

# CHAPTER XI PORT MANAGEMENT AND OPERATIONS



## CHAPTER XI PORT MANAGEMENT AND OPERATIONS

### XI-1 Management and Operations

#### (1) General

1) The main elements of port administration and operation systems are an appropriate form and structure of the port administrative body, efficient port operations, a sound financial system using modern accounting methods, a reasonable level of port dues, accurate port statistics, skillful promotion and publicity, development of the port city and of auxiliary commercial services, and regional cooperation with neighboring ports.

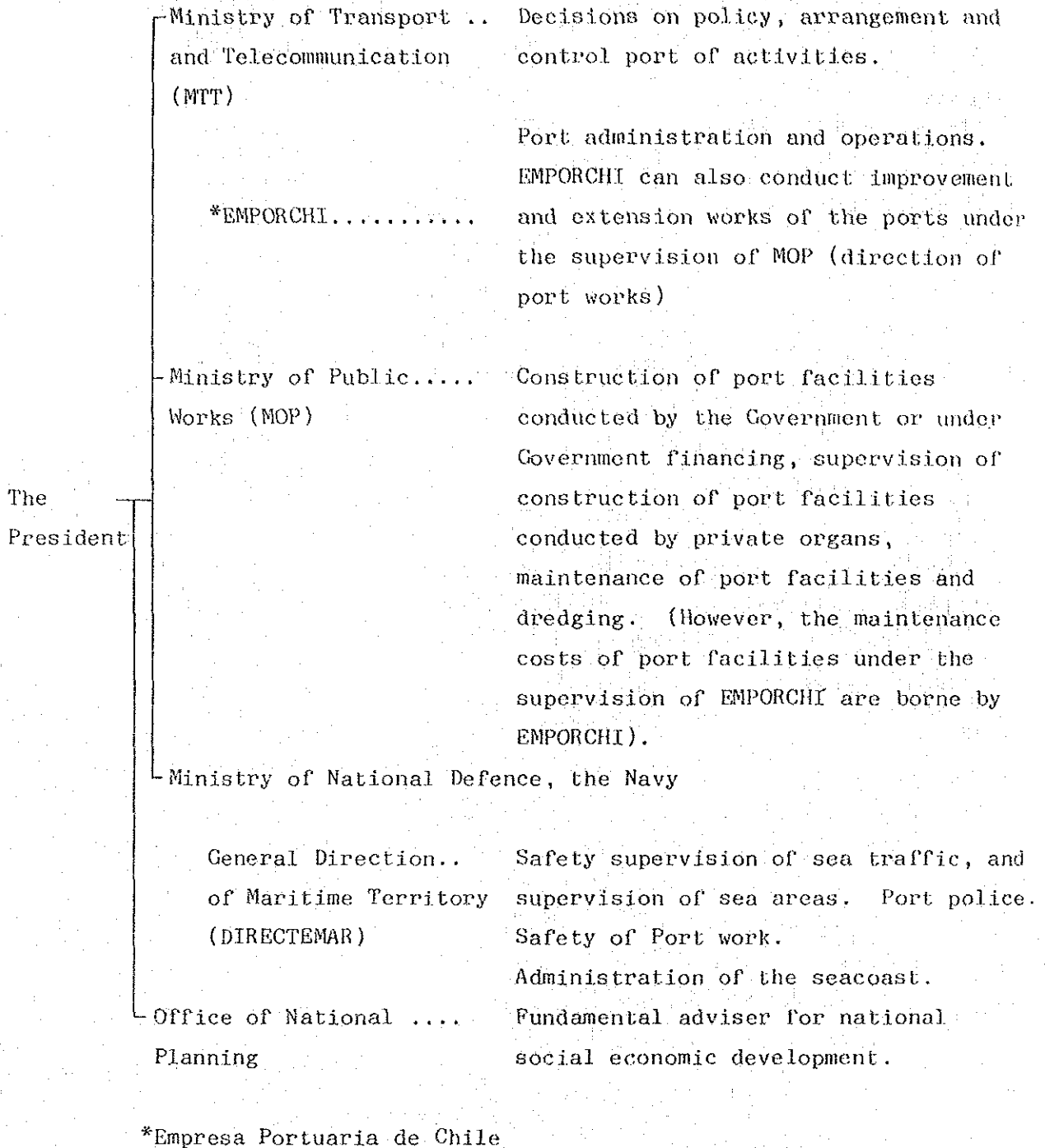
Port administration and operation systems vary greatly from country to country and from port to port. Furthermore, administration and operation systems at individual ports change over time in response to changing circumstances.

This chapter first describes the present conditions of the administration and operation systems and the current problems for the administration and operations at Valparaiso Port and San Antonio Port based on analyses of available data and field surveys.

Finally, considering these problems and the trends in worldwide maritime transportation, proposals to improve the administration and operation system for both ports are presented.

#### (2) Outline of the Governing Authorities for Ports in the Republic of Chile

As concerns the administration of ports in the Republic of Chile, there is no one organ which has overall responsibility or which plays the central administrative role. Port administrative authority and office work have been delegated to various systems and organs. The basic administrative framework is shown in Fig. XI-1-1.



**Fig. XI-1-1 Basic Administrative Framework for Chilean Ports**

The current Chilean port administrative system developed over time. Due to the historical development, the present administrative system is quite complicated. Different administrative bodies have been responsible for different aspects of cargo handling.

There are three main aspects of cargo handling:

- ① Stowing and unstowing of cargo inside ship holds;
- ② Handling cargo from the hook to the transit sheds and warehouses;  
and
- ③ Management and control of the transit sheds and warehouses.

The historical development of port administration, including which bodies have been responsible for each of these aspects of cargo handling, is reviewed below.

Prior to 1960 Ports were administrated by the Department of Finance  
(Customs)

Cargo Handling: ① - Private labor hired by ships  
② - S.E.P. (a department of the Customs General Board)  
③ - Customs services

1960: The customs department and the port department were separated. EMPORCHI was created to control port administration and operations. Port planning and construction were controlled by MOP.

Cargo Handling: ① - Private labor hired by ships  
② ③ - EMPORCHI

1975: MIT separated from MOP.  
EMPORCHI placed under the control of MIT.

1981: A new law (No. 18042) was passed to make port activities conform to the economic model adopted by the Government. However, this law has not been implemented.

Cargo Handling: ① ② - Private stevedore companies and EMPORCHI  
③ - EMPORCHI

In addition, safety supervision of the traffic on the sea and the supervision of sea areas is controlled by DIRECTEMAR, a department of the Ministry of National Defence, the Navy.

### (3) Characteristics and Organization of EMPORCHI

There are 68 ports of various sizes in the Republic of Chile.

These are classified as national ports, specialized ports, private ports and other ports. National ports are those ports which are crucial to the national economy, and they are controlled by EMPORCHI.

In 1960, EMPORCHI was created under Presidential Decree No. 290 as an autonomous public agency with the purpose of development, management and maintenance of the main public ports in Chile.

EMPORCHI is linked to the Government through the MTT and its head office is located at Valparaiso city. EMPORCHI manages Arica, Iquique, Antofagasta, Coquimbo, Valparaiso, San Antonio, Talcahuano, San Vicente, Puerto Montt, Chacabuco, and Punta Arenas ports.

It is stipulated in law No. 290 that at these main ports EMPORCHI is to receive or tranship goods loaded or unloaded within the port area and also to house the goods in transit sheds, open storage yards and other storage places, to watch over and store them and to deliver them to consignees.

EMPORCHI has the confidence of the President and is managed by the Director who has various duties and responsibilities as prescribed by law.

The director manages EMPORCHI with the assistance of the subdirector, the chiefs of bureaus and divisions and other persons nominated by the Director. The Director has the following authority, subject to the approval of the President.

- ① To charge for the services offered by EMPORCHI.
- ② To lease port facilities for periods up to ten years.
- ③ To determine the sea and land areas where EMPORCHI works.
- ④ To enter into loan agreements with entities outside the country as prescribed by law.
- ⑤ To issue debentures

A organizational chart of EMPORCHI is presented as Fig. XI-1-2 and Fig. XI-1-3 is an organizational chart of Valparaiso Port and San Antonio Port.

The number of EMPORCHI staff is about 1,470 persons as of 1986.

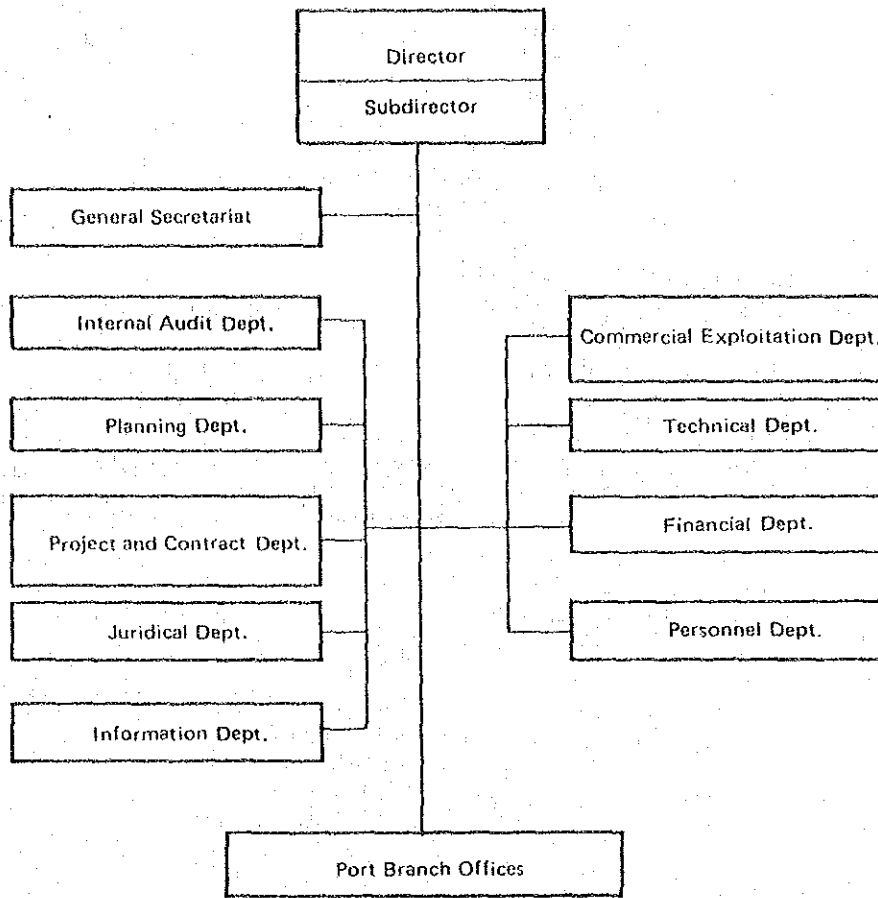


Fig. XI-1-2 Organizational Chart of EMPORCHI

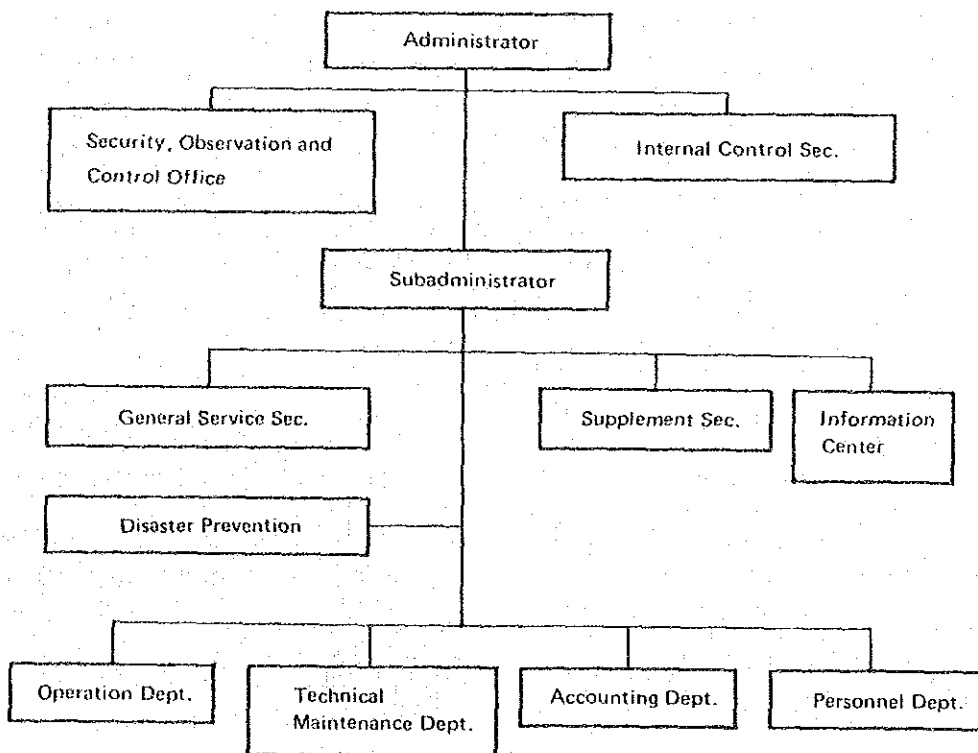


Fig. XI-1-3 Organizational Chart of Valparaiso Port and San Antonio Port

(4) Financial Status of EMPORCHI

A review of EMPORCHI's financial statements for the last 5 years reveals that the status of EMPORCHI's financial affairs is as follows.

1) Income and Expenditure

Table XI-1-1 shows the changes in EMPORCHI's profit and loss account for the last 5 years. As inflation accounting is widely used in Chile, figures for each year in the table are expressed in 1984 prices, adjustment based on the ratio of consumer price increases over the previous year.

Table XI-1-1 Profit and Loss Account

(Unit: thousand pesos)

	'80	'81	'82	'83	'84
Operating Income	5,347,088	5,581,453	4,668,476	3,404,932	4,247,847
Operating expenses	4,324,575	3,308,013	2,161,857	2,042,035	1,922,600
Administrative expenses	932,724	766,824	712,995	604,941	616,490
Operating profit	89,789	1,506,616	1,793,624	757,956	1,708,757
Non-operating income and expenditure	86,957	292,401	-656	-942,631	-471,674
Profit before taxes	176,746	1,799,017	1,792,968	-184,675	1,237,083
Income tax	75,904	774,025	752,247	-	528,088
Profit after taxes	100,842	1,024,992	1,040,721	-184,675	708,995
(Inflation adjustment ratio)	11.1%	20.0%	23.7%	22.2%	

Reference to this table shows that the figures for operating revenue in 1982 and 1983 are both substantially lower than those of previous years. Figures in 1984 are an increase over 1983 results. However, this increase did not reach 1982 levels.

A total annual volume of 8 million tons of cargo was handled by EMPORCHI consistently throughout the period from 1980 through 1983 leading to the conjecture that some changes must have been made to either the fees or the contents of port services. Further analysis is needed on this point.



Operating expenses during the past 5 years show consistent downward trends. The ratio of operating expenses to operating income for 1980 was 80.9%. EMPORCHI's operating expenses decreased by 1984 mainly because most of port operations (in the four main ports) were carried out by the private sector. In fact, the only part of port operations carried out by EMPORCHI were storage and part of port second phase.

Sales loss of assets and adjustment of owned capital as indicated by the Board of Audit are included in non-operating income and expenditure. For 1983 and 1984 respectively, of the -942,631 thousand pesos and -471,674 thousand pesos for non-operating income and expenditure, adjustment of owned capital included in these figures is 834,372 thousand pesos for 1983 and 673,955 thousand pesos for 1984.

Although EMPORCHI is a legally established public enterprise, it does not qualify for tax exemption for income received. EMPORCHI pays income tax in the same way as does a private corporation. In addition, it is decreed by the Minister of Finance that portions of excess profits be contributed to the national treasury. The balance sheets show that a contribution has been duly paid by EMPORCHI.

## 2) Breakdown of Operating Income

The main source of EMPORCHI's operating income derives from the following fees & service items: moorage fees, cargo handling fees, portage fees, storage/freight collection fees, transit fees, other service fees, license fees and miscellaneous revenue.

Figures for total operating revenue and shares for itemized revenue are shown in Table XJ-1-2. These figures were obtained from INFORME RESULTADOS ECONOMICOS, EMPORCHI's internal document.

Table XI-1-2 Operating Income

(Unit: thousand pesos)

	1982		1983		1984	
	Value	Share (%)	Value	Share (%)	Value	Share (%)
Moorage fee	963,788	20.6	916,467	26.9	1,179,809	27.8
Cargo handling fee	1,673,077	35.9	1,403,628	41.2	1,657,665	39.0
Portage fee	116,271	2.5	111,019	3.3	125,903	3.0
Storage/freight collection fee	1,051,354	22.5	427,426	12.6	664,972	15.6
Transit fee	154,435	3.3	123,152	3.6	126,031	3.0
Other services	298,604	6.4	276,539	8.1	361,626	8.5
License fee	144,400	3.1	97,516	2.9	124,667	2.9
Miscellaneous revenue	266,546	5.7	49,184	1.4	7,174	0.2
Total	4,668,475	100.0	3,404,931	100.0	4,247,847	100.0

Looking at these figures, it can be seen that under the heading of operating income, moorage fees, cargo handling fees and storage/freight collection fees are major items. Together these items comprise about 80% of total operating revenue each year. Although there have been no major changes in the area of moorage fees and cargo handling fees during the past 3 years, storage/freight collection fees display a sharp decrease as a share of revenue after 1982.

### 3) Operating Income for Various Chilean Ports

EMPORCHI's 1983 and 1984 data from INFORM RESULTADOS ECONOMICOS include specific figures for operating revenue and the volume of cargo handled by EMPORCHI's 10 ports and the per tonnage cargo handling fee at each port. These figures are reproduced below.

Table XI-1-3 Operating Income for EMPORCHI Ports

	1983		1984	
	Value* (thousand pesos)	Share (%)	Value* (thousand pesos)	Share (%)
Antofagasta	654,196	19.2	894,689	21.1
Valparaiso	933,296	27.4	1,038,629	24.5
San Antonio	750,045	20.7	920,6167	21.7
Talcahuano-San Vicente	557,588	16.4	624,653	14.7
6 other ports	554,806	16.3	769,260	18.0
Total	3,404,931	100.0	4,247,847	100.0

Note: In terms of 1984 prices.

The four ports of Antofagasta, Valparaiso, San Antonio and Talcahuano hold an 80% share in both the total operating revenue and the total cargo tonnage handled at all ten EMPORCHI ports.

Table XI-1-4 shows the share of cargo volume handled at the EMPORCHI ports.

Table XI-1-4 Volume of Cargo Handled by EMPORCHI Ports

	1983		1984	
	Volume (tons)	Share (%)	Volume (tons)	Share (%)
Antofagasta	1,345,993	16.2	1,728,104	18.8
Valparaiso	1,537,521	18.5	1,664,730	18.1
San Antonio	2,216,014	26.7	2,343,332	25.5
Talcahuano-San Vicente	1,821,539	21.9	1,858,478	20.2
6 other ports	1,381,097	16.7	1,587,186	17.4
Total	8,302,164	100.0	9,181,830	100.0

Reference to Table XI-1-3 and XI-1-4 shows that although the Port of Valparaiso does not handle the greatest volume of cargo, it does generate the highest operating income of all the EMPORCHI ports. The Port of San Antonio, on the other hand, handles the greatest volume of cargo, but in terms of operating income it is placed after Valparaiso. This is attributable to the fact that the share of different cargoes handled at each port differs.

Income received per ton of cargo handled at the main Chilean ports, and the average value of these figures can be seen in Table XI-1-5. Together with the Port of Talcahuano, the income received per ton of cargo handled by the Port of San Antonio is below the average value for all EMPORCHI ports.

Table XI-1-5 Income per ton of Cargo Handled

(Unit: peso)

Port	1983	1984
Antofagasta	486	518
Valparaiso	607	624
San Antonio	318	393
Talcahuano-San Vicente	306	336
6 other ports	402	485
Average	410	463

## 4) Fixed Assets and Annual Capital Investment

Reference to a detailed statement of fixed assets, which is appended to EMPORCHI's 1984 Financial Statement, shows that EMPORCHI retained the following fixed assets on 31 December, 1984. Total fixed assets before deduction of accumulated depreciation stood at 34,384 million pesos, and after deduction at 29,077 million pesos.

Roughly 73% of this figure, 21,199 million pesos, can be attributed to expenditure on breakwater structures, wharves and infrastructures. The remainder is related to expenditure on land, warehouses, buildings, cranes and other machinery and equipment.

The distribution of the above-mentioned fixed assets at each of the various EMPORCHI ports can be seen in Table XI-1-6. The total number of berths for all 10 ports is 52. The average balance of fixed assets per berth is evaluated at roughly 640 million pesos.

Table XI-1-6 Fixed Assets

(Unit: million pesos)

Port	Balance of Fixed Assets*
Arica	4,328
Iquique	2,934
Antofagasta	5,926
Coquimbo	831
Valparaiso	6,490
San Antonio	5,899
Talcahuano-San Vicente	4,415
Puerto Montt	1,642
Chacabuco	241
Punta Arenas	572
Total	33,278

Note: After deduction of accumulated depreciation

Reference to the Statements of Sources and Uses of Funds in EMPORCHI's 1983 and 1984 Financial Statements shows that for the three years starting in 1982, the amount of capital investment (based on 1984 prices) was 438, 228 and 502 million pesos, respectively.

A large part of annual capital investment expenditure is aimed at the renewal of existing facilities. The remaining amount would not even cover the cost of constructing one new berth.

## XI-2 Present Activities at Valparaiso Port and San Antonio Port

Valparaiso Port and San Antonio Port have different characteristics, judging from the kind and income received per ton of cargo handled at the ports.

Valparaiso Port is a historic port, and about 500 thousand people live in the immediate hinterland. There is a substantial accumulation of commerce, government organizations and port-related enterprises at Valparaiso.

### (1) The Role of the Public and Private Sectors at the Ports.

Law No. 18042 created a National Port Committee to establish a new semi-governmental, self-supporting port corporation to take the place of EMPORCHI. However, this law has not been implemented because some authorities concerned, including EMPORCHI, have stated their opposition to the law. For some years, cargo handling operations at the subject ports have been changing. The private sector has been able to participate in cargo handling operations at the ports of Valparaiso and San Antonio since 1982. At present, the private sector conducts all cargo handling operations at San Antonio Port. Only the operation of the transit sheds at Valparaiso Port is currently conducted by EMPORCHI. Thus, the private sector now plays the dominant role in cargo handling at the ports.

Table XI-2-1 outlines the roles of the private and public sectors at the ports as concerns the flow of cargo and vessels.

Table XI-2-1 Outline of Port Activities for Ship and Cargo Flow

	Name of Sector	Contents of activities	Approaching Undocking	Berthing (ship)	Apron	Transit shed	To and from transit shed	Remarks
Public	Customs	Inspection	○	○				
		Customs procedure				○		This is conducted even outside transit shed
	*1 S.A.G.	Quarantine			○			Export of fruits
	Directemar	Entrance notice	○	○				
		Clearance notice						
		Navigation control	○					
	EMPORCHI	Pilotage	○					
		Berth designation	○					
		Management of berths		○				
		Management of transit sheds				○		
Cargo handling and storage					○		Only Valparaiso Port	
		Oil supply, Water supply		○				
Private	*2 Stevedore companies	Cargo handling		○	○	○	○	
		Storage				○		
	Stevedore companies							
		Tugboats	○					Valparaiso Port has 6 tugboats from 670 HP to 3,200 HP.
		Line handling		○				
	Shipping agents, Customs clearance agents	Tally and weighing		○	○	○		Conduct between three places.
Vicarious execution of customs clearance						○		

○ mark shows the stage and location where the activity is mainly performed.

\*1: Servicio Agrico Gauadero (in charge of vegetable sanitation).

\*2: Saam, Agunsa and Ulutramar are the main stevedore companies

(2) Operations

1) Working Hours

Port working hours and pilotage hours are 24 hours a day. There are no restrictions on night navigation.

Office hours of EMPORCHI are as follows:

Ship control	:	Daily, first shift:	8:00 - 15:30
		second shift:	15:30 - 23:00
		third shift:	23:00 - 6:30
Operational	:	Daily	8:00 - 15:30
			15:30 - 23:00
Administrative	:	Monday - Friday:	8:00 - 17:15

2) Cargo Handling Operations

An outline of the main cargo handling operations at the subject ports is presented below.

(i) San Antonio Port

Imported wheat is discharged directly from ships to trains and trucks on the quaywall apron using pneumatic unloader with a hopper and a glove bucket. Exported copper is loaded onto ships using a glove bucket and pallets after being stocked in open storage areas and warehouses.

(ii) Valparaiso Port

Fruit for export is discharged directly from trucks on the quaywall apron onto ships using pallets.

Containers are handled using ship cranes and a level-luffing multipurpose crane (This is owned by the private sector). The container handling area is divided into two distinct areas: the loading yard and the unloading yard. All the container loading is conducted by private firms, all the way from the loading area to on board the ship. As for unloading, however, private firms can presently only carry the containers from on board the ship to the



edge of the unloading yard. Handling of containers within the unloading yard is carried out by EMPORCHI.

### 3) Formation of gangs and average cargo handling rate

Handling of break-bulk cargo is generally conducted by two or three gangs, with an average of 12 longshoremen in each gang, that is 1 tally man, 1 foreman, 1 signalman, 1 winch man, 1 forklift truck operator and 7 stevedores, using ship cranes and/or cargo handling equipment which is provided by EMPORCHI and the private sector. Average cargo volume handled per gang per hour is as follows:

① Break bulk cargo	13 - 15 tons/hr
② Container cargo (conventional ships)	5 boxes/hr
(container ships)	15 boxes/hr
③ Fruit cargo	2,400 boxes/hr (about 30 tons/hr)
④ Copper cargo	90 tons/hr
⑤ Wheat cargo	90 tons/hr

### (3) Administrative and Operational Problems

The following analysis of present administrative and operational problems which impede the smooth flow of port cargoes, including organizational problems, is based on site surveys, analysis of data, and interviews with port officials and port users. The problems fall into two main categories, as follows:

#### 1) Problems Concerning the Institutional Structure

##### (i) About law No. 18042

o As law No. 18042 has been passed but not implemented, the legal status of the port administration is not clear.

o If the ports administration and operations fall into private hands, the port in Chile may be monopolized by a strong private sector as these ports are relatively small compared with the ports in Europe and America.

- o. This law seems to have been issued without sufficient prior research.
- (ii) Separate management bodies are responsible for the sea areas and the land areas of the ports. This impedes comprehensive port administration.
  - (iii) The port administration and operations are very complicated because there are many organs involved including EMPORCHI, the Navy, NOP, MIT and the Office of National Planning, and there is no one organ responsible for the overall management of the ports.
  - (iv) According to the customs regulations, carriers must deliver cargo to EMPORCHI within 24 hours of the ship's departure in the case of unloading. The C.F.S. facilities are inadequate and is not easy to carry out this operation as there is a large volume of L.C.L. each day. Furthermore, there are many customs regulations for the inspection of import goods and so on.
  - (v) Office procedures concerned with cargo handling are complicated and the customs and S.A.G. examinations are not coordinated.
  - (vi) Most of the cargo handling at the ports is now operated by the private sector, but this is still partially limited. Private firms would like to operate all cargo handling at the ports.
  - (vii) In the past, all firms paying \$240 (U.S.) to DIRECTEMAR were permitted to engage in cargo handling operations. Current cargo handling charges are somewhat confused. As a law was passed in December 1985 requiring licensing of all stevedore companies, the private sector expects that cargo handling operations will be performed effectively.
  - (viii) As the stevedore wage system has changed from piece work, so much per ton of a given commodity, to time payment, so much per man per shift, there is no longer any economic incentive to promote efficiency.

## 2) Problems Concerning Infrastructures and Equipment

- (i) S.A.G. control is carried out before the loaded trucks come alongside the ship, and this regulates the flow of cargoes to be shipped. The quaywall apron on which the palletized fruit is placed is a little too narrow for efficient cargo handling. As there are no refrigerated transit sheds or warehouses, the trucks and ships are forced to wait.
- (ii) Though the private sector wants to use a large transfer crane on the apron at Valparaiso Port, EMPORCHI has not yet granted the requisite permission. Also, the area where the top lifter for containers is operated is too small.
- (iii) There is a shortage of large handling equipment including equipment to handle containers, and the container yard is too small.
- (iv) Berth use is not properly specialized.
- (v) Dredging is sometimes performed to maintain the depth of the berths. However, the maintenance dredging is not being performed adequately. The berths are not being dredged uniformly to a sufficient depth, and this impedes the use of the berths by large vessels.
- (vi) Fruit cargo trucks on the road to Valparaiso Port are sometimes forced to run at night because the roads are crowded in the summer season. As existing roads in Valparaiso city are narrow, new access roads which do not pass through urban districts are needed. On the other hand, parts of the roads to San Antonio Port are not wide enough, and many of the roads from the fifth and sixth regions are not paved.
- (vii) The railway facilities are old and the trains occasionally derail. Cargo handling is inefficient because it sometimes takes about one week for trains to shuttle between Santiago and the ports.

- (viii) There do not seem to be sufficient facilities, systematic training and drilling to respond to earthquakes and fires.

### XI-3 Proposals

#### (1) Proposals for Management and Operations

Considering the current problems at the port based upon site surveys and analysis of data, various proposals are presented below to improve the port administration and operations in the future. The analysis is limited to the main problems at the ports.

##### 1) Form of Port Management

As mentioned at the beginning of this chapter, port administration and operation systems vary greatly from country to country and from port to port.

The following are the main types of port administrative systems.

- ① The central government administers the ports directly.
- ② The ports are administered directly by the local government.
- ③ The ports are administered by an independent public agency.

In the case of Japan, historically ports developed rapidly using national funds based on a national policy to promote international trade for economic growth. At present, Japanese ports are generally administered by system ② above, that is they are administered directly by local (city or provincial) government bodies.

The ports in Chile have been classified as national ports, specialized ports, private ports and other ports. Thus, in Chile a progressive port administrative form has already been established. As mentioned before, a law which place those national ports which are presently administered by EMPORCHI under the control of the private sector was passed in 1981. However, this law has not been implemented. Placing these ports under private administration would bring quick changes to the present port administration and operations systems. When deciding the best form for port administration in Chile, the following aspects have to be considered.

- ① The historic background of port development in Chile.
- ② The ports currently administered by EMPORCHI are relatively small compared with the ports in Europe and America, and there are many large and small traders who make use of the ports.
- ③ The cargoes which are being handled at these ports include a wide variety of public cargoes.
- ④ The main ports which are important to the national economy should probably be administered by an independent public body under the supervision of the central government.
- ⑤ The private sector now plays the dominant role in cargo handling at the ports (Valparaiso and San Antonio Ports), and cargo handling efficiency seems to be pretty good.

Overall, we conclude that in Chile it seems preferable that at present the main national ports continue to be administered by a public government agency like the current EMPORCHI (not EMPORCHI as defined in Decree No. 290), although these ports may possibly be placed under private administration at some time in the future.

## 2) Form of Port Operations

Cargo unloading operations can be divided into four parts as follows:

- ① Cargo handling within ships' holds
- ② Unloading cargoes from ships to the quaywall apron
- ③ Transporting cargoes from the quaywall apron to the storage yard
- ④ Delivery of cargoes from the storage yard to trucks and trains.

Similarly, loading cargoes onto vessels involves the same 4 steps (in reverse). Efficient cargo handling operations are crucial to the overall smooth functioning of each port.

Another important aspect of port administration and operations is whether these cargo handling operations are carried out by the administrative body itself or by the private sector. There are advantages and disadvantages to both systems.

If the port administrative body is directly responsible for cargo handling operations, the handling operations will tend to be unified and orderly. However, when cargo handling operations are carried out by the administrative body directly, there is no free competition and this could result in less efficient operations. Furthermore, the administrative body may tend to attempt to increase overall revenues by applying a relatively expensive tariff for cargo handling. Finally, as the administrative body is a public organization, there may be certain limitations in its charter which would restrict the scope of its operations.

On the other hand, if the cargo handling operations are carried out by the private sector, there would probably be no major limitations on the operations which the private firms could engage in. The main advantage of private sector operations is free competition which tends to result in more efficient cargo handling and less cargo damage.

On the whole, it seems that cargo handling operations are probably best left to the private sector. As mentioned above, the private sector already plays an active role in port operations in Chile.

Of course, the port administrative body would still retain the overall administrative control of the cargo handling works as at present, but it would be better for the private sector to carry out the actual cargo handling works.

### 3) Control of the Entire Port Area

For smooth port operations, it is essential that one body (the port administrative body) retain primary administrative control over all the major port operations including the management of the flow of vessels and cargoes, pilotage operations and port maintenance. Ideally, one body should be responsible for all the wharves, sea areas and on-land facilities. Especially, if the port management body does not have control over all the undeveloped areas within the port, it is virtually impossible to design efficient plans for future port expansion.

Naturally, there are certain operations such as customs, health inspection, navigation control and so on which must be executed by the local representatives of various ministries and departments of the central government.

Concerning these special operations, the port administrative body must still take the responsibility to ensure close cooperation among the related

agencies. Essentially, the administrative body is responsible for the smooth flow of information, for proper scheduling and for allocating space as necessary.

The central point is that for smooth port operations, the entire port including both sea and land areas must be considered as an organic whole. Dividing the management of the port up into separate sections is generally inefficient: it tends to hinder both regular port operations and port development projects.

In Chile, the administration of main national ports is currently undertaken by two bodies: EMPORCHI and the Chilean Navy. The Navy is responsible for sea areas, and EMPORCHI is responsible for all other port activities. As noted above, this situation may not be ideal.

For national security, the Navy may have to retain control over certain sea areas nearby major ports. However, if possible, EMPORCHI should be given some control over the sea areas. Specifically, EMPORCHI should be given administrative responsibility for the following sea areas:

- ① Water areas used for the construction and maintenance of port facilities.
- ② Water areas where the weather and sea conditions directly influence port operations.
- ③ Water areas where navigation, anchorage, handling and other operations related to the port are conducted frequently.
- ④ Water areas where flotage which may interfere with safe navigation needs to be cleaned to ensure smooth port operations, and other areas which need to be administered to prevent pollution at the port.
- ⑤ Areas related to reclamation and dredging works in and around the port.

Thus, in general, the port administrative body should be responsible for all the water areas in the immediate vicinity of the port and for the major shipping lanes leading into the port.

#### 4) The Importance of Port Statistics

Accurate port statistics are essential for both regular port operations and long-term port planning. Statistics concerning ship traffic and cargo handling volume are particularly important.

Without accurate statistics, it is impossible to know the actual state of operations at the port. Of course, some statistics are being kept, but the following items should be recorded accurately to facilitate efficient port operations and good long-term planning.

- ① Entrance ship -----
  - by month and tonnage class
  - by year and tonnage class
  - by route and tonnage class
- ② Entrance and -----  
exit cargoes
  - by item and kind\*
  - by liner route and kind
  - by destination and origin\*

\*Note: Ideally, these classifications should be quite precise. If the classified groups are too large or vague, the statistics are of limited value.

  - by container vessel route
  - by containerized cargo route and kind
- ③ Handling conditions--  
of the mother ship
  - by facilities

#### 5) Improvement of Relations with Persons and Organizations Concerned with Port Activities

To promote port activities, the port administration body should keep close contacts with governmental officials, local entrepreneurs, transportation companies, local inhabitants, and other individuals and groups concerned with the activities of the port.

Periodic meetings should be held with all the parties concerned. This will make the port more responsive to the needs of its users, and help promote the growth of the port.



## 6) Maintenance

A reduction in the number of handling machines due to mechanical troubles will directly reduce working capacity, resulting in lower efficiency of overall operating work. Thus, maintenance and repair work must be sufficient. In particular, inspection and maintenance work for preventing trouble in advance should be conducted: maintenance inspections should take place regularly. For this purpose, it is necessary to maintain a sufficient mechanical staff, to establish a training program, to ensure proper supplies and to arrange facilities for the orderly storage of mechanical parts.

## 7) Introduction of a Computer System for the Administration of the ports

The bigger Japanese ports each control a large variety and number of port infrastructures and equipment such as wharves, transit sheds, and cargo handling machinery. In order to efficiently administer these large-scale ports, computers are widely used. Through the computers, the port managers have access to a large volume of timely data which they can use for making decisions concerning the flow of vessels and cargo. This results in more efficient use of the port facilities and better service for port users.

In Chile, along with the future growth of cargo throughput, it may also be appropriate to introduce a computer system to help with the administration of the ports. To give a rough idea of the ways in which such a system might be used, below is an outline of the main ways in which computers are currently used at major Japanese ports.

### (1) To control the entrance and exit of vessels

The computer system is used to record data concerning the movement of vessels and to prepare berthing schedule based on information supplied by shipping companies or agents.

### (2) To control the use of public facilities

Based on data supplied by shipping companies and timely data on current and planned conditions, the computer is used to produce schedules for the use of various public facilities including transit sheds and cargo handling yards.

(3) To collect port tariffs

The computer is used to compute charges, print bills, and generally keep track of accounts receivable and income from port tariffs.

(4) To record statistical data

The computer can be used to keep track of the historical flow of cargo and vessels and of other statistical data which, as noted above, is necessary for proper port operations and planning.

(2) Proposed Operating System

Judging from the site surveys and the analysis of data from both of the ports, the cargo handling system for general cargoes and bulk cargoes like wheat and copper is already mechanized, and the handling efficiency seems to be relatively good. The average cargo volume handled per gang per hour in Chile (actual and future) and in Japan are shown in Table XI-3-1.

However, the container cargo volume in Chile is currently small and the related port facilities such as container yards, gantry cranes and C.F.S. are not sufficient. In the future, the throughput of containerized cargoes will increase substantially and an improved handling system for containers like the one proposed below will have to be implemented.

Finally, the necessity of a refrigerated transit shed for exported fruit is considered.

Table XI-3-1 Average Cargo Volume Handled per Gang per Hour

Type of Cargo	Chile		Japan Actual	Remarks
	Actual	Future		
General Cargo	13 - 15 t	20 t	20t	
	Wharf crane or ship gear	Mobile crane or ship gear	Mobile crane or ship gear	
Container	12 - 15 boxes	25 boxes	25 boxes	
	Container gantry crane, 50 t mobile crane	Container gantry crane	Container gantry crane	
Wheat	90 t	90 t	(*1)	(*1)
	Pneumatic unloader, ship gear	Pneumatic unloader, ship gear		This varies depending on the efficiency of the pneumatic unloader (handling volume/unit time)
Fruit	30 t	30 t	(*2) 55 t	(*2) The handling is unloading ... ship → quaywall apron → refrigerated transit shed
	Wharf crane, ship gear	Mobile crane, ship gear	Wharf crane, ship gear	
Copper	90 t	90 t	(*3) 65 - 115 t	(*3) loading and unloading of steel
	Wharf crane, ship gear	Mobile crane, ship gear	Wharf and mobile cranes, ship gear	

Note: The figures given in the table are in metric tons (t)

## 1) Container Cargo Operations

### (i) Administrative structure

To accommodate a large number of containers and full container ships, the best management of container terminals is performed by a single organization which has enough skillful officers and workers to be able to supply full service to customers (shipping companies, shippers/consignees) from receiving containers to loading them onboard ship, or from discharging containers to delivery to the consignee.

There are two main ways to administer container terminals. Basically, the terminals can function as public terminals or as specialized terminals. Specialized terminals are basically terminals for the exclusive use of a firm or group of firms. In this case the shipping companies or terminal operators lease the terminal (the wharves, handling yards, etc.) from the port management body for a set period of time (usually 10-30 years), and then use the terminal facilities without paying any additional tariff beyond the leasing fee. At specialized terminals, the companies thus have the advantage of using the terminal without any incremental charges, and they may tend to maximize cargo handling efficiency as they directly realize all the benefits of the improved efficiency.

The specialized terminal system gives the shipping companies a great deal of freedom to choose the type of handling system and administrative system which they will use at the terminal. On the whole, this system is advantageous when one company handles a large volume of container cargoes. On the other hand, if the company only handles a small volume of containers, the leasing costs are generally prohibitive.

Under the public terminal system, the terminal facilities are usually managed directly by the port management body. The terminal is used on a public basis by all shipping companies, and the companies pay tariffs to the administrative body for the use of wharves, yards, etc.

In the case of Chile:

- ① The number of container berths is small;
- ② There are a large number of shipping companies which use the existing facilities at both of the ports; and
- ③ Containerization is still in its first stage with a relatively small volume of containerized cargo.

Thus, it would seem that the public terminal system would be preferable for the administration of the container terminal at the ports.

At any rate, the port management body should consult with present and future users of the terminal facilities (shipping companies, etc.) when determining the proper administrative system for the container terminals.

#### (ii) Operation of Container Terminals

Efficiency of operation and quality of the terminal service are governed by the selection of the container handling method and the kinds and numbers of equipment assembled at the container terminal.

Container handling methods in general use are classified by the handling equipment used such as the chassis system, the straddle carrier system and the transfer crane system. In the chassis system, each container is placed on a chassis and stored in the container yard. In the two other systems, containers are stacked in the container yard in layers, 3 layers maximum using a straddle carrier and normally 5 layers using a transfer crane, which facilitates the efficient use of the land area.

There are some other stacking machines for containers such as forklifts and side loaders (side forklifts), but they are mostly used as auxiliary equipment for terminal container handling.

The chassis system has the best handling efficiency among the three systems and results in the least damage to containers as the actual handling is kept to a minimum. There is no need to pave the yard heavily under this system. However, this system requires a large terminal land area, a large number of chassis and high

initial investment since the containers are stored in a single layer.

In contrast, the straddle carrier system can make good use of limited space because the containers are stacked in the storage area. However, since the wheel load of the straddle carrier is about ten tons and the carrier runs all over the yard, the entire terminal area has to be paved heavily, requiring an additional investment.

The transfer crane system has the highest storage capacity of the three systems. The running cost including maintenance is cheaper than for the straddle carrier system. However, the service areas (spots for receiving and delivering containers) are not fixed, and when delivering containers, more time is required than under the other systems because of the multi-stage shipment.

The selection of the best operation system for each container terminal has to be performed carefully considering the geographical conditions of the terminal as well as the flow of vessels and container cargoes. Each of the three main systems has advantages and disadvantages.

At the subject ports, there is a relatively large volume of L.C.L. cargoes and empty containers, and considering the available land area, the storage capacity, the estimated cargo throughput and other relevant factors, it seems that the transfer crane system would be most appropriate for the subject ports. Especially, there are relatively few mechanical difficulties under the transfer crane system.

(iii) Construction of Container Terminals and Container Handling Equipment

Construction of container terminals is divided into two parts:

1) the public works such as the preparation of the wharves (including gantry cranes), the reclamation of land and the pavement of yards, and 2) the works related to port operations such as the preparation of cargo handling equipment, etc. It is proposed that EMPORCHI should provide the necessary minimum facilities, that is the public works, and that the users should provide the necessary handling equipment for port operations themselves.

Various kinds of container handling equipment must be combined functionally in order to effectively carry out the terminal work of loading/unloading, storing and receiving/delivering a large number of containers. The kinds and numbers of equipment must be selected and determined in consideration of the specifications, working efficiency and capacity of each piece of equipment.

The average quantities of required main equipment are shown in Table XI-3-2 based on the conditions at terminals using the transfer crane system in Japan.

Table XI-3-2 Cargo Handling Equipment for Container Cargo per Berth

Equipment	Capacity	Number of Machines
Container Gantry Cranes	30.5 t	2
Transfer Cranes	30.5 t	5
Container Chassis	20', 40'	12 - 18
Trailer Head		6

(iv) Management of the Terminal

The number and functions of workers which will be required to effectively perform the container terminal operations depends on various factors such as regulations related to labor, employment agreements between laborers and employers, and work schedules as well as the ability of each worker at the ports in Chile. It is difficult to predict the number and type of workers required. The roles of workers in container terminals in Japan are described below for reference.

① Operations management department

Ship planner: Preparation and execution of ship loading/unloading plan

Yard planner: Preparation and execution of container yard plan

Radio operator: Communicating and giving instructions for work to be performed to drivers of container handling equipment in accordance with the containers yard plan and the ship plan.

Gate clerk: Receiving and delivering of containers at the gate and necessary documentation work.

Documentation/accounting clerk:

Preparation and issuing of necessary documents, and receiving of payment for work done.

Maintenance engineer:

Inspection, maintenance and repair of containers and handling equipment

② Operations department

Operators of container cranes, transfer cranes, yard tractors, etc.

Gate checker: Inspection of containers upon receiving or delivery at the gate

Worker on ship: Lashing and unlashng of containers on ship

③ Container freight station (CFS) department

Clerk: Preparing and issuing documents for cargo receiving and delivery, and preparation of plans for loading cargo into containers.

Worker and forklift operator:

Stuffing/unstuffing cargo to/from containers, and receiving cargo from and delivering cargo to trucks.

Tallying man: Tallying and checking during cargo stuffing and unstuffing and during cargo receiving and delivery.

2) Fruit Cargo Operations

The flow of exported fruit cargo as now conducted at the ports is as follows.

Control by S.A.G. ----> Transportation to quaywall apron by trucks ---->  
Discharging directly from trucks to ships.



In the case of direct delivery systems like this, S.A.G. control may interfere with the smooth cargo flow, and the direct delivery method does not provide efficient cargo handling since the buffer function of transit sheds is not effectively utilized.

If transit sheds are provided with appropriate refrigeration equipment, the following benefits may be expected:

- ① Improved handling efficiency
- ② Ships can load and unload cargo smoothly without waiting
- ③ Since the trucks which carry fruit cargo will not concentrate at the ports at one time, traffic congestion on the access road will ease up.
- ④ The time the trucks remain in the ports will decrease.
- ⑤ S.A.G. control will not directly interfere with the smooth cargo flow.

Below, we attempt to roughly estimate the appropriate storage tariff for the refrigerated transit shed.

(i) Rough Estimation of the Refrigerated Transit Shed Tariff

i) Fruit Cargo Refrigerated Transit Shed

In 2010, the volume of fruit cargoes at the port of Valparaiso is 597 thousand tons and the volume of cargoes passing through transit sheds is 298 thousand tons, about half of the 597 thousand tons total. Fruit cargoes are mainly handled during half the year from November to May.

The necessary area of transit sheds is determined by the following formula:

$$A = \frac{N}{R\alpha W}$$

A: Necessary area of transit sheds ( $m^2$ )

N: Annual volume of cargoes handled: 298 thousand tons

$\alpha$ : Utilization rate: 0.6

R: Turnover of transit sheds: 24 times a year

W: Volume of cargoes per unit area:  $1 t/m^2$

Table XI-3-3 shows the necessary size of the transit sheds.

Table XI-3-3 Required Area of Transit Sheds

Volume of cargo handled N (thousand tons)	Annual storage volume RoW (tons/m <sup>2</sup> )	Required area N/RoW (m <sup>2</sup> )
298	14.4	20,000

## ii) Estimation

The transit sheds will be two storey reinforced concrete buildings constructed on 10,000 m<sup>2</sup> lots. The construction costs are estimated as follows.

① Transit shed	3,430,000 thousand pesos
② Electric equipment	2,920,000
③ Refrigeration equipment	2,040,000
<u>Total</u>	<u>8,390,000</u>

The appropriate refrigerated transit shed tariff roughly estimated on the basis of these costs is shown in Table XI-3-4.

As a result of this estimation, it seems that the construction cost of the refrigerated transit sheds is pretty expensive, and the cost per ton of cargo handled, 3,450 pesos/tons, will significantly affect the transportation cost.

However, since the construction of such sheds would provide many benefits as noted above, we believe that the sheds probably should be constructed, but the decision should be made based on an economic analysis which would analyze the economic costs and economic benefits of the proposed construction from the viewpoint of the national economy, and through detailed discussions with the future users of the facilities.

Table XI-3-4 Appropriate Refrigerated Transit Shed Tariff

Unit: thousand pesos

Number	Items	Amount	Details
1	Management cost	2,880	
	° personnel cost	1,440	2 workers x 60,000 pesos/month x 12 months
	° operation cost	1,440	
2	Maintenance cost	83,900	8,390,000 thousand pesos x 1 percent
3	Depreciation cost	308,020	basis cost x (1-residual ratio) x 1/(the life of the machine)
	° transit sheds	102,900	3,430,000 thousand pesos x (1-0.9) x 1/30 years
	° electric equipment	105,120	2,920,000 thousand pesos x (1-0.9) x 1/25 years
	° refrigeration equipment	100,000	2,040,000 thousand pesos x (1-0.9) x 1/17 years
4	Electricity cost	120,000	1,000 thousand KW x 10 pesos x 12 month
5	Interest	499,205	principal and interest equal repayment system... interest ... 9 percent, term ... 20 years
6	Land rent	13,500	total area of facilities x rent of wharf area: 10,000 m <sup>2</sup> x (250 US\$/m <sup>2</sup> x 180 pesos x $\frac{2.5}{1000}$ x 12 months)
	Total	1,027,505	
Cost per ton of cargo		3,450 pesos/ton	1,027,505 thousand pesos ÷ 298,000 tons



## CHAPTER XII ECONOMIC ANALYSIS



## CHAPTER XII ECONOMIC ANALYSIS

### XII-1 Objectives

The volume of container cargoes handled at the two ports of Valparaiso and San Antonio is expected to grow at an average annual rate of 8.6% until the year 2010, constituting nearly half (46%) of the total cargoes at the two ports in that year. As the two ports share a common hinterland, the port development plans of the two ports will have a strong influence on the future distribution of cargoes between the two ports.

While the two ports are in a region prone to earthquake activity, it was found through the survey that the design of present port facilities does not give sufficient consideration to the potential for earthquake-related destruction. The early construction of new port facilities should be encouraged as a means to avoid a halt in port services caused by possible future earthquakes.

With these considerations in mind, analyses are performed in this chapter with three major objectives:

- ① To establish standards for evaluating from an economic viewpoint the three alternative plans outlined in VII-2, Allotment of Container Berths Between the Two Ports, to meet expected container cargo handling requirements.
- ② To consider from an economic viewpoint the optimal number of aseismic berths to be constructed in the near future.
- ③ To evaluate whether or not the execution of the entire Master Plan can be justified from an economic standpoint given the risk of earthquakes.

Furthermore, in response to a request by the Chilean counterpart, additional analysis is performed in the last part of this chapter to evaluate the Master Plan without consideration given to the occurrence of earthquake.

## XII-2 Determination of the Preferred Alternative Plan

### (1) Methodology

Of the three alternative plans outlined in Chapter VII, the optimal plan is to be determined using the least cost method.

The reasons this method has been chosen are as follows:

- ① Although it is normally a prerequisite to set up a "Without" case in order to apply a cost/benefit analysis, it is difficult to set up such a case for this project, given the risk of an earthquake which may cause severe damage to the port facilities at the two ports.
- ② Port facilities in all three alternatives are designed to meet the same cargo demand until 2010 and thus it is assumed that the effect of the project would be the same under all three alternatives.

Under this method of analysis, the total costs of undertaking each plan in each year until 2010 are estimated, and the present value of these costs are to be calculated and compared using an annual discount ratio of 12% as recommended by ODEPLAN.

The cost of land transportation is included in addition to port-related costs in the determination of total costs for this analysis. Although the same total tonnage of containerized cargoes are forecast under the three alternative plans, the decision to route cargo through a specified port affects the cost of transportation to and from the hinterland even when the same means of transportation is utilized. Moreover, it is conceivable that the means of overland cargo transportation will be determined by the choice of port.

Port costs have been estimated in four major categories: construction, ship waiting, cargo handling, and maintenance and administration. The three alternatives differ in the number of berths to be constructed at each of the two ports of Valparaiso and San Antonio. The number of container berths and the total containerized cargo demand forecast for the two ports in the year 2010 are given in Table XII-2-1.



Table XII-2-1 Alternative Plans

	Items	Valparaiso	San Antonio	Total
Alternative 1	Number of Container Berths	3	1 *	4
	Cargo demand ('000 tons)	3,084	551	3,635
Alternative 2	Number of Container Berths	2	2	4
	Cargo demand ('000 tons)	1,818	1,818	3,636
Alternative 3	Number of Container Berths	1 *	3	4
	Cargo demand ('000 tons)	551	3,084	3,635

\*: Multi-purpose berth

(2) Assumptions

1) Cargo demand

Non-containerized cargo demand is assumed to remain the same at the two ports under all three alternatives. The cargo demand by cargo type under each alternative is given below for the two ports.

Table XII-2-2 Cargo Demand

## (a) Port of Valparaiso

(Unit: '000 tons/year)

Year		1990	1995	2000	2005	2010
Common	Fruit	523	523	532	561	597
	Copper	225	225	201	210	210
	General Cargo	539	546	630	716	768
	Sub-total	1,287	1,294	1,372	1,487	1,575
Alt. 1	Container	1,295	1,848	2,432	2,778	3,084
	Total	2,582	3,142	3,804	4,265	4,659
Alt. 2	Container	764	1,089	1,433	1,637	1,818
	Total	2,051	2,383	2,805	3,124	3,393
Alt. 3	Container	232	330	435	496	551
	Total	1,519	1,624	1,807	1,983	2,126

## (b) Port of San Antonio

Year		1990	1995	2000	2005	2010
Common	Wheat	481	472	518	629	724
	Fruit	135	139	142	149	156
	Copper	644	723	480	480	480
	General Cargo	731	764	946	1,090	1,336
	Sub-total	1,991	2,098	2,086	2,348	2,696
Alt. 1	Container	232	330	435	496	551
	Total	2,223	2,428	2,521	2,844	3,247
Alt. 2	Container	764	1,089	1,433	1,637	1,818
	Total	2,755	2,187	3,519	3,985	4,514
Alt. 3	Container	1,295	1,848	2,432	2,778	3,084
	Total	3,286	3,946	4,518	5,126	5,780

## 2) Cargo Handling Capacity

Plans for the improvement of facilities at both ports in order to meet cargo demand under the various alternatives are given in Figures VII-2-1~6. The number of berths that can be used for different types of cargo in these plans is illustrated graphically below.

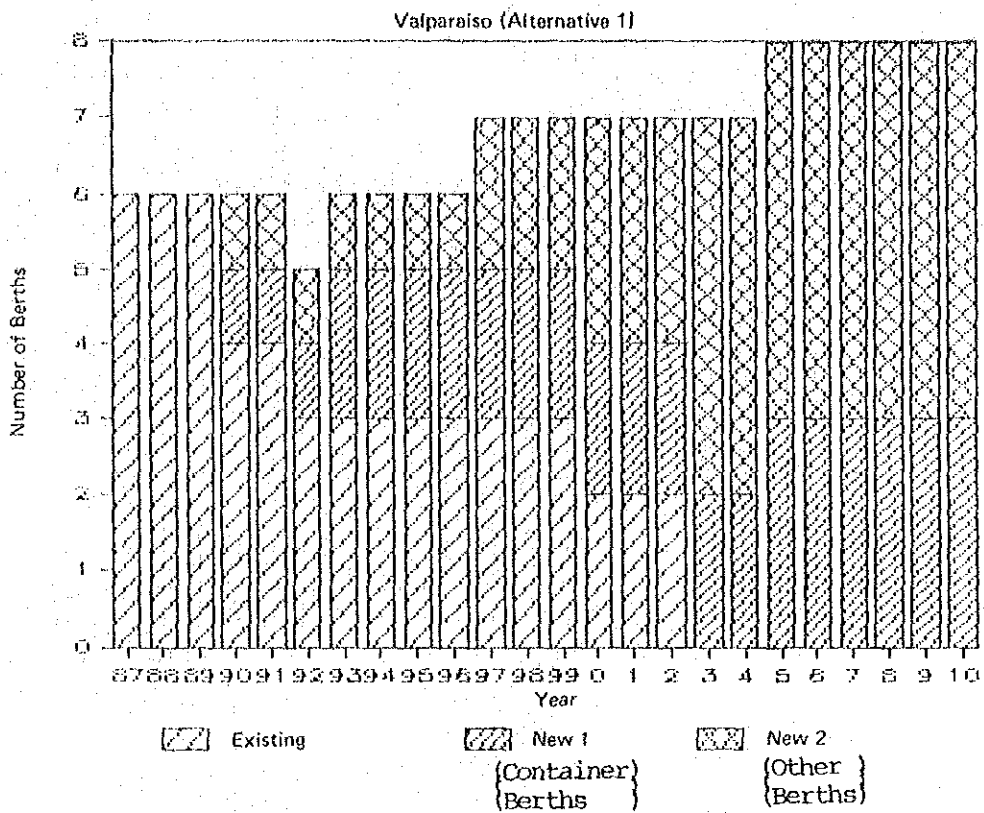


Fig. XII-2-1 Number of Available Berths

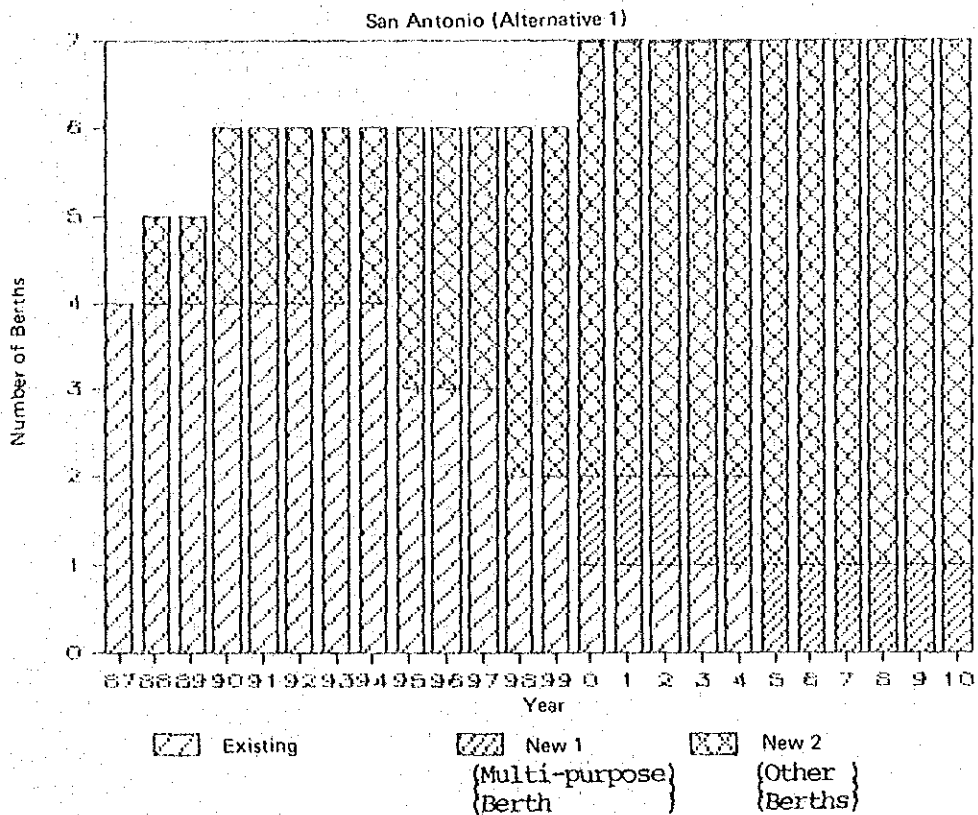


Fig. XII-2-2 Number of Available Berths

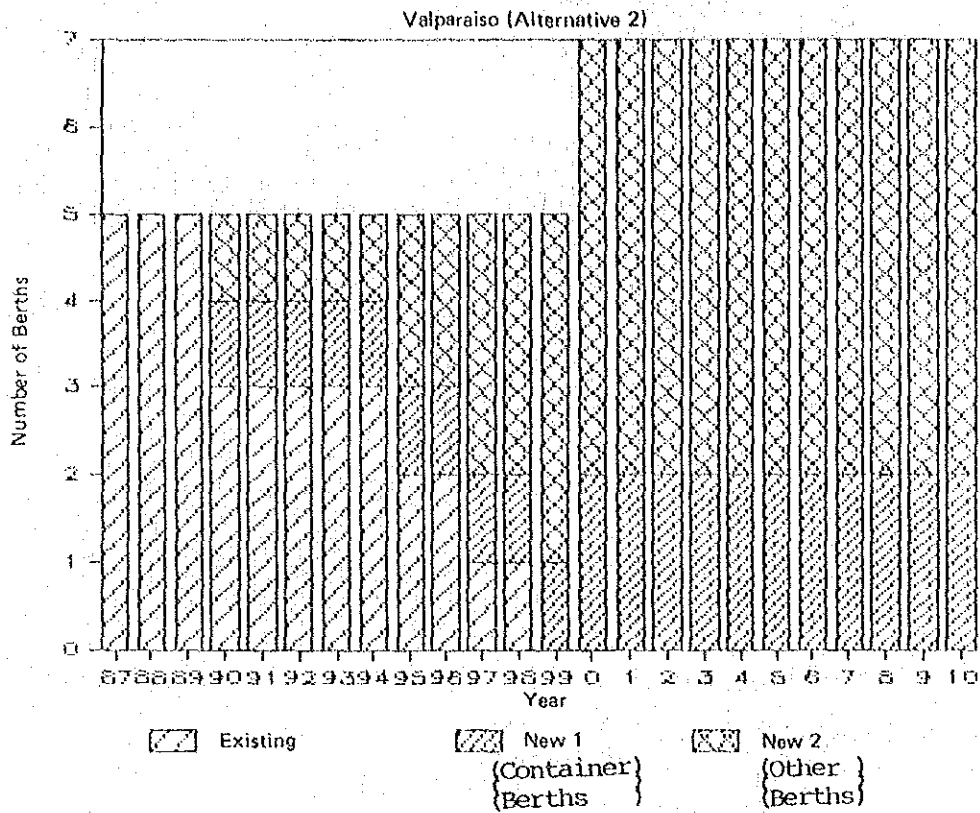


Fig. XII-2-3 Number of Available Berths

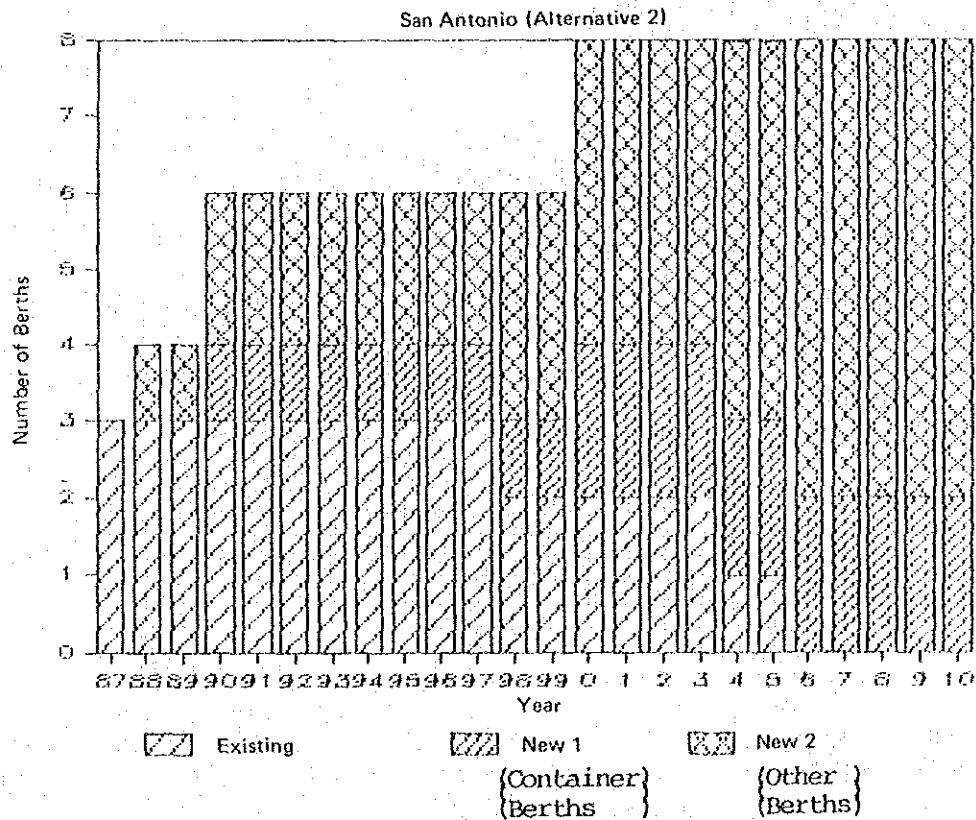


Fig. XII-2-4 Number of Available Berths

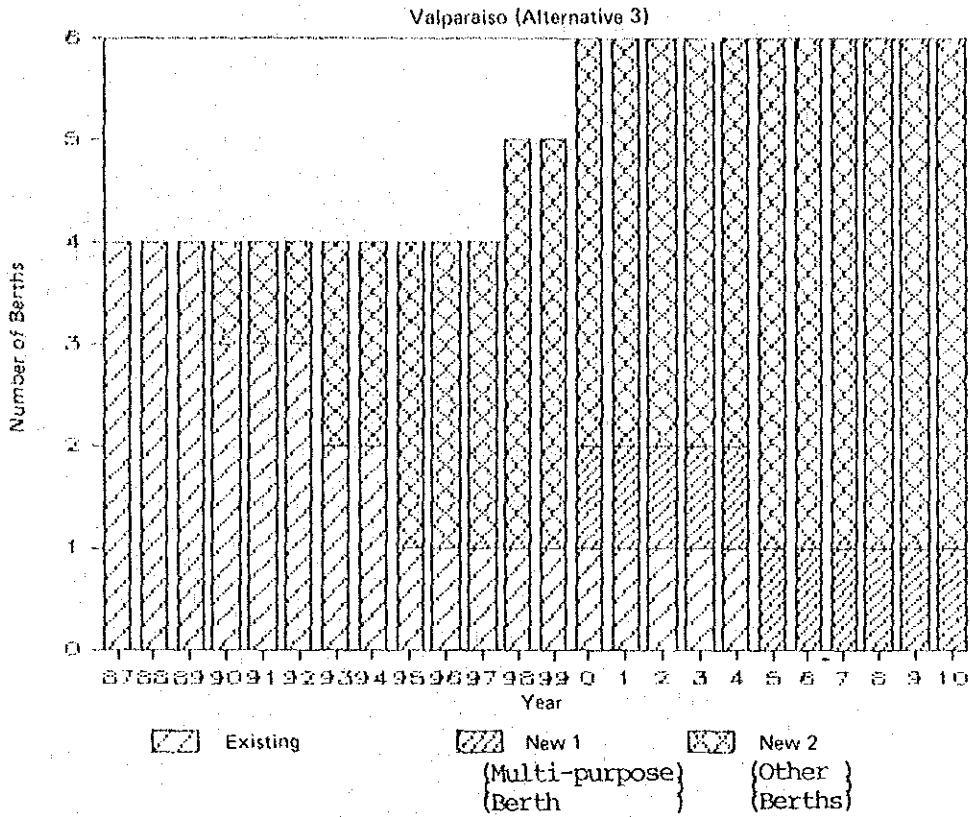


Fig. XII-2-5 Number of Available Berths

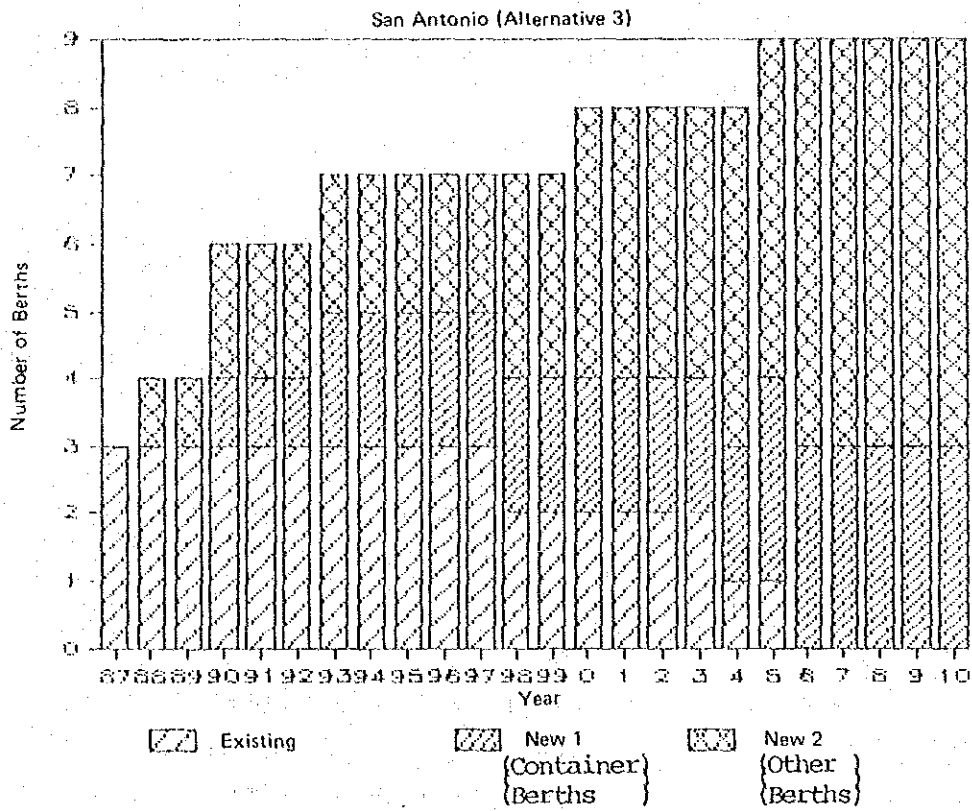


Fig. XII-2-6 Number of Available Berths

### 3) Market Price and Economic Prices

The following adjustments have been made to determine economic prices on the basis of market prices.

#### (i) Imported materials

In Chile, imported products are generally subject to import duties, value added tax, maritime freight charges and import registration fees. These various charges are applied in different manners to different products. As mentioned in VIII-6-(1)-2), Condition of Cost Estimation, the market prices for imported materials do not include import duties, and thus no adjustment is made for these market prices in this analysis except for an adjustment of the exchange rate.

#### (ii) Labor costs

Personal income taxes in Chile in 1985 progressed in eight stages from a low of 0% to a high of 56%. Estimating that the average tax rate of persons related to the port project is 10%, economic labor costs are calculated to be 90% of wages.

#### (iii) Domestic materials costs

Domestically obtained materials are subject to a 20% value added tax. The economic cost of domestically obtained materials is assumed to be 15% less than the market price considering the recovery, to a certain degree, of such tax.

#### (iv) Skilled and unskilled workers

Of the workers in the port construction works, it is estimated that 50% will be unskilled. The economic price of this labor is estimated to be 50% of the market price, as recommended by ODEPLAN. The market price of unskilled laborers is assumed to be 70% of that of skilled ones.

#### (v) Exchange rate

The market price of imported materials has been converted into pesos using the official exchange rate of the Central Bank of Chile as of December 31, 1985 of US \$1 = Peso 180.22. In determining economic prices, this has been multiplied by a factor of 1.13 to US \$1 = Peso 200 as recommended by ODEPLAN.

(3) Costs

1) Construction Costs

Construction costs based on market prices are given for each alternative in Appendix XII-1. These costs are given in economic prices in Appendix XII-2. Conversion factors used to calculate the economic costs are given in Appendix XII-3. Construction costs for each alternative are summarized for each phase below.

Table XII-2-3 Construction Costs in Economic Prices

(Unit: Million Peso)

		Phase 1 ( '87-'92)	Phase 2 ( '93-'00)	Phase 3 ( '01-'10)	Total
Alternative 1	Valparaiso	13,584	17,003	17,955	48,542
	San Antonio	8,346	5,338	6,918	20,602
	Total	21,930	22,341	24,873	69,144
Alternative 2	Valparaiso	8,270	23,326	229	31,825
	San Antonio	21,663	13,434	9,485	44,583
	Total	29,933	36,760	9,714	76,408
Alternative 3	Valparaiso	6,768	9,040	2,844	18,651
	San Antonio	31,032	4,140	18,492	53,669
	Total	37,800	13,180	21,341	72,320

As can be seen from this table, Alternative 1 has the lowest cost of the three, followed by alternative 3 and Alternative 2. The total construction costs of Alternative 2 and 3 are higher than that of Alternative 1 by 10.5% and 4.6% respectively.

The present value of total construction costs is given below.

Table XII-2-4 Present Value of Construction Costs

(Unit: Million Pesos)

	<u>Valparaiso</u>	<u>San Antonio</u>	<u>Total</u>
Alternative 1	17,631	8,082	25,713
Alternative 2	13,541	21,334	34,875
Alternative 3	7,709	25,327	33,036

In this case, Alternative 1 is again the lowest among the three alternatives and Alternative 1 is judged to be most economical as far as the total construction costs are concerned.

## 2) Ship Waiting Costs

The costs of keeping ships waiting at each port under the three alternatives are calculated as follows.

- ① The number of berths available for respective cargo uses are determined for each year based on the total available berths listed in XII-2-(2).
- ② The number of ships that will call at the various berth in each year are then estimated. Consideration is given to the annual cargo throughput based on the demand forecast, the size of ships, and the average amount of cargo loaded by size of ship.
- ③ The time required per ship to load/unload cargo is then determined. Consideration is given here to differences in the cargo handling speed at existing and new berths.
- ④ Based upon the above data, queuing theory is used to calculate the annual number of hours that ships will wait to berth, and then the annual cost of ship waiting is determined by multiplying the waiting time by the ship cost per unit time (daily ship cost).

As the daily ship cost will differ depending upon the size of the ship, a standard ship size is assumed for each cargo type. Moreover, as the average size of such ships is forecast to continue to become larger, the size of the ships is estimated for each 5-year period until 2010.



The daily ship cost used in the calculation is given below:

Table XII-2-5 Daily Ship Cost

		'87-'90	'91-'95	'96-'00	'01-'05	'06-'10
General Cargo	Ship Size (DWT)	13,600	14,000	14,300	14,700	15,000
	Ship Cost (US\$/day)	5,200	5,300	5,400	5,500	5,600
Wheat	Ship Size (DWT)	28,000	28,500	29,000	29,500	30,000
	Ship Cost (US\$/day)	8,700	8,800	8,900	9,000	9,100
Con-tainer	Ship Size (DWT)	17,000	19,000	21,000	23,000	25,000
	Ship Cost (US\$/day)	6,000	6,500	7,000	7,500	8,000

The hours of ship waiting and the total ship waiting costs until the year 2010 are given in Appendix XII-4 for each alternative. The ship waiting costs by phase for each alternative are summarized in the following table.

Table XII-2-6 Ship Waiting Costs in Present Value

(Unit: Million Pesos)

		Phase 1 ( '87-'92)	Phase 2 ( '93-'00)	Phase 3 ( '01-'10)	Total
Alternative 1	Valparaiso	940	758	1,321	3,019
	San Antonio	1,798	1,440	1,276	4,514
	Total	2,738	2,198	2,597	7,533
Alternative 2	Valparaiso	1,371	1,559	613	3,543
	San Antonio	2,280	2,066	988	5,334
	Total	3,651	3,625	1,601	8,877
Alternative 3	Valparaiso	1,162	808	988	2,958
	San Antonio	7,102	1,586	1,780	10,468
	Total	8,264	2,394	2,768	13,426

Although the total ship waiting costs at Valparaiso Port under the three alternatives differ somewhat, the ship waiting costs at San Antonio Port under the three alternatives differ greatly. The greater the number of container berths at San Antonio, the greater the increase in total ship waiting costs. This is due to the high occupancy ratio of berths at San Antonio Port brought about by the limited number of available berths during the construction period.

The ship waiting costs of Phase 1 for Alternative 3 at San Antonio are extremely high. This is based on the assumption that the annual container cargo volumes handled at San Antonio port from 1987 to 1990 will be in the order of 0.7 million tons, 0.9 million tons, 1.1 million tons and 1.3 million tons respectively, levels which are far beyond the present container cargo volume handled at the port. If Alternative 3 is selected, it will be necessary to further investigate the allocation of container cargo handled at each port under Phase I, so that minimum total ship waiting costs can be achieved for both ports.

### 3) Cargo Handling Costs

In this section, the total cargo handling costs under each alternative are estimated. Annual cargo handling costs are estimated by commodity type for the three major commodities of the two ports (fruit, copper and wheat) and by two cargo types (non-container and container) for general cargo. The total costs are estimated based on the estimated per ton handling costs and estimated volume of each type of cargo handled annually until 2010.

Cargo handling costs include the costs involved in loading, unloading, transport and storage of cargoes in the port. Cargo handling operations are divided into two categories. One, at the apron, includes loading and unloading, and the other comprises transport between the apron and the port gate. Operation flow is also divided into two cases, one in which the cargo is moved directly from apron to gate (or vice-versa) and the other in which cargoes are temporarily stored in a storage facility and later transferred to the apron or gate. Each type of cargo may have different handling costs depending upon whether the cargo is handled directly or indirectly. This aspect is also taken into consideration in estimating the per ton handling costs.

The per ton handling costs include labor costs, machine and equipment costs which are not included in the construction costs, and the cost of materials and energy consumed by machines and equipment.

The estimated per ton handling costs are given below:

<u>Cargo Type:</u>	<u>Per Ton Handling Costs</u>	<u>Assumptions</u>
Fruit	750 pesos	1) Number of Laborers per gang : 20 2) Machines & Equipment per shift gang: Wharf crane - 1 unit forklift - 2 units 3) Handling Capacity: 225t/ shift.gang 4) Share of Direct Transport : 100%
Copper	300 pesos	1) Number of Laborers per gang : 22 2) Machines & Equipment per shift gang: Wharf crane - 1 unit forklift - 4 units trailer - 2 units 3) Handling Capacity: 675t/ shift.gang 4) Share of Direct Transport : 0%
Wheat	170 pesos	1) Number of Laborers per gang : 9 2) Machines & Equipment per shift gang: Pneumatic unloader - 1 unit 3) Handling Capacity: 675t/ shift.gang
General Cargo (non-container)	1,000 pesos	1) Number of Laborers per gang: 17(28) 2) Machines & Equipment per shift gang: Wharf crane - 1 unit forklift 2(4) units Numbers in parentheses are those for indirect transport. 3) Handling Capacity: 150t/ shift.gang 4) Share of Direct Transport : 70%
General Cargo (container)	320 pesos	1) Number of Laborers per berth: 10 <sup>4</sup> (including those at the CFS) 2) Machines & Equipment: Transfer crane - 5 units Chassis - 45 units Tractor - 10 units Forklift - 4 units 3) Other facility: CFS -1 unit 4) Handling Capacity: 1 Million tons/year

Appendix XII-5 shows calculation of per-ton cargo handling costs for each cargo type.

Annual handling cost are given in Appendix XII-6 for each alternative. Cargo handling costs in present value are given below.

Table XII-2-7 Cargo Handling Cost in Present Value

		Container	Others	Total
Alternative 1	Valparaiso	4,084	7,967	12,051
	San Antonio	773	9,156	9,929
	Total	4,857	17,123	21,980
Alternative 2	Valparaiso	2,439	7,967	10,406
	San Antonio	2,418	9,156	11,574
	Total	4,857	17,123	21,980
Alternative 3	Valparaiso	794	7,969	8,761
	San Antonio	4,063	9,156	13,219
	Total	4,857	17,123	21,980

#### 4) Maintenance and Administration Costs

In order to keep cargo handling operations in the ports smooth and efficient, it is necessary that the port authority carefully administer all activities in the ports including periodical investigation of the facilities and appropriate maintenance. The costs for such activities are not included in the construction costs nor in the cargo handling costs in this analysis, and are therefore estimated separately.

The two ports are administered by EMPORCHI, and the number of staff in EMPORCHI's administrative divisions are 216 for Valparaiso and 76 for San Antonio as of march 1986. The Valparaiso workers also help administer EMPORCHI's other ports in Chile. In order to calculate the administration costs of the two ports, it is assumed that 100 employees are required for each and that an amount equal to the labor costs is additionally required for materials and other general expenses. The average monthly salary and wages needed to maintain an employee are assumed to be 100,000 pesos.

As for maintenance costs, one percent of the accumulated construction

costs of the facilities is assumed as the maintenance costs per year.

Annual maintenance and administration costs are given in Appendix XII-7 for each alternative. These costs are summarized by phase in the following table in present value.

Table XII-2-8 Maintenance and Administration Costs in Present Value

(Unit: Million Pesos)

		Phase 1 ( '87-'92)	Phase 2 ( '93-'00)	Phase 3 ( '01-'10)	Total
Alternative 1	Valparaiso	1,069	936	782	2,787
	San Antonio	977	670	498	2,145
	Total	2,046	1,606	1,280	4,932
Alternative 2	Valparaiso	1,045	836	654	2,735
	San Antonio	1,363	960	784	3,107
	Total	2,408	1,796	1,438	5,642
Alternative 3	Valparaiso	953	689	483	2,125
	San Antonio	1,461	1,120	807	3,388
	Total	2,414	1,809	1,290	5,513

#### 5) Inland Transport Cost

Per ton inland transport costs by truck and rail in economic prices are given in Chapter VI, Inland Transport System. The modal split of future cargo to and from the two ports is analysed in that Chapter for major commodities and containerized cargo. The percentage of modal split is calculated for each origin/destination by the hinterland region.

Based on these data, calculations are made in order to obtain the average percentage of future modal split for five categories (fruit, copper, wheat, general and containerized cargo). Also, average per ton inland transportation costs by cargo volume for each route are calculated for each category. Then, the total annual inland transportation costs are obtained by multiplying the cargo volume by average per ton cost for each category.

Below are the figures used to estimate the inland transportation costs.

Cargo	Mode	Valparaiso		San Antonio	
		Modal Split(%)	Cost/ton (US\$)	Modal Split(%)	Cost/ton (US\$)
Wheat	Truck	-	-	6	17.37 (0.02)
	Rail	-	-	94	20.71 (0.02)
Fruit	Truck	100	24.23 (0.11)	100	28.08 (0.12)
	Rail	0	-	0	-
Copper	Truck	80	6.09 (0.07)	19	9.30 (0.11)
	Rail	20	7.06 (0.13)	81	16.42 (0.21)
General	Truck	88	20.55 (0.13)	81	22.53 (0.15)
	Rail	12	38.97 (0.43)	19	27.63 (0.34)
Container	Truck	81	16.26 (0.16)	76	18.41 (0.17)
	Rail	19	27.78 (0.44)	24	20.96 (0.25)

Note: Figures in parenthesis represent time cost in per-ton inland transportation costs.

Annual Inland transportation costs are given in Appendix XII-8. Inland transportation costs by phase are summarized in the followings table in present value.

Table XII-2-9 Inland Transportation Costs by Container and Others in Present Value

(Unit: Million Pesos)

		Container	Others	Total
Alternative 1	Valparaiso	47,088	41,846	88,934
	San Antonio	9,191	66,602	75,793
	Total	56,279	108,448	164,727
Alternative 2	Valparaiso	28,125	41,846	69,971
	San Antonio	28,752	66,602	95,354
	Total	56,877	108,448	165,325
Alternative 3	Valparaiso	9,153	41,846	50,999
	San Antonio	48,304	66,602	114,906
	Total	57,457	108,448	165,905

6) Results

The following Table XII-2-10 summarizes all the above-mentioned costs for the three alternatives, and the costs in present value are given in Table XII-2-11. From these tables it is concluded that Alternative 1 involves the least total cost, and this alternative is therefore the most economically viable plan.

Table XII-2-10 Total Costs of Alternatives

(Unit: Million Pesos)

		Valparaiso	San Antonio	Total
Alternative 1	Port Costs:			
	Construction	48,542	20,602	69,144
	Ship Waiting	4,213	5,563	9,776
	Cargo Handling	42,611	34,177	76,788
	Maintenance & Administration	11,012	7,605	18,617
	Inland Costs:			
Transportation	326,444	255,443	581,887	
Total		432,822	323,390	756,212
Alternative 2	Port Costs:			
	Construction	31,825	44,583	76,408
	Ship Waiting	4,721	6,883	11,604
	Cargo Handling	35,908	40,881	76,789
	Maintenance & Administration	9,463	11,415	20,878
	Inland Costs:			
Transportation	249,141	335,149	584,290	
Total		331,058	438,911	769,969
Alternative 3	Port Costs:			
	Construction	18,651	53,669	72,320
	Ship Waiting	4,117	12,583	16,700
	Cargo Handling	29,204	47,584	76,788
	Maintenance & Administration	7,470	12,413	19,883
	Inland Costs:			
Transportation	171,847	414,843	586,690	
Total		231,289	541,092	772,381

Table XII-2-11 Total Costs in Present Value

(Unit: Million Pesos)

		Valparaiso	San Antonio	Total
Alternative 1	Port Costs:			
	Construction	17,631	8,082	25,713
	Ship Waiting	3,019	4,514	7,533
	Cargo Handling	12,051	9,929	21,980
	Maintenance & Administration	2,788	2,146	4,934
	Inland Costs:			
Transportation	88,934	75,793	164,727	
	Total	124,423	100,464	224,887
Alternative 2	Port Costs:			
	Construction	13,541	21,334	34,875
	Ship Waiting	3,543	5,334	8,877
	Cargo Handling	10,406	11,574	21,980
	Maintenance & Administration	2,535	3,107	5,642
	Inland Costs:			
Transportation	69,971	95,354	165,325	
	Total	99,996	136,703	236,699
Alternative 3	Port Costs:			
	Construction	7,709	25,327	33,036
	Ship Waiting	2,958	10,468	13,426
	Cargo Handling	8,761	13,219	21,980
	Maintenance & Administration	2,125	3,388	5,513
	Inland Costs:			
Transportation	50,999	114,906	165,905	
	Total	72,552	167,308	239,860



### III-3 Consideration of the Number of Asseismic Berths

#### (1) Intruduction

In the stability investigation outlined in III-3, it was determined that the current port facilities have not been engineered to withstand the level of earthquakes which many occur in the region. According to this analysis, if a major earthquake of magnitude 8 were to occur in the vicinity of the two ports, all the facilities with the exception of Berth 5 at San Antonio Port would suffer severe damage, and port services could possibly come to halt. Consequently it is important that measures be taken in the near future to improve port facilities to withstand such a shock.

However, it is obviously unrealistic to begin all construction works at the same time, as this would stop port services at all the berths under construction. Additionally, it might be difficult to obtain all the necessary funding for such an undertaking within a short period of time.

Therefore, analysis has been made to determine the appropriate number of berths that could be constructed at one time.

#### (2) Methodology

It is obvious that the more berths to be constructed at once, the greater the construction cost. It is equally apparent that the economic loss of a major earthquake will be lessened by the extent that new aseismically-engineered berths are completed at the time such an earthquake occurs. This is particularly true given the inadequate engineering of the current facilities, which are likely to become unusable in the event of such an earthquake. At the same time, construction of new berths will have a negative effect on the handling of cargo during the period of construction, and if the number is great then additional expenses become necessary to ensure adequate cargo handling during this construction period.

Below we give the estimated costs involved in constructing new berths at existing berth sites in the two ports. These costs include the construction costs, the additional costs of inland transportation to and from the alternative ports and the possible losses that might be incurred if an earthquake of magnitude 8 occurred at the completion of the construction. From an economic viewpoint, the optimal number of berths to be constructed immediately would be the case in which the total of these three figures is the least. We have undertaken an analysis of six cases, as given below:

Case	Number of aseismic berths		
	for container cargo	for non-container cargo	Total
1	1	1	2
2	1	2	3
3	1	3	4
4	1	4	5
5	1	5	6
6	1	6	7

(3) Assumptions

1) Economic cost of improvement per berth (as of Dec., 1985)

container berth : 8,000 million pesos

non-container berth : 3,000 million pesos

These costs include not only berth construction but also land reclamation, dredging, pavement, warehouse construction and crane purchase.

2) Cargo handling capacity of existing berth facilities

The earthquake of March 3, 1985 rendered Berth 1 and 2 at San Antonio Port unusable, leaving a total of 15 berths in service at the two ports. The cargo handling capacity of each berth is estimated at 400 thousand tons per year, for a total current capacity of 6 million tons.

3) Handling capacity of improved berths

Newly constructed berths are anticipated to be state-of-the-art facilities, and the annual handling capacity of container berths especially is expected to rise. The new handling capacity is expected to be as follows:

container berth : 1,000,000 tons/year

non-container berths: 400,000 tons/year

4) Construction period

Following the completion of this Master Plan survey, it is expected to take at least one year to complete engineering designs and arrange financing, and an additional two years to complete the necessary construction. Thus, the construction period is expected to last a full three years from January 1, 1987 to December 31, 1989.

#### 5) Cargo handling demand

The volume of cargo handled at the two ports in 1984 was 3,607 thousand tons. Demand is forecast at five-year intervals from 1990 to 2010 for the two ports in Chapter V, Demand forecast. Under this forecast, total demand (exports plus imports) is expected to be 4,805 thousand tons in 1990 and 5,570 thousand tons in 1995. Based on these three figures, we have estimated cargo volume to be as follows:

<u>Year</u>	<u>Cargo Volume</u> <u>(thousand tons)</u>
1987	4,200
1988	4,400
1989	4,600
1990	4,805
1991	4,960
1992	5,110

#### 6) Additional costs associated with construction

The volume of cargo to be handled during the construction period is the largest in 1989, when 4,600 thousand tons are forecast. If the cargo handling capacity per berth is 400 thousand tons as outlined above, then at least 12 of the available 15 berths must be in service to handle this volume of cargo. For example, if only eleven were operational at that time, then the total handling capacity of the ports would be just 4,400 thousand tons, or 200 thousand tons short. If the handling capacity is short by just this amount, however, it would be possible to raise the handling capacity somewhat through measures to raise the occupancy ratio of the available berths, though this would come at the loss of more ship-waiting time. If the number of berths to be constructed were to be raised still higher, however, it would not be feasible to compensate for the shortfall through such measures, and portions of the total cargoes would probably be lost to other nearby port. In this analysis, it is assumed that such cargoes will be lost to a nearby port, in which case the cost of inland transportation from the hinterland origin to the nearby port (or vice-versa) is calculated to rise by 3,000<sup>1/</sup> pesos per ton.

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<sup>1/</sup> We have assumed that US\$15.00 per ton would be added to the inland transportation costs regardless of cargo type and route if cargoes were transferred to alternative ports, based upon the economic costs of inland transportation as shown in Chapter VI, Inland Transport System.

7) Additional cargo handling capacity of alternative ports

The alternative ports for Valparaiso and San Antonio ports are Coquimbo in Region 4 and Lirquen, Talcahuano and San Vicente in Region 8. Based on a study by the Universidad Catolica de Chile entitled "Programa de Inversion para el Sistema Portuario Quinto Region: 1986 - 2000", we have estimated the additional handling capacity of these ports to be as follows:

<u>Year</u>	<u>Additional Capacity</u> <u>(thousand tons/year)</u>
1987	2,200
1988	2,200
1989	2,200
1990	2,000
1991	1,800
1992	1,600

8) Extent of loss in case of earthquake

We assume here that if an earthquake of magnitude 8 were to occur after the completion of the new berth construction on December 31, 1989, then the cargo handling capacity of the two ports would be limited to the capacity of the new berths plus berth 5 at San Antonio Port. It is assumed that alternative ports will handle cargo demand in excess of capacity at that time, but if the cargo handling capacity of the alternative ports is unable to meet this demand, then it becomes necessary to consider halting some portion of the trade-related transpostation.

The earthquake loss for that portion of cargo handled at the alternative ports is considered to be the additional 3,000 pesos per ton inland transportation costs.

It is particularly difficult to estimate the losses which would be incurred on that portion of cargo which would cease to be traded due to inadequate port handling capacity. In the case of export commodities, it would be necessary to either stop production or to sell to the domestic market. A halt in production would hinder the economically efficient utilization of production facilities and labor, while the sale of these products on the relatively small domestic market would definitely be limited and could lead to a significant fall in the domestic prices of the commodities in question. In the case of import commodities, a halt in availability of intermediate production factors could act as a hindrance to Chile's own

production capability or lead to drastic price increases or production capacity increases for domestic alternatives or both.

As this explanation suggests, it is not possible to accurately determine the actual loss which would be incurred on those cargoes that cannot be handled even at the alternative ports. For the purposes of this evaluation, we apply the value-added ratio of related industrial sectors to the trade-suspended cargo prices. The value-added ratio is obtained from the "Matriz de Insumo-Producto de la Economía Chilena 1977" by ODEPLAN.

Although the value-added portion in an input-output table consists primarily of employee compensation and operating surplus, only the operating surplus portion was used based on the assumption that workers who would lose their jobs due to the reduction of production activity would have the opportunity to find employment in other areas.

The following figures are used to estimate the trade-suspended loss:

Commodity	Trade Price (US\$/ton)	Related Sector in Input-output Table	Value-added Ratio
Copper	1,300 <sup>2/</sup>	Minería del Cobre	0.2608
Fruit	670 <sup>2/</sup>	Producción Agrícola	0.2669
Wheat	140 <sup>2/</sup>	Fabricación de productos alimenticios	0.1213
General Cargo Export	1,200 <sup>3/</sup>	All Sectors in Manufacturing Industry	0.0956
General Cargo Import	1,200 <sup>3/</sup>	All Sectors in Manufacturing Industry for intermediate goods All Sectors for capital goods	0.0821
(Average)	( 891 )		(0.1492)

<sup>2/</sup> Source: Indicadores de Comercio Exterior, Diciembre 1985,  
Banco Central de Chile

<sup>3/</sup> assumption based on available data.

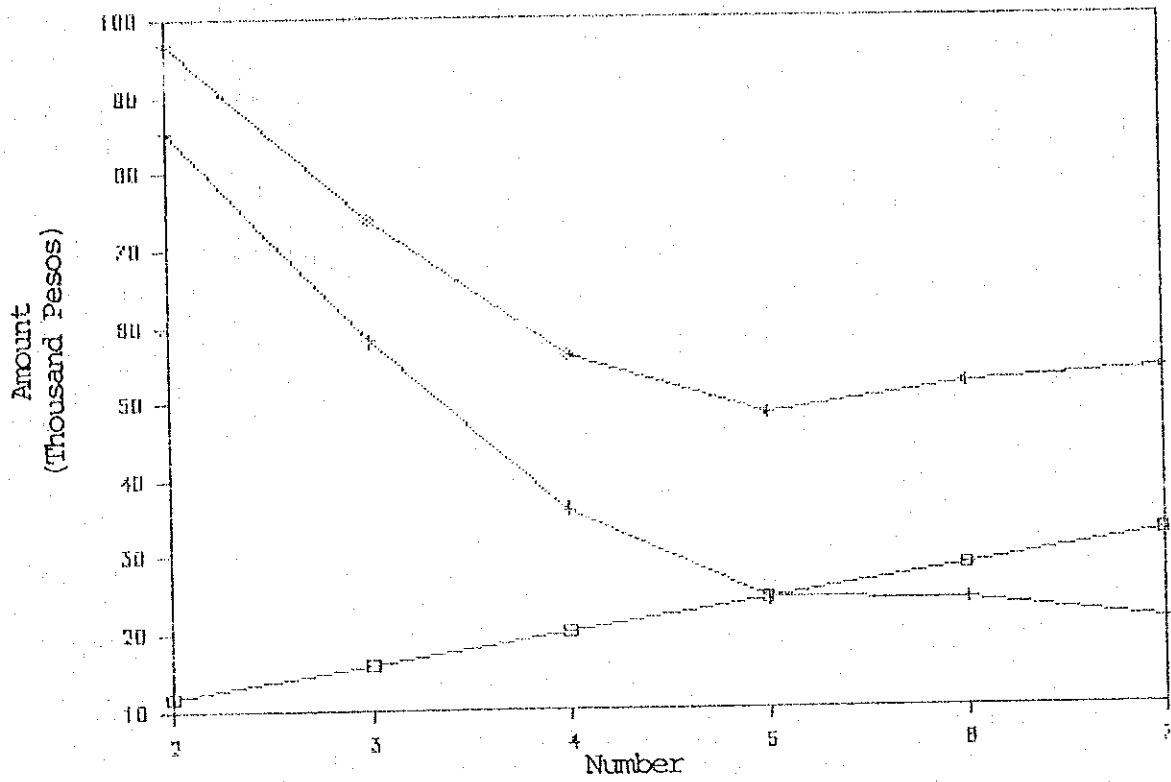
It is also assumed that the trading of wheat would be the first to be halted in the event of an earthquake, followed by general import cargo, general export cargo, and finally fruit and copper, based on the amount of trade-suspended loss per ton.

9) Period of earthquake-induced loss

It is assumed here that if the existing berths were destroyed in an earthquake with magnitude 8 then these berths would be reconstructed with state-of-the-art features. The period of time required to bring these berths to completion would be three years from the time of the earthquake. Trade-suspended losses are therefore calculated for a period of three years.

(4) Results

Construction costs and other costs (the total of additional inland transportation costs and trade suspended loss) are illustrated in Figure XII-3-1. Details of the calculation are shown in Appendix XII-9. Case 4 for the construction of one container berth and 4 non-container berths, shows the minimum value. This indicates that construction of five berths as in Case 4 is optimal from the economic viewpoint. A number of rough assumptions have been used in this analysis, so it would be advisable to conduct further technical analyses on this proposal.



□ Construction + Other Costs\* ◆ Total Costs

\* Additional Inland Transportation Costs and Trade Suspension Loss

	2	3	4	5	6	7
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Construction Costs	11700	15900	20100	24300	28500	32700
Other Costs	85262	58017	35873	24032	23763	21222
<b>Total</b>	<b>96962</b>	<b>73917</b>	<b>55973</b>	<b>48332</b>	<b>52263</b>	<b>53922</b>

Fig. XII-3-1 Number of Aseismic Berths

## XII-4 Evaluation of the Master Plan with Consideration Given to Earthquake Probability

### (1) Methodology

Given the potential for an earthquake of magnitude 8 which would cause severe damage to facilities at the two ports of Valparaiso and San Antonio, bringing port services to a virtual halt, the Master Plan calls for the construction of aseismic berths. The analysis here is aimed at evaluating the appropriateness of the optimal plan using a cost/benefit analysis that examines two specific cases, the case of executing the construction along the lines called for in the Master Plan (the "WITH" case), and the case of not doing so (the "WITHOUT" case).

In evaluating the benefits, the probability of earthquakes discussed in Chapter III has been taken into consideration. The Internal Rate of Return (IRR) is adopted here as the standard for evaluation. Earthquake-related damage to port facilities will differ according to the resistance of port facilities to earthquake shock. For instance, those port facilities with a seismic coefficient of  $K_h=0.25$  should not suffer damage in the case of an earthquake of magnitude 8, but the existing port facilities would suffer severe damage, bringing port services to a standstill with the exception of just one berth, Berth 5 at San Antonio Port. We consider that this difference of damage is represented by the cargo handling capacity of each berth taking the probability of earthquake into consideration. The expected cargo handling capacity of each berth is defined here as the cargo handling capacity of the berth multiplied by the probability of non-destruction, which is derived from the probability of earthquake occurrence.

### (2) Determination of Benefits

Benefits are determined in the following manner:

1) First we calculate the expected cargo handling volume for the two ports for each year by comparing the expected cargo handling capacity and cargo demand for each year in the WITH and WITHOUT cases (the expected cargo handling volume is the lower of the expected cargo handling capacity and the projected cargo demand).

2) Cargo demand that exceeds expected cargo handling capacity is the expected demand surplus that would be transferred to alternative ports or halted in the case of an earthquake.



3) The expected value of losses in the case of an earthquake are defined as the economic loss incurred in inland transportation to alternative ports plus that incurred from the stoppage of trade (the volume of cargo demand subject to such losses multiplied by the expected loss per ton). The benefit of undertaking the Master Plan is defined as the difference between the value of these losses in the WITH and WITHOUT cases.

(3) Costs

Construction costs in the WITH case are those indicated in Chapter VII, Master Plan.

The WITHOUT case envisions leaving facilities in their current state, so there are no costs incurred.

(4) Assumptions

1) Project Life

Project life is from 1987 until 2030: The year 2030 is 30 years after the assumed average completion year of the new facilities in the WITH case. A service life of 30 years for the new berths which are major port facilities is a conservative estimation; berths in fact have a much longer service life.

2) Cargo Demand

Cargo demand is forecast to grow as illustrated below. The tonnages from 1987 to 2010 are the same as those used in Alternative 1 of Section XII-2, Determination of the Preferred Alternative Plan.

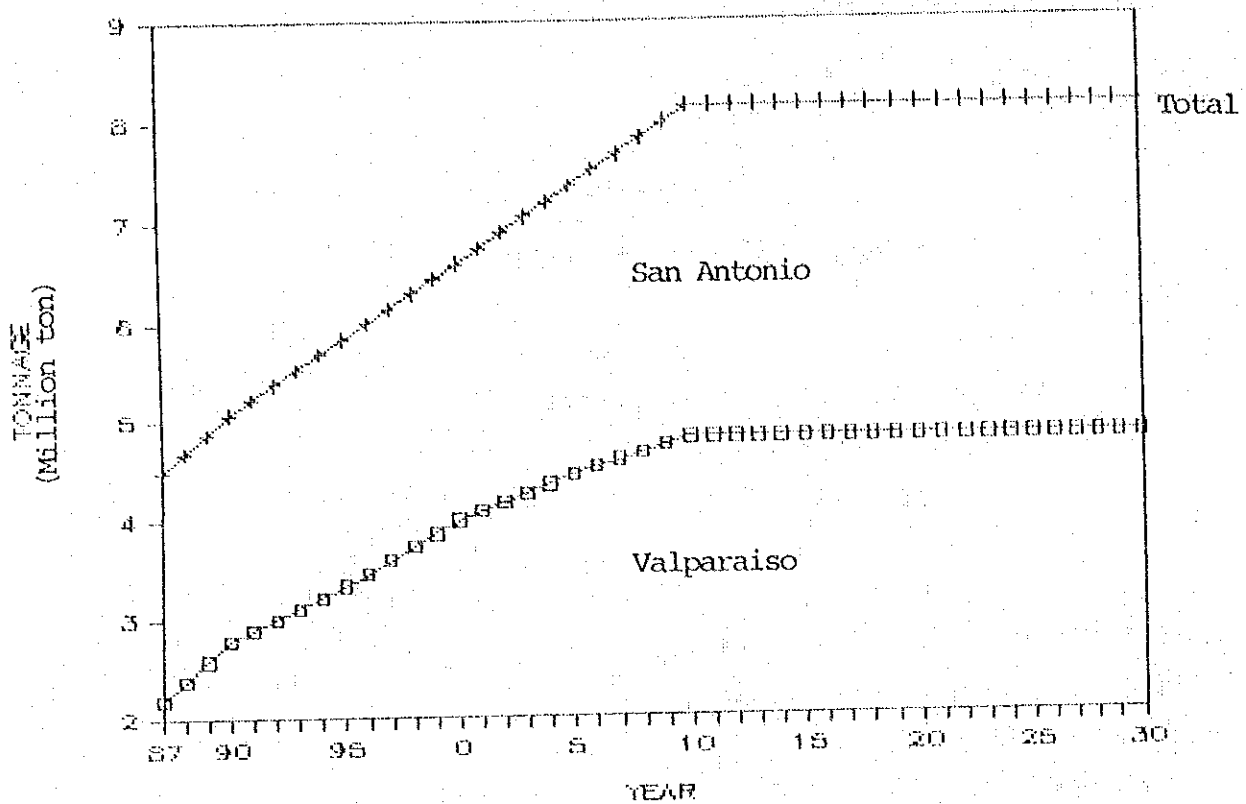


Fig. XII-4-1 Cargo Demand

### 3) Cargo Handling Capacities

WITHOUT case : 6,000 thousand tons/year

(It was assumed that each of the existing 15 berths in both ports have a capacity of 400 thousand tons/year)

WITH case : The number of existing and new berths will increase in accordance with the construction plan and as illustrated in Figures XII-2-1 and XII-2-2. Following are the cargo handling capacities by berth type.

Container berths : 1,000 thousand tons/year

Multi-purpose berths : 500 thousand tons/year

Others : 400 thousand tons/year

4) Earthquake resistance of facilities

WITHOUT case : All facilities with the exception of Berth 5 at San Antonio Port have a seismic coefficient of  $K_h=0.15$ .

San Antonio's Berth 5 has a seismic coefficient  $K_h=0.25$ .

WITH case : The facilities at one berth in Valparaiso and two berths in San Antonio are to have a seismic coefficient of  $K_h=0.25$ , with others to have a seismic coefficient of  $K_h=0.20$ .

5) Probability of non-destruction

The relation between the seismic coefficient level ( $K_h$ ) and the ground acceleration, and the relation between the ground acceleration and the return period of earthquakes are explained in Chapter III. We assume the probability of non-destruction for each berth at the two ports as follows:

Port	$K_h$	$\alpha$	$T_R$	$P_i$
Valparaiso	0.25	408.3	94	$(1-1/94)^{TD}$
"	0.20	326.7	66	$(1-1/66)^{TD}$
"	0.15	245.0	41	$(1-1/41)^{TD}$
San Antonio	0.25	408.3	161	$(1-1/161)^{TD}$
"	0.20	326.7	110	$(1-1/110)^{TD}$
"	0.15	245.0	67	$(1-1/67)^{TD}$

where  $K_h$  = Seismic coefficient

$\alpha$  = Ground acceleration

$T_R$  = Return Period of earthquake

$P_i$  = Probability of non-destruction

TD = Number of years from 1985

6) Expected cargo handling capacity

The expected cargo handling of given facilities ( $C_i$ ) during a given period of years ( $T_i$ ) is determined by applying the probability of non-destruction ( $P_i$ ) in the following manner:

$$C_i = P_i \times T_i \times C_a;$$

Where  $C_a$  = annual cargo handling capacity of facilities.

Therefore, the annual expected cargo handling volume ( $T_i - T_{i-1}$ ) is

$$C_{i-(i-1)} = (P_i \times T_i - P_{i-1} \times T_{i-1}) \times C_a$$

For example, in the case facilities with a seismic coefficient of  $K_h=0.25$  at Valparaiso and a cargo handling capacity of 400 thousand tons annually, the probability of non-destruction would be defined as  $P_i = (1-1/9^4)^{TD}$ , so the expected cargo handling capacity in each year would be as follow:

Year	Years from 1985	Volume until the year i ( $C_i = P_i \cdot T_i \cdot C_a$ ) (Unit: thousand tons)	Volume in the year i ( $\Delta C_i = (P_i \cdot T_i - P_{i-1} \cdot T_{i-1}) \times C_a$ ) (Unit: thousand tons)
1987	3	1,162.1	379.0
1988	4	1,533.0	370.9
1989	5	1,895.8	362.8
:			
1995	11	3,911.6	317.4
:			
2000	16	5,393.3	282.6
:			
2010	26	7,874.9	221.1
:			
2030	46	11,249.8	126.0

7) Losses per ton of cargo in the case of earthquake

Expected costs for cargoes handled at Alternative Ports:

US\$ 15.00 per ton as used in XIII-3, Consideration of the Number of Aseismic Berths.

Expected Trade suspension Loss:

US\$132.8 per ton for the expected trade suspended volume (This amount equals 14.9% of US\$891.00, which is the weighted average

trade price per ton for both ports. 14.9% is the average value-added ratio as shown in XIII-3)

(5) Results

On the basis of the above assumptions and cost/benefit analysis, the internal rate of return is calculated to be 23.4% for the Master Plan as noted in Appendix XII-10, and it is concluded that the execution of the Master Plan is justified from the economic standpoint.

(6) Sensitivity Analyses

In order to gauge the sensitivity of the Master Plan to various factors related to the project, sensitivity analyses are conducted and the internal rates of return are calculated as follows:

Factors	IRR
Construction Cost Increases by 20%	21.9%
Cargo Demand decreases by 20%	21.0%
Trade suspension loss decreases by 20%	21.2%

Although the IRR for each of these sensitivities is somewhat lower than that of the base case, it is also higher than the opportunity cost of capital in Chile. It is concluded that execution of the Master Plan will not be adversely affected by a change in the above factors.

## XII-5 Evaluation of the Master Plan without Consideration

### Given to the Occurrence of Earthquakes

#### (1) Background

In Chapter VII, it is proposed that berths be constructed with an earthquake resistance high enough to prevent destruction even in the case of a large earthquake. An evaluation is carried out in XII-4 for the implementation of the Master Plan based on this proposal.

However, it is impossible to predict such an earthquake and governmental authorities may decide not to construct berths with higher earthquake resistance. An evaluation of the Master Plan is therefore made in this section taking into account the need for higher earthquake resistant berths.

#### (2) Method

As in the case of XII-4, a cost/benefit analysis is used in evaluating the Master Plan. The Internal rate of return (IRR) is adopted here as the standard for evaluation.

#### (3) Assumptions

##### 1) Project life

As in the case of XII-4, a project life of 47 years from 1987 to 2030 is assumed.

##### 2) Cargo Demand

As for the figures of cargo demand for the period from 1987 to 2010, those for alternative 1 in XII-2, Determination of Preferred Alternative Plan, are used. The figures after 2010 are assumed to be constant.

##### 3) Cargo Handling Capacity

In the "With" case, cargo handling capacity is assumed to be sufficient to meet cargo demand throughout the project life. In the "With" case, cargo handling capacity throughout the project life is given below based on the analysis of capacity of present facilities for both ports in Chapter VII.

#### Port of Valparaiso

<u>Type of Berth</u>	<u>Number of Berths</u>	<u>Capacity ('000 tons)</u>
General Cargo	6	2,140
Container	1.5	1,060

Port of San Antonio

<u>Type of Berth</u>	<u>Number of Berths</u>	<u>Capacity ('000 tons)</u>
General Cargo	3	1,400*
Wheat	1	724
Container	1	670

\* : Tonnage at 90% berth occupancy ratio, which is calculated taking into consideration the different cargo volumes for each type of ship and different cargo handling capacities per hour for each type of cargo.

4) Costs

(i) Construction Costs

WITH case : Construction Costs shown in VIII-6 (1), Cost Estimate for the Master Plan, includes those to strengthen the berths' seismic coefficient up to  $K_h=0.25$ . In the With case, such costs are excluded since all the berths are assumed to have a seismic coefficient of  $K_h=0.20$ .

WITHOUT case: As in the case of XII-4, no construction costs are incurred since the WITHOUT case envisions leaving facilities in their current state.

(ii) Maintenance and Administration Costs

i) Administration Costs

In both the With and Without cases, administration costs are estimated based on the number of ENPORCHI staff in Valparaiso and San Antonio Ports. It is assumed that 100 employees are required for each ports in the WITH case, as in the case of XII-4. In the WITHOUT case staffs of 120 and 80, respectively, assumed for the Valparaiso and San Antonio ports considering the number of ENPORCHI as of March 1986.

ii) Maintenance Costs

WITH case : One percent of accumulated construction costs are assumed to be incurred for each year.

WITHOUT case: WITHOUT case: 70 and 30 million pesos are assumed to be incurred annually for the maintenance of Valpara-

iso and San Antonio ports, respectively, based on the actual maintenance costs of both ports for the year 1985.

(iii) Cargo Handling Costs

In both the WITH and WITHOUT cases, the cargo handling costs shown in XII-2 are used to calculate the total annual cargo handling costs.

5) Benefits

(i) Saving of Ship Waiting Costs

Even if the port facilities are constructed based on the Master Plan so that cargo handling capacity can meet cargo demand, ship waiting will occur to some extent due to the fact that not all ship entries and departures can be controlled.

However, if future cargo demand is to be handled at the present port facilities without implementing the Master Plan, ship waiting will increase tremendously year by year.

Therefore, the difference in ship waiting costs between the case where the Master Plan is implemented (WITH case) and the case where it is not (WITHOUT case) clearly shows the benefits of implementing the Master Plan.

In order to calculate annual ship waiting costs in the WITH case, annual ship waiting hours in Alternative 1 of XII-2, Determination of the Preferred Alternative Plan, are used until 2010 and the ship waiting hours thereafter are assumed to be constant. The figures of daily ship costs in Table XII-2-5 are applied to obtain the annual ship waiting costs by ship types.

In the Without case, ship waiting hours are calculated annually based on the data of available berth numbers by cargo type, number of ships, and average time of loading/unloading per ship. It is assumed that in case the cargo handling capacities of the general cargo berths at Valparaiso port exceed the annual general cargo demand of Valparaiso, the berths will receive the additional general cargoes not handled by containers at container berths (due to the limited capacities of such berths). It is also assumed that Valparaiso container cargoes will be handled at San Antonio's multi-purpose berth, provided it has remaining cargo handling



capacity and Valparaiso port does not handle all of Valparaiso container cargoes. Annual ship waiting hours for every five years from 1990 to 2010 are summarized below.

Table XII-5-1 Annual Ship Waiting Hours in the WITHOUT Case

(Unit: hours)

		1990	1995	2000	2005	2010
Valparaiso	General Cargo Berth	873	5,849	6,889	6,777	6,638
	Container Berth	2,986	2,986	2,986	2,986	2,986
San Antonio	General Cargo Berth	23,973	24,513	22,853	23,800	24,745
	Bulk Berth	625	625	757	1,256	1,819
	Multi-purpose berth	999	5,379	5,353	5,328	3,763
Total		29,456	39,352	38,838	40,147	39,951

Annual ship-waiting hours after 2010 are assumed to be constant. The following daily ship costs are applied to obtain ship waiting costs in the WITHOUT case :

General Cargo (13,600 DWT) : US\$5,200

Wheat (28,000 DWT) : US\$8,700

Container (17,000 DWT) : US\$6,000

In the WITHOUT case, no consideration has been paid to the enlargement of average ship size.

(ii) Savings of Inland Transportation Costs

In the With case, expanded port facilities are planned to meet future cargo demand for both ports for cargo assumed to be handled at no other ports in Chile.

However, future cargo demand exceeding the capacity of the port facilities in the WITHOUT case will be handled at other ports in neighboring regions of Chile.

Transporting the cargo to and from any other port leads to an increase in inland transportation costs. The additional inland transportation costs in the WITHOUT case show the benefits of the

WITH case, since the Master Plan does not require such cost. Additional inland transportation costs are assumed to be 3,000 pesos per ton, as in XII-3.

(iii) Savings of Trade Suspension Loss

As for Cargo demand exceeding the handling capacity of the two ports and not handled at any other ports in neighbouring regions due to limited capacity, it is assumed in this analysis that the trade representing such demand will be suspended. This suspension will leads to the loss of possible opportunities to add economic value in manufactussing export goods and in manufacturing domestic goods using imported materials. This loss shows the benefits of the With case, since it would not have occurred if the Master Plan were implemented. US\$132.8 per ton is the assumed figure of loss for the volume of trade suspension as in the case of XII-4, Evaluation of the Master Plan with Consideration Given To Earthquake Probability.

(iv) Results

On the basis of the above assumptions, the internal rate of return is calculated to be 10.88% for the Master Plan with the modification of berth aseismic coefficient from  $K_h=0.25$  to  $K_h=0.20$  (as noted in appendix XII-II). This figure may be found to be a little bit below the Chilean opportunity cost of capital based on the 12% of discount ratio suggested by ODEPLAN. However, it is appropriate in terms of the execution of the Master Plan since both ports are prone to the risks of earthquake damage, which is not considered in this analysis.

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Appendix XII-1 Construction Costs in Market Price

\*\* CONSTRUCTION COST ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE I

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
BERTH	4272				2317			2636	2635					5271		4537									21668
REPLENISHMENT						1445				923	923							2639							0
PAYMENT		817				180			4720	2360								3102							6747
RECLAMATION																									10362
DREDGING	6																								6
ROAD							97												337						945
SHED			193								338														1931
LIGHTING TOWER											644	644	643					14							150
DEMOLITION WORK			20			20				48	48														660
BREAKWATER																	278								0
OTHERS																									0
CONTAINER CRANE																									0
NAVIGATION AID			1676			1676												1676							5028
TEMPORARY EMBANKMENT																									0
LANE ACQUISITION						225			586																811
	0	4660	2706	0	2317	3546	97	2636	7941	3331	1953	644	643	5271	0	0	4815	7431	337	0	0	0	0	0	48328

\*\* CONSTRUCTION COST ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE I

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
BERTH	1622			1622						1591		2885			1931		1622	177							11273
REPLENISHMENT																									552
PAYMENT			458	375									457					458							3168
RECLAMATION			301		458																				603
DREDGING			302		302																				1207
ROAD			302		905																				885
SHED						295					295														1046
LIGHTING TOWER			19			523					20		39					19							145
DEMOLITION WORK				523																					392
BREAKWATER				241											151										0
OTHERS																									304
CONTAINER CRANE																									638
NAVIGATION AID																838									13
TEMPORARY EMBANKMENT																13									105
LANE ACQUISITION																									0
	0	1879	1986	2913	1684	818	0	0	0	1591	315	2885	496	295	2082	2217	1622	654	0	0	0	0	0	0	20531

\*\* CONSTRUCTION COST ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 2

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL	
BERTH	4232						2196	320	2196	320	2196	4323													15163	
BEVEIMENT			1214					320	320	320	320	320	2108													4282
PAVEMENT								1448	1448	1448	1448	1448														4344
RECLAMATION		64																								64
DREDGING				241					241			241		242												965
ROAD								644		644			644													1932
SHED								19		19		19	39													135
LIGHTING TOWER			39																							660
DEMOLITION WORK		382										278														0
BREAKWATER																										0
OTHERS																										0
CONTAINER CRANE			1676										1676													3352
NAVIGATION AID																										0
TEMPORARY EMBANKMENT			220				450																			670
LAND ACQUISITION																										0
	0	4698	3149	241	0	0	2646	2431	2437	2431	2196	6629	4467	242	0	0	0	0	0	0	0	0	0	0	0	31567

\*\* CONSTRUCTION COST ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 2

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL	
BERTH	6285									1560		4663				1630		1622								15760
BEVEIMENT	4231		354									1014														5599
PAVEMENT			2862										2395					469								5726
RECLAMATION			1448										740													2188
DREDGING			1448										740													2188
ROAD													348													1043
SHED																										1046
LIGHTING TOWER											20		40						19							159
DEMOLITION WORK		724									151															875
BREAKWATER																										5800
OTHERS			719																							739
CONTAINER CRANE			1676										1676													3352
NAVIGATION AID																										24
TEMPORARY EMBANKMENT															24											24
LAND ACQUISITION																										105
	0	11345	8587	1741	0	0	0	0	0	1560	171	5677	5939	4366	1458	1630	20	2091	19	0	0	0	0	0	0	44604

\*\* CONSTRUCTION COST ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 3

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL	
BERTH	2568				2500	262	1520	262	1520	1520							1520								11490	
REVEITEMENT PAVEMENT		262				262		262			262		1519					262								2829
RECLAMATION BREASTING ROAD	48					193			644					193					193	643						579
SHED			19			19		19			19		30					20								1931
LIGHTING TOWER		246					382																			126
DEMOLITION WORK																										628
BREAKWATER																										0
OTHERS																										0
CONTAINER CRANE													837													837
NAVIGATION AID																										0
TEMPORARY EMBANKMENT																										0
LAND ACQUISITION																										0
	0	2794	281	0	2500	1118	1902	281	644	1520	281	1930	2386	193	0	0	1520	282	836	0	0	0	0	0	0	18468

\*\* CONSTRUCTION COST ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 3

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL	
BERTH		6285			3041					1559		1622				1630	3041	1622								18800
REVEITEMENT PAVEMENT	4311				654								469					1014								5979
RECLAMATION	2862					1926												1926	469						7652	
BREASTING ROAD			1442			373												373								2188
SHED			2884			373							278					373	278							3630
LIGHTING TOWER	58					20					19						19	20	19						174	
DEMOLITION WORK	724												151					4366	1434						5800	
BREAKWATER																		217								956
OTHERS						217												1676								5828
CONTAINER CRANE			522			1676																				24
NAVIGATION AID	105																									105
TEMPORARY EMBANKMENT																										250
LAND ACQUISITION																										250
	0	14595	6524	1603	3695	4585	0	0	0	1559	19	1622	917	0	0	1630	3060	11587	2224	0	0	0	0	0	0	53620

# Appendix XII-2 Construction Costs in Economic Price

CONSTRUCTION COST - ECONOMIC PRICE (UNIT : MIL. PESO)

ALTERNATIVE :

	PHASE - 1										PHASE - 2										PHASE - 3									
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL					
BERTH	0	4357	0	0	2563	0	0	2489	2489	0	0	0	0	0	5276	0	4828	0	0	0	0	0	0	0	22181					
REWEIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
PAVEMENT	0	0	773	0	1367	0	0	0	873	873	0	0	0	0	0	0	0	0	2476	0	0	0	0	0	6383					
RECLAMATION	0	0	0	0	172	0	0	4543	2272	0	0	0	0	0	0	0	0	0	2986	0	0	0	0	0	9973					
DREDGING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
ROAD	0	182	0	0	0	0	0	0	0	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
SHED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1981					
DEMOLITION WORK	0	21	0	0	21	0	0	0	49	49	0	0	0	0	0	0	0	14	0	0	0	0	0	0	138					
BREATHWATER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
OPRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
CONTAINER CRANE	0	0	1861	0	0	1461	0	0	0	0	0	0	0	0	0	0	0	1961	0	0	0	0	0	0	5584					
NAVIGATION AID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
TEMPORARY EMBANKMENT	0	0	0	0	0	220	0	521	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	784					
LAND ACQUISITION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
TOTAL	0	4741	2827	0	3263	3842	92	2609	2905	2794	1903	661	660	5376	0	4902	3558	275	0	0	0	0	0	0	48542					
P.V.	0	3779	4929	0	1341	1845	42	1086	2214	1638	547	179	151	1100	0	9	714	457	0	0	0	0	0	0	17531					
TOTAL													17003												17583	48542				
P.V.													5823												2388	15231				

CONSTRUCTION COST - ECONOMIC PRICE (UNIT : MIL. PESO)

ALTERNATIVE :

	PHASE - 1										PHASE - 2										PHASE - 3									
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL					
BERTH	0	1654	0	1654	0	0	0	0	1623	0	2943	0	1970	0	1654	0	1654	0	0	0	0	0	0	0	11498					
REWEIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	173	0	0	0	0	0	0	541					
PAVEMENT	0	0	433	0	433	0	0	0	0	0	0	433	0	1263	0	1263	0	433	0	0	0	0	0	0	2997					
RECLAMATION	0	0	250	0	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580					
DREDGING	0	0	291	0	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1165					
ROAD	0	0	0	0	0	279	0	0	0	279	0	0	0	0	0	0	0	0	0	0	0	0	0	0	837					
SHED	0	0	0	577	0	577	0	0	0	21	0	0	40	0	20	0	0	30	0	0	0	0	0	0	1073					
DEMOLITION WORK	0	0	0	238	0	0	0	0	0	0	0	0	149	0	0	0	0	0	0	0	0	0	0	0	387					
BREATHWATER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
OTHERS	0	163	0	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	325					
CONTAINER CRANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	931	0	0	0	0	0	0	0	0	0	931					
NAVIGATION AID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	14					
TEMPORARY EMBANKMENT	0	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103					
LAND ACQUISITION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
TOTAL	0	1920	1034	2959	1617	816	0	0	1623	300	2943	472	279	2119	2240	1654	626	0	0	0	0	0	0	0	26602					
P.V.	0	1531	736	1881	917	413	0	0	523	86	755	108	57	387	363	241	81	0	0	0	0	0	0	0	8082					
TOTAL																									6918	20642				
P.V.																									1132	8082				

\*\*\* CONSTRUCTION COST - ECONOMIC PRICE - ( UNIT - MIL. RESD ) \*\*

VALPARAISO : ALTERNATIVE 2

	PHASE - 1										PHASE - 2										PHASE - 3									
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL					
BERTH	0	4327	0	0	0	0	2240	0	2240	0	2240	4400	0	0	0	0	0	0	0	0	0	0	0	0	15466					
REVEGETATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
PAVEMENT	0	0	1148	0	0	0	0	303	0	303	0	303	1994	0	0	0	0	0	0	0	0	0	0	0	4051					
RECLAMATION	0	0	0	0	0	0	1394	0	1394	0	1394	0	0	0	0	0	0	0	0	0	0	0	0	0	4181					
DREDGING	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62						
ROAD	0	0	0	0	0	0	0	228	0	228	0	228	0	229	0	0	0	0	0	0	0	0	0	0	913					
SEED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1902						
LIGHTING TOWER	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	179						
DEMOLITION WORK	0	377	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	552						
BREAKWATER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
OTHERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
CONTAINER CRANE	0	0	1361	0	0	0	0	0	0	0	0	1861	0	0	0	0	0	0	0	0	0	0	0	0	3722					
NAVIGATION AID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
TEMPORARY EMBANKMENT	0	0	215	0	0	0	441	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
LAND ACQUISITION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
TOTAL	0	4776	2553	239	0	0	2981	2377	2468	2323	2740	6623	4356	229	0	0	0	0	0	0	0	0	0	0	21225					
P.Y.	0	3808	2554	145	0	0	1213	960	990	745	644	1701	1044	41	0	0	0	0	0	0	0	0	0	0	12541					
TOTAL																									227	23825				
P.Y.																										47	13541			

\*\*\* CONSTRUCTION COST - ECONOMIC PRICE - ( UNIT - MIL. RESD ) \*\*

SAN ANTONIO : ALTERNATIVE 2

	PHASE - 1										PHASE - 2										PHASE - 3									
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL					
BERTH	0	6411	0	0	0	0	0	0	0	1591	0	4756	0	0	0	1463	0	1654	0	0	0	0	0	0	16075					
REVEGETATION	0	4744	247	0	0	0	0	0	0	0	0	992	0	0	0	0	0	0	0	0	0	0	0	0	5494					
PAVEMENT	0	0	2197	0	0	0	0	0	0	0	0	2386	0	0	0	0	444	0	0	0	0	0	0	0	3417					
RECLAMATION	0	0	1384	0	0	0	0	0	0	0	0	0	712	0	0	0	0	0	0	0	0	0	0	0	2026					
DREDGING	0	0	1362	0	0	0	0	0	0	0	0	0	316	0	0	0	0	0	0	0	0	0	0	0	2111					
ROAD	0	0	0	457	0	0	0	0	0	0	0	0	379	0	0	0	0	0	0	0	0	0	0	0	987					
SEED	0	0	0	1073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1023					
LIGHTING TOWER	0	0	62	0	0	0	0	0	0	0	25	0	41	0	0	0	21	0	0	0	0	0	0	0	194					
DEMOLITION WORK	0	215	0	0	0	0	0	0	0	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	865					
BREAKWATER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
OTHERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
CONTAINER CRANE	0	0	1361	0	0	0	0	0	0	0	0	1861	0	0	0	0	0	0	0	0	0	0	0	0	3722					
NAVIGATION AID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
TEMPORARY EMBANKMENT	0	0	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27					
LAND ACQUISITION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
TOTAL	0	11372	6557	1721	0	0	0	0	1591	170	5749	5924	4259	1426	1463	21	2098	20	0	0	0	0	0	0	44552					
P.Y.	0	7957	6092	1100	0	0	0	0	512	49	1476	1339	871	240	271	1	253	2	0	0	0	0	0	0	21124					
TOTAL																										9485	44552			
P.Y.																											1961	21124		



AA CONSTRUCTION COST - ECONOMIC PHASE - (UNIT MIL. RESC) 114

ALTERNATIVE 2

Table with columns for years (1987-2010) and rows for construction items (BERTH, REVENUE, PAVEMENT, etc.) and totals. Includes sub-sections PHASE - 1, PHASE - 2, and PHASE - 3.

AA CONSTRUCTION COST - ECONOMIC PHASE - (UNIT MIL. RESC) 114

ALTERNATIVE 3

Table with columns for years (1987-2010) and rows for construction items (BERTH, REVENUE, PAVEMENT, etc.) and totals. Includes sub-sections PHASE - 1, PHASE - 2, and PHASE - 3.

Appendix XII-3 Conversion Factors of Economic Prices

1. Calculation Formula

$$\text{Conversion Factors} = A/100 \times \text{E.R.} + B/100 \times 9/10 + C/100 \times 7/10 \times 1/2 + D/100 \\ \times 8.5/10 + E/100 \times 9/10$$

Whereas : A = Percentage of Imported Materials Costs  
 B = Percentage of Skilled Workers Costs  
 C = Percentage of Semi-skilled and Unskilled Workers Costs  
 D = Percentage of Domestic Materials  
 E = Percentage of Other Domestic Costs  
 E.R. = Exchange Rate Adjustment Factor (1.13)

2. Conversion Factors

<u>Construction Items</u>	<u>Estimated Percentage in Financial Costs</u>					<u>Factors</u>
	<u>Imported Materials</u>	<u>Skilled Workers</u>	<u>Semi-skilled and Unskilled Workers</u>	<u>Domestic Materials</u>	<u>Domestic Others</u>	
1 Berth	60	4	2	20	14	1.0200
2 Revetment	45	2	1	40	12	0.9795
3 Pavement	35	7	3	45	10	0.9460
4 Reclamation	35	3	2	20	40	0.9625
5 Dredging	35	3	2	15	45	0.9650
6 Road	35	7	3	45	10	0.9460
7 Shed	65	11	4	15	5	1.0260
8 Lighting Tower	65	4	2	23	6	1.0300
9 Demolition Work	45	4	2	15	34	0.9880
10 Breakwater	45	4	2	40	9	0.9755
11 Others	45	3	2	30	30	1.0705
12 Container Crane	95	0	2	0	3	1.1105
13 Navigation Aid	95	0	2	0	3	1.1105
14 Temporary Embankment	45	2	1	40	12	0.9795
15 Land Acquisition	0	0	0	0	100	0.9000

## Appendix XII-4 Ship Waiting Costs

\*\* SHIP WAITING COSTS \*\*

VALPARAISO : ALTERNATIVE I

( SHIP WAITING HOURS FOR EACH YEAR )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
GENERAL :	5	232	135	241	165	165	165	165	141	141	20	20	20	63	63	63	63	63	63	63	63	63	63	63	81	
5*10	250	205	316	276	276	276	276	276	189	188	36	36	36	48	48	48	48	48	48	48	48	48	48	48	123	
10*20	1340	1247	1873	1362	1362	1362	1362	1362	1426	1326	281	281	281	469	469	469	469	469	469	469	469	469	469	469	921	
20*30	117	129	165	119	119	119	119	119	130	130	38	38	38	50	50	50	50	50	50	50	50	50	50	50	109	
SUB TOTAL	2046	1213	2395	1922	1922	1922	1922	1922	1685	1685	175	175	175	611	611	611	611	611	611	611	611	611	611	611	1234	
REFER :	10	830	792	1357	822	822	822	822	956	956	175	175	175	206	206	206	206	206	206	206	206	206	206	206	526	
10*20	90	114	157	180	180	180	180	180	208	203	78	78	78	72	72	72	72	72	72	72	72	72	72	72	72	148
SUB TOTAL	920	906	1513	1002	1002	1002	1002	1002	1064	1064	253	253	253	278	278	278	278	278	278	278	278	278	278	278	278	673
WHEAT :	10*20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20*30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
CONTAINER :	10	340	526	1051	1183	1183	1183	616	616	616	616	616	616	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	133	
10*20	201	419	626	802	802	802	427	427	427	427	427	427	427	907	909	909	909	909	909	909	909	909	909	909	222	
20*30	56	114	207	303	303	303	291	291	291	291	291	291	291	766	766	766	766	766	766	766	766	766	766	766	283	
SUB TOTAL	600	1060	1083	2288	2286	2286	1104	1104	1104	1104	1104	1104	1104	2693	2693	2693	2693	2693	2693	2693	2693	2693	2693	2693	639	
TOTAL	3566	3679	5991	5212	5212	5212	4529	4529	4353	4353	2032	2032	2010	3581	3581	3581	3581	3581	3581	3581	3581	3581	3581	3581	2545	

( SHIP COST / DAY (US\$) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5500	5500	5600	5600	5600
REFER	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5500	5600	5600	5600	5600
WHEAT	8700	8700	8700	8700	8800	8800	8800	8800	8800	8900	8900	8900	8900	8900	8900	9000	9000	9000	9000	9000	9000	9100	9100	9100	9100
CONTAINER	6000	6000	6000	6000	6500	6500	6500	6500	6500	7000	7000	7000	7000	7000	7500	7500	7500	7500	7500	7500	8000	8000	8000	8000	8000

( WAITING COST (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	89	74	112	83	85	85	85	85	83	85	17	17	17	27	28	28	28	28	28	28	28	28	28	28	58
REFER	40	39	66	43	44	44	44	44	47	48	11	11	11	13	13	13	13	13	13	13	13	13	13	13	31
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	30	53	44	114	124	124	76	76	76	82	82	82	82	157	168	168	168	168	168	168	168	168	168	168	43
	159	166	222	241	257	257	203	205	206	215	210	210	210	197	209	209	209	209	209	209	209	209	209	209	132

( WAITING COST - PRESENT VALUE (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	79	59	80	53	48	43	39	34	30	27	5	4	4	6	5	5	4	4	4	4	4	4	3	3	4
REFER	40	39	66	43	44	44	44	44	47	48	11	11	11	13	13	13	13	13	13	13	13	13	13	13	31
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	30	53	44	0	124	0	76	76	0	82	82	82	0	157	168	168	168	168	168	168	168	168	168	168	0
	149	151	210	96	216	87	159	155	27	157	99	98	15	175	186	186	186	186	186	186	186	186	186	186	35

\*\* SHIP WAITING COSTS \*\*

VALPARAISO : ALTERNATIVE 2

( SHIP WAITING HOURS FOR EACH YEAR )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL :	75	239	135	241	140	140	140	140	88	88	88	88	88	17	17	17	17	17	63	63	63	63	63	63	91
5*10	250	205	316	225	225	225	225	225	155	155	155	155	155	34	34	34	34	34	86	86	86	86	86	86	123
10*20	1440	1247	1873	1344	1344	1344	1344	1344	1155	1155	1155	1155	1155	279	279	279	279	279	603	603	603	603	603	603	921
20*30	117	125	165	183	183	183	183	183	161	161	161	161	161	37	37	37	37	37	67	67	67	67	67	67	109
SUB TOTAL	2046	1713	2595	1892	1892	1892	1892	1892	1559	1559	1559	1559	1559	366	366	366	366	366	819	819	819	819	819	819	1231
REFER :	70	830	792	1157	886	886	886	886	252	252	252	252	252	163	163	163	163	163	276	276	276	276	276	276	526
10*20	70	114	157	255	255	255	255	255	300	300	300	300	300	83	83	83	83	83	115	115	115	115	115	115	148
SUB TOTAL	920	906	1513	1140	1140	1140	1140	1140	1052	1052	1052	1052	1052	246	246	246	246	246	391	391	391	391	391	391	673
WHEAT :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10*20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20*30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10*30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER :	70	793	1099	1591	614	614	614	614	1059	1059	1059	1059	1059	121	121	121	121	121	123	123	123	123	123	123	123
10*20	70	967	1359	2054	708	708	708	708	1417	1417	1417	1417	1417	191	191	191	191	191	246	246	246	246	246	246	301
20*30	70	586	858	1246	434	434	434	434	1273	1273	1273	1273	1273	226	226	226	226	226	339	339	339	339	339	339	409
SUB TOTAL	2346	3316	4993	1757	1757	1757	1757	1757	3748	3748	3748	3748	3748	538	538	538	538	538	708	708	708	708	708	708	911
TOTAL	5312	5955	9101	4790	4790	4790	4790	4790	6259	6259	6259	6259	6259	1150	1150	1150	1150	1150	1719	1719	1719	1719	1719	1719	2818

( SHIP COST / DAY (US\$) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	5206	5206	5206	5206	5309	5309	5309	5309	5309	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
REFER	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
WHEAT	8700	8700	8700	8700	8800	8800	8800	8800	8800	8900	8900	8900	8900	8900	9000	9000	9000	9000	9000	9100	9100	9100	9100	9100	9100
CONTAINER	6000	6000	6000	6000	6500	6500	6500	6500	6500	7000	7000	7000	7000	7000	7500	7500	7500	7500	7500	8000	8000	8000	8000	8000	8000

( WAITING COST (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	39	74	112	82	34	34	34	34	67	70	70	70	70	16	17	17	17	17	38	38	38	38	38	38	58
REFER	40	39	66	49	50	50	50	50	46	47	47	47	47	11	11	11	11	11	18	18	18	18	18	18	31
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	117	166	259	88	95	95	95	95	203	219	219	219	219	31	31	31	31	31	44	47	47	47	47	47	61
SUB TOTAL	246	379	428	219	229	229	229	229	318	326	326	326	326	59	62	62	62	62	100	104	104	104	104	104	150

( WAITING COST : PRESENT VALUE (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	79	59	30	52	47	42	38	34	25	23	20	19	16	3	3	3	2	2	4	4	4	4	5	5	4
REFER	40	39	66	49	50	50	50	50	46	47	47	47	47	11	11	11	11	11	18	18	18	18	18	18	31
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	117	166	250	88	95	95	95	95	203	219	219	219	219	31	31	31	31	31	44	47	47	47	47	47	61
SUB TOTAL	236	264	335	189	193	93	183	179	271	289	286	284	63	46	48	44	47	47	67	69	69	69	69	69	25

1) SHIP WAITING COSTS 11

VACPARALSO : ALTERNATIVE 3

( SHIP WAITING HOURS FOR EACH YEAR )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	75	269	273	281	287	287	287	287	189	188	189	188	189	22	22	22	22	22	43	43	43	43	43	43	43
5*10	410	420	444	444	433	433	433	432	189	189	189	189	189	14	14	14	14	14	44	44	44	44	44	44	44
10*20	2189	2361	2547	2547	1990	1990	1990	1990	1401	1401	1401	1401	1401	361	361	361	361	361	503	503	503	503	503	503	503
20*30	295	316	353	271	271	271	271	271	195	195	195	195	195	48	48	48	48	48	67	67	67	67	67	67	109
SUB TOTAL	3162	3329	3630	2801	2801	2801	2801	2801	1894	1894	1894	1894	1894	475	475	475	475	475	819	819	819	819	819	819	1234
REFER	10	1451	1596	1746	1432	1432	1432	1432	941	941	941	941	941	201	201	201	201	201	276	276	276	276	276	276	276
10*20	298	360	428	377	377	377	377	377	326	326	326	326	326	102	102	102	102	102	115	115	115	115	115	115	149
SUB TOTAL	1749	1956	2174	1809	1809	1809	1809	1809	1318	1318	1318	1318	1318	303	303	303	303	303	391	391	391	391	391	391	673
WHEAT	10*20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20*20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30*40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	10	171	164	151	110	110	110	110	90	90	90	90	90	193	193	193	193	193	202	202	202	202	202	202	189
10*20	207	179	192	145	145	145	145	145	141	141	141	141	141	111	111	111	111	111	160	160	160	160	160	160	539
20*30	102	109	124	103	103	103	103	103	139	139	139	139	139	459	459	459	459	459	686	686	686	686	686	686	924
SUB TOTAL	475	472	470	358	358	358	358	358	370	370	370	370	370	1014	1014	1014	1014	1014	1348	1348	1348	1348	1348	1348	1652
TOTAL	5386	5807	6274	4969	4969	4969	4969	4968	3591	3581	3581	3581	3581	1792	1792	1792	1792	1792	2559	2559	2559	2559	2559	2559	3559

( SHEP COST / DAY (US\$) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
REFER	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
WHEAT	8700	8700	8700	8700	8800	8800	8800	8800	8800	8900	8900	8900	8900	8900	9000	9000	9000	9000	9000	9100	9100	9100	9100	9100	9100
CONTAINER	6000	6000	6000	6000	6500	6500	6500	6500	6500	7000	7000	7000	7000	7000	7500	7500	7500	7500	7500	8000	8000	8000	8000	8000	8000

( WAITING COST (MIL. PESS) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	137	116	157	121	124	124	124	124	94	85	85	85	85	21	22	22	22	22	38	38	38	38	38	38	58
REFER	76	65	94	78	80	80	80	80	53	59	59	59	59	14	14	14	14	14	18	18	18	18	18	18	31
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	24	24	23	19	17	17	17	17	20	22	22	22	22	59	63	63	63	63	63	84	90	90	90	90	110
SUB TOTAL	237	255	275	218	223	223	223	223	162	166	166	166	166	94	99	99	99	99	140	146	146	146	146	146	199

( WAITING COST : PRESENT VALUE (MIL. PESS) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GENERAL	122	117	112	77	70	63	56	50	30	27	21	22	20	4	4	4	3	3	4	4	4	3	3	4
REFER	76	65	74	78	80	80	80	80	58	59	59	59	59	14	14	14	14	14	18	18	18	18	18	31
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTAINER	24	24	23	19	17	17	17	17	20	22	22	22	22	59	63	63	63	63	63	84	90	90	90	90
SUB TOTAL	222	225	230	173	167	143	155	149	109	109	105	103	79	77	81	81	80	80	107	112	112	111	111	35

\*\* SHIP WAITING COSTS \*\*

SAN ANTONIO : ALTERNATIVE 1

( SHIP WAITING HOURS FOR EACH YEAR )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
GENERAL :	75	606	180	180	152	152	152	152	80	80	80	35	35	32	32	32	32	32	21	21	21	21	21	21	51	
5*10	1010	301	301	369	369	369	369	369	116	116	116	37	37	35	35	35	35	35	73	73	73	73	73	73	127	
10*20	5412	1397	1397	2019	2019	2019	2019	2019	685	685	685	362	362	231	231	231	231	231	520	520	520	520	520	520	827	
20*30	819	199	199	298	298	298	298	298	75	75	75	61	61	37	37	37	37	37	29	29	29	29	29	29	144	
SUB TOTAL	7842	2078	2078	2839	2839	2839	2839	2839	957	957	957	498	498	335	335	335	335	335	651	651	651	651	651	651	1154	
REFER :	70	399	115	115	130	130	130	130	38	38	38	21	21	14	14	14	14	14	27	27	27	27	27	27	32	
10*20	150	37	37	46	46	46	46	46	11	11	11	19	19	5	5	5	5	5	0	0	0	0	0	0	12	
SUB TOTAL	548	152	152	176	176	176	176	176	49	49	49	40	40	19	19	19	19	19	27	27	27	27	27	27	44	
WHEAT :	10*20	937	228	228	213	213	213	213	244	244	244	205	205	205	205	205	205	205	126	126	126	126	126	126	204	
20*30	732	501	501	434	434	434	434	434	438	438	438	116	116	116	116	116	116	116	197	197	197	197	197	197	118	
30*40	1250	794	794	536	536	536	536	536	1190	1190	1190	507	507	507	507	507	507	507	239	239	239	239	239	239	317	
SUB TOTAL	2919	1523	1523	1184	1184	1184	1184	1184	1874	1874	1874	829	829	829	829	829	829	829	562	562	562	562	562	562	841	
CONTAINER	70	696	543	543	701	701	701	701	785	785	785	658	658	314	314	314	314	314	314	368	368	368	368	368	368	342
10*20	1043	512	512	658	658	658	658	658	503	503	503	652	652	380	380	380	380	380	380	429	429	429	429	429	429	597
20*30	402	154	154	231	231	231	231	231	288	288	288	433	433	265	265	265	265	265	265	375	375	375	375	375	375	633
SUB TOTAL	2141	1209	1209	1590	1590	1590	1590	1590	1576	1576	1576	1743	1743	958	958	958	958	958	1172	1172	1172	1172	1172	1172	1564	
TOTAL	13455	4962	4962	5788	5788	5788	5788	5788	4453	4453	4453	3110	3110	2142	2142	2142	2142	2142	1875	2412	2412	2412	2412	2412	3403	

( SHIP COST / DAY (US\$) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
REFER	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
WHEAT	8700	8700	8700	8700	8800	8800	8800	8800	8800	8900	8900	8900	8900	8900	9000	9000	9000	9000	9000	9100	9100	9100	9100	9100	9100
CONTAINER	6000	6000	6000	6000	6500	6500	6500	6500	6500	7000	7000	7000	7000	7000	7500	7500	7500	7500	7500	8000	8000	8000	8000	8000	8000

( WAITING COST (MIL. PESA) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	340	90	90	123	125	125	125	125	42	43	43	22	22	15	15	15	15	15	30	30	30	30	30	30	51
REFER	24	7	7	8	8	8	8	8	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2
WHEAT	212	110	110	96	87	87	87	87	137	137	137	62	62	62	62	62	62	62	62	42	42	42	42	42	42
CONTAINER	107	60	60	79	86	86	86	86	95	92	92	102	102	54	60	60	60	60	60	73	79	79	79	79	104
SUB TOTAL	682	267	267	296	306	306	306	306	267	275	276	137	137	133	139	139	139	139	146	152	152	152	152	152	209

( WAITING COST : PRESENT VALUE (MIL. PESA) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
GENERAL	304	72	64	78	71	64	57	51	15	14	12	6	5	5	3	3	2	2	3	3	3	3	3	2	4	
REFER	24	7	7	8	8	8	8	8	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	
WHEAT	212	110	110	85	87	87	87	87	137	139	139	62	62	62	62	62	62	62	62	42	42	42	42	42	42	
CONTAINER	107	60	60	72	86	86	86	86	92	92	92	102	102	54	60	60	60	60	60	73	79	79	79	79	104	
SUB TOTAL	646	249	242	251	252	158	237	231	240	247	245	171	68	121	126	125	125	125	125	165	120	125	125	125	124	54

44 SHIP WAITING COSTS 44

SAN ANTONIO : ALTERNATIVE 2

( SHIP WAITING HOURS FOR EACH YEAR )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL :	5	277	273	277	152	152	152	152	152	168	168	168	82	82	35	35	35	35	21	21	21	21	21	21	54
5*10	1744	494	419	369	369	369	369	369	369	335	335	335	310	310	41	41	41	41	73	73	73	73	73	73	129
10*20	3739	2486	2725	2019	2019	2019	2019	2019	2019	2074	2074	2074	2422	2422	276	276	276	276	528	528	528	528	528	528	827
20*20	1279	284	397	298	298	298	298	298	298	169	169	169	461	461	43	43	43	43	29	29	29	29	29	29	144
SUB TOTAL	14039	3530	3020	2839	2839	2839	2839	2839	2746	2746	2746	3275	3275	396	396	396	396	651	651	651	651	651	651	651	1154
REFER :	10	276	227	226	130	130	130	130	130	147	147	147	155	155	17	17	17	17	27	27	27	27	27	27	32
10*20	250	59	78	46	46	46	46	46	46	38	38	38	93	93	6	6	6	6	0	0	0	0	0	0	12
SUB TOTAL	1026	266	305	176	176	176	176	176	184	184	184	248	248	23	23	23	23	27	27	27	27	27	27	27	44
WHEAT :	10*20	337	220	220	213	213	213	213	213	244	244	244	205	205	205	205	205	205	126	126	126	126	126	126	204
20*30	732	501	501	434	434	434	434	434	434	438	438	438	316	316	316	316	316	197	197	197	197	197	197	118	
30*40	1250	794	794	536	536	536	536	536	536	1150	1150	1150	509	509	509	509	509	239	239	239	239	239	239	319	
SUB TOTAL	2919	1523	1523	1184	1184	1184	1184	1184	1194	1871	1871	1871	829	829	829	829	829	562	562	562	562	562	562	562	643
CONTAINER :	10	1351	702	810	662	662	662	662	662	1527	1527	1527	1527	1527	212	212	212	212	212	107	107	107	107	107	103
10*20	1140	460	443	763	763	763	763	763	763	1292	1292	1292	1292	1292	224	224	224	224	224	213	213	213	213	213	257
20*30	165	102	271	478	478	478	478	478	478	618	618	618	618	618	170	170	170	170	170	292	292	292	292	292	416
SUB TOTAL	2956	1344	1714	1902	1902	1902	1902	1902	1902	3437	3437	3437	3437	3437	605	605	605	605	605	612	612	612	612	612	775
TOTAL	20339	6691	7362	6100	6100	6100	6100	6100	6239	6239	6239	7790	7790	1054	1054	1054	1054	1845	1852	1852	1852	1852	1852	1852	2614

( SHIP COST / DAY (US\$) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
REFER	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600	5600
WHEAT	8700	8700	8700	8700	8800	8800	8800	8800	8800	8900	8900	8900	8900	8900	9000	9000	9000	9000	9000	9100	9100	9100	9100	9100	9100
CONTAINER	6000	6000	6000	6000	6500	6500	6500	6500	6500	7000	7000	7000	7000	7000	7500	7500	7500	7500	7500	8000	8000	8000	8000	8000	8000

( WAITING COST (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	608	153	166	123	125	125	125	125	121	124	124	147	147	18	18	18	18	39	39	39	39	39	39	39	54
REFER	44	12	13	8	8	8	8	8	8	8	8	11	11	1	1	1	1	1	1	1	1	1	1	1	2
WHEAT	212	110	110	96	97	97	97	97	137	139	139	62	62	62	62	62	62	62	62	42	42	43	43	43	49
CONTAINER	148	67	86	95	103	103	103	103	186	201	201	201	201	35	38	38	38	38	38	41	41	41	41	41	52
TOTAL	1012	343	375	312	323	323	323	323	453	471	471	471	471	115	119	119	119	111	111	115	115	115	115	115	156

( WAITING COST : PRESENT VALUE (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
GENERAL	543	122	118	78	71	64	57	51	44	40	36	38	34	4	3	3	3	4	3	3	3	3	3	2	4
REFER	44	12	13	8	8	8	8	8	8	8	8	11	11	1	1	1	1	1	1	1	1	1	1	1	2
WHEAT	212	110	110	95	97	97	97	97	137	139	139	62	62	62	62	62	62	62	62	42	42	43	43	43	49
CONTAINER	148	67	86	95	103	103	103	103	186	201	201	201	201	0	35	38	38	38	38	41	41	41	41	41	0
TOTAL	947	312	327	267	269	158	254	248	375	387	383	311	311	106	102	104	104	104	85	85	88	87	87	87	54

\*\* SHIP WAITING COSTS \*\*

SAN ANTONIO - ALTERNATIVE 5

( SHIP WAITING HOURS FOR EACH YEAR )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GENERAL :	5	3370	318	491	152	152	152	152	168	168	168	82	82	35	35	35	35	21	21	21	21	21	21	54
5*10	5412	630	845	369	369	369	369	369	335	335	335	310	310	41	41	41	41	23	23	23	23	23	23	129
10*20	30350	3316	5139	2019	2019	2019	2019	2019	2074	2074	2074	2422	2422	276	276	276	276	528	528	528	528	528	528	822
20*30	4156	365	549	298	298	298	298	298	169	169	169	461	461	43	43	43	43	29	29	29	29	29	29	144
SUB TOTAL	43287	4629	7025	2839	2839	2839	2839	2839	2716	2716	2716	3275	3275	396	396	396	396	651	651	651	651	651	651	1151
REFER :	10	1952	163	302	130	130	130	130	147	147	147	155	155	17	17	17	17	27	27	27	27	27	27	52
10*20	949	102	119	46	46	46	46	46	58	58	58	93	93	6	6	6	6	0	0	0	0	0	0	12
SUB TOTAL	2901	265	421	176	176	176	176	176	184	184	184	248	248	23	23	23	23	27	27	27	27	27	27	44
WHEAT :	10*20	937	228	229	213	213	213	213	244	244	244	205	205	205	205	205	205	126	126	126	126	126	126	204
20*30	732	501	591	434	434	434	434	434	438	438	438	458	458	116	116	116	116	197	197	197	197	197	197	118
30*40	1250	794	794	536	536	536	536	536	1190	1190	1190	509	509	509	509	509	509	239	239	239	239	239	239	319
SUB TOTAL	2918	1523	1523	1184	1184	1184	1184	1184	1871	1871	1871	829	829	829	829	829	829	562	562	562	562	562	562	841
CONTAINER :	10	23320	1469	1879	3888	3888	3888	428	428	428	428	428	428	428	428	428	428	99	99	99	99	99	99	94
10*20	19417	1134	1336	4482	4482	4482	574	574	574	574	574	574	574	574	574	574	574	1445	1445	1445	1445	1445	1445	234
20*30	6807	483	513	2698	2698	2698	520	520	520	520	520	520	520	520	520	520	520	271	271	271	271	271	271	379
SUB TOTAL	49544	3086	3749	11068	11068	11068	1523	1523	1523	1523	1523	1523	1523	1523	1523	1523	1523	3223	3223	3223	3223	3223	3223	707
TOTAL	98551	7423	12717	15266	15266	15266	5721	5721	5325	6325	6325	5875	5875	4471	4471	4471	4471	4463	1887	1887	1887	1887	1887	2546

( SHIP COST / DAY (US\$) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GENERAL	5200	5200	5200	5200	5200	5200	5300	5300	5300	5400	5400	5400	5400	5400	5400	5500	5500	5500	5500	5600	5600	5600	5600	5600
REFER	5200	5200	5200	5200	5300	5300	5300	5300	5300	5400	5400	5400	5400	5400	5500	5500	5500	5500	5500	5600	5600	5600	5600	5600
WHEAT	8700	8700	8700	8700	8800	8800	8800	8800	8900	8900	8900	8900	8900	8900	9000	9000	9000	9000	9000	9100	9100	9100	9100	9100
CONTAINER	6000	6000	6000	6000	6500	6500	6500	6500	6500	7000	7000	7000	7000	7000	7500	7500	7500	7500	7500	8000	8000	8000	8000	8000

( WAITING COST (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GENERAL	1876	201	304	123	125	125	125	125	121	124	124	147	147	13	13	13	13	30	30	30	30	30	30	54
REFER	126	12	18	8	8	8	8	8	8	8	8	11	11	1	1	1	1	1	1	1	1	1	1	2
WHEAT	212	110	110	86	97	97	97	97	137	137	137	62	62	62	62	62	62	62	62	62	62	62	62	62
CONTAINER	2477	150	187	553	600	600	33	33	83	83	83	89	89	189	201	201	201	201	25	38	38	38	38	47
	4690	473	620	770	919	919	302	302	349	360	360	399	399	289	293	293	293	295	104	112	112	112	112	152

( WAITING COST - PRESENT VALUE (MIL. PESO) )

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GENERAL	1675	160	217	78	71	64	57	51	44	48	36	38	34	4	3	3	3	3	3	3	3	3	3	4
REFER	126	12	18	8	8	8	8	8	8	8	8	11	11	1	1	1	1	1	1	1	1	1	1	2
WHEAT	212	110	110	86	97	97	97	97	137	137	137	62	62	62	62	62	62	62	62	62	62	62	62	62
CONTAINER	2477	150	187	553	600	600	83	83	83	89	89	89	89	189	201	201	201	201	25	38	38	38	38	47
	4489	432	533	725	765	768	234	228	272	276	271	199	186	254	259	268	267	249	82	85	84	84	84	54



1. Fruit

(1) Per Shift Cost in Direct Transport

1) Market Price

Labor Costs	Pesos 2,500 / man shift x 20 laborers	= 50,000
Crane	Pesos 12,600 / hour x 6 hours	= 75,600*
Forklift	Pesos 8,400 / shift x 5 units	= 42,000*
Total		167,600

\* Including fuel and materials

2) Economic Price

	Conversion Factor	Economic Price
Labor	0.90	45,000
Crane	1.11	83,916
Forklift	0.96	40,320
Total		169,236

(2) Handling Capacity 225 ton / shift

(3) Unit Cost in Economic Price  $169,236 / 225 = \text{Pesos } 750$

2. Copper

(1) Per Shift Cost in Indirect Transport

1) Market Price

Labor Costs	Pesos 2,500 / man shift x 22 laborers	= 55,000
Crane	Pesos 12,600 / hour x 6 hours	= 75,600
Forklift	Pesos 8,400 / shift x 3 units	= 25,200
Trailer	Pesos 25,200 / shift x 2 units	= 50,400
Total		206,200

2) Economic Price

	Conversion Factor	Economic Price
Labor	0.90	49,500
Crane	1.11	83,916
Forklift	0.96	24,192
Trailer	0.90	45,360
Total		202,968

- (2) Handling Capacity 675 ton / shift
- (3) Unit Cost in Economic Price  $202,968 / 675 = \text{Pesos } 300$

### 3. Wheat

#### (1) Per Shift Cost

##### 1) Market Price

Labor Costs	Pesos 2,500 / man shift x 9 laborers	=	22,500
Unloader			98,000*
	Total		120,500

\* Including fuel costs and ten years useful life is assumed based on the acquisition cost of Pesos 300,000 for an unloader

##### 2) Economic Price

	Conversion Factor	Economic Price
Labor	0.90	20,250
Unloader	0.96	94,080
Total		114,330

- (2) Handling Capacity 675 ton / shift
- (3) Unit Cost in Economic Price  $114,330 / 675 = \text{Pesos } 170$

### 4. General Cargo (Non-Container)

#### (1) Per Shift Cost in Direct Transport

##### 1) Market Price

Labor Costs	Pesos 2,500 / man shift x 17 laborers	=	42,500
Crane	US\$ 70 / hour x 6 hours x Pesos 180 / US\$	=	75,600
Forklift	Pesos 8,400 / shift x 2 units	=	16,800
	Total		134,900

2) Economic Price

	Conversion Factor	Economic Price
Labor	0.90	38,250
Crane	1.11	83,916
Forklift	0.96	16,128
<b>Total</b>		<b>138,294</b>

(2) Per Shift Cost in Indirect Transport

1) Market Price

Labor Costs	Pesos 2,500 / man shift x 28 laborers	= 70,000
Crane	US\$ 70 / hour x 6 hours x Pesos 180 / US\$	= 75,600
Forklift	Pesos 8,400 / shift x 4 units	= 33,600
<b>Total</b>		<b>179,200</b>

2) Economic Price

	Conversion Factor	Economic Price
Labor	0.90	63,000
Crane	1.11	83,916
Forklift	0.96	32,256
<b>Total</b>		<b>179,172</b>

(3) Handling Capacity 150 ton / shift

(4) Unit Cost in Economic Price

Direct Transport	$138,294 / 150 =$ Pesos 922
Indirect Transport	$163,044 / 150 =$ Pesos 1,194

(5) Weighted Average Unit Cost

$$922 \times 0.7 + 1,194 \times 0.3 = \text{Pesos } 1,000$$

5. General Cargo (Container)

(1) Total Cost for One Month Operation at One Berth

1) Market Price

(Unit: '000 pesos)

Labor Costs	$60,000 / \text{man month} \times 104 \text{ laborers}$	= 6,240
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Material	(30% of Labor Cost)	=	1,872
Machine			
Transfer Crane	$242,000 \times 0.9 \div 12 \text{ years} \div 12 \text{ months} \times 5 \text{ units}$	=	7,563
Chassis	$3,800 \times 0.9 \div 7 \text{ years} \div 12 \text{ months} \times 55 \text{ units}$	=	2,239
Tractor	$20,400 \times 0.9 \div 7 \text{ years} \div 12 \text{ months} \times 10 \text{ units}$	=	2,186
Forklift	$2,400 \times 0.9 \div 7 \text{ years} \div 12 \text{ months} \times 4 \text{ units}$	=	103
	Sub Total		12,091
CFS	$300,000 \times 0.9 \div 30 \text{ years} \div 12 \text{ months}$	=	750
Maintenance	(Annually 1.7% of Acquisition Cost of Machines and CFS)		2,738
Fuel			3,510
	Total		27,201

2) Economic Price

	Conversion Factor	Economic Price (Unit: '000 pesos)
Labor	0.90	5,616
Material	0.85	1,591
Machine	1.11	13,421
CFS	0.96	720
Maintenance	0.89	2,437
Fuel	0.85	2,984
Total		26,769

(3) Handling Capacity

$$1 \text{ million tons/berth - year} \div 12 \text{ months} = 83,333 \text{ tons/month}$$

(4) Unit Cost in Economic Price

$$26,769 \text{ thousand Pesos} \div 83,333 = \text{Pesos } 320 / \text{ton}$$

Appendix XII-6 Cargo Handling Costs

\*\* CARGO HANDLING COSTS ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 1	PHASE - 1										PHASE - 2										PHASE - 3										TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010							
COSTS:																															
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
NON-CONTAINER	937	958	978	997	1000	1002	1003	1004	1006	1023	1040	1058	1075	1092	1114	1135	1157	1178	1200	1216	1231	1247	1263	1279	26193						
CONTAINER	254	307	361	414	450	485	521	556	591	629	666	703	741	778	800	823	845	867	889	909	928	948	967	987	16419						
TOTAL	1191	1265	1339	1413	1450	1487	1524	1560	1597	1652	1706	1761	1816	1870	1914	1958	2001	2045	2089	2124	2159	2195	2230	2266	42611						
P.V.	1063	1008	953	898	823	753	689	630	576	532	491	452	416	383	350	319	291	266	243	220	200	181	165	149	12051						
TOTAL						2144						11616													22851	42611					
P.V.						5499						3796														2767	12051				
NON-CONTAINER P.V.	837	763	696	635	568	507	454	406	363	329	299	271	246	223	203	185	168	153	139	126	114	103	93	84	7967						
CONTAINER P.V.	227	245	257	263	255	246	235	225	213	202	191	181	170	159	146	134	123	113	103	94	86	78	71	55	4084						
						1493																				1175	4084				

\*\* CARGO HANDLING COSTS ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 1

SAN ANTONIO : ALTERNATIVE 1	PHASE - 1										PHASE - 2										PHASE - 3										TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010							
COSTS:																															
WHEAT	113	103	92	82	81	81	81	81	80	82	83	85	86	88	92	96	99	103	107	110	113	117	120	125	2298						
NON-CONTAINER	931	963	994	1025	1037	1049	1061	1073	1085	1107	1130	1152	1174	1197	1226	1256	1286	1316	1346	1396	1446	1497	1547	1597	28892						
CONTAINER	71	72	73	74	81	87	93	99	106	112	119	126	132	139	143	147	151	155	159	162	166	169	173	176	2986						
TOTAL	1115	1137	1159	1181	1199	1217	1235	1253	1271	1302	1332	1363	1393	1424	1461	1499	1536	1574	1611	1668	1725	1782	1839	1896	34177						
P.V.	996	907	825	751	681	617	559	506	458	419	383	350	319	291	267	244	224	205	187	173	160	147	136	125	9929						
TOTAL						7010																				18017	34177				
P.V.						4776																					2159	9929			
NON-CONTAINER P.V.	932	849	773	704	635	573	517	466	420	383	349	317	289	263	241	221	202	185	169	156	144	133	123	113	9156						
CONTAINER P.V.	64	58	52	47	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	17	15	14	13	12	12	773					
						310																					210	773			

\*\* CARGO HANDLING COSTS ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 2

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
COSTS:																															
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
NON-CONTAINER	937	958	978	999	1000	1002	1003	1004	1006	1023	1040	1058	1075	1092	1114	1135	1157	1178	1200	1216	1231	1247	1263	1279	26193						
CONTAINER	169	194	219	244	265	286	307	328	348	370	393	415	437	459	472	485	498	511	524	535	547	559	570	582	9715						
TOTAL	1106	1152	1197	1243	1265	1288	1310	1332	1354	1393	1433	1472	1511	1551	1585	1620	1654	1689	1724	1751	1778	1806	1833	1861	35908						
P.Y.	987	918	852	790	718	652	593	538	488	449	412	378	346	317	290	264	241	220	200	182	165	149	135	123	10407						
TOTAL						7251							9806												18851	35908					
P.Y.						4918							3204													2285	19407				
NON-CONTAINER P.Y.	837	763	696	635	568	507	454	406	363	329	299	271	246	223	203	185	168	153	139	126	114	103	93	84	7967						
CONTAINER P.Y.	151	155	156	155	151	145	139	132	126	119	113	106	100	94	86	79	72	66	61	56	51	46	42	38	2439						
						912							835												691	2439					

\*\* CARGO HANDLING COSTS ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 2

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
COSTS:																															
WHEAT	113	103	92	82	81	81	81	80	82	83	85	86	86	88	92	96	99	103	107	110	113	117	120	123	2298						
NON-CONTAINER	931	963	994	1025	1037	1049	1061	1073	1085	1107	1130	1152	1174	1197	1226	1256	1286	1316	1346	1396	1446	1497	1547	1597	28892						
CONTAINER	156	186	215	244	265	286	307	328	348	370	393	415	437	459	472	485	498	511	524	535	547	559	570	582	9690						
TOTAL	1201	1251	1301	1352	1364	1417	1449	1481	1514	1560	1606	1651	1697	1743	1790	1836	1883	1930	1977	2042	2107	2172	2237	2302	40881						
P.Y.	1022	997	926	859	785	718	655	598	546	502	462	424	389	357	327	300	274	251	229	212	195	179	165	152	11575						
TOTAL						7905							10958												22017	40881					
P.Y.						5357							3576													2641	11575				
NON-CONTAINER P.Y.	932	849	773	704	635	573	517	466	420	383	349	317	289	263	241	221	202	185	169	156	144	133	123	113	9156						
CONTAINER P.Y.	140	148	153	155	151	145	139	132	126	119	113	106	100	94	86	79	72	66	61	56	51	46	42	38	2418						
						892							835													691	2418				

\*\* CARGO HANDLING COSTS ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 3

	PHASE - 1										PHASE - 2										PHASE - 3										TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011						
COSTS:																															
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
NON-CONTAINER	937	958	978	999	1080	1002	1004	1036	1023	1040	1058	1075	1092	1114	1135	1157	1178	1200	1216	1231	1247	1263	1279	1295	1311						
CONTAINER	84	81	77	74	81	87	99	106	112	119	126	132	139	143	147	151	155	159	162	166	169	173	176	179	181						
TOTAL	1021	1038	1056	1073	1081	1088	1096	1104	1111	1115	1183	1207	1231	1257	1282	1308	1333	1358	1378	1397	1416	1436	1455	1475	1494						
P. V.	911	828	751	682	613	551	496	446	401	366	333	304	277	252	230	190	173	158	145	129	117	106	96	8761							
TOTAL						6556						7996												14851	29204						
P. V.						4337						2821												1803	8761						
NON-CONTAINER P. V.	837	763	696	635	568	507	454	406	363	329	299	271	246	223	203	185	168	153	139	126	114	103	93	84	7867						
CONTAINER P. V.	75	64	55	47	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	17	15	14	13	12	794						
						331						253												210	794						

\*\* CARGO HANDLING COSTS ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 3

	PHASE - 1										PHASE - 2										PHASE - 3										TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011						
COSTS:																															
WHEAT	113	103	92	82	81	81	81	81	80	82	83	85	86	88	92	96	99	103	107	110	113	117	120	123	126						
NON-CONTAINER	931	963	994	1025	1037	1049	1061	1073	1085	1107	1130	1152	1174	1197	1226	1256	1286	1316	1346	1376	1406	1437	1467	1497	1527						
CONTAINER	241	299	357	414	450	485	521	556	591	629	666	703	741	778	800	823	845	867	889	909	928	948	967	987	1007						
TOTAL	1285	1364	1443	1522	1569	1616	1663	1710	1757	1818	1879	1940	2002	2063	2119	2174	2230	2286	2342	2415	2488	2561	2634	2707	2780						
P. V.	1148	1088	1027	967	890	819	752	691	634	585	540	498	459	422	387	355	325	297	272	250	230	212	194	178	15219						
TOTAL						8799						12768												26017	47584						
P. V.						5938						4158												3123	15219						
NON-CONTAINER P. V.	932	849	773	704	635	573	517	466	420	383	349	317	289	263	241	221	202	185	169	156	144	133	123	113	9156						
CONTAINER P. V.	215	238	254	263	255	246	235	225	213	202	191	181	170	159	146	134	123	113	103	94	86	78	71	65	4063						
						1472						1418												1173	4063						

Appendix XII-7 Maintenance & Administration Costs

\*\* MAINTENANCE & ADMINISTRATION COST ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 1

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
NUMBER OF LABORER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2400						
LABOR COST	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	2592						
MATERIAL COST	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	2304						
ADMINISTRATION COST	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	4896						
CONSTRUCTION COST	0	4741	2837	0	2353	3642	92	2689	7805	3194	1903	661	660	5376	0	4902	7358	319	0	0	0	0	0	0	48542						
ACCUMULATED	0	4741	7578	7578	9941	13584	13675	16364	24169	27353	29266	29927	20586	35965	35963	40865	48223	48542	48542	48542	48542	48542	48542	48542	703000						
MAINTENANCE COST	0	41	66	86	86	118	119	142	210	238	255	260	266	313	313	356	420	422	422	422	422	422	422	422	6116						
TOTAL MAINT. & ADMIN.	204	245	270	270	290	322	323	346	414	442	459	464	470	517	517	560	624	626	626	626	626	626	626	626	11012						
PRESENT VALUE	182	196	192	172	165	163	146	140	149	142	132	119	108	106	94	84	81	81	73	63	56	52	46	41	2788						
TOTAL						1602							2919												6472						
PV						1069							936												782						

\*\* MAINTENANCE & ADMINISTRATION COST ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 1

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
NUMBER OF LABORER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2400						
LABOR COST	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	2592						
MATERIAL COST	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	2304						
ADMINISTRATION COST	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	4896						
CONSTRUCTION COST	0	1920	1034	2959	1617	816	0	0	0	1623	300	2943	472	279	2119	2240	1654	626	0	0	0	0	0	0	20602						
ACCUMULATED	0	1920	2954	5913	7530	8346	8346	8346	9346	9968	10268	13211	13683	13962	16081	18321	19975	20602	20602	20602	20602	20602	20602	20602	311302						
MAINTENANCE COST	0	17	26	51	66	73	73	73	73	87	89	115	119	121	140	159	174	179	179	179	179	179	179	179	2709						
TOTAL MAINT. & ADMIN.	204	221	230	255	270	277	277	277	277	291	293	319	323	325	344	363	378	383	383	383	383	383	383	383	7665						
PRESENT VALUE	182	176	163	162	153	148	125	112	100	94	84	82	71	67	63	59	55	50	44	40	35	32	28	25	2146						
TOTAL						1456							2056												4093						
PV						977							670												698						



\*\* MAINTENANCE & ADMINISTRATION COST ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 2

	PHASE - 1												PHASE - 2												PHASE - 3												TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010													
NUMBER OF LABORER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2400												
LABOR COST	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	2592												
MATERIAL COST	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	2304												
ADMINISTRATION COST	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	4896												
CONSTRUCTION COST	0	4776	3265	228	0	0	2681	2377	2462	2377	2240	6623	4556	229	0	0	0	0	0	0	0	0	0	0	31825												
ACCUMULATED	0	4776	8642	8270	8270	8270	10950	13327	15795	18172	20411	27040	31596	31825	31825	31825	31825	31825	31825	31825	31825	31825	31825	31825	524990												
MAINTENANCE COST	0	42	70	72	72	72	72	95	116	137	153	178	235	275	277	277	277	277	277	277	277	277	277	277	4567												
TOTAL MAINT. & ADMIN.	204	246	274	275	276	276	276	299	320	341	362	382	439	479	481	481	481	481	481	481	481	481	481	481	9463												
PRESENT VALUE	102	196	195	175	157	140	135	129	123	117	110	115	110	98	88	78	70	63	56	50	45	40	35	32	2535												
TOTAL						1551						2622													5290												
PV						1045						836													654												

\*\* MAINTENANCE & ADMINISTRATION COST ( UNIT : MIL. PESO ) \*\*

SAN ANTONIO : ALTERNATIVE 2

	PHASE - 1												PHASE - 2												PHASE - 3												TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010													
NUMBER OF LABORER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2400												
LABOR COST	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	2532												
MATERIAL COST	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	2304												
ADMINISTRATION COST	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	4896												
CONSTRUCTION COST	0	11373	8559	1731	0	0	0	0	0	1591	170	5749	5924	4259	1426	1663	21	2098	30	0	0	0	0	0	44583												
ACCUMULATED	0	11373	19932	21663	21663	21663	21663	21663	21663	23254	23424	29174	35097	39356	40782	42446	42465	44583	44583	44583	44583	44583	44583	44583	74939												
MAINTENANCE COST	0	99	173	188	188	188	188	188	188	202	204	254	305	342	355	369	369	388	388	388	388	388	388	388	6517												
TOTAL MAINT. & ADMIN.	204	303	377	392	392	392	392	392	392	406	408	438	509	546	559	573	573	592	592	592	592	592	592	592	11415												
PRESENT VALUE	182	242	269	249	223	199	178	159	142	131	117	118	117	112	102	94	84	77	69	61	55	49	44	39	3107												
TOTAL						2062						2959													6395												
PV						1363						836													784												

\*\* MAINTENANCE & ADMINISTRATION COST ( UNIT : MIL. PESO ) \*\*

VALPARAISO : ALTERNATIVE 3

	PHASE - 1												PHASE - 2												PHASE - 3												TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010													
NUMBER OF LABOURER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2400											
LABOR COST	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	2592											
MATERIAL COST	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	2304											
ADMINISTRATION COST	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	4896											
CONSTRUCTION COST	0	2839	267	0	2550	1111	1978	267	661	1550	267	1969	2397	183	0	1550	268	842	0	0	0	0	0	0	0	18651											
ACCUMULATED	0	2839	3107	3107	5657	6768	8695	8963	9824	11174	11441	13410	15907	15970	15970	15990	17540	17809	18651	18651	18651	18651	18651	18651	18651	295816											
MAINTENANCE COST	0	25	27	27	49	59	76	78	84	97	100	117	138	139	139	153	155	162	162	162	162	162	162	162	162	2574											
TOTAL MAINT. & ADMIN.	204	229	231	231	253	263	280	282	288	301	304	321	342	343	343	357	359	366	366	366	366	366	366	366	366	7470											
PRESENT VALUE	182	182	164	147	144	132	126	114	104	97	87	82	78	70	63	56	52	47	43	38	34	30	27	24	2125												
TOTAL						1411						2116													3942	7470											
PV						933						689													483	2125											

\*\* MAINTENANCE & ADMINISTRATION COST ( UNIT : MIL. PESO ) \*\*

SAH ANTONIO : ALTERNATIVE 3

	PHASE - 1												PHASE - 2												PHASE - 3												TOTAL
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010													
NUMBER OF LABOURER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2400											
LABOR COST	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	2592											
MATERIAL COST	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	2304											
ADMINISTRATION COST	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	4896											
CONSTRUCTION COST	0	14444	6591	1600	3742	4655	0	0	0	1590	20	1654	875	0	0	1663	3121	11542	2132	0	0	0	0	0	0	53669											
ACCUMULATED	0	14444	21035	22635	26377	31032	31032	31032	31032	32622	32642	34296	35172	35172	35172	36834	39956	51518	53669	53669	53669	53669	53669	53669	53669	864020											
MAINTENANCE COST	0	126	183	197	229	270	279	278	276	284	284	298	306	306	306	310	348	448	467	467	467	467	467	467	467	7517											
TOTAL MAINT. & ADMIN.	204	330	357	401	433	474	474	474	474	488	488	502	510	510	524	552	652	671	671	671	671	671	671	671	671	12413											
PRESENT VALUE	182	243	275	255	246	240	214	191	171	157	140	129	117	104	93	86	80	85	78	70	62	55	58	44	3388												
TOTAL						2229						3410													6774	12413											
PV						1461						1129													987	3388											

Appendix XII-8 Inland Transportation Costs

\*\* INLAND TRANSPORTATION COST \*\* ( UNIT : MIL. PESO )

VALPARAISO : ALTERNATIVE I

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
FRUIT	2,253	2,347	2,441	2,534	2,534	2,534	2,534	2,534	2,534	2,552	2,561	2,569	2,578	2,606	2,634	2,662	2,690	2,719	2,753	2,788	2,823	2,858	2,893	2,970	62,479						
COPPER	263	269	276	283	283	283	283	283	279	275	271	268	264	264	264	264	264	264	264	264	264	264	264	264	264	6,501					
GENERAL	2,392	2,413	2,433	2,454	2,460	2,466	2,473	2,479	2,485	2,562	2,638	2,715	2,791	2,868	2,946	3,024	3,103	3,181	3,259	3,307	3,354	3,401	3,449	3,496	68,149						
CONTAINER	2,926	3,543	4,161	4,778	5,106	5,594	6,003	6,411	6,819	7,250	7,681	8,112	8,543	8,973	9,229	9,484	9,739	9,995	10,250	10,476	10,702	10,928	11,153	11,379	189,314						
TOTAL	7,834	8,572	9,311	10,049	10,464	10,878	11,292	11,707	12,121	12,634	13,146	13,659	14,171	14,683	15,045	15,407	15,769	16,130	16,492	16,800	17,108	17,416	17,724	18,032	326,444						

TOTAL 57,108

PV 38,291

SAN ANTONIO : ALTERNATIVE I

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
WHEAT	2,726	2,475	2,224	1,973	1,966	1,958	1,951	1,943	1,936	1,974	2,012	2,049	2,087	2,125	2,216	2,307	2,398	2,489	2,580	2,658	2,736	2,814	2,892	2,970	55,458						
FRUIT	651	687	723	758	763	767	772	776	781	784	787	791	794	797	805	813	821	829	837	845	853	860	868	876	19,038						
COPPER	1,575	1,697	1,819	1,941	1,988	2,036	2,083	2,131	2,179	2,032	1,886	1,739	1,593	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	40,609						
GENERAL	3,231	3,299	3,367	3,436	3,467	3,498	3,529	3,560	3,591	3,762	3,933	4,104	4,275	4,446	4,581	4,717	4,852	4,987	5,123	5,354	5,585	5,815	6,048	6,279	104,838						
CONTAINER	846	859	871	883	957	1,032	1,106	1,181	1,255	1,335	1,415	1,495	1,575	1,655	1,701	1,748	1,794	1,841	1,887	1,929	1,971	2,013	2,054	2,096	35,499						
TOTAL	9,029	9,016	9,003	8,990	9,140	9,291	9,441	9,591	9,742	9,887	10,033	10,178	10,324	10,470	10,750	11,031	11,312	11,592	11,873	12,232	12,591	12,950	13,309	13,667	255,443						

TOTAL 54,470

PV 37,264

\*\* INLAND TRANSPORTATION COST \*\* ( UNIT : MIL. PESO )

VALPARAISO : ALTERNATIVE 2

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
FRUIT	2,253	2,347	2,441	2,534	2,534	2,534	2,534	2,534	2,543	2,552	2,561	2,569	2,578	2,578	2,605	2,634	2,662	2,690	2,719	2,753	2,768	2,823	2,858	2,893	62,479						
COPPER	263	269	276	283	283	283	283	283	279	275	271	268	264	264	264	264	264	264	264	264	264	264	264	264	264	6,501					
GENERAL	2,392	2,413	2,433	2,454	2,460	2,466	2,473	2,479	2,485	2,562	2,638	2,715	2,791	2,868	2,946	3,024	3,103	3,181	3,259	3,307	3,354	3,401	3,449	3,496	66,149						
CONTAINER	1,946	2,237	2,528	2,819	3,059	3,299	3,538	3,778	4,019	4,272	4,526	4,780	5,034	5,287	5,438	5,589	5,739	5,890	6,040	6,174	6,307	6,441	6,574	6,708	112,821						
TOTAL	6,855	7,266	7,678	8,090	8,336	8,582	8,828	9,075	9,321	9,656	9,991	10,327	10,662	10,997	11,254	11,511	11,768	12,025	12,282	12,498	12,714	12,929	13,145	13,361	249,151						
PV												67,860														134,484					
																											21,279				

SAH ANTONIO : ALTERNATIVE 2

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
WHEAT	2,726	2,475	2,224	1,973	1,966	1,958	1,943	1,936	1,974	2,012	2,049	2,087	2,125	2,216	2,307	2,398	2,489	2,580	2,658	2,736	2,814	2,892	2,970	3,048	55,458						
FRUIT	651	687	723	758	765	767	772	778	781	784	787	791	794	797	805	813	821	829	837	845	853	860	868	876	19,038						
COPPER	1,575	1,697	1,819	1,941	1,988	2,036	2,131	2,179	2,032	1,886	1,739	1,593	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	40,609						
GENERAL	3,231	3,299	3,367	3,436	3,467	3,498	3,529	3,560	3,591	3,762	3,933	4,104	4,275	4,446	4,717	4,852	4,987	5,123	5,354	5,585	5,815	6,046	6,279	6,512	104,838						
CONTAINER	1,958	2,208	2,557	2,907	3,154	3,401	3,648	3,896	4,143	4,405	4,666	4,928	5,190	5,452	5,607	5,762	5,917	6,073	6,228	6,366	6,503	6,641	6,779	6,916	115,205						
TOTAL	10,041	10,365	10,680	11,014	11,337	11,660	11,983	12,306	12,629	12,957	13,284	13,611	13,939	14,266	14,656	15,045	15,435	15,824	16,214	16,669	17,123	17,578	18,033	18,488	335,149						
PV																											179,332				
																											21,554				

\*\* INLAND TRANSPORTATION COST \*\* ( UNIT : MIL. PESO )

VALPARAISO : ALTERNATIVE 3

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
WHEAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
FRUIT	2,253	2,347	2,441	2,534	2,534	2,534	2,534	2,534	2,543	2,552	2,561	2,569	2,578	2,586	2,634	2,662	2,690	2,719	2,753	2,789	2,823	2,858	2,893	2,928	82,479						
COPPER	283	269	276	283	283	283	283	279	275	271	268	264	264	264	264	264	264	264	264	264	264	264	264	264	6,501						
GENERAL	2,392	2,413	2,433	2,454	2,460	2,466	2,479	2,485	2,562	2,638	2,715	2,791	2,868	2,945	3,024	3,103	3,181	3,259	3,307	3,354	3,401	3,449	3,496	68,149							
CONTAINER	965	929	892	856	928	1,001	1,073	1,145	1,218	1,295	1,373	1,450	1,528	1,605	1,680	1,740	1,785	1,830	1,871	1,911	1,952	1,992	2,033	34,717							
TOTAL	5,873	5,958	6,042	6,127	6,206	6,284	6,363	6,442	6,520	6,679	6,838	6,997	7,156	7,315	7,466	7,618	7,769	7,921	8,072	8,195	8,318	8,440	8,563	8,686	171,847						
PV	5,244	4,749	4,301	3,894	3,521	3,184	2,878	2,602	2,351	2,151	1,966	1,796	1,640	1,497	1,364	1,245	1,132	1,030	937	850	770	698	632	572	50,999						
																										88,362	171,847				
																											10,723	50,999			

SAN ANTONIO : ALTERNATIVE 3

I	PHASE - 1										PHASE - 2										PHASE - 3										I
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL						
WHEAT	2,726	2,475	2,224	1,973	1,766	1,558	1,351	1,143	936	728	520	312	104	0	0	0	0	0	0	0	0	0	0	0	0						
FRUIT	651	687	723	758	763	767	772	776	781	784	787	791	794	797	805	813	821	829	837	845	853	860	868	876	19,038						
COPPER	1,575	1,697	1,819	1,941	1,988	2,036	2,083	2,131	2,179	2,032	1,886	1,739	1,593	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	40,609						
GENERAL	3,231	3,299	3,367	3,436	3,467	3,498	3,529	3,560	3,591	3,762	3,933	4,104	4,275	4,446	4,581	4,717	4,852	4,987	5,123	5,354	5,585	5,816	6,048	6,279	104,638						
CONTAINER	2,869	3,555	4,241	4,927	5,347	5,768	6,189	6,610	7,031	7,475	7,919	8,364	8,808	9,252	9,516	9,779	10,042	10,305	10,569	10,801	11,034	11,267	11,500	11,733	194,899						
TOTAL	11,051	11,712	12,373	13,034	13,531	14,027	14,524	15,020	15,517	16,027	16,537	17,047	17,557	18,067	18,565	19,062	19,560	20,057	20,555	21,105	21,654	22,204	22,754	23,304	414,843						
PV	9,867	9,337	8,807	8,283	7,678	7,107	6,570	6,066	5,595	5,160	4,754	4,376	4,024	3,697	3,392	3,109	2,849	2,608	2,387	2,188	2,004	1,835	1,679	1,535	114,907						
																										226,887	414,843				
																											27,283	114,907			

## Appendix XII- 9

## Number of Aseismic Berth and Costs Involved

<CASE 1>	87	88	89	90	91	92
<hr/>						
Cargo Demand						
Copper				869	885	901
Fruits				658	659	659
General Export				699	734	768
General Import				2098	2202	2305
Wheat				481	479	477
<hr/>						
total	4200	4400	4600	4805	4959	5110
Cap. at Alt. Ports	2200	2200	2200	2000	1800	1600
Existing Capacity	5200	5200	5200	400	400	400
				1400	1400	1400
<hr/>						
	5200	5200	5200	1800	1800	1800
Ton. at Alt. Ports	0	0	0	3005	3159	3310
	0	0	0	2000	1800	1600
Trade suspended	0	0	0	1005	1359	1710
Wheat				481	479	477
General Import				524	880	1233
General Export				0	0	0
Fruits				0	0	0
Copper				0	0	0
Additional Inland Transportation Costs	0	0	0	9015	9477	9930
Trade suspension Loss						
Wheat	0	0	0	1634	1627	1620
General Import	0	0	0	10325	17340	24295
General Export	0	0	0	0	0	0
Fruits	0	0	0	0	0	0
Copper	0	0	0	0	0	0
<hr/>						
Total	0	0	0	11959	18966	25915
Construction Costs						
Container	7500					
Non-container	4200					
<hr/>						
	11700					
					85262	
Other Costs						

(CASE 2)	87	88	89	90	91	92
<i>Cargo Demand</i>						
Copper				869	885	901
Fruits				658	659	659
General Export				699	734	768
General Import				2098	2202	2305
Wheat				481	479	477
total	4200	4400	4600	4805	4959	5110
Cap. at Alt. Ports	2200	2200	2200	2000	1800	1600
<i>Existing Capacity</i>						
	4800	4800	4800	400	400	400
				1800	1800	1800
	4800	4800	4800	2200	2200	2200
Ton. at Alt. Ports	0	0	0	2605	2759	2910
	0	0	0	2000	1800	1600
Trade suspended	0	0	0	605	959	1310
Wheat				481	479	477
General Import				124	480	833
General Export				0	0	0
Fruits				0	0	0
Copper				0	0	0
Additional Inland Transportation Costs	0	0	0	7815	8277	8730
<i>Trade suspension Loss</i>						
Wheat	0	0	0	1634	1627	1620
General Import	0	0	0	9478	9438	9399
General Export	0	0	0	0	0	0
Fruits	0	0	0	0	0	0
Copper	0	0	0	0	0	0
Total	0	0	0	11111	11065	11019
<i>Construction Costs</i>		<i>Other Costs</i>		58017		
Container	7500					
Non-container	8400					
	15900					

<CASE 3>	87	88	89	90	91	92
<hr/>						
Cargo Demand						
Copper				869	885	901
Fruits				658	659	659
General Export				699	734	768
General Import				2098	2202	2305
Wheat				481	479	477
<hr/>						
total	4200	4400	4600	4805	4959	5110
Cap. at Alt. Ports	2200	2200	2200	2000	1800	1600
Existing Capacity	4400	4400	4400	400	400	400
				2200	2200	2200
<hr/>						
	4400	4400	4400	2600	2600	2600
Ton. at Alt Ports	0	0	200	2205	2359	2510
	0	0	200	2000	1800	1600
Trade suspended	0	0	0	205	559	910
Wheat				205	479	477
General Import				0	80	433
General Export				0	0	0
Fruits				0	0	0
Copper				0	0	0
Additional Inland Transportation Costs	0	0	600	6615	7077	7530
Trade suspension Loss						
Wheat	0	0	0	696	1627	1620
General Import	0	0	0	0	1576	8532
General Export	0	0	0	0	0	0
Fruits	0	0	0	0	0	0
Copper	0	0	0	0	0	0
<hr/>						
Total	0	0	0	696	3203	10152
Construction Costs					35873	
Container	7500					
Non-container	12600					
<hr/>						
	20100					



(CASE 4)	87	88	89	90	91	92
<hr/>						
Cargo Demand						
Copper				869	885	901
Fruits				658	659	659
General Export				699	734	748
General Import				2098	2202	2305
Wheat				481	479	477
<hr/>						
total	4200	4400	4600	4805	4959	5110
Cap. at Alt. Ports	2200	2200	2200	2000	1800	1600
Existing Capacity	4000	4000	4000	400	400	400
				2600	2600	2600
<hr/>						
	4000	4000	4000	3000	3000	3000
Ton. at Alt. Ports	200	400	600	1805	1959	2110
	200	400	600	1805	1800	1600
Trade suspended	0	0	0	0	159	510
Wheat				0	159	477
General Import				0	0	33
General Export				0	0	0
Fruits				0	0	0
Copper				0	0	0
Additional Inland Transportation Costs	600	1200	1800	5415	5877	6330
Trade suspension Loss						
Wheat	0	0	0	0	540	1620
General Import	0	0	0	0	0	650
General Export	0	0	0	0	0	0
Fruits	0	0	0	0	0	0
Copper	0	0	0	0	0	0
<hr/>						
total	0	0	0	0	540	2270
Construction Costs					24032	
Container	7500					
Non-container	16800					
<hr/>						
	24300					

<CASE 5>	87	88	89	90	91	92
Cargo Demand						
Copper				869	885	901
Fruits				658	659	659
General Export				699	734	768
General Import				2098	2202	2305
Wheat				481	479	477
total	4200	4400	4600	4805	4959	5110
Cap. at Alt. Ports	2200	2200	2200	2000	1800	1600
Existing Capacity	3600	3600	3600	400	400	400
				3000	3000	3000
	3600	3600	3600	3400	3400	3400
Ton. at Alt. Ports	600	800	1000	1405	1559	1710
	600	800	1000	1405	1559	1600
Trade suspended	0	0	0	0	0	110
Wheat				0	0	110
General Import				0	0	0
General Export				0	0	0
Fruits				0	0	0
Copper				0	0	0
Additional Inland Transportation Costs	1800	2400	3000	4215	4677	5130
Trade suspension Loss						
Wheat	0	0	0	0	0	374
General Import	0	0	0	0	0	2167
General Export	0	0	0	0	0	0
Fruits	0	0	0	0	0	0
Copper	0	0	0	0	0	0
Total	0	0	0	0	0	2541
Construction Costs						
Container	7500					
Non-container	21000					
	28500					
Other Costs					23763	

(CASE 6)	87	88	89	90	91	92
<hr/>						
Cargo Demand						
Copper				869	885	901
Fruits				658	659	659
General Export				699	734	768
General Import				2098	2202	2305
Wheat				481	479	477
<hr/>						
total	4200	4400	4600	4805	4959	5110
Cap. at Alt. Ports	2200	2200	2200	2000	1800	1600
Existing Capacity	3200	3200	3200	400	400	400
				3400	3400	3400
<hr/>						
	3200	3200	3200	3800	3800	3800
Ton. at Alt Ports	1000	1200	1400	1005	1159	1310
	1000	1200	1400	1005	1159	1310
Trade suspended	0	0	0	0	0	0
Wheat				0	0	0
General Import				0	0	0
General Export				0	0	0
Fruits				0	0	0
Copper				0	0	0
Additional Inland Transportation Costs	3000	3600	4200	3015	3477	3930
Trade suspension Loss						
Wheat	0	0	0	0	0	0
General Import	0	0	0	0	0	0
General Export	0	0	0	0	0	0
Fruits	0	0	0	0	0	0
Copper	0	0	0	0	0	0
<hr/>						
Total	0	0	0	0	0	0
Construction Costs					21222	
Container	7500					
Non-container	25200					
	32700					

Appendix XII-10 Output of Cost/Benefit Analysis with Consideration Given to Earthquake Probability

Capacities	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
With :																									
<b>Existing</b>																									
Valparaiso	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
1 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
4 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
6 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
7 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
9 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
10 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
San Antonio	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
4 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (K=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
8 (K=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
New Berths																									
Valparaiso	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
2 (K=0.20)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
3 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
4 (K=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
6 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
7 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
8 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
San Antonio	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
1 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
2 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
3 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
4 (K=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (K=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
6 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
7 (K=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Total	4000	4400	4400	5400	5000	5400	5400	5400	5000	5000	6400	5000	5000	5000	5400	6400	4900	5000	7800	7900	7900	7900	7900	7900	7900
Without :																									
<b>Existing</b>																									
Valparaiso	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
1 (K=0.15)	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
4 (K=0.15)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
San Antonio	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
1 (K=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Total	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Probability																									
Valparaiso	0.9854	0.9581	0.9479	0.9378	0.9279	0.9180	0.9082	0.8986	0.8890	0.8795	0.8702	0.8609	0.8519	0.8427	0.8333	0.8239	0.8145	0.8074	0.7988	0.7903	0.7819	0.7735	0.7654	0.7572	0.7500
1 (K=0.25)	0.9476	0.9272	0.9072	0.8874	0.8680	0.8489	0.8301	0.8115	0.7934	0.7755	0.7579	0.7406	0.7236	0.7068	0.6903	0.6741	0.6582	0.6425	0.6273	0.6119	0.5970	0.5825	0.5679	0.5537	0.5400
4 (K=0.20)	0.9552	0.9406	0.9265	0.9125	0.8986	0.8850	0.8716	0.8584	0.8454	0.8326	0.8200	0.8076	0.7953	0.7833	0.7714	0.7597	0.7482	0.7369	0.7257	0.7147	0.7039	0.6932	0.6827	0.6724	0.6624
5 (K=0.25)	0.9258	0.8975	0.8695	0.8423	0.8157	0.7897	0.7643	0.7396	0.7153	0.6917	0.6686	0.6460	0.6240	0.6025	0.5815	0.5610	0.5410	0.5215	0.5024	0.4838	0.4655	0.4479	0.4305	0.4138	0.4022
1 (K=0.15)	0.9286	0.9068	0.8859	0.8653	0.8453	0.8267	0.8082	0.7912	0.7761	0.7616	0.7486	0.7364	0.7247	0.7134	0.7024	0.6916	0.6810	0.6706	0.6604	0.6504	0.6406	0.6309	0.6215	0.6122	0.6031
5 (K=0.20)	0.8757	0.8380	0.7955	0.7545	0.7151	0.6771	0.6406	0.6054	0.5716	0.5391	0.5078	0.4777	0.4488	0.4210	0.3945	0.3687	0.3440	0.3204	0.2977	0.2759	0.2550	0.2350	0.2159	0.1973	0.1792

(Capacities) With: 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

Existing	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Valparaiso	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1 (Kh=0.15)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
2 (Kh=0.20)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
3 (Kh=0.25)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
4 (Kh=0.30)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (Kh=0.35)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
6 (Kh=0.40)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
7 (Kh=0.45)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
8 (Kh=0.50)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
San Antonio	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
4 (Kh=0.15)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (Kh=0.20)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
6 (Kh=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
7 (Kh=0.30)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
8 (Kh=0.35)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
San Antonio	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1 (Kh=0.20)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
2 (Kh=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
3 (Kh=0.30)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
4 (Kh=0.35)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
5 (Kh=0.40)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
6 (Kh=0.45)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
7 (Kh=0.50)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Total	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900	7900

Without: 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

Existing	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Valparaiso	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
San Antonio	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
1 (Kh=0.15)	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
2 (Kh=0.20)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
3 (Kh=0.25)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Total	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
Probability	0.7492	0.7412	0.7333	0.7255	0.7178	0.7102	0.7026	0.6951	0.6877	0.6804	0.6732	0.6660	0.6589	0.6519	0.6450	0.6381	0.6313	0.6246	0.6180	0.6114
Valparaiso	0.5397	0.5260	0.5125	0.4993	0.4863	0.4734	0.4609	0.4488	0.4363	0.4244	0.4126	0.4011	0.3897	0.3785	0.3676	0.3568	0.3462	0.3358	0.3256	0.3156
San Antonio	0.6622	0.6521	0.6423	0.6325	0.6229	0.6135	0.6042	0.5951	0.5860	0.5772	0.5684	0.5598	0.5513	0.5430	0.5347	0.5266	0.5187	0.5108	0.5031	0.4954
1 (Kh=0.15)	0.3973	0.3813	0.3656	0.3503	0.3354	0.3209	0.3068	0.2930	0.2795	0.2664	0.2536	0.2411	0.2290	0.2172	0.2057	0.1945	0.1835	0.1729	0.1625	0.1524
2 (Kh=0.20)	0.5134	0.5009	0.4887	0.4767	0.4651	0.4538	0.4427	0.4319	0.4214	0.4111	0.4011	0.3913	0.3817	0.3724	0.3633	0.3545	0.3458	0.3374	0.3292	0.3211
3 (Kh=0.25)	0.1797	0.1628	0.1466	0.1311	0.1163	0.1021	0.0885	0.0756	0.0632	0.0514	0.0401	0.0293	0.0191	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
San Antonio	0.9815	0.9754	0.9693	0.9633	0.9573	0.9514	0.9455	0.9396	0.9338	0.9280	0.9222	0.9165	0.9108	0.9051	0.8995	0.8939	0.8884	0.8828	0.8774	0.8719	0.8665	0.8611	0.8558	0.8504
(kh=0.25)	0.9692	0.9571	0.9451	0.9332	0.9214	0.9098	0.8982	0.8867	0.8754	0.8642	0.8530	0.8420	0.8311	0.8203	0.8095	0.7989	0.7884	0.7780	0.7677	0.7575	0.7473	0.7373	0.7274	0.7176
(kh=0.20)	0.9730	0.9641	0.9554	0.9467	0.9381	0.9295	0.9211	0.9127	0.9044	0.8962	0.8881	0.8800	0.8720	0.8641	0.8562	0.8484	0.8407	0.8331	0.8255	0.8180	0.8105	0.8032	0.7959	0.7886
(kh=0.15)	0.9559	0.9416	0.9276	0.9137	0.9001	0.8867	0.8734	0.8604	0.8475	0.8349	0.8224	0.8102	0.7981	0.7862	0.7744	0.7629	0.7515	0.7403	0.7292	0.7183	0.7076	0.6970	0.6866	0.6764
(kh=0.10)	0.9259	0.8968	0.8714	0.8445	0.8183	0.7926	0.7675	0.7431	0.7191	0.6957	0.6729	0.6506	0.6288	0.6075	0.5867	0.5664	0.5465	0.5272	0.5082	0.4898	0.4717	0.4541	0.4379	0.4202

(Expected Capacities)  
With :

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Existing	350	335	318	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valparaiso	350	315	318	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio	371	360	349	338	327	317	307	297	288	278	269	260	252	243	235	227	219	211	0	0	0	0	0	0
New Berths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valparaiso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3581	3523	3671	4450	4653	4270	4901	4745	4367	4233	4379	3974	3850	4070	3947	3627	4219	4101	4591	4463	4337	4214	4092	3975
Without :	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Existing	3503	3152	3152	3015	2860	2708	2562	2422	2286	2156	2031	1911	1795	1684	1577	1475	1376	1282	1191	1104	1029	949	863	789
Valparaiso	1453	1374	1351	1306	1268	1228	1189	1151	1113	1077	1041	1006	972	939	906	874	843	813	784	755	727	699	672	646
San Antonio	388	383	376	373	369	364	359	355	350	346	341	337	332	328	324	320	315	311	307	303	299	295	291	287
Total	5273	5173	4984	4743	4536	4341	4150	3965	3767	3615	3449	3269	3134	2984	2840	2700	2566	2436	2311	2180	2074	1961	1853	1749

San Antonio	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
	0.342	0.2599	0.5247	0.5225	0.5144	0.5192	0.5142	0.5091	0.5041	0.7991	0.7941	0.7892	0.7843	0.7794	0.7745	0.7696	0.7647	0.7598	0.7549	0.7500
(kh=0.25)	0.7078	0.6922	0.6836	0.6772	0.6698	0.6605	0.6515	0.6422	0.6332	0.6243	0.6154	0.6067	0.5980	0.5894	0.5809	0.5725	0.5642	0.5559	0.5477	0.5396
(kh=0.20)	0.7815	0.7744	0.7673	0.7604	0.7534	0.7466	0.7398	0.7331	0.7264	0.7198	0.7133	0.7068	0.7004	0.6940	0.6877	0.6814	0.6752	0.6691	0.6630	0.6570
	0.5653	0.5584	0.5526	0.5458	0.5393	0.5326	0.5261	0.5198	0.4998	0.4837	0.4777	0.4669	0.4562	0.4457	0.4353	0.4251	0.4151	0.4051	0.3954	0.3858
(kh=0.15)	0.6663	0.6584	0.6486	0.6389	0.6274	0.6180	0.6088	0.5997	0.5908	0.5820	0.5733	0.5647	0.5563	0.5480	0.5398	0.5317	0.5238	0.5160	0.5083	0.5007
	0.4038	0.3978	0.3923	0.3871	0.3822	0.3777	0.3735	0.3698	0.2684	0.2733	0.2606	0.2461	0.2350	0.2242	0.2126	0.2014	0.1905	0.1798	0.1694	0.1593

(Expected Capacities)  
 With:

Existing	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Valparaiso	397	381	366	358	335	321	307	293	279	266	254	241	229	217	206	194	184	173	163	152
San Antonio	397	381	366	358	335	321	307	293	279	266	254	241	229	217	206	194	184	173	163	152
New Berths	159	153	146	140	134	128	123	117	112	107	101	96	92	87	82	78	73	69	65	61
Valparaiso	397	381	366	358	335	321	307	293	279	266	254	241	229	217	206	194	184	173	163	152
San Antonio	397	381	366	358	335	321	307	293	279	266	254	241	229	217	206	194	184	173	163	152
Total	3859	3746	3635	3526	3420	3316	3214	3114	3016	2921	2927	2755	2646	2556	2472	2388	2306	2225	2146	2069

Without:

Existing	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Valparaiso	719	681	656	624	465	408	354	302	253	206	160	117	76	37	0	0	0	0	0	0
San Antonio	383	379	375	372	368	364	361	357	353	350	346	343	339	336	332	329	326	322	319	316
Total	1648	1551	1457	1367	1291	1197	1116	1039	964	893	824	757	693	632	573	551	530	510	490	471

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Carpo Demand</b>	4205	4406	4606	4805	4958	5111	5264	5417	5570	5722	5872	6023	6173	6325	6482	6639	6795	6952	7109	7268	7429	7586	7758	7906
<b>Available capacity at Alternative Ports</b>	2200	2200	2200	2000	1800	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Expected Handling Volume</b>																								
With :	3581	3823	3671	4490	4053	4270	4901	4746	4367	4233	4370	3974	3850	4070	3947	3827	4219	4101	4591	4463	4337	4214	4093	3875
Without :	4205	4406	4606	4743	4538	4341	4150	3965	3787	3615	3449	3289	3134	2984	2840	2700	2566	2436	2311	2190	2074	1961	1853	1749
<b>Expected Demand Surplus</b>																								
With :	624	583	935	315	905	841	363	671	1203	1489	1502	2049	2323	2255	2812	2576	2851	2518	2805	3092	3372	3665	3931	3657
Without :	0	0	0	62	420	770	1114	1452	1783	2107	2433	2734	3039	3341	3642	3939	4229	4516	4793	5078	5355	5625	5905	6157
<b>Expected Volume Handled at Alternative Ports</b>																								
With :	624	583	935	315	905	841	363	671	1203	1489	1502	2049	2323	2255	2812	2576	2851	2518	2805	3092	3372	3665	3931	3657
Without :	0	0	0	62	420	770	1114	1452	1800	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Difference</b>	-624	-583	-935	-253	-485	-70	751	781	397	111	98	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Trade Suspended Volume</b>																								
With :	0	0	0	0	0	0	0	0	0	0	0	449	723	655	935	1212	976	1251	918	1205	1452	1772	2065	2331
Without :	0	0	0	0	0	0	0	0	153	507	823	1134	1439	1741	2042	2339	2629	2916	3193	3478	3755	4025	4305	4557
<b>Difference</b>	0	0	0	0	0	0	0	0	163	507	823	685	716	1086	1107	1127	1653	1665	2280	2273	2263	2253	2240	2226
<b>(Benefit)</b>																								
Inland Transport Cost	-1872	-1748	-1586	-758	-1454	-210	2254	2343	1970	333	294	0	0	0	0	0	0	0	0	0	0	0	0	0
Saving	0	0	0	0	0	0	0	0	4854	13457	21851	18195	19019	28829	29403	29920	43885	44199	60550	60346	60098	59809	59481	59116
Trade Loss Saving	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	-1872	-1748	-1586	-758	-1454	-210	2254	2343	6044	13790	22146	18195	19019	28929	29403	29920	43665	44199	60346	60098	59809	59481	59116	
<b>(Costs)</b>																								
771	7233	5871	3009	3550	4458	92	2778	7895	1817	2203	3604	1132	5833	2119	2240	6559	7984	319	0	0	0	0	0	0
<b>(Net Benefit)</b>	-2643	-9951	-6677	-3767	-5434	-4668	2162	-435	-1951	8973	19943	14591	17887	22594	27284	27680	37266	36215	60346	60098	59809	59481	59116	
<b>IRR (1987-2030) %</b>																								



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cargo Demand	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906
Available capacity at Alternative Ports	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Expected Handling Volume																				
With :	3859	3746	3635	3526	3420	3316	3214	3114	3016	2921	2827	2735	2646	2558	2472	2388	2306	2225	2146	2069
Without :	1648	1551	1457	1367	1281	1197	1116	1039	964	893	824	757	693	632	573	511	450	390	330	271
Expected Demand Surplus																				
With :	4947	4160	4271	4380	4486	4590	4692	4792	4890	4985	5079	5171	5260	5348	5434	5518	5600	5681	5760	5837
Without :	6258	6355	6449	6539	6625	6709	6790	6867	6942	7013	7082	7149	7213	7274	7333	7389	7446	7506	7566	7635
Expected Volume Handled at Alternative Ports																				
With :	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Without :	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trade Suspended Volume																				
With :	2447	2560	2671	2780	2886	2990	3092	3192	3290	3385	3479	3571	3660	3748	3834	3918	4000	4081	4160	4237
Without :	4658	4755	4849	4939	5025	5109	5190	5267	5342	5413	5482	5549	5613	5676	5735	5795	5855	5916	5976	6035
Difference	2211	2195	2178	2159	2140	2119	2097	2075	2052	2028	2004	1978	1953	1926	1899	1877	1775	1715	1656	1599
(Benefit)																				
Inland Transport Cost																				
Saving	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trade-Loss Saving	58717	58284	57821	57328	56808	56262	55691	55099	54485	53851	53199	52530	51845	51146	50433	49747	47135	45538	43974	42443
Total	58717	58284	57821	57328	56808	56262	55691	55099	54485	53851	53199	52530	51845	51146	50433	49747	47135	45538	43974	42443
(Costs)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Net Benefit)	58717	58284	57821	57328	56808	56262	55691	55099	54485	53851	53199	52530	51845	51146	50433	49747	47135	45538	43974	42443

IRR (1987-2030) 1

Appendix XII-11 Output of Cost/Benefit Analysis without Consideration Given to the Occurrence of Earthquakes

Chilean Port Study

(Unit: Million Pesos)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
<b>&lt;Cost&gt;</b>																									
<b>Construction Cost: WITH</b>																									
Valparaiso	771	4883	2837	0	2363	3642	92	2776	7895	3194	1903	661	660	5556	0	0	4945	7358	319	0	0	0	0	0	0
San Antonio	0	1576	1034	2615	1617	816	0	0	0	1623	300	2943	472	279	2119	2240	1654	626	0	0	0	0	0	0	0
<b>Total Cost</b>	<b>771</b>	<b>6259</b>	<b>3871</b>	<b>2615</b>	<b>3980</b>	<b>4458</b>	<b>92</b>	<b>2778</b>	<b>7895</b>	<b>4817</b>	<b>2203</b>	<b>3604</b>	<b>1132</b>	<b>5835</b>	<b>2119</b>	<b>2240</b>	<b>6599</b>	<b>7984</b>	<b>319</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Maintenance &amp; Administration</b>																									
WITH	408	466	500	505	560	599	600	623	691	733	752	783	793	842	861	880	927	1007	1010	1010	1010	1010	1010	1010	1010
WITHOUT	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508
<b>Balance</b>	<b>-100</b>	<b>-42</b>	<b>-8</b>	<b>17</b>	<b>52</b>	<b>91</b>	<b>92</b>	<b>115</b>	<b>183</b>	<b>225</b>	<b>244</b>	<b>275</b>	<b>285</b>	<b>334</b>	<b>353</b>	<b>372</b>	<b>429</b>	<b>499</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>
<b>Cargo Handling</b>																									
WITH	3306	2402	2498	2595	2649	2704	2759	2913	2968	2953	3038	3124	3209	3294	3375	3456	3538	3619	3700	3792	3885	3977	4070	4162	4152
WITHOUT	2333	2428	2571	2760	2902	3022	3145	3274	3404	3516	3665	3835	4005	4176	4337	4485	4616	4744	4873	5007	5141	5245	5238	5222	5222
<b>Balance</b>	<b>-27</b>	<b>-56</b>	<b>-73</b>	<b>-165</b>	<b>-263</b>	<b>-318</b>	<b>-366</b>	<b>-461</b>	<b>-556</b>	<b>-663</b>	<b>-627</b>	<b>-711</b>	<b>-786</b>	<b>-882</b>	<b>-962</b>	<b>-1029</b>	<b>-1078</b>	<b>-1125</b>	<b>-1173</b>	<b>-1215</b>	<b>-1256</b>	<b>-1298</b>	<b>-1168</b>	<b>-1070</b>	<b>-970</b>
<b>Total Cost</b>	<b>644</b>	<b>6191</b>	<b>3790</b>	<b>2447</b>	<b>3775</b>	<b>4331</b>	<b>-302</b>	<b>2432</b>	<b>7542</b>	<b>4479</b>	<b>1820</b>	<b>3168</b>	<b>621</b>	<b>5287</b>	<b>1610</b>	<b>1383</b>	<b>5950</b>	<b>7359</b>	<b>-352</b>	<b>-713</b>	<b>-754</b>	<b>-766</b>	<b>-666</b>	<b>-568</b>	<b>-568</b>
<b>&lt;Benefit&gt;</b>																									
(1) Ship Waiting	-24	712	709	780	798	851	970	1079	1281	1357	1493	1465	1452	1413	1490	1527	1520	1507	1562	1580	1587	1545	1556	1478	1478
(2) Inland Transport	0	0	0	0	0	0	0	0	0	0	335	760	1186	1611	2015	2419	2822	3226	3630	4051	4472	4800	4800	4800	4800
(3) Trade Suspension	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Benefit</b>	<b>-24</b>	<b>712</b>	<b>709</b>	<b>780</b>	<b>798</b>	<b>851</b>	<b>970</b>	<b>1079</b>	<b>1281</b>	<b>1357</b>	<b>1828</b>	<b>2235</b>	<b>2638</b>	<b>3024</b>	<b>3595</b>	<b>3946</b>	<b>4342</b>	<b>4733</b>	<b>5192</b>	<b>5631</b>	<b>6059</b>	<b>7175</b>	<b>10912</b>	<b>14562</b>	<b>14562</b>
<b>Net Benefit</b>	<b>-670</b>	<b>-5479</b>	<b>-3081</b>	<b>-1567</b>	<b>-2581</b>	<b>-3580</b>	<b>1172</b>	<b>-1353</b>	<b>-6261</b>	<b>-3112</b>	<b>6</b>	<b>-743</b>	<b>2017</b>	<b>-2545</b>	<b>1895</b>	<b>2362</b>	<b>-1507</b>	<b>-2625</b>	<b>6344</b>	<b>6344</b>	<b>5814</b>	<b>7959</b>	<b>14578</b>	<b>15130</b>	<b>15130</b>

10.85

Chilean Port Study

(Unit: Million Pesos)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>(Cost)</b>																				
<b>Construction Cost: WITH</b>																				
Valparaiso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Cost</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Maintenance &amp; Administration</b>																				
WITH	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010
WITHOUT	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508
<b>Balance</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>	<b>502</b>
<b>Cargo Handling</b>																				
WITH	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162
WITHOUT	5251	5228	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226
<b>Balance</b>	<b>-1069</b>	<b>-1066</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>	<b>-1064</b>
<b>Total Cost</b>	<b>-567</b>	<b>-564</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>	<b>-562</b>
<b>(Benefit)</b>																				
(1) Ship Waiting	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478
(2) Inland Transport	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
(3) Trade Suspension	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284
<b>Total Benefit</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>	<b>14562</b>
<b>Net Benefit</b>	<b>15129</b>	<b>15127</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>	<b>15125</b>

(IRR (%))

Chilean Port Study

(Ship Waiting)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Without</b>																								
<b>Valparaiso</b>																								
General Cargo Berths	7	7	16	38	52	74	109	169	253	301	301	309	299	299	332	330	329	295	294	320	319	290	289	288
Container Berth	63	105	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149
Sub-total	70	112	165	187	201	223	258	318	402	450	450	449	448	448	481	479	478	444	443	469	468	439	438	437
<b>San Antonio</b>																								
General Cargo Berths	631	954	1004	1039	1045	1051	1051	1056	1062	1068	1068	984	984	990	996	1098	1014	1025	1031	1037	1049	1055	1066	1072
Bulk Berth	106	73	60	45	45	45	45	45	45	47	49	51	53	55	62	69	77	84	91	99	107	113	125	132
Container Berth	6	6	19	46	66	91	127	171	245	293	312	278	264	250	298	318	298	281	248	236	224	199	188	178
Sub-total	745	1033	1083	1130	1156	1187	1223	1272	1352	1408	1429	1313	1301	1295	1356	1395	1389	1390	1370	1372	1380	1367	1379	1382
Total	815	1145	1248	1317	1357	1410	1481	1590	1754	1866	1879	1762	1749	1743	1837	1874	1867	1934	1813	1841	1848	1806	1817	1819
<b>With</b>																								
<b>Valparaiso</b>																								
General Cargo Berths	159	166	272	241	253	253	205	205	206	215	110	110	110	197	209	209	206	209	105	109	109	109	109	132
Container Berth	682	267	267	296	306	306	306	306	267	276	276	187	187	133	138	138	138	118	146	152	152	152	152	209
Sub-total	841	433	539	537	559	559	511	511	473	491	386	297	297	330	347	347	347	327	251	261	261	261	261	341
Total	-25	712	709	780	798	951	970	1079	1261	1367	1463	1463	1452	1413	1490	1527	1520	1507	1562	1660	1587	1545	1556	1478

Chilean Port Study

Ship Maiting?	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Without</b>																				
Valparaiso	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288
General Cargo Berths	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149
Container Berth	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139
Sub-total	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427
<b>San Antonio</b>																				
General Cargo Berths	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072	1072
Zuliz Berth	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132
Container Berth	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
Sub-total	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382	1382
<b>Total</b>	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819
<b>With</b>																				
Valparaiso	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132	132
San Antonio	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209
Total	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341
<b>Benefit (1)</b>	1472	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478

(Cargo Handling in WITHOUT)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Cargo Demand ('000 tons):</b>																								
<b>Valparaiso</b>																								
General Cargo	1200	1229	1258	1287	1288	1290	1291	1293	1294	1310	1325	1341	1356	1372	1395	1418	1441	1464	1487	1505	1522	1540	1557	1575
Container	793	960	1128	1295	1406	1516	1627	1737	1848	1965	2082	2198	2315	2432	2501	2570	2640	2709	2778	2839	2900	2962	3023	3084
<b>San Antonio</b>																								
General Cargo	1327	1387	1450	1510	1533	1556	1580	1603	1626	1614	1603	1591	1580	1568	1596	1628	1659	1689	1719	1779	1820	1871	1921	1972
Wheat	665	603	542	481	479	477	476	474	472	481	490	500	509	518	540	562	585	607	629	648	667	686	705	724
Container	235	235	229	232	252	271	291	310	330	351	372	393	414	435	447	459	472	484	496	507	518	529	540	551
<b>Total</b>	<b>4208</b>	<b>4405</b>	<b>4607</b>	<b>4805</b>	<b>4958</b>	<b>5111</b>	<b>5264</b>	<b>5417</b>	<b>5570</b>	<b>5721</b>	<b>5872</b>	<b>6023</b>	<b>6174</b>	<b>6325</b>	<b>6482</b>	<b>6639</b>	<b>6795</b>	<b>6952</b>	<b>7109</b>	<b>7268</b>	<b>7428</b>	<b>7587</b>	<b>7747</b>	<b>7906</b>
<b>Handling Capa. ('000 tons):</b>																								
<b>Valparaiso</b>																								
General Cargo Berth	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140
Container Berth	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060
<b>San Antonio</b>																								
General Cargo Berth	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
Bulk Berth	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724
Container Berth	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
<b>Total</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>	<b>5994</b>
<b>Tonnage Handled ('000 tons):</b>																								
<b>Valparaiso</b>																								
<b>At General Berth</b>																								
General Total	1200	1229	1258	1287	1288	1290	1291	1293	1294	1310	1325	1341	1356	1372	1395	1418	1441	1464	1487	1505	1522	1540	1557	1575
(Fruit)	407	426	446	465	484	504	523	523	523	525	525	523	525	527	528	530	532	538	544	549	555	561	568	575
(Copper)	193	198	204	209	214	220	225	225	225	225	225	225	222	219	216	215	210	210	210	210	210	210	210	210
Others from Container	0	0	68	235	346	456	567	677	788	830	815	799	784	768	745	722	699	676	653	635	618	600	583	565
<b>Sub-total</b>	<b>1200</b>	<b>1229</b>	<b>1258</b>	<b>1287</b>	<b>1288</b>	<b>1290</b>	<b>1291</b>	<b>1293</b>	<b>1294</b>	<b>1310</b>	<b>1325</b>	<b>1341</b>	<b>1356</b>	<b>1372</b>	<b>1395</b>	<b>1418</b>	<b>1441</b>	<b>1464</b>	<b>1487</b>	<b>1505</b>	<b>1522</b>	<b>1540</b>	<b>1557</b>	<b>1575</b>
<b>At Container Berth</b>																								
General Total	793	960	1128	1295	1406	1516	1627	1737	1848	1965	2082	2198	2315	2432	2501	2570	2640	2709	2778	2839	2900	2962	3023	3084
<b>Sub-total</b>	<b>793</b>	<b>960</b>	<b>1128</b>	<b>1295</b>	<b>1406</b>	<b>1516</b>	<b>1627</b>	<b>1737</b>	<b>1848</b>	<b>1965</b>	<b>2082</b>	<b>2198</b>	<b>2315</b>	<b>2432</b>	<b>2501</b>	<b>2570</b>	<b>2640</b>	<b>2709</b>	<b>2778</b>	<b>2839</b>	<b>2900</b>	<b>2962</b>	<b>3023</b>	<b>3084</b>
<b>San Antonio</b>																								
<b>At General Berth</b>																								
General Total	1327	1387	1450	1510	1533	1556	1580	1603	1626	1614	1603	1591	1580	1568	1596	1628	1659	1689	1719	1779	1820	1871	1921	1972
(Fruit)	116	122	129	135	136	137	137	138	139	140	140	141	141	142	143	145	146	148	149	150	152	153	155	156
(Copper)	523	533	504	544	604	676	691	707	723	674	626	577	529	490	480	480	480	480	480	480	480	480	480	480
At Bulk Berth	665	603	542	481	479	477	476	474	472	481	490	500	509	518	540	562	585	607	629	648	667	686	705	724
<b>At Container Berth</b>																								
General Total	235	235	229	232	252	271	291	310	330	351	372	393	414	435	447	459	472	484	496	507	518	529	540	551
General Cargo	0	0	50	110	133	156	180	203	226	214	203	192	180	168	198	211	199	188	174	163	152	141	130	119
Container from Val.	0	0	0	0	0	0	0	0	0	74	95	96	76	67	25	0	0	0	0	0	0	0	0	0
<b>Sub-total</b>	<b>235</b>	<b>225</b>	<b>279</b>	<b>342</b>	<b>385</b>	<b>429</b>	<b>470</b>	<b>513</b>	<b>556</b>	<b>640</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>	<b>670</b>
<b>Total</b>	<b>4208</b>	<b>4405</b>	<b>4607</b>	<b>4805</b>	<b>4958</b>	<b>5111</b>	<b>5264</b>	<b>5417</b>	<b>5570</b>	<b>5721</b>	<b>5872</b>	<b>6023</b>	<b>6174</b>	<b>6325</b>	<b>6482</b>	<b>6639</b>	<b>6795</b>	<b>6952</b>	<b>7109</b>	<b>7268</b>	<b>7428</b>	<b>7587</b>	<b>7747</b>	<b>7906</b>

Chilean Port Study

(Cargo Handling is WITHOUT)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
<b>Cargo Demand ('000 tons):</b>																					
<b>Valparaiso</b>																					
General Cargo	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575
Container	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084	3084
<b>San Antonio</b>																					
General Cargo	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972
Wheat	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724
Container	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551
<b>Total</b>	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906	7906

Handling Caps. ('000 tons):

<b>Valparaiso</b>																					
General Cargo Berth	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140
Container Berth	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060
<b>San Antonio</b>																					
General Cargo Berth	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
Bulk Berth	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724
Container Berth	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
<b>Total</b>	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994

Tonnage Handled ('000 tons):

<b>Valparaiso</b>																					
At General Berth	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575
General Total (Fruit)	583	590	597	597	597	597	597	597	597	597	597	597	597	597	597	597	597	597	597	597	597
(copper)	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
Others from Container	585	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565	565
<b>Sub-total</b>	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140	2140
At Container Berth	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060
<b>San Antonio</b>																					
At General Berth	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
General Total (Fruit)	153	155	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156
(copper)	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480
At Bulk Berth	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724	724
At Container Berth	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551	551
General Cargo	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119
Container from Val.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sub-total</b>	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670	670
<b>Total</b>	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994	5994

Chilean Port Study

Tonnage over Capa. ('000 tons):

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Valparaiso</b>																								
General Cargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container	0	0	0	0	0	0	0	0	0	0	112	253	395	537	672	788	881	973	1065	1144	1223	1301	1380	1459
<b>San Antonio</b>																								
General Cargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	60	103	145	207	268	330	391	452	
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	0	0	0	0	0	0	0	0	0	0	112	253	395	537	672	788	881	973	1065	1144	1223	1301	1380	1459
<b>Available Capa. at Alternative Ports</b>																								
2200	2200	2200	2200	2000	1800	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Tonnage Handled at Alternative Ports</b>																								
0	0	0	0	0	0	0	0	0	0	0	112	253	395	537	672	806	941	1075	1210	1350	1491	1600	1600	1600
<b>Benefit (2)</b>																								
0	0	0	0	0	0	0	0	0	0	0	335	760	1184	1611	2015	2419	2822	3226	3630	4051	4472	4804	4800	4800
<b>&lt;Trade Suspension&gt;</b>																								
<b>Tonnage Suspended</b>																								
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Benefit (3)</b>																								
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>(Maintenance &amp; Administration in WITHOUT)</b>																								
<b>Valparaiso</b>																								
Administration	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Maintenance	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
<b>San Antonio</b>																								
Administration	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
Maintenance	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
<b>Total</b>	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508
<b>(Cargo Handling in WITHOUT)</b>																								
<b>Valparaiso</b>																								
General Cargo	963	994	1004	1024	1012	1010	1033	1064	1096	1021	1037	1053	1070	1087	1112	1136	1161	1183	1204	1220	1236	1253	1268	1284
Container	254	307	407	574	655	735	906	1017	1127	1193	1164	1156	1147	1129	1092	1061	1038	1015	992	975	957	939	922	904
<b>San Antonio</b>																								
General Cargo	832	852	898	1025	1037	1049	1062	1073	1085	1102	1130	1152	1174	1197	1226	1258	1286	1315	1301	1190	1178	1167	1155	1144
Wheat	113	103	92	82	81	81	81	81	80	82	83	85	86	88	92	96	99	103	107	110	112	117	120	123
Container	71	73	73	74	81	87	93	99	106	112	119	126	132	139	145	147	151	155	158	162	165	169	173	176
<b>Alternative Ports</b>	0	0	0	0	0	0	0	0	0	0	112	253	395	537	672	806	941	1075	1210	1350	1491	1600	1600	1600
<b>Total</b>	2353	2428	2571	2750	2802	3022	3145	3274	3404	3516	3665	3855	4005	4176	4337	4485	4616	4744	4873	5007	5141	5245	5328	5392



Chilean Port Study

Tonnage over Capa. (000 Tons):

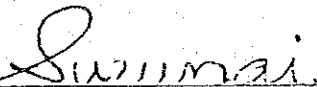
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Valparaiso</b>																				
General Cargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459
<b>San Antonio</b>																				
General Cargo	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912
<b>Available Capa. at Alternative Ports</b>																				
Tonnage Handled at Alternative Ports	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Benefit (2)	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
<b>(Trade Suspension)</b>																				
Tonnage Suspended	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Benefit (3)	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284	8284
<b>(Maintenance &amp; Administration)</b>																				
<b>Valparaiso</b>																				
Administration	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Maintenance	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
<b>San Antonio</b>																				
Administration	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
Maintenance	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
<b>Total</b>	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508	508
<b>(Cargo Handling in WITHOUT)</b>																				
<b>Valparaiso</b>																				
General Cargo	1282	1281	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279	1279
Container	904	904	904	904	904	904	904	904	904	904	904	904	904	904	904	904	904	904	904	904
<b>San Antonio</b>																				
General Cargo	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144	1144
Wheat	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123
Container	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176
Alternative Ports	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Total</b>	5231	5228	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226	5226

REPUBLICA DE CHILE  
MINISTERIO DE TRANSPORTES  
Y TELECOMUNICACIONES

MINUTES OF MEETINGS  
ON  
THE INTERIM REPORT  
FOR  
THE STUDY ON THE DEVELOPMENT PLAN  
OF  
THE PORTS OF VALPARAISO AND SAN ANTONIO  
IN  
THE REPUBLIC OF CHILE

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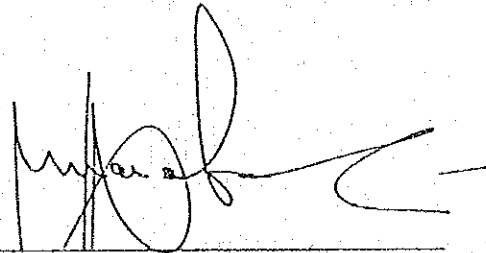
Santiago - Chile, March 6, 1986



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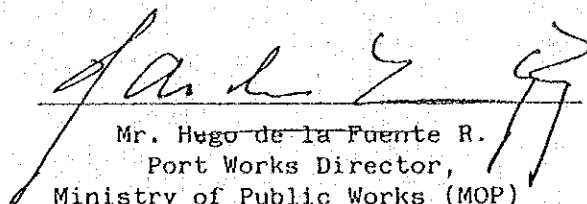
Mr. Katsuhiro Suzunai  
Leader,

JICA Study Team for the Development  
Plan of the Ports of Valparaiso and  
San Antonio in the Republic of Chile



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Mr. Marcos Maraboli B.  
Planning Office Chief,  
Ministry of Transport and  
Telecommunications (MTT)  
President,  
Plan Director Subcommittee,  
Ports of V Region Reconstruction  
Commission



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Mr. Hugo de la Fuente R.  
Port Works Director,  
Ministry of Public Works (MOP)  
Member,  
Plan Director Subcommittee,  
Ports of V Region Reconstruction  
Commission

REPUBLICA DE CHILE  
MINISTERIO DE TRANSPORTES  
Y TELECOMUNICACIONES

The Study Team for the development plan of the Ports of Valparaíso and San Antonio in the Republic of Chile (hereinafter referred to as "the Study Team") headed by Mr. Katsuhiro Suzunai, and dispatched by Japan International Cooperation Agency (hereinafter referred to as "JICA"), stayed in Chile from February 25th to March 8th, 1986 and submitted the Interim Report to the Ports of V Region Reconstruction Commission (hereinafter referred to as "the Commission") on the basis of the "Scope of Work" signed on June 7th, 1985 by both JICA for the Government of Japan, and the Commission for the Government of Chile.

The Study Team had a series of discussions with the Commission, and the following items were agreed upon and confirmed by both sides.

- 1.- The Study Team presented and explained the Interim Report, and the Commission expressed their general agreement with the contents of the report.
- 2.- The basic concepts for the master plans of each port proposed in the report were approved by the Commission so that the Study Team could conduct its study works based upon the concepts.
- 3.- The Commission is in agreement with the methodology used in calculating berth throughput capacities; however, the data provided by the Commission for calculating these capacities will be reviewed further by both the Commission and the Study Team before the departure of the three Study Team members remaining in Chile.
- 4.- Other alternative port layouts may be suggested by the Commission before the departure of the three Study Team members remaining in Chile, and those layouts will be evaluated based on the criteria proposed in the report.
- 5.- The aseismic coefficients for design of port facilities will be given to the Study Team before the departure of the three Study Team members remaining in Chile.



REPUBLICA DE CHILE  
MINISTERIO DE TRANSPORTES  
Y TELECOMUNICACIONES

TECHNICAL AGREEMENT  
ON  
THE INTERIM REPORT  
FOR  
THE STUDY ON THE DEVELOPMENT PLAN  
OF  
THE PORTS OF VALPARAISO AND SAN ANTONIO  
IN  
THE REPUBLIC OF CHILE

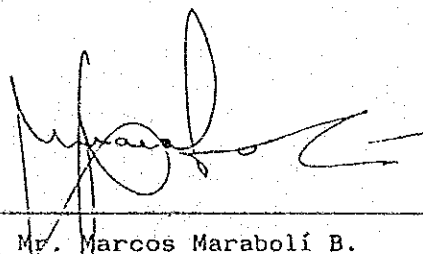
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Santiago, Chile, March 21, 1986



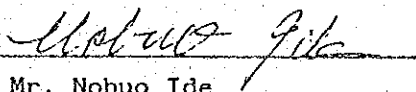
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Mr. Eiji Yasuda  
JICA Study Team for the Development  
Plan of the Ports of Valparaíso and  
San Antonio in the Republic of Chile



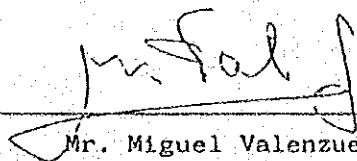
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Mr. Marcos Marabolí B.  
Planning Office Chief,  
Ministry of Transport and  
Telecommunications (MTT)  
President,  
Plan Director Subcommission,  
Ports of V Region Reconstruction  
Commission



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Mr. Nobuo Ide  
JICA Study Team for the Development  
Plan of the Ports of Valparaíso and  
San Antonio in the Republic of Chile



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Mr. Miguel Valenzuela G.  
Acting Port Works Director  
Ministry of Public Works (MOP)  
Member,  
Ports of V Region Reconstruction  
Commission

The Ports of V Region Reconstruction Commission and the Study Team for the Development Plan of the Ports of Valparaíso and San Antonio in the Republic of Chile dispatched by Japan International Cooperation Agency, had a series of discussions during the stay of three study team members in Chile and agreed upon the following as regards items 3, 4 and 5 set forth in the Minutes of Meetings on the Interim Report signed by both sides on March 6, 1986.

1.- New data on the berth throughput were given to the study team by the Commission. The study team will review the data to determine the berth throughput capacities to be adopted to the master plan.

2.- Port Layout for Future Development

Other alternative port layouts for the ports were indicated by the Commission.

Through the evaluation on the alternative layouts based upon the criteria proposed in the interim report, the following port layout plan for each port was confirmed to be forwarded to the study works for the Draft Final Report.

- (1) The Port of Valparaíso: A port layout plan "Alternative C" proposed in the interim report but being subjected to the revision that the future development of the port area to be constructed across the hill behind the present berth N°1 is precluded.
- (2) The Port of San Antonio: A port layout plan "Alternative D" proposed by the Commission with the following revisions that:
  - The berth handling wheat is located at the waterfront on the South of berth N° 4.
  - The general cargo berth at berth N° 2 is subjected to further studies on berth throughput capacities by the study team in relation to the possible provision of a chemical berth which may be constructed at the waterfront of berth N° 1.

*Handwritten signatures and initials:*  
E.g. 119

3.- Design Seismic Coefficient

Berthing facilities proposed in the framework of the master plan will be designed under the design seismic coefficients of 0.20 and 0.25 for those that require ordinary and high aseismicity respectively.

*Handwritten signature* 50 E.Y. 11.9.









JICA

