Chapter 8. Recommendations of the Improvement Plans

This chapter represents the recommendations by the study team regarding the improvement plans. The recommendations were examined by the study team through the site survey at each port and the discussions were held between the Mexican side and the study team on the improvement plans prepared by the Mexican side and related matter.

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. Therefore, the description of common items is elaborated relatively in detail. On the other hand, the recommendations for each port focus on those unique to each port and also represent the comments on the improvement plan of each port prepared by the Mexican side.

8.1 Common Items

8.1.1 Utilization of the ports

As is pointed out in Chapter 4, the promotion of further utilization of the ports is urgent for the effective use of port facilities and the sound management and operation of the ports. Referring to this point, the following four items are examined for the recommendations:

(1) System of Promoting Utilization of the Ports

As present, the system of promoting utilization of the ports seems to be insufficient. 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 by the study team:

a. To establish an organization to promote port utilization. In this regard, it will be significant for the local governments to participate in the organization, as they obtain great benefits from port development. The local offices of port-related governmental organizations as well as main port users are other members. It may be appropriate for the port development committee to play a role in this organization.

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 activities. This is now being elaborated by Puertos mexicanos.

d. To promote the improvement of port facilities and productivity, which are effective in terms of further utilization of the port. The improvement of transportation infrastructure and port facilities/equipment, such as cargo handling equipment and storage facilities, will be significant, as well as upgrading the efficiency of cargo handling operations.

(2) Promotion of Containerization

The containerization of general cargoes is a world-wide tendency, and the ports on the Pacific coast in Mexico are no exception. Therefore, an effective means of promoting further port utilization is to adopt a

policy that will accelerate the containerization of general cargoes through the ports. In this regard, the following points are recommended by the study team:

a. To ensure the future prospect of containerization at the ports. First, the prospective future demand for containerized cargo passing through the ports has to be examined, considering comprehensive conditions for the forecast.
b. To study and promote forming an effective container network between the ports. A port development policy by the government should be included in forming the container network.
c. To promote containerization by providing adequate facilities/equipment at the ports for container handling. The port sales mentioned above are also necessary to promote utilization of the ports.

(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 which will be a guideline for their business. The following are the recommendations of the study team:

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. The master plans should be authorized by the Federal Government if order to make them effective as well as to make them available to the The procedure for authorization of the master plans should be examined.
c. To make the master plans public. Port users can thus refer to the master plans of the ports.
d. To train personnel for demand forecast and port planning.

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

Puertos Mexicanos has proposed promoting domestic maritime trans-

portation in Mexico. The study team does not have any data or information concerning this problem, so it is difficult to make any concrete recommendations regarding it.

In general, in the ports on Mexico's Pacific coast favorable conditions for coastal shipping do not exist, except for maritime transportation between Baja California and mainland area.

The main hinterlands of the ports are located in inland areas rather far from the ports. However, 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 may be possible to shift to maritime transportation using the ports on the Pacific coast.
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

As mentioned in the section 4.1.2 of Chapter 4, several organizations exist at each port, among which coordination and communication do not always seem to be sufficient. Generally speaking, it is desirable that port management and operations be executed under an unified concept and also make a reasonable profit. From this point of view, the folbwing recommendations are made:

(1) Strengthening the Management Constitution of ESP

Each ESP is a company-joint-stock and executes cargo handling operations as a private enterprise. Naturally, therefore, the management and operating costs of the ESPs should be covered by the income from their own business activities. But in terms of obtaining major equipment items, payment has been made in the form of investment by Puertos Mexicanos, the result of which is a capital increase of the ESP. Considering this situation, the management of the ESPs cannot be said to be very firm or sound.

One reason is that the cargo volume handled by the ESPs remains at a

relatively low level and fluctuates every year, resulting in unsteady income for the ESPs. From this point of view, assistance from Puertos Mexicanos is considered indispensable at present, while efforts aimed at establishing financial independence should be continued.

On the other hand, cost accounting of individual tariffs is not carried out sufficiently at present. So the points where the profit or deficit occur is not clear. This is described in section 8.1.3 of this chapter.

Through analysis of the cost accounting of individual tariffs as well as examination of the present problems mentioned in Chapters 4 and 8, countermeasures for strengthening the management of each ESP should be comprehensively examined. In this regard, the study team has made the following recommendations:

a. To look over the services rendered by the ESPs
   The services that bring the ESPs reasonable profit should be emphasized, while the services that cause financial deficits should be re-examined, including shifting them to private sector bodies. At the same time, the services necessary for promoting port utilization should be considered when studying the services provided by the ESPs.
b. To improve the efficiency of cargo handling operations
   The cargo handling operating services yield the most basic income for the ESPs. Thus, the measures for improving this efficiency, which are described in section 8.1.8 in this chapter, are of a great importance.
c. To improve the personnel capability of the ESPs.

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

As mentioned in section 4.1.2 of chapter 4, port administration and operation are carried out by the local offices of the SCT, Puertos Mexicanos and the ESP.

This complicated and separated system of port management and operation sometimes seems to cause inefficiency in administrative activities. Basically, a port administration system should be simple and systematic so that the port administration can be executed efficienlty with a consistent

policy. Accordingly, the reformation of the administrative system of the ports will be required in the future under the consistent control of Puertos Mexicanos.

At present, the general director of the ESP concurrently holds a position as the local delegate of Puertos Mexicanos and some ESP personnel carry out duties and functions that belong to Puertos Mexicanos. This situation also makes the port management and operation complicated.

Puertos Mexicanos is now studying ways to make clear the allocation of the functions between the delegate of Puertos Mexicanos and the ESP, a move that is considered necessary.

Considering the above-mentioned situation, the following are recommended as urgent measures:

a. To promote further coordination and communication among the ESPs and the other local governmental organizations.

b. To strengthen the administrative functions of the local delegate of Puertos Mexicanos

   Puertos Mexicanos is now holding consultations with SCT on shifting some administrative and managerial functions from the Harbor Master to the local delegate of Puertos Mexicanos. This is seen as rational and essential. In particular, berth appointments should be made in close conjunction with cargo handling operations. The shift of the berth appointment function from the Harbor Master to the local delegate of Puertos mexicanos is expected to improve in cargo handling.

c. To make clear the functions of the local delegate of Puertos mexicanos and the ESP

   The local delegate of Puertos Mexicanos is in charge of administrative and managerial functions, while the ESP is in charge of providing port services. These different roles should be made clear, including the appropriate allocation of expenses.

d. To investigate an effective port management and operating system

   In line with the strengthening the functions of the local delegate of Puertos Mexicanos, an effective port management and operating system should be studied by Puertos Mexicanos.

(3) Standardization of Financial Statements

Generally speaking, financial statements must correctly describe the present financial situation of a company and they should be simple and clear. In addition, financial statements are used to analyze the financial status of a company.

The style and format of the financial statements of each ESP are almost the same in terms of fundamental structure, but differ in certain details. Therefore, it is recommended that the formats of financial statements be standardized to make clear the managerial weak points of each ESP and to compare each each ESP's financial statements effectively.

8.1.3 Tariff System

Tariffs are the monetary compensation for cargo handling services and tariff revenue is a great part of each of ESP's income. The tariff rate contracted with the unions is also important for ESPs' management of cargo handling operations.

In addition, some ways of improving cargo handling efficiency could be introduced in a tariff system.

The following items are examined for the recommendations:

(1) Simplification of Tariff

The port tariff is now being re-examined in Mexico aiming at the simplification and standarization of tariffs. The structure of the new tariffs is composed of the following items:

i. Operating costs (Labor costs, equipment costs, etc.)
ii. Administrative costs
iii. Profit or margin
iv. Others

The "others" include the following:

i. Training cost for cargo handling workers
ii. Bonus fund for workers in case of a rise in cargo handling efficiency
iii. Funds for further improvement of the operation

The simplification and standarization of tariffs mentioned above are necessary, because the procedures of tariff payments would become simple and quick, resulting in the clear and easy calculation of tariff rates. In carrying out this system, however, the following items should be considered:

a. Each ESP should make efforts to increase cargo handling productivity, as the tariff includes a kind of fund for bonus in itself.
b. In terms of worker training, the fund should be used practically to improve cargo handling efficiency.
c. A simplified tariff system should lead to a balance between what users are charged and the level of service they receive.

(2) Necessity of Coat Accounting for Individual Tariffs

A tariff should be decided on the basis of the following factors:

Cost factors	.Labor costs
	.Running costs
	.Depreciation and maintenance costs of facilities/equipment
	.Administrative costs
	.Profit or margin
Other factors	.Tariff level of neighboring rival ports
	.Policy factor
	.Rational burden of payment by port users

In these factors, the most basic factor is the cost factor. 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.

This analysis can follow the usual method of cost accounting as follows:

Direct Costs
- .Calculation of the direct cost for workers by estimating the number of workers required
- .Calculation of direct costs, such as fuel costs
- .Calculation of the direct cost for supervisors

Estimating the number of supervisors required

Indirect Costs
- .Allocation of administrative costs
- .Allocation of depreciation costs
- .Allocation of other costs

↓

Estimated bare costs

By calculating the bare cost of each service, the primary tariff level is obtained, which will give the base of setting a rational tariff. 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.

For the above reason, it is recommended that the cost accounting of each tariff and subsequent analysis be carried out adequately.

(3) Other Functions of Tariffs

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

a. Minimum cargo handling charge

This is a system in which the cost of workers, is charged even when the handling volume is not enough due to factors not caused by the workers. In some objective ports, this system is carried out through the negotiations with the users or shipping companies. However, it is not described in the present tariff, but this charge is paid from the ESPs'own funds. Puertos Mexicanos is studying regulation of this system in the new tariff. The study team also recommends that the minimum charge system be clearly described in the tariff schedules in combination with a waiting time charge.

b. Bonus system

In order to increase cargo handling efficiency, a bonus system has been proposed. This is a system in which an additional charge is paid by users or shipping companies in case of a remarkable increase in cargo handling efficiency. The charge is paid to

workers as a bonus for improved cargo handling efficiency. The existence of this system should raise motivation for workers to increase cargo handling efficiency. However, regulating this system in the tariff will be difficult because of the objections by the users who might, on the contrary, see it as a penalty system in case of low efficiency. Therefore, the bonus system should depend on negotiations with users on a case-by-case basis.

8.1.4 Cargo Handling Unions

The cargo handling union is a labor supplier at each port's cargo handling operations. But the union was a cargo handling operator in the past before the establishment of the ESPs by the permission of the Federal Government.

Concession is the privilege to use a port area as authorized by the SCT.

Permission is the privilege to operate cargo handling in a port area, also authorized by the SCT. Most of the ESPs have both concession and permission. The union's former permission has been suspended since the ESPs were established. However, there still exists the special condition that union's permission may revive in the event of an ESP's extinction. Some CTM unions have this permission even now, as at Mazatlan and Ensenada.

(1) Existence of Plural Cargo Handling Operators

One of the problems is that there exist two cargo handling bodies, those of the ESP and the CTM union, respectively, at several ports. In this case, the users must make contract with the two bodies separately. This contract procedure is not only complex but also may hinder smooth cargo handling operations.

As a measure for simplification, a one package contract system may be useful. It has been attempted at the Port of Ensenada. The ESP makes the united cargo handling contract with users instead of the CTM union. In this case, the present tariff of the CTM is applied and the ESP pays the handling charge to the CTM on behalf of the users.

By introducing this method, the complicated cargo handling system may be simplified to some extent, because the cargo handling plan can be arranged in a unified manner by the ESP. However, this system does not bring any direct financial profit to the ESP.

This type of contract may be worthwhile as a first stage in solving the problem. 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. Therefore, continuous negotiations with CTM union are recommended, taking into consideration the advantages which the CTM may enjoy as a result of unification.

(2) Improvement of Productivity

Another problem is the low cargo handling productivity rate caused by the present union system.

One reason for this problem is that the payment system by the collective contract between the ESP and the union is based on cargo handling performance. In this system, under the present comparatively low level of cargo handling volume, increased productivity does not directly bring the union workers an increase of wages.

Another reason is that the ESPs are not authorized, basically because of the regulation of the Federal Labor Law, to appoint the individual workers who operate cargo handling equipment. Thus, skilled workers are not always assigned to adequate roles.

Puertos Mexicanos is examining the improvement of the union problems and some of the Mexican side reports describe the necessary measures. The Mexican side's principal policy for improving the union problems is considered to be rational and correct. The recommendations with respect to this section are as follows:

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

   It seems significant union workers realize that upgraded cargo handling efficiency will help promote port utilization. In addition, the cargo handling plan will be more effective if it is drawn up based on adequate communication between the ESPs and the unions.

b. To assign skilled workers to adequate roles

   Since the refusal of union workers by the ESPs is not legal because of the Federal Labor Law, it is considered necessary to virtually obtain the agreement of the unions through a combination of measures such as c., e. and f. mentioned below. The introduction

of a licensing systems for machine operators by Puertos Mexicans may be an effective measure.

c. To introduce a wage system in accordance with the kind of job
This system is quite rational and is legal, because the range of the minimum wage according to the kind of occupation is regulated by the Federal Labor Law. This system will provide workers with an incentive to develop more skills.

d. To hold an adequate wage level and an incentive wage system
A bonus system described in section 8.1.3 may be useful in increasing cargo handling efficiency.

e. To introduce a compensation system designed to prevent damage to machines and equipment.
This system would impose some penalties on union members for damage to machines and equipment caused by rough handling by workers, as proposed in some Mexican side reports. This system would be effective both in preventing labor accidents and to reduce the maintenance costs of cargo handling machines and equipment. The problem with this system is the difficulty in certifying the damage cause by workers' rough handling.

f. To carry out effective training for workers
This is described in section 8.1.8 of this chapter.

8.1.5 Statistics

Statistical date on port activities such as vessels, cargoes and cargo handling operation are very important and are necessary in evaluating the past and present port situation and also in preparing port development policy and port management and operation plans, as mentioned in section 4.1.5 in Chapter 4.

Port statistics are generally utilized by each organization as follows:

i. Puertos Mexicanos: port planning, port development policy and other policies including for instructing and leading ESPs.
ii. ESP: management, financial and cargo handling plans
iii. Other governmental organizations and port users: for their business purposes

At present, there are some statistics with regard to cargoes, vessels and cargo handling operations in Mexico. However, they are not sufficient for grasping the present situation of port activities and cannot be used a wide variety of purposes. Puertos Mexicanos is now beginning to formulate an "Information Development Program" in which the reformation of statistics is included.

Considering the present situation mentioned above, the following items are examined with respect to the recommendations on statistics:

(1) Allocation of Preparing Port Statistics

The Harbor Master is presently responsible for collecting statistical data at each port and the SCT prepares Port Statistics. On the other hand, the ESPs also collect detailed data on cargoes and cargo handling operations related to its business. This duplicated and complex way of collecting statistical data makes it difficult for them to collect data efficiently and swiftly.

On the other hand, Puertos Mexicanos is now consultating with the SCT on the rational assignment of preparing port statistics. Puertos Mexicanos is supposed to be in charge of preparing port statistics related to port cargoes and cargo handling, while the SCT is supposed to be responsible for preparation of statistics regarding vessels.

This allotment is considered better than the present system, because Puertos Mexicanos can get statistical data directly and efficiently from the ESPs and, at the same time, can reform the contents and formats of statistics more usefully, as Puertos Mexicanos and ESP are the organizations that use utilize port statistics most often.

The recommendations by the study team with regard to the matters mentioned above are as follows:

a. Puertos Mexicanos should take the responsibility for preparing port statistics with appropriate allocation to the SCT.
   It would be preferable for Puertos Mexicanos to prepare port statistics, including those regarding vessels, in the future when the port management system becomes more complete under the control of Puertos Mexicanos.
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 Section in the ESPs

At present, each ESP retains statistical data as a result of carrying out its business. However, these data are neither processed to useful statistics nor utilized sufficiently for its business.

Taking into account this situation as well as desirable changes in the system used in preparing port statistics as mentioned above, the following steps are recommended:

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

As mentioned in Chapter 4, the present statistics regarding vessels in Mexico includes only the number of ships calling by each cargo type in foreign and domestic trade.

The following data regarding vessels are necessary and it is recommended they be collected:

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

.This is the most basic and important of the statistics regarding vessels.

.Vessels are usually classified as conventional general cargo vessel, full-container vessel, semi-container vessel, oil tanker, chemical tanker, agricultural bulk carrier, mineral bulk carrier, cruise ship, ferry boat, fishing boat and so on.

.Vessel Size should be compiled monthly and yearly.

.These statistics should be compiled monthly and yearly.

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

.Statistics by vessel type and vessel size are preferred.

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

.Statistics by vessel type and vessel size are preferred.

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

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

.This may be an internal statistic.

2) Cargo Statistics

Cargo statistics in Mexico are more or less as mentioned in Chapter 4.

The following are the recommended cargo statistics, all of which should be collected for each inbound and outbound cargo in both foreign and domestic trade.

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 complicated for analyzing the trend of cargoes.

.Therefore, grouping of general cargoes and perishables is necessary. The grouping of commodities adopted by an O/D investigation in this study may be an example (refer to Table 5.2.1 in section 5.2.1).

.The grouping of bulk cargoes is desirable but is not as important as general cargoes.

c. Cargo volume by liner routes for liner cargoes.

d. Origin and destination statistics.

.Puertos Mexicanos already possesses splendid statistical data which are computerized.

.Origin and destination ports should be added as for domestic trade cargoes.

.The commodity group idea mentioned in b. should be adopted for general cargoes.

.Use of these data should be examined.

e. Cargo volume and number of vehicles transported by ferry boats.

3) Container

Statistics regarding container in Mexico are not enough at present and the following data should be collected regarding import/export containers.

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

.The breakdowns of containers by their size and by loaded/empty are needed.

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

.Refer to 2) b. as for commodity group.

.Cargo volume should exclude tareweight.

c. Dwelling time of containers in the container yard

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

.These data will be included in the internal statistics.

4) Berth usage

The statistics regarding berth usage in Mexico are presently collected mainly from the viewpoint of cargo handling efficiency. It is recommended that the following data be collected, mainly for port planning.

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. Interval between vessels, arrival and the distribution of berthing

time by vessel type should be collected as internal statistics.

5) Cargo storage

The statistics regarding cargo storage are not sufficient at present, but it is necessary to evaluate the efficiency of the use of storage facilities and to draw a port plan. The following data should be collected:

a. Capacity of each storage facility.
b. Cargo volume handled at each storage facility broken down into domestic/foreign and inbound/outbound categories.
   .The data regarding major commodities should be collected together.
c. Turnover and average dwelling 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

As mentioned in section 4.1.6 in Chapter 4, the problems regarding the procedure of ship entry/exit and customs formalities are not too serious. This is, for one thing, because the number of ships calling at the ports is not very large at present. Accordingly, this may become a more significant problem when the cargo handling volume, especially that of containerized cargoes, increases at the ports.

The following are the recommendations with respect to this section:

a. To promote further coordination among related bodies
   The "port development committee" at each port is expected to deal with fundamental and significant matters, while the "program committee" will work as a daily coordinating organization.
b. Promotion of the unification of port services and related procedures
   .Countermeasures for the different work time of governmental offices and ESPs should be examined.
   .To promote the siting of port-related governmental offices as close together as possible, with the aim of locating them in a single building in the future.
   .To examine the possibility of unifying the procedures of collect-

ing wharfage fees by the representative of Puertos Mexicanos.

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

Enacting a new Customs Law and simplifying customs formalities are now being investigated in Mexico.

d. To request the reformation of fumigation system to the governmental organization concerned.

Especially as for loaded import containers, the fumigation should be limited to specific commodities from specific countries.

8.1.7 Land Transportation and the Storage System in the Port Area

As mentioned in section 4.1.7 in Chapter 4, the land transportation of maritime cargoes is one of the greatest problems at most of the ports, especially in the case of the transportation of discharged agricultural bulk cargoes. The maritime cargo flow is comprehensive, consisting of maritime transportation, loading/discharging at a port and land transportation, each of which is closely related. The bottleneck in land transportation directly affects the efficiency of the total transportation of cargoes. Therefore, countermeasures to cope with this situation are a fundamental requirement for efficient port operation.

Recommendations regarding this problem are examined according to four categories mentioned below:

(1) Truck Transportation

Formerly, land transportation by truck from a port was obliged to use trucks from a Cargo Center, a union of trucking companies, if one existed near a port. In addition, the transportation routes assigned to trucking companies were limited to the extent that only some trucks could carry the maritime cargoes to the necessary area.

The above situation, which has hindered smooth and efficient land transportation to a significant extent, was changed recently by a governmental ordinance aiming at encouraging free competition among trucking companies. Therefore, the land transportation of maritime cargoes by truck is being improved. However, the shortage of trucks in Mexico is still serious, basically because of the government's policy of keeping the freight tariff at a low level.

Taking into consideration the situation mentioned above and the actual

problems at the ports, the following steps should be considered:

a. To request an increase of the number of trucks from the port side However, this may be very difficult in the short term because of the governmental policy mentioned above.
b. To make sufficient coordination to secure the necessary number of trucks. There must be more coordination carried out by the "programming committee" at each port. Fundamentally, in the new system of free competition, users' attitude for the payment of freight tariff is seen as becoming more significant.
c. To request repair and construction of the roads connecting the ports with their hinterlands.

(2) Railway Transportation

Recently, the "Transportation Committee", chaired by the Secretary of the SCT and participated in by Puertos Mexicanos, the National Railway, trucking companies and port users such as CONASUPO, FERTIMEX and ANDSA, came to be held regularly to coordinate important matters related to land transportation.

Through this top-level coordination, the number of freight cars needed at a few ports to transfer agricultural bulk cargo by CONASUPO we decided.

On the other hand, national railway personnel were assigned to the Port of Manzanillo to coordinate the necessary number of freight cars required by users and to communicate these requests to the regional head office of the national railway at Guadalajara. The coordination scheme introduced this system is reported to be working efficiently.

The coordination needed to secure the required number of freight cars at the ports is significant at both the local level and the Federal government level. The recommendations in this regard are as follows:

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. The coordination system mentioned above seems to be effective.
c. To promote coordination aimed at securing the necessary number of freight cars at the local level.

.To adopt the type of coordinating system used at the Port of Manzanillo at other ports.

.To strengthen the coordinating function of the "programming committee".

.To request the consignees to announce the ship's arrival time accurately as well as the cargo volume as soon as possible.

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

(3) Storage in the Port Area

The problem related to the land transportation of maritime cargoes are, on the one hand, caused by a shortage of necessary trucks and freight cars. However, on the other hand, they are also caused by the shortage or the lack of storage facilities at the ports. Sufficient storage facilities are indispensable for a port, because a port is a place where the transportation mode is changed and, for this operation, to store the cargoes temporarily. It must be pointed out that the capacity of a port is decided by the capacity of its storage facilities.

Therefore, the problem of land transportation should be settled basically by the construction of the necessary number and scale of storage facilities in the port.

The following recommendations are made mainly with regard to discharged agricultural bulk cargoes, which are presently most serious cases of this problem:

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.

The necessary storage capacity should be examined by taking into consideration the long-term prospect of handling volume, the short term cargo handling volume and its seasonal variations, the direct discharging ratio, the prospect of available trucks and freight cars, the storage capacity of consignees' facilities and port conditions. The storage system should include several types of silo, yard storage, warehouse, structural modification of existing

warehouse, portable warehouse and barge storage.

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

- .To construct a storage facility for public use with government funds.
- .To construct a storage facility with government funds and to lease it to specific users at a special tariff rate.
- .To give a specific user the concession to construct and operate the storage facility. The Mexican government is now encouraging this system.
- .To construct a storage facility with a certain share of the construction cost paid by the specific users which, in return, get the right to use it preferentially.

(4) Dwelling Time of Cargoes at Ports

As mentioned in section 4.1.7, the countermeasures for rather long dwelling (or staying) time of cargoes, especially containers and break bulk cargoes stuffing/unstuffing containers at ports, should be examined. The recommendations in this connection focusing on containers are as follows:

a. The investigation on the present situation of dwelling time should be carried out.

As for containers, a dwelling curve (refer to appendix 10.1.1) of container should be investigated at each port.

b. The reformation of procedures for import/export should be promoted.

- . To lead to upgrade the knowledge of shippers/consignees regarding import/export procedure.
- . To promote the simplification of import/export procedures.
- . To reform the present fumigation system.

c. The installation of inland depot for containers should be examined.

In view of the long distance between the ports and their hinterlands, the installation of inland depots at principal cities in the hinterland will be very useful for gathering/distributing containers. In addition, inland depots will make much contribution to the effective transportation of containers between the ports and their hinterlands as well as reduction of dwelling time of

containers at the ports. However, the possibility of inland depot depends on the level of handling volume of containers. Further investigation should be done.

d. The level of storage charge at ports should be re-examined from the viewpoint of reducing dwelling time.
   Especially the level of storage charge at exclusive container terminals should be examined in line with appropriate planning of storage facilities (refer to section 9.2.4,(3)).

e. It may be appropriate to re-examine the free-of-charge period for storing cargoes in the storage facilities in a port.
   The free-of-charge period in Mexico is long: 90 days for export cargo and 10 days for import cargo, because of the export promotion policy. This period should be gradually shortened, as it may cause a long waiting period for cargoes in storage facilities in a port.

f. The disposal of long staying cargoes at the storage facilities at ports should be excuted as soon as possible.

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

The objective six ports' reports prepared by Mexican side do not describe concrete measures 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. This plan should be made by a supervisor who belongs to the cargo handling operation section of each ESP, because ESP staff members, are in the best position to coordinate with every concerned section and other organizations of the port cargo handling operation. As it is very important that the cargo handling plan should be implemented correctly on schedule and the plan should be implemented correctly on schedule and the plan should be watched carefully until the cargo operation is finished, the cargo handling operation planner should be the same person as the cargo supervisor. If the cargo handling plan is not prepared properly, not only ship operations but also shore side transportation and warehouse operations, will get much worse. The

discharging cargo handling plan will be made by checking a ship's stowage plan carefully according to cargo volume, package style and storage location. The loading cargo handling plan will be made by checking cargo booking lists and the available space for ships at a calling port informed by the shipping company or it's agent. The supervisor can then calculate the required handling hours, the number of gangs and cargo equipment required and thus the ship's departure time can be estimated

The opinions of the Mexican side regarding the above are as follows:

Puertos Mexicanos is not presently able to implement the, ESPs' own cargo handling plan rapidly and the Puertos Mexicanos is carefully examining the past relationship between shipping agents and the unions. If the ESPs were to change the present system rapidly, this would cause some confusion in the port cargo operation. Considering each ESP's cargo operating capability and organization, the ESPs should negotiate with the shipping agents and the shippers and consignees an understanding where by they will allow the ESPs to make cargo handling plans and to control all the cargo operations in the port area. On the other hand, the ESPs should negotiate carefully with the unions and try to secure stevedore workers who will follow ESP cargo handling plans.

Considering the above, the study team recommends the following:

a. That the ESPs 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 ant by the training of planners.

   Recommendation regarding training are described later.

b. To obtain necessary cargo working documents from shipping agents and shippers and consignees with enough time prior to a ship's arrival. The required documents are stowage plan, cargo manifest, heavy lift cargo list, dimension list of bulky cargo, dangerous cargo list and booking list, etc.

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. For example, at the Port of Manzanillo, once stevedore gang members are assigned onboard, they must work through until their operations are finished with the same members. A situation where the same gang members work continuously through

two or three days should not necessarily be considered normal. Their working time must be limited to at least one day (24 hours) and new gang members should be assigned to the next day's shift.

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.

The following are the recommended ways of training:

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 planner at each port. It will take time but effective learning about local circumstances such as human relationships with union staff members and other special local conditions.

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

For the sake of implementing better 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. The study team shows a samplde of a standard supervisor's manual in the Annex 7.1.

(2) Low Productivity of Container Loading/Unloading

1) Desirable container productivity

The container handling productivity observed at the site survey of the objective six ports is as follows:
(Handling data were obtained from TMM semi-container ships).

Table 8.1.1 Container Handling Productivity

Name of Port	Container/Hr/Ship	Container/Hr/Gang
Salina Cruz	42	12(18)
Lazaro Cardenas	33	9(15)
Manzanillo	16	8
Mazatlan	---	--
Guaymas	22	11
Ensenada	16	8
Yokohama	61	16 (29)

Note: ( ) shows the number of containers handled by gantry cranes.

The container handling productivities in the objective six ports are not at a high level compared with the results involving the same type of vessels calling at Japanese ports. Fundamentally, the containers should be carried by a full container ship because a full container ship's is fully mechanized and so has high productivity. However, the small volume of containerized cargo at the objective six ports does not allow full container ships to call, which results in low productivity of container handling. The reason why productivity is low at present referred to in Chapter 3 of this report.

The final productivity target is expected to be as follows:

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

2) The principal measures by Mexican side

The opinions of Mexican side are as follows:

a. To increase the amount of container handling equipment.
b. The present container handling plan and supervision for stevedore workers depend on a shipping agent, but in the future they will be managed by each ESP.

3) 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. Standard export and import container flows are shown in Appendix 8.2. Also, the container terminal operating staff's business manual is shown in the Appendix 7.3.

4) Recommendations by the study team

a. Container terminal operation manual

It would be useful to study standard container terminal operation and to compare it with the present container operation at each port on the Pacific coast. In order to understand container terminal operation, a container terminal operation manual is necessary, a sample of which is shown in Appendix 8.3.

b. Use of easy container handling slings and lashing/unlashing tools

In order to reduce container lashing/unlashing time, easy handling container sling and lashing tools should be prepared by each ESP. At present, it takes too much time unlash lashing rods and turn buckles, because of a shortage of lashing/unlashing tools in the ship's gear store.

The ESPs prepare a sufficient number of tools, then as soon as a container ship arrives, laborers can start unlashing work with sufficient numbers of unlashers.

c. Yard tractor chassis control

In some ports, it has been observed that the tractor driver is waiting in a distant position even when a container is unloading due to a lack of proper instruction by the yard supervisor. In order to prevent such waiting loss time, it is necessary that proper and timely instructions be provided by the yard supervisor or the shore side workers' leader.

d. Training of crane operator and signal man

To upgrade a crane operator's skill, training in accurate response to hand signals is required. Since a container is a bit box, sometimes hand signals cannot be seen by the crane operator because the signal man is improperly located. Hand signals should be standardized in order to avoid misunderstanding among the ports.

e. Preventions of container swing motion on trailer

i. Sufficient coordination between crane operators and signal men.

ii. The swing preventing rope should be fixed on each corner of the

container (at least two diagonal corners).

iii. A proper and timely signal should be given to a tractor driver to adjust a trailer's halt position.

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 recommendations particular to the bulk (dry) cargoes are here commented on.

1) Cargo handling planning

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

b. The study team, therefore, recommends that each ESP should plan bulk cargo handling operation of ESP's accord same as those of the containers and the other general cargos.

2) Handling and storage losses

a. The improvement of rough handling operations, typified by spillage from grab-buckets, would contribute to the increased reliability of port operations.

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

c. Good coordination between crane operators and bucket-rope handlers is necessary in order to prevent rough handling operations. The bulk cargo handling machinery should also be in good condition through adequate maintenance.

3) Contamination

a. This is the most disgusting depreciation in merchandise value caused by the intermixture of foreign substances during handling. It hampers the reliability of part operations.

b. The study team, therefore, recommends that each ESP take a prudent attitude toward bulk cargo handling.

c. Cleaning up the machines and equipment for bulk cargo handling is necessary in order to avoid contamination. Canvas sheets and other materials should be provided properly same as above mentioned reasons. The morale and skill of workers should be upgraded for the above mentioned reasons.

(4) Necessity of Training Workers

1) Present situation

The training of workers and ESP personnel in Mexico is being enthusiastically planned and implemented by governmental organizations and Puertos Mexicanos. Mexico has been appointed as a port operation training center for Central and South American countries by the United Nations (UNCTAD). Puertos Mexicanos has UNCTAD textbooks and instructors who can teach personnel from other countries.

In addition, in July 1989, Puertos Mexicanos opened a new training system for port workers, including a new incentive system. Workers who join this training course will be paid 16,000 pesos per day by each ESP. This system might cause non-union workers to lose a chance to gain port operation training, because candidates are to be agreed on by the unions and union members will receive preference.

2) Recommendations by the study team

In an effective training system, the result of training should reflect increased operating productivity by measures such as raised wages.

a. In order to increase cargo handling productivity, it is necessary to train workers in gang units. The key gang members should be recognized as such and daily work should be carried out based on a consistent team formation.

If this causes difference in capability by gang, the compositions of gangs can be changed once a year.

b. Training should be available to all port workers.
There are some non-union workers who do not work so often for the port. It is desirable that training should be carried out for union members those non-union members referred to as constant workers.

c. It is very important to teach all the workers about basic safety.
The port has a high risk of worker injuries because there are so many unskilled workers engaged in its operations. For example, in all six ports, not even safety helmets or safety shoes for workers were used. No damage to workers and cargoes makes for better cargo handling productivity.

8.1.9 Cargo Handling Facilities/Equipment and Maintenance System

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

To handle cargoes efficiently and economically, the most suitable handling system shall be described below:

1) Optimum possession level of cargo handling facilities/equipment

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

The possession required will lead to raising the operational rates of cargo handling facilities/equipment which will in turn make port operations more economical. To this end, it is recommended that the following steps should be taken:

i. To attempt to increase the actual operating days (hours) of cargo handling facility/equipment by allocating them for work other than their original purpose to such an extent that their substitution will not slow down or interfere with overall port operations.

ii. To attempt to increase the actual operating days (hours) of cargo handling facilities or equipment by renting or leasing the

same units for work outside the port as long as this does not impede the main business of the ESP.

As the next step, a "possession level" numerical index is required to assess whether the present combination of equipment is adequate or not in terms of the optimum cargo handling capacity of the port. The possession level of cargo handling facilities/equipment (which indicates that the number of existing cargo handling facilities and equipment is sufficient or insufficient) can be evaluated to a certain extent with such an index as "VALUE A".

"VALUE A" is drawn by dividing the annual operating days (hours) by the annual available days (hours) of each unit of equipment. Below are the recommendations proposed by the study team:

The ESPs should formulate a possession plan every year by using the past year's estimated "VALUE A" in future. (The "VALUE A" for 1988 has been estimated and tabulated in the Progress Report.

A reasonable way of increasing the "VALUE A" results from the combination of the following three items:

i. Postponement of the purchase plan
ii. Observance of earlier disposal
iii. Leasing to other ports

Decreasing "VALUE A", on the contrary is achieved by a combination of the following three items:

i. Carrying out purchases earlier
ii. Postponement of the disposal plan
iii. Leasing from other ports

2) Adequate stock of spare facilities

ESP should stock spare facilities of cargo handling facilities/ equipment in addition to the net amount of required facilities, giving due consideration to the number of days required for repair, except for the following special cases:

If the following conditions are fulfilled, spare facilities will not be necessary:

i. The number of facilities possessed is few (one to three units), and further, their purchase price is high.

ii. Annual operating days (hours) are so short that preventive maintenance is possible during the intervals of operations.

If spare facilities are not possessed, it is essential to carry out the enough preventive maintenance in order to reduce the number of interruptions in cargo handling work caused by break-down of the equipment and to minimize the number of days required for corrective maintenance. Moreover, preventive maintenance should be carried out so as not to interfere with cargo handling operations.

The following are the recommendations by the study team:

The ratio of non-operational days for cargo handling equipment has been set at 25% by as a guideline by Puertos Mexicanos. This ratio, hereinafter, is defined as "VALUE B".

$$\text{VALUE B} = \frac{\text{Preventive Maintenance (days)} + \text{Corrective Maintenance (days)}}{\text{365 days}}$$

The figure 0.25 (25%) is the ratio of non-operational days due to preventive and corrective maintenance against 365 days per year.

The simple average of the "VALUE B" of all the ports of ESP was 17% in 1988 though it must be kept in mind that there exist difficulties in obtaining the average for each type of equipment due to the great differences in sizes and kinds of equipment.

Meanwhile, it is generally accepted that the ratio of spare facilities/equipment is taken as 10% of the required net amount of facilities. As such, it is recommended that, based on the following 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.

i. In this country, it is understood that the frequency of the breakdown of handling equipment is higher than in other countries.

ii. Poor storage conditions of spare parts and frequent delays in delivering the necessary parts are common.

(2) Preparation of the replacement/Disposal Plan

The ESPs should prepare a cargo handling facilities/equipment possession plan (refer to 8.1.9 (1) to meet the estimated cargo volume in each fiscal year.

This plan will be composed of the following two plans:

i. Procurement plan for cargo handling facilities/equipment.
ii. Replacement or disposal plan for cargo handling facilities/equipment.

It can be understood that the lack of replacement or disposal plans owes to the fact that budgeting has not been conducted yet.

The replacement and disposal plan not only connects with the procurement plan, but also has an important role from the following viewpoint. For efficient, stable and safe cargo handling operations, cargo handling facilities/equipment must always be kept in satisfactory condition, keeping in mind lifespans such as economical service life, regulation service life and service life from the aspect of parts procurement.

1) Economical service life

One of the methods to determine economical service life is shown in Fig.8.1.1, where the horizontal axis stands for actual operating total hours and the initial and repair costs.

The average equipment cost per hour ("VALUE C") is expressed as c = y/x. For example, at point A, Xa is the actual operating hours of the equipment since its purchase and Ya is the sum of the initial cost and repair cost spent until XA hours, and the average equipment cost Ca per average actual operating hour is expressed as Ca = Ya/Xa.

As is clear from Fig.8.1.1, the figure Y (sum of initial cost and repair cost)divided by figure X (sum of operating hours) is at its smallest when the tanget line of (initial cost + repair cost) passes the origin.
In the Fig.8.1.1 the point which makes the "VALUE C" smallest is the Point M, and at this point, the average equipment cost Cm is described as follows:

$$Cm = Ym/Xm$$

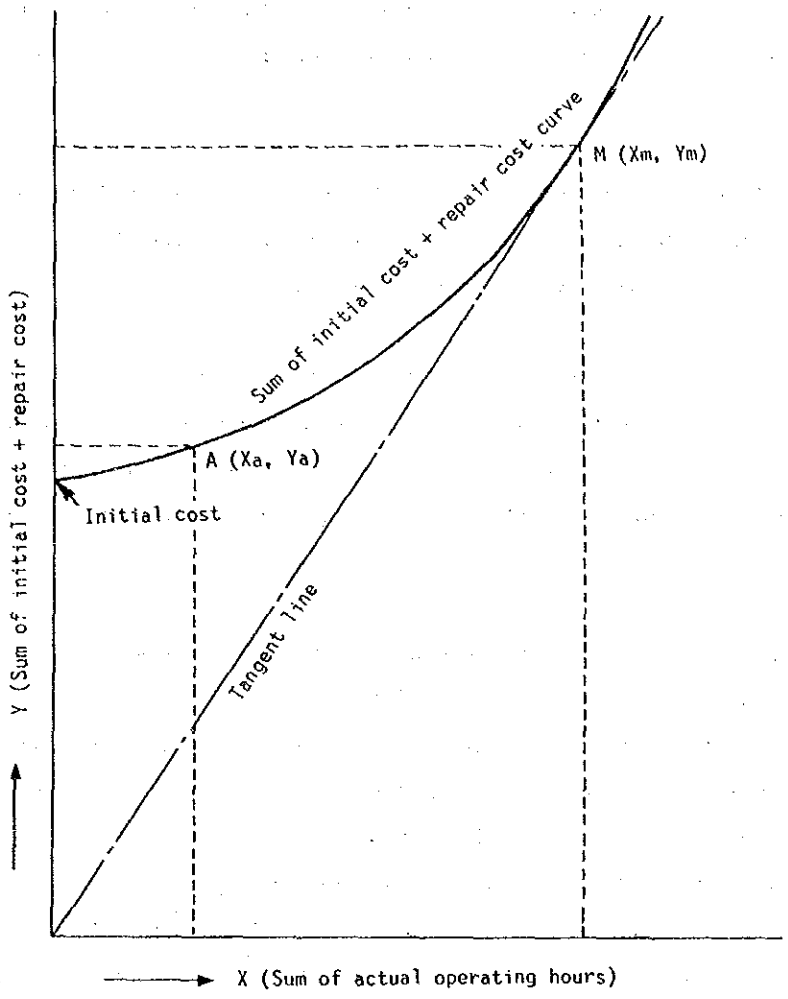


Fig. 8.1.1 Economical Service Life

Here Xm is called the economical service life of equipment. Therefore, replacing equipment at point M is the most desirable solution.

The calculations and figures presented so far have been made without considering the remaining value of durability and the interest and fluctuations of the currencies concerned. But in the actual stage of determining the economical service life, it is preferable to put the actual remaining value of durability, market interests and the actual currencies' fluctuation rate into consideration.

Regarding economical service life, the following two factors are recommended by the study team:

In order to determine the economical service life, the ESPs should keep the following records for each equipment:

i. Actual operating hours
ii. Actual repair costs (cost of parts for preventive and corrective maintenance, and personnel expenses required in the maintenance shop and outside contract costs).

2) Regulation service life and economical service life

The most ideal condition is that the regulation service life is equal to the economical service life, though such cases rarely occur. The time difference between the two lifespans is apt to widen more in the following cases:

i. When the annual operating hours are extremely longer or shorter than the generally assumed hours.
ii. When the purchase cost and repair cost are not balanced. This occurs particularly when the purchase price is high, due to the high tax imposed on imports.
iii. Repair cost is mostly composed of parts costs and personnel expenses. When the ratio of the two lifespans deviates enormously from the time, the regulation service life has been determined due to price on wages rises.

3) Service life from the aspect of parts procurement

Though the life of equipment is within the regulation service life and has not exceeded the economic service life, possession of equipment is sometimes difficult due to the shortage of spare parts.

This is especially true for equipment whose operating rate is small but which cannot be abandoned because of their special uses.

The following are recommendations by the study team:
The ESPs should make a replacement or disposal plan, taking into consideration the following three factors of the cargo handling facilities/equipment: regulation service life, economical service life and service life from the aspect of parts procurement.

(3) Establishment of Effective Maintenance System

In order to keep each handling facility/equipment in a condition of safety and to make the most of its original function display, maintenance(checking and repair) is indispensable. It can be roughly divided into two categories.

i. Preventive maintenance
ii. Corrective maintenance

Preventive maintenance is to check and repair before the equipment breaks down or its function deteriorates, and to avoid breakdowns and ensure its original function.

On the other hand, corrective maintenance is a passive form of maintenance which restores the original function of the equipment by carrying out repairs after the trouble.

1) Need for preventive maintenance

In order to handle cargo economically, cargo handling facilities/ equipment must be used economically, following these basic concepts:

i. To ensure the high operating availability ratio (refer to VALUE B).
ii. To ensure preventive maintenance costs and corrective maintenance costs are kept to a minimum.

- Operating availability ratio B (VALUE B) is determined by the sum of preventive maintenance days and corrective maintenance days.
- Number of corrective maintenance (number of break-downs x number of days required for repair) depends on the quality of preventive maintenance.
- Corrective maintenance cost (number of break-downs x required cost) depends on the quality of preventive maintenance cost.

2) Ratio of preventive maintenance and corrective maintenance

Optimum preventive maintenance quality can be achieved by minimizing the sum of preventive maintenance and corrective maintenance costs. However, as mentioned above, as the corrective maintenance cost depends on

the preventive maintenance cost, the sum of the cost is determined by the preventive maintenance cost.

Therefore, either the best preventive maintenance level or its cost shall be found and the maintenance should be carried out accordingly. One way to determine the optimum preventive maintenance cost is shown in Fig. 8.1.2, as a reference.

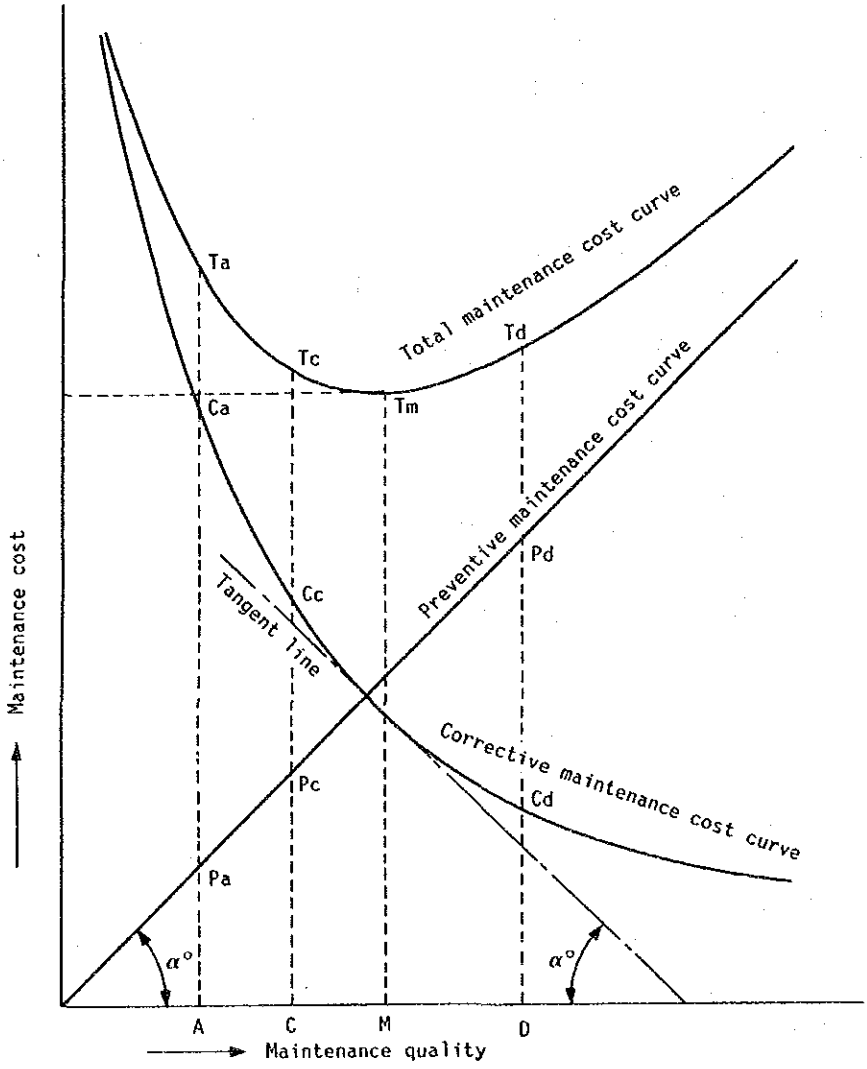


Fig. 8.1.2 Optimum Preventive maintenance Cost

In order to simplify the calculation, it as assumed that the number of days necessary for maintenance and the cost are proportional, and maintenance costs per day for preventive maintenance and corrective maintenance are equal.

When the preventive maintenance level is at A on the chart, the preventive maintenance cost is Pa, the corrective maintenance cost is Ca and the total (Pa + Ca) becomes Ta. Tc and Tm, the sums of costs are drawn for maintenance levels C and M, respectively.

As can be seen from the chart, when the angel (α°)of the tangent line of the corrective maintenance cost curve is the same angle (α°)of the preventive maintenance cost curve, the minimum total repair cost will be determined, the maintenance quality is at M and the total maintenance cost is Tm.

The preventive maintenance and corrective maintenance cost curves in the chart are peculiar to each type of equipment, and have to be based on data from actual results.

Therefore, as the study team has recommended in (2) 1), it is necessary to keep the records of repair costs of each piece of equipment from this aspect, too. At present, the number of days necessary for optimal preventive maintenance cannot be determined in the ports without the past data of maintenance.

The following is recommended by the study team:

Ports with past records should carry out the optimum preventive maintenance by getting the necessary days from the cost curve in Fig. 8.2.2.

Ports without past data should start collecting actual data and meanwhile carry out the maintenance in such a way that the total preventive maintenance days of the year are nearly half the total corrective days of the previous years.

The minimization of total maintenance in such a way that the total preventive maintenance days of the year are nearly half the total corrective days of the previous years.

The minimization of total maintenance costs plus decreasing the corrective maintenance days serves not only to decrease the total maintenance cost, but also to decrease losses caused by a sudden pause in the cargo handling operations due to equipment trouble.

3) Maintenance days (target figure for the total days of preventive maintenance days and corrective maintenance days).

In the previous clause, the ratio of the number of preventive maintenance days and the number of corrective maintenance days were

mentioned. In this clause, the sum of both numbers is presented.

The number of simple overall maintenance days in six ports averages 17%. Some ports have simple averages of more than 30%. Since there is specific data now, the number of corrective maintenance days is assumed to be more than that of preventive maintenance days.

The following is recommended by the study team.

It is preferable to determine each maintenance day and contents of maintenance so that the target figure of the number of total maintenance days should be lass than 55 days (365 x 0.15).

In the case of a large piece of equipment not having enough spare facilities,, sufficient preventive maintenance should be carried out during the idle time of cargo operations, without any concern over the above days, economical preventive maintenance days and corrective maintenance days.

4) Intervals of preventive maintenance

As cargo handling equipment is composed of an enormous number of parts, it is impossible to carry out individual preventive maintenance based on their necessary lifespans or intervals at which they have to be checked. Therefore, it is more rational to carry out preventive maintenance by grouping together the parts or portions of equipment.

The grouping shall be mode not according to the used time, but by each actual operating hour.

For example, when they are divided into 100 hours group, 500 hours group and 1000 hours group, they are called 100 hours maintenance, 500 hours maintenance and 100 hours maintenance, respectively. In the case of 100 hours maintenance, maintenance is done only once every 100 hours, and in case of 500 hours maintenance, the maintenance is done only once every 500 hours. When carrying out the simple 100 hours maintenance, there will be no problem if the lifespan of parts is 100 hours, more or less, or if the checking interval is 100 hours.

On the other hand, for parts whose lifespan or checking interval is 500 hours, 100 hours maintenance will be sufficient, although that may seem like over-maintenance and over-payment.

If a simple maintenance system for every 500 hours is adopted, then the checking for the parts with 100 hours life span or with 100 hours checking interval will be neglected totally, and this will also lead to trouble, shortening of the lifespan or increasing the total repair cost.

The interval in a preventive maintenance in order to change parts or to check is recommended as follows:

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

5) Unit of the combinations for carrying out preventive maintenance

Logically, the interval should be based on actual operating hours, but there is another way of carrying out preventive maintenance without giving concern for the actual operating results.

This way is to carry out preventive maintenance in a set period of time by making an assumption regarding actual operating hours within a certain limited period of time, based on the actual data of the past, and by determining what will be checked and repaired in advance.

This is so-called weekly, monthly or yearly maintenance.

This has the advantage that the repair plan is easier to make, and that the amount of idle time will decrease because the maintenance shops can handle the preventive maintenance in a regular fashion.

The following is recommended by the study team:

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 not carried out preventive maintenance to data or for those that have only been using a simple maintenance system.

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.

6) Preventive maintenance manual

In order to put preventive maintenance into practice accurately and promptly, manuals for preventive maintenance are essential. Generally, manuals for preventive maintenance are included in the brochures furnished by makers, which are usually supplemented by various paper and reports concerned with tests and inspections, etc.

This general manual tends to only mention general cases. To promote more reasonable preventive maintenance, it is recommended that the ESPs produce an original manual by improving on the makers' general manuals. The revised version should be made based on actual local data concerning

maintenance, such as the contents of work, weather conditions, peculiarities of equipment operators and workers at maintenance shop. etc.

(4) Need to Upgrade the Maintenance Ship

Puertos Mexicanos recommends that every ESP operate a maintenance shop to carry out maintenance smoothly and economically.

Before the maintenance shop itself is taken into consideration, in the first place there must be a firm idea what kind of jobs should be done in maintenance shops and also what results should be expected therefrom.

ESP policy as far as the above is concerned will be as follows*

The main work of a maintenance shop is to carry out preventive maintenance on facilities/equipment possessed by the ESP.

In addition, a maintenance shop also carries out corrective maintenance according to its abilities.

Corrective maintenance beyond the capacity of the maintenance shop will be assigned outside, giving due consideration to the following:

i. General repairs (preventive maintenance) are more smoothly and cheaply carried out by maintenance shops by outside contractors.
ii. Complicated and special repairs can be assigned outside.

At present, the size of a facility, its capability, and the technical quality of the maintenance shop differ greatly at each port and much greater differences in quality and quantity of the cargo handling facilities/equipment also exist. The maintenance shops are divided into three groups.

Class A - Posses the minimum necessary facilities for the replacement of parts and dissolving works in checking for preventive maintenance.

Class B - In addition to the above, posses necessary facilities for fabrication and processing of simple parts, and producing simple cargo handling equipment such as chutes, hoppers, grab buckets, etc.

Class C - Posses facilities capable of handling work between Class and Class B.

The facilities possessed by each class will be as follows:

Class A:
i. Dissolving and assembling tools.
ii. Measuring tools.
iii. Rust removers, painting tools (brushes, rollers).
iv. Compressor, battery charger, gas cutting and welding set.

Class B:
i. All types of dissolving and assembling tools.
ii. Measuring tools.
iii. Rust removers, painting tools (brushes, rollers, sprays).
vi. Handling machines (chain-blocks, hydraulic-jacks, vises)
v. Machinery (compressor, battery charger, gas cutting and welding sets, electric welding machine, drilling machine (table type), grinder, steam cleaner, lathe (small universal type), hacksaw, centering surface plate).

Class C: Facilities from Class a minus unnecessary facilities from Class B.

Each ESP should determine the category of its own maintenance shops by taking the following factors into consideration: quality and quantity of cargo handling facilities/equipment, the present size and capacity of maintenance shops and repair capability of the outside repair factories.

(5) Stocking of the Appropriate Spare Parts

To possess a sufficient amount of parts is necessary for reducing the maintenance period, but possessing too many spare parts is not a preferable measure because of the resulting heavy financially burden.

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. The demerits, on the other hand, are as follows:

i. Burden of interest.
ii. Inventory control costs.
iii. Losses caused by deterioration of quality attendant on long-term inventory.

Therefore, the appropriate amount of spare parts is determined by the

time loss caused by non-working hours of equipment, the interval of parts required, term of delivery and unit costs.

The following steps are recommended by the study team:

The ESPs should keep the following records for each spare part:

i. For parts delivered out of the storehouse: purchase date, date of use, purchase price, equipment requiring the part and type of maintenance (preventive or corrective).

ii. For parts newly purchased: required term of delivery, data of use, purchase price, equipment requiring the part and type of maintenance.

As a matter of fact, spare parts for both preventive and corrective maintenance will be kept together, and will be used without distinguishing preventive maintenance from corrective maintenance. However, it will be easier to separate them when determining the appropriate amount of parts. The appropriate amount, in principle, is determined by analysing the past data. If the data is not enough, the following methods can be taken as a temporary:

1) Spare parts for preventive maintenance

The amount of spare parts for preventive maintenance is predictable and is determined by the following factors: 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.

2) Spare parts for corrective maintenance

Just as it is hard to predict which part of the equipment will break-down, it is hard to predict which spare parts are needed for corrective maintenance.

When a fault occurs, it is quite natural to make use of the parts originally prepared for preventive maintenance to return equipment to operational condition.

Spare parts for corrective maintenance have some differences from those for preventive maintenance, and the possession of spare parts for corrective maintenance is indispensable.

The following table shows the amount of spare parts needed for this

purpose. Spare parts with a ratio less than that shown in the Table should be possessed by the ESP.

Table 8.1.2 Necessary Amount of Spare Parts for Corrective Maintenance

Frequency of use in last three years	Required term of delivery	The ratio of the price of the parts to the price of equipment.
1 - 3 times	More than 3 month	Possess one that is below 2.5%
1 - 3 times	More than 1 month - less than 3 months	Possess one that is below 0.8 %
4 - 6 times	More than 3 months	Possess one that is below 5.0%
4 - 6 times	More than 1 month - less than 3 months	Posses one that is below 1.6%
More than 6 times	More than 3 months	Possess all disregarding the price
More than 6 times	More than 1 month - less 3 months	Possess one that is below 5.0%

The methods used to determine the amount of spare parts described above in 1) and 2) are just for provisional use until the data of the last 3 years is compiled.

The following step is recommended by the study team:

The accumulated three years data shall be analyzed and then the formula to determine the most appropriate amount of the possession of spare parts shall be established for actual use.

3) Management of spare parts

These days, the number and types of spare parts have increased, and their names differ depending on the manufactures, even though their functions and sizes may be the same.

Inevitably, the management business (purchase, inventory, taking out of storage and using) has become complicated.

In addition to the above various matters, the following administrative problems tend to occur:

i. Negligence in finding the necessary spare parts causes delay in adequate maintenance timing and consequently under parts will be left in the warehouse for a long time.

ii. Spare parts with the same function and size but with more than two names are stocked at different places, thus causing duplication.

iii. The difference between the registered parts and those actually stocked becomes notable, and so a large number of parts are always lacking and the necessary parts must be purchased whenever trouble occurs.

Therefore, management of spare parts is as important as their possession. To this end, the following procedures are recommended:

a. Numbering and categorizing spare parts

As a first step, numbering the spare parts according to their function and equipment should be carried out to make categorizing easier. As a next step it is preferable that common parts - bolts, nuts, washers, bearings, oil rings, oil seals, springs, packings, etc.- have separate numbers to avoid duplication.

Duplicated possession of parts must be avoided as much as possible, recognizing that there are such parts with the same function and size but different names because of different manufactures. As for the numbering, puertos Mexicanos should tell the ESPs to make common numbers for the same parts possessed by each ESP under system of coordination among the ports.

This system not only makes for easy accommodation of the parts between the ESP ports, but also makes it easier for Puertos Mexicanos or other ESPs to procure the necessary parts.

b. Adoption of a card system and introduction of small capacity computers

Management of spare parts is really complicated, but is recognized as the sum of simple but tedious tasks where high-level decisions are unnecessary. As such, the introduction of a computer system with a small capacity is recommended.

The output from a computer will include, but not be limited to:

i. The whole list of inventories and their actual usage (including price).

ii. List of inventories by parts, by name of equipment, by the purpose of purchase, by nature of maintenance, by unit price, by the required term of delivery, and the actual results of the in use.

iii. List of inventories by the time of purchase, by the inventory period.

iv. Actual result of use by period of usage.

v. Actual results by frequency of use.

vi. Others

First, a card system should be adopted for the computerization of 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 and so provide a basis leading to introduction of a small capacity computer.

The minimum items for the input of cards will include:

i. Names of parts

ii. Their numbers

iii. Names of equipment (those in common use shall be categorized as such)

iv. Unit price

v. Purpose of purchase (for preventive maintenance or corrective maintenance)

vi. Time and amount of purchase

vii. Required term of delivery

viii. Purpose of use (for preventive maintenance or corrective maintenance)

ix. Time of use and amount of parts

x. Others

(6) Urgent Treatment for Disposing Necessary Equipment

The cargo handling facilities/equipment which are neglected inside the

maintenance shops are categorized into two or three groups: Those whose procedure for disposal is completed but still left in the maintenance shop, or those whose disposal procedure has not yet been completed or not even started.

The reasons for urgent disposal of the equipment are as follows:

i. To achieve efficient utilization of the maintenance shop
ii. To prevent the sale-price-down caused by prolonged stocking
iii. To achieve effective utilization of funds received from sales
iv. Better environmental appearance

The following are recommended by the study team:

i. The ESPs should promptly sell equipment whose disposal procedure has been completed and should immediately take the equipment out of the maintenance shops.
ii. Expedite the ongoing disposal procedure.
iii. For equipment which is not in use, for which there is no plan of use, or is too superannuated to be used, but which is neglected without the disposal procedure having been carried out, the disposal procedure must be made. carried out quickly.

Some equipment can be neglected at the spot if there is no record in the inventory list.

Therefore, the disposal procedure must progress from both in terms of the inventory list and by action.

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

Determination of the appropriate amount of cargo handling facilities/ equipment, the best effective maintenance system for cargo handling facilities/equipment and for stocking the appropriate spare parts cannot easily be achieved.

Only full analysis of all the actual records and data will be able to produce a reasonable and economical system.

1) Records

The following points are recommended by the study team:

a. Records related to cargo handling facilities/equipment(those bigger than the fork lift trucks; however hoppers, chutes, grab buckets, etc. are not included). They must be recorded by day and by equipment, including the followings:

i. Date and time to be delivered to/from the handling locations.

ii. Hours of cargo handling, name of cargoes handled and place of handling operation.

b. Records related to repair (records by equipment and by repair)

i. Date and time to be delivered to/from the maintenance shop.

ii. Types of maintenance.

iii. Name and their price of the parts to be exchanged and necessary personnel expenses for repair.

iv. Same for outside order costs (when outside orders are made).

v. Name and cost of the parts to be changed outside (when outside orders are made).

c. Records related to spare parts

Refer to (5) Stocking appropriate spare parts.

There records are necessary not only to keep records, but to efficiently utilize them afterward.

Therefore, records must be kept using only standardized marks, numbers and figures, without using obscure and time-consuming sentences and phrases.

2) Disposals

The collected records of 1) shall be inputted into a small-capacity computer and stored on cassettes or floppy disks.

3) Utilization

Necessary records and data shall be taken from cassettes or floppy disks whenever necessary and will be utilized for making various types of statistics and analyses.

(8) The Role of Puertos Mexicanos

Puertos Mexicanos is the organization that guides and directs the ESPs

and is also the in largest shareholder. Each ESP depends upon Puertos Mexicanos' leadership.

Described below is Puertos Mexicanos' role as it relates to cargo handling facilities/equipment.

1) To set out the format of documents necessary for each ESP to prepare its reports in accordance with the designated submission schedule. In order to provide sufficient guidance to the ESPs, the ESPs must furnish Puertos Mexicanos with at least the following data in a common format by the end of the fiscal year:

The recommended items are as follows:

i. Estimated and actual amount of cargo by kind of cargo and by type of packing
ii. Purchase and disposal plan of cargo handling facilities/ equipment
iii. Plans for both equipment repairs and spare parts purchases
iv. A list of cargo handling facilities/equipment that are expected to be lent to others or borrowed from others
v. Plan for preventive maintenance of cargo handling equipment
vi. Actual results of the operation of cargo handling equipment according to type of equipment
vii. Actual results of purchase, disposal, loan and borrowing of cargo handling facilities/equipment
viii. Actual results of handling equipment by type of maintenance and by equipment (including the period, required days and price)
ix. Actual results of purchase and disposal of repairing equipment
x. Actual results of purchase and use of spare parts by the type of maintenance
xi. Others things that Puertos Mexicanos need

For matters other than the above, it is quite natural that Puertos Mexicanos be asked to submit plans and reports if required.

Furthermore, the report format must be standardized, otherwise, the efficient utilization of data will be hindered. The items below are the minimum data for each piece of equipment:

i. Calculation of necessary days

ii. Calculation of hours

iii. Formula for calculation of preventive and corrective maintenance costs

2) Records and statistics with adequate format for use

Puertos Mexicanos must guide the ESP in making and keeping records with common items, form, contents, and period of custody, which are necessary for the ESP, but which don't have to be presented to Puertos Mexicanos. Here the items will be omitted.

3) Arranging and training personnel in charge of cargo handling facilities/equipment (of machine and electricity)

As mentioned before, preventive maintenance is also important in mechanized cargo handling to keep the handling machinery in good condition. In order to carry out preventive and corrective maintenance appropriately, there must be some well-experienced special staff to train the workers (assemblers, welders, electricians, etc.)

Especially for large-sized equipment, the control system has grown so complicated that the techniques needed for traditional mobile cranes and fork-lift trucks are not adequate. Therefore, the ESPs must always improve the level of their expertise.

Also, as some ESPs suffer from a shortage of experienced technicians, it is necessary to train and keep more technicians to meet demand.

As there seem to be some differences in the level of expertise as well as in the way of thinking between the ESPs, a total improvement of overall technical level and exchange of information should be made vigorously through close communication of personnel between the ESPs and through occasional conferences chaired by Puertos Mexicanos.

4) Active participation of Puertos Mexicanos in the exchange of cargo handling facilities/equipment

Though the lifespan of cargo handling facilities/equipment varies depending on their sizes and the type of equipment, they usually last at least 5 to 10 years. They are not economical when used for less than these periods.

There are some cases where some equipment cannot be constantly used

due to fluctuations in cargo volume depending on cargo types. This causes inefficiency in the use of cargo handling equipment.

Equipment for handling small sized cargo (fork lift trucks, tractor shovel, etc.) can be fully utilized as mentioned in (1) - 1), but for large sized equipment designed for special use, is difficult to realize their full use.

Therefore, leasing of the cargo handling equipment is now under way among the ESPs, which seems to be a very desirable way to ensure effective use of the equipment.

Active participation by Puertos Mexicanos is quite important for further progress on this measure.

As for large sized special cargo handling equipment, Puertos Mexicanos is planning to lend them to other ESPs. This also seems a very desirable measure, because it will enable cargo handling equipment to be used more efficiently among the ports than now.

Exchange of spare parts among all the ESPs could also be managed by Puertos Mexicanos. However, the study team opposes this idea for the following reasons:

a. Considering the distance between the ports in the ESPs and traffic conditions, it would be much more rational and economical for each ESP to possess spare parts for general use on their own.
b. Obtaining spare parts for special uses, which requires a long period before delivery and which is very expensive, is not common, but rather a limited problem for the ESPs.

It is a matter of concern which can be solved by active participation by Puertos Mexicanos once a problem occurs.

5) Assistance to all ESPs

As the study team mentioned in (8), Puertos Mexicanos should be an assisting organization as well as a guiding and directing organization. Because Puertos Mexicanos is located in Mexico City, the center of information sometimes is expected to act as a branch office for the ESPs, since the ESPs do not have branch offices in the city.

It's specific activities should be as follows:

a. To offer information collected from Puertos Mexicanos to ESPs in accordance with their interests.
b. Market research at the request of the ESPs.
c. To offer information on cargo handling equipment of other ESPs and spare parts at the request of ESPs.
d. To act as an agency to purchase and supply cargo handling equipment and spare parts for ESPs at their request.
e. Supervision and inspection as a proxy at the request of ESPs.
f. Other business activities requested by ESPs.

8.1.10 Port Facilities (Except Cargo Handling Facilities/Equipment)

As mentioned in section 4.2.10 of chapter 4, many facilities at the ports are superannuated, resulting in the low efficiency of port usage and making the modernization of cargo handling operations difficult. Therefore, the rehabilitation of superannuated facilities should be carried out preferentially.

On the other hand, it is significant to construct port facilities based on the long-term master plan, which is discussed in section 8.1.1 in this chapter, from the viewpoint of fruitful and efficient investment.

The recommendations with respect to this section are as follows:

a. To promote the rehabilitation of superannuated facilities at the ports to make the best use of them.
b. To carry out construction work at 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

8.2.1 Utilization of the Port

1) Promotion for further utilization

Considering the present problems pointed out in section 4.2.1 (1), the promotion of further utilization of the port is especially significant. For this, 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.

With respect to the promotion of port utilization, please refer to section 8.1.1 of this chapter.

2) Direct unloading of containers onto trains

In the improvement plan prepared by the Mexican side, the direct unloading of containers onto trains is described. This idea should be rejected because of the reasons mentioned below.

i. A container terminal is a system aimed at providing the highest efficiency by providing specialized facilities/equipment on the wharf. Any obstacle to increased productivity must be eliminated. It is obvious that the direct unloading of containers onto trains results in significantly low productivity. Trains should not be transferred to ship side for any reason.

ii. The presence of freight cars on the wharf while unloading would be an obstacle to the smooth movement of trailers to/from the ship side.

iii. The cargo handling sequence plan would become very complicated if trains are used for direct unloading because not all unloading containers are always sent to consignees in the hinterland by using trans.

8.2.2 Port Administration and Management

(1) Improvement of Service

As for fuel supply service, PEMEX supplies fuel by barged at present. The ESP is planning to provide this service in two stages as follows:

i. To complete the oil tank construction work which is now suspended, to set up an oil pipeline from the PEMEX area that will pass under the channel and to provide oil to the public berth and the container berth.

ii. In the future, the ESP plans to provide oil to the ships outside of the port by oil barge.

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

(2) Cost Accounting of Individual Tariff

As for the recommendations, refer to section 8.1.3 of this chapter.

(3) Cargo Handling Union

The workers' wages are paid to the union by the ESP and the actual wages for each worker are equalized. This seems to cause low productivity of cargo handling by workers. The rough operating of equipment may cause high maintenance costs.

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

As for the recommendations, refer to section 8.1.4 and 8.1.5 of this chapter.

8.2.3 Procedures of Ship Entry/Exit and Customs Formalities

The entrance channel is reported to have been widened in order to make ships' entrance and departure at night possible.

But this is not actually permitted as yet. Further coordination should be done to make it possible, including carrying out the necessary countermeasures.

As for other recommendations, refer to section 8.1.6 of this chapter.

8.2.4 Land Transportation and the Storage System in the Port Area

1) The Mexican side report says that a coordinating system for land transportation is not necessary, since it is the user's responsibility. However, the coordinating system is also very significant for the port management/operation side to promote port utilization (refer to section 8.1.7).

2) The ESP is trying to study renovating one of the warehouses for agricultural storage. Installing secondary walls on the floor, like one at the Port of Mazatlan, would be appropriate.

8.2.5 Cargo Handling Operation

1) The ESP should endeavor more to realize higher productivity through a certain degree of control over container handling as described in Appendix 8.2 and 8.3.

2) The slot locations and numberings in the container yard should be clearly marked for effective control of the container handling operation.

3) The main machinery for container handling, such as the existing gantry crane and transfer cranes, should be maintained and repaired more properly, because damage to machinery causes interruptions in container handling operations, which should be carefully avoided.

4) Small size (3-5 ton) bulldozers which are used in the holds of vessels, and also grab-buckets and hoppers/chutes to handle the agricultural and mineral bulk cargoes, should be provided.

5) The portable wireless telephone system should be increased to where there is an adequate number of units to secure the cargo handling operation at this port, as the existing wireless telephones are mainly used for general management purposes.

6) The others should be referred to the relative parts in this chapter.

8.2.6 Cargo Handling Facilities/Equipment and Maintenance System

(1) Maintenance Policy and methodology

It is strongly recommended that the ESP establish its own maintenance policy, basically following the general recommendations stipulated in items 8.1.9 - (3), based on which preventive maintenance should be progressively implemented.

In the past, brokendown equipment was frequently repaired by disassembling old parts already built into other equipment due to a shortage of new spare parts.

Such a repair method should be permitted only in emergencies and should not be carried out so frequently.

As the preventive maintenance can be upgraded by the ESP's own effort without incurring large amounts of investment, it is recommended to earmark the necessary minimum budget for spare parts which will ensure smoother and less frequently interrupted cargo handling.

(2) Spare Parts

The lack of spare parts is serious at the Port of Salina Cruz. 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 one for present use be purchased in advance and always be ready for replacement.

The optimal numbers of relevant spare parts and the reasonable inventory control are referred to in the recommendations in the common items of 8.1.9 - (5).

(3) Amount of Machinery and Equipment

1) Countermeasures against the low operating rate of machinery

Pneumatic unloaders and mobile cranes are now running at a considerably low operating rate. Increased operating rates of machinery can be effected either by a natural growth in cargo volume or by decreasing the amount of equipment in operation.

It can be understood that an increase in cargo volume may be the target for the middle and long-term plan while a decrease in the amount of equipment can be obtained by curtailing new purchases and by

disposing of the equipment still in operation beyond the life of regulations and economical life or by transferring surplus equipment to other ESPs or even to other uses at the ports.

2) Countermeasures against machinery repairs

Many pneumatic unloaders and forklift trucks are now given the status of "under repair" as seen from the inventory documents. Forklift trucks could be idle due to lack of spare parts for the reason mentioned above.

For these machines, which are idle but necessary for port operations both now and in the near future, immediate repairs should be made and idle machinery should be brought back into operation as soon as possible.

On the other hand, the machinery not expected to have high operating rates judging from present and future cargo demand should be transferred to other ports or be scrapped, as proposed in the recommendations in common items 8.1.9 - (1), (2) and (5).

(4) Other

The Port of Salina Cruz has large sized cargo handling equipment such as gantry crane, transfer cranes, etc., which require high levels of technology and skill in terms of both operation and maintenance. In order to keep these equipment in good operations, the upgrading of engineers and operators is highly important. The definitive details are mentioned in the recommendations in common items 8.1.9 - (8).

8.2.7 Port Facilities (except cargo handling facilities/equipment)

1) Countermeasures for strong winds effects

As for countermeasures against strong local winds, the ESP has a plan to replace the asbestos roofs with galvanised steel sheeting at the bonded warehouses (see 22-24 in Fig. 3.3.1) and to install new lighting poles on the counter yard. Strong winds should be fully taken into account in designing and constructing port facilities, including the above damaged facilities.

2) Levelling of the bonded berth apron

It is recommended, as the ESP has planned, to repair the pavement of the bonded berth apron (see 2 in Fig. 3.3.1) for safe traffic and smooth cargo handling.

3) Construction of parking yard for trailers and trucks

Trailers and trucks at present frequently park on the streets leading to the port gates. It is necessary to provide parking areas in some adequate place, most likely within the now idle bonded yard on a temporary basis or in a newly built parking lot closets to the port area. Utilization of the container yard as a temporary parking area also needs to be studied.

4) Others

As a whole, other construction/rehabilitation plans mentioned in the Mexican side's report seem to be adequate except for a few comments. The improvement of the control tower located in the container yard should be kept to a minimum level in view of its low priority.

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

8.3.1 Utilization of the Port

The unused area behind the general cargo berths and its neighborhood should be deliberately utilized in accordance with the master plan based on the future demand forecast.

8.3.2 Port Administration and Management

(1) Improvement of Service

a. Fuel supply services are now carried out on the PEMEX berth by shifting ships. The ships must wait for this service when the PEMEX berths are crowded.
   There is an extra pipe from PEMEX to FERTIMEX which runs under the bottom of channel. The ESP has a plan to use this pipe for fuel supply service and to lay a new pipe to the container or general cargo berth. The cost of this work does not seem so expensive and, therefore, a profit can be expected. This service will be effective for the quick dispatch of ships.
b. Water supply service may require a large investment at first because of the long water pipe line from the water source.
   A cost analysis will be necessary before carrying out this project.
c. Garbage collection service should be carried out from the viewpoint of keeping port environment clean.

(2) Improving Personnel Function and Number in Each Section

With many factories paying higher wages than the ESP, about 50% of the personnel in the operation department is reported to leave the ESP every year. So the ESP should examine ways of increasing the wages of personnel, considering conditions particular to the area.

(3) Cost According of Individual Tariff

As for the recommendations, refer to section 8.1.3 of this chapter.

(4) Port Finance

As for its separate offices, the ESP holds a plan to unify them in

future. The location of this unified office should be determined considering the master plan of this port.

On the other hand, communication among the ESP's offices is now carried out using tranceivers. Therefore the offices should be equipped with telephones as soon as possible, which is regarded as the minimum requirement for effective management and operation for the ESP.

(5) Cargo Handling Union

As for the present lack of union workers, the ESP negotiates with the union to add the non-associated worker to the union. Taking the tendency of increasing cargo volume into consideration, this proposal may be approved.

In this regard, 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.

(6) Statistics

As for the recommendations, refer to section 8.1.5 of this chapter.

8.3.3 Procedures of Ship Entry/Exit and Customs Formalities

As for the recommendations, refer to section 8.1.6 of this chapter.

8.3.4 Land Transportation and the Storage System in the Port Area

1) A road system, including a new highway, connecting Lazaro Cardenas with the Federal District should be developed. As an urgent measure, the improvement of the roads between Lazaro Cardenas and Acapulco is considered necessary. These measures should be coordinated among the SCT and other related governmental organizations.

2) 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, because the railways are expected to play a significant role for this port in the land transportation of seaborne cargoes, considering the unfavorable road conditions mentioned in section 4.3.4 in Chapter 4.

3) Repairs to the silo damaged by the earthquake in 1985 should be completed as soon as possible.

4) The coordination of land transportation will become more and more important in accordance with the increase in container handling and the commencement of the grain silo operation. As for the recommendations on the coordination, refer to section 8.1.7 of this chapter.

8.3.5 Cargo Handling Operation

1) The slot locations and numbering s in the container yard should be clearly marked for more effective control of the container yard.

2) A container terminal manual, which is described in Appendices 8.2 and 8.3, should be prepared considering the increasing volume of containerized cargo at the port.

3) A shift system should be studied in order to improve productivity which is kept low at present due to a gang shortage. As for the recommendations, refer to section 8.1.8 of this chapter.

4) The other operations should be referred to in the relative parts of this chapter.

8.3.6 Cargo Handling Facilities/Equipment and Maintenance System.

(1) Maintenance Policy and Methodology

All the improvement plans now under consideration are essential, but it is recommended that priority should be given, among other things, to preventive maintenance.

The repair of equipment during the stand-by period between their operating times, as proposed in the mexican side report, would e an effective approach, especially for such equipment as gantry cranes, transfer cranes, etc.. However, for large numbers of general types of machinery, periodical preventive maintenance is much more reasonable and useful.

More details of practicing the improvement plan are referred to the

recommendation in common item 8.1.9 - (3).

(2) Improvement of the Maintenance Workshop

In the Port of Lazaro Cardenas, the transfer of old equipment and construction of the new workshop have been almost completed. Arranging the necessary the necessary machines in the workshop is now under way. All the relevant improvement plans other than those above should be implemented as referred to the recommendations in common items 8.1.9 - (4).

(3) Spare Parts

Improvement plans concerning spare parts should be worked out, referring to the recommendations in common items 8.1.9 - (5).

(4) Amount of Machinery and Equipment

1) Counter measures against low operating rates of machinery
Mobile cranes are now operating at a remarkably low operating rate. Because an increase in the operating rate of the mobile cranes is not expected, positive steps would include decreasing their numbers by disposing of old inefficient ones or transferring them to other ports or users outside the port.

2) The purchase plan for container handling equipment, as cited in the Mexican side's report, is a preferable approach in improving the container handling operation in the Port of Lazaro Cardenas.
In light of the high initial and operating costs for container handling equipment, the procurement plan must be implemented with a careful and thorough investigation into the financial aspect and future prospect of containerization at the Port.

3) Replacement or disposal of old machinery such as forklifts, trucks and trailers must be put into effect, as referred to in the recommendations in common items 8.1.9 (2).

8.3.7 Port Facilities (except cargo handling facilities/equipment)

(1) Rehabilitation of Aprons and Yards

The Mexican side's report mentions the necessity of the rehabilitation of the pavement and railways levelling in the yards of the general cargo berth (see 3 in Fig. 3.4.1).

The proposed plan should be carried out, judging from the present situation.

(2) Partial Opening of the CFS

As for the CFS (see 20 in Fig. 3.4.1), the ESP's plan is limited to installing roofs on the CFS building and repairing the cracks in the yard pavement. It is preferable to utilize part of the unused CFS as far as is practical. To this end, it is recommended that walls and partitions be installed in some sections of the CFS and to allow container stacking on a provisional basis.

(3) Access to the Port

At present, access to the port area is provided through the SICARTSA berths (see 4 in Fig. 3.4.1).

Considering the security of the bonded area and the risk of hampering cargo handling operations, a new access road, as proposed in the Mexican report, should be constructed along the coast in consideration of the following key point: coordination with the Master Plan and protection of the coast from Playa Jardin to Espigon de Burras.

(4) New Parking Area for Trailers

Trailers now have no other choice but to be parked on the road near the general cargo berth due to the absence of a designated parking lot. It is recommended that a parking area be provided within the port area in such a manner as to observe the land-use plan set out in the Master-Plan.

(5) Others

Other construction/rehabilitation plans described in the Mexican side's report seem to be adequate on the whole.

It is generally recommended that the development plan should be made on a long-term basis so that the Port of Lazaro Cardenas may be able to accumulate more cargoes in future, including container cargoes.

8.4 Recommendations on the Improvement Plan of the Port of Manzanillo

8.4.1 Utilization of the Port

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

The site of the container wharf should be examined considering the future development of the port.

8.4.2 Port Administration and Management

(1) Improving the Functions and Number of Personnel at Each Port

The ESP has reconstructed its administrative structure and introduced a new service section named Related Services and Risk Reduction. This section may contribute to ensure safety in cargo handling.

(2) Cost Accounting of Individual Tariff

As for the recommendations, refer to section 8.1.3 of this chapter.

(3) Cargo Handling Union

As for the recommendations, refer to section 8.1.4 of this chapter.

(4) Statistics

As for the recommendations, refer to section 8.1.5 of this chapter.

8.4.3 Procedures of Ship Entry/Exit and Customs Formalities

As for the recommendations, refer to section 8.1.6 of this chapter.

8.4.4 Land Transportation and the Storage System in the Port Area

a. With regard to the shortage of storage facilities, the following measures will be necessary:

i. To construct an exclusive container wharf which will ease the congestion of cargoes in the existing storage area.

ii. To reclaim and utilize the area behind berths Nos. 7 - No. 9.

iii. To construct a warehouse for the discharged agricultural bulk

mentioned below.

iv. To examine more efficient utilization of the storage area behind berths Nos. 4 - No. 6. For this,it is considered necessary too introduce a road system by constructing a new road or by limiting truck and trailer usage to the side of this area.

b. As for the storage of discharged agricultural bulk, a project is being examined which would give permission to a private firm to construct and operate an exclusive warehouse for agricultural bulk cargo with an overall system of cargo handling.
This project suits the governmental policy of encouraging private investments in ports and is considered a way of settling problems with agricultural bulk cargo storage.
In the future, it would be desirable to install an exclusive silo berth with a deeper depth for large bulk carriers considering the increase of discharged agricultural bulk cargo at the port (refer to section 5.6.2 of Chapter 5).

c. The coordination of land transportation will become more important with the increase of containerized cargo volume at the port. As for the recommendations regarding this cooperation, refer to section 8.1.7 of this chapter.

8.4.5 Cargo Handling Operation

a. A shift system should be introduced to improve the present situation at this port especially. A shift system for stevedoring gangs is really necessary because of the reasons mentioned below:

i. To obtain higher productivity in cargo handling operations.
ii. To maintain cargo handling workers' health.
iii. To secure safety and to prevent accidents involving workers and damage to cargo.

For realizing the shift system, it recommended that key gang members be fixed, as mentioned in section 8.1.8 of this chapter. The necessary negotiations with the union should be carried out to

introduce the shift system.

b. Small size (3-5 ton) bulldozers to be used in the holds of vessels should be provided in order to improve bulk cargo handling, and also, the grab buckets should be properly maintained so as not to cause a large amount of bulk cargo spillage.

c. The slot locations and numberings in the container yard should be clearly marked, and a manual should be prepared in order to improve productivity and facilitate container handling operations.

d. The others should be referred to the relative parts in this chapter.

8.4.6 Cargo Handling Facilities/Equipment and Maintenance System

(1) Maintenance Policy and Methodology

Periodical preventive maintenance based on the operating hours has been satisfactorily conducted at the Port of Manzanillo, resulting in good maintenance conditions.

For further effective preventive and corrective maintenance, refer to the recommendations in common items 8.1.9 - (3).

(2) Improvement of the Maintenance Workshop

Expansion of the workshop is now under way. The necessary machines in the workshop should be prepared referring to the recommendations in common items 8.1.9 - (4).

(3) Spare Parts

The management of spare parts has been carried out by means of a card system and seems to have produced good results.

For more rational management of spare parts, the introduction of a mini-computer is recommended, as referred to the recommendations in common items 8.1.9 - (5) and (7).

(4) Amount of Machinery and Equipment

The procurement of container and bulk cargo handling equipment has been already planned by the ESP.

As for the container equipment, the schedule of procurement should be determined after through investigation into the progress of container terminal development now in progress and the future demand of container cargoes at the port.

As for the bulk cargo handling equipment, procurement should be simultaneously promoted with replacement and disposal as referred to the recommendations in common 8.1.9 (2).

8.4.7 Port Facilities (except cargo handling facilities/equipment)

(1) Full Utilization of Reclaimed Yard in the Inner Port

The ESP has a plan to utilize the temporarily paved yard behind the Inner Port "Band B" (see 17 in Fig. 3.5.1) as a container yard. In this case, investigation must be made to assess whether it can bear the weight of the transfer crane or not.

As the ESP has a container terminal plan, investment in temporary terminal pavement should be minimized to as low a level as possible.

(2) Construction of the Northern Access Road to the Port

In the Inner Port Area, there is an urgent need for construction of a north access road. The location of the road within the port area connecting the new access road should be determined after careful investigation of the land utilization plan.

(3) Sufficient Calmness at the Bonded Berth

When the ships are berthed along the bonded berth (see 5 in Fig. 3.5.1), they are reported to be occasionally affected by tidal currents, resulting in the gradual shifting of the vessel off the berth line. To cope with this problem, proper countermeasures should be investigated.

(4) Others

Other construction/rehabilitation plans mentioned in the Mexican side's report seems to be adequate on the whole.

The Port of Manzanillo will grow in the future, and so completion of facilities in the Inner Port area is eagerly expected.

8.5 Recommendations of the Improvement Plan of the Port of Mazatlan

8.5.1 Utilization of the Port

(1) Completion of the Former Ferry Berth

In the improvement plan prepared by the Mexican side, completion of the former ferry berth is planned. This is considered to be necessary to accommodate the cruise ships, as mentioned in section 4.5.1.

(2) Relocation of the PEMEX Berth

Judging from the present situation, this 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, which is not only significant for efficient utilization of the port, but also necessary for the safe berthing of cruise ships.

8.5.2 Port Administration and Management

(1) Cost Accounting of Individual Tariff

As for the recommendations, refer to section 8.1.3 of this chapter.

(2) Cargo Handling Union

In the Port of Mazatlan, the CTM has the handling permission in some parts of the cargo handling operation. This may cause some trouble in consistent cargo handling operation.

As for the recommendations, refer to section 8.1.4 of this chapter.

(3) Statistics

As for the recommendations, refer to section 8.1.5 of this chapter.

8.5.3 Procedures of Ship Entry/Exit and Customs Formalities

As for the recommendations, refer to section 8.1.6 of this chapter.

8.5.4 Land Transportation and the Storage System in the Port Area

a. The installation of belt conveyers at the No. 5 warehouse is considered necessary. Therefore coordination with FERTIMEX, which

uses this warehouse exclusively, should be continued.

b. The ESP is examining installation of a portable warehouse in the yard. However, a comprehensive investigation should be executed, as is recommended in section 8.1.7 (3) of this chapter.
The following points should be considered in the investigation:

i. Future prospects for agricultural bulk cargo handling volume at the port. The handling volume at this port is tending to decline slowly. (refer to section 5.6.2 of Chapter 5.).
ii. Utilization of the former ferry area which is not used at present.
iii. Future demand to use the open storage yard.

8.5.5 Cargo Handling Operation

a. 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.

b. The other should be referred to in the relative parts in this chapter.

8.5.6 Cargo Handling Facilities/Equipment and Maintenance System

(1) Maintenance Policy and Methodology

At the Port of Mazatlan preventive maintenance is carried out every 100 hours.

It is preferable, as proposed in the general recommendation, to carry out preventive maintenance by grouping the equipment and machinery into 3 or 4 groups.

Whether to carry out preventive maintenance on the basis of operating hours or not is subject to the ESP's judgment, as described in the recommendation in common items 8.1.9 - (3).

(2) Spare Parts

The management of spare parts has been conducted by means of a cargo system and seems to yield good results.

To achieve more rational management of the system, introduction of a

mini-computer is recommended, as referred to in the recommendation in common items 8.1.9 (5) and (7).

(3) Amount of Machinery and Equipment

1) Effective utilization of excess machinery

Due to the decrease in cargo volume and the change in kinds of cargo, the existing fleet of forklift trucks, pneumatic unloaders and grab buckets has become unnecessary to same extent.

surpulus machinery has been transferred to other ports. This is a good idea from the point of view of effective utilization of excess equipment.

2) The optimum numbers of equipment should be referred to the recommendations in common items 8.1.9 - (1).

8.5.7 Port Facilities (except cargo handling facilities/equipment)

(1) Different Levels between the Rail Top Surface and the Pavement of the Apron

The No.1 and No.2 berths and No.3, No.4 and No.5 berths (see 25-29 in Fig. 3.6.1) are of concrete blocks structure and open deck structure, respectively. Repairs need to be executed by the overlay-method or repaving of the pavement, depending on detailed estimation of the existing pavement structure.

(2) Completion of Berth for Cruise Ships

The work modifying the former ferry terminal into a cruise ship berth (see 23 in Fig. 3.6.1) is considered to be necessary as mentioned above.

Unused materials left at the site should be utilized in construction as much as possible.

(3) Others

Other construction/rehabilitation plans mentioned in the Mexican side's report seem to be adequate on the whole.

However, installation of a fuel station for berthing ships should be carefully considered for from the point of view of profitability.

8.6 Recommendations of the Improvement Plan of the Port of Guaymas

8.6.1 Utilization of the Port

As mentioned in the Mexican side's report, the change of production policy by Ford has resulted in a sudden reduction of containerized cargo with the suspension of container vessels calling at the port.

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 referring to the recommendations in section 8.1.1 of this chapter.

8.6.2 Port Administration and Management

(1) Cost Accounting of Individual Tariffs

In the Port of Guaymas, cost accounting of individual tariffs has already started. As for the recommendations, refer to section 8.1.3 of this chpater.

(2) Cargo Handling Union

As for the recommendations, refer to section 8.1.4 of this chapter.

(3) Statistics

As for the recommendations, refer to section 8.1.5 of this chapter.

8.6.3 Procedures of Ship Entry/Exit and Customs Formalities

As for the recommendations, refer to section 8.1.6 of this chapter.

8.6.4 Land Transportation and the Storage System in the Port Area

As for the recommendations, refer to section 8.1.7 of this chapter.

8.6.5 Cargo Handling Operation

a. Grain husk dispersal widely degrades the environment of the whole port area. This is caused by facilities over which the ESP has no direct control. The ESP should continue to promote coordination with the relevant organizations.

b. Suitable portable wireless telephone system units to be used for the rapid and correct communications should be provided in order to improve the cargo handling through smooth and definite supervising.

c. The others should be referred to in the relative parts in this chapter.

8.6.6 Cargo Handling Facilities/Equipment and Maintenance System

(1) Maintenance Policy and Methodology

Though weekly preventive maintenance is carried out, middle and long term preventive maintenance has not yet become practical.

It is highly recommended that periodical preventive maintenance based be carried out at certain intervals: weekly, monthly, semi-yearly and yearly, as proposed in the recommendations in common items 8.1.9 - (3).

A number of odometers have been left in a damaged or unusable condition. The value of these instruments should be fully recognized in terms of securing efficient port operation.

(2) Spare Parts

There are not enough spare parts at the Port of Guaymas. The management of spare parts should be performed giving due consideration to the recommendations in common item stipulated in 3.1.9 - (5).

(3) Amount of Machinery and Equipment

The present purchase plan for forklift trucks and large sized grab buckets seems to be reasonable.

There is a lot of old and unusable machinery, equipment and parts, and recommendations in common items 8.1.9 - (6).

8.6.7 Port Facilities (except cargo handling facilities/equipment)

(1) Supply and Replacement of Rubber Fenders

To ensure ships' safe berthing, the supply or replacement of fenders is necessary for the No.2 berth (see 6 in Fig. 3.7.1). In the light of current low level of container traffic, this investment should be kept to the minimum.

(2) Dealing with the Collapse of the Apron of No. 2 Berth

As emergency measure, the ESP plans to constructed two link ramps spanning the rubble stone-filled area and the edge of the coping concrete on the No.2 berth. This solution can be allowed as a compromise for a whole, but permanent repairs should be carried out in due course.

8.7 Recommendations of the Improvement Plan of the Port of Ensenada

8.7.1 Utilization of the Port

(1) Calling of Container Vessels

The commencement of container vessels calling at the port is expected. In this regard, the following items should be examined:

i. The propect of container vessels calling, considering competition with the ports on the west coast of the U.S.A.
Considering the fully modernized and large scale of the container terminals at the U.S west coast ports, as well as the established land transportation network, this competetion is considered hard for the Port of Ensenada. Threfore, measures to ensure a steady number of container vessels calling stable should be discussed.

ii. Promotion of the containerized cargo for export, since it is believed there is an imbalance between import/export containers at present.

(2) Cruise Ships

Since the number of cruise ships calling at the port is expected to grow, countermeasure for this should be examined based on ensuring maintaining the container vessels calling at the port.

8.7.2 Port Administration and Management

(1) Cost Accounting of Individual Tariff

As for the recommendations, refer to section 8.1.3 of this chpater.

(2) Port Administration and Management

The duty of the berth allotment came to be carried out under the delegate of Puertos Mexicanos, which may be favorable for the port operation.

As for the recommendations, refer to section 8.1.2 of this chapter.

(3) Cargo Handling Union

There is the union CTM having a permission of cargo unloading operation from vessels. ESP started to make one package contract system

with users to secure the efficient cargo handling operation.

As for the recommendations, refer to section 8.1.4 of this chapter.

(4) Statistics

As for the recommendations, refer to section 8.1.5 of this chapter.

8.7.3 Procedures of Ship Entry/Exit and Customs Formalities

As for the recommendations, refer to section 8.1.6 of this chapter.

8.7.4 Land Transportation and the Storage System in the Port Area

Land transportation when container vessels start calling at this port should be coordinated among the bodies concerned. As for the recommendations, refer to section 8.1.7 of this chapter.

8.7.5 Cargo Handling Operation

a. The commencement of container handling is expected at the port, as mentioned above.

   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.

b. The others should be referred to the relative parts in this chapter.

8.7.6 Cargo Handling Facilities/Equipment and Maintenance System

(1) Maintenance Policy and Methodology

Periodical preventive maintenance has been observed at intervals of every 100, 500 and 1,000 hours of operation by installing an horary-meter on all handling machines and consequently the machines are being kept in good condition.

(2) Improvement in the Maintenance Workshop

The plot readjustment in the workshop is maintained in a good manner, but some flexibility in job assignment might be needed.

Sufficient machinery should be properly provided referring to the recommendations in common items 8.1.9 - (4).

(3) Spare Parts

As much as 20% of the spare parts are being stocked for no reason, mainly because they are out of data. Sometimes they have rusted too much.

The reasonable management of spare parts should be conducted by referring to the recommendations in common items 8.1.9 - (5).

(4) Amount of Machinery and Equipment

Some container handling equipment, such as transfer cranes and forklift trucks, etc., have been transferred from the Port of Guaymas.

There measures are evaluated highly in view of the effective utilization of equipment. This equipment need a high level of technology to be maintained in good condition.

Without careful maintenance, they could be easily stop functioning at any time, so upgrading of the engineering staff's skill is essential for high-level maintenance, as mentioned in the recommendations in common items 8.1.9 - (8).

8.7.7 Port Facilities (except cargo handling facilities/equipment)

(1) Overtopping Waves and Overflow of Seawater from the Breakwater

The Port Ensenada has a plan for accommodating container ships. To reduced losses in port operations, wave problems must be swiftly mitigated. Possible countermeasures are to diminish the energy of waves by placing large rocks in front of the breakwater, which has already started and to build a parapet on the top of the breakwater (Rompeolas in Fig. 3.8.1).

Further countermeasures at the breakwater should be examined after careful observation of waves at the port site and be further confirmed by a model test analysis.

(2) Dealing with the Collapse of the Apron of No. 2 Berth

As emergency measure, the ESP plans to constructed two link ramps spanning the rubble stone-filled area and the edge of the coping concrete on the No.2 berth. This solution can be allowed as a compromise for a whole, but permanent repairs should be carried out in due course.

Chapter 9. Long-Term Development Plans in the Selected Ports

As was described in Chapter 6, the Ports of Lazaro Cardenas and Manzanillo are the ports selected in this study which play significant roles in the container network on the Pacific coast of Mexico. Long-term development plans (master plans) with the target year 2005 for containerized cargoes handled at these two ports are formulated in this chapter.

9.1 Long-Term Development Plan for Containerized Cargoes in 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 9.1.1 and Fig. 9.1.1. Both the containerized cargoes to/from the hinterland of Lazaro Cardenas and the those transported to/from the port by domestic feeder vessels are presented in the table and figure.

Table 9.1.1 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

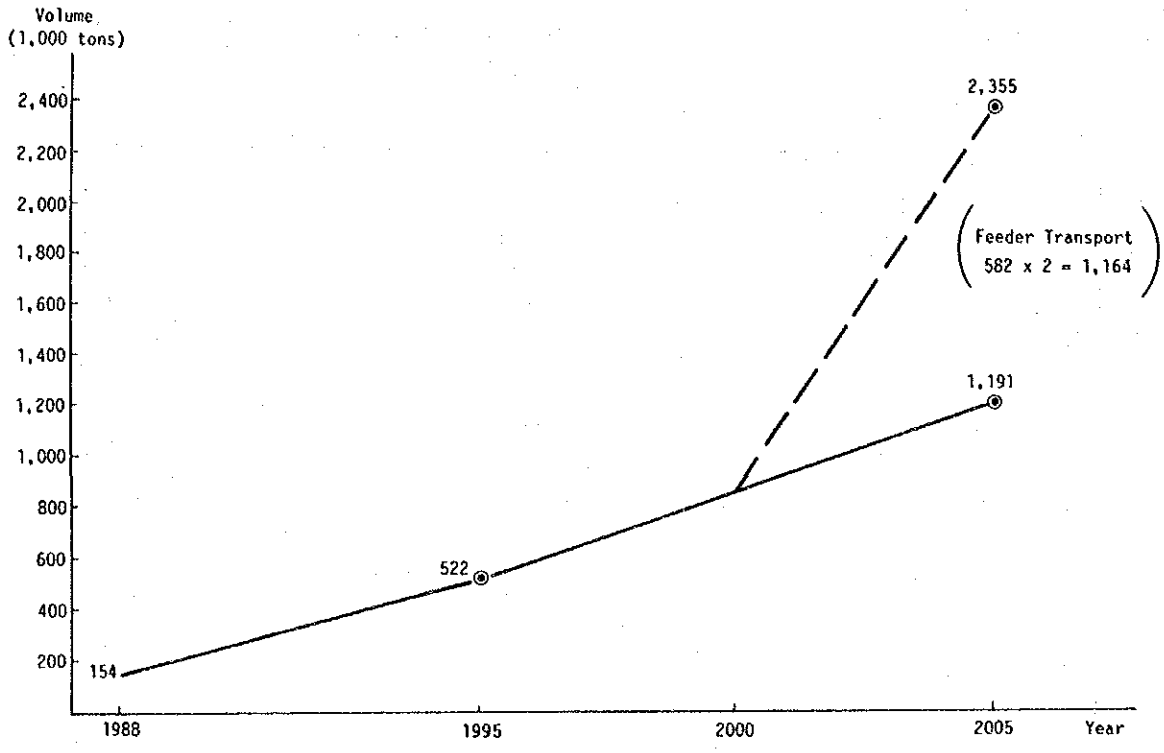


Fig. 9.1.1 Forecast Containerized Cargo Volume (Port of Lazaro Cardenas)

2) Containerized cargo volume at the container berths

The actual situation of containerized cargoes carried by each type of container vessels is summarized in Table 9.1.2. As the total containerized cargo handled at the port grows in the future, the share of cargo volume by vessel type III is expected to increase, as is now being observed at the Port of Manzanillo. Considering the smaller number of loading/discharging containers per vessel, it would be reasonable for some of this type of container vessels to utilize the general cargo berths. Given these considerations, the study team assumes that the share of each container vessel type of cargo handling volume and berth allotment in 2005 will be as shown in Table 9.1.3.

Table 9.1.2 Summary of Containerized Cargo by Container Vessel Type (Port of Lazaro Cardenas in 1988)

Type of Containerized Vessel	Shipping Lines	Loading/Discharging Number of Containerized per Vessel	Number of Calls per Month	Assumed Share in the Handling Value
		box	call	%
I	TMM (Transportation Maritime Mexicana)	650	3	89
II	Inter American Shipping	100	2	9
III	Canadian Tropical Line	20 - 30	2	2

Source: Based on the results of interviews at the port

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

Table 9.1.3 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	Import	86 %	428.3+175= 603.3	-	603.3
	Export	"	596.0+407= 1,003.0	-	1,003.0
	Sum	"	1,024.3+582= 1,606.3	-	1,606.3
II	Import	9	44.8	-	44.8
	Export	"	62.4	-	62.4
	Sum	"	107.2	-	107.2
III	Import	5	14.9	10.0	24.9
	Export	"	20.8	13.8	34.6
	Sum	"	35.7	23.8	59.5
Sub Total	Import	100	663.0	10.0	667.0
	Export	"	1,086.2	13.8	1,100.0
	Sum	"	1,749.2	23.8	1,773.0
IV Domestic Feeder	Import	-	175.0	-	175.0
	Export	-	407.0	-	407.0
	Sum	-	582.0	-	582.0
Grand Total	Import	-	838.0	10.0	848.0
	Export	-	1,493.2	13.8	1,507.0
	Sum	-	2,331.2	23.8	2,355.0

Note: i. All of the domestic feeder cargoes are assumed to use type I container vessels.

ii. Two-fifths of the containerized cargoes by vessel type III are assumed to go through the general cargo berths.

(2) Forecast of Container Vessel Size and Type

1) Present calling vessels

TMM, which is the main shipping line calling at the objective ports, is presently providing container transportation service at the Pacific ports of Mexico using six COMBO (or con-bulker) type vessels. The physical characteristics of these vessels are as follows:

- Gross tonnage 29,660 - 31,430 tons
- Overall length 193 - 196 m
- Overall width 32 m
- TEU capacity 1,600 - 2,069 TEUs

2) Vessel and berth size in 2005

Although TMM is believed to have no definite future plan for its container fleet at present, the size of container vessel calling at the port will increase in the target year of 2005. Taking into consideration the future demand of cargo handling volume and the prospect of a liner network linking the port of Lazaro Cardenas with foreign ports, the Penamax-size container vessel is adopted as the estimated maximum size of container vessel to call at the port. Referring to Appendix 9.1.1 - 3, the physical characteristics of the planned container vessel and the corresponding size of the container berth are as presented in Table 9.1.4.

The size of vessels for domestic feeder service is assumed on the basis of examination of its appropriate operation, which is described in the next section.

3) Vessel type

In the target year of 2005, some full container vessels which do not carry break bulk cargoes are expected to call at the port. However, the handling volume of break bulk cargoes through the objective ports is forecast not to increase hereafter significantly and therefore, conventional liners are predicted to not always call at the ports sufficiently. Thus, a significant portion of container vessels is considered to continue to transport break bulk cargoes.

Therefore, the vessel type for examining the scale of port facilities/equipment is assumed to be that which can carry some break bulk cargoes.

Table 9.1.4 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

1) Method of determining the number of berth

For planning purposes, various methods are used to determine the required number of berths. In this study, a method considering the frequency of ship entry and cargo handling productivity is used to determine the number of berths.

This method is summarized as follows:

$$\text{Number of berths} = \frac{\text{Total number of berthing days}}{\text{Annual number of workable days} \times \text{Berth occupancy ratio}}$$

where,

- Total number of berthing days:
  (Number of vessel calls) x (Average berthing days per vessel)
- Number of vessel calls:
  (Annual cargo volume handled) / (Average cargo volume handled per vessel)
- Average berthing days per vessel:
  (Average cargo volume handled per vessel) / (Average cargo handling productivity per vessel per day) + Number of days necessary other than cargo handling

In case of containers, the "cargo" and the "cargo volume" in the above formulas are substituted by "container" and "number of containers",

respectively.

According to the UNCTAD report, the berth occupancy ratio for conventional general cargo operations should be set so as not to exceed the figures given in Table 9.1.5, which are based on a ratio of ship cost to berth cost of 4 to 1.

Table 9.1.5 Berth Occupancy Ratio

Number of Berths in the Group	Recommended Maximum Berth Occupancy (%)
1	40
2	50
3	55
4	60
5	65
6 - 10	70

2) Premises for calculation

The values in the short-term plan in 1995 are discussed together for purposes of comparison.

a. Annual number of workable days

Number of days available for using berths is set at 350 days considering holidays and non-working due to rainfall.

b. Cargo handling hours per day

Eighteen (18) hours is adopted for planned cargo-handling hours.

c. The number of days necessary other than cargo handling

The necessary hours other than for cargo handling while berthing container vessels, such as vessels' maneuvering activities for berthing/deberthing and the procedure for vessel's entrance/departure, are around four (4) hours on an actual basis. Therefore a period of 0.2 days per vessel is adopted both for 1995 and 2005.

d. Average cargo handling productivity per day per vessel

i. Containers

Average cargo handling productivity throughout cargo handling hours is set at 25 boxes/hour/crane in the master plan in 2005,

while 20 boxes/hour/crane is adopted for the short-term plan in 1995.

Since two quayside gantry cranes per berth are planned, the average cargo handling productivity per day per vessel will be 25 x 2 x 18 = 900 boxes/day/vessel in the master plan, while it will be 20 x 2 x 18 = 720 boxes/day/vessel in the short-term plan.

ii. Break bulk cargoes

In view of the progress of palletization of break bulk (or general) cargoes handling productivity is assumed to be 50 tons/hour/gang in the master plan and 30 tons/hour/gang in the short-term plan.

Assuming three (3) gangs operation, average cargo handling productivity per day per vessel will be 50 x 3 x 18 = 2,700 tons/day/vessel in the master plan and 30 x 3 x 18 = 1,620 tons/day/vessel in the short-term plan.

e. Average number of container handled per vessel

i. Vessel type I

The average container capacity of container vessels in 2005 is assumed to increase to 2,500 TEUs from the present 2,000 TEUs.

The number of calls of container vessels will increase greatly while the amount of break bulk cargoes is not expected to grow greatly in the future. In addition, the Port of Lazaro Cardenas is projected to act as a pivotal base port, being called at by a considerable number of feeder containers.

These factors all affect to a remarkable increase in the average number of handling containers per vessel, which will be 1,200 boxes/vessel in 2005.

In the short-term plan, the average container capacity per vessel is assumed to be around the same as present.

Therefore, this figure will show only a slight increase to 700 boxes/vessel from 650 boxes/vessel at present.

ii. Vessel type II

The same value of 100 boxes/vessel is adopted for both 2005 and 1995, because this type represents international feeder vessels, and an increase in vessel size is not expected, on the whole.

iii. Vessel type III

The value is estimated at 90 boxes/vessel both in 2005 and 1995, a considerable increase from the 40 at present, resulting from the increase in the number of calls by this type of vessel.

iv. Vessel type IV

Vessels with a container capacity of 500 TEUs are assumed as mentioned before considering the average load factor to be 80%, the average number of containers handled per vessel will be 500 x 0.8 x 2 = 800TEUs/vessel which is converted to 593 boxes/vessel using a 20/40 feet container ratio, as explained later.

f. Average break bulk cargo volume handled per vessel

i. Vessel type I

This value, which is estimated to be around 800 tons/vessel at present, will show a tendency toward great decrease because of increase of vessels' calls and the progress in containerization. On the other hand, some portion of break bulk cargoes transported into/out of the port by domestic feeder vessels is expected to be handled by this type of vessel for import/export. Considering these factors, the value is adopted as 400 tons/vessel for both 2005 and 1995.

ii. Vessel type III

A value of 700 tons/vessel is projected for both in 1995 and 2005.

iii. Vessel type IV

Considering the transportation of break bulk cargoes by domestic feeder vessels, 300 tons/vessel is assumed.

g. 20/40 feet container ratio

Presently 20 foot containers occupy around 85% of the total handled boxes at the Port of Lazaro Cardenas (refer to Appendix 9.1.4). In the future the percentage of 40 foot containers is expected to increase (a world-wide trend) as the handling container throughput grows. In view of this and referring to the present situation at the Port of Manzanillo, the 20/40 container ratio is estimated at 75:25 for 1995 and 65:35 for 2005.

h. Empty container ratio

The empty container ratio is closely related to the import/export imbalance of containers. Because of improvement of the imbalance, the empty container ratio is estimated to decrease to 25% both in 2005 and 1995 from the actual situation of around 33% (refer to Appendix 9.1.5). As for domestic feeder vessel, this value is supposed to be 20%.

i. Unit weight of containers

Examining the port statistics (refer to Appendix 9.1.6) and referring to the data collected at the port, the average unit weight of containers excluding their tare weight is estimated to be 7 tons/TEU for imported containers and 12 tons/TEU for exported containers.

As for the value of domestic feeder containers, 7 tons/TEU for imported and 15 tons/TEU for export are adopted, considering the present situation of the feeder port.

j. Number of shifting containers

Actually there exists a significant number of shifting containers during cargo handling, both cell-quay-cell and cell-cell, for type I container vessel. The present level of 50 shifting boxes of container, which is counted as 100 (loading/discharging) in the calculation of required number of berths are assumed to continue existing in future.

3) Calculation of required number of container berths

Using each factor discussed above, the required number of container berths is calculated according to the procedures shown in Table 9.1.6.

Two (2) berths, are required in 2005, which is deemed reasonable judging from the berth occupancy rate of 54% shown in the Table.

The calling number of vessel type IV, that is domestic feeder vessel, implies about 7 round trips per month with one feeder vessel. This can be said to be an adequate frequency of feeder vessel service.

Table 9.1.6 Calculation of Required Number of Berths

(Port of Lazaro Cardenas : 2005)

Items	Unit	Calculation	Vessel Type				
			I	II	III	IV	Total
① Containerized Cargo Volume (Import)	1000 tons		603.3	44.8	14.9	175	
② Containerized Cargo Volume (Export)	1000 tons		1,003.0	62.4	20.8	407	
③ Number of Loaded Containers	TEUs	①/7+②/12(15 for IV)	169,770	11,600	3,862	52,133	
④ Number of Loaded and Empty Containers	TEUs	③/(1-0.25)	226,360	15,470	5,150	65,170	312,150
⑤ Number of Loaded and Empty Containers	boxes	④/(1x0.65+2x0.35)	167,670	11,460	3,810	48,270	
⑥ Average Number of Containers Handled per Vessel	boxes		1,200	100	90	593	
⑦ Number of Vessel Calls	calls	⑤/⑥	140	114	42.2	81.5	377.7
⑧ Container Handling Productivity per Day per Vessel	box/day.vessel		900	900	900	900	
⑨ Berthing Days per Vessel for Container Handling	days	⑥/⑧	1.33	0.11	0.10	0.66	
⑩ Number of Shifting Containers	boxes		100	-	-	-	
⑪ Berthing Days per Vessel for Shifting Container Handling	days	⑩/⑧	0.11	-	-	-	
⑬ Average Break Bulk Cargo Volume Handled per Vessel	tons		400	-	700	300	
⑭ Break Bulk Cargo Handling Productivity per Day per Vessel	t/day.vessel		2,700	-	2,700	2,700	
⑮ Berthing Days per Vessel for Break Bulk Cargo Handling	days	⑬/⑭	0.15	-	0.26	0.11	
⑯ Number of Days Necessary other than Cargo Handling	days		0.2	0.2	0.2	0.1	
⑰ Total Berthing Days per Vessel	days	⑨+⑪+⑮+⑯	1.79	0.31	0.56	0.87	
⑱ Total Berthing Days	days	⑦x⑰	250	34	23	71	378
⑲ Berth Occupancy	%	⑱/(350xB)					
B (Number of Berth) : 1							108
2							54
3							36

9.1.2 Site Selection

(1) Fundamental Policy

As determined above, 2 container berths with the scale of 300m in length and 14m in water depth are required in 2005. In the selection of the container terminal site, the following factors are considered to be essential:

i. Effective utilization of the existing container berth and continuity between container berths
ii. Assuring enough area for container handling and storage
iii. Low level of construction costs
iv. Potential for future expansion of the container terminal

(2) Alternatives for Terminal Site

Considering that the required number of berths is not so high and that the other definite utilization of the present container berth is not forecast at present, planning two new berths cannot be justified. Therefore one new berth should be planned.

Examining the present situation of the port, the following three (3) alternatives, as shown in Fig. 9.1.2, are considered as possible sites for the project.

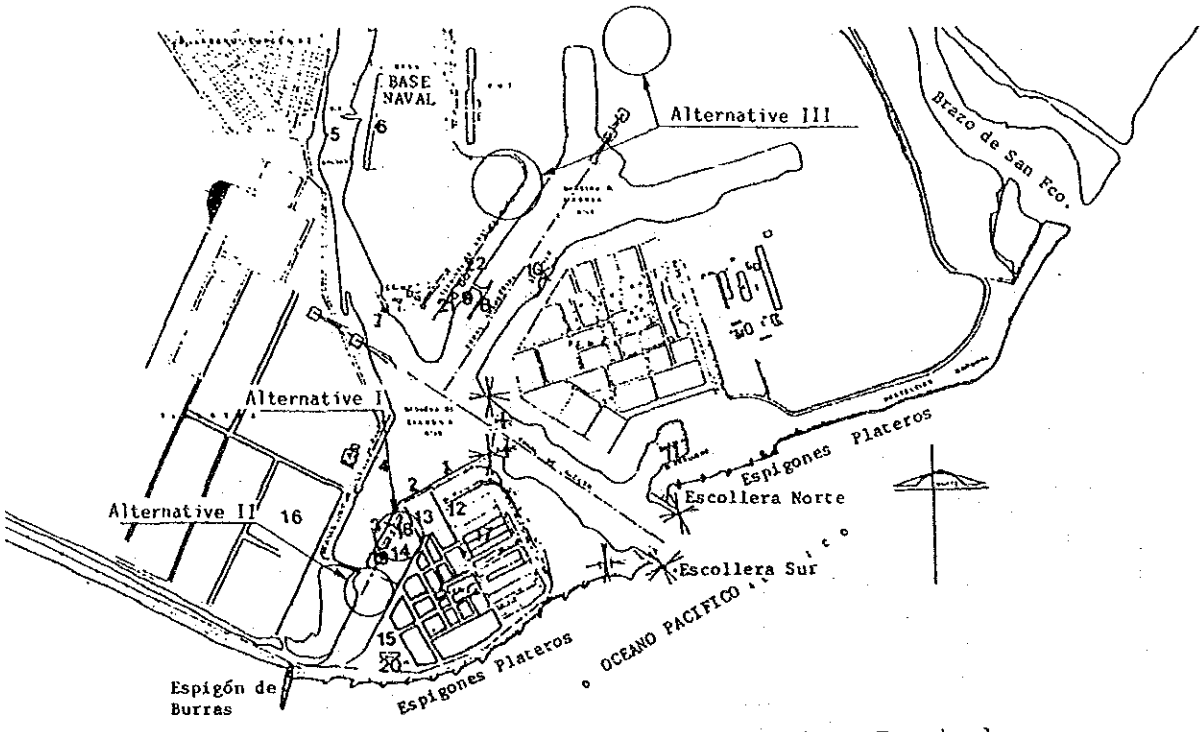


Fig. 9.1.2 Alternative Site for Container Terminal (Port of Lazaro Cardenas)

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

1) Alternative I

Since the present general cargo berths do not have the required water depth and cannot bear the heavy load of quayside gantry cranes, rebuilding the berth is inevitable.

This would require much greater expense compared to the construction of a new berth.

It is also necessary to build substitute general cargo berths including warehouses, prior to starting construction of the container berth. In addition, this alternative site does not provide enough area for a container terminal because it is located at the corner of the wharf.

Therefore, this alternative is not considered feasible.

2) Alternative III

In this case, the new terminal is located far away from the existing one, which causes great inconveniance for both the port users and the terminal operator, as well as being a poor investment. Besides, the construction costs, including dredging and port access facilities such as roads and railways may be very high, while sufficiant area can be easily provided at this site.

Therefore this alternative is considered realistic only when the container throughput of the port grows so large in future as to require many more container berths.

3) Alternative II

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.

However, this alternative has a few unfavorable conditions, as mentioned below, which should be carefully examined in the facilities planning.

i. The area behind the berth is not sufficiently wide for a modernized container terminal.

ii. There exists a maintenance shop for cargo handling equipment in this area, which will be an obstacle for the terminal.

iii. The new contaienr berth is separated from the existing one.

iv. Railway tracks running through the site must be removed to other position.

9.1.3 Operation System

At the Port of Lazaro Cardenas, the ESP already has experience in transfer crane system terminal operation and, as described in the following section, the operation system to be recommended is a transfer crane system.

(1) Container Handling Operation System

At a container terminal, containers are usually lifted by a quayside gantry crane.

After that, one of three typical container handling operation systems mentioned below is used. Some terminals use combination of these three systems.

1) Straddle carrier system

In this system, containers handled on the container terminal are removed by a machine which is called a straddle carrier. A straddle carrier can carry out two functions: container carrying and lifting.

Its standard capabilities are as follows:

a. Lifting weight : Up to 40.5 k/tons (40 feet container)
b. Running speed : Up to 30 - 40 km/hr
c. Stacking capability : Usually 3 or 4 tiers high stacking capability is available

2) Transfer crane system

This system uses separate machines for the function of container lifting and carrying on the premises. The lifting function is carried out by a machine called a transfer crane and the carrying function is implemented by the tractor heads and chassis between the shipside apron and the container stacking yard.

The transfer crane is a kind of small gantry crane. There are two

kinds of transfer crane. One is a rail-mounted crane and the other is a rubber-tired one. The rail-mounted transfer crane is the bigger type.

The standard capabilities of a transfer crane are as follows:

a. Stacking capability : 3 - 4 tiers high
b. Moving speed : 15 - 20 km/hr
c. Lifting cycle : 20 lifts/hr

The carrying function is implemented by the tractor heads and chassis. Usually, 3 or 4 pairs of head and chassis are engaged in container operations for every quayside gantry crane.

3) Tractor head and chassis system

In this system both storing and carrying functions are implemented by the tractor heads and chassis. It is a very simple way of operation but the storage yard space required is three or four times more than the other systems, because the chassis is not able to stack containers 2 or 3 tiers high. A lot of chassis must be used, as well.

(2) Evaluation and Selection of Operation System

Generally, the characteristics of each system mentioned above are summarized as shown below.

	(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

Based on the evaluation in the table and considering the specific conditions mentioned below, the study team adopts the transfer crane system as the operating system of the container terminal at the Port of Lazaro

Cardenas.

i. Transfer crane system is adopted at many of the existing container terminals in Mexico including the Port of Lazaro Cardenas.
ii. The projected site of new container terminal of this port can not be said wide enough.
iii. Straddle carrier system requires a high quality of maintenance including sufficient parts supply.

Among transfer crane system, a rail-mounted transfer crane system is preferable in the new terminal, as examined later, because of the narrow width of the projected area.

9.1.4 Required Scale of Facilities/Equipment

(1) Required Scale of Berths

As described in Section 9.1.1 (2), the scale of the two container berths is as follows:

Existing container berth : Length 286 m, Depth -14 m
New " " : Length 300 m, Depth -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), in case of vessels' maneuvering assisted by tug boats, to allow the safe turning of vessels. This water area should be planned in the center of the water basin in front of the existing container berth.

(3) Required Scale of Storage Facilities

1) Premises for calculation

The values for the short-term plan in 1995 should be discussed together for the purpose of comparison.

a. Stuffing/unstuffing ratio of containers within the port

FCL (Full containers Load) cargoes now account for around 98% of

the total amount of containerized cargoes, resulting in an extremely low ratio of containers that are stuffed/unstuffed within the port, that is around 1% for imported and 2 - 5% for exported containers.

However, the amount of LCL (Less than Container Load) cargoes are expected to grow as the container throughput of the port increases. In view of this and the present ratio at the Port of Manzanillo, the ratios for imported and exported containers are assumed to be 10% in 1995 and 20% in 2005.

b. Dwelling time in CY and CFS

At present, the average dwelling time of imported containers in the CY (Container Yard) is estimated to be around 5 days for Nissan cargoes and 15 days for other cargoes. Given the decrease in the share of Nissan cargoes in the future, this value is assumed to be 12 days in 1995 and 10 days in 2005.

The present average dwelling time of exported and empty containers at the CY is estimated to be around 10 days.

This percentage is assumed to be 10 days in 1995 and 8 days in 2005.

While the dwelling time in the CFS (Container Freight Station) is set as 10 days in 1995 and 7 days in 2005.

As for domestic feeder cargoes, the average dwelling time is set at 3 days, considering the frequency of both mother and feeder container vessels' calling at the port.

c. Reefer containers

The reefer (or refrigerated container) is assumed to maintain the present level of volume, that is around one percent of the number of exported containers, both for 1995 and 2005.

d. Returning empty containers

Other than imported and exported empty containers, a considerable portion of loaded import containers return to the port after delivering their cargoes to the consignees and stay at container yard as empty containers. These empty containers should also be added to the storage capacity of the empty container yard.

These containers are said to amount to around 70 percent of the number of loaded import containers at present.

In view of the improvement in the imbalance of import/export

containers and the improvement of land transportation of containers, the study team assumes this percentage will be reduced to 40% in 1995 and 30% in 2005.

2) Container Yard

a. Calculation of storage volume

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

$$M_L = \left(\frac{M_y}{D_y} \times D_w + M_I \right) \times p$$

where M_L : Required storage number of containers (TEUs)
M_y : Annual container throughput (TEUs)
D_w : Average dwelling days (days)
D_y : Operating days (350 days)
M_I : Half of the average number of container handled per vessel (TEUs)
P : Peak ratio (1.3)

Applying the premises previously mentioned to the above formula, the required storage number of containers is calculated as shown in Table 9.1.7.

b. Stacking height of containers

Import/export containers, excluding loaded reefers (or refrigerated containers) could be stacked 3 layers high in the container yard using rubber tired transfer cranes. However, operationally, it is desirable to stack import containers 2 high and export containers 2.5 high on an average basis. The stacking height of loaded reefers should be 2 or 1. As for empty containers, 3 layers should be normal stacking height.

Considering these factors, the stacking height of each category of container is adopted as shown in Table 9.1.7.

c. Required number of ground slots

$$S_L = M_L / L$$

where S_L : Required number of ground slots (TEUs)
M_L : Required storage number of containers (TEUs)
L : Stacking height of containers (Layers)

The results of the calculation are shown in Table 9.1.7.

Table 9.1.7 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

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

$$A = (M_c \times D_w \times p) / (w \times \gamma \times D_y)$$

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

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

D_w : Dwelling time at CFS (days)

P : Peak ratio (1.3)

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

γ : Utilization rate of CFS floor (0.5)

D_y : Operating days of CFS (350 days)

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

$$A = (233,440 \times 6 \times 1.3) / (1.3 \times 0.5 \times 350) = 800\ m^2$$

Given that the floor area of the existing CFS is around 5,100m^2, another CFS with floor area of around 2,900m^2 is required.

4) Storage facilities for break bulk cargoes

Based on the demand forecast in Chapter 5, the handling volume of break bulk cargoes at the port in the target years is obtained as shown in Table 9.1.8:

Table 9.1.8 Forecast Handling Volume of Break Bulk Cargoes

(1,000 tons)

	Actual	Forecast	
	1988	1995	2005
① Total General Cargo	276.3	705	1,375
② Containerized Cargo	154.4	522	1,191
③ Break Bulk Cargo (① - ②)	121.9	188	184

Note: Domestic feeder cargoes are excluded

The required storage facilities area is calculated using the following formula:

$$A = (M_S \times D_W \times p) / (w \times \gamma \times D_y)$$

where A : Required storage facilities area (m^2)

M_S : Annual handling volume of break bulk cargo (tons)

D_W : Dwelling time at storage facilities (days)

P : Peak ratio (1.3)

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

γ : Utilization rate of ground area (0.5)

D_y : Operating days (350 days)

$$A = (184{,}000 \times 15 \times 1.3) / (1.3 \times 0.5 \times 350) = 15{,}770\ m^2$$

As the total area of the existing warehouses are estimated to be about 7,900m^2, and additional 7,870m^2 of storage facilities are required.

(4) Required Amount of Cargo Handling Equipment

1) Container handling system

a. From/to ship

Two different systems are generally used for handling containers to and from ships: the roll-on roll-off method and the lift-on lift-off method.

Basically the lift-on, lift-off method is adopted at most ports, while the roll-on, roll-off method is found only for special cases.

For handling from/to ships, a quay-side gantry (or container) crane system is recommended for the following reasons:

i. Quay-side crane is the most popular system.

ii. One quay-side gantry crane has already been introduced at the existing container berth.

iii. It is the most expensive system, but can get the highest throughput.

b. At terminals

The most suitable handling system for the terminal has already been discussed in the previous section and the transfer crane system is recommended.

2) Required number of units of handling equipment

a. Design conditions

i. The container volumes to be handled at the port in the target years are as follows:

Import (Loaded)	71,143 TEU
Export (Loaded)	57,750 TEU
Empty (Total)	74,770 TEU
Feeder (Import)	50,000 TEU
Feeder (Export)	54,267 TEU
TOTAL	307,930 TEU

ii. Characteristics

Unit weight	Import	7 t/TEU
	Export	12 t/TEU
	Export (Feeder)	15 t/TEU

Ratio of 20/40 feet containers 65/35

Percentage of containers to be stuffed/unstuffed at port site 25%

iii. Ship size

The maximum ship size planned for the quay-side gantry crane is panamax size.

b. Quay-side gantry crane

The required number of quay-side gantry cranes will be determined by two factors : container volume to be handled and quick despatch of the container ship.

i. Container volume to be handled

The formula below will be used usually.

$$N = \frac{Q}{D \cdot H \cdot T_3 \cdot e \cdot Qt \cdot K}$$

N : Required number of quay-side gantry cranes

Q : Container volume to be handled (TEU/Year)

D : Workable days per year (Days/Year)

H : Workable hours per day (Hours/Day)

T_3 : Berth occupation

e : net working hour rate of quay-side gentry crane against ship's berthing period

Qt : Handling capacity of the quay-side gantry crane (Box/Net working hour)

K : Substitution coefficient (TEU/Box)

ii. Quick despatch of the container ship

In general, container ships need to be rotated as quickly as possible, even more so than other types of ship because the ship is very costly (including initial cost & running cost). Thus the berthing hours required for container handling must be minimized.

It is a very important factor for an attractive port to provide sufficient container handling capacity for container ships.

From the point of view of productivity, two quay-side gantry cranes will be required per berth.

iii. Conclusion

If two container cranes per berth are erected, the numbers of containers needing to be handled by each container crane per year are as follows:

1995 Nc = 37,800 TEU/Unit•year

2005 Nc = 76,983 TEU/Unit•year

The above value in 2005 (76,983 TEU) seems to be rather large. However there is a general cargo berth next to the container berth, and it would be available for container handling at peak time.

Therefore two quay-side gantry cranes are planned to be on each container berth. General design of planned quay-side gantry cranes at the existing is as container berth is as shown in Fig.9.1.3. As for the gantry cranes at the new container berth, refer to Fig.9.2.3 in chapter 9.

c. Minor cargo handling equipment

c-1. Introduction

The cost of minor handling equipment is lower than that for the quay-side container cranes.

The required minor handling equipment will be provided to support the smooth operation of the quay-side gantry cranes.

Mostly the amount of minor handling equipment will depend on the number of quay-side gantry cranes.

c-2. Transfer crane

The transfer crane system is adopted at terminals. The system can be classified as the rubber-tyred system and the rail-mounted system.

The required number of transfer cranes is usually calculated by the following formula:

$$NT = 2N + 1 \text{ or } 2$$

$$NR = 2N$$

NT : Required number of rubber-tyred transfer cranes

NR : Required number of rail-mounted transfer cranes

N : Number of quay-side gantry cranes

Rubber-tyred 4 units (6x3)

2 units (3x2) (Existing)

Rail-mounted 4 units (12x4)

c-3. Chassis

The required number of chassis for shipping is calculated by the following formula:

$$Ns = T_1/T_2 \times N$$

Ns : Required number of chassis

N : Number of quay-side gantry cranes

T_1 : Maximum calculated cycle time of the chassis

T_2 : Minimum cycle time of the quay-side gantry cranes

Cycle Time

$$T_1 = \frac{0.6 \times 2}{15} \times 3,600 + 15 + 15 = 318 \text{ sec.}$$

$$T_2 = 90 \text{ sec.}$$

$$Ns = \frac{318}{90} \times 4 = 16 \text{ units}$$

The required number of chassis for CFS is determined by the number of gangs loading and unloading cargos at the CFS.

$$Nc = \frac{46,310}{350 \times 4.8} \times 1.3 \fallingdotseq 36 \text{ units}$$

Total (include 15% spare)

N = 60 units

c-4. Tractors

N = 26 units

c-5. Fork-lifts

40t (Top lifter) for rail, reefer and general service (40 feet)

$$N = \frac{45,080 \times 0.35 \times 1.3}{350 \times 7 \times 6} = 1.4 = 2 \text{ units}$$

25t (Top lifter) for rail, reefer and general service (20 feet)

$$N = \frac{45,080 \times 0.65 \times 1.3}{350 \times 7 \times 6} = 2.2 = 3 \text{ units}$$

5t for empty containers

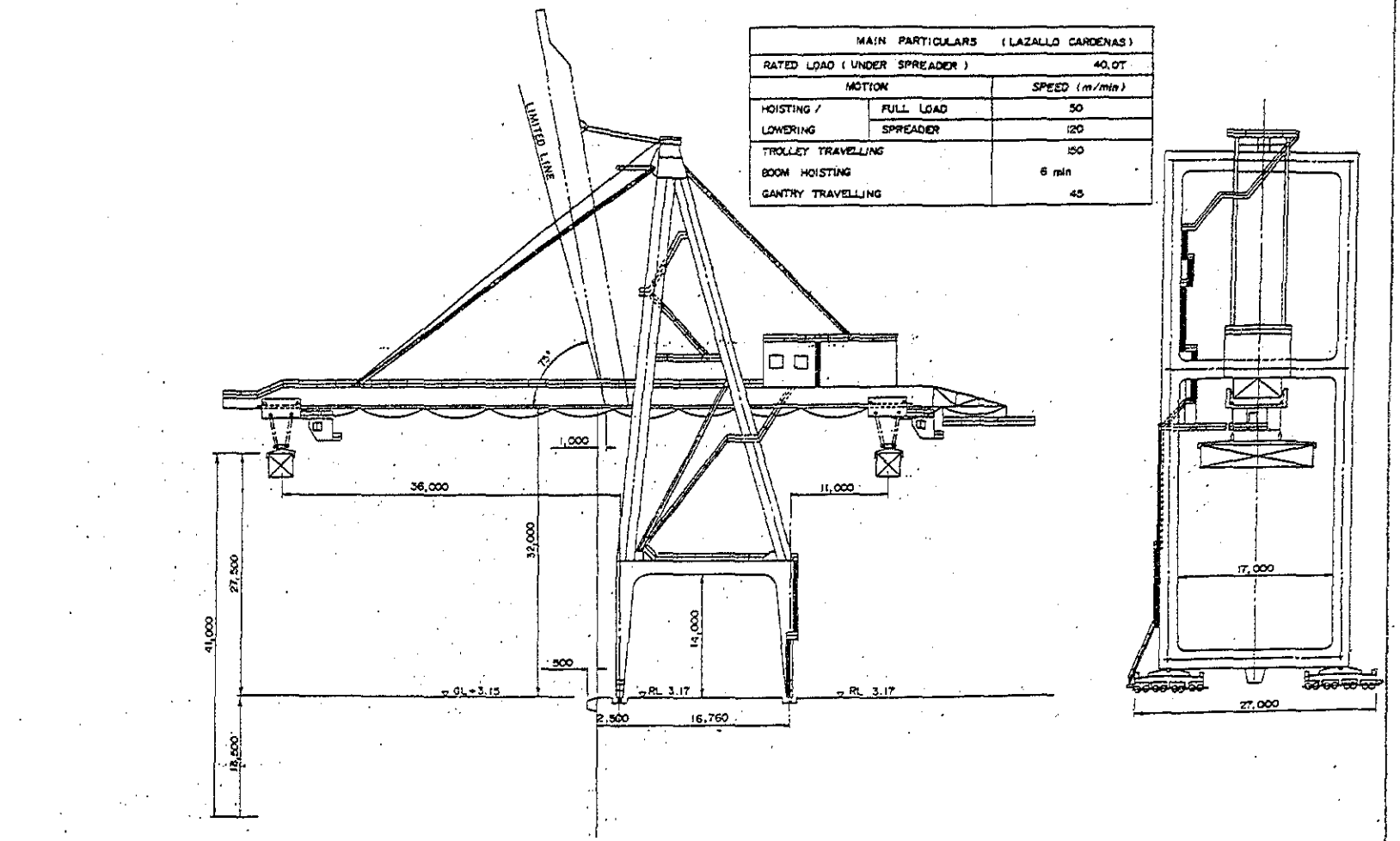
$$N = \frac{74,770 \times 1.3 \times 2 \times 1.05}{1.35 \times 350 \times 7 \times 10} = 6.17 = 7 \text{ units}$$

3t for trucks at C.F.S.

N = 20 units

2t for containers at C.F.S.

N = 42 units



Notes:

1. All dimensions are in millimeters unless otherwise indicated no dimensions shall be scaled
2. All elevations are in meters above mean sea level (MSL)
3. "A" type crane is shown but are also acceptable "H" type crane or "Transformed H" type crane

Fig. 9.1.3 Quayside Container Crane (40')

(5) Other Facilities

1) Terminal gate

A terminal gate with 4 truck lanes, two equipped with truck scales, will be required for each of the two container terminals. For a detailed examination, refer to the short-term plan.

2) Railway facilities

i. Share of railway in the land transportation of containers

Presently it is estimated that about 18% of imported and 43% of exported containers passing through the Port of Lazaro Cardenas use railway freight cars for land transportation, according to interviews conducted at the port. This ratio is expected to increase significantly in the future, mainly because of the unfavorable condition of the roads connecting this port with its hinterland.

In this report, the share of railway transport is assumed to increase to 20% in 1995 and 25% in 2005 for imported containers and to 50% in 1995 and 60% in 2005 for exported containers.

ii. Share of railways of the land transportation of break bulk cargoes

Presently, no break bulk cargoes for stuffing/unstuffing containers are carried into/out of the port by railway. It is believed that this situation will not change in the future for imported cargoes. However, a relatively low share of 10% in 1995 and 20% in 2005 is assumed for exported cargoes.

iii. Railway facilities

According to calculations, an estimated 230 TEUs of containers per day will be transported by railway into/out of the port in 2005. Assuming 20 - 25 freight cars comprise a train, an estimated 3 trains arrive at the port per day.

3) Maintenance for the container handling equipment and containers

a. Method of maintenance

< Container handling equipment >

There is a workshop of the ESP for maintenance of the existing

cargo handling equipment.

The workshop has been moved to another place, and was improved and enlarged. The study team recommends that the additional cargo handling equipment for containers shall be repaired at the existing workshop. The reasons are as follows:

- General repair (preventive and corrective maintenance) will be done more smoothly and at a lower cost in the ESP workshop than in an outside shop.
- It is uneconomical to establish one more workshop because the required facilities/equipment for repair and technique (except electrical control system) are the same as for the existing handling equipment.
- The workshop can be improved and enlarged to cope with the increased amount of cargo handling equipment.
- Any complicated and special repairs could be done by outside workshops.

< Damaged containers >

Some damaged containers will be found at the container terminal. The damaged empty containers shall be repaired before they are delivered. They can be categorized into two groups; seriously damaged and slightly damaged.

The seriously damaged containers will be repaired at the workshop, and the slightly damaged containers can be repaired with portable repair facilities at the terminal. The required area for container repair will be provided at the terminal. Most of the damaged containers can be repaired there.

< Dirty containers >

Dirty containers shall be cleaned before they are used again to keep them in good condition. Most of the dirty containers can be cleaned with high pressure water.

A block for container cleaning will be prepared at the terminal and a high pressure water supply facility will be prepared at the block.

If the containers cannot be cleaned with high pressure water, they shall be moved to the workshop and cleaned with steam.

b. Required facilities at the workshop

The main work of the workshop is to undertake preventive

maintenance of facilities/equipment in possession.

In addition the workshop also carries out the possible corrective maintenance within its capacity.

The corrective maintenance beyond the capacity of the workshop will be ordered from an outside shop.

The required facilities of the workshop will be as follows:

- All types of tools for assembling and disassembling.
- Measuring tools.
- Rust removers, painting tools (brushes, rollers, sprays).
- Handling machinery (chain-blocks, hydraulic-jacks, vise).
- Machinery (compressor, battery charger, gas cutting and welding sets, electric welding machine, drilling machine (table type), grinder, steam cleaner, lathe (small universal type), hacksaw, centering surface plate).

c. Arrangement of the persons in charge of the cargo handling facilities/equipment (of machine and electricity).

< Engineers >

In order to execute preventive and corrective maintenance appropriately, some well-experienced engineers will be necessary to order and/or to advise workers. The special control system of the large-size equipment is complicated.

At least one high-grade mechanical engineer, one high grade electrical engineer and some other well-experienced engineers must be arranged at the workshop.

The required number of engineers will be about 14 persons in the year 2005.

< Workers >

The required number of skilled workers must be kept to maintenance the required maintenance level.

The required number of workers are as follows:

1995	40 persons
2005	75 persons

9.1.5 Layout Plan

Based on the matters discussed so far, the layout plans of facilities in the container terminals and related areas are examined in this section. The general layout plan is as illustrated in Fig. 9.1.4.

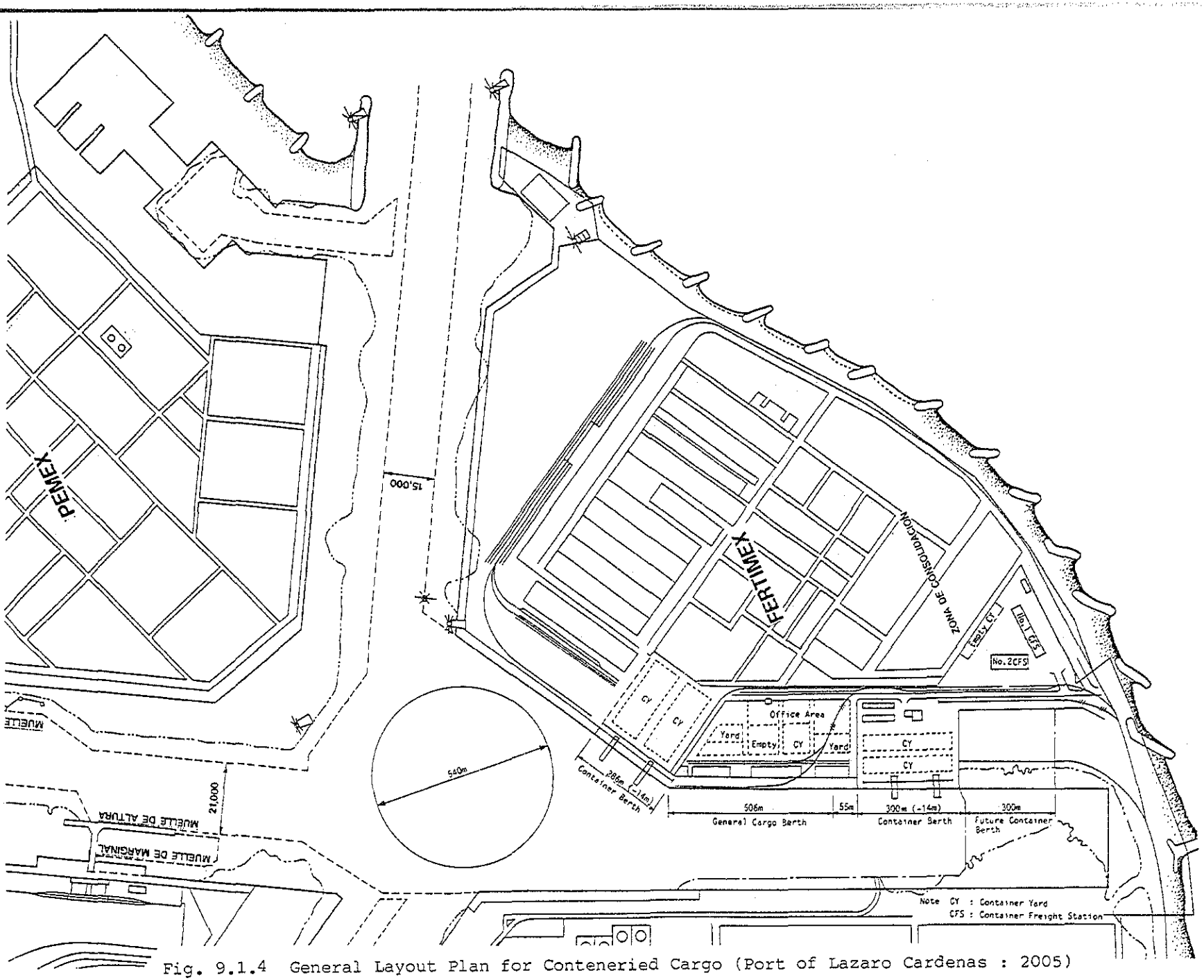


Fig. 9.1.4 General Layout Plan for Conteneried Cargo (Port of Lazaro Cardenas : 2005)

(1) Existing Container Terminal

The layout plan of the existing container terminal is shown in Fig. 9.1.5, which is fundamentally the same as the short-term plan. For a detailed explanation of the layout plan, refer to section 10.1.4.

(2) New Container Terminal

1) Alternatives

A new terminal is planned in the area adjacent area to the general cargo berths. This area is long enough to permit construction of two 300 m berths in the future. Therefore, two alternative layout plans are examined considering future expansion of the container terminal.

Fig. 9.1.6 represents the layout plan of the rail mounted transfer crane system. Containers are stacked in 12 lines between the crane rails and in 3 lines on the one outreach side. Another outreach side is used as the travelling lane for trailers.

Fig. 9.1.7 shows the layout plan of a rubber tyred transfer crane system. The transfer cranes are of the six-line stacking type, with one travelling lane for trailers between the wheels.

Both alternative plans have enough container storage capacity for the volume expected in 2005. The dotted lines in both figures show the expansion plan for the second berth.

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. A rough estimate of number of ground slots for the two berths is given below:

Rubber-tyred transfer crane system	2,620 slots
Rail mounted "	3,120 "

In addition, as seen in Fig 9.1.7, 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.

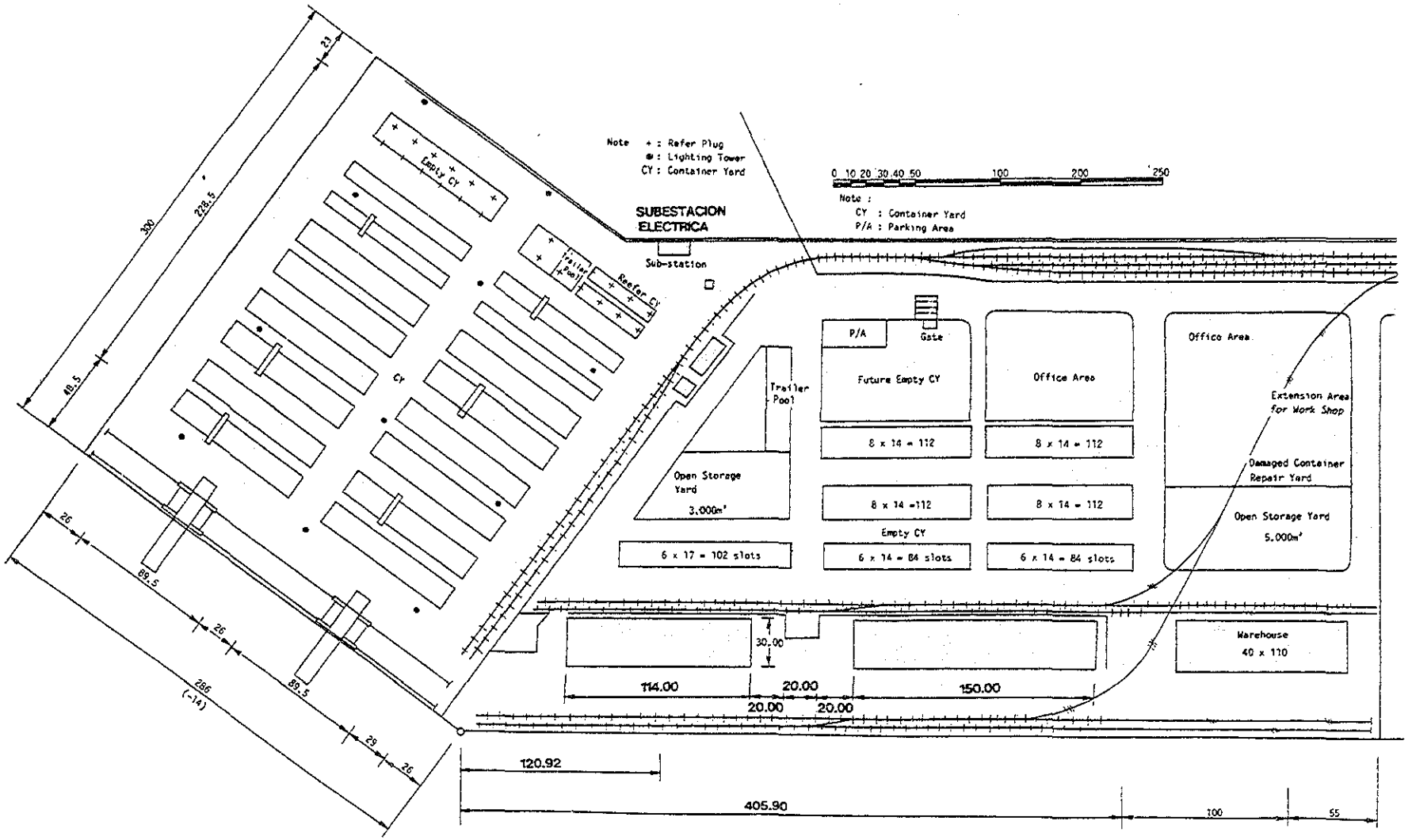


Fig. 9.1.5 Layout Plan of Existing Container Terminal and the Area behind the General Cargo Berths (Port of Lazaro Cardenas : 2005)

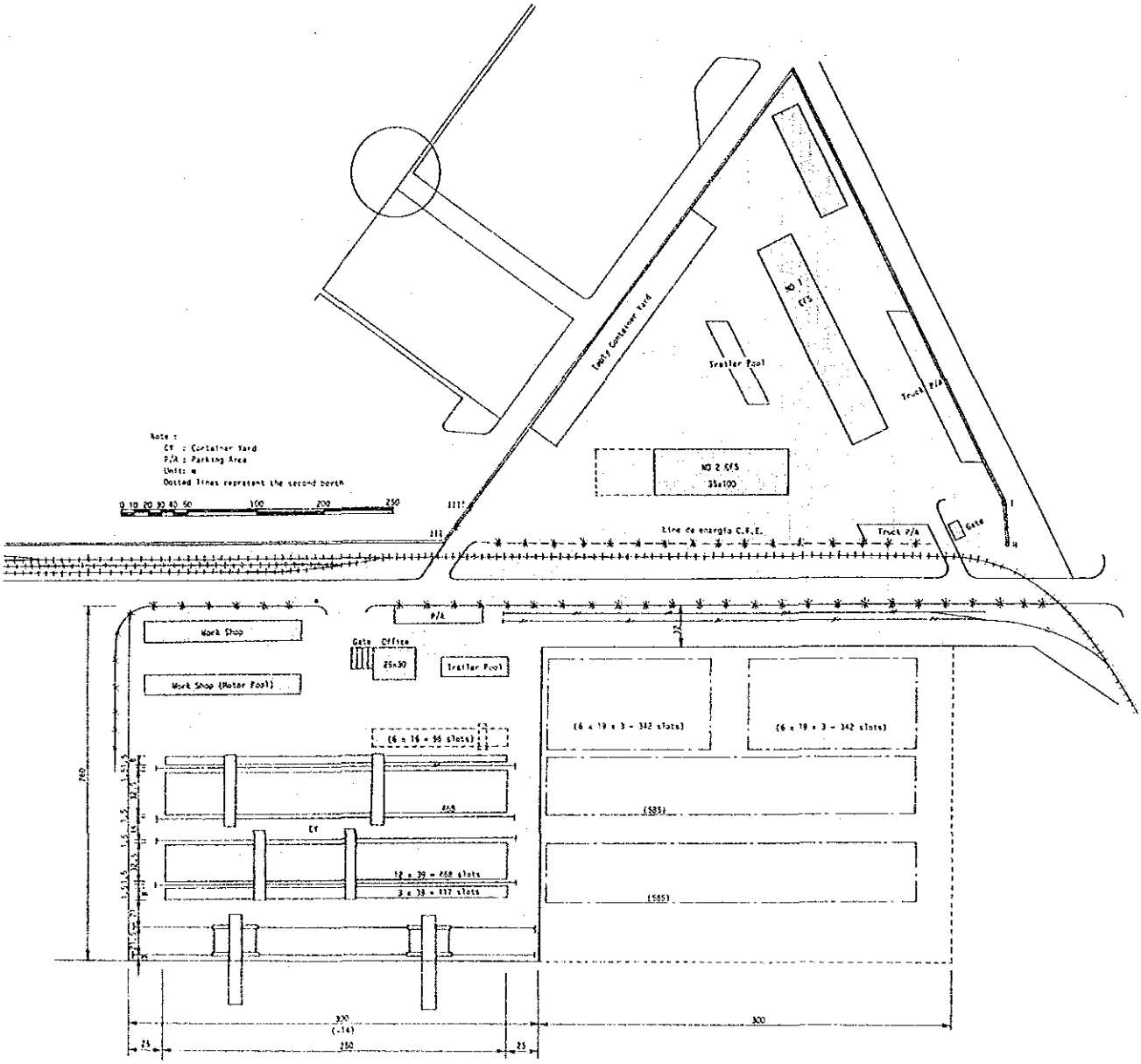


Fig. 9.1.6 Layout Plan of New Container Terminal
- Rail-mounted Transfer Crane System : Adopted Plan -
(Port of Lazaro Cardenas : 2005)

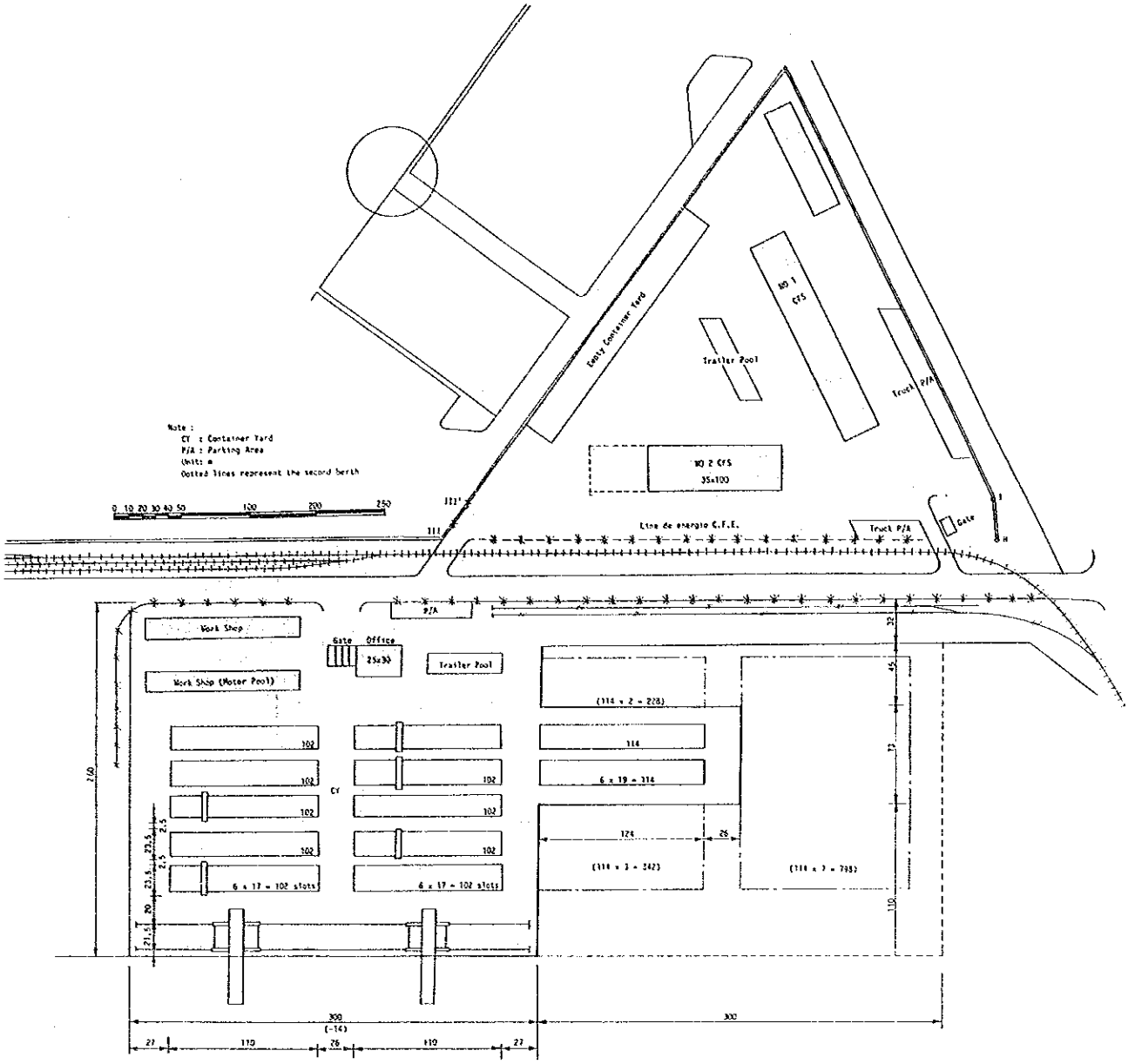


Fig. 9.1.7 Layout Plan of New Container Terminal
- Rubber Tyred Transfer Crane System -
(Port of Lazaro Cardenas : 2005)

2) Layout of facilities

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

ii. Because of the insufficient width of the terminal, the empty container yard and the CFS are located in adjacent areas, as shown in Fig. 9.1.5 and 9.1.6.

iii. Two quayside gantry cranes and four rail-mounted transfer cranes are provided.

iv. Enough areas for apron and passages are planned to allow the smooth movement of trailers.

v. The scale required at the terminal gate and office are located near the entrance of the terminal.

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

vii. Two railway tracks with lengths of 300 - 350 m each are positioned at the back of the second berth mainly for container transportation from/to the hinterland.

(3) Area behind the General Cargo Berths

1) *Extension of general cargo berths*

The total length of the general cargo berths is presently 506 m, which is not sufficient for 3 berths. An extension of 55 m of the berths is planned. This will allow the mooring of three 20,000 DWT class vessels. This expantion of the berths is also required for the layout of the new container terminal.

The berth occupancy of these berths in 2005 is estimated to be fairly low, which will allow such uses of the berths as follows:

- Shift and stay for domestic feeder vessels
- Further utilization by multipurpose vessels which plan to moor at the container berths
- Berthing of vessels such as bulk carriers

2) Facility layout and land use plan

Facility layout and land use plan of this area are drawn up as shown in Fig. 9.1.5.

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 tracks in view of the transportation of empty containers by railway.

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

vi. The gate and parking areas for road trailers are located at the entrance of the existing container terminal.

(4) CFS Areas

Fig 9.1.6 shows the layout plan of the CFS area.

i. Necessary additional CFS are planned. This could be extended in the future.

ii. Adequate parking areas for both trailers and trucks are provided.

iii. An empty container yard is planned which can store empty containers for the CFS and various uses.

9.1.6 Operation System

(1) Management

Container terminals have the function to handle containerized cargo in a specialized manner improving cargo handling efficiency and realizing the intermodal transportation that lead to reduce the total period of transportation. As for the operation at the terminal, it is necessary to prepare a special container handling section in the ESP by the following reasons:

i. The containerized cargo volume treated in this port is estimated at 2,355 thousand tons including feeder cargoes in 2005 and will show

an upward tendency in the future. The ESP should strengthen this section.

ii. Container cargo handling procedures are specialized and standardized throughout the world. Specialization is necessary at this port too.

iii. Initial investment in a container terminal is large. It would be better to manage this section independently to ensure profitability.

iv. The ESP executes cargo handling operations exclusively, so the new container handling organization should be established as part of the present ESP organization.

The new container terminal organization in the ESP is proposed as shown in Fig. 9.1.8. The required numbers of personnels of the container terminal and operation section in the year of 1995 and 2005 are estimated as shown in the same Fig, based on the demand forecast.

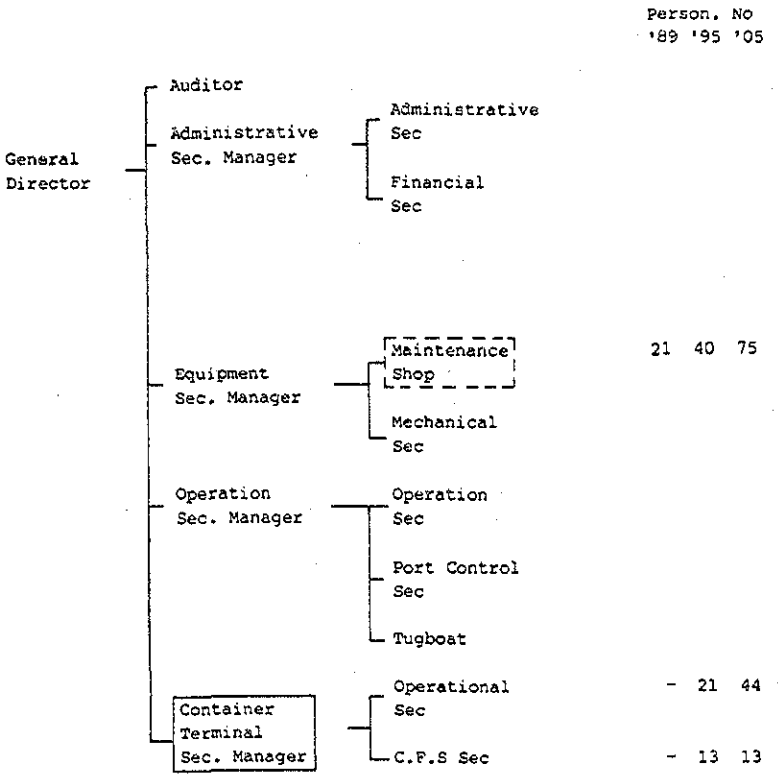
The local office of Puertos Mexicanos should execute its maintenance and construction work in close contact with the ESP to maintain the smooth cargo handling as referred to in Chapter 8.

(2) Premises and Handling Operation Method

In the master plan, a new container berth will be constructed (berth length 300m, water depth -14m) next to the end of the present general cargo berth and 600m far from the present container berth (berth length 286m)

The study team estimated container terminal conditions of the year 2005 master plan as follows:

a. Container berths	2 berths
b. Quayside gantry cranes	4 units(each berth 2 units)
c. Transfer cranes	2 " (rubber tire 3 lanes, 2 layers)
	4 " (rubber tire 6 lanes, 3 layers)
	4 " (steel rail 15 lanes, 3 layers)
d. Tractor heads	26 units
e. Container chassis	60 " (20'/40' concurrently use)
f. Containers handled per year	312,150 TEU/year



Note: " '89 " = The year of 1989
" '95 " = The year of 1995
" '05 " = The year of 2005
Person. No = Personnel number

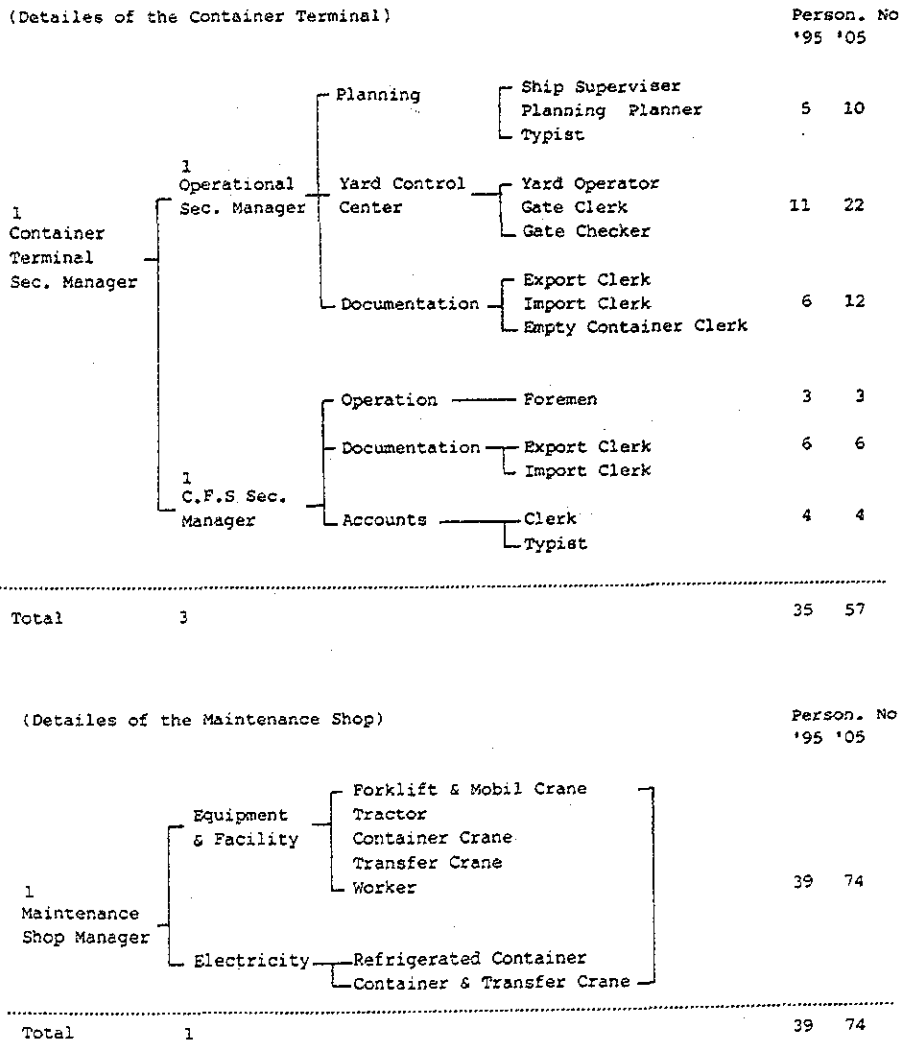


Fig. 9.1.8 Example of New Organization for the Container Terminal
(Port of Lazaro Cardenas)

g.	Ships' calling at port per year	378 ships/year
h.	Handling container 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)
i.	CY storage container needed	7,930 TEU

As for general handling operation method, refer to section 9.2.6 (1).

(3) Special Points Regarding Container Operation

Two container terminals in the year 2005 is planned in separate locations and between the two terminals there are three general cargo berths (561m length).

The new terminal has a berth length of 300m and a water depth of -14m.

Behind the general cargo berths there will be empty container yard and an area connecting the two container terminals.

The points to be noted are as follows:

a. It is necessary to transfer the transshipment containers from one terminal to another when the first discharging berth and second loading berth are different.
b. As the terminal gate houses are located at two separate places, it is necessary to maintain close contact between the operation center and the gate houses. A direct line telephone system and a facsimile system will be effective.
c. The existing CFS warehouse will be used as a CFS area for both terminals. It is necessary to dray containers about 1,000 meters distance from the present container berth.
d. As there is a distance of 600m between two terminals, two operation control center offices are necessary. one for each berth.
e. It is necessary to have more container chassis and tractors compared with a situation in which the berths are continuous.

(4) Empty Container Yard Operation

Points regarding the empty container handling operation should be noted as follows:

a. When receiving empty containers, the terminal operator should check them at the terminal gate and assort them into two groups: sound containers and damaged/dirty containers. Both groups should be stored separately.
b. The empty containers should be stored separately by the shipping company handling the containers.
c. When taking out the empty containers to the shipper's place for export stuffing, the empty containers should be checked carefully in order to not deliver the damaged/dirty containers.
d. Efforts must be made to give preference to using empty containers which have stayed for a long period in the terminal.
e. When the empty containers are stacked three or four layers high, they should be block-stowed and containers on the outside of the block should have stacking cones between each tier.
f. The damaged containers should be repaired as quickly as possible by making contact with the shipping company or its agents.
g. Specialized containers should be stored separately from ordinary dry containers (refrigerated containers, flat rack, tank, open top containers).
h. When handling empty containers, a top-lifter should be used and not an ordinary fork-lift truck.

(5) Telephone, Facsimile Equipment Supply

At present (1989), the operation office in the port area has no telephone line services and it depends on a few wireless walkie-talkie set for communication.

According to the year 2005 container terminal master plan, the two container terminals are about 600 meters from each other. It will be necessary to have a large volume of correspondence between Mexico city and the other ports offices in 2005. At least until the 1995 short-term plan, telephone services should be acceptable in this port area's offices.

It will be necessary to have facsimile equipment and adequate wire or

wireless telephone equipment in place before 2005.

(6) Terminal Operating Organization and Staffs

With regarding to this point, the study team will recommend a direct ESP management system, the reason for why is described in section 9.2.6,(3).

The necessary number of staff members will be transferred from the present ESP operation and maintenance section to the new terminal operation section and new CFS operation staff members will be added.

At present ESP staff members has 137 staff members.

Operation and maintenance section	80 persons
General affairs section	34 "
Secretaries	6 "
Bonded area patrol	17 "

New container terminal staff members for two berths will be 97 persons.

ESP operation and maintenance section	76 persons
Administration	8 " (concurrent with ESP)
CFS staffs	13 "

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

Container gantry crane operator	4 persons
Transfer crane operator	8 "
Tractor head driver	12 "
Top lifter driver	4 "
Lashing/unleashing workers	16 "