,417.8
16	2023		258.2		258.2	7,300.0	7,041.8
17	2024		258.2		258.2	7,300.0	7,041.8
18	2025		258.2		258.2	7,300.0	7,041.8
19	2026		258.2		258.2	7,300.0	7,041.8
20	2027		258.2		258.2	7,300.0	7,041.8
21	2028		258.2		258.2	7,300.0	7,041.8
22	2029		258.2		258.2	7,300.0	7,041.8
23	2030		258.2		258.2	7,300.0	7,041.8
24	2031		258.2		258.2	7,300.0	7,041.8
25	2032		258.2		258.2	7,300.0	7,041.8
26	2033		258.2		258.2	7,300.0	7,041.8
27	2034		258.2		258.2	7,300.0	7,041.8
28	2035		258.2		258.2	7,300.0	7,041.8
29	2036		258.2		258.2	7,300.0	7,041.8
30	2037		258.2		258.2	7,300.0	7,041.8
Total		77,713	9,028	28,215	114,956	150,056	35,100

EIRR = **1.75%**
(Discount Rate 15%)
B/C = **0.17**
NPV = **-43,240**

Table 9.3.24 Cash Flow of Economic Cost and Benefit for Grain Terminal Plan (Alternative-2) (Traffic Demand Forecast : Case-2) Development at Existing Terminal Area at North Port . " Without Project

No.	Year	Cost				Benefit	Net Benefit
		Capital Cost	O&M Cost	Replacement Cost	Total	Ship Lease Cost Savings for Ship Scale Economy	
-4	2004	2,194.8			2,194.8	0.0	-2,194.8
-3	2005				0.0	0.0	0.0
-2	2006	37,759.2			37,759.2	0.0	-37,759.2
-1	2007	37,759.2	1,489.7		39,248.9	0.0	-39,248.9
1	2008		49.7		49.7	0.0	-49.7
2	2009		258.2		258.2	0.0	-258.2
3	2010		258.2		258.2	3,431.4	3,173.1
4	2011		258.2		258.2	3,489.2	3,231.0
5	2012		258.2		258.2	3,548.0	3,289.8
6	2013		258.2		258.2	3,607.8	3,349.6
7	2014		258.2		258.2	3,668.6	3,410.4
8	2015		258.2		258.2	3,730.4	3,472.2
9	2016		258.2		258.2	3,793.3	3,535.1
10	2017		258.2		258.2	3,857.2	3,599.0
11	2018		258.2		258.2	3,922.2	3,664.0
12	2019		258.2		258.2	3,988.3	3,730.1
13	2020		258.2		258.2	7,300.0	7,041.8
14	2021		258.2		258.2	7,300.0	7,041.8
15	2022		258.2	28,215.1	28,473.3	7,300.0	-21,173.3
16	2023		258.2	0.0	258.2	7,300.0	7,041.8
17	2024		258.2		258.2	7,300.0	7,041.8
18	2025		258.2		258.2	7,300.0	7,041.8
19	2026		258.2		258.2	7,300.0	7,041.8
20	2027		258.2		258.2	7,300.0	7,041.8
21	2028		258.2		258.2	7,300.0	7,041.8
22	2029		258.2		258.2	7,300.0	7,041.8
23	2030		258.2		258.2	7,300.0	7,041.8
24	2031		258.2		258.2	7,300.0	7,041.8
25	2032		258.2		258.2	7,300.0	7,041.8
26	2033		258.2		258.2	7,300.0	7,041.8
27	2034		258.2		258.2	7,300.0	7,041.8
28	2035		258.2		258.2	7,300.0	7,041.8
29	2036		258.2		258.2	7,300.0	7,041.8
30	2037		258.2		258.2	7,300.0	7,041.8
Total		77,713.2	9,027.6	28,215.1	114,956.0	168,436.4	53,480.5

EIRR = **2.75%**
(Discount Rate 15%)
B/C = **0.24**
NPV = **-39,358**

Table 9.3.26 Navigation Time Saving Benefit for Cargo and Vessel for Barge Terminal Plan (Traffic Demand Forfecast:Case-1)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Unit Load (ton/ship)	Rate of Empty Barge	No. of Barge (Ship/Year)	Average Variable Dwelling Time (without-project) (Days/barge))	Total Dwelling Time (without-project) (Days/\Year)	Rate of Improvement of Efficiency for Barge Operation (%)	Total Saved Dwelling Time (with-project) (Days/\Year)	Average Time for Forming Up Convoy : Without-Project (Hours/Convoy): Without	No. of Convoy	Total Time for Forming Up Convoy (without-project) (Days/Year)	Rate of Improvement of Efficiency for Convoy Forming Up (%)	Total Saved Time for Forming Up Convoy (Days/Year) : With	Total Saved Time for Forming Up Convoy for Barge(Days/Year)	Total Saved Time for Forming Up Convoy for Cargo(Days/Year)	Ship Lease Cost for Navigation (Lei/day)		Average Time Value of Cargo (Lei/Ton/Day)	Dwelling Time Saving Benefit for Cargo (Million Lei)	Dwelling Time Saving Benefit for Barge & Pussher (Million Lei)			Time Saving Benefit for Forming Up of Convoy for Cargo (Million Lei)	Time Saving Benefit for Forming Up of Convoy for Barge (Million Lei)		
																	Barge	Pussher Barge			Barge	Pussher Barge	Total		Barge	Pussher Barge	Total
	(A)	(B)	(C)	(D)	(D)'	(D)"	(D)"'	(E)	(F)	(F)'	(FA)	(FB)	(FC)	(F)''	(F)'''	(FD)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(M)'	(N)	(O)	(P)
			(B) x0.7		{(A)/(C)} /(1-(D)}		(D)' x (D)"		(D)''' x {E)/100}		(D)'/5	{(F)' x (FA)}/24/365		(FB) x {1-(FC)/100}	(F)" x 5	(F)"' x (C)	(24,000/2 Yenx (235Lei/Yen)	[{(130,000 /2Yen x(235Lei/Yen)}/5		{(I) x (F) x (C)}/1,000,000	{(F)x(G)}/ 1,000,000	[(F)}x(H)]/ 1,000,000	(K)+(L)	(I) x (FD)/1,000,000	{(F)"'x(G)}/ 1,000,000	[(F)"']x(H)]/ 1,000,000	(K)+(L)
1999	7,338,767	1,500	1,050	0.10	7,766	2.0	15,532	0	0	5	1,553	323.6	0	0	0	0	2,820,000	3,055,000	2,866	0	0	0	0	0	0	0	0
2000	7,956,474	1,500	1,050	0.10	8,420	2.0	16,839	0	0	6	1,684	399.4	0	0	0	0	2,820,000	3,055,000	2,885	0	0	0	0	0	0	0	0
2001	8,138,279	1,500	1,050	0.10	8,612	2.0	17,224	0	0	6	1,722	438.7	0	0	0	0	2,820,000	3,055,000	2,903	0	0	0	0	0	0	0	0
2002	8,404,574	1,500	1,050	0.10	8,894	2.0	17,787	0	0	7	1,779	491.3	0	0	0	0	2,820,000	3,055,000	2,921	0	0	0	0	0	0	0	0
2003	8,693,358	1,500	1,050	0.10	9,199	2.0	18,399	0	0	7	1,840	551.9	0	0	0	0	2,820,000	3,055,000	2,940	0	0	0	0	0	0	0	0
2004	9,048,168	1,500	1,050	0.10	9,575	2.0	19,150	0	0	8	1,915	627.8	0	0	0	0	2,820,000	3,055,000	2,958	0	0	0	0	0	0	0	0
2005	9,435,229	1,500	1,050	0.10	9,984	2.0	19,969	0	0	9	1,997	716.8	0	0	0	0	2,820,000	3,055,000	2,977	0	0	0	0	0	0	0	0
2006	9,663,272	1,500	1,050	0.10	10,226	2.0	20,451	0	0	9	2,045	789.4	0	0	0	0	2,820,000	3,055,000	2,996	0	0	0	0	0	0	0	0
2007	9,915,095	1,500	1,050	0.10	10,492	2.0	20,984	0	0	10	2,098	872.7	0	0	0	0	2,820,000	3,055,000	3,014	0	0	0	0	0	0	0	0
2008	########	1,500	1,050	0.10	10,785	2.0	21,569	0	0	11	2,157	968.1	0	0	0	0	2,820,000	3,055,000	3,034	0	0	0	0	0	0	0	0
2009	########	1,500	1,050	0.10	11,104	2.0	22,208	0	0	12	2,221	1,077.6	0	0	0	0	2,820,000	3,055,000	3,053	0	0	0	0	0	0	0	0
2010	########	1,500	1,050	0.10	11,116	2.0	22,232	50	11,116	12	2,223	1,133.9	10	113	567	595,275	2,820,000	3,055,000	3,072	35,854	31,346	33,959	65,305	1,829	1,678,674	1,732	1,680,406
2011	########	1,500	1,050	0.10	11,116	2.0	22,232	50	11,116	13	2,223	1,190.6	10	119	595	625,052	2,820,000	3,055,000	3,118	36,387	31,347	33,959	65,306	1,949	1,762,647	1,819	1,764,466
2012	########	1,500	1,050	0.10	11,131	2.1	23,407	50	11,703	14	2,226	1,253.5	10	125	626.74	658,081	2,820,000	3,055,000	3,164	38,878	33,003	35,753	68,757	2,082	1,855,787	1,915	1,857,702
2013	########	1,500	1,050	0.10	11,160	2.2	24,705	50	12,353	14	2,232	1,323.0	10	132	661.52	694,595	2,820,000	3,055,000	3,211	41,644	34,834	37,737	72,572	2,230	1,958,759	2,021	1,960,780
2014	########	1,500	1,050	0.10	11,202	2.3	26,137	50	13,069	15	2,240	1,399.7	10	140	699.87	734,860	2,820,000	3,055,000	3,258	44,712	36,854	39,925	76,779	2,394	2,072,305	2,138	2,074,443
2015	########	1,500	1,050	0.10	11,257	2.5	27,713	50	13,857	16	2,251	1,484.1	10	148	742.06	779,166	2,820,000	3,055,000	3,307	48,111	39,076	42,332	81,408	2,576	2,197,248	2,267	2,199,515
2016	########	1,500	1,050	0.10	11,324	2.6	29,444	50	14,722	17	2,265	1,576.8	10	158	788.42	827,837	2,820,000	3,055,000	3,356	51,875	41,517	44,976	86,493	2,778	2,334,500	2,409	2,336,909
2017	########	1,500	1,050	0.10	11,390	2.7	31,280	50	15,640	18	2,278	1,675.1	10	168	837.56	879,436	2,820,000	3,055,000	3,406	55,926	44,104	47,780	91,884	2,995	2,480,010	2,559	2,482,569
2018	########	1,500	1,050	0.10	11,454	2.9	33,214	50	16,607	19	2,291	1,778.7	10	178	889.36	933,832	2,820,000	3,055,000	3,456	60,267	46,832	50,735	97,567	3,227	2,633,405	2,717	2,636,122
2019	########	1,500	1,050	0.10	11,514	3.1	35,243	50	17,621	20	2,303	1,887.4	10	189	943.68	990,863	2,820,000	3,055,000	3,507	64,896	49,692	53,833	103,526	3,475	2,794,234	2,883	2,797,117
2020	########	1,500	1,050	0.10	11,569	3.2	37,358	50	18,679	21	2,314	2,000.7	10	200	1,000.33	1,050,343	2,820,000	3,055,000	3,559	69,813	52,675	57,065	109,740	3,739	2,961,966	3,056	2,965,022
2021	########	1,500	1,050	0.10	11,631	3.4	39,649	50	19,825	22	2,326	2,123.3	10	212	1,061.67	1,114,750	2,820,000	3,055,000	3,612	75,193	55,905	60,564	116,470	4,027	3,143,595	3,243	3,146,838
2022	########	1,500	1,050	0.10	11,694	3.6	42,081	50	21,040	23	2,339	2,253.5	10	225	1,126.77	1,183,107	2,820,000	3,055,000	3,666	80,988	59,334	64,278	123,612	4,337	3,336,362	3,442	3,339,804
2023	########	1,500	1,050	0.10	11,757	3.8	44,661	50	22,330	24	2,351	2,391.7	10	239	1,195.86	1,255,656	2,820,000	3,055,000	3,720	87,230	62,972	68,220	131,192	4,671	3,540,949	3,653	3,544,602
2024	########	1,500	1,050	0.10	11,820	4.0	47,400	50	23,700	26	2,364	2,538.4	10	254	1,269.19	1,332,653	2,820,000	3,055,000	3,776	93,953	66,833	72,403	139,236	5,031	3,758,081	3,877	3,761,959
2025	########	1,500	1,050	0.10	11,883	4.2	50,306	50	25,153	27	2,377	2,694.0	10	269	1,347.02	1,414,372	2,820,000	3,055,000	3,832	101,194	70,932	76,843	147,774	5,419	3,988,529	4,115	3,992,644
2026	########	1,500	1,050	0.10	11,947	4.5	53,391	50	26,695	29	2,389	2,859.2	10	286	1,429.62	1,501,102	2,820,000	3,055,000	3,888	108,993	75,281	81,555	156,836	5,837	4,233,107	4,367	4,237,475
2027	########	1,500	1,050	0.10	12,012	4.7	56,665	50	28,332	30	2,402	3,034.6	10	303	1,517.29	1,593,150	2,820,000	3,055,000	3,946	117,393	79,898	86,556	166,453	6,287	4,492,683	4,635	4,497,318
2028	########	1,500	1,050	0.10	12,076	5.0	60,140	50	30,070	32	2,415	3,220.7	10	322	1,610.33	1,690,843	2,820,000	3,055,000	4,005	126,440	84,797	91,863	176,660	6,771	4,768,177	4,920	4,773,096
2029	########	1,500	1,050	0.10	12,141	5.3	63,827	50	31,914	34	2,428	3,418.1	10	342	1,709.07	1,794,526	2,820,000	3,055,000	4,064	136,185	89,997	97,496	187,493	7,293	5,060,563	5,221	5,065,785
2030	########	1,500	1,050	0.10	12,206	5.5	67,741	50	33,871	36	2,441	3,627.7	10	363	1,813.87	1,904,567	2,820,000	3,055,000	4,124	146,681	95,515	103,475	198,990	7,855	5,370,879	5,541	5,376,421
2031	########	1,500	1,050	0.10	12,272	5.9	71,895	50	35,948	38	2,454	3,850.2	10	385	1,925.10	2,021,356	2,820,000	3,055,000	4,186	157,986	101,372	109,820	211,192	8,461	5,700,224	5,881	5,706,105
2032	########	1,500	1,050	0.10	12,338	6.2	76,304	50	38,152	40	2,468	4,086.3	10	409	2,043.15	2,145,307	2,820,000	3,055,000	4,248	170,162	107,589	116,554	224,143	9,113	6,049,764	6,242	6,056,006
2033	########	1,500	1,050	0.10	11,164	6.5	72,885	50	36,442	42	2,233	3,903.2	10	390	1,951.59	2,049,172	2,820,000	3,055,000	4,311	164,948	102,767	111,331	214,099	8,833	5,778,665	5,962	5,784,627

Table 9.3.27 Navigation Time Saving Benefit for Cargo and Vessel for Barge Terminal Plan (Traffic Demand Forfecast:Case-2)

Year	Traffic Demand (ton)	Average Capacity (ton/ship)	Unit Load (ton/ship)	Rate of Empty Barge	No. of Barge (Ship/Year)	Average Variable Dwelling Time (without-project) (Days/barge))	Total Dwelling Time (without-project) (Days/\Year)	Rate of Improvement of Efficiency for Barge Operation (%)	Total Saved Dwelling Time (with-project) (Days/\Year)	Average Time for Forming Up Convoy : Without-Project (Hours/Convoy): Without	No. of Convoy	Total Time for Forming Up Convoy (without-project) (Days/Year)	Rate of Improvement of Efficiency for Convoy Forming Up (%)	Total Saved Time for Forming Up Convoy (Days/Year): With	Total Saved Time for Forming Up Convoy for Barge(Days/Year)	Total Saved Time for Forming Up Convoy for Cargo(Days/Year)	Ship Lease Cost for Navigation (Lei/day)		Average Time Value of Cargo (Lei/Ton/Day)	Dwelling Time Saving Benefit for Cargo (Million Lei)	Dwelling Time Saving Benefit for Barge & Pussher (Million Lei)			Time Saving Benefit for Forming Up of Convoy for Cargo (Million Lei)	Time Saving Benefit for Forming Up of Convoy for Barge (Million Lei)		
																	Barge	Pussher Barge			Barge	Pussher Barge	Total		Barge	Pussher Barge	Total
	(A)	(B)	(C)	(D)	(D)'	(D)"	(D)"'	(E)	(F)	(F)'	(FA)	(FB)	(FC)	(F)"	(F)"'	(FD)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(M)'	(N)	(O)	(P)
			(B) x0.7		{(A)/(C)}/(1-(D)}		(D)' x (D)"		(D)"' x {E)/100}		(D)'/5	{(F)' x (FA)}/24/365		(FB) x {1-(FC)/100}	(F)" x 5	(F)"' x (C)	(24,000/2 Yenx (235Lei/Yen)	[{(130,000/2 Yen x(235Lei/Yen)}/5		{(I) x (F) x (C)}/1,000,000	{(F)x(G)}/1,000,000	[(F)}x(H)]/1,000,000	(K)+(L)	(I) x (FD}/1,000,000	{(F)"x(G)}/1,000,000	[(F)"'}x(H)]/1,000,000	(K)+(L)
1999	7,338,767	1,500	1,050	0.10	7,766	2.0	15,532	0	0	5	1,553	323.6	0	0	0	0	2,820,000	3,055,000	2,866	0	0	0	0	0	0	0	0
2000	8,016,294	1,500	1,050	0.10	8,483	2.0	16,966	0	0	6	1,697	405.4	0	0	0	0	2,820,000	3,055,000	2,885	0	0	0	0	0	0	0	0
2001	8,278,661	1,500	1,050	0.10	8,760	2.0	17,521	0	0	6	1,752	454.0	0	0	0	0	2,820,000	3,055,000	2,903	0	0	0	0	0	0	0	0
2002	8,558,180	1,500	1,050	0.10	9,056	2.0	18,113	0	0	7	1,811	509.4	0	0	0	0	2,820,000	3,055,000	2,921	0	0	0	0	0	0	0	0
2003	8,855,902	1,500	1,050	0.10	9,371	2.0	18,743	0	0	7	1,874	572.7	0	0	0	0	2,820,000	3,055,000	2,940	0	0	0	0	0	0	0	0
2004	9,172,957	1,500	1,050	0.10	9,707	2.0	19,414	0	0	8	1,941	645.2	0	0	0	0	2,820,000	3,055,000	2,958	0	0	0	0	0	0	0	0
2005	9,510,567	1,500	1,050	0.10	10,064	2.0	20,128	0	0	9	2,013	728.3	0	0	0	0	2,820,000	3,055,000	2,977	0	0	0	0	0	0	0	0
2006	9,741,573	1,500	1,050	0.10	10,309	2.0	20,617	0	0	9	2,062	802.3	0	0	0	0	2,820,000	3,055,000	2,996	0	0	0	0	0	0	0	0
2007	9,991,391	1,500	1,050	0.10	10,573	2.0	21,146	0	0	10	2,115	886.1	0	0	0	0	2,820,000	3,055,000	3,014	0	0	0	0	0	0	0	0
2008	10,260,675	1,500	1,050	0.10	10,858	2.0	21,716	0	0	11	2,172	981.3	0	0	0	0	2,820,000	3,055,000	3,034	0	0	0	0	0	0	0	0
2009	10,550,132	1,500	1,050	0.10	11,164	2.0	22,328	0	0	12	2,233	1,089.3	0	0	0	0	2,820,000	3,055,000	3,053	0	0	0	0	0	0	0	0
2010	10,627,316	1,500	1,050	0.10	11,246	2.0	22,492	50	11,246	12	2,249	1,160.5	10	116	580	609,288	2,820,000	3,055,000	3,072	36,274	31,713	34,356	66,069	1,872	1,718,192	1,773	1,719,965
2011	10,507,314	1,500	1,050	0.10	11,119	2.0	22,238	50	11,119	13	2,224	1,191.2	10	119	596	625,386	2,820,000	3,055,000	3,118	36,397	31,355	33,968	65,323	1,950	1,763,589	1,820	1,765,408
2012	10,396,909	1,500	1,050	0.10	11,002	2.1	22,861	50	11,431	13	2,200	1,224.6	10	122	612.31	642,928	2,820,000	3,055,000	3,164	37,973	32,235	34,921	67,156	2,034	1,813,058	1,871	1,814,928
2013	10,295,297	1,500	1,050	0.10	10,894	2.2	23,538	50	11,769	14	2,179	1,260.8	10	126	630.42	661,944	2,820,000	3,055,000	3,211	39,676	33,188	35,954	69,142	2,125	1,866,681	1,926	1,868,607
2014	10,201,746	1,500	1,050	0.10	10,795	2.2	24,267	50	12,134	14	2,159	1,299.9	10	130	649.97	682,467	2,820,000	3,055,000	3,258	41,513	34,217	37,068	71,286	2,224	1,924,557	1,986	1,926,543
2015	10,115,597	1,500	1,050	0.10	10,704	2.3	25,052	50	12,526	15	2,141	1,342.0	10	134	670.99	704,539	2,820,000	3,055,000	3,307	43,492	35,324	38,267	73,591	2,330	1,986,800	2,050	1,988,849
2016	10,030,906	1,500	1,050	0.10	10,615	2.4	25,866	50	12,933	16	2,123	1,385.6	10	139	692.79	727,431	2,820,000	3,055,000	3,356	45,571	36,471	39,511	75,982	2,441	2,051,354	2,116	2,053,471
2017	9,953,191	1,500	1,050	0.10	10,532	2.5	26,740	50	13,370	16	2,106	1,432.4	10	143	716.20	752,013	2,820,000	3,055,000	3,406	47,810	37,704	40,846	78,550	2,561	2,120,676	2,188	2,122,864
2018	9,881,932	1,500	1,050	0.10	10,457	2.6	27,677	50	13,838	17	2,091	1,482.6	10	148	741.28	778,348	2,820,000	3,055,000	3,456	50,219	39,024	42,276	81,300	2,690	2,194,940	2,265	2,197,205
2019	9,816,654	1,500	1,050	0.10	10,388	2.8	28,678	50	14,339	18	2,078	1,536.2	10	154	768.10	806,503	2,820,000	3,055,000	3,507	52,808	40,436	43,806	84,241	2,829	2,274,339	2,347	2,276,685
2020	9,756,924	1,500	1,050	0.10	10,325	2.9	29,747	50	14,873	19	2,065	1,593.4	10	159	796.72	836,555	2,820,000	3,055,000	3,559	55,588	41,943	45,438	87,380	2,978	2,359,084	2,434	2,361,518
2021	9,689,606	1,500	1,050	0.10	10,254	3.0	30,804	50	15,402	19	2,051	1,650.1	10	165	825.05	866,303	2,820,000	3,055,000	3,612	58,419	43,434	47,054	90,488	3,129	2,442,975	2,521	2,445,496
2022	9,622,753	1,500	1,050	0.10	10,183	3.1	31,900	50	15,950	20	2,037	1,708.8	10	171	854.39	897,110	2,820,000	3,055,000	3,666	61,394	44,979	48,727	93,706	3,289	2,529,850	2,610	2,532,460
2023	9,556,361	1,500	1,050	0.10	10,113	3.3	33,034	50	16,517	21	2,023	1,769.5	10	177	884.77	929,012	2,820,000	3,055,000	3,720	64,521	46,578	50,460	97,038	3,456	2,619,814	2,703	2,622,517
2024	9,490,426	1,500	1,050	0.10	10,043	3.4	34,209	50	17,104	22	2,009	1,832.5	10	183	916.24	962,049	2,820,000	3,055,000	3,776	67,807	48,235	52,254	100,489	3,632	2,712,977	2,799	2,715,777
2025	9,424,947	1,500	1,050	0.10	9,973	3.6	35,425	50	17,713	23	1,995	1,897.6	10	190	948.82	996,260	2,820,000	3,055,000	3,832	71,260	49,950	54,112	104,062	3,817	2,809,454	2,899	2,812,352
2026	9,359,920	1,500	1,050	0.10	9,905	3.7	36,685	50	18,343	24	1,981	1,965.1	10	197	982.56	1,031,688	2,820,000	3,055,000	3,888	74,889	51,726	56,037	107,763	4,012	2,909,361	3,002	2,912,362
2027	9,295,341	1,500	1,050	0.10	9,836	3.9	37,990	50	18,995	25	1,967	2,035.0	10	204	1,017.50	1,068,376	2,820,000	3,055,000	3,946	78,703	53,565	58,029	111,595	4,216	3,012,821	3,108	3,015,929
2028	9,231,208	1,500	1,050	0.10	9,768	4.0	39,341	50	19,670	26	1,954	2,107.4	10	211	1,053.68	1,106,369	2,820,000	3,055,000	4,005	82,712	55,470	60,093	115,563	4,431	3,119,960	3,219	3,123,179
2029	9,167,517	1,500	1,050	0.10	9,701	4.2	40,740	50	20,370	27	1,940	2,182.3	10	218	1,091.15	1,145,712	2,820,000	3,055,000	4,064	86,924	57,443	62,230	119,673	4,656	3,230,908	3,333	3,234,242
2030	9,104,265	1,500	1,050	0.10	9,634	4.4	42,188	50	21,094	28	1,927	2,259.9	10	226	1,129.96	1,186,455	2,820,000	3,055,000	4,124	91,351	59,486	64,443	123,928	4,893	3,345,803	3,452	3,349,255
2031	9,041,450	1,500	1,050	0.10	9,568	4.6	43,689	50	21,844	29	1,914	2,340.3	10	234	1,170.14	1,228,646	2,820,000	3,055,000	4,186	96,003	61,601	66,734	128,335	5,143	3,464,783	3,575	3,468,358
2032	8,979,069	1,500	1,050	0.10	9,502	4.8	45,242	50	22,621	31	1,900	2,423.5	10	242	1,211.75	1,272,338	2,820,000	3,055,000	4,248	100,893	63,792	69,108	132,899	5,405	3,587,994	3,702	3,591,696
2033	8,917,118	1,500	1,050	0.10	8,492	5.0	42,166	50	21,083	32	1,698	2,258.7	10	226	1,129.36	1,185,826	2,820,000	3,055,000	4,311	95,428	59,454	64,409	123,863	5,112	3,344,028	3,450	3,347,478

Table 9.3.29 Cash Flow of Economic Cost and Benefit for Barge Terminal Plan (Traffic Demand Forecast : Case-1)

(Unit : 1,000 US$)

No.	Year	Cost				Benefit					Net Benefit
		Civil Works	O&M Cost	Repalacement Cost	Total	Dwelling Time Savings for Cargo	Dwelling Time Savings for Vessel	Time Savings for Forming Up of Convoy for Cargo	Time Savings for Forming Up of Convoy for Barge	Total	
-4	2004	1,201.2			1,201.2					0.0	-1,201.2
-3	2005				0.0					0.0	0.0
-2	2006	11,683.3			11,683.3					0.0	-11,683.3
-1	2007	11,683.3	34.6		11,717.9					0.0	-11,717.9
1	2008		134.9		134.9	1,417.2	2,581.2	72.3	68.5	4,139.1	4,004.3
2	2009		136.7		136.7	1,438.2	2,581.3	77.0	71.9	4,168.4	4,031.7
3	2010		138.7		138.7	1,536.7	2,717.7	82.3	75.7	4,412.3	4,273.6
4	2011		138.8		138.8	1,646.0	2,868.4	88.1	79.9	4,682.5	4,543.7
5	2012		138.8		138.8	1,767.3	3,034.7	94.6	84.5	4,981.2	4,842.4
6	2013		138.9		138.9	1,901.6	3,217.7	101.8	89.6	5,310.8	5,171.9
7	2014		139.0		139.0	2,050.4	3,418.7	109.8	95.2	5,674.1	5,535.1
8	2015		139.3		139.3	2,210.5	3,631.8	118.4	101.1	6,061.8	5,922.5
9	2016		139.6		139.6	2,382.1	3,856.4	127.6	107.4	6,473.5	6,333.8
10	2017		140.1		140.1	2,565.1	4,091.9	137.4	114.0	6,908.3	6,768.3
11	2018		140.5		140.5	2,759.4	4,337.6	147.8	120.8	7,365.5	7,225.1
12	2019		140.5		140.5	2,972.1	4,603.5	159.2	128.2	7,863.0	7,722.5
13	2020		140.5		140.5	3,201.1	4,885.8	171.4	136.1	8,394.4	8,254.0
14	2021		140.5		140.5	3,447.8	5,185.4	184.6	144.4	8,962.3	8,821.8
15	2022		140.5		140.5	3,713.6	5,503.4	198.9	153.3	9,569.1	9,428.6
16	2023		140.5		140.5	3,999.8	5,840.9	214.2	162.7	10,217.5	10,077.0
17	2024		140.5		140.5	4,308.0	6,199.1	230.7	172.6	10,910.4	10,769.9
18	2025		140.5		140.5	4,640.0	6,579.2	248.5	183.2	11,650.9	11,510.4
19	2026		140.5		140.5	4,997.6	6,982.6	267.6	194.4	12,442.4	12,301.9
20	2027		140.5		140.5	5,382.8	7,410.8	288.3	206.4	12,793.6	12,653.1
21	2028		140.5		140.5	5,797.7	7,865.2	310.5	219.0	13,662.9	13,522.4
22	2029		140.5		140.5	6,244.5	8,347.5	334.4	232.5	14,592.0	14,451.5
23	2030		140.5		140.5	6,725.8	8,859.4	360.2	246.7	15,585.2	15,444.7
24	2031		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
25	2032		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
26	2033		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
27	2034		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
28	2035		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
29	2036		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
30	2037		140.5		140.5	6,519.7	8,462.4	349.1	235.7	14,982.1	14,841.6
Total		24,567.8	4,228.8	0.0	28,796.6	122,743.1	173,837.1			301,695.8	272,899.2

EIRR = **19.80%**
(Discount Rate 15%)
B/C = **1.46**
NPV = **7,414**

Table 9.3.30 Cash Flow of Economic Cost and Benefit for Barge Terminal Plan (Traffic Demand Forecast : Case-2)

(Unit : 1,000 US$)

No.	Year	Cost				Benefit					Net Benefit
		Civil Works	O&M Cost	Repalacement Cost	Total	Dwelling Time Savings for Cargo	Dwelling Time Savings for Vessel	Time Savings for Forming Up of Convoy for Cargo	Time Savings for Forming Up of Convoy for Barge	Total	
-4	2004	1,201.2			1,201.2					0.0	-1,201.2
-3	2005				0.0					0.0	0.0
-2	2006	11,683.3			11,683.3					0.0	-11,683.3
-1	2007	11,683.3	34.6		11,717.9					0.0	-11,717.9
1	2008		135.4		135.4	1,433.8	2,611.4	74.0	70.1	4,189.2	4,053.9
2	2009		137.1		137.1	1,438.6	2,581.9	77.1	71.9	4,169.5	4,032.4
3	2010		139.1		139.1	1,500.9	2,654.4	80.4	73.9	4,309.6	4,170.5
4	2011		139.6		139.6	1,568.2	2,732.9	84.0	76.1	4,461.2	4,321.7
5	2012		138.8		138.8	1,640.8	2,817.6	87.9	78.5	4,624.8	4,486.0
6	2013		138.0		138.0	1,719.0	2,908.7	92.1	81.0	4,800.9	4,662.8
7	2014		137.4		137.4	1,801.2	3,003.2	96.5	83.7	4,984.6	4,847.2
8	2015		136.8		136.8	1,889.7	3,104.7	101.2	86.5	5,182.2	5,045.4
9	2016		136.2		136.2	1,984.9	3,213.5	106.3	89.5	5,394.2	5,258.0
10	2017		135.6		135.6	2,087.3	3,329.7	111.8	92.7	5,621.5	5,485.9
11	2018		135.1		135.1	2,197.2	3,453.8	117.7	96.2	5,864.8	5,729.7
12	2019		135.1		135.1	2,309.1	3,576.6	123.7	99.6	6,109.0	5,973.9
13	2020		135.1		135.1	2,426.7	3,703.8	130.0	103.2	6,363.6	6,228.5
14	2021		135.1		135.1	2,550.2	3,835.5	136.6	106.8	6,629.2	6,494.1
15	2022		135.1		135.1	2,680.1	3,971.9	143.6	110.6	6,906.2	6,771.1
16	2023		135.1		135.1	2,816.6	4,113.1	150.9	114.6	7,195.2	7,060.1
17	2024		135.1		135.1	2,960.1	4,259.4	158.6	118.6	7,496.7	7,361.5
18	2025		135.1		135.1	3,110.8	4,410.9	166.6	122.9	7,811.2	7,676.1
19	2026		135.1		135.1	3,269.2	4,567.7	175.1	127.2	8,139.3	8,004.2
20	2027		135.1		135.1	3,435.7	4,730.1	184.0	131.8	8,165.9	8,030.8
21	2028		135.1		135.1	3,610.7	4,898.4	193.4	136.4	8,509.1	8,374.0
22	2029		135.1		135.1	3,794.6	5,072.5	203.3	141.3	8,867.1	8,732.0
23	2030		135.1		135.1	3,987.8	5,252.9	213.6	146.3	9,240.8	9,105.7
24	2031		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
25	2032		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
26	2033		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
27	2034		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
28	2035		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
29	2036		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
30	2037		135.1		135.1	3,771.8	4,895.8	202.0	136.4	8,667.6	8,532.5
Total		24,567.8	4,110.7	0.0	28,678.5	82,616.2	119,075.0			205,709.0	177,030.5

EIRR = **17.72%**
(Discount Rate 15%)
B/C = **1.22**
NPV = **3,566**

CHAPTER 10 INITIAL ENVIRONMENTAL EXAMINATION (IEE)

10.1 Overview of the Master Plan

The target year of master plan for the development of the Port of Constantza is 2020. The master plan aims to enhance the overall operational efficiency and safety of the port with improved, efficient and safe cargo handling, and improved and a safe road transportation system inside the port area.

A detailed description of the facilities of the master plan is presented in chapters 6 and 7. In particular, the Master Plan envisages the development of South Port for dedicated handling of containerized cargo, edible dry-bulk (grain) cargo and others. In principle handling of these types of cargo, excluding that of grains, would be totally transferred from the inner areas of the North Port to the newly developed modern terminals in the South Port, located favourably close to the entrance of the port, by this master plan.

Also, following the transfer of entire container handling to the South Port, it is planned to reallocate the function of the existing container terminal in the North Port to that of multi-purpose terminal to handle principally break-bulk cargoes including timber. In fact, the terminal area assigned in the South Port to handle predominantly steel products would also function as a multi-purpose terminal. In other words, in order to enhance flexibility in cargo handling, two multipurpose terminal areas are planned (one each in North Port and South Port) to handle miscellaneous break-bulk cargo, while still in principle to delineate timber cargo handling to north multipurpose terminal and steel product handling to south multipurpose terminal.

Moreover, in order to enhance both safety and efficiency of cargo handling at the existing Barge Terminal linking Danube-Black Sea canal based river transport and sea transport, entire rehabilitation of the Barge Terminal is planned to facilitate efficient use of wet basin and safe berthing of barges.

The access road improvement plan, to enhance the safety and efficiency of vehicle road transport including cargo trucks inside the port, targets the improvement of port road access at Gate 5. The planned improvement would eliminate sharp turns of the road in this sloped area, thereby enhancing safety.

Accordingly, as per this master plan, significant new port facility development with new cargo terminals, including installation of new cargo handling equipment, will basically be confined to the South Port in the Agigea area only. The most significant new civil infrastructure development with installation/provision of cargo handling equipment projects planned are the provision of a new Modern Grain Terminal and Expansion of Container Terminal, both being located in the South Port area. All other port development project

components of this master plan are of small-scale and are referred to as other projects. These other projects basically include the two multipurpose terminals principally dedicated for steel products (South Port) and timber (North Port), rehabilitation of the Barge Terminal and road access improvement of Gate 5.

It is noted that a Project for the development of a new container terminal is ongoing at Pier S2 of the South Port with financial assistance from JBIC (Japan Bank for International Cooperation, formerly known as OECF). The above JBIC project is aimed at developing Phase 1 of the container terminal for which an EIA has already been conducted in May 2000. The expansion of Container Terminal by this master plan envisages further future expansion of this new terminal to be provided at Pier S2 to handle increased containerised cargo demand by 375,000TEUs until the year 2020. It is projected that the containerised cargo would increase at a much higher rate both due to increased containerised cargo and increased containerisation ratio of cargo.

10.2 Initial Environmental Examination

10.2.1 Introduction

It is noted that the proposed port facility improvement of the master plan basically aims at increasing the efficiency and safety of the port operation with rationalisation of cargo handling at dedicated zones principally with the provision of new terminal facilities at South Port.

The improved safety and efficiency of the port operation in combination with increased containerisation of the cargo handling will essentially lead to decrease in cargo damage and subsequent reduced loss of product (cargo) in cargo handling operation. This in itself will lead to decrease of potential pollution and environmental deterioration inherent in loss of product in the port area including port water environment and hence to long-term environmental improvement of the port.

10.2.2 Baseline Environment of the Port

The baseline environmental condition of the port area is described in Chapter 7 of Part I. Basically, the port water environmental quality is assessed as somewhat polluted for the average port. Overall port water environmental degradation is progressing, in particular within the port hub area in comparison to the surroundings, as evident basically based on the results of supplemental field survey which are illustrated in Section 7.3.2 of Chapter 7 (Part I). **Port seawater environmental degradation was indicated by heavy metal accumulation in seabed and also by the results of biological sampling represented by high density and biomass of phytoplankton in seawater and low density and biomass of macrobenthos in**

the seabed. It is noted that high density and biomass of phytoplankton in seawater indicates progressing eutrophication of the sea.

The Black Sea in a unique environment as summarized under Item (2) of Section 7.1 of Chapter 7 (Part I) and requires the utmost effort by all polluting agents to mitigate progressing eutrophication of the sea. In this respect, there remain a variety of pollution sources to be addressed both due to direct port operational activity as well as non-port related activities, predominantly attributed Constantza city sewage outlets into the port waters.

The environmental issues related to these pollution sources of direct port operational activity and that of non-port activity are illustrated respectively in Section 7.2.1 and Section 7.2.2 of Chapter 7 (Part I). Also the planned and ongoing environmental improvement measures are illustrated in the subsequent Section 7.2.3.

It is noted that with the implementation of upgrading of both the sewage treatment plants of Constantza city, NSTP (north sewage treatment plant) and SSTP (south sewage treatment plant), most of the non-port pollution to the port waters would be controlled. Also with the implementation of the waste management projects of the port, the management of vessel originated liquid (in particular ballast and bilge waste) and solid waste would be improved to conform to MARPOL requirement including the special status requirement of the Black Sea "closed sea". **Hence it is imperative for the CPA to undertake the implementation of these waste management projects on a priority basis. This master plan until 2020 also duly incorporates the planned waste management projects of the port.**

The potential long-term environmental impact consequent to the implementation of this master plan is evaluated as beneficial in an overall sense as illustrated in the subsequent sections. The impacts illustrated distinguished between social impacts and other impacts.

10.2.3 Social Impacts

All the facilities of the proposed master plan are confined within the present administrative boundary of the Port. Moreover, all land and offshore areas of the planned project facilities by this master plan fall under the administration of the port authority (CPA). Accordingly, no acquisition of land owned by others, either public or private, is involved. Also no resettlement of population for the implementation of the facilities proposed by the master plan is required.

Based on the above aspects, potential adverse social effect by the implementation of this master plan is evaluated as irrelevant and hence insignificant.

10.2.4 Other Impacts

In evaluating the long-term environmental impacts due to this master plan, due consideration was given to the fact that the modern Constantza Port has been in existence for the very long time of over 100 years. This long term existence of the port and its development and operation has irreversibly altered the coastal environmental condition of the port on a long-term basis.

Since the baseline environmental condition is a functional port, the proposed development plan of the port by this master plan, leading to improved port operational safety and efficiency will probably result in overall long term environmental improvement of the port.

The most significant port operational and safety improvement realised by the implementation of this master plan and the resultant environmental improvement, with due consideration to potential adverse environmental effects, is illustrated hereunder with emphasis on two significant project components of the master plan: namely, Development of Modern Grain Terminal and Expansion of Container Terminal. Both of these project facilities will be provided at the newly developing South Port in Agigia.

An important navigational safety enhancement common to the implementation of these 2 significant projects is their favorable location close to the entrance of the port with easy and safe access in South Port compared to the North Port. Particularly, in order to access the inner areas of the North Port a vessel has to pass the Oil Terminal with protruding piers that restrict the free passage of vessels. This restriction by the protruding piers is an impediment to navigational safety. Hence a reduction in vessels navigating across the Oil Terminal that will be realised consequent to the implementation of these project components of the master plan would enhance the overall navigational safety of the port.

(1) Development of Modern Grain Terminal

This is the most significant project component of this master plan with the entire new terminal being developed with new land reclamation. The planned modern grain terminal, with a total handling capacity of 4 million tons, having 2 units each with a capacity of 2 million tons of bulk grains, will be located in the new Pier S3 that will be created with reclamation land. The new Pier S3 is located at the east-most (offshore side closing to port entrance) adjacent to the Pier S2, which is the future container terminal area by the ongoing JBIC Project.

It is noted that the planned capacity of 4 million tons as per this master plan is to accommodate the increased future demand of about 8.5 million tons by the year 2020. The total available grain handling capacity of the port is about 3.7 million tons resulting in a capacity enhancement requirement of 4.8 million tons by 2020. Of the available grain handling capacity of 3.7 million tons, 1.5 million ton (future 2.0 million ton) is provided by a

modern grain terminal of only 3 years old (operated by SILOTRANS) located at Pier S1 of the South Port. The planned modern grain terminal in Pier S3 will use, similar to the existing one at Pier S1, closed chain conveyor system as the means of dry-bulk cargo (grain) handling thereby mitigating potential fugitive emission.

In consideration to the planned in-built mitigation measure of closed chain conveyor system for the modern grain terminal, potential long-term adverse environmental effect due to fugitive emission on its surrounding environment is evaluated as insignificant.

(2) Expansion of Container Terminal

Container handling is estimated to increase from about 110,000 TEUs in 2,000 to more than 790,000 TEUs in 2020, an increase of more than seven folds. This entire future demand will be mostly accommodated in the new container terminals to be provided at Pier S2 of South Port. Since the container handling capacity to be provided by the ongoing JBIC phase 1 project is 375,000 TEUs, the remaining future requirement will be met with the expansion of the Pier S2 terminal to a total handling capacity of 790,000 TEUs (or 750,000TEUs) by 2020, as per this master plan.

Increased containerized cargo will lead to safer cargo handling with negligible cargo damage and hence reduce potential port environmental pollution due to loss of product (cargo). Hence, as far as the potential port environmental pollution due to cargo handling is concerned, increased containerization in the port will result in decreased port environmental pollution due to cargo handling activity.

Still it is noted that increased containerised cargo handling will lead to increased exhaust gas emission due to the operation of equipment/machinery at the terminals and hence potential increase in air pollutants. However, the potential air quality deterioration due to increased emission of air pollutants is evaluated as insignificant in consideration to the favourable topographic condition of the terminal areas having open-air environment with active exchange of air between land and sea. It is noted that in general since ports are located invariably along seacoasts, ambient air quality deterioration caused by vehicular exhaust gas emission is not a serious concern due to their favourable location having active exchange of air between land and sea and the resultant diffusion and dispersion of air pollutants.

(3) Other Projects

Other projects of the master plan are basically small-scale ones and terminal rearrangement so as to rationalise cargo handling in dedicated terminals to enhance efficiency of cargo handling. Still, projects having somewhat new construction and facility installation works are Rehabilitation of Barge Terminal and Road Access Improvement of Gate 5. The two Multi-purpose Terminals dedicated to in principle handle steel products in South Port and timber in

North Port involve simply rearrangement of existing terminal functions and hence are not considered as significant projects requiring environmental evaluation and are not dealt with any further in this IEE. It is noted that the dedicated area for the North Port Multi-purpose Terminal would be created in the current container terminal while that of South Port in the current Pier S1 having the current modern grain terminal operated by SILOTRANS.

1) Rehabilitation of Barge Terminal

The Barge Terminal serves as the link between river (via Danube-Black Sea canal) and sea transport of bulk cargo. At present the terminal facility lacks well-prepared quay-walls and dolphins, which are essential for safe berthing of barges and also for using the limited basin by barges.

Hence, the planned rehabilitation of the barge terminal with the provision of quay-walls and dolphins has very significant long-term safety improvement and environmental pollution mitigation elements and requires no further environmental justification.

2) Road Access Improvement of Gate 5

This project component aims at improving access to the port terminals while eliminating sharp turns at the entrance of Gate 5. This improvement to the existing hazardous and inefficient road access system could also be regarded as a long-term environmental improvement of the road transportation system of the port.

10.3 Conclusion

It is concluded that the implementation of the proposed master plan will lead to overall enhancement of operational efficiency and safety as well as long-term environmental improvement of the Constantza Port in comparison to the baseline (present) environmental condition of the port. In order to realise these benefits, including enhanced navigational safety, the master plan essentially envisages dedicated zoning of cargo handling operation with effective utilisation of newly developed South Port area.

Finally, concerning the overall environmental improvement of the port, prompt implementation of the planned waste management improvement project, targeting the improved management of both liquid (ballast and bilge waste) and solid waste arising from shipping activity, is emphasized.