

## **14. INITIAL ENVIRONMENTAL EXAMINATION (IEE)**

### **14.1 Purpose and Methodology**

1. Principal sources of potential adverse environmental effects of port development in La Union Bay can be categorized into three types, as follows:

a) Port Location:

Effects of port site development and location on existing buildings, structures, and landfills.

b) Construction of Port facilities:

Effects of construction activities such as dredging, disposal of dredged materials, and transport of construction materials on nearby land and sea areas.

c) Port Operations:

Operational aspects such as vessel traffic, discharges, and emissions; spills and leakage from ships; cargo handling and storage; land transport; handling equipment; hazardous materials; and, waterfront industry discharges.

2. The impact of the port redevelopment project in La Union Bay on each environmental aspect was evaluated by using the check-list shown in Table 10-1-1. This check-list was prepared based on the international standards typically used by international funding agencies as the World Bank and the Inter-American Development Bank, and comprehensive laws and regulations regarding environmental resources in El Salvador.

3. Results from this evaluation, called the initial environmental examination (IEE), will provide a reference for the environmental impact assessment (EIA) of this project at the stage of feasibility study.

### **14.2 IEE**

4. Each item on the list was evaluated using the preliminary information. Major environmental aspects are briefly explained and evaluated below:

### (1) Air Quality, Noise and Smell

5. New container terminal does not produce air pollution, noise or foul odours itself to any significant degree. Liquid bulk will be connected directly to the tank farm, thereby avoiding these kinds of impacts.

6. Dust and odours caused by old-fashioned equipment for cereal handling, which is observed in other developing countries, is expected to be solved together with the improvement of the cargo handling system.

7. However, port oriented road traffic tends to produce adverse environmental impacts. It is thus desirable for the traffic to be as far away from residential areas as possible. Therefore, a new road bypassing the town area should be constructed as explained in Chapter 11.

### (2) Current

8. In general, no significant current was observed in the bay. Maximum current velocities at Cutuco and Punta Chiquirin measured in the Study were estimated at 1.03 m/sec and 1.42 m/sec, respectively.

9. In addition, the proposed plan includes only limited change in terms of geography, therefore currents are not likely to be greatly affected.

### (3) Water Quality

10. Seawater in the La Union Bay study area is polluted. A few small rivers flowing into La Union Bay serve as drains of raw sewage, untreated industrial discharges, and raw municipal solid waste from nearby settlements and the City of La Union. They are the main sources of pollution, and should be dealt with properly by the city in order to prevent serious environmental consequences.

11. Since the port, which also handles liquid bulk and oil, is located at the La Union bay, it is recommended to establish necessary measures in the event of a large oil spill. The most effective approach would be for neighboring countries surrounding the bay to cooperate with one another in these effects.

12. The government of El Salvador participated in many international meetings regarding a convention entitled the Prevention of Marine Pollution from

Ships (1973) and the Protocol of 1978 (MARPOL), but, to date, has not signed it yet. Since many authorities in El Salvador are aware of their importance, they are expected to take appropriate measures for them as soon as possible.

(4) Terrestrial Ecology

13. Although there remains a small remaining mangrove colony and associated fauna around the project sites, they are already developed in some ways, mainly by farming activities, to a significant degree.

14. Therefore, the north area of the town, which is still covered with massive mangrove growth at present, should be conserved with priority from now .

(5) Coastal Marine Ecology

15. Since an inshore fishery does not exist around the port development area, there is no need to evaluate the effect on the fishery.

(6) Displacement of Villages and Facilities

16. Three private port facilities and related facilities are subject to a new plan of port development especially in Alternative (B-3) at Pueblo Viejo. Compensation, including their relocation, should be reconfirmed at need.

(7) Disposal of Dredging Spoil

17. To minimize environmental damage as much as possible, the place and method for dumping dredging spoils will be examined based on laws and regulations concerned, in case that a great amount of dredging is needed for a deep port construction.

**Table 14 Checklist for Initial Environmental Evaluation (IEE)**

Checklist of Environmental Parameters for Port and Harbor Projects  
For the Study of Port Reactivation Plan in La Union Province

	Actions Affecting Environmental Resources and Values	Damage to Environment	Recommended Feasible Protection Measures	IEE				REMARKS
				No Significant Effect (D1)	Small (D2)	Moderate (D3)	Major (D4)	
A	Actions Affecting Coastal Marine Ecology							
1.	Location on harbor in fisheries reproduction zone	Loss of fisheries reproduction	Consider relocation of harbor site	*				
2.	Location of harbor in fisheries capture zone	Displacement of fishermen families	Relocation of fishing zones	*				
3.	Disposal of dredging spoils into fisheries reproduction zone	Loss of fisheries reproduction	Proper spoils disposal	*				
4.	Disposal of dredging spoils into coral beds	Loss of fragile/precious marine ecology	Proper spoils disposal	*				
5.	Oil spills/leakage within harbor which escape harbor area	Damage to marine ecology (fisheries/corals)	Improved routine and emergency control of oil leakage/spills	*				
6.	Oil spills from tankers on way to and from harbor	Damage to marine ecology (fisheries/corals)	Improved routine and emergency control oil leakage/spills	*				
B.	Actions Affecting Recreational/Resort/Beach Areas along Coastal Zone.	Deprecation of Recreation Areas by:						
1	Location of harbor too close to recreational areas	Visible turbidity or discoloring of beach waters	Consider relocation of port or of resort	*				
2	Escape of liquid and solid wastes from harbor ships/facilities area, especially floatables	Silt depositions along shoreline	Extraordinary attention to liquid/ solid waste management	*				
3.	Air pollutant emissions from harbor ships/facilities	Visible floatable wastes	Extraordinary attention to air pollution control		*			
4	Disposal dredging spoils which reach along shoreline	Waste deposition along shoreline	Proper spoils disposal		*			
5.	Oil spills/leakage within harbor which escapes harbor area	Oil firms on beach waters and shoreline	Improved spilt/leakage control and improved emergency oil spill cleanup	*				
6.	Oil spills from tankers on way to and from harbor	Contamination of beach waters	Improved emergency oil spill cleanup	*				
C.	Action Causing Unacceptable Sanitation Conditions in Harbor Area	Unsanitary Harbor Environment including:						
1.	Inadequate provision of water supply to port facilities and ships	unacceptable environmental activities	Extraordinary attention to water supply	*				
2	Inadequate management of waste emissions from port facilities	health hazards to port and ship workers	Extraordinary attention to waste management from shore facilities	*				
(a)	liquid sanitary and industrial wastes	destruction of harbor ecology		*				
(b)	solid sanitary and industrial wastes	hazards for pollution of coastal areas by escape of wastes from harbor		*				
(c)	gaseous emissions from shore industries			*				
3.	Inadequate management of wastes from ships	Similar to A 1,2,3,4, above	Extraordinary attention to management from ships	*				
(a)	liquid wastes, especially floatables, including bilge waters			*				
(b)	solid wastes, especially floatables, including garbage			*				
4	Escape of oils within harbor	Similar to A 1,3,4, above	Improved routine and emergency controls of oil leakage and spills	*				
D.	Handling of Hazardous Cargoes within Harbor Especially	Similar to A 1,2,3,4	Extra Careful Attention in Design/ Operations					
1.	Dust Emissions ( for example, handling of coal and cassava dust)	Air pollution and explosion hazards	Proper air pollution control	*				
2.	Hazardous materials (inflammable, explosives, toxic substances)	Health and safety of workers and nearby residents	Proper control of hazardous materials	*				
E.	Handling of Materials to and from Harbor							

I.	Traffic congestion	Airpollution and explosion hazards	Proper air pollution control		*			
2.	Hazardous materials (inflammable, explosives, toxics)	Health and safety of workers and nearby residents	Proper control of hazardous materials	*				
F.	Actions Affecting Local Socioeconomics							
1.	Inadequate housing for new population	Hazards for creating slums	Planning to prevent slum problems	*				
2.	Inadequate health precautions during construction (especially inoculations against malaria)	Communicable disease hazards	Proper planning of construction worker facilities	*				
(a)	communicable disease hazards from imported workers/carriers)	Proper precautions during construction	spraying of workers camp for anopheline mosquito control	*				
(b)	inadequate water supply and sanitation for workers	provision for adequate facilities	provision for adequate facilities	*				
3.	Changes in land use patterns			*				
(a)	displacement of agriculture	loss of agricultural values	appropriate resettlement	*				
(b)	displacement of villages	displacement of villages	appropriate resettlement		*			
4.	Excessive noise from harbor operations	Health of harbor workers and nearby residents	Adequate noise control	*				
G.	Actions Affecting Terrestrial Ecology							
1.	Adverse impact on local forest	Similar to A 1 to A 6 above	Similar to A1 to A6 above		*			
2.	Adverse effects on wildlife from loss in forest habit	(ditto)	(ditto)		*			
3.	Adverse effects on estuarine lagoons (fisheries, wildlife)	(ditto)	(ditto)	*				
II.	Actions Caused by Changes in Coastal Hydrology	Physical Damage to Coastal Facilities/ Ecology	Careful Project Design with Respect to Hydrology plus Protection Facilities.					
1.	Deposition along nearby coastal areas	Damage to shoreline properties	Proper engineering to avoid problem	*				
2.	Erosion along nearby coastal areas	(ditto)	(ditto)	*				
3.	Adverse effect on marine water quality	Damage to living conditions	(ditto)		*			
I.	Actions Affecting Precious Historical/Culture/Religious Monuments/Sites	Loss or Damage to Resources	Relocation or Protection Measures					
1.	By displacement or submergence			*				
2.	By alternations in coastal zone hydrology/shoreline			*				
J.	Hazards from Access Roads/ Traffic Living Harbor	Collision/Spill Hazards to Ships	Proper Design for Harbor Access	*				
K.	Navigation Hazards from Ship Entering or Leaving Harbor			*				

CONCLUSIONS: ( ) No significant adverse environmental effect to be caused by project. No EIA needed.  
 (\*) Significant environmental impact as shown in columns. Follow-up EIA needed



## 15. PRELIMINARY ECONOMIC ANALYSIS

### 15.1 Purpose and Methodology

1. The purpose of the preliminary economic analysis is to appraise the economic feasibility of the master plan for the study ports before a feasibility study on the short term plan can proceed. The preliminary economic evaluation of a project should show whether the project is justifiable from the viewpoint of the national economy by assessing its contribution to the national economy.

2. 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. 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 projects during the project life equal.

### 15.2 Prerequisites of Analysis

#### 15.2.1 Base Year

1. The "Base Year" in the cost estimation of construction and benefits calculation, 1997 is set as the "Base Year" of the study.

#### 15.2.2 Project life

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

#### 15.2.3 Foreign Exchange Rate

3. The exchange rate adopted for this analysis is US\$ 1.00 = 130 Y = colon 8.75.

#### 15.2.4 "With" and "Without" case

4. A cost-benefit analysis is conducted on the difference between the "With" and "Without" investment cases. In this study, following conditions are adopted as the "Without" cases.

- 1) No investment is made for the construction of a new port in La Union.
- 2) When handling volume of container cargo from/to El Salvador exceeds the handling capacity of Acajutla port, the containers which can not be handled in

- Acajutla port are assumed to be handled in Quetzal port of Guatemala.
- 3) A small scale of investment is made in Acajutla port coinciding with the increment of handling volume of general cargo, liquid bulk cargo and dry bulk cargo.
  - 4) The size of vessels and the working efficiency of cargo handling are not the same as "With" case.
5. To convert Acajutla port into competitive container terminal, it is necessary to construct a large scale breakwater and new container wharves with a container stacking area equivalent to the neighboring foreign ports. Therefore, the total investment in Acajutla port would likely be equal or higher than the investment in La Union. In addition, investment in Acajutla port will widen the economic gap between the Western region and the Eastern region. But, the Eastern regional economic development will be accelerated as a result of the investment in La Union.

### 15.3 Preliminary Costs of the Projects

#### 15.3.1 Kinds of Costs

##### (1) construction Costs

1. Construction costs are divided into such categories as civil costs and mechanical costs. Main mechanical costs are purchasing of handling equipment. Civil costs and mechanical costs are estimated in Chapter 13.

##### (2) Renewal Costs

2. The renewal investment costs for facilities and equipment after their useful lifetimes are considered. Expected lifetime of gantry crane is 15 years and other equipment is 10 years.

##### (3) Maintenance Costs

3. The costs of maintaining the port facilities is assumed to be fixed portion ( 1 % of structure, 4 % for handling equipment ) of the original construction costs excluding the costs of dredging and reclamation costs.

##### (4) Operation Costs

4. Operation costs are divided into personnel costs and administration costs. Administration costs are 30 % personnel costs.

### 15.4 Preliminary Benefits of the Project

#### 15.4.1 Kinds of Benefits



1. The development of the new port will greatly contribute to the national economy of El Salvador. 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 land transportation costs.
- 2) Savings in handling costs of container on foreign ports
- 3) Earnings of foreign currency from transit container cargo handling
- 4) Earnings of foreign currency from land transportation of foreign container cargo.
- 5) Generation of job opportunities
- 6) Promotion of regional economic development
- 7) Savings in interest of cargo costs

2. Items 1), 2), 3), 4), 5), 6) and 7) are considered countable and in this study the monetary benefits of these items 1), 2), 3) and 4) are calculated.

#### 15.4.2 Calculation Method of Benefits

(1) Savings in land transportation cost ( Benefits from Transport )

3. When the container cargo volume reaches the maximum volume of handling capacity of Acajutla port, the container cargoes from/to El Salvador which can not be handled in Acajutla port are assumed to be handled in Quetzal port of Guatemala. And then these cargoes are to be transported to El Salvador by land transportation. In accordance with the implementation of the project, all El Salvadoran cargoes will be transported from/to new port and Acajutla port. The benefits 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)

(2) Savings in Handling Cost of Container in Foreign Ports ( Benefits from Container Handling )

4. When handling volume of container cargo from/to El Salvador exceeds the handling capacity of Acajutla port , the containers which can not to be handled in Acajutla port are assumed to be handled in Quetzal port of Guatemala. The benefit from the project can be calculated buy the following formula.

Savings in handling costs of container in foreign port

= Difference in container handling cargo volume in El Salvador port between "With" and "Without" case

× Container cargo handling cost in El Salvador port ( unit cost )

(3) Earnings of Foreign currency from Transit Container Cargo Handling  
( Benefits from Container Handling )

5. The foreign currency earnings from handling of transit container cargo from/to southern part of Honduras. The benefits that will accrue from the projects can be calculated by the following formula.

Earnings of foreign currency from transit cargo handling  
= Transit Cargo Volume  
× Handling cost of transit container cargo

(4) Earnings of Foreign Currency from Land Transportation of Transit Container  
Cargo ( Benefits from Transport )

6. The foreign currency earnings from land transportation of transit container cargo from/to southern part of Honduras. The benefits that will accrue from the projects can be calculated by the following formula.

Earnings of foreign currency from land transportation of transit cargo  
= Transit Cargo Volume × 1/2 × Land Transportation cost of container cargo

## 15.5 Evaluation of the Projects

### 15.5.1 Calculation of the EIRR

#### (1) Calculation of the EIRR

1. 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

Calculation result of EIRR base case are shown in Table 15-5-1 and 15-5-2. Table 15-5-3 shows summary of EIRR calculation base case.

**Table 15-5-3 Summary of EIRR Calculation Base Case**

Case	Case 1	Case 2
Base Case	15.4%	14.5%

**(2) Sensitive Analysis**

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

Case A : The costs increased by 10 %

Case B : The benefits decreased by 10 %

Case C : The costs increased by 10 % and the benefits decreased by 10 %

3. The sensitive analysis for the three alternative is calculated by using above formula as the base case and the results are shown in Table 15-5-4, 15-5-5, 15-5-6, 15-5-7, 15-5-8 and 15-5-9. Table 15-5-10 shows summary of sensitivity analysis.

**Table 15-5-10 Summary of Sensitivity Analysis**

Case	Case 1	Case 2
Case A	14.2%	13.3%
Case B	14.1%	13.2%
Case C	12.9%	12.0%

**15.5.2 Evaluation**

4. There are various views concerning the appropriate EIRR level used to guide the judgment as to whether a project is feasible or not. The leading views is that the project is feasible if the EIRR exceeds the opportunity cost of capital. In general, the opportunity cost of capital is considered to range from 8% to 10% according to the degree of development in each country. On the other hand, the standard value of EIRR of IBRD and IDB for social-infrastructure project is 12%. As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR over 12%. Therefore, this master plan development project is viable from the viewpoint of national economy.

**15.5.3 Other Economic Effects**

5. In this section, economic benefits which are not included in the calculation of EIRR are explained.

**(1) Benefits of Generation Job Opportunities**

6. A vast number and type of jobs are generated and required, once development of a new port begins. Shipping and related industries are referred to called as port-related industries. Banking, insurance, commercial, manufacturing, construction are referred to called as port-dependent industries. Furthermore, the employment of construction workers during the construction period of La Union new port will arise.

(2) Promotion of Regional Economic Development

7. In the development plan, materials will be needed for port construction. 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.

(3) Savings in Interest of Cargo Costs

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

**Table 15-5-1 EIRR calculation Case 1 Base Case**

**I.a Union Mastert Plan B-3 Case 1**

Construction cost      \$US 142,504,154  
 Road cost                  \$US Include above cost  
 Equipment cost          \$US 9,216,000 Gantry Crane  
                                         6,426,000 Other  
                                         158,146,154

Year	Initial cost	Renewal cost	Mainte cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	10,674,865	0	0	0	10,674,865	0	-10,674,865	0	10,674,865	-10,674,865
2 2001	14,233,154	0	0	0	14,233,154	0	-14,233,154	0	12,331,577	-12,331,577
3 2002	27,280,212	0	0	0	27,280,212	0	-27,280,212	0	20,477,771	-20,477,771
4 2003	37,955,077	0	0	0	37,955,077	0	-37,955,077	0	24,684,384	-24,684,384
5 2004	28,466,308	0	0	0	28,466,308	0	-28,466,308	0	16,039,877	-16,039,877
6 2005	9,884,135	0	982,571	2,957,500	13,824,206	17,251,794	3,427,588	8,422,124	6,748,815	1,673,308
7 2006	9,884,135	0	982,571	2,957,500	13,824,206	20,428,255	6,604,049	8,640,445	5,847,161	2,793,284
8 2007	9,884,135	0	1,226,925	3,542,500	14,653,560	23,604,717	8,951,157	8,650,400	5,369,891	3,289,209
9 2008	9,884,135	0	1,226,925	3,542,500	14,653,560	26,781,178	12,127,619	8,502,947	4,652,463	3,850,484
10 2009	0	0	1,226,925	3,542,500	-4,769,425	29,957,640	25,188,215	8,240,714	1,314,968	6,928,746
11 2010	0	0	1,226,925	3,542,500	-4,769,425	33,134,101	28,364,676	7,896,778	1,136,687	6,760,091
12 2011	0	0	1,226,925	3,542,500	-4,769,425	36,310,563	31,541,138	7,497,650	984,823	6,512,827
13 2012	0	0	1,226,925	3,542,500	-4,769,425	39,487,024	34,717,599	7,064,218	853,249	6,210,969
14 2013	0	0	1,226,925	3,542,500	-4,769,425	42,663,486	37,894,061	6,612,771	739,253	5,873,518
15 2014	0	3,213,000	1,226,925	3,542,500	7,982,425	45,839,947	37,857,522	6,155,860	1,071,962	5,083,898
16 2015	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	5,703,003	554,917	5,148,086
17 2016	0	3,213,000	1,226,925	3,542,500	7,982,425	49,016,409	44,033,984	4,941,071	804,664	4,136,407
18 2017	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	4,280,934	416,516	3,864,388
19 2018	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	3,708,993	360,899	3,348,098
20 2019	0	9,216,000	1,226,925	3,542,500	13,985,425	49,016,409	35,030,984	3,213,464	916,870	2,296,595
21 2020	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	2,784,139	270,904	2,513,235
22 2021	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	2,412,173	234,711	2,177,462
23 2022	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	2,089,902	203,353	1,886,549
24 2023	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	1,810,687	176,185	1,634,502
25 2024	0	3,213,000	1,226,925	3,542,500	7,982,425	49,016,409	44,033,984	1,568,776	255,478	1,313,297
26 2025	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	1,359,181	132,252	1,226,932
27 2026	0	3,213,000	1,226,925	3,542,500	7,982,425	49,016,409	44,033,984	1,177,595	191,734	985,824
28 2027	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	1,020,266	99,275	920,991
29 2028	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	883,956	86,011	797,945
30 2029	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	765,858	74,520	691,338
31 2030	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	663,538	64,564	598,974
32 2031	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	574,858	55,938	518,920
33 2032	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	498,082	48,465	449,617
34 2033	0	0	1,226,925	3,542,500	-4,769,425	49,016,409	44,246,984	431,537	41,990	389,547
35 2034	0	-642,600	1,226,925	3,542,500	-1,126,825	49,016,409	44,889,584	373,853	31,478	342,405
Total	158,146,154	21,425,400	36,319,042	105,105,000	320,995,596	1,295,786,885	974,791,289	117,945,535	117,945,535	0

EIRR= 0.15420

**Table 15-5-2 EIRR Calculation Case 2 Base Case**

**La Union Mastert Plan B-3 Case 2**

Construction cost           \$US 142,504,154  
 Road cost                   \$US Include above cost  
 Equipment cost           \$US 9,216,000 Gantry Crane  
                                   6,426,000 Other  
                                   158,146,154

Year	Initial cost	Renewal cost	Mainte cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	10,674,865	0	0	0	10,674,865	0	-10,674,865	0	10,674,865	-10,674,865
2 2001	14,233,154	0	0	0	14,233,154	0	-14,233,154	0	12,432,318	-12,432,318
3 2002	27,280,212	0	0	0	27,280,212	0	-27,280,212	0	20,813,719	-20,813,719
4 2003	37,955,077	0	0	0	37,955,077	0	-37,955,077	0	25,294,308	-25,294,308
5 2004	28,466,308	0	0	0	28,466,308	0	-28,466,308	0	16,570,478	-16,570,478
6 2005	7,907,308	0	982,571	2,957,500	11,847,379	17,251,794	5,404,415	8,771,808	6,023,891	2,747,917
7 2006	7,907,308	0	982,571	2,957,500	11,847,379	19,658,383	7,811,005	8,730,792	5,261,725	3,469,067
8 2007	7,907,308	0	1,226,925	3,542,500	12,676,733	22,064,973	9,388,240	8,559,733	4,917,724	3,642,009
9 2008	7,907,308	0	1,226,925	3,542,500	12,676,733	24,471,563	11,794,830	8,292,195	4,295,514	3,996,681
10 2009	7,907,308	0	1,226,925	3,542,500	12,676,733	26,878,153	14,201,420	7,955,330	3,752,028	4,203,301
11 2010	0	0	1,226,925	3,542,500	4,769,425	29,284,742	24,515,317	7,570,963	1,233,036	6,337,927
12 2011	0	0	1,226,925	3,542,500	4,769,425	31,691,332	26,921,907	7,156,509	1,077,027	6,079,481
13 2012	0	0	1,226,925	3,542,500	4,769,425	34,097,922	29,328,497	6,725,732	940,758	5,784,975
14 2013	0	0	1,226,925	3,542,500	4,769,425	36,504,512	31,735,087	6,289,400	821,729	5,467,671
15 2014	0	3,213,000	1,226,925	3,542,500	7,982,425	38,911,101	30,928,676	5,855,812	1,201,292	4,654,521
16 2015	0	0	1,226,925	3,542,500	4,769,425	41,317,691	36,548,266	5,431,261	626,947	4,804,314
17 2016	0	3,213,000	1,226,925	3,542,500	7,982,425	43,724,281	35,741,856	5,020,399	916,538	4,103,861
18 2017	0	0	1,226,925	3,542,500	4,769,425	46,130,871	41,361,446	4,626,560	478,335	4,148,225
19 2018	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	4,252,013	417,815	3,834,198
20 2019	0	9,216,000	1,226,925	3,542,500	13,985,425	48,537,460	34,552,035	3,714,031	1,070,149	2,643,882
21 2020	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	3,244,117	318,776	2,925,341
22 2021	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	2,833,658	278,443	2,555,215
23 2022	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	2,475,133	243,213	2,231,919
24 2023	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	2,161,969	212,441	1,949,528
25 2024	0	3,213,000	1,226,925	3,542,500	7,982,425	48,537,460	40,555,035	1,888,428	310,569	1,577,859
26 2025	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	1,649,496	162,084	1,487,412
27 2026	0	3,213,000	1,226,925	3,542,500	7,982,425	48,537,460	40,555,035	1,440,796	236,952	1,203,844
28 2027	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	1,258,500	123,664	1,134,837
29 2028	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	1,099,270	108,017	991,253
30 2029	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	960,186	94,351	865,835
31 2030	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	838,699	82,413	756,286
32 2031	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	732,584	71,986	660,598
33 2032	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	639,894	62,878	577,016
34 2033	0	0	1,226,925	3,542,500	4,769,425	48,537,460	43,768,035	558,932	54,922	504,010
35 2034	0	-642,600	1,226,925	3,542,500	4,126,825	48,537,460	44,410,635	488,214	41,510	446,704
<b>Total</b>	<b>158,146,154</b>	<b>21,425,400</b>	<b>36,319,042</b>	<b>105,105,000</b>	<b>320,995,596</b>	<b>1,237,124,140</b>	<b>916,128,544</b>	<b>121,222,413</b>	<b>121,222,413</b>	<b>0</b>

EIRR= 0.14485

**Table 15-5-4 EIRR Calculation Case 1 Sensitivity Analysis A**

La Union Mastert Plan B-3 Case 1 Sensitivity Analysis A

Construction cost           \$US 142,504,154  
 Road cost                   \$US Include above cost  
 Equipment cost           \$US 9,216,000 Gantry Crane  
                                   6,426,000 Other  
                                   158,146,154

Year	Initial cost	Renewal cost	Mainte cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	11,742,352	0	0	0	11,742,352	0	-11,742,352	0	11,742,352	-11,742,352
2 2001	15,656,469	0	0	0	15,656,469	0	-15,656,469	0	13,712,026	-13,712,026
3 2002	30,008,233	0	0	0	30,008,233	0	-30,008,233	0	23,017,388	-23,017,388
4 2003	41,750,585	0	0	0	41,750,585	0	-41,750,585	0	28,046,972	-28,046,972
5 2004	31,312,938	0	0	0	31,312,938	0	-31,312,938	0	18,422,775	-18,422,775
6 2005	10,872,548	0	1,080,828	3,253,250	15,206,626	17,251,794	2,045,167	8,889,417	7,835,594	1,053,824
7 2006	10,872,548	0	1,080,828	3,253,250	15,206,626	20,428,255	5,221,629	9,218,879	6,862,458	2,356,421
8 2007	10,872,548	0	1,349,618	3,896,750	16,118,916	23,604,717	7,485,801	9,329,394	6,370,749	2,958,646
9 2008	10,872,548	0	1,349,618	3,896,750	16,118,916	26,781,178	10,662,263	9,270,265	5,579,539	3,690,726
10 2009	0	0	1,349,618	3,896,750	5,246,368	29,957,640	24,711,272	9,081,924	1,590,483	7,491,441
11 2010	0	0	1,349,618	3,896,750	5,246,368	33,134,101	27,887,731	8,797,378	1,392,954	7,404,424
12 2011	0	0	1,349,618	3,896,750	5,246,368	36,310,563	31,064,195	8,443,429	1,219,957	7,223,472
13 2012	0	0	1,349,618	3,896,750	5,246,368	39,487,024	34,240,657	8,041,704	1,068,446	6,973,259
14 2013	0	0	1,349,618	3,896,750	5,246,368	42,663,486	37,417,118	7,609,530	935,751	6,673,779
15 2014	0	3,534,300	1,349,618	3,896,750	8,780,668	45,839,947	37,059,280	7,160,666	1,371,630	5,789,036
16 2015	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	6,705,924	717,754	5,988,169
17 2016	0	3,534,300	1,349,618	3,896,750	8,780,668	49,016,409	40,235,742	5,873,087	1,052,089	4,820,998
18 2017	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	5,143,683	550,543	4,593,140
19 2018	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	4,504,868	482,169	4,022,699
20 2019	0	10,137,600	1,349,618	3,896,750	15,383,968	49,016,409	33,632,442	3,945,389	1,238,274	2,707,115
21 2020	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	3,455,395	369,841	3,085,554
22 2021	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	3,026,255	323,909	2,702,346
23 2022	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	2,650,411	283,681	2,366,730
24 2023	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	2,321,245	248,450	2,072,796
25 2024	0	3,534,300	1,349,618	3,896,750	8,780,668	49,016,409	40,235,742	2,032,960	364,179	1,668,781
26 2025	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	1,780,478	190,570	1,589,909
27 2026	0	3,534,300	1,349,618	3,896,750	8,780,668	49,016,409	40,235,742	1,559,353	279,338	1,280,015
28 2027	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	1,365,691	146,174	1,219,517
29 2028	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	1,196,080	128,020	1,068,060
30 2029	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	1,047,533	112,121	935,413
31 2030	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	917,436	98,196	819,240
32 2031	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	803,496	86,000	717,495
33 2032	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	703,706	75,320	628,386
34 2033	0	0	1,349,618	3,896,750	5,246,368	49,016,409	43,770,042	616,310	65,965	550,344
35 2034	0	-706,860	1,349,618	3,896,750	4,539,508	49,016,409	44,476,902	539,768	49,989	489,779
Total	173,960,769	23,567,940	39,950,946	115,615,500	353,095,156	1,295,786,885	942,691,729	136,031,654	136,031,654	0

EIRR= 0.14181

**Table 15-5-5 EIRR Calculation Case 1 Sensitivity Analysis B**

**La Union Mastert Plan B-3 Case 1 Sensitivity Analysis B**

Construction cost            \$US 142,504,154  
 Road cost                        \$US Include above cost  
 Equipment cost                \$US 9,216,000 Gantry Crane  
    6,426,000 Other  
    158,146,154

Year	Initial cost	Renewal cost	Mainte cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	10,674,865	0	0	0	10,674,865	0	-10,674,865	0	10,674,865	-10,674,865
2 2001	14,233,154	0	0	0	14,233,154	0	-14,233,154	0	12,479,478	-12,479,478
3 2002	27,280,212	0	0	0	27,280,212	0	-27,280,212	0	20,971,926	-20,971,926
4 2003	37,955,077	0	0	0	37,955,077	0	-37,955,077	0	25,583,252	-25,583,252
5 2004	28,466,308	0	0	0	28,466,308	0	-28,466,308	0	16,823,343	-16,823,343
6 2005	9,884,135	0	982,571	2,957,500	13,824,206	15,526,614	1,702,409	8,045,503	7,163,358	882,146
7 2006	9,884,135	0	982,571	2,957,500	13,824,206	18,385,430	4,561,224	8,353,059	6,280,756	2,072,302
8 2007	9,884,135	0	1,226,925	3,542,500	14,653,560	21,244,245	6,590,685	8,462,688	5,837,275	2,625,413
9 2008	9,884,135	0	1,226,925	3,542,500	14,653,560	24,103,060	9,449,501	8,418,496	5,118,061	3,300,435
10 2009	0	0	1,226,925	3,542,500	4,769,425	26,961,876	22,192,451	8,256,723	1,460,574	6,796,149
11 2010	0	0	1,226,925	3,542,500	4,769,425	29,820,691	25,051,266	8,007,015	1,280,616	6,726,399
12 2011	0	0	1,226,925	3,542,500	4,769,425	32,679,507	27,910,082	7,693,495	1,122,831	6,570,665
13 2012	0	0	1,226,925	3,542,500	4,769,425	35,538,322	30,768,897	7,335,681	984,486	6,351,195
14 2013	0	0	1,226,925	3,542,500	4,769,425	38,397,137	33,627,712	6,949,245	863,187	6,086,058
15 2014	0	3,213,000	1,226,925	3,542,500	7,982,425	41,255,953	33,273,528	6,546,674	1,266,686	5,279,988
16 2015	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	6,137,809	663,583	5,474,226
17 2016	0	3,213,000	1,226,925	3,542,500	7,982,425	44,114,768	36,132,343	5,381,566	973,777	4,407,789
18 2017	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	4,718,500	510,136	4,208,364
19 2018	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	4,137,131	447,282	3,689,849
20 2019	0	9,216,000	1,226,925	3,542,500	13,985,425	44,114,768	30,129,343	3,627,392	1,149,969	2,477,423
21 2020	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	3,180,459	343,852	2,836,607
22 2021	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	2,788,593	301,486	2,487,107
23 2022	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	2,445,009	264,340	2,180,669
24 2023	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	2,143,758	231,770	1,911,987
25 2024	0	3,213,000	1,226,925	3,542,500	7,982,425	44,114,768	36,132,343	1,879,624	340,112	1,539,512
26 2025	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	1,648,034	178,176	1,469,859
27 2026	0	3,213,000	1,226,925	3,542,500	7,982,425	44,114,768	36,132,343	1,441,979	261,464	1,183,515
28 2027	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	1,266,942	136,974	1,129,968
29 2028	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	1,110,842	120,098	990,744
30 2029	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	973,974	105,300	868,674
31 2030	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	853,970	92,326	761,644
32 2031	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	748,752	80,951	667,801
33 2032	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	656,498	70,977	585,521
34 2033	0	0	1,226,925	3,542,500	4,769,425	44,114,768	39,345,343	575,610	62,232	513,379
35 2034	0	-642,600	1,226,925	3,542,500	4,126,825	44,114,768	39,987,943	504,689	-47,212	457,477
Total	158,146,154	21,425,400	36,319,042	105,105,000	320,995,596	1,166,208,196	845,212,600	124,292,712	124,292,712	0

EIRR= 0.14052



**Table 15-5-6 EIRR Calculation Case 1 Sensitivity Analysis C**

**La Union Mastert Plan B-3 Case 1 Sensitivity Analysis C**

Construction cost        \$US 142,504,154  
 Road cost                    \$US Include above cost  
 Equipment cost            \$US 9,216,000 Gantry Crane  
                                       6,426,000 Other  
                                       158,146,154

Year	Initial cost	Renewal cost	Maintenance cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	11,742,352	0	0	0	11,742,352	0	-11,742,352	0	11,742,352	-11,742,352
2 2001	15,656,469	0	0	0	15,656,469	0	-15,656,469	0	13,872,297	-13,872,297
3 2002	30,008,233	0	0	0	30,008,233	0	-30,008,233	0	23,558,602	-23,558,602
4 2003	41,750,585	0	0	0	41,750,585	0	-41,750,585	0	29,041,979	-29,041,979
5 2004	31,312,938	0	0	0	31,312,938	0	-31,312,938	0	19,299,321	-19,299,321
6 2005	10,872,548	0	1,080,828	3,253,250	15,206,626	15,526,614	319,988	8,479,095	8,304,350	174,746
7 2006	10,872,548	0	1,080,828	3,253,250	15,206,626	18,385,430	3,178,803	8,896,129	7,358,007	1,538,123
8 2007	10,872,548	0	1,349,618	3,896,750	16,118,916	21,244,245	5,125,329	9,108,003	6,910,631	2,197,372
9 2008	10,872,548	0	1,349,618	3,896,750	16,118,916	24,103,060	7,984,145	9,156,059	6,123,112	3,032,947
10 2009	0	0	1,349,618	3,896,750	5,246,368	26,961,876	21,715,508	9,074,883	1,765,833	7,309,050
11 2010	0	0	1,349,618	3,896,750	5,246,368	29,820,691	24,571,324	8,893,305	1,561,603	7,328,702
12 2011	0	0	1,349,618	3,896,750	5,246,368	32,679,507	27,433,139	8,635,262	1,386,305	7,248,958
13 2012	0	0	1,349,618	3,896,750	5,246,368	35,538,322	30,291,954	8,320,540	1,228,325	7,092,215
14 2013	0	0	1,349,618	3,896,750	5,246,368	38,397,137	33,150,770	7,965,408	1,088,348	6,877,059
15 2014	0	3,534,300	1,349,618	3,896,750	8,780,668	41,255,953	32,475,285	7,583,162	1,613,951	5,969,208
16 2015	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	7,181,591	854,431	6,330,163
17 2016	0	3,534,300	1,349,618	3,896,750	8,780,668	44,114,768	35,334,101	6,365,856	1,267,069	5,098,787
18 2017	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	5,640,819	670,789	4,969,630
19 2018	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	4,997,651	594,318	4,403,303
20 2019	0	10,137,600	1,349,618	3,896,750	15,383,968	44,114,768	28,730,801	4,428,131	1,544,201	2,883,926
21 2020	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	3,923,512	466,605	3,456,907
22 2021	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	3,476,399	413,432	3,062,966
23 2022	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	3,080,237	366,318	2,713,918
24 2023	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	2,729,221	324,574	2,404,647
25 2024	0	3,534,300	1,349,618	3,896,750	8,780,668	44,114,768	35,334,101	2,418,206	481,323	1,936,882
26 2025	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	2,142,633	254,814	1,887,819
27 2026	0	3,534,300	1,349,618	3,896,750	8,780,668	44,114,768	35,334,101	1,898,461	377,873	1,520,591
28 2027	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	1,682,120	200,047	1,482,073
29 2028	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	1,490,429	177,250	1,313,179
30 2029	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	1,320,581	157,051	1,163,533
31 2030	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	1,170,093	139,154	1,030,940
32 2031	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	1,036,752	123,296	913,456
33 2032	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	918,607	109,246	809,361
34 2033	0	0	1,349,618	3,896,750	5,246,368	44,114,768	38,868,401	813,925	96,796	717,128
35 2034	0	-706,860	1,349,618	3,896,750	4,539,508	44,114,768	39,575,261	721,172	74,210	646,962
<b>Total</b>	<b>173,960,769</b>	<b>23,567,940</b>	<b>39,950,946</b>	<b>115,615,500</b>	<b>353,095,156</b>	<b>1,166,208,196</b>	<b>813,113,041</b>	<b>143,550,850</b>	<b>143,550,850</b>	<b>0</b>

EIRR= 0.12861

**Table 15-5-7 EIRR Calculation Case 2 Sensitivity Analysis A**

**La Union Mastert Plan B-3 Case 2 Sensitivity Analysis A**

Construction cost           SUS 142,504,154  
 Road cost                    SUS Include above cost  
 Equipment cost            SUS 9,216,000 Gantry Crane  
                                       6,426,000 Other  
                                       158,146,154

Year	Initial cost	Renewal cost	Mainte post	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	11,742,352	0	0	0	11,742,352	0	-11,742,352	0	11,742,352	-11,742,352
2 2001	15,656,469	0	0	0	15,656,469	0	-15,656,469	0	13,819,764	-13,819,764
3 2002	30,008,233	0	0	0	30,008,233	0	-30,008,233	0	23,380,513	-23,380,513
4 2003	41,750,585	0	0	0	41,750,585	0	-41,750,585	0	28,713,292	-28,713,292
5 2004	31,312,938	0	0	0	31,312,938	0	-31,312,938	0	19,008,640	-19,008,640
6 2005	8,698,038	0	1,080,828	3,253,250	13,032,117	17,251,794	4,219,677	9,244,178	6,983,112	2,261,066
7 2006	8,698,038	0	1,080,828	3,253,250	13,032,117	19,658,383	6,626,267	9,297,981	6,163,903	3,134,078
8 2007	8,698,038	0	1,349,618	3,896,750	13,944,406	22,064,973	8,120,567	9,211,939	5,821,671	3,390,268
9 2008	8,698,038	0	1,349,618	3,896,750	13,944,406	24,471,563	10,527,157	9,018,123	5,138,714	3,879,409
10 2009	8,698,038	0	1,349,618	3,896,750	13,944,406	26,878,153	12,933,747	8,743,004	4,535,877	4,207,127
11 2010	0	0	1,349,618	3,896,750	5,246,368	29,284,742	24,038,375	8,408,325	1,506,353	6,901,972
12 2011	0	0	1,349,618	3,896,750	5,246,368	31,691,332	26,444,965	8,031,846	1,329,639	6,702,207
13 2012	0	0	1,349,618	3,896,750	5,246,368	34,097,922	28,851,554	7,627,981	1,173,655	6,454,326
14 2013	0	0	1,349,618	3,896,750	5,246,368	36,504,512	31,258,144	7,208,336	1,035,970	6,172,366
15 2014	0	3,534,300	1,349,618	3,896,750	8,780,668	38,911,101	30,130,434	6,782,172	1,530,463	5,251,709
16 2015	0	0	1,349,618	3,896,750	5,246,368	41,317,691	36,071,324	6,356,794	807,162	5,549,632
17 2016	0	3,534,300	1,349,618	3,896,750	8,780,668	43,724,281	34,943,613	5,937,882	1,192,440	4,745,443
18 2017	0	0	1,349,618	3,896,750	5,246,368	46,130,871	40,884,503	5,529,774	628,890	4,900,884
19 2018	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	5,135,699	555,113	4,580,586
20 2019	0	10,137,600	1,349,618	3,896,750	15,383,968	48,537,460	33,153,493	4,533,216	1,436,804	3,096,411
21 2020	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	4,001,411	432,509	3,568,902
22 2021	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	3,531,994	381,770	3,150,224
23 2022	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	3,117,646	336,983	2,780,663
24 2023	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	2,751,906	297,451	2,454,455
25 2024	0	3,534,300	1,349,618	3,896,750	8,780,668	48,537,460	39,756,793	2,429,072	439,431	1,989,641
26 2025	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	2,144,111	231,755	1,912,356
27 2026	0	3,534,300	1,349,618	3,896,750	8,780,668	48,537,460	39,756,793	1,892,579	342,377	1,550,202
28 2027	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	1,670,555	180,569	1,489,986
29 2028	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	1,474,578	159,386	1,315,192
30 2029	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	1,301,591	140,688	1,160,903
31 2030	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	1,148,897	124,183	1,024,714
32 2031	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	1,014,117	109,615	904,502
33 2032	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	895,148	96,756	798,392
34 2033	0	0	1,349,618	3,896,750	5,246,368	48,537,460	43,291,093	790,136	85,405	704,731
35 2034	0	-706,860	1,349,618	3,896,750	4,539,508	48,537,460	43,997,953	697,443	65,229	632,214
<b>Total</b>	<b>173,960,769</b>	<b>23,567,940</b>	<b>39,950,946</b>	<b>115,615,500</b>	<b>353,095,156</b>	<b>1,237,124,140</b>	<b>884,028,985</b>	<b>139,928,432</b>	<b>139,928,432</b>	<b>0</b>

EIRR= 0.13290

**Table 15-5-8 EIRR Calculation Case 2 Sensitivity Analysis B**

**I.a Union Mastert Plan B-J Case 2 Sensitivity Analysis B**

Construction cost           \$US 142,504,154  
 Road cost                   \$US Include above cost  
 Equipment cost           \$US 9,216,000 Gantry Crane  
                                   6,426,000 Other  
                                   158,146,154

Year	Initial cost	Renewal cost	Mainte cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	10,674,865	0	0	0	10,674,865	0	-10,674,865	0	10,674,865	-10,674,865
2 2001	14,233,154	0	0	0	14,233,154	0	-14,233,154	0	12,577,122	-12,577,122
3 2002	27,280,212	0	0	0	27,280,212	0	-27,280,212	0	21,301,394	-21,301,394
4 2003	37,955,077	0	0	0	37,955,077	0	-37,955,077	0	26,188,481	-26,188,481
5 2004	28,466,308	0	0	0	28,466,308	0	-28,466,308	0	17,156,083	-17,156,083
6 2005	7,907,308	0	982,571	2,957,500	11,847,379	15,526,614	3,679,235	8,365,222	6,382,973	1,982,249
7 2006	7,907,308	0	982,571	2,957,500	11,847,379	17,692,545	5,845,166	8,423,085	5,640,312	2,782,773
8 2007	7,907,308	0	1,226,925	3,542,500	12,676,733	19,858,476	7,181,743	8,354,240	5,332,960	3,021,279
9 2008	7,907,308	0	1,226,925	3,542,500	12,676,733	22,024,406	9,347,674	8,187,388	-4,712,469	3,474,919
10 2009	7,907,308	0	1,226,925	3,542,500	12,676,733	24,190,337	11,513,605	7,946,268	-4,164,172	3,782,097
11 2010	0	0	1,226,925	3,542,500	4,769,425	26,356,268	21,586,843	7,650,422	1,384,419	6,266,003
12 2011	0	0	1,226,925	3,542,500	4,769,425	28,522,199	23,752,774	7,315,847	1,223,341	6,092,506
13 2012	0	0	1,226,925	3,542,500	4,769,425	30,688,130	25,918,705	6,955,561	1,081,005	5,874,556
14 2013	0	0	1,226,925	3,542,500	4,769,425	32,854,060	28,084,635	6,580,076	955,230	5,624,817
15 2014	0	3,213,000	1,226,925	3,542,500	7,982,425	35,019,991	27,037,566	6,197,807	1,412,723	-4,785,085
16 2015	0	0	1,226,925	3,542,500	4,769,425	37,185,922	32,416,497	5,815,415	745,879	5,069,537
17 2016	0	3,213,000	1,226,925	3,542,500	7,982,425	39,351,853	31,369,428	5,438,104	1,103,106	-4,334,998
18 2017	0	0	1,226,925	3,542,500	4,769,425	41,517,783	36,748,358	5,069,868	582,410	-4,487,458
19 2018	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	-4,713,703	514,646	-4,199,057
20 2019	0	9,216,000	1,226,925	3,542,500	13,985,425	43,683,714	29,698,289	-4,165,262	1,333,517	2,831,745
21 2020	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	3,680,633	-401,855	3,278,778
22 2021	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	3,252,390	-355,099	2,897,291
23 2022	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	2,873,973	-313,783	2,560,191
24 2023	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	2,539,586	-277,274	2,262,312
25 2024	0	3,213,000	1,226,925	3,542,500	7,982,425	43,683,714	35,701,289	2,244,104	-410,070	1,834,034
26 2025	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	1,983,092	-216,506	1,766,496
27 2026	0	3,213,000	1,226,925	3,542,500	7,982,425	43,683,714	35,701,289	1,752,279	-320,198	1,432,081
28 2027	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	1,548,401	-169,056	1,379,345
29 2028	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	1,368,244	-149,386	1,218,858
30 2029	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	1,209,049	-132,005	1,077,044
31 2030	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	1,068,376	-116,646	951,729
32 2031	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	944,070	-103,074	840,995
33 2032	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	834,227	-91,082	743,145
34 2033	0	0	1,226,925	3,542,500	4,769,425	43,683,714	38,914,289	737,164	-80,484	656,680
35 2034	0	-642,600	1,226,925	3,542,500	4,126,825	43,683,714	39,556,889	651,395	-61,538	589,857
Total	158,146,154	21,425,400	36,319,042	105,105,000	320,995,596	1,113,411,726	792,416,130	127,865,162	127,865,162	0

EIRR= 0.13167

**Table 15-5-9 EIRR Calculation Case 2 Sensitivity Analysis C**

**La Union Mastert Plan B-3 Case 2 Sensitivity C**

Construction cost      \$US 142,504,154  
 Road cost                \$US Include above cost  
 Equipment cost        \$US 9,216,000 Gantry Crane  
                                  6,426,000 Other  
                                  158,146,154

Year	Initial cost	Renewal cost	Mainte cost	Operation cost	Cost Total	Benefit Total	Benefit - Cost	Net Present Value (NPV)		
								Benefit	Cost	Benefit - Cost
1 2000	11,742,352	0	0	0	11,742,352	0	-11,742,352	0	11,742,352	-11,742,352
2 2001	15,656,469	0	0	0	15,656,469	0	-15,656,469	0	13,976,551	-13,976,551
3 2002	30,008,233	0	0	0	30,008,233	0	-30,008,233	0	23,914,033	-23,914,033
4 2003	41,750,585	0	0	0	41,750,585	0	-41,750,585	0	29,701,690	-29,701,690
5 2004	31,312,938	0	0	0	31,312,938	0	-31,312,938	0	19,886,054	-19,886,054
6 2005	8,698,038	0	1,080,828	3,253,250	13,032,117	15,526,614	2,494,498	8,802,535	7,388,324	1,414,211
7 2006	8,698,038	0	1,080,828	3,253,250	13,032,117	17,692,545	4,660,428	8,954,215	6,595,567	2,358,647
8 2007	8,698,038	0	1,349,618	3,896,750	13,944,406	19,858,476	5,914,070	8,972,001	6,300,041	2,671,959
9 2008	8,698,038	0	1,349,618	3,896,750	13,944,406	22,024,406	8,080,001	8,882,880	5,624,056	3,258,825
10 2009	8,698,038	0	1,349,618	3,896,750	13,944,406	24,190,337	10,245,931	8,709,590	5,020,602	3,688,988
11 2010	0	0	1,349,618	3,896,750	5,246,368	26,356,268	21,109,901	8,471,219	1,686,245	6,784,974
12 2011	0	0	1,349,618	3,896,750	5,246,368	28,522,199	23,275,831	8,183,728	1,505,313	6,678,415
13 2012	0	0	1,349,618	3,896,750	5,246,368	30,688,130	25,441,762	7,860,403	1,343,795	6,516,608
14 2013	0	0	1,349,618	3,896,750	5,246,368	32,854,060	27,607,693	7,512,243	1,199,608	6,312,635
15 2014	0	3,534,300	1,349,618	3,896,750	8,780,668	35,019,991	26,239,324	7,148,301	1,792,315	5,355,986
16 2015	0	0	1,349,618	3,896,750	5,246,368	37,185,922	31,939,554	6,775,971	955,986	5,819,985
17 2016	0	3,534,300	1,349,618	3,896,750	8,780,668	39,351,853	30,571,185	6,401,244	1,428,324	4,972,920
18 2017	0	0	1,349,618	3,896,750	5,246,368	41,517,783	36,271,416	6,028,920	761,841	5,267,080
19 2018	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	5,662,799	680,096	4,982,703
20 2019	0	10,137,600	1,349,618	3,896,750	15,383,968	43,683,714	28,299,747	5,055,188	1,780,271	3,274,917
21 2020	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	4,512,773	541,979	3,970,794
22 2021	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	4,028,559	483,826	3,544,733
23 2022	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	3,596,300	431,912	3,164,388
24 2023	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	3,210,422	385,568	2,824,854
25 2024	0	3,534,300	1,349,618	3,896,750	8,780,668	43,683,714	34,903,047	2,865,948	576,071	2,289,877
26 2025	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	2,558,436	307,265	2,251,170
27 2026	0	3,534,300	1,349,618	3,896,750	8,780,668	43,683,714	34,903,047	2,283,919	459,080	1,824,839
28 2027	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	2,038,858	244,865	1,793,993
29 2028	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	1,820,091	218,591	1,601,500
30 2029	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	1,624,798	195,136	1,429,661
31 2030	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	1,450,459	174,199	1,276,261
32 2031	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	1,294,827	155,507	1,139,320
33 2032	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	1,155,894	138,822	1,017,072
34 2033	0	0	1,349,618	3,896,750	5,246,368	43,683,714	38,437,347	1,031,868	123,926	907,942
35 2034	0	-706,860	1,349,618	3,896,750	4,539,508	43,683,714	39,144,207	921,150	95,724	825,426
<b>Total</b>	<b>173,960,769</b>	<b>23,567,940</b>	<b>39,950,946</b>	<b>115,615,500</b>	<b>353,095,156</b>	<b>1,113,411,726</b>	<b>760,316,571</b>	<b>147,815,536</b>	<b>147,815,536</b>	<b>0</b>

EIRR= 0.12020

## **16. PORT ADMINISTRATION, MANAGEMENT AND OPERATION**

### **16.1 General Principles of Port Administration, Management and Operation**

1. The most important function of a port is to be as a terminal where sea and land transportation meet. Efficiency and safety are thus vital in the transfer of cargo and passenger. For cargo handling, quickness, reliability and cost effectiveness are strongly required.

2. In executing port projects, proper port planning and efficient management and operation are fundamental requirements. The functional layout and design of port facilities must be based on excellent port planning to successfully realize port projects. If a management and operation system is inappropriate, the full benefits of modernized port facilities cannot be enjoyed. In this sense, there is an interdependent relationship between the management and operation system and design of port facilities.

3. There is no definitive management and operation system that has been adopted in ports all over the world. The structure of the port management body at each port is slightly different depending on historical, socio-economic and institutional factors. However, the final goal is the same: to utilize the port facilities in a such a way that the maximum benefits are generated.

4. In principle, port management is a kind of commercial business, so the following three points are commonly required for port management and operation to satisfy users around the world.

#### **(1) High Efficiency**

5. In order to ensure efficient utilization of the port facilities and port services, and to minimize the cost of transport through the port, efficient port management and operation are indispensable.

#### **(2) Provision of services at reasonable charges**

6. The following points should be considered in terms of the port tariff structure.

- The revenue from the tariff can cover costs for construction, management,

maintenance and repair.

- The tariff should be rational in correspondence with the service provided.
- The tariff structure should include a system which leads to more effective management and operation of the port. For example, an incentive should be provided in the tariff structure for vessels and cargo to move efficiently through the port.
- The tariff structure and the way of imposition should be as simple as possible.

### (3) Reliability and safety

7. Delivery/receiving or unloading/loading of cargo and arrival/departure of vessels must be carried out on time and correctly. Operation of cargo and vessels must be carried out in a safe manner. Even if the above factors are given different priorities, it is impossible to attract users to ports without all of them. When the above requirements are satisfied, port activities can be promoted and the port management body can make the best use of port facilities.

## 16.2 Port Modernization in El Salvador

1. Port activity has a great influence on the national economy. Safeguarding the national interest should be the first priority of port management and operation. In particular, in developing countries, ports are one of the vital instruments of the national economic policy to achieve a so called economic take-off. Therefore, it is better for ports to be under the strong supervision of the government to facilitate optimum capital distribution and the realization of a trade policy. In other words, the basic role of ports is normally to function as a public facility.

2. On the other hand, port management is a kind of commercial business in terms of provision of services for port users. A much more flexible, business-like system of management is required, free from political pressures and rictions.

3. Therefore, the port is on the one hand a public enterprise and on the other a commercial one. A administration body is established to reconcile this dualistic nature of ports. The port administration body is a separate autonomous body under the general overall supervision of the government, and

in charge of the current administration and development of the port, within the framework of the national economic policy. On the other hand, autonomy cannot be achieved by a port unless it has a wide measure of financial independence and self-sufficiency, and these make the port administration body sensitive to cost and benefits. To raise the capacity of the port administration body to its highest level, it is necessary to adhere to the following essential principles.

- a) Administration body over whole port area and main port function
- b) Autonomy
- c) Commercial management methods

a) Authority

4. A port administration body should have authority over the whole port area and main port functions. Port operation cannot be performed with full efficiency unless the port management body owns all land and facilities, such as infrastructure, quay cranes and so on, in the port area to control and coordinate all port activities on wharves and piers, land facilities and port water. Also, the planning of future port expansion cannot be made properly unless the port can freely dispose of the entire undeveloped water frontage within the port area.

5. However, highly specialized terminals, which are used by one single customer with sufficient volume of cargo, for example, berths for loading ores, can remain in private ownership, under a certain degree of supervision by the port administration body.

b) Autonomy

6. Port Administration body should be responsible for port improvement and expansion plans and for maintenance of all existing port facilities. It should have the right to select and appoint personnel in accordance with their professional abilities. It should be able to lease some property to private firms in case of need, incur financial obligations in its own name and in general to act as a legal entity. Therefore, government's control should be limited to a minimum number of areas.

7. Autonomy cannot be achieved by a port unless it has a wide measure of

financial independence. Therefore, port charges and any other receipts of the port should be used exclusively for port administration, maintenance and improvement. Port charges should be kept at a reasonable level to cover normal current expenses, including amortization and repayment of loans.

c) Commercial management methods

8. In port management and operation, new problems constantly arise and must be solved quickly. Port management is a kind of business so the administration body must always fight against rising costs. Therefore, ports cannot be managed in accordance with the bureaucratic systems prevailing in most governmental departments. The management must be flexible and be able to make decisions according to the merits of each case, rather than according to formalities and rigid regulations.

9. Clearly defining responsibilities and an organization chart are essential conditions of efficient management. An organization chart with responsibilities of each section should be publicized to enhance internal cooperation among related departments or sections and the control of organization by the staff of an administration department.

10. The port administration must have the freedom to adjust its organization and the level of expenses to the changing requirements of traffic and conditions of port operations. A certain section should be in charge of analysis of those changing situations, correction of related information and research of needs of port users.

11. Port management should not sit and wait for the traffic to come but should make all efforts to attract traffic. Therefore, one more aspect of the need of a business-like approach to port problems is the necessity of promotional activities. A reasonable amount of publicity and close contact with shipping companies and their agents, local and international commerce, industrial organization and with all actual and potential port users can greatly contribute to improving the image of the port, making known its advantages and opportunities and promoting a steady growth of traffic. Also, these activities of port promotion can bring to light current problems of the port and stimulate their quick resolution.



## **16.3 Expected Roles and Organization of CEPA**

### **(1) Required functions for CEPA**

1. The Port of Acajutla, which is the major port in El Salvador, is managed and operated by CEPA. CEPA has authority of planning, construction, management and operation and maintenance of port facilities. Port operation, such as tugs, cargo handling, maintenance of equipment and so on, are done by them. Under this situation, if the port is to be attractive and profitable port for users, attention must be given the following points.

#### **a) Administration of port water area**

2. In El Salvador, port water area is not is ordained by law. Therefore, the boundary of port water area managed by CEPA is not clear. This situation will create problems for the port development in future. The port water area should be defined including future expansion.

#### **b) Organization improvement**

3. In order to realize efficient port management and operation related to a basic policy and plan and ensure sound finance for the port development, it is necessary to introduce or reinforce sections which are in charge of the following functions:

- Functional Port Planning and Arrangement
- Active Marketing and Port Promotion
- Attractive Tariff and Efficient Cargo Handling
- Environmental Administration
- Flexible and Effective Reorganization

#### **c) Administration and management system**

4. In order to promote rational and efficient management, it is important to introduce measures for activation of administration and management system. In particular, communication among sections should be improved.

#### **d) Reliable port operation**

To carry out the port management and operation effectively, the port

# EXPECTED ROLES AND ORGANIZATION OF CEPA

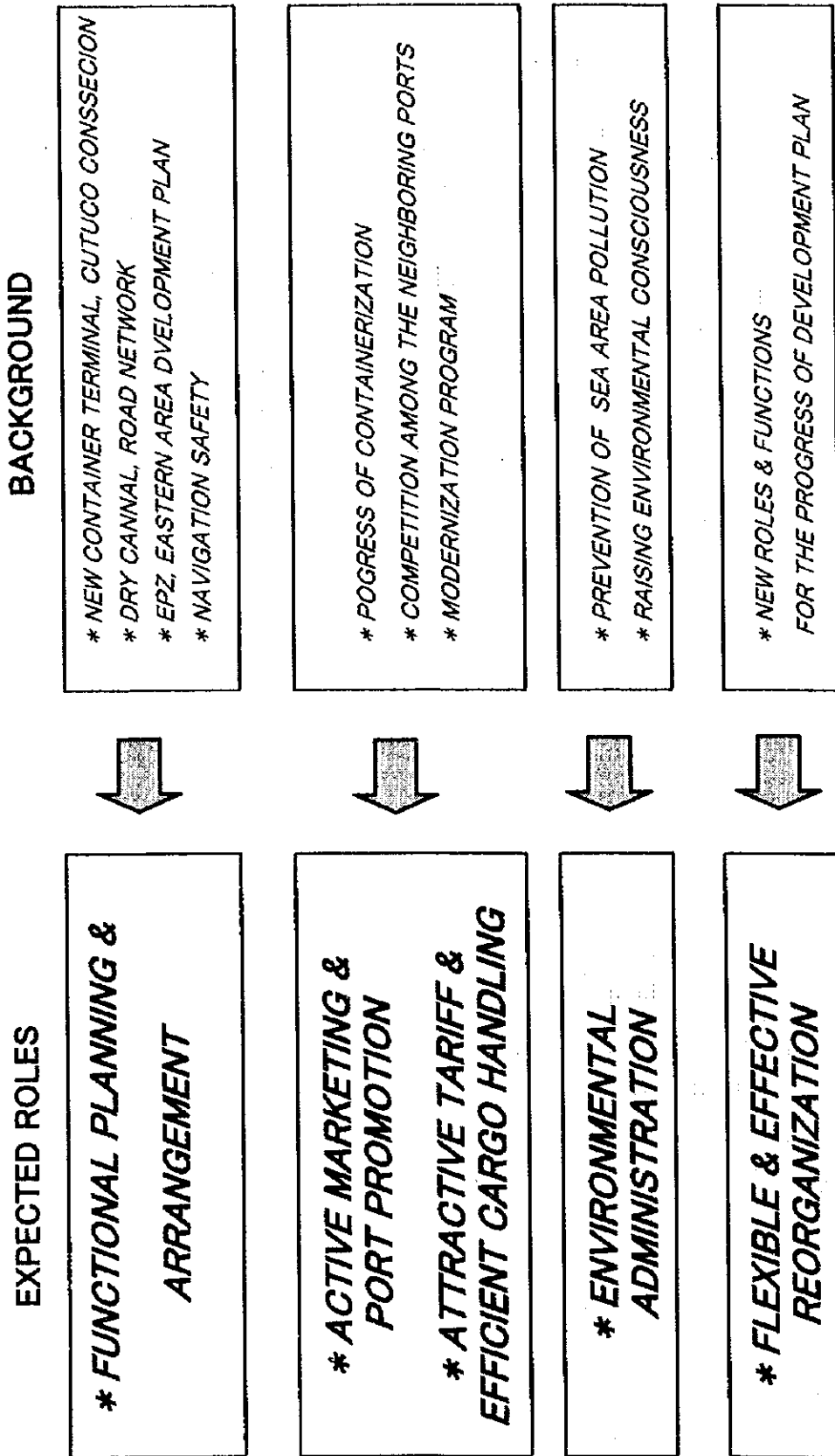


Fig 16-3-1 Expected Roles and Organization of CEPA

operation should be considered from the commercial business standpoint. That is "efficiency", "provision of service at reasonable charges" and "reliability and safety" as described in 16.1.

5. A new container terminal is proposed to handle efficiently the increasing container cargo in El Salvador. It is necessary to examine not only a suitable cargo handling system but also the best management system for the container terminal.

e) Strategic statistic system

6. Systematic collection and compilation of data and information on various port affairs is a basic requirement for sound and effective port administration. Port statistics required for planning, administration, management, operation, budgeting, accounting and auditing should normally cover the essential fields including port activities, facilities, financial status, organization and personnel affairs, engineering management and other related information.

7. However, collected port statistics are not utilized sufficiently for planning, management and operation. Improvements in this areas will be necessary.

f) Active port promotion

8. Port promotion is one of the most important fields of activities for attracting port users: shipping lines, shipping agents, forwarders, shippers consignees and so on. There are mainly three objectives of port promotion.

- To improve the financial condition of port management by increasing cargo volume and the number of calling vessels.
- To reinvigorate local economies of the eastern area by preparation of infrastructure.
- To improve living standards by full utilization of ports.

9. CEPA does not seem active in promoting itself. In future, sales activities of the port will be vital for securing adequate level of revenues from users at the ports in El Salvador.

**(2) Port management and operation in future**

10. This section discusses the measures to improve managerial weak points in CEPA.

**1) Organization**

**(a) Activation of the organization**

11. Generally speaking, inner organization of executive department (head office) should be simplified and streamlined. The following points need to be considered in order to activate the organization.

- Training middle-ranked staff for positions of authority.

(For adjustment of gap between the few high ranking staffs and the majority of workers)

- Establishment of system and clear criteria for promotion of regular staff.

(Personnel changes not influenced by higher-ranking staff's change)

- Sharing information for strengthening organization.

- Necessity of incentive for workers.

(Measures to prevent well-trained personnel from flowing out of the organization)

- Establishment of task force for improving organization consisting of efficiency specialists.

(For objective proposals to improve the organization)

**(b) Reinforcement of port planning section**

12. Port planning section is in charge of preparing port development policy which indicates future conditions of the port. In order to realize the proposed port plans, it is essential to secure active utilization of the plans through such efforts by CEPA as promoting full understanding on the plan, securing adequate financial support with proper budgetary arrangements and reviewing periodically the plan according to the actual situation of the country and region.

13. Therefore, it is necessary to improve the port planning section for future port development. Establishing a task force consisting of experts is another way to assist in strengthening the planning section.

(c) Reinforcement of port promotion and statistic sections

14. Port sales and statistic system, mentioned below in this chapter, are essential to support every day activities. In CEPA, the sections in charge of these works should be created or reinforced.

(d) Introduction of port management and operation strategy section

15. Port management and operation strategy section is in charge of preparing personnel affairs policy and port promotion policy. These policies should be prepared as part of the strategy which leads to the establishment of a proper future port management and operation system.

(e) Introduction of Section for Environmental Affairs

16. Environmental affairs will become an important issue. The establishment of a section which deals with administration of environmental affairs such as monitoring and assessment of environmental impact will be necessary in the future.

2) Personnel administration

(a) Introduction of measures for activation of the organization

17. For activation of the organization, not only its reformation but also the improvement of minds of its personnel toward rational and efficient management are important. For this purpose, many companies adopt a Quality Control (QC) circle and a proposal activity system.

(b) Personnel evaluation system

18. It is thought necessary to raise morale of personnel and to promote their ability to discharge duties for proper port management. Personnel management system to realize this will be important.

19. One way to improve personnel morale is to evaluate their ability properly and fairly with objective standards and reflect that evaluation in promotions and wages. Through this evaluation, the proper personnel transfer according to experience, knowledge and judgment becomes possible. Moreover it also gives personnel the incentive to work hard and display their ability

because they are satisfied with the proper evaluation of their works.

20. The following points should be kept in mind at the time of the evaluation.

- Evaluation should be done not only for promotion and wages but also for the nurturing of personnel. So it is important to look at the shortcomings or promising points of each employee and to evaluate their efforts to rectify/cultivate them.

- Managers of each section should make efforts to improve abilities of personnel under them through training on the job or through some training courses and seminars.

- Evaluating items should include the contribution and attitude toward efficient business.

21. Lack of communication in organization is frequently caused by the lack of a smooth lateral relationship rather than relations between top and bottom. Withholding of information is an effective means for one section to hold power over another, however this hinders the activities of an organization as a whole.

(c) Others

22. A house journal is another measure to promote communication. A house journal is a newspaper published by the management body which details the organization's prospects, imparts broad knowledge of current undertakings and can serve as a forum to hear opinions and requests of employees. It should not be a one-sided communication from top to bottom. Rather, it should promote mutual understanding between top and bottom and make lateral communication among employees smooth. This will result in a stronger organization.

3) Port operation

23. Generally, the best management of container terminals is performed by a single organization which has enough skillful officers and workers to be able to supply full service to customers (shipping companies, shippers/ consignees), from receiving containers to leading them onboard ship, or from discharging

containers to delivery to the consignees.

24. At present, CEPA does not have a container terminal. Concerning management and operation body of the new container terminal, the important thing to be considered is to choose the best method which enables a port management body to operate a port efficiently and effectively without sacrificing public interest, based on a detailed examination of the present situation of the study port rather than seeking a common management and operation system.

#### 4) Active marketing and port promotion

25. At the first step, it is essential that CEPA establishes a special section in charge of port sales. To go ahead with it concretely, the following actions as port sales are recommended.

- To collect information on port users' requirements.
- Establishment of port promotion strategy focusing on the most effective target groups of users.
- Under the systematic action program, the staffs should call for sales at shipping companies or shippers and point out the real merits of utilizing the Acajutla port and La Union new port.
- It is useful for effective sales activities to prepare an attractive brochure in which the sales points including various advantages and merits for the target users are explained plainly.
- To hold seminars to introduce this port to shippers of various countries is another effective way to assist the promotion activities.

## **16.4 Administration, Management and Operation of Port of La Union in Future**

### **16.4.1 Policy for Port Management and Operation**

#### **(1) Background for Port Management and Operation**

1. Major issues to be taken into consideration in examining management and operation system are listed below.

1) The basic role of ports is normally as a public facility. This concept means that public port should be managed and operated not for limited or specified users but for open public use.

2) Safe and punctual operation is the most vital requirement for transportation sector including maritime transportation sector. In this sense, the Salvadorian ports are required to provide quick, reliable and economical service to users.

3) One of the most important national policies in this country is commercialization which will have a great impact on future port development.

4) Efficient service is often obtained by establishing a competitive environment.

## (2) Policy for Port Management and Operation

2. Taking the above mentioned issues into consideration, main policies for port management and operation are formulated as follows.

1) Ports are vital to the Salvadorian economy. Revenue from ports is important income for El Salvador. Consumption goods for Salvadorian people must be provided steadily through the ports. The ports should be owned by the public sector or entities under proper control of the government.

2) In principle, the terminals of the ports should be open use terminals for the public. Under such operation, the terminals will accept all different shipping companies.

3) To improve cargo handling efficiency, cargo handling service should be transferred to the private sector. At the same time, a competitive climate should be fostered.



## 16.4.2 Organization for New Container terminal in La Union

3. An example of organization for container terminal is shown in Fig. 16-4-1. This was made based on the case of a typical container terminal. Following is a short explanation of the business of each section of the container terminal.

1) *General affairs section:*

Administration of terminal properties and cost, labor costs and the flow of general administration funds. Other general affairs.

2) *Accounting/Claim adjustment section:*

Issuing bills for loading/unloading containers, storage, delivering, and repairing. Receiving charges.

Dealing with all claims which are concerned with human injury, container ships, terminal facilities and equipment, containers, vehicles and so on.

3) *Planning assistant section:*

Planning of container ship stevedoring, container marshaling in the container yard, shifting within the container yard and so on.

4) *Yard control section:*

(a) Arrangement of necessary equipment and their drivers, and other workers for performing the above operations.

(b) Controlling yard operation at the operation center in the office. Controlling road trailers arranged for by the shipper/consignee, in the container terminal area.

(c) Clerical work of container delivery and receiving at a gate house, inspection of the exterior condition of loaded containers, and damage inspection of empty containers which are returned from the consignee, or discharged from a ship.

5) *Documentation section:*

Issuing and typing of necessary documents for export/import containers. Arrangement for government official's inspection. Inventory control of

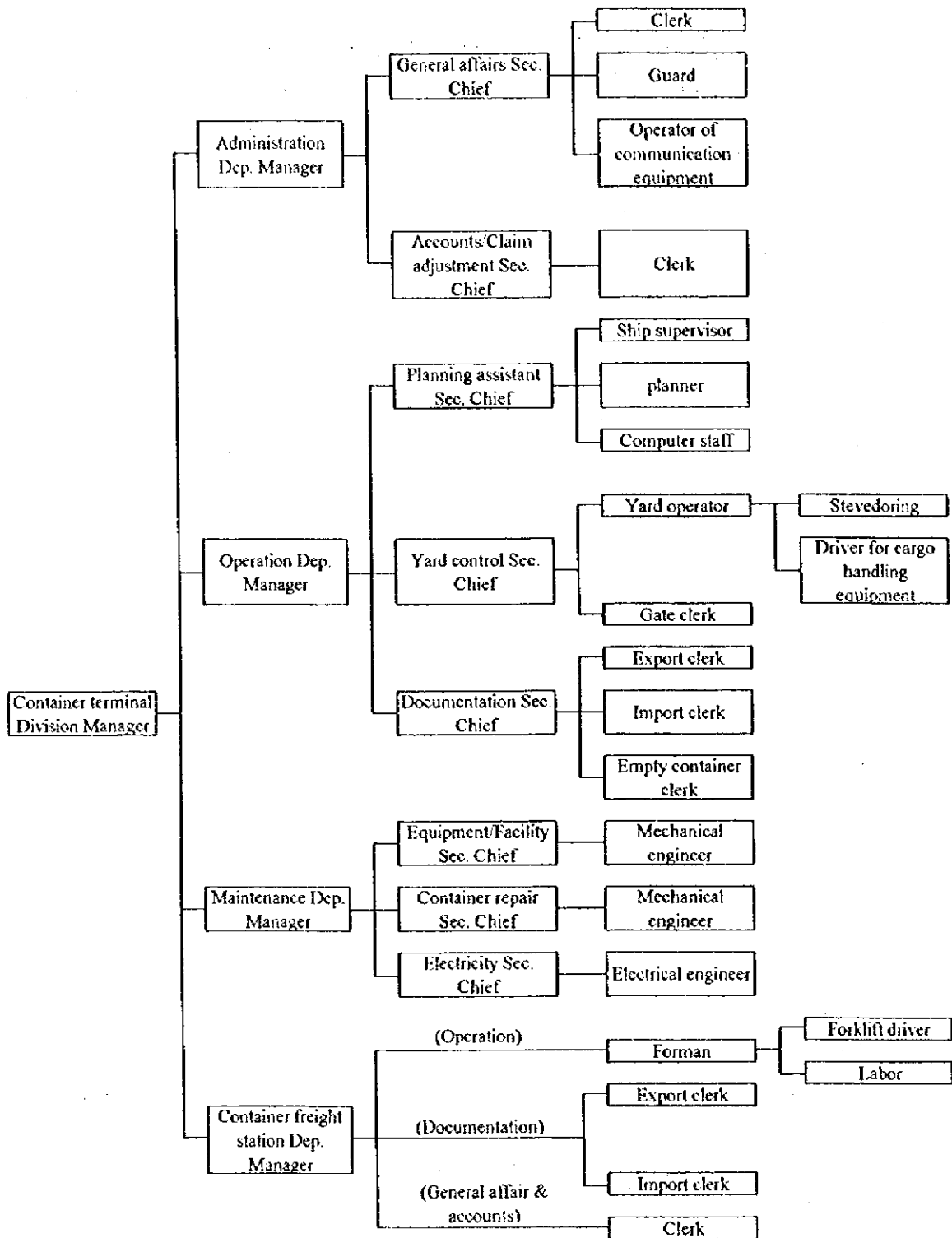


Fig 16-4-1 Example of new organization for the container terminal

empty containers, and the documentation of their delivery.

6) *Equipment/Facilities section:*

Maintenance of terminal equipment and facilities.

7) *Container repair section:*

Inspection of damaged and dirty containers which are returned to a gate house or discharged from a container ship. Cleaning and damage repair of containers, and inventory control of repairing materials.

8) *Electricity section:*

Maintenance, checking, and repair of electrical equipment which is concerned with the transformer substations, illumination of the terminal, refrigerated containers, and cargo handling (container gantry crane, transtainer, etc.).

9) *CFS department:*

(Operation)

(a) Planning of cargo operation such as delivery/receiving, storage, container vaning and devanning at the CFS.

(b) Arrangement, operation orders, and supervising of necessary equipment, their drivers and other workers.

(c) Control of shipper/consignee's vehicles at the CFS.

(Documentation)

Issuing and typing of necessary documents for export/import containers. Arrangement for government official's inspection.

(General affairs and accounts)

Bill issuing for all charges for CFS operations, and collection.

### **16.4.3 Port Management and Operation System and Application of Private Participation for the Port Service**

#### **(1) General Concept for Application of Private Participation for the Port Service**

4. Throughout the world, there is a tendency for port management and operation to move toward privatization. Many port administration bodies have

already adopted privatization or are considering its adoption. However, it is very difficult to define and evaluate this so-called "privatization" because of peculiarities among individual ports and countries. In addition, each port administration body has its own jurisdiction and duties. The range of duties of several representative port administration bodies is shown in Table 16-4-1. It should be recognized that the definition of "privatization" is a relative matter. The privatization scheme to be adopted depends upon the degree of remaining duties in the public sector.

5. As is commonly understood, public sector is normally not flexible in providing personnel or investment in response to the actual fluctuation of demand. In this sense, full involvement of the public sector in cargo handling services is not always suitable for increasing efficiency of such services under a competitive market, and increased situation of cargo flow in particular.

6. Therefore, it is necessary for CEPA to examine introduction of privatization corresponding to the stage of national economic development in El Salvador. This will be one of the solutions to realize an efficient port operation and contribute to improvement of the Salvadorian economy in the future.

Table 16-4-1 Port administration bodies' duties in the world

Country Port	Japan Yokohama	U.S.A New York	Netherland Rotterdam	Philippines Manila	Thailand Bangkok	Malaysia Port Kelang	Singapore
Ownership	⊙	⊙	○	○	⊙	○	○
Berth allocation	⊙	⊙	○	○	○	⊙	○
Fee and charge	⊙	⊙	○	○	○	⊙	○
Statistic	○	○	○	○	○	○	○
Water traffic control			○	○			○
Shed and heaping yard	⊙			○	○	⊙	○
CY operation					⊙		○
CFS operation					○		○
Stevedoring						○	○
Longshore cargo handling					○	○	○
Warehouse					○	○	○
Tug					○	○	○
Line handling					○	○	○
Water supply					○		○
Pilot			○			○	○
Tally					○	○	○

Note: ⊙Leased berths and facilities are under the control of separate organization

Source: OCDF Survey Report

## (2) Merit of Private Participation for the Port Service

7. Generally speaking, the private sector runs business more efficiently than public sector because of the following reasons.

### a. Incentive

When a business is run by the public sector, incentives to make the management efficient by reducing deficits do not work well since there is no possibility of bankruptcy. On the contrary, the prospect of bankruptcy compels private companies to run an efficient operation.

Workers in the public sector lack incentives to perform the best possible job. Wage systems are often so rigid that the diligence or ability of an employee go unrewarded. This type of situation usually results in lackadaisical efforts on the part of workers.

### b. Competition

Introduction of principle of competition will induce incentives for effective management. When services are monopolized by a single company without any competition, it is difficult to judge whether the company provides effective services or not. Participation of plural companies makes a comparison possible.

### c. Flexibility

Flexible management free from budget system, seniority system, formalism and the strict application of regulations which are peculiar to officialism should be introduced.

## (3) Private Participation for the Port Service scheme

8. Generally speaking, the method of terminal operation can be classified as in Fig 16-4-2.

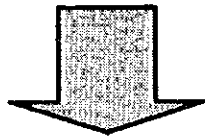
9. Case-A concentrates many port activities in the hands of the port administration body. Under this method, the port administration body becomes not only a public body for administration, maintenance and extension of the port but also a commercial enterprise performing functions which, in other fields of

# ADMINISTRATIVE ORGANIZATION FOR THE NEW CONTAINER TERMINAL IN LA UNION

1. REQUIRED FUNCTION FOR THE NEW CONTAINER TERMINAL IN LA UNION

## CONCEPT : COMPETITIVE NEW PORT

REQUIRED FUNCTION
* HIGH EFFICIENCY
* ATTRACTIVE TARIFF
* SAFE AND RELIABLE SERVICE



BACK GROUND
PROGRESS OF CONTAINERIZATION COMPETITION AMONG THE NEIGHBORING PORTS MODERNIZATION PROGRAM

2. ADMINISTRATIVE ORGANIZATION FOR THE NEW CONTAINER TERMINAL IN LA UNION

CASE	PLANNING & SUPERVISION	CONSTRUCTION			OPERATION			REMARKS
		CHANNEL DREDGING	SITE DEVELOPMENT	TERMINAL FACILITIES	ADMINISTRATIVE OPERATIONS	CARGO HANDLING		
A	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC		
B	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC	<b>PRIVATE</b>		LUP
C	PUBLIC	PUBLIC	PUBLIC	PUBLIC	<b>PRIVATE</b>	<b>PRIVATE</b>		LAG
D	PUBLIC	PUBLIC	PUBLIC	<b>PRIVATE</b>	<b>PRIVATE</b>	<b>PRIVATE</b>		
E	PUBLIC	PUBLIC	<b>PRIVATE</b>	<b>PRIVATE</b>	<b>PRIVATE</b>	<b>PRIVATE</b>		BOT

NOTE: **BOLD PRINT INDICATES STRONG RECOMMENDATION**

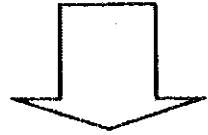
Fig. 16-4-2 ADMINISTRATIVE ORGANIZATION FOR THE NEW CONTAINER TERMINAL IN LA UNION

ADMINISTRATIVE ORGANIZATION FOR THE NEW CONTAINER TERMINAL IN LA UNION

1. REQUIRED FUNCTION FOR THE NEW CONTAINER TERMINAL IN LA UNION

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		CHANNEL DREDGING	SITE DEVELOPMENT	TERMINAL FACILITIES	ADMINISTRATIVE OPERATIONS	CARGO HANDLING	
A	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC	
B	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC	<b>PRIVATE</b>	LUP
C	PUBLIC	PUBLIC	PUBLIC	PUBLIC	<b>PRIVATE</b>	<b>PRIVATE</b>	LAQ
D	PUBLIC	PUBLIC	PUBLIC	<b>PRIVATE</b>	<b>PRIVATE</b>	<b>PRIVATE</b>	
E	PUBLIC	PUBLIC	<b>PRIVATE</b>	<b>PRIVATE</b>	<b>PRIVATE</b>	<b>PRIVATE</b>	BOT

NOTE: BOLD PRINT INDICATES STRONG RECOMMENDATION

Fig. 16-4-2 ADMINISTRATIVE ORGANIZATION FOR THE NEW CONTAINER TERMINAL IN LA UNION

economic activity, are usually performed by private firms. This method has been adopted by the Port of Acajutla.

10. Case-B,C restrict responsibilities of the port administration body in the field of port operations to administrative activities where it plays the role of coordinator and supervisor. The port administration body is responsible for aspects of port development such as port planning, construction and maintenance of facilities, management and financing. Also, the port administration body owns land and main port facilities such as the quay, apron, yard, transit shed and so on.

11. Case-D makes the port administration body just a landowner. Lands are leased out to other private sector which can only build facilities that are appropriate to the port plan. The staff of the port administration body need not think about the detailed design of facilities, construction and maintenance, operation, financing and so on. Co-ordination and determining the amount of rent are the main responsibilities they have. Usually, there is a little work for the port staff to do under this method.

12. Case-E makes the private sector the owner of lands and port facilities. Therefore, a private entity operates all of the port by itself. This method is only adopted in the case of a special terminal, for instance, an exclusive terminal for coal, iron ore and so on.

13. Ports should contribute to the national interest, development of hinterland cities and their economies, especially in developing countries. From this point of view, Case-B or Case-C is recommended.

14. Also, concerning construction and operation of terminals, the following privatization methods can be taken as samples even though the responsibilities of port administration body may differ from one another.

**· LAQ (Lease a Quay)**

A private sector makes a contract with a public sector to conduct port service business, through this contract the public sector leases a terminal including quay wall to the private sector. The private sector pays a lease charge.



**- LUP (License to Use a Port)**

A public sector licenses the private sector to conduct limited port activities in the terminal constructed by the public sector.

**- BOT (Build, Operate and Transfer)**

The public sector permits the private sector to construct a terminal under the condition that the private sector uses it for a certain period (usually 10 to 15 years) to recover the construction cost. After this period the terminal is transferred to the public sector.

**(4) Application of Private Participation for the Port Service**

15. La Union port is an important public port which supports the national economy and contributes to development of hinterland. Public ports should be managed and operated not only for limited or specified users but for the open public, and should fairly accept all ships and cargoes of different companies.

16. It is advisable that the CEPA introduce privatization, which is one solution to realize an efficient port management and operation, corresponding to the stage of national economic development in El Salvador. The operation of monopolistic cargo handling, which is conducted in the Port of Acajutla, should be modernized. It is advisable that CEPA encourage private sectors to enter into the area of cargo handling service by providing an attractive environment.

17. The following guidelines should be taken into account in introducing privatization.

a) The ultimate objective of privatization of port operation is to maximize economic return from the port activity for both the public and private sectors under careful consideration on effective removal of possible inefficiency of public sector.

b) Port functions and activities to be privatized should be limited within the areas where the privatized activities can be fully controlled under CEPA, and the areas where the effect of privatization can be fully expected without any negative impact to the sound performance of the port.

c) The target areas to be privatized should be planned and arranged appropriately to guarantee the necessary conditions under which the free market system can be fully activated.

d) In principal, ownership of the land and water areas necessary for CEPA, and the basic port facilities such as water area for navigation channels, anchorages and berthing basins, public wharves, utility mains, reserved space/land for public use or future expansion should belong to CEPA.

e) Basic port facilities and major cargo handling equipment should be open to public use, but can be leased out to private sectors on a contract basis for their exclusive use under appropriate conditions.

18. According to above mentioned guidelines, Case B or Case C are considered the best selection for the Port of La Union at the long-term stage. In addition , each terminal such as container terminal, general cargo terminal and bulk cargo terminal should be open to public use (as mentioned below).

a) Container/ General cargo terminal

Containerization will progress in El Salvador, and in the beginning of the containerization process, semi container ships or small full container ships operated by various shipping companies will call on the port rather than big full container mother ships operated by the major companies. This kind of container terminal should be not used as an exclusive berth but be used as a public berth.

General cargo terminals are normally used by various users and handle a smaller amount of cargoes compared with container terminals. Naturally, these terminals should be open to public use.

b) Bulk cargo terminal

In the case of terminals for bulk cargo such as fruits, grain and maize, on-land facilities can be used by a specified entity, while the berth will be used by many shipping companies. Therefore, the berth should be open to public use.

19. When CEPA introduces privatization, attention should be paid to the selection of private companies. It is important to decide qualification criteria

for private companies wishing to participate. Examples of criteria are as follows:

- Companies which are able to perform efficient cargo handling to fit customer demand
- Companies which can provide reliable service.

20. Also, it is necessary to select plural companies, in order to increase competition. At the same time, CEPA should introduce a system to encourage fair competition. A system in which a certain company is always appointed to a specified berth or pier is not preferable. Instead, a port user should be able to evaluate the ability of a company and make his selection accordingly.

21. When setting the tariff, it also should be considered that if cargo handling services are privatized, the ports can reduce personnel costs but cargo handling revenue is transferred to the private entities. The ports need considerable income if they want to become financially independent and make investments by themselves. Therefore, tariff should be set at a sufficiently high level.

## 17. OVERALL EVALUATION OF THE PROPOSED ALTERNATIVE PLANS

### 17.1 Overall Evaluation

1. In order to select the best alternative, the comparative evaluation of the alternatives is summarized as shown in Table 17-1-1.

Table 17-1-1 Comparative Evaluation of the Alternatives

Evaluation	Alternative Plans			
	A-1	B-1	B-2	B-3
Terminal Plan	○	○	○	○
Land Access	◎	○	○	○
Water Area Plan	○	○	○	○
Water Access	○	◎	◎	◎
Effect on Existing Piers	△ Cutuco	○	○	△ Private
Use of Neighboring Area	○	◎	○	○
Future Expansion	△	◎	◎	◎
Construction Cost	△	△	○	○
Environmental Impact	○	○	○	○
Effect on Other Projects	△ Cutuco	△ Marina, Plant	△ Plant	◎
Overall Evaluation				

Note: ◎ Good  
○ Fair  
△ Poor

2. The overall evaluation will depend on the political decision of the Government of El Salvador, since each alternative is affected by the concession for the existing Port of Cutuco(CEPA) or the other projects such as the marina(MARINA) and the power plant (CEL) as well as the construction cost.

3. From the viewpoint of regional development, it is desirable that as

many public projects as possible remain as future possibilities. If that is the case, the alternative (B-3) is the best.

4. In that alternative, the container berth, which should be constructed at once, will be located in the east area of the site where there are relatively good natural conditions for port development, similar to the development of the existing private piers. The bulk terminal will be developed on the west side, that is, the side of the power plant, where its fuel is stored.

5. The container terminal will be able to develop to the east at need without any interference with the bulk zone.

6. However, it requires some compensations for private piers. The piers are not so large, which means that the cost would not be prohibitively high. The fishing Port of Punta Gorda might be available for them under special conditions. Otherwise, the Port of Cutuco could be utilized for the time being. On the other hand, the power plant might be expected to share the expenses for the common channel and basin.

(Note)

7. The power plant project should be paid special attention to. A power plant needs a wide area close to the waterfront and a deep pier for handling of its fuel. That is, the requirements of that project are similar to those of this project. Therefore, it is natural that the selected sites would be more or less the same.

8. Regarding the marina, it could be moved to the west side of the Port of Punta Gorda, if it should be located in the land of CORSAIN. Otherwise, it would be better to move it to the town area apart from the cargo flow.

## **17.2 New Alternative on the Existing Port of Cutuco**

1. In the previous section, all the alternatives are examined on the basis that the existing Port of Cutuco will be utilized in some way by concession. Taking into consideration the cost estimate of (A-1), more

economical alternatives could be formed.

2. If the west part of alternative (A-1) is shifted slightly to the sea and if expensive dredging of the hard rock under the quay structure (around 8% of the total cost) could be avoided, the construction cost is expected to decrease remarkably (i.e. alternative (C-3)). Instead, the Port of Cutuco should be partially demolished.

3. Therefore, this case will be effective if no competitors should apply for the concession or no proper plans are submitted. However, the area behind the port is already developed ( it is wider and more level than the other sites), and it has a good access to the hinterland. Further it would not affect the other existing projects.

4. In order to examine the alternatives which require the demolition of the existing Port of Cutuco, the following alternatives are prepared and examined.

1) Alternative Plan C-1 (see Figure 17-2-1)

5. The existing pier of Cutuco is totally demolished. The same sound layer in the subsoil is utilized as much as possible for the foundation of the new structure. However, a lot of land reclamation will be necessary.

2) Alternative Plan C-2 (see Figure 17-2-2)

6. This alternative occupies the position between the previous (C-1) and the following (C-3). The alternative (C-1) is shifted to the land.

3) Alternative Plan C-3 (see Figure 17-2-3)

7. This plan is the one modified slightly from (A-1) as explained first in this section to avoid the hard rock dredging. The quay face line is almost in accordance with that of the Port of Punta Gorda. The necessary length(300+280+280m) is almost the same as the distance between the west end of Punta Gorda and the east end of Cutuco.

8. Based on the additional structural design and the cost estimate of three alternatives, the alternative (C-3) is the most economical of the three. ( See the overall comparison of construction cost among seven alternatives

shown in Figure 17-2-4.)

9. Even of all the seven alternatives (A-1), (B-1)-(B-3), and (C-1)-(C-3), the alternative (C-3) is the most economical for the Master Plan. ( As for the Short-Term Plan, it is the second best. However, the difference between the most economical (B-2) is only 1 % and could be negligible, considering the accuracy of cost estimates at this stage.)

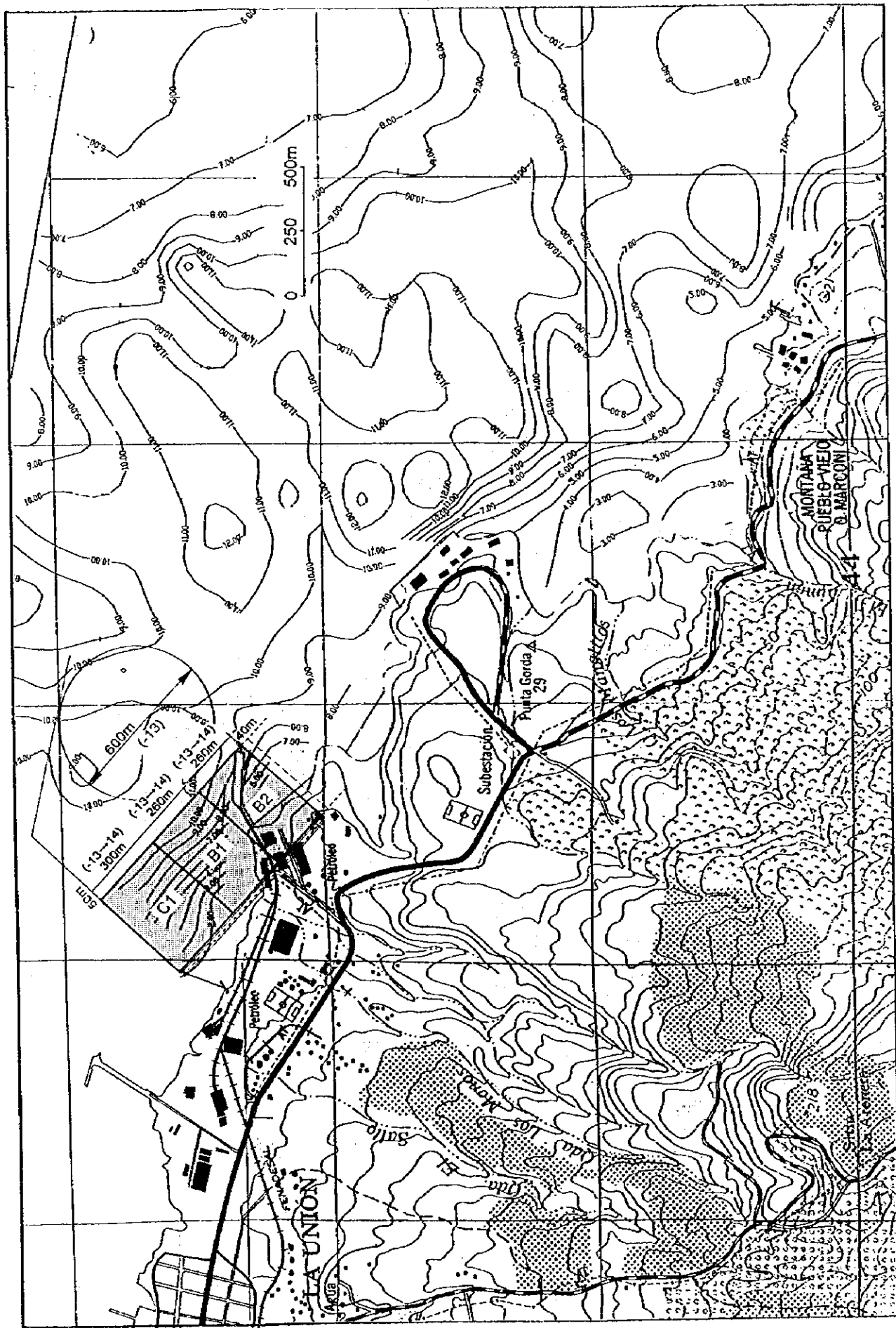


Figure 17-2-1 Layout Plan for Site (C-1)



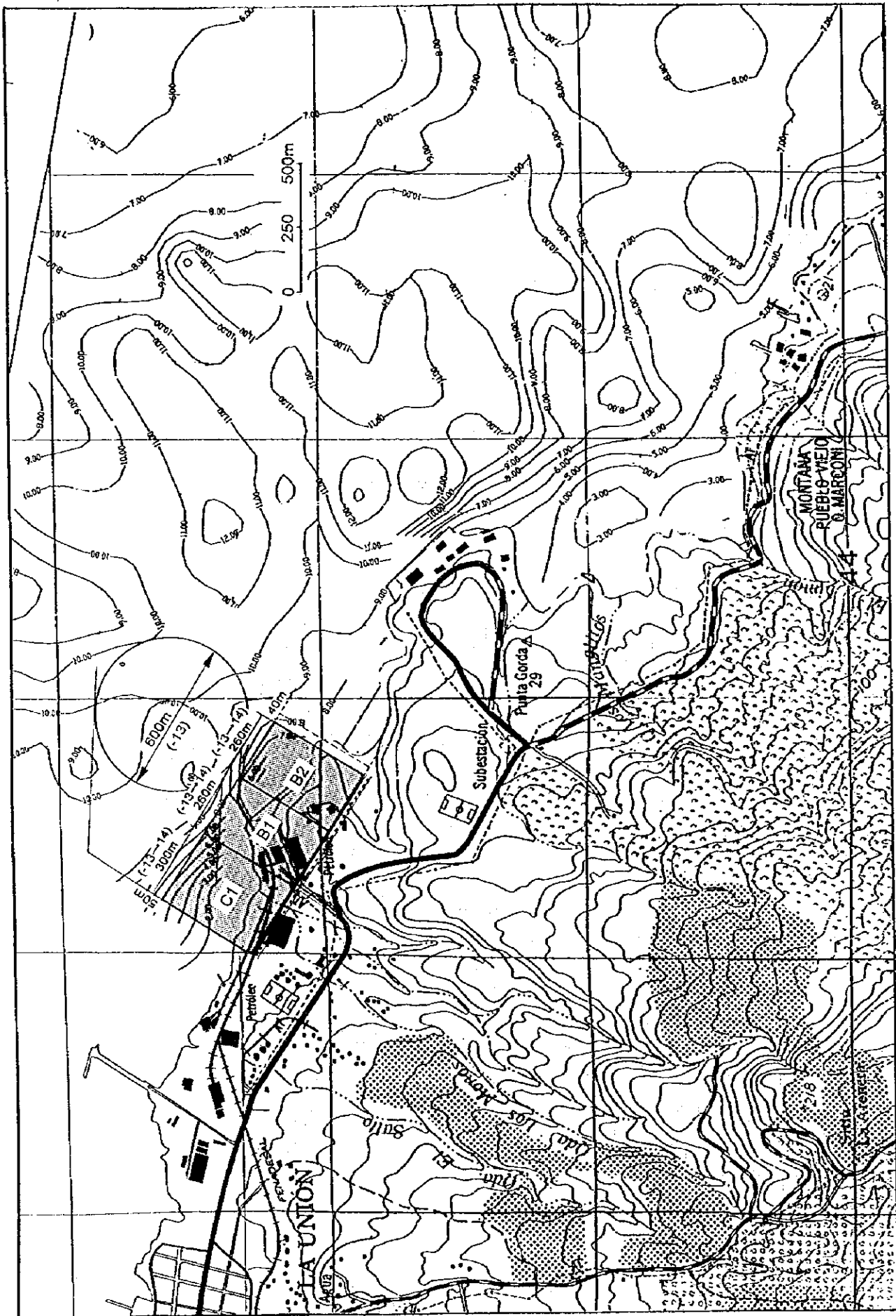


Figure 17-2-2 Layout Plan for Site (C-2)

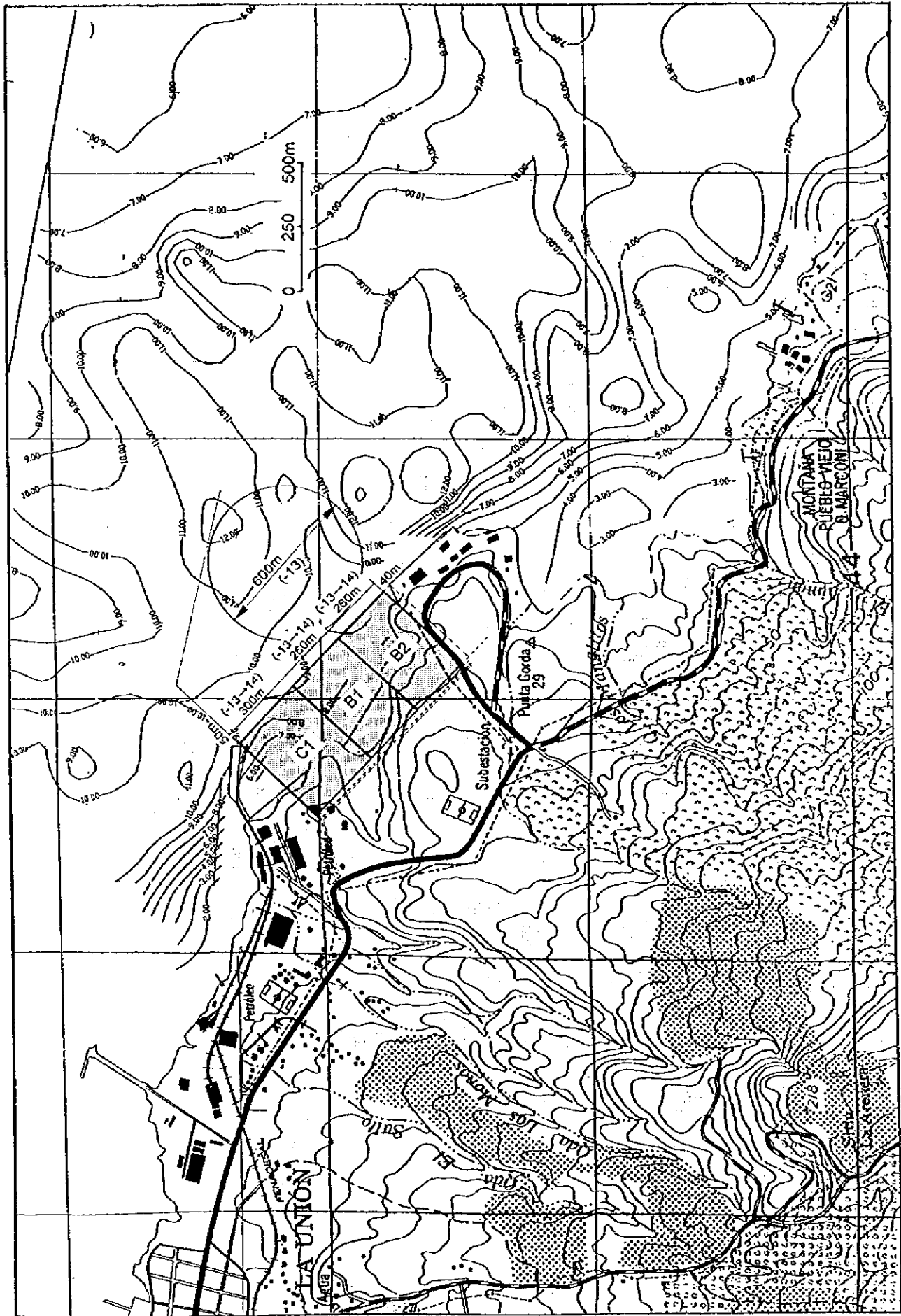
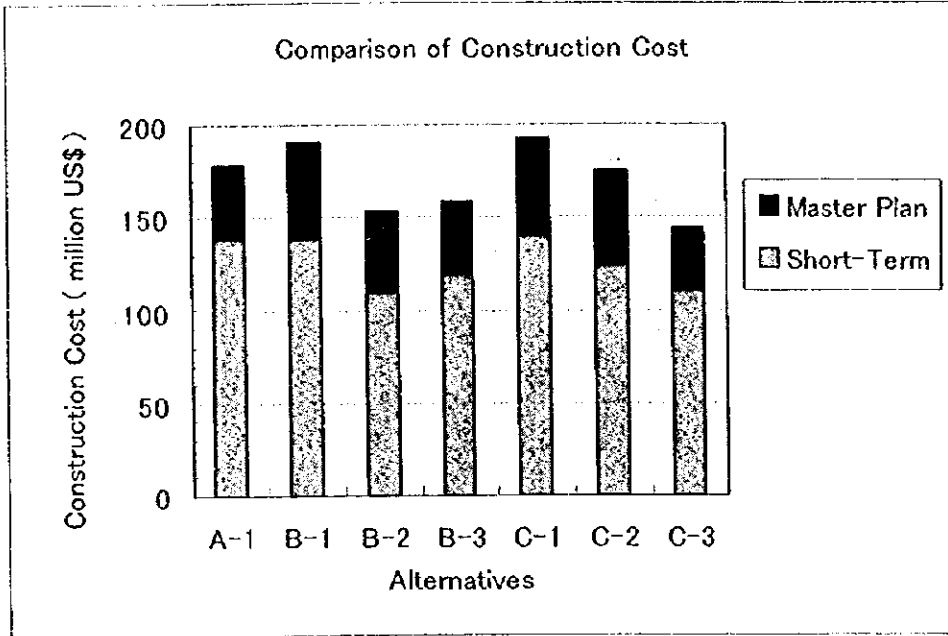


Figure 17-2-3 Layout Plan for Site (C-3)



(Note) Exchange Rate: 1 US Dollar = 8.75 Colon = 130 Yen

Figure 17-2-4 Overall Comparison of Construction Cost among Seven Alternatives

**PART III**  
**SHORT TERM PLAN AND**  
**FEASIBILITY STUDY**



## **18. SHORT TERM DEVELOPMENT PLAN**

### **18.1 Basic Policy for Short Term Plan**

#### **18.1.1 Short Term Prospect for the development of the Port of La Union in El Salvador**

(1) The economic activity of El Salvador has continued to grow steadily since the peace accord of 1992. To sustain this growth, the two national ports, the Port of La Union and Acajutla, have to increase their capacity and productivity corresponding to the increase of export and import cargoes and the progress of containerization.

(2) In particular, the Port of La Union should be improved immediately as a reliable and efficient container port on the Pacific, taking advantage of its geographical and natural conditions. It will also handle the other cargoes for the eastern region. On the other hand, the Port of Acajutla would focus on general and bulk cargoes for the western and central region.

(3) At the same time, the Port of La Union is expected to contribute to the development of the eastern region. Among various kinds of regional development, EPZs (Export Processing Zones), which have already been established and developed in the western and central region, related to port activities should be vigorously promoted.

(4) The modernization of the port sector is included in the most important policies in El Salvador. CEPA should continue to take the initiative in this respect together with the central government. Private sector will be allowed to participate in port services as much as possible under the overall control of the public sector.

(5) Each port should make efforts to expand cargo volume through modernization including private participation in port services. Both competition and cooperation between the ports could be expected.

### **18.1.2 Objectives of the Short Term Plan**

1. Taking into consideration various requirements for the Port of La Union and traffic demand through the port, the scale and substance of the physical and administrative development will be identified as an intermediate step of the Master Plan. The main objectives of the short term plan with target year of 2005 are summarized as follows:

- (1) Immediate establishment of modern container terminal as main gateway of El Salvador
- (2) Successive construction of required berths for other cargoes for the eastern region
- (3) Reinforcement of effective administration and management system for the public ports
- (4) Efficient port operation and cargo handling system, including private participation
- (5) Economical investment, including appropriate financing, for smooth implementation of the project
- (6) Enhanced cooperation for promotion of the regional development
- (7) Necessary environmental consideration

## 18.2 Demand Forecast in 2005

1. According to the Table 10-3-37, 10-3-38, 10-3-39, 10-3-40, 10-4-2 and 10-4-3 in Chapter 10 of PART II, traffic projection volume in 2005 is shown in following Tables 18-2-1, 18-2-2 and 18-2-3.

**Table 18-2-1 Cargo Traffic Projection in 2005**

unit : ton

		El Salvador total volume	Acajutla	La Union		
				El Salvador	Honduras	Total
Import	General Cargo	582,000				
	non container	321,000	256,800	64,200		64,200
	container	261,000	121,918	139,082	7,282	146,364
	(TEU)	41,745	19,500	22,245	1,110	23,355
	Dry Bulk Cargo	991,000	792,800	198,200		198,200
	Liquid Bulk Cargo	1,104,000	883,200	220,800		220,800
	sub total	2,677,000	2,054,718	622,282	7,282	629,564
Export	General Cargo	219,000				
	non container	72,000	57,600	14,400		14,400
	container	147,000	68,666	78,334	7,282	85,615
	(TEU)	41,745	19,500	22,245	1,110	23,355
	Dry Bulk Cargo	126,000	100,800	25,200		25,200
	Liquid Bulk Cargo	157,000	125,600	31,400		31,400
	sub total	502,000	352,666	149,334	7,282	156,615
	Total	3,179,000	2,407,384	771,616	14,563	786,179
Domestic	Liquid Bulk Cargo	200,000		200,000		200,000
	Total	3,379,000		971,616	14,563	986,179

**Table 18-2-3 La Union Port Calling Vessel Projection in 2005**

Type of Vessel	Year 2005			
	Import		Export	
	Average Size DWT	Calling frequency Number	Size DWT	Calling frequency Number
General Cargo	17,900	17	17,900	2
General + Container	19,400	105 (87)	19,400	91(87)
Dry Bulk cargo	29,300	11	16,600	13
Tanker	22,200	25 (1)	20,400	3 (1)
Gas Tanker	8,300	9		
Oil Tanker	22,200	18		

Note : ( ) Import and export activity in same time



Table 18-2-2 Container Box Handling Number in 2005

unit : number

	Total Volume (ton)	Acajutla						La Union							
		40'			20'			40'			20'				
		Volume	Laden	Empty	Total	Laden	Empty	Total	Volume	Laden	Empty	Total	Laden	Empty	Total
Import	268,282	121,918	3,384	1,251	4,635	7,433	2,768	10,250	146,364	4,053	1,499	5,552	8,961	3,315	12,276
FCL			3,214			5,762				3,850			6,900		
LCL			169			1,721				203			2,061		
Export	154,281	68,666	1,942	2,693	4,635	4,289	5,961	10,250	85,615	2,366	3,186	5,552	5,233	7,043	12,276
FCL			1,806			2,788				2,200			3,401		
LCL			136			1,501				166			1,832		
Total	422,563	190,584	5,326	3,944	9,270	11,772	8,729	20,500	231,979	6,419	4,685	11,104	14,194	10,358	24,552
FCL			5,020			8,550				6,050			10,301		
LCL			305			3,222				369			3,893		

## **18.3 Physical Plan of Port Facilities**

### **18.3.1 Basic Consideration for the Short Term Plan in 2005**

1. The Short Term Plan with the target year of 2005 is proposed under the framework of the Master Plan, taking into consideration the request of CEPA.

2. The Master Plans to be considered for the time being are as follows;

(1) "Alternative B-3" on the east side of the Port of Punta Gorda under the given conditions for the Study( excluding the current concession area of the existing Port of Cutuco)

(2) Alternative C-3" to facilitate project implementation if the site around the existing Port of Cutuco becomes available for the Study( that is, in the event of an appropriate proposal is not submitted for the said concession)

3. Basic physical requirement such as the number of berths is the same for both cases. However, the layout plan, especially land use plan, depends on the corresponding available area for port development. In the case of "Alternative C-3", the entire area of the existing Port of Cutuco will be considered as the available area for effective port development.

(Note)

4. For convenience' sake, the facilities of the existing Port of Cutuco is summarized again as follows, the details of which are explained in PART I;

(a) Area

Facility	Area
Infrastructure	31,504 m <sup>2</sup>
Pier <sup>(*)</sup>	5,916 m <sup>2</sup>
Warehouse	21,772 m <sup>2</sup>
Residence	2,770m <sup>2</sup>
Other buildings (Office, maintenance shop, etc.)	1,046 m <sup>2</sup>
Land area and yard	366,997 m <sup>2</sup>
Total	398,501 m <sup>2</sup>

(\*) The transit shed on the pier (2,243m<sup>2</sup>) is included.

(b) Pier

Berth	Length	Width	Depth
North	152 m	7.6 m	9.15 m
South	174 m	6.1 m	7.62 m

(c) Warehouse

No.	Construction	Area (m <sup>2</sup> )	Remarks
1	1910	2,243	Transit shed on the pier
2	1955	2,388	
3	1958	9,327	
4	1977	2,557	
5	1979	4,096	
6		3,404	Custom office

(d) Pipeline

5. Connects tanks on land with the pier. Three (3) are private and two(2) are of CEPA.

(e) Land area and yard

6. For the open storage of the cargoes with a total area of 366,997 m<sup>2</sup>.

(f) Other buildings

7. An administration building, which includes a CEPA-FENADESAL office and a custom office, and a maintenance shop and a materials deposit.

(g) Cargo handling equipment

8. One(1) scale, five(5) forklifts and three(3) front-loaders.

(Source: Public Tender CEPA 20/96, September, 1996 )

9. According to CEPA officials, the total area of 398,501 m<sup>2</sup> (570,196.41 Vrs<sup>2</sup>) includes the area in the center for a customs office (24,980.06 Vrs<sup>2</sup>) and that in the south along the existing road for a private company ( International Heart Technologies El Salvador de C.V.) (25,614.50 Vrs<sup>2</sup>). The former is available for port development since it is national land.

10. In addition, the following real estate/ buildings are now for rent in the said area (FENADESAL, 519,601.85 Vrs<sup>2</sup> ). It is understood, however, that all contracts will expire by the year 2000.

No.	Lessee	Real estate/ building	Area (m <sup>2</sup> )	Expiration
1	CEL	Land	10,793	Dec. 4, 2000
2-1	Mars, S.A. de C.V.	Warehouse	3,718	Dec.31,1998
2-2	Mars, S.A. de C.V.	Land	2,503	Dec.31,1998
2-3	Mars, S.A. de C.V.	Warehouse	206	Dec.31,1998
3	Shell	Land	8,345	Dec.31,1998
4	Importadora Industrial	Land	1,258	Expired
5	Corte Suprema de Justicia	Warehouse	1,148	Dec.31,1998
6	Salvamar	Residence		Dec.31,1998

### 18.3.2 Development Schedule

11. The development schedule of each berth is determined based on the required number of berth, which is increasing year by year in general. That is, a new berth or an additional berth should be constructed by the year when the berth occupancy exceeds the existing capacity.

12. Figure 18-3-1 demonstrates how the total berth occupancy by terminal will increase in future (1996 to 2020), concerning (a) the container terminal for container/ general cargoes, (b) the bulk terminal for dry/ liquid bulk and oil cargoes, and (c) both terminals for all the cargoes, respectively.

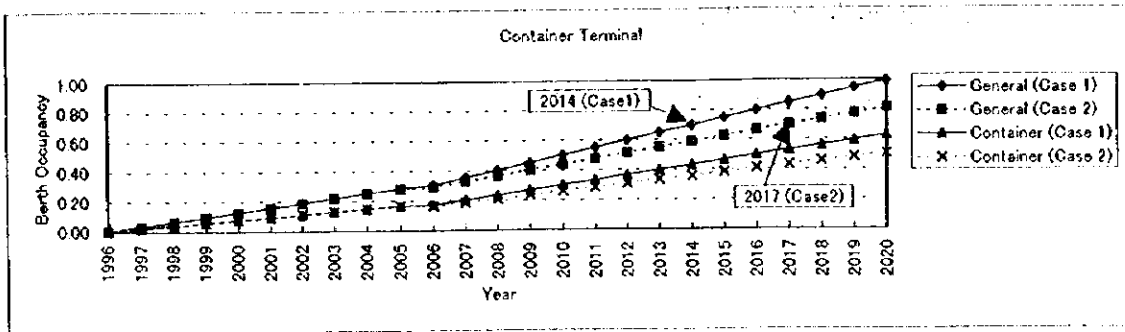
13. Case 1 and Case 2 are corresponding to the cases for traffic projection (see Chapter 10, PART II). The cargo volume is the same for both cases till 2005, and that in 1996 is simply assumed at zero.

14. Cargo handling efficiency, the other factor affecting the berth occupancy, is already set up for the target year of 2005 and 2015 in 11.1.3, PART II. Container handling efficiency will be improved, and is assumed to be the same as the target level of the Master Plan from 2006.

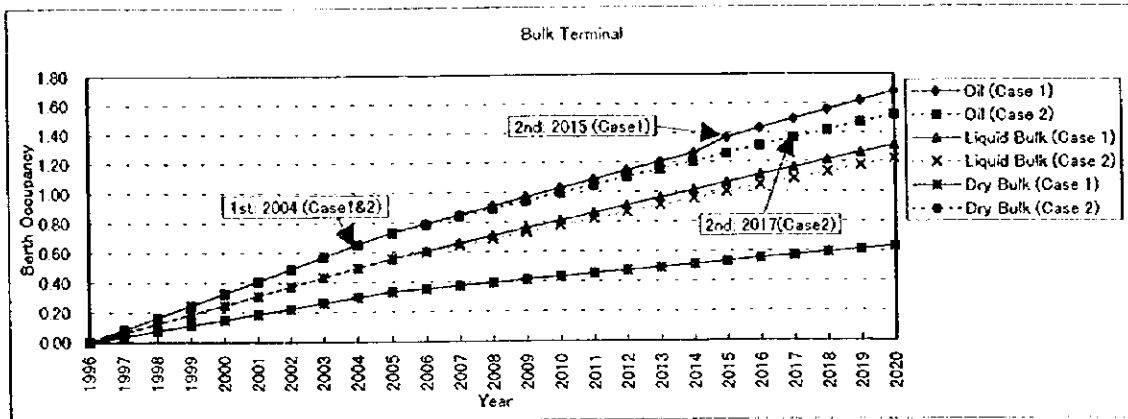
15. The appropriate berth occupancy ratio by berth is said to be 0.6-0.7 for port planning. Using the same method as in the Master Plan, the saturating year of the existing berth is calculated and indicated in the said figures.

16. For example, if the container terminal is utilized exclusively for the container/ general cargoes other than dry/ liquid bulk and oil cargoes, the container terminal will reach its capacity in 2014 for Case 1 or in 2017 for Case 2. By the next year an additional berth should be prepared.

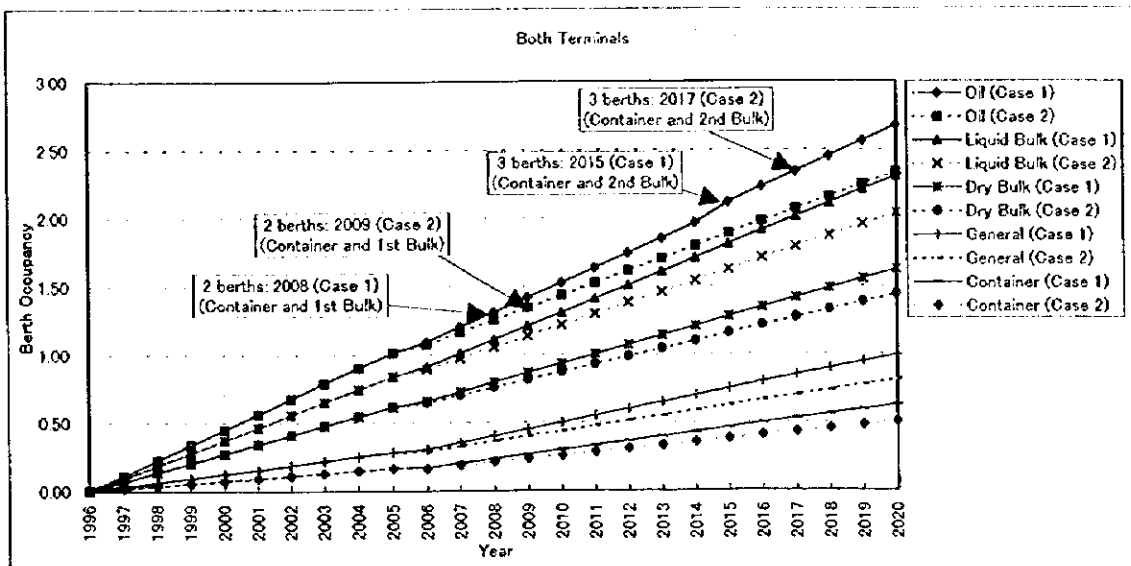
17. In case that some interchange of utilization between the container terminal and the bulk terminal is practically allowed by the target year of the Master Plan, the third berth, namely the second bulk berth, could be prepared as late as 2008 for Case 1 or 2009 for Case 2 ( also see 11.5, PART II). Even in such a case, it should be remembered that two berths are required in the target year 2005 of the Short Term Plan.



(a) Container Terminal



(b) Bulk Terminal



(c) Both Terminals

Figure 18-3-1 Berth Occupancy Increase and Saturating Year of the Existing Berth Capacity

### 18.3.3 The Short Term Plan

18. Physical plan in short term stage is described in this section.

#### (1) Wharf

19. One container terminal and one bulk terminal is planned to be developed. The corresponding berths are consecutive for convenient use and easy expansion in future.

##### One(1) container berth

Principally for container ship and general ship

Length: 300m

Depth<sup>1)</sup>: -13 m (capable of being deepened up to -14 m in future)

Gantry crane: two(2) of Panamax type

##### One(1) bulk berth

Principally for dry bulk ship, liquid bulk ship and oil barge

Length: 260m (capable of being extended up to 280 m in future)

Depth<sup>1)</sup>: -13 m (capable of being deepened up to -14 m in future)

\*) at berthing pocket for a ship just in front of the quay wall  
( area: 50 m in width along quay wall of total 560m )

#### (2) Terminal Area

##### a) For container cargo

20. Terminal area of 12 ha ( berth length of 300 m by depth of 400 m ) for container berth is assured. This area consists of apron, container yard and general cargo area, including reserved area for future expansion.

Apron:	50 m in width
Container yard <sup>1)</sup> :	12,000 m <sup>2</sup> (350 slots)
CFS <sup>2)</sup> :	1,400 m <sup>2</sup>
Maintenance shop:	1,000 m <sup>2</sup>
Terminal office:	1,500 m <sup>2</sup>
Terminal gate:	4 lanes

Transfer crane system<sup>3)</sup>: 4 transfer cranes  
8 tractors  
8 chassises

(Note 1)

21. In order to provide 350 slots, four (4) blocks closest to the quay face will be arranged at first. Around 400 slots will be prepared by this improvement. Two(2) blocks on the ship side will be used mainly for export, with the other two blocks on the land side being for import.

22. In the container yard, the appropriate number of reefer plugs should also be equipped. With reference to other planning examples, a section of 2 bays x 6 rows x 2 tiers on the land side will be assigned as a reefer block with a storage capacity of 24 TEUs, around 5 % of the laden containers( see Table 11-3-1 (c )). Plugs will be installed at both ends of the block in order to be able to accommodate both 20' and 40' containers.

(Note 2)

23. Concerning "Alternative C-3", the existing warehouse will be utilized economically with necessary improvement.

(Note 3)

24. As a further cost saving means, top-lifters might be able to introduced instead of transfer cranes. The cost of a top-lifter is around half that of a transfer crane. It would work as provisional cargo handling system before the transfer cranes are introduced after their service life.

25. In this case, however, the layout of the container terminal should be modified to suit the said equipment. The row number of a container storage block in the yard will be reduced to two (or three ) for top-lifters from six for transfer cranes. In addition, the space between blocks will be widened to 15 m from 6 m for the operation of top-lifters.

26. The wide area to be required for top-lifters at the short term stage could be covered by the area planned for transfer cranes at the Master Plan stage. However, this is not recommendable from the viewpoints of continuity



of cargo handling system to cope with the increase of container and the complexity of practical operation and maintenance.

27. Basic flows of the container on both land side operation (receiving and delivery) and quay side operation ( loading and unloading) are added onto Figure 11-3-3, PART II, as shown in Figure 18-3-2 below. For effective terminal operation, the Transfer Crane System has been adopted here.

28. In this system, containers are quite easily spotted on/from yard tractor/chassis by gantry cranes and transfer cranes, which are efficient and not prone to accidents. Containers are carried by yard tractors between both cranes. They move in the same direction in a simple manner.

29. In the figure, the main traffic comes from the east ( the direction of the town area) to the terminal and goes out vice versa keeping to the right on the access road. In the terminal, flow of containers is drawn anticlockwise on land side operation and clockwise on quay side operation so that the traffic crossing inside the terminal gate is avoided.

30. In this operation, ships are desirable to moor at the quay on their right side so that the door of the container on the ship, which always faces the stern, coincides with that on the tractor/chassis on the apron. ( Recently, refrigerated containers also tend to be loaded on the ship with the door facing the stern since the freezing machine has been improved to withstand the water hammer damage.)

31. In case that ships moor at the quay on their left side, the container flow in the terminal will be totally reversed. As a result, the traffic crossing inside the terminal gate is brought about.

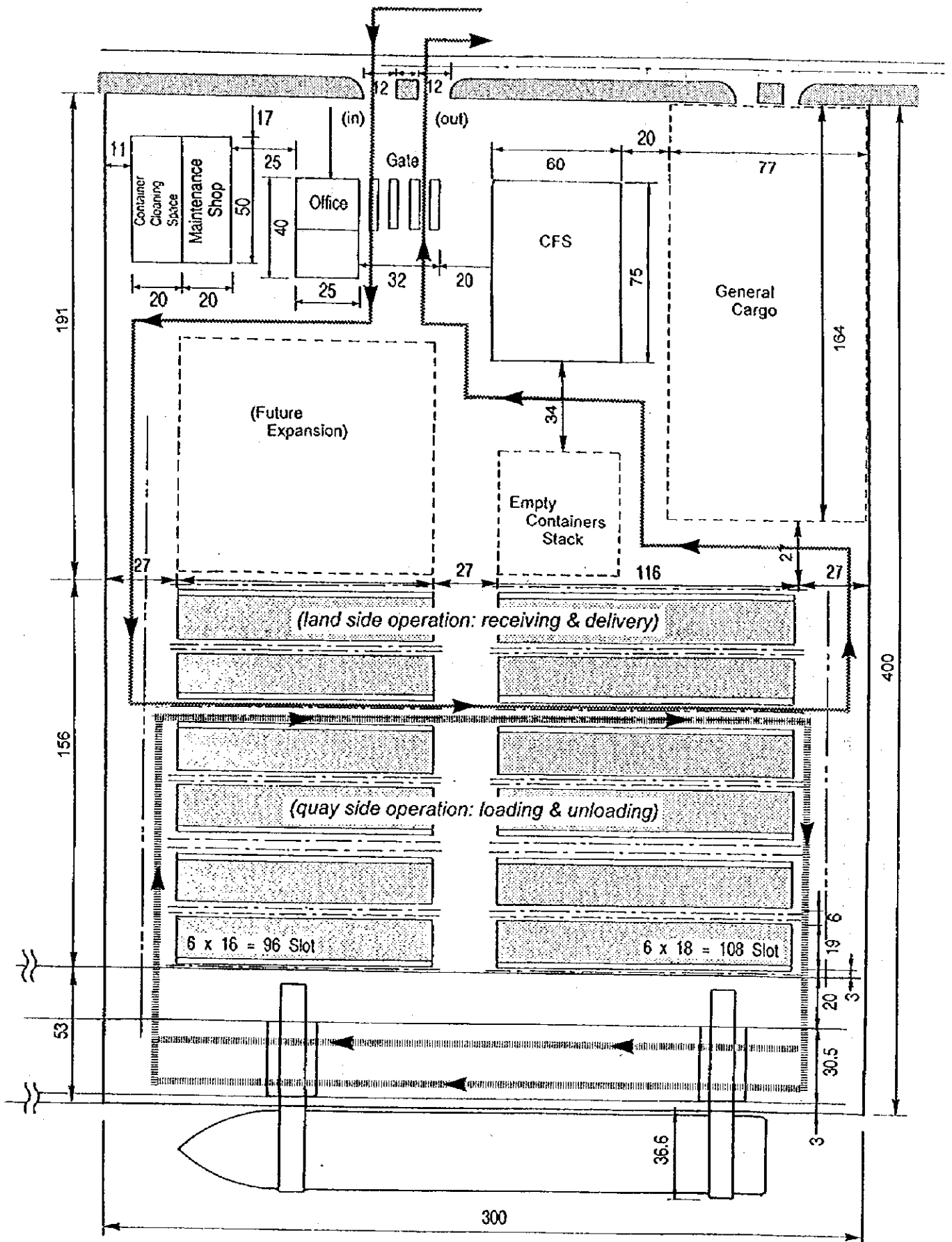


Figure 18-3-2 Basic Flows of the Container

b) For General Cargo

32. General cargo is handled by the same berth as container cargo. Required area behind it is calculated for transit shed and sorting yard/warehouse and open shed in 2005 as follows (see Table 11-3-6 and 7);

Transit shed and sorting yard:	1,051 m <sup>2</sup> for 70,740 ton/year
Warehouse and open shed:	1,871 m <sup>2</sup> for 39,300 ton/year

33. In general, the area allocated for transit shed (with a roof) and that for sorting yard (not covered) are determined according to whether cargo must be protected from rain or not. Required area for warehouse or open shed are also determined in a similar way.

34. Transit sheds and warehouses require extra structures( simple roofs and their supports) compared with open storage. Even if the expense is not great, their construction will be held down as much as possible as they will likely be demolished in future as containerization progresses. From this viewpoint, current cargo handling system at Acajutla could be referred to and employed at need.

35. General cargo (*non* container) distributed to La Union in 2005 is calculated by cargo type as follows in the same way as in 10.3, PART II.

Table 18-3-1 General Cargo (Non Container) by Cargo Type in 2005

	Total Volume (ton)	Non-containerization ratio	Distribution to La Union ( 20% ) ( ton)
<b>Import</b>			
Iron, vehicle	241,000	0.9 = 1-0.1	43,400
Others	341,000	0.321 = 1-0.679	21,900
<b>Export</b>			
Sugar	41,000	1.0 = 1-0.0	8,200
Coffee, others	178,000	0.161 = 1-0.839	5,700

36. Iron and vehicle are generally handled in open space. At Acajutla, the space is not strictly divided into sorting yard or open shed. Most cargoes are transported directly between the ship and open space on land in the port / private storage space outside the port because the existing area on the pier is limited. ( For open space, even the space between warehouses is utilized for iron storage without serious problems.)

37. Among import cargoes other than iron and vehicle, around 60 % are handled in a similar way, while 40 % require covered space. ( Transit shed and warehouse could share a common area. )

38. The majority of export cargoes (95 %) such as sugar and coffee are loaded to ship directly from warehouse, and the remaining 5 % are transported directly from the private storage outside the port to the transit shed.

39. Therefore, the required area for transit shed and warehouse is as follows;

Transit shed

Volume:  $21,900 \times 0.4 + (8,200+5,700) \times 0.05 = 9,455 \text{ ton}$   
Required Area:  $1,051 \times 9,455 / 70,740 = 140 \text{ m}^2$

Warehouse

Volume:  $21,900 \times 0.4 + (8,200+5,700) \times 0.95 = 21,965 \text{ ton}$   
Required Area:  $1,871 \times 21,965 / 39,300 = 1,045 \text{ m}^2$

40. As a result, total of  $1,200 \text{ m}^2$  is required for transit shed and warehouse. On the other hand, the major cargoes such as import iron and vehicle, handled in open space, could be easily controlled with reference to the existing situation at Acajutla as explained above.

( Note )

41. Taking into consideration the possibility of future expansion, the required area for Case 1 is reviewed as follows;

Table 18-3-2 General Cargo (Non Container) by Cargo Type in 2015

	Total Volume (ton)	Non-containerization ratio	Distribution to La Union ( 30% ) ( ton)
<b>Import</b>			
Iron, vehicle	447,000	0.9 = 1-0.1	120,700
Others	708,000	0.242 = 1-0.758	51,400
<b>Export</b>			
Sugar	41,000	1.0 = 1-0.0	8,200
Coffee, others	353,000	0.111 = 1-0.889	11,800

Transit shed

Volume:  $51,400 \times 0.4 + (8,200+11,800) \times 0.05 = 21,560$  ton  
 Required Area:  $2,555 \times 21,560 / 171,990 = 320$  m<sup>2</sup>

Warehouse

Volume:  $51,400 \times 0.4 + (8,200+11,800) \times 0.95 = 39,560$  ton  
 Required Area:  $4,550 \times 39,560 / 95,550 = 1,883$  m<sup>2</sup>

42. As a result, total of 2,200 m<sup>2</sup> is required for transit shed and warehouse. In this case, an area of 1,000 m<sup>2</sup> should be reserved for future expansion.

43. As well as CFS, the existing warehouse will be utilized for this purpose in case of "Alternative C-3".

c) For Bulk Cargo

44. Regarding the bulk berth, the aforementioned width of the apron ( 50 m) is assured so as to cope with container handling as well. Gantry cranes should be able to move to the apron of the bulk berth.

45. Required area behind the berth is estimated at 7.4 ha for dry bulk and 4.8 ha for liquid bulk and oil, respectively ( see Table 11-3-9). ( Some companies such as TROPIGAS (gas) and SERTESA (fertilizer) already have their own facilities of a certain scale outside the port area. )

46. In case of "Alternative B-3", as much area around the terminal as

possible, such as the site for landfill materials or vacant lands, should be involved and utilized for the development of the port and related activities.

47. Dangerous cargoes such as diesel oil, butane gas and lubricants are included in liquid bulk. Therefore, an area for liquid bulk should be set apart from the town area as much as possible. In this area many permanent facilities such as tanks will be installed.

48. Required storage capacity for tank is estimated at 22,610 tons in 2005 (see 11.3.3(2)). At Acajutla, these tanks are all installed by private sector.

49. On the other hand, the area for dry bulk is advisable to be located neighboring the container terminal, taking into consideration a possible mutual usage or a future expansion between this area and the area for the container terminal.

50. For dry bulk, required storage capacity is estimated at 11,170 tons to handle the forecasted 223,400 tons in 2005 (see 11.3.3(1)). At Acajutla, fertilizer and sugar are transported directly between ships and private warehouses. It is also true for more than 96 % of the other cargoes (cereals, soybean flour and others).

51. As the latter type is forecasted to represent around 60 % of total dry bulk cargo, the capacity of 250 tons ( $= 11,170 \text{ tons} \times 0.6 \times 0.04$ ) might have to be prepared by public the sector.

52. As to dry bulk cargo handling, a conventional method using ship gear and movable hopper is employed mainly from the economic viewpoint. As cargo handling volume increases, expensive equipment such as pneumatic unloader or similar exclusive system would be examined. These are desirable not only to increase cargo handling efficiency but also from the environmental aspect.

53. In the conventional case, the space left between a ship and the apron should surely be covered with a sheet so that cargo cannot fall into the sea during cargo handling. As well, apron cleaning after handling should be executed without water so that contaminants will not fall into the sea.

54. In case of "Alternative C-3", the existing area of Cutuco will be

utilized in addition. Several old warehouses and tanks are also included there. In case that the existing tanks are utilized, needless to say it is necessary to check their soundness, it is desirable to move their functions to the above-mentioned area in the long term.

### (3) Turning Basin and Access Channel

55. In the Master Plan, the dimensions of turning basin and access channel are determined as follows;

#### Turning Basin

Diameter: 600 m  
Depth: - 13 m

#### Access Channel

Width: 150 m  
Depth: - 12 m (in the La Union Bay)  
- 13 m (outside the bay)

56. At the short term stage, however, the tidal benefit will be fully utilized in order to reduce the dredging cost as much as possible. Since the channel length is as long as 20 km, this will reduce the construction cost considerably.

57. Table 18-3-1 shows the practical draft for ships to enter the Port of Acajutla in 1998.

58. Although large ship size of dry and liquid bulk ships have already reached the Panamax size, even these kinds of ships usually leave a margin, entering the port in practice. The mooring draft of almost all the ships is less than 11 m, which requires that the turning basin and access channel have a minimum depth of 12.1 m (= 11m x 1.1).

59. The amplitude of the tide is approximately 3 m at the spring tide and 1.8 m at the neap tide with a 12 hour cycle at the Port of La Union. The total time when the tide comes up beyond various sea levels per a 12 hour cycle is calculated as shown in Table 18-3-3.

**Table 18-3-3 Time of Tide beyond Various Sea Level per a 12 Hour Cycle**

Tide (Amplitude)	Spring (3 m)	Neap (1.8 m)
(Sea level)		
+1.0 m	7.3 hr	8.3 hr
+1.5 m	6.0 hr	6.0 hr
+2.0 m	4.7 hr	3.7 hr
+2.2 m	4.1 hr	2.6 hr
+2.5 m	3.2 hr	- hr

60. The number of larger ships to call the port will be only one or two a day, and it would take around one hour for them to enter the port. Therefore, the depth of turning basin and access channel could be reduced as below for the time being. The turning basin and channel work with a depth of more than 13 m, corresponding to the wharf depth, for more than 2 hours during an appropriate tide.

**Turning Basin**

Diameter: 600 m  
 Depth: - 11 m

**Access Channel**

Width: 150 m  
 Depth: - 11 m (in the La Union Bay)  
 - 11 m (outside the bay)

61. Regarding the other types of ships such as general cargo ships, such considerations are not necessary at the short term stage.



**Table 18-3-4 : Mooring Draft of Ships by Ship Type  
at the Port of Acajutla in 1998**

General Cargo								
Tonnage(DWT)	-10000	-20000	-30000	-40000	-50000	-60000	Total	Share(%)
Full load draft(m)	(-8.5)	(-9.7)	(-10.9)	(-11.7)	(-12.4)			
Mooring draft(m)								
-5	22	19	8	1			50	26.6
-6	10	40	7				57	30.3
-7	3	31	12				46	24.5
-8	2	16	6				24	12.8
-9		7	2				9	4.8
-10			1				1	0.5
-11							0	0.0
-12				1			1	0.5
-13							0	0.0
<b>Total</b>	<b>37</b>	<b>113</b>	<b>36</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>188</b>	<b>100.0</b>
<b>Share(%)</b>	<b>19.7</b>	<b>60.1</b>	<b>19.1</b>	<b>1.1</b>	<b>0.0</b>	<b>0.0</b>	<b>100.0</b>	

Dry Bulk								
Tonnage(DWT)	-10000	-20000	-30000	-40000	-50000	-60000	Total	Share(%)
Full load draft(m)	(-8.5)	(-9.7)	(-10.9)	(-11.7)	(-12.4)			
Mooring draft(m)								
-5	2	6	5	1			14	17.7
-6	1	0	2	2	1		6	7.6
-7	1	1	0	3			5	6.3
-8		4	4	4		1	12	15.2
-9		9	1	1			11	13.9
-10		1	10	6			17	21.5
-11			6	6			12	15.2
-12			1				1	1.3
-13							0	0.0
<b>Total</b>	<b>4</b>	<b>21</b>	<b>29</b>	<b>23</b>	<b>1</b>	<b>1</b>	<b>79</b>	<b>100.0</b>
<b>Share(%)</b>	<b>5.1</b>	<b>26.6</b>	<b>36.7</b>	<b>29.1</b>	<b>1.3</b>	<b>1.3</b>	<b>100.0</b>	

Liquid Bulk								
Tonnage(DWT)	-10000	-20000	-30000	-40000	-50000	-60000	Total	Share(%)
Full load draft(m)	(-8.0)	(-9.8)	(-10.9)	(-11.8)	(-12.7)	(-13.6)		
Mooring draft(m)								
-5	18	2	1	1			22	31.0
-6	6	2	0				8	11.3
-7	7	4	4				15	21.1
-8	2	3	1			3	9	12.7
-9	2	5	2			1	10	14.1
-10			1		2		3	4.2
-11			1	2			3	4.2
-12							0	0.0
-13						1	1	1.4
<b>Total</b>	<b>35</b>	<b>16</b>	<b>10</b>	<b>3</b>	<b>7</b>	<b>0</b>	<b>71</b>	<b>100.0</b>
<b>Share(%)</b>	<b>49.3</b>	<b>22.5</b>	<b>14.1</b>	<b>4.2</b>	<b>9.9</b>	<b>0.0</b>	<b>100.0</b>	

Liquid Bulk (Gas)								
Tonnage(DWT)	-10000	-20000	-30000	-40000	-50000	-60000	Total	Share(%)
Full load draft(m)	(-9.0)	(-11.0)	(-12.0)		(-13.5)			
Mooring draft(m)								
-5	2						2	8.3
-6	11						11	45.8
-7	9	1					10	41.7
-8	1						1	4.2
-9							0	0.0
<b>Total</b>	<b>23</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>100.0</b>
<b>Share(%)</b>	<b>95.8</b>	<b>4.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>100.0</b>	

Source: CIEPA

62. As navigation aids, two tugboats of 3,000 HP and pairs of buoys placed at intervals of around 2 km and corners of turning basin and access channel are required especially at dredged places.

### (3) Access Road

63. An access road of 2 lanes is planned, coordinating the alignment of the existing road and the land use around the port. The road must be sufficiently wide to allow for 4 lanes to cope with the future traffic increase.

64. In addition, an alternative road bypassing the town area is mapped out roughly. It is vitally important to connect the port with the principal network of national roads in order for cargoes to be gathered and distributed smoothly. Although further investigations will be necessary concerning its exact alignment, it should be realized as early as possible through coordination with related persons.

65. In the same sense, the American Highway from San Miguel to La Union is paved but worn out by heavy traffic. Although it serves as minimum access to the port, it should be improved at an early occasion. (On the other hand, access to the competing Port of Quetzal has already been improved, even from the Port of Acajutla.)

### (4) Temporary Measures for Passenger Cruisers

66. As well as the above mentioned functions of the port related to cargo flow, the contribution to the regional development by tourism is also expected. There are some attractive places such as beautiful beaches and islands around the site.

67. Last year three passenger ships of 2,000 to 25,000 GT called at the Port of Acajutla. Passengers enjoyed a short stay visiting the Mayan ruins, beautiful beaches or the capital around the port.

68. Like the Port of Acajutla, some cruising companies have started to try to call at La Union. Passenger ships can also function as hotels. Therefore, transportation facilities such as pier and public bus are minimum requirements for the time being. CORSAIN is also planning to utilize and develop the Port of Punta Gorda as a tourism port.

69. The Port of La Union, equipped with only two berths at the short term stage, is planned principally as a container handling port. Therefore, container liner should be given first priority. In general, however, passenger ships have priority over other cargo ships. Besides, it is not desirable to handle cargoes and passengers together at the same terminal from the viewpoints of security.

70. Taking the aforementioned in mind, the strategy to accommodate passenger ships can be considered as follows;

(a) For the time being, when the berth occupancy is not so high till around 2010, passenger ships are allowed to call the port, but the arrival should be coordinated so not to fall on the same day for the container liner as much as possible.

(b) Passengers should be controlled on land, for example, by the immediate arrangement of public buses for the destinations on the apron in order to keep them from entering the cargo handling area.

(c) At the same time, the study on potential market and the promotion for cruising should be continued together with the authorities concerned.

(d) In case that the traffic demand is sufficient to develop one berth, an exclusive terminal for passenger ships should be planned separate from the cargo handling area.

(e) For the Alternative C-3, the west revetment of the terminal, for which the existing access bridge to the pier of Cutuco is expected to be utilized as partial structure, could work as tentative berth with a depth of -7.5 m and a length of 220 m for 15,000 GT. At the post Master Plan stage, its principal structures will be removed and utilized for another revetment.

#### (5) Layout Plan

71. Layout plans are considered under the conditions of minimum cost for investment and continuity of utilization of port facilities. The Layout Plans for Alternative B-3 and for Alternative C-3 are shown in Figure 18-3-3 and in Figure 18-3-4, respectively. The container terminal has been planned on the town side in both cases. Next to it, the first bulk terminal is located.

72. In Alternative B-3, the second bulk terminal, which will be constructed later, will be located around private shrimp piers in use. ( Some time allowance for coordination with them could be assured if necessary. From the planning viewpoint, it is desirable that these kinds of activities should be brought together at the fishing Port of Punta Gorda with other shrimp boats. )

73. For future expansion of the container terminal, the area the container terminal and between the project of the power plant is so important. For that purpose, it is recommended the direction of the plant pier and the layout plan on land should be modified slightly to afford space for container terminal expansion before the power plant is realized.

74. On the other hand, the second bulk terminal in Alternative C-3 can be constructed easily between the first bulk terminal and the Port of Punta Gorda. The west side of the container terminal should be reserved for consecutive expansion of this terminal in future. The existing area of Cutuco could also be used for future expansion.

75. Figure 18-3-5 shows the entire plan of the channel and turning basin, which is basically the same as in Figure 11-3-4, PART II, with the exception of the depth. At the short term stage, dredging will be executed only up to - 11 m at channel and turning basin, while berthing pockets in front of the quay face are -13 m deep.

76. In addition, rough alignment of the road bypassing the town area is shown in Figure 18-3-6. It is necessary to conduct the study on the exact alignment as aforementioned.