1.8 Implementation Plan

1.8.1 Conditions for Construction Works

203. Honduras is located in a tropical zone, but its weather conditions vary depeucling on the locations, Mainly there are two distinctive areas, the coastal area and the central mountainous area. The weather conditions, of the plains in the central mountainous area are comparatively mild but those in the coastal area are characterized by typical tropical weather with high temperatures and high humidity. The weather patterns are divided into the dry season, and rainy season, and usually there are about fourteen (14) rainy days per month during the rainy season. Although hurricanes cause strong rainfall of over 100 mm per day and affect construction works both on land and off shore, the average annual precipitation is only 1,000 mm with a monthly average of 120 mm during the rainy season. Therefore, it would not greatly affect the construction work.

Average monthly wind velocity is 4.2 knots and prevailing wind directions are E-NE. At the Port of Cortes, waves coming from the E-NE are protected by the adjoining horn, and construction works are not often interrupted by the wind-originated waves. Generally, the weather and marine conditions are favorable, so construction work can be performed continuously throughout the year. Large amounts of seabed materials at the planned site for dredging are fine sand and suitable for reclamation.

204. 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

205. In the case of "Offshore Works", non-working days are the days with over 1.0 m wave height estimated from the wave record. And in the case of "Works on Land", non-working days caused by the rough winds and rainfall are defined based on verbal information given by local contractors. (In this case, non-working days are approximately the days with over 10 m/sec wind velocity or 25 mm rainfall per day). The total number of workable days per year is around 340 days in both cases.

206. 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 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

207. 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) Consideration of the daily supply rate of each construction material and the speed of the construction works. In this project, the cutter suction dredger owned by ENP is planned to be used for the dredging and reclamation. The dimensions of the dredger are shown below. In this project, the dredging capacity is planned to be 200 m^3/hour considering the field conditions.

Cutter Suction Dredger

IHC Beaver 3300

Type	:	Cutter suction dredger	
Purchase year	:	1986	
Main engine	:	Diesel 750 PS	
Total weight	:	444 kg	
Length overall	:	48.80 m	
Length over pontoon	:	36.00 m	
Breadth	:	11.90 m	
Depth	:	2.85 m	
Draught	:	1.70 m	
Suction depth	:	-16 m (max)	
Diameter of discharge pipe	:	d=26 cm	
Nominal dredging capacity	:	400 m^3/hour	
Working conditions	:	Number of crew	12 persons
		Average working hours	10 hours/day

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

1.9 Cost Estimate

1.9.1 General

208. Construction costs are estimated carefully on the basis of the preliminary design, construction methods and work schedule of the project. The cost estimate is also based on the comprehensive study of the site conditions such as land use, workable conditions of construction machines, and procurement methods of materials which have to be transported to the site. 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, which are defined basically in accordance with the following categories:

   Foreign portion:
   - Imported construction equipment, materials, and goods.
   - Imported goods procured in the local market.
   - Salary allowance and indirect cost for the foreign staff.

   Local portion:
   - Construction equipment and machinery procured locally.
   - Construction materials and goods procured locally.
   - Salary allowance and indirect cost for the local staff.

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.

7) The cost of land acquisition is excluded from the cost estimate.

1.9.2 Conditions of the Cost Estimate

209. The situations of labor force, construction materials and construction equipment are important factors in the cost estimate. These conditions in Honduras are as follows:

1) Labor force for the construction works

Laborers required for the construction works are available any time in Honduras. The basic labor cost is shown in Table 1-9-1.

2) Construction materials

The main materials necessary for the project at the Port of Cortes are stones, cement, aggregates for concrete, sand for fill, etc. There are some rivers in the coastal area and stones produced from the river sites have been used for construction works so far. The Rio Chachaguala is one of the rivers near the Port of Cortes. But, the big stones adopted for the armored works have to be produced

at some quarries and transported to the port.

There are two cement factories in the North and South of Honduras. The two factories produce 40,000 tons/month of portland cement. One factory is located 30 km from Cortes and supplies cement in bags of 42.7 kg.

Ready mixed concrete is also obtainable from the concrete plant near the Port of Cortes.

As for the cement products, many kinds of regular size products such as piles, slabs, and beams are manufactured by order at the local factories. Prestressed concrete products are also available and they are used mainly in port construction, bridges and building foundations.

Steel products such as iron rods, angies, iron sheets, piles, and H-shaped sheet piles are imported.
The unit costs of main materials are shown in Table 1-9-2.

3) Construction equipment and machinery

As for the construction equipment and machinery, the standard type and size of construction machines have been used for construction works on the land and are mostly available in Honduras. But, the working vessels are limited to a few types, that is, suction dredger, pontoon, tug boat and surveyor boat. These vessels are owned by ENP. ENP has truck cranes mainly for cargo handling, and sometimes these cranes are used also for construction works. The rental charges of main construction machinery are shown in Table 1-9-3.
(The unit cost of other items are shown in Appendix.)

Table 1-9-1 Basic Labor Cost per Day

(Unit: Lps.)

Type of Occupation	Cost per Day		Total
	Direct Cost	Indirect Cost	
Skilled laborer	50.00	20%	60.00
Unskilled laborer	20.00		24.00
Worker for placing of reinforcement	40.00		48.00
Operator of special vehicle	50.00		60.00
Driver	45.00		54.00
Seaman: Officer	100.00		120.00
Seaman: Crew	50.00		60.00
Diver	250.00*		300.00
Assistant to Diver	35.00		42.00
Steel metal worker	45.00		54.00

* per hour

Sources: (1) Statistical Bulletin of the National Information Center of Construction Industry, (Centro Nacional de Información, de la Industria de la Construcción).
(2) Empresa Nacional Portuaria (ENP).

Table 1-9-2 Unit Cost of Materials

(Unit: Lps.)

Material		Unit	Cost	
			Foreign	Local
Fuel:	Regular gasoline	liter	2.20	
	Diesel oil	liter	1.89	
Aggregate:	Sand	m^3		70.00
	Gravel	m^3		65.00
	Cobble stone	m^3		52.00
	Rock (200 kg)	m^3		55.00
Cement & Products:				
	Ready-mixed concrete	m^3		670.00
	Prestressed concrete pile (0.45mx0.456m)	m		531.61
	Steel bar	ton	5,000.000	
Wood products:				
	Wooden pile, pine ø1.0', l=75.0'			1,400.00

Source: (1) Statistical Bulletin of the National Information Center of Construction Industry (Centro Nacional de Información de la Industria de la Construcción).
(2) Empresa Nacional Portuaria (ENP).
(3) Hearing from the local materials suppliers.

Table 1-9-3 Rental Charge of Main Construction Machinery

(Unit: Lps.)

Machines			Unit	Rental Charge	Owner
EARTH/ROCK MOVING			-	- -	-
Bulldozer:	9 ton		hour	250.00 ~ 270.00	Private
	21 ton		hour	500.00 ~ 620.00	company
Tractorshovel:	1.0m³		hour	190.00 ~ 200.00	-
Wheel type:	1.4m³		hour	220.00 -	-
	2.1m³		hour	230.00 -	-
Power Shovel:	0.4m³		hour	200.00 ~ 225.00	-
	0.6m¾		-	- -	-
TRANSPORTATION			-	- -	-
Dump truck:	2 ton		hour	55.00 ~ 80.00	-
	8 ton		hour	60.00 ~ 95.00	-
Tractor-trailer:	20 ton		hour	270.00 -	-
FURNISHING & PLACING			-	- -	-
Crawlercrane:	25 ton		hour	900.00 -	-
Truckcrane:	25 ton		hour	930.00 -	-
Mobilcrane:	25 ton		hour	140.00 -	ENP
WORKING VESSELS			-	- -	-
Suction dredger:	750 ps		hour	2,080.00 *	ENP
Tugboat:	210 ps	15 GT	hour	230.00 *	-

Note: The availability depends on the companies and the ENP which own machines.
* Estimated

1.9.3 Construction Cost of the Facilities under the Master Plan

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

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	Staddle Carrier	Nos.	7	7	7	5
	27	Tractor Head	Nos.	15	15	15	10
	28	Chassis	Nos.	30	30	30	20
	29	Folklift (7.5T)	Nos.	4	4	4	2
	30	Folklift (4.0t)	Nos.	8	8	8	4
	31	Bridge-type Crane	Nos.	-	-	-	-

211. The structural types of the project components proposed in the Master Plan are described in Section 1.7.

212. The construction cost of each alternative plan is approximately as below: (unit: 1000 Lps)

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)

Chapter 2 Port Management and Operation

2.1 Port Management and Operation System

213. Concerning port operation and administration, there is no one definitive system that has been adopted in ports all over the world. The structure of the port management body at each port is slightly different depending on historical, socio-economic and institutional factors. Port activities are conducted by a port management body or private company or both. In Honduras, as mentioned in table 4-2 in Chapter 4 of Part I, port activities are conducted by ENP and private companies. To simplify the organization and improve cargo handling, participation of private companies is very important. Recently, there has been a trend toward privatization in the world. In order to realize smooth and effective cargo handling in the terminal, the participation of the private sector should be considered in the near future. As numerous activities are performed in the terminal, it is quite reasonable to let the private sector participate in some activities step by step.

214. As participation of private companies, however, involves some problems such as retirement of personnel and keeping up service level, ENP will not be able to introduce it easily. An obstacle which must be surmounted when participation of private companies is sought, is the natural reluctance of labor unions to cooperate, especially when there is an evident redundancy of workers, and underemployment has been tacitly accepted by the port authority. Such opposition can be partly mitigated by a carefully planned strategy, which should include an aggressive public relations campaign, and proper compensation paid to those who choose, or agree, to leave and seek work elsewhere. There may be a high financial cost in obtaining worker cooperation, but this cost must be treated like any other investment in a more efficient port system. Privatization in Honduran ports is already mentioned in Chapter 4 of Part I.

2.2 Container Handling System

2.2.1 Container Terminal Operation

(1) Function of Container Terminal

215. 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.

216. Those two are the main functions and there is another functions as well;

consolidating and supporting function. Sometimes stowing function for empty containers and consolidating function are conducted at side of container terminal.

(2) Structure of Container Terminal Management System

217. Container terminal management system is composed of facilities, equipment, personal and information. These factors are combined under rule, method and procedure. Container terminal should be managed by one single organization, namely, terminal operator is the organization that conducts overall activities.

(3) The Basic Concept in Container Terminal Operation

218. 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.

219. 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 space of terminal facilities efficiently, and
3) To minimize and save investment, running costs for handling containers.

2.2.2 Container Flow

220. General flow of containers is as follows. (See Fig. 2-2-1 and 2-2-2.)

1) Import container
All import containers are discharged from ships and then transferred to the container stacking yard for stacking. FCL containers (door-to-door service containers) are basically delivered from the container stacking yard directly to consignees through the gate. Containers with consolidated cargoes (LCL cargoes) are moved to the designed shed (CFS). Cargoes are unstuffed from the container in the CFS, stored and then delivered. The empty containers are then stored at the stacking yard or transferred to shipping companies' empty container depots. If space is available in the container terminal, empty containers are stacked in stacking yard.

2) Export container
Prior to a ship's arrival, export FCL containers are received at the gate and stacked in the stacking yard. LCL cargoes are brought into the CFS by shippers, and then stuffed into the containers by the operator. All export(full

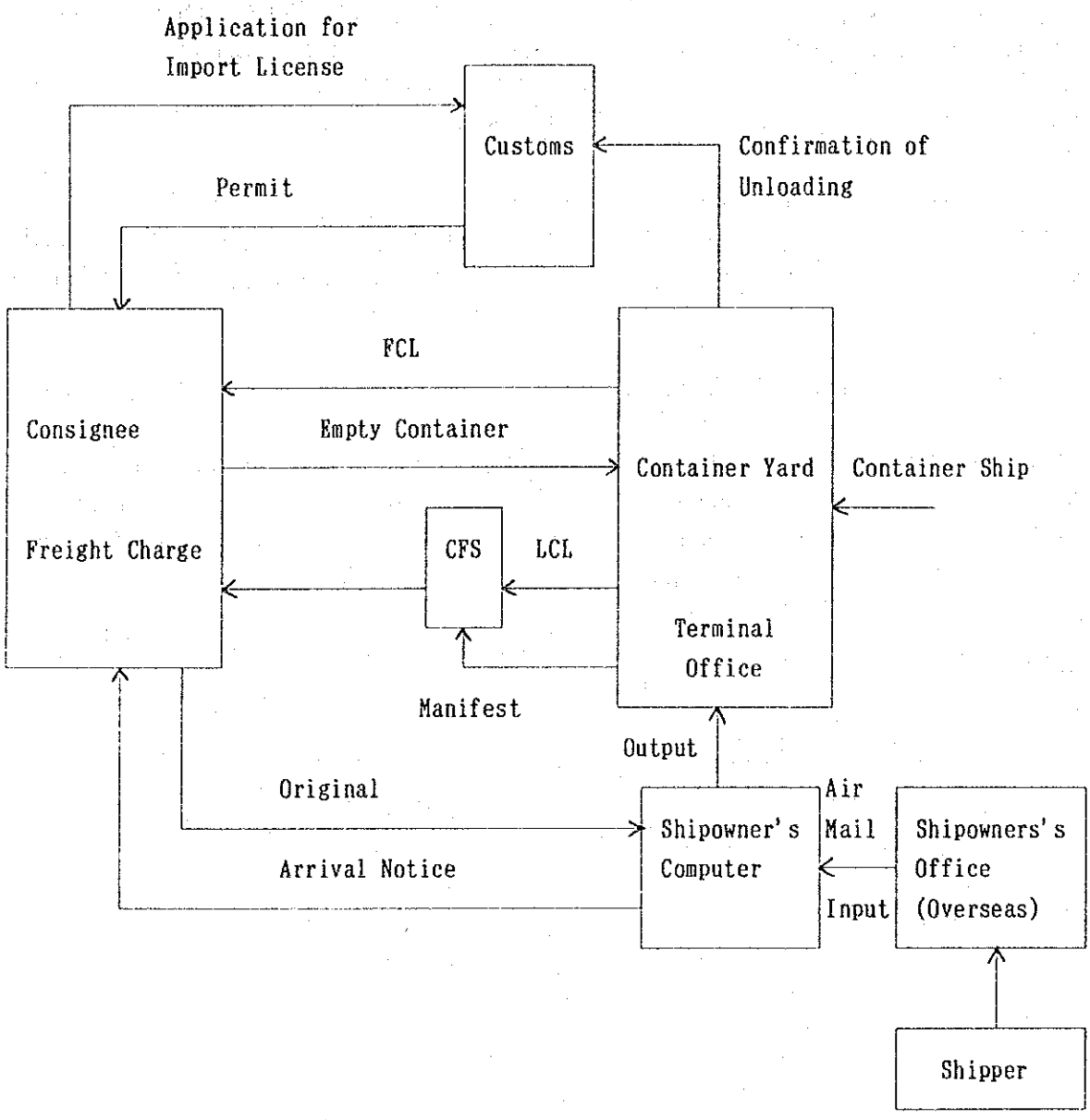


Fig. 2-2-1 Basic Flow of Container (Import Container)

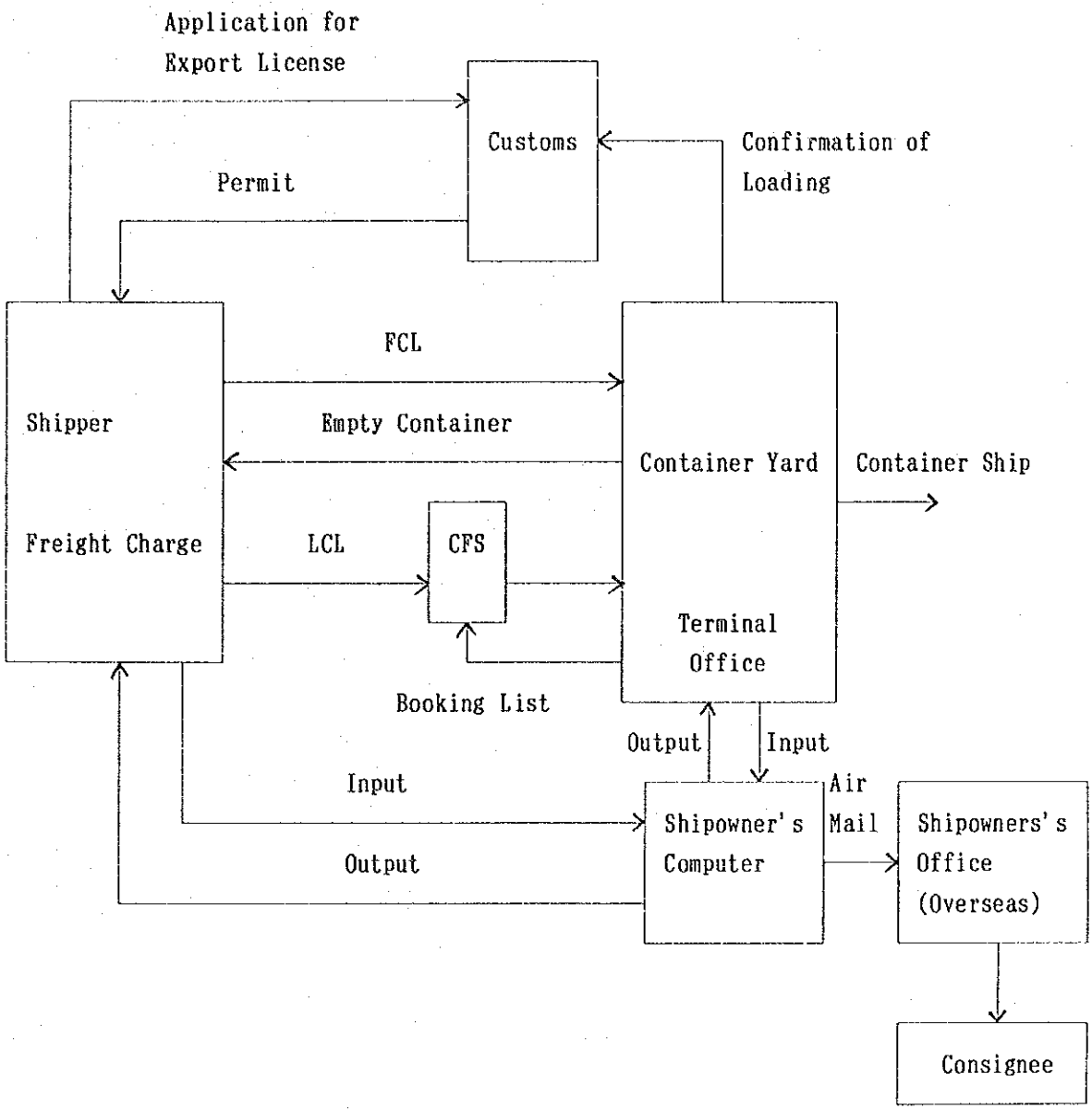


Fig. 2-2-2 Basic Flow of Container (Export Container)

and empty) containers are loaded onto a ship in accordance with the loading sequence plan.

221. In the port of Cortes, import and export containers are divided at stacking yard. However, due to limited container yard and no MY(marshaling yard) and CFS, containers are stuffed/unstuffed at the apron. As charge of stored container is low, many empty containers are stored in the yard. ENP makes a effort to remove these containers and utilize limited yard effectively for upgrading handling efficiency.

2.2.3 Container Handling System

222. The type of container handling system adopted in the terminal depends on conditions such as site situation, safety, the volume of containers handled and the amount of funds available to the terminal. There are four major handling systems. However, there are many terminals that combine two or more system to handle the containers efficiently and use the container yard fully and effectively.

223. The features of each system are as follows. (See Table 2-2-1.)

Table 2-2-1 Comparison of Handling Systems

System / Item	Chassis	Straddle Carrier	Transtainer
Storage Capacity	△	○	◎
Flexibility of Operation	◎	◎	△
Initial Cost	△	○	△
Safety of Operation	◎	△	○
Expandability	◎	◎	○
Operation Cost	◎	○	◎
Heavy Pavement	◎	△	○
Ratio of Damage of Container	◎	△	○
Ratio of Breakdown of equipment	◎	△	◎
Noise	○	△	◎
Safety of Yard	○	△	◎
Skill Labor	◎	○	○
Skill to maintain equipment	◎	○	△
Handling in Strong Wind	◎	△	○

Note : ◎ Excellent, ○ Good, △ Some problems

1) Chassis

This system has been developed by Sea-Land Service, Inc. In this system, containers are placed on chassises and lined up in the container yard. Tractors are linked to these containers directly for transportation. Other special cargo handling equipment is not required and containers are lined up with no relation to each other. In other words, it is a very flexible, safe and simple

system. This system, therefore, enables quick delivery at any time. The possibility of damage is lessened. There is no need for skilled personnel. However, this system requires a large container yard and many chassises. This system is advantageous for ports with many Ro-Ro ships calling.

2) Straddle carrier

This system mainly employs a cargo-handling device called a straddle carrier for marshalling containers. As the machine enables three or four layers stacking of containers, this system has the advantage of efficient utilization of the container yard. It is a very flexible and simple system and quick dispatch of containers is possible. However, it requires a thick durable pavement in the container yard. This system requires a high maintenance cost and skilled personnel. ENP has experience using this system.

3) Transtainer

This system makes use of a cargo-handling machine called a transtainer (transfer crane) for marshalling containers. The machine can stock container four or five layers in the yard. Thus, this system results in the most efficient use of the container yard. It requires the most heavy pavement, however, this pavement is limited to some fixed truck lanes for the transtainer. This system needs highly skilled maintenance personnel.

4) Forklift

In this system, a large forklift is used to handle containers. The investment in equipment is relatively small. This system is used in comparatively small container yards.

224. Actual container handling is conducted by a combination of these systems. In the port of Cortes, straddle carrier system is adopted. Taking account of effective container handling, safety in container yard and ratio of container damage, introduction of transtainer system might be considered. However, to change container handling system needs much investment as well as time for labor training. In the port of Cortes, therefore, it is 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

225. At present, a shift system has not been introduced in container handling. As mentioned in Chapter 1 of Part II, a shift system is recommended to improve cargo handling productivity and working conditions.

226. Concerning introduction of a shift system, following problems are considered.

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

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 a 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.

227. The solutions to these problems are considered as follows.

1) Increase of average wages

2) Change wage system to be based on handling volume rather than 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.

228. Measure 1) directly responds to the request of labors. It is, however, 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.

229. In Japan, all stevedoring is conducted by private companies. Under this situation in which competition is severe, they make efforts to conduct their activities as efficiently as possible. Privatization is one option in attempting to create a competitive climate. Wages based on working hours is undesirable from the view point of stability of wages.

230. 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 introduction of shift system and/or urge private companies to adopt such a system.

2.4 Introduction of Computer System for Container Terminal Operation

2.4.1 Necessity of Introduction of Computer System

231. The outline and effects of introduction of computer system to port activities are already mentioned in Chapter 3 of Part I. In this chapter, the outline and effects of introduction of computer system to container terminal operation are mentioned.
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. Concerning No.5 wharf, currently more than 100 thousand TEU are handled with narrow shaped container yard through complicated operation. Thus, computer for container terminal operation should be introduced as soon as possible.

2.4.2 Effects of Computer System

232. The effects of introducing 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

233. 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.

234. 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

At least one day before the arrival of the ship, containers will be carried into the yard by trucks and rail. They will undergo a damage check to see if there are holes and scratches in the ceiling and the sides. This check takes place at the gate of the terminal.

If the container number is input into the computer at the gate, data which have already been put into the computer are displayed. The staff at the gate can indicate the location of container to truck driver.

b) CFS Control

The data concerning LCL container are input into the computer before the arrival of the ship. When LCL containers are received, these data are output and containers are stuffed/unstuffed.

c) Yard Control

The terminal operator receives the information regarding the container vessel's schedule from the shipping company. The information concerning the container number, name of ship, weight, shipping company and last/next port are put into the computer. The information includes the number of container for loading/unloading. The yard planner decides the yard stacking position according to which places/ports they will be loaded/unloaded. The operator arranges the yard space for containers(yard plan).

Containers should be piled up to use the yard space efficiently.

At the control center, the operator confirms whether truck will carry the container to the correct position or not.

(2) Yard Operation System

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

235. 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 Present Conditions

236. High efficiency with punctuality is the prerequisite for cargo handling. The current container handling practice in the port of Cortes shows considerably high efficiency as already mentioned in para. 210, Chapter 2 of Volume II., and the effort made by ENP as well as private operators should be highly commended.

237. Present cargo handling equipment maintenance in ENP is as follows;

1) Trailer and Forklift
Concerning the trailer, two mechanics start to check the machine at 6 o'clock every morning. Mechanics check oil, water and condition of engine. Oil is changed periodically, and engine is washed out. Driver has to report condition of machine based on driver's report, as well, he must inform the maintenance division when a faulty part is found. Forklifts are maintained same as

trailers.

2) Gantry Crane
Gantry crane is checked for oil, water, fuel oil and condition of spreader every day. Periodical inspection is done for whole of machine when running time reaches a certain number of fixed hours.

3) Truck
Generally, truck crane is checked for oil, water fuel oil, condition of brakes, boom and hanging block one day prior to use. And oil, water and fuel oil are checked after working. Periodical inspection also is carried out same as gantry crane.

4) Straddle Carrier
Straddle Carriers are checked every day based on a very detailed daily report, while the entire machine is checked every 250 hours.

2.5.2 Improvement Plan

238. 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. ENP is conducting preventive maintenance for above mentioned. However, ENP has not 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
Study team already suggested training of operator in urgent improvement plan. This also is one of the very important points. The details are mentioned in the next section.

4) Introduction of Computerized Maintenance and Repair

Records related to maintenance and repair can neither be analyzed nor utilized sufficiently. Thus a computerized maintenance and repair system should be introduced for effective maintenance and repair.

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

2.6 Personnel Training

(1) Completion of Training System

240. At present, PROYECT TRAINMAR is responsible for training system. PROYECT TRAINMAR is an affiliate of the training center network(mentioned in 2.4 of Part I) and the basic programs for each six months are established in the network. PROYECT TRAINMAR arranges the programs taking into account problems of present port activities in Honduras. Once in six months, a meeting in which coordinator of United Nations and Central America participate is held. In the meeting, they report and discuss the problems in their ports, and training programs are determined according to the port activities. Therefore, it is possible to establish timely training programs corresponding to the needs of port activities.
Concerning training program, three courses are carried out by TRAINMAR, IMO(International Maritime Organization) and ILO(International Labor Organization). (mentioned in 2.4, Part I)
As video tape and over head projector are effectively used at the lecture, a considerably efficient training system has been established.

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

242. Trainees are selected by PROYECT TRAINMAR according to the theme. 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. PROYECT TRAINMAR should foster this thirst for knowledge on the part of enthusiastic staff members. Their enthusiasm and desire to learn makes the training programs more effective and the benefits more visible. The demand and request of theme should be taken into account and reflected in the theme. A system which rewards trainees who achieve good results, by promotion for example, might be introduced. That contributes to aggressive and independent participation.

243. The curriculum of the training courses should be tailored to the type of trainee. One theme may not be practical for all workers. For example, the goal of a training course for office workers would be to teach special knowledge and raise morale while that for operational workers would be to improve their working abilities. The training system should establish themes that correspond to the objectives. Present training system seems not to take these points into account, and office workers and operational workers have the same programs. There may be an understanding of the overall operation, however, the main purpose of training is to improve one's ability, and it would be better to group together 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.

244. As mentioned in paragraph 270, Chapter 4 of Part I, the container terminals to be built in future may be operated by private sector, and ENP will only play role of landlord. Even in that era, ENP should get actively involved in the training of workers because well-trained workers are the key element in keeping the port competitive vis-a-vis surrounding ports, and there still remain berths at which ENP will handle unit cargo. ENP should coordinate the training scheme, give lectures, provide facility and above all encourage the private companies to send their employees to the training scheme.

245. ENP should make the most of training programs in which trainee can observe and experience the latest port activities in advanced countries. For example, JICA (Japan International Cooperation Agency) has the following three training courses and receives trainees from all over the world.

1) Port and Harbor Engineering : To cultivate the human resources development of port engineers who are expected to play an important role in port development in developing countries. (about three months)
2) Port Administration and Management : To cultivate the human resources development of port administrators and managers who are expected to play an important role in port development in developing countries. (about two months)
3) Development of Container Terminal : To cultivate the human resources development of port engineers who are expected to play important role in container operation and planning in developing countries. (about two months)

(2) Improvement of Promotion System

246. The rank and wage of personnel is different according to the type of work. In the labor regulation (REGLAMENTO DE ESCALAFON), it is said that promotion is done based on age and experience objectively. However, actual promotion is sometimes based on one's connections. This will lead to ill feelings among the personnel and affects the morale in general. Establishment of an objective promotion system based on experience and acknowledge is one method to engender an eagerness for work. In central government office, an objective promotion system is executed to some extent. The

important point of a promotion system is that evaluations should be conducted objectively. In improving this system, following items should be taken into account for objective evaluation.

1) Evaluation items should be objective 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. For example, if a staff member proposes a method to improve management and gets remarkable results, that should be included in evaluation.

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 are sometimes known to transfer to private companies. The wage and promotion system should be restructured take into account both ability and experience.

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. Objective 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 asumption. It is foreseen that vessel size will not change drastically in the future and thus, the objective vessel sizes are forecasted as follows;

Objective 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. Cargo volume for each cargo packing type is forecasted in Chapter 2, Part 1. Unit cargo shows the biggest cargo increase to 1,850 thousand metric tons from 1,300 thousand while the volume of dry bulk will expand to twice that of 1992, to 700 thousand ton. General cargo will experience a drop in cargo volume to 450 thousand ton from 510 thousand.

4. Average cargo volume per ship is assumed as almost the same as that in 1992 for conventional and dry bulk. (This assumes the general cargo berth. When exclusive use dry bulk terminal is realized, average cargo volume per vessel for dry bulk cargo is assumed as 10,000 tons)

5. Efficiency refers for the volume of cargo handled per hour. The efficiency for unit cargo is improved to 220 tons per hour, 150% of that of 1992. The efficiency, at the moment, is hindered by several factors such as the areal limitation of the container yard, port road and long distance to container stacking yard. With the new unit cargo terminal, these problems will be solved, making it easy to achieve this improved efficiency in 2000. The efficiencies for other cargo items are assumed the same as at present.

6. Total berth time is calculated by multiplying the handling time (which includes non-handling time) by the total number of ship calls. Then equivalent berth number is calculated by dividing the total berth time by 8,400 hours (24 hours times 359 days. 15 days are assumed as non working days). After applying the optimum berth ocupancy ratio (50% for unit cargo berth and 65% for general berth including conventional as well as dry bulk cargoes), number of required berths is obtained.

7. From the table above, it is noted that there are two berths required in 2000 for unit cargo and five berths for general as well as dry bulk cargoes. To solve the present bottle-neck such as areal limitation of the port, the berth newly constructed should be a unit cargo berth, not a general cargo berth. Two newly constructed unit cargo berths will contribute to improve the port's efficiency and, together with by-pass road, to alleviate traffic congestion in the port.

8. For the shortage in general cargo as well as dry bulk cargoes, the conversion of No.5 wharf fills the gap. Therefore, with two new unit cargo terminals, the port can provide sufficient capacity for both the unit cargo group as well as general cargo group.

9. 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

10. 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 occpancy 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

11. 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.

12. 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

13. 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

14. 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

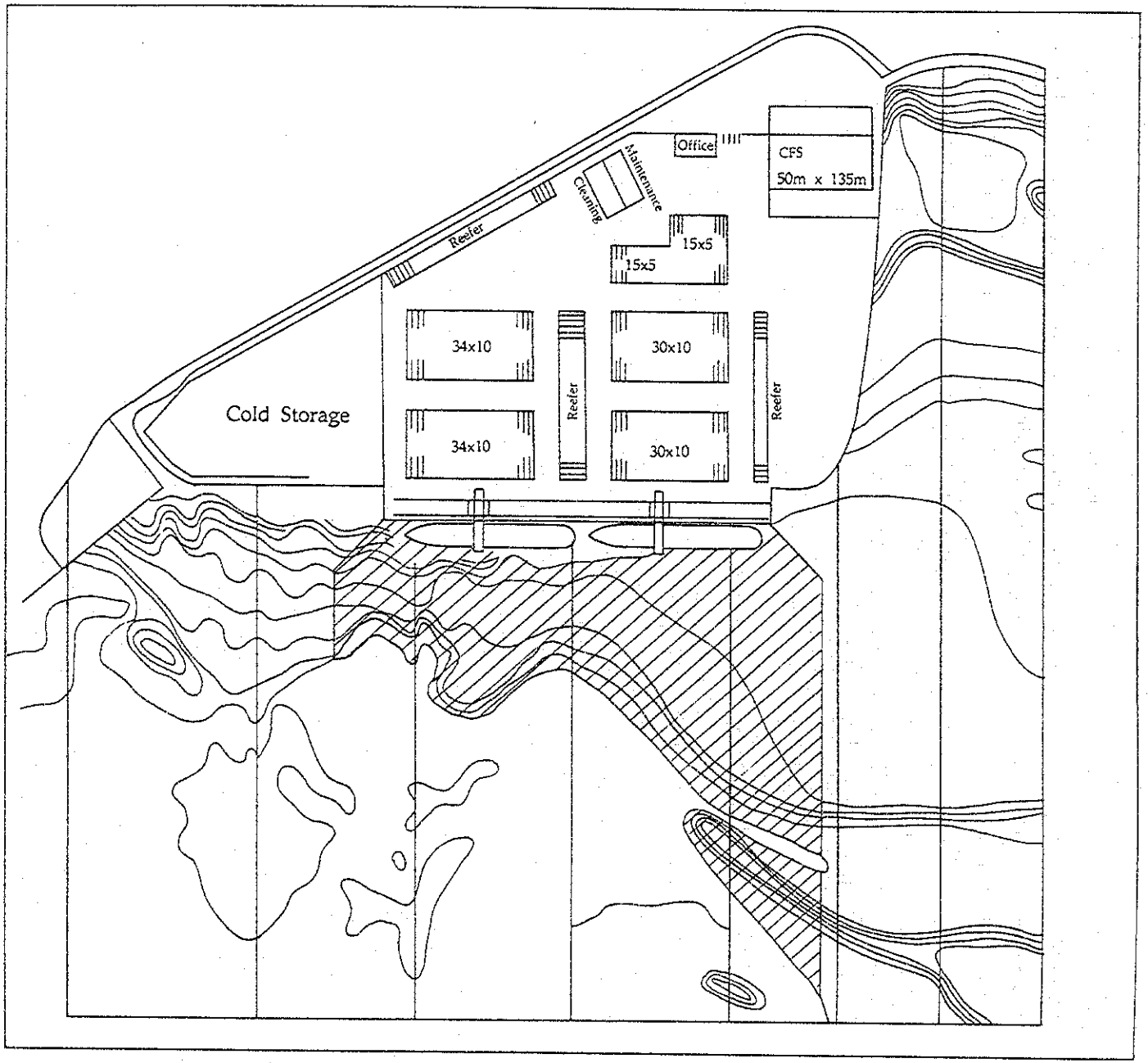


Fig. 1-2-1 Layout Plan of Unit Cargo Terminal for Short-term Plan

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

15. 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(ton)	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

16. 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, concrete block quay of total length 200m is constructed. Roads of 7m width provide access to the main road as well as the international wharves.

17. 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 improvment to port amenity.

18. By-pass road is planned to accommodate traffic to and from the container terminal. As already shown in 1.3.4, Part III, traffic volumes by packing type are calculated as follows (Number in each cell indicates the maximum volume of traffic and the number in parenthesis means cargo volume in the indicated years);

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)

19. Presently, access road to/from the port receives some 400 vehicles. In 2000, the number of vehecles increases to almost 600 and by 2010, the number of vehicles would be double that of 1992. 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.

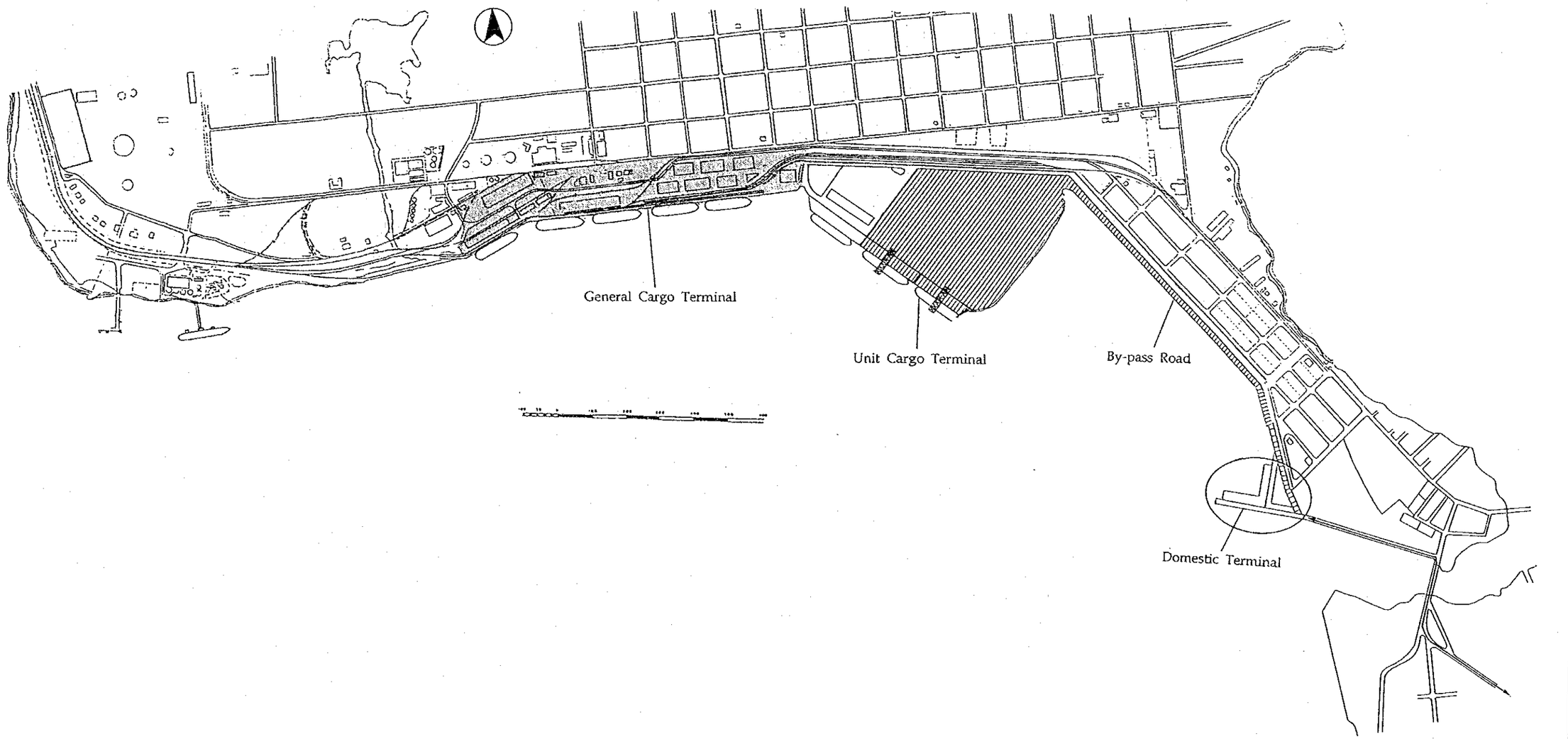


Fig. 1-3-1 Short-term plan (2000)

1.4 Rough Design of the Projected Port Facilities

1.4.1 General

20. In the Short-Term Plan for the Port of Cortes by 2000, the layout and dimensions of the port facilities are proposed in section 1,1, 1.2, and 1.3, Chapter 1, and the main facilities considered and designed includes 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, the procedure, conditions/criteria, and results of the design are described.

1.4.2 Procedure of the Design

21. The wharf design is carried out in stepwise manner as shown below.

Step-1: To determine the design conditions and criteria:
- Datum level
- Ship' size
- Crown height and water depth of the wharf
- Surcharge on the apron
- Soil conditions
- Seismic force
- Allowable stress of the materials
- Safety factor
- etc.

Step-2: To select several structural types of new wharf, comprising open deck on concrete or steel piles type, sheet pile type, etc.

Step-3: To set up the major dimensions and structural requirement for respective wharf type.

Step-4: To conduct the structural analysis and assumed structural dimensions satisfy the allowable stress/safety factor or not.

Step-5: To compare the merits and demerits of each type, and choose the best one.

22. Some items in Step-1 should be determined based on the usage of the wharf, and some others on the local conditions in Honduras. The selection of thee types of structures in Step-2 should be carried out considering various factors such as the natural conditions, construction period, availability of materials, and types normally used in Honduras. Concerning Step-3 and Step-4, the methodology of calculation in Honduras is almost the same as that in Japan, and so, it should be carried out based on the technical manual: "Technical Standards for Port and Harbor Facilities in Japan".

1.4.3 Design Conditions

1) Datum Level

23. 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

24. The maximum ship size is 15,000 GRT as described in Table 1-1-1 section 1.1, Chapter 1.

3) Crown Height/Water Depth of the Wharf

25. The crown height of the wharf should be determined by employing the following value as a height above H.W.L. (In the case of the tidal range of less than 3.0 m)

Ship Size	Crown Height above H.W.L.
Wharf for a Small Ship (with a water depth of less than 4.5m)	0.5m ~ 1.5m
Wharf for a Large Ship (with a water depth of 4.5m or more)	1.0m ~ 2.0m

26. 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.

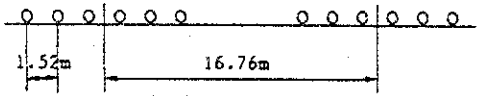
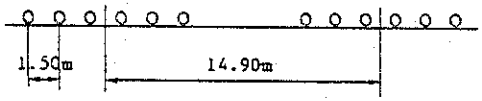
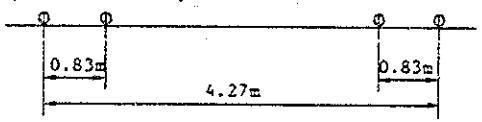
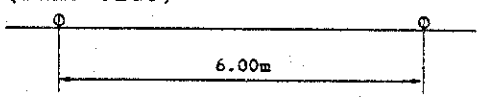
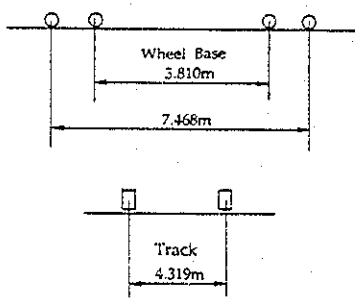
27. The water depth of the wharf should be not less than the full load draft of the vessels plus some allowance. In this case, the proper depth, that is the designed water depth, means the depth obtained by adding an allowance to The draft of the vessels. The designed water depth of the wharf is set at 12m below M.L.W.

4) Surcharge on the Apron

28. Wharf No. 5 was constructed in 1975, and ENP is constructing a pier eastwards to extend it eastward by 124 m. The live loads such as the cranes and the uniform loads on the apron are summarized in Table 1-4-1. 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 No. 5 as mentioned in the right column of this table.

29. In the case of an earthquake, the uniform live load is reduced to half of the ordinary loads mentioned above.

Table 1-4-1 Surcharge on the Apron

Items	Wharf No. 5	Extension of Wharf No. 5	Wharf No. 6
1) Uniform Load	600 psf (3 Ton/m^2)	1,200 Lbs/pie^2 (6 Ton/m^2)	3 Ton/m^2
2) Automobile	M20-516 (AASHO)	HS20-44 (AASHO)	The same as Extension of Wharf No. 5.
3) Container Crane	Rail Gauge: 18.29m  Wheel Load: (Water side and Land side) In service: 85K (38.3 Ton)	Rail Gauge: 18.29m  Wheel Load: In Service / Out of S. Water Side: 34 Ton / 28 Ton Land Side: 32 Ton / 35 Ton	The same as Extension of Wharf No. 5.
4) Others Note: psf = Lbs/$Feet^2$ = 5kg/m^2 K = 1,000 Lbs = 450 kg Lbs/pie^2 = psf	Gantry Crane (Rail Gauge 25.18m) (Water Side)  Wheel Load: In service : 40.5K (18.3 Ton) Out of service: 24.0K (10.8 Ton) (Land Side)  Wheel Load: In service : 14K (6.3 Ton) Out of service: -11K (-5.0 Ton)	(1) Straddle Carrier: FERRANTI DP-40 Maximum Load Under Spreader: 40TON  Wheel Load: 12.041 Ton/1wheel (Fully Loaded) (2) Folk Lift : CAT V925 (3) Mobile Crane: P&H6250-TC (DE300 Tons)	The same as Extension of Wharf No. 5. (No Gantry Crane)

5) Soil Conditions

30. 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. The laboratory tests indicates the soil characteristics as shown below.

Table 1-4-2 Index of Soil Characteristics

Depth (M.L.W)	N	Angle of Internal Friction	Unconfirmed Compression
11m ~ 15m	15	30°	-
15m ~ 33m	40	40°	-
Under 33m	15	-	0.35kg/cm^2

6) Seismic Force

31. The seismic force acting on a structure shall be calculated by the seismic coefficient method. For Wharf No. 5 and its extension, the seismic coefficient of 0.115 is adopted in accordance with the Uniform Building Code (UBC). (Refer to section 2.7.1, Part I, Volume II).

7) Allowable Stresses

32. The allowable stresses of steel and concrete are determined in accordance with the American Standard Testing Material (ASTM) in Honduras. On the other hand, the Japanese Industrial Standard (JIS) standardizes the allowable stress of the materials in Japan. 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/cm²)	1,400kg/cm² (SS41)
Steel sheet	None	1,800kg/cm² (SY30)
Steel pipe	None	1,400kg/cm² (SKK41)
Reinforcement bar	20,000 psi (1,400kg/cm²)	1,400kg/cm² (SR24)
2. CONCRETE		
Plain concrete	None	(compression) 55kg/cm²
Reinforced concrete	3,500 psi (245kg/cm²)	70 - 90kg/cm²
	4,000 psi (280kg/cm²)	70 - 90kg/cm²

Note: psi = Lbs/inch² = 0.07 kg/cm²

8) Safety Factor and Others

33. The safety factor of the structure design is empirically determined based on the investigations, tests, importance of the structure, and design formulas. In this design, 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
Gravity Type	Sliding	1.2	1.1
	Overturn	1.2	1.1
	Bearing	2.5	-
Pile Capacity	Compressive stress	2.5	1.5
	Pulling stress	3.5	2.5
Sheet Pile	Embedded length		
	(sandy soil)	1.5	1.2
	(cohesive soil)	1.2	1.2

1.4.4 Structural types to be designed/compared.

34. 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.

35. The merits and demerits of wharf structure are briefed below.

- Concrete caisson type:

(1) A large-scale fabricating facility and a caisson yard are required.
(2) The load per square meter on the existing sea bottom is increased due to the weight of the caisson, however, the sea bottom is in danger of subsidence.
(3) In Honduras, people have little experience in constructing caissons.

- The cellular cofferdam type as well as the concrete block type has almost the same demerits and therefore, the gravity types are excluded from the comparative analysis.

- Open deck on piles:

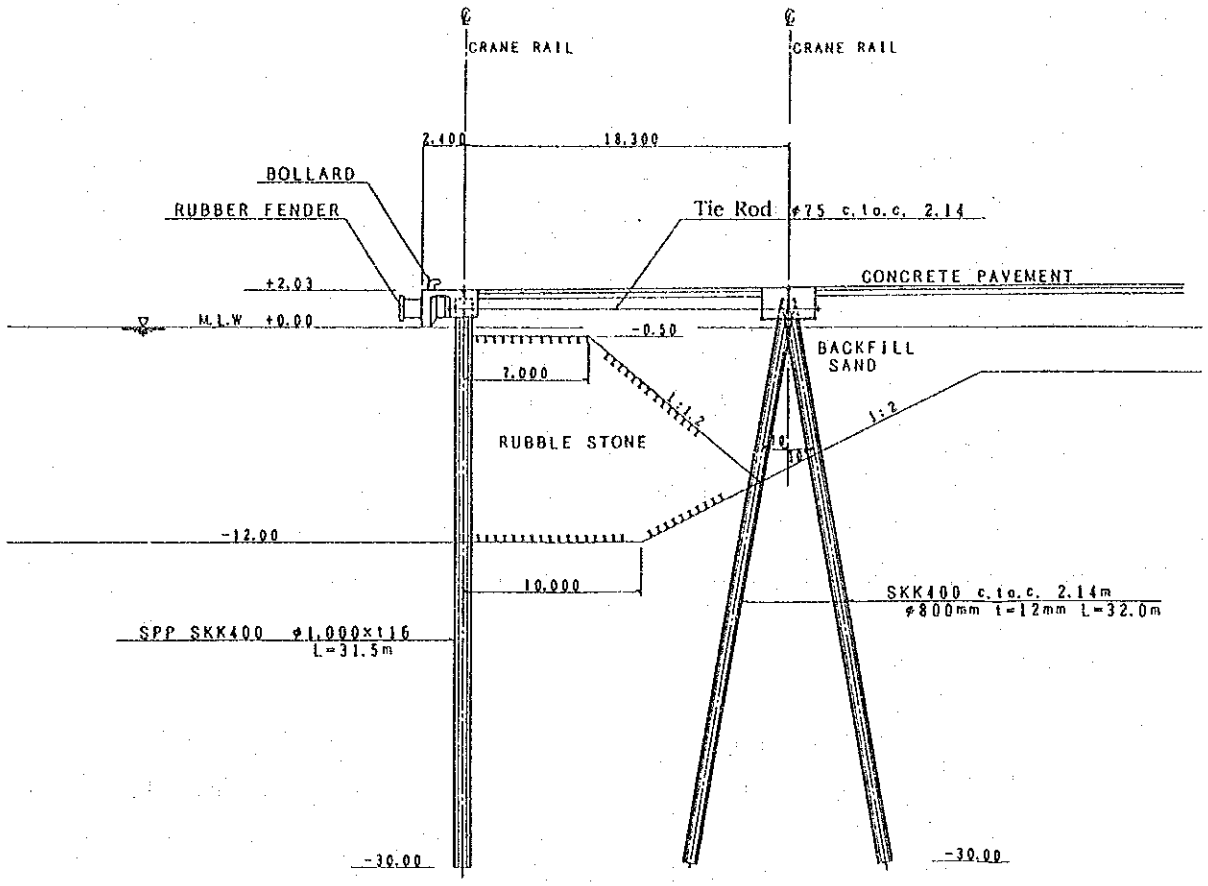
36. The type of open deck on square concrete piles is popular in Honduras, for example, the wharves in the Ports of Cortes, Castilla, and San Lorenzo were constructed using this type of structure. Neverthless, steel piles are often used instead of concrete piles in Japan.

Therefore, three structural types - the open deck on steel piles or on concrete piles, and the sheet pile type compared for the new wharf in this Study.

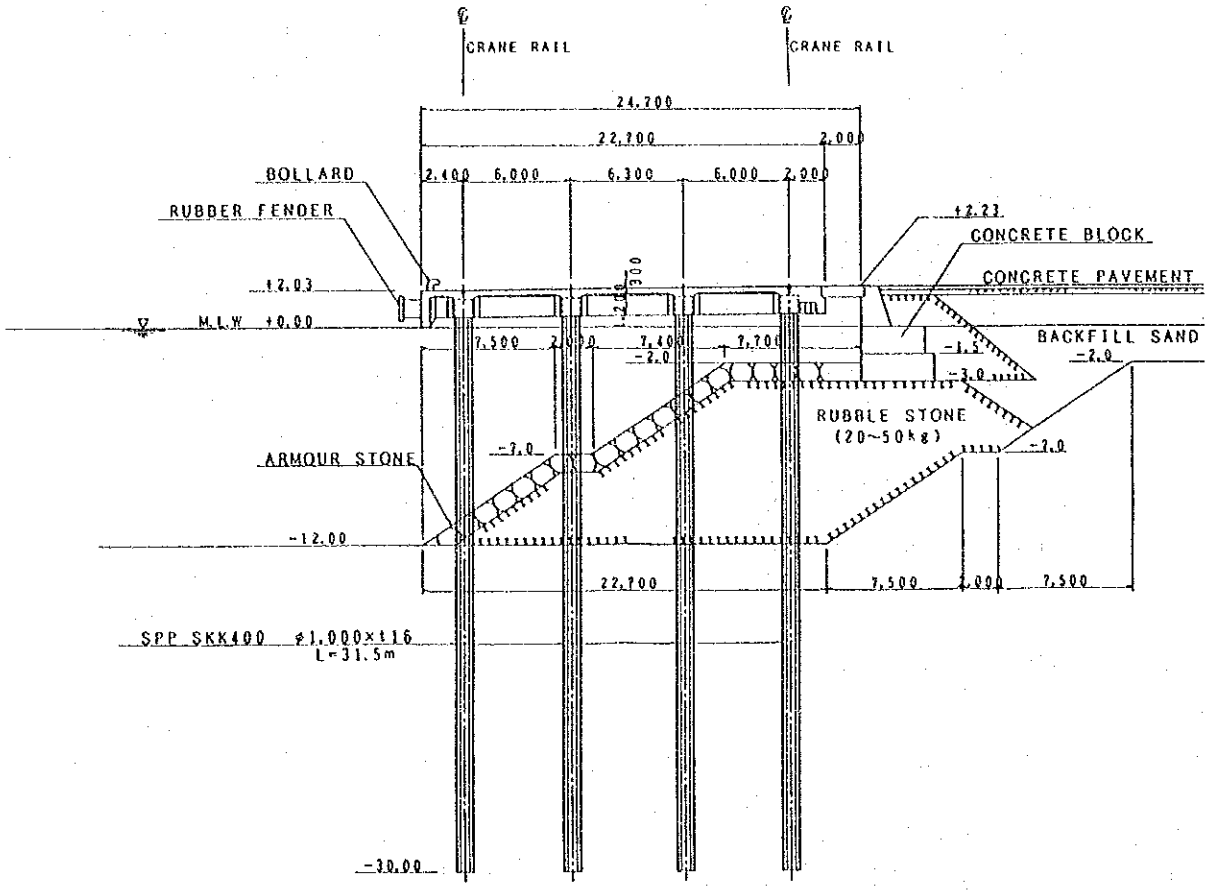
1.4.5 Design and Analysis

37. 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	Fig. 1-7-1 in Section 1.7, Chapter 1, Part III.



(a) Steel sheet piles type



(b) Open deck on steel piles type

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

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

- Steel Sheet Piles

  (1) The structure is simple and easy to construct
  (2) The constructon 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
  (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
  (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
  (5) The cost per one meter along quayside is approximately 290 million Lps.

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

1.4.6 Design and Quantity of Materials

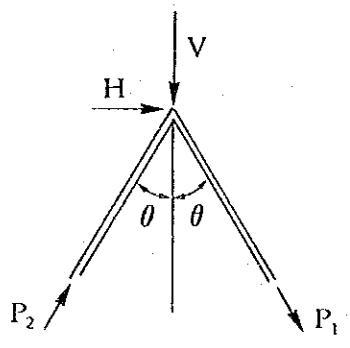
1) Result of the Design

40. 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.

41. The horizontal force per 1.0m of wharf and 1 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

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



1 coupled pile

$$P_1 = \frac{V \sin\theta + H \cos\theta}{Sin2\theta}$$

$$P_2 = \frac{V \sin\theta - H \cos\theta}{Sin2\theta}$$

where:

P_1 = Compressive stress

P_2 = Pulling stress

θ = Angle of batter pile = 10^0

V = Vertical load per 1 coupled pile

H = Horizontal force on 1 coupled pile

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)

$$\text{Safety Factor} = \frac{\text{Resisting Force}}{\text{Acting Stress}}$$

	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)

2) Quantity of Main Materials

43. Quantity of main materials of each facility is summarized in Table 1-4-5.

Table 1-4-5 Quantity of Main Materials (Net Volume)

a) Unit Cargo Wharf

Facility	Item	Unit	Q'ty	Remarks
Wharf	Pile Concrete	m^3	11,107	0.45m square length = 31.5m 306 pieces
	Driven Piles	pieces	1,742	Vertical: 968 Batter : 774
	Deck Concrete	m^3	9,190	
	Crane Rail	kg	57,424	Rail weight = 77.6kg/m
	Rubber Fender	pieces	47	H: 1.00m and Circle Type
	Bollard	pieces	24	
Bulkhead	Rubble Base	m^3	5,310	
	Gravel Filling	m^3	3,028	
	Concrete Block (A)	m^3	888	L=2m W=2m H=1.2m
	Concrete Block (B)	m^3	723	L=2m W=1.5m H=1.3m
	Placing Blocks	pieces	370	Weight of (A) = 11t (B) = 9t
	In-Situ Concrete	m^3	342	

b) Domestic Cargo Terminal

Facility	Item	Unit	Q'ty	Remarks
Wharf	Concrete Block (A)	m^3	750	2.50m x 1.50m x 2.00m
	ditto (B)	m^3	600	2.00m x 1.50m x 2.00m
	ditto (C)	m^3	1,050	3.50m x 1.50m x 2.00m
	ditto (D)	m^3	750	2.50m x 1.50m x 2.00m
	ditto (E)	m^3	600	1.50m ~ 2.00m x 1.70m x 2.00m
	Placing Blocks	pieces	500	
	Rubble Base	m^3	1,800	100kg/piece
	Gravel Filling	m^3	4,744	100kg/piece
	Backfill	m^3	17,550	
	Concrete Pavement	m^3	820	
	Subbase Course	m^3	615	
Training Wall	Armor Stone (A)	m^3	8,531	3,000kg/piece
	ditto (B)	m^3	2,228	500 ~ 700kg/piece
	Placing Stones	m^2	40,000	

c) By-Pass Road

Item	Unit	Q'ty	Remarks
Sand Filling	m^3	71,291	
Armor Stone (A)	m^3	24,288	3,000kg/piece
Armor Stone (B)	m^3	6,210	500-700kg/piece
Concrete Pavement	m^3	2,208	
Lean Concrete	m^3	1,049	
Subbase Course	m^3	2,885	

1.5 Implementation Plan

1.5.1 General

44. 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

45. The implementation plan was formulated based on the following considerations:

46. 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.

47. In construction planning, construction materials, equipments and laborers are procured in Honduras, as much as possible in order to achieve an economical and practical construction cost and to ensure efficiency in the implementation of the construction program.

48. The construction of the port facilities will be affected by the natural conditions especially marine conditions. But, at this construction site, the weather and marine conditions are favorable as mentioned in section 1.8, Part III, and the workable days per year are assumed as 280 or an average 23 days per month excluding a holidays.

49. Most of the construction materials are abailable locally except some items such as steel pipe, sheet piles, rubber fenders, bollards and some other steel products.

50. Materials for the armored stone of the revetments and training wall are not available in sufficient quantities at the neighboring river sites, and have to be transported from the inland quarries.

51. The ready mixed concrete is available from the nearby concrete plant for the construction works.

52. As for the construction equipment and machinery, the construction machinery of standard type and size is available in Honduras. But, the working vessels are limited to the few types described before.

Almost all types of workers are available in Honduras.

53. The main construction materials needed are listed in Table 1-5-2.

Table 1-5-2 Main Construction Materials

Materials	Unit	Unit Cargo Terminal	Domestic Termina	By-Pass Road	Total
Concrete	m^3	35,593	4,817	3,300	43,710
Concrete Pile	nos	1,742			1,742
	m^3	11,189			11,189
Concrete Block	nos	555	500		1,055
	m^3	1,998	3,900		5,898
Steel Bar	ton	1,103			1,103
Armored Stone	m^3	6,592	12,841	2,900	22,333
Stone (< 1 ton)	m^3	122,035	11,701	7,500	141,236
Gravel	m^3	65,000	11,043		76,043

1.5.2 Construction Schedule

54. The following points will be considerated for the project implementation.

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

2) The survey and detailed design will be carried out in advance of the construction works.

3) 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

4) 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 are assumed to be suitable and will be used 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.

5) The cutter suction dredger owned by ENP will be used for the dredging and reclamation. Its nominal dredging capacity is 400m^3/hour, but the capacity of 1,500m^3/day (workable time: 10 hours a day) will be adopted for the implementation program considering the actual results of the La Ceiba.

6) 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.

7) The existing reclaimed land neighboring the container yard will be used as the temporary yard for the construction materials and machines. The access road to this area is often congested, so transport should be planned in advance.

8) 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.

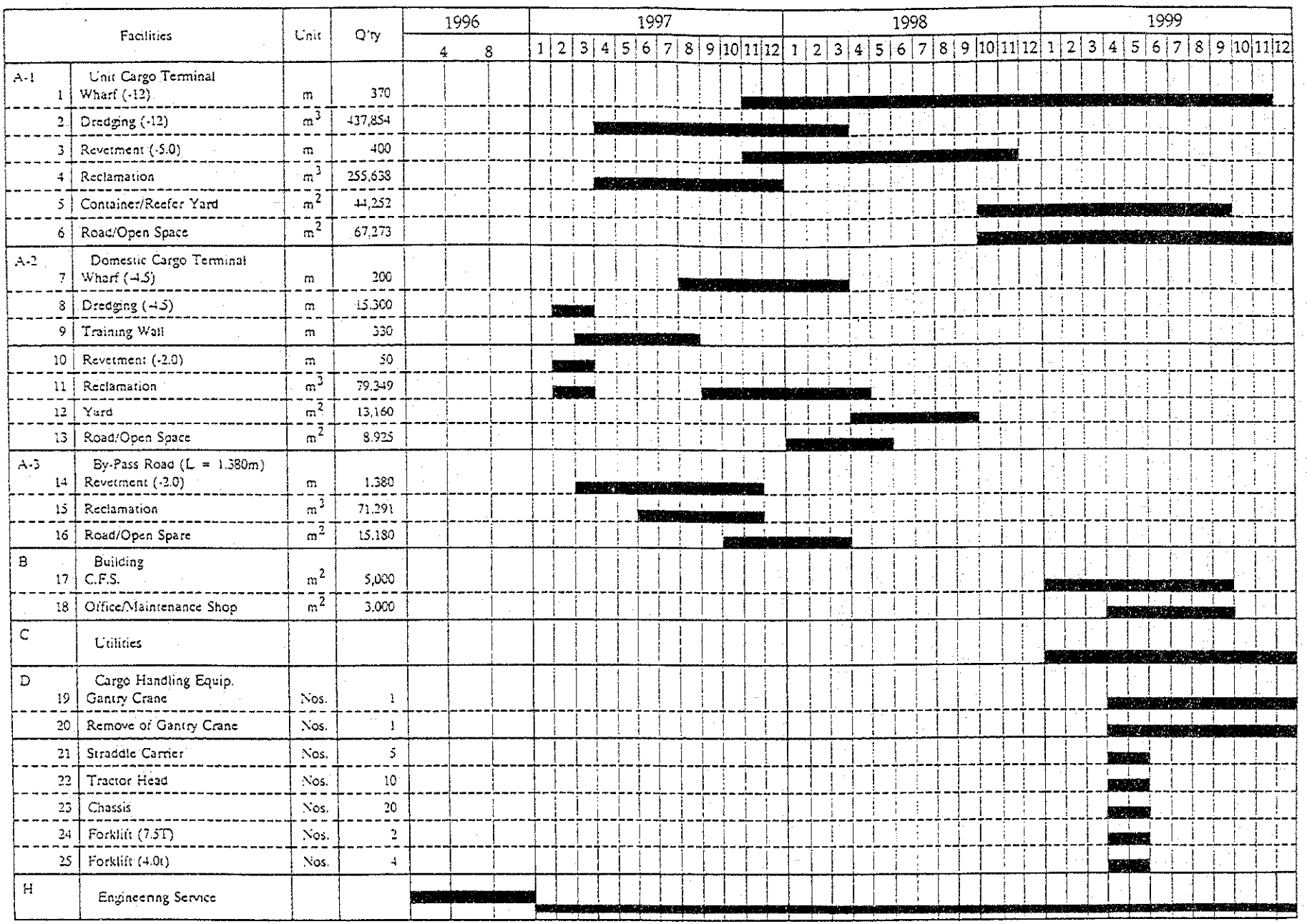
9) The construction of the wharf (-4.5m in depth/ 200m in length) and training wall (330m in length) are the main works of the domestic terminal. The planned reclaimed land will be used temporarily for the construction yard of the concrete blocks and the other construction materials.

10) The revetment of the By-pass road with a total length of 1,380m needs a construction period of 9 months. The subbase works and the pavement works are planned to continue to the subbase works.

11) The buildings for CFS and the warehouses have been designed as concrete block one-story buildings with steel frames.

12) The procurement and installation of the cargo handling equipment is planned for the final year.

55. 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

56. 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) Inflation is not taken into account.

4) 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.

5) 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.

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

7) The cost of land acquisition is excluded from the cost estimate.

8) The ratios of the 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 Buildings	8%
Dredging/Reclamation/Revetment/Yard and Open Space/Road/Pavement	4%
Cargo Handling Equipment	0%

1.6.2 Construction Cost of the Short-Term Plan

57. 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
Buildings	7,060
Utilities	15,400
Cargo Handling Equipment	84,206
Engineering Fee/Physical Contingency	23,852
Total	288,489

58. 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

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

60. To pursue the purpose mentioned above, the following alternative methods are considered. One is that the department of container terminal becomes independent of superintendence but is vested with the legal power. The other is to establish a new organization. In future, general cargoes are also expected to increase. To use the terminal for container exclusively and to establish an organization which handles and stores cargoes consistently contributes to greater efficiency. Cargo handling and cargo storage of containers and general cargoes are operated by same divisions in ENP and both divisions are in charge of operations in the entire port area. Basically, the same cargo 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. It will be produce efficient and reliable cargo handling, storage and delivery. Therefore, 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.

61. However, concerning container handling at the new container terminal, the following problems must be addressed.
One is to handle both banana container ships, which is given priority of berthage, and the others at the same berths. Operation organization should make an effort to collect information of container handling in advance. And it is necessary to develop the system of effective berth allotment and competent personnel.

The other is most of the banana container ships use own shipgears to handle containers. In the field survey of our team in March, efficiency of shipgear was sometimes more effective than that of gantry crane. It is caused by the fact that the contents, weight and kinds of container except banana are various and efficiency decreases. At present, special discount charge applies to container handling by own shipgears. For increase of ENP's revenue, it is necessary to raise efficiency of two gantry cranes including new one purchased in this project. ENP should make container flow by using ENP's equipment smooth, and make an effort to get higher efficiency than one of using shipgears.

62. It has already been recommended by the team that in view of creating higher quality of container terminal management, new container berths should be operated by an appropriate private comany under a lease contact (or concessions, paragraph 356 of PART I). It has also been suggested that two terminals should be operated under one operator, since the combined usage is vital for realizing maximum capacity.

63. In privatizing the terminals, it should been born in mind that banana exports have a considerable share among container cargo, and banana containers are normally handled by shipgear with higher efficiency than other cargo which uses gantry crane at quay side. Also banana is enjoying a favorable tariff. Banana containers are now exported mainly through berth No.3 and No.4, however, they should be gathered to new berth.

64. New terminal operator should negotiate on handling terms with banana exporters who have a strong position, nevertheless, to create efficient and profitable management, the terminal operator should give priority to establish a balanced and fair relationship with shippers and consignees.

65. For the terminal operator, good terms with ENP is also required for smooth operation. Going beyond the typical landlord and lessee relationship, ENP and the terminal operator should have close contact in carrying out every day business. Presently it is observed that Ro/Ro vessels, passenger vessels, cabotage ships and others are mooring at the same berth one by one. This is inevitable in view of the shortage of mooring capacity, and will continue to some extent even after new terminals come into operation. ENP may request the terminal operator to accommodate some extra vessels -notably Ro/Ro vessels-, and close contact and good relations help the port become profitabl

(2) Organization

66. At present, Department of Container Terminal, which is under jurisdiction of superintendence of Puerto Cortes, manages and operates container terminal. It consists of 63 persons, that is, 12 in management, 36 in operation and 15 in maintenance section.

67. Assuming that new 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. The team has, however, made a preliminary calculation of personnel.

68. The management section retained in ENP will be responsible for general management of the assets, and supervision and consultation with the operator. And concerning the management section, it is necessary to take account of all containers including banana container. Container handling volume except banana in 1992 was 650,000 MT and all containers including banana in 2000 are forecasted at 1,850,000 MT, that is, handling volume will increase by almost three times in 2000. Taking account of the rising handling efficiency, personnel needed in management sections is assumed to be two times the present number, that is, 24 persons.

69. Port police and gate watch will be carried out by ENP (see paragraph 343-345 of PART I). The required staff is 12 altogether.

70. Cargo handling operation will be conducted by the new terminal operator. Referring to present container handling, the constitution of gang is assumed as follows;
1 planner, 1 controller, 1 checker
1 operator of gantry crane
2 operators of straddle carrier
2 workers, 4 drivers Total 12 persons
Two-shift system will be applied and a relief geng will be required, that is, one berth will need three gangs or 36 persons. The new container terminal will have two berths. Therefore 72 persons will be needed in operation of the new container terminal. Also 40 persons will be required for warehouse and folklift operation.

71. For maintenance of equipment, 20 persons are required. For the moment it is not clear whether this work is conducted by public or private sector.

72. In short, personnel needed in the new container terminal 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

73. There will be an increase in personnel of about 100 employees. However, basically,

increase of personnel should be coped with through efficient deployment of personnel. Operators of gantry crane and straddle carrier who require special skill, however, should be trained or newly employed.

74. Concerning the management and operation of domestic terminal, five and 10 persons required in management and operation respectively.

2.2 Pricing

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

76. Although the first phase of pricing has a 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 be preferred, however, to attract as many client as possible it might be necessary to provide some incentives or subsidies in the lease term.

77. With respect to the issue in the second phase, it is urgent to establish price structure for diminishing long staying cargo in storage space. Shortage of storage space in one of the most basic problems in port management and operation.

78. Shortage of space is caused mainly by over staying of cargoes in the port besides limited land. 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. At present, storage charge is free for four and two weeks to imported and exported container respectively. After this term, it costs 10 Lps./day, nevertheless, it is cheaper than charge of storage outside port. Some users store container in port area as long time storage. With investigating standard storage charge around port, it is necessary to establish an adequate storage charge.

79. Term of free storage is decided as a countermeasure 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. (For example, Singapore applies four-week free storage, the same as Cortes.)

Chapter 3 Economic Analysis

3.1 Purpose of the Economic Analysis

80. 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. Thus, this chapter focuses on whether the net benefits of this development project exceed those which could be derived from other investment opportunities in the Republic of Honduras.

3.2 Methodology of the Economic Analysis

81. Economic analysis will be carried out according to the following method. Short-term development plan will be defined and it will be compared all conditions with "Without" case. All benefits and costs of it in market price for the difference from "Without" case will be calculated and it will be converted to the economic price. All benefits and costs are evaluated using economic prices in the economic analysis based on the border price concept. There are various methods to evaluate the feasibility of this type of development project. Here, the economic internal rate of return (EIRR) based on cost-benefit analysis in used to appraise the feasibility of this project. The EIRR is a discount rate which makes the costs and the benefits of the project during the project life equal, and it is calculated using the following formula:

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

Where, Bi : Benefits in the i-th year
Ci : Cost in the i-th year
r : Discount rate
n : Period of project life

82. The procedure used for this economic analysis is shown in Fig. 3-2-1.

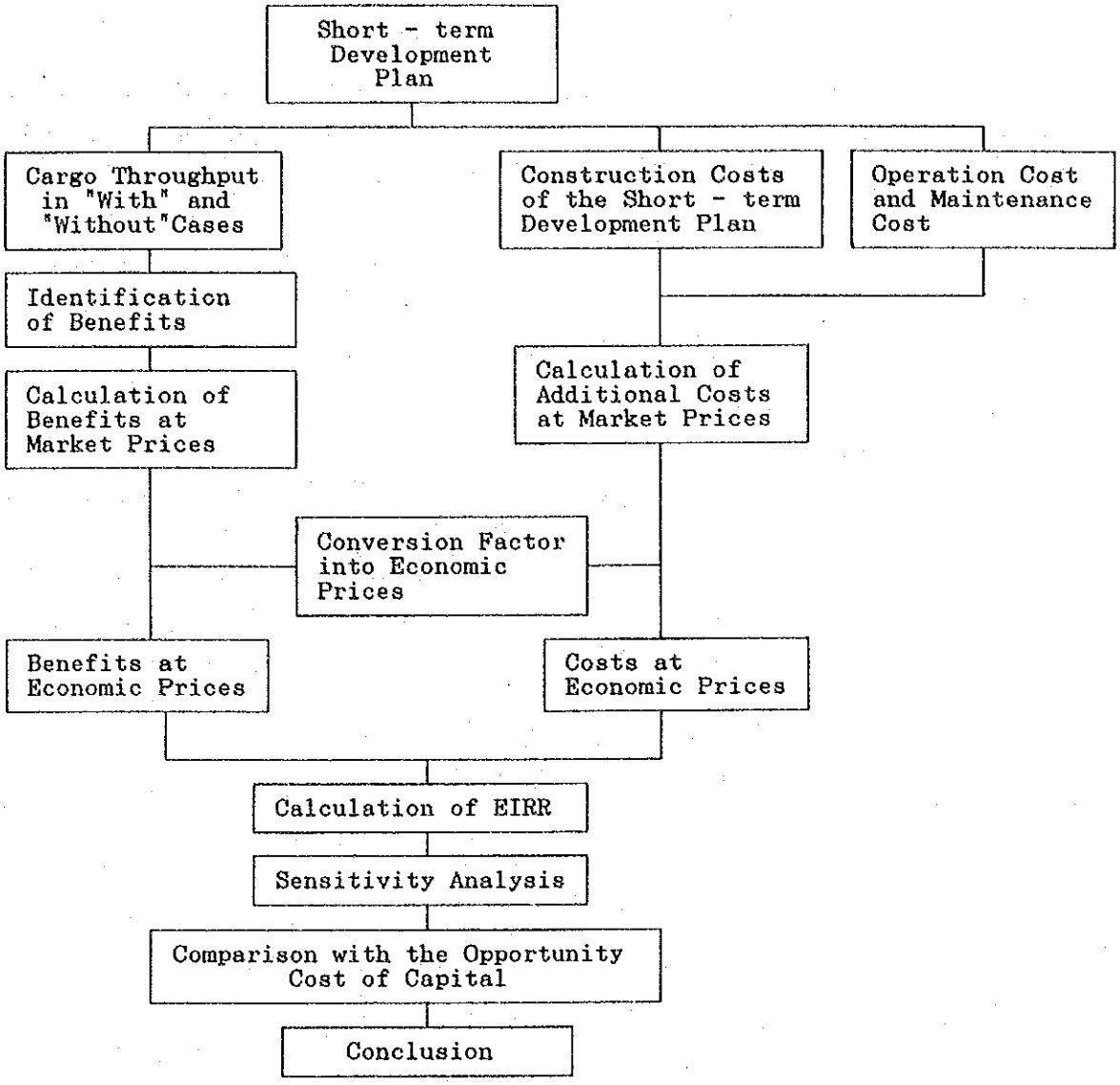


Fig.3-2-1 The Procedure of the Economic Analysis

3.3 "Without" case and "With" case

83. In the cost-benefit analysis, the benefits and the project costs are defined as the difference between the "Without" the project and the "With" the project cases. Therefore, it is very important to define the difference between "Without" case and "With" case in the economic analysis in order to evaluate the feasibility of the development project. In this study, the following conditions are adopted as the "Without case" considering the existing situation.

3.3.1 "Without" Case

84. In the "Without" case, it is assumed that no additional investment will be made to enlarge the existing port facilities but the required funds will be provided to maintain the existing facilities at their current level of services. Thus the level of capacities of the port which are efficiency of loading and unloading and available berth length and so on are not improved. The conditions of "Without" case are assumed as follows.

Table 3-3-1 Berth Conditions

Wharf name	Number of Berth	Purpose of Use	Main facilities
No.1 Berth	1 Berth	Petroleum	Dolphin
No.1-A Berth	1 Berth	Other liquid	Dolphin
No.3 Berth	1 Berth	Multipurpose	
No.4 Berth	2 Berth	Multipurpose and Container	
No.5 Berth	2 Berth	Multipurpose and Container	2 Gantry Cranes

Table 3-3-2 Cargo Handling Conditions

	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)

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

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

3.3.2 "With" case

86. In the "With" case, it is assumed that short term plan for the port development is completed and the level of capacities of the port which are efficiency of loading and unloading, available berth length and so on are improved. The conditions of "With" case are assumed as follows.

Table 3-3-3 Berth Conditions

Wharf name	Number of Berth	Purpose of Use	Main facilities
No.1 Berth	1 Berth	Petroleum	Dolphin
No.1-A Berth	1 Berth	Other liquid	Dolphin
No.3 Berth	1 Berth	Multipurpose	
No.4 Berth	2 Berth	Multipurpose	
No.5 Berth	2 Berth	Multipurpose	
New Container Terminal	2 Berth (370m)	Container	2 Gantry Cranes C.F.S., Yard
New Domestic Terminal	4 Berth (200m)	Domestic	
New By-Pass Road			

Table 3-3-4 Cargo Handling Conditions

	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)

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

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

3.3.3 Cargo Handling Volume and Calling Vessels

88. According to the demand forecast at Port of Cortes (PART I Chapter 1), future cargo volume by packing type is as follows:

Table 3-3-5 Estimated Cargo Volume by Packing Type

(Unit:Thousand MT)

Cargo	1992	2000	2010
Unit	1,301	1,850	2,500
General	509	450	600
Dry Bulk	353	700	1,000
Liquid Bulk	646	650	1,000
Domestic	48	70	110
Total	2,857	3,720	5,210

Source : PART I Table 1-7-5, PART I Table 1-9-2 and PART III Table 1-3-1

89. Followings are the summary of estimated calling vessels and the total berthing time which is calculated based on the above. The results of calculation are shown in Table 3-3-6 and 3-3-7, summaries of which are given as follows:

Summary for No. of Calling Vessels and Required 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)

3.3.4 Cargo Flow for the "Without" Case

90. Under the "Without" case, the estimated cargo volume will be handled without the construction of the new container terminal, new domestic terminal, the dredging works for the required basins and new by-pass road. The berth capacity will be limited by the handling capacity at the port utilizing the existing facilities and the current level of services. The maximum berthing time for the calling vessels was calculated based on above and as follows:

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

91. Under the "Without" case, in 2000 the total required berthing (unloading / loading) time for the calling vessels will exceed the available total berthing time at the port. The excess cargo volume after the year in 2000 has to be handled at other ports. The other ports are assumed as Port of Tela, Port of La Ceiba, Port of Castilla and Port of Santo Tomas de Castilla considering the characteristics of the cargo. The cargo exceeding the port capacity will be transported on land, mainly by trucks and trailers, from/to the other ports to/from San Pedoro Sula and Tegucigalpa.

92. Taking into account the characteristics of the cargoes and the port facilities, the excess cargo will be handled as follows:

Port of Tela

93. There are no facilities for handling containers at the Port of Tela, thus domestic cargo and general cargo will be handled at the port and the cargoes will be transported to/from San Pedoro Sula and port of Cortes by trucks and trailers.

Port of La Ceiba

94. Large ships can not enter the port because the water depth is only 6m, thus domestic cargo and general cargo will be handled at the port and the cargoes will be transported to/from San Pedoro Sula and port of Cortes by trucks and trailers.

Port of Castilla

95. It is assumed that import container cargo and general cargo will be handled mainly at the port of Castilla and the cargoes will be transported to/from Tegucigalpa and port of Cortes by trucks and trailers.

Port of Santo Tomas de Castilla

96. It is assumed that import container cargo and general cargo which is overflown from Port of Cortes will be handled mainly at the port of Santo Tomas de Castilla and the cargoes will be transported to/from San Pedoro Sula and port of Cortes by trucks and trailers.

97. The cargo volume which will shift to other ports will be calculated based on the above and according to the following conditions.

1) In 2000, number of domestic ships at the Port of Cortes will be at the same level as 1992 (400 ships) and 70 % of others will be served at the Port of La Ceiba and 30 % will be at the Port of Tela.

2) All the ships loading dry bulk cargo will be served at the port of Cortes.

3) It is assumed that 70 % of the shift cargo to other ports except domestic cargo is container cargo and 30 % of it is general cargo. 60 % of container cargo will be handled at the Port of Santo Tomas de Castilla and 40 % at the Port of Castilla.

98. The results of the calculation for cargo flow are shown in Table 3-3-8, 3-3-9, 3-3-10 and 3-3-11 and a summary of which is given below.

Summary of cargo flow from the Port of Cortes

(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

3.4 Prerequisites of the Economic Analysis

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

3.4.1 Base Year

100. The "Base Year" here means the starting year of the economic analysis. Taking into consideration the construction schedule in chapter 1, Construction of this part, 1993 is set as the "Base Year" for this Study.

3.4.2 Project Life

101. Taking into consideration the depreciation period of the main facilities mentioned in the chapter of Financial Analysis and construction period of four years, the period of calculation ("project life") in the economic analysis is assumed to be thirty years from the beginning of construction. It is from 1996 to 2025.

3.4.3 Foreign Exchange Rate

102. The exchange rate adopted for this analysis is US$ 1.00 = 5.85 Lempiras, that is, the same rate as used in the cost estimation.

3.4.4 Others

103. The other ports selected under the "Without" case are the port of Castilla, Port of Tela, Port of La Ceiba, and Port of Santo Tomas de Castilla and these ports have enough capacity to handle the overflown cargo from the port of Cortes.

104. The land transportation capacity from/to the other ports is also assumed to be sufficient; the road between the Port of Cortes and the Port of Santo Tomas de Castilla which is now under planing will be completed before 2000.

105. Under the "With" case, the short-term plan for the port development will be carried out from the year 1996 and the new container terminal will start operation in 2000.

3.5 Economic Prices

3.5.1 Method for Converting to Economic Prices from Market Prices

106. For the economic analysis, prices are expressed in economic prices rather then prices based on the border price concept. There are various methods to convert the market prices into border prices. Here, the border prices (economic prices) are calculated by eliminating transfer items, such as taxes, subsidies, etc.

107. In general, all the costs and benefits are divided into three categories: labor, tradable goods and non-tradable goods. And labor is further classified into skilled labor and unskilled labor. As for skilled labor, the economic price is determined by multiplying the market wage by the conversion factor for consumption. On the other hand, the economic price of unskilled labor is determined by multiplying the nominal wage by the shadow wage rate and the conversion factor for consumption.

108. The prices of tradable goods are expressed in CIF and FOB value for import goods and export goods respectively.

109. These values show the actual border prices. However, as the border price of non-tradable goods cannot be converted directly, the border price of the inputs needed to produce the non-tradable goods is considered. After some classification of the non-tradable goods, the economic price of a small amount of the non-tradable goods is calculated by multiplying the market prices by the standard conversion factor directly.

3.5.2 Conversion Factors

110. Conversion factors for goods and labor are determined as follows:

(1) Standard Conversion Factor (SCF)

111. The standard conversion factor 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. The standard conversion factor is expressed by the following equation:

$$SCF = \frac{X + M}{(X - Tx) + (M + Tm)}$$

Where, X : Value of exports

M : Value of imports
Tx : Value of taxes on exports
Tm : Value of taxes on imports

112. The standard conversion factors for the last four years for which data are available (1989 - 1992) are shown in table 3-5-1. In this study, for the average standard conversion factor over the four years, 0.948 is adopted.

(2) Conversion Factor for Consumption Goods (CFC)

113. This conversion factor is used to convert the market prices of consumption goods into the border prices. The conversion factor for consumption goods is usually calculated in the same manner as the SCF, replacing total imports and exports by those of consumption goods only.

114. However in this case, it is difficult to directly calculate the CFC due to the shortage of necessary data such as export value and taxes on the consumption goods. Therefore, in this study, all export goods are assumed to be consumption goods and conversion factor for consumption goods is calculated as 0.920.

(3) Conversion Factor for Labor (CFL)

115. For the economic analysis, labor costs are usually measured in terms of their opportunity costs, that is the value of the foregone marginal product from other alternate employment due to the employment of laborers for the project.

116. The cost of skilled labor is calculated based on actual market wages, assuming that the market mechanism is functioning properly. However, as these are domestic costs or market cots, they are converted into border prices by multiplying the market wages by the conversion factor for consumption goods.

Thus, the conversion factor for skilled labor

= (Market wage rate) x (CFC)
= 1 x 0.920
= 0.920

117. As the wages paid to unskilled labors by a project are usually far above the opportunity cost, these market wages should not be used for calculation of the economic value of the unskilled labors. Considering the labor market, the labor is usually provided from the agricultural sector and the marginal wage rate is calculated based on the labor

market in the agricultural sector. Therefore, in this study, the economic cost of unskilled labor is estimated based on a simplified measure of the opportunity cost considering the productivity of the agriculture sector. The conversion factor for unskilled labor is calculated as follows;

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

$$= 13 / 20 \times 0.92 = 0.598$$

Where, CFL : The conversion factor for unskilled labor
Opportunity Cost : Estimate agricultural workers Cost 13 Lemp. / Day
(Source : PART I Chapter 1.2 Table 1-2-3 and 1-2-4)
Nominal Wages : Unskilled labor cost 20 Lemp. / Day
(Source : PART III Chapter 1.8.2 Table 1-8-1)

3.6 Costs of the Project

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

3.6.1 Construction Costs

119. Construction costs are converted by multiplying the market costs by the conversion factor for construction estimated in 3.5.2. Based on the construction schedule as shown in Chapter 1, the annual construction costs at economic prices are shown in Table 3-6-1 and summary of which is given below.

Annual Construction Costs

(Unit : Thousand Lempiras)

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

3.6.2 Maintenance Costs

120. Maintenance costs for the new terminal and the installed handling machinery are

considered at economic prices. The maintenance costs are estimated in the following Chapter 4 at market prices, and the standard conversion factor is applied to convert the maintenance costs at market prices into the economic prices.

3.6.3 Operation Costs

121. Operation costs consist of personnel costs, administration costs and other costs. Based on the estimation of operation costs in the following Chapter 4, the necessary operation costs for the new terminal are considered as follows:

(1) Personnel Costs

122. The personnel costs which are salary for an additional number of operators and stevedores as estimated in the following Chapter 4 are considered at economic prices. The conversion factor for skilled labor is applied to convert the personnel costs at market prices into the economic prices.

(2) Administration Costs

123. Based on the analysis of historical data, the administration costs are set at 8% of the personnel costs. The economic prices of the administration costs are calculated by multiplying the market costs by the standard conversion factor.

(3) Other Costs

124. Other costs consist of fuel, lubricant, electricity and other expenses necessary for the operation. The economic costs of other costs is calculated by multiplying the market costs by the conversion factor for consumption goods.

3.6.4 Replacement Costs for Handling Equipment

125. The additional replacement costs for handling machinery and equipment such as gantry cranes, straddle carriers and forklifts after their useful lifetimes are considered. The economic cost of this machinery are considered as the same as the market costs because they are purchased at international prices.

3.6.5 Costs of the Project

126. All the costs measured at economic prices are summarized in Table 3-6-2.

3.7 Benefits of the Project

3.7.1 Kinds of Benefits

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

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

(1) Savings in ships' staying costs.
(2) Savings in interest of cargo costs.
(3) Savings in cargo handling labor costs.
(4) Savings in land transportation costs to/from other ports.

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

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

3.7.2 Calculation of Benefits

(1) Savings in Ships' Staying Costs

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

Saving in ships' staying costs	=	Difference of ships' staying time between "Without "and "With" cases
	x	Ships' staying cost
	x	Percentage accruing to Honduras

(a) Ships' Staying Time

131. Ships' staying time at the port comprises the waiting time for berthing and the mooring time for unloading/loading. As for the ships' waiting time, the total waiting time for "Without" and "With" cases is calculated using queuing simulations based on the estimated number of calling ships in both cases respectively. The results of the calculation are shown in Table 3-7-1 and 3-7-2.

(b) Ships' Staying Costs

132. Usually ships' staying costs are estimated by compiling the depreciation, personnel expenses, fuel cost, interest and other expenses, based on the ship building prices. The fuel consumption costs for ships' staying are also estimated for each ship based on the average fuel consumption rate of vessels presently operating. Based on the interviews and the above, the estimated ships' staying costs are shown in Table 3-7-3.

(c) Percentage Accruing to Honduras

133. The benefit derived from the savings of ships' staying costs will be belong to the shipping companies. Therefore, for foreign ships the benefits accrue to foreign shipowner and for Honduran ships benefits accrue to Honduras. However, it is now standard practice to include some of the benefits accruing to foreign shipowner in the appraisal

on the understanding that in the long run this benefit will filter through to the national economy, for example, trough lower freight rates. Thus, in this study, it is assumed that 50% of savings of ocean going ships' staying costs and 100% of domestic ships' accrue to the Honduras economy.

(d) Savings of Ships' Staying Costs

134. Benefits derived from savings of ships' staying costs due to the implementation of this project are calculated in Table 3-7-4, a summary of which is given below.

Savings of Ships' Staying Costs

(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

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

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

x | Interest of cargo |

136. According to the above, benefits derived from savings of interest of cargo costs due to the implementation of this project are calculated in Table 3-7-5 a summary of which is given below.

Savings of Interest of Cargo

(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

137. In accordance with the implementation of the port, the efficiency of cargo handling capacity will be improved and the total ships' berthing time for unloading/loading at the port will be greatly decreased. According to the reduction of the ships' berthing time under the "With" case, cargo handling labor cost will be decreased. In this study, the benefits derived from the reduction of the cargo handling labor costs are calculated by the following formula.

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

x | Unit labor cost |

138. According to the above, benefits derived from savings in cargo handling costs due to the implementation of this project are calculated in Table 3-7-6, a summary of which is given below.

Savings of Cargo Handling Labor Costs

(Unit : Thousand Lempiras)

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

Source : Study team estimates

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

139. Under the "Without" case, as described in chapter 3.3.4 of the Cargo flow for the " Without " case, the excess cargo volume would be handled at the other ports. The additional transportation costs under this case are the benefits of savings in transportation costs if the Short-term Development is executed. Therefore, in this study, the difference of the transportation costs between the "Without" and "With" cases is calculated as the benefit. The benefit is calculated by the following formula.

Saving in transportation costs for other ports	=	Difference of transportation costs between "Without and "With" cases
	x	Transportation volume
	x	Percentage accruing to Honduras

(a) Transportation costs on sea

140. The transportation costs on sea are defined as the additional transportation costs in accordance with the change of the unloading/loading port from port of Cortes to other ports. When considering the major trade partners of the port, the United States and European Countries, there is not so much difference in transportation costs between the ports of Cortes and other ports. Therefore, in this study, the additional sea cost are considered to be negligible.

(b) Transportation Costs on Land

141. The transportation costs on land are defined as the additional costs caused by the additional land transport due to the change of handling port. In this study, it is assumed that the cargoes which will be handled at the Port of Castilla are transported from/to Tegucigalpa by trucks and trailers and the cargoes which will be handled at the other ports are transported from/to San Pedro Sula by trucks and trailers. Based on the Data Bank which was established by FIDE and interviews, the transportation costs are estimated in the Table 3-7-7, summary of which is given below. Additional land transportation costs will be calculated by using the difference of land transportation cost.

Land Transportation Costs

(unit : Lempiras/ton)

	Cortes	Tela	La Ceiba	Castilla	Santo Tomas
San Pedro Sula	85	120	230		130
Tegucigalpa	310			410	

Source : Study team estimates.

(c) Transportation Cargo Volume

142. Based on chapter 3.3.4 Cargo flow for the " Without " case, the cargo volumes handled at the other ports are estimated as shown in Table 3-3-11, a summary of which is given below.

Cargo Volume through the other Ports

(unit : t)

	Castilla	Santo Tomas	Tela	La Ceiba	Total
2000	0	0	6,000	15,000	21,000
2005	212,000	292,000	25,000	40,000	569,000
2010	435,000	600,000	45,000	70,000	1,150,000

Source : Study team estimates.

(d) Percentage accruing to Honduras

143. As for the savings of the costs of ships' staying, the percentage accruing to Honduras is considered to be 50% as described in the previous section. However, 100% of the savings of the land transportation cost is considered to accrue to Honduras taking the capability of domestic land transportation companies into consideration.

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

144. Based on the above, the benefits derived from the savings in transportation costs from/to the other ports are calculated in Table 3-7-8 and summarized in the following Table.

Savings in Transportation Costs from/to the Other Ports

(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.

3.7.3 Uncountable Benefits

145. As described in Chapter 3.7.1, there are other benefits derived from the implementation of this project. however, they are difficult to appraise in monetary terms. Therefore, qualitative analyses are undertaken as follows:

(1) Promotion of Regional Economic Development

146. Without the implementation of this development project, the port of Cortes will handle a limited cargo volume, and the development or expansion of export industries and services which are dependent on the Port will be stagnant. Furthermore, the limited port activity will diminish the probability of the establishment of new businesses. On the other hand, the new development project will make port-related industries, such as ZIP, more active, and the value added from those industries and the employment opportunities from them are therefore considered as economic benefits of this project.

(2) Increase in Employment Opportunities and Incomes

147. Additional employment will arise directly from the project, both assumed employment for construction during the construction period and employment for operations after the construction. Therefore, this employment is one of the major benefits of the project.

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

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

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

3.7.4 Benefits of the Project

150. In converting the market prices into economic prices, benefits derived from savings in ships' costs and interest of cargo cost are considered at economic prices without any converting procedure, because they are already presented at international prices. However, benefits derived from savings in cargo handling labor cost and land transport costs are expressed in market prices, and therefore the conversion factor is applied to theses benefits for converting market prices into economic prices.