b) Conversion factor for unskilled labor

26. As the wages paid to unskilled labors by a project are usually far above the opportunity cost, these market wages should not be used for calculation of the economic value of the unskilled labors. Considering the labor market, the labor is usually provided from the agricultural sector and the marginal wage rate is calculated based on the labor market in the agricultural sector. Therefore, in this study, the economic cost of unskilled labor is estimated based on a simplified measure of the opportunity cost considering the productivity of the agriculture sector. The conversion factor for unskilled labor is calculated as follows;

$$CFL(Unskilled) = \frac{Opportunity\ Cost}{Nominal\ Wages} \times CFC$$

$$= 9{,}037\ /\ 17{,}291 \times 0.954 = 0.499$$

Where, CFL : The conversion factor for unskilled labor
Opportunity Cost : Estimate agricultural workers cost S/.9,037 / Day
(Source : Central Bank of Ecuador, INEC, estimated by the study team)
Nominal Wages : Unskilled labor cost S./17,291 / Day
(Source : Part II Chapter 5 Table II-5-4)

D. Costs

27. The project costs must be converted from market prices into economic prices for the economic analysis. The costs arising from the implementation of this project are as follows:

1) Construction Costs

28. Construction costs are estimated in Chapter 6 of this part. Construction costs are converted by multiplying the market costs by the conversion factor for construction estimated in Section C. Economic Price of this part. Table III-9-4 shows construction costs of the project to be analyzed, divided into local and foreign currency portions at economic prices. The annual construction costs at economic prices are shown in Table III-9-5.

Table III-9-4 Construction Cost at Economic Price

Case X
Unit: Million sucres

Facilities		Construction Costs Market Price	Foreign Portion Economic Price	Local Portion Non-Traded Goods	Skilled Labor	Unskilled Labor	Total Market Price	Economic Price	Overall Conv. Factor	Construction Costs Economic Price
	Conversion Factor		1.000	0.965	0.954	0.499				
X-1	Container Terminal									
1	Wharf	22,131	8,963	10,089	2,240	839	13,168	12,291	93.3%	21,254
2	Reclamation	85	11	34	40	4	78	73	93.7%	90
3	Pavement	174	39	110	19	6	135	127	94.1%	168
4	Dredging	190	156	17	11	6	34	30	87.6%	185
	Sub-Total	22,590	9,175	10,251	2,309	855	13,415	12,522	93.3%	21,698
X-2	Multi-Purpose Terminal									
1	Wharf	15,528	6,289	7,079	1,571	589	9,239	8,624	93.3%	14,913
2	Revetment	1,702	235	1,204	199	65	1,467	1,384	94.3%	1,619
3	Reclamation	1,255	226	453	527	49	1,029	964	93.7%	1,190
4	Pavement	613	131	388	67	23	478	448	94.1%	585
5	Road	130	29	82	14	5	101	95	94.1%	124
	Sub-Total	19,229	6,916	9,205	2,378	729	12,312	11,516	93.5%	18,432
X-3	Service Boats Area									
1	Pontoon	291	291	0	0	0	0	0		291
	Sub-Total(Civil Work)	42,109	16,382	19,456	4,688	1,584	25,727	24,037	93.4%	40,419
B	Utilities	1,623	639	148	177	61	983	919	93.4%	1,558
C	Cargo Handling									
1	Gantry Crane	19,858	19,858	0	0	0	0	0		19,858
2	Straddle Carrier	8,296	8,296	0	0	0	0	0		8,296
	Sub-Total	28,154	28,154	0	0	0	0	0		28,154
D	Total Cost (A,B,C)	11,886	45,175	20,201	4,855	1,645	26,711	24,956	93.4%	70,131
E	Engineering Service	3,031	3,031	0	0	0	0	0		3,031
F	Physical Contingency	3,202	1,277	1,256	549	121	1,925	1,798	93.3%	3,073
	Grand Total	78,120	49,483	21,457	5,413	1,766	28,638	26,752	93.4%	76,235

Case Y
Unit: Million sucres

Facilities		Construction Costs Market Price	Foreign Portion Economic Price	Local Portion Non-Traded Goods	Skilled Labor	Unskilled Labor	Total Market Price	Economic Price	Overall Conv. Factor	Construction Costs Economic Price
	Conversion Factor		1.000	0.965	0.954	0.499				
X-1	Container Terminal									
1	Wharf	22,131	8,963	10,089	2,240	839	13,168	12,291	93.3%	21,254
2	Reclamation	95	11	34	40	4	78	73	93.7%	90
3	Pavement	174	39	110	19	6	135	127	94.1%	166
4	Dredging	190	156	17	11	6	34	30	87.6%	185
	Sub-Total	22,590	9,175	10,251	2,309	855	13,415	12,522	93.3%	21,698
X-2	Service Boats Area									
1	Pontoon	291	291	0	0	0	0	0		291
	Sub-Total(Civil Work)	22,881	9,466	10,251	2,309	855	13,415	12,522	93.3%	21,987
B	Utilities	904	372	403	95	34	532	497	93.3%	868
C	Cargo Handling									
1	Gantry Crane	19,858	19,858	0	0	0	0	0		19,858
2	Straddle Carrier	8,296	8,296	0	0	0	0	0		8,296
	Sub-Total	28,154	28,154	0	0	0	0	0		28,154
D	Total Cost (A,B,C)	51,858	37,991	10,654	2,404	883	13,947	13,018	93.3%	51,009
E	Engineering Service	2,034	2,034	0	0	0	0	0		2,034
F	Physical Contingency	1,812	749	688	311	68	1,063	992	93.3%	1,741
	Grand Total	55,784	40,774	11,340	2,715	955	15,010	14,010	93.3%	54,784

Table III-9-5 Annual Construction Costs

Unit: Million sucres

	1999	2000	2001	2002	Total
Case X	1,485	15,785	21,763	37,201	76,235
Case Y	997	10,921	10,736	32,131	54,784

2) Maintenance Costs

29. Maintenance costs for the new terminal and the installed handling machinery are considered at economic prices. The costs of maintaining the port facilities are estimated as a fixed proportion (1% for structure, 5% for handling equipment) of the original construction costs excluding the costs of dredging and reclamation costs. Annual maintenance costs at economic price are shown as Table III-9-6 .

Table III-9-6 Maintenance Cost at Economic Price

Case X
Unit: Million sucres

		Foreign Portion	Local Portion	Total	Maintenance (%)	Maintenance Cost
A	Container Terminal					
A-1	Wharf	8,963	12,291	21,254	1	213
A-2	Pavement	39	127	166	1	2
	Sub-Total	9,002	12,418	21,420		214
B	Multi-Purpose Terminal					
B-1	Wharf	6,289	8,624	14,913	1	149
B-2	Pavement	137	448	585	1	6
B-3	Road	29	95	124	1	1
	Sub-Total	6,456	9,167	15,623		156
C	Service Boats Area					
C-1	Pontoon	291	0	291	1	3
D	Utilities	639	919	1,558	1	16
	Total(A,B,C,D)	16,388	22,505	38,893		389
E	Equipment	28,154	0	28,154	5	1,408
	Total Cost	44,542	22,505	67,046		1,797

Case Y
Unit: Million sucres

		Foreign Portion	Local Portion	Total	Maintenance (%)	Maintenance Cost
A	Container Terminal					
A-1	Wharf	8,963	12,291	21,254	1	213
A-2	Pavement	39	127	166	1	2
	Sub-Total	9,002	12,418	21,420		214
B	Service Boats Area					
B-1	Pontoon	291	0	291	1	3
C	Utilities	372	497	868	1	9
	Total(A,B,C)	9,665	12,915	22,580		226
D	Equipment	28,154	0	28,154	5	1,408
	Total Cost	37,818	12,915	50,734		1,633

3) Operation Costs

30. Operation costs consist of personnel costs, administration costs and other costs. Based on the estimation of operation costs in the following Chapter 10, the necessary operation costs for the new terminal are considered as follows:

(a) Personnel Costs

31. The personnel costs which are salary for an additional number of operators and stevedores as estimated in the following Chapter 10 are considered at economic prices. The conversion factor for skilled labor is applied to convert the personnel costs at market prices into the economic prices. Table III-9-7 shows the personnel costs.

(b) Administration and Other Costs

32. Based on the analysis of historical data, the administration and other costs are set at 11% of the personnel costs. The economic prices of the administration costs are calculated by multiplying the market costs by the standard conversion factor. Table III-9-7 shows administration and other costs.

Table III-9-7 Operation Cost

Unit: Million sucres

	Personal Cost Market Price	SCF	Economic Price Personal Cost	Administration Cost (11%)	Operation Cost
Case X	5,377	0.954	5,130	564	5,694
Case Y	2,583	0.954	2,464	271	2,735

4) Replacement Costs for Handling Equipment and Others

33. The additional replacement costs for handling machinery and equipment such as gantry cranes and straddle carriers after their useful lifetimes are considered (Life of gantry crane, straddle carriers, pontoon and utilities is 15, 6, 25 and 15 years). The economic cost of this machinery and others is considered the same as the market costs because machinery is purchased at international prices. Also, residual values should be considered as a negative cost in the final year of the project. Table III-9-8 shows the replacement cost.

Table III-9-8 Replacement Cost and Residual Value

Case X

Unit: Million sucres

Year	Gantry Crane	Straddle Carrier	Pontoon	Utilities	Total
2008		8,296			8,296
2014		8,296			8,296
2017	19,858			1,558	21,416
2020		8,296			8,296
2026		8,296			8,296
2027			291		291
2029	-5,295	-5,531	-280	0	-11,106

Case Y

Unit: Million sucres

Year	Gantry Crane	Straddle Carrier	Pontoon	Utilities	Total
2008		8,296			8,296
2014		8,296			8,296
2017	19,858			868	20,726
2020		8,296			8,296
2026		8,296			8,296
2027			291		291
2029	-5,295	-5,531	-280	0	-11,106

5) Costs of the Project

34. All the costs measured at economic prices are summarized in Table III-9-9.

Table III-9-9 Total Cost in Economic Price

Case X

Unit: Million sucres

	Year	Construction	Maintenance	Operation	Replacement Investment	Residual Value	Total
1	1999	1,485					1,485
2	2000	15,785					15,785
3	2001	21,763					21,763
4	2002	37,201					37,201
5	2003		1,797	5,694			7,491
6	2004		1,797	5,694			7,491
7	2005		1,797	5,694			7,491
8	2006		1,797	5,694			7,491
9	2007		1,797	5,694			7,491
10	2008		1,797	5,694	8,296		15,787
11	2009		1,797	5,694			7,491
12	2010		1,797	5,694			7,491
13	2011		1,797	5,694			7,491
14	2012		1,797	5,694			7,491
15	2013		1,797	5,694			7,491
16	2014		1,797	5,694	8,296		15,787
17	2015		1,797	5,694			7,491
18	2016		1,797	5,694			7,491
19	2017		1,797	5,694	21,416		28,907
20	2018		1,797	5,694			7,491
21	2019		1,797	5,694			7,491
22	2020		1,797	5,694	8,296		15,787
23	2021		1,797	5,694			7,491
24	2022		1,797	5,694			7,491
25	2023		1,797	5,694			7,491
26	2024		1,797	5,694			7,491
27	2025		1,797	5,694			7,491
28	2026		1,797	5,694	8,296		15,787
29	2027		1,797	5,694	291		7,782
30	2028		1,797	5,694		-11,106	-3,615
Total		76,235	46,722	148,042	54,891	-11,106	314,784

Case Y

Unit: Million sucres

	Year	Construction	Maintenance	Operation	Replacement Investment	Residual Value	Total
1	1999	997					997
2	2000	10,921					10,921
3	2001	10,736					10,736
4	2002	32,131					32,131
5	2003		1,633	2,735			4,368
6	2004		1,633	2,735			4,368
7	2005		1,633	2,735			4,368
8	2006		1,633	2,735			4,368
9	2007		1,633	2,735			4,368
10	2008		1,633	2,735	8,296		12,664
11	2009		1,633	2,735			4,368
12	2010		1,633	2,735			4,368
13	2011		1,633	2,735			4,368
14	2012		1,633	2,735			4,368
15	2013		1,633	2,735			4,368
16	2014		1,633	2,735	8,296		12,664
17	2015		1,633	2,735			4,368
18	2016		1,633	2,735			4,368
19	2017		1,633	2,735	20,726		25,094
20	2018		1,633	2,735			4,368
21	2019		1,633	2,735			4,368
22	2020		1,633	2,735	8,296		12,664
23	2021		1,633	2,735			4,368
24	2022		1,633	2,735			4,368
25	2023		1,633	2,735			4,368
26	2024		1,633	2,735			4,368
27	2025		1,633	2,735			4,368
28	2026		1,633	2,735	8,296		12,664
29	2027		1,633	2,735	291		4,659
30	2028		1,633	2,735		-11,106	-6,737
Total		54,784	42,458	71,116	64,281	-11,106	211,454

E. Benefits of the Project

1) Kinds of Benefits

35.   The development of the port of Guayaquil will greatly contribute to the national economy. Considering the " With " and " Without " case, the following items are identified as major benefits of the short term development plan for the port of Guayaquil from the viewpoint of the national economy.

(1) Savings in ships' staying costs.
(2) Savings in time cost of cargo.
(3) Promotion of regional economic development.
(4) Increase in employment opportunities and incomes.
(5) Reduction of cargo damage and accidents at the port.

36.   It is impossible to evaluate all these benefits in monetary terms, but the following items are considered countable and the monetary benefits of theses items are calculated.

(1) Savings in ships' staying costs.
(2) Savings in time cost of cargo.

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

(3) Promotion of regional economic development.
(4) Increase in employment opportunities and incomes.
(5) Reduction of cargo damage and accidents at the port.

2) Calculation of Benefits

(a) Savings in Ships' Staying Costs

38.   In accordance with the implementation of the project, the total ships' staying time, (ships' waiting time for berthing and ships' mooring time for unloading/loading at the port) will be greatly decreased. The reduction of the ships' staying time under the "With" case is one of the main benefits of the project. In this study, the benefits derived from the reduction of the ships' staying costs is calculated by the following formula.

| Saving in ships' staying costs | = | Difference of ships' staying time between "Without "and "With" cases |

| | x | Ships' staying cost |

| | x | Percentage accruing to Ecuador |

a) Ships' Staying Time

39.   Ships' staying time at the port comprises the waiting time for berthing and the mooring time for unloading/loading. As for the ships' waiting time, the total waiting time for "Without" and "With" cases is calculated using computer queuing simulations based on the estimated number of calling ships in both cases respectively. In this calculation, it is assumed that only container ships can berth at the container terminals, and that only general cargo ships can berth at the general cargo berths.

40. The average waiting time is estimated by the results of a simulation in accordance with Queuing Theory. In order to avoid miss-estimation of staying time, it is assumed the both the distribution of ships' arrival and the distribution of cargo handling periods are random distributions.

b) Application of queuing theory

41. Ships calling at a port expect to be moored at a designated berth immediately, in order of arrival, and carry out cargo handling. If a ship is already berthed at the quay and there is no room, the latter ship has to wait until after the first ship completes its cargo handling and leaves.

42. This phenomenon of ships arriving and leaving a port can be analyzed by queuing theory, as in the analysis of the situation at a bank, where variables include the number of windows and the time each customer takes at the windows. For a port, the variables included the arrival of ships, number of berths and the berthing time. Great efforts are being exerted to clarify the pattern of ship entries and the berthing time at ports. As to the pattern of ship entries, normally it is a random: Poisson arrivals, namely, entry time intervals are of exponential distribution.

43. Figure III-9-2 shows arriving pattern (data of March in 1993) and berthing pattern (data of one year in 1993) in Guayaquil port. In this port, the arriving pattern is phase 1 Erlang distribution (Poisson distribution), the berthing pattern is phase 2 Erlang distribution.
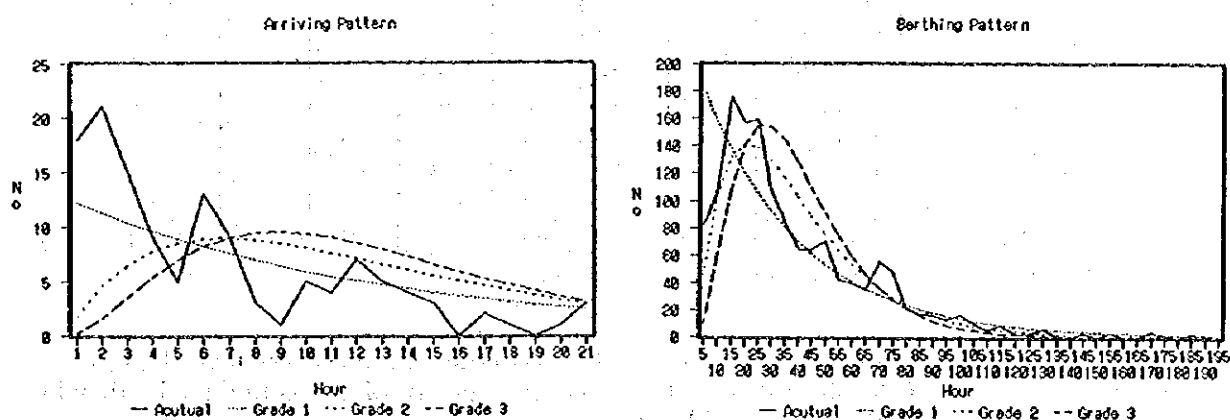
Figure III-9-2   Arriving and Berthing Pattern

44. The results of the calculation for ship' waiting time are shown in Table III-9-10.

Table III-9-10 Ship Waiting Time

Case X
Unit: Hour/Ship

Case	Berth Name	2003	2004	2005	2006	2007	2008
With Case	FC Banana	3.8	4.7	5.0	5.4	5.7	6.0
Container 2 Berth	FC GC	3.6	4.4	4.9	5.3	5.8	6.2
Multi 8 Berth	Multi Ship	2.1	2.7	2.7	2.7	2.7	2.9
Without Case	FC Banana	100.3	420.2	-	-	-	-
Container 1 Berth	FC GC	103.6	416.5	-	-	-	-
Multi 7 Berth	Multi Ship	8.4	8.5	8.6	8.9	9.4	9.8
Without Case	FC Banana	3.8	4.7	5.0	5.4	5.7	6.0
Container 2 Berth	FC GC	3.6	4.4	4.9	5.3	5.8	6.2
Multi 6 Berth	Multi Ship	39.8	43.7	45.9	47.0	51.2	53.4

Remarks: '-' shows that the result of simulation is diverged.

Case Y
Unit: Hour/Ship

Case	Berth Name	2003	2004	2005	2006	2007	2008	2009
With Case	FC Banana	1.3	2.0	2.6	3.3	4.0	4.8	5.5
Container 2 Berth	FC GC	1.3	2.1	2.8	3.7	4.4	5.0	5.7
Multi 7 Berth	Multi Ship	3.5	4.2	4.9	5.5	5.7	5.9	9.5
Without Case	FC Banana	24.0	48.0	71.9	300.4	-	-	-
Container 1 Berth	FC GC	24.7	48.4	72.1	307.7	-	-	-
Multi 7 Berth	Multi Ship	3.5	4.2	4.9	5.5	5.7	5.9	9.5
Without Case	FC Banana	1.3	2.0	2.6	3.3	4.0	4.8	5.5
Container 2 Berth	FC GC	1.3	2.1	2.8	3.7	4.4	5.0	5.7
Multi 6 Berth	Multi Ship	11.0	14.6	15.6	21.0	23.8	33.3	44.7

Remarks: '-' shows that the result of simulation is diverged.

45. In both Case X and Case Y, one of the "Without" cases is assumed to have 2 container berths and 6 multipurpose berths because capacity of the container berth will have been exceeded in the other "Without" case.

c) Ships' Staying Costs

46. Usually ships' staying costs are estimated by compiling the depreciation, personnel expenses, fuel cost, interest and other expenses, based on the ship building prices. The fuel consumption costs for ships' staying are also estimated for each ship based on the average fuel consumption rate of vessels presently operating.

47. Although it is possible to estimate the ship cost based on the charter rate, this rate fluctuates sharply with market conditions, so it is not appropriate for use as the base for the economic price of the ship cost.

48. Referring to the Ecuadorian shipping company, the waiting cost of general cargo ship (14,000 - 16,000 DWT) is US$ 7,000/day and the wage of the crews is US$ 900 - 1,300/day, one of container ship (32,000 DWT) is US$ 20,000/day and wage is US$ 1,300/day at market price.

49. After interviewing Japanese shipping companies with international routes, we chose to estimate the ship cost based on the hire rate. The estimated ships' staying costs are shown in Table III-9-11. This price is the international price.

Table III-9-11 Ship Cost

Ship Type	Unit	Container Ship	Container Ship	Multi Type Ship
Size	DWT	12,000	20,000	12,000
Build Cost	US$	20,000,000	29,600,000	15,600,000
Depreciation	US$/day	4,700	7,000	3,700
Man Power	US$/day	900	900	900
Fuel	US$/day	100	200	100
Miscellaneous	US$/day	6,600	10,500	4,000
Total	US$/day	12,300	18,600	8,700

Source: Japan shipping company

d) Percentage Accruing to Ecuador

50. The benefit derived from the savings of ships' staying costs will belong to the shipping companies. Therefore, for foreign ships the benefits accrue to foreign shipowners and for Ecuadorian ships benefits accrue to Ecuador. However, it is now standard practice to include some of the benefits accruing to foreign shipowner in the appraisal on the understanding that in the long run this benefit will filter through to the national economy, for example, through lower freight rates.

51. In this study it is assumed that 50% of the benefit attributed to foreign ship operators is assumed to return to Ecuador over time through the market mechanism of world shipping as well as 100% of benefits for Ecuadorian ship operators will accrue to the Ecuadorian economy. According to the Table III-9-12, the total benefits to Guayaquil port can be estimated at 60% (Rate= 0.148 x 100% + 0.852 x 50% =0.6) of savings in costs of container and general cargo vessels.

Table III-9-12 Share in Cargo for Vessels

	1991	1992	1993	1991	1992	1993	Average
Flag Import		Ton			%		
Ecuador	505,176	359,714	425,051	24.9	16.7	19.9	20.4
Other Country	1,525,403	1,793,388	1,716,054	75.1	83.3	80.1	79.6
Total	2,030,579	2,153,102	2,141,105	100.0	100.0	100.0	100.0
Flag Export							
Ecuador	115,245	134,213	162,374	6.6	8.1	9.1	7.9
Other Country	162,924	1,522,855	1,630,665	93.4	91.9	90.9	92.1
Total	1,737,169	1,657,068	1,793,039	100.0	100.0	100.0	100.0
Flag Total							
Ecuador	620,421	493,927	587,425	16.5	13.0	14.9	14.8
Other Country	3,147,327	3,316,243	3,346,719	83.5	87.0	85.1	85.2
Total	3,767,748	3,810,170	3,934,144	100.0	100.0	100.0	100.0

Source: APG

e) Savings of Ships' Staying Costs

52. Benefits derived from savings of ships' staying costs due to the implementation of this project are calculated in Table III-9-13.

Table III-9-13 : Savings in Ship Waiting Costs

Case X

Year	Ship Type	Unit	FC Banana	FC GC	Multi Ship	Total 1,000Sucres	Benefit (60%) Million Sucres
	Size	DWT	12,000	20,000	12,000		
	Ship Cost	US$/day	12,300	18,600	8,700		
2003	Ship	No	124	336	1,300		
With	Waiting	Hr/Ship	3.8	3.6	2.1		
Without	Waiting	Hr/Ship	3.8	3.6	39.8		
Without-With	Cost	US$/day	0	0	17,766,125	39,796,120	23,878
2004	Ship	No	132	389	1,327		
With	Waiting	Hr/Ship	4.7	4.4	2.7		
Without	Waiting	Hr/Ship	4.7	4.4	43.7		
Without-With	Cost	US$/day	0	0	19,722,538	44,178,484	26,507
2005	Ship	No	137	432	1,364		
With	Waiting	Hr/Ship	5.0	4.9	2.7		
Without	Waiting	Hr/Ship	5.0	4.9	45.9		
Without-With	Cost	US$/day	0	0	21,360,240	47,846,938	28,708
2006	Ship	No	143	480	1,387		
With	Waiting	Hr/Ship	5.4	5.3	2.6		
Without	Waiting	Hr/Ship	5.4	5.3	47.0		
Without-With	Cost	US$/day	0	0	22,323,765	50,005,234	30,003
2007	Ship	No	148	528	1,424		
With	Waiting	Hr/Ship	5.7	5.8	2.7		
Without	Waiting	Hr/Ship	5.7	5.8	51.2		
Without-With	Cost	US$/day	0	0	25,035,700	56,079,968	33,648
2008	Ship	No	156	581	1,455		
With	Waiting	Hr/Ship	6.0	6.2	2.9		
Without	Waiting	Hr/Ship	6.0	6.2	53.4		
Without-With	Cost	US$/day	0	0	26,635,594	59,663,730	35,798

Case Y

Year	Ship Type	Unit	FC Banana	FC GC	Multi Ship	Total 1,000Sucres	Benefit (60%) Million Sucres
	Size	DWT	12,000	20,000	12,000		
	Ship Cost	US$/day	12,300	18,600	8,700		
2003	Ship	No	124	336	1,300		
With	Waiting	Hr/Ship	1.3	1.3	3.5		
Without	Waiting	Hr/Ship	1.3	1.3	11.0		
Without-With	Cost	US$/day	0	0	3,534,375	7,917,000	4,750
2004	Ship	No	132	389	1,327		
With	Waiting	Hr/Ship	2.0	2.1	4.2		
Without	Waiting	Hr/Ship	2.0	2.1	14.6		
Without-With	Cost	US$/day	0	0	5,002,790	11,206,250	6,724
2005	Ship	No	137	432	1,364		
With	Waiting	Hr/Ship	2.6	2.8	4.9		
Without	Waiting	Hr/Ship	2.6	2.8	15.6		
Without-With	Cost	US$/day	0	0	5,290,615	11,850,978	7,111
2006	Ship	No	143	480	1,387		
With	Waiting	Hr/Ship	3.3	3.7	5.5		
Without	Waiting	Hr/Ship	3.3	3.7	21.0		
Without-With	Cost	US$/day	0	0	7,793,206	17,456,782	10,474
2007	Ship	No	148	528	1,424		
With	Waiting	Hr/Ship	4.0	4.4	5.7		
Without	Waiting	Hr/Ship	4.0	4.4	23.8		
Without-With	Cost	US$/day	0	0	9,343,220	20,928,813	12,557
2008	Ship	No	148	528	1,424		
With	Waiting	Hr/Ship	4.8	5.0	5.9		
Without	Waiting	Hr/Ship	4.8	5.0	33.3		
Without-With	Cost	US$/day	0	0	14,143,880	31,682,291	19,009
2009	Ship	No	160	624	1,485		
With	Waiting	Hr/Ship	5.5	5.7	9.5		
Without	Waiting	Hr/Ship	5.5	5.7	44.7		
Without-With	Cost	US$/day	0	0	18,948,600	42,444,864	25,467

f) Land Transportation Cost and Ships' Waiting Time

53. The road transport distance from the port of Guayaquil to its service area is calculated as 104 km (based on a formula which yields the average distance between cargo volume and road distance). The road transport distance from the other ports to the service area of the port of Guayaquil is shown in the following table.

Table III-9-14 Average Road Transport Distance

Unit: km

```
                    ┌──────────────┐
                    │  Esmeraldas  │
                    └──────────────┘
                           │ 185
                    ┌──────────────┐        ┌────────┐
                    │    Santo      │  133   │ Quito  │
                    │   Domingo     │        └────────┘
                    └──────────────┘
                           │ 104
 ┌──────────┐   178  ┌──────────────┐
 │  Manta   │────────│   Quevedo    │
 └──────────┘        └──────────────┘
                           │ 79
                    ┌──────────────┐
                    │ Service Area │
                    └──────────────┘
                           │ 104
                    ┌──────────────┐
                    │  Guayaquil   │
                    └──────────────┘
                           │ 191
                    ┌──────────────┐
                    │   Bolivar    │
                    └──────────────┘
```
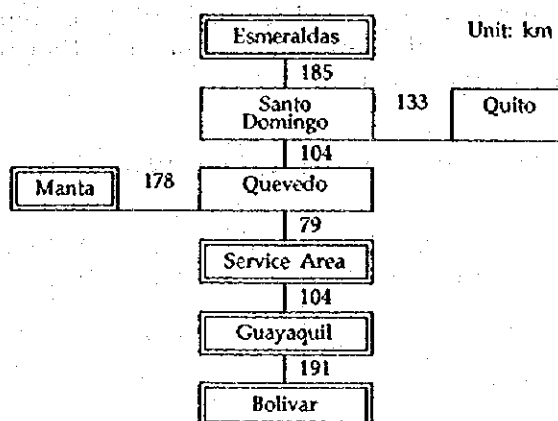
Unit: km

From	To Service Area	Difference from Guayaquil port
Guayaquil port	104	-
Esmeraldas port	368	264
Manta port	257	153
Bolivar port	295	399

54. Referring to the Ecuadorian land transportation company, the land transportation cost is shown in Table III-9-15.

Table III-9-15 Land Transportation Cost at Market Price

Unit: sucres

From Guayaquil	Distance (km)	Driving hour (hr)	15 ton truck	Container 40 foot
Esmeraldas	472	13.5	1,250,000	1,750,000
Quito	420	12.4	960,000	1,740,000
Manta	196	9.5	1,150,000	1,700,000
Machala	250	7.0	900,000	1,600,000

Source: Land transportation company in Guayaquil, modified by Study team.

55. Unit price of the land transportation is calculated by the current tariff levels in Guayaquil and Quito (see Table III-9-16).

Table III-9-16 Land Transportation Cost at Economic Price

	Distance (km)	Cost (Sucres)	SCF	Cargo volume (ton)	Economic Price (Sucres/ton/km*SCF)
15 Truck	420	960,000	0.965	13.5	163.39
40 ft container	420	1,740,000	0.965	16.3	245.27

Source: Estimated by Study Team

56. Land transportation cost and ships' waiting cost is shown in Table III-9-17. According to queuing simulation presented in Table III-9-10, ship waiting time is lower than the critical waiting time of the land transportation. Therefore ships' waiting cost can be calculated as part of the benefit.

Table III-9-17 Ships' Critical Waiting Time

Ship Type	Cargo Volume (ton)	Land Transportation Cost (Sucres/km/ton)	Total land Transportation cost 153 km (Sucres)	Ship Waiting Cost (Day/Ship)	Critical Waiting Time (HR)
FC GC	1,460	245	54,728,000	US$ 18,600	32
Mix Type Ship	2,400	163	59,854,000	US$ 8,700	74

Remarks: Estimated by Study Team

(b) Savings in Time Cost of Cargo

57. In accordance with the implementation of the project, the total ships' staying time will be greatly decreased. According to the reduction of the ships' staying time under the "With" case, interest of cargo cost will decrease. In this study, the benefits of savings in time cost of cargo are calculated by the following formula.

Saving in time cost of cargo	=	Difference of ships' staying time between "Without" and "With" cases

$$\times \quad \boxed{\text{Interest of cargo}}$$

58. According to the above, benefits derived from savings of time cost of cargo due to the implementation of this project are calculated in Table III-9-18.

Table III-9-18 Savings of Interest of Cargo

Case X

| Year | Item | Unit | FC Banana | FC GC | Multi Ship | Interest Rate 7% Unit Price (CIF:FOB) US$318/ton | | | |
| | | | | | | Total Save | | Total Save Cost | |
						Ton*Day	Ton*Year	US$	Million Sucres
		DWT	12,000	20,000	12,000				
2003	Ship	No	124	336	1,300				
	Cargo	Ton	932,000	621,000	3,121,000				
	Average	Ton/Ship	7,516	1,848	2,401				
With	Waiting	Hr/Ship	3.8	3.6	2.1				
Without	Waiting	Hr/Ship	3.8	3.6	39.8				
	Saving Time	Day	0	0	2,042	4,902,571	13,432	293,990	670
2004	Ship	No	132	389	1,327				
	Cargo	Ton	983,000	714,000	3,184,000				
	Average	Ton/Ship	7,447	1,835	2,399				
With	Waiting	Hr/Ship	4.7	4.4	2.7				
Without	Waiting	Hr/Ship	4.7	4.4	43.7				
	Saving Time	Day	0	0	2,287	5,439,333	14,902	331,725	743
2005	Ship	No	137	432	1,364				
	Cargo	Ton	1,025,000	788,000	3,274,000				
	Average	Ton/Ship	7,482	1,819	2,400				
With	Waiting	Hr/Ship	5.0	4.9	2.7				
Without	Waiting	Hr/Ship	5.0	4.9	45.9				
	Saving Time	Day	0	0	2,455	5,893,200	16,146	359,404	805
2006	Ship	No	143	480	1,387				
	Cargo	Ton	1,080,000	885,000	3,329,000				
	Average	Ton/Ship	7,552	1,427	2,400				
With	Waiting	Hr/Ship	5.4	5.3	2.6				
Without	Waiting	Hr/Ship	5.4	5.3	47.0				
	Saving Time	Day	0	0	2,566	6,158,650	16,873	375,593	841
2007	Ship	No	148	528	1,424				
	Cargo	Ton	1,124,000	984,000	3,412,000				
	Average	Ton/Ship	7,595	1,826	2,398				
With	Waiting	Hr/Ship	5.7	5.8	2.7				
Without	Waiting	Hr/Ship	5.7	5.8	51.2				
	Saving Time	Day	0	0	2,878	6,895,083	18,891	420,506	942
2008	Ship	No	158	581	1,455				
	Cargo	Ton	1,169,000	1,057,000	3,493,000				
	Average	Ton/Ship	7,494	1,819	2,401				
With	Waiting	Hr/Ship	6.0	6.2	2.9				
Without	Waiting	Hr/Ship	6.0	6.2	53.4				
	Saving Time	Day	0	0	3,062	7,349,854	20,137	448,240	1,004

Case Y

| Year | Item | Unit | FC Banana | FC GC | Multi Ship | Interest Rate 7% Unit Price (CIF:FOB) US$318/ton | | | |
| | | | | | | Total Save | | Total Save Cost | |
						Ton*Day	Ton*Year	US$	Million Sucres
		DWT	12,000	20,000	12,000				
2003	Ship	No	124	336	1,300				
	Cargo	Ton	932,000	621,000	3,121,000				
	Average	Ton/Ship	7,516	1,848	2,401				
With	Waiting	Hr/Ship	1.3	1.3	3.5				
Without	Waiting	Hr/Ship	1.3	1.3	11.0				
	Saving Time	Day	0	0	406	975,313	2,672	59,481	133
2004	Ship	No	132	389	1,327				
	Cargo	Ton	983,000	714,000	3,184,000				
	Average	Ton/Ship	7,447	1,835	2,399				
With	Waiting	Hr/Ship	2.0	2.1	4.2				
Without	Waiting	Hr/Ship	2.0	2.1	14.6				
	Saving Time	Day	0	0	575	1,379,733	3,780	84,145	188
2005	Ship	No	137	432	1,364				
	Cargo	Ton	1,025,000	788,000	3,274,000				
	Average	Ton/Ship	7,482	1,819	2,400				
With	Waiting	Hr/Ship	2.8	2.8	4.9				
Without	Waiting	Hr/Ship	2.8	2.8	15.6				
	Saving Time	Day	0	0	603	1,459,658	3,999	89,019	199
2006	Ship	No	143	480	1,387				
	Cargo	Ton	1,080,000	885,000	3,329,000				
	Average	Ton/Ship	7,552	1,427	2,400				
With	Waiting	Hr/Ship	3.3	3.7	5.6				
Without	Waiting	Hr/Ship	3.3	3.7	21.0				
	Saving Time	Day	0	0	896	2,149,979	5,890	131,119	294
2007	Ship	No	148	528	1,424				
	Cargo	Ton	1,124,000	984,000	3,412,000				
	Average	Ton/Ship	7,595	1,826	2,398				
With	Waiting	Hr/Ship	4.0	4.4	5.7				
Without	Waiting	Hr/Ship	4.0	4.4	23.8				
	Saving Time	Day	0	0	1,074	2,573,217	7,050	156,931	352
2008	Ship	No	158	581	1,455				
	Cargo	Ton	1,169,000	1,057,000	3,493,000				
	Average	Ton/Ship	7,494	1,819	2,401				
With	Waiting	Hr/Ship	4.8	5.0	5.9				
Without	Waiting	Hr/Ship	4.8	5.0	33.3				
	Saving Time	Day	0	0	1,661	3,987,842	10,926	243,204	545
2009	Ship	No	158	581	1,455				
	Cargo	Ton	1,169,000	1,057,000	3,493,000				
	Average	Ton/Ship	7,494	1,819	2,401				
With	Waiting	Hr/Ship	5.5	5.7	9.5				
Without	Waiting	Hr/Ship	5.5	5.7	44.7				
	Saving Time	Day	0	0	2,134	5,123,087	14,036	312,437	700

Remarks: Usance interest is estimated as 7% per year based on the American bank acceptance rate.
Unit price is based on the data of Centaral Bank of Ecuador

3) Other intangibles

59. As described in Section E 1), there are other benefits derived from the implementation of this project, however, they are difficult to appraise in monetary terms. Therefore, qualitative analyses are undertaken as follows;

(a) Promotion of Regional Economic Development

60. Without the implementation of this development project, the port of Guayaquil will handle a limited cargo volume, and the development or expansion of export industries and services which are dependent on the port will be stagnant. Furthermore, the limited port activity will diminish the probability of the establishment of new businesses. The value added from those industries and the employment opportunities from them are therefore considered as economic benefits of this project.

(b) Increase in Employment Opportunities and Incomes

61. Additional employment will arise directly from the project, both assumed employment for construction during the construction period and employment for operations after the construction. Therefore, this employment is one of the major benefits of the project. The increase in employment opportunities is estimated as 235,000 person days for skilled labor and 87,000 person days for unskilled labor in Case X (the handling capacity will be improved slightly) and as 101,000 person days for skilled labor and 40,000 person days for unskilled labor in Case Y (the handling capacity will be significantly improved).

62. Along with the increased direct employment, secondary employment will also occur based on the new demand form the expanding industries and services through the port activities. Similarly, the income of already employed local workers is also expected to rise. These rippling effects are also generated by port development.

(c) Reduction of Cargo Damages and Accidents at the Port

63. Under "Without" case, it is anticipated that containerization will be stagnant and according to the increase of cargo volume, the port will be very congested. On the other hand, with the implementation of the project, containerization will be improved, and by that the port capacity will not only be improved but also reduce cargo damage, accidents and pilferage at the port. This is obviously considered to be one of the great benefits of this project.

F. Evaluation

1) Calculation of the EIRR

64.   Here, the lifetime of the facilities is taken as 30 years, the same as the project lifetime. The cost-benefits analysis is carried out starting in 1999 (the first year of the investment schedule) and ending in 2028 (the 30th year form the start from the operations of the new terminal in 2003). The economic internal rate of return (EIRR) is calculated by using the formula which was mentioned in Chapter A of this part. The calculation for the EIRR is shown in Table III-9-19 and Table III-9-20.

2) Case X

(a) Sensitivity Analyses

65.   In order to estimate the variation for the EIRR, sensitivity analyses are made for three alternatives.

    a) Case A: The forecast benefits decreases by 10%
    b) Case B: The costs increase by 10%
    c) Case C: The benefits decreases by 10% and the costs increase by 10%

66.   The calculation for the EIRR is shown in Table III-9-22. The results of the sensitivity analyses are shown as follows.

Table III-9-21   Results of Sensitivity Analyses (Case X)

	EIRR (%)
Original Case	24.7
a) Case A	22.2
b) Case B	21.9
c) Case C	19.6

(b) Results and Conclusion

67.   There are various view concerning the critical percentage of EIRR used to guide a judgement as to whether a project is feasible or not. The leading view is that the project is feasible if the EIRR exceeds the Opportunity Cost of Capital (OCC). The value of OCC varies from 8% to 12% according to degree of development in each country. It is generally considered that EIRR of more than 10% is economically feasible for infrastructure or social service projects.

68.   From the above calculations, the EIRR of this project is in all cases more than 19.6%. The results of the EIRR calculation, only taking into account the four major quantitative benefits, shows more than 10% under every probable case. Therefore, this Short-term Development Project of Case X is feasible from the viewpoint of the national economy.

Case X

Table III-9-19 Cost/Benefit Analysis (Case X)

Unit: Million Sucres

		Cost						Benefit (Saving Cost)			Benefit	Net Present Value (NPV)		
No.	Year	Construction	Maintenance	Operation	Replacement Investment	Residual Value	Total	Ship Cost	Interest	Total	- Cost	Benefit	Cost	Benefit - Cost
1	1999	1.485					1.485			0	-1.485	0	1.485	-1.485
2	2000	15.785					15.785			0	-15.785	0	12.661	-12.661
3	2001	21.763					21.763			0	-21.763	0	14.002	-14.002
4	2002	37.201					37.201			0	-37.201	0	19.199	-19.199
5	2003		1.797	5.694			7.491	23.878	.670	24.548	17.057	10.162	3.101	7.061
6	2004		1.797	5.694			7.491	26.507	.743	27.250	19.759	9.048	2.487	6.561
7	2005		1.797	5.694			7.491	28.708	.805	29.513	22.022	7.860	1.995	5.865
8	2006		1.797	5.694			7.491	30.003	.841	30.844	23.353	6.589	1.600	4.989
9	2007		1.797	5.694			7.491	33.648	.942	34.590	27.099	5.927	1.284	4.644
10	2008		1.797	5.694	8.296		15.787	35.798	1.004	36.802	21.015	5.058	2.170	2.889
11	2009		1.797	5.694			7.491	35.798	1.004	36.802	29.311	4.057	826	3.232
12	2010		1.797	5.694			7.491	35.798	1.004	36.802	29.311	3.255	662	2.592
13	2011		1.797	5.694			7.491	35.798	1.004	36.802	29.311	2.611	531	2.079
14	2012		1.797	5.694			7.491	35.798	1.004	36.802	29.311	2.094	426	1.668
15	2013		1.797	5.694			7.491	35.798	1.004	36.802	29.311	1.680	342	1.338
16	2014		1.797	5.694	8.296		15.787	35.798	1.004	36.802	21.015	1.347	578	769
17	2015		1.797	5.694			7.491	35.798	1.004	36.802	29.311	1.081	220	861
18	2016		1.797	5.694			7.491	35.798	1.004	36.802	29.311	867	176	690
19	2017		1.797	5.694	21.416		28.907	35.798	1.004	36.802	7.895	695	546	149
20	2018		1.797	5.694			7.491	35.798	1.004	36.802	29.311	558	114	444
21	2019		1.797	5.694			7.491	35.798	1.004	36.802	29.311	447	91	356
22	2020		1.797	5.694	8.296		15.787	35.798	1.004	36.802	21.015	359	154	205
23	2021		1.797	5.694			7.491	35.798	1.004	36.802	29.311	288	59	229
24	2022		1.797	5.694			7.491	35.798	1.004	36.802	29.311	231	47	184
25	2023		1.797	5.694			7.491	35.798	1.004	36.802	29.311	185	38	147
26	2024		1.797	5.694			7.491	35.798	1.004	36.802	29.311	149	30	118
27	2025		1.797	5.694			7.491	35.798	1.004	36.802	29.311	119	24	95
28	2026		1.797	5.694	8.296		15.787	35.798	1.004	36.802	21.015	96	41	55
29	2027		1.797	5.694	.291		7.782	35.798	1.004	36.802	29.020	77	16	60
30	2028		1.797	5.694		-11.105	-3.615	35.798	1.004	36.802	40.417	61	-6	68
	Total	76.235	46.722	148.042	54.891	-11.106	314.784	894.502	25.085	919.587	604.803	64.901	64.901	-0

EIRR = 0.24670

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Table III-9-20 Cost/Benefit Analysis (Case Y)

Case Y

Unit: Million Sucres

Year	Construc-tion	Mainte-nance	Operation	Replacement Investment	Residual Value	Total	Ship Cost	Interest	Total	Benefit - Cost	NPV Benefit	NPV Cost	NPV Benefit - Cost
1999	997					997			0	-997	0	997	-997
2000	10.921					10.921			0	-10.921	0	9.386	-9.386
2001	10.736					10.736			0	-10.736	0	7.929	-7.929
2002	32.131					32.131			0	-32.131	0	20.395	-20.395
2003		1.633	2.735			4.368	4.750	133	4.883	515	2.664	2.383	281
2004		1.633	2.735			4.368	6.724	188	6.912	2.544	3.241	1.193	2.048
2005		1.633	2.735			4.368	7.111	199	7.310	2.942	2.945	1.185	1.760
2006		1.633	2.735			4.368	10.474	294	10.768	6.400	3.729	2.216	1.513
2007		1.633	2.735			4.368	12.557	352	12.909	8.541	3.842	2.542	1.300
2008		1.633	2.735	8.296		12.664	19.009	366	19.375	6.711	4.955	3.239	1.716
2009		1.633	2.735			4.368	25.467	497	25.964	21.596	5.707	960	4.747
2010		1.633	2.735			4.368	25.467	497	25.964	21.596	4.905	825	4.080
2011		1.633	2.735			4.368	25.467	497	25.964	21.596	4.215	709	3.506
2012		1.633	2.735			4.368	25.467	497	25.964	21.596	3.623	609	3.013
2013		1.633	2.735			4.368	25.467	497	25.964	21.596	3.113	524	2.590
2014		1.633	2.735	8.296		12.664	25.467	497	25.964	13.300	2.676	1.305	1.371
2015		1.633	2.735			4.368	25.467	497	25.964	21.596	2.300	387	1.913
2016		1.633	2.735			4.368	25.467	497	25.964	21.596	1.976	332	1.644
2017		1.633	2.735	20.726		25.094	25.467	497	25.964	870	1.698	1.642	57
2018		1.633	2.735			4.368	25.467	497	25.964	21.596	1.460	246	1.214
2019		1.633	2.735			4.368	25.467	497	25.964	21.596	1.254	211	1.043
2020		1.633	2.735	8.296		12.664	25.467	497	25.964	13.300	1.078	526	552
2021		1.633	2.735			4.368	25.467	497	25.964	21.596	927	156	771
2022		1.633	2.735			4.368	25.467	497	25.964	21.596	796	134	662
2023		1.633	2.735			4.368	25.467	497	25.964	21.596	684	115	569
2024		1.633	2.735			4.368	25.467	497	25.964	21.596	588	99	489
2025		1.633	2.735			4.368	25.467	497	25.964	21.596	505	85	420
2026		1.633	2.735	8.296		12.664	25.467	497	25.964	13.300	434	212	223
2027		1.633	2.735	291		4.659	25.467	497	25.964	21.305	373	67	306
2028		1.633	2.735		-11.106	-6.737	25.467	497	25.964	32.701	321	-83	404
Total	54.784	42.458	71.116	54.201	-11.106	211.454	569.965	11.472	581.437	369.983	60.011	60.011	-0

EIRR = 0.16358

3) Case Y

(a) Sensitivity Analyses

69.   In order to estimate the variation for the EIRR, sensitivity analyses are made for three alternatives.

 a) Case A: The forecast benefits decreases by 10%
 b) Case B: The costs increase by 10%
 c) Case C: The benefits decreases by 10% and the costs increase by 10%

70. The calculation for the EIRR is shown in Table III-9-22. The results of the sensitivity analyses are shown as follows.

Table III-9-22   Results of Sensitivity Analyses (Case Y)

	EIRR (%)
Original Case	16.4
a) Case A	14.8
b) Case B	14.6
c) Case C	13.1

(b) Results and Conclusion

71. From the above calculations, the EIRR of this project is in all cases more than 13.1%. The results of the EIRR calculation, only taking into account the four major quantitative benefits, shows more than 10% under every probable case. Therefore, this Short-term Development Project of Case Y is feasible from the viewpoint of the national economy.

Chapter 10 FINANCIAL ANALYSIS

A. Methodology of the Financial Analysis

1. The purpose of the financial analysis is to examine the viability of the project and the financial soundness of the project.

1) Viability of the Project

2. The viability of the project is analyzed using the Financial Internal Rate of Return (FIRR) by means of the discount cash flow method. The FIRR is a discount rate that makes the costs and the revenue during the project life equal, and it is calculated using the following formula:

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

- n : Project life
- Bi : Revenue in the i-th year
- Ci : Cost in the i-th year
- r : Discount rate

3. Here, the revenue and the cost in this analysis cover the following items;
- Revenues : Increase of operating revenues by the project
- Costs   : Investments for the project (initial investments for the project and its re-investments)
           : Increase of maintenance, repair, personnel and administration costs by the project)

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

2) Financial Soundness of the Project

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

(a) Profitability

6. Rate of Return on Net Fixed Assets:

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

7. This indicator shows the profitability of the investments, which are presented as net total fixed assets. It is necessary to keep the rate above the average interest rate of the funds for investments.

(b)　Loan Repayment Capacity

8.　Debt Service Coverage Ratio

$$\frac{\text{Net Operating Income before Depreciation}}{\text{Repayment and Interest of Long-term Loans}}$$

9.　This indicator shows whether the operating income can cover the repayment and the interest on long-term loans. The ratio must be higher than 1.0.

(c)　Operational Efficiency

10.　Operating Ratio:

$$\frac{\text{Operating Expenses}}{\text{Operating Revenues}} \times 100 \ \%$$

11.　Working Ratio:

$$\frac{\text{Operating Expenses - Depreciation Expenses}}{\text{Operating Revenues}} \times 100 \ \%$$

12.　The operating ratio shows the operational efficiency of the organization as an enterprise, and the working ratio shows the efficiency of the routine operations of the port. When the calculated operating ratios are less than 70-75%, and the working ratios are less than 50-60%, the operation of the port is efficient.

B. Presuppositions of Financial Analysis

13. At present, APG is privatizing port services to realize port modernization. According to the result of the study by UNCEMP, APG will not invest in new facilities or equipment, and instead leave the procurement of new berths and gantry crane etc. to private entities. In line with this policy, new berths which are recommended in this report would be constructed and operated by private entities.

14. However, the scope of modernization has not yet been decided. So, financial analysis is conducted based on the following premises.
   - New berths, Gantry crane and straddle carrier etc. will be procured and operated by APG.
   - Operation, cargo handling, maintenance will be also performed by APG.

15. Even if the project is carried out by an entity other than APG, the result of calculation under this condition will reflect financial soundness of the entity. But if the entity is a private one, it is necessary to reconsider condition of foreign funds such as interest rate, loan period etc..

1) Scope of the Financial Analysis

16. The focus of the financial analysis is the entire project of the short-term plan. Maintenance and repair work of existing berths and renewal of existing facilities are not included in the project.

2) Project Life

17. Taking account of the conditions of the long-term loans and the service lives of the port facilities, the project life is determined as the construction period and 36 years after construction.

3) Base Year

18. In principal, all costs and revenues are indicated in prices as of Aug. 1994. Neither price inflation nor increases in nominal wage are considered during the project life.

4) Cargo Volume

19. Cargo volume is estimated based on the demand forecast.

5) Port Charges and Revenues

20. Revenues from port activities are calculated based on the tariffs as shown in Table III-10-1. The revenues/year during the project life are shown in Table of Financial Statement (CASE X: Table III-10-6, CASE Y: Table III-10-8).

Table III-10-1 New Tariff of APG (1995.3)

Item			UNIT	US$	Remark
General Tariff					
	Use of Access Facilities				
		Access Channels to Port	GRT	0.21	Arrival/Departure
		Access Channels to Private Berth	GRT	1.02	Arrival/Departure
	Wharf use				
		Wharfs of Berths 1, 1A & 1B	m · hr	0.73	
		Wharfs of Berth 1D	m · hr	0.67	
		Wharfs of Berths 2, 3, 4, 5 & 6	m · hr	0.55	
		Mooring on other Berthing Sites			Set by Month
	Use of Anchorage				
		Ships engaged in Commercial Operations	m · day	3.50	
		Ships not engaged in Commercial Operations	m · day	1.75	
	Use of Port Infrastructure by Cargos				
		Loaded Cargo			
		General	Ton	3.50	Without Facilities 3.16
		Solid	Ton	3.30	Without Facilities 3.00
		Liquid	Ton	1.80	Without Facilities 1.6
		Container	TEU	40.00	Without Facilities -10%
		Unloaded Cargo			
		General	Ton	6.55	Without Facilities -10%
		Solid	Ton	3.50	Without Facilities 3
		Liquid	Ton	2.00	Without Facilities -10%
		Container	TEU	95.00	Without Facilities -10%
		Transhipment Cargo	Ton or Box		2 Operation (70% of Loaded Cargo)
		Transit Cargo			Each Operation (50% of Unloaded Cargo)
		General	Ton	3.275	
		Container	Box	47.5	
	Empty Containers		Box	20.00	Each Operation
	Dangerous Cargo				+20% than Normal Tariff
Special Tariff					
	Tugboats and Boats				
		Tugboats in Berthing & Departure	GRT	0.09	
		Tugboats in other Port Maneuvers	hr	500.00	
		Special Tugboats	hr	600.00	
		APG Boat Service	hr	150.00	
	Pilot Boat				
		General Tariff	GRT	0.14	
		Other Service	hr	130.00	
	Use of Storage Areas				
		1st Line, Open (Yards)	Ton/day	0.10	6 free days: e/6days+100%
		1st Line, Closed (Warehouses)	Ton/day	0.16	ditto ditto
		Silos of Solid Bulk	Ton/day	0.30	ditto ditto
		Tanks of Liquid Bulk	Ton/day	0.30	ditto ditto
		2nd Line, Open (Yards, Sheds)	Ton/day	0.08	
		2nd Line, Closed (Warehouses)	Ton/day	0.16	Monthly; pays 25days; e/month+20%
		Bulk Warehouses	Ton/day	0.07	ditto ditto
		Containers	TEU/day	1.25	6 free days: Monthly; 25days; c/m+20%
		Empty Containers	TEU/day	1.25	25days; following days+100%
		Mobilization of Containers in Port			
		In the Storage Area	Box	25.00	
		Other Area	Box	40.00	
	Service and Various Supplies				
		Gates use		0.00	
		DEMAG Crane	hr	90.00	Include Operator
		Equipment for Container (Without Wheels)	hr	70.00	ditto
		Other Port Equipment	hr	20.00	ditto
		Electric Power Supply	KWH		Over Official Rate +30%
		Drinking Water Supply	M3		ditto
		Telecommunications Supply	Impulse		ditto
		Labor Crew of Port	hr	30.00	1 Foreman, 3 Labor, 1 Worker

Source: APG

6) Fund Raising

21. Generally, fund raising is mainly divided into three kinds, foreign funds, internal funds and domestic funds (government funds and domestic bank). This analysis, however, is calculated under the assumption that there are no government funds and internal funds, because of the modernization policy of Ecuador.

(a) Foreign Funds

22. The portion of project costs assumed to be raised by loans from abroad is as follows;

- Loan period   : 30 years
- Interest rate   : 3.0%
- Grace period   : 10 years
- Repayment   : fixed amount repayment of principal
- Ratio of investment : less than 75% of the project cost

23. These conditions are quoted from those of the OECF (Japan).

(b) Domestic Bank

24. The terms of the domestic bank are considered as follows;

- Loan period   : 8 years
- Interest rate : 36%
- Repayment   : fixed amount repayment of principal

(c) Weighted Average Interest Rate

25. The weighted average interest rate of the funds for investments is 7.25% when above funds are applied.

(d) Domestic Short-term Loan and Interest Rate for Deposit

26. Any cash shortage should be covered by short-term loans with an annual interest rate of 32~44%/year. Cash excess will be deposited to a bank with an annual deposit interest rate of 3~4%/year.

7) Expenditure

(a) Investment

27. Initial investment cost is shown in Chapter 6 of this part. The depreciable facilities will be renewed based on their service lives, the re-investment cost is included in the investment.

(b) Maintenance and Repair

28. Concerning construction works such as berth, yard and buildings, maintenance and repair costs are calculated as 1.0% of depreciable assets each year, others are as 5%.

(c) Personnel Cost and Administration Cost

a) Number of Personnel

29. The number of terminal operation personnel (such as crane and lift operators, tractor driver, cargo handling worker, line handlers, mechanics) and terminal clerk is assumed as shown in Table III-10-2, using Japanese terminals as models. The actual number is adopted for the category of administrative personnel.

Table III-10-2   Future Number of Personnel in APG (2003)

Unit: persons

		CASE X				CASE Y		
		Container	Multi	Existing	Total	Container	Existing	Total
Employee	Operation	19	23	202	244	19	205	224
	Administration	30	32	298	360	30	330	360
	Others	8	7	72	87	8	79	87
	Total	57	62	572	691	57	614	671
Labor	Operation	26	31	276	333	26	280	306
	Administration	7	6	60	73	7	66	73
	Others	20	20	186	226	20	206	226
	Total	53	57	522	632	53	552	605
TOTAL	Operation	45	54	478	577	45	485	530
	Administration	37	38	358	433	37	396	433
	Others	28	27	258	313	28	285	313
	Total	110	119	1,094	1,323	110	1,166	1,276

30. By the way, according to the schedule of APG, the number of administrative personnel will be reduced to 300 by Dec. 1995 under the process of privatization.

b) Personnel Cost

31. Unit personnel cost is assumed as 24,000,000 sucres/year per one labor and 23,000,000 sucres/year per one employee based on the actual unit cost of APG in recent years.

c) Administration Cost

32. Administration cost is assumed as 11% of total personnel cost. This ratio is based on the actual one of APG in recent years.

(d) Depreciation

33. The annual depreciation costs are calculated by the straight line method, based on their service lives, as shown in Table III-10-3. Residual values after all depreciations are estimated as zero.

Table III-10-3 Service Lives for Port Facilities and Equipment

Unit: years

Item	Service Lives
Berth	40
Revetment	40
Pontoon	25
Yard	25
Road	15
Utilities	15
Gantry Crane	15
Straddle Carrier	6

Source: UNITAD NATIONS (Port Development), OCDI Report

(e) Contribution to the other institution

34. Contribution to the General Auditor, DIGMER, Culture House and others are assumed respectively, 0.4%, 1.7%, 1.7% and 0.3% of operation revenue. This ratio is based on the actual one of APG in recent years.

C. Financial Internal Rate of Return (FIRR)

35. The FIRR of CASE X and CASE Y is respectively about 25.4% and 27.6% as shown in Table III-10-4. Both rates exceed the weighted average interest rate (11.25%) of funds.

Table III-10-4(a) FIRR Calculation (CASE X)

FIRR = 25.4%   (Unit=1,000,000sucres)

Year	Revenues			Cost			(Revenue) (Cost)	Revenue	Net Present Value	
	Operating Revenues	Subsidy (G. Fund)	Total	Investment (total)	Operating Expense	Total			Cost	Difference
1999	0	0	0	1,485	0	1,485	-1,485	0	1,485	-1,485
2000	0	0	0	16,412	0	16,412	-16,412	0	13,091	-13,091
2001	0	0	0	22,655	162	22,817	-22,817	0	14,517	-14,517
2002	0	0	0	37,566	389	37,955	-37,955	0	19,261	-19,261
2003	26,778	0	26,778	0	7,858	7,858	18,920	10,839	3,181	7,658
2004	29,090	0	29,090	0	7,858	7,858	21,232	9,392	2,537	6,855
2005	31,144	0	31,144	0	7,858	7,858	23,286	8,020	2,024	5,997
2006	33,271	0	33,271	0	7,858	7,858	25,413	6,834	1,614	5,220
2007	35,215	0	35,215	0	7,858	7,858	27,357	5,770	1,287	4,482
2008	37,354	0	37,354	8,400	7,858	16,258	21,096	4,882	2,125	2,757
2009	38,432	0	38,432	0	7,858	7,858	30,574	4,006	819	3,187
2010	39,521	0	39,521	0	7,858	7,858	31,663	3,286	653	2,633
2011	39,521	0	39,521	0	7,858	7,858	31,663	2,621	521	2,100
2012	39,521	0	39,521	0	7,858	7,858	31,663	2,091	416	1,675
2013	39,521	0	39,521	0	7,858	7,858	31,663	1,668	332	1,336
2014	39,521	0	39,521	8,400	7,858	16,258	23,263	1,330	547	783
2015	39,521	0	39,521	0	7,858	7,858	31,663	1,061	211	850
2016	39,521	0	39,521	0	7,858	7,858	31,663	846	168	678
2017	39,521	0	39,521	21,916	7,858	29,774	9,747	675	509	166
2018	39,521	0	39,521	0	7,858	7,858	31,663	538	107	431
2019	39,521	0	39,521	0	7,858	7,858	31,663	429	85	344
2020	39,521	0	39,521	8,400	7,858	16,258	23,263	343	141	202
2021	39,521	0	39,521	0	7,858	7,858	31,663	273	54	219
2022	39,521	0	39,521	0	7,858	7,858	31,663	218	43	175
2023	39,521	0	39,521	0	7,858	7,858	31,663	174	35	139
2024	39,521	0	39,521	0	7,858	7,858	31,663	139	28	111
2025	39,521	0	39,521	0	7,858	7,858	31,663	111	22	89
2026	39,521	0	39,521	8,400	7,858	16,258	23,263	88	36	52
2027	39,521	0	39,521	324	7,858	8,182	31,338	70	15	56
2028	39,521	0	39,521	0	7,858	7,858	31,663	56	11	45
2029	39,521	0	39,521	0	7,858	7,858	31,663	45	9	36
2030	39,521	0	39,521	0	7,858	7,858	31,663	36	7	29
2031	39,521	0	39,521	0	7,858	7,858	31,663	28	6	23
2032	39,521	0	39,521	30,461	7,858	38,319	1,202	23	22	1
2033	39,521	0	39,521	0	7,858	7,858	31,663	18	4	15
2034	39,521	0	39,521	0	7,858	7,858	31,663	14	3	12
Total	1,219,303	0	1,219,303	164,418	252,005	416,423	802,880	65,924	65,924	0

Table III-10-4(b) FIRR Calculation (CASE Y)

FIRR = 27.6 %   (Unit=1,000,000sucres)

Year	Revenues			Cost			(Revenue) (Cost)	Revenue	Net Present Value	
	Operating Revenues	Subsidy (G. Fund)	Total	Investment (total)	Operating Expense	Total			Cost	Difference
1999	0	0	0	997	0	997	-997	0	997	-997
2000	0	0	0	11,354	0	11,354	-11,354	0	8,901	-8,901
2001	0	0	0	11,164	112	11,276	-11,276	0	6,929	-6,929
2002	0	0	0	32,270	223	32,493	-32,493	0	15,653	-15,653
2003	18,415	0	18,415	0	4,550	4,550	13,866	6,954	1,718	5,236
2004	20,611	0	20,611	0	4,550	4,550	16,061	6,101	1,347	4,754
2005	22,448	0	22,448	0	4,550	4,550	17,898	5,209	1,056	4,153
2006	24,461	0	24,461	0	4,550	4,550	19,911	4,450	828	3,622
2007	26,273	0	26,273	0	4,550	4,550	21,723	3,747	649	3,098
2008	28,534	0	28,534	8,382	4,550	12,932	15,602	3,190	1,446	1,744
2009	30,330	0	30,330	0	4,550	4,550	25,780	2,658	399	2,259
2010	30,293	0	30,293	0	4,550	4,550	25,743	2,081	313	1,768
2011	30,293	0	30,293	0	4,550	4,550	25,743	1,631	245	1,386
2012	30,293	0	30,293	0	4,550	4,550	25,743	1,279	192	1,087
2013	30,293	0	30,293	0	4,550	4,550	25,743	1,002	151	852
2014	30,293	0	30,293	8,382	4,550	12,932	17,361	786	335	450
2015	30,293	0	30,293	0	4,550	4,550	25,743	616	93	524
2016	30,293	0	30,293	0	4,550	4,550	25,743	483	73	410
2017	30,293	0	30,293	21,095	4,550	25,645	4,648	379	320	58
2018	30,293	0	30,293	0	4,550	4,550	25,743	297	45	252
2019	30,293	0	30,293	0	4,550	4,550	25,743	233	35	198
2020	30,293	0	30,293	8,382	4,550	12,932	17,361	182	78	105
2021	30,293	0	30,293	0	4,550	4,550	25,743	143	21	121
2022	30,293	0	30,293	0	4,550	4,550	25,743	112	17	95
2023	30,293	0	30,293	0	4,550	4,550	25,743	88	13	75
2024	30,293	0	30,293	0	4,550	4,550	25,743	69	10	59
2025	30,293	0	30,293	0	4,550	4,550	25,743	54	8	46
2026	30,293	0	30,293	8,382	4,550	12,932	17,361	42	18	24
2027	30,293	0	30,293	332	4,550	4,882	25,411	33	5	28
2028	30,293	0	30,293	0	4,550	4,550	25,743	26	4	22
2029	30,293	0	30,293	0	4,550	4,550	25,743	20	3	17
2030	30,293	0	30,293	0	4,550	4,550	25,743	16	2	14
2031	30,293	0	30,293	0	4,550	4,550	25,743	13	2	11
2032	30,293	0	30,293	29,477	4,550	34,027	-3,734	10	11	-1
2033	30,293	0	30,293	0	4,550	4,550	25,743	8	1	7
2034	30,293	0	30,293	0	4,550	4,550	25,743	6	1	5
Total	928,389	0	928,389	140,217	145,926	286,143	642,246	41,917	41,917	0

D. Evaluation

1) CASE X

(a) Sensitivity Analysis

36. Sensitivity analysis is conducted to examine the impact of unexpected future changes. Table III-10-5 shows the calculation cases and results. All the cases exceed the weighted average interest rate.

Table III-10-5 : FIRR Sensitive Analysis (CASE X)

	Project Costs	Revenues	Operation Costs	FIRR
1	100%	100%	100%	25.4%
2	ditto	ditto	110%	24.9%
3	ditto	90%	100%	20.0%
4	ditto	ditto	110%	19.5%
5	110%	100%	100%	23.3%
6	ditto	ditto	110%	22.9%
7	ditto	90%	100%	18.3%
8	ditto	ditto	110%	17.8%

(b) Financial Soundness of the Project

37. The projected financial statements and financial indicators, the rate of return of net fixed assets, debt service coverage ratio, operating ratio and working ratio of the project are shown in Table III-10-6.

a) Profitability

38. The rate of return on net fixed assets exceeds the weighted average interest rate of funds (11.25%) in the beginning phase.

b) Loan Repayment Capacity

39. The debt service coverage ratio exceeds 1.0 throughout the project life. There will be no problem with the repayment of the long-term loans using the annual operating revenues.

c) Operational Efficiency

40. Both the operating ratios and the working rations maintain positive levels. This shows that the operation will be efficient.

(c) Conclusion

41. Judging from the above analysis, this project can be regarded as financially feasible. Furthermore, it is recommended that the following measures be taken to improve the financing during the project life.

a) Efficient Cargo Handling

42. Judging from the sensitivity analysis, FIRR will be affected more by cargo volume than project costs and operation costs. So, APG has to make efforts to heighten the quality of the service and improve cargo handling efficiency to secure forecast cargo volume.

b) Fund raising

43. FIRR is less than the interest on loan in Ecuadorian domestic banks. Therefore this project will not be feasible without soft loan for public sector. This means that it would be difficult for the private sector to initiate the project.

44. At present, APG has no desire to invest in port facilities. But APG should prepare an appropriate funding scheme for new project of APG to cope with the increasing cargo volume, if there is no private entity which will invest in new port facilities. If not, sooner or later cargo will flow out to other ports.

c) Privatization

45. If possible, APG should procure new berth and main facilities by itself for port development project at Port of Guayaquil because the project is financially feasible and will yield a good profit.

46. When APG concede port facilities and equipment to private company, it is important to set the charge at a reasonable level in the contract. Otherwise private company will profit too much from public facilities.

d) Port Tariff

47. According to the results of the sensitivity analysis, this project will be feasible if the operation income is 90%. Therefore port tariff level can be adjusted (discounted) to successfully compete with neighboring ports and alternative transportation.

Table III-10-6 Financial Statement (CASE X)

PROFIT AND LOSS STATEMENT

(Unit= 1,000,000 sucres)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Operating Revenue	0	0	0	0	26,778	29,090	31,144	33,271	35,215	37,354	38,432	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521	39,521
Operating Expenses	0	0	162	389	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840	11,840
Personnel	0	0	0	0	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377	5,377
Maintenance and repair	0	0	162	389	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889	1,889
Administration	0	0	0	0	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591	591
Depreciation costs	0	0	0	0	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982
Net Operating Income	0	0	-162	-389	14,938	17,250	19,304	21,431	23,374	25,513	26,592	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681
Non-operating Revenues	0	0	0	0	0	304	775	1,327	1,916	2,431	3,365	4,415	5,536	6,668	7,791	8,662	9,862	11,106	11,629	12,942	14,303	15,421	16,875	18,383	18,947	21,569	23,250	24,700	26,486	28,349	30,289	32,284	34,383	35,520	37,815
Interest on deposit	0	0	0	0	0	304	775	1,327	1,916	2,431	3,365	4,415	5,536	6,668	7,791	8,662	9,862	11,106	11,629	12,942	14,303	15,421	16,875	18,383	18,947	21,569	23,250	24,700	26,486	28,349	30,289	32,284	34,383	35,520	37,815
Non-operating Expenses	0	167	1,997	4,344	8,114	7,235	6,437	6,592	7,993	4,352	2,858	2,180	1,756	1,736	1,690	1,602	1,514	1,427	1,339	1,251	1,163	1,075	987	869	811	724	636	548	460	372	284	196	110	42	-0	-0
Interest on long-term loans	0	167	1,997	4,344	8,114	7,235	6,356	5,478	4,599	3,720	2,858	2,180	1,756	1,736	1,690	1,602	1,514	1,427	1,339	1,251	1,163	1,075	987	899	811	724	636	548	460	372	284	196	110	42	-0	-0
Interest on short-term loans	0	0	0	0	0	0	81	1,114	3,394	633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Income Before Tax	0	-167	-2,159	-4,733	6,824	10,015	13,171	15,614	16,709	23,076	26,186	28,856	30,340	31,491	32,658	33,869	34,828	36,115	37,448	38,059	39,459	40,908	42,114	43,656	45,252	46,904	48,614	50,383	51,921	53,795	55,745	57,764	59,855	62,021	63,201	65,496
Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Income After Tax	0	-167	-2,159	-4,733	6,824	10,015	13,171	15,614	16,709	23,076	26,186	28,856	30,340	31,491	32,658	33,869	34,828	36,115	37,448	38,059	39,459	40,908	42,114	43,656	45,252	46,904	48,614	50,383	51,921	53,795	55,745	57,764	59,855	62,021	63,201	65,496
(Contribution To the Government)	0	0	0	0	1,098	1,193	1,277	1,364	1,444	1,531	1,576	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620
Net Income After Contribution	0	-167	-2,159	-4,733	5,726	8,822	11,894	14,250	15,265	21,545	24,590	27,245	28,720	29,861	31,038	32,249	33,208	34,495	35,827	36,439	37,839	39,288	40,494	42,036	43,632	45,284	46,993	48,763	50,300	52,174	54,125	56,144	58,234	60,400	61,581	63,875
Retained Earnings	0	-167	-2,326	-7,059	-1,333	7,489	19,383	33,633	48,898	70,443	95,033	122,278	150,998	180,858	211,896	244,144	277,353	311,848	347,675	384,114	421,953	461,241	501,734	543,770	587,402	632,686	679,679	728,442	778,742	830,916	885,041	941,186	999,420	1,059,820	1,121,401	1,185,276

CASH FLOW STATEMENT

(Unit= 1,000,000 sucres)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Cash Beginning	0	0	-213	-2,932	-8,931	-1,665	8,699	22,134	37,924	54,731	69,463	96,154	126,152	158,182	190,505	222,595	247,497	281,758	317,306	332,270	369,762	408,653	440,595	482,141	525,230	569,915	616,251	664,297	705,713	756,742	809,969	865,147	922,400	982,358	1,014,871	1,080,434
Cash Inflow (excluding G. Funds)	1,485	16,412	22,493	37,177	18,920	21,232	23,591	26,187	28,684	31,411	33,006	35,028	36,078	37,199	38,330	39,454	40,325	41,524	42,769	43,292	44,604	45,966	47,084	48,538	50,046	51,610	53,232	54,913	56,363	58,149	60,012	61,943	63,917	66,045	67,183	69,478
Net operating income	0	0	-162	-389	14,938	17,250	19,304	21,431	23,374	25,513	26,592	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681	27,681
Depreciation costs	0	0	0	0	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982	3,982
Long-term loans	1,485	16,412	22,655	37,566	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest on deposits	0	0	0	0	0	304	775	1,327	1,916	2,431	3,365	4,415	5,536	6,668	7,791	8,662	9,862	11,106	11,629	12,942	14,303	15,421	16,875	18,383	18,947	21,569	23,250	24,700	26,486	28,349	30,289	32,284	34,383	35,520	37,815
Cash Outflow (excluding G. Funds)	1,485	16,625	25,211	43,177	11,653	19,869	10,156	10,397	11,878	16,678	6,315	5,030	4,047	4,877	6,240	14,552	6,064	5,976	27,804	5,861	5,713	14,035	5,537	5,449	6,361	6,273	5,185	13,497	5,334	4,932	4,854	4,698	3,989	33,532	1,620	1,620
Investment	1,485	16,412	22,655	37,566	0	0	0	0	0	8,400	0	0	0	0	0	8,400	0	0	21,916	0	0	8,400	0	0	0	0	0	8,400	324	0	0	0	0	30,464	0	0
Repayment for long-term loans	0	46	559	1,267	2,441	2,441	2,441	2,441	2,441	2,395	1,882	1,230	671	1,521	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,874	2,258	1,429	0	0	0	0	0
Interest on long-term loans	0	167	1,997	4,344	8,114	7,235	6,356	5,478	4,599	3,720	2,858	2,180	1,756	1,736	1,690	1,602	1,514	1,427	1,339	1,251	1,163	1,075	987	899	811	724	636	548	460	372	284	196	110	42	-0	-0
Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Contribution to the Government)	0	0	0	0	1,098	1,193	1,277	1,364	1,444	1,531	1,575	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620
Interest on short-term loans	0	0	0	0	0	0	81	1,114	3,394	633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Inflow - Cash Outflow	0	-213	-2,718	-6,000	7,267	10,363	13,435	15,791	16,806	14,733	26,691	29,998	32,031	32,322	32,090	24,902	34,261	35,548	14,964	37,493	38,892	31,941	41,547	43,089	44,685	46,337	48,046	41,416	51,029	53,227	55,178	57,513	59,958	32,513	65,563	67,858
Cash Ending	0	-213	-2,932	-8,931	-1,665	8,699	22,134	37,924	54,731	69,463	96,154	126,152	158,182	190,505	222,595	247,497	281,758	317,306	332,270	369,762	408,653	440,595	482,141	525,230	569,915	616,251	664,297	705,713	756,742	809,969	865,147	922,400	982,358	1,014,871	1,080,434	1,148,292
Cash excess	0	0	0	0	0	8,699	22,134	37,924	54,731	69,463	96,154	126,152	158,182	190,505	222,595	247,497	281,758	317,306	332,270	369,762	408,653	440,595	482,141	525,230	569,915	616,251	664,297	705,713	756,742	809,969	865,147	922,400	982,358	1,014,871	1,080,434	1,148,292
Cash shortage	0	-213	-2,932	-8,931	-1,665	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BALANCE SHEET

(Unit= 1,000,000 sucres)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
(Assets)																																				
Current Assets	0	0	0	0	0	8,699	22,134	37,924	54,731	69,463	96,154	126,152	158,182	190,505	222,595	247,497	281,758	317,306	332,270	369,762	408,653	440,595	482,141	525,230	569,915	616,251	664,297	705,713	756,742	809,969	865,147	922,400	982,358	1,014,871	1,080,434	1,148,292
Cash & Deposit	0	0	0	0	0	8,699	22,134	37,924	54,731	69,463	96,154	126,152	158,182	190,505	222,595	247,497	281,758	317,306	332,270	369,762	408,653	440,595	482,141	525,230	569,915	616,251	664,297	705,713	756,742	809,969	865,147	922,400	982,358	1,014,871	1,080,434	1,148,292
Fixed Assets	1,485	17,897	40,552	78,118	74,136	70,153	66,171	62,189	58,206	62,624	58,642	54,659	50,677	46,695	42,712	47,130	43,147	39,165	57,099	53,117	49,134	53,552	49,569	45,587	41,605	37,622	33,640	38,058	34,400	30,417	26,435	22,453	18,471	44,949	40,967	36,984
Construction costs	1,485	17,897	40,552	78,118	78,118	78,118	78,118	78,118	78,118	86,518	86,518	86,518	86,518	86,518	94,917	94,917	94,917	94,917	116,833	116,833	116,833	125,233	125,233	125,233	125,233	133,633	133,633	133,957	164,418	164,418	164,418	164,418	164,418	194,882	194,882	194,882
Accumulated depreciation	0	0	0	0	3,982	7,965	11,947	15,929	19,912	23,894	27,876	31,858	35,841	39,823	43,805	47,788	51,770	55,752	59,735	63,717	67,699	71,681	75,664	79,646	83,628	87,611	91,593	95,575	99,558	103,540	107,522	111,504	115,487	119,469	123,451	127,434
Net fixed assets	1,485	17,897	40,552	78,118	74,136	70,153	66,171	62,189	58,206	62,624	58,642	54,659	50,677	46,695	42,712	47,130	43,147	39,165	57,099	53,117	49,134	53,552	49,569	45,587	41,605	37,622	33,640	38,058	34,400	30,417	26,435	22,453	18,471	44,949	40,967	36,984
Total Assets	1,485	17,897	40,552	78,118	74,136	78,852	88,305	100,113	112,937	132,087	154,795	180,811	208,859	237,199	265,307	294,627	324,905	356,471	389,369	422,878	457,788	494,146	531,711	570,817	611,519	653,874	697,938	743,771	791,142	840,387	891,583	944,853	1,000,828	1,059,820	1,121,401	1,185,276
(Liabilities and capital)																																				
Liabilities	1,485	18,064	42,878	85,177	76,468	71,363	68,922	66,480	64,039	61,644	59,762	58,533	57,852	56,341	53,412	50,482	47,553	44,623	41,694	38,764	35,835	32,906	29,976	27,047	24,117	21,188	18,258	15,329	12,400	9,470	6,541	3,667	1,409	-0	-0	-0
Current Liabilities (short-term loan)	0	213	2,932	8,931	1,665	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Liabilities (long-term loan)	1,485	17,851	39,946	76,245	73,834	71,363	68,922	66,480	64,039	61,644	59,762	58,533	57,852	56,341	53,412	50,482	47,553	44,623	41,694	38,764	35,835	32,906	29,976	27,047	24,117	21,188	18,258	15,329	12,400	9,470	6,541	3,667	1,409	-0	-0	-0
Capital	-167	-2,326	-7,059	-1,333	7,489	19,383	33,633	48,898	70,443	95,033	122,278	150,998	180,858	211,896	244,144	277,353	311,848	347,675	384,114	421,953	461,241	501,734	543,770	587,402	632,686	679,679	728,442	778,742	830,916	885,041	941,186	999,420	1,059,820	1,121,401	1,185,276	
In kind By Government Funds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Owned Capital	0	0	0	0	0	0	0	0	8,400	8,400	8,400	8,400	8,400	8,400	16,799	16,799	16,799	38,715	38,715	38,715	47,115	47,115	47,115	47,115	47,115	55,515	55,839	55,839	55,839	55,839	55,839	86,300	86,300	86,300		
Retained Earnings	0	-167	-2,326	-7,059	-1,333	7,489	19,383	33,633	48,898	62,043	86,633	113,878	142,598	172,459	203,496	227,345	260,553	295,048	308,960	345,398	383,237	414,126	454,619	496,655	540,267	585,571	632,564	672,927	722,903	775,077	829,202	885,346	943,580	973,520	1,035,101	1,098,976
Total Liabilities and capital	1,485	17,897	40,552	78,118	74,136	78,852	88,305	100,113	112,937	132,087	154,795	180,811	208,859	237,199	265,307	294,627	324,905	356,471	389,369	422,878	457,788	494,146	531,711	570,817	611,519	653,874	697,938	743,771	791,142	840,387	891,583	944,853	1,000,828	1,059,820	1,121,401	1,185,276

FINANCIAL INDICATORS

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Working Ratio (%)	0.0%	0.0%	0.0%	0.0%	28.3%	27.0%	25.2%	23.6%	22.3%	21.0%	20.4%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%	19.9%
Operating Ratio (%)	0.0%	0.0%	0.0%	0.0%	44.2%	40.7%	38.0%	35.6%	33.6%	31.7%	30.8%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
Rate of Return on Net Fixed Assets (%)	0.0%	0.0%	-0.4%	-0.5%	20.1%	24.6%	29.2%	34.5%	40.2%	40.7%	45.2%	50.6%	54.6%	59.3%	64.8%	58.7%	64.2%	70.7%	48.5%	62.1%	56.3%	51.7%	55.8%	60.7%	66.5%	73.6%	82.3%	72.7%	84.5%	91.0%	104.7%	123.3%	149.9%	61.6%	67.6%	74.8%
Debt Service Coverage Ratio	0.0	0.0	-0.1	-0.1	1.8	2.2	2.6	3.2	3.9	4.0	6.5	9.3	13.0	9.1	7.0	7.1	7.3	7.4	7.6	7.7	7.9	8.1	8.3	8.5	8.7	8.9	9.1	9.3	9.6	9.9	10.3	13.4	21.8			

III-10-13

2) CASE Y

(a) Sensitivity Analysis

48.   Table III-10-7 shows the calculation cases and results. All the cases exceed the weighted average interest rate.

Table III-10-7   FIRR Sensitive Analysis (CASE Y)

	Project Costs	Revenues	Operation Costs	FIRR
1	100%	100%	100%	27.6%
2	ditto	ditto	110%	27.2%
3	ditto	90%	100%	22.2%
4	ditto	ditto	110%	21.8%
5	110%	100%	100%	25.4%
6	ditto	ditto	110%	25.0%
7	ditto	90%	100%	20.2%
8	ditto	ditto	110%	19.9%

(b) Financial Soundness of the Project

49.   The projected financial statements and financial indicators, the rate of return of net fixed assets, debt service coverage ratio, operating ratio and working ratio of the project are shown in Table III-10-8.

a) Profitability

50.   The rate of return on net fixed assets exceeds the weighted average interest rate of funds (11.25 %) in the beginning phase.

b) Loan Repayment Capacity

51.   The debt service coverage ratio exceeds 1.0 throughout the project life. There will be no problem with the repayment of the long-term loans using the annual operating revenues.

c) Operational Efficiency

52.   Both the operating ratios and the working rations maintain positive levels. This shows that the operation will be efficient.

(c) Conclusion

53.   Judging from the above analysis, this project can be regarded as financially feasible.

54.   The main features of measures to be taken to improve the financing during the project life are the same as those of CASE X.

55.   If the cargo handling efficiency is improved, CASE Y will be able to cope with the increasing cargo volume in place of CASE X.

Table III-10-8 Financial Statement (CASE Y)

PROFIT AND LOSS STATEMENT
(Unit = 1,000,000 sucres)

Years: 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034

Rows:
- Operating Revenue
- Operating Expenses
  - Personnel
  - Maintenance and repair
  - Administration
  - Depreciation costs
- Net Operating Income
- Non-operating Revenues
  - Interest on deposit
- Non-operating Expenses
  - Interest on long term loans
  - Interest on short-term loans
- Net Income Before Tax
- Tax
- Net Income After Tax
- (Contribution To the Government)
- Net Income After Contribution
- Retained Earnings

CASH FLOW STATEMENT
(Unit = 1,000,000 sucres)

Rows:
- Cash Beginning
- Cash Inflow (excluding G. Funds)
  - Net operating income
  - Depreciation costs
  - Long-term loans
  - Interest on deposits
- Cash Outflow (excluding G. Funds)
  - Investment
  - Repayment for long-term loans
  - Interest on long-term loans
  - Tax
  - (Contribution to the Government)
  - Interest on short-term loans
- Cash Inflow - Cash Outflow
- Cash Ending
  - Cash excess
  - Cash shortage

BALANCE SHEET
(Unit = 1,000,000 sucres)

(Assets)
- Current Assets
  - Cash & Deposit
- Fixed Assets
  - Construction costs
  - Accumulated depreciation
  - Net fixed assets
- Total Assets

(Liabilities and capital)
- Liabilities
  - Current Liabilities (short-term loan)
  - Fixed Liabilities (long-term loan)
- Capital
  - In kind By Government Funds
  - Owned Capital
  - Retained Earnings
- Total Liabilities and capital

FINANCIAL INDICATORS

- Working Ratio (%)
- Operating Ratio (%)
- Rate of Return on Net Fixed Assets (%)
- Debt Service Coverage Ratio

Chapter 11 ENVIRONMENTAL IMPACT ASSESSMENT

A. Basic Concept

1. The purpose of Environmental Impact Assessment (EIA) of the Study is to evaluate environmental impact of the Short Term Plan.

2. The Short Term Plan creates job opportunities. The construction stage continues for about 3 years and bring various job opportunities in both direct and indirect fashions. Direct effects increase jobs in the Port of Guayaquil or its vicinity; workers for the construction work itself, transportation of construction materials and other related works. This will activate not only APG but other companies as well.

3. After the completion of the project, the new berth starts operation. Much larger cargo volume goes in and out of the port. The same can be said of people. This implies that both the number of workers of port administration, operation and service in the port area and the number of workers of port related industries will increase. The development of the port contributes growth of industrial and commercial activities. This also translates into an increase in job opportunities.

4. Through this process, employment oppotunities in the city of Guayaquil will increase and so will generated income in this area. The Port of Guayaquil is expected to stimulate economic growth throughout Ecuador towards the year 2000.

5. Adverse effects of the project are expected to be small and negligible. The berth(or berths) is constructed in the Short Term Plan. Therefore EIA for the Short Term Plan should be conducted in the Study.

6. The Government of Ecuador has paid much attention to environmental preservation. The constitution expresses the spirit for keeping this valuable environmental condition in Chapter 5 of PART I.

7. There also exist many individual rules and regulations concerning environmental conservation. Various international treaties and agreements related to environmental condition in Chapter 8 of PART II have been signed.

8. The basic environmental policy in Ecuador has already been published by the Government but detailed measures such as technical standards have not been established. There is no regulation or procedure on EIA for the development.

9. There are several methods to examine the environmental effects by a certain project or activity. The methods of EIA should be adopted according to the content of the project and the environmental situation related to the project. Four kinds of methods of EIA are described below.

10. The impact grasping method tries to determine the magnitude of impacts by the port development on the present environment in and around the port, in comparison with environmental impacts from other causes. If the impact from the port development project is determined to be small, then impacts of port development project would not be further examined, and no mitigatory countermeasures are needed.

```
┌─────────────────────────────────────────┐
│ Impact from port development project     │
└─────────────────────────────────────────┘
                    ↑
               Comparison
        (Evaluation by comparing the two)
                    ↓
┌─────────────────────────────────────────┐
│ Present environmental burden other       │
│ than the project                         │
└─────────────────────────────────────────┘
```
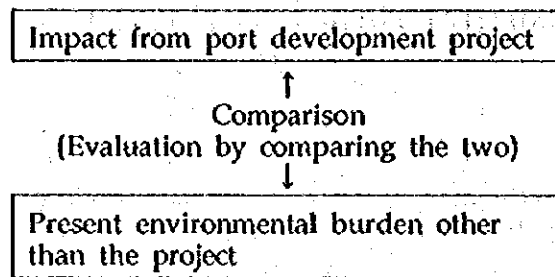
Figure III-11-1   Impact Grasping Method

11.   The impact assessment method first conducts prediction of magnitude of the impact generated in the future only by port development project, and compares it with the present environmental condition in the background, then conducts assessment using the degree of differences or ratio between them.

```
┌──────────────────────┐   Estimation    ┌──────────────────────┐
│ Impact from port     │                 │ Level of Environmental in│
│ development project   │───────────────► │ the future associated with│
│                      │                 │ port development project │
└──────────────────────┘                 └──────────────────────┘
                                                     │
                                          Evaluation by comparing
                                                the two
                                                     │
┌──────────────────────┐   Measurement   ┌──────────────────────┐
│ Present environmental│                 │ Level of the present │
│ burden other than the│───────────────►│ environmental conditions│
│ project              │                 │ in/around the port   │
└──────────────────────┘                 └──────────────────────┘
```
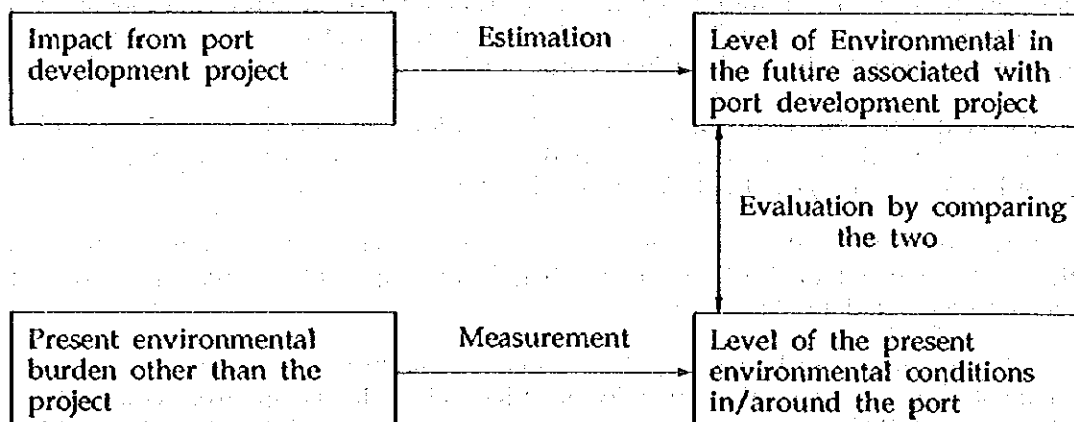
Figure III-11-2   Impact Assessment Method

12.   As impact grasping method and impact assessment method can be done without an estimation of environmental situation in the background, they can be conducted easily. However, it is necessary to consider the appropriate additional load.

13.   The general assessment method stands between impact assessment and comprehensive method (described in next paragraph). It estimates the impact associated only with the port development project in future, then adds it to the present level of background area, and obtains the future environmental level. The detailed result is evaluated by comparison with the environmental level to be achieved. This method is applied where the site is presently in a favorable environmental condition, and environmental burden other than the project continues to be almost at the same level in the future.
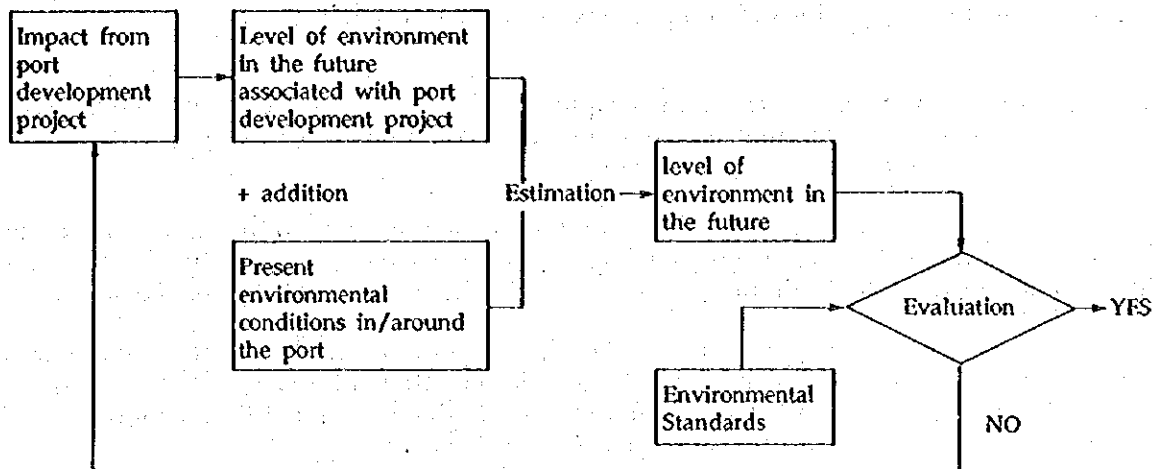
Figure III-11-3   General Assessment Method

14.   The comprehensive assessment method tries to obtain an assessment of the future environmental level through separate assessment of impacts associated with port development and the impacts that can be generated in the future by other projects for the background area.

15.   Full understanding of environmental situation in the vast background and new source of environmental burden reduction plans, if any, is needed to use this method. As this method requires information that is supposed to be beyond the reach of a port authority, the plan by concerned authorities which have the responsibility on related projects such as road development are important for EIA.
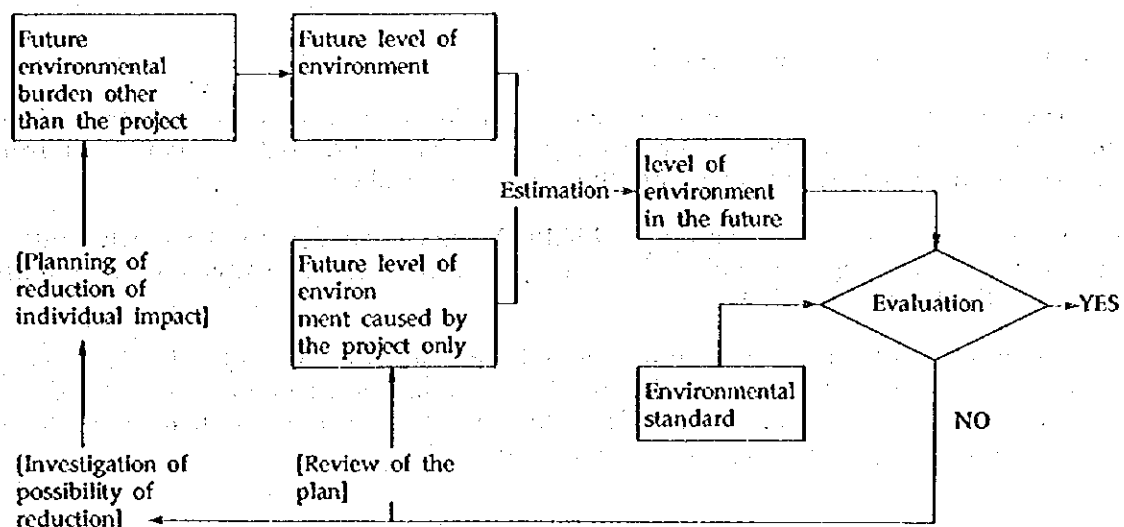
Figure III-11-4   Comprehensive Assessment Method

16.   According to initial environmental examination, this project will not produce serious environmental impact. The components to be discussed in EIA have been listed in Chapter 8 PART II, so the method for each component will be selected from the methods described above.

B. Environmental Impact by the components selected through IEE

17. Present situation is described in Chapter 8 of PART I. Considering the present situation in Ecuador, the preliminary environmental examination for this project has been conducted at the stage of the Master Plan.

18. Two cases, Case X and Case Y, are prepared for the Short Term Plan. The berth is different between these cases but the impact on environment from each case does not differ significantly. Thus, for the purpose of EIA, these cases will be treated as one.

19. As described in Chapter 9 of PART II, the impact on the components: waste produced in the port, treatment of waste oil, deforestation of mangrove, air pollution from traffic from/to the port, water pollution by dredging and noise and vibration by traffic from/to the port are discussed in EIA of this chapter.

1) Waste in the Port

20. At present, waste collection is carried out by APG itself. The volume of waste daily collected is about 30 m³ at present.

21. Under the assumption that the volume is proportional to the growth of cargo volume through the port, the volume of waste to be collected in the port area becomes 45 m³ per day or 1.5 times the present because the cargo volume in 2003 becomes 1.5 times larger than in 1993. As the increase is not so large, the impact of increased waste is not considered to be serious.

22. It is recommended that the waste collecting should be implemented by the public service of the city. Namely the collected waste is taken out of the port and transported to municipal disposal sites.

2) Waste Oil Treatment and Disposal

23. There is no special waste oil treatment system in the Port of Guayaquil. The private companies collect the waste oil from calling ships based on contract. Waste oil from small boats and from the maintenance shop is not controlled.

24. Ecuador has been a signatory of MARPOL since August 10, 1993. DIGMER is responsible for enforcing port authorities to prepare the appropriate system to accomplish MARPOL stipulations by 2000.

25. The increase of calling ships and port activity will results in higher levels of waste oil. In order to preserve sound environmental condition of water in the port area and the surroundings, appropriate system for collecting and treatment system of waste oil should be prepared at the stage of the Short Term Plan.

3) Mangrove Forest

26. The mangrove forest is not included in the developing area of the Short Term Plan. In this sense the Short Term Plan does not have a direct impact on mangrove forest.

27. The reclamation and dredging work in the Short Term Plan will be conducted in a limited area. Therefore the indirect influence to the mangrove will also be small or negligible. In addition, the mangrove area is spread widely through this area.

Considering the above, it is thought that the impact by the Short Term Plan will not be serious.

4) Air Pollution by Traffic

28. Port traffic may have an impact on air quality in terms of SOx and NOx. In the target year of the Short Term Plan, the volume of port traffic, cars and ships, increases. The impact from port traffic is calculated on the basis of data shown in Table I-5-2. the SOx volume emitted in the port area (it is assumed that vehicles drive 2 km in the area) from vehicles and ships is estimated. The result will be compared with total volume of emanation of SOx by transportation in the city of Guayaquil.

29. According to the Table, annual emittance from trucks (diesel) is estimated as 1.7 g of SOx per one km. Though this figure will become smaller in future because of progress of environmental countermeasures against air pollution, the estimation will be conducted using this figure. The increase in traffic from/to the port is assumed as 400 trucks per day in proportion to increase of cargo and as 300 cars. On the other hand, SOx emitted by a truck is estimated as 1.7 g/km-year and 0.12g/km-year by a car. Therefore an increase in emitted SOx by trucks is estimated as approximately 500 kg/year(1.7 g/km x 2 km x 365 x 400) and 35 kg/year(0.16 x 2 km x 365 x 300).

30. In case of ships, the number of calling ships in 2003 increases by 1.3 times over thepresent number. On the other hand, the SOx emitted by ships is 19.5 g/day. Therefore an increase in emitted SOx is estimated as 200 kg/year (19.5 g/day x 0.3 x 365 day).

31. The increase in SOx emitted in the port area by traffic is estimated as less than 0.7 ton and the figure is negligibly small compared with the estimated emittance of 607 tons in 1987. Therefore the impact on air pollution by the Short Term Plan is small.

5) Water pollution by dredging

32. There are two types of water pollution to be discussed in port development. One is water pollution caused by discharged pollutant to a water area. The other is turbidity by dredging and reclamation work.

33. On the former, in general, the port activity itself does not produce large pollutant and the influence by urban activity is larger and serious. In case of the Port of Guayaquil the problems of water quality in the water area should be solved from the viewpoint of urban activities. But APG should prepare the adequate treatment and discharge system for waste water produced at buildings such as restaurants and toilets as well as the maintenance shop.

34. On the latter 131,000 m^3-dreading and 150,000 m^3-reclamation in Case X (55,000 m^3 and 18,000 m^3 in Case Y) are planned for the Short Term Plan. Because the volume of materials is small and the velocity of stream in the site is very small, the divergence of soil material is limited. But near the port many shrimp breeding pools are located so it is necessary to take sufficient care not to make remarkable turbidity of sea bed. Therefore the adequate work method to minimize the suspension of material should be adopted and environmental monitoring should be implemented through the whole period of dredging work.

6) Noise and Vibration by traffic from/to the port

35. With increase of cargo, road traffic volume will increase. The traffic volume into and out of the port in operation stage is estimated as about 780 vehicles per hour. It is as 1.5 times as many at present and not so much increase.

36. On the other hand, the access road to the port is in good condition and there are no public facilities in which it is to secure calmness in the vicinity of the entrance of the port.

37. The increase of traffic will not greatly increase noise and vibration at stage of the Short Term Plan.

C. Overall Evaluation of Environmental Impact and Conclusion

38. The result is summarized as follows.

Table III-11-1   Result of EIA for 6 Components

Component	Result of Evaluation
Waste Disposal	No significant impact Introducing city treatment system is recommended
Oil Treatment and Disposal	Not serious if adequate collecting and treatment system is introduced
Mangrove Forest	No significant impact
Air Pollution by Traffic	No significant impact
Water Pollution by Dreading	No significant impact Adequate work method should be adopted Monitoring should be implemented during work
Noise and Vibration by Traffic	no significant impact

39. The Table III-11-1 shows the result of EIA for Case X and Case Y. In the Table 6 components are evaluated. The impact of the other components is evaluated to be small and/or negligible through IEE. Finally, the impact of the Short term Plan on surrounding environment is small and negligible. On the other hand, its economic effect will largely contribute to the growth of the region and Ecuador as a whole.

Chapter 12 OVERALL EVALUATION

1. Viability of the Short Term Plan was evaluated from various points of view mentioned in the preceding chapters. These evaluations are summarized as follows.

2. Two cases, Case X and Case Y, are prepared as the Short Term Plan. The improvement levels of cargo handling efficiency are different between both. Case X is the case of gradual improvement and the Case Y is the rapid improvement.

1) Case X

3. Case X is the case of gradual progress of improvement of cargo handling efficiency and two berths are constructed: one container berth next to berth No.1B and one multi purpose berth next to berth No.6.

a) Engineering Soundness

4. Almost all existing facilities are observed to be in sound condition in both physical and functional aspects. According to APG, it has been decided that the front side of each transit shed behind the berth will be removed to gain wide apron areas for improvement of cargo handling efficiency before the implementation of the Short Term Plan while other facilities will be used as they are at the stage of the Short Term Plan.

5. Proposed construction sites for additional berths are the reserved area next to the existing berth No.1B and new expansion area next to the existing berth 6. At present the depth of basin in front of berth has become smaller than its design depth by sedimentation for years. Therefore the basin in front of proposed berths requires maintenance dredging but the efforts to maintain the design depth will be the same as at present.

6. The conditions such as wave, current and foundations give no problems in engineering aspects for the two projects sites.

b) Economic Feasibility

7. The result of economic analysis in Chapter 9 indicates that EIRR is 24.7 % which is sufficiently high the from economic viewpoint. A sensitivity analysis is conducted to check EIRR when basic conditions change. Even costs increase by 10 % compared with base case and benefits decrease by 10 %, EIRR has been calculated as 19.6 %.

8. Accordingly, the Short Term Plan is economically feasible.

c) Financial Feasibility

9. The result of financial analysis in Chapter 10 indicates that FIRR is 25.4 % which is sufficiently high from the financial viewpointA sensitivity analysis is conducted to check the FIRR when aome conditions change. Even when costs increase by 10 % compared with base case and income dorps by 10 %, FIRR has been calculated as 17.8 %.

10. Accordingly, the Short Term Plan is financially feasible.

d) Environmental Aspect

11. There are no important or non-substitutive nature in the project site of the Short

Term Plan. And the Impact to environmental components in and around the site by the plan is small and negligible.

12. On the other hand the Short Term Plan creates direct and indirect employment and will increase income through its construction and operation.

e) Conclusion

13. Based on the comprehensive judgment from various points of view including items mentioned above, the Short Term Plan of Case X is recommended for execution. The result of overall evaluation is summarized in Table III-12-1

Table III-12-1 Overall Evaluation

Case X

Item	Result	Remarks
Engineering Aspect	Good	Many existing facilities are used. Berth construction sites are all in good condition for construction.
Economic Feasibility	Good	EIRR is good. Project greatly contributes to foreign trade throughout nation.
Financial Feasibility	Good	FIRR is good. Project has profitability.
Environmental Aspect	Good	Project has no significant environmental impact and contributes to local and national economy and social stability.

2) Case Y

14. Case Y is the case of rapid improvement of cargo handling efficiency. Only one berth is constructed next to berth No.1B in container terminal.

a) Engineering Soundness

15. Almost all existing facilities to be observed being in sound condition in both physical and functional aspects. According to APG, it has been decided that the front side of each transit shed behind the berth will be removed to gain wide apron areas for improvement of cargo handling efficiency before the implementation of the Short Term Plan while other facilities will be used as they are at the stage of the Short Term Plan.

16. Proposed construction site for additional berth is at reserved area next to the existing berth No.1B. At present the depth of basin in front of berth has become smaller than its design depth by sedimentation for years. Therefore the basin in front of proposed berth (berths) requires maintenance dredging but the efforts to maintain the design depth will be the same as at present.

17. The other conditions such as wave, current and foundation present no problems from the engineering aspect.

b) Economic Feasibility

18. The result of economic analysis in Chapter 9 indicates that EIRR is 16.4 % which is sufficiently high the from economic viewpoint. A sensitivity analysis is conducted to check EIRR when basic conditions change. Even costs increase by 10 % compared with base case and benefits decrease by 10 %, EIRR has been calculated as 13.1 %.

19. Accordingly, the Short Term Plan is economically feasible.

c) Financial Feasibility

20. The result of financial analysis in Chapter 10 indicates that FIRR is 27.6 % which is sufficiently high from the financial viewpointA sensitivity analysis is conducted to check the FIRR when aome conditions change. Even when costs increase by 10 % compared with base case and income dorps by 10 %, FIRR has been calculated as 19.9 %.

21. Accordingly, the Short Term Plan is financially feasible.

d) Environmental Aspect

22. There are no important or non-substitutive nature in the project site of the Short Term Plan. And the impact to environmental components in and around the site by the plan is small and negligible.

23. On the other hand the Short Term Plan creates direct and indirect employment and will increase income through its construction and operation.

e) Conclusion

24. Based on the comprehensive judgment from various points of view including items mentioned above, the Short Term Plan of Case Y is recommended for execution. The result of overall evaluation is summarized in Table III-12-2.

Table III-12-2   Overall Evaluation

Case Y

Item	Result	Remarks
Engineering Aspect	Good	Many existing facilities are used. Berth construction site is all in good condition for construction.
Economic Feasibility	Good	EIRR is good. Project greatly contributes to foreign trade across the national.
Financial Feasibility	Good	FIRR is good. Project has profitability.
Environmental Aspect	Good	Project has no significant environmental impact and contribute to local and national economy and social stability.

PART IV

CONCLUSION

AND

RECOMMENDATION

CONCLUSION AND RECOMMENDATION

1.   The Study Team has formulated this report based on the findings and materials obtained through its own activities of the project, the discussions with counterparts and interviews with many people related to this project and by repeated discussions within the team to solve some of the special problems. While detailed explanation of results of the study are expressed in the main parts of the text of the report, issues which are assumed to be most useful for considering the implementation of this proposed project are summarized here for the readers' convenience.

CONCLUSION

2.   Having paid most attention to ensure progress of the ports modernization program which is one of the most important national policies in the Republic of Ecuador now in progress, the Study Team has formulated the Master Plan for the Port of Guayaquil up to the target year 2010, has conducted a feasibility study of a short-term improvement plan within the framework of the Master Plan and has examined the possibilities of the plans for developments of container terminals, multi-purpose terminals and other important port related facilities in accordance with the scope of work of the team.

3.   Total cargo volume calculated by using a future economic framework forecasted with actual facts and figures concerning the economic growth in Ecuador acquired during the period of the study will be 6,572,000 tons in which container cargo volume will be 3,374,000 tons in 2010. For meeting these demands derived from the increase of cargo in the future, the enlargement and improvement of port facilities are essential together with a gradual improvement of efficiency in handling cargo as well.

4.   The necessary number of berths estimated by the team taking account of the improvement of efficiency in cargo handling as a given condition is:

        3 container berths
       10 multi-purpose berths
        1 bulk berth

5.   According to the estimation stated above and taking the full utilization of the existing usable facilities as the premise for planning, the main projects proposed by the Master Plan in this report are:

        Extension and full equipment of the container berths
        Additional installment of 3 multi-purpose berths
        Development of access roads

6.   For activating the local economy while keeping pace with conservation of the environment, some important measures closely related to the development of the port such as the settlement of Export Proceeding Zone by utilizing the neighboring open spaces possessed by the APG, conservation of the mangrove forests surrounding the port area and so on are also proposed in this report.

7.   The cost needed for the development of the port is estimated to be 200,214 million sucres.

8.   As mentioned earlier, the importance of modernization and privatization and the improvement of administrative organization must not be underestimated. Management

of port works and above all, efficiency in handling cargo for the future development of port activities of Guayaquil is required. Without these, smooth implementation of port improvement will be difficult. Recommendations concerning the above are also expressed in this summary.

9.   In the Short Term Plan, assuming that inadequately combined and disordered movements of cargo handling would be gradually improved, the following development works will be needed up to 2003:

    1 container berth
    1 multi-purpose berth

In the present plan, these two additional berths are to be constructed next to the existing berths, and with the same specifications. Other facilities such as sheds and warehouses will remain sufficient up to this time.

10.   The cost for construction works is estimated as follows:

    · For the construction of 1 container berth 22,589 million sucres for the construction of 1 multi-purpose berth, including the cost for reclamation of the areas located behind 19,228 million sucres.
    Within the total sum of cost combined the above two and the related work, the portion in foreign currency is estimated to be 49,483 million sucres, and in domestic currency 28,636 million sucres.

11.   The Economic Internal Return Rate (EIRR) calculated based on the countable benefit is 24.7 per cent and the Financial Internal Return Rate (FIRR) is 25.4 per cent. So, the project is judged as being feasible, both economically and financially.

12.   Some technical problems are found in the water area in front of the berths on maintaining the navigable depth, but these are of no importance. Soil conditions of the area concerned present no problem. Furthermore, the EIA revealed no unfavorable impact and thus the execution of this project will cause no problems for the environment.

Table IV - 1   Overall Evaluation

Case X

Item	Result	Remarks
Engineering Aspect	Good	Many existing facilities are used. Berth construction sites are all in good condition for construction.
Economic Feasibility	Good	EIRR is good. Project greatly contributes to foreign trade throughout nation.
Financial Feasibility	Good	FIRR is good. Project has profitability.
Environmental Aspect	Good	Project has no significant environmental impact and contributes to local and national economy and social stability.

13.   The case in which cargo handling efficiency makes rapid progress is almost the same. The project can be selected according to the progress of modernization program.

14.   When considering important factors which would affect this project, it can be duly said that this proposed project should be implemented in a deliberate and well harmonized way with general movements of modernization.

RECOMMENDATION

15. To ensure the smooth implementation of this proposed plan of the port of Guayaquil, the Study Team recommends the following items. The measures which have been already implemented or planned according to the modernization program by APG may be included. However these items are mentioned for further promotion of them.

1) Proper Application of Privatization

16. The ultimate objective of introduction of privatization into port operation is to maximize economic return in port activity for both the public and private sectors by removing possible inefficiency of public sector and entrusting a greater part of port activities to the private sector.

17. Commercialization of port functions and activities should be selected within the fields where the activities of the private sector can be fully controlled under the APG or other related administrative authorities. The effects of commercialization can be fully realized without any negative impact to sound performance of the port.

18. The fields to be commercialized should be planned and arranged appropriately as to guarantee the necessary conditions under which the free market system can be fully activated.

19. In principle, ownership of the land and water areas as well as the basic port facilities should be retained by APG.

20. Basic port facilities and major cargo handling equipment should be open for public use, in principle, but can be leased out to the private sector on a contract basis for exclusive use under appropriate conditions.

21. Practice of commercialization should be introduced gradually based on capability of the private sector at each step, and at the rate of grading up of the productivity intended in the scheme and also as to secure the proper improvement of total administration activity.

2) Establishment and Utilization of Information System

22. Modern and easy access information system should be introduced. This can serve as the most important base data for making port plans and supporting daily work in various kinds of activities of APG and other organizations concerned.

23. Systematic collection and compilation of data and information on various port activities is a basic requirement for sound and effective port administration. The management system for APG port statistics seems to be insufficient as a whole, any thus there will be much need for APG to improve the present information system in its arrangement and practice.

24. Port statistics are required for planning, administration, management, operation, budgeting, accounting and auditing. They should cover most essential facts and figures of the port activities on:

       (1) organization and personnel affairs
       (2) cargo handling
       (3) ship movements
       (4) facility conditions

(5) engineering management
(6) maintenance
(7) other related important fields

25. It is also very important that the structure of statistics be well balanced as to be effectively used for making any management or development plans in the future through cross references among each part of data and information.

26. In light of current situation of APG port statistics system and its practice, all statistics records should be well maintained in good condition for easy access of users, and renewed annually or monthly if necessary, to ensure the updated information can be accessed.

3) Upgrading of APG's Technical Function

27. In order to carry out future port development and maintenance work appropriately, APG will be expected to improve its functions with respect to technical aspects.

28. On such improvement, it is suggested that:

(1) Closer coordination is to be made between the technical department and other related ones.
(2) Technical standards and common criteria reflecting on recent world-wide trends is to be prepared.
(3) To the educational program to upgrade ability of engineers is to be emphasized.

29. Past engineering records of APG contain a variety of useful information. However, if these records are not given to those who need them, utilization of such records will be limited to only those who know of their existence. To avoid such inconvenience and ensure that technical information is shared with all concerned, a technical reference system that stores these records orderly and allows access at any time should be established.

4) Establishment of Environmental Policy

30. Environmental issues cover a wide scope and the preparation of an environmental strategy should be comprehensive, covering technical know-how and institutional frame. Some basic elements in drafting an environmental strategy are listed below.

(1) Clear understanding of the present situation of environment
(2) Estimation and forecasting of the impact and future situation
(3) Possible countermeasure to prevent the impact
(4) Process to acquire social consensus
(5) Coordination with other organizations concerned

31. There are many kinds of environmental components related to the port. The water front zone, in particular, has various features from the environmental viewpoint. So, one of the most important issues in the first stage is clearly understanding the environment of the port in question.

32. When planning port development projects, careful consideration should be given to the possible effects which may happen during the port construction stage as well as operation stage. If degradation of environment is forecasted, countermeasures should be taken to prevent the environmental burden.

33. Results of environmental analysis sometime remains at a qualitative level. The evaluation of projects is often relative and decisions should be made through social consensus.

34. Environmental issues cover a wide scope, thus, the countermeasures to the issues should be examined and carried out through coordinated efforts of related organizations.

35. The function of collecting information, understanding and evaluating what is happening and what will happen in the port, know-how on necessary countermeasures for environmental problems should be carried out by APG.

5) Reinforcement of Personnel Policy and Training System

36. It is important that APG make efforts to recruit young talented specialists such as engineers and economists. On the other hand, the managing staff are required to have sufficient experience in port management and administration.

37. A designed personnel policy and training system are essential to encourage positive contribution and upgrade capability of APG staff. In order to support the personnel policy of APG, the following measures need to be carefully examined and applied under the "appoint the right person to the right position" principal.

    (1) establishment of proper personnel evaluation and transfer system
    (2) introduction of steady and encouraging promotion system
    (3) provision of attractive positions for able technocrats
    (4) creation of positive incentive mechanism built in the salary/wages system

38. The core purpose of staff training is:

    (1) to give them full knowledge and understanding both on technological and functional requirements of the ports, and thus
    (2) to make them cost-conscious and efficient in conducting their duty and assignment.

6) Systematic and Flexible Planning and Project Implementation

39. The system of port planning should be established. It is necessary that the nation-wide port development policy should be authorized at first and under the policy the plan of each port should be prepared.

40. In order to realize the proposed schemes of the plans, it is essential to secure active utilization of the plans through such efforts by APG 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.

41. All the facilities specified in the Master Plan reflect on the forecast data of cargo demand together with type of cargo. However actual figures may deviate from the forecasts due to changes in various social and economic factors. Although a detailed study to cope with the situation is required in such an occasion, following countermeasures may be useful for being ready at any time of necessity in the future.

    (1) review of cargo forecast based on the latest data
    (2) review of the Master Plan
    (3) review of the implementation schedule

(4) review of the progress of modernization program
(5) review of the improvement of cargo handling efficiency

42. The Short Term Plan is implemented mainly based on the assessment of the progress of modernization program and the improvement of cargo handling efficiency. On the other hand, after the implementation of the Short Term Plan, the Master Plan should be reviewed including the necessity of constructing a new port in the outer area of Guayaquil Bay.

7) Establishment of Effective Maintenance System

43. There are several structures and facilities which require periodical maintenance work while some of them require urgent rehabilitation.

44. Maintenance work on the structure can be divided into two categories, the routine maintenance and the urgent rehabilitation. The former consists of preventive measures and required measures which case is minor, however the latter consists of corrective measures against large scale damage and required cost is large. Past experiences reveal that if preventive maintenance is appropriately performed at adequate intervals of time, maintenance cast can be minimized.

45. In case of the Port of Guayaquil, maintenance of channel depth is one of the most important issues. Therefore, regular sounding survey and implementation of maintenance dredging should be done timely according to the result of the survey.

8) Reinforcement of Port Promotion

46. Port promotion or sales is one of the most important fields of activities for attracting port users. However, APG does not seem very active in conducting this assignment. Since competition among the neighboring ports or other transportation modes of handling cargo will be much tighter in future, the following actions by APG are recommended in securing adequate level of revenue from users.

(1) Establishment of port promotion strategy focusing on most effective target groups of clients.
(2) Under the systematic action program, APG staff should call for sales at shipping companies or shippers and point out the real merits of utilizing the Port of Guayaquil.
(3) 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.
(4) To hold seminars to introduce the Port of Guayaquil to shippers of various countries is another effective way to assist promotion activities.
(5) Establishment of organization of wide-range of supporting groups composed of both public and private sectors.

9) Regional Development

47. As is commonly understood, a port is dependent on the various activities in its hinterland or surrounding areas. At the same time, such activities relating to the ports can not run well without the necessary port functions. In this sense, the promotion of regional development with a port as its core is considered vital in maximizing economic and social benefits expected from the port activities.

48. The port of Guayaquil is located in Guayaquil City which is the most important industrial and commercial center in Ecuador. The development of this area would have the greatest influence on the nation's economic growth in future.

49.   The City of Guayaquil, together with the Guayas Province area, is strongly expected to be developed for increasing the production both in agriculture and in industry in this area. For this purpose, the APG should maintain a close relationship with the municipal and other related local and national organizations as well as port related private firms to coordinate its development projects with the overall development of the area.

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