11.5 Required Scale Under the Master Plan

11.5.1 Required Port Facilities

The port facilities necessary to handle cargoes in 2010 are summarized as follows:

(1) Number of berths

The wharves necessary to handle cargoes in 2010 are shown in Table 11.5.1.

Table 11.5.1 Berths Proposed in the Master Plan

Type	Cargo Volume ('000 t)	Number of Berths	Water Depth (m)	Length (m)	Name of Berth	
					Quay	Berth No.
General Cargo Berths			9.15	130.0	No. 8	birth: 3
			9.15	130.0	No. 8	birth: 4
			9.15	130.0	No. 8	birth: 5
			8.20	120.0	No.11	birth: 9
			8.20	120.0	No.11	birth: 10
			7.50	110.0	No.13	birth: 14
			9.00	110.0	No.13	birth: 15
			10.00	200.0	No.14	birth: 16
			8.50	180.0	No.15	birth: 18
			8.00	120.0	No.16	birth: 19
			12.00	130.0	No.18	birth: 22
			10.50	120.0	No.19	birth: 24
			9.00	120.0	No.19	birth: 25
			8.50	100.0	No.20	birth: 26
Sub-total	1,009	14 (14)		1,820.0		
Cereals Berths			12.00	370.0	No.12	birth: 12
			14.00	250.0	New berth	
			14.00	250.0	New berth	
Sub-total	2,700	3 (1)		870.0		
Vegetable Oil Berth	150	1 (1)	8.50	100.0	No.20	birth: 27
Animalfeef Berth	246	1 (1)	12.00	200.0	No.15	birth: 17
Petroleum Berths			9.00	172.5	No.17	birth: 20
			10.50	172.5	No.17	birth: 21
Sub-total	1,320	2 (2)		345.0		
Cement Berth	433	1 (1)	10.50	110.0	No.19	birth: 23
Alumina Berth	600	1 (1)	12.00	200.0	No.21	birth: 28
Container Berths			12.00	200.0	No.21	birth: 29
			13.00	300.0	New berth	
Sub-total	1,104	2 (1)		500.0		
Car Ferry Berths			7.00	130.0	No. 9	birth: 6
			8.20	130.0	No. 9	birth: 7
			8.40	140.0	No.10	birth: 8
Sub-total		3 (3)		400.0		
Others			8.00	112.5	No. 2	birth: 1
			8.00	112.5	No. 2	birth: 2
Sub-total		2 (2)		225.0		
Grand Total	7,562	30 (27)		4,770		

Note: In "Number of berths" column, number of each parenthesis represents number of existing
: In numeral outside parentheses shows total number of berths

(2) New Development Area

1) Main facilities

Total area: 40 hectares

Reserved area: 5.3 hectares

Turning basin: 5.3 hectares (-14 m)

Berths: total berths; 800 m (3 berths)
water depth; -13 m to -14 m

Main breakwater: 800 m

Sub-breakwater: 465 m

2) Other main facilities

Cereals silo: 105,000 ton capacity

Container freight station : 5,000 m^2

Container terminal office: 900 m^2

Railway yard: 3.2 hectares

Access road: 5.5 hectares

Cargo handling facilities : four (4) units of gantry cranes for containers (capacity of 400 tons each)
: four (4) units of rail-mounted pneumatic unloader for cereals (400tons/hour each)
: belt conveyors for cereals (800tons/hour)

(3) Facilities for Reception of Ballast and Bilge from vessels

Location: behind Quay No.7

11.5.2 Construction Plan of the Master Plan

A construction plan with a target year of 2010 must naturally be executed in gradual stages.

Fig. 11.5.1 shows the time period required for each stage and the main work being undertaken.

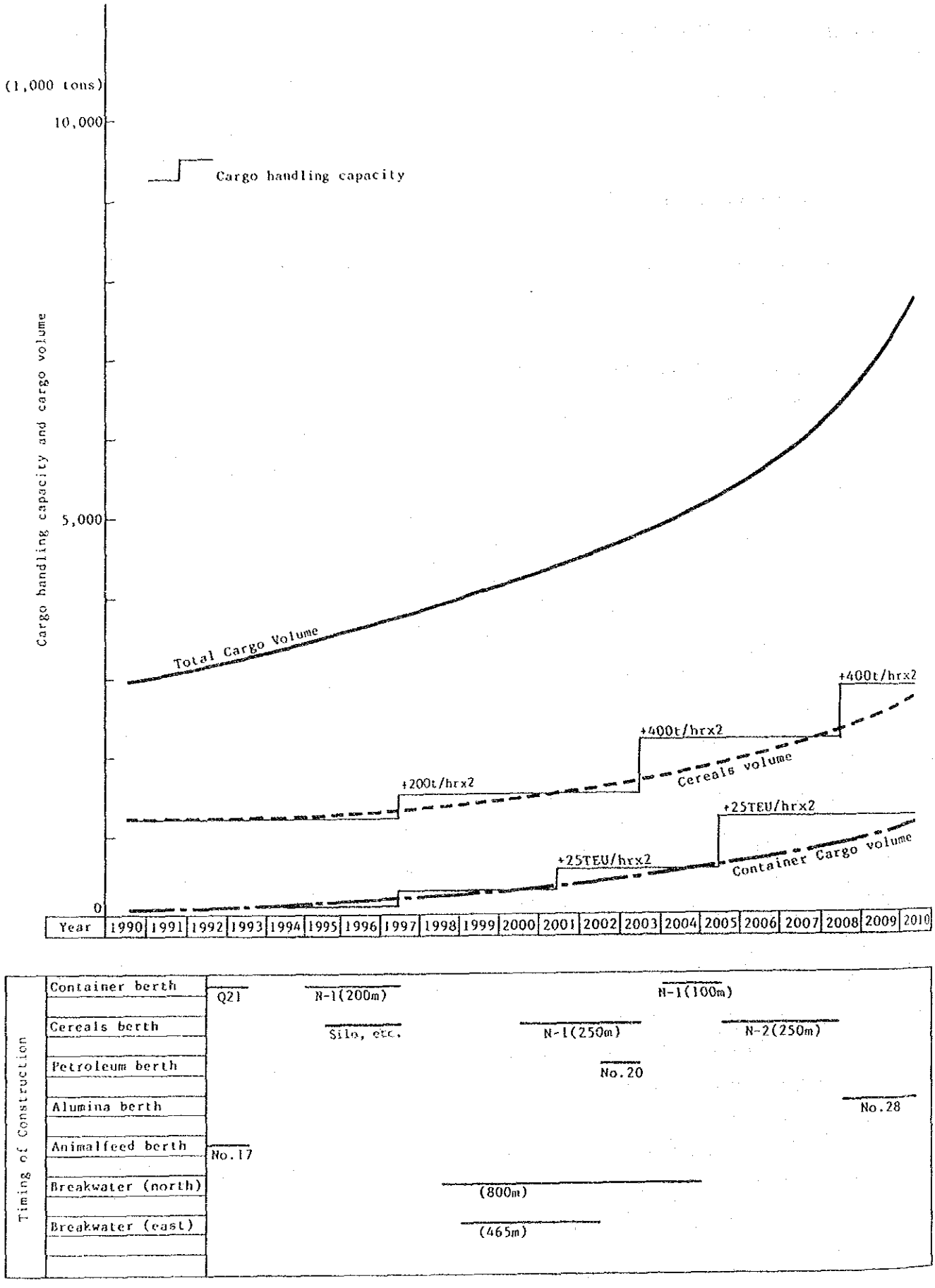


Fig. 11.5.1 Stage Plan for Construction of the Master Plan

11.6 Examination of Cargo Handling System

The future cargo handling system is examined with regard to the following vessel's types, considering the present cargo handling system and cargo flow within the port.

General cargo vessel
- General cargo vessel laden with various kinds of cargoes
- General cargo vessel laden with one kind of commodity
  - Foodstuffs or agricultural products excluding cereals
  - Wood (Timber)
  - Iron (Steel Goods)
  - Sugar

Ro-Ro vessel

Bulk carrier
- Cereals
- Animal feed
- Alumina
- Cement

Tanker
- Petroleum Products
- Vegetable oil

Car ferry

Container vessel

11.6.1 General Cargo Vessel

(1) General cargo vessel laden with various kind of cargoes

The cargo flows in this port are the same as the port of Algiers. Therefore the cargo handling operation will be carried out with same idea as the port of Algiers, which is described in paragraph 10.5.1.

(2) General cargo vessel laden with one kind of commodity

1) Foodstuffs or agricultural products excluding cereals

At present, most foodstuffs, which are packaged in various way are directly delivered from the port by trucks as they are. Given the nature of such cargo, this handling system is considered to be unavoidable; however, in order to ensure smooth operation at the berth apron in future, it is necessary to examine the use of transit sheds for short periods.

2) Timber

Timber cargo is usually bundled in cubes fit for forklift handling, so the cargo handling throughout the port is carried out by forklifts. This cargo is kept in open yards of the port in accordance with the nature and packing of the cargo, and requires a wide apron and wide open yards for smooth handling and storage.

3) Steel products

There are many kinds of steel products and many types of packaging for international trade. Generally, these kind of cargoes, except for high quality goods, is kept in open yards of the port, and requires a wide apron and wide open yards for smooth handling and storage given the type of cargo packaging. In addition, the handling of these goods is very difficult because they are lengthy and/or heavy; in order to ensure quick handling and prevent damage at all stages of port traffic, it is necessary that the equipment and handling tools are properly chosen and used.

4) Sugar

At present, refined sacked sugar is carried in loose by general cargo vessels laden only with sacked sugar as mono-cargo and is unloaded directly onto trucks or loaded in rail wagons by means of ship's gear/cranes and/or quay cranes with rope slings. The handling of this cargo will be carried out in the same way as present. However, in order to improve the cargo handling rate, the handling system for sacked sugar needs some reformation throughout the

port, eg. introduction of palletization and/or provision of temporary storage facilities within the port.

5) Aluminium ingots in break bulk

Though there are a variety of shapes and sizes to aluminium ingots for international transportation, they are usually packed with bundles and customarily stored in open yard and can be handled by forklifts. In order to obtain smooth loading, it is necessary that the cargo is prearranged at the apron before a vessel's entry into the port.

11.6.2 Ro-Ro Vessels

The basic idea of cargo handling within the port is the same as the port of Algiers, which is mentioned in paragraph 10.5.2.

11.6.3 Bulk Carrier

(1) Cereals in bulk

1) General

General ideas on the cereals cargo handling systems is mentioned in Appendix A.5.1.

2) Proposed cargo handling system

The cargo handling systems for the cereals terminals to be planned for target year 2010 are recommended as undermentioned.

a) Unloading equipment

- New berths

Four rail-mounted pneumatic unloaders with an unloading capacity of 400 tons/hour with three unloading arms are recommended. Also, considering the

size of vessels to be handled at these berths, one crane per unit for lifting bulldozers and/or wheel-loaders into/from vessel's holds is recommended. The cargo from vessels is put directly in silos through conveyer systems.

- Berth, No.12 in quay No.12

In addition, in order to improve the unloading rate, it is preferable that the existing rail-mounted pneumatic unloaders at quay No.12 are replaced by a rail-mounted pneumatic unloader with an unloading capacity of 400 tons/hour to match the unloading capacity of 400 tons/hour of the existing screw type unloader. The cargo is put in silos using the existing conveyer system.

b) Cargo handling flow in the port

Basically, the cargo is directly put into the silos through conveyer systems and then transported to the hinterland by trucks and rail wagons; loading into trucks and rail wagons is carried out through separate evacuation lines associated with the respective marshaling areas. Direct deliver by trucks is advised to be adopted only for short distanced transportation of cargo from the port. The transfer of cargoes from the berth to the silo which is located behind berth No.20 is carried out by trucks, and loading onto trucks is done through evacuation nozzles fitted to conveyer systems.

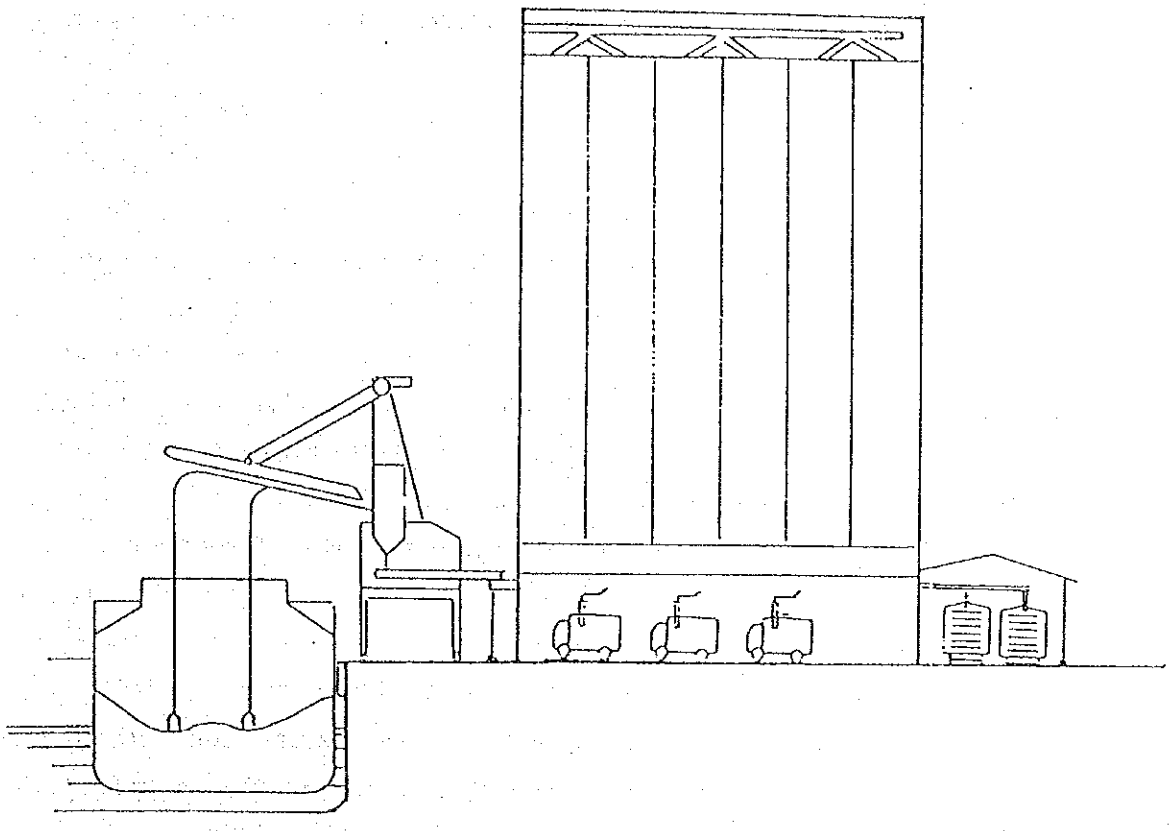


Fig. 11.6.1 Outline Cargo Handling Flow

(2) Animal feed in bulk

New sheds for storage and handling of animal feed in bulk are now being constructed within the port area. Cargo handling will be done using these sheds. Therefore, the following two cargo handling systems are considered.

1) The unloading from vessels is done by means of quay cranes, each with lifting capacity some of 20 tons, and grab buckets, and the cargo loaded onto trucks through movable hoppers and transferred to the sheds. Transport to the hinterland is carried out by trucks and or rail cars.

2) The unloading from vessels is done by means of ship' gear/cranes with grab buckets, and the cargo is loaded onto trucks through movable hoppers and transferred to the sheds. Transport to hinterland is carried out by trucks and or rail cars.

In order to achieve a high handling productivity, it is preferable to adopt the former handling system.

(3) Alumina in bulk

At present, this cargo is generally handled by the following types and systems of equipment and storage facilities.

Unloading equipment: Quay crane with grab buckets or Pneumatic unloader

Transfer from unloading equipment to storage facilities
: Sheltered conveyer system or Duct line system

Storage facility : Silo type or Shed type

According to the expected handling volume, the nature and use of this cargo, the recommended cargo handling system consists of the unloading the cargo using a pneumatic unloader system; transfer is by sheltered conveyer system; and the storage facility is preferably the silo type in order to prevent dust pollution and/or contamination with foreign material during the handling stage. Required nominal capacity and number of the unloader and conveyer is assessed;

Unloader : 350 tons/hour X 2 units
Conveyer : 700 tons/hour of one line

(4) Cement in bulk

The imported cement in bulk is carried to the port by cement carriers and unloaded into a processing barge. The cement in bulk is put in bags on board the barge and discharged onto trucks by a conveyer system provided on board the barge. With respect to the forecast handling volume, this system is considered to be suitable.

11.6.4 Tanker

(1) Petroleum products

According to the size of the existing pipe line provided in berths Nos.20 and 21 in quay No.17, it is considered that the cargo can be handled at a higher unloading rate (refer to Appendix A.5.2). So the petroleum products are handled by the present systems at the berth. However the unloading rate often depends on the condition and maximum capacity of the storage tanks, therefore it may be necessary to strictly control the stored oil in shore tanks and consider the installation of more shore tanks.

(2) Vegetable oil

This cargo is also handled using the present pipe lines. These cargoes are unloaded at quays No.20 near the user's factories within the port area by shore pipelines running to storage tanks in the factories; the actual unloading rates per hour fluctuate per carrying vessel. The fluctuating unloading rate is probably determined by shore tank capacity or lack of cargo heating. It is possible to handle the forecast cargo providing the current high unloading rate is maintained.

11.6.5 Car Ferry

The expected cargoes carried by car ferries are imported/exported vehicles or those owned by passengers and trucks laden with some imported and/or exported cargoes. The unloading from and/or loading to vessels is carried out by driving the vehicle through the vessel's ramp way, and transferring between storage area to vessel is accomplished by the same means.

11.6.6 Container Vessel

(1) General

General ideas on the cereals cargo handling systems is mentioned in Appendix A.5.3

(2) Proposed cargo handling system

Taking the scale of the container terminal to be planned for the target year 2010 into the consideration, the straddle carrier system or the transfer crane system will be considered as the container handling system.

11.7 Consideration of Environmental Aspects

11.7.1 Environmental Impacts by the port Development

The main components of environment to be affected by the port development are as follows:

1) Air pollution

This is a factor which has a strong relationship with the usage of automobile. In the port area, exhaust fumes from ships and automobiles are the main sources of air pollution, however, the port area creates little air pollution compared with the other plants in the port.

2) Water quality

The construction of the breakwater for protecting port facilities from waves will result in the closed water area in which it is not easy to exchange water with the outer sea.

The water pollution during the capital dredging and reclamation works can be easily prevented by proper countermeasures commonly used.

3) Vibrations

At the container terminal, the operation of container handling cause some vibrations, however, it is only near the container terminal.

11.7.2 Measures in the Future

1) Monitoring system

In order to minimize the water pollution at the port, a standard for discharge water will have to be established and a monitoring system arranged in advance.

2) Facilities for reception of ballast and bilge from vessels

In conformity with MARPOL convention, it is necessary to provide facilities to receive waste such as ballast, bilge and etc. from vessels at the port. The construction of facilities for reception of ballast and bilge from vessels is proposed at the behind area of Quay No.7.

3) Consideration of sewage and waste water from the wharves

Sewage and waste water from wharves need to be treated before being discharged into the basins of the port at earliest possible time.

11.8 Cost Estimation

The main conditions for the cost estimation are as follows;

(a) Construction costs have been estimated using the prices and rates obtained in October 1991 in principle

(b) The inflation factor has been excluded from the estimation.

(c) The exchange rates of the U.S.$ against the Algerian Dinar (DA) and the Japanese Yen (JY) are as follows;

1 US$ = 21.899 DA = JY 131.25

A summary of estimation results is presented in Table 11.8.1.

Table 11.8.1 Summary Construction Cost of the Port of Oran

Unit; Million DA

Facilities		Alternative Plan A			Alternative Plan B		
Item	Sub Item	Foreign Portion	Local Portion	Total Cost	Foreign Portion	Local Portion	Total Cost
1.Main structures	1)Main BreakWater	2,407.5	900.8	3,308.3	1,591.3	595.6	2,186.9
	2)Sub BreakWater	654.7	236.9	891.6	736.9	264.6	1,001.5
	3)Besin & Channel	3.3	18.9	22.2	5.0	28.4	33.4
	4)Reclametion of Land	856.8	286.3	1,143.1	641.3	207.6	848.9
	Sub Total	3,922.3	1,442.9	5,365.2	2,974.5	1,096.2	4,070.7
2.Container Berth	1)Civil Works	152.7	90.2	242.9	150.6	88.6	239.2
	2)Container Crane etc	939.9	180.3	1,120.2	939.9	180.3	1,120.2
	Sub Total	1,092.6	270.5	1,363.1	1,090.5	268.9	1,359.4
3.Cereal Berth	1)Silos & Buildings	838.4	374.3	1,212.7	838.4	374.3	1,212.7
	2)Civil Works	169.8	108.3	278.1	194.9	123.2	318.1
	3)Pneumatic Unloader etc	916.1	79.9	996.0	916.1	79.9	996.0
	Sub Total	1,924.3	562.5	2,486.8	1,949.4	577.4	2,526.8
4.Almina Berth	1)Siros & Buildings	574.4	256.5	830.9	574.4	256.5	830.9
	2)Civil Works	6.5	5.3	11.8	6.5	5.3	11.8
	3)Unloader etc	372.3	65.7	438.0	372.3	65.7	438.0
	Sub Total	953.2	327.5	1,280.7	953.2	327.5	1,280.7
5.Animal foods Berth	1)Civil Works	6.5	5.3	11.8	6.5	5.3	11.8
	2)Backet Unloader etc	279.6	49.9	329.5	279.6	49.9	329.5
	Sub Total	286.1	55.2	341.3	286.1	55.2	341.3
6.Miscellanies	1)Other Civil Works	59.7	51.9	111.6	51.1	44.4	95.5
7.Direct Cost		8,238.2	2,710.5	10,948.7	7,304.8	2,369.6	9,674.4
8.Indirect Cost	1)Physical Contingency	502.5	208.0	710.5	420.7	177.6	598.3
	2)Engineering Services	458.4	186.8	645.2	383.8	159.5	543.3
	Sub Total	960.9	394.8	1,355.7	804.5	337.1	1,141.6
9.Total Cost		9,199.1	3,105.3	12,304.4	8,109.3	2,706.7	10,816.0
10.Tax(VAT)		643.9	217.4	861.3	567.7	189.5	757.2
11.Project Cost		9,843.0	3,322.7	13,165.7	8,677.0	2,896.2	11,573.2

CHAPTER 12 MASTER PLAN FOR THE PORT OF ANNABA

12.1 Strategy of the Master Plan

The port planning strategy for accomplishing these goals is considered as follows:

(1) Expansion of area for port development

An expanded site and creation of a new port area will be necessary for the increased port functions in the port of Annaba. For this purpose, the south east water areas of the port are being considered. In this area, the water is shallow and the sea bed soil is soft. Further, if the port is expanded to the south east side, the integrated use of existing and new port facilities would be highly feasible, and the developed site would have easy access to major roads. Therefore, future development space for the port of Annaba will be developed at the south eastern sea area by the northern and eastern breakwaters.

(2) Promoting the development of cereals berths

At the port of Annaba, the specialization of cargo handling by berth, streamlining of loading and unloading, and the quick dispatch of ships are in practice even at present.

The forecasted increase in cargo volume will result in the construction of large ships and special carriers. This trend is expected to grow at the port of Annaba, particularly in regard to cereals. Therefore, it will be necessary to develop berths and cargo-handling equipment from the economic point of view. Unloading efficiency will thus be increased and the overall functions of the port will be enhanced.

(3) Promoting the development of container terminal

The volume of container handling at the port of Annaba is still on a small scale. No.1 and No.2 berth at the port of Annaba will be combined in order to cope with the increasing container transportation traffic. This berth has however, a total quay length of 240 m and a water depth -10.0 m and it would still be insufficient to handle the full scale container traffic.

Therefore, it is desirable to acquire the container terminals of sufficient scale at the port of Annaba to facilitate the berthing of large container ships.

(4) Coordination with industrial development planning

Industrial use of berths represent a significant part of activities for the port of Annaba.

The port plan shall be considered in conjunction with industrial development planning.

(5) Reserving space for future development

The port plan must consider room for further development in the long term. As further expansion of port facilities may be necessary after the year 2010, space should be set aside for future development.

(6) Optimization of investment size and time of investment

In port planning, consideration must be given not only to minimizing the total investment size, but also to the timing of each investment to maximize its effect at each stage.

12.2 Present Capacity of the Port of Annaba

In order to determine the required scale of the plan for future cargo traffic, it is necessary to determine the present cargo-handling capacity of the port. Port capacity is generally calculated in terms of the volume of cargo.

Since port capacity varies according to the type of cargo, size of lot, size of the berth, method of loading and unloading, etc., it is often represented simply as the volume of cargo handled at the port.

The present capacity of Annaba is estimated by analyzing the relationship between the volume of cargo handled at each berth, in terms of general cargoes, cereals and petroleum products.

(1) General cargoes

1) Cargo handling capacity at berths

Some of the data related to the handling of general cargoes is as shown below.

a. Average loading/unloading capacity : 23.6 tons/hour
b. Average working hours per day: 12.0 hours
c. Average mooring days per ship: 5.1 days
d. Number of berths for general cargo: 10 berths
e. Working days per year: 280 days

These are used to estimate the annual port capacity for handling general cargo.

The number of ships which can moor at the general cargo berths per year is obtained from c, d and e above. This figure is about 549. the actual number of general cargo ships entering the port in 1990 was 401. This indicated a berth occupancy ratio of 73%.

The annual cargo-handling capacity is estimated at about 793 thousand tons. This is obtained from the daily cargo handling volume of 283 tons calculated from a, and b above. The volume of general cargo handled at the

port of Annaba in 1990 was 668 thousand tons. This shows that the port of Annaba is being operated roughly at full capacity according to the berthing data analysis.

2) Capacity of cargo storage facilities

The present transit sheds measure 7,000 m^2, and the open storage area is 82,000 m^2. Since data on the cargo handling capacity of the port of Annaba from the view point of storage space is not available, we substitute the actual values for the port of Yokohama in Japan where transit shed capacity is estimated at 0.55 t/m^2, and open storage area is 1.05 t/m^2, assuming 1.0 times a month cargo turnover rate. The capacity of cargo storage facilities is estimated at 1.1 million tons. In view of the present handling volume of 727 thousand tons, the accommodating capacities of transit sheds and the open storage area seem to be sufficient.

3) Situation of ship entry

From the time a ship arrives outside the port to its final berthing, a minimum of 0.5 hours is required. As shown in Fig. 7.4.2.(2).1, which indicates elapsed time from arrival of a general cargo ship to final berthing, 43% of all ships are forced to wait outside the port for more than 24 hours.

(2) Cereals

1) Capacity of cargo handling equipment

Cargo handling equipment, working hours and other items concerning cereal handling are as follows:

a. Cargo handling equipment:

	Nominal capacity	Actual
Screw type # 1	400 t/hr.	-
Pneumatic type # 1	100 t/hr.	-
Total	500 t/hr.	114 t/hr.

b. Working hours: 16 hours/day

c. Average mooring days per ship: 16 days

d. Annual working days: 300 days

These are used to estimate the annual cereals handling capacity.

The volume of cereals that can be handled in a year by these equipments is estimated from the relation of a, b and d, to be about 547 thousand tons.

The volume of cereals handled at the cereal berth in 1990 was 541 thousand tons. The mooring capacity at the cereal berth has already reached its limit, however, the cargo handling equipment is not operating at full capacity.

2) Silo capacity

The storage capacity of the silo at the port of Annaba is 16,000 tons. The annual cereal handling volume in 1990 was 866 thousand tons, and the volume handled at the silo was 675 thousand tons. The annual silo turnover rate was 42.4 turns. The silo turnover rate at the port of Annaba is exceedingly high, presumably because the silo serves as a transit shed for temporary storage.

(3) Petroleum products

1) Cargo handling capacity at berth

Some of the data related to the handling of petroleum products is as shown below.

a. Average unloading capacity per hour: 120 tons/hour
b. Working hours: 12 hours/day
c. Average mooring days per ship: 2.8 days
d. Annual working days: 300 days

These are used to estimate the annual petroleum products handling capacity.

The volume of petroleum products that can be handled in a year is estimated from the relation of a, b and d, to be about 432 thousand tons.

The volume of petroleum handled at Berth No.26 in 1990 was 350 thousand tons.

The number of ships which can moor at the petroleum berth per year is

obtained from c and d above. This figure is about 107. The actual number of petroleum products carriers which moored at that berth in 1990 was 75. This indicates a berth occupancy ratio of 70%. The mooring capacity at the petroleum berth has already reached its limit. However, it will be possible to increase the handling capacity beyond the present level by improving the unloading capacity from 120 tons/hour to 190 tons/hour, and by increasing the storage capacity so as to shorten the number of staying days.

(4) Container handling capacity

The container handling capacity is estimated for the container terminal planned at berth No.1 and No.2 and its related areas as shown in Fig. 12.2.1.

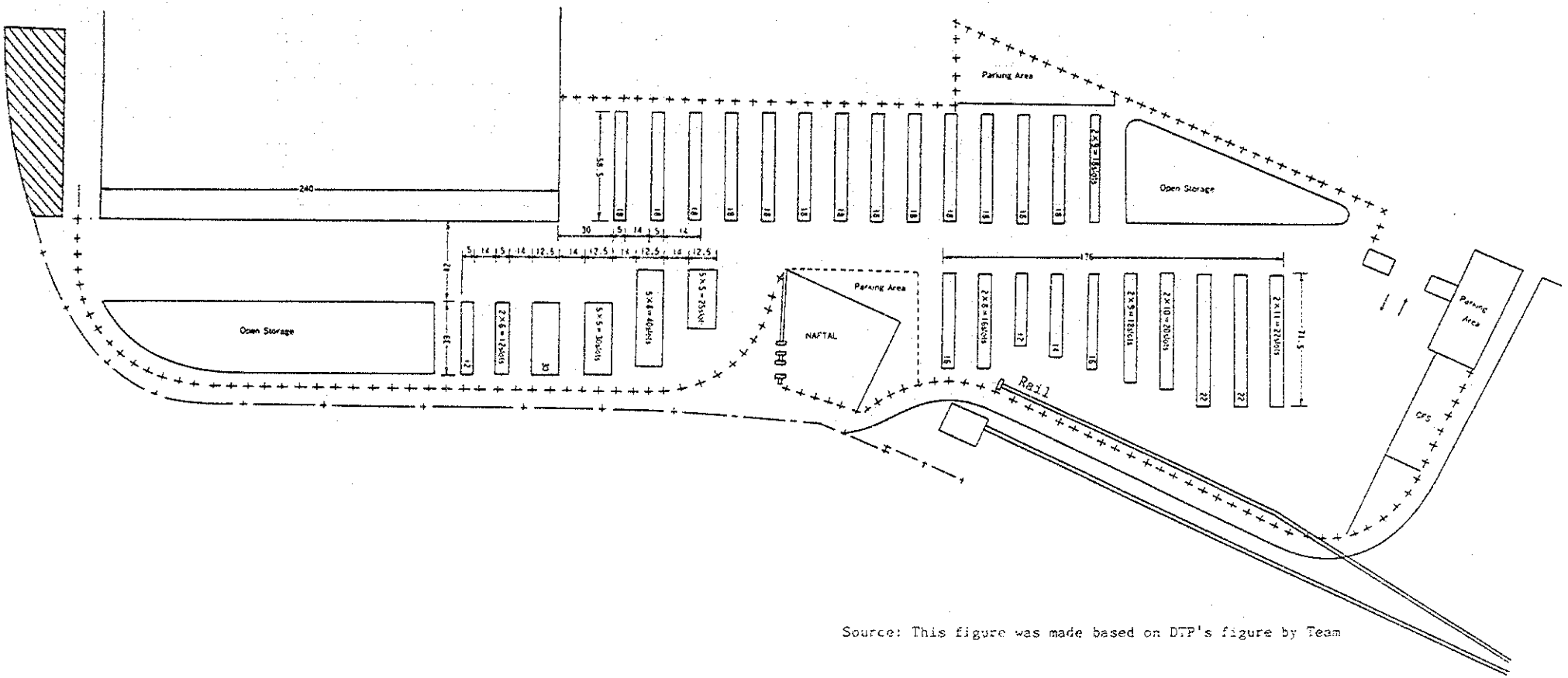
The number of containers handled per year is calculated according to the following assumptions.

a. Number of containers loaded/unloaded per ship: 500 TEU
b. Handling capacity of container: 15 TEU/hour
c. Working hours per ship: 12.0 hours

It will take 33 hours to load/unload 500 TEU. Thus it is necessary for container ships to berth at least 3.0 days. The maximum number of container ships which can be berthed per month is estimated at 10. Therefore the annual number of containers handled is estimated at 60,000 TEU. The actual number is given at 48,000 TEU which is 80% of the estimate (calculated in terms of berth occupancy, loading efficiency, etc.).

The maximum number which can be stored is 579 slots judging from the area of the yard. With an average of 2.5 layers for storage, and twice a month rate of turnover, the annual number handled will be 34,700 TEU.

From the above, the capacity of the container handling facilities is determined by the number of containers stored, and is estimated to be around 271 thousand tons per year.



Source: This figure was made based on DTP's figure by Team

Fig. 12.2.1 The Layout of the Container Terminal at Berth No.1 and No.2

12.3 Proposed Scale in Master Plan

12.3.1 Methods to Determine Number of Berths

The methods are mentioned in the previous Section 10.2 and therefore which are not explained here.

The proposed scale in the master plan (2010) must be in accordance with the volume of cargoes handled. In Chapter 8, the volume of cargoes that will be handled at the port of Annaba in 2010 is shown as Table 12.3.1.

Table 12.3.1 Volume of Cargoes Handled in 2010

Commodities	Volume of Cargoes (tons)			
	Import	Export	Total	
(General Cargoes)				EPA
Timber	110,000		110,000	
Sugar	73,000		73,000	
Other Agricultural Prod.	15,000		15,000	
Other Foodstuff	59,000		59,000	
Chemical,Manufacture Pro.	110,000	4,000	114,000	
Other Construction Mater.	63,000		63,000	
Sub-total	430,000	4,000	434,000	
(Bulk Cargoes)				EPA
Cereals	1,400,000		1,400,000	
Sugar	100,000		100,000	
Vegetable Oil	154,000		154,000	
Sub-total	1,654,000		1,654,000	
Total	2,084,000	4,000	2,088,000	
Coal	2,200,000		2,200,000	SIDER
Coke		46,000	46,000	
Metallic Prod.	288,000	246,000	534,000	
Tar		47,000	47,000	
Phosphat		2,114,000	2,114,000	FERPHOS
Iron Ore	770,000		770,000	
Carbonic Chemical	24,000		24,000	ASMIDAL
Fertilizer		99,000	99,000	
Sulphur	335,000		335,000	
Potash	160,000		160,000	
Ammonia		140,000	140,000	
Petroleum Prod.	1,120,000		1,120,000	NAFTAL
Sub-total	4,897,000	2,692,000	7,589,000	
(Container Cargoes)				
	423,000		423,000	
		217,000	217,000	
Sub-total	423,000	217,000	640,000	
Grand Total	7,404,000	2,913,000	10,317,000	

The port facilities required to handle this volume are determined by referring to the past performance at the port of Annaba.

12.3.2 General Cargo Wharf

As mentioned in the previous chapter, the majority of ships transporting general cargo which call at the port of Annaba were 1,000 - 3,000 DWT in numbers, however the average ship size was 5,000 DWT.

Considering shipping trends and under these circumstances, general cargo ships which call at port of Annaba are considered to present ship size.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of general cargoes to be handled in 2010 is 434 thousand tons.
b. The cargo handling capacity of 23.6 tons/hours is used for calculation.
c. The average per-ship loading/ unloading volume is 1,700 tons.
d. Average time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

Based on the above data, the required number of general cargo berths in 2010 is determined as follows: The hourly volume of handled cargoes is 23.6 tons. The per-ship berthing time of about 74 hours is derived from the relation between the average per-ship loading/unloading volume and the cargo handling productivity. Since the annual number of ships calling at this port is 255, the total berthing time is 18,870 hours. Since the available time for using berths is 3,720 hours, the berth occupancy ratio is 63.4% for eight berths, 56.3% for nine berths. Based on these results, the required berth number is determined to be eight.

According to the simulation based on the queuing theory, the berth occupancy ratio is 53.2%, the ship waiting ratio between the waiting time and service time is less than 3% and the per-waiting ship waiting time is 4.4 hours in the case of eight berths. Therefore, eight berths are considered reasonable.

(2) Planning of cargo handling and storage Facilities

The size of cargo handling and storage facilities including the storageyard, transit shed and warehouse have to be decided in consideration of the types, quantities of cargoes and the conditions of handling.

In 2010, the volumes of cargoes through transit shed and open storage yards area are estimated as shown in Table 12.3.2.

Table 12.3.2 Volume of Cargoes Passing through Transit Shed and Open Storage Yard in 2010

Commodities	Volume of Cargo (tons)	(tons)		
		Open Storage	Transit Shed	Sub-total
Timber	110,000	110,000		110,000
Sugar	73,000		73,000	73,000
Other Agricultural Prod.	15,000		15,000	15,000
Other Foodstuff	59,000		59,000	59,000
Chemical, Manufacture Prod.	114,000		114,000	114,000
Other Construction Mater.	63,000	63,000		63,000
Total	434,000	173,000	261,000	434,000

1) Transit shed

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

$A = (N \times p / R \times a \times W) / B$

where, A: Required area of transit shed (m^2)

N: Annual volume of cargoes handled

R: Turnover of transit shed

a : Utilization rate: 0.5

W: Volume of cargoes per unit area: 2.5 tons/m^2

P : Peak ratio: 1.3

B : Efficiency storage rate: 0.75

Table 12.3.3 shows the required size of the transit shed.

Table 12.3.3 Required Area of Transit Shed

	Volume of Cargo Handled N	Annual Storage Volume R x a x W (tons/m2)			Required Area (N x P / R x a x W) /B (m2)
Sugar	73,000	122	0.5	2.5	830
Other Agricultural Prod.	15,000	122	0.5	2.5	170
Other Foodstuff	59,000	122	0.5	2.5	671
Chemical, Manufacture Prod	114,000	37	0.5	2.5	4,272
Total					6,000

2) Open storage yard

The required area for the open storage yard is determined by the following formula:

$$A = (N \times p / R \times a \times W) / B$$

where, A: Required area of open storage yards (m^2)

N: Annual volume of cargoes handled

R: Turnover of open storage

a : Utilization rate: 0.5

W: Volume of cargoes per unit area:

P : Peak ratio: 1.3

B : Efficiency storage rate: 0.75

The Table 12.3.4 shows the necessary size of open storage yard.

Table 12.3.4 Required Size of Open Storage Yard

	Volume of Cargo Handled N	Annual Storage Volume R x a x W (tons/m2)			Required Area (N x P / R x a x W) /B (m2)
Timber	110,000	37	0.5	1.2	8,589
Other Construction Mater.	63,000	24	0.5	2.0	4,550
Total					13,200

12.3.3 Cereals Wharf

The type of cereals ship serving at the port of Annaba is mainly in the 20,000 - 30,000 DWT class.

With imports expected to increase in the near future, larger ships will be increasingly used; with the demand for rational transportation, ship size tends to increase. However, Berth No.12 has a water depth of -11.0 m. So, the new cereals wharf is planned from the economic point of view to accommodated a ship size of 65,000 DWT.

The standard dimensions for 65,000 DWT are as follows: length 224 m, width 32.2 m and maximum draft 13.1 m.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of cereals to be handled in 2010 is 1.4 million tons.
b. The cargo handling equipment consists of two unloaders (400 tons /hours x 2) for each berth. The work efficiency is 0.64.
c. The average per-ship unloading volume is 24,000 tons.
d. The per-berth available time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

The number of cereals berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 58. Since the per-ship berthing time is 49 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 2,842 hours. Since the per-berth available time for use is 3,720 hours per year, the berth occupancy ratio is 76.4% for one berth and 38.2% for two berths. So, it is judged that two berths are necessary.

(2) Planning of cereal silos

In planning, the following conditions are set:

a. The volume of cereals through silos in 2010 is 1.4 million tons.
b. The turnover rate of silos is 20 times.

The silo capacity required in 2010 is calculated to be 70,000 tons.

12.3.4 Raw Sugar Wharf

At present, raw sugar is handled at Berth No.11 together with vegetable oil.

Of sugar carriers calling at the port of Annaba, the predominate ship size was 15,000-19,000 DWT and the volume handled per-ship was about 6,000 tons.

The volume of sugar handled in 2010 is 283 thousand tons, however, since 183 thousand tons will be handled as container and general cargoes, the volume handled as raw sugar is assumed to be 100 thousand tons.

The ship size of raw sugar carriers is estimated as 15,000-19,000 DWT.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of raw sugar in 2010 is 100 thousand tons.
b. The cargo handling capacity of 64 tons/hour is used for calculation.
c. The average per-ship unloading volume is 6,000 tons.
d. The per-berth available time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

The number of sugar berths required in 2010 is calculated as follows: The annual number of ships calling at port is 17. Since the per-ship berthing time is 96 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 1,632 hours. Since the per-berth available time for use is 3,720 hours per year, the berth occupancy ratio is 43.8% for one berth and 21.9% for two berths. So, it is judged that one berth is necessary.

12.3.5 Vegetable Oil Wharf

(1) Number of berths

In planning, the following conditions are set:

a. The volume of vegetable oil to be handled in 2010 is 154 thousand tons.
b. A cargo handling capacity of 64 tons/hour is used for calcula tion.
c. The average per-ship unloading volume is 1,700 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

The number of vegetable oil berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 91. Since the per-ship berthing time is 28 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 2,548 hours. Since the per-berth available time for use is 7,440 hours per year, the berth occupancy rate is 34.2% for one berth. So, it is judged that one berth is necessary.

12.3.6 Coal and Coke Wharf

The volume of coal and coke to be handled at Berth No.13 in 2010 will be 2.246 million tons or about 2.4 times that of the present level. Therefore, this berth must be used as efficiently as possible and the cargo handling equipment has to be replaced to increase cargo handling volume.

Of coal carriers calling at this berth, the ship size was about 60,000 DWT. A ship size of 60,000 DWT is planned for and per-ship loaded/unloaded volume will remain the same as at present.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of coal and coke to be handled in 2010 is 2.246 million tons.

b. A cargo handling capacity of 1,200 tons/hour is used for calculation.
c. The average per-ship loading / unloading volume is 33,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

The number of coal and coke berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 68. Since the per-ship berthing time is 30 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 2,040 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy ratio is 36.6% for one berth So, it is judged that one berth is necessary.

(2) Stockyard capacity

The existing stockyard capacity is calculated as follows:

C = (B x H x L / 2) x R x E x 2 (two lines)
where, C: Stockyard capacity (tons)
B: Breadth of pile: 25 m
H: Height of pile: 10 m
L: Length of pile: 500 m
R: Specific gravity: 1.1 tons/m3
E: Efficiency storage rate: 0.75
therefore,
C = 103,000 tons

The number of staying days in the stockyard is calculated as follows:

M = C x N / A
where, M: Mean staying days
C: Stockyard capacity (tons)
N: Annual working days: 310 days
A: Annual throughput: 2.246 million tons
then,
M = 14.2 days

The number of staying days shall be more than 20 days, therefore the

existing stockyard is small to execute smooth handling. Additionally, when the number of coal types to be handled increases, stockyard capacity should be enlarged.

The required stockyard is calculated as follows:

C = 20 x 2,246,000 / 310 = 150,000 tons

The additional stockyard capacity is 50,000 tons

12.3.7 Metallic Products Wharf

(1) Number of berths

In planning, the following conditions are set:

a. The volume of metallic products to be handled in 2010 is 534 thousand tons.
b. A cargo handling capacity of 100 tons/hour is used for calculation.
c. The average per-ship loading/ unloading volume is 5,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

The number of metallic products berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 107. Since the per-ship berthing time is 52 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 5,564 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy rate is 99.7% for one berth and 49.8 for two berths. So, it is judged that two berths are necessary.

(2) Stockyard capacity

The capacity of the existing stockyard is 34,000 m^2. The required stockyard capacity is calculated as follows:

$$A = (N \times p / R \times a \times W) / B$$
$$= (534{,}000 \times 1.3 / 37 \times 0.5 \times 2.0) / 0.75$$
$$= 25{,}000\ m^2$$

Thus no additional stockyard will be required.

12.3.8 Ammonia, Tar and Petroleum Products Wharf

The above three kinds of commodities are planned to be handled at Berth No.18 as they are at present.

Of the respective volumes to be handled at this berth, ammonia and tar handled in 2010 will be 140 thousand tons or about twice the present level, tar will be 47 thousand tons or 4.7 times the present level, and petroleum products will be 80 thousand tons the same as the present volume, thus the handling capacity must be increased.

The ship size of these carriers is planned as follows:

(1) Number of berths

1) In planning for ammonia, the following conditions are set:

a. The volume of ammonia to be handled in 2010 is 140 thousand tons.
b. A cargo handling capacity of 140 tons/hour is used for calculation.
c. The average per-ship loading volume is 5,000 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 6,000 DWT.

2) In planning for tar, the following conditions are set:

a. The volume of tar to be handled in 2010 is 47 thousand tons.
b. A cargo handling capacity of 100 tons/hour is used for calculation.
c. The average per-ship loading volume is 4,000 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24 hours/days x 310 days).

e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 5,000 DWT.

3) In planning for petroleum products, the following conditions are set:

a. The volume of petroleum to be handled in 2010 is 80 thousand tons.
b. A cargo handling capacity of 60 tons/hour is used for calculation.
c. The average per-ship unloading volume is 5,000 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to 6,000 DWT.

Based on the above data, the necessary number of berths in 2010 is determined as follows: The annual number of ship calls for ammonia carriers is 28, tar is 12 and petroleum is 16. The per-ship berthing time of ammonia carriers is 38 hours, tar is 42 hours and petroleum is 85 hours. Then, the total berthing time of the three kinds of carriers is 2,920. Since the available berth time for use is 7,440 hours per year, the berth occupancy ratio is 39.2% for one berth. So, it is judged that one berth is necessary.

12.3.9 Fertilizer and Carbonic Chemical Wharf

Fertilizer and carbonic chemical are handled at berth No.20 together with sulphur and potash. This berth has a total quay length of 135 m and a water depth -8.0 m, which is insufficient to handle increasing volumes of cargo.

It is estimated that the volume of above four kinds of commodities in 2010 will reach the level of 618 thousand tons.

Therefore berth No.20 is planned to handle fertilizer and carbonic chemical, and a new wharf will be planned to handle sulphur and potash.

Fertilizer and carbonic chemical handled in 2010 will be 99 thousand tons and 24 thousand tons, respectively.

The ship size of these carriers is planned as follows:

(1) Number of berths

1) In planning for fertilizer, the following conditions are set:

a. The volume of fertilizer to be handled in 2010 is 99 thousand tons.
b. A cargo handling capacity of 60 tons/hour is used for calculation.
c. The average per-ship loading volume is 5,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 6,000 DWT.

2) In planning for carbonic chemical, the following conditions are set:

a. The volume of carbonic chemical to be handled in 2010 is 24 thousand tons.
b. A cargo handling capacity of 45 tons/hour is used for calculation.
c. The average per-ship unloading volume is 5,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 6,000 DWT.

Based on the above data, the necessary number of berths in 2010 is determined as follows: The total annual number of ship calls for these carriers is 25. The total berthing time of these carriers is 2,265 hours. Since the available berth time for use is 5,580 hours per year, the berth occupancy ratio is 40.6% for one berth. So, it is judged that one berth is necessary.

12.3.10 Petroleum Products Wharf

At present, petroleum is mainly handled at Berth No.26. The volume of petroleum products to be handled at the port of Annaba in 2010 will be 1.12 million tons. However, since 80 thousand tons is planned to be handled at Berth No.18, the same as at present, the volume to be handled at Berth No.26 is assumed to be 1.04 million tons or about 3 times the present level.

However, this berth was constructed about 20 years ago, and is seriously damaged. Therefore, this berth should be replaced to increase cargo handling volume.

Petroleum carriers calling at the petroleum berth are mostly in the 6,000 DWT class. Therefore, a ship size of 6,000 DWT is planned for and per-ship loaded/unloaded volume will remain the same as at present.

It is assumed that petroleum will be temporarily stored immediately behind the port, as at present, and that petroleum will be transported to the inland-depot by pipeline.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of petroleum products handled in 2010 is 1.04 million tons.
b. Ship pump is used for discharge from ship and the average discharge capacity of 190 tons/hour (nominal capacity 300 tons/hour) is used for calculation.
c. The average per-ship unloading volume is 5,000 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 6,000 DWT.

The number of petroleum berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 208. Since the per-ship berthing time is 28 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 5,824 hours. Since the per-berth available time for use is 7,440 hours per year, the berth occupancy rate is 78.3% for one berth and 39.2% for two berths. So, it is judged that two berths are necessary.

As for construction sites of new berths, one is planned at the exisiting berth after demolition and another is planned outside the port out of regard for ship's safety and maneuverability.

12.3.11 Sulphur and Potash Wharf

At present, sulphur and potash are handled at Berth No.20, but are planned to be handled at the new berth because fertilizer and carbonic chemical are planned to be handled at Berth No.20.

The volume of sulphur and potash to be handled at the new berth in 2010 will be 335 thousand tons and 160 thousand tons respectively, totaling 495 thousand tons or about 3.5 times the present level. Therefore, this berth must be used as efficiently as possible. it will be necessary to increase the cargo handling volume at this wharf.

The ship size of these carriers is planned as follows:

(1) Number of berths

1) In planning for sulphur, the following conditions are set:

a. The volume of sulphur to be handled in 2010 is 335 thousand tons.
b. A cargo handling capacity of 380 tons/hour is used for calculation.
c. The average per-ship unloading volume is 10,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 15,000 DWT.

2) In planning for potash, the following conditions are set:

a. The volume of potash to be handled in 2010 is 160 thousand tons.
b. A cargo handling capacity of 130 tons/hour is used for calculation.
c. The average per-ship loaded/ unloading volume is 10,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 15,000 DWT.

Based on the above data, the required number of berths in 2010 is determined as follows: The total annual number of ship calls for these carriers

is 50. The total berthing time of these carriers is 2,211. Since the available berth time for use is 5,580 hours per year, the berth occupancy ratio is 39.6% for one berth. So, it is judged that one berth is required.

12.3.12 Phosphate Wharf

The volume of phosphate to be handled at Berth No.19 in 2010 will be 2.114 million tons or about 2.8 times the present level. Therefore, this berth must be used as efficiently as possible, and the cargo handling equipment has to be replaced to increase cargo handling volume.

Of phosphate carriers calling at this berth, the average ship size was about 10,000 DWT class. Berth No.19 has a berth length of 220 m and a water depth of -9.5 m. In the future, therefore, large ships will be increasingly used, since ship size tends to increase with the demand for rational transportation. A ship size of 40,000 DWT is planned for and per-ship loaded volume will be increased.

The standard dimensions of a 40,000 DWT ship are as follows: length 208 m, width 30.2 m and maximum draft 11.4 m.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of phosphate to be handled in 2010 is 2.114 million tons.
b. A cargo handling capacity of 1,200 tons/hour is used for calculation.
c. The average per-ship loading/ unloading volume is 35,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.

The number of phosphate berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 61. Since the per-ship berthing time is 31 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 1,891 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy ratio is 33.9% for one berth So, it is judged that one berth is necessary.

12.3.13 Iron Ore Wharf

At present, No.16 Berth, which was used for iron ore exportation until 1985, is not being used. Therefore, imported iron ore is planned to be handled at this berth.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of iron ore handled in 2010 is 770 thousand tons.
b. A cargo handling capacity of 380 tons/hour is used for calculation.
c. The average per-ship unloading volume is 20,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 25,000 DWT.

The number of iron ore berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 39. Since the per-ship berthing time is 55 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 2,103 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy ratio is 37.7% for one berth So, it is judged that one berth is necessary.

(2) Stockyard capacity

The capacity of the existing stockyard is 25,122 m^2. The required stockyard capacity is calculated as follows:

$$A = (N \times p / R \times a \times W) / B$$
$$= (770{,}000 \times 1.3 / 24 \times 0.6 \times 6.0) / 0.75$$
$$= 15{,}500\ m^2$$

Thus no additional stockyard will be required.

12.3.14 Car Ferry Wharf

The frequency of ferry services depends on both passengers and cargo. At present, ferry services at the port of Annaba are provided about three times a month. And the average mooring time per-ship is 2.2 days and the staying time is generally rather long. This seems to be a result of the fixed schedule of ferry services.

(1) Number of berths

In planning, the following conditions are set:

a. The number of passengers in 2010 is 88,000
b. The average number of passengers per ship is 1,300.
c. The average mooring time per ship is 36 hours.
d. The annual available hours for using berth is 5,580 hours. (18 hours/days x 310 days)
e. The size of ships is considered to be the 10,000 DWT class.

The number of car ferry berths required in 2010 is calculated as follows: The annual number of ships calling at the port is 68. Since the per-ship berthing time is 36 hours, the total berthing time is 2,448 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy ratio is 43.9% for one berth. So, it is judged that one berth is necessary.

(2) Passenger terminal

The required area of passenger terminals is estimated based on the following formula:

$A = a \times n \times N \times c \times b$

where, a : Required area per person (1.2 m^2/person)
n : Fixed number of passengers
N: Number of departure/arrival vessels in the same period of time
c : Rate of concentration (1.0)
b : Rate of fluctuation (1.0)

The size of passenger terminal at the port of Annaba is as follows:

$A = 1.2 \times 1,300 \times 1 \times 1.0 \times 1.0 = 1,560\ m^2$

(3) Size of parking lot

The required area for parking lots is estimated based on the following formula:

$A = a \times n \times c \times b$

where, a : Required area per vehicle : 30 m^2/car
n : Number of vehicles
c : Rate of concentration (0.8)
b : Rate of fluctuation (1.0)

Since the maximum number of vehicles for a car ferry is 350 cars, the area of the parking lot is calculated as follows:

$A = 30 \times 350 \times 0.8 \times 1.0 = 8,400\ m^2$

Regarding the existing car ferry wharf, its area is too small to promote the smooth operation of the terminal. Therefore the new terminal will be necessary by the target year of 2010.

12.3.15 Container Wharf

(1) Number of berths

In planning, the following conditions are set:

a. The volume of container cargoes handled in 2010 is 640 thousand tons, but since 271 thousand tons is handled at No.1 and No.2 berth, the volume to be handled at the new container berth is 369 thousand tons.
b. Based on 1990 results, 10.3 tons is used as per-container cargo volume.
c. The handling capacity of a container crane is 25 TEU/hour and its work efficiency is 0.75.
d. The per-berth number of container crane is two units.
e. It is assumed that the per-ship number of loaded containers that are loaded or unloaded is 500 TEU. Since the import/export ratio in 2010 is 66% for import and 34% for export, the ratio of empty

containers to loaded container is 32%. So, the per-ship number of containers handled is 700 TEU.

f. The per-berth annual hours available for use are 3,720 hours (12 hours/days x 310 days).

e. The necessary processing time for entry and departure is 2 hours per ship.

The number of container berths required in 2010 is calculated as follows: Since the total number of containers in 2010 is 47 thousand TEU, the number of ships calling at the port is 67 based on the per-ship number of containers loaded or unloaded (700 TEU). Since the per-ship berthing time is 21 hours, the annual total berthing hours are 1,407 hours. Since the per-berth annual hours available for use are 3,720 hours per year, the berth occupancy ratio is 37.8% for one berth So, it is judged that one berth is necessary.

(2) Required scale of storage facilities

Considering the size of the yard, ease of maintenance, and efficient operation, the straddle carrier system seems to be the most suitable for the port of Annaba.

1) Container yard

a. Calculation of storage volume

The required storage number of containers is calculated by the following formula:

$Ml = (My \times Dw / Dy) \times p$

where Ml : Required storage number of containers (TEUs)
My : Annual container throughput (TEUs)
Dw : Average dwelling days (days)
Imported containers : 10 days
Exported containers : 7 days
Empty containers : 10 days
Dy : Operation days (310 days)
P : Peak ratio (1.3)

b. Required number of ground slots

Sl = Ml / L

Where Sl : Required number of ground slots (TEUs)

Ml : Required storage number of containers (TEUs)

L : Stacking height of containers (Layers)

Imported containers: 2.2

Exported containers: 2.2

Empty containers : 3.0

The results of the calculation are shown in Table 12.3.5.

Table 12.3.5 Results of Required Storage Capacity in Container Yard

Items	Unit	Loaded Containers		Empty Containers	Total
		Import	Export		
Container Handling Volume	tons	244,000	125,000	-	369,000
Tons per-container	tons	10.3	10.3		
Annual Container Throughput (Hy)	TEUs	23,689	12,136	19,884	55,709
Hy x Dw x P /Dy	TEUs	993	356	834	2,184
Stacking Height	Layers	2.2	2.2	3.0	-
Required Number of Ground Slots	Slots	452	162	278	891
Slot area	m2				21,000

2) Container freight station

Considering the rather long period of cargo stay at the CFS (Container Freight Station), the required area for the CFS is calculated in the same manner as the warehouse, according to the formula below:

A = (Mc x Dw x P) / (w x u x Dy)

where A : Required floor area of CFS (m^2)

Mc : Annual handling volume of containerized cargo through CFS (tons)

Dw : Dwelling time at CFS (days)

Imported cargoes: 7 days

Exported cargoes: 5 days

P : Peak ratio (1.3)

w : volume of cargoes per unit area (1.3 tons/m^2)

u : Utilization rate of CFS floor (0.5)

Dy : Operation days of CFS (310 days)

Using the premises mentioned before, the required area of the CFS is calculated as follows:

$$A = (48,000 \times 7 + 13,000 \times 5) \times 1.3/(1.3 \times 0.5 \times 310) = 2,600 \ m^2$$

12.3.16 Harbor Facilities

(1) Layout of breakwater

New breakwaters are arranged in consideration of the dominant wave direction, which is N-NE. The northern breakwater is the main breakwater and eastern breakwater is the auxiliary breakwater and the top of both breakwaters are situated such a way to shield the port entrance against north eastern waves. The length of the northern breakwater will be 900 m which is decided in consideration of the critical wave height for cargo handling. The detailed analysis concerned can be found in following A.7.

(2) Layout of channel

In planning harbor facilities for the new port, the present channel lines will be used as much as possible. Changing the channel lines is deemed unnecessary due to natural conditions, such as waves and winds. At present, the channel width of 180 m is determined by the distance between the tips of both breakwaters. The widening of the channels will not be considered to ensure the calmness of the harbor. An increase in the number of ships using the port is also likely, however, widening the channels will be unnecessary if the control system at the harbor entrance is improved as required. The water depth of the channel is planned at 14 meters, based on the assumption that ship size will reach 65,000 DWT.

12.3.17 Port Traffic Facilities

An access road and inner port road connecting with the national road are proposed to smoothly distribute port traffic generated at the wharves. The railway transportation of cargoes will be planned in accordance with the future transportation demand.

(1) Determination of traffic volume

The volume of traffic generated at the port is determined by the following formula:

$$T = N \times a / W \times m / 12 \times d / 30 \times (1 + v) / t \times h$$

where T : Proposed traffic volume (cars/hour)
N : Annual volume of cargoes handled (t/year)
a : Share of automobile = 1.0
W : Average tonnage/truck
m : Monthly rate of variation = 1.0
d : Daily rate of variation = 1.5
v : Rate of related vehicles = 0.5
t : Rate of loaded truck = 0.5
h : Rate of hourly variation = 0.1

Table 12.3.6 shows generated traffic volume by Wharf.

Daily port generated traffic volume is about 3,800 cars.

Table 12.3.6 Generated Traffic Volume in 2010

Type	Cargo Volume ('000t)	Cargo weight of loaded (t/car)	Hourly generated traffic volume (car/hour)
Genral Cargo	434	8	68
Container Cargo	610	8.1	94
Cereals	714	12.0	74
Other Bulk	1,242	10.5	148
Total	3,000		384

(2) Road plan

Future port roads in the master plan have to be able to cope with such qualitative and quantitative changes as the increase in volume of port cargo and the introduction of container transportation. The standard sections of roads are as shown in the previous Section 11.3.

(3) Railway plan

At present, railway transportation is the major mode of transportation at the port of Annaba; the volume of railway cargoes at the port in 1990 was

about 2.55 million tons or about 59% of port-handled cargo.

The total volume of railway cargoes at the port of Annaba in 2010 is assumed to be about 7.3 million tons.

The average number of arrival trains per day is calculated by the following formula.

$$T = (A / W \times 1 / V \times K \times P) / N$$

where A: Cargo handling volume per year: 7.3 million tons
W: Working days per year: 310 days
V: Actual wagon loading volume: 50 tons
K: Empty wagon rate: 1.0
P: Peak rate: 1.3
N: Average number of wagons per train: 25 wagons

The average number of arrival trains in 2010 is 21.8 trains.

In planning, a railway connection between existing and new port facilities has to be considered, though the obstruction of efficient cargo handling in the port area must be avoided.

12.4 Master Plan and Evaluation

12.4.1 Preparation of alternative plans

(1) Alternative master plans and rationales for each plan

The alternative master plans are designed as A, B and C as shown in Fig. 12.4.1 - 3. Special considerations have been made in preparing each alternative plan, as outlined below.

(Plan A)

In order that the construction of the cereals terminal and the commencement of services is begun as soon as possible, the initial amount of work and the initial investment will be kept as small as possible. This plan shapes the development area so that the breakwater length is minimized, and is studied in consideration of the possibility that there would be further expansion of port of Annaba after the year 2010.

(Plan B)

This Plan is similar to Plan A in regard to the early construction of the cereals terminal and the early commencement of services. The initial stage will be started from all parts of the port area. This plan will be able to flexibly cope with future demands.

(Plan C)

This Plan was selected as the most appropriate of the alternative plans which were prepared in the previous study report in 1985. The breakwater in that plan was located along the south side of the existing channel, and the initial stage will be started behind the breakwater.

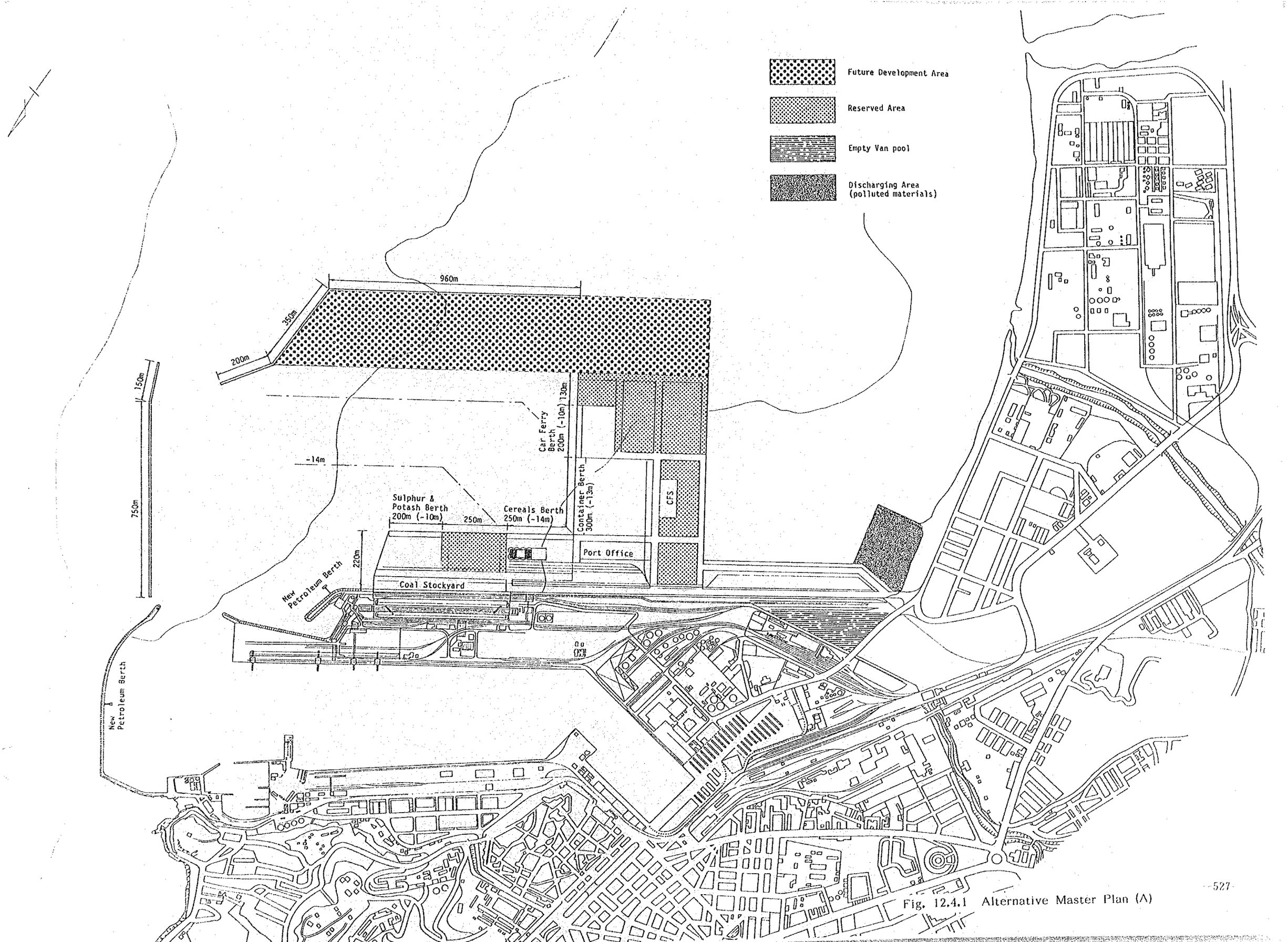


Fig. 12.4.1 Alternative Master Plan (A)

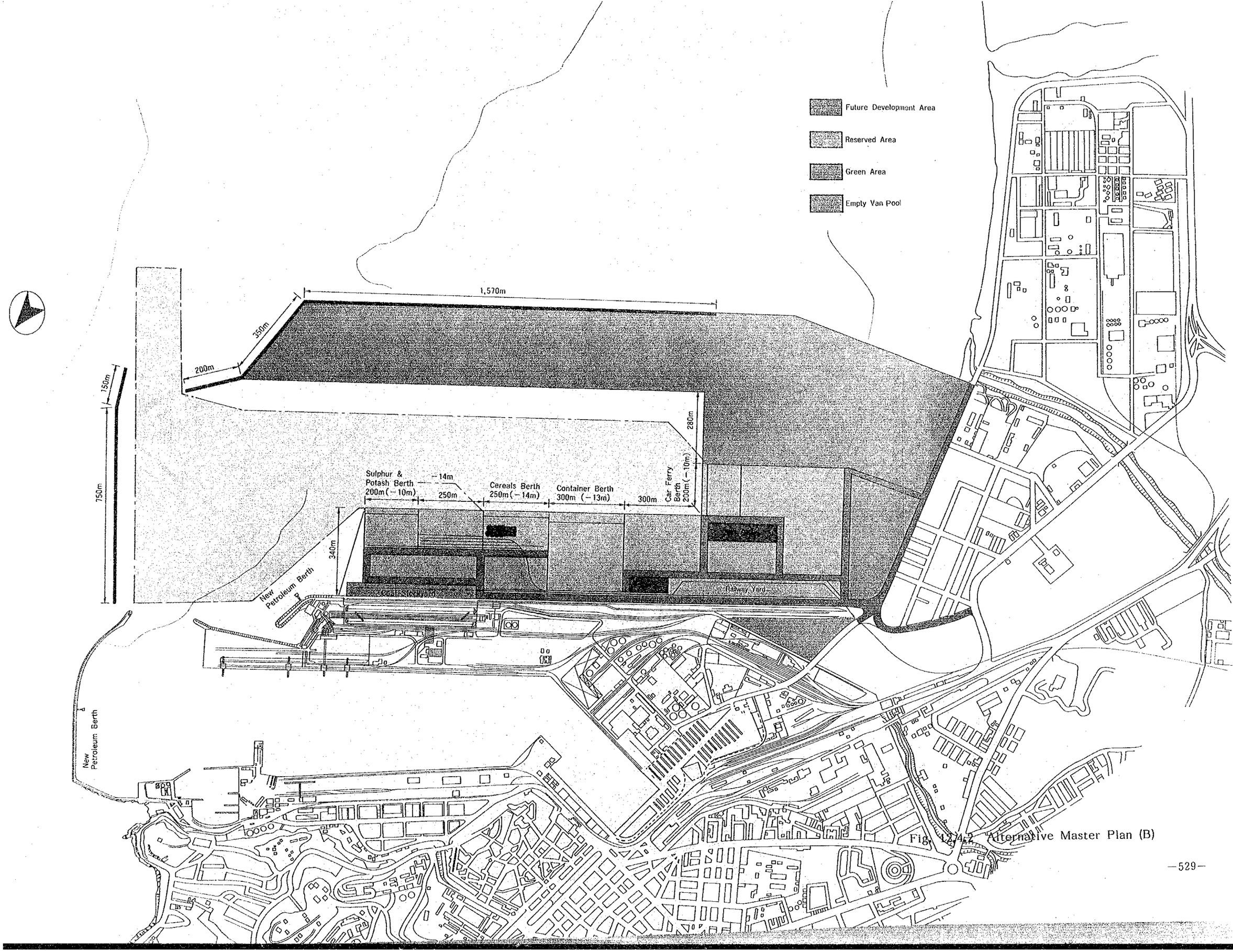


Fig. 12.42 Alternative Master Plan (B)

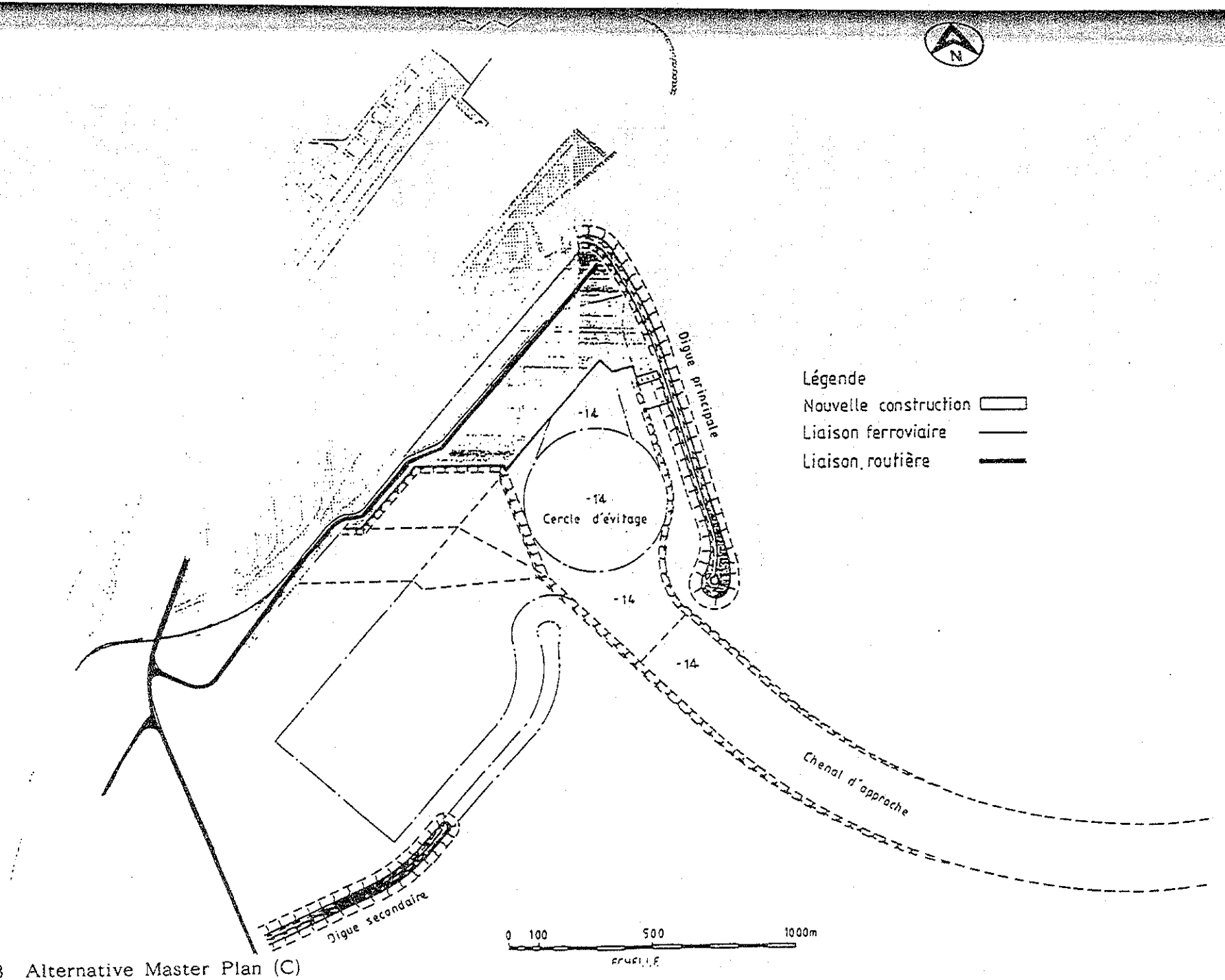


Fig. 12.4.3 Alternative Master Plan (C)

12.4.2 Evaluation of Alternative Plans

Alternative plans for each case are evaluated from the following viewpoints.

(1) Criteria for evaluation

1) Convenience

a. Maneuverability of ship - ease with which entry/departure and berthing/deberthing of ships is possible.

b. Land use - ease with which cargo can be stored or transported, from the standpoint of users, and with regard to shape of the reclaimed land and the arrangement of facilities and roads.

2) Safety

a. Calm waters of the port area - sufficient width of calm water area secured against invading waves in front of the berths, and secured against reflection of waves on the existing channel.

b. Emergency measures - effectiveness and adaptability of measures to deal with accidents occurring inside the port.

3) Economy

a. Total construction cost - minimization of total construction budget, in consideration of costs for soil conditions, balance between dredging and reclamation volume, maintenance dredging, etc.

b. Graduated investment - minimization of investment and maximization of effect while conforming to the requirement of early construction and early start of service.

4) Flexibility of the plan

a. Adaptability to changing conditions - whether it is possible to adapt the plan according to changing circumstances.

b. Potential for future development - availability of space for future expansion in order to meet post 2010 future demands.

5) Environmental Protection

a. Impact on the social environment - harmful effects on the living standards of citizens in terms of noise and vibrations created by port

activities, and harmful effects on scenery.

b. Impact on the natural environment - the effect of port pollution on marine life.

(2) Selection of the optimal plan

Alternative plan A, B and C have been evaluated according to the above mentioned criteria, as follows.

Table 12.4.1 Evaluation of Alternative Plans

Items of evaluation		Evaluation		
		Plan A	Plan B	Plan C
Convenience	Maneuvability of ship	◎	○	△
	Land use	○	◎	○
Safety	Calmness waters of the port area	◎	◎	△
	Emergency measures	◎	○	○
Economy	Total construction cost	○	○	△
	Investment by stage	○	○	○
Flexibility	Changing conditions	○	◎	○
	Future development	◎	◎	○
Environment preservation	Effects on social environment	◎	◎	◎
	Effects on natural environment	○	○	○

Note: Ranking of evaluation ◎ Excellent
○ Ordinary
△ Some problems

As can be seen from the foregoing evaluations, essential difference among these three plans lies in the possibility of acquiring future expansion space after the year 2010.

Plan A considers only the initial amount of work and the initial investment, therefore this plan lacks the flexibility of Plan B in terms of future cargo volumes.

Plan B can make all berths continuous and functionally it is best, as it will be able to flexibly cope with future cargo volumes; however, the initial investment cost is greater. This plan makes partial amends for the defect of Plan A.

Plan C requires considerable maintenance dredging of the new channel, as well as the reflection of waves from the new breakwater has a great influence on the existing channel. This is a serious defect of this plan. So, this plan is not favorable.

Both Plan A and Plan B have their respective problems. In selecting either plan, it is important to consider the conditions that will prevail when the construction is finally completed. In the case of port of Annaba, more importance should be attached to the future conditions. Plan A, which considers only the construction of the required berths, is clearly inferior to Plan B in view of such factors as connection with the future face line of container berth and industrial land use. Plan B is superior from the view-point of the effective use of initial investment, as stated already. Hence, Plan B is recommended to be adopted as the master plan.

12.5 Required Scale Under the Master Plan

12.5.1 Required Port Facilities

The port facilities necessary to handle cargoes in 2010 are summarized as follows:

(1) Number of berths

The wharves necessary to handle cargoes in 2010 are shown in Table 12.5.1.

Table 12.5.1 Berths Proposed in the Master Plan

Type	Cargo Volume ('000 t)	Number of Berths	Water Depth (m)	Length (m)	Name of Berth
General Cargo Berths			7.00	130.0	Berth No. 3
			9.80	220.0	Berth No. 4
			6.20	160.0	Berth No. 6
			9.80	165.0	Berth No. 7
			9.80	145.0	Berth No. 8
			9.80	145.0	Berth No. 9
			7.50	130.0	Berth No.21
			7.00	90.0	Berth No.22
Sub-total	434	8 (8)		1,185.0	
Cereals Berths			11.00	155.0	Berth No.12
			14.00	250.0	New berth
Sub-total	1,400	2 (1)		405.0	
Vegetable Oil Berth	154	1 (1)	9.80	145.0	Berth No.10
Sugar Berth	100	1 (1)	11.00	145.0	Berth No.11
Coal & Coke Berth	2,246		12.50	320.0	Berth No.13
Metallic Prod. Berth	534		9.75	380.0	Berth No.14
			9.75	250.0	Berth No.15
Sub-total	2780.0	3 (3)		950.0	
Iron Ore			12.50	155.0	Berth No.16
			12.50	130.0	Berth No.17
Phosphat Berths			12.00	220.0	Deepening(No.19)
Sub-total	2,884	3 (3)		505.0	
Ammonia, Tar, Petroleum	267	1 (1)	12.50	125.0	Berth No.18
Carbnic Chemical, Fertil	123	1 (1)	8.00	135.0	Berth No.20
Petroleum Prod. Berths			12.00	240.0	Reconstructed(No.26)
			12.00	240.0	New berth
Sub-total	1,040	2		480.0	
Sulphur, Potash Berth	495	1	10.00	200.0	New berth
Car Ferry Berth		1	10.00	200.0	New berth
Container Berth			10.00	240.0	Berth No.1,2
			13.00	300.0	New berth
Sub-total	640	2 (1)		540.0	
Total	10,317	26 (20)		5,015	

Note: In "Number of berths" column, number of each parenthesis represents number of existing
: In numeral outside parentheses shows total number of berths

(2) New Development Area

1) Main facilities

Total area: 87 hectares

Reserved area: 32 hectares

Water area: 142 hectares

Future development area: 101 hectares

Berths: total berths: 950 m (4 berths)
water depth: -10 m to -14 m

Breakwater (Main): length: 900 m
(Sub): length: 2,120 m

2) Other main facilities

Cereals silo: 25,000 ton capacity

Coal stockyard: 1.3 hectares

Container freight station: 2,600 m^2

Port office area: 2 hectares

Empty van pool: 4 hectares

Green area: 8.6 hectares

Railway yard: 4.7 hectares

Access road: 7.4 hectares

Cargo handling facilities : two (2) units of gantry cranes for containers (capacity of 400 tons each)

: two (2) units of rail-mounted pneumatic unloader for cereals (400tons/hour each)

12.5.2 Construction Plan of the Master Plan

The construction plan with a target year of 2010 must naturally be executed in gradual stages.

Fig. 12.5.1 shows the time period required for each stage and the main work being undertaken.

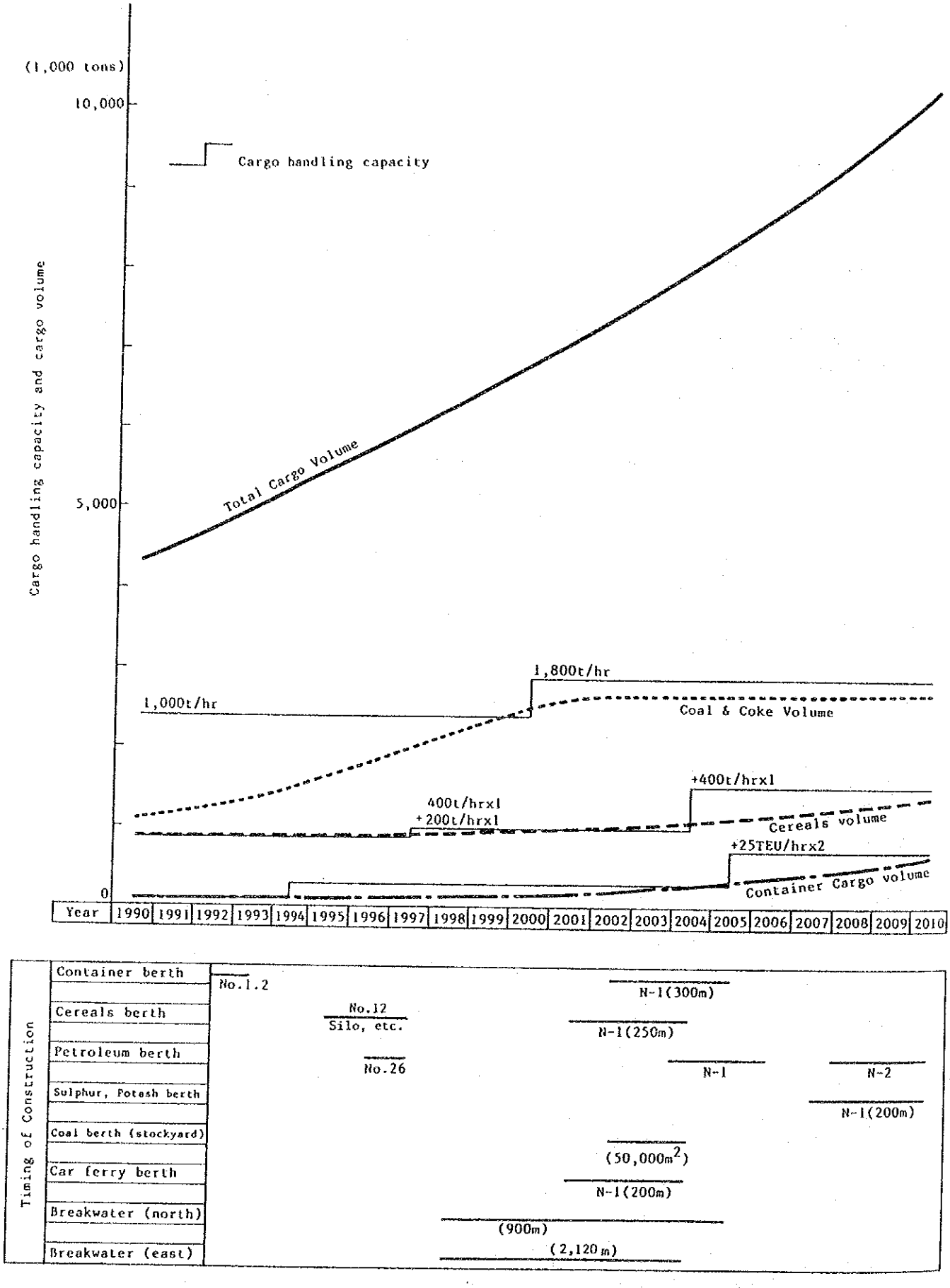


FIg. 12.5.1 Stage Plan for Construction of the Master Plan

12.6 Examination of Cargo Handling System

The future cargo handling system of EPAN is examined separately from handling by concessionaires with regard to the following vessel's types, considering the present cargo handling system and cargo flow within the port of Annaba.

Handling by EPAN

General cargo vessel

General cargo vessel laden with various kinds of cargoes

General cargo vessel laden with one kind of commodity

- Foodstuffs or agricultural products excluding cereals
- Wood (Timber)
- Sugar in sacks

Ro-Ro vessel

Bulk carrier

- Cereals
- Raw sugar in bulk

Tanker

- Vegetable oil or animal fat

Car ferry

Container vessel

Handling by Concessionaires

Bulk carrier

- Coal & Coke
- Iron ore
- Phosphate
- Sulfur and potash

Tanker

- Ammonia
- Petroleum Products

General cargo vessel

- Metallic products
- Others

12.6.1 Handling by EPAN

(1) General cargo vessel laden with various kind of cargoes

The cargo flows in this port are the same as the port of Algiers. Therefore the cargo handling operation is carried out with same idea as the port of Algiers, which is described in paragraph 10.5.1.

(2) General cargo vessel laden with one kind of commodity

1) Foodstuffs or agricultural products excluding cereals

At present, most foodstuffs, which are break bulk cargoes, are directly delivered from the port by trucks as they are. Given the nature of such cargo, this handling system is considered to be unavoidable; however in order to ensure smooth operation at the berth apron in future, it is necessary to examine the use of transit sheds for short periods.

2) Sugar in sacks

At present, refined sacked sugar is carried without unititizing by general cargo vessels laden with sacked sugar only as mono-cargo and is unloaded directly onto trucks by means of ship's gear/cranes and or quay cranes with rope slings. The handling of this cargo will be carried out in the same way as present; however in order to raise the cargo handling rate, the handling system for sacked sugar needs some reformation throughout the port, eg. introduction of palletization and/or provision of temporary storage facilities within the port.

3) Timber

Timber cargo is usually bundled in cubes fit for forklift handling. This cargo is also kept in open yards of the port in accordance with the nature and packing of the cargo, and requires a wide apron and wide open yards for smooth handling and storage.

(3) Ro-Ro vessels

The basic idea of cargo handling within the port is the same as the port

of Algiers, which is mentioned in paragraph 10.5.2.

(4) Bulk carrier

1) Cereals in bulk

a) General

General ideas on the cereals cargo handling systems is mentioned in Appendix A.5.1.

b) Proposed cargo handling system

The cargo handling systems for the cereals terminals to be planned for target year 2010 are recommended as follows.

Unloading equipment

- New berth

Two rail-mounted pneumatic unloaders with an unloading capacity of 400 tons/hour provided with three unloading arms are recommended. In addition one crane per unit for lifting bulldozers and/or wheel-loaders into/from vessel's holds, considering the size of vessels to be handled at this berth is recommended. The cargo from vessels is directly put in silos through conveyer systems.

- Berth, No.12

In order to improve the unloading rate, it is preferable that the existing pneumatic unloaders be replaced by rail-mounted pneumatic unloader with an unloading capacity of 400 tons/hour to match the unloading capacity of 400 tons/hour of the existing screw type unloader. The cargo is put in silos using the existing conveyer system.

c) Cargo handling flow in the port

Basically, the cargo is directly put into the silos through conveyer systems, and deliver to the hinterland from the port is carried out by two land

transport modes, "trucks" and "rail wagons"; loading into trucks and rail wagons is carried out through separate evacuation lines associated with the respective marshaling areas. Direct delivery is advised to be adopted only for short distanced delivery of the cargoes from the port.

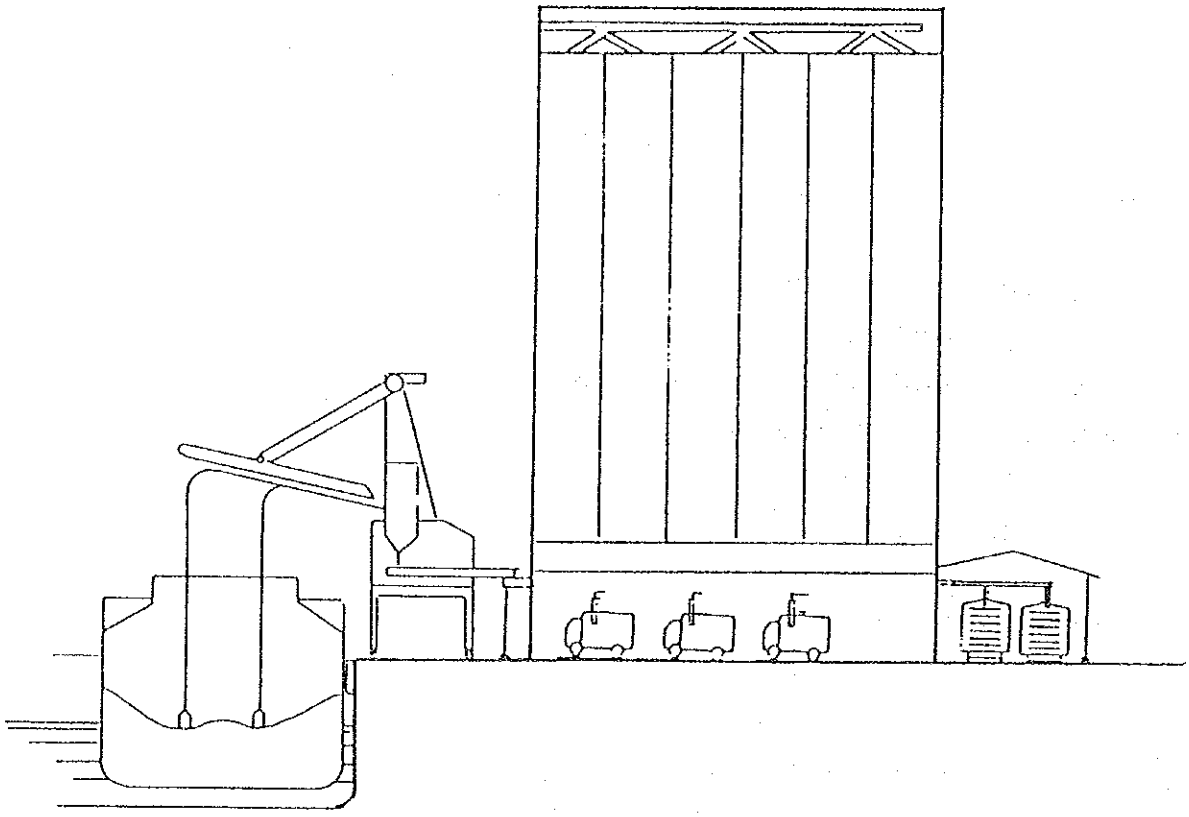


Fig. 12.6.1 Outline Cargo Handling Flow

2) Raw sugar in bulk

There are quay cranes and conveyor systems with hoppers for unloading and evacuating to wagons for inland transportation of raw sugar in bulk at the berth No.11 and a storage warehouse just behind the berth, which are owned by ENSUCRE the importer. The cargo handling of raw sugar in bulk until the target year of 2010 will be carried out at the berth No.11 with similar handling to the present system. However, it will be necessary to modernize the handling facilities or to examine new handling system, because the existing conveyor system and quay cranes are rather deteriorated.

(5) Tanker

Vegetable oil and animal fat.

This cargo is planned to be unloaded using the present pipe lines. These cargoes are unloaded at berth No.10 near the user's factories within the port area by shore pipelines running to storage tanks in the factories; the actual unloading rates per hour fluctuate per carrying vessel. The fluctuating unloading rate is probably determined by the shore tank capacity or lack of cargo heating (refer to Appendix A.5.2). However, it is possible to handle the forecast cargo provided the current high unloading rate is maintained.

(6) Car ferry

The expected cargoes carried by the car ferries are imported and/or exported vehicles or those owned by passengers and trucks laden with some imported and/or exported cargoes. The unloading from and/or loading to vessels will be carried out by driving under own power through vessel's ramp way, and transferring between storage area to vessel will accomplished by the same means.

(7) Container vessel

1) General

General ideas on the container cargo handling systems are mentioned in Appendix A.5.3 in Part I.

2) Cargo handling system in the new terminal

Taking the scale of the new terminal planned for the target year 2010 into consideration, a straddle carrier system is recommended as the container handling system.

3) Cargo handling system in the container terminal to be reconstructed financed by the World Bank

On the basis of the layout plan of the container stacking and the

container handling system, the container handling flow in the terminal is to be as undermentioned.

- Use of berth

These berths are to be used by Ro-Ro vessels and geared conventional vessels laden with containers, and berth allocation of vessels.

- Allocation of stacking of containers

The containers are to be separately stacked in four groups as shown in Fig.12.6.2. The number of slots per group can be flexibly changed to match the volume of containers handled.

- Container handling flow

a) Marshaling of containers unloaded from vessels

Basically, the containers unloaded from vessels are to be directly forwarded from the apron to the allocated stacking zone by shuttle chassis (see Fig.12.6.3), and the handling manner is to be as follows.

Conventional vessel

Unloading of containers is to be carried out by ship's gear/cranes and containers unloaded from vessels are to be directly loaded onto chassis by ship's gear/cranes or placed on the apron and then loaded onto chassis by forklift handling. The stacking of the containers in the allocated stacking yard to be carried out by forklifts.

Ro-Ro vessel

Containers unloaded by ro-ro handling are to be loaded on chassis by forklifts. Forwarding and stacking of the containers are to be carried out in the same manner for conventional vessel

b) Marshaling of containers to be loaded onto vessels

All the containers are to be handled by forklifts from the stacking zones to the apron (see Fig.12.6.4).

c) Delivery of full load containers

Loading of the containers onto chassis is to be carried out by forklifts between the slots of the stacked containers or at the side ways of the stacking zones (see Fig.12.6.5).

d) Receiving of export full load containers

Containers forwarded by chassis to the port are to be received at the side ways of the allocated stacking zones, and lifting from the chassis and stacking are to be carried out by forklifts (see Fig.12.6.6).
Containers stowed with cargoes at the CFS in the terminal are completely handled by forklifts from the CFS to stacking zone. The forwarding of the containers from the stacking zone to the ship's side is to be carried out by forklifts.

e) Receiving of empty containers to be loaded onto vessels

Receiving of the empty containers is to be carried out in a similar manner to the export full load containers (see Fig.12.6.6).

f) Marshaling of discharged LCL containers

Transport from the apron to the allocated stacking zone is to be carried out in a similar manner to the unloaded containers, and forwarding to CFS is to be by forklifts.

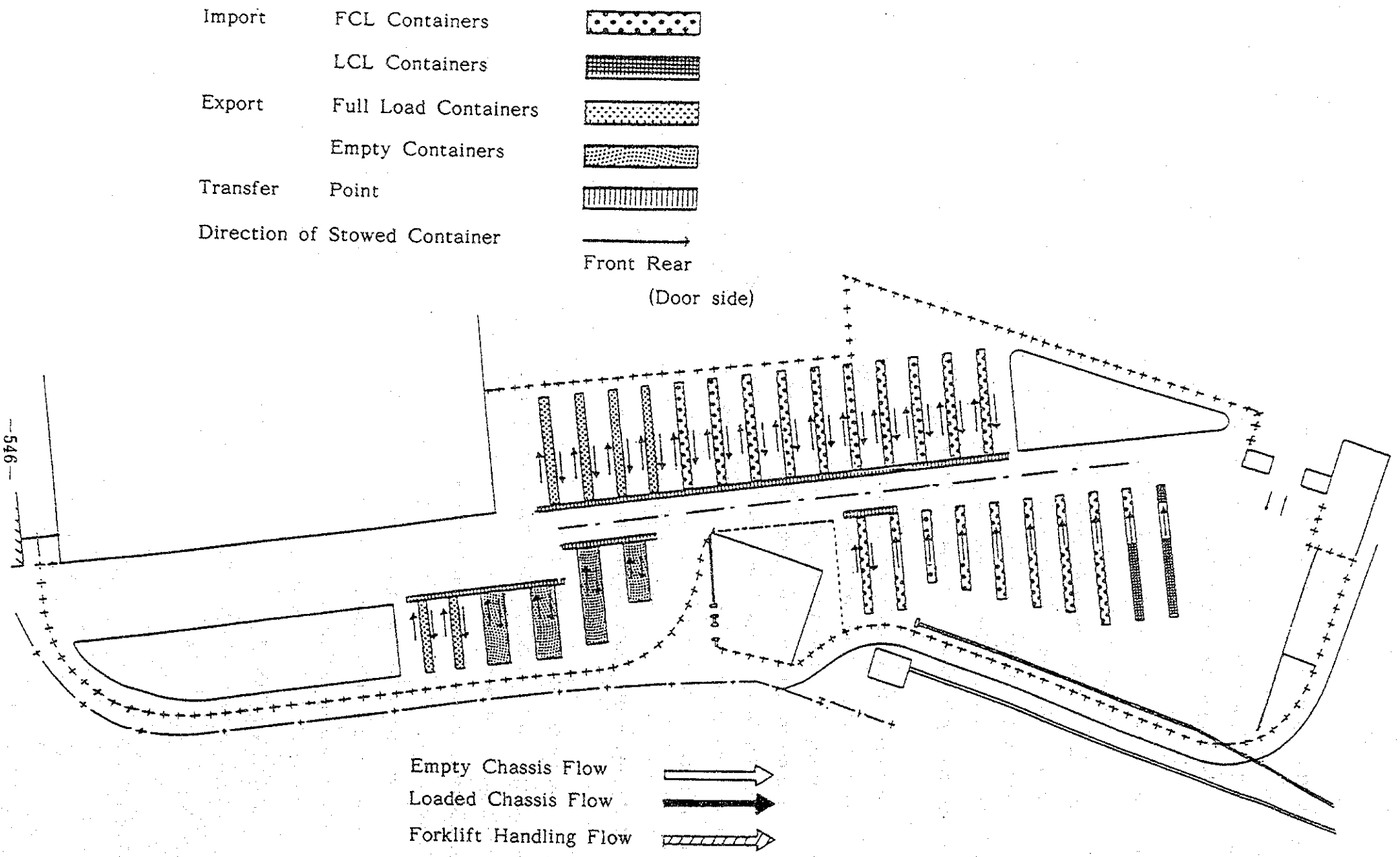


Fig. 12.6.2 Allocation of Stacking of Container

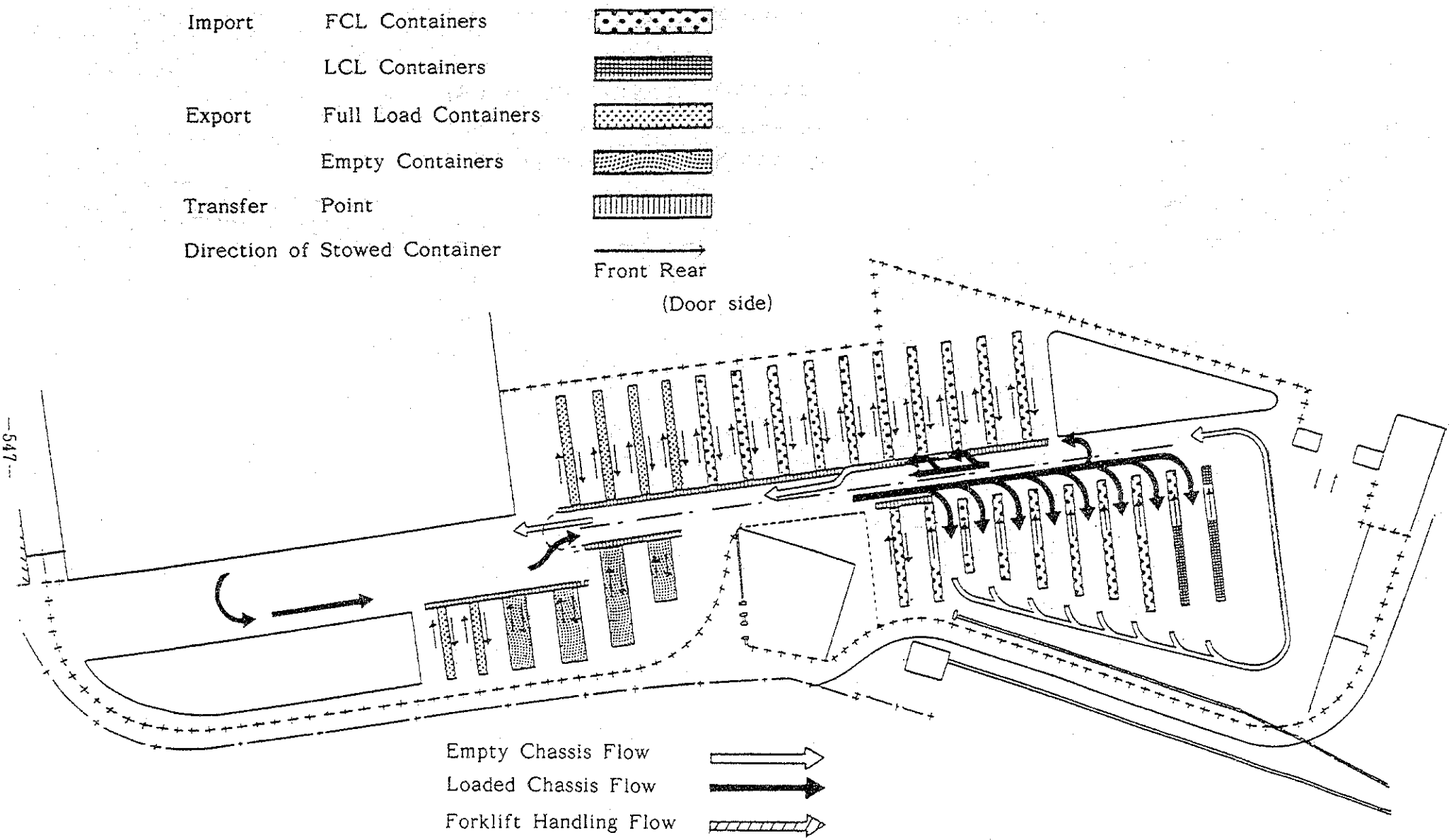


Fig. 12.6.3 Marshaling of Containers Unloaded from Vessels

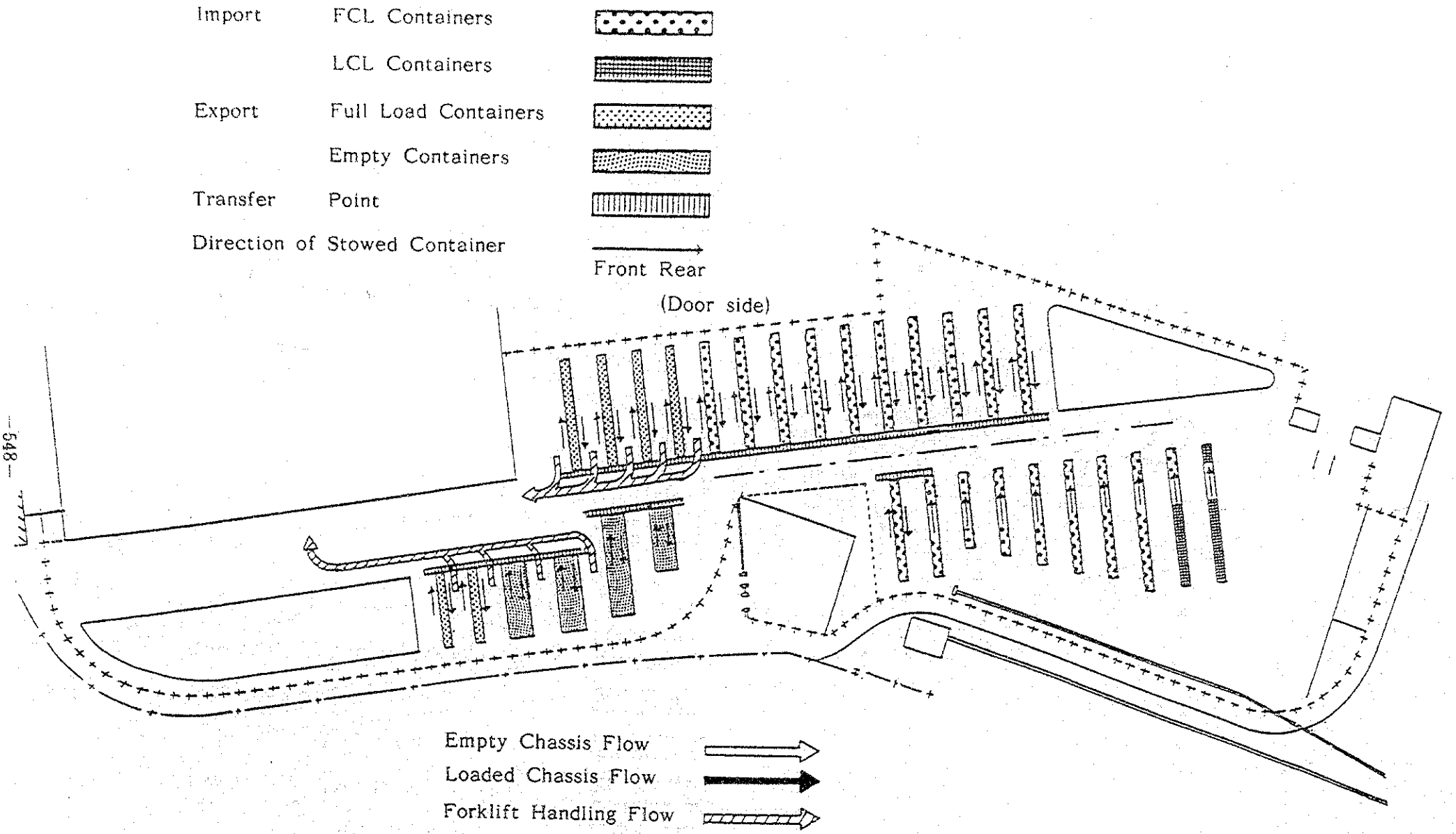


Fig. 12.6.4 Marshaling of Containers to be Loaded onto Vessels

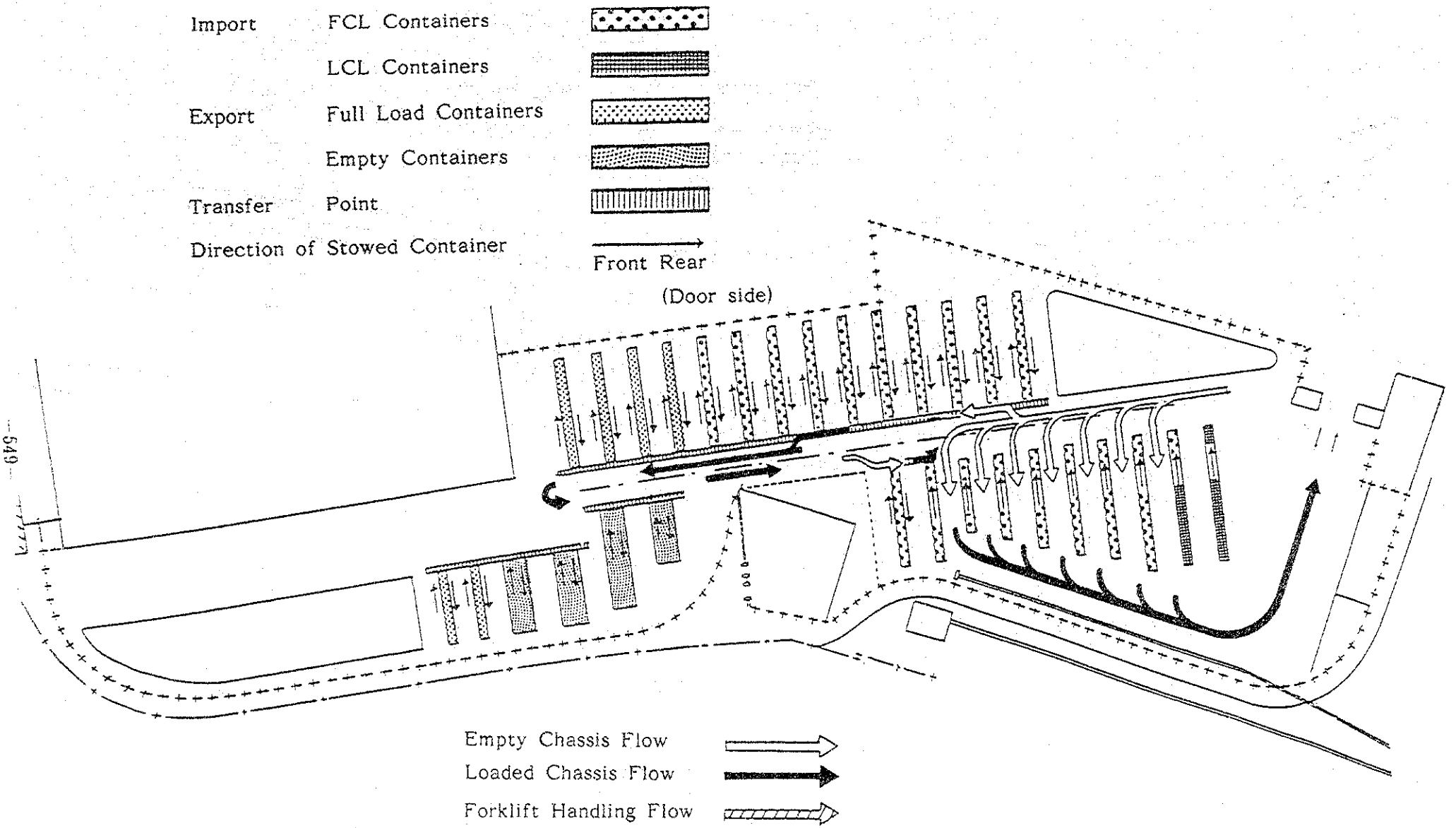


Fig. 12.6.5 Delivery of Full Load Containers

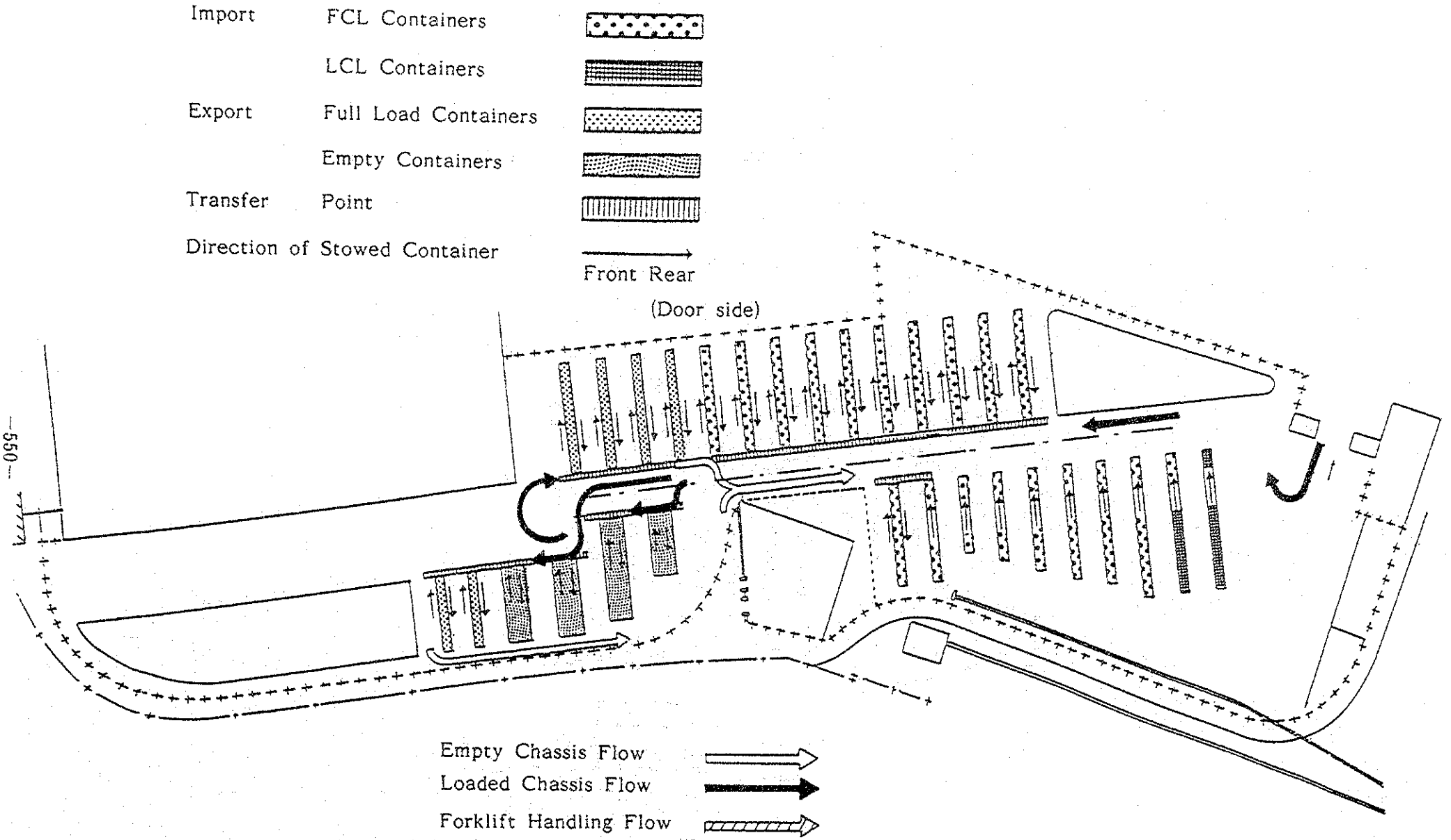


Fig. 12.6.6 Receiving of Export Full Load Containers

12.6.2 Handling of Concessionaires

(1) Bulk carrier

1) Coal in bulk at berth No.13

In order to meet the coal handling demand at the port in target year 2010, a new storage yard is to be established outside the existing port district, in addition to the existing storage yards.

Based on the capacity of the existing coal handling equipment at the berth No.13 and the layout plan of the new storage yard for target year 2010, the nominal capacity and quantity of the handling equipment to be newly installed are assessed as follows ;

	Nominal Capacity	No. of Units
Unloader	800 T/H	1 unit
Stacker/Reclaimer in New Yard	2,000 T/H	1 unit
Conveyor from berth to New Yard	2,000 T/H	1 unit
Evacuation Facility to Rail Wagon	1,000 T/H	1 unit

2) Coke to be exported

This cargo is also planned to be loaded at berth No.13, using the existing gantry crane with grab buckets.

3) Iron ore

At present, there is an iron ore storage yard behind berth No.16 and 17, which are conceded to the FERPHOS as importer. So the cargo is planned to be unloaded at the berths No.16 or 17 using the existing quay cranes with grab buckets and to be transferred to the above-mentioned storage yard. Hence one conveyer with a transferring capacity 600 T/H will be required.

4) Phosphate

This cargo is planned to be loaded at berth No.19 as it at present which is conceded to the FERPHOS as it does at present. However, in order to handle the forecast handling volume, it is necessary to install another conveyer system with a nominal transferring capacity of 1,200 T/H, and also to improve the capacity of the feeding equipment into the conveyer system in the shed.

The details of the existing complex loading facilities are as follows.

Capacity of loaders	:	1,200 T/H and 800 T/H
Conveyer system		
from shed to loader	:	800 T/H

5) Sulfur and potash

Handling of these cargoes are planned to be transferred from the existing berth to a new berth planned for in the target year 2010. Given the nature and the forecast handling volume of these cargoes, unloading will be carried out using the same cranes, however transfer to storage facilities should be done using separated conveyer systems per cargo.

The following handling facilities and systems will be required.

Unloader	:	Traveling overhead trolley unloader grabbing crane Nominal capacity 300 T/H X 2 units
Conveyer	:	Two lines of conveyer system Capacity for sulfur ; 600 T/H Capacity for Potash ; 300 T/H
Storage facility	:	Shed type per each cargo

(2) Tanker

1) Liquefied ammonia

This cargo is planned to be handled at berth No.18 be under the control of ASMIDL as exporter as it is at present, and the existing loading arms installed at the berth have enough capacity to handle more large amount of cargo.

2) Petroleum products

Almost all of the petroleum products carried by tankers are unloaded at berth No.26 by pipe line systems running to shore tanks, however, the actual unloading rate fluctuates and is at a very low level given the diameter of the shore pipe line (10 inches) equipped at the berth (refer Appendix A.4.2). These cargoes are planned to be handled at a berth to be planned for the target year 2010. It is preferable to install a steel unloading arm with a quick coupler connected to the shore pipe line running to storage tanks.

(3) General cargo vessel

1) Metallic products (Steel products)

Berths Nos.14 and 15 are equipped with quay cranes and the storage yard behind the berths is equipped with three transfer cranes. These facilities are exclusively used for handling steel products. For inland transport of steel products from/to the port, railways are laid on the berths and in the storage yard to directly load/unload cargoes by quay cranes and transfer cranes.

The layouts of the existing facilities are fit for the handling of a large amount of steel products. Hence the cargo handling of steels goods in these berths for target year 2010 will be carried out as at the present. However in order to achieve smooth cargo handling, it is necessary to avoid long holding over of cargo in the storage yard, and to use the storage yard for cargo sorting and transit just before loading and/or after unloading for short periods only.

2) Other (Manufactured Fertilizer for export)

Concerning cargo handling of this cargo, unitization of the cargo is recommended with wooden pallets and/or flexible container (big bags) used for one way traffic, in order to quickly handle the cargo throughout all stages from a manufacturer to vessel.

12.7 Consideration of Environmental Aspects

12.7.1 Environmental Impacts by the Port Development

The main components of environment to be affected by the port development are as follows:

1) Air pollution

This is a factor which has a strong relationship with the usage of automobiles. In the port, exhaust fumes from ships and automobiles in the port area are the main sources of air pollution, however, the port area creates little air pollution compared with the other plants.

2) Water quality

The construction of the breakwater for protecting port facilities from waves will result in a closed water area in which it is not easy to exchange water with the outer sea.

The water pollution during the capital dredging and reclamation works can be easily prevented by the proper countermeasures commonly used.

3) Vibrations

At the container terminal, the operation of container handling causes some vibrations, however, it is only near the container terminal.

12.7.2 Measures for the Polluted Sediment Inside the Port Area

According to the report "Study on the pollution of dredging materials" of June, 1991, polluted sediment inside the port area was found which contained high concentrated heavy metals, and it was recommended that the polluted materials be discharged into an enclosed embankment which will be constructed at the existing neighboring port.

The plan recommended above will be carried out by the DTP, after which

a site will be developed for the green area planned in the Master Plan by the year 2010.

12.7.3 Measures in the Future

In conformity with MARPOL convention, the port was equipped facilities to receive waste such as ballast, bilge and etc. from vessels at the port. However, in order to minimize the water pollution at the port, a monitoring system will have to be arranged for discharged water in advance.

At the same time, sewage from the city and drainage water from the wharves need to be treated before being discharge into the basins of the port at the earliest possible time.

12.8 Cost Estimation

The main conditions for the cost estimation are as follows;

(a) Construction costs have been estimated using the prices and rates obtained in October 1991 in principle

(b) The inflation factor has been excluded from the estimation.

(c) The exchange rates of the U.S.$ against the Algerian Dinar (DA) and the Japanese Yen (JY) are as follows;

1 US$ = 21.899 DA = JY 131.25

A summary of estimation results is presented in Table 12.8.1.

Table 12.8.1 Summary Construction Cost of the Port of Annaba

Unit: Million DA

Facilities		Alternative A			Alternative B			Alternative C		
Item	Sub Item	Foreign Portion	Local Portion	Total Cost	Foreign Portion	Local Portion	Total Cost	Foreign Portion	Local Portion	Total Cost
1.Main structures	1)Main BreakWater	1,084.2	568.1	1,652.3	1,084.2	568.1	1,652.3	1,537.8	849.1	2,386.9
	2)Sub BreakWater	1,047.8	435.9	1,483.7	1,325.0	554.0	1,879.0	271.5	153.6	425.1
	3)Basin & Channel	91.5	496.2	587.7	114.5	620.5	735.0	180.5	978.4	1,158.9
	4)Reclamation of Land	593.8	190.4	784.2	333.6	109.4	443.0	457.4	149.1	606.5
	Sub Total	2,817.3	1,690.6	4,507.9	2,857.3	1,852.0	4,709.3	2,447.2	2,130.2	4,577.4
2.New Sulphur & Patosh Both	1)Civil Works & Warehouses	291.0	168.2	459.2	309.3	178.5	487.8	291.0	168.2	459.2
	2)Unlooder & Conueyors	221.9	29.9	251.8	221.9	29.9	251.8	221.9	29.9	251.8
	Sub Total	512.9	198.1	711.0	531.2	208.4	739.6	512.9	198.1	711.0
3.New Cereal Berth	1)Silos & Buildings	253.3	113.1	366.4	253.3	113.1	366.4	253.3	113.1	366.4
	2)Civil Works	234.2	121.9	356.1	257.6	134.1	391.7	234.2	121.9	356.1
	3)Pneunatic Unlooders	309.1	28.1	337.2	309.1	28.1	337.2	309.1	28.1	337.2
	Sub Total	796.6	263.1	1,059.7	820.0	275.3	1,095.3	796.6	263.1	1,059.7
4.New Container Berth	1)Civil Works & Buildings	321.3	171.9	493.2	337.4	180.5	517.9	321.3	171.9	493.2
	2)Container Game etc	519.2	78.4	597.6	519.2	78.4	597.6	519.2	78.4	597.2
	Sub Total	840.5	250.3	1,090.8	856.6	258.9	1,115.5	840.5	250.3	1,090.8
5.New Car Ferry Berth		144.3	80.7	225.0	141.4	78.3	219.7	144.3	80.7	225.0
6.New Petroleam Berth	1)Civil Works	10.4	5.7	16.1	10.4	5.7	16.1	10.4	5.7	16.1
	2)Unlooding System	192.7	26.3	219.0	192.7	26.3	219.0	192.7	26.3	219.0
	Sub Total	203.1	32.0	235.1	203.1	32.0	235.1	203.1	32.0	235.1
7.Reinforcement Works of Existing Berthes	1)Cereal Silos	253.3	113.1	366.4	253.3	113.1	366.4	253.3	113.1	366.4
	2)Peteroleiun Berth	0.3	0.1	0.4	0.3	0.1	0.4	0.3	0.1	0.4
	3)Phosphate Berth	34.1	71.4	105.5	34.1	71.4	105.5	34.1	71.4	105.5
		287.7	184.6	472.3	287.7	184.6	472.3	287.7	184.6	472.3
	4)CargoHandling Equipments	872.6	150.0	1,022.6	872.6	150.0	1,022.6	872.6	150.0	1,022.6
	Sub Total	1,160.3	334.6	1,494.9	1,160.3	334.6	1,494.9	1,160.3	334.6	1,494.9
8.Misec llauies	1)Other Civil Works	245.3	161.1	406.4	245.3	161.1	406.4	245.3	161.1	406.4
10.Direct Cost		6,720.3	3,010.5	9,730.8	6,815.2	3,200.6	10,015.8	6,350.2	3,450.1	9,800.3
11.Indirect Cost	1)Physical Contingency	403.8	240.4	644.2	412.2	257.3	669.5	371.4	279.5	650.9
	2)Engineering Services	368.3	215.8	584.1	376.0	231.0	607.0	338.8	251.0	589.8
	Sub Total	772.1	456.2	1,228.3	788.2	488.3	1,276.5	710.2	530.5	1,240.7
12.Total Cost		7,492.4	3,466.7	10,959.1	7,603.4	3,688.9	11,292.3	7,060.4	3,980.6	11,041.0
13.Tax(VAT)		524.4	242.7	767.1	532.2	258.2	790.4	494.2	278.6	772.8
14.Proiect Cost		8,016.8	3,709.4	11,726.2	8,135.6	3,947.1	12,082.7	7,554.6	4,259.2	11,813.8

CHAPTER 13 PORT MANAGEMENT AND OPERATIONS

13.1 General Condition

Currently, EPs have a lot of problems to be solved in the areas of port management and operations. In this chapter, considering those problems, future port management system will be studied from the long-term point of view. The main problems and factors to be considered are as follows.

First, Algerian public corporations have been faced with a very difficult reformation process. The EPs recently should also be reformed if necessary.

Second, the EPs do not have some of the principal authorities enjoyed by an independent port administration body.

Third, there are problems concerning cargo handling and cargo storage operations, part of which could be solved by the reorganization of the EPs.

Lastly, the largest problem facing the management is clearly its financial situation, deficit or decreasing profit, mainly caused by rapidly increasing personnel expenses.

13.2 Analysis of Operational Performance and Cost

13.2.1 Tugs

(1) Port of Algiers

In the port, there are four tug boats and 103 persons for the tug service. The service is available 24 hours a day as they have adopted four shifts -one team works 24 hours straight after four days off. Crew members per boat number seven persons and one shift team is composed of 25.7 persons on average. Total number of tug boats which served last year was 6,321 boats and annual revenue in 1990 was 17.6 million DA. Based on the information which was shown in chapter 5.5.3 "Port Service Performance", cost and revenue of the tug boat service in 1990 can be calculated as follows:

[tug]		
revenue		17.6 million DA
cost	personnel	11,986,110 DA
	depreciation	514,550
	fuel	4,171,860
	supply	4,355,000
	total	21,027,520
profit		- 3.4 million DA

There is - 3.4 million DA deficit from this service according to the above calculation. Personnel expenses account for 57.0% of the total cost.

(2) Port of Oran

There are three tug boats and 87 persons for the tug service. The service is available 24 hours a day with four shifts. Crew members per boat number seven persons and one shift team is composed of 21.7 persons on average. Total number of tug boats which served last year was 1,835 boats and annual revenue in 1990 was 10.9 million DA.

[tug]

revenue		10.9 million DA
cost	personnel	8,898,534 DA
	depreciation	714,977
	fuel	1,211,100
	maintenance	6,565,000
	total	17,389,611
profit		- 6.4 million DA

There is - 6.4 million DA deficit from this service. Personnel expenses account for 51.2 % of the total cost.

(3) Port of Annaba

In the port, there are three tug boats and 62 persons for the tug service. The service is available 24 hours a day with four shifts. Crew members per boat total seven persons and one shift team is composed of 15.5 persons on average. Total number of tug boats which served last year was 1,942 boats and annual revenue in 1990 was 10.3 million DA.

[tug]

revenue		10.3 million DA
cost	personnel	5,835,564 DA
	depreciation	1,035,140
	fuel	1,281,720
	supply	2,340,000
	total	10,492,424
profit		- 0.2 million DA

There is - 0.2 million DA deficit from this service and personnel expenses account for 56.6 % of the total cost.

13.2.2 Pilot

(1) Port of Algiers

There are 20 pilots in the EPAL and seven pilot boats used exclusively for the service. Usually one service team is composed of two crewmen and one pilot. The service is available 24 hours a day with four shifts, the same as the tug boat service. There are 99 persons in a pilotage section including mooring men so that one shift team is composed of 24.7 persons on average. Total number of pilots which served last year was 4,681 persons and annual revenue in 1990 was 5.5 million DA.

[pilot]

revenue	pilot	5.5 million DA
cost	personnel	4,654,800 DA
	depreciation	514,550
	fuel	561,720
	total	5,731,070
profit		- 0.2 million DA

There is - 0.2 million DA deficit from this service and personnel expenses account for 81.2 % of the total cost.

(2) Port of Oran

There are nine pilots in the EPO and four pilot boats used exclusively for the service. Usually one service team is composed of two crewmen and one pilot. The service is available 24 hours a day and 17 persons are in the pilotage section. Total number of pilots which served last year was 1,482 persons and annual revenue in 1990 was 3.1 million DA.

[pilot]

revenue	pilot	3.1 million DA
cost	personnel	1,738,794 DA
	depreciation	88,441

	fuel	177,840
	total	2,005,075
profit		1.1 million DA

There is 1.1 million DA profit from the service of pilot according to the above calculation. Personnel expenses in the pilotage service account for 86.7% of the total cost.

(3) Port of Annaba

There are eight pilots in the EPAN and two pilot boats used exclusively for the service. Usually one service team is composed of two crewmen and one pilots. The service is available 24 hours a day and there are 29 persons in the pilotage section including mooring men. Total number of pilots which served last year was 1,736 persons and annual revenue in 1990 was 2.3 million DA.

[pilot]

revenue	pilot	2.3 million DA
cost	personnel	1,788,318 DA
	depreciation	128,200 DA
	fuel	208,320 DA
	total	2,124,838
profit		0.2 million DA

There is 0.2 million DA profit from the service of pilot according to the above calculation, so it can be said that the cost and profit are almost balanced in the operation. Personnel expenses in the pilot service account for 84.2% of the total cost.

13.2.3 Mooring

(1) Port of Algiers

There are 40 men in the mooring division. Revenue, cost and profit for

the service are shown below.

[mooring]

revenue		3.8 million DA
cost	personnel	4,654,800 DA
profit		- 0.8 million DA

(2) Port of Oran

There are 30 men in the mooring division. Revenue, cost and profit for the service are shown below.

[mooring]

revenue	mooring	3.6 million DA
cost	personnel	3,068,460 DA
profit		0.5 million DA

The revenue and cost are almost equal.

(3) Port of Annaba

There are 10 men in the mooring division. Revenue, cost and profit for the service are shown below.

[mooring]

revenue		2.0 million DA
cost	personnel	941,220 DA
profit		1.0 million DA

There is 1.0 million DA profit from this service and the average amount of profit per person per year is 100,000 DA.

13.2.4 Cargo handling

(1) Port of Algiers

There are 2,383 persons involved in the cargo handling operation including workers for arrangement of cargo handling equipment and general administration staff for the Cargo Handling Department. The workers involved in cargo handling are divided into seven teams in order to operate the seven major wharves. In addition, in the Department of Technical Works & Maintenance, there are 459 persons who conduct maintenance and repair of the infrastructure, superstructure and cargo handling equipment. This personnel expense should be added to the cargo handling and cargo storage operation cost as the maintenance cost. The total revenue from cargo handling and rental of cargo handling equipment was 348.3 million DA in 1990. Total costs and revenues of the cargo handling operation are shown below.

[handling]

revenue		348.3 million DA
cost	personnel	277,309,710 DA
	depreciation	35,785,450
	maintenance	44,093,468
	total	357,188,628
profit		- 8.9 million DA

There is - 8.8 million DA deficit from the operation according to the above calculation and the personnel expenses in the operation account for 77.6% of the total cost.

(2) Port of Oran

There are 804 persons in the Cargo Handling Division who are divided into three sectors to operate cargo handling in the port. In the Solid Bulk Division, there are 49 persons for the operation of solid bulk (cereals) unloading and stock. Also, there are 63 persons for the operation and administration of cargo handling equipment in the Commercial Division. In addition, in the Department of Technical Works & Maintenance, there are 76 persons who conduct maintenance

and repair of the infrastructure, superstructure and cargo handling equipment. The total revenue from cargo handling and rental of cargo handling equipment was 117.1 million DA in 1990, which includes the 15.2 million DA for the solid bulk unloading operation. Total costs and revenus of the cargo handling operation are shown below.

[handling]		
revenue	unloading/loading	52.4
	equipments	64.7
	solid bulk	15.2
	total	132.3 million DA
cost	personnel	91,235,544 DA
	depreciation	10,498,291
	maintenance	13,847,653
	total	115,581,488
profit		16.7 million DA

There is 16.7 million profit from the operation according to the above calculation. Personnel expenses in the operation account for 78.9% of the total cost.

NOTE:Solid Bulk Operation

The EPO has the Solid Bulk Division in the Operation Department. The division is mainly in-charge of the operation of special facilities such as a silo for cereals. There are 49 workers in the division and revenue generated from solid bulk unloading and silo operation was 42.8 million DA in 1990. It is difficult to calculate the ratio or total cost of the solid bulk operation, so the profit from the operation can not be calculated here. However, it is clear that the solid bulk operation brought a large amount of revenue to the EPO and personnel expenses were very little (5 million DA/year) ensuring a large profit, though other expenses were necessary. (the difference between personnel expenses and the revenue is about 37.8 million DA.)

(3) Port of Annaba

There are 666 persons involved in the cargo handling operation including

152 persons who administrate and operate cargo handling equipment. Also, in the Department of Technical Works & Maintenance, there are 138 persons who conduct maintenance and repair of the infrastructure, superstructure and cargo handling equipment. The total revenue from cargo handling and rental of cargo handling equipments was 100.2 million DA in 1990. Total costs and revenus from the cargo handling operation can be calculated as follows.

[handling]		
revenue	loading	61.7
	equipments	38.5
	total	100.2 million DA
cost	personnel	62,685,252 DA
	depreciation	9,718,330
	maintenance	10,513,971
	total	82,917,553
profit		17.3 million DA

There is 17.3 million DA profit from the operation according to the above calculation. Personnel expenses in the operation account for 75.6% of the total cost.

13.2.5 Cargo Storage

(1) Port of Algiers

In the Commercial Department, 533 persons are in charge of cargo storage, preparation of bills and administration of EPAL's property. For the cargo storage operation, transit sheds and stock yards are divided into seven sectors and two special terminals, container and trailer terminals. Costs and revenue of the cargo storage operation in 1990 can be calculated as follows:

[storage]		
revenue		226.8 million DA
cost	personnel	62,025,210 DA

	depreciation	35,785,450
	maintenance	33,520,362
	total	131,331,022
profit		95.5 million DA

There is 95.5 million DA profit from the cargo storage operation. Personnel expenses in the operation account for 47.2% of the total cost. The amount of profit is very large. However, 124.7 million DA, 55% of the revenue, is the tax revenue which is transferred to EPs by the provision of the Financial Law.

(2) Port of Oran

In the Commercial Division, 175 persons are in charge of cargo storage. Also, in the solid bulk division, there are 49 persons for the operation of solid bulk unloading and stock. The costs and revenues of the cargo storage operation in 1990 can be calculated as follows:

[storage]		
revenue	silo	27.6 million
	others	34.3 million
	total	61.9 million DA
cost	personnel	20,354,118 DA
	depreciation	10,498,291
	maintenance	6,025,779
	total	36,878,188
profit		25.0 million DA

There is 25.0 million DA profit from the cargo storage operation. Personnel expenses in the operation account for 55.2% of the total cost. However, 18.3 million DA, 29.6% of the revenue, is the tax revenue which is transferred to EPs by the provision of the Financial Law. 27.6 million DA, 45% of the revenue, is from the operation of the silo for cereals.

(3) Port of Annaba

In the Commercial Division, 81 persons are in charge of cargo storage. Total revenue from the operation was 49.4 million DA in 1990 including 34.6 million DA for the silo for cereals. The costs and profit of the cargo storage operation in 1990 can be calculated as follows:

[storage]		
revenue	silo	34.6 million
	others	14.8 million
	total	49.4 million DA
cost	personnel	7,623,882 DA
	depreciation	9,765,290
	maintenance	7,274,865
	total	24,664,037
profit		24.7 million

There is 24.7 million DA profit from the cargo storage operation. Personnel expenses account for 30.9% of the total cost. However, 6.5 million DA, 13% of the revenue, is the tax revenue. 34.6 million DA, 70% of the revenue, is from the operation of the silo for cereals.

The EPAN also generates revenue from renting land in the port area for the private port facilities operated by the heavy industry companies. EPAN earned 8.3 million DA in 1990 from land rental.

13.2.6 Comparison of Operational Performance

A comparison of revenues, costs and profits of the operations which are studied above is shown in Table 13.1.1. According to the table, tug, pilot and mooring services brought little profit or a deficit to the EPs. Only the cargo storage operation generated substantial profits for the EPs.

Table 13.1.1 Operational Performance

(million DA)

	EPAL	EPO	EPAN
TUG	- 3.4	- 6.5	- 0.2
PILOT	- 0.2	1.1	0.2
MOORING	- 0.9	0.5	1.1
HANDLING	- 8.9	16.7	17.3
STORAGE	95.5	25.0	24.7

13.3 General Idea of the Port Management and Operations

13.3.1 General Principles

Generally, it is said that whatever the legal statute of a port may be, it should be based on the following essential principles: autonomy, authority over the whole port area and main port functions, financial self-sufficiency and commercial management methods. On the other hand, it is also said that a major port of national importance should be managed by a administration body under the general overall supervision of the government. In reality, there is great variety in the types of port administrations around the world, such as state controlled, municipal, autonomous and private.

In principle, a port management is a kind of commercial business, so a port can never be managed efficiently under rules and regulations established for quite different purposes and different kinds of activities, namely for Ministries and entire civil service departments. A much more flexible, business-like system of management is required, free from political pressures and fluctuations.

However, construction and expansion of port facilities, such as quays, breakwaters and passages, needs a great deal of capital; the return on the investment will not materialize in the short term because the port charge should be minimal to coincide with the public characteristic of ports. The private sector can not afford such capital so that it is inevitable that the public sector is involved as a investor and administrator of ports.

Also, the distribution of very limited capital resources to many urgent requests for infrastructures, such as roads, mass transportation systems and other national projects, requires national level coordination especially in developing countries. In addition, ports are one of the vital instruments of the national economic policy to achieve a so called economic take-off.

Therefore, in developing countries it is better for ports to be under the strong supervision of the government to facilitate optimum capital distribution and the realization of a trade policy.

The basic aim of government's control should consist in insuring that the port will be managed and developed in accordance with the economic policy of

the country and that management will be honest and efficient. Still, the basic four principles should be applied to a port administration body as much as possible, such as autonomy, authority over the whole port area and main port functions, financial self-sufficiency and commercial management methods.

(1) Autonomy

A major port of national importance should be managed by a separate autonomous body under the general overall supervision of the government. The port administration body should be in charge of the current administration and development of the port, within the framework of the national economic policy.

Also, the body should be responsible for preparations of port improvement and extension plans and for maintenance of all existing port facilities. It should have the right to select and appoint personnel in accordance with their professional abilities. It should be able to lease some property to private firms in case of need, incur financial obligations in its own name and in general to act as a legal entity.

Government's control should be limited to a minimum number of areas; however, the following decisions should be subject to government approval.

(a) Plans for major port extension and improvement
(b) General level of main port dues
(c) Annual budgets
(d) Loans and obligations exceeding a certain limit
(e) Sale or long-term lease of property exceeding a certain amount

In (a) and (b), the government's approval is needed to avoid deviation from the general economic policy of the government. From (c) to (e), they are listed to check the port administration body's financial soundness.

The two requirements, autonomy and government's control, though contradictory, should be reconciled to realize efficient port management without deviating from the general economic policy of the government.

(2) Authority

A port administration body should have authority over the whole port area

and main port functions. Port operations cannot be performed with full efficiency unless the port management body owns all land and facilities, such as infrastructure, superstructure, quay cranes and so on, in the port area to control and coordinate all port activities on wharves and piers, land facilities and port waters. Also, the planning of future port extension cannot be made properly unless the port can freely dispose of the entire undeveloped water frontage within the port area.

Private ownership or other governmental organization's ownership of land or of port installations can make it difficult to achieve a full unity of control. However, highly specialized terminals, which are used by one single customer with sufficient volume of cargo that requires exclusive use of the terminal, for example berths for loading ores or crude oil, can remain in private ownership, under a certain degree of supervision by the port administration body.

It is difficult to say whether the office of Harbor Master should be placed under control of the port administration body or under control of another governmental department. Activities of the Harbor Master are closely connected with the safety and order of port waters. Enforcement of rules on navigation and traffic safety on port waters is the responsibility of the Harbor Master. Therefore, there is a reason to separate the office of the Harbor Master from the main body of the port administration and to make a separate organization for these responsibilities.

On the other hand, to have the office in the port administration body as one of its departments will bring the benefit of eliminating frictions and inter-office rivalries because all operating responsibilities are unified within one administrative body.

It depends on the situation of the country in deciding Which type of organization should be adopted.

(3) Financial independence

Autonomy cannot be achieved by a port unless it has a wide measure of financial independence and self-sufficiency. Financial independence and self-sufficiency make the port administration body more sensitive to costs and benefits.

If the government is obliged to cover yearly operating deficits of a port, in addition to having financed the initial capital investments, it will be reluctant to entrust port management to a separate autonomous body. Whoever supplies the funds will inevitably tend to exercise strict control on expenditures and on the management of the port. Financial self-sufficiency should be the aim of every major port.

Port charges and any other receipts of the port should be used exclusively for port administration, maintenance and improvement. Port tariffs should be kept at a reasonable level to cover normal current expenses, including amortization and repayment of loans. Only funds for investments to major port infrastructure and superstructure based on a port extension or improvement plan should in case of need be supplied by the government, either in the form of direct donations or of low-interest loans.

Financial self-sufficiency should be obtained not only by maintaining the level of port charges at a proper level but also by exercising due economy in all aspects of port management.

(4) Commercial management methods

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

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

The port administration must have a vast latitude of freedom to adjust its organization and the level of expenses to changing requirements of traffic and