4.4 Cost Estimation and Execution Program

4.4.1 General Construction Situation

Based on the foregoing limitations and restrictions, the following factors have been assumed in assessing the amount of available working time for the estimation of the costs of construction.

Working time will be lost because of public holidays, weather and sea limitations.

(1) Workable Days of Major Work Activities

1) Sundays and public holidays

For the purpose of cost estimation, it has been assumed that the following days will be not worked;

- Sunday 52 days per year
- Official Public Holiday 5 days per year
- Physical conditions (Rainfall or Wave) 30 days per year

2) Working hours

Eight hour per day : From 7:30 a.m to 12:00 a.m

: From 1:00 p.m to 4:30 p.m

3) Wet weather

Generally only work on land will be affected by wet weather. Daily rainfall figures are recorded at Tekirdag. It is estimated that average rainfall is 49 mm per month.

4) Sea conditions

All offshore work will be affected to some degree by strength of the wind, the height of the waves and the speed of the tidal currents. However, proposed sea area will be calm that average wind velocity is recorded at 3.1 m/sec at Tekirdag.

5) Tidal conditions

Tide will not affect the effective working days due to small height variation throughout the year.

6) Natural conditions affecting workability of construction

The degree of workability against operation of construction equipments is shown in Table 4.4.1.

(2) Construction Materials

1) Cement production

Cement for ready-mixed concrete is available in local factories, AKCIMENTO / Catalca, NUH CIMENTO / Hereke, and CANAKKALE CIMENTO / Canakkale located around Marmara sea.

2) Ready mixed concrete

Regarding ready-mixed concrete factories, around Marmara Sea there are so many companies including temporary butching plant and these factories are located in suburbs of big city.

Cement for concrete is manufactured. The available types are six types of concrete (Dosage 180, Dosage 250, Dosage 300, Dosage 325, Dosage 350, Dosage 375). The supply of aggregate for concrete as well is sufficient, because quarry site will be developed in designated mountain near the project site.

3) Steel production

Regarding steel materials, steel bar, steel plate, steel pipe pile are available from local companies. The quality is Turkish Standard in terms of carbon. Typical diameter of steel pipe pile are following 14 types, 12" (304.8 mm), 14" (355.6 mm), 16" (406.4 mm), 18" (457.2 mm), 20" (508 mm), 22" (558.8 mm), 24" (609.6 mm), 26" (660.4 mm), 28" (711.2 mm), 30" (762 mm), 32" (812.8 mm), 34" (864 mm), 35" (914 mm), 40" (1,016 mm), 44" (1,118 mm), and thickness of steel pipe pile is 10 mm.

TABLE 4.4.1 Workability of Construction

Category	Name of Work	Type or Capacity	Conditions Affecting Work Day	
			Wind Velocity (m/sec)	Wave Height (m)
Dredging Work	Cutter suction pump dredger	Steel Diesel 1350 ps	>10	>0.4
		Steel Diesel 2600 ps	>10	>0.4
		Steel Diesel 3200 ps	>10	>0.5
		Steel Diesel 4000 ps	>10	>0.5
	Grab dredger (pontoon mounted without hopper)	Steel Diesel 120 ps (Grab: 1.5 cu.m)	>10	>0.4
		Steel Diesel 350 ps (Grab: 4.0 cu.m)	>10	>0.4
	Bucket dredger	Steel Diesel 150 ps 200 ton	>5	>0.3
		Steel Diesel 400 ps 800 ton	>10	>0.4
	Dipper dredger	Steel Diesel 350 ps Bucket: 2.3 cu.m	>5	>0.3
		Steel Diesel 1000 ps Bucket: 4.0 cu.m	>10	>0.3
	Rock breaking ship	Dropping hammer type10t	>5	>0.3
Works at Sea	Filing rubble inside structure	(including rubble discharging from carrier)	>10	>0.4
	Diving works	(excluding installation of blocks)	>5	>0.3
	Installation of structures	Towing caisson inside port area	>10	>0.4
		Towing caisson outside port area	>10	>0.5
		Installation of caisson	>10	>0.6
		Installation of blocks by crane barge diesel type which less than 30 ton	>10	>0.3
		Installation of blocks by crane barge diesel type which less than 50 ton	>10	>0.4
	Piling work by pile driving barge	Piling steel sheet pile	>5	>0.3
		Piling steel pipe pile or concrete pile	>5	>0.3
	Concrete works using concrete mixing barge with carrier	Form work		>0.2
		Concrete mixing, transporting and placing		>0.3
			Wind Velocity (m/sec)	Rainfall (mm/h)
Works at Land	Earth work	Cutting or embankment		>10
		Compaction of pavement works with roadroller, tire roller and vibrating roller		>10
	Piling work by pile driving rig or piling machine of crawler type	Steel sheet pile or steel pipe pile or concrete pile	>10	>10
	Concrete	Forming, fabrication of steel bar, mixing concrete, transport and placing of plain or reinforced concrete		>3
		Concrete pavement		0
	Cutting or welding steel painting for unti-corrosion	at site		>85% air humidity

Source: *Cost Estimate of Port Construction,*
Economic Research Committee, Japan

On the other hand, as to steel bar is divided into undeformed and deformed and also classified 6 mm diameter, small diameter (8 to 12 mm) and large diameters (14 to 50 mm) in nondeformed steel bars.

Steel materials are manufactured as following companies, KARABUK DEMIR CELIK / Karabuk, EREGLI DEMIR CELIK / Eregli, ASIC CELIK / Organgazi (Bursa), IZMIR CELIK / Foca (Rebarprp).

4) Rock production

A large volume of rocks of various sizes are required for the port construction works and projects. Hard rock are available around Marmara sea area and rocks are classified as following weight for riprap structures and riprap work, 0 to 0.25 ton, 0 to 0.4 ton, 0.4 to 2 ton, 0 to 2 ton, 2 to 6 ton, 2 to 4 ton, 4 to 6 ton, 6 to 15 ton, 6 to 10 ton, 6 to 8 ton, 8 to 10 ton, 10 to 15ton, 10 to 12 ton, 12 to 15 ton.

4.4.2 Available Construction Machine and Condition

Almost of the public construction works were conducted by the private contractor and the public agency managed under each Ministry, such as Public Works, Transport and Communications, Energy and Natural Resources, Industry and Commerce, Agriculture, Forest and Village Affair.

At present, most construction equipments for heavy works on land are held by the private contractors, however procurement of marine construction equipment such as Bucket Dredger, Cutter Suction Pump Dredger, Rock Carrier, Rock Breaking Barge, Pile Driving Barge., etc are available from DLH under the Ministry of Transport and Communications excluded some contractor's floating equipments as shown in Table 4.4.2. The built year of these floating equipment are comparatively old.

DLH will supply and carry out directly designated marine works if required for the project.

Small Scale Floating Equipments, Tug Boats, Service Boats, Split Dump Barge, Bottom Door Dump Barge, Landing Craft, Jack Up Platform, Backhoe Dredger, Floating Crane, Pontoon will be available in local contractors. However, most of the floating equipment owned by the contractor were made in Istanbul and various countries in Europe and severely deteriorated. According to the observation at some construction work sites

TABLE 4.4.2 Floating Equipment Owned DLH (As of Year 1996)

No	Name of Equipment	Capacity	Built Year	Quantity
1	Tug Boat	140 / 155 ps	1968	1
	ditto	140 / 155 ps	1970	2
	ditto	140 / 155 ps	1971	1
	ditto	240 ps	1954	2
	ditto	300 ps	1958	4
	ditto	305 ps	1972	5
	ditto	525 ps	1985	4
	ditto	2*300 ps	1965	1
	ditto	2100 ps	#	1
2	Bucket Dredger	Normal 660 cu.m/h Dredging depth 20 m Bucket volume 0.5 cu.m Steam power	1953	1
	ditto	Normal 305 cu.m/h Dredging depth 16 m Bucket volume 0.25 cu.m Electric power	1974	2
	ditto	Normal 610 cu.m/h Dredging depth 20 m Bucket volume 0.5 cu.m Electric power	1974	2
	ditto	Normal 915 cu.m/h Dredging depth 22 m Bucket volume 0.75 cu.m Electric power	1974	2
3	Cutter Suction Pump Dredger	Normal 800 cu.m/h Dredging depth 16 m Discharge length 800 m Electric power	1961	1
4	Floating Excavator	BEKO type Reversed bucket 2.2 cu.m Dredging depth 7 m 405 ps	1985	1
	ditto	BEKO type Reversed bucket 2.2 cu.m Dredging depth 12 m 405 ps	1991	4
	ditto	BEKO type Reversed bucket 4.5 cu.m Dredging depth 15 m 455 ps	1992	3
	ditto	Reversed bucket 1.15 cu.m	1970	1
	ditto	Reversed bucket 1.91 cu.m	1954	2

TABLE 4.4.2 Floating Equipment Owned DLH (As of Year 1996)

No	Name of Equipment	Capacity	Built Year	Quantity
5	Barge with engine	500 cu.m opening at middle point 2*300ps motor drive	1985	2
	ditto	50 cu.m opening at middle point 2*300ps motor drive	1990	6
	ditto	250 cu.m opening at middle point 300ps motor drive	1991	10
6	Clape barge	300 cu.m	1954	1
	ditto	300 cu.m	1969	1
	ditto	350 cu.m	1981	2
	ditto	350 cu.m	1984	2
	ditto	350 cu.m	1985	2
	ditto	350 cu.m	1989	2
	ditto	400 ton	1960	1
	ditto	400 ton	1965	1
	ditto	400 ton	1970	1
	ditto	400 ton	1974	2
	ditto	290 ton	1980	4
	ditto	250 ton	1966	2
	ditto	250 ton	1971	5
	ditto	300 ton	1960	1
	ditto	150 ton	1954	1
	ditto	200 ton	1961	2
7	Barge	100 ton-Coal 50 ton-Water	1954	1
8	Pontoon	65 ton	1966	2
9	Pile driving barge	Winch 7 m Hammer 5 ton Carrying capacity 180 ton	1970	1
10	Crane barge	Lifting capacity 60 ton Reach max 18 m	1954	3
	ditto	Lifting capacity 60 ton	1961	2
	ditto	Lifting capacity 60 ton Reach 15 m: 30 ton Reach 10 m: 45 ton	1955	1
	ditto	Lifting capacity 40 ton	1951	1
11	Rock breaking barge	Weight 6 ton 1.25 m stroke: 25 time/min 1.5 m stroke: 50 time/min	1954	2
12	Driver boat	#	1960	#

Source: DLH at Istanbul in Turkey

around Marmara sea, land equipment input is maximized because of availability of equipments. Construction equipment for onshore activity is as shown in Table 4.4.3.

TABLE 4.4.3 Construction Equipment for Onshore Activity

No	Equipment	Capacity
1	Crane	
	1) Crawler Crane	40 ~ 250 t
	2) Mobile Cranes	15 ~ 60 t
	3) Tower Cranes	14 m/t ~ 60 m/ 2.3t
2	Truck	
	1) Off-highway Dump Trucks	25 ~ 50 t
	2) On-highway Dump Trucks	19 ~ 35 t
	3) Tire-wheeled Tractors	33 t
	4) Water Tankers	15 ~ 30 cu.m
	5) Fuel Tankers	10 ~ 33 t
	6) Trailers	16 ~ 80 t
	7) Agitator Cars	4 ~ 12 cu.m
3	Soil and Quarry Works	
	1) Bulldozers	140 ~ 460 HP
	2) Wheel Loaders	0.1 ~ 7.9 cu.m
	3) Graders	135 ~ 200 HP
	4) Vibration Roller	50 kg ~ 32.4 t
	5) Hydraulic Excavators	0.9 ~ 3.0 cu.m
	6) Drilling Equipments	
	7) Crushing and Screening Plants	85 ~ 400 t/h
	8) Compressors	
	9) Subsoil Improvement Machines	
4	Concrete	
	1) Truck Mounted Concrete Pump	60 ~ 80 cu.m/h
	2) Stationary Concrete Pumps	25 ~ 75 cu.m/h
	3) Batching Plants	25 ~ 70 cu.m
5	Paving Equipments	
	1) Asphalt Distributor	
	2) Asphalt Finisher	
	3) Asphalt Mixing Plants	
6	Miscellaneous	

Source: DLH & Contractor's Data at Istanbul in Turkey

4.4.3 Basic Conditions for Cost Estimation

The main conditions for the cost estimation are as follows:

(1) Construction costs have been estimated in principle using the prices and rates obtained in June 1996.
(2) The inflation factor has been excluded from estimation.
(3) The exchange rates of US$ against the Turkish Lira (TL) and Japan Yen (¥) are as follows:

US$ 1 = TL78,400 = ¥105

(4) Rents or compensation for land requisition will be excluded from the cost estimate.
(5) The cost will be divided into Foreign and Local portions and the foreign portion will be including following category.
    1) Foreign currency portion of equipment (depreciation cost for imported equipment)
    2) Imported materials and products
    3) Foreign currency portion of indirect cost
    4) Cost of engineering services by foreign consultants
(6) Physical contingency will be 5%.
(7) The engineering services fee will be 5%.

4.4.4 Preliminary Cost Estimation

A summary of preliminary cost estimation is presented in Table 4.4.4 to determine a reasonable layout of Port Master Plan in Tekirdag and estimation of cargo handling equipments is as shown in Table 4.4.5.

TABLE 4.4.4 Summary of Construction Cost Unit: *1000US$

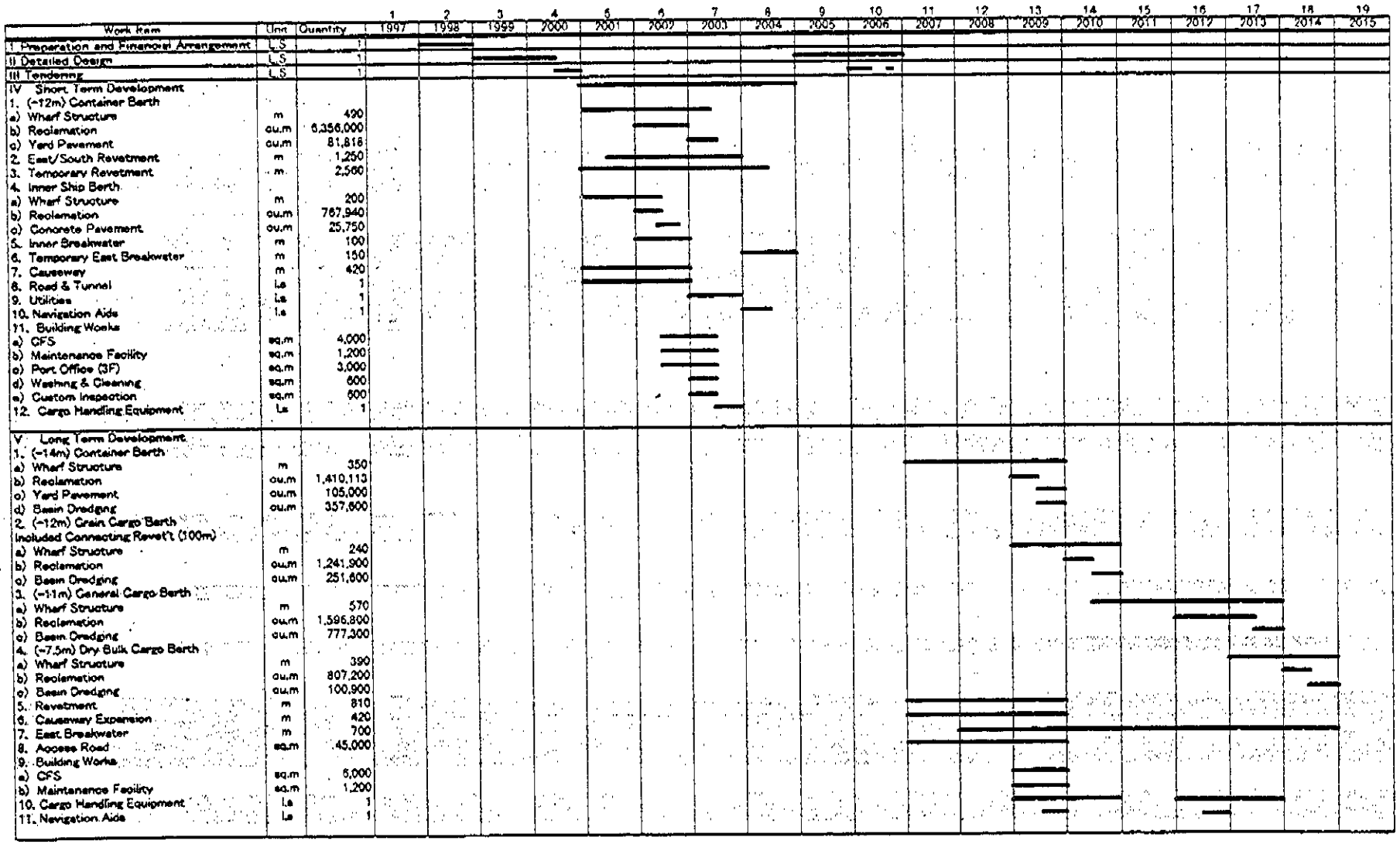
Facilities	Depth(m)	Length(m)	Plan 1	Plan1-3	Plan 1-4	Plan 2	Plan 2-4	Plan 3
Container Berth	-14	350	18,514	18,715	18,621	18,644	15,798	18,583
Container Beth	-12	490	23,657	23,394	23,342	23,538	18,821	23,679
Grain Cargo Berth	-12	240	10,971	10,734	10,753	10,720	8,629	10,491
General Cargo Berth	-11	570	22,628	22,569	22,293	22,373	12,929	22,480
Dry Bulk Cargo Berth	-7.5	390	10,286	9,908	9,966	10,021	5,676	10,191
Small Ship Berth	-4	150	2,796	2,796	2,796	2,796	2,796	2,796
Revetment			84,251	27,497	25,294	68,101	87,556	97,974
Breakwater		700/150/	118,285	86,421	77,631	25,868	36,575	57,848
		100						
Causeway		420	15,771	16,789	15,998	1,165	7,850	0
Road & Tunnel			8,761	8,761	8,761	8,761	8,761	0
Reclamation			18,171	33,578	34,881	30,529	20,288	43,761
Basin Dredging			1,029	6,330	4,196	2,797	2,226	4,196
Building			7,734	7,734	7,734	7,734	7,734	7,734
Total			342,854	275,226	262,266	233,047	235,639	299,733
			#6	#4	#3	#1	#2	#5

TABLE 4.4.5 Rough Cost of Cargo Handling Equipments Unit: *US$1000

Berth	Equipment	Capacity	Unit	Number	Unit Cost	Amount
Container Berth	Gantry crane	40 ton	set	6	5,760	34,560
	Transfer crane	40 ton	set	20	1,170	23,400
	Top loader	40 ton	set	2	360	720
	Tractor		set	44	90	3,960
	Chassis	20' / 40'	set	62	36	2,232
	Forklift	2/4 ton	set	24	45	1,080
	CFS		sq.m	10,000	0.324	3,240
	Maint'ce facility		sq.m	2,400	0.33	792
	Office building		sq.m	3,000	1.2	3,600
	Sub Total					73,584
Grain Berth	Silo	45,000 ton	l.s	1		32,760
	Loader	300 t/h	set	2	2,970	5,940
	Belt conveyor	300 t/h 500 m	m	2set*500	3	3,000
	Sub Total					41,700
Bulk Berth	Shore Crane	10 ton	set	8	2,970	23,760
	Sub Total					23,760
General Cargo Berth	Shore Crane	10 ton	set	4	2,970	11,880
	Forklift	2/4 ton	set	13	45	585
	Forklift	10 ton	set	13	81	1,053
	Cement Unloader	200 t/h	set	1	1,000	1,000
	Belt Conveyor	200 t/h	m	500	2	1,000
	Sub Total					15,518
	Total					154,562

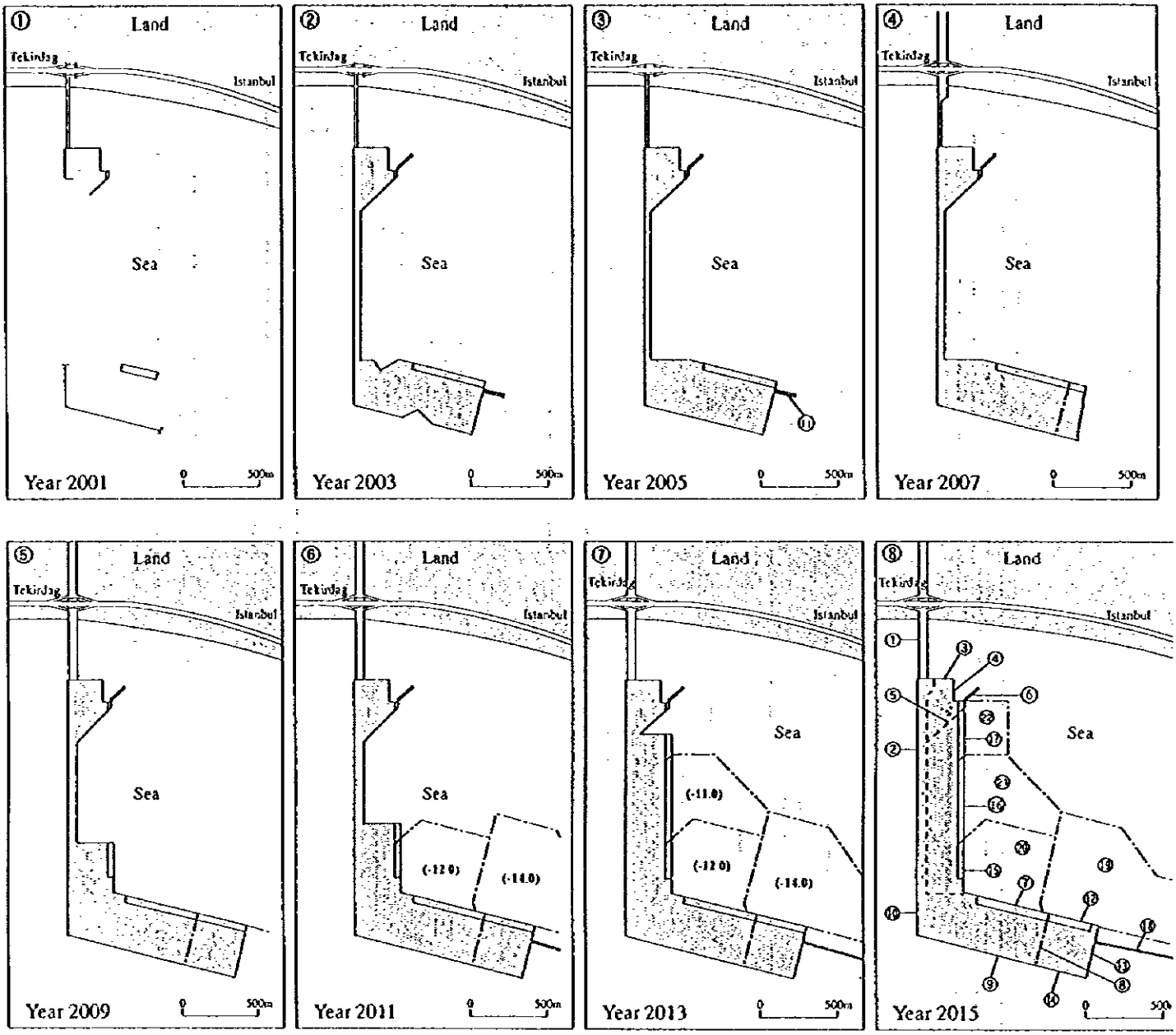
4.4.5 Execution Program

Long term development schedule of the new port is shown in Figure 4.4.1 and the procedure of new port construction is shown in Figure 4.4.2.



Work Item	Unit	Quantity
I Preparation and Financial Arrangement	L.S	1
II Detailed Design	L.S	1
III Tendering	L.S	1
IV Short Term Development		
1. (-12m) Container Berth		
a) Wharf Structure	m	490
b) Reclamation	cu.m	6,356,000
c) Yard Pavement	cu.m	81,818
2. East/South Revetment	m	1,250
3. Temporary Revetment	m	2,560
4. Inner Ship Berth		
a) Wharf Structure	m	200
b) Reclamation	cu.m	767,940
c) Concrete Pavement	cu.m	25,750
5. Inner Breakwater	m	100
6. Temporary East Breakwater	m	150
7. Causeway	m	420
8. Road & Tunnel	Ls	1
9. Utilities	Ls	1
10. Navigation Aids	Ls	1
11. Building Works		
a) CFS	sq.m	4,000
b) Maintenance Facility	sq.m	1,200
c) Port Office (3F)	sq.m	3,000
d) Washing & Cleaning	sq.m	600
e) Custom Inspection	sq.m	500
12. Cargo Handling Equipment	Ls	1
V Long Term Development		
1. (-14m) Container Berth		
a) Wharf Structure	m	350
b) Reclamation	cu.m	1,410,113
c) Yard Pavement	cu.m	105,000
d) Basin Dredging	cu.m	357,600
2. (-12m) Grain Cargo Berth		
Included Connecting Revet't (100m)		
a) Wharf Structure	m	240
b) Reclamation	cu.m	1,241,900
c) Basin Dredging	cu.m	251,600
3. (-11m) General Cargo Berth		
a) Wharf Structure	m	570
b) Reclamation	cu.m	1,596,800
c) Basin Dredging	cu.m	777,300
4. (-7.5m) Dry Bulk Cargo Berth		
a) Wharf Structure	m	390
b) Reclamation	cu.m	807,200
c) Basin Dredging	cu.m	100,900
5. Revetment	m	810
6. Causeway Expansion	m	420
7. East Breakwater	m	700
8. Access Road	sq.m	45,000
9. Building Works		
a) CFS	sq.m	5,000
b) Maintenance Facility	sq.m	1,200
10. Cargo Handling Equipment	Ls	1
11. Navigation Aids	Ls	1

FIGURE 4.4.1 Construction Schedule of Port Development



NO	Name of Facility	NO	Name of Facility	NO	Name of Facility
1	Causeway	9	South Revetment-1	17	(-7.5m) Dry Bulk Cargo Berth
2	Dockway	10	West Revetment	18	East Breakwater
3	North Revetment	11	Temporary East Breakwater	19	(-14m) Basin
4	Inner Ship Berth	12	(-14m) Container Berth	20	(-12m) Basin
5	Temporary Inner Revetment	13	East Revetment	21	(-11m) Basin
6	Inner Breakwater	14	South Revetment-2	22	(-7.5m) Basin
7	(-12m) Container Berth	15	(-12m) Grain Cargo Berth		
8	Temporary East Revetment	16	(-11m) General Cargo Berth		

FIGURE 4.4.2 Procedure of New Port Construction

4.4.6 Implementation Plan for Short Term Port Development

(1) Construction Facilities

1) Site establishment

The contractors will be required to establish their own temporary site facilities, such as site offices, storehouses, workshops, construction yards, ablution facilities, stockpile area, access roads and temporary jetties.

2) Electric power supply

Electrical power from the public supplier is available at the construction sites. However, it is considered that the contractors will supply their own electric power generators which can be moved about the site, as required.

3) Water supply

The contractor will be required to provide their own water supply. This could be provides by way of ground water wells or transport to site by tankers.

4) Sanitary waste disposal

The contractors will be required to provide their own sanitary waste disposal systems, to the approval of the relevant Local Authorities.

5) Procurement of construction equipments

The factors which affect the selection of equipment for a particular marine work and which also affect the equipment's performance can be divided into following three factors.

a) Constructual factors: The constraints placed upon the proposed equipment due to the nature of the work being carried out and any contractual stipulations.

b) Operation factors: The influence of the site location on the operational cycles of the equipment and construction method.

c) Environmental factors: The environmental factors to be considered in the light of the extraction and operational methods proposed.

(2) Implementation Program

1) Pre-construction stage

During design stage another months are required intermittently for tendering of the contractor, evaluation and negotiation which culminates in the awards of the contracts. The construction works therefore will start from January 2001. For the Short Term Development Plan, a construction period or about four years construction period is allocated

In accordance with implementation program, some preparation works shall be on time in order to avoid any delay of the implementation of the project.

The necessary actions indicated below.

- Loan arrangement
- Selection of consultant
- Land acquisition
- Right of ways of site access and quarry site, if required
- Tendering for contractor

2) Construction quantities

The construction quantities for each facility in the Short Term Plan are shown in Table . The main construction materials which have been estimated based upon the foregoing preliminary design are listed in Table 4.4.6.

TABLE 4.4.6 Main Material of Short Term Development

Name	Unit	(-12m)Container Berth	East/South Revetment	Temporary Revetment	Inner Ship Berth	Inner Breakwater	Temporary East Breakwater	Causeway	Road & Tunnel	Building	Total
Armor Stone 500kg/p.c	cu.m							6229			6229
Armor Stone 0.4-2t	cu.m		36766	73273		9996		4527			124562
Armor Stone 2-4t	cu.m						10631				10631
Armor Stone 6-8t	cu.m										0
Tetrapot 8t	cu.m		26743								26743
Rubble Stone	cu.m	50740	207191	510293	4935	13965	37690	28497			853311
Backfill Stone 1-10kg/p.	cu.m	84828			13944			8423		32727	139922
Filter Layer 1-5kg/p.c	cu.m		27196	49256							76452
Rock Waste	cu.m		1048499				19688				1068187
Asphalt Pavement	sq.m							3780	9524		13304
Cement	ton	51254	3276	1894	10247			1141	595	10342	78749
Aggregate	cu.m	105524	6744	3899	21098			2350	1225	21292	162132
Sand	cu.m	60299	3854	9258	12056			1343	700	12167	99677
Fender	no	25			20						45
Bit/Bollard	no	15			10						25
Steel	ton	8843	422	313				235	91	4722	14626

3) Preliminary study on construction procedure

The construction method of major works is briefly described below:

a) Dredging and reclamation

The required dredging volume for the basin is estimated approximately 103,000 cu.m. Dredging material will be dumped into the reclamation area by the clape barge at the time of partial completion of wharf or revetment.

The most material of reclamation will be conducted by borrow materials to be obtained from the land borrow area as well as sea bottom area. The top layer of the land reclamation fill will be sufficiently compacted to provide sufficient bearing capacity for heavy traffic load of cargo handling equipment.

b) Wharf

At first, the foundation rubble will be installed and concrete block will be enough from the production yard with flat barge and tug boat. It will be placed in the planned location with crane barge.

Finally, reinforcement concrete will be placed for the apron of the wharf including mooring bit and other relative facilities.

c) Productivity

The targeted productivity of major works in the project has been compiled as follows:

i)	Dredging Work	
	Grab dredger	17,000 cu.m/month
	Cutter suction pump dredger	230,000 cu.m/month
ii)	Dumping of rubble and armored stone	200 cu.m/day
iii)	Leveling works of rubble mound	9 sq.m/day/gang
iv)	Fabrication of concrete block	15 nos/day
v)	Leveling of backfill stone	16 sq.m/day/gang
vi)	Reclamation of borrow materials	3,000 cu.m/day

4) Construction schedule

The construction schedule of the project is shown in Fig. 4.4.3.

5) Construction Cost

A summary of the cost estimation is shown in Table 4.4.7 and yearly investment schedule is shown in Table 4.4.8.

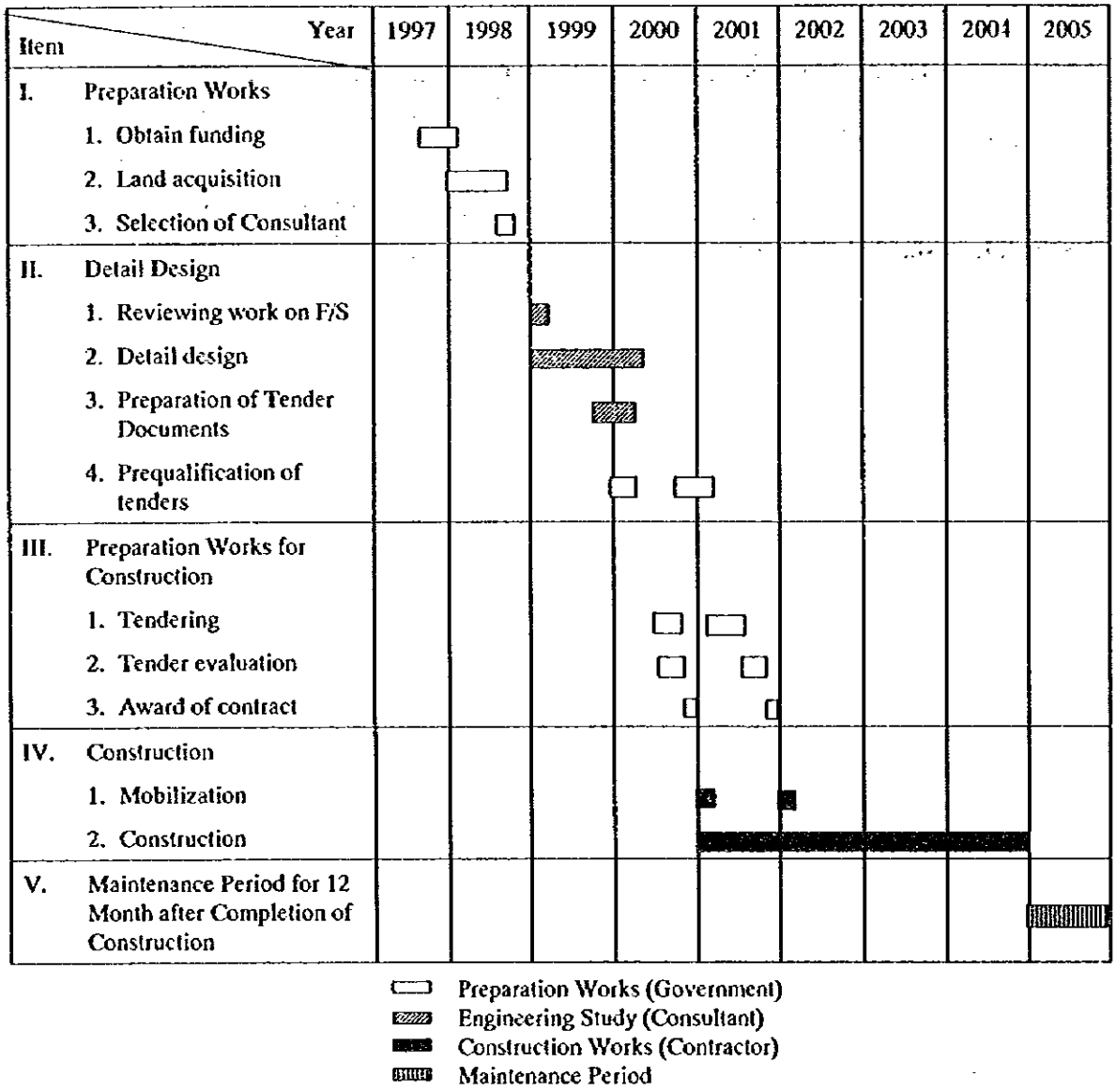


FIGURE 4.4.3 Tentative Short Term Development Schedule

TABLE 4.4.7(1) Construction Cost of Short Term Development (Unit : $)

Place		Work Item	Unit	Quantity	Unit Price F.C	Unit Price L.C	Amount F.C	Amount L.C	Total
(-12m) Container Berth		Included(-14m)Wharf(50m) L=490+100+50m							
	1	Bed Excavation	cu.m	26,675	1.8	2.2	48,015	58,685	106,700
	2	Foundation Rock	cu.m	45,070	7.9	46.5	356,053	2,095,755	2,451,808
	3	Concrete Block Wall	cu.m	63,963	8.2	91.2	524,497	5,833,426	6,357,922
	4	Backfill Stone	cu.m	84,828	5.2	24.4	441,106	2,069,803	2,510,909
	5	Rail Foundation Rock	cu.m	5,670	5.6	26.2	31,752	148,554	180,306
	6	Concrete Foundation	cu.m	1,417	0.6	41.1	850	58,239	59,089
	7	Fender	nos	25	16266.5	132.1	406,663	3,303	409,965
	8	Bit/Bollard	nos	15	6008.1	61.2	90,122	918	91,040
	9	Pavement	cu.m	3,550	0.1	51.4	355	182,470	182,825
	10	Reclamation	cu.m	6,356,000	0.5	1.1	3,178,000	6,991,600	10,169,600
	12	Yard Pavement	cu.m	81,818	0.1	51.4	8,182	4,205,445	4,213,627
		Sub Total					5,085,593	21,648,197	26,733,790
East/South Revetment		Le=400m Ls=850m							
	1	Rock Waste of Bed	cu.m	1,048,499	3	8	3,145,497	8,387,992	11,533,489
	2	Base Rock Mound	cu.m	207,191	7.7	45.8	1,595,371	9,489,348	11,084,719
	3	Concrete Wall	cu.m	9,634	8.5	76.5	81,889	737,001	818,890
	4	Armor Rock 0.4-2t	cu.m	36,766	13.2	49.6	485,311	1,823,594	2,308,905
	5	Tetrapot 8t	cu.m	26,743	12.7	92.1	339,636	2,463,030	2,802,666
	6	Filter Layer	cum	27,196	1.9	47.8	51,672	1,299,969	1,351,641
		Sub Total					5,699,376	24,200,934	29,900,310
Temporary Revetment		L1=290m L2=810m L3=430m L4=1,030m							
	1	Rock Mound of Quarry Run	cu.m	510,293	7.4	45	3,776,168	22,963,185	26,739,353
	2	Filter Layer	cu.m	49,256	8.1	47.4	398,974	2,334,734	2,733,708
	3	Armor Stone 0.2-2t	cu.m	73,273	15.1	46	1,106,422	3,370,558	4,476,980
	4	Parapet	cu.m	2,974	8.5	76.5	25,279	227,511	252,790
	5	Sand Filling	cu.m	7,030	0.7	5.2	4,921	36,556	41,477
	6	Concrete Pavement	cu.m	2,596	0.1	51.4	260	133,434	133,694
		Sub Total					5,312,024	29,065,979	34,378,003
Inner Ship Wharf		L=200m							
	1	Bed Excavation	cu.m	0	0	0	0	0	0
	2	Foundation Rock	cu.m	4,935	8.1	46.9	39,974	231,452	271,425
	3	Concrete Block Wall	cu.m	4,389	7	77.8	30,723	341,464	372,187
	4	Back Filling Stone	cu.m	13,944	10.5	49.1	146,412	684,650	831,062
	5	Fender	no	20	5,500	600	110,000	12,000	122,000
	6	Bollard	no	10	1500	166	15,000	1,660	16,660
	7	Reclamation	cu.m	767,940	0.5	1.3	383,970	998,322	1,382,292
	8	Concrete Pavement	cu.m	25,750	0.1	51.4	2,575	1,323,550	1,326,125
		Sub Total					728,654	3,593,098	4,321,752
Inner Breakwater		L=100m							
	1	Rock Mound of Quarry Run	cu.m	18,703	7.6	45.6	142,143	852,857	995,000
	2	Armor Stone	cu.m	3,787	12.8	68.2	48,474	258,273	306,747
		Sub Total					190,616	1,111,130	1,301,747
Temporary East Break Water		L=150m							
	1	Rock Waste of Bed	cu.m	19,688	3	8	59,064	157,504	216,568
	2	Quarry Mound	cu.m	37,690	7.4	45	278,906	1,696,050	1,974,956
	3	Armor Stone 2-4t	cu.m	10,631	12.1	64.2	128,635	682,510	811,145
		Sub Total					466,605	2,536,064	3,002,669
Causeway		L=420m							
	1	Quarry Run	cu.m	28,497	7.6	45.5	216,577	1,296,614	1,513,191
	2	2nd Armor Stone(500kg/pc	cu.m	6,229	16.8	49.4	104,647	307,713	412,360
	3	Armor Stone (1t/pc)	cu.m	4,527	16.6	49	75,148	221,823	296,971
	4	Side Concrete Wall	cu.m	882	0.6	39.7	529	35,015	35,545
	5	Base Stone(1-10kg/pc)	cu.m	7,232	7	43.9	50,624	317,485	368,109
	6	Sub Base Course	cu.m	1,191	7	41.2	8,337	49,069	57,406
	7	Asphalt Pavement	sq.m	3,780	0.5	26.5	1,890	100,170	102,060
	8	Box Culvert(4*3)	cu.m	1,974	15.5	132.5	30,597	261,555	292,152
	9	Box Culvert(4*2.5)	cu.m	501	52.9	95.8	26,503	47,996	74,499
		Sub Total					514,853	2,637,439	3,152,292
Road Tunnel									
	1	Earth Excavation	cu.m	121,500	0.6	1.5	72,900	182,250	255,150
	2	Asphalt Pavement	sq.m	9,524	0.5	26.5	4,762	232,386	257,148
	3	Box Culvert	cu.m	1,750	1	84.1	1,750	147,175	148,925
		Sub Total					79,412	581,811	661,223
							18,077,133	85,374,652	103,451,785
		Utilities	ls				903,857	4,268,733	5,172,589
		Total					18,980,990	89,643,385	108,624,375
Building Works									
	1	CFS	sq.m	4,000	49	275	196,000	1,100,000	1,296,000
	2	Maintenance Facility	sq.m	1,200	99	231	118,800	277,200	396,000
	3	Port Office (3F)	sq.m	3,000	120	1080	360,000	3,240,000	3,600,000
	4	Washing Cleaning	sq.m	600	0	100	0	60,000	60,000
	5	Custom Inspection	sq.m	600	0	70	0	42,000	42,000
		Sub Total					674,800	4,719,200	5,394,000
		Total of Const'n					19,655,790	94,362,585	114,018,375
Contingency		Physical Contingency	%	5			982,789	4,718,129	5,700,919
Handling Equipment		Handling Equipment	ls	1			32,625,000	0	32,625,000
									146,643,375
Consultant		Engineering Fee	ls	1			7,332,168	0	7,332,169
		GRAND TOTAL					60,595,747	99,080,714	159,676,462
							38.50%	61.50%	100%

Table 4.4.7(2) Summary of Construction Cost for Short Term Development (Unit : $)

Place	Work Item	Unit	Quantity	Unit Price		Amount		Total
				F.C	L.C	F.C	L.C	
(-12m) Container Berth	Included(-14m)Wharf(50m) L=430+100+50m							
	Sub Total	ls	1			5,085,593	21,648,197	26,733,790
East/South Revetment	Le=400m Ls=850m							
	Sub Total	ls	1			5,639,376	24,200,934	29,900,310
Temporary Revetment	L1=290m Connecting L2=810m, West revet't L3=430m, East Small L4=1030m, East Dockway							
	Sub Total	ls	1			5,312,024	29,065,979	34,378,003
Inner Ship Wharf	L=200m							
	Sub Total	ls	1			728,654	3,593,098	4,321,752
Inner Breakwater	L=100m							
	Sub Total	ls	1			190,616	1,111,130	1,301,746
Temporary East Break Water	L=150m							
	Sub Total	ls	1			466,605	2,536,064	3,002,669
Causeway	L=420m							
	Sub Total	ls	1			514,853	2,637,439	3,152,292
Road Tunnel								
	Sub Total	ls	1			79,412	581,811	661,223
						18,077,133	85,374,652	103,451,785
	Utilities	%	5%			903,857	4,268,733	5,172,589
	Total					18,980,990	89,643,385	108,624,374
Building Works								
	Sub Total	ls	1			674,800	4,719,200	5,394,000
	Total of Const'n					19,655,790	94,362,585	114,018,374
Contingency	Physical Contingency	ls	1			982,789	4,718,129	5,700,919
Handling Equipment	Handling Equipment	ls	1			32,625,000	0	32,625,000
								148,643,374
Consultant	Engineering Fee	ls	1			7,332,168	0	7,332,169
	GRAND TOTAL					60,595,747	99,080,714	159,676,462
						38.50%	61.50%	100%

TABLE 4.4.8 Yearly Investment Schedule

No	Work Item	TOTAL			1st YEAR			2nd YEAR			3rd Year			4th YEAR			5th YEAR			6th YEAR			7th YEAR		
		Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1	(-12m Container Berth																								
1.1	Bed Excavation	49015	58,685	106,700										49,015	58,685	106,700									
1.2	Foundation Rock	356053	2,095,755	2,451,808										356,053	2,095,755	2,451,808									
1.3	Concrete Block	524497	5,833,426	6,357,923										262,249	2,916,713	3,178,961	262,249	2,916,714	3,178,962						
1.4	Backfill Stone	441106	2,069,803	2,510,909										132,332	620,941	753,273	308,774	1,448,862	1,757,636						
1.5	Rail Foundation Rock	31752	148,554	180,306																31,752	148,554	180,306			
1.6	Concrete Foundation	850	58,239	59,089																850	58,239	59,089			
1.7	Fender	406683	3,303	409,986																406,683	3,303	409,986			
1.8	Bit. Bollard	90122	918	91,040																90,122	918	91,040			
1.9	Pavement	355	182,470	182,825																355	182,470	182,825			
1.10	Reclamation	3178000	6,991,600	10,169,600													3,178,000	6,991,600	10,169,600						
1.11	Yard Pavement	8182	4,205,445	4,213,627																8,182	4,205,445	4,213,627			
2	East/South Revetment			0																					
2.1	Rock Waste	3145497	8,387,992	11,533,489										3,145,497	8,387,992	11,533,489									
2.2	Base Rock Mound	1595371	9,489,348	11,084,719										797,685	4,744,675	5,542,360	797,685	4,744,674	5,542,359						
2.3	Concrete Wall	81889	737,001	818,890													81,889	737,001	818,890						
2.4	Armor Rock 0.4-2t	485311	1,823,594	2,308,905																485,311	1,823,594	2,308,905			
2.5	Tetrapot 5t	339838	2,463,030	2,802,868																339,838	2,463,030	2,802,868			
2.6	Filter Layer	51672	1,299,969	1,351,641													51,672	1,299,969	1,351,641						
3	Temporary Revetment			0																					
3.1	Rock Mound of Quarry Run	3776188	22,963,185	26,739,353										1,510,487	9,185,274	10,695,741	1,510,487	9,185,274	10,695,741	755,234	4,592,637	5,347,871			
3.2	Filter Layer	398974	2,334,734	2,733,708													199,487	1,167,367	1,366,854	199,487	1,167,367	1,366,854			
3.3	Armor Stone 0.2-2t	1106422	3,370,558	4,476,980													276,606	842,639	1,119,245	553,211	1,685,279	2,238,490	278,606	842,639	1,119,245
3.4	Parapet	25279	227,511	252,790																			25,279	227,511	252,790
3.5	Sand Filling	4921	36,556	41,477																4,921	36,556	41,477			
3.6	Concrete Pavement	260	133,434	133,694																			260	133,434	133,694
4	Inner Ship Berth			0																					
4.1	Bed Excavation	0	0	0										0	0	0									
4.2	Foundation Rock	39974	231,452	271,426										39,974	231,452	271,425									
4.3	Concrete Block Wall	30723	341,464	372,187										30,723	341,464	372,187									
4.4	Back Filling Stone	146412	684,650	831,062										146,412	684,650	831,062									
4.5	Fender	110000	12,000	122,000													110,000	12,000	122,000						
4.6	Bollard	15000	1,660	16,660													15,000	1,660	16,660						
4.7	Reclamation	383970	998,322	1,382,292													383,970	998,322	1,382,292						
4.8	Concrete Pavement	2575	1,323,550	1,326,125													2,575	1,323,550	1,326,125						
5	Inner Breakwater			0																			142,143	852,857	995,000
5.1	Rock Mound of Quarry Run	142143	852,857	995,000																			43,474	258,273	306,747
5.2	Armor Stone 0.4-2t	43474	258,273	306,747																					
6	East Breakwater			0																			59,064	157,504	216,568
6.1	Sand Filling of Foundation	59064	157,504	216,568																			278,906	1,696,050	1,974,956
6.2	Quarry Mound	278906	1,696,050	1,974,956																			128,835	682,510	811,145
6.3	Armor Stone 2-4t	128835	682,510	811,145																					
7	Causeway			0																					
7.1	Quarry Run	216577	1,298,614	1,513,191										216,577	1,298,614	1,513,191									
7.2	Armor Stone 500kg/pc	104847	307,713	412,560										52,324	153,856	206,180	52,324	153,858	206,180						
7.3	Armor Stone 1t	75148	221,823	296,971										37,574	110,912	148,486	37,574	110,912	148,486						
7.4	Side Concrete Wall	529	35,015	35,544													529	35,015	35,544						
7.5	Base Stone(1-10kg)	50824	317,485	368,109													50,824	317,485	368,109						
7.6	Sub Base Course	8337	49,069	57,406													8,337	49,069	57,406						
7.7	Asphalt Pavement	1890	100,170	102,060													1,890	100,170	102,060						
7.8	Box Culvert(4x3)	30597	261,555	292,152										15,298	130,778	146,076	15,298	130,778	146,076						
7.9	Box Culvert(4x2.5)	26503	47,996	74,499										13,252	23,998	37,250	13,252	23,998	37,250						
8	Road/Tunnel			0																					
8.1	Earth Excavation	72900	182,250	255,150										72,900	182,250	255,150									
8.2	Asphalt Pavement	4782	252,366	257,148													4,782	252,366	257,148						
8.3	Box Culvert	1750	147,175	148,925										875	73,588	74,463	875	73,588	74,463						
9	Utilities	915161	4,257,428	5,172,589																367,601	1,705,748	2,073,353	547,555	2,551,681	3,099,236
10	Building			0																					
10.1	CFS	196000	1,100,000	1,296,000													98,000	550,000	648,000	98,000	550,000	648,000			
10.2	Maintenance Facility	118800	277,200	396,000													60,000	140,000	200,000	58,800	137,200	196,000			
10.3	Port Office	360000	3,240,000	3,600,000													180,000	1,620,000	1,800,000	180,000	1,620,000	1,800,000			
10.4	Washing/Cleaning	0	60,000	60,000																0	60,000	60,000			
10.5	Custom Inspection	0	42,000	42,000																0	42,000	42,000			
11	Handling Equipment	32625000	0	32,625,000																			32,625,000	0	32,625,000
12	Engineering Fee	7332168	0	7,332,168	1,294,168	0	1,294,168	783,000	0	783,000	878,000	0	878,000	1,392,000	0	1,392,000	1,000,000	0	1,000,000	1,000,000	0	1,000,000	1,000,000	0	1,000,000
	Total	59824284	94,351,281	153,975,545	1,294,168	0	1,294,168	783,000	0	783,000	878,000	0	878,000	8,270,206	31,239,597	39,509,802	8,702,038	35,226,879	43,928,727	4,580,131	20,482,337	25,062,468	35,131,922	7,402,459	42,534,381

c/) Excluded contingency cost

(3) Engineering Works on Future Actions

1) Detailed Engineering Work for Short Term Development of New Tekirdag Port

The Stage I development of the project should be completed by the end of 2004 to handle container cargo from/to Thrace region. To ensure the target completion date, it is necessary for DLH to continue detailed surveys and investigations in accordance with the feasibility designs for the Stage I development of the project, presented in this report.

When an international consulting firm is selected by DLH for the detailed engineering work of the Stage I development of the project, The following surveys and investigations should be conducted and completed by DLH by the end of 1998.

a) Geotechnical Investigations at Container Terminal Site

For the purpose of the detailed design, it is recommended to conduct a sonic prospecting profiler with some additional core drillings including at least 3 drilling at the site.

b) Detailed Design

The detailed designs will include the following works.

- Review of existing data, information, reports, technical papers, feasibility design., etc. related to the project
- Review and re-assessment of survey and investigation data carried out by DLH.
- Planning of supplemental surveys and investigations for the purpose of detailed designs
- Execution or supervision of such supplemental surveys and investigations to be carried out by the Consultants, DLH or local subcontractors, and preparation of an Investigation Report.
- Preparation of tender designs for all project facilities, and preparation of a Design Report
- Preparation of Tender Documents for each contract package, consisting generally of the following,

Instruction to Tenders
General Conditions of Contract
Conditions of Particular Application
Contract Forms
Form of Tender with Bill of Quantities
Form of Agreement
Form of Tender Bond
Form of Performance Bond
General Specifications
Technical Specifications
Tender Drawings

- Preparation of construction plan and cost estimates in the form of priced Bill of Quantities with detailed breakdowns of unit rates and prices to facilitate tender evaluation

c) Pre-construction Services

The pre-construction services will include the following works.

- Assistance to DLH in pre-qualification calling, evaluation of pre-qualification and selection of qualified applicants for tendering
- Assistance to DLH in tender procedures such as: (i) issuance of tender notice,
  (ii) answer to tenderers' questions during the tender period, (iii) pre-bit conference with site inspection by tenderers, (iv) opening of tenders
  (v) tender evaluation, (vi)selection of the lowest responsible tenderer for contract award, (vii) contract negotiation with the successful tenderer,
  (viii) preparation of Contract Documents, and (ix) contract signing

d) Construction Supervision

The construction supervision will include the following works.

- Preparation of construction drawings as necessary

- Review and approve the Contractor's drawings for both permanent and temporary work
- Review and approve the Contractor's construction plan and time schedule
- Site design changes and issuance of Change Orders to the Contractor
- Quality control of the Contractor's construction works
- Progress control of the Contractor's construction works including issuance of Hand-over Certificate, Completion Certificate and Maintenance Certificate
- Payment control to the Contractor including issuance of Payment Certificate
- Settlement of Contractor's claims for increase of Contract Price or time extension for completion

5. Management and Operation

5.1 Role of Public Sector in Port Development, Management and Operation

Before examining the system of port development, management and operation, it is necessary to consider the role of public sector in general.

Concerning the port operation, private sector is generally more sensitive to the customers' needs and can provide better service compared with public sector. On the other hand, though the private sector could be more efficient in pursuing profit, it tends to take only short term and narrow range of matters into consideration. As a consequence,

(1) It might cause many kinds of external uneconomic results, such as congestion of roads around the facilities or some kind of public nuisance. Finally necessary investment by the government is needed to prevent such external uneconomic results.

(2) It could happen that future expansion is impossible or inefficient and private sectors cause losses of national resources.

(3) Private sector can not afford to carry out a project related to the regional development which requires a considerable term for maturity, although it is profitable from the viewpoint of the entire nation's welfare.

As to the other aspect, water area of the sea or other public water area is common property belonging to all the people of the nation. Reclamation is an action to convert common property into a specific estate. If such an action is limitlessly allowed to any private sector, any individual can convert public property into his own property and he can treat it as he likes. It could probably be the cause of trouble in the future in the light of the entire national profit. In Japan, any reclamation of public water area is, in practice, not permitted to any private sector. Only sectors considered to be public can obtain permission for reclamation of the public water area. In most European countries, lands in the port area are possessed by the public sector. This is based on the concept that those lands are very valuable and there is no alternative for running port function which is inevitable to support the life at the nation.

The role of the public sector in the port development, management and operation, may be clarified as follows referring to the above concept:

(1) The master plan of a port must be drawn by public sector, taking such matters into consideration as the efficient utilization of national resources in the long term and the necessity of a port in the light of regional development. It is also important to evaluate the project from the national economic point of view taking all relevant investment excluded in the project and all external uneconomic results caused by the project into consideration.

(2) Land reclamation and possession must be performed by public sector.

(3) In case that the project, which is necessary in line with the regional development and is expected to require some period for maturity, is regarded as economically feasible in a long range of time but no private sector feels an interest in constructing and operating the facilities, public sector must construct the facilities and even operate them.

5.2 Patterns of Port Development, Management and Operation

Possible patterns of development, management and operations for the New Port are shown in Table 5.2.1.

TABLE 5.2.1 Patterns of Port Development, Management and Operation

Pattern		A	B	C	D	E	F	G	H
Master Plan		○[1]							
Construction	Breakwater	○[2]	○[2]	○[2]					
	Dredging								
	Reclamation	●[3]							
	Terminal		●[3]						
Ownership		●[4]	land:○[5] terminal:●[4] (land lease)	○[6]					
Berthing Scheme		●[7]		○ (Exclusive[8])		○ (Priority[9])		○ (Open[10])	
Operator		●[11]		●[11]	○[12]	●[13]	○[12]	●[13]	○[12]
Tug & Pilot		● or ○							

○ Public ● Private

Recommended Pattern

The main merits and demerits of each factor in these patterns are as follows;

(1) Master Plan

1 - Merit

The master plan can be drawn by taking such matters into consideration as the efficient utilization of national resources in a long term and the necessity of a port from the viewpoint of regional development.

(2) Construction

2 - Merit

In case that private companies do not get interested in the project in spite of the necessity for development from a national point of view, the project can be promoted. (In the case that public sector performs reclamation) inappropriate and limitlessly disordered development of the public property can be prevented.

2 (A, B) - Demerit

Prior-investment - like breakwater, dredging or reclamation - provided by public sector before starting of the project by a private company may rise to a huge amount.

3 - Merit

Since a private company builds the berth, public sector does not need to provide funds. Therefore, the pattern A and B are useful when public sector does not have sufficient funds and construction of the port is urgent.

(3) Ownership

4 (A) - Demerit

Because the berths are occupied by a private company for a long time, public sector can not improve facilities or equipment easily in case of need according to a master plan in the future. In particular, in the case that main berths of the port are occupied by a specific shipping company, there is the risk that public sector cannot control overall management of the port.

5 - Merit

In case of need according to a master plan in the future, public sector can improve facilities or equipment on the basis of ownership of the land, although the berths are occupied by a private company.

6 - Merit

Since public sector owns the berths, public sector can improve facilities or equipment easily in case of need according to a master plan in the future.

(4) Berthing Scheme

7 - Merit

The shipping company (the builder of the berth) can make its own berthing plan, and can control the overall operation from entry to departure to/from the port.

7 - Demerit

There is the possibility that only one shipping company can use the berth and other shipping companies stop calling to the port.

There is the risk that benefit of port development is monopolized by specific private companies.

8 - Merit

The selected shipping company (the lessor of the berth) can make its own berthing plan, and can control the overall operation from entry to departure to/from the port.

8 - Demerit

There is the possibility that only some selected shipping companies can use the berth and the other shipping companies stop calling to the port.

There is the risk that benefit of port development is monopolized by specific private companies.

9 - Merit

When public sector wants to increase cargo volume to a specific country or on a specific sailing route by giving priority to target groups, public sector can manage port activities strategically.

9 - Demerit

There is the possibility that shipping companies, which are not prioritized, stop calling to the port.

10 - Merit

All shipping companies, especially small or medium-scale companies which do not have enough funds to own or lease private berths, can use the berths easily.

(5) Operator

11 - Merit

Since the contracted stevedoring company operates cargo handling for the specified shipping company, cargo handling efficiency is high.

11 - Demerit

Since private companies operate cargo handling, public sector has to cope with an increase in surplus labour in Operation Division, it may cause a dispute between public sector and unions.

There is the danger that benefit of port development is monopolized by specific private companies.

12 - Merit

There is no danger that benefit of port development is monopolized by specific private companies.

12 - Demerit

Generally speaking, cargo handling efficiency of public sector is lower compared with the private sector due to the absence of competition in the market.

13 - Merit

Generally speaking, cargo handling performed by private stevedoring companies is more efficient than that by public sector.

13 - Demerit

Since private companies operate cargo handling, public sector has to cope with an increase in surplus labour in Operation Division, which may cause a dispute between public sector and unions.

Development, management and operation patterns of container terminals in the world and bulk terminals in Europe are shown in Table 5.2.2 and 5.2.3, respectively. In most of these ports master plan was drawn by public sector. Reclamation work was also carried out by public sector in most ports with the exception of Hong Kong container port and Nordenham bulk port, while terminal operations have been carried out by private companies in most ports excluding Dunkerque port.

TABLE 5.2.2 Development, Management and Operation Patterns of Container Terminals in the World

Port		Yokohama	Singapore	Laem Chabang	Hong Kong	Colombo	Hamburg	Los Angels
Country		Japan	Singapore	Thailand	Hong Kong	Sri Lanka	Germany	U.S.A
Master Plan		○	○	○	○	○	○	○
Construction	Reclamation	○	○	○	●	○	○	○
	Terminal	○	○	○	●	○	●	○
Ownership		○	○			○	Land: ○ Terminal: ●	Land: ○ Terminal: ●
Operator		●	○	○ & ●	●	○	●	●
Tug & Pilot		●	○	○	●	○	●	●

○ Public ● Private

TABLE 5.2.3 Development, Management and Operation Patterns of Bulk Terminals in Europe

Port		Tilbury	Aarhus	Nordenham	Wilhelmshaven	Rotterdam	Dunkerque
Country		U.K.	Denmark	Germany	Germany	Holland	France
Main Commodity		Cereals	Cereals Coal	Coal	Coal	Coal Iron Ore Cereals	Iron Ore Coal
Master Plan		○	○		○	○	○
Construction	Reclamation	○	○	●	○	○	○
	Terminal	○	●	●	●	●	○
Ownership		●	Land: ○ Terminal: ○&●	●	Land: ○ Terminal: ●	Land: ○	○ (movable facilities:●)
Operator		●	●	●	●	●	● & ○
Tug & Pilot			○	●			
Remarks		Privatized in 1992					

○ Public ● Private

5.3 Development, Management and Operation for the New Port

Based on the analysis above, recommendations on the new port development, management and operation are as follows:

(1) Master plan for the new port must be drawn by public sector and public sector should administer the port from the viewpoint of people's welfare according to its master plan.

(2) For the above purpose, construction of infrastructure such as the breakwater, dredging and land reclamation must also be performed by public sector and ownership of the land should be retained by public sector.

(3) Construction of the terminal including the superstructure and pavement, and its operation is recommended to be performed by private sector in order to encourage efficient cargo handling.

5.4 Methods to Support Efficient Management and Operation

5.4.1 Port Promotion

Since the new port is located somewhat far from Istanbul which is the major consumer city in its hinterland, port promotion activities are one of the most important factors to attract port users and to secure adequate level of revenue. In order to accomplish this aim, following actions by a port management body are necessary.

(1) Establishment of port promotion strategy focusing on the most effective target groups of clients

(2) Under the action program based on the above strategy, the port management body should call for sales at shipping companies or shippers through active appeals in getting their understanding on real merits of utilizing the new port.

5.4.2 Tariff

Port management body should set its tariff at a proper level to obtain sufficient income for maintaining sound financial condition and making the necessary investments. On the other hand, tariff should be set taking levels of neighboring ports into consideration to

attract more port users. Port management body should always study tariffs of neighboring ports and major hub ports in the world.

In case of the new port, to conquer the locational disadvantage and the customary commercial practices which ignore rational economic principles and to survive the heated competition between container ports in the East Mediterranean Sea and the Black Sea by attracting mother container vessels, port tariff should be competitive.

For reference, present tariff rates for public ports in Turkey are compared with those of other foreign ports in Table 5.4.1.

TABLE 5.4.1 Tariff Comparison between Turkish Ports and Selected Foreign Ports (Container Handling Charge : US$/TEU)

		Turkish Ports		Port of Singapore	Port of Colombo
		Loading	Unloading		
20ft	Full	55×2/3*=36.7	90×2/3*=60.0	99.98	106.70
	Empty	35×2/3*=23.3	25×2/3*=16.7	54.83	106.70
40ft	Full	55×2/3*=36.7	90×2/3*=60.0	141.90	160.05
	Empty	35×2/3*=23.3	25×2/3*=16.7	79.34	160.05
Transshipment 20ft (within 72 hours)	Full	-	-	54.83	34.25
	Empty	-	-		
Transshipment 40ft (within 72 hours)	Full	-	-	80.63	52.00
	Empty	-	-		

Note(*): The ratio "2/3" is a coefficient for converting the unit of tariff rates from US$/Unit to US$/TEU. This ratio is calculated based on the assumption that the number of 20ft containers equals that of 40ft containers in Turkish ports

According to the financial analysis based on the present tariff for public ports in Turkey, calculation results of financial indicators for the management body of the new port are very good. Therefore tariff for the new port can be lowered to some extent taking account of the above mentioned situation, although the tariff for import/export and domestic cargo is not at a high level compared with other ports in the Mediterranean Sea or in the world.

5.4.3 Personnel Evaluation and Training System

In order to support the effective personnel management of the port management

body, the following measures need to be carefully examined and applied under the "appointing the right person to the right position" principle.

a) Establishment of proper personnel evaluation and transfer system based on ability and actual performance of each staff.
b) Introduction of steady and encouraging promotion system
c) Provision of attractive positions for able technocrats and engineers
d) Creation of positive incentive mechanism built in the salary/wages system

With respect to staff training, the port management body needs to develop its own training courses in order to make up for the lack of expertise in the new port and to improve container handling productivity. It is also important to instill in them cost-conscious and the need for efficiency in conducting their duty and assignment.

The following training courses are necessary to foster capable operation staff, operators and engineers.

(1) Training for administrative staffs

In this course staffs can gain basic knowledge on general administration. For more details including financial management, accounts system, related laws, regulations and so on, course for each expertise should be established.

(2) Training for engineers

For better understanding of port construction and maintenance, training courses on civil engineering, architecture, electrical engineering, mechanical engineering and so on should be established and experts for each field should be fostered.

(3) Training for operators

In these courses on cargo handling, operation of port equipment and so on, operators can attain a higher level of skill and thus the efficiency of port operations will be enhanced.

In addition to above mentioned courses, several staff members and operators could be sent to foreign ports to acquire knowledge or skill based on the latest management and operation or cargo handling techniques. They should pass on their knowledge or skill to other staffs or operators. Also, specialists could be employed or invited from abroad. Since field training is very useful for skill acquisition, the employment or invitation of technical supporting experts or engineers makes it possible to accelerate technology transfer.

5.4.4 Simplification and Modernization of Procedures and Documentation

As mentioned in chapter 4.2.2, complicated documentation procedures are necessary for import and export. In order not only to develop trade in this country but also to establish efficient container transport operations, these procedures and documentation required for export/import container transport should be simplified and modernized. It is desirable to accomplish this rationalization by extending the present computer system in TCDD ports in cooperation with all concerned organizations.

At present empty containers are subject to custom clearance in which containers are regarded as imported commodities and taxed. To reduce the waiting time of containers in the new port and to secure smooth door to door transportation, relevant customs law and legislation should be changed and customs clearance needs to be simplified in accordance with the European Customs regulations.

5.5 Organization

As a result of the examination in chapter 5, part Ⅱ, management and operation of a container terminal is best performed by a private sector, while the infrastructure should be developed and managed by a public sector.

An example of proposed organization chart for managing and operating container terminal in the short term plan is shown in Fig. 5.5.1. Number of officials in the chart is estimated based on the case of a typical container terminal, while number of workers is calculated using the labor formation in chapter 4.2.4 and forecast cargo volume. Table 5.5.1 shows the number of employees at container terminal in short term plan.

FIGURE 5.5.1 Organization Chart of the Container Terminal for the Short Term Plan

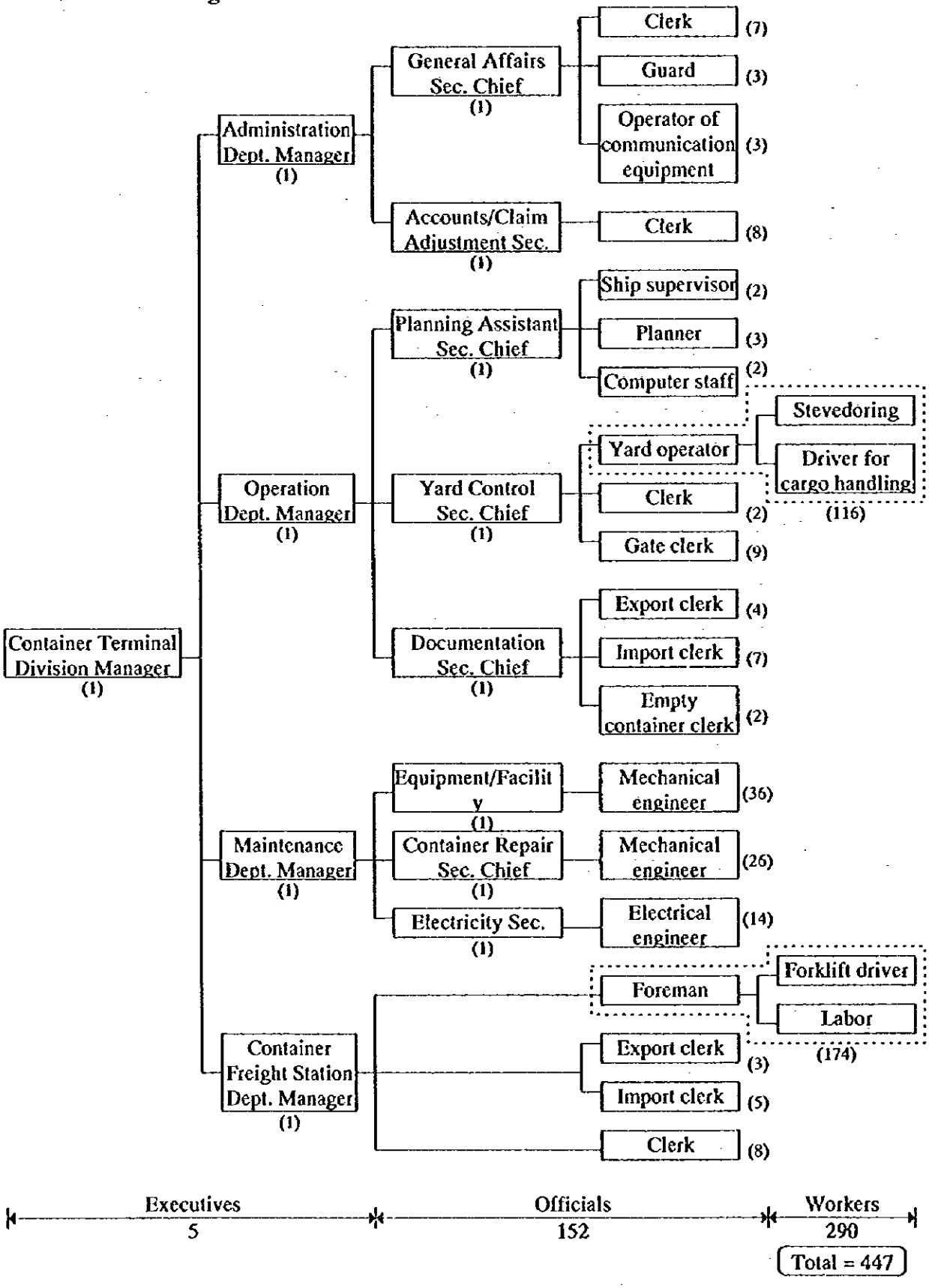


TABLE 5.5.1 Number of Employees at Container Terminal in Short Term Plan

Section	Number of employees
Container Terminal Manager	1
Administration Department	24
Operation Department	151
Maintenance Department	80
C.F.S. Department	191
Total	447

For infrastructure facilities, number of officials for developing and maintaining them is estimated to be 2 to 10 according to its stage.

6 Economic Analysis

6.1 Methodology

6.1.1 Purpose

The purpose of the economic analysis is to appraise the economic feasibility of the development plan for the New Port from the viewpoint of the national economy.

Therefore, the purpose of this chapter is to investigate the economic benefits as well as the economic costs that will arise from the project and to evaluate whether the net benefits of this project exceed those which could be obtained from other investment opportunities (the opportunity cost of capital) in the Republic of Turkey.

6.1.2 Methodology

An economic analysis will be carried out according to the following method. Master plan will be defined and it will be compared to the "Without case". All benefits and costs of it in market price for the difference from "With case" will be calculated and evaluated.

There are various methods to evaluate the feasibility of this type of development project. Here, the economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project. The EIRR is a discount rate which makes the costs and the benefits of the project during the project life equal. Figure 6.1.1 shows the flow chart of the economic analysis procedure.

6.2 Prerequisites

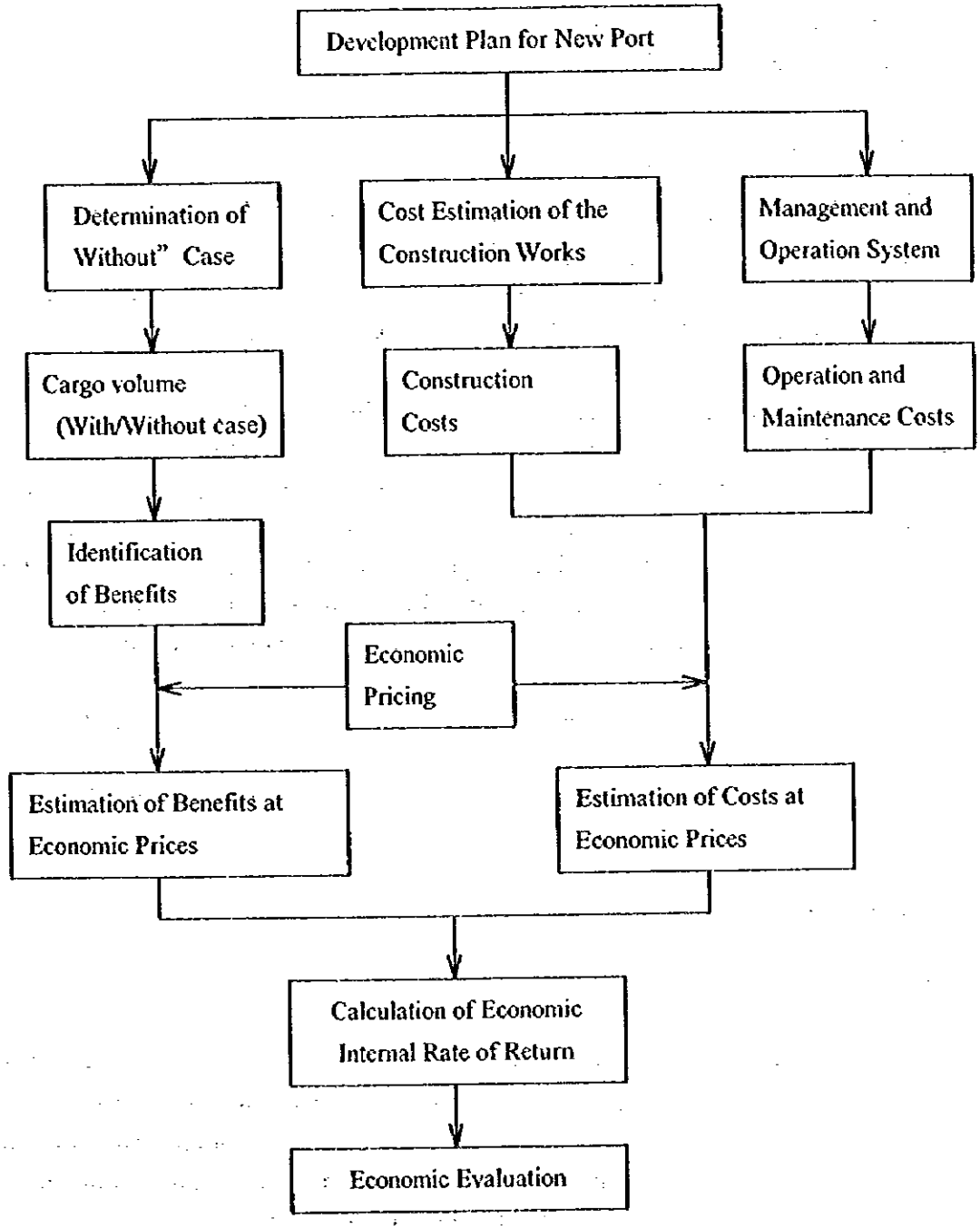
6.2.1 Base Year

The "Base Year" here means the standard year in the estimation of costs and benefits. Taking into consideration the base year in the cost estimation of construction, 1996 is set as the "Base Year" of the study.

6.2.2 Project life

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

FIGURE 6.1.1 Flowchart of the Economic Analysis Procedure



6.2.3 Foreign exchange rate

The exchange rate adopted for this analysis is US$ 1.00 = 105 ¥ = TL 78,400, the same rate as used in the cost estimation.

6.2.4 "With" and "Without" case

A cost-benefit analysis is conducted on the difference between the "With" case where investment is made and the "Without" case where no investment is made. In other words, incremental benefits and costs arising from the proposed investment are compared. In this study, following conditions are adopted as the "Without" case.

1) No investment is made for construction of new port in Thrace Region
2) When handling volume of container cargo from/to Thrace Region exceeds the handling capacity of Ambarli port, the containers which can not be handled in Ambarli port are assumed to be handled in Izmit bay ports and Gemport.
3) When handling volume of container cargo from/to Thrace Region and Izmit bay exceeds the handling capacity of Izmit bay and Gemport, the containers which can not be handled in Izmit bay and Gemport are assumed to be handled in Bandirma port and Izmir port.
4) Under the present condition of Izmit bay and Gemport, no mother vessel of container will call.
5) The size of vessels and the working efficiency of cargo handling are not the same as "With" case

6.3 Economic Pricing

6.3.1 Methodology

The purpose of the economic analysis is to examine the value of a project, that is, to see if it represents an efficient allocation of resources in the national economy. The local currency portion of the goods and materials at market price often includes customs duties. The labour cost at market price is often influenced by a minimum wage system. Therefore, economic pricing should be conducted for the economic analysis.

There are several ways for "economic pricing" to be conducted. In this study, the prices of domestic goods and services are revised to border prices in an effort to determine a more rational valuation. In general, these border prices are intended to represent the international market value, or the world prices, of these goods and services.

The market prices are changed to border prices by various conversion factors such as "Standard Conversion Factor" , "Conversion Factor for Consumption" and so forth.

6.3.2 Method of Applying Conversion Factors

Labor is divided into skilled and unskilled labor. Skilled labor costs are estimated based on local market wages, and unskilled labor costs are estimated based on the value of the gross marginal product. Economic prices for the labor costs are calculated by multiplying these costs by the conversion factor for consumption. Since all the benefits are estimated at market prices, it is necessary to re-evaluate them from the economic point of view.

Conversion factor for goods and labor are determined as follows.

(1) Standard Conversion Factor (SCF)

Import duties and subsidies cause a price differential between the domestic market and the international market. The Standard Conversion Factor (SCF) is used to determine the economic prices of certain non-traded goods and services that cannot be directly valued at border prices.

SCF is expressed by the following equation:

$$SCF = \frac{I + E}{(I + D_I) + (E - D_E)}$$

where, I : Total Amount of Imports
E : Total Amount of Exports
D_I : Total Amount of Import Duties
D_E : Total Amount of Export Subsides

There is no data available regarding export subsidies in Turkey, and thus only import duties are taken into account. Table 6.3.1 shows SCF of Turkey in 1989-1995.

TABLE 6.3.1 SCF of Turkey in 1989 - 1995

year	Import value of Turkey Total million US$	tax %	Tax million US$	Export value of Turkey Total million US$	S.C.F
1988	14,335	0.213	3,053		
1989	15,792	0.214	3,379	11,625	0.890
1990	22,302	0.239	5,330	12,959	0.869
1991	21,047	0.261	5,493	13,593	0.863
1992	22,871	0.260	5,946	14,715	0.863
1993	29,428	0.252	7,416	15,345	0.858
1994	23,270	0.158	3,677	18,106	0.918
1995	35,709	0.262	9,356	21,637	0.860
Average					0.875

Source: SIS Foreign Trade Statistics 1994, SPO

In this study, the average SFC in 1989- 1995 ,0.875 is adopted.

(2) Conversion Factor for Consumption (CFC)

The CFC is used for converting the price of consumer goods from domestic market prices to border prices. This is particularly required in converting domestic labour costs to the corresponding border prices. The CFC is usually calculated in the same manner as the SCF, replacing total imports and total exports and consumer goods only. Table 6.3.2 shows CFC of Turkey in 1992 - 1994.

TABLE 6.3.2 CFC of Turkey in 1992 - 1994.

year	Import Value of Consumption Goods Total million US$	Tax million US$	Export Value of Consumption Goods Total million US$	C.F.C
1989	1,377.3		5,778.9	
1990	3,024.9		6,949.6	
1991	2,910.5		7,284.6	
1992	2,971.5	660.9	8,250.9	0.944
1993	4,116.8	870.3	8,557.6	0.936
1994	2,779.7	294.2	9,756.6	0.977
Average				0.952

Source: SIS Foreign Trade Statistics 1994, SPO

In this study, the average CFC in 1992-1994, 0.952 is adopted.

(3) Shadow Wage Rate

For economic analysis, labour costs should be measured in terms of their opportunity costs, that is, the value of lost marginal production which the employment of the labours for a given project would create for other purposes.

1) Conversion Factor for Skilled Labour

The cost of skilled labour is calculated based on actual market wage, assuming that the market mechanism is functioning properly. However, since these are domestic costs, they should be converted to border prices by multiplying the local wage by the CFC.

$$\boxed{\text{Conversion Factor for skilled labour}} = \boxed{\text{Nominal Wage Rate}} \times \text{CFC} = 1 \times 0.952 = 0.952$$

2) Conversion Factor for Unskilled labour

The cost of unskilled labour is calculated based on actual market wage.

$$\boxed{\text{Conversion Factor for Unskilled Labour}} = \frac{\text{Unskilled labour wage}}{\text{Skilled labour wage}} \times \text{CFC}$$

$$= 0.708 \times 0.952 = 0.674$$

3) Conversion Factor for Foreign Labour

Specific consideration should be given to foreign labour, whether it is skilled or unskilled. Since foreign workers have a strong tendency to remit most of their earning to their own homes, the economic cost of foreign labour should be treated just like that of imported goods and services.

Therefore, in this study it is assumed that the conversion factor for foreign labour is 1.00.

6.4 Benefits of the Project

6.4.1 Kinds of Benefits

The development of the new port will greatly contribute to the national economy of

of Turkey. Considering the "With" and "Without" case, the following items are identified as major benefits of the development plan for the new port from the viewpoint of the national economy.

1) Savings in waiting costs of ships.
2) Savings in land transportation costs.
3) Creation of productive opportunity by eliminating the road congestion.
4) Savings in sea transportation costs.
5) Savings in interest of cargo costs.
6) Earning of foreign currency from transshipment cargo handling
7) Promotion of regional economic development.
8) Increase in employment opportunities and incomes
9) Reduction of the traffic congestion in Istanbul.

It is impossible to evaluate all these benefits in monetary terms, but of the above, Items 1),2),3),4),5) and 6) are considered countable and the monetary benefits of these items are calculated.

The other benefits are considered uncountable and only a qualitative analysis is undertaken.

6.4.2 Calculation Method of Benefits

In converting the market price into economic prices, benefits derived from benefit item 1),4),5) and 6) are considered at economic prices without any converting procedure, because they are already presented at international prices. However, benefits derived from benefit item 2) and 3) are expressed in market prices, and therefore the conversion factor is applied to these benefits for converting market prices into economic prices.

(1) Savings in waiting costs of ships

When the container cargo volume exceeds the handling capacity of Ambarli port, the container cargoes from/to Thrace Region which can not be handled in Thrace Region are assumed to be handled in Izmit bay and Gemport. The Study team evaluates the container cargo handling capacity of Ambarli port to be 50,000 TEU in a year.

In the year 2005, total number of 7 container berths and 13 gantry cranes in Izmit bay and Gemport will handle the above mentioned containers and containers from/to Izmit Region. In the year 2015, total number of 10 container berths and 18 gantry cranes in Izmit bay and Gemport will handle the above mentioned containers and containers from/to Izmit Region. The total ship staying time, namely ship waiting time for berthing and ship mooring time for unloading/loading in the port, will be increased.

The benefits that will accrue to Turkey from the projects can be calculated by the following formula.

Savings in waiting costs of ships
= Difference in waiting time between "With" and "Without" case
× Ships staying cost (unit cost)
× Share of benefits accruing to Turkey

In this study it is assumed that 50% of the benefits attributed to foreign ship operators is assumed to return to Turkey over time through the market mechanism of world shipping as well as 100% of benefits for Turkey ship operators will accrue to the Turkey economy.

The average waiting time is estimated using a computer simulation in accordance with the Queuing Theory

(2) Savings in land transportation cost

When the container cargo volume reaches the maximum volume of handling capacity of Ambarli port, the container cargoes from/to Thrace Region which can not be handled in Thrace Region are assumed to be handled in Izmit bay and Gemport. And handling volume of container cargo from/to Thrace Region and Izmit bay exceeds the handling capacity of Izmit bay and Gemport, the containers which can not be handled in Izmit bay and Gemport are assumed to be handled in Bandirma port and Izmir port. And then these cargoes are to be transported to Thrace Region by land transportation. In accordance with the implementation of the projects, all cargoes will be transported from/to new port in Thrace Region.

The benefit from the project can be calculated by the following formula.

Savings in land transportation costs
= Difference in handling cargo volume between "With" and "Without" case
× Difference in land transportation cost (unit cost)

(3) Creation of productive opportunity by eliminating road congestion

The heavy traffic in Istanbul always causes serious traffic jam around the Bosphorus bridges. Container transportation vehicles are forced to wait for long periods of time when they could be engaged in other duties. After the completion of the new port in Thrace region, container transport vehicles will not be affected by traffic congestion in Istanbul.

The benefit from the project can be calculated by the following formula.

Creation of productive opportunity by eliminating road congestion
= Difference in lost time of vehicles between "With" and "Without" case
× Productive value of container transportation vehicle (unit cost)

(4) Savings in sea transportation costs

The size of calling vessel becomes is becoming larger to capitalize on mass transportation. Large vessel can call at deep berths but can not call at existing shallow berths. The sea transportation cost per unit of cargo will become cheaper by enlargement of ship size.

If sea transportation time is shortened, operation cost of vessel can be saved. The benefit that will accrue to Turkey from the projects can be calculated by the following formula.

Savings in sea transportation costs (a)
= Difference in sea transportation cost between "With" and "Without" case
× Handling cargo volume

Savings in sea transportation costs (b)
= Difference in sea transportation time between "With" and "Without" case
× Operation cost of vessel

(5) Savings in interest of cargo cost

In accordance with the implementation of the project, the total ship staying time and sea transportation time and land transportation time will be greatly decreased. According to the reduction of cargo transportation time under "With case" ,interest of cargo cost will be

cost will be decreased. In this study, the benefits of savings in interest of cargo costs are calculated by following formula.

Savings in interest of cargo costs
= Difference in cargo transportation time between "With" and "Without" case
× Cargo value × Interest of cargo

(6) Earnings of Foreign Currency from Transshipment Cargo Handling

The foreign currency earnings from handling of transshipment container cargo is assumed to be 60 US$ per 1 TEU in 2005 - 2014, and 66.7 US$ per 1 TEU after 2015.
The benefit that will accrue from the projects can be calculated by the following formula.

Earnings of foreign currency from transshipment cargo handling
= Transshipment Cargo Volume
× Handling cost of transshipment container cargo.

(7) Uncountable Benefits

1) Promotion of Regional Economic Development

In the development plan, materials will be needed for port construction. (See Table 6.4.1) This volume is not small, and will stimulate the development of related industries. The development of the port contributes to the improvement of the distribution mechanism and to the activation of industries in the hinterland.

TABLE 6.4.1 Material List

Item	Short term	Long Term	Total	(unit)
Armor stone	141,422	160,534	301,956	m3
Rubble stone	2,281,826	1,285,100	3,566,926	m3
Cement	71,622	97,871	169,493	ton
Steel	14,626	8,031	22,657	ton

2) Increase in Employment Opportunities and Income

Additional employment will arise directly from the project, both assumed employment for construction during construction period and employment for operations after

the construction . The construction will provide employment for those people who would remain unemployed if the project does not take place. This employment is one of the major benefits of the projects.

3) Reduction of the Traffic Congestion in Istanbul

After the completion of new port, passage number of vehicles related to port cargoes through the Bosphorus Straits will be reduced.

6.4.3 Benefits of Short Term Development Plan

Benefits of the short term development plan consists of savings in land transportation costs, creation of productive opportunity by eliminating road congestion, savings in sea transportation costs, savings in cargo interest costs and earnings of foreign currency from transshipment cargo handling.

Total benefits of short term development plan are shown in Table 6.4.2.

6.4.4 Benefits of Long Term Development Plan

Benefits of long term development plan consist of savings in waiting costs of ship, savings in land transportation costs, creation of productive opportunity by eliminating road congestion, savings in sea transportation, savings in interest of cargo costs and earnings of foreign currency from transshipment cargo handling.

Vessels are forced to wait , since container cargo handling capacity of Izmit bay ports is not sufficient for the total container cargo volume of Izmit bay area and Thrace Region.

As the result of some simulation analysis, study team found that the lowest transportation cost by setting vessel waiting day in Izmit bay ports as one day. Overflow container cargo which will not be able to handled in Izmit bay ports, is to be handled in Bandirma port and Izmir port, and transported to Thrace region by land.

Total yearly benefits of long term development plan are shown in Table 6.4.3.

TABLE 6.4.2 Total Benefits of Short Term Development Plan

unit : $US

year	(2)	(3)	(4)	(5)	(6)	Total
2005	6,765,749	12,264,110	2,523,485	140,566	2,760,000	24,453,910
2006	8,145,092	13,965,617	2,863,857	161,093	3,132,000	28,267,659
2007	9,631,814	15,667,124	3,203,872	182,334	3,504,000	32,189,143
2008	11,227,679	17,378,022	3,545,537	204,274	3,865,800	36,221,312
2009	12,366,380	18,249,216	3,716,006	226,939	4,059,600	38,618,141
2010	12,947,841	18,249,216	3,709,782	250,360	4,059,600	39,216,799
2011	13,523,677	18,249,216	3,704,398	274,451	4,059,600	39,811,342
2012	14,099,514	18,249,216	3,699,694	299,253	4,059,600	40,407,277
2013	14,670,829	18,249,216	3,695,549	324,724	4,059,600	40,999,918
2014	15,246,666	18,249,216	3,691,869	350,947	4,059,600	41,598,298
2015	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2016	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2017	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2018	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2019	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2020	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2021	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2022	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2023	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2024	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2025	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2026	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2027	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2028	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2029	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116
2030	15,822,503	18,249,216	3,688,592	377,884	4,512,922	42,651,116

Note
(2) Savings in Land Transportation Costs
(3) Creation of Productive Opportunity by Eliminating the Road Congestion
(4) Savings in Sea Transportation Costs
(5) Savings in Interest of Cargo Costs
(6) Earnings of Foreign Currency from Transshipment Cargo Handling

TABLE 6.4.3 Yearly Benefits of Long Term Development Plan

unit : US$

Kinds of Benefits	Value of Benefits
Savings in Waiting Costs of Vessel	36,771,884
Savings in Land Transportation (1)	102,044,785
Savings in Land Transportation (2)	18,054,858
Savings in Land Transportation (3)	3,231,829
Creation of Productive Opportunity by Eliminating Road Congestion	15,026,296
Savings in Sea Transportation	8,258,649
Savings in Interset of Cargo Costs	428,982
Earnings of Foreign Currency from Transshipment Cargo Handling	7,203,600
Total	191,020,883

Note : (1) Between Izmir Port and Thrace Region
(2) Between Izmit Bay and Thrace Region
(3) Between Bandirma port and Thrace Region

6.5 Costs

6.5.1 Kinds of Costs

(1) Construction costs

In the economic analysis, construction costs have to be divided into foreign currency portion and local currency portion. Moreover, the local currency portion can be divided into skilled labour, unskilled labour and local products. As the foreign currency potion is shown in CIF prices, there is no need for conversion into economic prices. The local currency portion should be converted into economic prices by using the conversion factor. Table 6.5.1 shows economic prices of construction costs in each year.

(2) Renewal Costs

The renewal investment costs for facilities and equipment after their useful lifetimes are considered. The renewal costs for equipment is considered as 85 % of their original cost ,since there is a residual value of 15 % even after the service life expires. Table 6.5.2 shows renewal costs of facilities and equipment.

(2) Maintenance Costs

The cost of maintaining the port facilities is assumed to be a fixed portion (1% for

TABLE 6.5.1 Investment Costs in Economic Prices

year	Cost of Investment in Market Price	Foreign Portion				Local Portion					Investment Costs in Economic Prices	Overall Conversion Factor
		Total	(CIF) 1.000	Engineering fee 1.000	Contingency fee 1.000	Total	Skilled labour 0.952	Unskilled labour 0.674	Local Products 0.875	Contingency fee 0.875		
2001	42,528,000	9,786,000	7,708,000	1,830,000	248,000	32,742,000	1,788,000	1,443,000	28,337,000	1,174,000	38,282,883	0.900
2002	45,115,000	11,428,000	9,350,000	1,830,000	248,000	33,687,000	2,268,000	1,253,000	28,992,000	1,174,000	40,826,908	0.905
2003	30,632,000	4,945,000	2,867,000	1,830,000	248,000	25,687,000	1,659,000	897,000	21,957,000	1,174,000	27,368,571	0.893
2004	41,301,000	35,648,000	33,570,000	1,830,000	248,000	5,653,000	278,000	246,000	3,955,000	1,174,000	40,566,335	0.982
2005	0	0	0	0	0	0	0	0	0	0	0	
2006	0	0	0	0	0	0	0	0	0	0	0	
2007	23,274,000	6,786,000	5,245,000	1,423,000	118,000	16,488,000	689,000	504,000	14,683,000	612,000	21,164,749	0.909
2008	19,229,000	5,452,000	3,911,000	1,423,000	118,000	13,777,000	823,000	591,000	11,751,000	612,000	17,451,455	0.908
2009	69,301,000	40,388,000	38,847,000	1,423,000	118,000	28,913,000	1,355,000	817,000	26,129,000	612,000	65,626,993	0.947
2010	53,133,000	41,603,000	40,062,000	1,423,000	118,000	11,530,000	685,000	454,000	9,779,000	612,000	51,897,903	0.977
2011	6,123,000	2,145,000	604,000	1,423,000	118,000	3,978,000	723,000	503,000	2,140,000	612,000	5,580,318	0.911
2012	44,057,000	31,635,000	30,094,000	1,423,000	118,000	12,422,000	761,000	432,000	10,617,000	612,000	42,476,015	0.964
2013	23,621,000	14,486,000	12,945,000	1,423,000	118,000	9,135,000	544,000	261,000	7,718,000	612,000	22,468,552	0.951
2014	9,598,000	2,782,000	1,241,000	1,423,000	118,000	6,816,000	331,000	128,000	5,745,000	612,000	8,745,759	0.911

TABLE 6.5.2 Short-Term Equipment Renewal Cost

	year	Gantry crane	Transfer crane	Top Loader	Tractor	Chassis	Forklift	Total
1	2005	0	0	0	0	0	0	0
2	2006	0	0	0	0	0	0	0
3	2007	0	0	0	0	0	0	0
4	2008	0	0	0	0	0	0	0
5	2009	0	0	0	0	0	0	0
6	2010	0	0	0	0	0	0	0
7	2011	0	0	0	0	0	0	0
8	2012	0	0	0	1,606,500	765,000	420,750	2,792,250
9	2013	0	0	0	0	0	0	0
10	2014	0	0	0	0	0	0	0
11	2015	0	0	0	0	0	0	0
12	2016	0	9,945,000	0	0	0	0	9,945,000
13	2017	0	0	0	0	0	0	0
14	2018	0	0	0	0	0	0	0
15	2019	14,688,000	0	0	0	0	0	14,688,000
16	2020	0	0	0	1,606,500	765,000	420,750	2,792,250
17	2021	0	0	0	0	0	0	0
18	2022	4,896,000	0	0	0	0	0	4,896,000
19	2023	0	0	0	0	0	0	0
20	2024	0	0	0	0	0	0	0
21	2025	0	0	0	0	0	0	0
22	2026	0	0	0	0	0	0	0
23	2027	0	0	0	0	0	0	0
24	2028	0	9,945,000	0	1,606,500	765,000	420,750	12,737,250
25	2029	0	0	306,000	0	0	0	306,000
26	2030	-9,656,800	-10,042,500	-347,760	-1,488,375	-708,750	-389,813	-22,633,998
	total	9,927,200	9,847,500	-41,760	3,331,125	1,586,250	872,437	25,522,752

Long-Term Equipment Renewal Cost

	year	Gantry crane	Transfer crane	Top Loader	Tractor	Chassis	Forklift	Loader/Unloader	Belt Conveyor	Shore Crane	Total
1	2005	0	0	0	0	0	0	0	0	0	0
2	2006	0	0	0	0	0	0	0	0	0	0
3	2007	0	0	0	0	0	0	0	0	0	0
4	2008	0	0	0	0	0	0	0	0	0	0
5	2009	0	0	0	0	0	0	0	0	0	0
6	2010	0	0	0	0	0	0	0	0	0	0
7	2011	0	0	0	0	0	0	0	0	0	0
8	2012	0	0	0	1,606,500	765,000	420,750	0	0	0	2,792,250
9	2013	0	0	0	0	0	0	0	0	0	0
10	2014	0	0	0	0	0	0	0	0	0	0
11	2015	0	0	0	0	0	0	0	0	0	0
12	2016	0	9,945,000	0	0	0	0	0	0	0	9,945,000
13	2017	0	0	0	1,759,500	795,600	497,250	0	0	0	3,052,350
14	2018	0	0	0	0	0	834,700	0	1,700,000	0	2,534,700
15	2019	14,688,000	0	0	0	0	0	0	0	0	14,688,000
16	2020	0	0	0	1,606,500	765,000	420,750	0	1,020,000	0	3,812,250
17	2021	0	9,945,000	0	0	0	0	0	0	0	9,945,000
18	2022	4,896,000	0	0	0	0	0	0	0	0	4,896,000
19	2023	0	0	0	0	0	0	0	0	0	0
20	2024	9,792,000	0	0	0	0	0	0	0	0	9,792,000
21	2025	0	0	0	1,759,500	795,600	497,250	3,060,000	0	0	6,112,350
22	2026	0	0	0	0	0	334,700	0	1,700,000	10,098,000	12,632,700
23	2027	0	0	0	0	0	0	1,989,000	0	0	1,989,000
24	2028	0	9,945,000	0	1,606,500	765,000	420,750	0	1,020,000	10,098,000	23,855,250
25	2029	0	0	306,000	0	0		0	0	10,098,000	10,404,000
26	2030	-17,260,000	-14,283,750	-450,720	-2,458,688	-1,147,500	-1,228,081	-4,522,200	-2,095,000	-30,927,600	-74,373,539
	total	12,116,000	15,551,250	-144,720	5,879,812	2,738,700	2,698,069	526,800	3,345,000	-633,600	42,077,311

structure, 4% for handling equipment)of the original construction costs excluding the costs of dredging and reclamation costs. Table 6.5.3 shows maintenance cost of port facilities .

(3) Operation Cost

Operation costs consist of personnel costs and administration costs. Based on the estimation of operation costs in the following Chapter 7, the necessary operation costs for the new port are considered as follows.

1) Personnel costs

Two kinds of personnel cost are adopted, one is for operation work and the other is for maintenance work for port facilities.

2) Administration costs

Administration costs of operation and maintenance are set at 24.9% and 4.7% respectively . Table 6.5.4 shows operation cost of development plan.

6.6 Evaluation

6.6.1 Calculation of the EIRR

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

The EIRR is a discount rate which makes the costs and benefits of a project during the project life equal. It is calculated by using the following formula.

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

where, n: Period of economic calculation (project life)
Bi: Benefits in i-th year
Ci: Costs in i-th year
r: Discount rate

TABLE 6.5.3 Maintenance Cost of Short Term Development Plan

unit : US$

year	Structure Maintenance cost			Equipment Maintenance cost			Total
	Structure cost	ratio		Equipment cost	ratio		
2005	93,813,660	0.01	938,137	32,625,000	0.04	1,305,000	2,243,137
2006	93,813,660	0.01	938,137	32,625,000	0.04	1,305,000	2,243,137
2007	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2008	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2009	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2010	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2011	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2012	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2013	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2014	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2015	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2016	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2017	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2018	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2019	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2020	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2021	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2022	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2023	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2024	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2025	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2026	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2027	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2028	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2029	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2030	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537

Maintenance Cost of Long Term Development Plan

unit : US$

year	Structure Maintenance cost			Equipment Maintenance cost			Total
	Structure cost	ratio		Equipment cost	ratio		
2005	93,813,660	0.01	938,137	32,625,000	0.04	1,305,000	2,243,137
2006	93,813,660	0.01	938,137	32,625,000	0.04	1,305,000	2,243,137
2007	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2008	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2009	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2010	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2011	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2012	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2013	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2014	93,813,660	0.01	938,137	38,385,000	0.04	1,535,400	2,473,537
2015	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2016	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2017	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2018	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2019	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2020	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2021	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2022	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2023	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2024	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2025	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2026	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2027	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2028	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2029	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846
2030	196,748,642	0.01	1,967,486	144,734,000	0.04	5,789,360	7,756,846

TABLE 6.5.4 Operation Cost of Short Term Development Plan

unit : US$

year	Operation			Maintenance			Total
	Personnel	ratio	Administrarion	Personnel	ratio	Administration	
2001	0	0.249	0	87,000	0.047	4,089	91,089
2002	0	0.249	0	87,000	0.047	4,089	91,089
2003	0	0.249	0	36,000	0.047	1,692	37,692
2004	0	0.249	0	29,000	0.047	1,363	30,363
2005	2,671,000	0.249	665,079	22,000	0.047	1,034	3,359,113
2006	2,847,000	0.249	708,903	22,000	0.047	1,034	3,578,937
2007	3,022,000	0.249	752,478	22,000	0.047	1,034	3,797,512
2008	3,198,000	0.249	796,302	22,000	0.047	1,034	4,017,336
2009	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2010	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2011	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2012	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2013	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2014	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2015	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2016	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2017	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2018	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2019	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2020	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2021	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2022	3,282,000	0.249	817,218	29,000	0.047	1,363	4,129,581
2023	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2024	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2025	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2026	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2027	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2028	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2029	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252
2030	3,282,000	0.249	817,218	22,000	0.047	1,034	4,122,252

Operation Cost of Long Term Development Plan

unit : US$

year	Operation			Maintenance			Total
	Personnel	ratio	Administrarion	Personnel	ratio	Administration	
2001	0	0.249	0	87,000	0.047	4,089	91,089
2002	0	0.249	0	87,000	0.047	4,089	91,089
2003	0	0.249	0	36,000	0.047	1,692	37,692
2004	0	0.249	0	29,000	0.047	1,363	30,363
2005	2,671,000	0.249	665,079	22,000	0.047	1,034	3,359,113
2006	2,847,000	0.249	708,903	22,000	0.047	1,034	3,578,937
2007	3,022,000	0.249	752,478	54,000	0.047	2,538	3,831,016
2008	3,198,000	0.249	796,302	47,000	0.047	2,209	4,043,511
2009	3,282,000	0.249	817,218	73,000	0.047	3,431	4,175,649
2010	3,422,319	0.249	852,157	47,000	0.047	2,209	4,323,685
2011	3,422,319	0.249	852,157	47,000	0.047	2,209	4,323,685
2012	3,422,319	0.249	852,157	47,000	0.047	2,209	4,323,685
2013	3,422,319	0.249	852,157	40,000	0.047	1,880	4,316,356
2014	3,422,319	0.249	852,157	40,000	0.047	1,880	4,316,356
2015	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2016	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2017	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2018	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2019	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2020	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2021	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2022	7,900,000	0.249	1,967,100	29,000	0.047	1,363	9,897,463
2023	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2024	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2025	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2026	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134
2027	7,900,000	0.249	1,967,100	40,000	0.047	1,880	9,908,980
2028	7,900,000	0.249	1,967,100	40,000	0.047	1,880	9,908,980
2029	7,900,000	0.249	1,967,100	40,000	0.047	1,880	9,908,980
2030	7,900,000	0.249	1,967,100	22,000	0.047	1,034	9,890,134

(1) EIRR of Short Term Development Plan

The EIRR of the short term development plan is calculated as 14.8%. Calculation result of the EIRR is shown in Table 6.6.1.

(2) EIRR of Long Term Development Plan

The EIRR of the long term development plan is calculated as 18.2%. Calculation result of the EIRR is shown in Table 6.6.2.

6.6.2 Sensitivity Analysis

(1) Identification of Cases

In order to see if the project is still feasible when some factors are varied, the following case is examined .

Case 1: The construction costs are increased by 10% and the benefits are decreased by 10%

(2) Result of calculation

The result of sensitivity analysis of short term development plan and long term development plan are11.8 % and 15.5% respectively.

Table 6.6.3 shows the result of EIRR calculation

TABLE 6.6.3 Result of EIRR Calculation

case	EIRR	Sensitive analysis
Short-term	14.8%	11.8%
Long-term	18.2%	15.5%

6.6.3 Evaluation

There are various views concerning the appropriate EIRR level used to determine whether a project is feasible or not. According to the SPO, the standard cut off line of EIRR in social infrastructure project is 11 to 12 % in Turkey. As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR is 11.8%. Therefore, this master plan development project is viable from the viewpoint of the national economy.

TABLE 6.6.1 EIRR of Short Term Development Plan

	Year	Cost					Benefit Total	Benefit - Cos	Net Present Value (NPV)		
		Construction	Renewal	Maintenance	Operation	Total			Benefit	Cost	Benefit - Cost
1	2001	38,282,883	0	0	91,089	38,373,972	0	-38,373,972	0	38,373,972	-38,373,972
2	2002	40,826,908	0	0	91,089	40,917,997	0	-40,917,997	0	35,646,838	-35,646,838
3	2003	27,368,571	0	0	37,692	27,406,263	0	-27,406,263	0	20,799,990	-20,799,990
4	2004	40,566,335	0	0	30,363	40,596,698	0	-40,596,698	0	26,841,740	-26,841,740
5	2005	0	0	2,243,137	3,359,113	5,602,250	24,453,910	18,851,660	14,085,585	3,226,926	10,858,659
6	2006	0	0	2,243,137	3,578,937	5,822,074	28,267,659	22,445,585	14,184,796	2,921,534	11,263,262
7	2007	5,760,000	0	2,473,537	3,797,512	12,031,049	32,189,143	20,158,094	14,071,789	5,259,487	8,812,302
8	2008	0	0	2,473,537	4,017,336	6,490,873	36,221,312	29,730,440	13,794,651	2,472,007	11,322,645
9	2009	0	0	2,473,537	4,122,252	6,595,789	38,618,141	32,022,352	12,812,815	2,188,366	10,624,449
10	2010	0	0	2,473,537	4,122,252	6,595,789	39,216,799	32,621,010	11,335,273	1,906,455	9,428,818
11	2011	0	0	2,473,537	4,122,252	6,595,789	39,811,342	33,215,554	10,024,745	1,660,861	8,363,884
12	2012	0	2,792,250	2,473,537	4,122,252	9,388,039	40,407,277	31,611,879	8,994,067	2,059,435	6,934,633
13	2013	0	0	2,473,537	4,122,252	6,595,789	40,999,918	35,002,509	7,949,785	1,260,511	6,689,274
14	2014	0	0	2,473,537	4,122,252	6,595,789	41,598,298	36,055,328	7,100,957	1,098,129	6,002,828
15	2015	0	0	2,473,537	4,122,252	6,595,789	42,651,116	36,055,328	6,186,194	956,665	5,229,529
16	2016	0	9,945,000	2,473,537	4,122,252	16,540,789	42,651,116	26,110,328	5,389,273	2,090,047	3,299,226
17	2017	0	3,052,350	2,473,537	4,122,252	9,648,139	42,651,116	33,002,978	4,695,013	1,062,062	3,632,951
18	2018	0	2,534,700	2,473,537	4,122,252	9,130,489	42,651,116	33,520,628	4,090,190	875,603	3,214,587
19	2019	0	14,688,000	2,473,537	4,122,252	21,283,789	42,651,116	21,367,328	3,563,281	1,778,151	1,785,130
20	2020	0	3,812,250	2,473,537	4,122,252	10,408,039	42,651,116	32,243,078	3,104,251	757,522	2,346,729
21	2021	0	9,945,000	2,473,537	4,122,252	16,540,789	42,651,116	26,110,328	2,704,353	1,048,792	1,655,562
22	2022	0	4,896,000	2,473,537	4,129,581	11,499,118	42,651,116	31,151,999	2,355,972	635,191	1,720,781
23	2023	0	0	2,473,537	4,122,252	6,595,789	42,651,116	36,055,328	2,052,469	317,404	1,735,065
24	2024	0	9,792,000	2,473,537	4,122,252	16,387,789	42,651,116	26,263,328	1,788,065	687,026	1,101,039
25	2025	0	6,112,350	2,473,537	4,122,252	12,708,139	42,651,116	29,942,978	1,557,722	464,132	1,093,590
26	2026	0	12,632,700	2,473,537	4,122,252	19,228,489	42,651,116	23,422,628	1,357,053	611,803	745,250
27	2027	0	1,989,000	2,473,537	4,122,252	8,584,789	42,651,116	34,066,328	1,182,234	237,959	944,274
28	2028	0	23,855,250	2,473,537	4,122,252	30,451,039	42,651,116	12,200,078	1,029,935	735,329	294,606
29	2029	0	10,404,000	2,473,537	4,122,252	16,999,789	42,651,116	25,651,328	897,256	357,627	539,630
30	2030	0	-74,373,539	2,473,537	4,122,252	-67,777,750	42,651,116	110,428,867	781,670	-1,242,167	2,023,837
	Total	152,804,697	42,077,311	63,851,152	105,700,004	364,433,164	1,001,550,545	682,012,337	157,089,394	157,089,394	0

EIRR= 0.14787

TABLE 6.6.2 EIRR of Long Term Development Plan

	Year	Cost					Benefit Total	Benefit - Cos	Net Present Value (NPV)		
		Construction	Renewal	Maintenance	Operation	Total			Benefit	Cost	Benefit - Cost
1	2001	38,282,883	0	0	91,089	38,373,972	0	-38,373,972	0	38,373,972	-38,373,972
2	2002	40,826,908	0	0	91,089	40,917,997	0	-40,917,997	0	34,628,616	-34,628,616
3	2003	27,368,571	0	0	37,692	27,406,263	0	-27,406,263	0	19,628,692	-19,628,692
4	2004	40,566,335	0	0	30,363	40,596,698	0	-40,596,698	0	24,606,679	-24,606,679
5	2005	0	0	2,243,137	3,359,113	5,602,250	24,453,910	18,851,660	12,543,865	2,873,727	9,670,138
6	2006	0	0	2,243,137	3,578,937	5,822,074	28,267,659	22,445,585	12,271,387	2,527,444	9,743,944
7	2007	26,924,749	0	2,473,537	3,831,016	33,229,302	32,189,143	-1,040,159	11,825,895	12,208,036	-382,142
8	2008	17,451,455	0	2,473,537	4,043,511	23,968,503	36,221,312	12,252,810	11,261,845	7,452,230	3,809,615
9	2009	65,626,993	0	2,473,537	4,175,649	72,276,179	38,618,141	-33,658,038	10,161,492	19,017,845	-8,856,353
10	2010	51,897,903	0	2,473,537	4,323,685	58,695,125	39,216,799	-19,478,326	8,732,911	13,070,401	-4,337,490
11	2011	5,580,318	0	2,473,537	4,323,685	12,377,540	39,811,342	27,433,802	7,502,646	2,332,609	5,170,037
12	2012	42,476,015	2,792,250	2,473,537	4,323,685	52,065,487	40,407,277	-11,658,210	6,444,482	8,303,828	-1,859,346
13	2013	22,468,552	0	2,473,537	4,316,356	29,258,445	40,999,918	11,741,473	5,533,911	3,949,121	1,584,790
14	2014	8,745,759	0	2,473,537	4,316,356	15,535,652	41,598,298	26,062,646	4,751,662	1,774,596	2,977,066
15	2015	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	18,465,946	1,705,930	16,760,016
16	2016	0	9,945,000	7,756,846	9,890,134	27,591,980	191,020,883	163,428,903	15,627,602	2,257,326	13,370,275
17	2017	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	13,225,530	1,221,807	12,003,723
18	2018	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	11,192,674	1,034,007	10,158,667
19	2019	0	14,688,000	7,756,846	9,890,134	32,334,980	191,020,883	158,685,903	9,472,282	1,603,417	7,868,866
20	2020	0	2,792,250	7,756,846	9,890,134	20,439,230	191,020,883	170,581,653	8,016,326	857,747	7,158,580
21	2021	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	6,784,161	626,738	6,157,424
22	2022	0	4,896,000	7,756,846	9,897,463	22,550,309	191,020,883	168,470,574	5,741,388	677,780	5,063,609
23	2023	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	4,858,897	448,877	4,410,020
24	2024	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	4,112,051	379,881	3,732,169
25	2025	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	3,480,000	321,491	3,158,509
26	2026	0	0	7,756,846	9,890,134	17,646,980	191,020,883	173,373,903	2,945,100	272,076	2,673,024
27	2027	0	0	7,756,846	9,908,980	17,665,826	191,020,883	173,355,057	2,492,417	230,502	2,261,916
28	2028	0	12,737,250	7,756,846	9,908,980	30,403,076	191,020,883	160,617,807	2,109,315	335,721	1,773,595
29	2029	0	306,000	7,756,846	9,908,980	17,971,826	191,020,883	173,049,057	1,785,099	167,948	1,617,151
30	2030	0	-22,633,998	7,756,846	9,890,134	-4,987,018	191,020,883	196,007,901	1,510,717	-39,441	1,550,157
	total	388,216,441	25,522,752	148,384,109	199,148,239	761,271,541	3,227,097,044	2,656,846,386	202,849,601	202,849,601	0

EIRR= 0.18162

7. Financial Analysis

7.1 Purpose

The purpose of the financial analysis is to examine the viability of the project itself and the financial soundness of the port management body during the project life. (here the project means the short-term development plan)

7.2 Methodology

7.2.1 Viability of the Project Itself

The viability of the project itself is analyzed using the Financial Internal Rate of Return (FIRR) by means of the Discounted Cash Flow Method.

Sensitivity analysis is conducted to measure the impact of changing conditions on the financial status of the project.

The FIRR is calculated as the discount rate in the following formula:

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

where n : project life
B_i : benefit in the i-th year
C_i : cost in the i-th year
r : discount rate

7.2.2 Financial Soundness of the Port Management Body

The financial soundness of the port management body is appraised using the following indices calculated based on the projected financial statements in order to examine the project's profitability, creditworthiness and efficiency.

(1) Profitability

The long-term success of the port management body depends on the funds it can generate for reinvestment and growth, along with its ability to provide a satisfactory return on investments. The principal way of calculating this earning power of a port management body's assets is to compute the return on net fixed assets by using the following equation.

$$\text{Rate of Return on Net Fixed Assets (\%)} = \frac{\text{Net Operating Income}}{\text{Net Fixed Assets}} \times 100$$

(2) Loan Repayment Capacity

The degree of financial risk inherent in an operating equity before and after undertaking a project can be shown by the debt service coverage ratio as calculated as follows:

$$\text{Debt Service Coverage Ratio (times)} = \frac{\text{Net Operating Income} + \text{Depreciation Cost}}{\text{Debt Service}(=\text{Repayment Amount of Principal and Interest for Long - term Loans})}$$

(3) Efficiency

The operating ratio shows the operational efficiency of the organization as an enterprise.

$$\text{Operating Ratio (\%)} = \frac{\text{Operating Expenses}}{\text{Operating Revenues}} \times 100$$

However the operating ratio depends on the amount of investment through its depreciation costs. Instead, the working ratio is preferable to compare the efficiency by excluding the effect of the depreciation costs.

$$\text{Working Ratio (\%)} = \frac{\text{Operating Expenses} - \text{Depreciation Costs}}{\text{Operating Revenues}} \times 100$$

Satisfactory level for each index is shown as follows:

Financial Indices	Satisfactory Level
FIRR (Financial Internal Rate of Return)	over the weighted average interest rate of the funds
Rate of Return on Net Fixed Assets	over the weighted average interest rate of the funds
Debt Service Coverage Ratio	higher than 1.00 over 1.75 preferable (according to the World Bank)
Operating Ratio	below 70~75% (ditto)
Working Ratio	below 50~60% (ditto)

7.3 Prerequisites

7.3.1 System of the Port Development, Management and Operation

Based on the examination of the port management body in chapter 5 and the consensus in the steering committee, the project is financially analyzed according to the system of the port development, management and operation as shown in Table 7.3.1. In

this system, the fundamental infrastructure is developed and managed by the public sector and the superstructure is developed and operated by the private sector.

TABLE 7.3.1 System of the Port Development, Management and Operation

Infrastructure Breakwater Channel and Basin Land (excluding Paving) Quaywall Revetment Causeway Access Road(to Container Terminal)	to be developed and managed by the public sector
Superstructure Yard Pavement Cargo Handling Equipment Building Utilities Navigation Aids	to be developed, operated and managed by the private sector

7.3.2 Scope of the Analysis

The financial analysis is implemented from the viewpoint of each of the above management bodies namely, the public and private sector, according to the short term development plan.

7.3.3 Prerequisites for the Infrastructure Project

(1) Fund Raising

For the infrastructure developed by the public sector, all the initial investment costs are assumed to be raised by foreign funds. Reinvestment costs and any cash shortage will be covered by the internal resources of the managing public sector. Excess funds will be deposited in a bank with an annual deposit interest rate of 7.1%.

1) Foreign funds[1]

Covered range : 75% of the initial investment costs of the project
Loan period : 25 years including a grace period of 7 years
Interest rate : 2.7% per annum
Repayment : Fixed amount repayment of principal

2) Other foreign funds

Covered range : 25% of the initial investment costs of the project

[1] These conditions are quoted from those of the OECF (Japan).

Loan period : 15 years including a grace period of 5 years
Interest rate : 11.0% per annum
Repayment : Fixed amount repayment of principal

(2) Project Life and Base Year

1) Project life

Taking account of the conditions of the long-term loans and service lives of the port facilities, the project life for the financial analysis is determined as 29 years: 4 years of construction and 25 years of management.

2) Base year

In principal, all costs and revenues are indicated in prices as of May 1996 (US$1.00 =78,400TL.). Neither price inflation nor increases in nominal wage are considered during the project life.

(3) Revenue

As mentioned in chapter 7.3.1, the public sector will develop the fundamental infrastructure including the breakwater, channel, basin, land, quaywall, revetment and causeway, and will manage these facilities. The private sector operates and manages the terminal, making use of the infrastructure developed and managed by the public sector. Therefore, the public sector receives the lease charge for the infrastructure facilities from the private sector.

The annual lease charge up to 2029 is calculated as the sum of the following cost minus average interest on deposits per year.

- Total repayment of the principal and interest of the loans for funds of the infrastructure construction / 27 years
- Average maintenance cost per year for the infrastructure
- Average personnel and administration cost of the public sector per year for the work such as estimation and management of design, maintenance and construction of the infrastructure
- Average corporate income tax charged to the public sector per year

The lease charge per year from 2028is calculated as the sum of the following cost.

- Annual cost for the maintenance work of the infrastructure facilities
- Personnel and administration cost of the managing public sector per year

(4) Expenditure

1) Investment

Initial investment costs for the infrastructure developed by the public sector are shown in chapter 4.4.6 and are summarized in Table 7.3.2. Since service lives of these infrastructure facilities are longer than the project life, reinvestment costs for these facilities are left out of consideration in the analysis.

2) Personnel cost

Annual personnel costs for the public sector are estimated based on the required number of employees to estimate the construction costs and to manage the design, construction and maintenance work for the infrastructure. Unit personnel costs are assumed to be same as those which are calculated as average salaries of officials, workers and shipmen in the 4th directorate of DLH in Istanbul.

3) Administration cost

Annual administration costs are assumed as 4.7% of the total annual personnel costs. This ratio is based on the actual one of the Istanbul 4th directorate of DLH in 1996.

4) Maintenance and repair cost

Annual maintenance and repair costs for the infrastructure facilities are calculated as 1% of construction costs. For maintenance dredging, annual costs are calculated as 25% of the initial dredging costs.

5) Depreciation cost

Annual depreciation costs for the infrastructure facilities are calculated by the straight line method, based on their service lives. Residual value after all depreciation is estimated as zero.

6) Tax

Corporate income tax is charged on the net income of the managing public sector at a rate of 50.4%.

TABLE 7.3.2 Project Cost of the New Port Unit:'000US$

Initial Investment	Intial Investment Costs by Facilities				Mainte.	Depr.	Depr.
	Direct Cost	P.Cont.	Eng.	Total	Cost	Period	/Year
Short Term Development	147,552	5,746	7,378	160,676	2,672		5,313
Infrastructure	99,239	4,962	4,962	109,163	1,130		2,380
(-12m) Container Berth	22,519	1,126	1,126	24,771	248		340
Wharf Structure	12,349	617	617	13,584	136	40	340
Reclamation	10,170	509	509	11,187	112		
East/South Revetment	29,900	1,495	1,495	32,890	329	40	822
Temporary Revetment	34,379	1,719	1,719	37,817	378	40	945
Inner Ship Berth	4,322	216	216	4,754	86		77
Wharf Structure	2,796	140	140	3,076	31	40	77
Reclamation	1,382	69	69	1,520	15		
Basin Dredging	144	7	7	158	40		
Inner Breakwater	1,302	65	65	1,432	14	50	29
Temporary East Breakwater	3,003	150	150	3,303	33	50	66
Causeway	3,153	158	158	3,468	35	50	69
Road & Tunnel	661	33	33	727	7		32
Excavation/Box Culvert	404	20	20	444	4	25	18
Pavement	257	13	13	283	3	20	14
Superstructure	48,313	784	2,416	51,513	1,543		2,933
Yard Pavement	4,214	211	211	4,635	46	30	155
Building Works	5,394	270	270	5,933	59		158
CFS	1,296	65	65	1,426	14	25	57
Maintenance Facility	396	20	20	436	4	25	17
Port Office (3F)	3,600	180	180	3,960	40	50	79
Washing & Cleaning	60	3	3	66	1	20	3
Custom Inspection	42	2	2	46	0	50	1
Cargo Handling Equipment	32,625	0	1,631	34,256	1,370		2,278
Gantry Crane	17,280	0	864	18,144	726	15	1,028
Transfer Crane	11,700	0	585	12,285	491	12	870
Top Loader	360	0	18	378	15	25	13
Tractor	1,890	0	95	1,985	79	8	211
Chassis	900	0	45	945	38	8	100
Forklift	495	0	25	520	21	8	55
Utilities	5,165	258	258	5,682	57	20	284
Navigation Aids	915	46	46	1,007	10	17	59

7.3.4 Prerequisites for the Superstructure Project

(1) Fund Raising

For the superstructure developed by the private sector, all the initial investment costs are assumed to be raised by foreign funds below. Reinvestment costs are assumed to be raised by the internal resources of the management body (private sector). Any cash shortage should be covered by short-term loans from a domestic bank with an annual interest rate of 9.0%. Cash excess will be deposited to a domestic bank with an annual interest rate of 7.1%.

1) Foreign funds

Covered range : Less than 75% of the initial investment costs of the project
Loan period : 15 years including a grace period of 5 years
Interest rate : 11.0% per annum
Repayment : Fixed amount repayment of principal

2) Other foreign funds (Supplier's credit)

Covered range : Initial investment costs for the cargo handling equipment
Loan period : 10 years after the last year of the series of construction works for the cargo handling equipment
Interest rate : 8.9% per annum
Repayment : Fixed amount repayment of principal

(2) Project Life and Base Year

1) Project life

Taking account of the conditions of the long-term loans and service lives of the port facilities, the project life for the financial analysis is determined as 17 years consisting of 2 years of construction and 15 years of operation.

2) Base year

In principal, all costs and revenues are indicated in prices as of May 1996 (US$1.00 =78,400TL.). Neither price inflation nor increases in nominal wage are considered during the project life.

(3) Revenue

1) Cargo handling volume

Cargo handling volume is estimated based on the demand forecast mentioned in chapter 2 of Part Ⅱ. The volume for each service is shown in Table 7.3.3. Handling capacity at the container terminal will reach its limit in 2009.

TABLE 7.3.3 Cargo Handling Volume for the Short Term Plan

Type	Service			2005	2006	2007	2008	2009	2019
Container (box)	Loading /Unloading & Trans-shipment	Import	Full	65,431	74,584	83,736	92,889	97,237	97,237
		Export	Full	35,071	41,017	46,963	52,909	55,734	55,734
		Domestic Loading	Full	7,952	8,544	9,135	9,727	10,008	10,008
		Unloading	Full	107	1,128	2,148	3,169	3,654	3,654
		Reefer Loading	Full	3,339	3,818	4,298	4,778	5,006	5,006
		Unloading	Full	111	125	138	151	158	158
		Empty Loading	Empty	33,642	36,299	38,957	41,614	42,877	42,877
		Unloading	Empty	3,680	4,219	4,758	5,297	5,553	5,553
		Transhipment	Full only	30,587	34,765	38,943	43,121	45,107	45,107
		Total		179,920	204,498	229,077	253,655	265,333	265,333
	Storage	Import (Full)	20ft	32,716	37,292	41,868	46,444	48,619	48,619
			40ft	32,716	37,292	41,868	46,444	48,619	48,619
		Export (Full)	20ft	17,535	20,508	23,481	26,454	27,867	27,867
			40ft	17,535	20,508	23,481	26,454	27,867	27,867
		Domestic (Full)	20ft	4,030	4,836	5,642	6,448	6,831	6,831
			40ft	4,030	4,836	5,642	6,448	6,831	6,831
		Reefer (Full)	20ft	1,725	1,972	2,218	2,465	2,582	2,582
			40ft	1,725	1,972	2,218	2,465	2,582	2,582
		Empty	20ft	18,661	20,259	21,857	23,456	24,215	24,215
			40ft	18,661	20,259	21,857	23,456	24,215	24,215
		Transhipment (Full only)	20ft	15,293	17,382	19,472	21,561	22,553	22,553
			40ft	15,293	17,382	19,472	21,561	22,553	22,553
	Terminal	Import	Full	65,431	74,584	83,736	92,889	97,237	97,237
		Export	Full	35,071	41,017	46,963	52,909	55,734	55,734
		Domestic	Full	8,059	9,672	11,284	12,896	13,662	13,662
		Reefer	Full	3,450	3,943	4,436	4,929	5,163	5,163
		Empty	Empty	37,322	40,518	43,715	46,911	48,430	48,430
		Transhipment	Full only	30,587	34,765	38,943	43,121	45,107	45,107
		Import (LCL)	20ft	3,272	3,729	4,187	4,644	4,862	4,862
			40ft	3,272	3,729	4,187	4,644	4,862	4,862
		Export (LCL)	20ft	1,754	2,051	2,348	2,645	2,787	2,787
			40ft	1,754	2,051	2,348	2,645	2,787	2,787
		Domestic Loading (LCL)	20ft	398	427	457	486	500	500
			40ft	398	427	457	486	500	500
		Domestic Unload. (LCL)	20ft	5	56	107	158	183	183
			40ft	5	56	107	158	183	183

2) Revenue

Revenues from port activities are calculated based on the new tariff which was revised in 1997 with the exception that the tariff in Malta Port is applied for the transshipment cargo (which is 58 US$/Unit for full container loading/unloading). The reason for this is that present Turkish ports do not have the tariff for the transshipment cargo due to the low necessity. Tariffs for storage services are based on those applied to Izmir Port except for reefer containers because of the comparatively less congested situation planned in the new port. In this calculation the tariff for every service is discounted by 10% for the first 10 years in order to conquer the locational disadvantage of the New Port and the customary commercial practices which ignore rational economic principles and to attract port users. The revenues and tariff are shown in Table 7.3.4 and 7.3.5, respectively.

(4) Expenditure

1) Investment

a) Initial investment

Initial investment costs for the superstructure developed by the private sector are shown in chapter 4.4.6 and are summarized in Table 7.3.2.

b) Reinvestment

Depreciable facilities and equipment will be renewed based on their service lives. The service lives of these facilities and equipment are decided based on the standard of TCDD, Japan and the United Nations. Funds for the reinvestment costs will be financed by the internal resources of the management body (private sector).

2) Lease Charge

The lease charge imposed on the private sector for the infrastructure facilities is as calculated in chapter 7.3.3.

3) Personnel cost

Annual personnel costs for the private sector are estimated based on the required number of employees to manage and operate the superstructure facilities. Unit personnel costs for workers, officials and executives are assumed considering the current salary levels in the private ports in Turkey.

4) Administration cost

Annual administration costs are assumed as 24.9% of the total annual personnel costs. This ratio is based on the actual one of the TCDD ports in recent years.

TABLE 7.3.4 Total Revenue for Short Term Plan (US$)

		2005	2006	2007	2008	2009	2014	2015	2019
Container	Loading/Unloading, Transhipment	10,351,683	11,502,443	12,947,643	14,392,844	15,079,541	15,079,541	16,755,045	16,755,045
	Terminal Service	5,476,984	6,274,784	7,072,585	7,870,386	8,249,466	8,249,466	9,166,073	9,166,073
	Storage Service	9,749,648	11,066,894	12,384,140	13,701,387	14,327,285	14,327,285	15,919,206	15,919,206
	Sub-total	25,578,315	28,844,121	32,404,368	35,964,616	37,656,292	37,656,292	41,840,325	41,840,325
Other Revenue		1,922,202	2,167,627	2,435,178	2,702,730	2,829,858	2,829,858	3,144,287	3,144,287
Total		27,500,517	31,011,748	34,839,547	38,667,345	40,486,151	40,486,151	44,984,612	44,984,612

5) Maintenance and repair cost

Annual maintenance and repair costs for the superstructure facilities are calculated as follows:

Cargo handling equipment : 4.0% of the original procurement cost
Other facilities : 1.0% of the original construction cost

TABLE 7.3.5 Present Container Tariff Rates for Main Services

Service					Charge			
Cargo Handling	Loading		(US$/Unit)	55	Full	35	Empty	
	Unloading			90		25		
	Shifting			85		40		
	Re-stow			110		50		
Terminal Service (US$/Unit)				35	Full	12	Empty	
	20ft			40	Filling	50	Emptying	
	40ft			55		85		
Storage Service (US$/Unit/ Day)	Full	Import	20ft	8	up to 10th day	15	from the 11th day	
			40ft	15		22		
		Export /Domestic	20ft	7	3days free, from the 4th day up to 13th day	12	from the 14th day	
			40ft	12		18		
		Reefer	20ft	40				
			40ft	70				
		Transship-ment	20ft	4	7days free, from the 8th day up to 17th day	8	from the 18th day	
			40ft	7		12		
	Empty	Import	20ft	5	up to 10th day	10	from the 11th day	
			40ft	9		16		
		Export /Domestic	20ft	4	3days free, from the 4th day up to 13th day	9	from the 14th day	
			40ft	7		12		

Note: Tariffs for storage services are those applied to Izmir Port except for reefer containers.

6) Depreciation cost

Annual depreciation costs for the superstructure facilities are calculated by the straight line method, based on their service lives. For cargo handling equipment, residual value after all depreciation is estimated as 15% of the initial investment cost, which is standard at TCDD ports. However, for other facilities it is estimated as zero.

7) Tax and other cost

a) Corporate income tax

Corporate income tax is charged on the net income of the operating private sector at a rate of 50.4%.

b) Charge on the benefiting right

A charge of 15% is levied on annual operating revenues for the right of benefiting from the government's property.

7.4 Sensitivity Analysis

Sensitivity Analysis is conducted to examine the impact of unexpected future changes. The following three cases are envisioned.

Case 1 : The revenue decreases by 10%
Case 2 : The project cost increases by 10%
Case 3 : The revenue decreases by 10% and the project cost increases by 10%

Unexpected future changes could be as follows:

(1) Decrease of the revenue

- Decrease of the estimated cargo volume
- Decrease of the tariff level

(2) Increase of the project cost

- Increase of the facilities construction cost by soil condition
- Sudden rise in building materials' prices