is very limited which causes an occasional mix-up with trailers and trucks around Gate No. 11.

8. Passenger rail cars run across the port area which accelerates the traffic congestion in the port.

1.2.3 Possible Countermeasures

9. Possible countermeasures against the above bottlenecks are as follows;

1) Unit cargoes and bulky cargoes are the cargo items which will significantly increase.
   ---> New unit cargo terminal with sufficient storage yard and CFS.
   ---> New terminals for dry bulk cargoes with appropriate cargo handling facilities.

2) Areal limitation (inefficient cargo handling, traffic congestion and safety problem)
   ---> Acquisition of new land area for port operation
   ---> Optimum layout of terminals
   ---> Streamlining of cargo movement

3) Improper access
   ---> New bypass road to/from the port
   ---> Segregation of passenger rail cars

4) Mixture of domestic shipping vessels
   ---> New quay for domestic shipping vessel

1.3 Planning Objectives for the Year 2010

1.3.1 Targeted Cargo Volume

10. The future cargo volume at the port of Cortes is forecasted through two methods in Chapter 1, PART I. The macro approach provides two (2) scenarios which set a range of cargo volume by packing type. Micro approach gives the result of cargo-wise forecast which eventually locates between the two scenarios by the macro approach.

11. For the port planning purpose, the rounded number of cargo forecast result obtained by micro approach is adopted. The cargo volume by packing type as planning target is listed in the following table. (Fruit containers are included in the category of unit cargoes. Although the fruit containers are currently handled at the general berth by ship gear, it is foreseen that vessels will pursue the maximum loading capacity and install no ship gear in future. This is why we include fruits containers in that category)

Table 1-3-1 Targeted Cargo Volume by Packing Type

unit:1,000ton

Year	General	Dry Bulk	Unit Cargo	Liquid	Total
1992	509	353	1,301	646	2,809
2000	450	700	1,850	650	3,650
2010	600	1,000	2,500	1,000	5,100

1.3.2 Future Quay Requirements

1.3.2.1 Quay Requirement in 2010

12. When planning berth length, it is reasonable for a continuous berth to adopt the LOA which includes 70% or 80% of vessel callings, rather than the maximum size which is suitable for single berth. Table 1-3-5 lists vessel size (Top 20%), average cargo volume per vessel, number of calls per year, average waiting time and cargo handling efficiency in 1992.

13. For planning the Masterplan, the vessel sizes are assumed to almost maintain current levels following the interview results with shipping agents. Therefore, for unit cargo vessel, GRT 15,000 MT, LOA 160 m and 25 m for vessel width are adopted where two or more continuous berths are constructed, however, the water depth in front of the quay should be set to accommodate the maximum vessel size, -12 m or more. (The frequency of call of the maximum vessel type is expected to be small. Moreover, for the moment, it is hard to imagine that the maximum vessel makes her call with full load. Therefore, the water depth of -12 m is thought to be enough.) For the conventional vessels, the sizes are assumed as GRT 10,000 MT, LOA 155m and 25 m wide, and for dry bulk vessel, GRT 7,000 MT, LOA 128 m and 15 m wide.

14. As for the average cargo volume per vessel, 2,000 MT is assumed for unit cargo vessel because the cargo volume is expected to soon catch up with the vessel's up-scale trend. For conventional vessel and dry bulk carrier, the current cargo volume levels are assumed to be maintained, 1,500 MT and 7,000 MT, respectively.

15. Dividing the total estimated cargo volume in 2010 by the average cargo volume per vessel, number of calls is obtained. They are; 1,250 for unit cargo, 400 for conventional and 143 for dry bulk.

16. Cargo handling efficiency is assumed to be improved, as there is room to improve the productivity of unit cargo handling. In this report, the productivity is assumed to

be 150 % of that in 1992, thus 220 MT/hour mainly because of the high productivity of new unit cargo terminals. This implies that the productivity is around 20 TEU per hour which is comparable to the international standard for a gantry crane. The productivity for other types of cargo is assumed to be 110% of that in 1992, thus 40 MT/hour for conventional cargo and 60 MT/hour for dry bulk cargo.

17. Waiting time is also improved. Even now, unit cargo shows considerably low waiting time and the same waiting time is assumed for 2010. For conventional cargo, 24 hours is assumed, which is the waiting time generally observed in world's ports. Dry bulk cargo is usually carried by tramps, for which shippers tend to minimize the waiting time in port and 12 hours is assumed.

18. In-port times per vessel are 13.1 hrs for unit cargo, 61.5 hrs for conventional cargoes and 134.8 hrs for dry bulk cargoes. Accordingly, total berth time per year by vessel type is 11,375 hours, 15,000 hours and 17,560 hours, respectively.

19. Based on the assumption that every wharf works 24 hours a day, 350 days a year, and applying the recommended maximum berth occupancy rate, the required number of berths for each vessel type is obtained; 3 berths for unit cargoes and 6 berths for general cargoes which includes conventional as well as dry bulk cargoes. In this calculation, the number of gantry cranes is assumed to be one crane per berth because calling vessels at the berth include RO-RO vessel which require no land crane and total number of quay at the unit cargo terminal is more than two which makes the use of the cranes flexible and more than two cranes can be allocated to a large vessel or a vessel in need of quick dispatch.

Table 1-3-5 . Base Number for Port Planning [1992]

	Unit Cargo	Conventional	Dry Bulk
Vessel size (Top 20%)	15,375 GRT	9,996 GRT	6,166 GRT
Ave. Cargo per Vessel	1,777 ton	1,565 ton	6,860 ton
No. of Calls	730 vessels	264 vessels	40 vessels
Ave. Waiting Time (hr)	4.1hrs	26.5 hrs	34.0 hrs
Handling Vol.(ton/hr)	144.3 ton/hr	36.2 ton/hr	51.9 ton/hr

Table 1-3-6 Base Number for Port Planning [2010]

	Unit Cargo	Conventional	Dry Bulk
Vessel size (Top 20%)	15,000 GRT	10,000 GRT	7,000 GRT
Vessel Length, Width	160m, 25m	155m, 20m	128m, 15m
Total Cargo Volume	2,500,000 MT	600,000 MT	1,000,000 MT
Ave. Cargo per Vessel	2,000 MT	1,500 MT	7,000 MT
No. of Calls	1,250	400	143
Efficiency (MT/hr)	220	40	57
Handling Time (hr)	9.1	37.5	122.8
Ave. Waiting Time (hr)	4	24	12
In port time(hr)	13.1	61.5	134.8
Total Berth Time(hr)	11,375	15,000	17,560
Berth (24hrs, 350 days)	1.35	1.79	2.09
No. of Berth required	3(2.45)	6(5.54)	

Note: No. of berth required is calculated by adopting recommended maximum berth occupancy

1.3.2.2 Quay Requirement in 2000

20. Table 1-3-7 shows the calculation results for the year 2000. In the table, the vessel sizes are assumed the same as 2010. Productivities of cargo handling are assumed as follows;

Unit Cargoes: 150% of the present level, 220 MT per hour
General Cargoes: same to the present level, 38 MT per hour
Dry Bulk cargo; same to the present level, 55 MT per hour

Average waiting time for dry bulk cargoes is assumed to be 24 hours, a little longer than 2010 and average waiting times for unit cargo and general cargo are the same as 2010.

21. After a similar calculation as in table 1-3-6, number of required berths for the year 2000 are obtained as shown below;

2 berths for unit cargoes
5 berths for general cargoes including conventional and dry bulk

Table 1-3-7 Base Number for Port Planning [2000]

	Unit Cargo	Conventional	Dry Bulk
Vessel size (Top 20%)	15,000 GRT	10,000 GRT	7,000 GRT
Vessel Length, Width	160m, 25m	155m, 20m	128m, 15m
Total Cargo Volume	1,850,000 MT	450,000 MT	700,000 MT
Ave. Cargo per Vessel	1,850 MT	1,500 MT	7,000 MT
No. of Calls	1,000	300	100
Efficiency (MT/hr)	220	36.2	51.9
Handling Time (hr)	8.4	41.4	134.9
Ave. Waiting Time (hr)	4	24	24
In port time(hr)	12.4	65.4	158.9
Total Berth Time(hr)	8,400	12,420	13,490
Berth (24hrs, 350 days)	1.0	1.48	1.61
No. of Berth required	2(2.0)	5(4.75)	

1.3.3 Areal Requirements

1.3.3.1 Present Situation

22. One of the biggest problems facing the port of Cortes is areal limitation. Modern port terminal such as container terminal and dry bulk terminal requires large back-up land for cargo handling and cargo storage. Even for general cargo terminal, considerable land is reserved behind the quay for mechanized cargo handling. For example, in Japan, a container terminal with quay length of 250m is usually designed to have 300m wide back-up yard (75,000 sq.m) for container marshalling, container storage and other related activities.

23. The following is yards currently available for container marshalling and storage of unit cargoes in the port.

Container yard	: 24,471 sq.m
# 10 Yard	: 14,000 sq.m
# 10 1/2 Yard	: 2,500 sq.m
# 11 Yard	: 48,000 sq.m
Free Zone (North Part)	: 22,000 sq.m
Total	**:110,971 sq.m**

24. At present, the port of Cortes can satisfy areal requirement, which will be verified in 1.3.3.2, however, the yards are scattered and many of these areas are located at distant places from No.5 wharf. Currently, the cargo handling efficiency at the port is observed considerably high in spite of the condition of yard, due to the effort of management and labor. However, with the increase of cargo volume, problems from the areal limitation will emerge, and thus the efficiency might suffer and possibility of accident may increase.

1.3.3.2 Areal Requirement

25. For port planning, areal requirement should be evaluated and woven into port layout. The basic idea for the calculation of areal requirement is to estimate the maximum number of containers which should be located in the yard for operation and storage. The factors to be considered include various aspects of container handling practice at the port. The following table lists the assumed number for various indices of unit cargoes.

Table 1-3-8 Indices of Unit Cargoes

	ton/ TEU		Empty (%)		40ft	RO - RO (%)		No.(I/O
	In	Out	In	Out	(%)	In	Out	each)
1992	7.1	9.4	41	24	60	28	28	45,000
2000	8.0	9.5	35	25	65	25	25	62,500
2010	8.5	9.0	30	25	70	25	25	87,100

26. Areal requirement also depends on staying time of unit cargoes. From the port statistics, the staying time of unit cargoes (including fruit containers) in 1992, 2000 and 2010 are analyzed as follows;

Staying Time of Unit Cargoes (unit: days)

	1992		2000 & 2010	
	In	Out	In	Out
Loaded:	4	2	7	2
Empty:	15	10	14	10

27. Areal requirement is calculated as follows and resultant requirements are shown in Table 1-3-10.

A = (L x S) / (H x d)

A:Areal requirement
L:No. of Container in storage yard, TEU ---->(see the equation below)
S:Unit area per TEU ---->22.7 sq.m
H:Average layers ---->2.5 (for container)
1.0 (for RO-RO)
d:(Storage area)/(Storage area + Road area) ---->50%

L = (M x Ds / Dy +Mi) x p

M: No. of container handled per year (TEU)
Mi:Average number of import containers per vessel --->see the table below
Ds:Staying time
Dy:Operational days per year ---->350days
p: Peak ratio ---->1.3

Average number of import containers per vessel (Mi)

Year	1992	2000	2010
per vessel	1,777 ton	1,850 ton	2,000 ton
Import	889 ton	925 ton	1,000 ton
TEU	99 TEU	103 TEU	118 TEU

Table 1-3-9 Areal Requirement for Unit Cargoes at Peak Time

Year	1992	2000	2010
Areal requirement (sq.m)	105,366	150,408	211,697
Container in the yard(TEU)	3,561	5,425	7,886

(Actual storage area at present: 110,971sq.m)

note: Number of container in the yard includes RO-RO cargoes which are regarded to have the same size as 40 foot container. The stacking layers are assumed 2.5 for containers which includes reefers and 1.0 for RO-RO cargoes.

28. The calculation results indicates that the current storage area is almost equal to the areal requirement at peak period. (Storage area at present includes the northern part of free zone of 22,000 sq.m which is currently in temporary use for RO-RO storage) In future, the areal shortage will dramatically increase and an additional 45,000 sq.m in 2000 and 100,000 sq.m in 2010 are required.

1.3.4 Port Road and Access to/from Hinterland

29. Another planning objective is port road and access to/from hinterland. The port traffic inside the port area is not regulated due to the areal limitation, sometimes resulting in inefficient flow of port traffic as well as cargo handling operation. With the increase of port cargo, the situation will worsen unless effective countermeasures are taken. Access to/from hinterland is another issue. Even now, traffic congestion is observed at the port gate.

30. Traffic volume is calculated as follows;

$$n = V \times a/W \times b/12 \times r/30 \times (1+d)/e \times f$$

n : Number of traffic per hour
V : Annual cargo turnover (MT/year)
a : Share of truck (%)
W : Average cargo weight per loaded truck

b : Monthly fluctuation rate
r : Daily fluctuation rate
d : Rate of other port related traffic
e : Rate of number of loaded truck vs number of total truck
f : Hourly fluctuation rate

31. After calculations with the numbers from the Japanese experience, the results are obtained as in the table 1-3-10. The table shows that the traffic volume generated from the port will be doubled. This necessitates a bypass road to trunk line or widening of the present road. The most critical traffic congestion would occur at gate No.11 and thus some countermeasures should be taken here, too.

Table 1-3-10 Traffic Volume by Packing Type (number / hour, ton/year)

Year	General	Dry Bulk	Unit Cargo	Total
1992	127(509)	95(353)	195(1,301)	417
2000	113(450)	189(700)	278(1,850)	580
2010	150(600)	270(1,000)	375(2,500)	795

1.3.5 Dredging work

32. The port of Cortes is located on the north coast of the Cortes bay. The Bay provides the port with sufficient water area which is calm year round thanks to the shelter of the Punta Caballos. Until 2010, the Bay provides a sufficient water area for anchoring. However, the water depth in front of the reclaimed land area which will be utilized as new terminal is not deep enough to accommodate deep draught vessels. Therefore, dredging work will be required for new terminal as well as ship manoeuvering basin.

1.4 Requisites for the Masterplan

1.4.1 Wharf Requirement

33. From the table 1-3-6, it is noted that three berths are required for unit cargoes and six berths are required for conventional as well as dry bulk cargoes, unless a dry bulk terminal is realized. The Port of Cortes currently has five berths, three for general use and two for unit cargoes. ENP is planning to expand 124m of No. 5 mainly for handling refrigerated cargoes.

34. Table 1-4-2 shows berth requirement for general cargo in relation to dry bulk cargoes. For example, if no dry bulk terminal is realized by 2010(case-1), six berths are required to handle both general cargoes and dry bulk cargoes. Total berth requirement will be nine when combining the berth requirement for unit cargoes and this is far greater than the number of present berths(5). Table 1-4-3 gives similar calculation for the year 2000.

Table 1-4-2 Berth Requirement in Relation to Dry Bulk Cargoes (2010)

	Dry Bulk Terminal	Cargo Vol.	No. of Call	Berth No.	General B.
1	Non	1,000,000t	143	2.09	6
2	Fertilizer	800,000t	114	1.67	*6
3	Fertilizer+Grains	480,000t	69	1.01	5
4	Fertilizer+Grains+Cement	180,000t	26	0.38	4

Note: For the case 2, the berth requirement falls on the border between 5 berths (70%) and 6 berths(65%), which means that if we adopt 5 berths, they will be running a little over their optimum occupancy level.

Table 1-4-3 Berth Requirement in Relation to Dry Bulk Cargoes (2000)

	Dry Bulk Terminal	Cargo Vol.	No. of Call	Berth No.	General B.
1	Non	700,000t	100	1.61	5
2	Fertilizer	560,000t	80	1.28	5
3	Fertilizer+Grains	310,000t	45	0.72	4
4	Fertilizer+Grains+Cement	140,000t	20	0.32	*3

Note: For the case 4, number of berths falls on the border between 3 and 4. That means three berths are running a little more than the level of their optimum occupancy rate.

1.4.2 Areal Requirement for Unit Cargoes

35. Areal requirements for unit cargoes in 2000 and 2010 are shown in table 1-4-4. In the calculation of the areal limitation, the northern part of the free zone which currently is utilized for temporary RO-RO storage area is counted as storage area.

36. Some additional area would be required for parking place. Moreover, the fact that the increase of container other than fruit container prevails in future implies that the number of unit cargoes handled and stored inside port will be larger than the calculated results which are obtained by average number of fruits and others.

Table 1-4-4 Areal Shortage for Unit Cargoes in 2000 and 2010

Year	2000	2010
Areal requirement (sq.m)	45,042	106,331

(Actual storage area at present: 110,971 sq.m)

1.4.3 Domestic Cargo Terminal

37. Features of domestic cargo vessels are shown as follows;

	No. of ships	Cargo volume	No. of mooring ship
1992	396	47,520	2-3
2000	579	69,494	3-5
2010	913	109,600	4-7

Average ship size: 120 GRT

Although number of mooring ship is expected as above, some other water area should be reserved as some of vessels engaging in domestic trade would use the basin as their mother port. In 2010, 15-20 vessels would stay in the basin.

38. There are some other small crafts which are suitable to be accommodated in the basin for domestic shipping. As of summer, 1993, there are two tug boats and one ENP vessel and ENP is purchasing two more tug boats. Therefore, 10 vessels should be assumed to moor at the domestic quay.

39. In total, quay length of about 200m and water area which can accommodate 25 vessels are required.

1.4.4 Access to/from Hinterland

40. As already calculated in 1.3 of this Report, the traffic volume generated from the port will be almost doubled in 2010 and there will be big traffic congestion. There are two countermeasures to be considered against this; construction of a new by-pass road and widening of the present road.

41. It is not practical to widen the access road because the road is contained at the both sides by private residents and the free zone, and there is practically no possibility to widen the road. The practical solution to the access problem would be to construct a new by-pass to major road. The possible location of this road will be the seaside rim of the free zone.

42. Another problem concerning traffic will be the congestion around gate No.11. Possible solution is to prepare another gate for unit cargoes which are handled at the new terminal. Parking space for waiting trucks may be required around the gate.

1.5 Alternatives of Port Layout

1.5.1 General Description of Alternatives

43. The possibility of the realization of bulk terminals should be carefully evaluated, taking into consideration various factors including the cargo volume and the cost, however, the shortage of berth is clear in future and it should be recommended to encourage private entities to accelerate the construction of dry bulk terminals.

44. ENP fully recognizes the necessity of dry bulk terminal. Their priority remains on fertilizer and grain. For fertilizer, a fertilizer company has already initiated their action. Lots of talks are required among the company, ENP and other relevant entities, however, fertilizer seems to be the first item to be realized. Grain is and continues to be the biggest single cargo item in dry bulk cargoes.

45. Taking into consideration the above, the following four options (two for each 2000 and 2010) are drawn, in which No.5 berths are converted to general cargo berth from the unit cargo berth and for the year 2010, the quay in front of the cold storage is assumed to be constructed and utilized as general cargo berth.

[2000]

(Option 1) Two unit cargo berths without DBT

(Option 2) Two unit cargo berth and 1 DBT for fertilizer

[2010]

(Option 1) Three unit cargo berths and 1 DBT for fertilizer

(Option 2) Three unit cargo berths and 2 DBTs for fertilizer and grain

46. Basing upon the above sketch, the following four alternatives for the Masterplan of the Port of Cortes in 2010 are proposed.

a. Alternative 1-1, 1-2 and 1-3 (Figs. 1.5.1, 1.5.3, 1.5.4 and Fig. 1.5.5)

Three unit cargo terminals of total quay length 555m with a container yard of 160,000 sq.m, 240,000 sq.m and 120,000 sq.m for Alternative 1-1, 1-2 and 1-3, respectively and one dry bulk terminal for fertilizer is constructed. Domestic wharf is located at the right side of the river mouth of Rio Medina. Three lane by-pass road (one lane is for temporary car parking or for outrun) is constructed along the sea-side of the free zone.

b. Alternative 2 (Fig. 1.5.2 and Fig. 1.5.6)

Two unit cargo terminals of quay length 370m with a container yard of 120,000 sq.m and two dry bulk terminals for fertilizer and grain are constructed. The terminal(s) for fertilizer and grains are constructed at wharf No.2. Domestic wharf is located at the right side of the river mouth of Rio Medina. Three lane by-pass road (one lane is for temporary car parking) is constructed along the sea-side of the free zone.

1.5.2 Priority of the Projects

47. The basic philosophy for prioritization of the projects is to minimize the total port cost including ship cost. Toward this end, the optimum berth occupancy rate is proposed by UNCTAD applying so called queuing theory and is listed in this report (Table 2-4-3 of PART I, far right column). According to the priority of each project thus clarified, several projects are needed for the port of Cortes by 2010. The question is in what order these projects should be realized and in what manner the Masterplan should be established.

48. For the port of Cortes, basic direction of the port development is to realize efficient cargo handling, especially of unit cargoes and of dry bulk cargoes. In this context, new unit cargo terminals and dry bulk terminals are to be proposed in the Masterplan. And these terminals are expected to be operated exclusively by cargo types. General cargo and dry bulk cargoes which are not shifted to the exclusive terminal will be handled only at the general cargo terminal.

49. An important factor in determining the Masterplan is that when the capacity of the

general cargo terminals becomes smaller than the cargo demand. Unit cargo terminals should be constructed rather than new general cargo terminals and No.5 berth should be converted to a general cargo berth. In this way, the port of Cortes can acquire new unit cargo terminals with sufficient container yard and achieve improved efficiency.

50. In analyzing the priority of berth construction, the following four cases are assumed and berth time is calculated based on the forecasted future cargo demand and cargo handling efficiency.

Case-1 : Construction of both fertilizer and grain terminals. Wharves No.3-No.5 handle all the other cargoes including unit cargoes.

Case-2 : Construction of three dry bulk terminals for fertilizer, cement and grains. Wharves No.3-No.5 handle the rest of the cargoes (general, dry bulk and unit cargoes).

Case-3 : Construction of two unit cargo terminals for handling all the unit cargoes excluding fruit companies' containers. Wharves No.3-No.5 handle all the rest of the cargoes (general, dry bulk and fruit companies' containers).

Case-4 : Construction of two unit cargo terminals for handling all the unit cargoes including fruit companies' containers. Wharves No.3-No.5 handles all the rest of the cargoes (general and dry bulk).

51. In short, Case-4 gives the smallest total berth time for No.3-No.5 wharves, however, total berth time still increases by 5,000 hours compared with the present situation. On the contrary, construction of dry bulk terminals only (Case-1 and Case-2) do not give sufficient effect to lessen the burden on No.3-No.5 wharves. Thus, construction of new unit cargo terminal accompanied with the transfer of fruit containers to the new terminal is most effective countermeasure against the port congestion.

52. From the analyses above, the priority should be given to the construction of new unit cargo terminal together with the by-pass road.

53. At the same time, it is noted that even in case-4, total berth time for wharves No.3-No.5 is larger than the optimum time after 2003. Thus, two dry bulk terminals are justified for the Masterplan. The total berth time for unit cargo berth also exceeds the optimum time (8,400 hours)and another unit cargo terminal is justified as well. In short, as the Masterplan of the port, three unit cargo terminals together with the domestic terminal is justified, among which two unit cargo terminals with domestic terminal should be given the first priority. Two dry bulk terminals are included in the Masterplan with the second priority.

54. However, dry bulk terminals are possibly constructed by the private sector, thus ENP should encourage private participation no matter what the priority is.

1.5.3 Evaluation of Alternatives

55. Through the evaluation stated hereunder, only three projects are included. These are, unit cargo terminal, domestic terminal and by-pass road. Dry bulk terminal and cold storage terminal are excluded because they will possibly be constructed by the private sector. Table 1-5-3 shows the quantity and cost of works (extract from 1.6 and 1.7 of this PART) the major items which are important to compare each alternative. From the table, it is noted that alternative 1-1 has the lowest project cost among the 1-1, 1-2 and 1-3 alternative group. The volume of dredging (Fig. 1-5-3) is a little larger than the volume of reclamation (if we take the extra volume of dredging into account, the difference will be much larger).

56. Alternative 1-2 has the largest project cost among the alternatives. The volume of reclamation is larger than the volume of dredging (Fig. 1-5-4) and other reclamation material should be obtained from another place.

57. Alternative 1-3 has almost the same project cost as Alternative 1-1. However, the volume of dredging is far larger than the volume of reclamation (Fig. 1-5-5) and this makes it difficult to dispose of the excess amount of dredged material. Furthermore, this alternative has a certain limitation for future expansion of the port and after 2010 when the cargo volume is expected to increase further, the project cost will be much higher than the rest.

58. Alternative 2 has the lowest project cost among the four alternatives because of the limited scale of the project. The volumes of dredging as well as reclamation are small compared to the other three alternatives.

59. Alternative 2 should be thought as part of alternative 1-1 and could also be regarded as the stage plan. The adoption of an alternative depends on the realization of dry bulk terminals. Therefore, the base of the Masterplan should be alternative 1-1 and in this report the alternative will be treated as such.

Table 1-5-3 Brief Comparison of Each Alternative

Alternative	Dredging (cu.m)	Reclamation (cu.m)	Revetment(m)	Project cost ('000Lps)
1-1	746,760	637,580	480 (-5.3m)	273,123.0
1-2	887,774	1,133,278	725 (-7.0m)	351,843.3
1-3	1,058,455	244,302	200 (-6.4m)	274,709.0
2	437,354	255,638	400 (-5.0m)	212,560.1

Note: 1) Dredging volume is obtained from the dredging plan and does not include dredging for depth allowance.
2) Reclamation volume includes the volume required for by-pass road.
3) Revetment is to protect the reclamation slope of the new terminal.
4) Project cost means the construction costs of major port facilities such as wharves, jetty, by-pass road as well as dredging, reclamation including compaction and revetment, and pavement.

1.5.4 Other Items of Port Planning

(1) Container Freight Station (CFS)

a. Optimum System of CFS

60. There are two types of CFS flooring, high (platform style) and low (ground style). High floors are generally the same height as a container on top of a chassis, or of a truck's loading bed. Low floors are set at about the same height as the surrounding pavement. For simultaneous handling of containers, the ground system needs 15 meter's space for the container and forklift, while 3.5-4.0m is needed for platform system. Further, in the ground system, containers must be lifted up and down each time and a large top-lifter or a straddle carrier must stand by. For the port of Cortes, the platform system is more appropriate than the ground system.

b. Size of CFS

61. From experience in many ports, it is well known that a CFS with a length of 40-50m is effective for efficient cargo handling. After calculations, the sizes of CFS required in 2000 and 2010 are obtained as follows;

	1992	2000	2010
Size of CFS (sq.m)	3,502	4,867	6,762
Width(m)	70	100	135

Note: The length of CFS is assumed as 50m.

62. Together with the CFS itself, there is some other space necessary for CFS operation; namely 25m at container side, 15-25m at truck side and 10-15m at the remaining two sides.

(2) Other Facilities in Unit Cargo Terminal

a. Terminal Gates

63. Usually, two lanes with truck scales for "in" container (export) and another two lanes for "out" container (import) are required for a terminal of 300m length. For the port of Cortes, some factors which should be taken into consideration are; the unit length of a terminal is 185m, and containers of fruit companies might be treated in different way. After calculations, the number of gates are obtained as follows;

	Import	Export
2000	3	4
2010	4	5

b. Maintenance Shop and Cleaning House

The sizes of the maintenance shop and cleaning house depend on such factors as the rates of container damage, the type and number of cargo-handling vehicles and machines to be used in the terminal. Considering other examples, following dimensions are assumed for each building;

Area : 1,000 m^2 (40 m x 25 m)
Height : 10 m
Width of the space in front of the maintenance shop : more than 10 m

c. Terminal Office Building

The area of the terminal office is decided from the number of persons working in the terminal. It is assumed that around 50 persons work at one terminal and required floor

area for one person is usually set as 10 sq.m. Accordingly, required floor area is 1,000 sq.m. In case that half of the office is two stories and some space is reserved for future expansion, necessary area of terminal office is 1,000 sq.m. It is located next to the terminal gate.

1.5.5 Dry Bulk Terminal

(1) Basic Plan of Dry Bulk Terminal

64. Since dry bulk terminal is one of the suitable port facilities in which private investment should be encouraged, the basic idea for the terminal should be decided with close consultation between ENP and the interest parties. The team gives for the reference some suggestions which is consistent with the Masterplan items.

a. Cargo Volumes for Grain and Fertilizer

65. Cargo volumes of grain and fertilizer for the years of 2000 and 2010 are forecasted and listed as follows.

unit:'000 MT

Year	2000	2010
Grain	250	320
Fertilizer	140	200
Total	390	520

b. Average Cargo Volume Handled per Ship

66. One of the major objectives for constructing a dry bulk terminal is to pursue the scale merit. The basic idea is that the greater the volume handled per ship, the cheaper the cost of transportation. The optimum volume carried per ship varies by cargo items as well as the distribution system in the hinterland, however, the construction of a dry bulk terminal contributes to enlarge the cargo volume carried per ship and eventually the size of the ships calling at the port (in this report, the volume is assumed to increase to 10,000 tons).

c. Objective Vessel

67. From the port statistics, it is noted that the size of dry bulk carriers is rather small. In 1992, the number of ships greater than 15,000 GRT counts only 2 out of 40. However, for port planning purposes, the maximum ship size should be adopted as the target ship size. The maximum ship size will be enlarged in future (to 20,000 GRT in this report).

Expected maximum vessel size: 20,000 GRT, Draught 10.0m, LOA 185m
(1992 port statistics: 16,522 GRT, Draught 9.5m, LOA 186m)

d. Location

68. There are several candidates for the location of the dry bulk terminal. The waterfronts available for the terminal are: Wharf No.2 and its vicinity, the reclaimed land in front of the free zone and the north shore outside the port. Among these possible locations, the north shore requires a larger amount of investment for the construction of breakwater as well as the pier to reach the sufficient water depth and to ensure the calmness of water area. The reclaimed land is reserved for the new unit cargo terminal and the usage of the area is already given in this report. Therefore, the location for the dry bulk terminal should be wharf No.2 or its vicinity.

69. The soil condition at the bottom in front of wharf No.2 is said to be very soft and may require lots of engineering work as well as civil works. The western vicinity of wharf No.2 is reported to have no such problem, although a small reclamation work is required. At any rate, the exact location should be decided by ENP based on the detailed soil examination as well as other relevant considerations.

e. Wharf Dimensions

70. Taking into consideration the objective ship size, wharf dimensions should be as follows;

Depth in front of the wharf	:	-11.0m
Length of the wharf	:	220m
Apron width	:	30m

f. Others

Terminal Type	:	Marginal
Structure Type	:	Concrete piles with concrete slab on top with supportive civil works

(2) Cargo Handling Equipment

71. The cargo volume listed in the paragraph 65 can be handled by one terminal if it is equipped with appropriate cargo handling facilities. There are basically two possible cargo handling systems; batch system and continuous system. As for unloading, batch system adopts crane and continuous system includes pneumatic unloader as well as other mechanical continuous unloaders. There are also two systems for transportation after unloading; trucks (batch system) and conveyer (continuous system).

72. A pneumatic unloader can be operated even during rain which gives a certain advantage to this system. This system has long prevailed in the new installment list of granular cargo handling in Japan, however, mechanical unloader has recently gained popularity.

73. When deciding the type of unloader, a detailed study on total cost including initial investment as well as operation cost should be conducted. However, it should be borne in mind that there is no pneumatic unloader in the port and mechanical unloader has a disadvantage in completing ship hold. Even if a mechanical unloader is adopted, pneumatic unloader may be needed for this purpose. A derrick crane should also be installed to lay a small bulldozer down to the ships hold, which is used to gather scattered remaining cargoes.

74. On the contrary, crane system has an advantage in flexibility of usage; (the system could be applied even to general cargo). The system needs no derrick crane to lay down a small bulldozer to the ship hold. There are two typical cranes; gantry type crane and level luffing crane. Level luffing crane is suitable for rather small vessels of 60 thousand DWT or less, while gantry type crane has an advantage in handling larger vessels. As for the unloading capacity, level luffing crane is more economical than gantry type crane, handling up to 900 tons per hour.

75. At any rate, ENP should conduct a further study with relevant private sector to decide which system is more suitable to the terminal. The basic idea is that if the terminal handles only a single cargo item, then one of the continuous unloading systems is suitable. Crane system is appropriate for a terminal at which more than two cargo items are handled, including break bulk cargo because it can be applied to a wide selection of cargo by just changing the attachment. As for transportation system, the continuous system usually has an advantage in terms of workers' cost as well as of easing traffic congestion, although batch system has the advantage of creating new job opportunities for truck drivers.

(3) Model Terminal

[Unloader]

76. The capacity of the unloader is calculated as, at minimum, **250 ton/hour.**

77. The average berth time per ship is a little over two days (10,000/250/0.6 + 5 = 72 hours). This, in turn, indicates that total berth time will be around 160 days per year in 2010 and the terminal has little spare capacity from the practical point of view. Another unloader is required soon.

78. Two unloading lines are required for handling fertilizer and grain while a crane is commonly utilized. Cost for an unloader is roughly estimated as 30 million Lps. If other supplemental installments are included, the total cost should be doubled.

79. Examples of usage of crane type unloader indicates that although the objective cargoes vary from terminal to terminal, they are all rather heavy materials. Objective ship size varies from 3,000 DWT to 20,000 DWT. Unloading capacity also varies considerably, from 210 tons per hour to 700 tons per hour and lifting capacity is scattered from 62 kN to 167 kN.

80. Examples of usage of pneumatic type unloader indicates that objective cargo is grain, objective ship sizes are 60,000 DWT and unloading capacities are in the range of 400 to 600 tons per hour.

1.5.6 Important Items for the Masterplan

81. As stated in 1.5.4, alternative 1-1 is adopted as the Masterplan of the Port of Cortes in the year 2010. In this section, items which are important for the realization of the Masterplan are summarized.

(1) Dry Bulk Terminal

82. As the volume of port cargoes increases and port activities progress, dry bulk cargoes tend to be handled separately to pursue higher efficiency. In the port of Cortes, dry bulk cargoes are expected to show the largest growth rate. Thus, the move toward the exclusive dry bulk terminal will be strengthened.

83. This type of terminal handles a limited number of cargo item(s) with a large volume in one time. The benefit of efficient handling is clear to the operator, and this tempts private entrepreneurs to invest the installation, thus, in this report, dry bulk terminal is assumed to be funded by the private sector although the exact form of

private participation is to be considered in future by ENP and the interest party.

84. At the same time, the quay requirement for the Port of Cortes is quite large and it is thought to be difficult for ENP to meet the entire demand without private participation. Some private talks have already been initiated concerning dry bulk terminals and ENP should thoroughly consider these offers.

85. Attention should be paid to another item. A private company is planning to modify the oil terminal to handle fertilizer as well as oil. There are not many examples of handling dry bulk cargo at a liquid terminal. The terminal should be planned taking into account operational as well as managerial consideration. ENP, as the port management body, should also keep eye on this project from the view point of operation and management of the entire port.

(2) Unit Cargo Terminal

86. When planning the Masterplan, fruit containers are included in the cargo items, although fruit containers are currently handled at the general berth by ship gear. The reason is that as the volume of cargo increases and terminal efficiency is improved, fruit containers are expected to be handled by gantry crane(s) to pursue higher efficiency.

87. Eighty(80) per cent of the accumulated LOA distribution is adopted as the unit length of a terminal (185m), on the assumption that more than two terminals are constructed and the maximum vessel (GRT 40,000 ton, LOA 230m) will thus be accommodated.

88. The number of gantry cranes is assumed as one per berth, taking into account the characteristics of the calling vessel; a considerably large number of RO-RO vessels and small vessels will call. For large vessel, two gantry cranes may be allocated. In this way, flexible container handling practice is realized and the investment can be minimized.

(3) Dredging Area

89. It is assumed that all the calling vessels have a tug service. The dredging area is decided as such. If vessels are to manoeuver themselves, far larger dredging work is required.

(4) Port Road

90. From the view point of port operation, the port road running through the back of

the wharf No.5 is the most troublesome part in the port. Heavy port traffic goes back and forth while the container handling operation takes place. This is detrimental to safety as well as the cargo handling operation. This is the reason that in this report relocation of the port road is mentioned as an item for urgent improvement plan (PART II)

1.5.7 Initial Environmental Examination

91. Any new project affects the surrounding environment to some extent. The relationship between Environmental Impact Element (EIE) and Constituent of Environment (CE) is shown in Table 2-9-1 of 2.8, PART I. In this section, the degree of effect to the environment is briefly examined for each project stage; construction, emergence of sites and utilization, and the CEs which require special attention are selected. Deeper analyses on these selected CEs are conducted in a latter stage of this study.

92. In total, the following items are selected for further examination;

Construction	--->	· water quality and sea bottom material quality · noise and vibration
Emergence of sites	--->	· water and current around the new unit cargo terminal
Utilization	--->	· noise and vibration · water quality · air quality

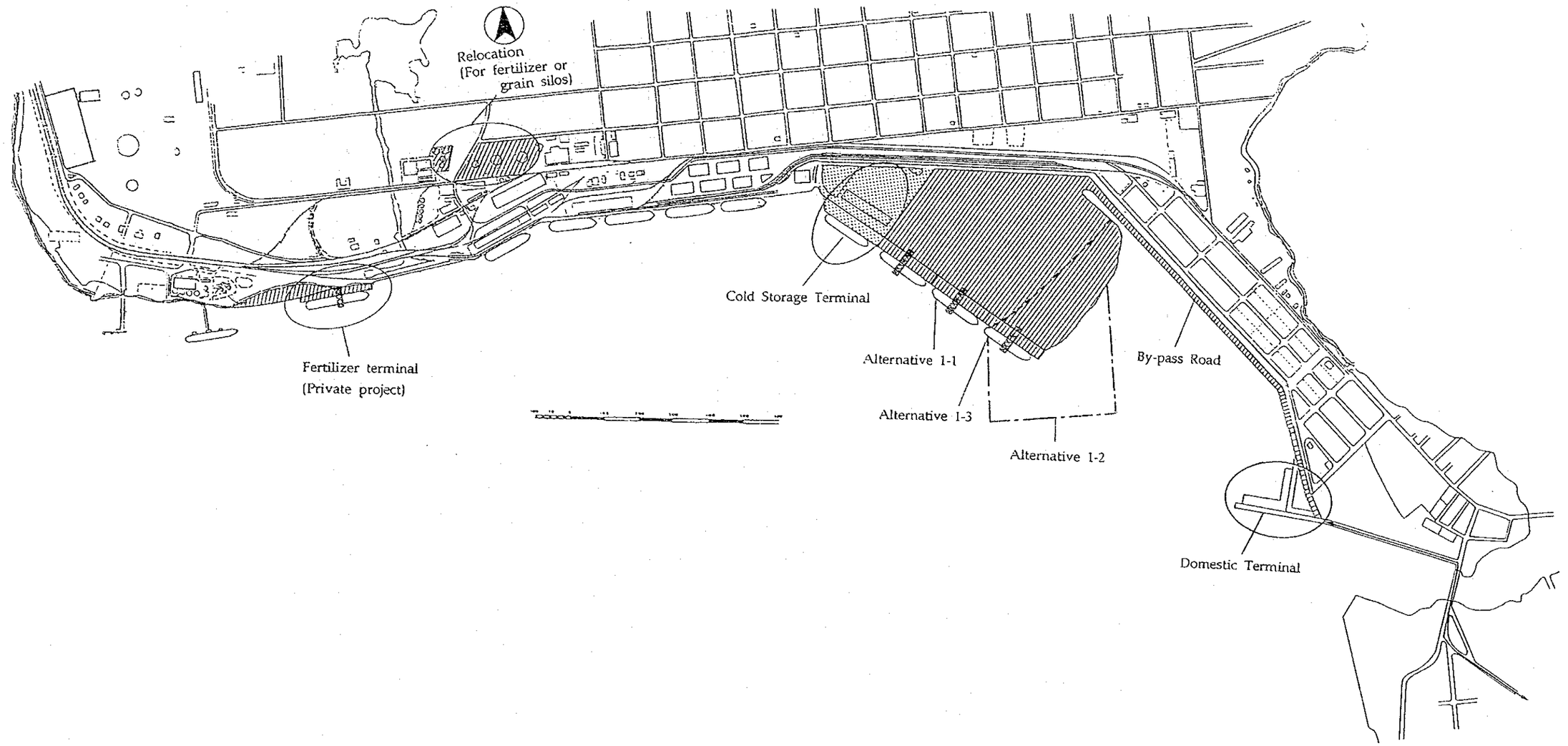


Fig. 1-5-1 Alternatives 1-1, 1-2, 1-3
for Masterplan (2010)

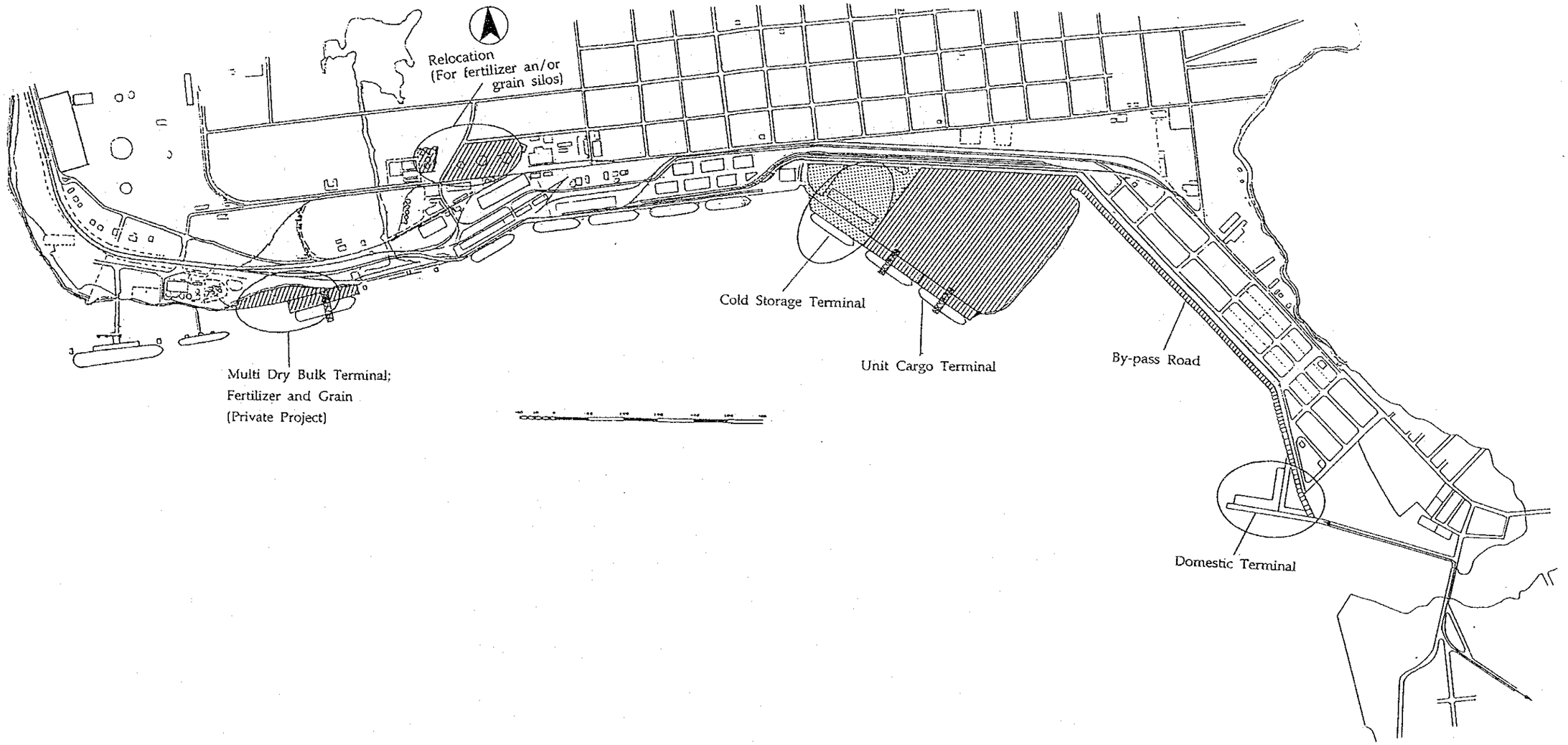


Fig. 1-5-2 Alternative 2 for Masterplan (2010)

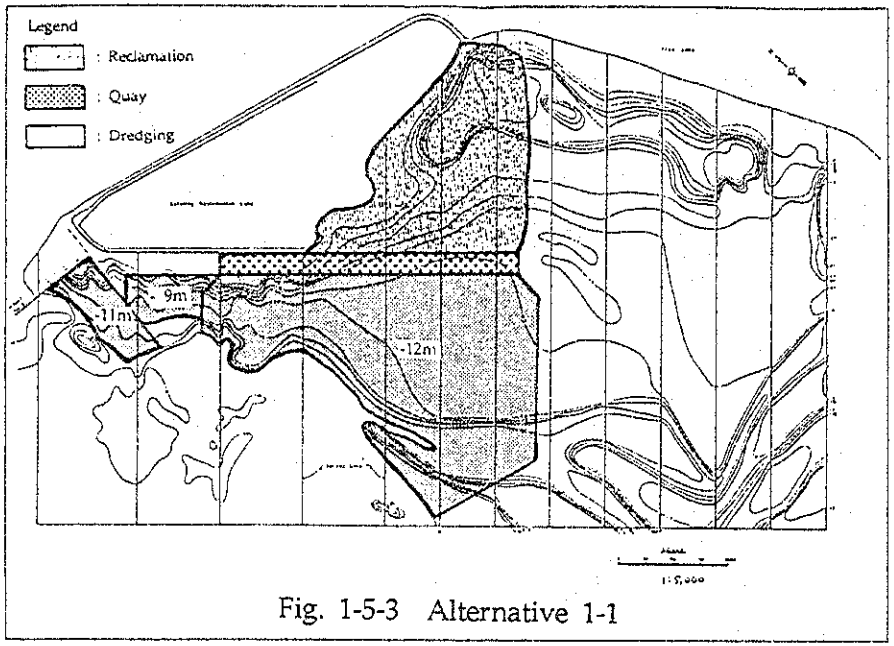


Fig. 1-5-3 Alternative 1-1

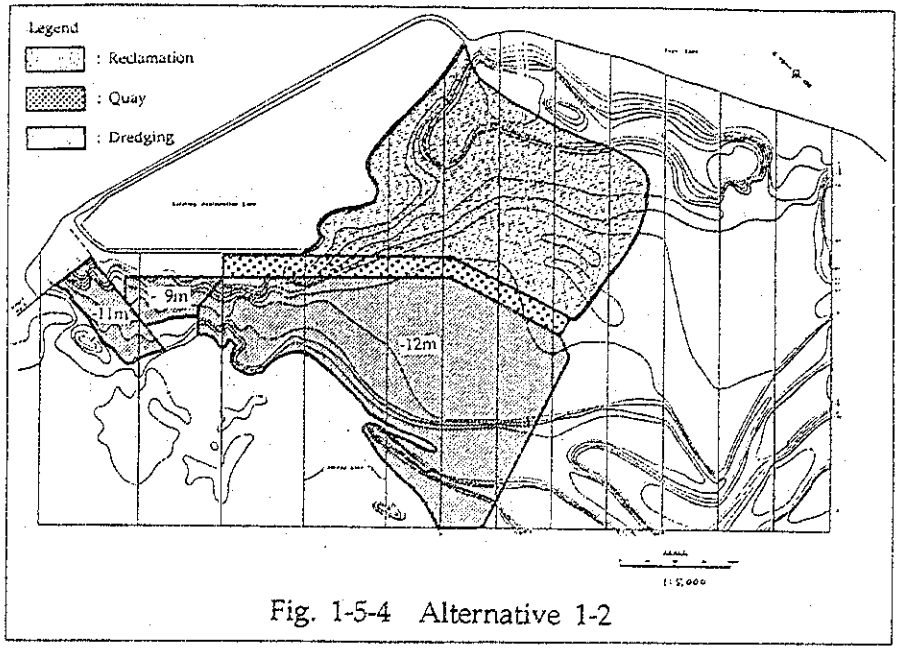


Fig. 1-5-4 Alternative 1-2

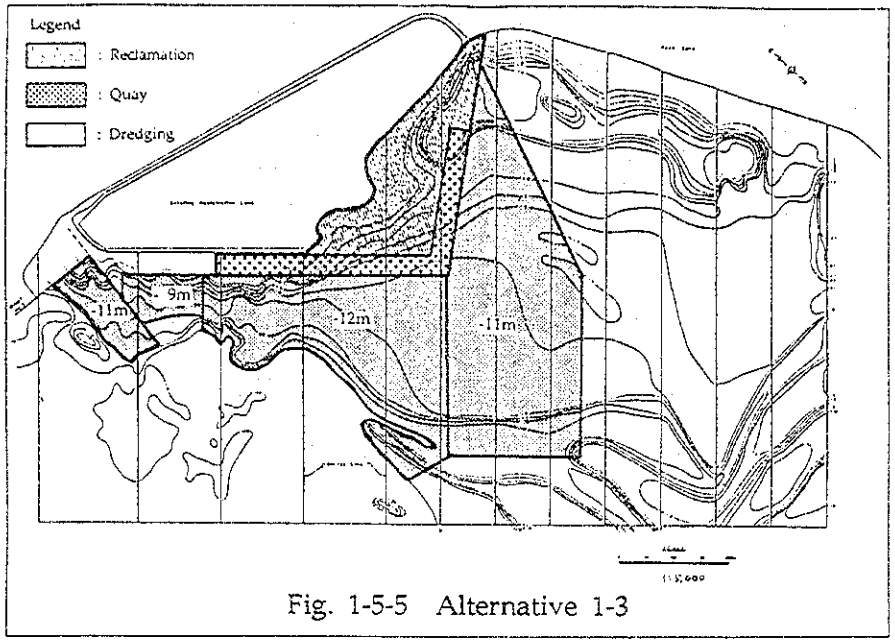


Fig. 1-5-5 Alternative 1-3

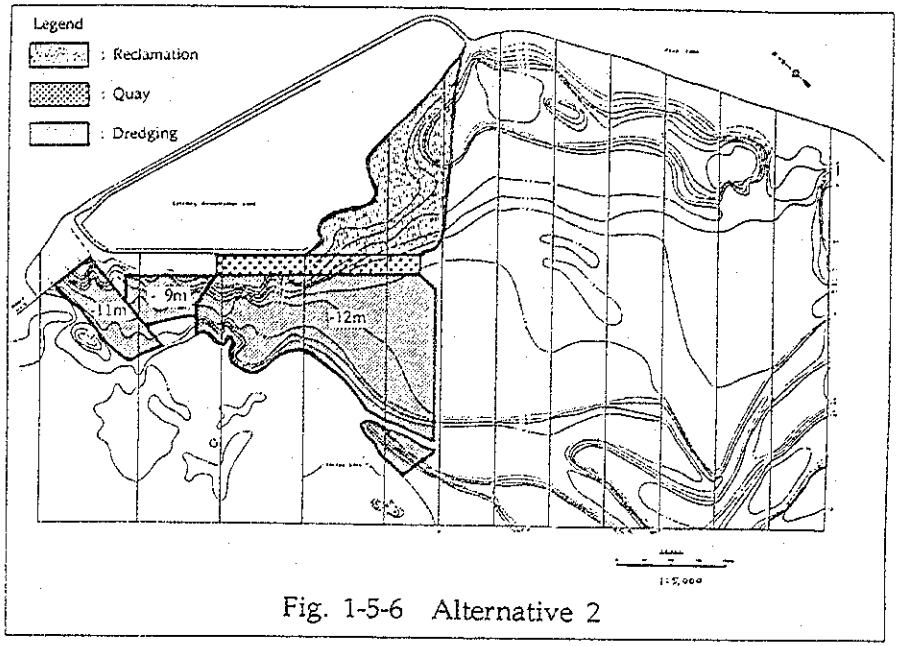


Fig. 1-5-6 Alternative 2

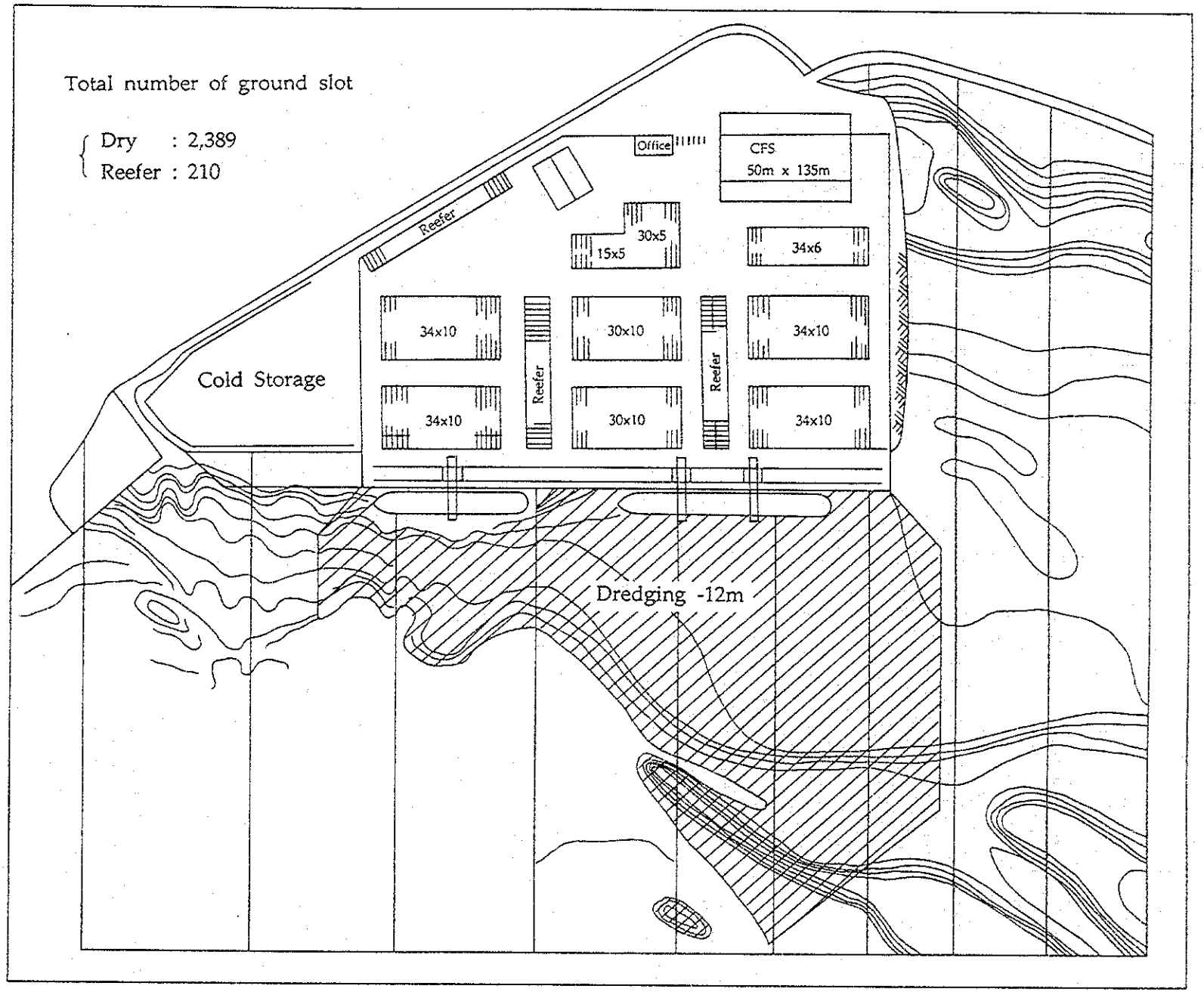


Fig. 1-5-7 Lay-out Plan of Alterative 1-1

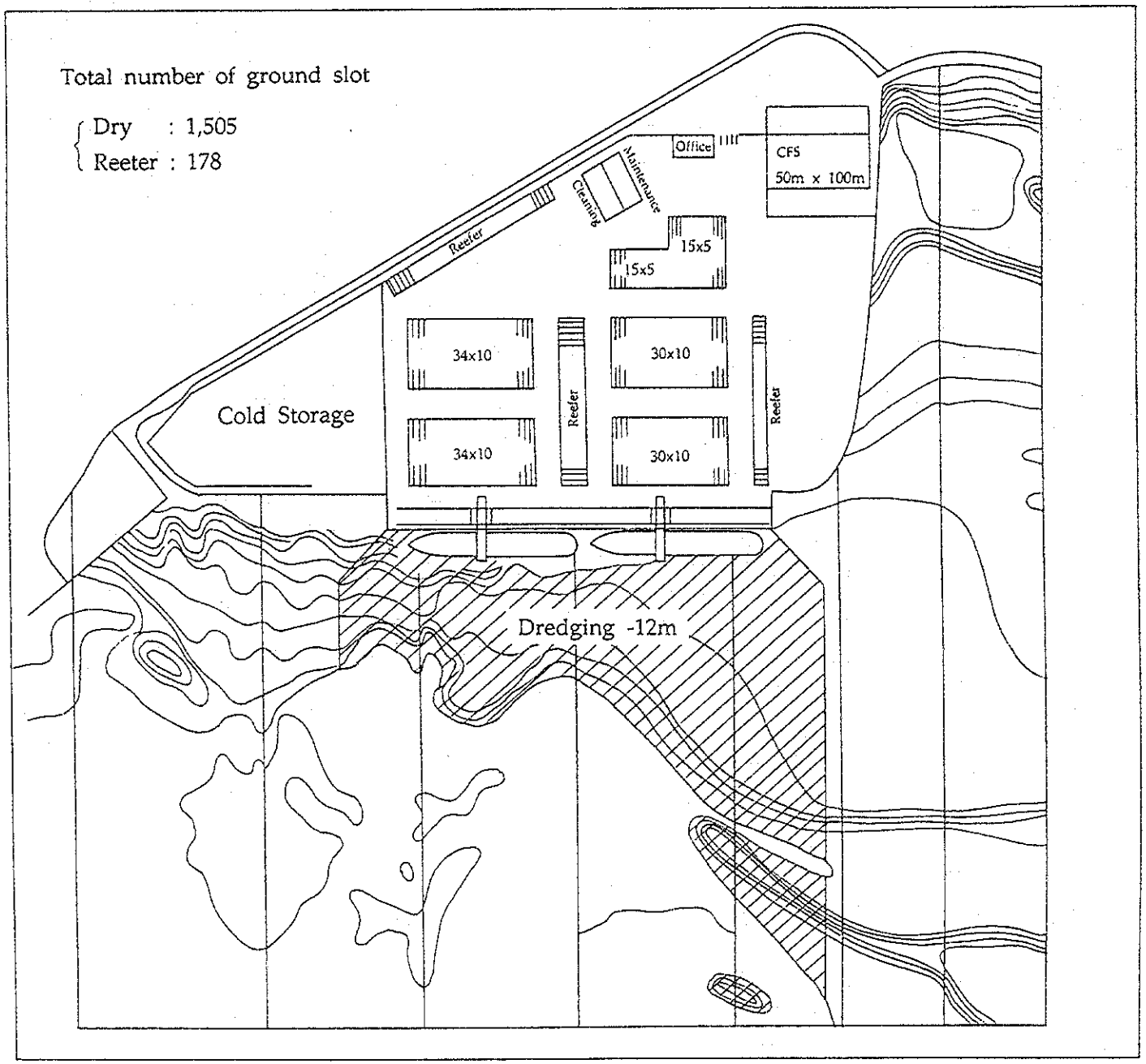


Fig. 1-5-8 Layout plan of Alternative

1.6 Stage Plan of the Projects

93. As already mentioned in 1.5.4, the terminals interact with one another. Construction of a dry bulk terminal directly affects the cargo volume handled at the general cargo terminal and construction of unit cargo terminal push No.5 berth out to the general cargo terminal group from the unit cargo terminal group. Therefore, the stage plan of the Masterplan should be established based on the evaluation of future port capacity not only of unit cargo terminal alone but also general cargo terminal as well.

94. Fig. 1-6-1 and Fig. 1-6-2 show the yearly change of berth time and the optimum berth time. Both figures assume the completion of two unit cargo terminals by 2000. In Fig. 1-6-1, it is assumed that all berths are for all cargoes, in other words, vessels calling at the port can berth at any berth available. The present berth allocation practice is similar to this. The lines with the shade thereunder indicate the optimum berth time and the thick continuous line indicates the yearly change of total berth time. The calculation of berth time is made on the basis of cargo handling efficiencies. The efficiency for each cargo item is assumed as follows;

General cargo	:	36 tons per hour (same to the present)
Dry bulk cargo	:	52 tons per hour (same to the present)
Unit cargo	:	144 tons per hour (till 2000: at wharf No.5)
		220 tons per hour (after 2000: at wharf No.6)

95. The optimum berth time are given as follows;
Till 2000: 8,400 hours x 5 berths x 65% = 27,300 hours
After 2000: 8,400 hours x 7 berths x 70% = 41,160 hours

96. From the figure, it is noted that the total berth time has exceeded the optimum berth time since around 1985 and is forecasted to keep exceeding the optimum. Currently, the berth occupancy rate is a little over 70%. In 2000, the occupancy rate will increase to 93% if no countermeasure is taken. (Actually, ENP has already initiated some project/plan. The completion of a 124m expansion of wharf No.5 is an example.) With the construction of two new terminals in 2000, the port can meet the demand. The berth occupancy rate in 2000 is around 65%. Then the rate gradually increases and in 2003 surpass the optimum, 70%. In 2010, the total berth time reaches the level of 90% and a long line of waiting vessels is expected.

97. Fig. 1-6-2 is drawn using similar assumptions as in Fig. 1-6-1 except two items. The first difference is that the berths are separated into two categories and each vessel is allocated to one of the berth groups to which the vessel belongs. This is to secure

higher terminal efficiency by specializing the terminals by cargo groups. Until 2000, when the new unit cargo terminal is realized, Nos. 3-4 berths are belong to the general cargo group and No.5 berth belongs to the unit cargo group. After 2000, with the construction of the new unit cargo terminals, No.5 berth will be converted to a general cargo terminal. The second difference is that fruit companies' containers are transferred to the unit cargo group from the general cargo group after 2000.

98. The optimum berth times till 2000 are given as follows;

General cargo terminal: 8,400 hours x 3 berths x 55% = 13,860 hours
Unit cargo terminal : 8,400 hours x 2 berths x 50% = 8,400 hours

Similarly, after 2000, they are calculated as follows;

General cargo terminal: 8,400 hours x 5 berths x 65% = 27,300 hours
Unit cargo terminal : 8,400 hours x 2 berths x 50% = 8,400 hours

99. The figure shows that the total berth time in 1992 (25,000 hours per year) for the general cargo group already far exceeds the optimum berth time (13,860 hours per year) and almost touches the maximum capacity of the three berth terminal (25,200 hours per year). On the contrary, total berth time for unit cargoes is far below the optimum berth time and the port has been utilizing this spare time for the general cargo group. In 2000, without any new terminal, the total berth time for the general cargo group is about 31,500 hours per year and far exceeds the maximum berth time. As for the total berth time of unit cargoes, the terminal continues to hold excess capacity compared with the optimum berth time. After 2000, with the construction of new unit cargo terminals and the transfer of two No.5 berths to the general cargo group from the unit cargo group, total berth times are a little below the optimum berth times for both general cargo group and unit cargo group. The total berth time will catch up to the optimum berth time by the year 2003, and after that continue to exceed it. Therefore, another unit cargo terminal should be constructed and new terminal(s) for dry bulk cargo as well as refrigerated cargo should be constructed to ease the congestion at the general cargo terminal.

100. The real situation falls between the two figures. That is, till 2000, all the terminals are used as multi-purpose terminals and after that terminals are divided into two groups. Anyhow, with the construction of two unit cargo terminals in 2000, the port provides sufficient capacity to both unit cargo and general cargoes. After 2004, the demands exceed the optimum occupancies, however, for the unit cargo terminals, considerable share of Ro-Ro vessels would work to alleviate the congestion. This is because this type of vessel occupies a small portion of the quay for berthing and it is commonly observed

that No.5 wharf accommodates two vessels while berthing a Ro-Ro vessel. Therefore, even if the berth occupancy rate is calculated considerably high, the port still can provide sufficient services to vessels, under the condition that the cargo handling operation is conducted smoothly with sufficient cargo handling equipment as well as competent workers in the well planned container yard. (Assuming 65% for optimum occupancy rate, then optimum berth time will be about 11,000 tons a year.)

101. In short, it may be appropriate that projects be realized in following order:

i By 2000, two unit cargo terminals, by-pass road and domestic terminal should be completed. All unit cargoes including fruit container should be handled at the new unit terminal.

ii By 2004, dry bulk terminals for fertilizer and grains should be completed.

iii By 2009, another unit cargo terminal should be completed.

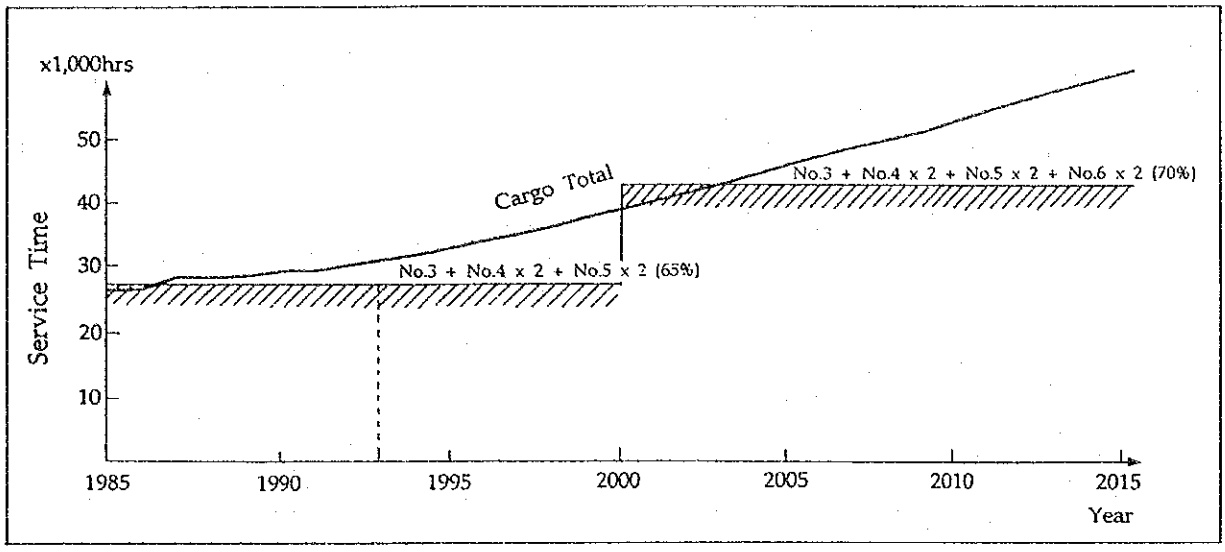


Fig. 1-6-1 Cargo Volume - Terminal Capacity Relation in all

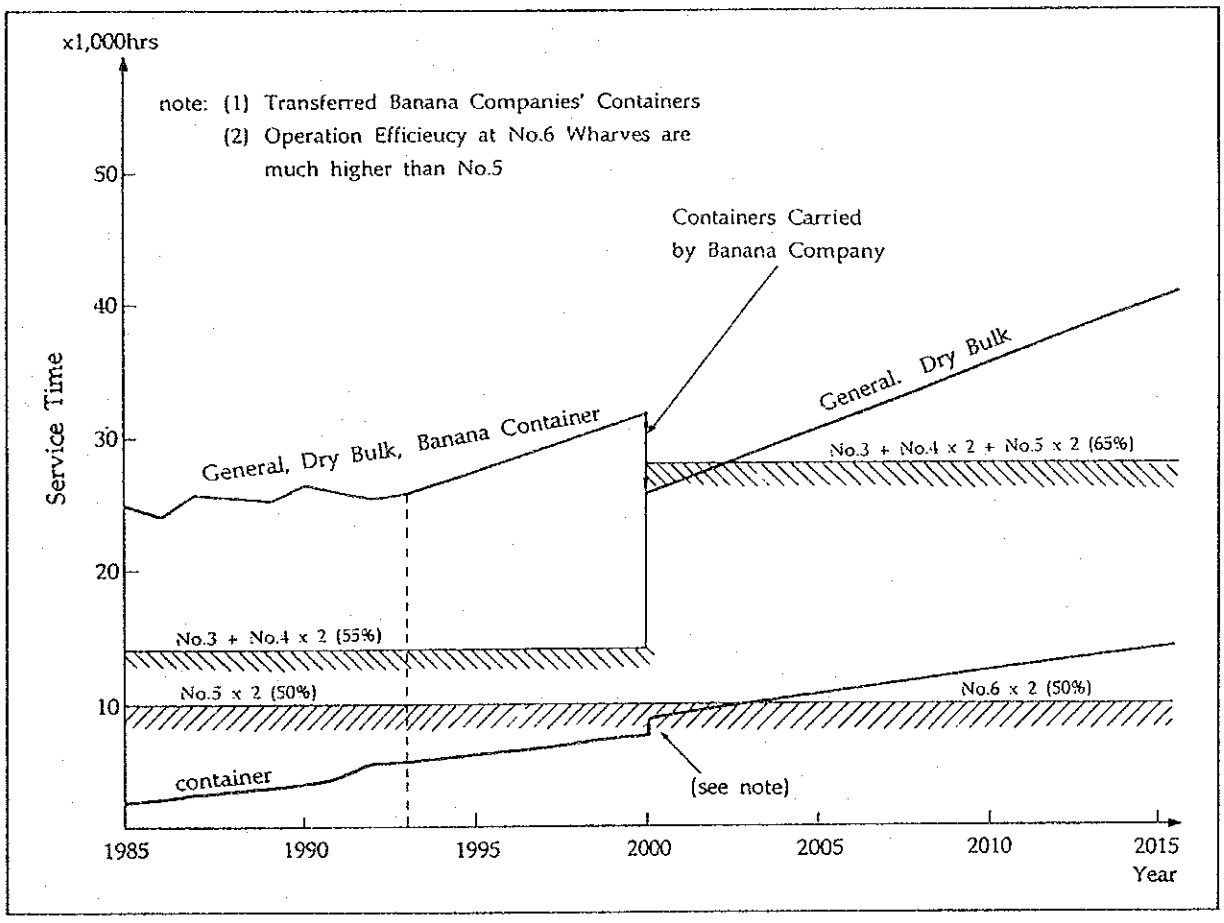


Fig. 1-6-2 Cargo Volume - Terminal Capacity Relation by Terminal Type

1.7 Rough Design of Port Facilities

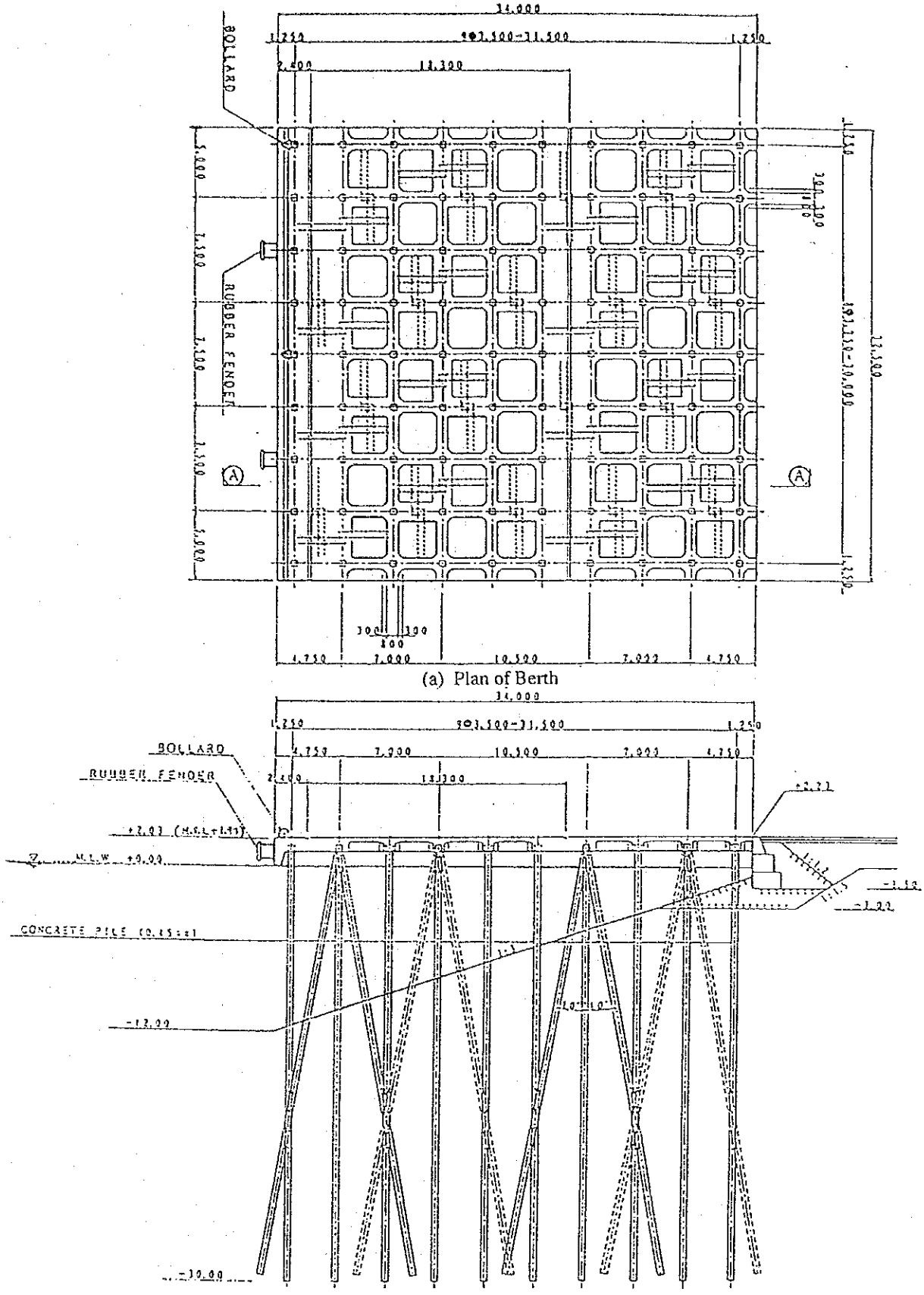
102. According to the Masterplan of the Port of Cortes for the year 2010 mentioned in section 1.5, the new facilities to be designed are summarized as below:

	Water Depth	Length
(A)Unit Cargo Berth	-12.0m	185m
(B)Multi Purpose Berth	-10.0m	Dolphin Type
(C)Domestic Cargo Berth	-4.5m	200m
(D)Bypass	--	approx.1,380m

103. As the aim of design is to get quantities of the materials for a preliminary cost estimation required in Port of Cortes by 2010, only the major structural components are determined.

104. Types of the port facilities are tentatively the same as that of the existing wharves in the Port of Cortes--open deck type on concrete piles, which is popular in Honduras. The typical cross sections of the main facilities are shown in figures as below:

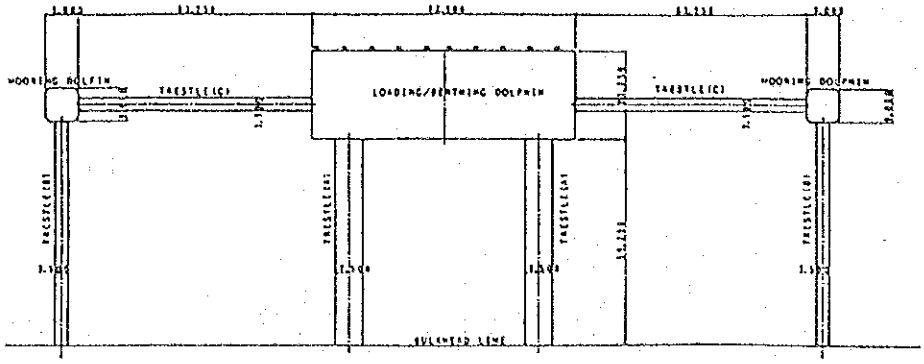
(A)Unit Cargo Berth ---------- Fig.1-7-1
(B)Multi Purpose Berth ---------- Fig.1-7-2
(C)Domestic Cargo Berth and Training Wall --------- Fig.1-7-3



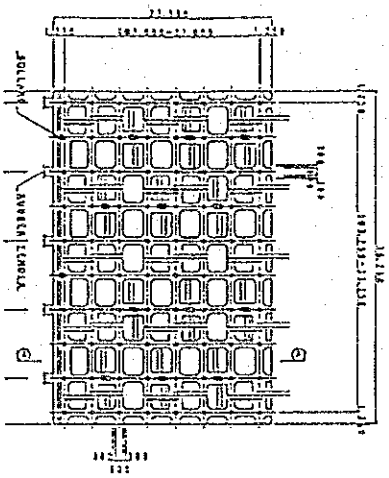
(a) Plan of Berth

(b) Cross Section (A) - (A)

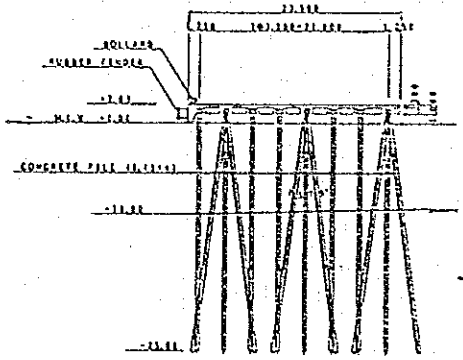
Fig. 1-7-1 Unit Cargo Terminal Berth



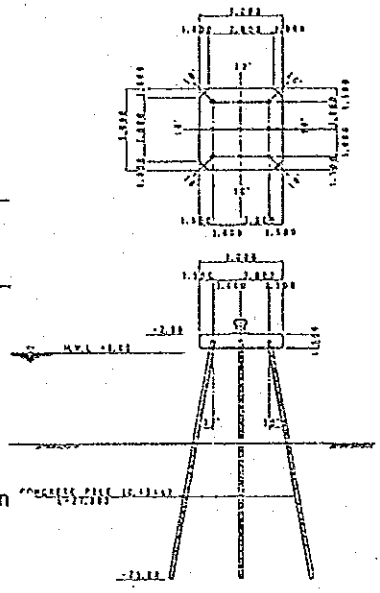
(a) Location of Grain Terminal



(b) Plan of Loading Dolphin

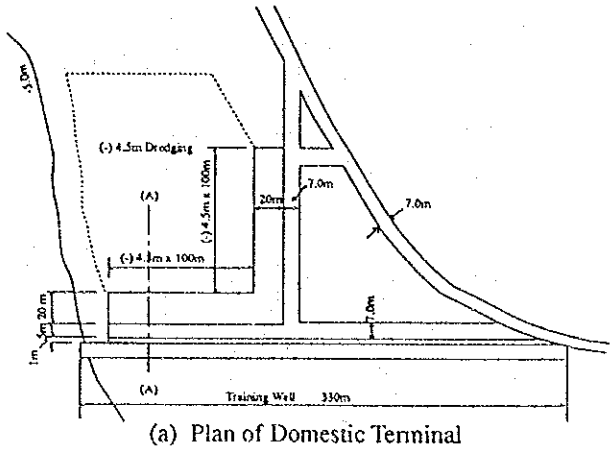


(c) Cross Section of Loading Dolphin

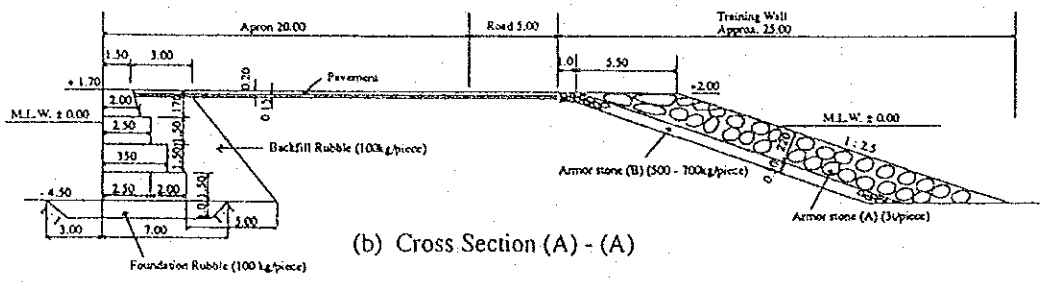


(d) Mooring Dolphin

Fig. 1-7-2 Grain Terminal Berth



(a) Plan of Domestic Terminal



(b) Cross Section (A) - (A)

Fig. 1-7-3 Domestic Terminal Berth and Training Wall

1.8 Implementation Plan

1.8.1 Conditions for Construction Works

105. Considering the natural conditions at the Port of Cortes, the workable days per year are assumed as follows:

Workable Days

Items	Offshore Works	Works on Land
Non-working days	26	24
Workable days	339	341
Workable days per month (average)	28	28

106. In Honduras, the fiscal year is the same as the calendar year, and holidays for the construction works are set as follows:

Sundays..... 48
National Holidays..... 12
Total..... 60

Besides non-working days due to the weather condition, 60 extra days per year are subtracted for Sundays and the national holidays, and the net workable days are assumed to be 280 days per year or 23 days per month.

1.8.2 Construction Schedule

107. The construction schedule is planned based on the following considerations:

1) Minimizing interference of the construction works with the daily port operations to secure efficient and safe port operation.

2) In this project, the cutter suction dredger owned by ENP is planned to be used for the dredging and reclamation. In this project, the dredging capacity is planned to be 200 m^3/hour considering the field conditions.

The construction of the facilities envisaged in the Masterplan will require about five years.

1.9 Cost Estimate

1.9.1 General

108. The following premises and conditions are adopted for the cost estimate:

1) Costs are estimated considering that the construction works are carried out in accordance with international tender regulations.

2) The exchange rate of the foreign currency is assumed as follows:
   1 US$ = 5.85 Lps.
   1 US$ = 115 Yen

3) The information on the market prices of labor, construction materials and the rental charges of the construction equipment and machinery, etc. is collected verbally from construction companies.

4) Construction costs are divided into a foreign currency portion and a local currency portion.

5) The ratios of utilities, engineering fee and physical contingency are shown below.

- Utilities:

Facilities	Utilities
Wharf/Dolphin	4%
Dredging/Reclamation	0%
Container Yard	6%
Yard/Road	4%
C.F.S/Warehouse	8%

- Engineering Fee:
  Civil Works 5%
  Cargo Handling Equipment 3%

- Physical Contingency:
  Wharf/Training Wall/Dolphin and Building 8%

Dredging/Reclamation/Revetment/Yard and Open Space/Road/Pavement	4%
Cargo Handling Equipment	0%

6) Taxes/Duties on the imported equipment are excluded from the cost estimate.

1.9.2 Conditions of the Cost Estimate

109. The situations of labor force, construction materials and construction equipment are important factors in the cost estimate. These cost items are counted by individual items taking into account costs for similar works in Honduras.

1.9.3 Construction Cost of the Facilities under the Masterplan

110. An outline of major port facilities to be constructed under the Masterplan in 2010 is shown in Table 1-9-4 below, by Alternative A1-1, A1-2, A1-3, and A-2.

111. The construction cost of each alternative plan is approximately estimated on the basis of the structural types of the project components, as shown below.

(unit: 1000Lps)

Alternative	Construction Cost
A 1-1	429,000
A 1-2	451,000
A 1-3	422,000
A 2	372,000

(Refer to Appendix - B for further details)

Table 1-9-4 Main Facilities under Master Plan (A1-1, A1-2, A1-3, A2)

Facilities			Unit	A1-1	A1-2	A1-3	A2
A	A-1	Unit Cargo Terminal					
	1	Wharf (-12)	m	555	555	555	370
	2	Dredging (-12)	m^3	746,760	887,774	1,058,455	437,854
	3	Revetment (-5.0)	m	480	725	200	400
	4	Reclamation	m^3	637,580	1,133,278	244,302	255,638
	5	Container/Reefer Yard	m^2	66,951	80,341	46,866	44,252
	6	Road/Open Space	m^2	100,724	169,659	113,134	67,273
	A-2	Domestic Cargo Terminal					
	7	Wharf (-4.5)	m	200	200	200	200
	8	Dredging (-4.5)	m	15,300	15,300	15,300	15,300
	9	Training Wall	m	330	330	330	330
	10	Revetment (-2.0)	m	50	50	50	50
	11	Reclamation	m^3	79,349	79,349	79,349	79,349
	12	Compaction	m^3	0	0	0	0
	13	Yard	m^2	13,160	13,160	13,160	13,160
	14	Road/Open Space	m^2	8,925	8,925	8,925	8,925
	A-3	By-Pass Road (L=1,380m)					
	15	Revetment (-2.0)	m	1,380	1,380	1,380	1,380
	16	Reclamation	m^3	71,291	71,291	71,291	71,291
	17	Road/Open Space	m^2	15,180	15,180	15,180	15,180
	A-4	Behind No. 5 Wharf					
	18	Port Road (L=550m)	m^2	3,850	3,850	3,850	3,850
	A-5	Dry Bulk Terminal					
	19	Dolphin (-10)	m	-	-	-	73
	20	Revetment	m	-	-	-	250
	21	Reclamation	m^3	-	-	-	38,000
	22	Pavement (Apron)	m^2	-	-	-	7,200
B		Building					
	23	C.F.S.	m^2	6,750	6,750	6,750	5,000
	24	Office/Maintenance/Shop	m^2	3,000	3,000	3,000	3,000
C							
		Utilities	L.S.	1	1	1	1
D		Cargo Handling Equip.					
	25	Gantry Crane	Nos.	2	2	2	1
	26	Straddle Carrier	Nos.	7	7	7	5
	27	Tractor Head	Nos.	15	15	15	10
	28	Chassis	Nos.	30	30	30	20
	29	Forklift (7.5T)	Nos.	4	4	4	2
	30	Forklift (4.0t)	Nos.	8	8	8	4
	31	Bridge-type Crane	Nos.	1	1	1	1

Chapter 2 Port Management and Operation

2.1 Port Management and Workers

112. Concerning port operation and administration, there is no single definitive system that has been adopted in ports all over the world. The structure of the port management body at each port is different depending on historical, socio-economic and institutional factors. In Honduras, port activities are conducted both by ENP and by private companies. To streamline the organization and improve cargo handling, participation of private companies is becoming the agenda of global ports. Section 4.1 and 4.3 of PART I gave some observation to the port privatization issue and suggested a prudent approach toward the privatization while advocating the general trend.

113. An obstacle which must be surmounted when private participation is sought, is the natural reluctance of labor unions to cooperate, since during the course of privatization redundancy of workers is envisaged. Such opposition can be partly mitigated by a carefully planned strategy, which should include an aggressive public relations campaign, and for those who choose, or agree, to leave and seek work elsewhere should be rewarded by special retirement bonus other than ordinary allowance. This high financial cost in obtaining workers' cooperation will be compensated by the smooth transition.

2.2 Container Handling System

(1) Function of Container Terminal

114. A container terminal has the following two main functions.
The first function is transferring function. International container transport is linked transport of different transport modes (marine, railroad and road).
The second function is stowing function. This function is required to adjust different pattern of transport modes linked at container terminal.

(2) The Basic Concept in Container Terminal Operation

115. The procedure of the best container terminal operation is to provide a quick, exact and safe operation on handling vessels and containers with lowest cost, which depends upon the container terminal facilities, equipment and machineries, labor conditions, and inland traffic access to the terminal.

116. A container terminal operator is requested to pay keen attention to the following points;

1) To increase the number of handling container units within the limited time,
2) To use the limited area of terminal efficiently, and
3) To save investment and running costs for handling containers.

117. In the port of Cortes, straddle carrier system is adopted among other systems, viz chassis system, transtainer system and forklift system. With a view to realizing effective container handling, safety in container yard and ratio of container damage, transtainer system might be commended. However, to change container handling system needs much investment as well as time for labor training. In the port of Cortes, therefore, it may be better to continue the straddle carrier system in future. As labor can make the most of past experience, increase of burden is not brought. It is important to improve skill in the present container handling system.

2.3 Introduction of Shift System

118. At present, a shift system has not been adopted in cargo handling. A shift system is recommended to improve cargo handling productivity and working conditions. Concerning introduction of a shift system, following problems are envisaged.

1) Decrease of real wages
   Due to shortening working hours, real wages decrease compared with the present level. The calculation method of retiring allowance is based on wage before six months.

2) Increase of number of labors (Increase of personnel expense)
   Following introduction of shift system, the number of labors will increase. In other words, there is possibility of increase of personnel expense. The ratio of personnel expense to operation and administration expense excluding depreciation is about 72% in 1992. Increase of personnel expense is a big problem for ENP's financial condition.

119. Alternatives to solve these problems are as follows.

1) Increase of average wages

2) Change wage system to be based on handling volume rather than on working hours
   By introducing a wage system based on handling volume, if cargo handling is conducted efficiently, labors can earn the same wages as at present in a shorter time. This may raise the efficiency of port activities at the port of

Cortes and with increase of handled cargoes ENP will earn more revenue.

3) Introduction of incentives in wage system
An incentive could be given if a gang handled cargoes over a certain minimum volume.

120. Although measure 1) directly responds to the request of labors, it is harmful to the financial condition of ENP. ENP should, accordingly, investigate introduction of shift system using measures 2) and 3).
Concerning 2), it is necessary to compare increase of income and expense by simulation which is done under an assumed cargo volume handled with shift system. In the simulation, the following points should be taken into account.

1) Increase of personnel expense according to increase of average wages and number of personnel
2) Decrease of overtime pay according to decrease of working hours
3) Increase of operation income according to upgrading of handling efficiency

Concerning 3), ENP establishes proper criteria of container handling per gang. If gang exceeds the basic volume, they receive extra payment.

121. Introduction of shift system contributes in upgrading container handling efficiency as well as in improving safety of working conditions. ENP should start to investigate early adoption of shift system and/or to urge private companies the adoption.

2.4 Introduction of Computer System for Container Terminal Operation

2.4.1 Necessity of Computer System

122. When the number of containers is not great, terminal operation can be conducted without a computer system. In fact, at some terminal, container terminal operation is effectively conducted using the blackboard or cards. However, when the number of containers increases and exceeds a certain level of handling activity, trouble such as delay and mistakes in container handling usually occur. Generally, it is said that 50 thousand TEU is the limit of manual processing of yard operational control. At No.5 wharf, more than 170 thousand TEU are currently handled with narrow shaped container yard through complicated operation. Computer for container terminal operation in the port of Cortes should be introduced as soon as possible.

2.4.2 Effects of Computer System

123. The effects of computer for container terminal operation are as follows:

1) An optimum yard operation plan can be developed. Yard operation can be conducted more quickly and accurately.
2) Container yard can be better utilized.
3) Various kinds of information such as container location and storage can be obtained more easily.
4) Efficient allotment of cargo handling equipment can be realized.

These effects greatly contribute to upgrading quality of service for the clients.

2.4.3 Computer System

124. At No.5 wharf, a simple system is already introduced to improve the container inventory management system. This system consists of minimum data filing of container and its location (name of ship, name of agent, container number, its location address). However, as there is not a basic communication system to connect container control center with container yard and gate, computer is not used for container terminal operation.

125. The recommendation is made for the early adoption of computer system which will serve for container terminal operation, as suggested in the next two paragraphs. Computer system for container handling is mainly divided into two systems; one is yard control system and the other is yard operation system.

(1) Yard Control System

A yard control system controls container flow from gate-in to stacking at the container yard. The system should connect control center with terminal gates, container yard, CFS and accounting section. This system includes following functions.

a) Gate Control
b) CFS Control
c) Yard Control

(2) Yard Operation System

In the case of vessel planning, it is important that loading/unloading is done safely, correctly and speedily. To this end, accurate loading/unloading plan should be prepared. Based on the information from agent, the planner draws up the plan of items below and registers the plan into the computer.

a) Allocation of container stowage space in CY
b) Allocation of container stowage space on board
c) Assignment of cargo handling equipment

Based on the registered plan, the computer processes the loading/unloading activities and finally makes the complete stowage condition.
In the port of Cortes, as there is no marshaling yard, containers are loaded/unloaded to/from ships from/to stacking yard directly by gantry crane or ship gears. During the operation, the control center must pay attention to loading/unloading the container properly according to the plan.

126. Since these systems are all connected to the container control center on-line, effective and prompt cargo handling is realized. Because it will be difficult to quickly introduce the total computer system, it may thus be necessary to start with a small scale computer system. However, the development of small scale computer system should take into consideration the possibility of extending component of system for further development.

2.5 Maintenance of Cargo Handling Equipment

2.5.1 Improvement Plan

127. The main purpose of maintenance and repair is to keep equipment in good condition thereby increasing productivity of handling equipment by minimizing trouble during cargo handling operation. Although ENP is conducting preventive maintenance, ENP has not yet adopted a statistical approach which is a useful tool to clarify spare parts needs. The main points of improvement plan for maintenance are outlined as follows.

1) Procurement of Spare Parts
It is necessary to consider systematic purchases based on the analyzed consumption of spare parts (for example used by computer). Skilled expert is necessary to carry out the analysis.

2) Planning of Replacement Plan or Disposal Plan
Replacement plan or disposal plan are important in terms of having the appropriate amount of cargo handling equipment and also in terms of renewing cargo handling equipment in budget.

3) Training of Personnel

4) Introduction of Computerized Maintenance and Repair
Records related to maintenance and repair can neither be analyzed nor utilized sufficiently. A computerized maintenance and repair system should be introduced to serve for analyzing maintenance and repair records.

128. Since ENP has been executing maintenance and repair works by itself, it needs to reinforce its maintenance ability to catch up with new maintenance machines and tools.

2.6 Personnel Training

(1) Completion of Training System

129. Training programs are determined at the meeting in which coordinator of United Nations and Central America participate. In the meeting, they report and discuss the problems in their ports. Therefore, it is possible to establish timely training programs corresponding to the needs of port activities.

130. Every six months, six or seven training programs are initiated, however, some of them are canceled because preparation and check of the textbooks are not finished. The theme of training programs take into account present problems of port activities, and enforcement of these programs directly contributes to improvement of port activities in Honduras. ENP, therefore, should make an effort to implement all training programs.

131. As the principal objective of training programs is enlightening oneself, raising one's morale and improving one's ability, a system is required in which trainee can participate in the training course independently. A system which rewards by promotion for example those trainees who achieve good results might be introduced. It may encourage to aggressive and independent participation.

132. The curriculum would be better to be formulated so as to grouping only those people who have the same requirements.

1) Training System for Office Workers

The theme of the training courses focuses upon personnel management as well as public service such as tax system, accounting system and legal knowledge etc. The purpose of the course for office workers is to encourage personnel to be mindful of efficiency concerning port management and operation. By these training courses, the office workers will have enough knowledge for conducting their job and also become conscious of competitive port management. The expected goals are as follows:

a) To keep "aggressive port management by providing good service for port users" in mind.
b) To make ENP office workers recognize that all ENP staffs must contribute to improve efficiency of port activities to survive competition with neighboring ports.
c) To make ENP office workers recognize cost-consciousness.

2) Training System for Operational Employees

It is important to further improve their technical ability to cope with modernized container handling operation corresponding to the introduction of computer. ENP should examine the training system for operational employees to develop their ability to conduct more quick and reliable cargo handling.

133. ENP should also try to formulate the most of training programs in which trainee can observe and experience the latest port activities in advanced countries.

(2) Improvement of Promotion System

134. Establishment of a promotion system which is only judged by the personnel's experience and acknowledge is one method to engender an eagerness for work. The important point of a promotion system is that evaluations should be conducted without bias. In improving this system, following items should be taken into account for evaluation.

1) Evaluation items should be sufficiently detailed to reflect one's conduct objectively as much as possible.

2) Various personnel evaluation sheets should be carefully designed corresponding to the type of work and rank.

Contribution to improvement of port management and operation should be counted in evaluation. Work achievements and good results of training should be considered in the promotion system.

Demand for an increase of wages is decided by negotiation between ENP and labor union every three years. The amount of increase is not different according to the rank, in other words, all personnel get the same wage increase without distinction of rank or age. Wage levels are not necessarily high compared with that of private companies. In the present conditions, able personnel sometimes tend to transfer to private companies. The wage and promotion system should be restructured take into account both ability and experience in order to retain able personnel in ENP.

PART IV

Short Term Plan of the Port of Cortes in 2000

Chapter 1 Port of Cortes in 2000

1.1 Planning Targets for the Short-Term Plan

1. The planning target for the short term plan of the port of Cortes is, again, listed as Table 1-1-1.

Table 1-1-1 Planning Target for the Short-Term Plan [2000]

	Unit Cargo	Conventional	Dry Bulk
Vessel size (Top 20%)	15,000 GRT	10,000 GRT	7,000 GRT
Vessel Length, Width	160m, 25m	155m, 20m	128m, 15m
Total Cargo Volume	1,850,000 MT	450,000 MT	700,000 MT
Ave. Cargo per Vessel	1,850 MT	1,500 MT	7,000 MT
No. of Calls	1,000	300	100
Efficiency (MT/hr)	220	36	52
Handling Time (hr)	8.4	41.7	134.6
Ave. Waiting Time (hr)	4	24	24
In port time(hr)	12.4	65.7	158.6
Total Berth Time(hr)	8,400	12,510	13,460
Equivalent Berth (24hrs, 350 days)	1.00	1.49	1.60
No. of Berth required	2(2.00)	5(4.75)	

2. Assumed vessel sizes are the same sizes to 2010 which are set to cover at least 80% of the total vessel calls on the assumption that more than two continuous berths are constructed. It turns out that the berth requirement for the year 2000 is two and this fulfills the above assumption. It is foreseen that vessel size will not change drastically in the future and thus, the objective vessel sizes are forecasted as follows;

Vessel Size

Unit cargo : 15,000 GRT, 160 m long and 25 m wide
Conventional : 10,000 GRT, 155 m long and 20 m wide
Dry bulk : 7,000 GRT, 128 m long and 15 m wide

3. In short, the facilities required in the short term plan are as follows;

a. Unit cargo terminal x 2 berths (total length 370m)
b. By-pass road
c. Domestic terminal
(See Fig. 1-1-1)

4. In the scope of middle range, the unit cargo berth will soon reach and exceed the optimum occupancy rate (50%). Thus, another new berth for unit cargo terminal is theoretically required. However, in reality, the considerably high share of Ro-Ro vessel (25% in 2000) would work to mitigate the quay congestion, because Ro-Ro vessels can be berthed while another Lo-Lo vessel is being berthed. Thus, the affordable occupancy rate could rise to some degree, say 10-15%. Therefore, with the actual optimum occupancy rate of 65% for two unit cargo terminals, the terminals can satisfy the demand, without congestion, probably up to 2009.

1.2 Unit Cargo Terminal

5. Two berths of the unit cargo terminal are proposed on the reclamation area at the eastern-most part of the port. One gantry crane per berth is installed and straddle carrier system is adopted as cargo handling system.

6. Layout plan of major facilities is shown in Fig. 1-2-1. The dimensions of facilities are as follows;

Container Base	: 1,505 slots
Reefer Base	: 178 slots
Container Freight Station	: 5,000 sq.m
Maintenance Shop	: 1,000 sq.m
Cleaning House	: 1,000 sq.m
Office Building	: 1,000 sq.m
Road and Other Open Space	:67,273 sq.m

7. Lists of cargo handling equipment for unit cargo terminal is as follows;

Gantry Crane	: 2 (outer reach 30m, lifting capacity 41 ton, rail span 18.29m)
Straddle Carrier	: 5
Tractor Head	: 10
Chassis	: 20

8. The rails for gantry crane should be installed continuously over the two terminals to allow for flexible operation. When a large vessel berths at the terminal, two cranes may be required for quick cargo handling. With the continuous rails, the terminal could provide sufficient service. The dimensions of gantry crane are assumed to be equal to the ones presently installed at the wharf No.5, because after the transfer of the unit terminal function to the new terminal, the cranes currently used at the wharf No.5 can be transferred to the new terminal. Other equipment is also transferrable to the new terminal, depending on the equipment's condition.

1.3 Domestic Terminal and By-pass Road

9. Domestic terminal also contributes to mitigate the port congestion by providing an exclusive berthing facility meet the large future demand of cabotage which in turn results in efficient cargo handling activities for international sea borne trade.
The total number of domestic trade ships mooring at the berth and working ships in the port reaches to 20 in 2000 and 25 in 2010.

	1992	2000	2010
a. No. of calls	396	579	913
b. Cargo volume(MT)	47,520	69,494	109,600
c. No. of ship at cargo handling	2-3	3-5	4-7
d. No. of ship mooring(including c.)	5-10	10-15	15-20
e. No. of working vessel	3	5	10

10. The location and layout plan of the domestic terminal is as shown in Fig. 1-1-2. On the river side, training wall is constructed so as not to disturb the river flow. On the other side of the training wall, L-shaped quay of total length 200m is constructed. Roads of 7m width provide access to the main road as well as the international wharves.

11. The by-pass road runs through the sea side rim along the free trade zone. Total length is about 1,380m. The road has three lanes, two for traffic movement and one is for overdriving or parking. Along the seaside of the road, side walk with appropriate vegetation should be provided for the improvement to port amenity.

12. By-pass road is planned to accommodate traffic to and from the container terminal. Estimated traffic volumes by packing type are shown again, which has already been shown as Table 1-3-10 , PART III.

Traffic Volume by Packing Type (number/hour, ton/year)

Year	General	Dry Bulk	Unit Cargo	Total
1992	127(509)	95(353)	195(1,301)	417(2,672)
2000	113(450)	189(700)	278(1,850)	580(3,000)
2010	150(600)	270(1,000)	375(2,500)	795(4,100)

13. Presently, access roads to/from the port receives some 400 vehicles. In 2000, the number of vehicles increases to almost 600 and by 2010. With the construction of the new by-pass road, the traffic can be divided, and even if the general traffic to/from the city considerably increase the traffic congestion could be avoided.

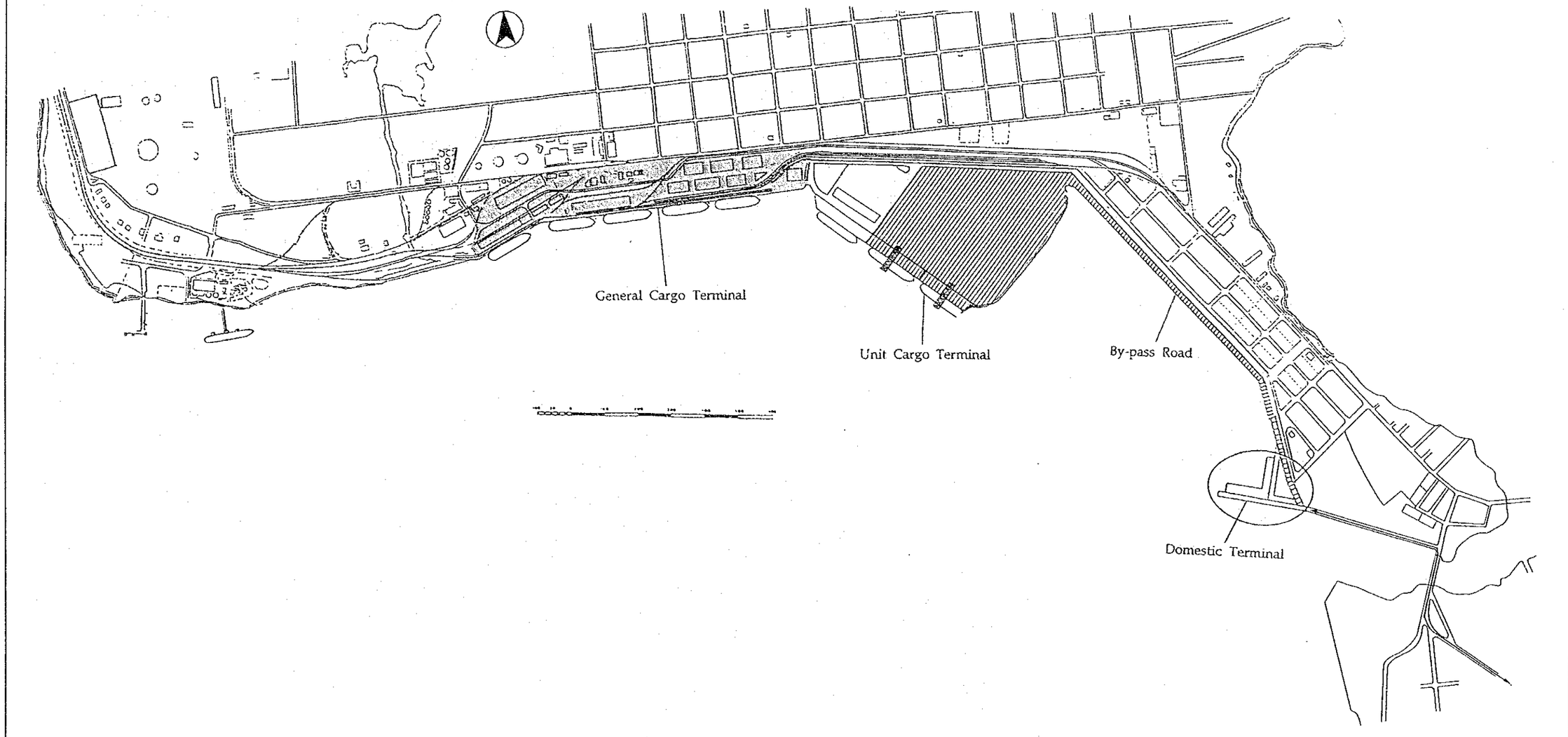


Fig. 1-1-1 Short-term plan (2000)

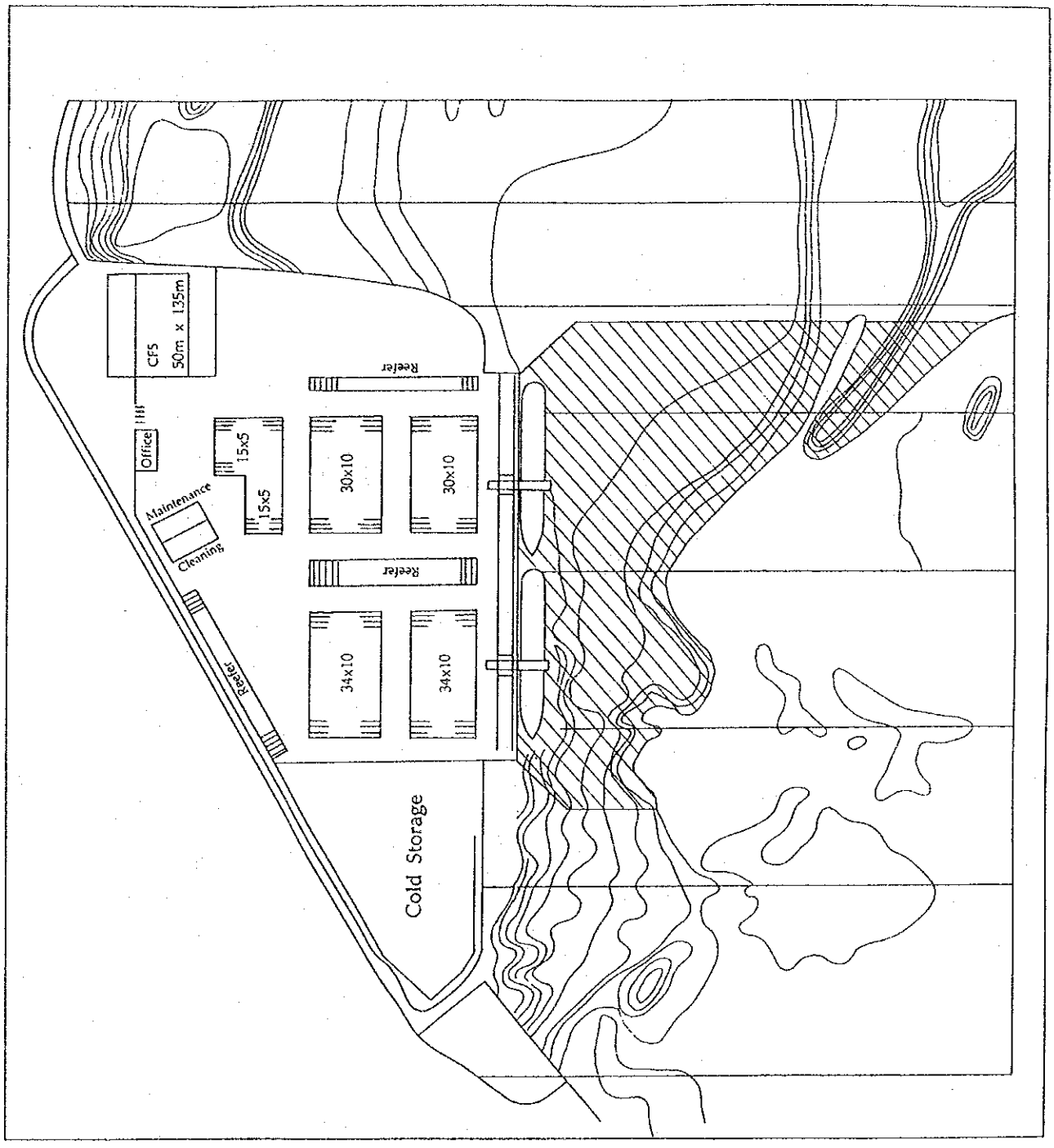


Fig. 1-2-1 Layout Plan of Unit Cargo Terminal for Short-term Plan

1.4 Rough Design of the Projected Port Facilities

1.4.1 General

14. According to the layout of the port facilities which is proposed in section 1.2, and 1.3, Chapter 1, the main facilities to be designed include the followings:

1) Unit cargo berth (water depth = 12 m, length = 370 m)
2) Domestic cargo berth (water depth = 4.5 m, length = 200 m)
3) By-pass road (length = 1,380 m)

In this section, conditions/criteria, and results of the design are described.

1.4.2 Design Conditions

1) Datum Level

15. The datum level for the design or construction works should be the same level as the Chart Datum, which is approximately equal to the lowest low sea level. In the Port of Cortes, the tidal range is as small as 0.35 m, and the mean sea level is usually adopted as the datum level by ENP. In this project, the mean low water level (M.L.W = M.S.L - 0.1 m) is used as the datum level.

2) Ship Size

16. The maximum ship size is 15,000 GRT as described in section 1.1 of this Chapter.

3) Crown Height/Water Depth of the Wharf

17. The crown height of existing wharves in the Port of Cortes is 1.93m above M.S.L. (2.03m above M.L.W.), and the crown height should be the same as that of Wharf No. 5: 2.03 m above M.L.W.

18. The designed water depth of the wharf is set at 12m below M.L.W.

4) Surcharge on the Apron

19. Wharf No. 5 was constructed in 1975, and ENP is planning to extend it eastward by 124 m. The usage of the new wharf - Wharf No. 6 - will be almost the same as that of the extension of Wharf No. 5, and so the surcharge on the apron of Wharf No. 6 will be similar to the loads on Wharf No. 5 and extension of Wharf No5.

5) Soil Conditions

20. The Study Team carried out three core soil borings of the sea bottom in the study area, and their results and analysis are mentioned in section 2.7.3, Part I, Volume II.

6) Seismic Force

21. For Wharf No. 5 and its extension, the seismic coefficient of 0.115 is adopted in accordance with the Uniform Building Code (UBC).

7) Allowable Stresses

22. The comparison of each standard as the accepted allowable stresses are described in Table 1-4-3. In addition, it is assumed that when the influence of an earthquake is considered, the allowable stresses can be increased by 50% of their normal values.

Table 1-4-3 Allowable Stresses of Materials

Material	ASTM	JIS
1. STEEL		
Structural steel	20,000 psi (1,400kg/cm^2)	1,400kg/cm^2 (SS41)
Steel sheet	None	1,800kg/cm^2 (SY30)
Steel pipe	None	1,400kg/cm^2 (SKK41)
Reinforcement bar	20,000 psi (1,400kg/cm^2)	1,400kg/cm^2 (SR24)
2. CONCRETE		
Plain concrete	None	(compression) 55kg/cm^2
Reinforced concrete	3,500 psi (245kg/cm^2)	70 - 90kg/cm^2
	4,000 psi (280kg/cm^2)	70 - 90kg/cm^2

8) Safety Factor and Others

23. The values for the safety factor are chosen according to the above mentioned Japanese Standards, as shown below:

Table 1-4-4 Safety Factor

	Items	Normal Conditions	Special Conditions
Pile Capacity	Compressive stress Pulling stress	2.5 3.5	1.5 2.5
Sheet Pile	Embedded length (sandy soil) (cohesive soil)	 1.5 1.2	 1.2 1.2

1.4.3 Structural Types to be Designed/Compared.

24. The types of wharves are mentioned below:

- Gravity type : Concrete caisson type.
  Cellular cofferdam type.
  Concrete block type.
- Sheet pile type : Steel sheet.
- Open deck on piles : On steel piles or on concrete piles.

25. While the type of open deck on square concrete piles is popular in Honduras, for example, the wharves in the Ports of Cortes, Castilla, and San Lorenzo were constructed using this type of structure. Steel piles are often used instead of concrete piles in Japan. Here, three structural types - the open deck on steel piles or on concrete piles, and the sheet pile type will be compared in this Study.

1.4.4 Design and Analysis

26. Fig 1-4-1 shows the standard cross section of each type; that is the:

Sheet piles type ..... Fig. 1-4-1 (a)
Open deck on steel piles ..... Fig. 1-4-1 (b)
Open deck on concrete piles ..... shown as Fig. 1-7-1 in Section 1.7, Part III.

27. The merits and demerits of each type are as follows:

- Steel Sheet Piles

(1) The structure is simple and easy to construct,
(2) The construction period is shorter than that of the other types,
(3) There are no examples in Honduras,
(4) Steel sheet piles should be imported from abroad, and
(5) The cost per one meter along quayside is approximately 270 million Lps.

- Open deck on steel piles

(1) The process of construction is complex compared with that of the sheet pile type,
(2) The number of piles is less than that required for the concrete pile type,
(3) Steel piles should be imported from abroad,
(4) There are no examples in Honduras,
(5) A revetment is necessary at the end of the deck to embark the back-fill materials, and
(6) The cost per one meter along quayside is approximately 300 million Lps.

- Open deck on concrete piles

(1) The process of the construction is complex compared with that of the sheet pile type,
(2) A revetment is necessary at the end of the deck to embark the back-fill materials,
(3) A longer construction period is needed,
(4) Very popular and skillful in Honduras, and
(5) The cost per one meter along quayside is approximately 290 million Lps.

28. Comparing the merits and demerits mentioned above, the cost difference in each alternative structures is minor within almost 10%. As such, the open deck on concrete piles, which has been widely used in Honduras and can save foreign currency, should be chosen as the wharf structure for this Project.

1.4.5 Design

1) Result of the Design

29. The standard cross section of the open deck wharf on concrete piles is shown in Fig. 1-7-1 (b) in Chapter 1, Part III, and the design conditions are mentioned in section 1.4.3.

30. The horizontal force per 1.0m of wharf and one coupled pile generated by 1) earthquakes 2) ship's berthing, and 3) the tractive force acting on mooring posts was calculated as shown below.

	Horizontal force (t)	
	per 1.0 m	1 coupled pile
1) Earthquakes	17.6	35.7
2) Ship's berthings	8.5	17.3
3) Mooring posts	5.1	10.4

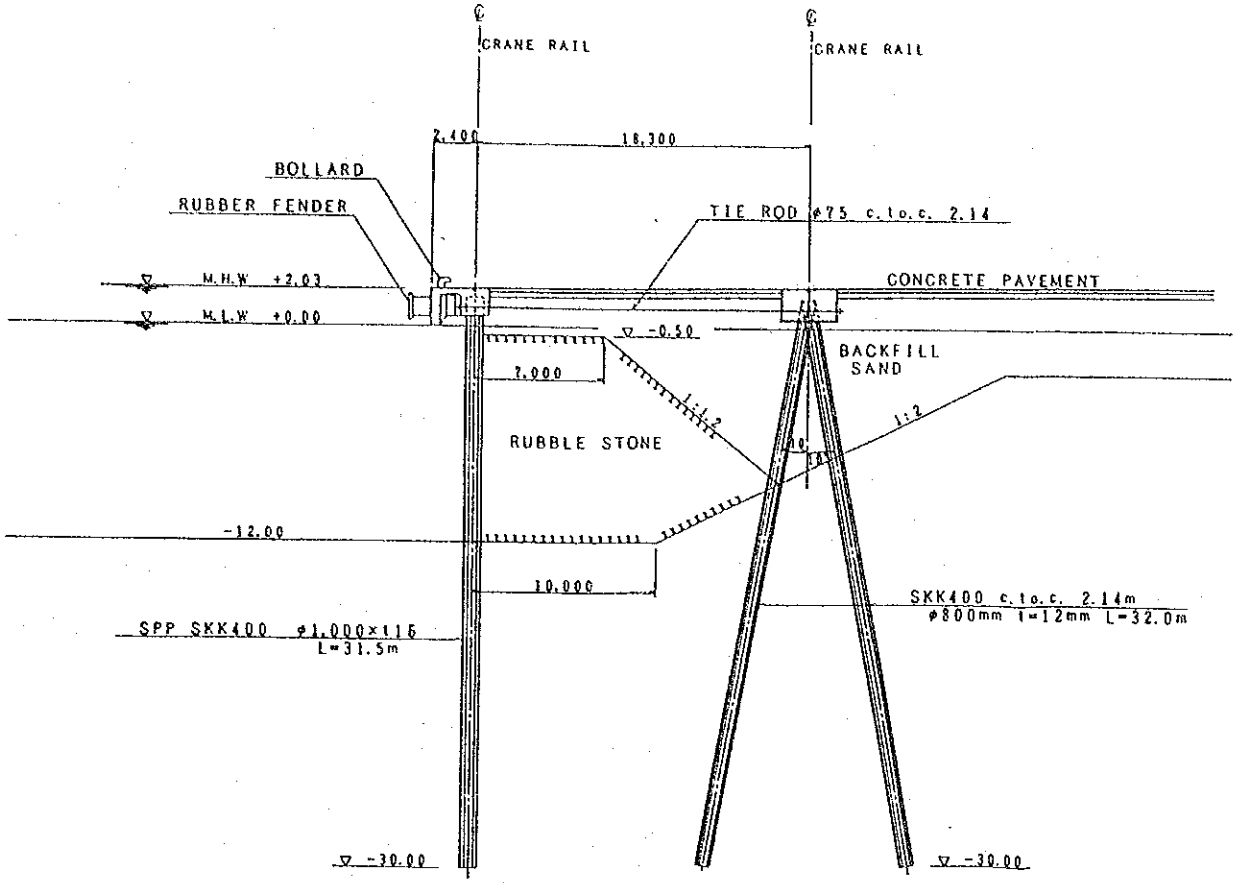
31. From the above, the compressive stress and pulling stress of a coupled pile is calculated in regard to an earthquake and the results follow:

Case-1	(Maximum Vertical Load)	V= 79.0t	P_1=140.8	(compressive stress)
		H= 35.7t	P_2=-61.8	(pulling stress)
Case-2	(Minimum Vertical Load)	V= 22.8t	P_1= 91.7	(compressive stress)
		H= 27.8t	P_2=-68.5	(pulling stress)

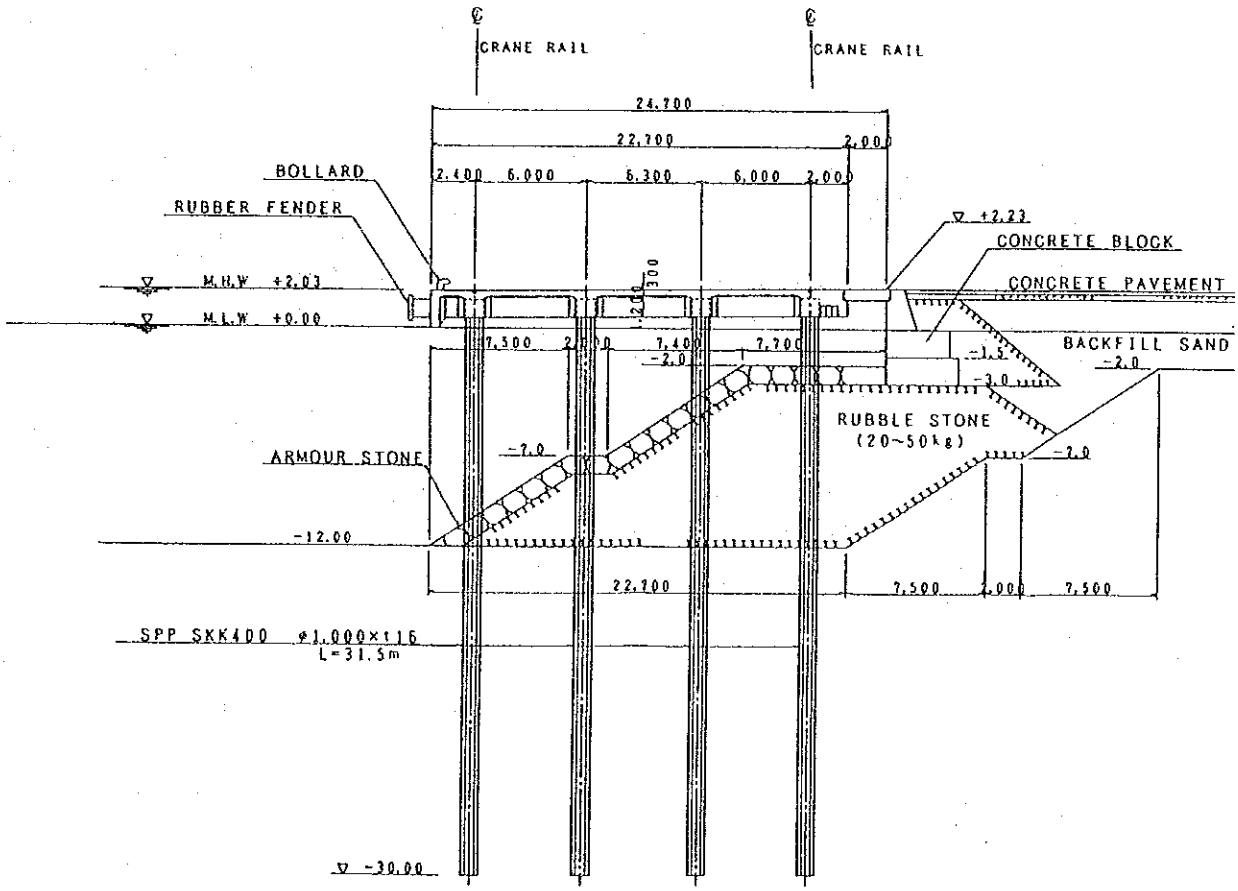
$$\text{Safety Factor} = \frac{\text{Resisting Force}}{\text{ActingStress}}$$

	Acting Stress	Resisting Force	S.F.
Compression	140.8	476 - 557	3.4 - 4.0
Pulling	68.5	233	3.4

(In case of earthquake)



(a) Steel sheet piles type



(b) Open deck on steel piles type

Fig 1-4-1 Typical Cross Section (Scale: 1: 400)

1.5 Implementation Plan

1.5.1 General

32. The following port facilities are planned to be constructed under the short-term plan by 2000:

Table 1-5-1 Facilities to be Constructed

Unit Cargo Terminal:		
Wharf (-12m)	370	m
Dredging (-12m) (89,604m^2)	437,854	m^3
Reclamation (46,906m^2)	255,638	m^3
Container/Reefer Yard	44,252	m^2
Road/Open Space	67,273	m^2
Domestic Terminal:		
Wharf (-4.5m)	200	m
Dredging (-4.5m) (3,000m^2)	15,300	m^3
Training Wall	330	m
Reclamation (13.160m^2)	79,349	m^3
Yard	13,160	m^2
Road/Open Space	8,925	m^2
By-Pass Road:		
Revetment	1,380	m
Reclamation (15,180m^2)	71,291	m^3
Road (1,380m x 11m)	15,180	m^2
Building:		
C.F.S.	5,000	m^2
Office/Maintenance Shop	3,000	m^2
Cargo Handling Equipment:		
Gantry Crane	1	nos
Remove of Gantry Crane	1	no.
Straddle Carrier	5	nos
Tractor Head	10	nos
Chassis	20	nos
Forklift (7.5t)	2	nos
Forklift (4.0t)	4	nos

33. The implementation should not obstruct the daily operations of the Port of Cortes which has about 1,200 ship calls a year. For this purpose, the dredging work is planned to be done prior to the other construction works to avoid the navigational obstructions caused by the many working vessels.

34. To programing the construction work, construction materials, equipments and laborers are presumabley procured in Honduras as much as possible with a view to achieving an economical and reasonable construction cost and to ensure efficiency in the implementation of the construction program.

1.5.2 Construction Schedule

35. The following points will be considerated for the programing implementation of the roject:

1) The construction of the port facilities is to start in 1996 and will be completed by 1999.

2) Working efficiency of main works are assumed as follows:

Table 1-5-3 Working Efficiency

Dredging (cutter suction dredger 750PS)	1,500m^3/day
Pile-driving	3.5 piles/day
Disposal of rubble stone	174m^3/day
Pavement	350m^2/day

3) The dredging work at the unit cargo terminal should be carried out in the first stage, and the dredged materials are to be used for the reclamation of the unit cargo terminal, the domestic terminal, and by-pass road. According to the subsoil data, the sea bed materials of the planned dredged areas suitable for the reclamation.

The balance of the reclaimed volume and the dredged volume is:

	Dredging	Reclamation
Unit Cargo Terminal	437,854m^3	255,638m^3
Domestic Terminal	15,300m^3	79,349m^3
By-Pass Road	-	71,291m^3
Total	453,154m^3	406,278m^3

The imbalanced volume, 46,876m^3, is planned to be dumped off-shore.

4) After completion of the dredging work, wharf construction (-12m) is scheduled. Prestressed concrete piles for the wharf are manufactured locally. Concrete piles will be driven from the land side using a diesel hammer on a crawler crane.

5) The construction works of the domestic terminal and the by-pass road are planned for the same period because their construction sites are apart from each other.

6) The construction of the wharf (-4.5m in depth/ 200m in length) and training wall (330m in length) are the main works of the domestic terminal. The planned reclaimed land will be used temporarily for the construction yard of the concrete blocks and the other construction materials.

36. The construction schedule is shown in Fig. 1-5-1.

	Facilities	Unit	Q'ty
A-1	Unit Cargo Terminal		
1	Wharf (-12)	m	370
2	Dredging (-12)	m^3	437,854
3	Revetment (-5.0)	m	400
4	Reclamation	m^3	255,638
5	Container/Reefer Yard	m^2	44,252
6	Road/Open Space	m^2	67,273
A-2	Domestic Cargo Terminal		
7	Wharf (-4.5)	m	200
8	Dredging (-4.5)	m	15,300
9	Training Wall	m	330
10	Revetment (-2.0)	m	50
11	Reclamation	m^3	79,349
12	Yard	m^2	13,160
13	Road/Open Space	m^2	8,925
A-3	By-Pass Road (L = 1,380m)		
14	Revetment (-2.0)	m	1,380
15	Reclamation	m^3	71,291
16	Road/Open Spare	m^2	15,180
B	Building		
17	C.F.S.	m^2	5,000
18	Office/Maintenance Shop	m^2	3,000
C	Utilities		
D	Cargo Handling Equip.		
19	Gantry Crane	Nos.	1
20	Remove of Gantry Crane	Nos.	1
21	Straddle Carrier	Nos.	5
22	Tractor Head	Nos.	10
23	Chassis	Nos.	20
24	Forklift (7.5T)	Nos.	2
25	Forklift (4.0t)	Nos.	4
H	Engineering Service		

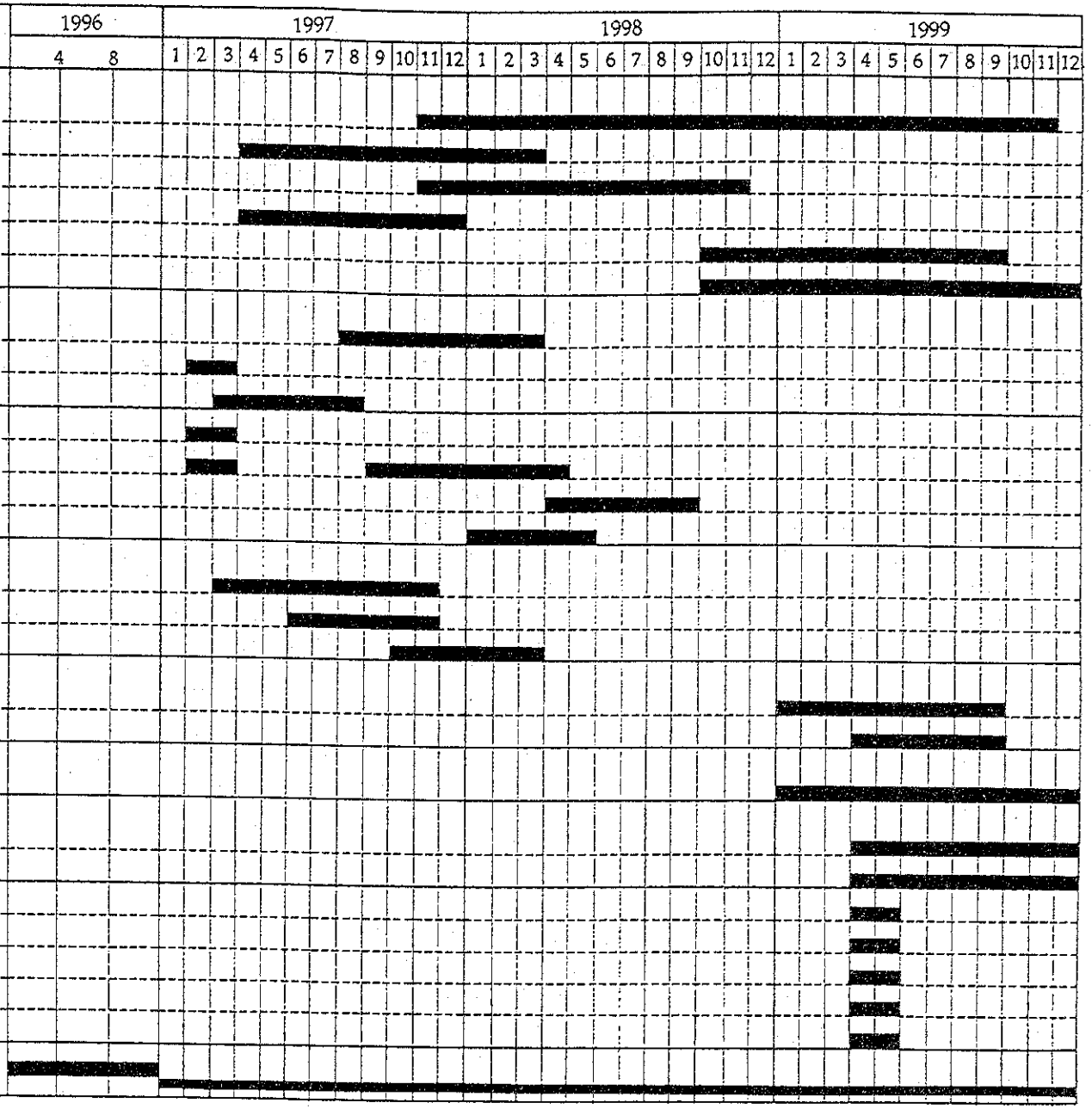


Fig 1-5-1 Constrution Schedule

1.6 Cost Estimate

1.6.1 Conditions of the Cost Estimate

37. The cost estimate is based on the following conditions.

1) The cost of the construction materials, equipment and labor force is based on the market prices as of July 1993.

2) The exchange rate is:

1 US$ = 5.85 Lps.
1 US$ = 115 Yen

3) Foreign currency portion.

The cost estimate consists of a foreign currency portion (direct and indirect) and a local currency portion. The costs of the foreign currency portion comprise:

- Costs of foreign laborers.
- Imported materials such as oil and steel products.
- Indirect foreign exchange components included in the materials/equipment which are locally procurable such as cement and tractors.
- Rubber fenders, bits, crane-rails, and their attachments.
- Cargo handling machines such as gantry cranes, straddle carriers, tractor heads, chassis, a bridge-type crane, and forklifts.
- Consultation and technical cooperation fee.

4) Unit cost of labors, materials, and rental charge of main construction machinery are the same price as that shown in Table 1-9-1 ~ 1-9-3 in section 1.9, Chapter 1, Part III.

5) Taxes/duties on the imported equipment are excluded from the cost estimate.

6) The ratios of the utilities, engineering fee, and physical contingency are the same as that of the Master Plan in paragraph 108 of Part III.

1.6.2 Construction Cost of the Short-Term Plan

38. The construction cost of the short-term plan is estimated at around 290,000 thousands Lps. The cost comprises:

	(Unit 1000 Lps.)
Civil Works	157,971
Utilities	7,060
Buildings	15,400
Cargo Handling Equipment	84,206
Engineering Fee/Physical Corti	23,852
Total	288,489

39. The project components of the Short-Term Plan and their costs are tabulated in Table 1-6-1, and the yearly investments based on the construction schedule (Fig. 1-5-1) are shown in Table 1-6-2.

Table 1-6-1 Construction Cost for the Short-Term Plan

(Unit:Thousand Lempiras)

		Facilities	Unit	Q'ty	Unit Cost	Foreign Portion	Local Portion	Total
A	A-1	Unit Cargo Terminal						
	1	Wharf (-12)	m	370	288.8400	43,282.7	63,588.1	106,870.8
	2	Dredging (-12)	m3	437,854	0.0064	504.7	2,297.6	2,802.3
	3	Revetment (-5.0)	m	400	16.2000	894.2	5,585.8	6,480.0
	4	Reclamation	m3	255,638	0.0063	289.9	1,320.6	1,610.5
	5	Container/Reefer Yard	m2	44,252	0.1499	1,485.8	5,147.6	6,633.4
	6	Road/Open Space	m2	67,273	0.1499	2,258.8	7,825.5	10,084.2
		Sub-Total				48,716.1	85,765.1	134,481.2
	A-2	Domestic Cargo Terminal						
	7	Wharf (-4.5)	m	200	48.8700	1,642.0	8,132.0	9,774.0
	8	Dredging (-4.5)	m	15,300	0.0063	17.4	79.0	96.4
	9	Training Wall	m	330	6.5800	304.0	1,867.4	2,171.4
	10	Revetment (-2.0)	m	50	6.9200	47.4	298.6	346.0
	11	Reclamation	m3	79,349	0.0063	90.0	409.9	499.9
	12	Yard	m2	13,160	0.1073	307.3	1,104.8	1,412.1
	13	Road/Open Space	m2	8,925	0.1073	208.4	749.3	957.7
		Sub-Total				2,616.5	12,640.9	15,257.4
	A-3	By-Pass Road (L=1,380m)						
	14	Revetment (-2.0)	m	1,380	4.4600	861.7	5,293.1	6,154.8
	15	Reclamation	m3	71,291	0.0063	80.8	368.3	449.1
	16	Road/Open Space	m2	15,180	0.1073	354.5	1,274.3	1,628.8
		Sub-Total				1,297.0	6,935.7	8,232.7
		Total of Civil Works				52,629.6	105,341.8	157,971.3
B		Building						
	17	C.F.S.	m2	5,000	2.0000	2,400.0	7,600.0	10,000.0
	18	Office/Maintenance Shop	m2	3,000	1.8000	1,296.0	4,104.0	5,400.0
		Sub-Total				3,696.0	11,704.0	15,400.0
C		Utilities				2,352.2	4,708.6	7,060.8
D		Cargo Handling Equip.						
	19	Gantry Crane	Nos.	1	45,000.0	45,000.0	0.0	45,000.0
	20	Remove of Gantry Crane	Nos.	1	4,500.0	4,500.0	0.0	4,500.0
	21	Staddle Carrier	Nos.	5	4,700.0	23,500.0	0.0	23,500.0
	22	Tractor Head	Nos.	10	714.0	7,140.0	0.0	7,140.0
	23	Chassis	Nos.	20	103.0	2,060.0	0.0	2,060.0
	24	Folklift(7.5T)	Nos.	2	459.0	918.0	0.0	918.0
	25	Folklift(4.0t)	Nos.	4	272.0	1,088.0	0.0	1,088.0
		Sub-Total				84,206.0	0.0	84,206.0
E		Total Costs (A--D)				142,883.7	121,754.4	264,638.1
F		Engineering Service				11,547.8	0.0	11,547.8
G		Physical Contingency				4,210.0	8,093.5	12,303.5
H		Grand Total				158,641.5	129,847.9	288,489.4

Table 1-6-2 Yearly Investments for Short-Term Plan

(Unit:Thousand Lempiras)

		Facilities	Grand Total			1996			1997			1998			1999		
			Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total
A	A-1	Unit Cargo Terminal															
	1	Wharf (-12)	43.282.7	63.588.1	106.870.8	0.0	0.0	0.0	3.967.0	5.829.0	9.796.0	19.838.0	29.144.0	48.982.0	19.477.0	28.615.0	48.092.0
	2	Dredging (-12)	504.7	2.297.6	2.802.3	0.0	0.0	0.0	449.0	2.042.0	2.491.0	56.0	256.0	312.0	0.0	0.0	0.0
	3	Revetment (-5.0)	894.2	5.585.8	6.480.0	0.0	0.0	0.0	75.0	465.0	540.0	820.0	5.120.0	5.940.0	0.0	0.0	0.0
	4	Reclamation	289.9	1.320.6	1.610.5	0.0	0.0	0.0	290.0	1.321.0	1.611.0	0.0	0.0	0.0	0.0	0.0	0.0
	5	Container/Reefer Yard	1.485.8	5.147.6	6.633.4	0.0	0.0	0.0	0.0	0.0	0.0	374.0	1.286.0	1.660.0	1.112.0	3.861.0	4.973.0
	6	Road/Open Space	2.258.8	7.825.5	10.084.3	0.0	0.0	0.0	0.0	0.0	0.0	452.0	1.565.0	2.017.0	1.807.0	6.260.0	8.067.0
		Sub-Total	48.716.1	85.765.2	134.481.3	0.0	0.0	0.0	4.781.0	9.657.0	14.438.0	21.540.0	37.371.0	58.911.0	22.396.0	38.736.0	61.132.0
	A-2	Domestic Cargo Terminal															
	7	Wharf (-4.5)	1.642.0	8.132.0	9.774.0	0.0	0.0	0.0	1.100.0	5.441.0	6.541.0	542.0	2.691.0	3.233.0	0.0	0.0	0.0
	8	Dredging (-4.5)	17.4	79.0	96.4	0.0	0.0	0.0	17.0	79.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0
	9	Training Wall	304.0	1.867.4	2.171.4	0.0	0.0	0.0	304.0	1.867.0	2.171.0	0.0	0.0	0.0	0.0	0.0	0.0
	10	Revetment (-2.0)	47.4	298.6	346.0	0.0	0.0	0.0	47.0	299.0	346.0	0.0	0.0	0.0	0.0	0.0	0.0
	11	Reclamation	90.0	409.9	499.9	0.0	0.0	0.0	45.0	205.0	250.0	45.0	205.0	250.0	0.0	0.0	0.0
	12	Yard	307.3	1.104.8	1.412.1	0.0	0.0	0.0	0.0	0.0	0.0	307.0	1.105.0	1.412.0	0.0	0.0	0.0
	13	Road/Open Space	208.4	749.3	957.7	0.0	0.0	0.0	0.0	0.0	0.0	208.0	750.0	958.0	0.0	0.0	0.0
		Sub-Total	2.616.5	12.641.0	15.257.5	0.0	0.0	0.0	1.513.0	7.891.0	9.404.0	1.102.0	4.751.0	5.853.0	0.0	0.0	0.0
	A-3	By-Pass Road (L=1.380m)															
	14	Revetment (-2.0)	861.7	5.293.1	6.154.8	0.0	0.0	0.0	862.0	5.293.0	6.155.0	0.0	0.0	0.0	0.0	0.0	0.0
	15	Reclamation	80.8	368.3	449.1	0.0	0.0	0.0	81.0	368.0	449.0	0.0	0.0	0.0	0.0	0.0	0.0
	16	Road/Open Space	354.5	1.274.3	1.628.8	0.0	0.0	0.0	178.0	637.0	815.0	177.0	637.0	814.0	0.0	0.0	0.0
		Sub-Total	1.297.0	6.935.7	8.232.7	0.0	0.0	0.0	1.121.0	6.298.0	7.419.0	177.0	637.0	814.0	0.0	0.0	0.0
		Total of Civil Works	52.629.6	105.341.9	157.971.5	0.0	0.0	0.0	7.415.0	23.846.0	31.261.0	22.819.0	42.759.0	65.578.0	22.396.0	38.736.0	61.132.0
B		Building															0.0
	17	C.F.S.	2.400.0	7.600.0	10.000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.400.0	7.600.0	10.000.0
	18	Office/Maintenance Shop	1.296.0	4.104.0	5.400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.296.0	4.104.0	5.400.0
		Sub-Total	3.696.0	11.704.0	15.400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.696.0	11.704.0	15.400.0
C		Utilities	2.352.2	4.708.6	7.060.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.352.0	4.709.0	7.061.0
D		Cargo Handling Equip.															
	19	Gantry Crane	45.000.0	0.0	45.000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.000.0	0.0	45.000.0
	20	Remove of Gantry Crane	4.500.0	0.0	4.500.0			0.0			0.0	0.0	0.0	0.0	4.500.0	0.0	4.500.0
	21	Staddle Carrier	23.500.0	0.0	23.500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.500.0	0.0	23.500.0
	22	Tractor Head	7.140.0	0.0	7.140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.140.0	0.0	7.140.0
	23	Chassis	2.060.0	0.0	2.060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.060.0	0.0	2.060.0
	24	Folklift(7.5T)	918.0	0.0	918.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	918.0	0.0	918.0
	25	Folklift(4.0t)	1.088.0	0.0	1.088.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.088.0	0.0	1.088.0
		Sub-Total	84.206.0	0.0	84.206.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.206.0	0.0	84.206.0
E		Total Costs (A--D)	142.883.7	121.754.5	264.638.3	0.0	0.0	0.0	7.415.0	23.846.0	31.261.0	22.819.0	42.759.0	65.578.0	112.650.0	55.149.0	167.799.0
F		Engineering Service	11.547.8	0.0	11.547.8	5.547.0	0.0	5.547.0	2.400.0	0.0	2.400.0	1.800.0	0.0	1.800.0	1.800.0	0.0	1.800.0
G		Physical Contingency	4.210.0	8.093.5	12.303.5	0.0	0.0	0.0	1.400.0	2.600.0	4.000.0	1.400.0	2.600.0	4.000.0	1.410.0	2.894.0	4.304.0
H		Grand Total	158.641.5	129.848.0	288.489.6	5.547.0	0.0	5.547.0	11.215.0	26.446.0	37.661.0	26.019.0	45.359.0	71.378.0	115.860.0	58.043.0	173.903.0

Chapter 2 Port Management and Operation

2.1 Management and Operation of the Projected Terminal

(1) Concept of the Projected Terminals' Management

40. The purpose of the new container terminal is to separate unit cargoes and other cargoes to raise cargo handling efficiency at respective terminals. To this end, it is effective to promote specialization of wharves through controling by one operator of cargo from ship to consignee including cargo handling and storage. After completing the new container terminal, all unit cargoes including those of banana companies will be handled at the terminal. By this utilization, No. 5 berth, in which both unit and general cargoes are handled at present, can be used for general cargoes except containers thereby eliminating confusion. Stuffing/unstuffing of containers in No.3 and No.4 warehouses, located far from No.5 berth causes traffic congestion. New CFS will reduce this congestion despite of the increase of general cargo.

41. To use the terminal for container exclusively and leave tha operation to a body which specifically handles and stores cargoes may contribute to greater efficiency. Cargo handling and cargo storage of both containers and general cargoes are nevertheless operated by same divisions in ENP and both divisions are in charge of operations in the entire port area.

42. Basically, cargoes of same packing type should be handled at the same quay by the same workers using the same equipment and be stored at the same yards or shed behind the quay. This will produce efficient and reliable cargo handling, storage and delivery. In this sense, wharves should be as specialized as possible in accordance with the delivery of cargo. Also, cargo handling and storage operations should be performed by the same divisions which are established by each wharf. Then the port of Cortes will win the confidence of shipping companies, and this upgrades ENP's competitive ability against the neighboring ports. Moreover, establishing an organization specialized in container contributes to develop skilled labors and clarify the responsibility of the cargo administration.

43. To create efficient and profitable management, the terminal operator should give priority to establish a balanced and fair relationship with shippers and consignees. In this context, new terminal operator should negotiate handling terms with banana exporters who have a strong position.

(2) Organization

44. Assuming that new container terminals are run by the private sector, ENP will retain general management sector, port police and gate watch, leaving cargo handling sector to the terminal operator. Details of personnel deployment both in ENP and private sector should be altered according to the outcome of lease negotiation and further study.

45. Personnel needed in the new container terminal by a preliminary calculation will be as follows.

24 in Management
72 in Operation
12 of Gate, Port police
40 of Warehouse, Operator of Forklift
20 for Maintenance
Total 168

46. There will be an increase in personnel of about 100 employees. However, increase of personnel should be coped with through efficient deployment of personnel.

2.2 Pricing

47. This subject involves two phases; i) port authority's pricing to lessee(s)/terminal operator(s), and ii) terminal operator's pricing to clients.

48. Although the first phase of pricing has various types, they can be categorized into two. One is a flat rate and the other is a rate variable according to the operator's revenue, cargo throughput or other indicator. The type is determined by various factors, viz. installations provided by the port authority, lease term, the profitability of the port, economic risk and overall strategy of the port and trade. At this stage, it is premature to predict what type of pricing should be preferred, however, to attract as many clients as possible it might be necessary to provide some incentives or subsidies in the lease term.

49. With respect to the issue in the second phase, it is urgent to establish price structure for diminishing long staying cargo in storage space. Because shortage of space is caused not only by limited land but also by over staying of cargoes in the port. This causes ineffective operation, improper cargo administration and other problems in port operations. This problem can be considerably dissolved by construction of the new container terminal. However, taking account of the increase in future cargo volume,

revision of storage charge is necessary so as not to cause the same problem again. Storage charge is cheaper than charge of storage outside port. Some users store container in port area as long time storage. By taking into account normal storage charge around the port, an adequate storage charge should be established. Term of free storage is decided as a measure of collection of cargoes. It should, however, be examined whether long time storage will be an obstacle to the container flow or not and apply properly referring to condition of neighboring ports.

2.3 Private Participation

50. Within the maritime circle it is almost unanimously agreed that container terminals should be operated by the private sector for bettering services of clients, bettering public relations and thus realizing a competitive and prosperous terminal. Although there are many methods for private operation, lease or concession is recommended since many developing countries get in this way. Under this scheme ENP plays a role of landlord with powers to approve certain steps taken by the operator. It is advisable to hire a consultant knowledgeable for the lease contact matters to draft a standard form of contact at the early stage.

51. ENP has made up mind that investment and operation of these facilities will be carried out by certain private sector.

52. ENP expressed its view that while free zones at Tela and La Ceiba will be on sale, it maintain the Cortes free zone. The Cortes free zone is closely located to the area where container will in the masterplan be handled. Container transport is now the mainstream of maritime transport and in future this transport mode will require the area and the water front line for expansion. This fact suggest that ENP should retain the area for the free zone.

53. With praivate participation to the operation, it is important for ENP to keep and create unified manner of overall port management. For that, ENP should study and realize the adequate scheme for the folowing items by persuasion, ruling, contract clause and agreement;

- training of employees within and out of ENP utilizing the TRAINMAR assets,
- developing computer network connecting agencies pertaining to port management and operation keeping pace with port activity and world's progress in this respect,
- providing a rule that ENP may order private operators to use installations under their operation in case of emergency such as abnormal port congestion,
- forming a machinery with relevant private sector to keep up with users' request and work for active port sales.

Chapter 3 Economic Analysis

3.1 Purpose and Methodology of the Economic Analysis

54. The purpose of this chapter is to appraise the economic feasibility of the Short-term Plan for the port development from the viewpoint of the national economy. Besides the installations in the Short-term plan, ENP already has a plan to build one dry bulk terminal and one cold storage. Feasibility studies are not conducted for the construction of the dry bulk terminal and cold storage based on the fact that facilities will be constructed and operated with more private participation, while the other three assets are expected to be installed by ENP by the year 2000. Thus, this chapter focuses on whether the net benefit of this development project exceeds that which could be derived from other investment opportunities in Honduras.

55. Economic analysis will be carried out according to the following steps: Cost and benefit "with roject (identified as the short-term development plan)" and " without project" (in this chapter referred to as "with case" and "without case") are analysed and compared. All benefits and costs are expressed in market price taking the difference between the "With case" and "Without" case and converting it to economic price. Here, the economic internal rate of return (EIRR) based on cost-benefit analysis is used to evaluate the feasibility of this type of development project. The EIRR is a discount rate which makes the costs and the benefits of the project during the project life equal. The procedure used for this economic analysis is shown in Fig. 3-2-1.

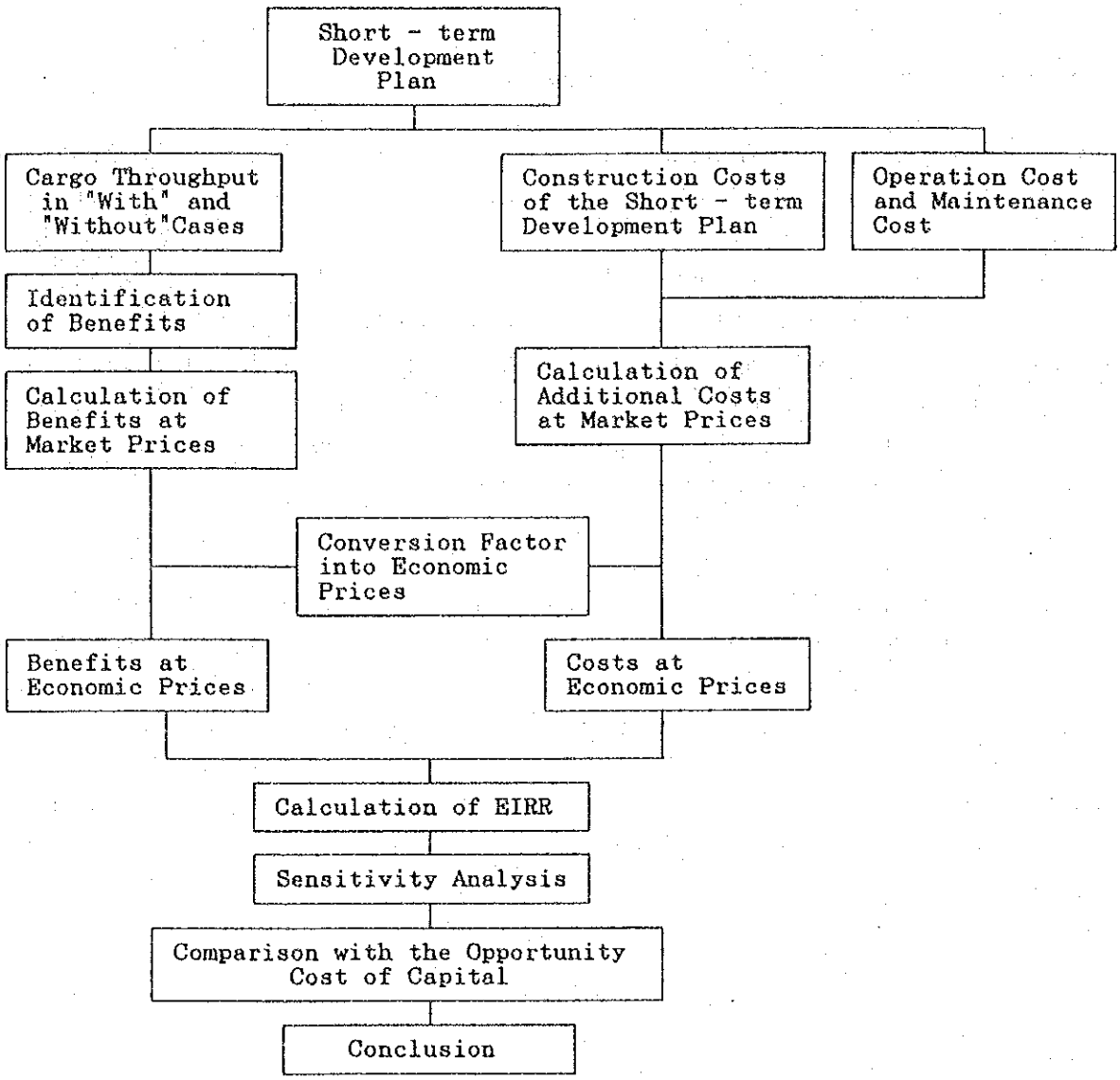


Fig.3-2-1 The Procedure of the Economic Analysis

3.2 "Without" case and "With" case

3.2.1 "Without" Case

56. The conditions of "Without" case are assumed as follows.

Table 3-3-2 Cargo Handling Conditions (without case)

	Unit Cargo	Conventional	Dry Bulk
Ave. Cargo / Vessel	1,850 - 2,000	1,500 (MT)	7,000 (MT)
Handling Efficiency	150 (MT/hour)	36 (MT/hour)	53 (MT/hour)
Ave. Berthing Time	12.3 (hours)	43.2 (hours)	132.2 (hours)

The maximum berth capacity for the calling vessels except liquid bulk cargo will be calculated as follows:

350day/year x 24 hours x 5 Berths = 42,000 hours / year

3.2.2 "With" case

57. The conditions of "With" case are assumed as follows.

Table 3-3-4 Cargo Handling Conditions (with case)

	Unit Cargo	Conventional	Dry Bulk
Ave. Cargo / Vessel	1,850 - 2,000	1,500 (MT)	7,000 (MT)
Handling Efficiency	220 (MT/hour)	40 (MT/hour)	57 (MT/hour)
Ave. Berthing Time	9.1 (hours)	37.5 (hours)	122.8 (hours)

The maximum berth capacity for the calling vessels except liquid bulk cargo and domestic cargo will be calculated as follows:

350day/year x 24 hours x 7 Berths = 58,800 hours / year

3.2.3 Number of Calling Vessels and Berth Time

58. Future cargo volume by packing type for the port of Cortes is estimated. Here total berthing time to handle the said cargo volume is calculated. Followings are the result.

No. of Calling Vessels and Berthing Time

	1992	2000	2010
Container Cargo	730	1,000	1,250
Conventional Cargo	264	300	400
Dry Bulk Cargo	40	100	143
Domestic Cargo	396	597	913
Required Berthing Time (Without)	28,858	43,134	58,891
Required Berthing Time (With) (Except Domestic Cargo)	28,858	36,104 (32,630)	49,413 (43,935)

3.2.4 Cargo Flow in the "Without" Case

59. As seen in the table above, the total required berthing time in 2000 will exceed the maximum berthing capacity of without case (paragraph 56 of this chapter). Here, the excess cargo volume after the year 2000 may be presumed to be handled at other ports. The following table summarizes the assumed cargo volume which is transferred to/from the other ports.

Flow to/from the Port of Cortes of Excess Cargo

(Unit: MT)

	Castilla	Santo Tomas	Tela	La Ceiba	Total
2000	0	0	6,000	15,000	21,000
2002	80,000	110,000	13,000	24,000	227,000
2004	168,000	231,000	21,000	35,000	455,000
2006	257,000	354,000	29,000	45,000	685,000
2008	346,000	476,000	37,000	58,000	917,000
2010	435,000	600,000	45,000	70,000	1,150,000

3.3 Prerequisites of the Economic Analysis

60. In order to estimate the costs and benefits under the "With" and "Without" cases, the following prerequisites are assumed for the analysis.

- Base Year : 1993 is set as the "Base Year" for this Study.
- Project Life : assumed to be thirty years from the beginning of construction including detail design stage.
- Foreign Exchange Rate : US$ 1.00 = 5.85 Lempiras.

3.4 Economic Prices

61. For the economic analysis, prices are expressed in economic prices based on the border price concept that eliminates transfer items, such as taxes, subsidies, etc. In general, all the costs and benefits are divided into three categories: labor, tradable goods and non-tradable goods. Labor is further classified into skilled labor and unskilled labor. For skilled labor, the economic price is determined by multiplying the market wage by the conversion factor for consumption, while that of unskilled labor is determined by multiplying the nominal wage by the shadow wage rate and the conversion factor for consumption.

62. The prices of tradable goods are expressed in CIF and FOB value for import goods and export goods respectively. These values show the actual border prices. However, since the border price of non-tradable goods cannot be converted directly, the border price of the consditnants of the non-tradable goods are approximate value.

63. The standard conversion factor(SCF) is used to determine the economic prices of certain goods which cannot be directly revalued at border prices. These goods include most non-tradable goods and services. 0.948 is adopted for the standard conversion factor.

64. The conversion factor for consumption Goods (CFC)is used to convert the market prices of consumption goods into border prices. 0.920 is adopted.

65. For the economic analysis, labor costs are usually measured in terms of their opportunity costs, and here, the conversion factor for skilled labor is assumed to be 0.920 and the conversion factor for unskilled labor 0.598

3.5 Costs of the Project

66. The project costs must be converted from market prices into economic prices for the economic analysis.

67. Construction costs are converted by multiplying the market costs using the above by the conversion factors. Based on the construction schedule, the annual construction costs at economic prices are given below.

(Unit : Thousand Lempiras)

Year	1996	1997	1998	1999	Total
Costs	5,547	35,089	67,516	168,771	276,923

68. For the economic analysis, costs for operations of the installation should also be accounted. These costs include many worksmaintenance, replacement and personnel. All those costs are measured at economic prices, as shown in Table 3-6-2.

3.6 Benefits of the Project

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

(1) Savings in ships' staying costs.
(2) Savings in interest of cargo costs.
(3) Savings in cargo handling labor costs.
(4) Savings in land transportation costs to/from other ports.
(5) Promotion of regional economic development.
(6) Increase in employment opportunities and incomes.
(7) Reduction of cargo damage and accidents at the port.

Within the above subjects, (1) - (4) are quantifiable in monetary ferms, which are caluculated below.

(1) Savings in Ships' Staying Costs

70. Benefits derived from savings of ships' staying costs due to the implementation of this project are calculated in ferms of the difference between "with case" and "without case". The result is given below.

Table 3-6-2 Total Costs in Economic Price

(Unit : Thousand Lempiras)

	Years	Costs								
		Container Terminal			By-Pass Road		Domestic Terminal			Total
		Investme	Mainte.	Operatio	Investme	Mainte.	Investme	Mainte.	Operation	
1	1996	5,547								5,547
2	1997	19,701			6,775		8,613			35,089
3	1998	61,348			764		5,404			67,516
4	1999	168,771								168,771
5	2000		2,932	5,887		78		145	0	9,042
6	2001		2,932	5,887		78		145	0	9,042
7	2002		2,932	5,887		78		145	0	9,042
8	2003		2,932	5,887		78		145	0	9,042
9	2004		2,932	5,887		78		145	0	9,042
10	2005		2,932	5,887		78		145	0	9,042
11	2006		2,932	5,887		78		145	0	9,042
12	2007	34,706	2,932	5,887		78		145	0	43,748
13	2008	45,000	2,932	5,887		78		145	0	54,042
14	2009		2,932	5,887		78		145	0	9,042
15	2010		2,932	5,887		78		145	0	9,042
16	2011		2,932	5,887		78		145	0	9,042
17	2012		2,932	5,887		78		145	0	9,042
18	2013		2,932	5,887		78		145	0	9,042
19	2014	45,000	2,932	5,887		78		145	0	54,042
20	2015	34,706	2,932	5,887		78		145	0	43,748
21	2016		2,932	5,887		78		145	0	9,042
22	2017		2,932	5,887		78		145	0	9,042
23	2018		2,932	5,887		78		145	0	9,042
24	2019		2,932	5,887		78		145	0	9,042
25	2020		2,932	5,887		78		145	0	9,042
26	2021		2,932	5,887		78		145	0	9,042
27	2022		2,932	5,887		78		145	0	9,042
28	2023	79,706	2,932	5,887		78		145	0	88,748
29	2024		2,932	5,887		78		145	0	9,042
30	2025	-77,030	2,932	5,887		78		145	0	-67,987
	Total	417,456	76,236	153,064	7,539	2,021	14,017	3,771	0	674,104

Source : Estimated by The Study Team

(Unit : Thousand Lempiras)

	2000	2005	2010
Accruing to Honduras	65,238	55,461	38,591

Source : Study team estimates

(2) Savings in Interest of Cargo Cost

71. Benefits derived from savings of interest of cargo costs due to the reduction of the ships' staying time are calculated on the basis of interest. The result is given below.

(Unit : Thousand Lempiras)

	2000	2005	2010
Accruing to Honduras	1,595	1,415	956

Source : Study team estimates

(3) Savings in Cargo Handling Labor Cost

72. In the "with case", cargo handling labor costs will be greatly reduced with improved efficiency and capacity. The savings are calculated using unit labor cost, as shown below.

(Unit : Thousand Lempiras)

	2000	2005	2010
Accruing to Honduras	919	1,067	1,214

Source : Study team estimates

(4) Savings in Transportation Costs to/from Other Ports

73. Under the "Without" case, extra costs are involved in carrying the overflown cargo to/from the other ports. In this report, extra costs are classified into sea transportation cost and land transportation cost, however, in this study, the additional sea cost is considered to be negligible. Additional land transportation costs by trucks and trailors to/from the other ports are calculated using the unit cost per ton, which are given below.

(Unit:Thousand Lempiras)

	Castilla	Santo Tomas	Tela	La Ceiba	Total
2000	0	0	210	675	885
2005	21,200	13,140	875	1,800	37,015
2010	43,500	27,000	1,575	3,150	75,225

Source : Study team estimates.

3.7 Evaluations

3.7.1 Calculation of the EIRR

74. The detailed calculation for the EIRR is shown in Table 3-8-1, and the resultant figure is: EIRR = 22.73%

3.7.2 Sensitivity Analyses

75. In order to determine whether the project is feasible under the certain changes in the assumptions for EIRR, sensitivity analyses are conducted for three alternatives.

(1) Case A : The forecast benefits decrease by 10 %
(2) Case B : The construction costs increase by 10 %
(3) Case C : The construction costs increase by 10 % and the benefits decrease by 10 %

The results of the sensitivity analyses are shown as follows.

Case	EIRR (%)
Base Case	22.73
Case A	21.04
Case B	21.25
Case C	19.08

3.7.3 Conclusive Remarks

76. From the above calculations, the EIRR of this project is in any cases alone 19%. There are various views concerning the appropriate EIRR level used to guide the judgment as to whether a project is feasible or not. The leading view is that the project is feasible if the EIRR exceeds the opportunity cost of capital(OCC). Taking into account that World Bank and Asian Development Bank estimated OCCs in developing countries to be a little more than 10%, this project is feasible from the viewpoint of the national economy.

77. It should be noted that in this calculation, only the quantifiable benefit are taken into account. However, as pointed out in paragraph 69 of this section, through the construction and operation activities of the projects, employment opportunity may be created and thus the income increases, and ultimately regional development will be triggered by attracting population and industry. This aspects is also a big advantage of the projects. One of the unquantifiable advantage is that accidents in terms of vessels and labors are reduced, and cargo damage may also diminished. With above consideration in mind, this project must be not only feasible but also desirable.

Table 3-8-1 Calculation of EIRR for Short Term Plan

EIRR = 22.731%

(Unit : Thousand Lempiras)

	Years	Costs									Benefits (Saving Cost)					Cash Flow Benefits - Costs	Cash Flow		
		Container Terminal			By-Pass Road		Domestic Terminal			Total	Save Ship Cost	Save Interest	Save Labor	Land Tranport	Total		Costs	Benefits	Differen
		Investme	Mainte.	Operatio	Investme	Mainte.	Investme	Mainte.	Operation										
1	1996	5,547								5,547						-5,547	4,520	0	-4,520
2	1997	19,701			6,775		8,613			35,089						-35,089	23,295	0	-23,295
3	1998	61,348			764		5,404			67,516						-67,516	36,521	0	-36,521
4	1999	168,771								168,771						-168,771	74,383	0	-74,383
5	2000		2,932	6,365		78		145		9,520	65,238	1,595	919	885	68,637	59,117	3,419	24,648	21,229
6	2001		2,932	6,365		78		145		9,520	64,054	1,584	949	6,830	73,417	63,897	2,785	21,481	18,696
7	2002		2,932	6,365		78		145		9,520	62,133	1,552	978	14,485	79,148	69,628	2,270	18,869	16,599
8	2003		2,932	6,365		78		145		9,520	60,072	1,513	1,008	21,995	84,588	75,068	1,849	16,431	14,582
9	2004		2,932	6,365		78		145		9,520	57,853	1,468	1,037	29,505	89,862	80,342	1,507	14,222	12,716
10	2005		2,932	6,365		78		145		9,520	55,461	1,415	1,067	37,015	94,957	85,437	1,228	12,245	11,018
11	2006		2,932	6,365		78		145		9,520	52,734	1,349	1,096	44,715	99,894	90,374	1,000	10,496	9,496
12	2007	34,706	2,932	6,365		78		145		44,226	49,806	1,275	1,126	52,270	104,476	60,250	3,786	8,944	5,158
13	2008	45,000	2,932	6,365		78		145		54,520	46,454	1,184	1,155	59,925	108,718	54,199	3,803	7,584	3,781
14	2009		2,932	6,365		78		145		64,040	42,768	1,080	1,185	67,480	112,512	48,473	3,640	6,395	2,755
15	2010		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	441	5,371	4,930
16	2011		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	359	4,376	4,017
17	2012		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	293	3,566	3,273
18	2013		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	238	2,905	2,667
19	2014	45,000	2,932	6,365		78		145		54,520	38,591	956	1,214	75,225	115,986	61,466	1,113	2,367	1,255
20	2015	34,706	2,932	6,365		78		145		44,226	38,591	956	1,214	75,225	115,986	71,760	735	1,929	1,193
21	2016		2,932	6,365		78		145		108,266	38,591	956	1,214	75,225	115,986	7,720	1,467	1,572	105
22	2017		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	105	1,280	1,175
23	2018		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	86	1,043	958
24	2019		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	70	850	780
25	2020		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	57	693	636
26	2021		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	46	564	518
27	2022		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	38	460	422
28	2023	79,706	2,932	6,365		78		145		89,226	38,591	956	1,214	75,225	115,986	26,760	288	375	86
29	2024		2,932	6,365		78		145		9,520	38,591	956	1,214	75,225	115,986	106,466	25	305	280
30	2025	-77,030	2,932	6,365		78		145		-67,510	38,591	956	1,214	75,225	115,986	183,496	-145	249	394
	Total	417,455	76,236	165,490	7,539	2,021	14,017	3,771	0	686,530	1,174,026	29,316	29,944		2,771,991		169,221	169,221	-0

Chapter 4 Financial Analysis

4.1 Purpose and Methodology of the Financial Analysis

78. While in the economic analysis of the project contained in short-term plan is appraised in terms of the national economy, the financial analysis focuses its attention on the project's financial aspects. These analysis are conducted to measure the viability of the project itself and the financial soundness of the possible undertaking organ in the project life. Major part of the facilities under this project will be operated by a private sector, accordingly, implementing body is divided in some way. In this study, it is assumed that an implemeting body undertakes all the work to avoid unnecessary complication. The resultant figure will not much differ.

79. 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 the discount rate that makes the costs and revenues the project life equal.

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

(1) Profitability : Rate of Return on Net Fixed Assets
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 investment.

(2) Loan Repayment Capacity : Debt Service Coverage Ratio
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.

(3) Operational Efficiency : Operating Ratio and Working Ratio
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 operations of port are efficient.

4.2 Prerequisites of the Financial Analysis

4.2.1 Project Life

81. Taking account of the conditions of the long-term loans and the service lives of the port facilities, the project life for the financial analysis is determined as 30 years from the beginning of the project including four years of detailed design and construction of the port facilities.

4.2.2 Revenue

82. The revenues from the port activities are calculated based on the present tariff system and future cargo handling volume. The following charges are the sources of revenue generated from the operation of the new terminal.

- Harbour Dues
- Berthage charge
- Wharfage charge
- Loading/Unloading
- Cargo handling charge

4.2.3 Initial Investment and Re-investment

83. The initial investment of the short-term plan is 288,489 thousand Lps.
The facilities and equipment will be renewed based on their service lives which are as follows:

depreciable assets excluding cargo handling equipment	: 40 years
CFS	: 30 years
gantry crane	: 15 years
cargo handling equipment excluding gantry crane	: 8 years

The fund for reinvestment will be financed by the internal resources of the management body.

4.2.4 Costs

84. The annual personnel expense is estimated based on the required number of workers and existing pay scales. Number of workers are mentioned in paragraph 45 of this PART and personnel expense including social benefit and travelling allowance is about 1.7 times as wage based on the past conditions.

85. Administration cost is 8 % of personnel costs based on the past conditions.

86. The annual maintenance and repair costs for the port facilities are calculated as follows:

Infrastructure, CFS	: 1 % of the construction cost
equipment	: 2 % of the procurement cost

4.2.5 Depreciation

87. The annual depreciation expenses of the port facilities and equipment are calculated by the straight line method, based on their service lives. Residual values after all depreciations are estimated as zero. At the end of the project life, fixed assets are assumed to be sold at their residual values.

4.2.6 Fund Raising Plan

88. Case 1 : 85 % of the project costs is assumed to be raised by soft foreign fund and conditions are assumed as follows:

Soft Loan

Loan period	: 30 years
Grace period	: 10 years
Interest rate	: 3 %
Repayment	: Fixed amount repayment of principal

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

The rest of the project costs is assumed to be raised by internal resources of the implementation body.

89. Case 2 : All project costs are assumed to be raised by foreign fund which is usually used in ENP's projects.

Loan period	: 20 years
Grace period	: 5 years
Interest rate	: 8 %
Repayment	: Fixed amount repayment of principal

(Note) These conditions are referred from those of present situations.