Chapter 7 Improvement Plans of Each Port by the Mexican Side

The improvement plans of each port was prepared by the Mexican side with the cooperation between Puertos Mexicanos and each ESP.

The contents of the improvement plans were discussed between the Mexican side and the study team and were referred to by the study team for preparing the recommendations on the improvement plans which are described in the next Chapter.

Chapter 8 Recommendation on the improvement plans

The recommendations, in line with Chapter 4, consist of the common items and the recommendations of the improvement plan of each port. The common items are common to most of the ports and are comparatively significant. The recommendations for each port focus on those unique to each port and also represent the comments on the improvement plan of each port by the Mexican side.

8.1 Common Items

8.1.1 Utilization of the ports

(1) System of Promoting Utilization of the Ports

Promotional activities should be carried out both at the local level and the central government level. However, the local port side should play a more significant role in the promotional activities. The following points are recommended.

a. To establish an organization to promote port utilization.
b. To carry out port sales activities as well as to examine measures to promote port utilization by the above-mentioned organization.
c. To prepare brochures or maps about the ports which will be useful for sales.
d. To promote the improvement of port facilities and productivity, which are effective in terms of further utilization of the port.

(2) Promotion of Containerization

An effective means of promoting further port utilization is to adopt a policy that will accelerate the containerization of general cargoes.

a. To ensure the future prospect of containerization at the ports.
b. To study and promote forming an effective container network between the ports.
c. To promote containerization by providing adequate facilities/equipment at the ports for container handling.

(3) Formulation of the Master Plans of the Ports

It is very important to formulate a master plan for each port so

that the port may be constructed and developed in line with the long term development policy. It also should be emphasized that the preparation of master plans helps promote port utilization by providing port users with the future figure of the ports.

a. To formulate long term master plans for the ports based on the long term forecast of cargo handling volume.
b. Authorization of the master plans.
c. To make the master plans public.

(4) Investigation of the Possibility of Promoting Domestic Maritime Transportation

The following investigation is recommended as a means of examining the possibility of further development of domestic maritime transportation.

a. To examine the actual inland movement of the cargoes which it may be possible to shift to maritime transportation.
b. To carry out time and cost analyses for inland and maritime transportation and to examine the possibility of cargo shift.
c. To study measures to promote domestic maritime transportation based on the investigation and analysis mentioned above.

8.1.2 General Port Administration

(1) Strengthening the Management Constitution of ESPs

In this regard, the study team has made the following recommendations:

a. Look over the services rendered by the ESPs.
b. Improve the efficiency of cargo handling operations.
c. Improve the personnel capability of the ESPs.

(2) Improvement of Coordination and Communication among ESPs and the Other Local Governmental Organizations

a. Promote further coordination and communication among the ESPs and the other local governmental organizations.
b. Strengthen the administrative functions of the local delegate of Puertos Mexicanos.
c. Make clear the functions of the local delegate of Puertos Mexicanos

and the ESP.

d. Investigate an effective port management and operating system.

8.1.3 Tariff System

(1) Simplification of Tariff

The port tariff is now being re-examined in Mexico aiming at the simplification and standarization of tariffs. The simplification and standarization of tariffs are necessary, because the procedures of tariff payments would become simple and quick, resulting in the clear and easy calculation of tariff rates.

(2) Necessity of Cost Accounting for Individual Tariffs

The cost analysis of individual tariff should be performed and its basic cost should be calculated in order to set up the individual tariff rate. This effort is being carried out by Puertos Mexicanos and each ESP at present. The cost accounting of individual tariffs is also very useful in evaluating the present situation of ESP finance and to examine the financial policy, as mentioned previously.

(3) Other Functions of Tariffs

Other ways of improving cargo handling efficiency could be included in the tariff system as follows:

a. The minimum charge system should be clearly described in the tariff schedules in combination with a waiting time charge.

b. A bonus system should depend on negotiations with users on a case by case basis.

8.1.4 Cargo Handling Unions

(1) Existence of Plural Cargo Handling Operators

As a measure for simplification, a one package contract system may be useful. It has been attempted at the Port of Ensenada. However, the essential solution, that is the unification of cargo handling operation at the ports by the ESP, should be sought from the viewpoint of efficient cargo handling.

(2) **Improvement of Productivity**

a. To strengthen the leadership of the ESPs through sufficient communication with the unions

b. To assign skilled workers to adequate roles

c. To introduce a wage system in accordance with the kind of job

d. To hold adequate wage level and an incentive wage system

e. To introduce a compensation system designed to prevent damage to machines and equipment

f. To carry out effective training for workers

8.1.5 Statistics

(1) **Allocation of Preparing Port Statistics**

a. Puertos Mexicanos should take the responsibility for preparing port statistics with appropriate allocation to the SCT.

b. Port statistics should be published in a single edition even if statistical compilation is divided between SCT and Puertos Mexicanos.

c. Port statistics should be available to the public, while more detailed data necessary for Puertos Mexicanos and the ESPs to carry out their businesses and duties should be handled as internal statistics.

(2) **Strengthening of the Statistics Sections in the ESPs**

a. To strengthen the statistics section in each ESP, including employing skilled personnel in charge of statistics and computerization.

b. To introduce a computer system to make data processing easy and efficient.

c. To examine how to utilize statistics for carrying out daily business and setting managerial policy.

d. To make the allotment of the task of compiling statistics clear between the local delegate of Puertos Mexicanos and the ESPs.

(3) **Improvement of Port Statistics**

The basic data to be collected and processed as statistics are examined and summarized according to each statistical item.

1) Statistics regarding vessels

a. Number of vessel calls by vessel type and vessel size for foreign and domestic trade vessels, respectively.

b. Number of vessel calls by registered country for international trade vessels.

c. Number of vessel calls by liner route for international liner vessels.

d. Number of vessel calls by TEU capacity for full and semi-container vessel.

e. The dimensions of the maximum and typical types of each vessel.

2) Cargo statistics

a. Yearly and monthly cargo volume of the six cargo groups adopted by the Port Statistics of Mexico.

b. Cargo volume by commodity group for general cargoes and perishables

The Port Statistics of Mexico contain detailed commodity statistics which are too complicate for analyzing the trend of cargoes.

c. Cargo volume by liner routes for liner cargoes.

d. Origin and destination statistics.

3) Container

a. Yearly and monthly number of containers in terms of TEU.

b. Yearly and monthly cargo volume of containerized cargoes by commodity and liner route.

c. Dwelling time of containers in the container yard

The dwelling curve of containers by loaded/empty container should be investigated.

4) Berth usage

a. Occupancy of each berth per year.

b. Cargo handling time during berthing time.

c. Average berthing time per vessel by vessel type.

d. Cargo volume by main commodity handled at each berth.

e. Internal between vessels arrival and the distribution of berthing time by vessel type should be collected as internal statistics.

5) Cargo storage

a. Capacity of each storage facility.

b. Cargo volume handled at each storage facility broken down into domestic/foreign and inbound/outbound categories.

c. Turnover and average resting time of cargo at each storage facility.

d. Cargo volume to/from each storage facility by land transportation mode.

8.1.6 Procedures of Ship Entry/Exit and Customs Formalities

The following are the recommendations with respect to this section:

a. To promote further coordination among related bodies.

b. Promotion of the unification of port services and related procedures.

c. To request the simplification and unification of customs formalities.

d. To reform the fumigation system.

8.1.7 Land Transportation and the Storage System in the Port Area

(1) Truck Transportation

a. To request an increase of the number of trucks from the port side.

b. To make sufficient coordination to secure the necessary number of trucks.

c. To request repair and construction of the roads connecting the ports with their hinterlands.

(2) Railway Transportation

a. To request the required number of freight cars and locomotives from port side.

b. To promote coordination to secure the necessary number of freight cars at the Federal government level.

c. To promote coordination aimed at securing the necessary number of freight cars at the local level.

d. To request repair and construction of the railways connecting the ports with the hinterlands.

(3) Storage in the Port Area

Sufficient storage facilities are indispensable for a port. It must be pointed out that the capacity of a port is decided by the capacity of its storage facilities.

a. In the long and medium terms, silos should be installed at the base ports for agricultural bulk cargo handling according to the cargo volume forecast.

b. As an urgent measure, the optimum type of storage facility should be installed at each port.

c. A variety of ways of procuring construction funds based on facilities usage should be examined.

d. Comprehensive measures to reduce the staying time of cargoes in ports should be examined including adequate storage charge and free-of-charge period.

8.1.8 Cargo Handling Operation

(1) Formulation of Cargo Handling Plans and Supervision of Cargo Handling Activities by ESPs

1) Need for a cargo handling plan

It is very important to prepare a concrete cargo handling plan before a ship's arrival and to arrange workers and cargo equipment properly.

The study team recommends the following:

a. To undertake to draw up a cargo handling plan by themselves. It will be appropriate for ESPs to undertake this function by means of sufficient negotiations with organizations concerned and by the training of planners.

b. To obtain necessary cargo working documents from shipping agents and shippers and consignees with enough time prior to a ship's arrival.

c. To secure proper assignment of stevedore gangs according to ESPs' cargo handling plan and to secure a separate gang system based on the day and night shifts.

d. To establish a fixed key gang members system and give them cargo working responsibility as a gang unit.

2) How to train an able cargo operation supervisor

For the sake of making a concrete cargo operation plan, each ESP should increase supervisors' capability and secure the necessary number of supervisors.

a. To have a seminar course for cargo supervisors by inviting a cargo planner now working for a shipping agent.

b. To delegate an ESP supervisor to a shipping agent as an assistant trainee of the shipping agent at each port.

c. To invite an experienced captain or chief officer from a shipping company as a chief instructor of the cargo supervisor at Puertos Mexicanos.

3) Necessity to make a manual describing standard ship's cargo supervisor business

It is necessary to make a cargo supervisor's manual, and the cargo handling operation should be implemented according to the provisions of the manual.

(2) Low Productivity of Container Loading/Unloading

1) Desirable container productivity

The final productivity target is expected to be as follows:

12 untis/Hr/gang	By a ship's gear
25 units/Hr/gantry crane	By a gantry crane

2) Need to understand export and import container flow

To achieve higher container terminal operation productivity, it is necessary to study export and import container flows.

3) Other recommendations by the study team

a. Container terminal operation manual

In order to understand container terminal operation, a container terminal operation manual is necessary.

b. Container handling slings and lashing/unlashing tools

At present, it takes too much time to unlash lashing rods and turn buckles. The ESPs should prepare a sufficient number of tools.

c. yard tractor chassis control

In order to prevent such waiting loss time, it is necessary that proper and times instructions be provided by the yard supervisor or the shore side workers' leader.

d. Training of crane operator and signal man

e. Prevention of container swing motion on trailer

f. Communication systems for container operation

Portable wireless telephone sets are needed for smooth container operation. It is necessary to have a good communication system between container ships, container yards and container control center offices.

(3) Bulk Cargo Handling

The recommendation particular to the bulk (dry) cargoes commented.

1) Cargo handling planning

Each ESP shall be able to improve its operations by using planning bulk cargo handling as a form of training for landling containers, since planning bulk cargo handling is simpler compared with containers.

2) Handling and storage losses

a. The shortage rates of the bulk cargoes caused by transportation and storage in the port area should be reduced to below one (1) percent, that is, in line with the standards in many other countries.

b. Good coordination between crane operators and bucket-rope handlers is necessary.

3) Contamination

Cleaning up the machines and equipment for bulk cargo handling is necessary in order to avoid contamination.

(4) Necessity of Training Workers

a. In order to increase cargo handling productivity, it is necessary to train workers in gang units.

b. Training should be available to all port workers.

c. It is very important to teach all the workers about basic safety.

8.1.9 Cargo Handling Facilities/Equipment and Maintenance System

(1) Determination of the Appropriate Amount of Cargo Handling Facilities/Equipment

1) Optimum possession level of cargo handling facilities/equipment

To handle cargoes reliably and functionally, the minimum requirement of cargo handling facilities/equipment owned and maintained by the ESPs should be examined.

The possession level can be evaluated to a certain extent with "VALUE A" which is drawn by dividing the annual operating days (hours) by the annual available days (hours) of each unit of equipment.

The ESPs should formulate a possession plan every year by using the past year's estimated "VALUE A" to meet the demand for the target fiscal year.

2) Adequate stock of spare

It is generally accepted that the ratio of spare facilities/equipment is taken as 10% of the required net amount of facilities. It is recommended that, based on the local factors, the ESPs should possess approximately 15% of the spare units in addition to the net amount of facilities/equipment needed to realize the smooth cargo handling operations.

(2) Preparation of the Replacement/Disposal Plan

ESP should prepare cargo handling facilities/equipment possession plan to meet the estimated cargo volume in each fiscal year. This plan will be composed by procurement plan and replacement or disposal plan. The study team recommends that ESP should make a replacement or disposal plan, taking into consideration the following three factors, regulation service life, economical service life and service life from the aspect of parts procurement.

(3) Establishment of Effective Maintenance System

It is required in the first place to have a firm idea of what kind of jobs should be done in maintenance shops and also what results should be expected there from.

The main work of a maintenance shop should be to make preventive maintenance on facilities/equipment possessed. In addition, a maintenance shop also carries out the possible corrective maintenance within its capacities. The corrective maintenance beyond the capacity of the maintenance shop will be ordered to outside.

The followings are pointed out as recommendations:

a. It is preferable to determine each maintenance day and contents so that total maintenance days should be less than 55 days (365 x 0.15). maintenance days should be less than 55 days (365 x 0.15).

b. In the case of a large piece of equipment, preventive maintenance should be carried out during the idle time of cargo operations.

c. it is preferable to carry out preventive maintenance by combining 3 or 4 preventive maintenance intervals.

d. It is recommended that preventive maintenance be done according to a combination of weekly, monthly, semi-yearly and yearly intervals. This is suitable for ports that have only been using a simple maintenance system.

e. For those that have already carried out the preventive maintenance based on a combination of 100 hours, 500 hours and 1000 hours, it will not be necessary to change to the periodic preventive maintenance system recommended above.

f. In order to put preventive maintenance into practice accurately and promptly, manuals for preventive maintenance are essential.

g. The maintenance shop of each ESP should be categorized (refer to the main report).

(4) Stocking of the Appropriate Spare Parts

The most appropriate amount of spare parts to be possessed must be determined from an economical point of view. The biggest and the only merit of possessing spare parts is the reduction of the maintenance period.

a. To sum up the amount of spare parts used in the previous year for preventive maintenance and always keep one twelfth (1/12) of this amount in the storehouse.

b. Spare parts for corrective maintenance have some differences from those for preventive maintenance. As for recommended amount of spare part, refer to main report.

c. As for the management of spare parts, first, a card system should be adopted for inventory control of parts. After the basis for computerization has been made, introduction of computers should be promoted. Ports that have already adopted the card system should consider the introduction of computers, and those that have not yet adopted the card system should adopt it.

(5) Urgent Treatment for Disposing Equipment

a. The ESP should promptly sell equipment whose disposal procedure has been completed.

b. To expedite the ongoing disposal procedure.

c. For equipment which is not in use or is too superannuated to be used, the disposal procedure must carried out quickly.

(6) Management and Utilization of Records and Data (regarding the cargo handling facilities/equipment, maintenance shops and spare parts only)

Full analysis of all the actual records and data are indispensable to examine such matters as the appropriate amount of cargo handling facilities/equipment, the best effective maintenance system and for stocking the appropriate spare parts. As for recommendation, refer to the main report.

(7) The Role of Puertos Mexicanos

Below should be the Puertos Mexicanos' role related only to cargo handling facilities/equipment.

a. To set out the format of documents necessary for each ESP to prepare its reports in accordance with the designated submission schedule.

b. Records and statistics with adequate format for use.

c. Arranging and training the person in charge of cargo handling facilities/equipment (or machine and electricity).

d. Active participation of Puertos Mexicanos into the exchange of cargo handling facilities/equipment.

e. Assistance to every ESP.

8.1.10 Port Facilities (Except Cargo Handling Facilities/Equipment)

a. To promote the rehabilitation of superannuated facilities at the ports to make the best use of them.

b. To carry out construction work on port facilities based on the long-term master plans of the ports.

c. In planning construction work at port facilities, the following matters should be considered:

- To utilize unused areas in the ports effectively.
- To promote utilization of the port by developing and improving port facilities.
- To make financial evaluation of facilities that need a large amount of investment.

8.2 Recommendations on the Improvement Plan of the Port of Salina Cruz

a. For the promotion of further utilization, the future demand forecast should be carefully carried out with the close cooperation of shippers and consignees. An investigation into the possibility of the so-called alpha-omega plan is also considered useful.

b. In the improvement plan prepared by the Mexican side, the direct unloading of containers onto trains is described. However, trains should not be transferred to ship side for any reason.

c. It is essential for the ESP to examine whether fuel supply service can be profitable or not on commercial basis. So this plan should be executed on the base of cost accounting.

d. The Mexican side report describes several measures to cope with union problems. The main policy mentioned in this report is believed to be rational and correct.

e. The ESP should endeavor more to realize higher productivity of container handling.

f. The main machinery for container handling, such as the existing gantry crane and transfer cranes, should be maintained and repaired

more properly.

g. It is strongly recommended that the ESP establish its own maintenance policy, basically following the general recommendations in the common items.

h. The ESP's procurement of spare parts usually involves a time-consuming process so it is mandatory that the extra amount of spare parts in addition to the ones for present use be purchased in advance and always be ready for replacement.

i. In order to keep equipment in good operational conditions, the upgrading of engineers and operators is highly important.

j. It is recommended, as the ESP has planned, to repair the pavement of the bonded berth apron for safe traffic and smooth cargo handling.

8.3 Recommendations on the Improvement Plan of the Port of Lazaro Cardenas

a. The unused area behind the general cargo berths should be deliberately utilized in accordance with the master plan.

b. Fuel supply service by the ESP will be effective for the quick dispatch of ships.

c. The ESP should examine ways of increasing the wages of personnel considering conditions particular to the area.

d. As for the present lack of union workers, the necessary number of workers in the future should be estimated considering the forecast cargo handling volume and the progress of the cargo handling operation system.

e. As an urgent measure, the improvement of the roads between Lazaro Cardenas and Acapulco is considered necessary.

f. Together with securing the necessary number of freight cars, the railways between the Port of Lazaro Cardenas and the Federal District should be sufficiently improved.

g. Repairs of the silo damaged by the earthquake should be completed as soon as possible.

h. A shift system should be studied in order to improve productivity which is kept low at present due to a gang shortage.

i. For large numbers of general types of machinery, periodical preventive maintenance is much more reasonable and useful.

j. Replacement or disposal of old machinery such as forklifts, trucks and trailers must be put into effect.

k. A new access road, as proposed in the Mexican report, should be constructed along with the Master Plan.

8.4 Recommendations on the Improvement Plan of the Port of Manzanillo

a. Judging from the containerized cargo volume at present and its future demand, an exclusive container wharf should be constructed without delay.

b. Projects being examined which would give permission to private firms to construct and operate exclusive warehouses are considered a reasonable way of settling problems with agricultural bulk cargo storage.

c. In the future, it would be desirable to install an exclusive silo berth with a deeper depth for large bulk carriers.

d. The coordination of land transportation will become more important with the increase of containerized cargo volume at the port.

e. A shift gang system should be introduced to improve the present situation at this port especially.

f. Expansion of the workshop, which is now under way is necessary.

8.5 Recommendations of the Improvement Plan of the Port of Mazatlan

a. Completion of the former ferry berth is considered necessary to accommodate the increasing cruise ships.

b. The relocation of the PEMEX berth seems to be very difficult. However, the coordination among the bodies concerned should be continued so that, at least, the waterfront line may be used as a public berth.

c. The installation of belt conveyers at the No.5 warehouse is considered necessary. Therefore coordination with FERTIMEX should be continued.

d. A comprehensive investigation regarding the storage facilities in the yard should be executed.

e. The container yard is not integrated at present. Therefore, the yard location should be planned more definitely in consideration of a comprehensive yard usage plan.

f. It is preferable to carry out preventive maintenance by grouping the equipment and machinery into 3 or 4 groups.

8.6 Recommendations on the Improvement Plan of the Port of Guaymas

a. It is considered probable that container vessels will call at the port again in the future. The promotion of the utilization of the port should be examined.
b. Grain husk dispersal widely degrades the environment of the whole port area. The ESP should continue to promote coordination with the relevant organizations.
c. Suitable portable wireless telephone system units for the rapid and correct communications should be provided.
e. It is highly recommended that periodical preventive maintenance be carried out at certain intervals: weekly, monthly, semi-yearly and yearly.
f. There is a lot of old and unusable machinery, equipment and parts, and these should be scrapped as early as possible.
g. To ensure ships' safe berthing, the supply or replacement of fenders is necessary for the No.2 berth.

8.7 Recommendations on the Improvement Plan of the Port of Ensenada

a. The prospect of container vessels calling considering competition with the ports on the west coast of the U.S.A. should be examined. Promotion of the containerized cargo for export is necessary since there is an imbalance between import/export containers at present.
b. Since the number of cruise ships calling at the port is expected to grow, countermeasure for this should be examined.
c. In the case of container handling, continuous and smooth operations between ships and the container yard are especially required. Therefore, negotiation with the CTM union should be carefully held so that loading and discharging operations can be carried out without any interruption.
d. The reasonable management of spare parts should be conducted, because as much as 20% of the spare parts are being stocked for no reason.

e. Upgrading of the engineering staff's skill is essential for high-level maintenance such as transfer cranes.

f. Against overtopping waves and overflow of seawater from the breakwater, further countermeasures at the breakwater should be examined after careful observation of waves at the port site.

Chapter 9 Long-term Development Plans in the Selected Ports

The long-term development plans (master plans) for containerized cargoes with the target year of 2005 are formulated in this Chapter.

9.1 Long-Term Development Plan for Containerized Cargoes at the Port of Lazaro Cardenas

9.1.1 Fundamentals of the Long-term Development Plan

(1) Containerized Cargo Handling Volume in 2005

1) Containerized cargo

The containerized cargo volume handled at the Port of Lazaro Cardenas in the target year of 2005 is shown in Table 9.1 and Fig.9.1.

Table 9.1 Forecast Containerized Cargo Volume of Each Port

(Unit: 1,000 tons)

Name of Port		Actual Result	Forecast Values	
		1988	1995	2005
① Guaymas	Import	67.4	74.0	129.0
	Export	66.2	120.0	186.0
	Total	133.6	194.0	315.0
② Mazatlan	Import	0.1	17.0	47.0
	Export	21.3	78.0	155.0
	Total	21.4	95.0	202.0
③ Manzanillo	Import	21.2	204.0	390.0
	Export	142.3	432.0	894.0
	Total	163.5	636.0	1,284.0
④ Lazaro Cardenas	Import	92.1	241.0	498.0
	Export	62.3	281.0	693.0
	Total	154.4	522.0	1,191.0
⑤ Salina Cruz	Import	35.5	63.0	134.0
	Export	125.5	238.0	367.0
	Total	161.0	301.0	501.0
⑥ Other Pacific Ports	Import	10.1	29.0	81.0
	Export	2.9	22.0	81.0
	Total	13.0	51.0	162.0
Manzanillo Feeder	Import	(72.6)	(106.0)	217.0
	Export	(89.0)	(209.0)	387.0
(① + ② + 1/2 x ⑥)	Total	(161.6)	(315.0)	599.0
Lazaro Cardenas	Import	(40.6)	(78.0)	175.0
Feeder	Export	(127.0)	(249.0)	407.0
(⑤ + 1/2 x ⑥)	Total	(167.6)	(327.0)	582.0

Note: The Port of Ensenada is excluded from the Other Pacific Ports

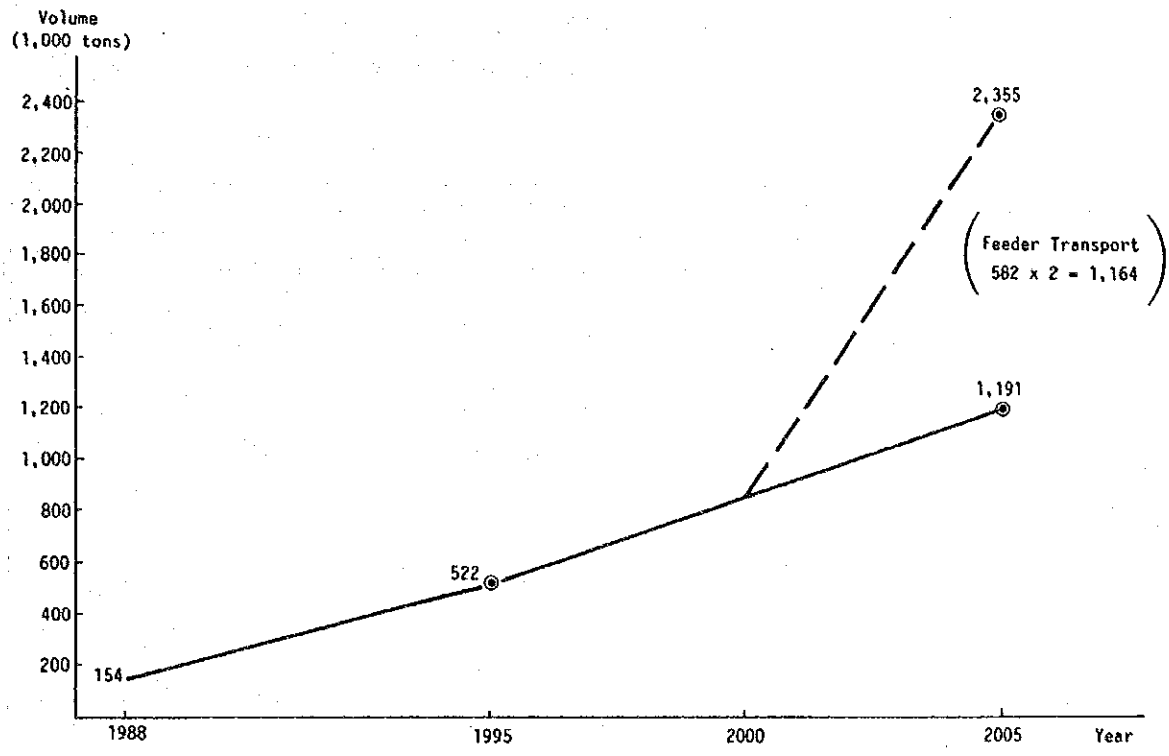


Fig.9.1 Forecast Containerized Cargo Volume

2) Containerized cargo at the container berth

As shown in Table 9.2, some portion of type III container vessels is assumed to use general cargo berths due to their small handling volume of containers per vessel.

(2) Forecast of Container Vessel Size

In view of the demand forecast of containerized cargoes, the container vessel size is forecast as Table 9.3.

Table 9.2 Containerized Cargoes by Container Vessel Type in the Year 2005 (Port of Lazaro Cardenas)

(Unit: 1,000 tons)

Type of Container Vessel	Assumed Share in the Handling Volume	Containerized Cargo Volume		
		Container Berth	General Cargo Berth	Total
I	86%	1,606.3	-	1,606.3
II	9	107.2	-	107.2
III	5	35.7	23.8	59.5
Sub Total	100%	1,749.2	23.8	1,773.0
IV (Domestic Feeder)	-	582.0	-	582.0
Grand Total	-	2,331.2	23.8	2,355.0

Note: Type I represents so-called mother vessels.
Type II represents international feeder vessels.
Type III represents multipurpose-type vessels.

Table 9.3 Physical Characteristics of Planned Container Vessel and Container Berth in 2005

Planned Container Ship						Planned Container Berth	
Type of Container	Container Capacity	Dead Weight Tonnage	Overall Length	Overall Width	Draught	Length	Water Depth
I (Mother Vessel)	TEU 3000	tons 50,000	m 270	m 32	m 13	m 300	m -14
IV Domestic Feeder Vessel	500	12,000	140	21	8	-	-

(3) Required Number of Container Berths

Based on the demand forecast, the required number of container berths is calculated by examining the frequency of vessel call and cargo handling productivity.

1) Premises for calculation

Annual number of working days		350	days
Cargo handling hours per day		18	hours
Average cargo handling productivity		25	boxes/h-crane
Average number of containers handled per vessel			
	Type I vessel	1,200	box/vessel
	Type II "	100	"
	Type III "	90	"
	Type IV "	593	"
20/40 feet container ratio		65:35	
Empty container ratio		0.25	
Unit weight of containers	import	7	tons/TEU
	export	12	"
	(export feeder)	15	"

Other than the above, the handling volume of break bulk general cargoes and number of shifting container are considered in the calculation.

2) Calculation of required number of container berths

Using the above-mentioned premises, the required number of container berths in 2005 is calculated to be 2 berths, which is deemed reasonable judging from the calculated berth occupancy rate of 54%.

9.1.2 Site Selection

(1) Alternatives for Terminal Site

Since it is rational to utilize the existing container berth, one new berth should be planned in 2005.

Examining the present situation of the port, the following three (3) alternatives are considered as possible sites for the project.

Alternative I: Existing general cargo berths

Alternative II: Area adjacent to the general cargo berths

Alternative III: Inner part of the port beyond the grain berth

(3) Evaluation of the Alternatives

Alternative I requires reconstruction of a container berth; a costly investment. It is also necessary to build substitute general cargo berths including warehouses, prior to starting construction of the container berth.

As for alternative III, the new terminal is located far away from the existing one, which causes great inconvenience for both the port users and the terminal operator. Besides, the construction costs including dredging and port access facilities may be very high.

Alternative II thus remains a relatively feasible one which does not have significant defects, unlike the other alternatives. Therefore, this site is selected as the site for a new container berth.

9.1.3 Operation System

There are three typical container handling operation systems. The general characteristics of each system are summarized in Table 9.4.

Considering the present operating system adopted in Mexico and physical and other conditions of the port, a transfer crane system is selected. In view of the narrow width of projected area, the study team recommends a rail-mounted transfer system in the new container terminal.

Table 9.4 Characteristics of Operation Systems

	(1) Straddle carrier	(2) Transfer crane	(3) Chassis
Operating speed	quick	moderate	moderate
Maintenance	hard	moderate	easy
Space efficiency	moderate	good	bad
Skill required to operate	very much	moderate	not so much
Automation system application	moderate	easy	hard
Investment costs	higher	much higher	cheap

9.1.4 Required Scale of Facilities/Equipment

(1) Required Scale of Berths

Existing container berth: Length 286m, Depth -14m

New " : Length 300m, Depth -14m

(2) Required Scale of Water Basin

The water basin for vessels' turning should ensure an area larger than a circle with a diameter of 2L (L: Length overall of planned vessel size, 270m)

(3) Required Scale of Storage Facilities

1) Premises for calculation

- Stuffing/unstuffing ratio of containers within the port 20%
- Dwelling time

Container yard	Import	10	days
	Export	8	"
	Empty	8	"
	Domestic Feeder	3	"
CFS		7	"

- Returning empty containers 30% of loaded import containers

2) Container yard

Based on the demand forecast and the above premises, the required scale of container yard in terms of ground slots is calculated as Table 9.5.

Table 9.5 Results of Required Storage Capacity in Container yard (Port of Lazaro Cardenas in 2005)

Item	Unit	Loaded Containers				Empty Containers
		Import	Export	Reefer	Total	
M_L (Required Storage Number of Container)	TEUs	3,680	2,150	40	5,870	2,060
L (Stacking Height)	Layers	2.2	2.8	2		3
S_L (Required Number of Ground Slots)	Slots	1,673	768	20	2,461	687

3) Container freight station

Calculating in the same manner as the size of the warehouse, a container freight station of 8,000 m^2 is required.

(4) Required Amount of Cargo Handling Equipment

Based on the demand forecast and operation system the required amount of cargo handling equipment is examined.

1) Quay-side gantry crane

The required number of quay-side gantry crane will be determined by two factors: container volume to be handled and quick dispatch of the container ship. Two quay-side gantry cranes per berth are required, although the handling number of containers will be rather large in 2005 because of the calling of domestic feeder vessels.

2) Transfer crane

From the planning of containers stacking yard, the following transfer cranes are required:

Existing Terminal	Rubber-tired	4 units	(6 lanes x 3 layers)
		2 untis	(3 " x 2 ")
			(Existing)
New Terminal	Rail-mounted	4 untis	(12 " x 4 ")

3) Other minor cargo handling equipment

The required numbers of other minor cargo handling equipment are as follows.

Chassis		60
Tractors		26
Fork-lift	40t	2
"	25t	3
"	5t	7
"	3t	20
"	2t	42

4) Maintenance of container handling equipment

The study team recommends that additional cargo handling

equipment for container be repaired at the existing workshop from the reasons given below:

- General repairs (preventive and corrective maintenance) will be done more smoothly and at a lower cost in the E.S.P. workshop than in outside shops.
- It is uneconomical to establish one more workshop.
- The workshop can be improved and enlarged to cope with the increased number of cargo handling equipment.
- Complicated and special repairs could be handled outside the workshop.

9.1.5 Layout Plan

The general layout plan is illustrated in Fig.9.2.

(1) Existing Container Terminal

The layout plan of the existing container terminal is shown in Fig.9.3, which is fundamentally the same as the short-term plan.

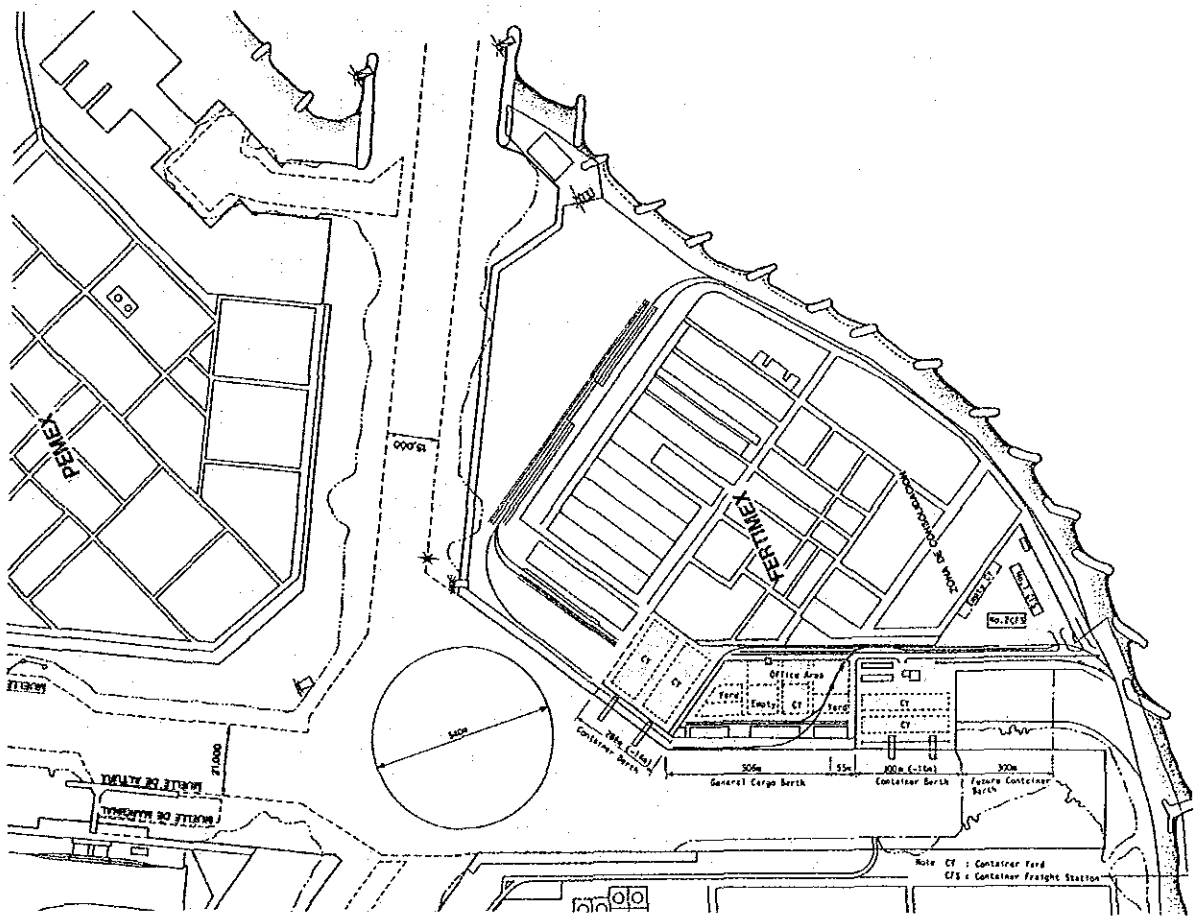


Fig.9.2 General Layout Plan for Containerized Cargo

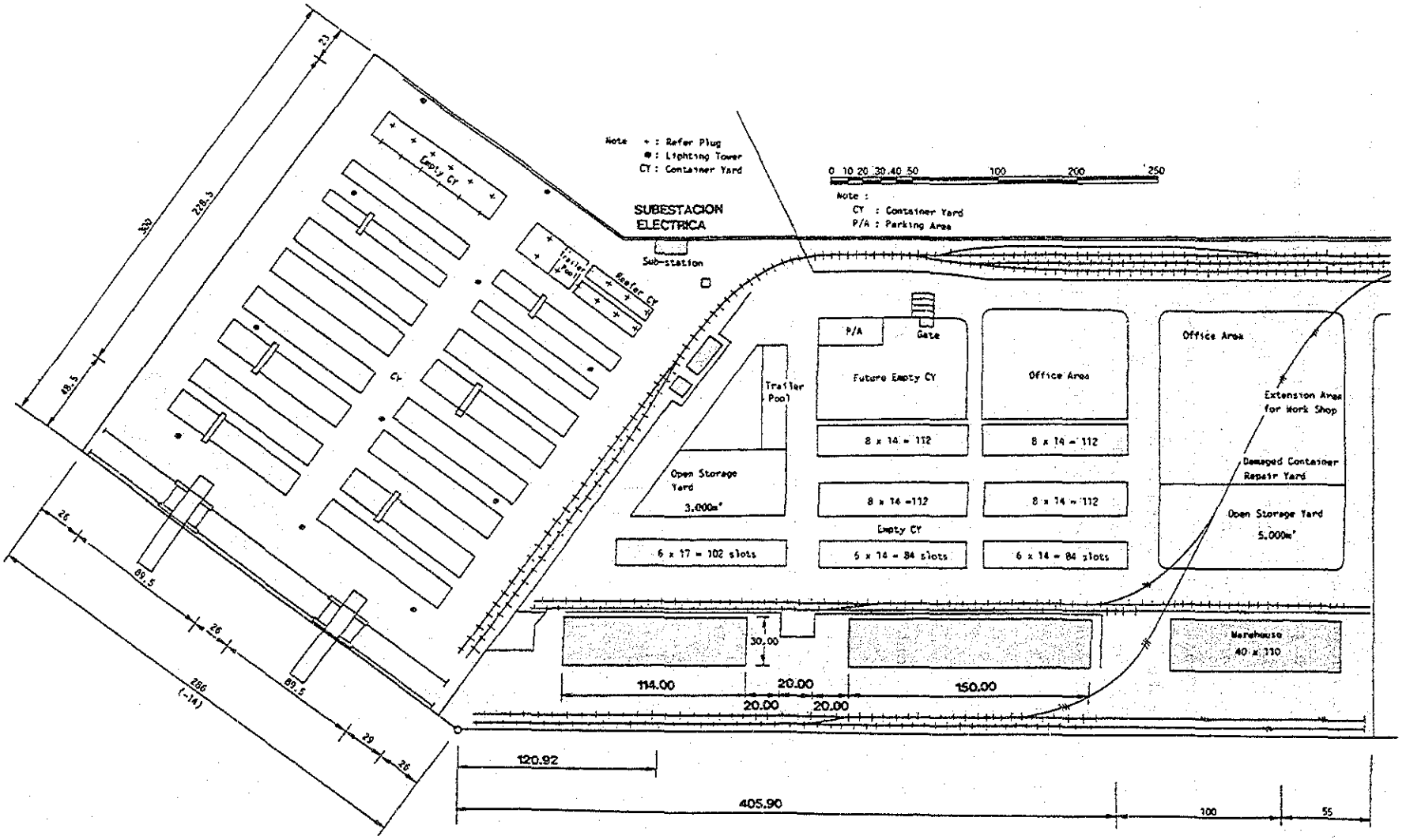


Fig.9.3 Layout Plan of Existing Container Terminal and the Area behind the General Cargo Berths

(2) New Container Terminal

The layout plans of the new container terminal of both the rail-mounted and rubber-tyred transfer crane system are shown in Fig. 9.4 and Fig. 9.5.

As is obvious by comparing these two plans, the rubber-tyred transfer crane system needs a much wider area and will not provide enough storage capacity when the two berths are operated in the future. In addition the area between the container yard and the gate/office is rather narrow, which may hinder the smooth travelling of trailers.

Taking these factors into consideration, the rail-mounted transfer crane system plan is adopted as the master plan for the new container terminal.

Some comments on the layout of facilities are as follows:

i. The required number of ground slots for loaded containers is planned in the stacking area.

ii. Because of the insufficient width of the terminal, the empty container yard and the CFS are located in adjacent areas.

iii. The existing maintenance shop is left as it is. It will continue to play a role for maintaining cargo handling equipment at the terminal.

iv. Two railway tracks with lengths of 300 - 350m each are positioned at the back of the second berth.

3) Area behind the general cargo berths

An extension of 55m of the general cargo berths is planed due to the adequate layout of the new container berth. This will be greatly useful for the further utilization of the general cargo berths allowing the mooring of three 20,000 DWT class vessels.

Facility layout and land use plan of this area are drawn up as shown in Fig.9.3.

i. Substitution of the existing railway tracks is planned considering the layout of new warehouse and the position of the new container terminal.

ii. Roads are planned for each end of the berths.

iii. The third warehouse is located in the same line as the existing ones, while two open storage yards are laid out at the ends of the area.

iv. The required number of ground slots for empty container storage are arranged near the railway track.

v. Office areas are laid out along the main road.

4) CFS areas

In Fig.9.4 the layout plan of the CFS area is shown.

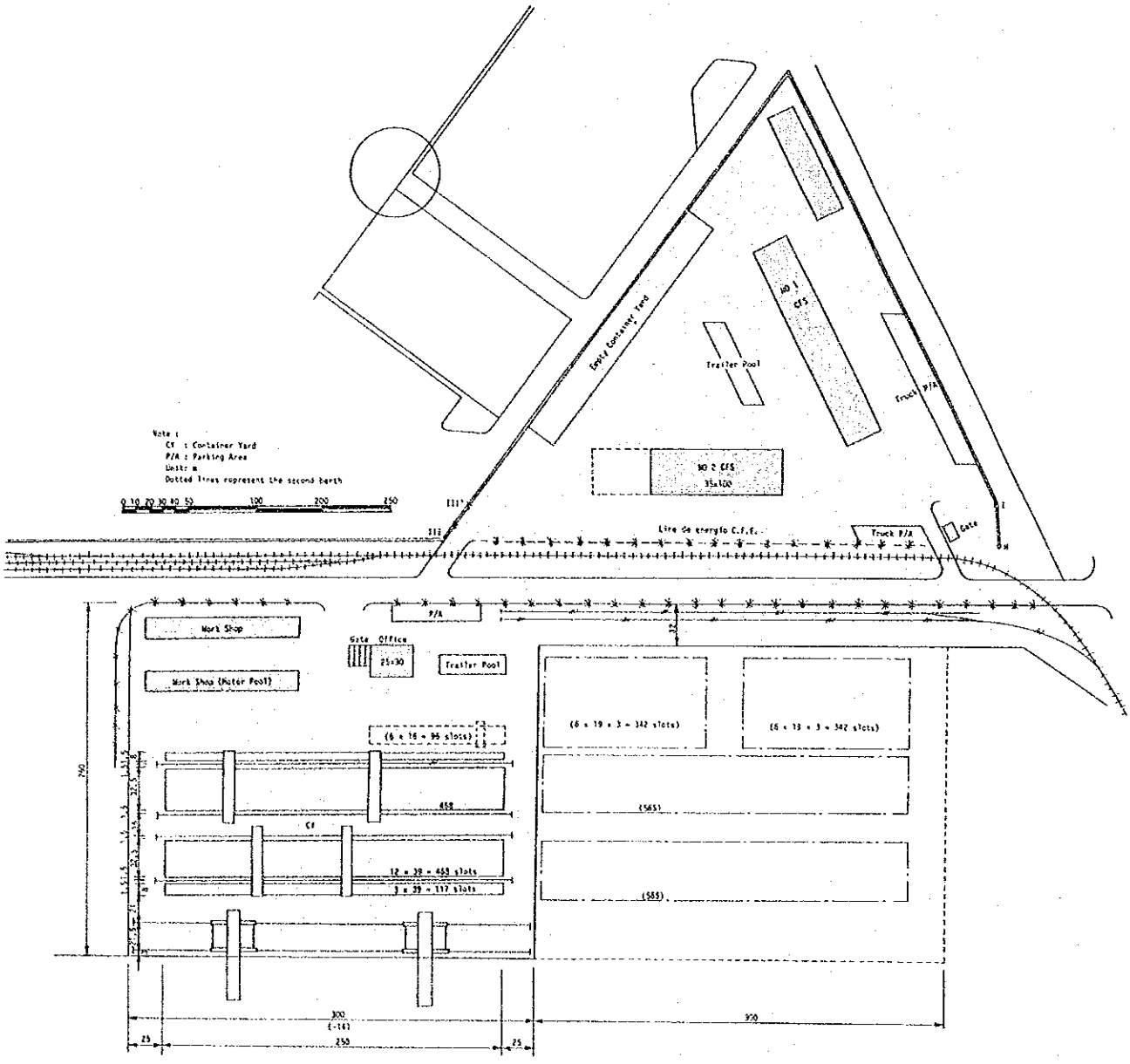


Fig.9.4 Layout Plan of New Container Terminal - Rail Mounted Transfer Crane System

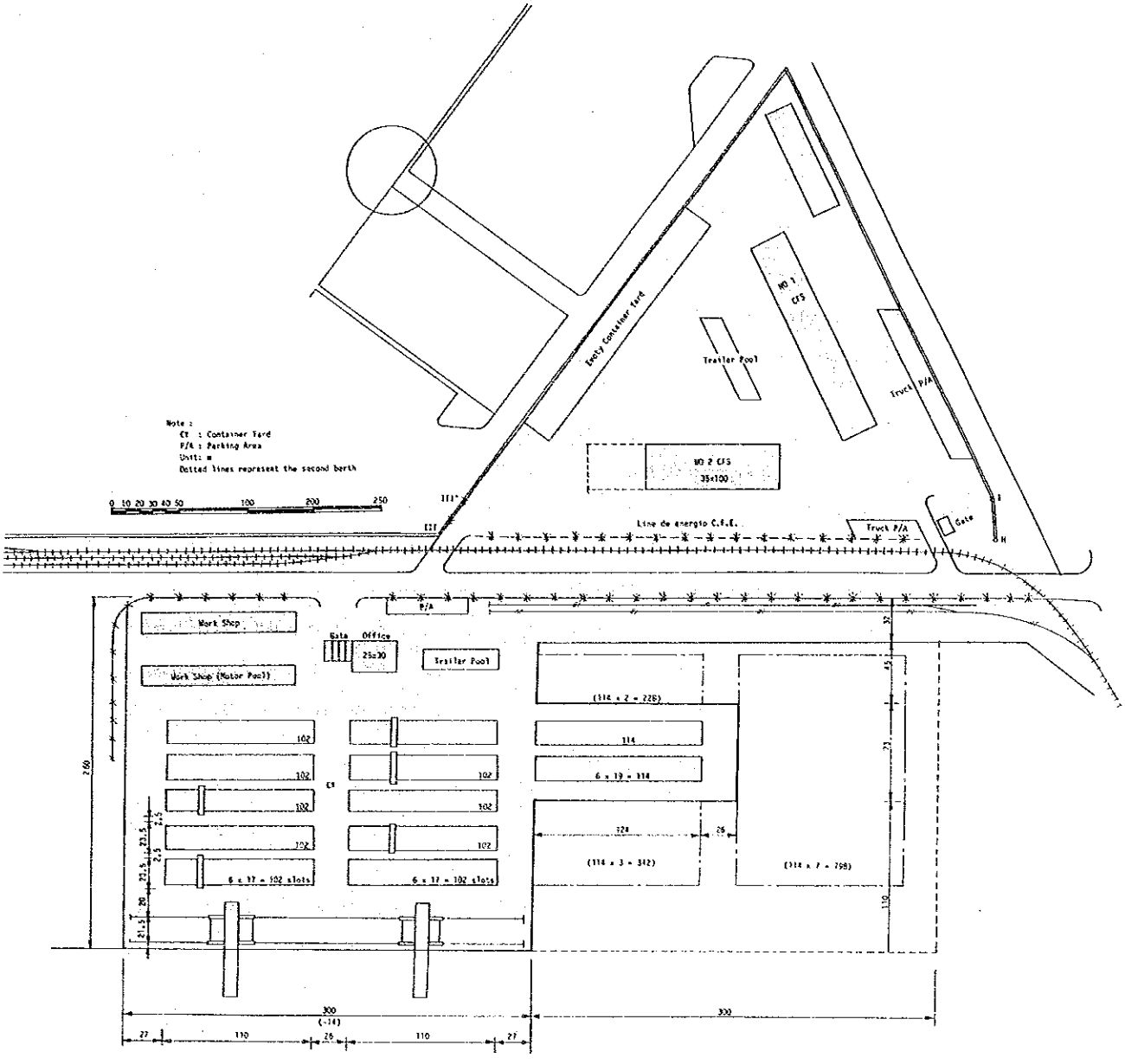


Fig. 9.5 Layout Plan of New Container Terminal - Rubber Tyred

9.1.6 Operation System

(1) Management

It is necessary to prepare a special container handling section in the ESP organization. The new section is proposed as described in 10.1.5.

(2) Premises and Handling Operation System

i.	Containers handled per year	312,150 TEU/year
ii.	Ships' calling at port per year	378 ships/year
iii.	Handling containers per ship	1,620 TEU/ship(Vessel Type I)
		135 TEU/ship(Vessel Type II)
		122 TEU/ship(Vessel Type III)
		800 TEU/ship(Vessel Type IV)
iv.	CY storage containers needed	7,930 TEU

As for the general handling operation method, refer to Section 9.2.6,(1) and the main report.

(3) Principal Policy of Terminal Operating

Direct management system by the ESP is assumed from the reason described in section 9.2.6.

(4) Specific Points Regarding Terminal Operation

Two container terminals in the year 2005 are planned, in separate locations, and between the two terminals there are three general cargo berths. Considering these factors, the following points should be noted for terminal operation:

i. It is necessary to transfer the transshipment containers from one terminal to another when the discharging and loading berths are different.

ii. As the terminal gate houses and offices are located in two separate places, it is necessary to maintain close contact between the operation center and the gate houses.

iii. It is necessary to dray containers about 1,000 meters distance from the present container berth.

9.2 Long-Term Development Plan for Containerized Cargo in the Port of Manzanillo

9.2.1 Fundamentals of the Long-Term Development Plan

(1) Containerized Cargo Handling Volume in 2005

1) Containerized cargo

The containerized cargo volume handled at the Port of Lazaro Cardenas in the target year of 2005 is shown in Table 9.1 and Fig.9.6. Both the containerized cargoes to/from the hinterland of Manzanillo and those transported to/from the port by domestic feeder vessels are presented.

2) Containerized cargo at the container berth

As shown in Table 9.6, Type III container vessels is assumed to use general cargo berths due to their small handling volume of containers per vessel.

(2) Forecast of Container Vessel Size

Refer to 9.1.1, (2).

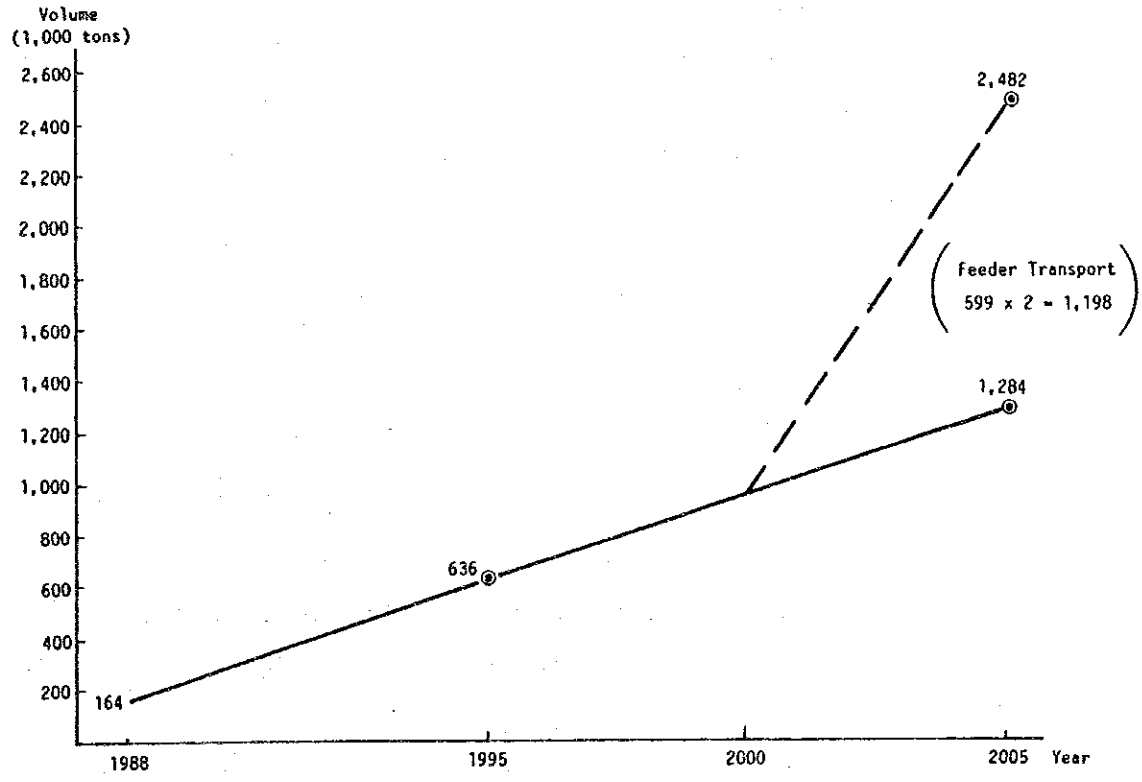


Fig.9.6 Forecast Containerized Cargo Volume (Port of Manzanillo)

Table 9.6 Containerized Cargoes by Container Vessel Type in the Year 2005 (Port of Manzanillo)

(Unit: 1,000 tons)

Type of Container Vessel	Assumed Share in the Handling Volume	Containerized Cargo Volume		
		Container Berth	General Cargo Berth	Total
I	92%	1,780.3	-	1,780.3
II	3	38.5	-	38.5
III	5	-	64.2	64.2
Sub Total	100%	1,818.8	64.2	1,883.0
IV Domestic Feeder	-	595.0	-	595.0
Grand Total	-	2,417.8	64.2	2,482.0

(3) Required Number of Container Berths

Based on the demand forecast, the required number of container berths is calculated.

1) Premises for calculation

- Annual number of working days 340 days
- Cargo handling hours per day 18 hours
- Average cargo handling productivity 25 boxes/h-crane
- Average number of containers handled per vessel

Type I	vessel	1,200 box/vessel
Type II	"	100 "
Type IV	"	593 "

- 20/40 feet container ratio 50:50
- Empty container ratio 0.25
- Unit weight of containers import 7 tons/TEU
  export 11 "

Other than the above, the handling volume of break bulk general cargoes and number of shifting container are considered in the calculation.

2) Calculation of the required number of container berths,

Using the above-mentioned premises, the required number of container berths in 2005 is calculated to be 2 berths, which is deemed reasonable judging from the calculated berth occupancy rate of 52%.

9.2.2 Site Selection

Given the actual geographical conditions of the port and the requirement of early commencement of container terminal operation, the project site is limited to the extension area of "band C" of the inner port.

9.2.3 *Operation System*

A rubber-tired transfer crane system is adopted for the same reasons as at the Port of Lazaro Cardenas.

9.2.4 Required Scale of Facilities/Equipment

(1) Required Scale of Berths

Number of berths	2
Length of each berth	300 m
Depth of each berth	-14 m

(2) Required Scale of Water Basin

The water basin for vessels' turning should ensure an area larger than a circle with a diameter of 2L (L: Length overall of planned vessel size, 270 m).

(3) Required Scale of Storage Facilities

1) Premises for calculation

• Stuffing/unstuffing ratio of containers within the port			30%
• Dwelling time container yard		Import	10 days
		Export	8 "
		Empty	8 "
		Domestic Feeder	3 "
	CFS		6 "

. Returning empty containers 30% of loaded import containers

2) Container yard

Based on the demand forecast and using above premises, the required scale of container yard in terms of ground slots is calculated as Table 9.7.

Table 9.7 Results of Required Storage Capacity in Container Yard (Port of Manzanillo in 2005)

Item	Unit	Loaded Containers				Empty Containers
		Import	Export	Reefer	Total	
M_L (Required Storage Number of Containers)	TEUs	3,190	2,600	100	5,890	1990
L (Stacking Height)	Layers	2.2	2.8	2		3
S_L (Required Number of Ground Slots)	Slots	1,450	929	50	2,429	663

3) Container freight station

Calculating in the same manner as warehouse, the container freight station of 12,360 m^2 is required.

(4) Required Amount of Cargo Handling Equipment

Based on the demand forecast and operation system, the required amount of cargo handling equipment is examined.

1) Quay-side container crane

Two quay-side container cranes are required based on the same type of examination as carried out at the Port of Lazaro Cardenas.

2) Transfer crane

From the planning of containers stacking yard, 10 units (6 lanes x 3 layers) of transfer cranes are required.

3) Other minor cargo handling equipment

The required numbers of other minor cargo handling equipment are as follows:

Chassis		64
Tractors		25
Fork-lift	40t	1
"	25t	1
"	5t	7
"	3t	28
"	2t	56

4) Maintenance of container handling equipment

For the same reasons as mentioned in section 9.1.4 (4), the ESP workshop should be used for the maintenance of container handling equipment.

9.2.5 Laytout Plan

The layout plan is as illustrated in Fig. 9.7 and Fig. 9.8. The projected site has a spacious non-use area, but the rear side of the site is limited by the hills behind the lagoon. The plan is drawn up so as to make the best use of the available area some comments regarding the facilities layout are as follows:

i. An adequate number of ground slots for the storage of loaded import/export containers is planned in the container yards.

ii. An empty container yard with sufficient storage capacity is planned beyond the trunk road running behind CFSs.

iii. Two CFSs are planned corresponding to the required scale of operations. For the storage of break bulk cargoes carried by container vessels, a warehouse is installed outside the terminal.

iv. A maintenance shop is not planned for this container terminal for the reasons mentioned previously.

v. Two railway tracks with lengths of 400 - 450 m each are located behind the trunk road.

vi. The trunk road is located 340 m behind the quay line considering the necessary width for container yards and other facilities.

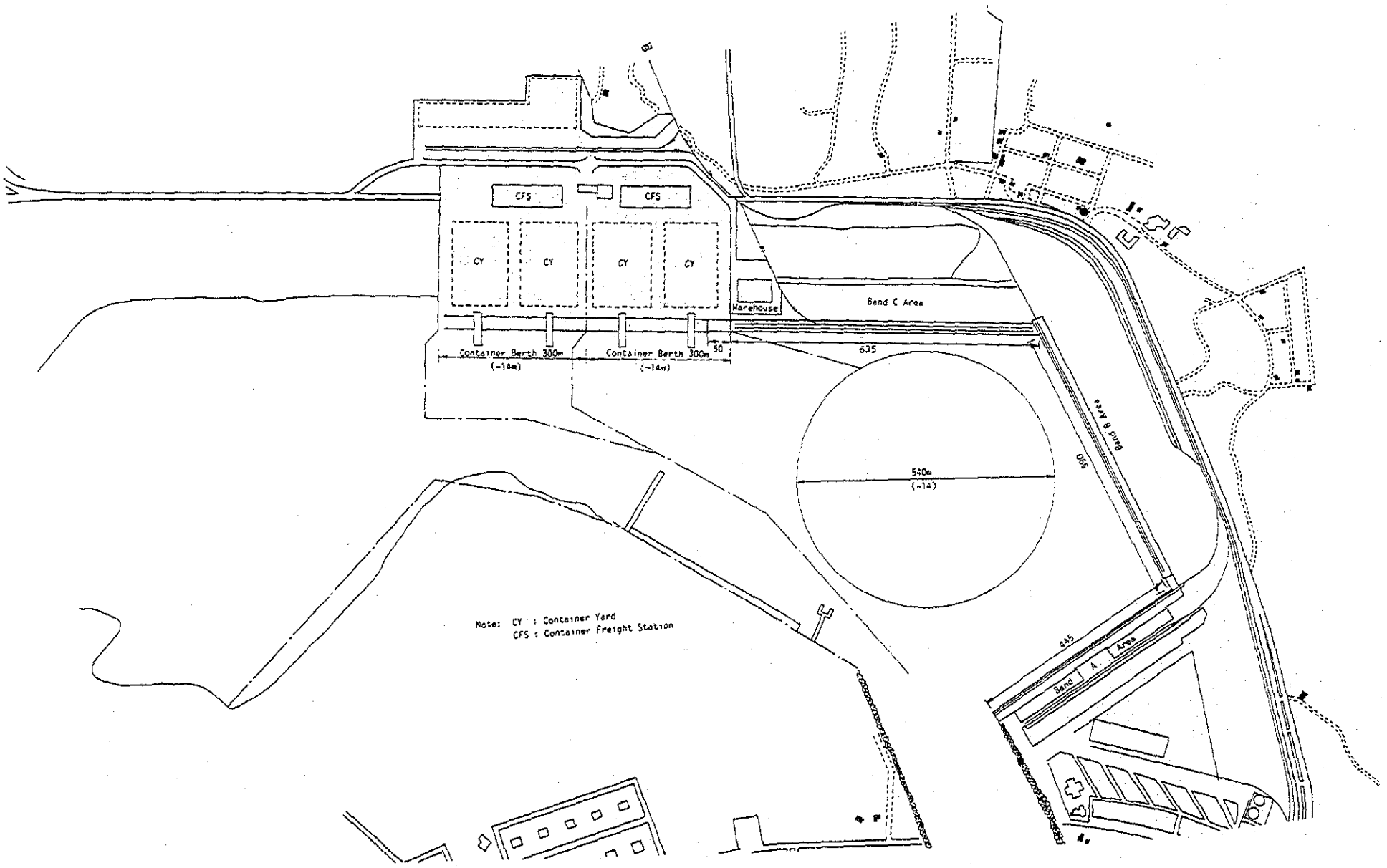


Fig.9.7 General Layout Plan for Containerized Cargo

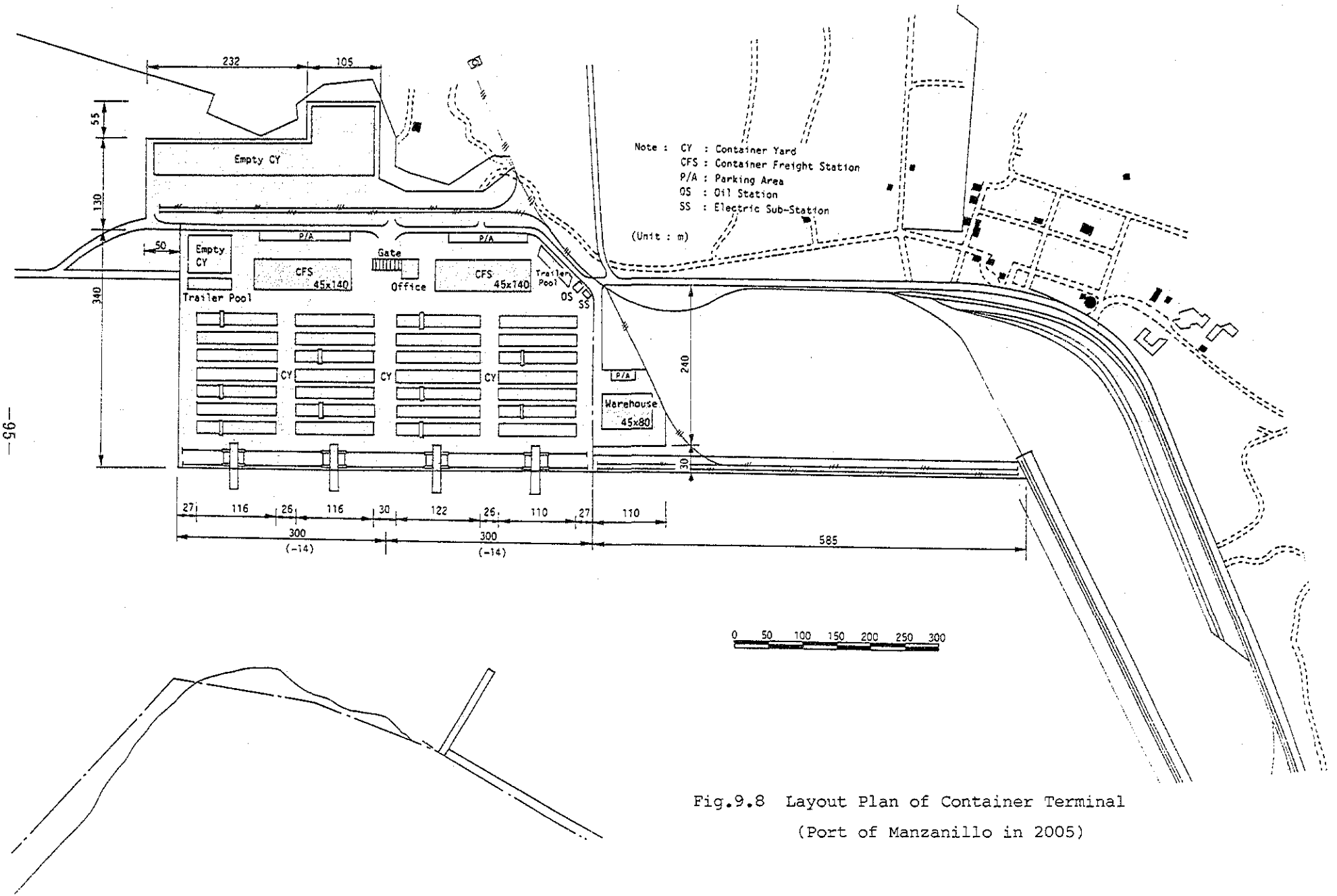


Fig.9.8 Layout Plan of Container Terminal
(Port of Manzanillo in 2005)

9.2.6 Operation System

(1) Management

It is necessary to propare a special container handling section in ESP. The new section is proposed in section 10.2.5.

(2) Premises and Handling Operation Method

i. Containers handled per year 343,320 TEU/year
ii. Ships' calling at port per year 305 ships/year
iii. Handling containers per ship 1,800 TEU/ship(Vessel Type I)
90 TEU/ship(Vessel Type II)
806 TEU/ship(Vessel Type IV)
iv. CY storage containers needed 7,880 TEU

The terminal operation consists of the following sections:

a. Ship's planning section (Ships discharging/loading operation)
b. Yard control center section
(CY container movement/administration)
c. Gate clerk section (Gate check operation)
d. Import and export documentation section

The details regarding each terminal operation can be found in the main report of this study.

(3) Principal Policy of the Terminal Operating Body

Regarding the organization of operations at the new container terminal, the following scenarios will be possible.

a. System directly managed by the ESP.
b. System directly managed by the shipping company.
c. Container terminal system managed by a private company with the will and necessary capital.

Given the present situation of Mexico's Pacific coast ports, a direct ESP management system is assumed to be the most suitable. The reasons are as follows:

i. The present volume of cargo handled by the ESP is not large enough for a commercial economic base.
ii. Many shipping companies provide container service at the port.
iii. It is necessary to avoid an overlapping organization between the new terminal management and the present ESP.

(4) Terminal Operating Staffs

The new container terminal organization will have 97 staff members.

Shifted from ESP operation section	76 persons
Administrative staff	8 (concurrent with ESP)
CFS operation staff	13 (increased)

The required new container terminal staff members will be taken from the present ESP operational and maintenance staff members. However, it is necessary to recruit new staff members for the new services starting at the terminal, such as the CFS operation.

When ships are operating, it is necessary to obtain 44 workers from the labor union.

Container gantry crane operators	4 persons
Transfer crane operators	8 "
Tractor head drivers	12 "
Toplifter drivers	4 "
Lashing/unlashing workers	16 "

Chapter 10 Short-Term Improvement Plans in the Selected Ports

The short-term improvement plans in the target year of 1995 for containerized cargoes and bulk cargoes in the Ports of Lazaro Cardenas and Manzanillo are described in this Chapter. The short-term plans for containerized cargoes are formulated based on the master plans in the previous Chapter. On the other hand, the short-term plans for bulk cargoes focus on the main issues that the two ports are facing now.

10.1 Short-Term Improvement Plan for Containerized Cargoes in the Port of Lazaro Cardenas

10.1.1 Fundamentals of Short-Term Improvement Plan

(1) Containerized Cargo Handling Volume in 1995

The volume of containerized cargo through the port in 1995 is described in Table 9.1.

Assuming that the share of handling volume by vessel type and the berth allocation follow the same line as the master plan, the container cargo handling volume at the container berth is obtained as shown in Table 10.1.

Table 10.1 Containerized Cargoes by Container Vessel Type in the Year 1995 (Port of Lazaro Cardenas)

(Unit: 1000 tons)

Type of Container Vessel	Assumed Share of the Handling Volume	Containerized Cargo Volume		
		Container Berth	General Cargo Berth	Total
I	86	449.0	-	449.0
II	9	47.0	-	47.0
III	5	15.6	10.4	26.0
Total	100	511.6	10.4	522.0

(2) Forecast of Container Vessel Size

Considering the sizes of the vessels now calling at the port and planned vessels in the master plan, the planned maximum vessel size in 1995 is assumed as shown in Table 10.2.

Table 10.2 Physical Characteristics of Planned Container Vessel and Container Berth in 1995

Type of Container	Container Capacity	Dead Weight Tonnage	Length Overall	Width Overall	Draught
I (Mother Vessel)	TEU 2500	tons 40,000	m 240	m 32	m 12

(3) Required Number of Container Berths

1) Premises for calculation

- Average cargo handling productivity 20 boxes/h•crane
- Average number of containers handled per vessel

Type I vessel	700	box/vessel
II "	100	"
III "	90	"

- 20/40 feet container ratio 75:25

Other premises and calculation method are the same as the master plan.

2) Calculation of required number of container berths

The required number of container berths in 1995 is calculated to be 1 berth, which is deemed reasonable judging from the calculated berth occupancy rate of 43%.

10.1.2 Operation System

In view of the present system at this port, a transfer crane system is adopted.

10.1.3 Required Scale of Facilities/Equipment

(1) Required Scale of Berth

The existing container berth has a length of 286m and a depth of 14m, which are sufficient given the planned vessel size.

(2) Required Scale of Storage Facilities

1) Premises for calculation

- Stuffing/unstuffing ratio of containers within the port 10%
- Dwelling time

Container yard	Import	12	days
	Export	10	"
	Empty	10	"
CFS		10	"

- Returning empty Containers 40% of loaded import containers

2) Container yard

The storage volume can be calculated more precisely by examining the dwelling curve of containers into/out of container yard and overlapping the dwell curves.

Since these is no data concerning the actual dwelling curve at the Port of Lazaro Cardenas, the curve is assumed to be as shown in Fig.10.1, which is represented by a exponential function. The storage number of containers at the CY is then obtained by overlapping these dwelling curves of arriving vessels (refer to Fig.10.2).

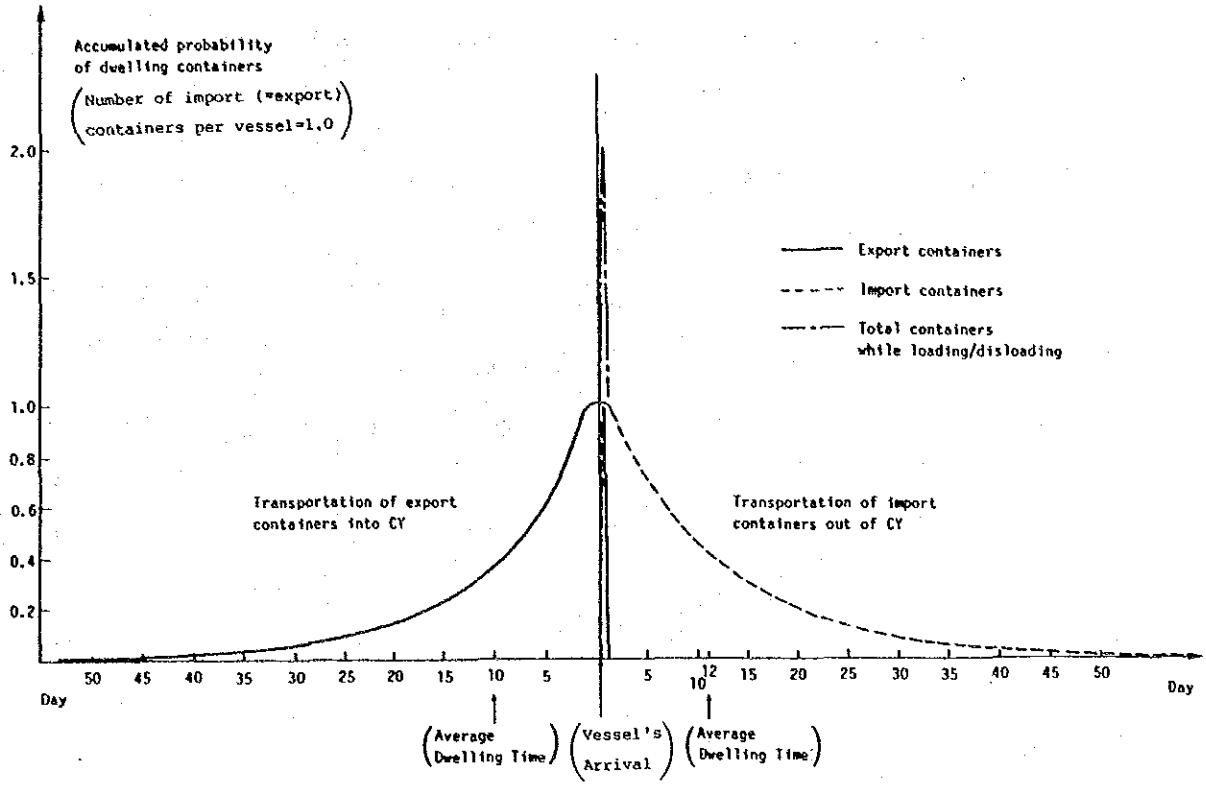


Fig.10.1 Model of Dwelling Containers at Container Yard

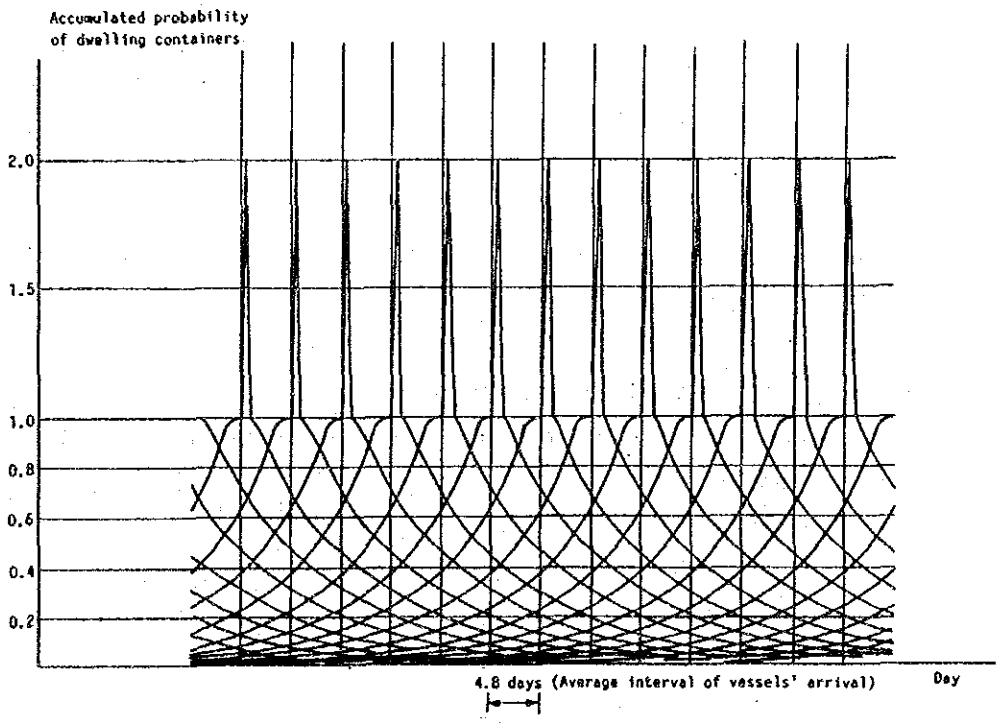


Fig.10.2 Movement of Dwelling Containers by Arrival of Type I Container Vessel (Port of Lazaro Cardenas)

The calculated numbers of stored containers and required ground slots are shown in table 10.3.

Table 10.3 Results of Required Storage Capacity in Container yard (Port Lazaro Cardenas in 1995)

Item	Unit	Loaded Containers				Empty Container
		Import	Export	Reefer	Total	
Required Storage Number of Containers	TEUs	1,800	990	30	2,820	1,190
Stacking Height	Layers	2.2	2.8	2		3
Required Number of Ground Slots	Slots	818	354	15	1,187	397

3) Container freight station

Based on calculations carried out in the same way as for warehouse, a container freight station of 2,920 m^2 is required.

(3) Required Amount of Cargo Handling Equipment

1) Quay-side gantry crane

Two cranes, including the existing one, are required.

2) Transfer crane

The same number of cranes as the master plan is required at the existing terminal.

3) Other minor cargo handling equipment

The required numbers of other minor cargo handling equipment are as follows.

Chassis	15
Tractors	11
Forklift 40t	1
" 25t	2
" 5t	2
" 3t	3
" 2t	6

(4) Other Facilities

1) Terminal gate

Calculating the daily number of trucks coming into/out of terminal and taking into account the hourly variation in the number of trucks, 4 truck lanes are required 2 of which should be equipped with truck scales.

2) Terminal office

Around 600 m^2 of terminal office is required.

3) Railway facilities

Around 100 TEUs of containers per day are estimated to be transported by railway into/out of the port in 1995. Assuming 20 - 25 freight cars comprise a train, one train is projected to arrive at the port per day.

4) Repair of damaged containers

On the assumption that about 5% of the loaded containers carried into terminal will be damaged, a container repair yard of around 600 m^2 is allowed for.

5) Fumigation of containers

In Mexico almost all, loaded import containers must be fumigated at present. This situation should be reformed. Otherwise, the container terminal will need a large area of fumigation area. Assuming this reform, a fumigation of around 600 m^2 is planned.

6) Customs inspection

A customs inspection yard of around 400 m^2 is planned.

7) Washing and cleaning containers

For washing and cleaning of empty containers a yard of around 300 m^2 is allowed for.

10.1.4 Layout Plan

(1) Existing Container Terminal

The layout plan of this area is shown in Fig.10.3. The existence of lighting poles in the CY is fully considered in planning the stacking yard. 4 - 6 lines type transfer cranes are introduced, while the existing 2 - 3 lines type transfer cranes are placed in the area behind the CY.

(2) Area behind the General Cargo Berths

The layout plan of this area is formulated in line with the master plan.

i. A road is laid out in the area adjacent to the container terminal.

ii. The terminal gate is placed at the entrance to the container terminal.

iii. An open storage yard is placed for the storage of break bulk cargoes for container vessels and conventional liners.

iv. The required scale of damaged container yard, container cleaning yard and fumigation yard are laid out at the back of empty container yard.

(3) CFS Area

Fig.10.4 shows the layout plan of the CFS area.

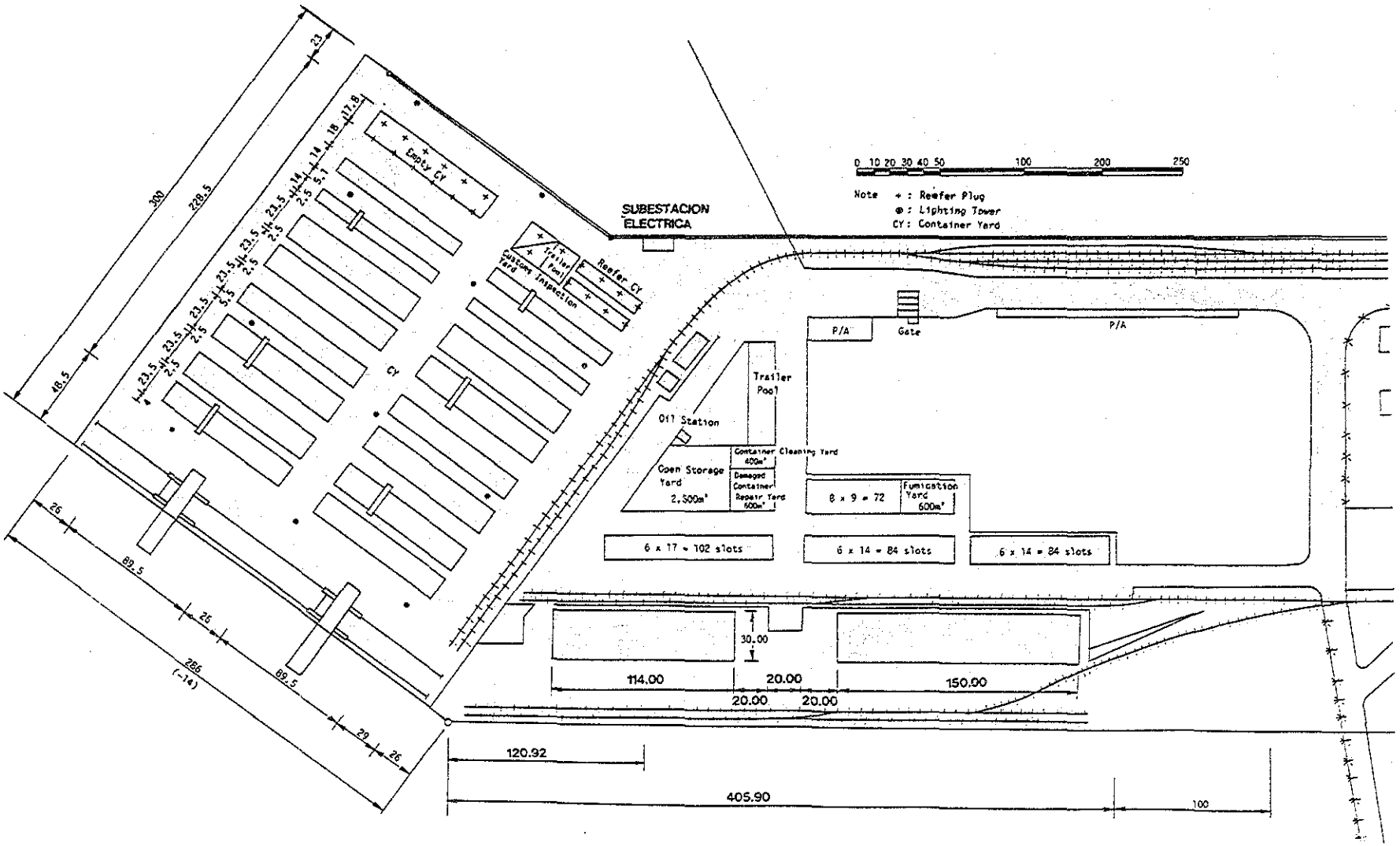


Fig.10.3 Layout Plan of Existing Container Terminal

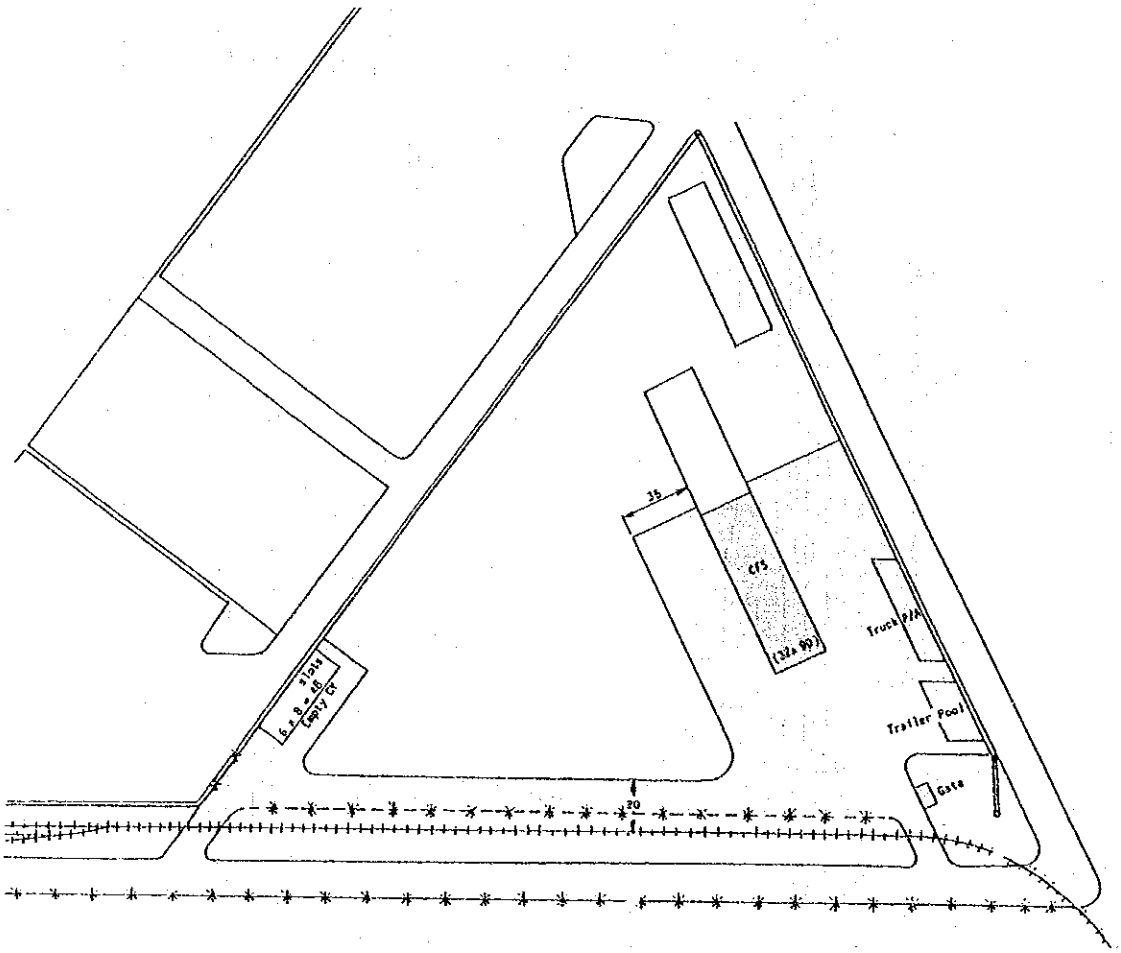
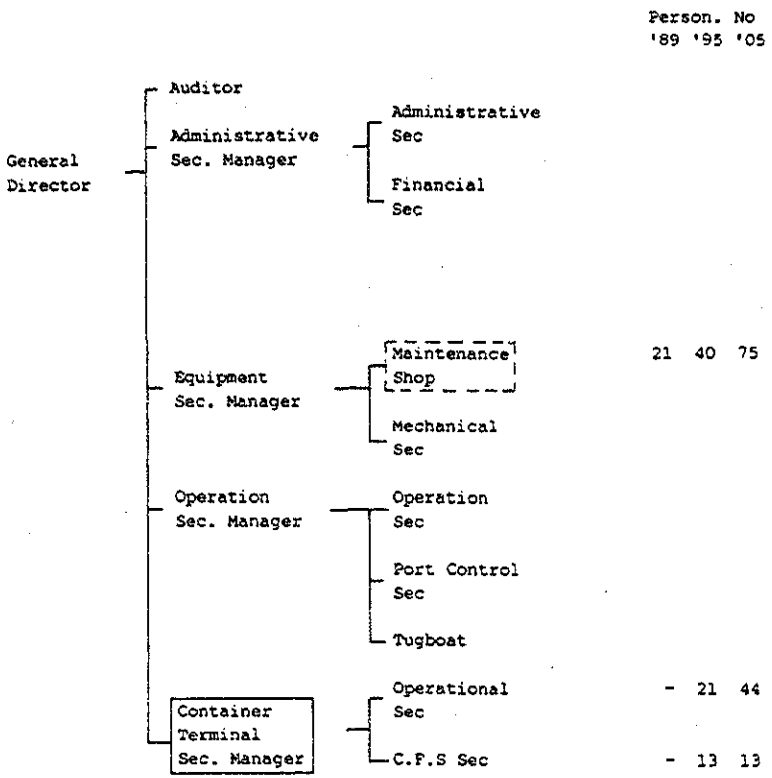


Fig.10.4 Layout Plan of CFS AREA

10.1.5 Management and Operation System

(1) Management

To ensure efficient operation, it is necessary to prepare a special container handling section in the ESP. A new container terminal organization is proposed as shown in Fig.10.5.



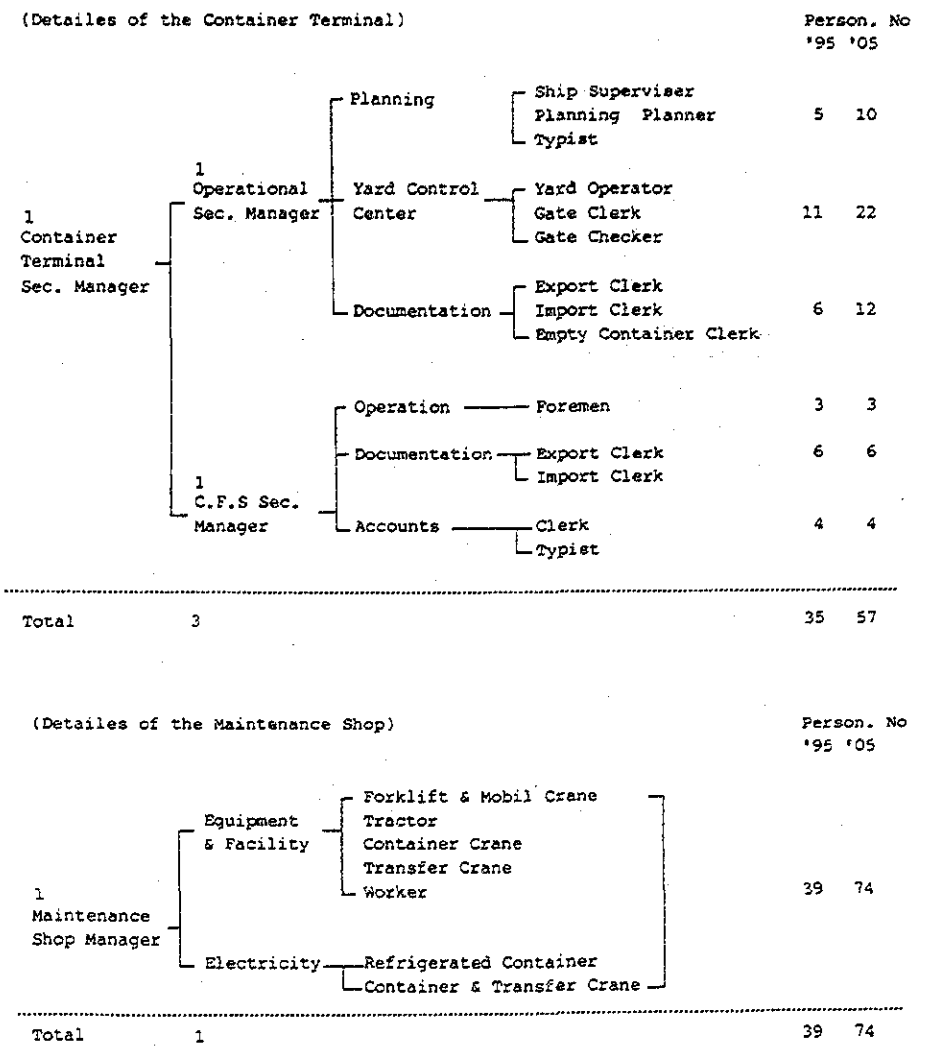


Fig.10.5 Example of New Organization for the Container Terminal (Port of Lazaro Cardenas)

(2) **Handling Operation Method**

The main premises are as follows:

i.	Containers handled per year	56,690 TEU
ii.	Ships calling at port per year	152 ships/year
iii.	Containers handled per ship	875 TEU/ship (Vessel Type I)
		125 " (Vessel Type II)
		113 " (Vessel Type III)
iv.	Necessary CY storage	3,010 TEU

The key points of the transfer crane system container terminal operation are described precisely in the main report.

(3) **Introduction of Computer System to the Container Terminal**

In the future, Mexican ports, container terminals should introduce computer systems to rationalize their operations. It is said that terminal container operation can be handled on a manual basis up to 5,000 TEU per month.

Generally, container terminal computer systems comprise the three following operations:

a. Container terminal administration subsystem

b. Container gate in and out subsystem

c. Container loading/unloading subsystem

Computerization of the container terminal recommended to be introduced in the above order.

(4) **Recommendation**

i. To maintain an adequate pool of skillful fixed workers for container handling operation.

ii. To simplify the procedure of customs inspection and fumigation system.

iii. To establish necessary communication system among separate areas for container handling.

10.2 Short-Term Improvement Plan for Containerized Cargoes in the Port of Manzanillo

10.2.1 Fundamentals of the Improvement Plan

(1) Containerized Cargo Handling Volume in 1995

The containerized cargo volume through the port in 1995 is as described in Table 9.1.

Assuming that the share of handling volume by vessel type and berth allocation are on the same lines as the master plan, the container cargo handling volume at the container berth is obtained as shown in Table 10.4.

Table 10.4 Containerized Cargoes by Container Vessel Type in the Year 1995

(Unit: 1,000 tons)

Type of Container Vessel	Assumed Share of the Handling Volume	Containerized Cargo Volume		
		Container Berth	General Cargo Berth	Total
I	92	585.1	-	585.1
II	3	19.1	-	19.1
III	5	-	31.8	31.8
Total	100	604.2	31.8	636.0

(2) Forecast of Container Vessel Size

Refer to section 10.1.1 (2).

(3) Required Number of Container Berths

1) Premises for calculation

- Average cargo handling productivity 20 boxes/h-crane
- Average number of containers handled per vessel

  Type I vessel 650 box/vessel

  II " 100 "
- 20/40 feet container ratio 56:44

Other premises and calculation method are the same as the master plan.

2) Calculation of required number of container berths

The required number of container berths in 1995 is calculated to be 1 berth, which is deemed reasonable judging from the calculated berth occupancy rate of 40%.

10.2.2 Operation System

As in the master plan, a rubber-tyred transfer crane system is adopted.

10.2.3 Required Scale of Facilities/Equipment

(1) Required Scale of Berth

Berth length	300m
Berth water depth	-13m

(2) Required Scale of Storage Facilities

1) Premises for calculation

- Stuffing/unstuffing ratio of containers within the port 40%
- Dwelling time

Container yard	Import	12	days
	Export	10	"
	Empty	10	"
CFS		6	"

- Returning empty Containers 40% of loaded import containers

The dwelling time at the CFS is assumed to decrease greatly from the present situation of an average of 15 days, so as to avoid the need for a huge CFS area.

(2) Required Scale of Storage Facilities

1) Container yard

The required scale of container yard is examined in the same manner as the port of Lazaro Cardenas assuming the dwelling curve of containers at the CY.

The calculated number of stored containers and required ground slots are show in Table 10.5.

Table 10.5 Results of Required Storage Capacity in Container Yard

Item	Unit	Loaded Containers				Empty Container
		Import	Export	Reefer	Total	
Required Storage Number of Containers	TEUs	1,490	1,640	60	3,190	1,270
Stacking Height	Layers	2.2	2.8	2		3
Required Number of Ground Slots	Slots	677	586	30	1,293	423

2) Container freight station

Calculated in the same manner as the warehouse, a container freight station of 8,250 m^2 is required. This value is too large for a CFS area in the container terminal. Taking the CFS area in the terminal as 6,300 m^2, the remaining 1,950 m^2 is planned to be added to the area of the warehouse.

3) Storage facility for break bulk cargoes

The annual volume of break bulk cargoes carried by container vessels through the planned berth is calculated to be around 26,910 tons. Adding the above-mentioned shortage of CFS area, the total required area of the warehouse will be 3,490 m^2.

(3) Required Amount of Cargo Handling Equipment

1) Quay-side gantry crane

Two cranes are required.

2) Transfer crane

Five (6 lanes) transfer cranes are required at the container terminal.

3) Other minor cargo handling equipment

The required numbers of other minor cargo handling equipment are as follows.

Chassis		34
Tractors		12
Forklift	40t	1
"	25t	1
"	5t	2
"	3t	12
"	2t	25

(4) Other Facilities

1) Terminal gate

4 truck lanes are required, 2 of which should be equipped with truck scales.

2) Terminal office

Around 600 m^2 of terminal office is required.

3) Railway facilities

Around 35 TEUs of containers per day are estimated to be transported by railway into/out of the port in 1995. Assuming 20 freight cars comprise a train, one train is forecast to arrive at the port every two days.

4) Repair of damaged containers

Assuming the same conditions as the port of Lazaro Cardenas a container repair yard of around 600 m^2 is allowed for.

5) Fumigation of containers

Assuming the same type of reforms as described in section 10.1.3, (5), a fumigation area of around 600 m^2 is planned.

6) Customs inspection

A customs inspection yard of around 400 m^2 is planned.

7) Washing and cleaning containers

For washing and cleaning of empty containers a yard of around 300 m^2 is allowed for.

10.2.4 Layout Plan

Based on the master plan, the layout plan of the container terminal is drawn up as shown in Fig. 10.6.

i. The necessary number of ground slots for the storage of loaded import/export containers are planned.

ii. Required scale of CFS and warehouse are located in the terminal and at neighboring position respectively.

iii. Two railway tracks with length of 300 - 350 m each are located behind the trunk road.

iv. The customs inspection yard is laid out near the warehouse.

v. The fumigation, damaged container repair and container cleaning yards are located around the empty container yard, considering their functions.

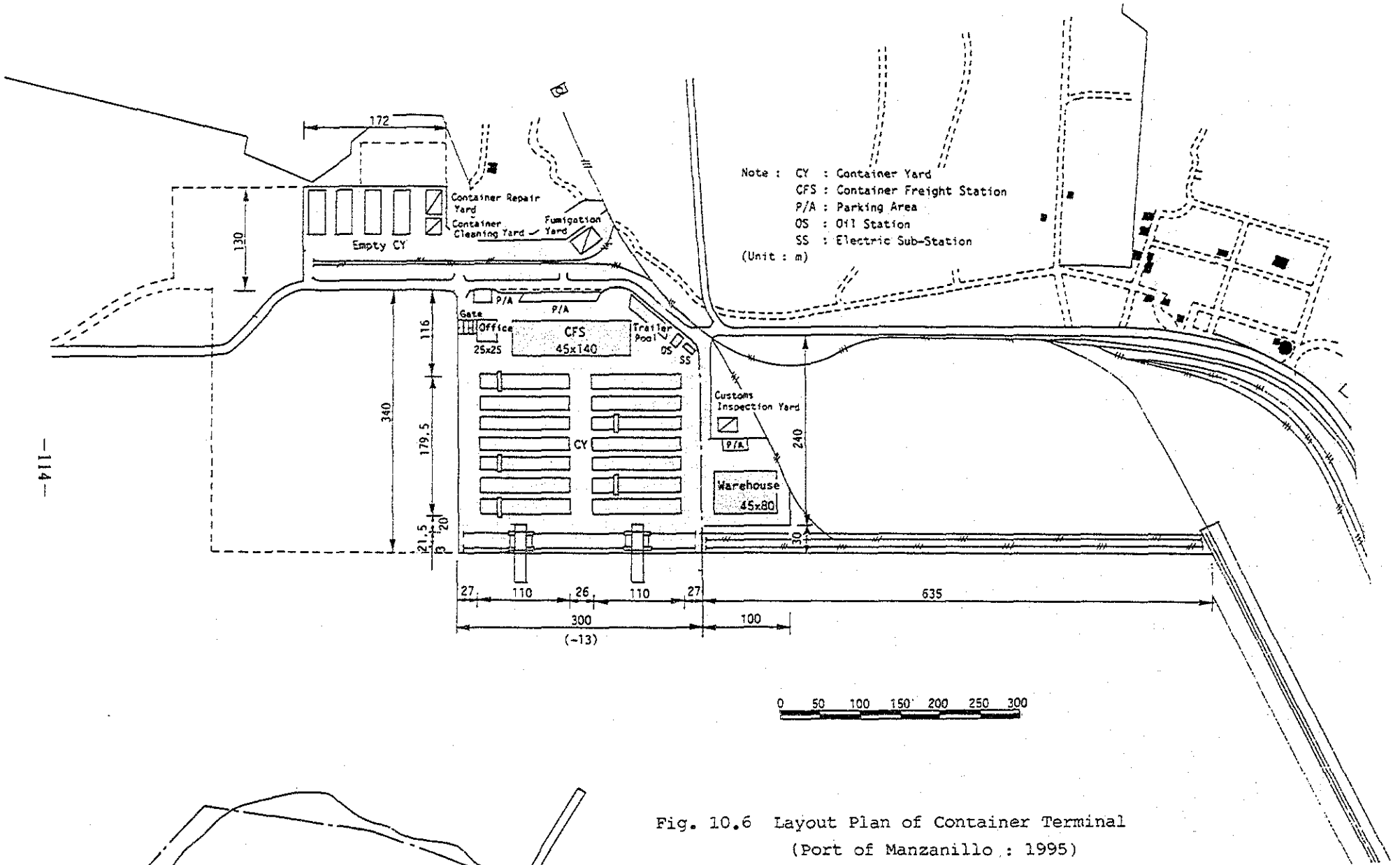


Fig. 10.6 Layout Plan of Container Terminal
(Port of Manzanillo : 1995)

10.2.5 Management and Operation System

(1) Management

It is necessary to prepare a special container handling section in the ESP.

A new container terminal organization in the ESP is shown in Fig. 10.7.

(2) Handling Operation Method

The estimated terminal conditions for 1995 by the study team are as follows:

i. Container handled per year 86,660 TEU/year
ii. Ship's calling at port per year 121 ships/year
iii. Containers handled per ship 936 TEU/ship (Vessel Type I)
86 TEU/ship (Vessel Type II)
iv. Required amount of CY storage 4,460 TEU

Concerning the transfer crane system terminal operation, refer to the main report.

(3) Introduction of Computor System to the Container Terminal

Refer to 10.1.5,(3).

(4) Recommendations

i. To take necessary measures to decrease dwelling time at the CFS.
ii. To make an effective communication system between the terminal and existing offise/general cargo berths areas.

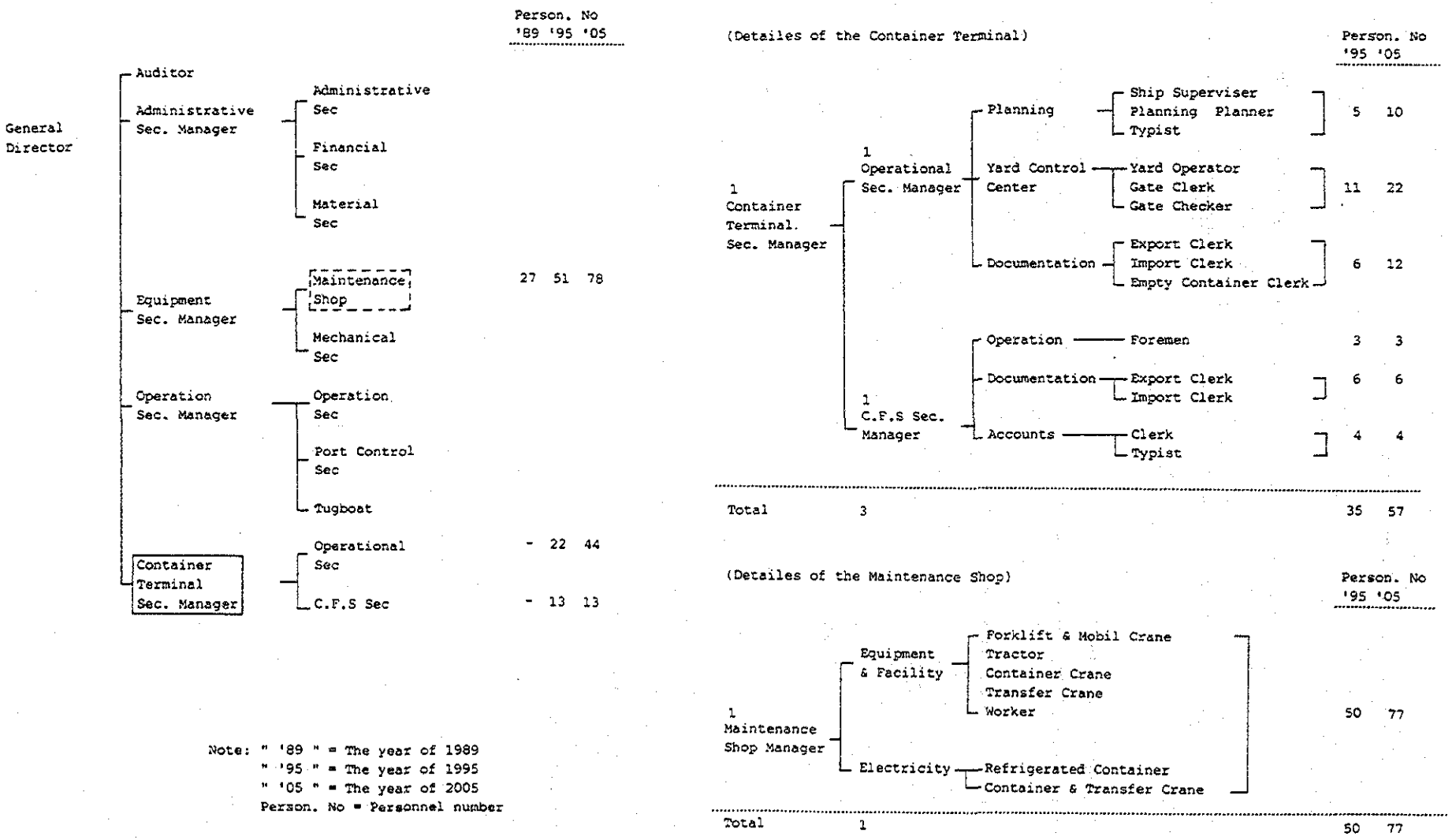


Fig. 10.7 Example of New Organization for the Container Terminal (Port of Manzanillo)

10.3 Short Term Improvement Plans for Bulk Cargoes in the Port of Lazaro Cardenas

10.3.1 Improvement Plan of Cargo Handling of Grain Silo Complex

(1) Grain Silo Complex

The present situation of the grain silo complex at the Port of Lazaro Cardenas is as illustrated in Fig. 10.8.

(2) Recommendations on Operation Improvement

Some recommendations on operation of the silo are as follows:

i. To coordinate to ensure enough freight cars and trucks for land transportation so as to get required turnover of the silo.

ii. To keep the shortage rate less than 1%.

iii. To keep the whole silo system in good condition by sufficient maintenance and repairing.

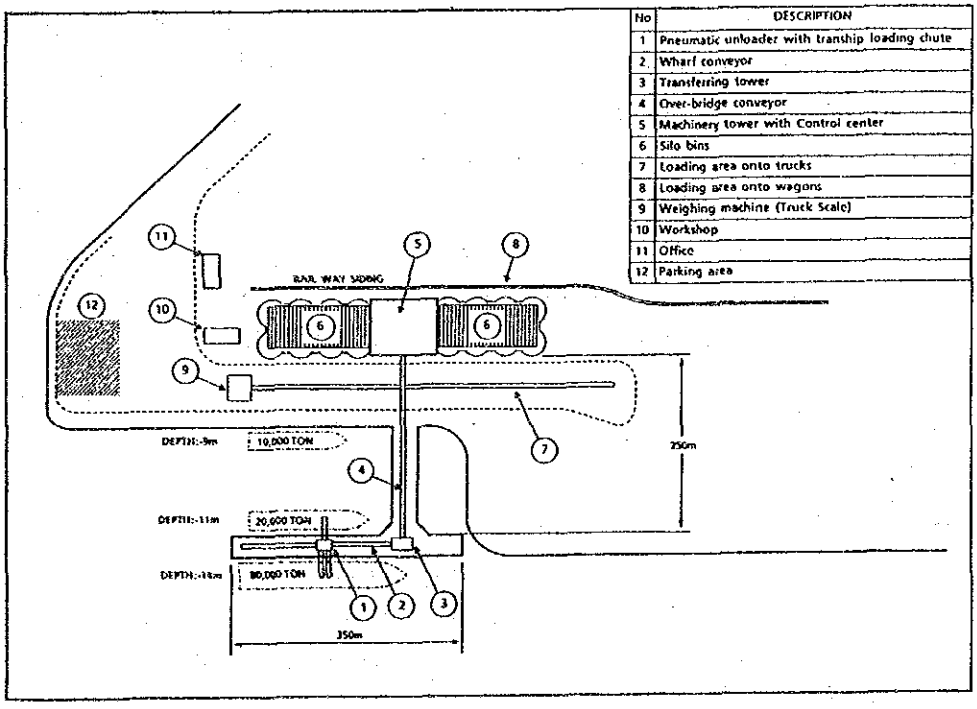


Fig. 10.8 80,000T Grain Silo Complex, Lazaro Cardenas

(3) Examination of the Management and Operation System of Grain Silo

Based on the demand forecast and the origin/destination investigation of agricultural bulk cargoes as well as other conditions regarding the management/operation of grain silo at the Port of Lazaro Cardenas, the desirable management/operation body of the silo is examined.

1) Alternative of management and operation body

Alternative I : ESP
" II : Private sector
" III : Third sector

The alternative III is supposed to be a half-government/half-private corporation in which the private companies occupy the majority of it's membership.

2) Evaluation of the alternatives

The general evaluation of the alternatives is summarized in Table 10.6.

The private sector may be inferior from the viewpoint of necessary governmental involvement, however much superior in securing specialists and engineers, the total efficiency of silo operation, gathering sufficient volume of grains through the silo and the coordination of required land transportation means with its vitality and maneuverability.

The third sector has a merit of both government and private sector, while it may cause a complexity in the administration and less efficiency/flexibility in silo operation.

Taking all these factors into consideration, both alternative II and III are found preferable.

3) Recommendations regarding necessary measures

- To examine the measures to encourage the participation of the private sector in the management/operation of the silo.
- To coordinate to ensure the required land transportation means by the government.
- To examine the reasonable allocation of handling volume of grains between the Port of Lazaro Cardenas and Manzanillo.

Table 10.6 Evaluation of Management Bodies for Grain Silo Operation

Evaluation Items		Alternative I ESP	Alternative II Private Sector	Alternative III Third Sector
Governmental Involvement	.Securing Public Interests	○	△	○
	.Securing Government Control	○	△	○
	.Complexity of Administration	○	○	△
Organization	.Securing Required Personnel	△	○	○
	.Safety and Stability	○	△	○
	.Efficiency and Flexibility of Organization	△	○	△
Operation	.Efficiency of Operation	△	○	○
	.Sales Activities and Inducement of Users	△	○	◎
	.Coordination of Secondary Transportation	△	○	○
	.Consistent Contracts from Purchase to Delivering	×	○	○
Others	.Relation with Cargo Handling Union	◎	○	○
Overall Evaluation		△	○	○

Note: ◎ (Especially superior), ○ (Superior),
△ (Comparatively Interior), × (Interior)

10.3.2 Improvement Plan of Cargo Handling at SICARTSA Berth

(1) Present Situation

The present situation and undergoing improvement plan of the SICARTSA berth are summarized as shown in Fig. 10.9.

(2) Evaluation of Cargo Handling Volume

Examining the productivity of the cargo handling cranes and assuming the berth occupancy rate as around 60%, the handling capacity of the berths is calculated.

According to the calculated results, the programmed cargoes in each year from 1990 to 1995 of the improvement plan are estimated to be handled by cargo handling equipment of an unloader, a multi-purpose crane and conventional ship cranes with the existing 3 berths.

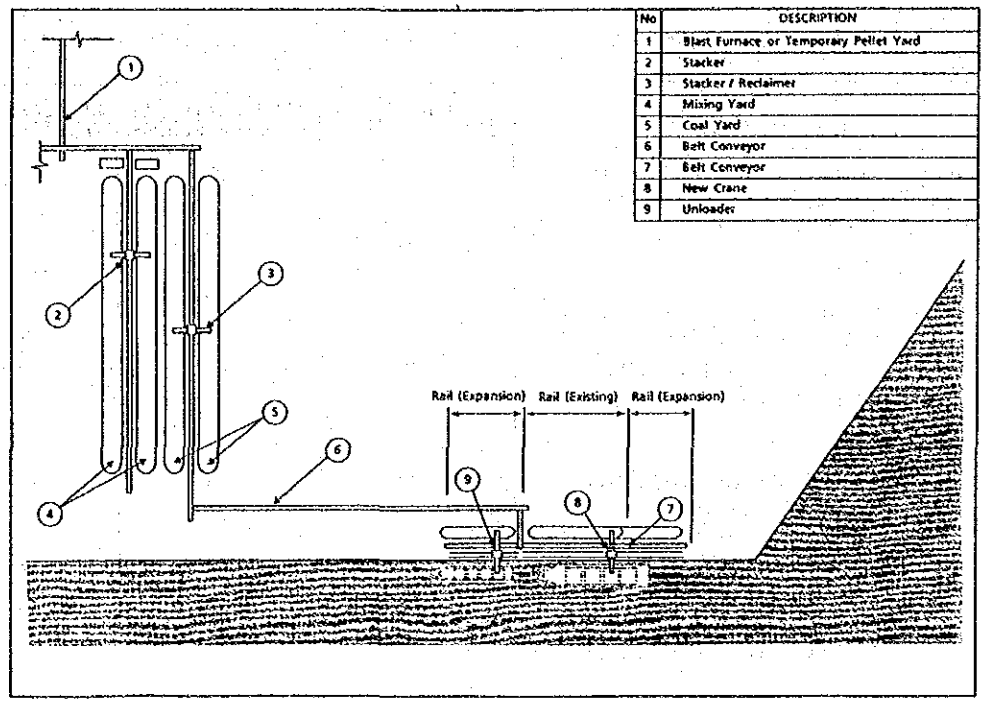


Fig. 10.9 General Plan for Expansion, Sicartsa Berth, Lazaro Cardenas

(3) Recommendations

i. The loss time of working hours should be improved to realize higher productivity.

ii. Increase in unit weight of handling cargoes seems to be significant to realize high productivity.

iii. New multi-purpose cranes are desirable to be installed at the berth in case of increased cargo volume. The existing old unloader should be replaced by a multi-purpose crane.

10.4 Short Term Improvement Plans for Bulk Cargoes in the Port of Manzanillo

10.4.1 Berth and Wharf Use Plan

The berth and wharf use plan of the band B and C areas is examined in this section, including the rough consideration of general and containerized cargoes.

(1) Fundamentals of the Berth and Wharf Use Plan

1) Cargo volume in 1995

Table 10.7 and 10.8 show the forecast cargo volume in 1995.

2) Concession

This system for bulk cargo handling is considered reasonable and should be encouraged, because bulk cargoes are characterized by a relatively small number of consigners/consignees and large volumes of cargo, which requires high cargo-handling, cargo storage and land transportation efficiency with specialized and costly facilities/ equipment.

In this section the following concessions are assumed:

Table 10.7 Forecast Values of Bulk Cargoes

(Unit : 1,000 tons)

Year			Actual Values in 1988	Forecast Values in 1995
Agricultural Bulk Cargoes	Foreign Trade	Import	434	570
		Export	0	0
	Domestic Trade	Inward	66	80
		Outward	0	0
Mineral Bulk Cargoes	Foreign Trade	Import	132	227
		Export	407	1,300
		(cement)	(397)	(900)
		(Iron Ore Pellets)	(0)	(400)
	Domestic Trade	Inward	33	60
		Outward	50	0

Table 10.8 Forecast Values of Break Bulk and Containerized Cargoes

(Unit: 1,000 tons)

		Actual Values	Forecast Value		Berth Allocation in 1995	
		1988	1995	2005	Container Berth	General Cargo Berth
Foreign Trade	Containerized Cargoes	163.5	632	1,284	600.2	31.8
	Break Bulk Cargoes	219	245	231	26.9	218.1
	Total General Cargoes	382.5	877	1,515	627.1	249.9
Domestic Trade	Total General Cargoes	61.8	90	-	-	90

Note: The total domestic general cargoes in 1995 are estimated by assuming a roughly 50 % increase in the handling volume in the year 1988.

Concession A : Handling of agricultural bulk cargo, mainly imports of grains

" B : "

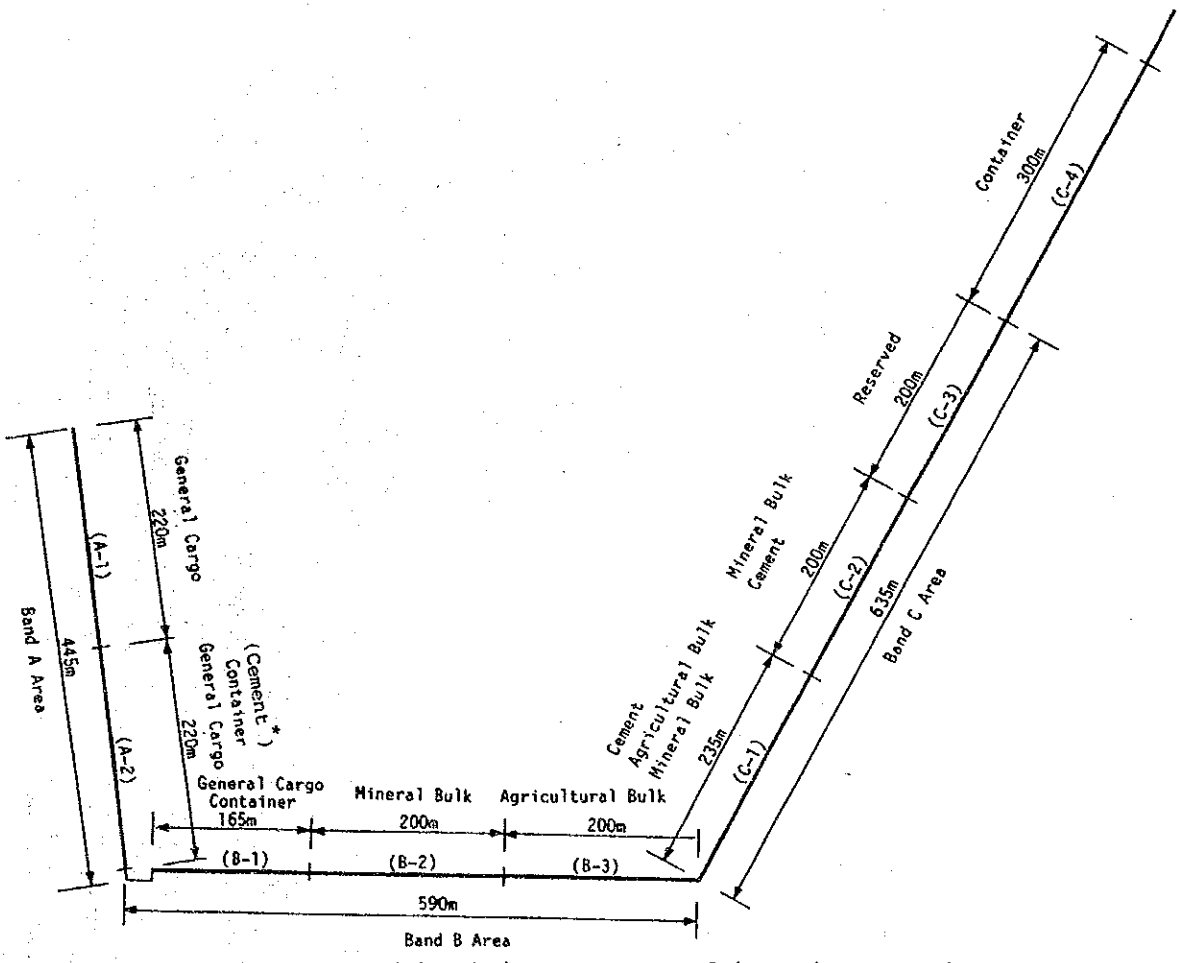
" C : Handling of mineral bulk cargoes mainly materials for fertilizers

" D : Handling of cement, mainly for export

" E : Handling of mineral bulk cargoes, mainly petrochemical products

(2) Berth Use Plan

Taking into consideration the handling volume of each cargo, the calling vessels' size and physical conditions of the berths, the berth use plan is formulated as shown in Fig. 10.10.



Note: Cement at A-2 berth is temporary and is to be removed to the concessioned site in future.

Fig. 10.10 Berth Allocation Plan of Inner Port Area
(Port of Manzanillo in 1995)

(3) Wharf Use Plan

Based on the berth use plan and considering the assumed sites for the concessions and the physical conditions of each wharf, the wharf use plan is drawn up as shown in Fig. 10.11.

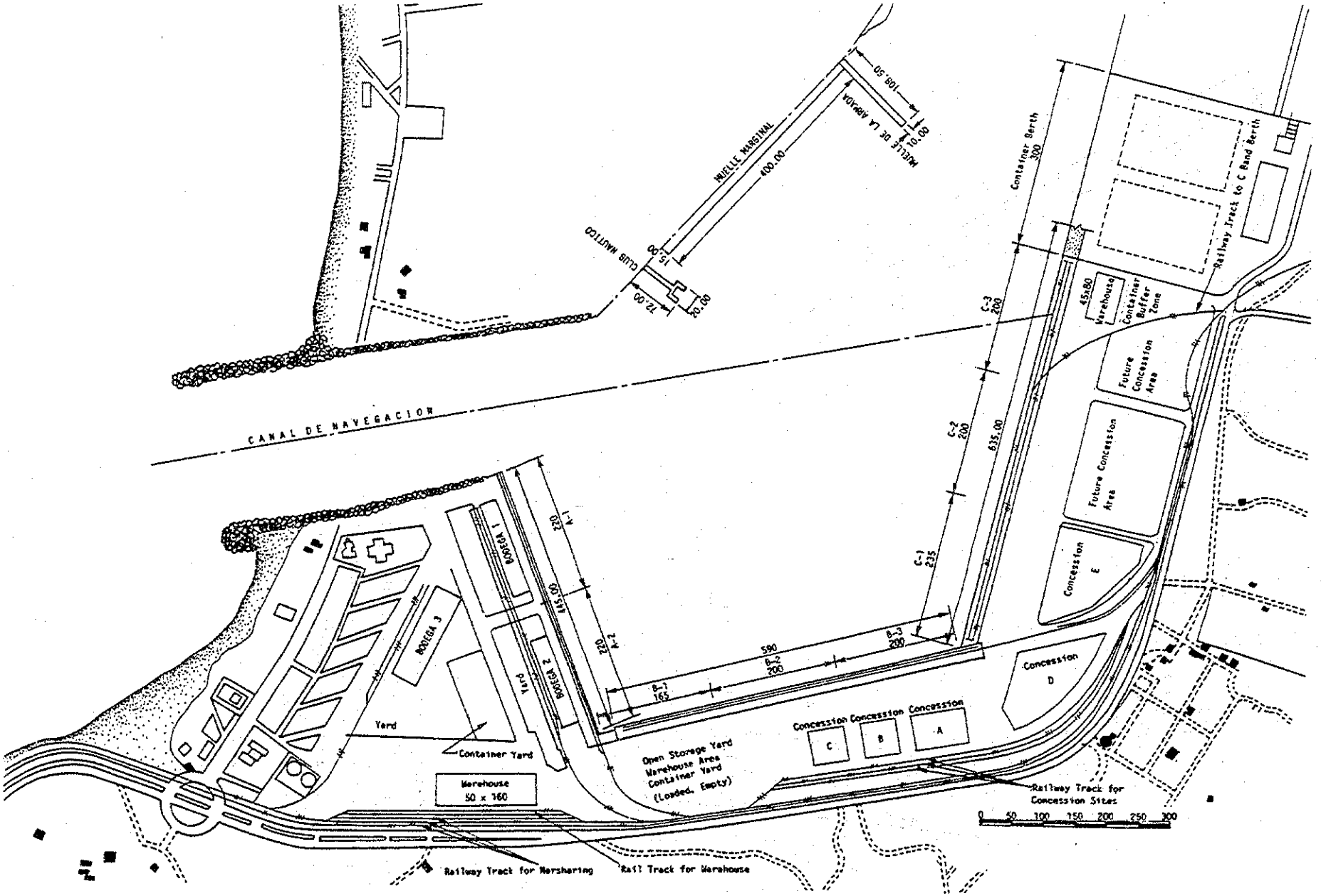


Fig. 10.11 Wharf Use Plan of Inner Port Area

10.4.2 Improvement Plan of Bulk Cargo Handling

An examination is executed regarding bulk cargo handling by the concessions focusing on agricultural bulk cargo.

Recommendations in this section are as follows:

i. Given relatively small scale of grain warehouse, it is significant to guarantee enough number of freight cars and trucks so as to realize high turnover required.

ii. Quay-side conveyers should be portable and less number of conveyers are preferable.

iii. Hoppers should be size of enough volume in order to prevent spillage of grains and for easy cargo handling.

iv. Some type of discharging equipment to wagon cars, which does not require workers in wagon cars and is effective to make full use of cars space, is recommended. As for the detail, refer to the main report.

Chapter 11 Preliminary Design and Cost Estimate

11.1 Preliminary Design of Port of Lazaro Cardenas

11.1.1 Design Policy and Scope of Design

In Mexico, there are no specific design codes and design manuals which are applicable exclusively to port facilities. Accordingly, the design of marine structure has been carried out on the basis of Technical Standards for Port and Harbour Facilities in Japan. In the process of design, technical information and approaches now prevailing in Mexican Ports, most of which had been given by the Engineers in Puertos Mexicanos during the stay of the Study Team, have been also duly considered to reflect local conditions.

The design deals with a master plan and a short term plan. For the master plan the scope of the design is limited to preparing conceptual plans, while for the short term plan the design covers the preliminary structural analysis of the main port facilities, such as quaywalls and pavements.

11.1.2 Design Criteria

The following are the basic design criteria.

Table 11.1 Design Criteria

	Bulk Berth	Silo Berth	Container Berth
(i) Vessel Size	40,000DWT	80,000DWT	50,000DWT
(ii) Berth Length	700m	420m	286m
(iii) Berth Water Depth	-14.0m C.D.L.	-11.0 ~ -14.0m C.D.L.	-14.0m CDL
(iv) Docking Speed	10cm/sec	10cm/sec	10cm/sec
(v) Surcharge	$4t/m^2$	-	$3t/m^2$
(vi) Crane and Cargo Carrier	Gantry crane	Pneumatic crane Quayside 300t/hr X 2	Quayside Gantry crane (40') fork-lift (40'), (25')
(vii) Soil	Sangy soil, N = 20 between -7m ~ -17m		
(viii) Earthquake	kh = 0.32 Kv = 0.0		

11.1.3 Preliminary Design

(1) Bulk Berth

The surface condition of the pavement at the bulk berth is judged poor, requiring overlay work. The pavement structure will follow the Class-C specification.

(2) Silo Berth

No definite plan has yet been established for the future expansion of the silo berth. It is considered that thorough consideration of seismographic force should be taken into account in designing the rehabilitation work of the damaged facilities.

(3) Container Berth

In the short term plan, onshore facilities of the existing wharf are to be modernized to handle the growing number of containers in Lazaro Cardenas Port. In the long term plan, a new container berth will be constructed next to the general cargo berth.

11.2 Preliminary Design of Port of Manzanillo

11.2.1 Design Policy and Scope of Design

Design policy and scope of design are same as the port of Lazaro Cardenas.

11.1.2 Design Criteria

The key design criteria for the preliminary design have been determined as follows:

Table 11.2 Design Criteria

	Bulk Berth	Container Berth
(i) Vessel Size	25,000 DWT	50,000 DWT
(ii) Berth Length	200 @3=600m	300 @1=300m
(iii) Berth Water Depth	-14.0m C.D.L.	-14.0m C.D.L.
(iv) Docking Speed	15cm/sec	10cem/sec
(v) Surcharge	4 ton/m2	3 ton/m2
(vi) Crane and Cargo Carrier	Trailer truck, Fork-lift (25 ton)	Quayside Container crane (40') Transfer crane (40')
(vii) Soil	Above -10m C.D.L. ..... clayey soil Between -10m and -18m ... sandy soil Below -18m ..... sandy soil (N>30)	
(viii) Earthquake	kh = 0.24 kv = 0.00	

11.2.3 Preliminary Design

(1) Bulk Berth

The bulk berths on "Band C" have been already constructed in the form of open deck piers with concrete piled foundation. Once the yard area has been reclaimed, the pavement work will proceed with asphalt-concrete specification Class-C (see container berth pavement).

(2) Container Berth

a) Expansion of Container Berth

For the new container berth, a total of 300m of quaywall is considered necessary, consisting of 250m of new berth section (open deck pier type with concrete piled foundation) and 50m of the existing section, which was originally planned as a bulk berth (partly reinforced for gantry-crane foundation). In addition to expansion of one berth in the short-term plan, another 300m long container berth will be constructed in the long-term plan.

Typical section of the container berth at the Port of Manzanillo is designed as shown in Fig. 11.1.

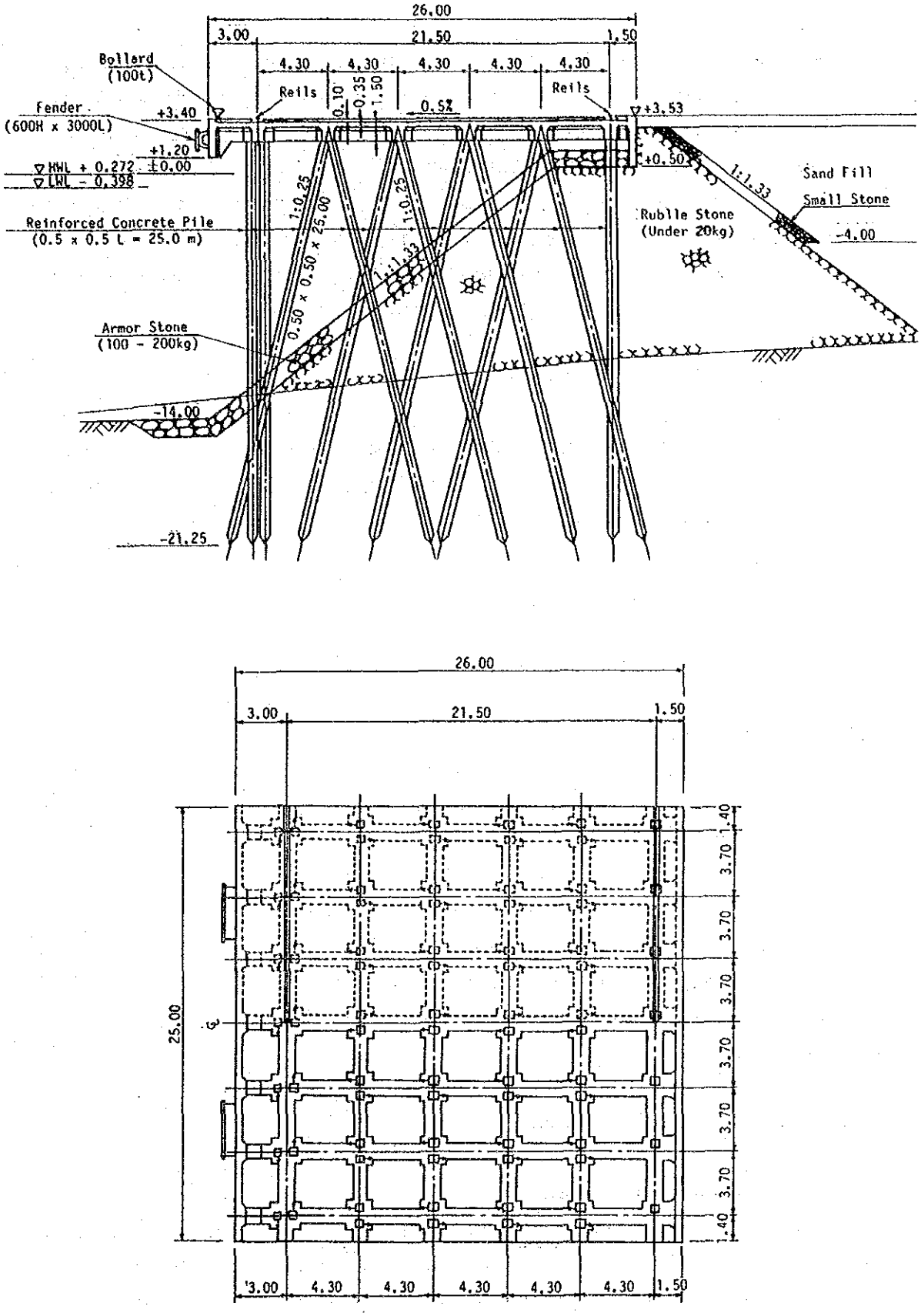


Fig. 11.1 Container Berth (Short Term Plan 1995 L=10@25m=250m)

b) Pavement

The container yard has been classified into three Class: class-A, B and C. Class-A, which will take care of heavy loads from 40 ton-class transfer cranes, will be paved with 30cm thick concrete pavement. Class-B, which will bear the loads of 40 ton-class fork-lifts, will be paved with 15cm thick asphalt concrete. Class-C, which will cope with comparatively lighter loads of trailer-trucks and 25 ton-class forklifts, will be paved with 10cm thick asphalt concrete.

c) Buildings

The main component of the building works will consist of one container freight station (CFS), one administration building and one warehouse to be sited behind the No.9 berth. Structually, CFS and warehouse will be steel-framed, and the administration building of R.C. concrete.

11.3 Basis for Cost Estimate

11.3.1 Construction Plan

The berth expansion modernization areas at Manzanillo Port and Lazaro Cardenas Port lie with already well-developed port complexes, so it can be generally said that no significant difficulty is expected for preparation of the construction and project implementation. Moreover, in terms of geological, meteorological and hydrographical engineering aspects, no particular adverse points have been found out, so the construction program for the project berth development has basically followed the construction method which had been applied for the existing port facilities.

11.3.2 Basis for Cost Estimate

(1) Currency for Cost Estimate

The cost estimate has been made both in foreign currency (Japanese Yen ¥) and local currency Mexican Peso ($). Portion of local/foreign components on the major construction materials have been reasonably set

up, following the figures generally accepted in public works projects in Mexico.

(2) Exchange Rate

The exchange rate for the cost estimate has been taken from the official rate as of November 1989. The exchange rate adopted is 1US$ = 2,600 $ = ¥143.

(3) Price Level and Price Escalation

The cost estimate has been fixed at the price level as of November 1989 and price escalation has not been considered.

(4) Labour Costs, Material Cost and Equipment Cost

The labour costs are based on the prevailing rate in Mexico as authorized by the Puertos Mexicanos. The unit price of local materials identified on site and confirmed by Regional Office of Puertos Mexicanos, Manzanillo and Lazaro Cardenas in November 1989 have been basically used for the cost estimate. Only materials that cannot be supplied in Mexico have been costed on an import basis. The basic information on equipment costs has been obtained from Puertos Mexicanos and supplemented by other authorized reference books, such as the "Costos y Presupuertos - Edification by Peimbert, Oct. 1989".

(5) Indirect Costs

Indirect costs have been assumed as follows:

- Composition of overhead, contingency and miscellaneous 30%
- Contractor's profit 10%
- Contractor's tax (IVA) 15%

(6) Physical Contingency and Engineering Fee

The physical contingency for the construction work except for mechanical components has been assumed to be 15% of the total cost of foreign and local currency portions.

The engineering fee for supervising the project has been assumed to be 5% of the Project Cost.

11.4 Cost Estimate

11.4.1 Cost Estimate of Port of Lazaro Cardenas

The cost breakdown of Lazaro Cardenas Port Re-Development is summarized as follows:

Table 11.3 Breakdown of Cost Estimate

Lazaro Cardenas

(million$)

	Work Item	Foreign	Local	Total
1.	Direct Cost			
1.1	Civil Work	330	2,101	2,431
1.2	Building	562	1,166	1,728
1.3	Utilities	-	935	935
1.4	Electric Work	61	218	279
1.5	Fence	-	134	134
1.6	Mechanical Work	26,103	4,909	31,012
	Total Cost (Direct)	27,056	9,463	36,519
2.	Indirect Cost	410	1,958	2,368
3.	Sub-Total (1.+2.)	27,466	11,421	38,887
4.	Physical Contingency	204	977	11,810
5.	Sub-Total (3.+4.)	27,670	12,398	40,068
6.	Technical Overhead 5 X 0.05	1,001	1,002	2,003
	Total (5.+6.)	28,671	13,400	42,071
7.	IVA 6 X 0.15	-	6,311	6,311
	Grand Total (5.+6.+7.)	28,671	19,711	48,382

11.4.2 Cost Estimated of Port of Manzanillo

The cost breakdown of Manzanillo Port Development is summarized as follows:

Table 11.4 Breakdown of Cost Estimate

Manzanillo

(million$)

	Work Item	Foreign	Local	Total
1.	Direct Cost			
1.1	Earth work	6,026	4,554	10,580
1.2	Pavement	1,023	5,507	6,530
1.3	Quay wall	2,242	11,883	14,125
1.4	Buildings	1,009	5,200	6,209
1.5	Utilities and Others	667	2,920	3,587
1.6	Mechanical Work	38,573	6,952	45,525
	Total Cost (Direct)	49,540	37,016	86,556
2.	Indirect Cost	4,716	12,928	17,644
3.	Sub-Total (1.+2.)	54,256	49,944	104,200
4.	Physical Contingency	2,352	6,448	8,800
5.	Sub-Total (3.+4.)	56,608	56,392	113,000
6.	Technical Overhead 5 X 0.05	2,830	2,820	5,650
	Total (5.+6.)	59,438	59,212	118,650
7.	IVA 6 X 0.15	-	17,798	17,798
	Grand Total (5.+6.+7.)	59,438	77,010	136,448

Chapter 12 Economic Analysis

12.1 General

12.1.1 Purpose and Methodology of Economic Analysis

The purpose of the analysis is to determine whether the net benefits of the project exceed costs through comparing the case where the project is carried out (hereinafter called the "with case") with the case where it is not done (hereinafter called the "without case"). The economic internal rate of return (EIRR) based on cost-benefit analysis is used in order to appraise the feasibility of the project.

Analyses of investments for the bulk cargo berths are carried out through the qualitative analysis.

12.1.2 Prerequisites to the Economic Analysis

i. The period of economic calculation (project life) is assumed as 30 years.

ii. When the Lazaro Cardenas project is analyzed, the Manzanillo project is as assumed to have carried out. When the Manzanillo project is analyzed, the Lazaro Cardenas project is assumed to have been carried out.

iii. In the without case cargoes are assumed to be handled at the alternative ports.

12.1.3 Benefits

The following benefits are considered:

- Saving of land transportation costs
- Saving of the navigation costs
- Saving of ship's staying costs
- Saving in time costs
- Saving of labor costs
- Other intangible benefits

12.1.4 Shadow Pricing

All the costs and benefits are examined in calculations using real market prices. Those prices are revised into shadow prices by selectively using various conversion factors.

12.2 Port of Lazaro Cardenas

12.2.1 Alternative Case

i. The Ports of Salina Cruz and Guaymas are assumed as the alternative calling ports is without case.

ii. Around 47% of the containerized cargoes are asumed to remove from the port of Lazaro Cardenas to the altaernative ports.

12.2.2 Benefits

(1) Saving of Land Transportation Cost

Saving transportation cost is calculated to be 7,941 million pesos/year in 1995.

(2) Saving of the Ships' Staying Costs

The total benefits to the Mexican economy through saving in staying time are 1,306 million pesos/year from 1995 to 1999 and 1,451 million pesos/year from 2000.

(3) Saving of Navigation Costs

The calculated results are 3,122 million pesos from 1995 to 1999, 3,469 million pesos from 2000.

(4) Saving in Time Costs

The saving in time cost for cargoes, which accrue to the Mexican economy is 228 million pesos/year in 1995.

(5) Saving of the Labor Cost

Calculating the saving of the labor costs based on these figures, 31 million pesos are saved in 1995.

(6) Other Intangible Benefits

The value added by the factories leads to economical benefits of the improvement plan. This contributes to promotion of the regional economy.

As for the additional employment arising from the project, employment for construction during the construction period and for operation after the facilities are completed are considered.

12.2.3 *Costs*

(1) Construction Costs

The construction costs including procured handling equipment, are determine based on the figures of Cost Estimate (Chapter 11).

(2) *Maintenance Cost*

The annual breakdown of maintenance costs base on this calculation is 1,716 million pesos/year from 1995.

12.2.4 Conversion into Shadow Prices

(1) *Shadow Prices of Benefits Items*

i. The saving of land transportation costs at shadow prices converted is 7,377 million pesos/year from 1995.

ii. Saving in staying costs, navigation costs, and time costs do not have to be converted for economic analysis.

iii. The shadow price of the labor cost is amounted to 27 million pesos/year in 1995.

(2) Shadow Prices of Cost Items

i. The integrated conversion factors are used, and the prices of the construction costs are changed into 36,480 million pesos.

ii. The shadow prices of maintenance cost is converted to 1,594 million pesos/year.

12.2.5 Economic Profitability

(1) Definition of the Economic Internal Rate of Return

The economic internal rate of return is expressed as a discount ratio satisfying the following equation:

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

where, n : Period of Calculating EIRR

Bi : Total Amount Benefits at i-th Year

Ci : Total Amount Costs at i-th Year

(2) Calculation and Assessment of the Economic Internal Rate of Return

Calculated EIRR is 29.05%. In port investment projects, EIRRs usually range from 10 to 20%. It is generally considered that a project of more than around 10% is economically feasible. Therefore, the project is considered feasible.

12.2.6 Sensitivity Analysis

Sensitivity analysis is conducted in the following cases:

a. 10% increase in costs

b. 10% decrease in benefits

c. Both of a and b

The results of the sensitivity analysis are 26.04%, 25.73%, 23.00% for the case a, b and c respectively. These values of the EIRRs well exceed 10%.

It is concluded that the short tern improvement project of the port of Lazaro Cardenas is feasible from an economical point of view considering the EIRR as well as the in tangible benefits.

12.2.7 Qualitative Analysis of the Improvement Plans for Bulk Cargo

Through more efficient handling at SICARTSA berth, the staying time of the bulk vessels will be reduce and staying costs will be saved.

On the other hand the reasonable utilization of the port area will be realized when agricultural bulk cargoes are removed from the general cargo berths to the grain silo berth.

Taking into consideration the above merits and a low level of the investment, the improvement plan is found to be reasonable and feasible from the economical point of view.

12.3 Port of Manzanillo

12.3.1 Alternative Case

i. The Ports of Salina Cruz and Guaymas are assumed as the alternative calling ports in without case.

ii. Around 48% ofthe containerized cargo are assumed to remove from the Port of Manzanillo to the alternative ports.

12.3.2 Benefits

(1) Saving of Land Transportation Cost

The benefits of saving transportation cost are estimated 11,294 million pesos/year.

(2) Saving of the Ships' Staying Cost

The total benefits to the Mexican economy through saving in the staying time are 2,623 million pesos/year from 1995 to 1999, 2,886 million pesos/year from 2000.

(3) Saving of Navigation Costs

The calculating results are 4,114 million pesos/year from 1995 to 1999, 4,571 million pesos/year from 2000.

(4) Saving in Time Cost

The estimated saving in time cost which is accrue to Mexican economy is 359 million pesos/year in 1995.

(5) Saving of the Labor Cost

The saving of labor cost is 82 million pesos in 1995.

(6) Other Intangible Benefits

Efficient and safe cargo handling will be realized by construction of a new container berth.

As for the additional employment arising from the project, employment for construction during the construction period and for operation after the facilities are completed are considered.

12.3.3 Costs

Construction costs and the maintenance costs are estimated in the same way as in Section 12.2.3.

In the study of Manzanillo the construction and maintenance costs are also estimated.

12.3.4 *Conversion into Shadow Prices*

(1) The Shadow Prices of Benefit

The saving of land transportation costs becomes 10,492 million pesos per year from 1995.

The saving of labor costs become 70 million pesos per year from 1995.

Other benefits are not converted.

(2) Shadow Prices of Cost Items

The shadow prices of the construction costs are calculated year by year. That of the maintenance costs become 234 million pesos per year in 1993, 1,691 million pesos per year in 1994 and 2,800 million pesos per year from 1995.

The shadow prices of the costs in the without case are converted to 11,971 million pesos for the construction costs and 462 million pesos per year for maintenance costs.

12.3.5 Economic Profitability

The EIRR is calculated as 13.75% from the same means deseribed in section 12.2.5. Therefore, the project is considered feasible.

12.3.6 Sensitivity Analysis

Sensitivity analysis is conducted in the following case:

a. 10% increase in costs

b. 10% decrease in benefits

c. Both of a and b

The results of the sensitivity analysis are 12.33%, 12.18%, 10.84% for the case a, b and c respectively. These values of the EIRRs exceed 10%.

It is concluded that the short term development project of the port of Manzanillo is feasible from an economic point of view considering the EIRR as well as the intangible benefits.

12.3.7 Qualitative Analysis of the Improvement Plan for Bulk Cargo

If the berth allotment is made from a reasonable port area utilization viewpoint, as well as the efficient port operate the following benefits are expected to be produced:

Saving of Ship Costs

Reduction of Damage, Loss, and Pilferage and Theft

Promotion of Amenities

Advanced Utilization of the Port

Taking into consideration the above benefits and a low level of the investment, the improvement plan will be concluded to be feasible.

Chapter 13 Financial Analysis

13.1 Purpose and Methodology of the Financial Analysis

(1) Methodology and Management Bodies

Financial analysis is executed by the two methods: by the financial statements and by the discount cash flow method (FIRR). The analyzed management bodies for the former are the ESP and the local office of the Puertos Mexicanos of each port, and for the latter the united management body of the ESP and the local office of Puertos Mexicanos.

(2) Assumptions for Financial Analysis

The assumptions for the financial analysis are as follows:

i. The accounting is carried out according to the business accounting method in each management body.

ii. The financial analysis covers the period from 1989 to 2024.

iii. The funds necessary to execute this project are to be raised under the following conditions:

Source of Fund

Unit: Million Pesos

Port	Body	Source	Amount	Allotment			
				1991	1992	1993	1994
Lazaro Cardenas	ESP	Loan	15,600	15,600			
		Self-Fund	21,847	21,847			
		Total	37,447	37,447			
	Puertos Mexicanos	Loan	-	-			
		Self-Fund	10,935	10,935			
		Total	10,935	10,935			
Manzanillo	ESP	Loan	6,760			3,380	3,380
		Self-Fund	48,212			24,106	24,106
		Total	54,972			27,486	27,486
	Puertos Mexicanos	Loan	4,680		2,340	2,340	
		Self-Fund	76,796		22,835	36,564	17,397
		Total	81,476		25,175	38,904	17,397

Loan Condition

Port	Body	Items	Long-Term Loan	Short-Term
Lazaro Cardenas	ESP	Interest Rate	7.9%	Interest Rate
		Repayment Term	15 Years	
		Grace Period	3 Years	Borrowing :
Manzanillo	ESP	Interest Rate	7.8%	
		Repayment Term	15 Years	12%
		Grace Period	5 Years	
	Puertos Mexicanos	Interest Rate	7.8%	Deposit :
		Repayment Term	15 Years	7%
		Grace Period	5 Years	

(3) Base Year

All costs, expenses and revenues analyzed here are indicated in prices as of 1989. Neither inflation of prices nor incomes are considered during the project life.

(4) Cargo Volume

The cargo volumes which can be handled through the proposed project of both "With case" and "Without case" are as same as the case of Economic Analysis.

(5) Cost and Expense

i. The annual maintenance costs for the facilities/equipment are calculated based on the fixed proportions of the original construction or procurement costs.

ii. Personnel costs calculated for the new organization of the ESP and for the local office of Puertos Mexicanos are assumed to remain at the same level as now.

iii. Union costs are assumed to be 40% of the operating income of the ESP in the "With Case", and in the "Without Case" remains at the same level as at present.

iv. Administration costs are estimated as 130% of the personnel costs in case of the ESP, and in case of local office of Puertos Mexicanos at 50% of that.

v. The annual depreciation expense is calculated by the straight line methods.

(6) Revenues

The container handling tariff of the ESP is raised to 30% of the present level at the port of Lazaro Cardenas. Other tariffs or port dues are maintained at the same level as at of present.

(7) Sensitive Analysis

Sensitive Analysis is calculated for the following cases:

Port of Lazaro Cardenas

Case A : Expenditures are increased by 10%

Case B : Revenues are decreased by 10%

Port of Manzanillo

Case A : Expenditures are increased by 10%

Case B : Revenues are decreased by 10%

13.2 Port of Lazaro Cardenas

13.2.1 Financial Analysis of ESP

Financial statements such as profit/loss statement and cash flow statement from 1989 to 2024 are prepared according to the above estimation of revenues and expenditures.

The evaluation of these statements is as follows:

i. The profit/loss statement shows that the operating revenues are sufficient to cover operating expenditures.

ii. The accumulated net income of the ESP in the year 2024 will be an estimated 75,971 million pesos.
Assuming 10% of the revenue is allotted to the ESP and a 7.9% of rate of return, it is estimated that around 90% of the initial contribution by the government can be recovered.

iii. The cash flow statement shows that the management body can pay off the long-term loans completely.

iv. The working ratio is calculated as 61% which can be said favorable.

v. Based on the above evaluation with regard to the financial statements, it can be concluded that the ESP will operate soundly as management body of the project.

13.2.2 Financial Analysis of Puertos Mexicanos

The evaluation of the financial statements is as follows:

i. The profit/loss statement shows that the net income becomes profit after the year of 2004 and it indicates the upward tendency.

ii. The working ratio is calculated as 70% showing that the financial situation of the management body is sound.

iii. Based on the above evaluation with regard to the financial statements, it can be concluded that Puertos Mexicanos will operate soundly as a management body of the project.

13.2.3 Financial Analysis by the FIRR

(1) Calculation and Evaluation of the FIRR

The value of FIRR of the project is calculated as 10.06%. This value shows that there is no problem from the view point of the profitability for repaying the loan.

On the other hand, the value implies that the project could be feasible if all the funds were procured by a loan with the interest rate of 10%, or that the investor could expect the same amount of return.

Judging from the above, the project itself can be regarded as sufficiently feasible.

(2) Sensitive Analysis by the FIRR

The FIRR is calculated for each of the two cases. The calculated result are Case A 8.44% and Case B 8.27%. The results of the sensitive analysis thus prove that each case would be feasible.

13.3 Port of Manzanillo

13.3.1 Financial Analysis of ESP

Financial statements from 1989 to 2024 are prepared according to the above estimation of revenues and expenditure.

The evaluation of these statements is as follows:

i. The profit/loss statement shows that the operating revenue is sufficient to cover operating expenditures.

ii. The accumulated net income of the ESP in the year 2024 will be estimated 178,278 million pesos.
Assuming 10% of the revenue is allotted to the ESP and a 7.8% of rate of return, it is estimated that around 95% of the initial contribution by the government can be recovered.

iii. The cash flow statement shows that the management body could pay off the long-term loans completely.

iv. The working ratio is calculated as 63% which can be said favorable.

v. Based on the above evaluation with regard to the financial statements it can be concluded that the ESP will operate soundly as management body of the project.

13.3.2 Financial Analysis of Puertos Mexicanos

The evaluation of the financial statements is as follows:

i. The profit/loss statement shows that the net income becomes profit after the year of 2006 and it indicates the upward tendency.

ii. The cash flow statement shows that the management body could pay off the long-term loans completely.

iii. The working ratio is calculated as 34%, and it shows that the financial situation of the management body is sound.

iv. Based on the above evaluation with regard to the financial statement, it can be concluded that the Puertos Mexicanos will operate soundly as management body of the project.

13.3.3 Financial Analysis by the FIRR

(1) Calculation and Evaluation of the FIRR

The value of FIRR of the project is calculated to be 6.58%. This value shows that there is no problem from the view point of profitability for repaying the loan.

On the other hand, the value of FIRR implies that the project could be feasible, if all the fund were raised by a loan with 6.5% of interest rate, or that the investor could expect the same amount of return.

Judging from the above, the project itself can be regarded as feasible.

(2) Sensitive Analysis

The FIRR is calculated for each of the two cases. The result obtained are Case A 5.16% and Case B 5.01%. The result of the sensitive analysis thus prove that each case would be feasible.

13.3.4 Financial Analysis of Bulk Cargo Project

(1) ESP

The revenue from the bulk terminal may not increase so much because a considerable portion of the cargo handling operation will be carried out by the private companies concessioned. However, the concessions will lead to higher productivity and increase of the total handling capacity of the port.

Judged from the above and low level of the investment by ESP, the project will be feasible from financial point of view.

(2) Puertos Mexicanos

The revenue component of Puertos Mexicanos does not change by the introduction of concession system. The dues of concessionner become the income of Federal Government. Judged from the above and low level of the investment by Puertos Mexicanos, the project will be financially feasible.