社会開発調査部報告書

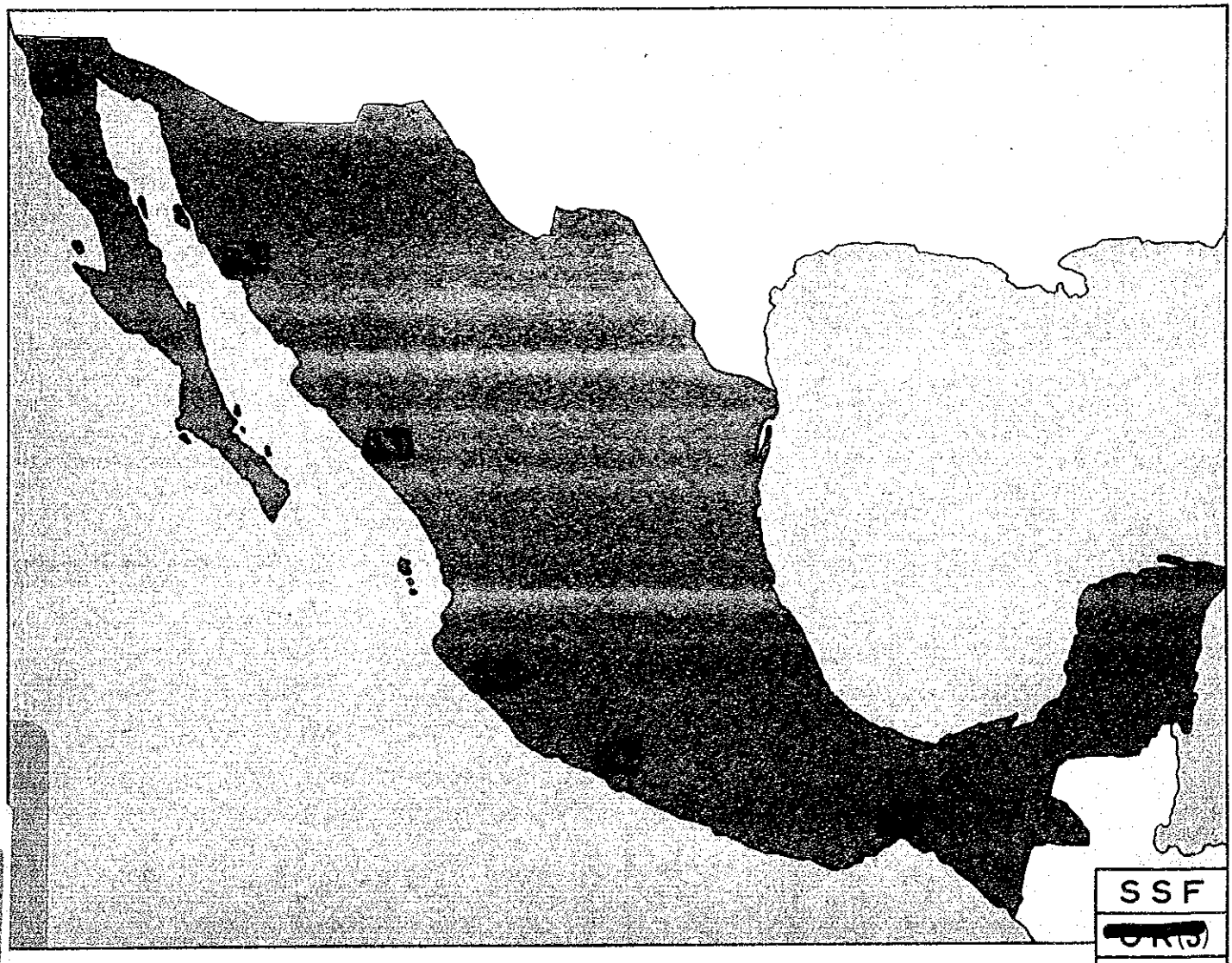
NO. 32

FINAL REPORT

THE STUDY ON THE IMPROVEMENT PLAN OF THE PACIFIC COAST PORTS IN THE UNITED MEXICAN STATES

VOL.1 SUMMARY

JULY 1990



JAPAN INTERNATIONAL COOPERATION AGENCY

FINAL REPORT

THE STUDY ON THE IMPROVEMENT PLAN OF THE PACIFIC COAST PORTS IN THE UNITED MEXICAN STATES

VOL.1 SUMMARY

JULY 1990

PREFACE

In response to a request from the Government of the United Mexican States, the Japanese Government decided to conduct the study on the Improvement Plan of the Pacific Coast Ports in the United Mexican States and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the United Mexican States a survey team headed by Mr. Terumi Iijima, and composed of members from the Overseas Coastal Area Development Institute of Japan (OCDI) and Nippon Koei Co., Ltd, three times from April, 1989 to March, 1990.

The team held discussions with concerned officials of the Government of the United Mexican States, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the United Mexican States for their close cooperation extended to the team.

July, 1990

kensuke Yanagiya, President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Mr. Kensuke Yanagiya

President
Japan International Cooperation Agency

Dear Mr. Yanagiya

It is my great pleasure to submit herewith the Report for the Study on the Improvement Plan of the Pacific Coast Ports in the United Mexican States.

This report is the result of studies carried out by the Overseas Coastal Area Development Institute of Japan and Nippon Koei Co., Ltd at the contract of the Japan International Cooperation Agency. Regarding this study, our study team started the study in March, 1989 and conducted three series of field surveys. Based on the field surveys and their analysis in Japan, this report was prepared for the purpose of formulating a long-term development policy for the Pacific Coast ports focusing on the container network system for the target year 2005, examining urgent measures to make the fullest use of the existing facilities and equipment at each port and formulating short-term improvement plans in the two ports selected based on the above mentioned long-term development policy.

The report shows that the project is extremely important, so I hope the project is executed promptly.

On behalf of the study team, let me express my heartfelt thanks to Puertos Mexicanos Secretaria de Comunicaciones and to the other related agencies of the Mexican Government for the generous cooperation, assistance and warm hospitality which were extended to the study team during their stay in Mexico.

Our thanks are also due to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Transport and the Japanese Embassy in Mexico for their valuable advice and support during the field surveys and the preparation of this report.

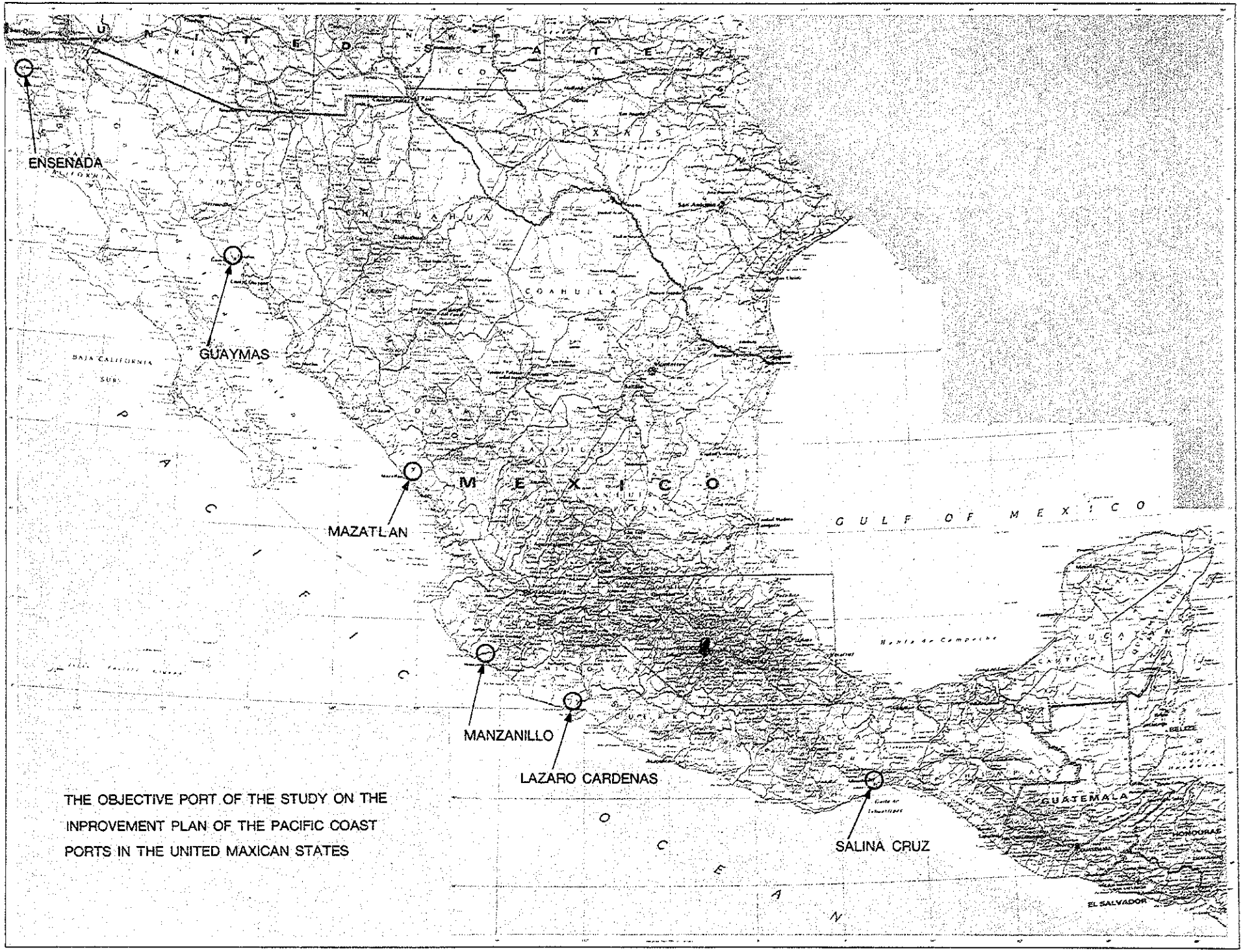
July 1990

Your faithfully,

T. Iijima

Terumi Iijima,

Head
Japanese Study Team for the Study on the Improvement Plan of the Pacific Coast Ports in the United Mexican States
(Executive Director, the Overseas Coastal Area Development Institute of Japan)


ENSENADA
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INPROVEMENT PLAN OF THE PACIFIC COAST
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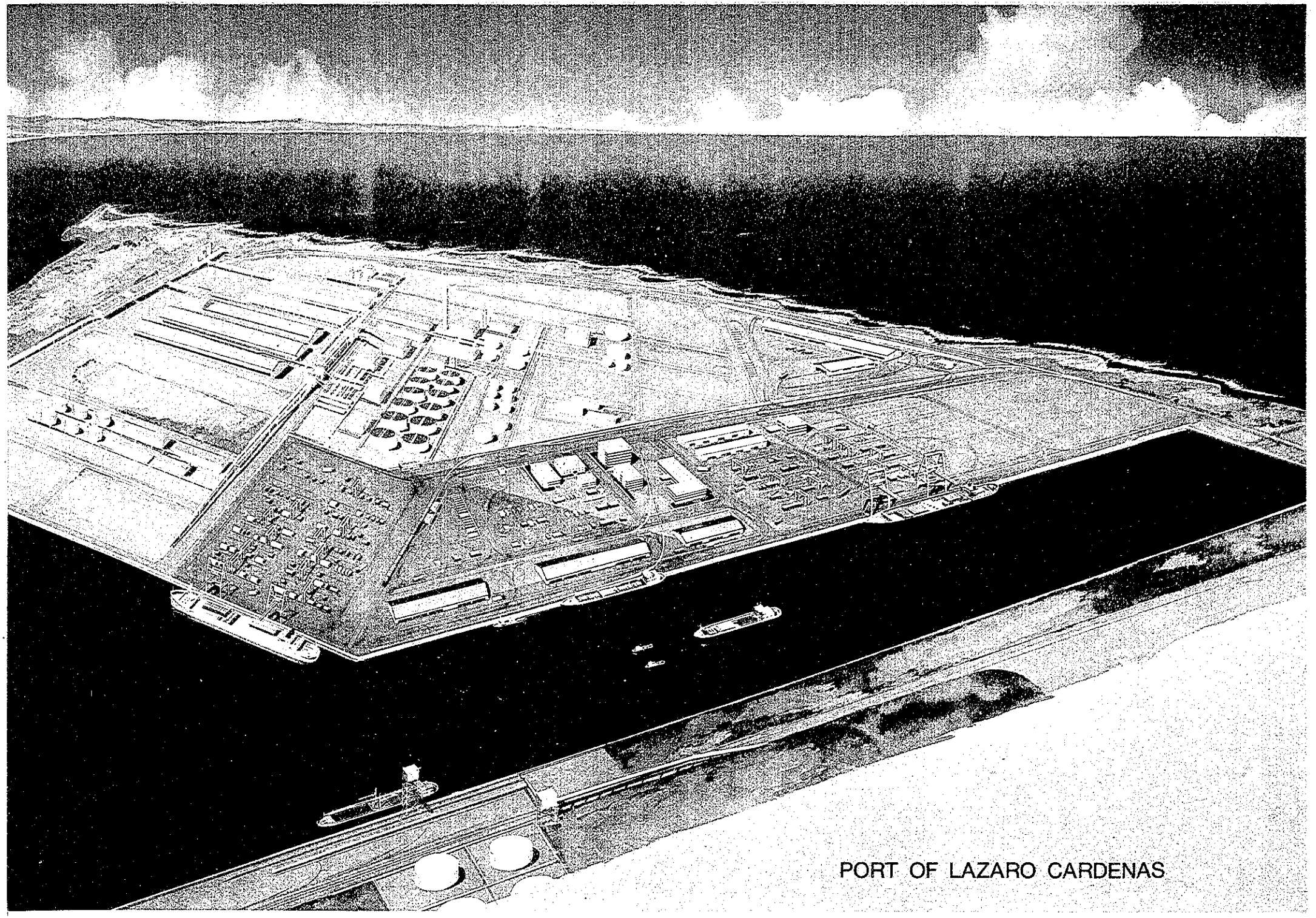

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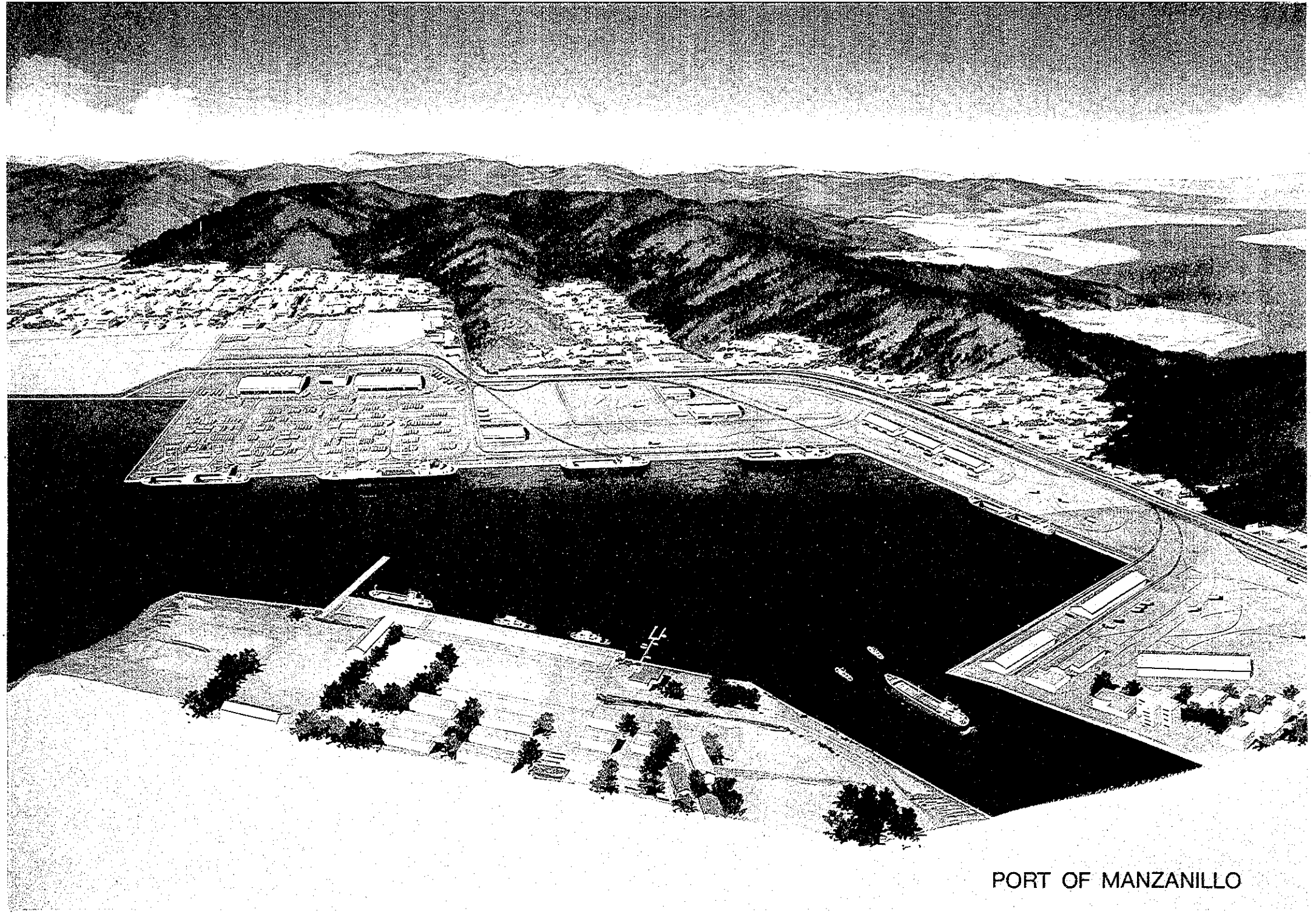
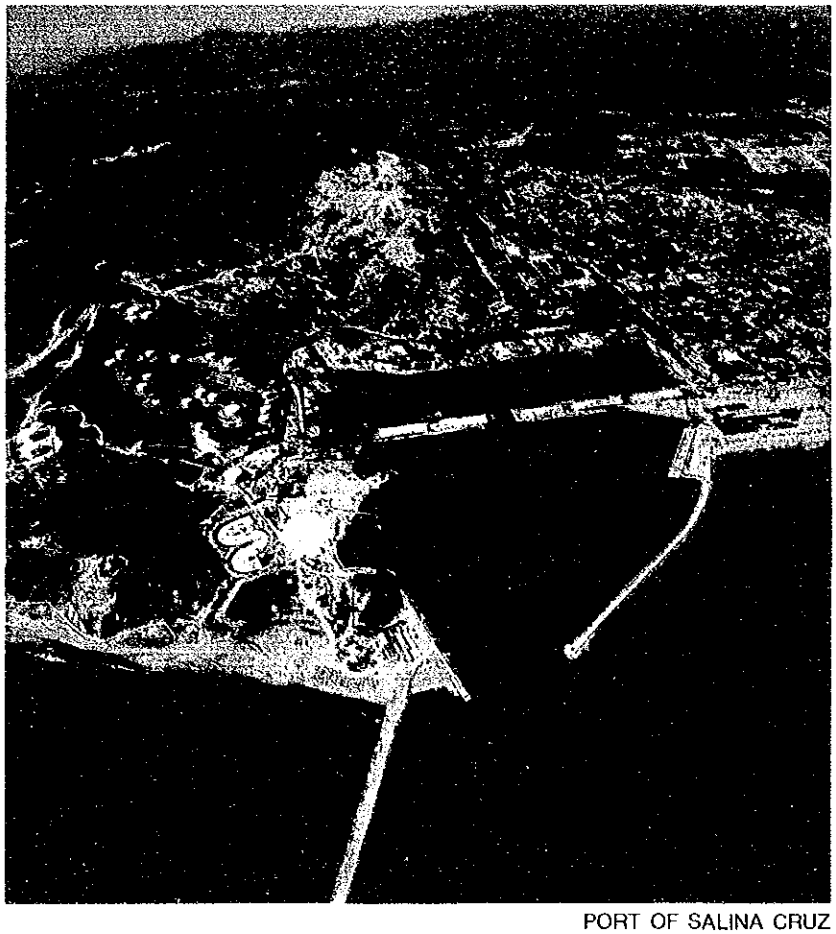
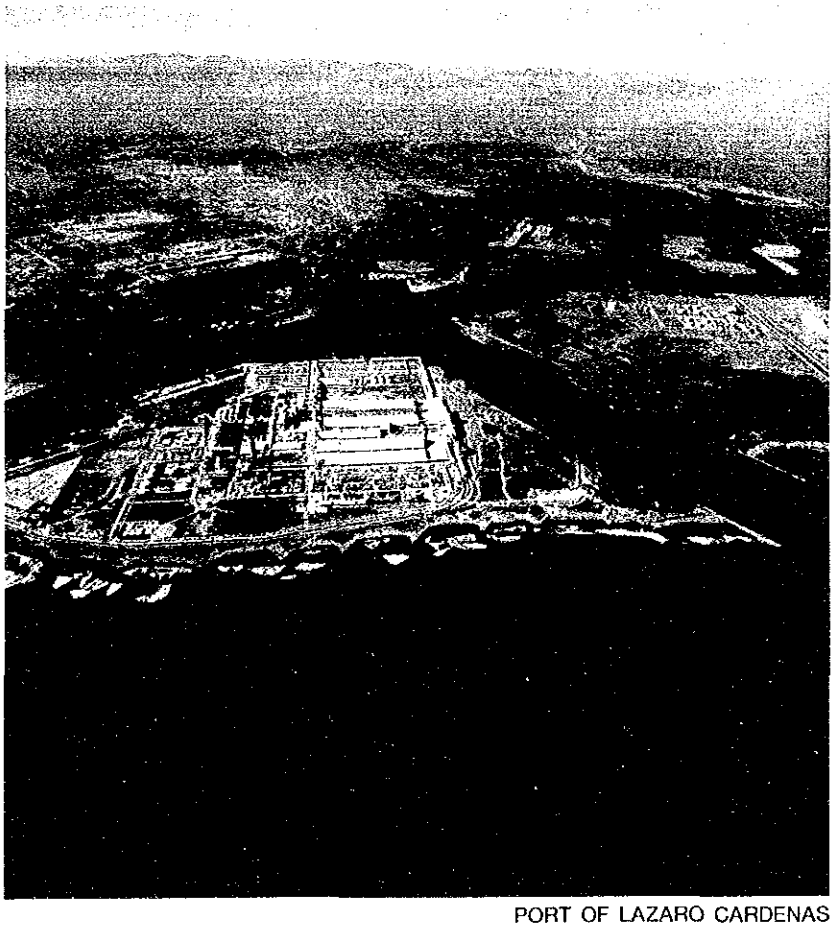


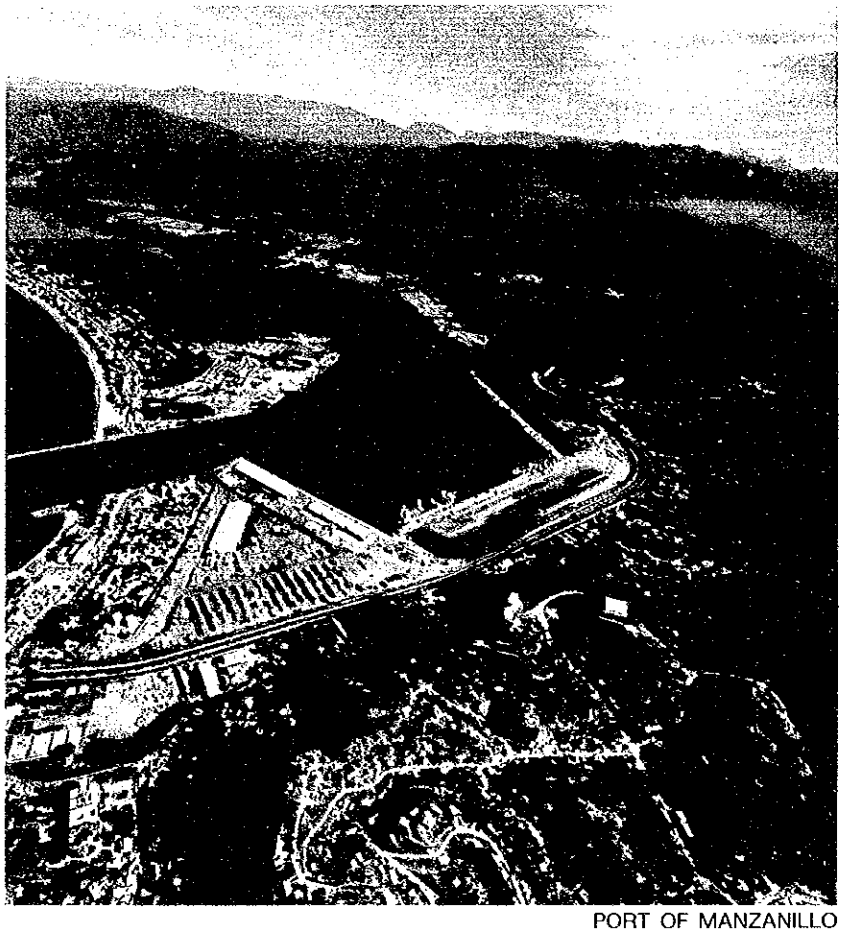
PORT OF MANZANILLO



PORT OF SALINA CRUZ



PORT OF LAZARO CARDENAS



PORT OF MANZANILLO

PORT OF MAZATLAN

PORT OF GUAYMAS

PORT OF ENSENADA

EXCHANGE RATE

US $ 1 = $ 2,600 PESOS

US $ 1 = ¥ 143

(As of October 1989)

ABBREVIATIONS LIST

ANDSA	Almacenes Nacionals de Deposits, S.A.
ASA	Aeropuertos y Servicios Auxiliares
CDL	Construction Datum Level
CFS	Container Freight Station
CKD	Completely Knocked-Down (auto parts)
CLP	Container Load Plan
CNCP	Comision Nacional Coordinadora de Puertos
CONASUPO	Cia. Nacional de Subsistencias Populares
CPF	Caminos y Puentes Federales de Ingresos y Servicios Conexos
CROM	Confederacion Revolucionaria de Obreros Mexicanos
CTM	Confederacion de Trabajadores Mexicanos
CY	Container Yard
DST	Double Stack Train
D/R	Dock Receipt
DWT	Dead Weight Ton
EIR	Equipment Interchange Receipt
ESP	Empresa de Servicios Protuarios
ETA	Estimated Time of Arrival
FERTIMEX	Fertilizantes Mexicanos, S.A.
FDWS	a Fixed Day Weekly Service
FCL	Full Container Load
FIRR	Financial Rate of Return
FNM	Ferrocarriles Nacionales de Mexico (Ferronales)
GDP	Gross Domestic Product
GRT	Gross Registered Tonnage
G.T	Gross Tonnage
LCL	Less Container Load
M.H.W	Mean Height Water
M.L.L.W	Mean Lowest Low Water
N.A.	Not Available

JICA	The Japan International Cooperation Agency
PEMEX	Petroleos Mexcicanos
ROK	The Republic of Korea
SCT	Secretaria de Comunicaciones y Transportes
SICARTSA	Siderurgica Lazaro Cardenas - Las Truchas, S.A.
SEDUE	Secretaria de Desarrollo Urbano y Ecologia
SPM	Servicio Postal Mexicano
SPP	Secretaria de Programacion y Presupuesto
TEU	Twenty-foot Equipment Unit
TM	Telecomunicasiones de Mexico
TMM	Transportation Maritima Mexicana S.A. de C.V.
TR	Telereservaciones
UNCTAD	United Nations Conference on Trade and Development
$	U.S. Dollar
$	Peso

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1. Need for Urgent Measures and Development of the ports

(1) Need for the Urgent Measures at the Ports

The development of infrastructures in the transport sector is one of the most significant issues in the United Mexican State in line with the government's policy of stabilizing and developing the national economy. However, because of the limited funds available for the development of infrastructures in the short term, there is an urgent need for measures to be taken which would allow the most efficient and fullest utilization of infrastructures without a large amount of investment.

The main ports on the Pacific coast of the United Mexican States, namely the Ports of Salina Cruz, Lazaro Cardenas, Manzanillo, Mazatlan, Guaymas and Ensenada, now suffer from many problems, such as superannuated facilities/equipment, low cargo handling productivity and shortage of cargo handling facilities/equipment.

Therefore there is an urgent need to examine and implement measures that will effectively cope with the present problems at the port, thus contributing to their fullest and most effective use.

(2) Need to Develop Selected Ports

Container traffic through the objective ports has been showing remarkable progress. But the facilities/equipment and productivity of container handling are not sufficient, having lead to problems in dealing with this increased traffic. It is thus necessary to develop and improve the port facilities/equipment and operations regarding container handling.

Taking into consideration an optimum cost/benefit conception for investment as well as the sailing costs of large container vessels, it is important to examine the rational container network among the ports on a long-term basis and select the pivotal base ports for container vessels' calling. These selected ports need to be developed and the operational ability of container handling at them must be improved.

On the other hand, another crucial issue at the ports is improving the facilities/equipment and operation for handling bulk cargoes, which are one of the main types of cargoes passing through the ports. Improvement in handing these cargoes along the lines mentioned above is urgently required.

2. Demand Forecast and Container Network

(1) Demand Forecast

The general and containerized cargo volume through the ports on the Pacific coast are forecast in the years 1995 and 2005 as follows:

(Unit:1000tons)

	1988	1995	2005
General Cargoes	1,247	2,630	4,600
Containerized Cargoes	647	1,841	3,758
Containerized Ratio	52%	70%	82%

(Note:Excluding general cargoes by SICARTSA)

The handing volume of containerized cargoes is forecast to grow significantly due to greater amounts of general cargoes and the promotion of containerization.

The container traffic demands through each port are estimated as follows:

(Unit:1000tons)

	1988	1995	2005
Salina Curuz	161	301	501
Lazaro Cardenas	154	522	1,119
Manzanillo	164	636	1,284
Mazatlan	21	95	202
Guaymas	134	194	315
Ensenada	-	42	103

(2) Container Network

The container network among the ports on the Pacific coast is examined taking into account the forecast results of container traffic through the ports and geographical conditions of the ports.

The Ports of Lazaro Cardenas and Manzanillo are selected as pivotal base ports which container mother vessels are assumed to call at on a fixed day weekly service basis.

Other ports except Ensenada are to act as feeder ports connected to

the base ports by domestic feeder routes. As for the Port of Salina Cruz, the direct calls of some container mother vessels are also assumed.

Two feeder service routes, one connecting Manzanillo with Mazatlan and Guaymas and another connecting Lazaro Cardenas with Salina Cruz, are proposed as comprising the most feasible network.

3. Recommendations on the Urgent Improvement Plans

The recommendations regarding the urgent improvement plans of the ports are proposed covering a series of comprehensive items with respect to urgent measures as follows:

1) Utilization of the ports

- Establishment of a system for promoting utilization of the port
- Promotion of containerization at the ports
- Formulation of the master plans of the ports and make them available to the public
- Investigation of the possibility of promoting domestic maritime transportation

2) General port administration

- Strengthening of the management constitution of the ESP
- Improvement of the coordination and communication system among the ESPs and other local governmental organizations

3) Tariff system

- Simplification of the tariff system
- Carrying out cost accounting for individual tariffs
- Taking full account of the need to improve cargo handling efficiency in the tariff system

4) Cargo handling unions

- Taking the necessary measures regarding the existence of more than one union
- Taking integrated measures to improve productivity

5) Statistics

- Allocation of more responsibility for preparing port statistics to

Puertos Mexicanos

- Strengthing the statistics sections in the ESPs
- Improvement of port statistics regarding vessels, cargoes, containers and others

6) **Procedures of ship entry/exit and customs formalities**

- Promotion of further coordination among related bodies
- Requesting the simplification and unification of customs formalities
- Requesting reform of the fumigation system

7) **Land transportation and storage system in the port area**

- Requesting repair and construction of the roads and railways connecting the ports with their hinterlands
- Requesting the required number of trucks and freight cars from the port side
- Promotion of coordination to secure necessary number of trucks and freight cars
- Promotion of installation of adequate storage facilities in the port area
- Taking necessary and effective measures to reduce the dwelling time of cargoes at the port area
- Investigation of the installation of inland depots for container transportation

8) **Cargo handling operation**

- Formulation of cargo handling plans and surpervision of cargo handing activities by ESP
- Preparation of a manual describing the standard activities of ship cargo supervisors
- Preparation of a container operation manual at the container terminals
- Taking comprehensive measures to improve container handling productivity
- Taking necessary measures to prevent large handling/storage losses and contamination during bulk cargo handling
- Improvement of the training system for workers

9) Cargo handling facilities/equipment and maintenance system

- Examination of the optimum possession level of cargo handling facilities/equipment and spare parts at each port
- Preparation of a replacement or disposal plan for cargo handling facilities/equipment at each port
- Establishment of an effective maintenance policy and system
- Promotion of the disposal of superannuated equipment
- Management and utilization of the records and data effectively
- Making clear the role of Puertos Mexicanos

10) Port facilities (except cargo handling facilities/equipment)

- Promotion of the rehabilitation of superannuated facilities at the ports
- Carrying out construction works based on the long-term master plans of the ports

4. Long-term Development Plans in the Selected Ports

(1) Port of Lazaro Cardenas

The long-term development plan (master plan) in the Port of Lazaro Cardenas is formulated with regard to the amount of containerized cargoes expected in the target year 2005.

The handling volume of containerized cargoes in the target year is estimated to be around 2,360 thousand tons, including domestic feeder cargoes.

Two container berths are planned to meet the anticipated container traffic demand. One is the existing berth with a length of 286m and water depth of 14m. The other is a newly planned berth with a length of 300m and water depth of 14m, which it is proposed be located in th area adjacent to the general cargo berths.

An area use plan for the area behind the general cargo berths is proposed. This area is to be used for an empty container yard, office area, open storage yards and other purpose.

A rubber-tyred transfer crane system is adopted as the operation system at the existing container terminal, while a rail-mounted transfer crane system is proposed for the newly planned terminal, considering the relatively narrow width of the terminal.

(2) Port of Manzanillo

The long-term developement plan (master plan) for the Port of Manzanillo is formulated with respect to containerized cargoes for the target year of 2005.

The handling volume of containerized cargoes in 2005 is estimates to be around 2,480 thousand tons, including domectic feeder cargoes.

Two container berths are required to accommodate the anticipated container traffic demand in the target year. Two continuous berths with lengths of 300m and water depths of 14m each are proposed at the C band area of the port.

A rubber-tyred transfer crane system is adopted as the operation system at the proposed container terminal.

5. Short-term Improvement Plans in the Selected Ports

(1) Port of Lazaro Cardenas

1) Improvement plan for containerized cargoes

The short-term improvement plan for containerized cargo is formulated with a target year of 1995, based on the master plan of this port.

The estimated handling volume of containerized cargo in 1995 is 522 thousand tons. One container berth is required to accommodate the container traffic in the target year.

Therefore, the existing berth is where the reformed utililization of the container yard along with the installation of the required cargo handling equipment are proposed.

The use plan for the area behind the general cargo berths is proposed in line with the master plan. This area will be used mainly as an empty container yard in 1995.

The operation system at the terminal is the same as in the master plan : a rubber tyred transfer crane system.

The construction cost component of the project is limited to modernization of container handling facilities/equipment, pavement of yards and roads and other items. The project cost is estimated at 48.4 billion pesos (prices as of october 1989). Around 59% of the project cost comprises the foreign price portion.

2) Improvement plans for bulk cargoes

The improvement of the grain silo operation is examined. The recommendations in this connection concern the coordination needed to ensure sufficient land transportation means, the significance of maintenand of the overall silo system and others.

As for the management/operation body of the silo complex, a private or third sector is recommended as preferable to the ESP, given the vitality and adaptability required for management/operation of the silo complex.

In the next place, the improvement of cargo handling operations at the SICARTSA berth is examined focussing on the handling productivity. Assuming operations improve, it will be possible to handle projected volume of cargoes arriving at the port annually from 1990 to 1995 on the existing berths.

3) Economic and financial analyses

The short-term improvement plan for containerized cargoes is evaluated on an economic basis using the EIRR (Economic Internal Rate of Return), which is calculated based on a cost-benefit analysis from the viewpoint of the national economy. Benefits considered are the reduction in land transportation cost, ships' staying cost and cargo handling costs, while costs are construction and maintenance costs. The calculated EIRR, using 30 years as the period of calculation, is 29.05%. This shows that the project is sufficiently advantageous from the viewpoint of the national economy.

The port finances, regarding the above project are analyzed using the financial statement from the viewpoint of each management body of the ESP and the local office of Puertos Mexicanos. The profitability of the project itself is analyzed based on the FIRR (Financial Internal Rate of Return) using the Discount Cash Flow Method. The analyzed results show that, given the relatively low portion of loans in the total fund, each management body will maintain its financial viability throughout the entire project life and will be able to pay all expenditures and repay long-term loans. As to the protitability of the project itself, the FIRR si expected to be 10.06. This result shows that the project is feasible from the financial point of view.

Judging from the above, it is concluded that the short-term improvement plan for containerized cargoes with a target year of 1995 is

feasible both economically and financially.

On the other hand, the short-term improvement plans for bulk cargoes, which are dealt with in this report, do not require much investment. Therefore, judging from the expected benefits, the projects are considered feasible, both economically and Financially.

(2) Port of Manzanillo

1) Improvement plan for containerized cargoes

The improvement plan for containerized cargoes with the target year of 1995 is formulated based on the master plan.

The projected handling volume of containerized cargoes in 1995 is 636 thousand tons. One berth is required to meet the container traffic in the target year. The required scale of the berth is 300m in length and 13m in water depth.

The operation system at the terminal is the same as that in the master plan:a rubber tyred transfer crane system.

The construction cost of the project is estimaled at 136.4 billion pesos (prices as of october, 1989). Around 44% of the project cost belongs to the foreign price portion.

2) Improvement plans for bulk cargoes

The berth and land use plans of the inner port area are examined and proposed based on the demand forecast and assuming the concessions for bulk cargo handling.

Improvement of cargo handling operation at the band B berths is examined. The recommendations are proposed regarding ensuring enough number of freight cars and trucks and other items.

3) Economic and financial analyses

The short-term improvement plan for containerized cargoes is evaluated economically according to the same concept and methods used for the Port of Lazaro Cardenas. The calculated EIRR is 13.75% showing that the project is advantageous from the viewpoint of the national economy.

The above project is evaluated financially using the same concept and methods as the Port of Lazaro Cardenas. The analyzed results shows that given the low ratio of loans to the total fund, each management body will

be viabile and will be able to pay all expenditures and repay long-term loans. The FIRR of this project is expected to be 6.22% showing that the project is regarded feasible from financial point of view.

Judging from the above, it is concluded that the short-term improvement plan for containerized cargoes with target year 1995 will be feasible both economically and financially.

The short-term improvement plan for bulk cargoes is regarded as feasible both economically and financially for the same reasons given before.

RECOMMENDATIONS

The urgent measures at the ports and the implementation of the projects at the selected ports shall be conducted in accordance with the plans and recommendations presented in this report. The recommendations below concern the main matters which the study team noticed while carrying out the study.

1. In view of the urgency of the projects, the urgent improvement plans at the objective ports and the short term improvement plans at the Ports of Lazaro Cardenas and Manzanillo should be carried out as soon as possible, considering the priority and effects of the projects.

2. Socio-economic factors are in constant flux and the demands of maritime cargo traffic at the ports are greatly affected by changes in the domestic and world economies. Therefore, before implementation, the master plans as well as the long-term cargo demand at the ports should be reviewed taking into consideration the regional and national economic development and the change in port environments.

3. Taking into consideration the long distance between the ports and their hinterlands, the inland transportation of maritime cargoes is a crucial factor. It is strongly recommended to improve the road and railway links cennecting the ports with main cities and to coordinate to ensure sufficient land traffic means. Also, installation of storage facilities required at the ports should be encouraged.

4. The countermeasures to meet the increasing volume of containerized cargoes through the ports should be further examined and implemented in an integrated manner taking into account the following points:

- Promotion to realize the container network among the Pacific coast ports presented in this report.
- Improvement of land transportation of containers, including bonded transportation.
- Investigation of the installation of inland depots in the main hinterland cities.

. Installation of modernized facilities/equipment and improvement in the management and operation of container terminals at the ports.

5. A port management system should be simple and integrated so that the port can be developed and managed effectively according to a consistent policy. In view of the rather complicated port management system at the ports at present, an investigation should be carried out with the aim of simplifying and unifying the management system under the strong control of Puertos Mexicanos.

6. The countermeasures to strengthen the financial constitution of the ESPs should be comprehensively examined aiming at obtaining financial self-dependence based on their own incomes as soon as possible.

In this connection, upgrading the tariff level should be examined based on cost-accounting of individual tariffs and taking into consideration other factors such as the tariff levels at rival ports and a reasonable level of cost bearing by port users.

7. Cargo handling operations should be improved in accordance with the recommendations presented in the report. The key points of the recommendations are as follows:

- More involvement of ESPs in formulation of cargo handling plans and supervision of cargo handling activities.
- Upgrading cargo handling productivity, especially with respect to container handling.
- Improvement of the system regarding cargo handling unions and adequate training of union workers.
- Preparation of manuals for cargo handling surpervision and container terminal operation.

8. Cargo handling facilities/equipment and the maintenance system should be improved in accordance with the recommendations presented in this report. The key points are as follows:

- Examination of the optimum possession level of cargo handling facilities/equipment at each port.
- Establishment of the policy and method of preventive maintenance of cargo handling facilities/equipment at each port.

. Examination of the optimum scale of workshops and possession level of spare parts at each port.

9. In the implementation of the project of the container wharf at the Port of Manzanillo, further investigation on the settlement due to the consolidation of the clayey layer should he carried out.

Chapter 1 Introduction

1.1 Background

In response to the agreement reached between the Government of Japan and the Government of the United Mexican States (hereinafter referred to as Mexico), the Japan International Cooperation Agency (hereinafter referred to as the JICA), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, organized the Japanese study team (hereinafter referred to as "the study team"), which headed by Mr. T. Iijima and conducted the Study on the Improvement Plan of the Pacific Coast Ports in the United Mexican States (hereinafter referred to as "the study").

1.2 Objectives of the Study

The Objectives of the study are as follows;

i. To formulate a long-term development policy for the Pacific coast ports focusing on the container network system.

ii. To examine urgent measures to make the fullest use of the existing facilities and equipment at each port.

iii. To formulate short-term improvement plans in the selected ports.

The objective ports for the study are Saline Cruz, Lazaro Cardenas, Manzanillo, Mazatlan, Guaymas and Ensenada.

1.3 Scope of the Study

The study covers the following items:

i. Review and analysis of the related data and reports.

ii. Review/analysis and diagnosis of the present situation of each port.

iii. Identification and analysis of the present problems.

iv. Examination of improvement plans and recommendation on the urgent measurers.

v. Demand forecast.

vi. Formulation of the long-term development policy of each port and container network system.

vii. Formulation of the long-term development plans for containerized cargoes in the selected ports.

viii. Formulation of short-term improvement plans for containerized and bulk cargoes in the selected ports.

ix. Preliminary structural design and cost estimate.

x. Economic and financial evaluation.

Chapter 2 Outline of the Hinterland of Objective Ports

2.1 Natural Conditions

The United Mexican States, the third largest country in Latin America after Brazil and Argentina, is bordered on the north by the U.S.A. The western coastline including both sides of the Baja California Peninsula and the entire Pacific coast is 7,360 km long.

The coastal plain located between the Sierra Madre Occidental and the Gulf of California and the Pacific Ocean is widest in the north where it includes low wills and mountains and numerous bay and lagoons.

The target ports of the project - Lazaro Cardenas Port and Manzanillo Port - are located in harmony with the natural geographical features of the Mexican coast outlined above.

Manzanillo Port development has been initiated making full use of the geographical potential of the natural shape of the lagoon named San Pedrito, which provides a natural haven for the inner port area. Geographically, the Manzanillo Port area extends over a swampy soil stratum. The hilly range extends close to the shoreline of the San Pedrito Lagoon. Lazaro Cardenas Port is an artificially excavated port developed at the estuary of Rio Balgas. The geological surface condition surrounding the vicinity of Lazaro Cardenas is characterized as an alluvial one.

The climate of Mexico is diversified. This wide variety of climates is due not only to the latitudinal difference but also to differences in altitude. The gale called 'Nortes', from the north, caused by northern anticyclones, and tropical cyclones called 'Hurricanes' further vary this diverse climate. These cyclones have hit the project port several times, but having not caused severe damage on the port facilities yet.

According to the wave records of the Project Ports, there seem no distinct significant wave periods, most of them being distributed over a wide range from 5-11 seconds and concentrated around 7 m in wave height. The maximum offshore wave ever recorded was 11.5 m.

As for littoral drift, there was very limited information available during the period of the study, so, it cannot be addressed in detail. But it seems that shorelines which extend in an orientation close to the predominant wave directions near the coastal zone suffer considerable erosion or accretion in the beach line. Lazaro Cardenas is a typical case.

2.2 Socio-economic Conditions

2.2.1 Population

The population of Mexico increased at an annual rate of about 3% from 1960 to 1985 and reached 78 million in 1985. This is primarily due to a rapid decrease in the death rate, brought about by social development and economic progress.

The population is concentrated in the central regions due to the topographic and climatic conditions of Mexico.

Table 2.1 Movement of Population in Mexico

Item	Unit	1950	1960	1970	1980	*1985
Total Population	(Thousand Persons)	25,791	34,923	48,225	69,655	77,938
Annual Increase Rate	(%)	2.7	3.1	3.4	3.8	2.3
Birth Rate	(per thousand)	45.6	46.1	44.2	34.4	33.0
Death Rate	(per thousand)	16.1	11.5	10.1	7.5	6.9

Note: *is estimated

Source: Programación y Presupuesto SPP "Anuario Estadística de los Estados Unidos Mexicanos 1980
INEGI "Proyecciones de la Población de México y de las Entidades Federativas 1980-2010, 1980"

2.2.2 Economic Activity

Due to its abundant oil resources, Mexico was economically the most stable country in Latin American until the early 1980's. Through the 1980's the world-wide oil demand recession, the overvalued Mexican peso and the demand-pull inflation impeded economic growth and worsened Mexico's international balance of payments. Due to effective administration of finance and trade policies economic growth is now stable once again after fluctuating.

Table 2.2 Annual Growth Rate of GDP

(unit; %)

	1980	1981	1982	1983	1984	1985	1986	1987
Total	+ 8.3	+ 8.8	- 0.6	- 4.2	+ 3.6	+ 2.6	4.0	1.4
Agriculture, Forestry Fishery	+10.7	+ 6.1	- 2.0	+ 2.0	+ 2.7	+ 3.8	- 2.7	+ 1.6
Mining	+22.3	+14.6	+ 8.7	+ 0.9	+ 2.2	+ 0.1	- 4.3	+ 4.2
Manufacturing	+ 7.2	+ 6.4	- 2.7	- 7.8	+ 5.0	+ 6.0	- 5.7	+ 2.0
Construction	+12.3	+14.4	- 7.1	-19.2	+ 5.4	+ 2.3	-10.2	+ 1.7
Electricity	+ 6.5	+11.6	+ 9.7	+ 1.1	+ 5.0	+ 8.4	+ 2.9	+ 3.8
Transport, Communication	+14.1	+10.1	- 7.5	- 2.6	+ 5.1	- 2.0	- 3.5	+ 2.3
Commerce, Hotel Restaurant	+ 8.1	+10.6	- 0.9	- 7.5	+ 2.5	+ 1.2	- 6.8	+ 0.0
Other Services	+ 6.0	+ 7.0	+ 3.9	+ 3.3	+ 3.4	+ 1.1	+ 0.8	+ 1.5

Source: Same as Table 2.2.3

2.2.3 Industrial Composition

Amid general modernization and industrialization, the mining and communication sector grew until the early 1980's. Due to the stagnation of economic growth, the sectoral constitution of the GDP has not changed much since the early 1980's. During this period, the electricity sector grew faster than the rest of the economy while the construction sector suffered a relative decline in a stagnant economy.

Table 2.3 Sectoral Composition of GDP (1980 price)

(Unit: %)

Sector	1980	1981	1982	1983	1984	1985	1986	1987
Total	100	100	100	100	100	100	100	100
Agriculture, Forestry Fishery	8.2	8.0	7.9	8.4	8.4	8.5	8.6	8.6
Mining	3.2	3.4	3.7	3.8	3.8	3.7	3.7	3.8
Manufacturing	22.1	21.6	21.2	20.4	20.7	21.3	20.9	21.1
Construction	6.4	6.8	6.3	5.3	5.4	5.4	5.1	5.1
Electricity	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.4
Transport, Communication	6.4	6.5	6.0	6.1	6.2	6.2	6.3	6.3
Commerce, Hotel Restaurant	28.0	28.4	28.4	27.4	27.1	26.7	25.9	25.5
Other Services	24.7	24.3	25.4	27.4	27.3	26.9	28.2	28.2

Source: Same as Table 2.2.3

2.3 Transportation

2.3.1 General View of Cargo Movement

Total freight volume in Mexico increased rapidly and reached 432 million tons of freight. Due to the stagnation of the economy cargo volume showed an average annual growth rate of 1.6% from 1980 to 1986 and reached 475 million tons in 1986.

Marine transportation reached 126 million tons in 1983, but it has made little growth since then.

The total foreign trade cargo volume also grew and reached 116 million tons in 1984 and fell to 104 million tons in 1986, mainly due to the sharp oil decrease in exports and severe import restrictions.

2.3.2 Roads and Railways

The road and railway network has been developed around the Mexican Plateau and connects the principal cities of the central region of the country.

The construction of roads was carried out at a remarkable pace, and the total length of the road network reached 225 thousand km in 1986, of which paved roads amounted to 78 thousand km, around 33% of the total.

Railways have also been developed, but still do not cover the entire country and is less comprehensive than the road network, with a total length of 27 thousand km.

2.3.3 Ports and Shipping

In the United Mexican States, there are 41 principal ports and 11 major ports that are considered to be essential for foreign trade. The total length of quaywall amounts to around 59 km: 33 km on the Gulf side and 26 km on the Pacific side.

The volume of cargoes handled at all Mexican ports increased gradually at an average annual rate of 3% in the period from 1980 to 1987 and reached 154 million tons 1987.

The volume of containerized cargoes increased rapidly in this period at an average rate at around 16% per annum. The containerized ratio of the general cargo also progressed and occupied around 37% in 1987 of total foreign trade.

Table 2.4 Total Cargo Movement in Mexico

(unit: 1,000 tons)

Year	Volume of Cargo		
	Total	Marine	Other
1970	207,024	28,155	178,869
1980	432,121	95,256	336,865
1983	467,287	125,511	341,776
1985	492,000	126,161	365,839
1986	474,760	119,153	355,607

Source: Manual Estadístico del Sector Transporte 1989, Instituto Mexicano del Transporte
Movimiento de Cargo y Buques 1987 Sistema Porturario Nacional

Table 2.5 Cargo Movement in Foreign Trade

(unit: 1,000 tons)

Year	Total Cargo Volume			Marine Cargo Volume		
		Export	Import		Export	Import
1970	23,048	14,183	8,865	13,021	9,705	3,316
1980	80,221	56,817	23,404	66,056	52,536	13,520
1981	83,130	59,680	23,450	70,781	55,799	14,982
1982	108,881	92,633	16,248	100,822	88,555	12,267
1983	113,287	96,339	16,948	103,011	91,710	11,301
1984	115,930	98,790	17,140	107,080	95,899	11,181
1985	108,800	93,680	15,120	100,061	89,158	10,903
1986	103,860	88,970	14,890	95,953	86,377	9,576

Note: Total cargo volume is estimated and does not include the exported volume of Natural Gas

Source: DGODP "Estadisticas del Movimiento Portuario de Cargo y Buques 1987"

Table 2.6 Volume of Cargo Handled at Mexican Port

(Unit: Thousand tons)

Year	Grand Total	Foreign Trade			Domestic Trade		
		Export	Import	Total	Out	In	Total
1980	124,576	52,536	13,520	66,056	25,215	33,305	58,520
1981	131,038	55,799	14,982	70,781	25,996	34,261	60,257
1982	150,444	88,555	12,267	100,822	21,228	28,394	49,622
1983	147,913	91,710	11,301	103,011	20,481	24,421	44,902
1984	153,082	95,899	11,182	107,081	21,222	24,779	46,001
1985	152,228	89,158	10,903	100,061	24,383	27,784	52,167
1986	142,313	86,378	9,576	95,954	20,245	26,114	46,359
1987	153,644	90,644	11,746	102,390	25,381	25,873	51,254

Source: DGODP "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"
SCT "Movimiento de Carga y Buques, Sistema Portuario Nacional 1985, 1986, 1987"

Chapter 3 Present Situation of Each Port

3.1 General Outline of Port Administration in the United Mexican States

Fig.3.1 shows the present outline of the administration system concerning ports in Mexico. The SCT legally supervises Puertos Mexicanos which mainly carries out the planning, construction and dredging at ports as well as the supervision of ESPs.

Puertos Mexicanos has local construction and dreading division offices at most main ports to superintend construction work.

The ESP is a joint-stock-company and is basically independent from Puertos Mexicanos in finance, but the share of stock held by the Federal Government amounts to more than 92% at the all objective ports. The ESP provides various port services to users and shipping companies using the cargo handling unions.

The relation between the ESP and the unions is based on a collective private contract.

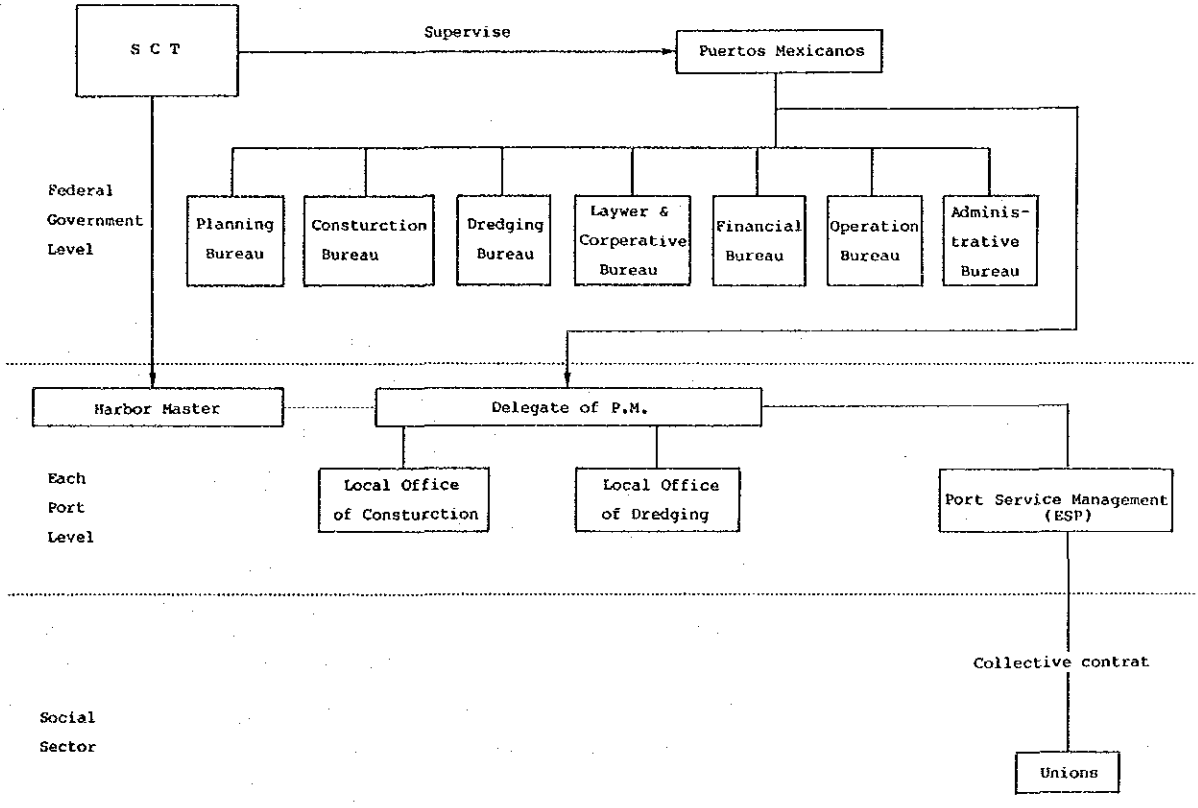


Fig.3.1 Outline of the Port Administration System in Mexico

The flow of port funds and their expenditures are summarized in Fig.3.2.

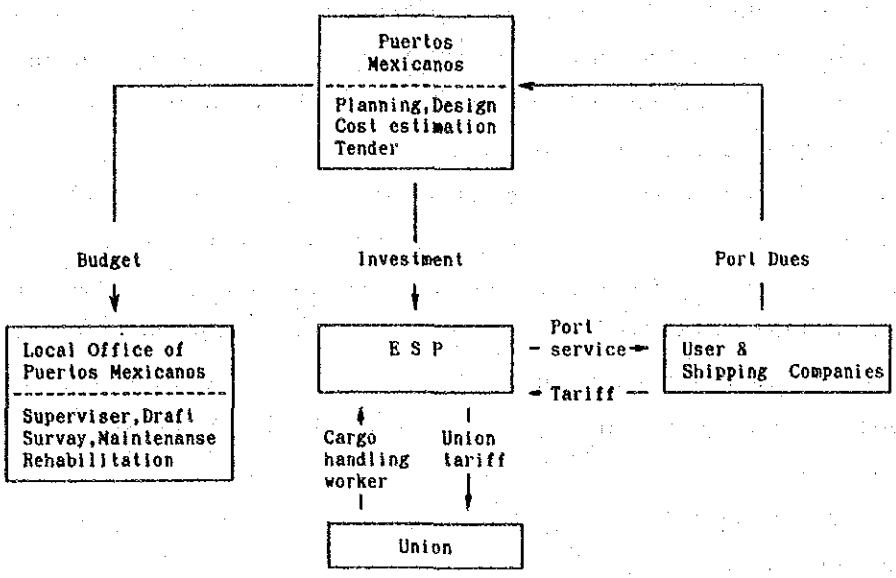


Fig.3.2 Flow of Port Funds and their Expenditure

3.2 Summary of the Pacific Coast Ports in the United Mexican States

There are more than a handred ports in Mexico including small ports. Among these ports, the main ports on the Pacific Coast are Salina Cruz, Acapulco, Lazaro Cardenas, Manzanillo, Mazatolan, Guaymas and Ensenada.

In 1987, the cargo volume handled at these Pacific Coast ports was 54,440 thousands tons, which occupied 35% of the total maritime cargo volume in Mexico, the domestic cargo volume handled at the Pacific Coast ports accounts for 63% of the total maritime cargo volume in Mexico.

As for the containerized cargo, about 36% is presently handled at the Pacific Coast ports. The volume of containerized cargo handled at the Pacific Coast ports is expected to increase according to the growth of the trade between Mexico and the Far East and Japan.

3.3 Port of Salina Cruz

(1) Port Facilities

The Port of Salina Cruz is an old port built at the beginning of this century and was used as a base port for the land transport between Salina Cruz and Coatzacoalcos before the Panama Canal opened.

The Port of Salina Cruz is divided into the outer port area and the inner port area. The outer port area has a container berth and an LPG berth. The inner port comprises a general cargo area, a fishing port area and a naval area. The west pier of the general cargo area is used exclusively by PEMEX.

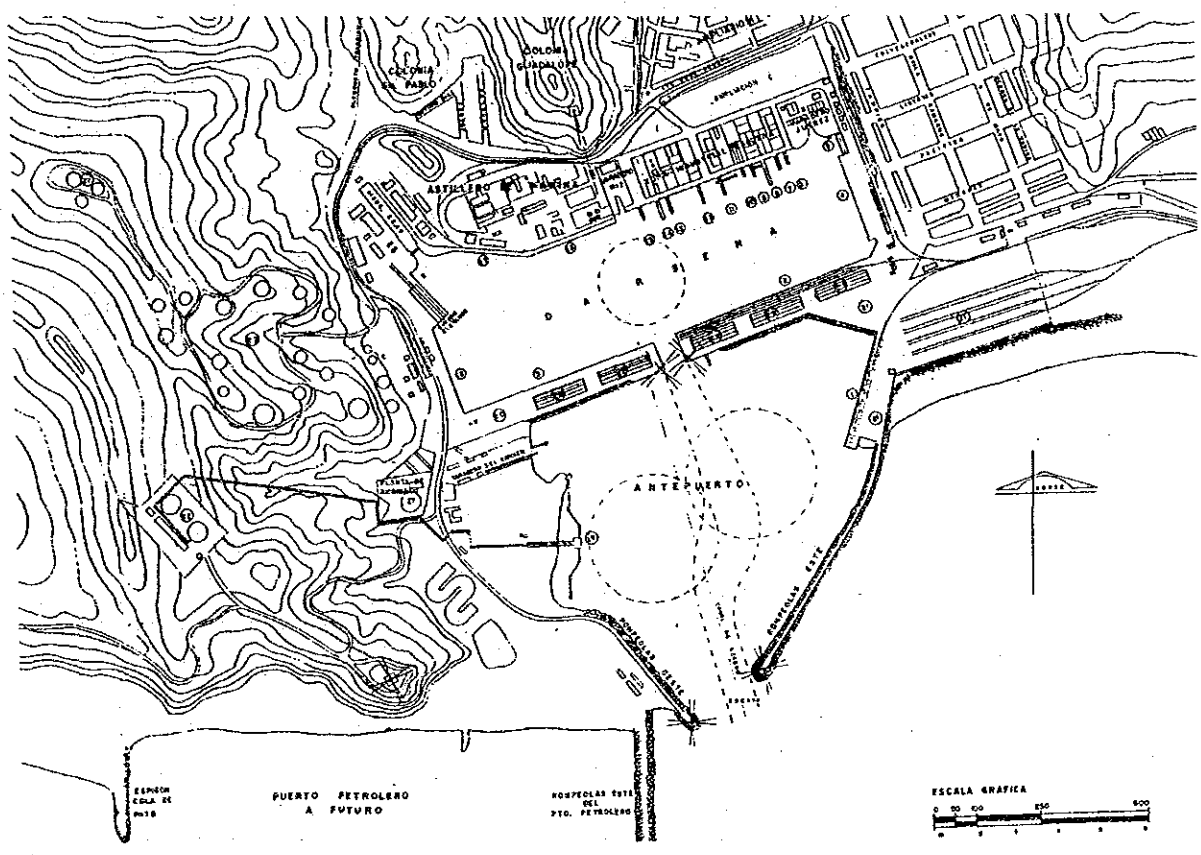


Fig.3.3 Port of Salina Cruz

Source* Catastro Portuario 1989, S.C.T.

(2) Utilization of the Port

• The number of vessel calls per year were in the range of 450 to 500 during the last seven years. In 1987, 490 vessels called at the port, and most of them were tankers.

• The cargo volume handled at the Port of Salina Cruz increased to 15 million tons in 1987.

• The containerized cargo volume has also increased, but the imbalance between the imports and exports is remarkable.

(3) Management and Finance

• One ESP operates both the Ports of Salina Cruz and Coatzacoalcos. The main office is located at Coatzacoalcos and the Salina Cruz office is a branch.

• The number of staff members at this branch is 104.

• The cargo handling union of this port belongs to CROM, and the numbers of its laborers are as follows:

Associated: 86 Non-associated: 100 - 200

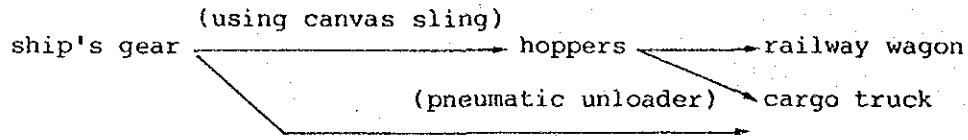
• Each ESP at all the objective ports of this study is a joint-stock-company, and its shareholders at this port are as follows:

Federal Government: 99.8% Union: 0.1% Others: 0.1%

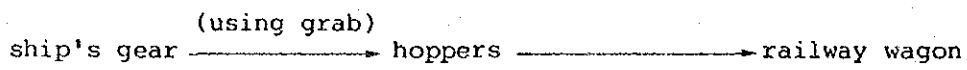
(4) Cargo Handling Operations

The following charts show the main cargo flows in discharging:

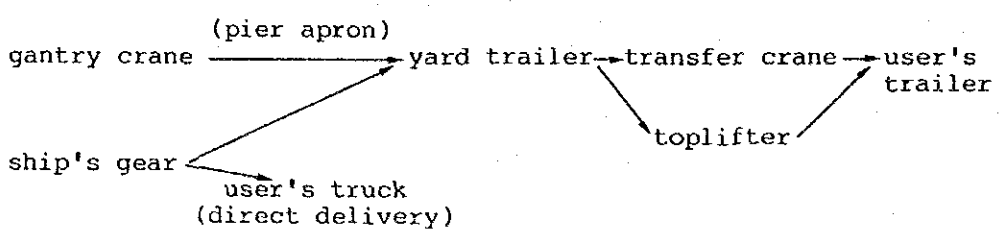
a. Agricultural bulk cargo



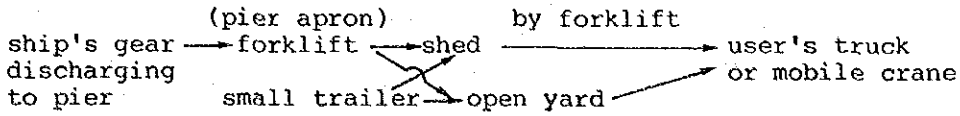
b. Mineral bulk cargo



c. Container



d. General Cargo



(5) Cargo Handling Facilities/Equipment and Maintenance System

1) Cargo handling facilities/equipment

The existing cargo handling facilities/equipment at the port are shown in Table 3.1.

Table 3.1 Existing Cargo Handling Facilities/Equipment

Name of Group	No. of Units	Average Age
Container Crane	1	8
Pneumatic Unloader	5	8
Transfer Crane	3	8
Mobile Crane	3	8
Forklift	19	5
Tractor	8	8
Chassis	20	-
Truck Mobile	1	-

2) Maintenance system for cargo handling facilities/equipment

- Preventive maintenance adopted at this port consists of monthly maintenance only.
- Almost all repairs are performed at the maintenance shop.
- There is a maintenance shop that belongs to ESP in the port area. The number of workers in the shop is twenty six (26) persons. The capability of the maintenance shop is limited.
- The stock of spare parts held at the maintenance shop is recognized to be insufficient.

3.4 Port of Lazaro Cardenas

(1) Port Facilities

The Port of Lazaro Cardenas is an artificially excavated port in the mouth area of the River Balsas. This port is a representative Mexican industrial port, with large scale factories in the port area. Among them, FERTIMEX and PEMEX have their own exclusive private berths. ESP mainly provides cargo handling services at the container wharf, the general cargo wharf, the mineral wharf and the grain wharf.

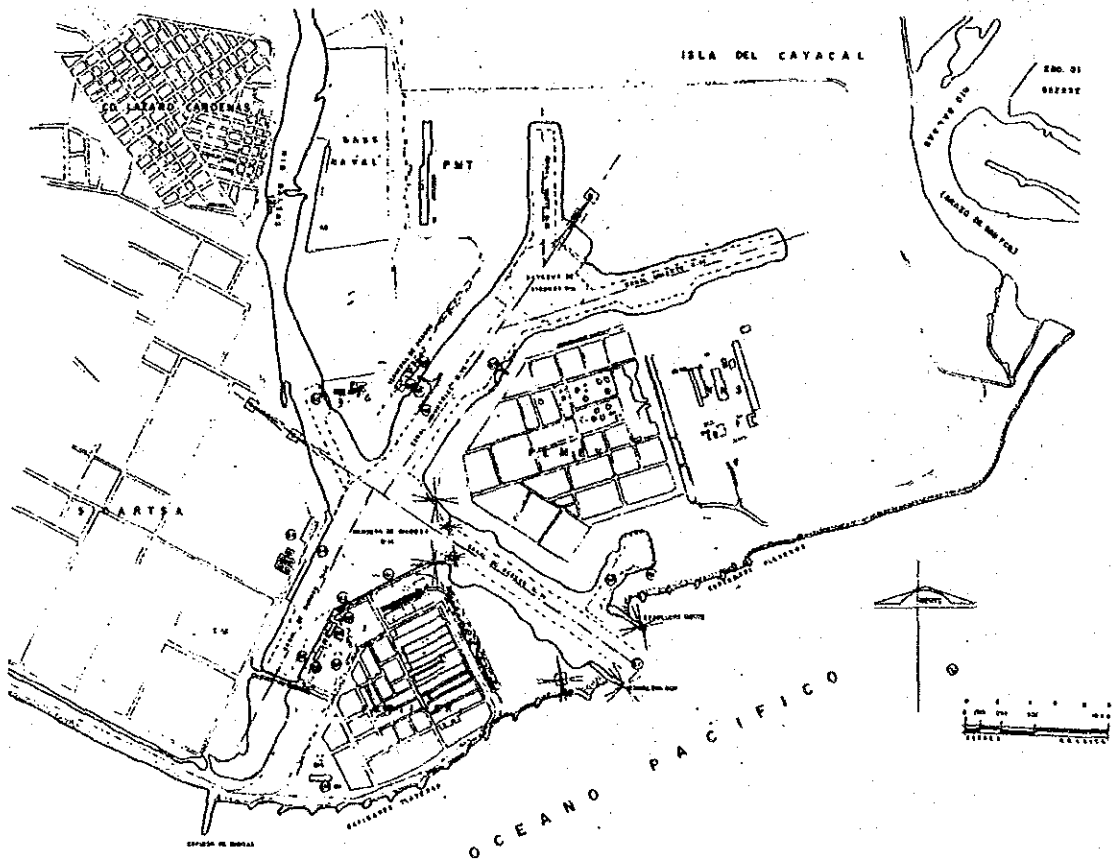


Fig.3.4 Port of Lazaro Cardenas
Source: Catastro Portuario 1989, S.C.T.

(2) Utilization of the Port

• The total number of vessels calls, 286 calls in 1987, was relatively stable until 1985, increasing in 1986 and 1987.

• The cargo volume through the Port of Lazaro Cardenas increased to 2.6 million tons in 1987. The share of the foreign trade cargo was about 50% of the total cargo volume.

• Import mineral bulk products, inward petroleum and its derivatives, and exported general cargo are the main commodity groups.

• The volume of containerized cargo has consistently increased, but the cargo volume is still small.

(3) Management and Finance

• The number of staff members of this ESP is 141.

• The cargo handling union of this port belongs to CROM, and the numbers of its laborers are as follows:

Associated: 140 Non-associated: 250

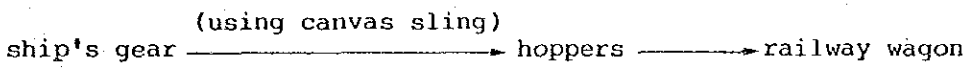
• The shareholders at this port are as follows:

Federal Government: 92% SICARTSA: 7% Others: 1%

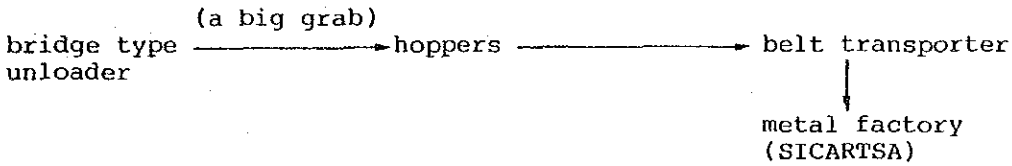
(4) Cargo Handling Operations

The following charts show the main cargo flows in discharging.

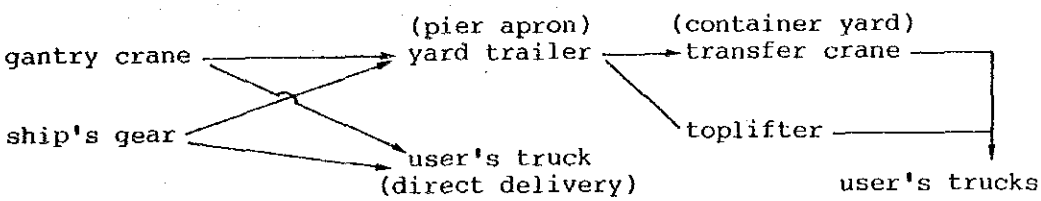
a. Agricultural bulk cargo



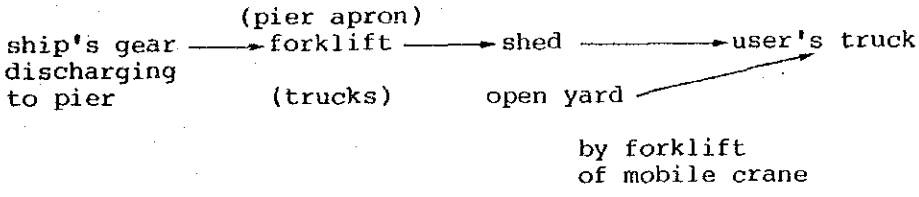
b. Mineral bulk cargo (mechanical unloading)



c. Container



d. General Cargo



(5) Cargo Handling Facilities/Equipment and Maintenance System

1) Cargo handling facilities/equipment

The existing cargo handling facilities/equipment at the port are shown in Table 3.2.

Table 3.2 Cargo Handling Facilities/Equipment

Name of Group	No. of Units	Average Age
Container Crane	1	15
Bridge Type Unloader	1	13
Transfer Crane	2	2
Mobile Crane	6	-
Forklift	45	6.4
Tractor Shovel	15	-
Trailer	14	2.8
Tractor	14	8
Chassis	21	-
Truck Mobile	1	1

2) Maintenance system for cargo handling facilities/equipment

- There is no preventive maintenance scheme.
- Almost all repairs are performed at the maintenance shop and/or in the field.
- There is a maintenance shop that belongs to ESP in the port. The number of workers in the shop is sixteen (16) persons.
- The stock of spare parts at the maintenance shop is recognized to be insufficient.

3.5 Port of Manzanillo

(1) Port Facilities

The Port of Manzanillo is one of the main ports for cargo distribution in Mexico. The Port of Manzanillo is divided into the outer port area and the inner port area, as shown in Fig. 3.5.

The outer port area is an old port comprising Fishing Wharf and the PEMEX berths. The inner area is a relatively new port which is being developed. There are public wharves, a fishing port and a navy area in the inner port.

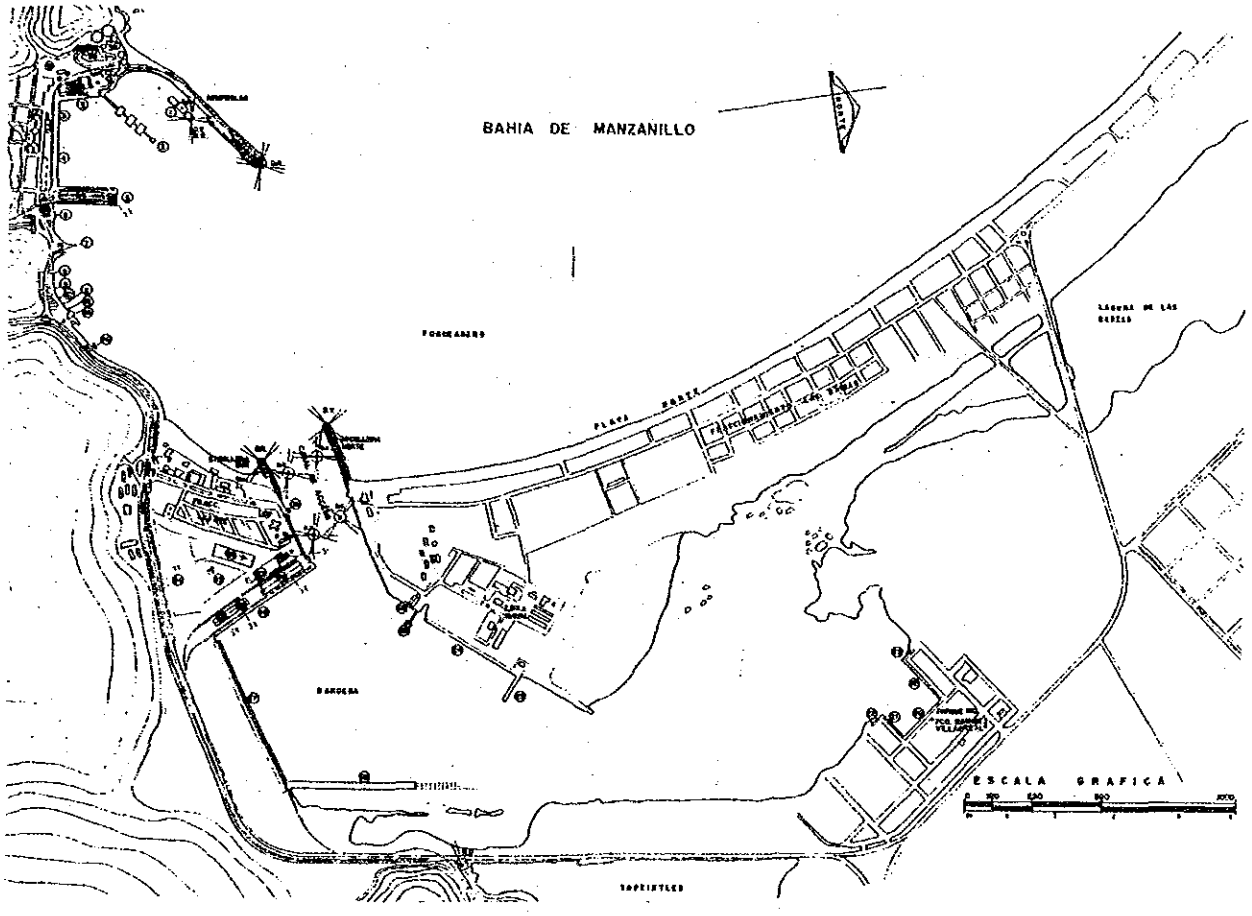


Fig.3.5 Port of Manzanillo

Source: Catastro Portuario 1989, S.C.T.

(2) **Utilization of the Port**

• The number of vessel calls, 426 calls in 1987, at the Port of Manzanillo has not changed much. The number of general cargo vessels, including container vessels, was 146, which represented about 55 percent of the foreign trade vessels.

• The total cargo volume through the Port of Manzanillo was about 4 million tons per year in recent years.

• While the amount of containzerized cargo has constantly increased, the ratio of containerized cargo among general cargo is not so high.

(3) **Management and Finance**

• The number of staff members at this ESP is 137.

• The cargo handling union of this port belongs to CROM, and the numbers of its laborers are as follows:

Associated: 180 Non-associated: 350

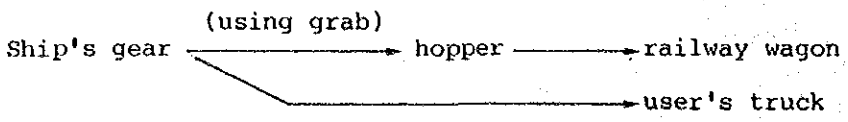
• The shareholders at this port are as follows:

Federal Government: 98% Union: 2%

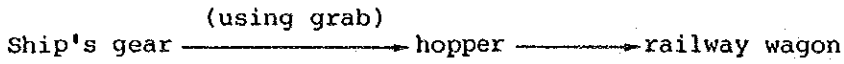
(4) **Cargo Handling Operations**

The following charts show the main cargo flows in discharging.

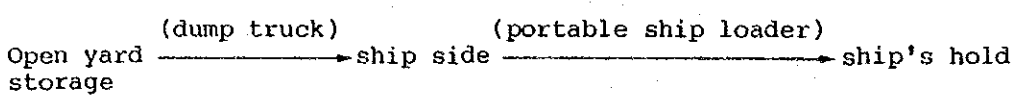
a. Agricultural bulk cargo



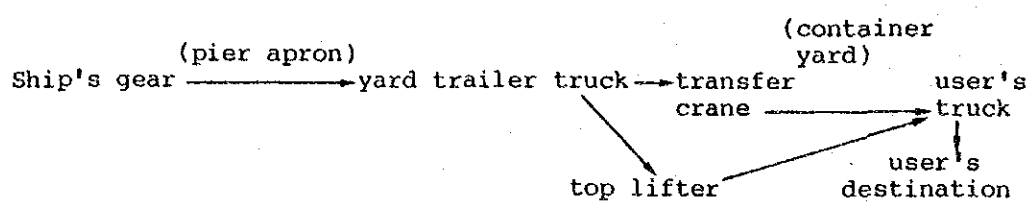
b. Mineral bulk cargo (Urea)



c. Mineral bulk cargo (loading steel pellets)



d. Container



(5) Cargo Handling Facilities/Equipment and Maintenance System

1) Cargo handling facilities/equipment

The existing cargo handling facilities/equipment at the port are shown in Table 3.3.

Table 3.3 Cargo Handling Equipment

Name of Group	No. of Equipment
Transfer Crane	1
Pneumatic Crane	3
Mobile Crane	8
Tractor Shovel	32
Fork-lift	83
Trailer	-
Tractor	18
Chassis	11
Truck Mobile	1

2) Maintenance System for Cargo Handling Facilities/Equipment

- The preventive maintenance adopted at this port is carried out according to the records of the previous historical working hours such as 100 hours, 250 hours, 500 hours, 1,000 hours and 2,000 hours.
- Almost all repairs (approximately 90%) are performed at the maintenance shop.
- There is a maintenance shop that belongs to the ESP in the port. The number of workers in the shop is twenty two (22) persons. It can be said that machinery and tools for maintenance are poor.
- The stock of spare parts at the maintenance shop is recognized to be insufficient.

3.6 Port of Mazatlan

(1) Port Facilities

The port of Mazatlan has multiple functions. The pleasure boat area and the ferry terminal connecting with La Paz of Baja California are located near the entrance channel. Next to these facilities, there are a cruise ship berth and PEMEX berth.

The main public wharf is 11,138 m in length and has 5 berths with 5 sheds. Most of the inner area is used as a fishing boat terminal.

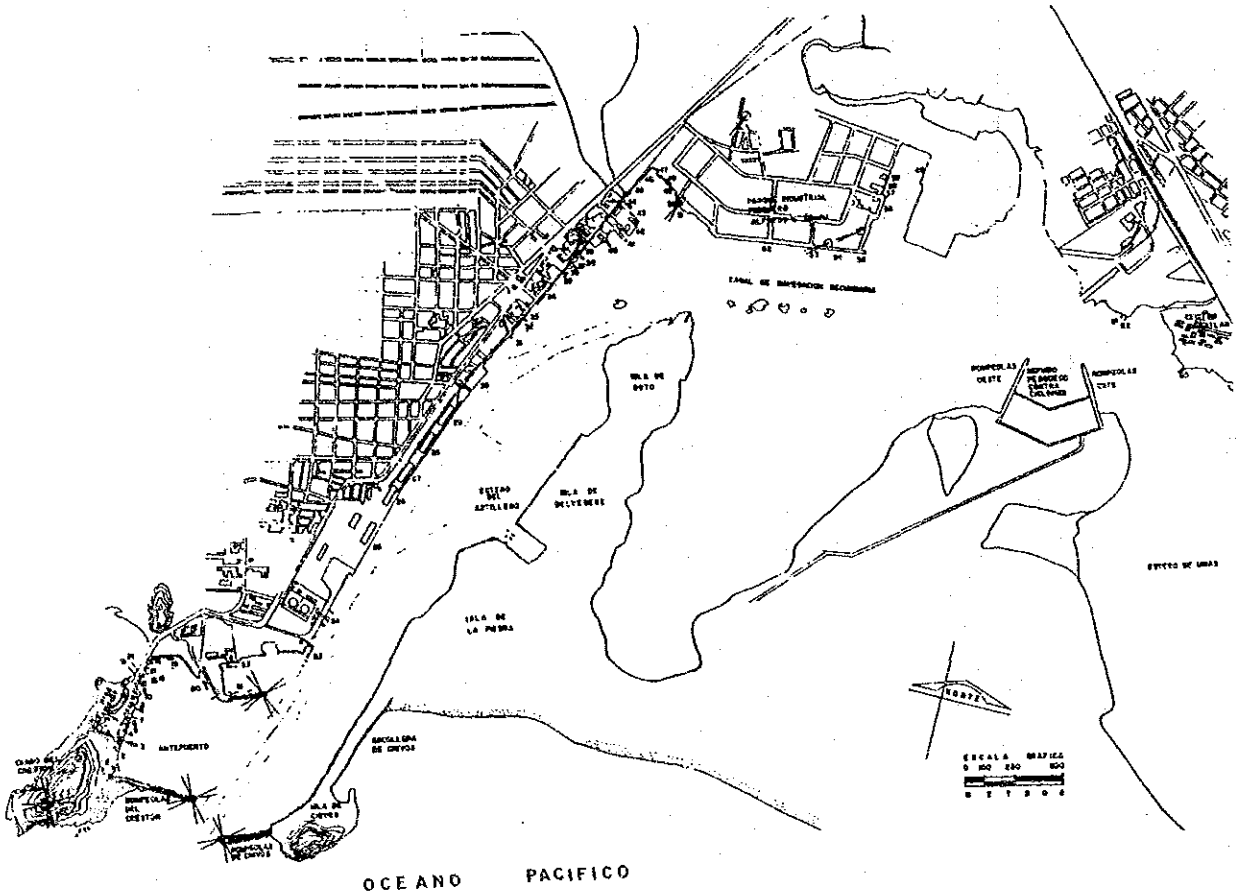


Fig.3.6 Port of Mazatlan

Source: Catastro Portuario 1989, S.C.T.

(2) Utilization of the Port

• The number of vessel calls at the Port of mazatlan is 620 in 1987. Other than this, about 200 cruising ships call at the port each year, especially from October to March.

• The total cargo volume through the Port of Mazatlan has not changed in the past few years, as for foreign trade, very few cargoes are exported and the main imported cargoes are agricultural bulk products.

• The containerized cargo, of which the volume is not so large, is mainly frozen tuna for Europe.

(3) Management and Finance

• The ESP provides services at the Ports of Mazatlan and Topolobampo. But the operations at Topolobampo account for only 5%.

• The number of staff of this ESP is 141.

• The two unions belonging to CROM are the "Union" and "Liga". The number of laborers is a follows:

CROM (Union)	Associated:	58	Non-associated	:	170
(Liga)	Associated:	71	Non-associated		

• The shareholders are as follows:

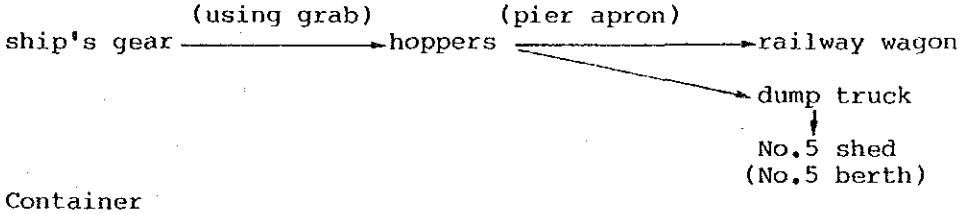
Federal Government: 99.9% Others: 0.1%

(4) Cargo Handling Operations

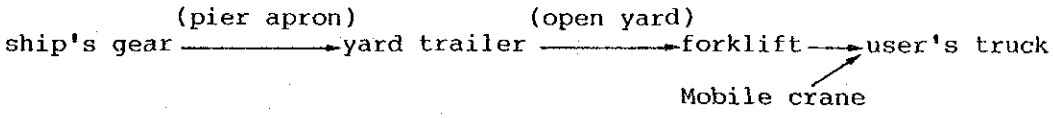
The following charts show the main cargo flows in discharging.

a. Agricultural bulk cargo

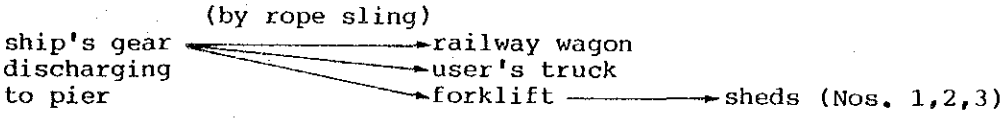
b. Mineral bulk cargo (Urea)



c. Container



d. Sugar in bags



e. Frozen tuna (loading for export)

refrigerator warehouse → truck → (ship side) —(using net sling)→ ship's gear

(5) Cargo Handling Facilities/Equipment and Maintenance System

1) Cargo handling facilities/equipment

The existing cargo handling facilities/equipment at the port are shown in Table 3.4.

Table 3.4 Existing Cargo Handling Facilities/Equipment

Name of Group	No. of Units	Average Age
Mobile Crane	7	10
Forklift	34	7
Tractor Shovel	13	6
Tractor	48	8
Chassis	5	5
Truck Mobile	1	8

2) Maintenance system for cargo handling facilities/equipment

- The preventive maintenance which is adopted at this port is carried out in accordance with the records of each 100 hours of use of each facility piece of equipment.
- Ordinary repairs are performed at the maintenance shop.
- There is a maintenance shop that belongs to the ESP in the port. The number of workers in the shop is forty-one (41) persons. The machinery and tools for maintenance in this shop seem to be the most efficient among the six (6) ports.
- Sufficient spare parts are stored at this shop and are supplied to the shop on a steady basis, so management of the shop seems to be excellent.

3.7 Port of Guaymas

(1) Port Facilities

The Port of Guaymas has a long history. It was constructed by reclaiming a water area between an island and the coast. The west half of the main port area is an industrial area with some private berths as well as shipbuilding yards. The east half of the port has 6 public berths and a ferry terminal. The PEMEX berths are located in the off-water area from the public berths.

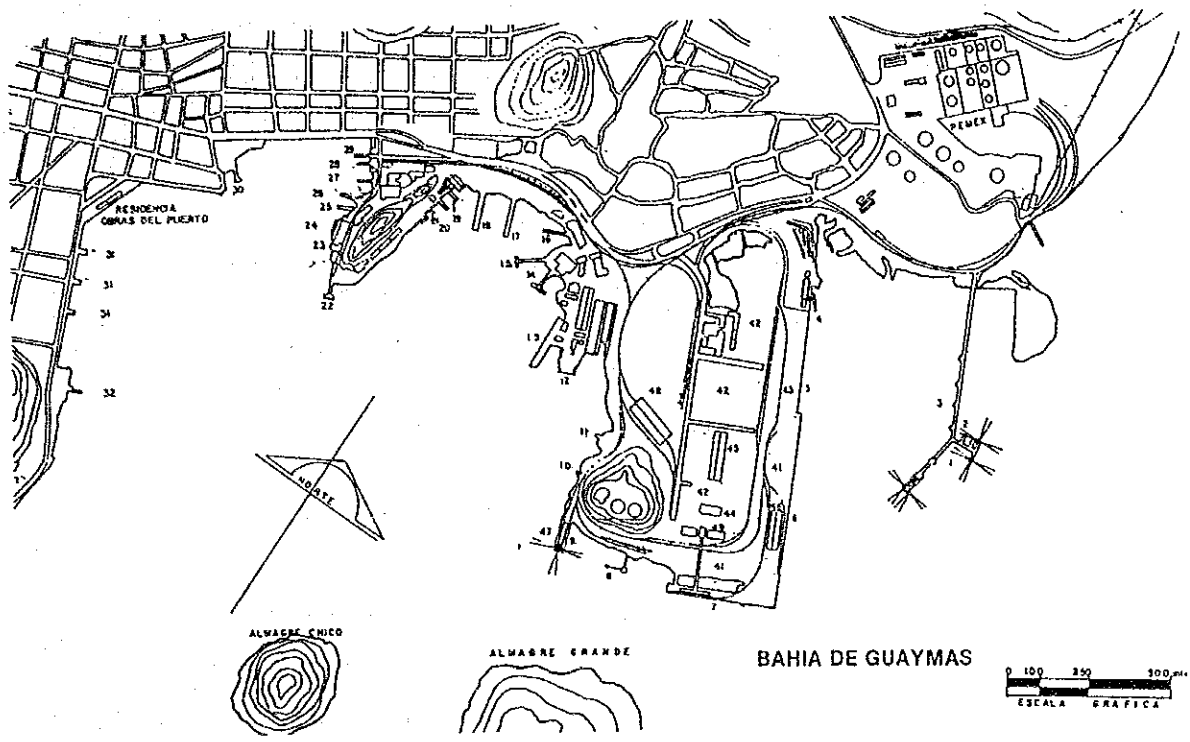


Fig. 3.7 Port of Guaymas
Source: Catastro Portuario 1989, S.C.T.

(2) Utilization of the Port

* The total number of vessel calls per year ranged between 600 and 700 in the 1980's.

* The total cargo volume was around 5 million tons annually in the 1980's. The volume of agricultural bulk products totals more than 50 percent of all imported cargoes, and mineral bulk accounts for more than

85 percent of all exported cargoes.

• The amount of containerized cargo has rapidly increased since 1986, because auto parts shipments from Japan to Hermosillo started that year.

(3) Management and Finance

• The number of authorized staff members of this ESP is 80.

• The numbers of laborers are as follows:

CROM	Associated:	94	Non-associated:	50
CTM	Associated:	22	Non-associated:	28

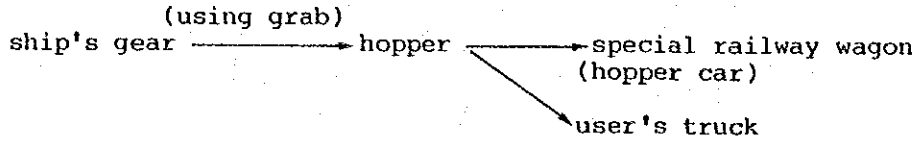
• The shareholders are as follows:

Federal Government: 99.9% Union: 0.1%

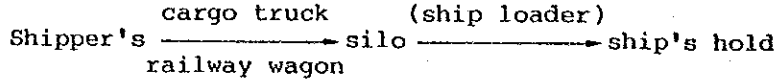
(4) Cargo Handling Operations

The following charts show the cargo flows in discharging.

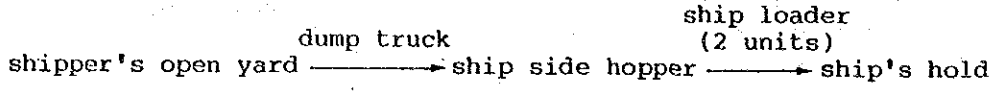
a. Agricultural bulk cargo



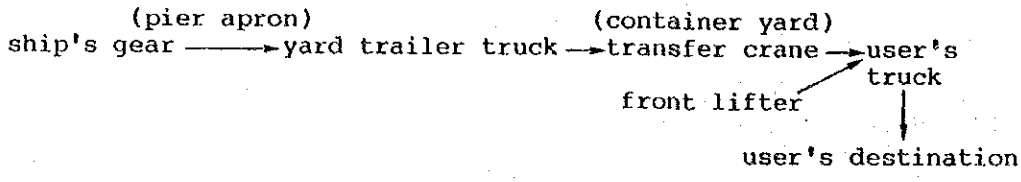
b. Agricultural bulk cargo (loading via silo)



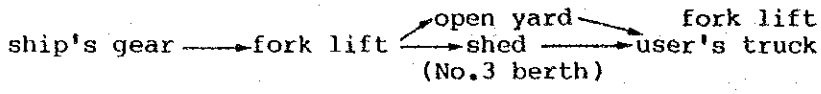
c. Mineral bulk cargo (loading of copper concentrate)



d. Containers



e. General cargo



(5) Cargo Handling Facilities/Equipment and Maintenance System

1) Cargo handling facilities/equipment

The existing cargo handling facilities/equipment at the port are shown in Table 3.5.

2) Maintenance system for cargo handling facilities/equipment

The preventive maintenance at this port is carried out in accordance with a weekly maintenance plan.

Table 3.5 Existing Cargo Handling Facilities/Equipment

Name of Group	No. of Units	Average Age
Mobile Crane	4	11
Forklift	25	6
Tractor Shovel	11	6
Tractor	6	8
Chassis	20	-
Truck Mobile	1	9

- Approximately eighty (80) percent of repairs are carried out in the maintenance shop.
- There is a maintenance shop that belongs to the ESP in the port. The number of workers is nine (9) persons. The machinery and tools at this shop seem to be sufficient.
- The spare parts stored at the maintenance shop seem to be insufficient.

3.8 Port of Ensenada

(1) Port Facilities

The Port of Ensenada is the most northern port on the Pacific coast of Mexico. The number of ocean-going cargo ships calling at this port is not large at present, and they use Berth No.1 and Berth No.2, 3.

Cruise ships use, on a preferential basis, Berth No.2 and No.3. The domestic berth accommodates domestic ships bound for Cedros Island. The berth between walls is exclusively used for the loading/unloading of tuna fish.

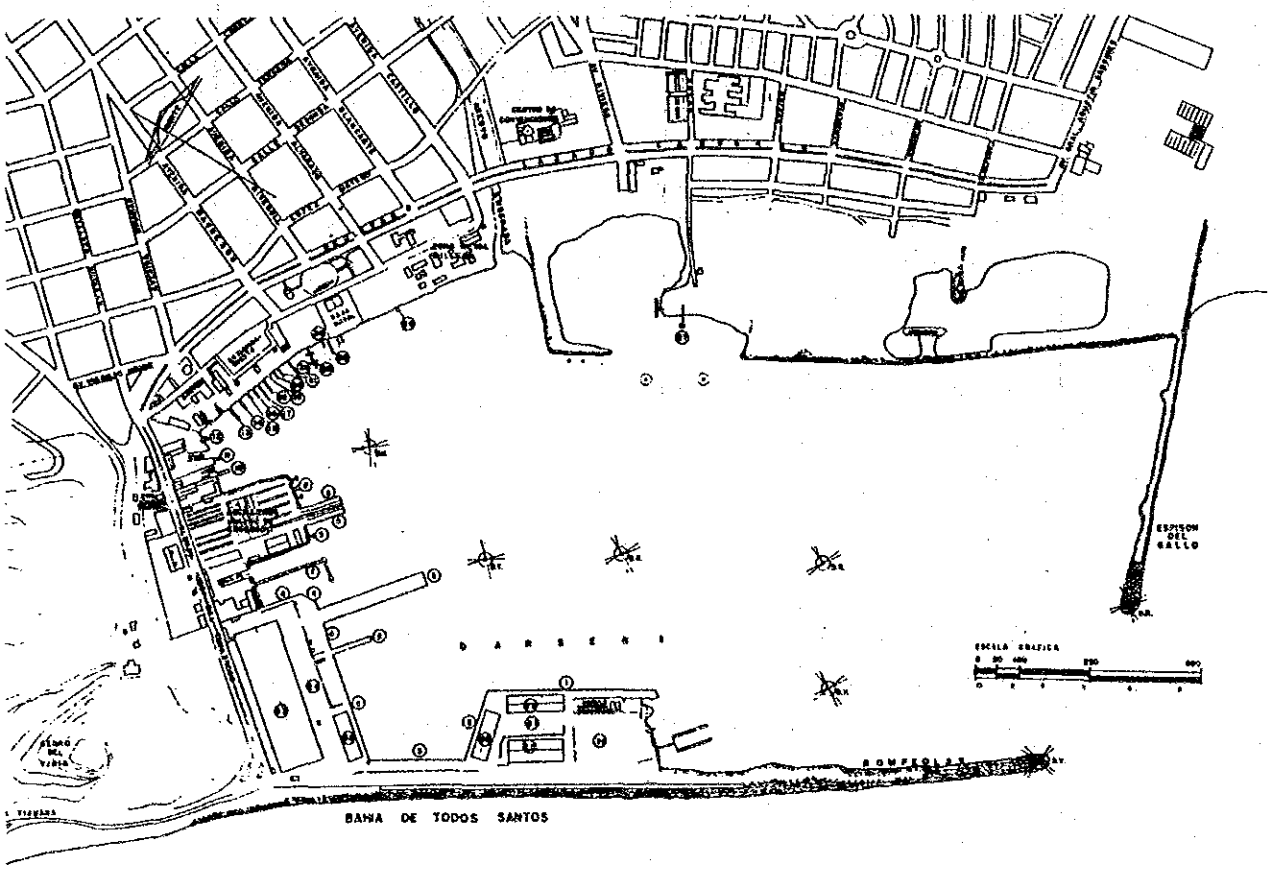


Fig.3.8 Port of Ensenada
Source: Catastro Portuario 1989, S.C.T.

(2) Utilization of the Port

• The total number of vessel calls at the Port of Ensenada was about 600 annually in the recent past.

• The cargo volume through the Port of Ensenada was about 1 million tons annually in the 1980s. The volume of foreign trade cargo is less than 10 percent of the total cargo, and the main cargo is imported agricultural bulk products and exported tuna.

(3) Management and Finance

• The number of stuff members of this ESP is 50.

• The numbers of laborers are as follows:

CROM	Associated:	41	Non-associated	:	100
CTM	Associated:	35	Non-associated		

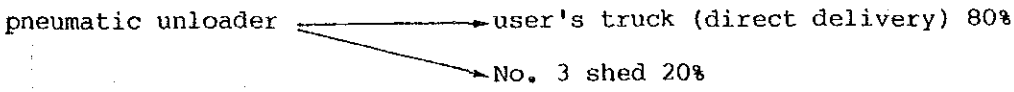
• The shareholders are as follows:

Federal Government: 99.5% CONASUPO: 0.3% Others: 0.2%

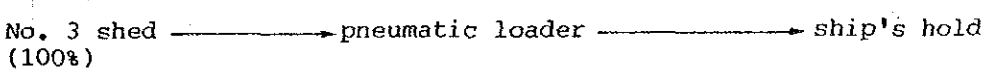
(4) Cargo Handling Operations

The following charts show the main cargo flows in discharging.

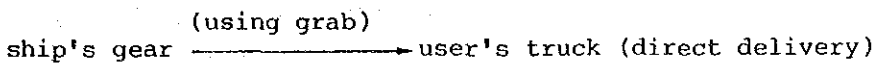
a. Agricultural bulk cargo (wheat)



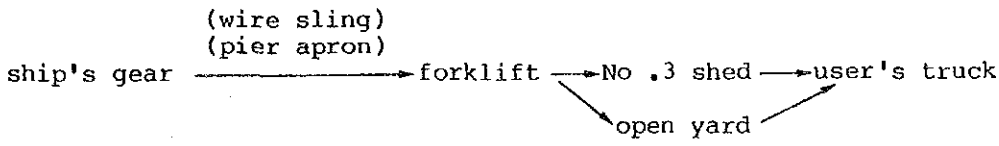
b. Agricultural bulk cargo (wheat loading, domestic)



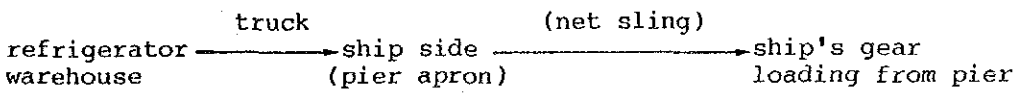
c. Agricultural bulk cargo (maize)



d. Steel bars, sheet in coils



e. Frozen tuna (loading for export)



(5) Cargo Handling Facilities/Equipment and Maintenance System

1) Cargo handling facilities/equipment

The existing cargo handling facilities/equipment at the port are shown in Table 3.6.

2) Maintenance system for cargo handling facilities/equipment

- The preventive maintenance adopted at this port is carried out according to the periodic maintenance plan in which equipment is checked every 100 hours, 500 hours and 1,000 hours.
- Almost all repairs are carried out at the maintenance shop.

Table 3.6 Existing Cargo Handling Facilities/Equipment

Name of Group	No. of Units	Average Age
Pneumatic Loader Unloader	5	-
Mobile Crane	4	11
Forklift	24	8.5
Tractor Shovel	2	3.5
Tractor	12	10

- There is a maintenance shop which belongs to the ESP in the port. The number of workers in the shops is ten (10) persons. The machinery and tools for maintenance in this shop do not seem to be sufficient.

Chapter 4 Principal Problems of Each Port

4.1 Common Items

(1) Utilization of the Ports

As a whole, the volume now handled at each port cannot said to be at a high level. Thus, measures to promote further utilization of the ports should be examined.

Also, measures for effective utilization of unused areas and coordinating systems for promoting further utilization should be examined.

(2) General Port Administration

Port management and operation are presently executed by several governmental organizations and the ESPs. At times, the coordination and communication among these organizations seems to be insufficient.

On the other hand, the financial constitution of the ESPs at the ports can not be said to be firm or sound at present, basically because of a low level of cargo handling volume as well as the lack of efficiency in cargo handling operations.

(3) Tariff System

At present cost accounting analysis of tariffs is not carried out sufficiently at all the objective ports. Also, some way of improving the efficiency of cargo handling operations should be considered when looking at the tariff system.

(4) Cargo Handling Union

In some objective ports, cargo handling services are provided by two organizations: the ESP and the CTM. In addition, some problems in cargo handling operation between the union and the ESP are found at several ports.

(5) Statistics

The collection and analysis of the basic data concerning port activities is very important in formulating basic port policy. Statistical data is also very important in examining the required number

of berths and their dimensions, storage facilities and so on. But the present amount and quality data is insufficient.

(6) Procedures of Ship Entry/Exit and Customs Formalities

There are some opinions regarding Customs the bureaucratic and inflexible formalities, as well as criticism regarding poor knowledge of importers and exporters, which may prevent the quick dispatch of ships. The work hours of the port-related governmental organizations and ESPs differ from each other. On the other hand, the dwelling time of cargoes at the port seems to be rather long. The fumigation is forced to almost every imported general cargoes. This is unusual situation compared to other countries.

(7) Land Transportation and the Storage System in the Port Area

In case of discharging bulk cargoes, the available number of freight cars and trucks, which are extremely insufficient at present, mostly determines the daily productivity of the discharging operation, because most of the bulk cargoes are discharged to freight cars and trucks directly.

The discharging times fluctuate from less than one week to more than one month depending mainly on the arrangement of land transportation.

At the ports it is necessary to provide cargo storage capacity to achieve effective discharging and quick dispatch of the calling vessels. But the ports do not have sufficient storage capacity for the discharged bulk cargoes at present.

(8) Cargo Handling Operations

1) Formulation of cargo handling plan and supervision of cargo handling activities by ESPs.

ESPs do not make ship cargo operation plans by themselves at present, and they arrange ships' cargo operations based on the cargo operation plan which is made by the shipping agents. It seems that the stevedoring operation is supervised by the shipping agent's supervisor on board instead of by the ESP's supervisors.

At present, the ESP at each port does not make the necessary working reports, which are important in terms of achieving more

effective cargo handling operations.

2) Low productivity of container loading/unloading

According to the time cycle study, the average container handling productivity rate was 7-8 containers per gang per hour. This seems very low compared with foreign ports under the same conditions. The operation productivity by ship gear is reported to be an average of 12 containers per gang per hour at some ports in Southeast Asia.

The problems seen at some ports are as follows:

i. Too much time is wasted before unloading of containers starts.
ii. It seems that there may be no leader who indicates properly what workers should do next.
iii. There may be no one to direct trailer drivers properly.
iv. Crane operators and signal men do not seem to be skillful in handling containers.
v. Unhooking workers on the pier should help each other and cooperate to keep containers stable in order to place them accurately on the trailer.

(9) Cargo Handling Facilities/Equipment and Maintenance System

1) Insufficient facilities/equipment and imbalance between the ports

Insufficient facilities and equipment and imbalance among the port were found:

i. Unsuitable cargo handling system due to the lack of grab buckets, pallets and minor handling equipment.
ii. Ineffective cargo handling caused by a shortage of minor handling equipment.
iii. The low ratio of the operating days of the equipment to the available days of the equipment.

2) Lack of replacement plan or disposal plan

The ESPs have procurement plans for cargo handling facilities/equipment but do not have any replacement plan or disposal plan for the sames.

3) Need for preventive maintenance and different maintenance policy by port

Preventive maintenance of existing facilities/equipment is particularly important in the Mexican Ports in order to make the best use of these machines. However, following problems should be mentioned.

i. Damage to and trouble with cargo handling facilities/equipment were observed at each port.

ii. The policy and the implementation method of preventive maintenance differ among the objective ports. It may be said that there is no basic preventive maintenance policy.

iii. The spare parts at most of the objective ports are not sufficient in terms of achieving effective preventive maintenance.

iv. Although every ESP keeps records concerning the operation of cargo handling facilities/equipment, these records are neither analyzed nor utilized sufficiently for maintenance planning.

4) Need to upgrade the maintenance shops and spare parts considering the financial aspect

i. Maintenance shops

It seems that none of the maintenance shops have any definite scope of work. The machinery and tools in the maintenance shops are insufficient, and vary among the ports.

ii. Spare Parts

The delivery term needed to get spare parts differs greatly among the objective ports. In general, the stock of spare parts at the maintenance shops is insufficient. On the other hand there are some old spare parts which have not been used for long time. The kinds and quantities of spare parts to be held at the maintenance shops should be examined.

(10) Port Facilities (Except Cargo Handling Facilities/Equipment)

At most of the ports, the superannuation and deterioration of port facilities were observed.

At some ports, construction of the facilities such as wharves and warehouses is now suspended. This may be caused, for one thing, by

insufficient estimates of future demand and the requirements of the ports.

4.2 Principal Problems of the Port of Salina Cruz

a. The biggest problem of the Port of Salina Cruz may be the decreasing volume of cargo handled. A good example of this is that the container cargoes of Nissan moved from this port to the Port of Lazaro Cardenas.

b. The Port of Salina Cruz suffers from strong winds from October to March. During this period it is sometimes impossible for calling vessels to enter the port. Container handling must be also be suspended at times.

c. The apron surface conditions at the general cargo berth are not smooth and flat, so pavement rehabilitation should be implemented for the safe and effective operation of the forklifts.

d. Grab-buckets and hoppers should be prepared to handle agricultural/mineral bulk cargo more efficiently.

e. It is necessary for the maintenance shop to keep a sufficient amount of spare parts in order to repair the existing cargo handling facilities/equipment rapidly.

f. Forklifts are one of the most popular cargo handling machines in a port. A result of the analysis of the available days of each forklift at this port shows the lowest ratio among the six ports.

4.3 Principal Problems of the Port of Lazaro Cardenas

a. The roads connecting Lazaro Cardenas and the hinterlands, Mexico City in particular, are in poor condition. This is one of the biggest problems for the development of the port. Specially the road condition between Lazaro Cardenas and Acapulco is bad for the traffic of container trailers with bad pavement and narrow width.

b. Public roads through the bonded ports area should be removed as soon as possible. The new road project parallel to railway tracks beside the shore line has to be promoted.

c. The out-reach length of the existing gantry crane is insufficient for the handling of the farthest containers on deck.

d. A gang shortage of stevedores may result in delayed dispatch, so the

optimum number of workers should be carefully examined.

e. A shortage of railway wagons is a great impediment to bulk grain handling.

f. Restoration of the grain silo complex which was damaged by the earthquake in 1985 seems to be one of the most urgent matters.

g. The maintenance shop has no periodic preventive maintenance plan. The introduction of periodic preventive maintenance at this port should be examined.

4.4 Principal Problems of the Port of Manzanillo

a. The shortage of freight cars and trucks is remarkable. In order to attain quick dispatch of ships, countermeasures in the port area should be studied as well as further coordination with the railway.

b. The access roads and rails run through the central area of the city. particularly, freight cars from to Manzanillo Wharf which is located in front of the downtown area, hinder public traffic. Thus, a new access road project from the north of the port should be implemented on an urgent basis.

c. It seems necessary to increase the number of minor handling facilities/equipment, especially equipment used in ships' holds.

d. The aprons and sheds of the outer port area (Manzanillo Wharf) are superannuated and not in good condition. The need to rehabilitate the wharf should be examined, given that there are plans for this area become a base for cruise ships.

e. The capacity of storage facilities are insufficient at the port because of the limited storage area. This will become a significant problem when the quantity of containerized cargoes increases.

4.5 Principal Problems of the Port of Mazatlan

a. During the tourist season from October to April, two to four cruise ships call at this port almost every day, staying the whole day and causing considerable congestion. It will be necessary to examine the future prospect of cruise ship traffic together with appropriate countermeasures.

b. Effective utilization of the former ferry berth, which is not being

used at present should be examined.

c. There are two cargo handling operators, the ESP and the CTM union in this port which seems to prevent smooth cargo handling operations.

d. ESP should sincerely discuss on the arrangement of the necessary number of freight cars with the railway. Using sheds for discharging fertilizer seems effective in case freight cars are not available.

e. The slot locations and numbering in the container yard should be clearly marked to facilitate cargo handling operation, inventory control and yard planning.

f. Periodic maintenance, except every 100 hours maintenance has never been done at this port. The introduction of a combination maintenance system (e.g. 100 hrs., 500 hrs., 1000 hrs.) to save the maintenance cost and to get high productivity should be considered.

g. Different level between the rail top surface and the pavement surface on the apron should be repaired.

4.6 Principal Problems of the Port of Guaymas

a. The prospect of container cargoes from now on will largely affect the utilization of the port. The container vessels of TMM are under the suspension of calling at the port because of the change of production policy of the Ford. The utilization of the port area and the provision of equipment shall be examined based on this examination.

b. The utilization of No.1 berth shall be examined.

c. All of the cargo handling facilities/equipment including equipment in good condition are checked weekly. They are also checked daily before and after operation. However, it should be recognized that there are other types of periodical maintenance such as 500 hours and 1,000 hours which should probably be introduced to save total maintenance cost and to maintain high efficiency.

d. There are many facilities/equipment, components and parts which are very old and useless. The disposal of these items shall be examined.

e. The railway lines in the port are complicated, making the freight car handling in the port difficult. Considering the complicated and

inefficient freight car handling, it is necessary to examine the new connection lines. At the same time rearrangement of the railway lines within the port should be considered in the future.

f. Damaged and missing rubber fenders were found at the No.2 berth. Sufficient fenders are required to maintain safety.

g. Grain dust, especially husks, which are scattered all over the land and water area of the port, not only pollute the environment but are also potentially dangerous, such as possibly causing a dust explosion. Appropriate countermeasures should be examined.

4.7 Principal Problems of the Port of Ensenada

a. The cargo handling volume of this port has been at a low level. Considering this situation, it will be necessary to examine the causes of this and measures to promote ship calls. Many cruise ships call at this port. It will also be necessary to examine the future prospect of calls by cruise ships at the port.

b. There is a shed in the port area which is not used for maritime cargoes. The utilization of this shed for maritime cargoes should be examined.

c. There are two cargo handling operators, the ESP and the CTM union, in this port, which seems to prevent smooth cargo handling operations. This factor should be considered.

d. The insufficient capacity of the refrigerated warehouse may hinder the quick handling of tuna.

e. Adequate container handling equipment should be considered.

f. There is a maintenance manual which is prepared for cargo handling facilities/equipment of the ESP. All the cargo handling facilities/ equipment have meters which indicate the running hours. They are maintained according to the meters and the manual. This kind of maintenance system has not been adopted at other ports.

g. The ratio of the operating days of the equipment to available days of the equipment is the lowest among the six ports.

h. When big waves come, the overtopping and overflow of big waves beyond the south breakwater seem to be huge. The repair and improvement of the breakwater should be carried out to prevent the overtopping waves and the overflow of seawater.

Chapter 5. Demand Forecast

5.1 Scope and Principal Policy for Demand Forecast

The demand forecast carried out in this chapter is comprised of the following two items:

i. Demand forecast of general cargo and containerized cargo to formulate the long-term development policy of each port in the target year of 2005.

ii. Demand forecast of containerized cargo and bulk cargo for the short-term improvement plans of the "selected ports" in the target year 1995.

5.2 Forecast of Total Volume of Export and Import General Cargo

5.2.1 Forecast of Export General Cargo Volume in 1995

Fig.5.1 shows the historical trend of export general cargo volume from 1981 to 1988.

The total export cargo volume of the Pacific coast ports has been showing great variation in recent years, mainly caused by the yearly fluctuation of the cargo volume by SICARTSA. Therefore the forecast of export general cargo is carried out fundamentally for the cargo excluding SICARTSA, cargo while the estimation of the export cargo volume by SICARTSA is carried out separately.

(1) Time Series Analysis - 1 -

A time series analysis is carried out as a demand forecast for the effective year 1985 to 1988 and the export general cargo volume in the target year 1995 is estimated to be 1,728 thousand tons.

(2) Time Series Analysis - 2 -

As for the movement of export general cargo, it should be carefully noted that the value in 1988 includes the export of sugar, which was an abnormal phenomenon at the Pacific coast ports.

Therefore, a time series analysis eliminating the exported volume of sugar in 1988 was executed and the export general cargo volume in the target year 1995 is estimated to be 1,499 thousand tons.

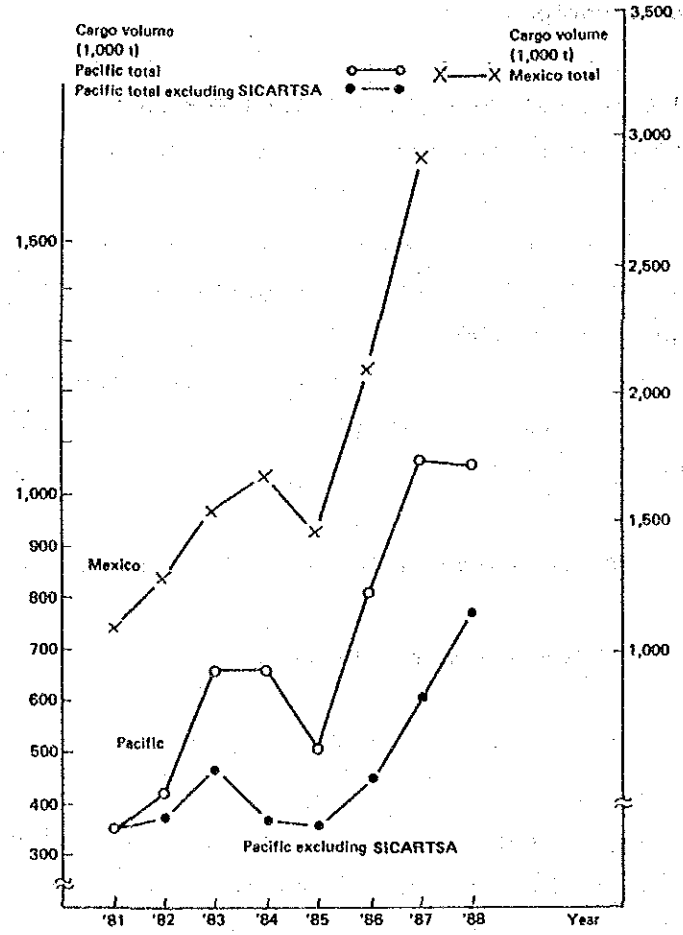


Fig.5.1 Historical Trend of Export Cargo Volume in Mexico

(3) Correlation Analysis with Value of Exports - 1 -

There is a close correlation between the exported general cargo volume and the export of non-petroleum goods. Therefore an analysis of this correlation is executed for the year 1984 to 1988 and 2,314 thousand tons is calculated as a forecast value.

(4) Correlation Analysis with Value of Exports - 2 -

In this method, three-year moving average values are used for both the cargo volume and the value of exports to eliminate yearly variations. Thus, the export general cargo in 1995 is estimated to be 2,184 thousand tons.

(5) Forecast of Cargo Volume of Each Port

The forecast of the export general cargo volume of each port is roughly carried out as described later. According to this forecast, the total cargo volume in 1995 is estimated to be 1,559 thousand tons.

(6) Adopted Value for the Forecast in 1995

Fig.5.2 shows the estimated cargo volume in 1995 by each forecast method. The forecast values by each method present a considerably wide distribution. The study team adopts 1,710 thousand tons, which is the average value of *1, *5 and *6 in Fig.5.2, as the estimated total volume of export general cargo (excluding SICARTSA) through the Pacific coast ports.

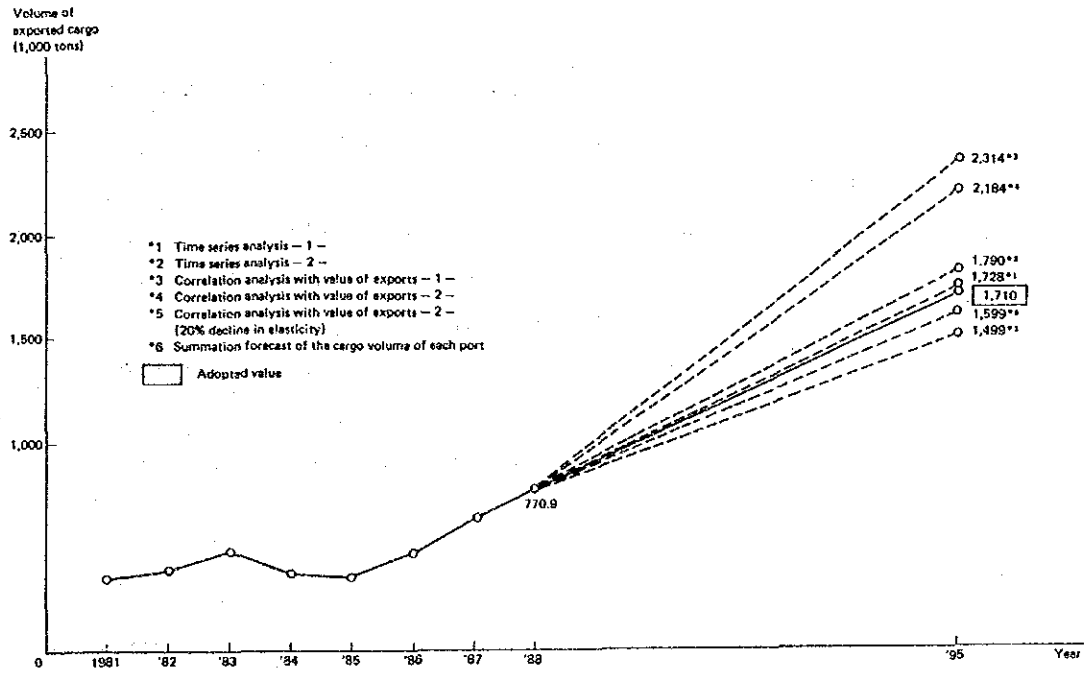


Fig.5.2 Results of Forecast by Each Method (Export General Cargo in 1995)

(7) Estimation of SICARTSA Cargo

According to interviews with SICARTSA's personnel and the available data, the maximum volume of export cargo until 1995 is around 1,300 thousand tons. Therefore, this value is

adopted as the estimated volume of export general cargo by SICARTSA in 1995.

5.2.2 Forecast of Export General Volume in 2005

Because of the lack of long-term social and economic indices and the recent fluctuation in the cargo movement through the Mexican ports, the total export volume of general cargo in 2005 is forecast based on the estimated cargo volume in 1995 and referring the forecast results of cargo volume of each port.

The forecast value in 2005 is 3,050 thousand tons excluding SICARTSA cargoes.

SICARTSA seems to have no definite program on the export of its iron and steel products beyond the year 2000. Therefore the value of 1,300 thousand tons, the same as for 1995 is assumed as the forecast value in 2005.

5.2.3 Forecast of Import General Cargo Volume in 1995

Fig.5.3 shows the historical trend of import general cargo volume from 1981 to 1988.

Since 1981, the cargo volume has shown a continuous decline affected by the economic crisis in Mexico in the 1980s and the following governmental policy to restrict imports.

However, the import cargo volume excluding sugar and rice, which is illustrated by a dotted line in the Figure shows a general tendency toward increase. Therefore, the forecast is carried out for the cargoes except for sugar and rice.

(1) Time Series Analysis - 1 -

A time series analysis is carried out for the effective year 1984 to 1988 and the import general cargo volume in the target year 1995 is estimated to be 746 thousand tons.

(2) Time Series Analysis - 2 -

The movement of import general cargo volume may show an exponential trend for the coming period. Therefore an exponential type correlation formula is analysed and 1,012 thousand tons is obtained as a forecast value.

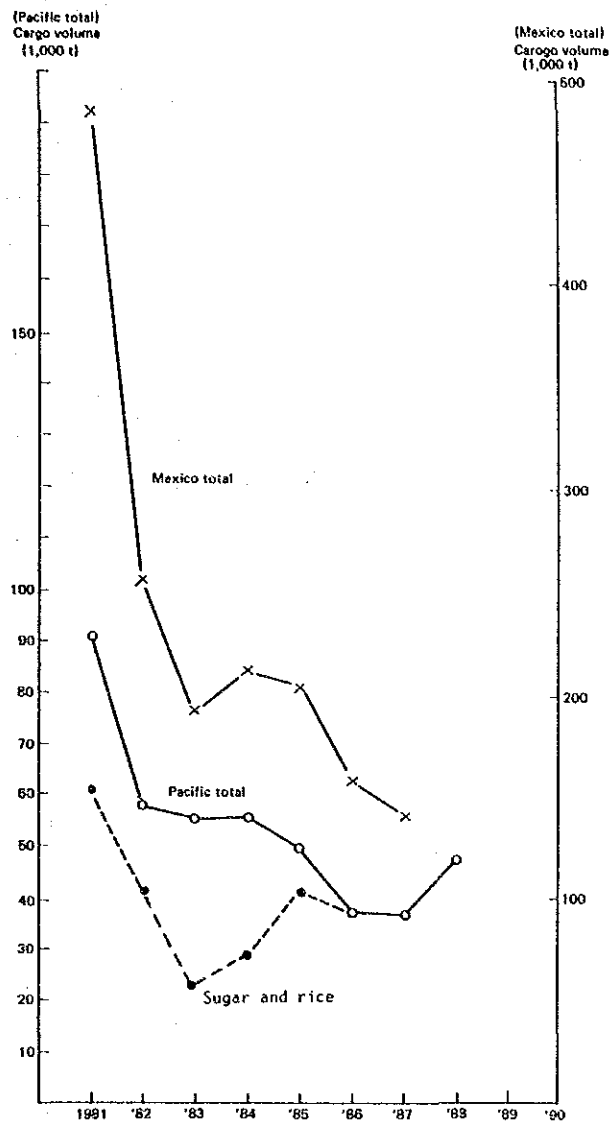


Fig.5.3 Historical Trend of Import Cargo Volume in Mexico

(3) Forecast of Cargo Volume of Each Port

A forecast of the import general cargo volume of each port is roughly carried out and the total cargo volume in 1995 is estimated to be 935 thousand tons.

(4) Adopted Value for the Forecast

Fig.5.4 shows the estimated cargo volume by each forecast method. Considering that the correlation coefficient of each time series analysis is better than that of (1), the study team adopts 920 thousands tons as the estimated total volume.

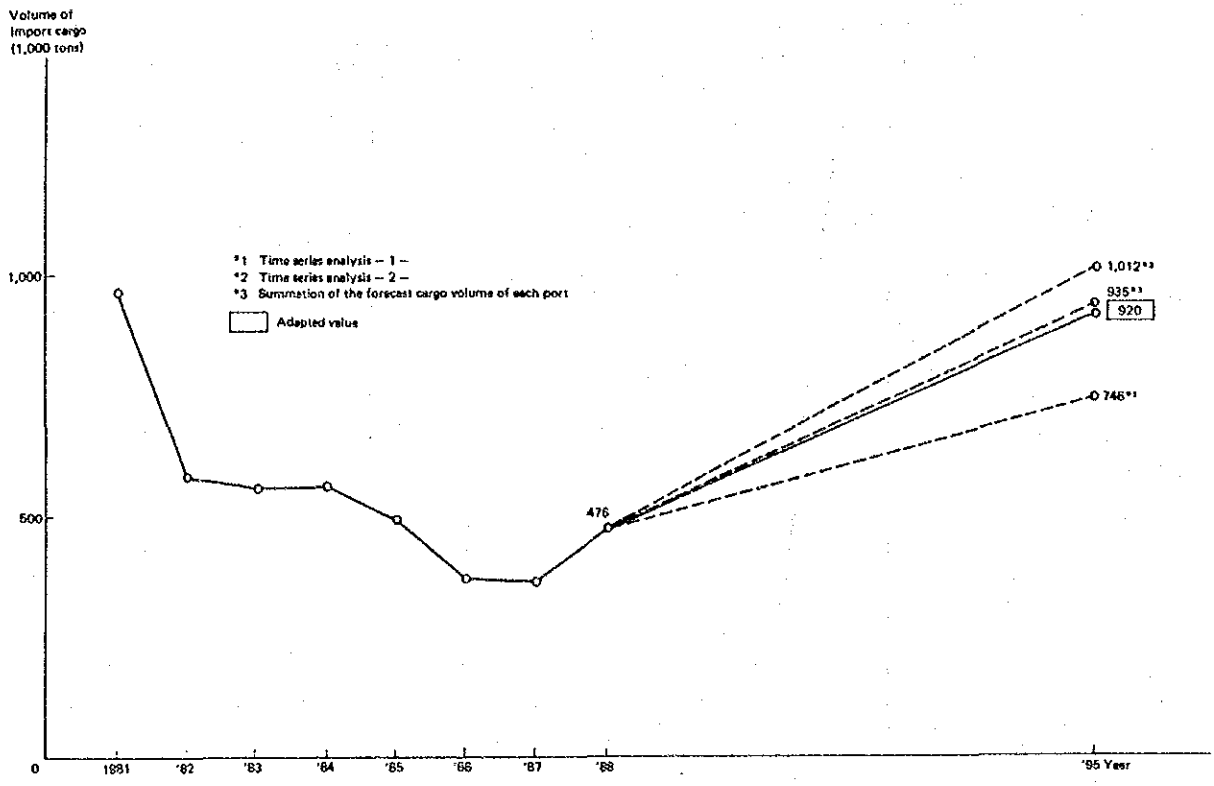


Fig.5.4 Result of Forecast by Each Method
(Import General Cargo in 1995)

5.2.4 Forecast of Import General Cargo in 2005

In conformity with the same methods as the forecast of export cargo volume, 1,550 thousand tons is estimated as the total volume of import general cargo of the Pacific coast ports in 2005.

5.2.5 Summary of the Forecast Results

The results of the forecast of total general cargo through the Pacific coast ports are summarized in Table 5.1 and Fig.5.5. The total general cargo volume including SICARTSA is estimated to increase from 1,539 thousand tons in 1988 to 3,930 thousand tons, around 2.6 times as compared with the present volume in 1988 and to 5,900 thousand tons in 2005, around 3.8 times the present volume.

Table 5.1 Summary of the Forecast Results of General Cargo
(Total Volume of the Pacific Coast Ports)

(unit: thousand tons, %)

		Actual Result 1988	Estimated 1995	Cargo Volume 2005
Export	Excluding SICARTSA	771	1,710	3,050
	SICARTSA	292	1,300	1,300
	Sub-Total	1,063	3,010	4,350
Import		476	920	1,550
Total		1,539	3,930	5,900

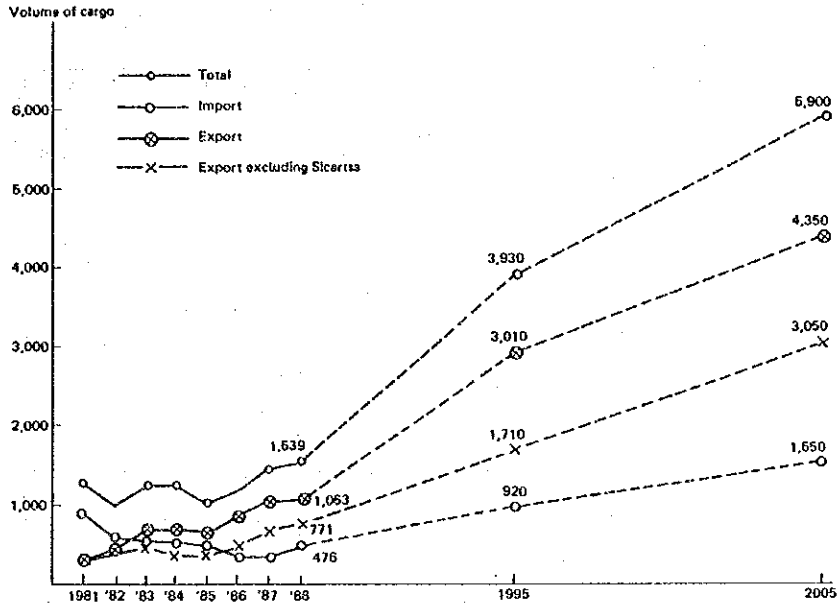


Fig.5.5 Summary of the General Cargo Forecast Results
(Total Volume of the Pacific Coast Ports)

5.3 Forecast of Total Volume of Containerized Cargo

5.3.1 Actual Situation and Historical Trend

Fig.5.6 shows the historical trend of containerized cargo in Mexico. Both the Pacific and the Gulf ports have been recording remarkable growth in the handling volume of containerized cargo.

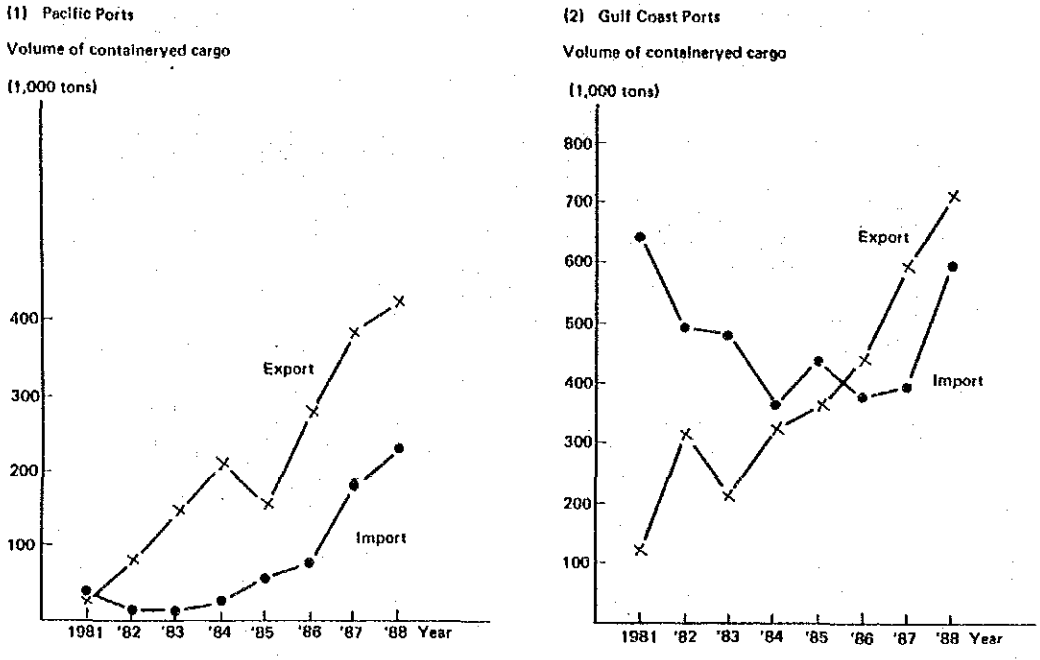


Fig.5.6 Historical Trend of Containerized Cargo in Mexico

5.3.2 Forecast

The future containerized ratio of total general cargo shall be estimated based on the trend of containerization, the ratio of containerizable cargo and the balance between import and export containers.

Examining these factors, the projected containerized ratios of the import and export general cargo in 1995 and 2005 are estimated as shown in Fig.5.7.

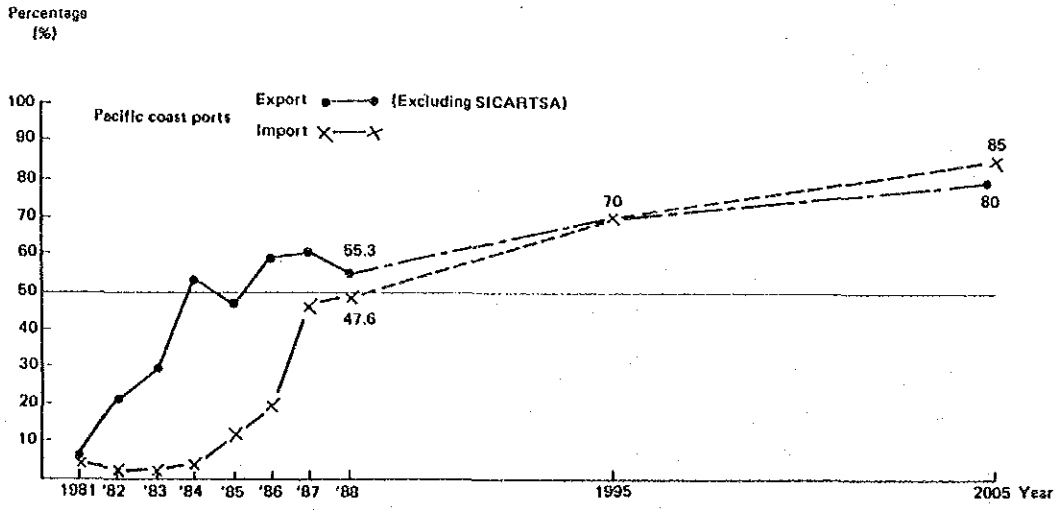


Fig.5.7 Estimated Containerized Ratio of the General Cargo in the Pacific Coast Ports

Using the estimated general cargo volume and the estimated containerized ratio, the total import and export containerized cargo volumes through the Pacific coast ports in 1995 and 2005 are forecast as shown in Table 5.2.

Table 5.2 Result of Forecast of Containerized Cargo Volume

(Unit; thousand tons, %)

		Actual Result	Estimated Value	
		1988	1995	2005
Import	General Cargo Volume	475.8	920 <9.9>	1,550 <5.4>
	Containerized Ratio (%)	47.6	70	85
	Containerized Cargo Volume	226.4	644<16.1>	1,318 <7.4>
Export	General Cargo Volume	770.9	1,710<12.1>	3,050 <6.0>
	Containerized Ratio (%)	55.3	70	80
	Containerized Cargo Volume	420.5	1,197<16.1>	2,440 <7.4>
Total	General Cargo Volume	1,246.7	2,630<11.2>	4,600 <5.7>
	Containerized Ratio (%)	51.9	70	82
	Containerized Cargo Volume	646.9	1,841<16.1>	3,758 <7.4>

Note: Export general cargo excludes SICARTSA cargo.
< > shows average annual growth rate.

5.4 Origin and Destination Analysis

The Maritime cargo flow excluding petroleum and its derivatives is investigated by processing and analyzing the data in 1985 and 1986 obtained from Direction General de Puertos y Marina Mercante de S.C.T.

The hinterlands of the Ports of Salina Cruz, Lazaro Cardenas and Manzanillo are illustrated in Fig.5.8 - 5.11 regarding general cargo and agricultural bulk cargo.

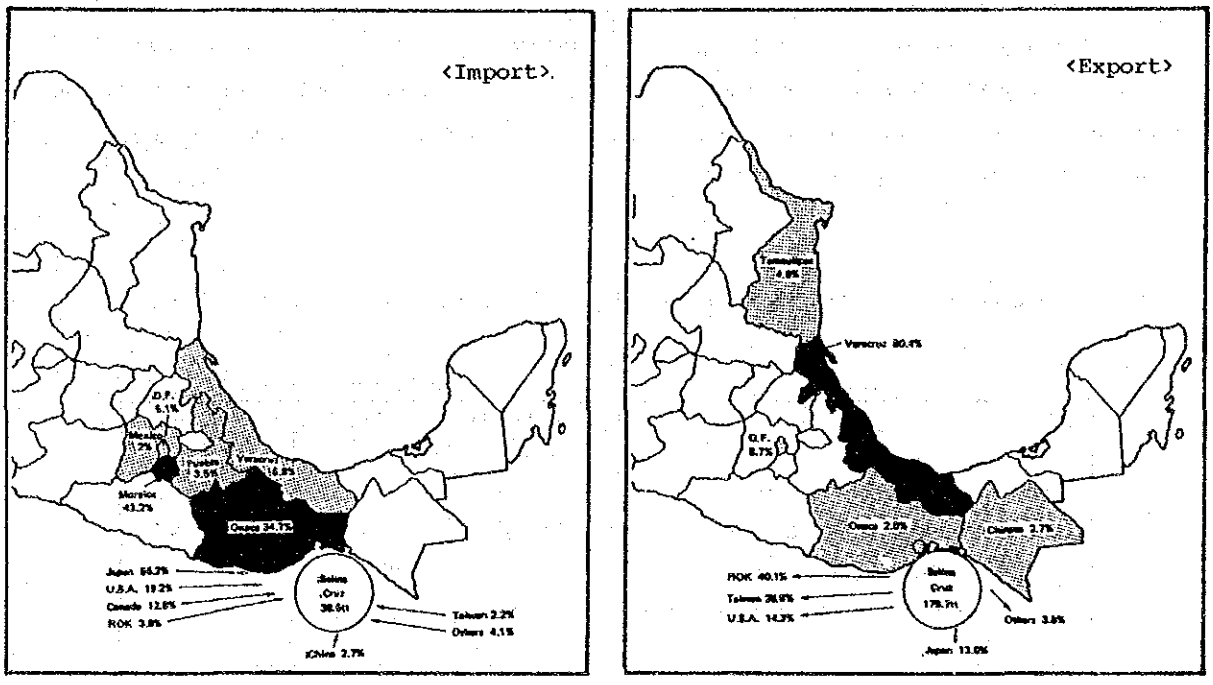


Fig.5.8 Hinterland of Salina Cruz for General Cargo

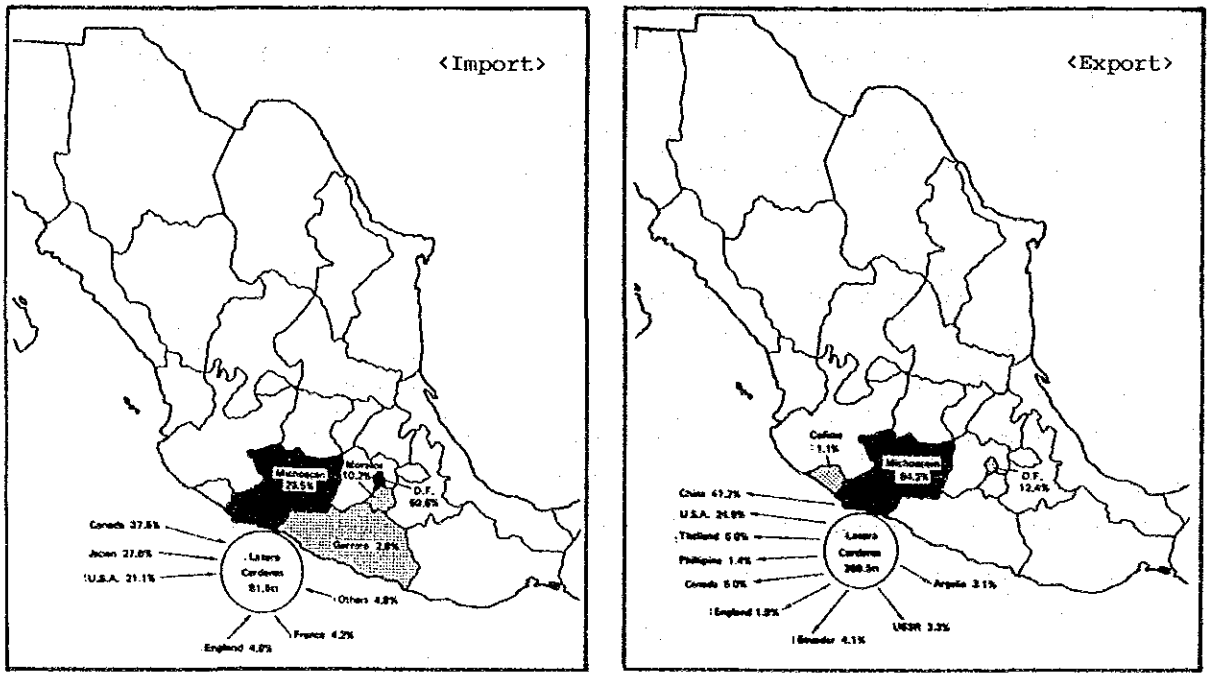


Fig.5.9 Hinterland of Lazaro Cardenas for General Cargo

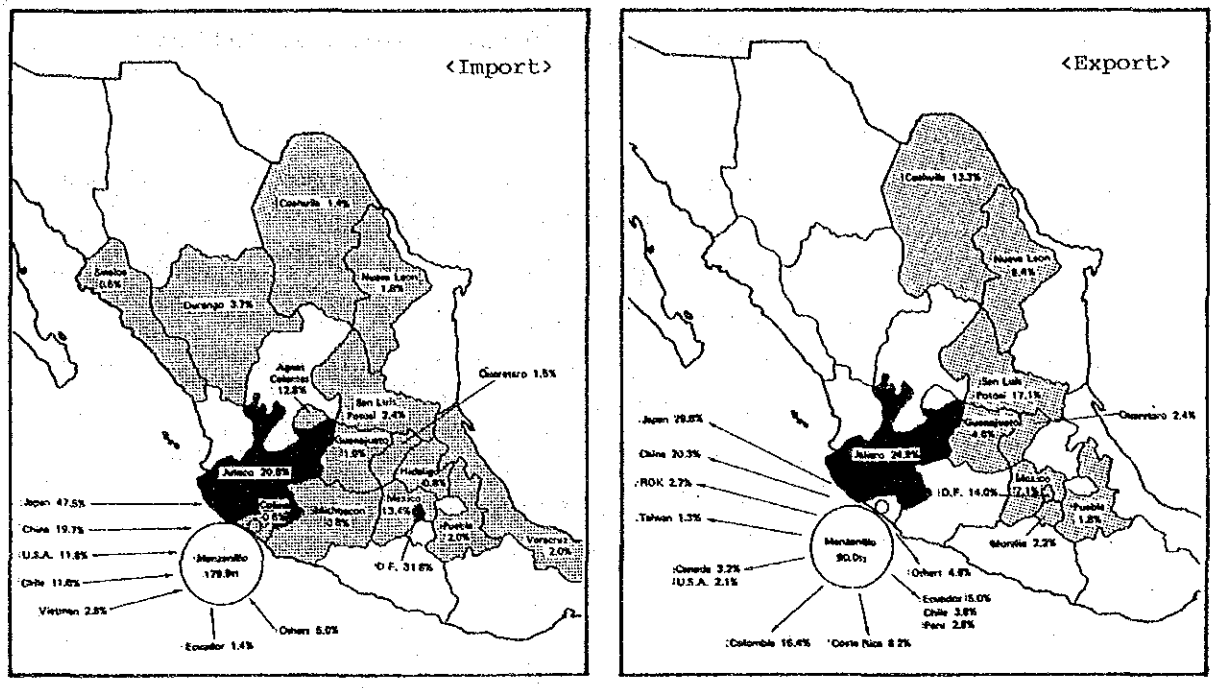


Fig.5.10 Hinterland of Manzanillo for General Cargo

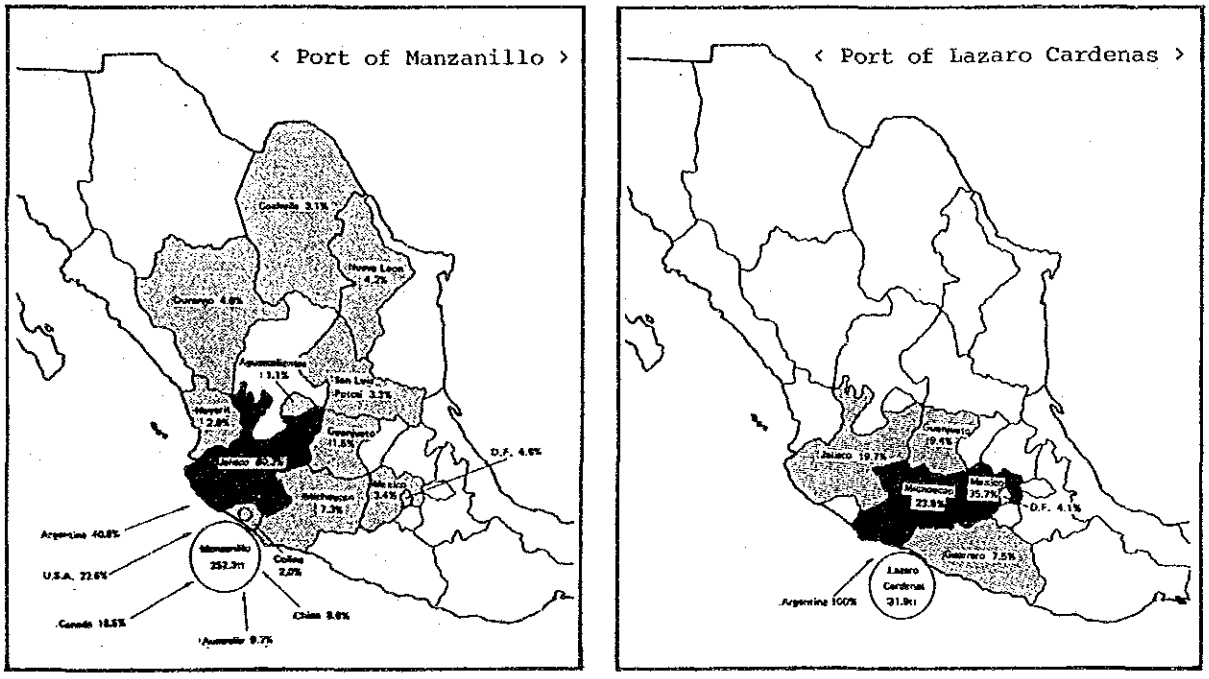


Fig.5.11 Hinterland for Import Agricultural Bulk

5.5 Forecast of General and Containerized Cargo Volume of Each Port

5.5.1 Forecast Methodology

The estimation of the general and containerized cargo volume of each port in the target years 1995 and 2005 is roughly carried out based on the port statistics and the collected data and the results of interviews with the organizations concerned at each port and in Mexico City.

For the forecast, the cargoes are classified into specific cargoes which will show a specific growth rate, newly projected cargoes and others. Based on the examination of the hinterland of each port, some portion of the cargoes now being handled at the Port of Salina Cruz and Manzanillo are estimated to shift to the Port of Lazaro Cardenas.

5.5.2 Result of the Forecast

Tables 5.3 and 5.4 and Fig.5.12 show the result of the forecast of the general and containerized cargo volumes through each port in 1995 and 2005.

As a whole, Lazaro Cardenas and Manzanillo are estimated to grow at a higher rate of increase than the other ports, showing an increasing share of the handling cargo volume of the two ports among the Pacific coast ports.

Table 5.3 Estimate of General Cargo and Containerized Cargo (Import)

(unit; 1,000 tons; %)

Year / Item / Ports		1988 General Cargo	1988 Containerized ratio (%)	1988 Containerized cargo	Average Annual Growth Rate (%)	1995 General Cargo	1995 Containerized ratio (%)	1995 Containerized cargo	Average Annual Growth Rate (%)	2005 General Cargo	2005 Containerized ratio (%)	2005 Containerized cargo
Ensenada	①	(0.5)	2.6	-	37.4	(2.6)	24	65	8.0	(3.4)	52	75
			-	-	-		65	-	-		75	-
			-	-	-		16	9.3			39	
Guaymas	②	(19.5)	93.0	72.5	1.7	(11.4)	105	70	3.8	(9.8)	152	85
			72.5	-	-		70	-	-		85	-
			67.4	1.3			74	5.7			129	
Mazatlan	③	(0.4)	1.8	5.6	49.5	(3.3)	30	55	6.6	(3.7)	57	83
			5.6	-	-		55	-	-		83	-
			0.1	-			17	10.7			47	
Manzanillo	④	(25.5)	121.4	17.5	12.5	(30.0)	276	74	4.7	(28.3)	438	87
			17.5	-	38.2		74	-	6.7		87	390
			21.2				204				390	
Lazaro Cardenas	⑤	(33.6)	159.8	57.6	10.7	(35.3)	325	74	5.6	(36.1)	560	89
			57.6	-	-		74	-	-		89	-
			92.1		14.7		241	8.5			498	
Salina Cruz	⑥	(12.2)	57.9	61.3	5.8	(9.4)	86	73	7.8	(9.8)	152	88
			61.3	-	-		73	-	-		88	-
			35.5		8.5		63	7.8			134	
Sub-Total	⑦	(91.7)	436.5	49.6	9.9	(92.0)	846	72.7	5.2	(91.0)	1,411	87.7
⑦=①~⑥			49.6	-	-		72.7	-	-		87.7	-
			216.3		16.1		615	7.2			1,237	
Acapulco and Other Pacific Ports	⑧	(8.3)	39.3	25.7	9.5	(8.0)	74	39.2	6.5	(9.0)	139	58.3
			25.7	-	-		39.2	-	-		58.3	-
			10.1		16.3		29	10.8			81	
Pacific Coast Total	⑨	(100.0)	475.8	47.6	9.9	(100.0)	920	70	5.4	(100.0)	1,550	85
⑨=⑦+⑧			47.6	-	-		70	-	-		85	-
			226.4		16.1		644	7.4			1,318	

Note: ( ); Share to the Pacific Coast Total

Table 5.4 Estimated of General Cargo and Containerized Cargo (Export)

(unit; 1,000 tons; %)

Year / Item / Ports		1988 General Cargo	1988 Containerized ratio (%)	1988 Containerized cargo	Average Annual Growth Rate (%)	1995 General Cargo	1995 Containerized ratio (%)	1995 Containerized cargo	Average Annual Growth Rate (%)	2005 General Cargo	2005 Containerized ratio (%)	2005 Containerized cargo
Ensenada	①	(3.2)	24.9	-	10.8	(3.0)	51	51	6.1	(3.0)	92	70
			-	-	-		51	-	-		70	-
			-	-	-		26	9.4			64	
Guaymas	②	(11.1)	85.8	77.2	10.4	(10.0)	171	70	3.8	(8.1)	248	75
			77.2	-	-		70	-	-		75	-
			66.2		8.9		120	4.5			186	
Mazatlan	③	(14.7)	113.4	24.8	4.7	(9.1)	156	50	3.5	(7.2)	221	70
			24.8	-	-		50	-	-		70	-
			21.3		20.4		78	7.1			155	
Manzanillo	④	(33.9)	261.1	54.5	12.6	(35.1)	601	72	6.0	(35.3)	1,077	83
			54.5	-	-		72	-	-		83	-
			142.3		17.2		432	7.5			894	
Lazaro Cardenas	⑤	(15.1)	116.5	53.5	18.4	(22.2)	380	74	7.9	(26.7)	815	85
			53.5	-	-		74	-	-		85	-
			62.3		24.0		281	9.4			693	
Salina Cruz	⑥	(18.1)	139.9	89.7	9.6	(15.5)	265	90	4.2	(13.1)	399	92
			89.7	-	-		90	-	-		92	-
			125.5		9.6		238	4.4			367	
Sub-Total	⑦	(96.2)	741.6	56.3	11.8	(95.0)	1,624	72.4	5.8	(93.5)	2,852	82.7
⑦=①~⑥			56.3	-	-		72.4	-	-		82.7	-
			417.6		15.9		1,175	7.2			2,359	
Acapulco and Other Pacific Ports	⑧	(3.8)	29.3	9.9	16.6	(5.0)	86	25.6	9.5	(6.5)	198	40.9
			9.9	-	-		25.6	-	-		40.9	-
			2.9		33.6		22	13.9			81	
Pacific Coast Total	⑨	(100.0)	770.9	54.5	12.1	(100.0)	1,710	70	6.0	(100.0)	3,050	80
⑨=⑦+⑧			54.5	-	-		70	-	-		80	-
			420.5		16.1		1,197	7.4			2,440	

Note: ( ); Share to the Pacific Coast Total excluding SICARTSA cargo

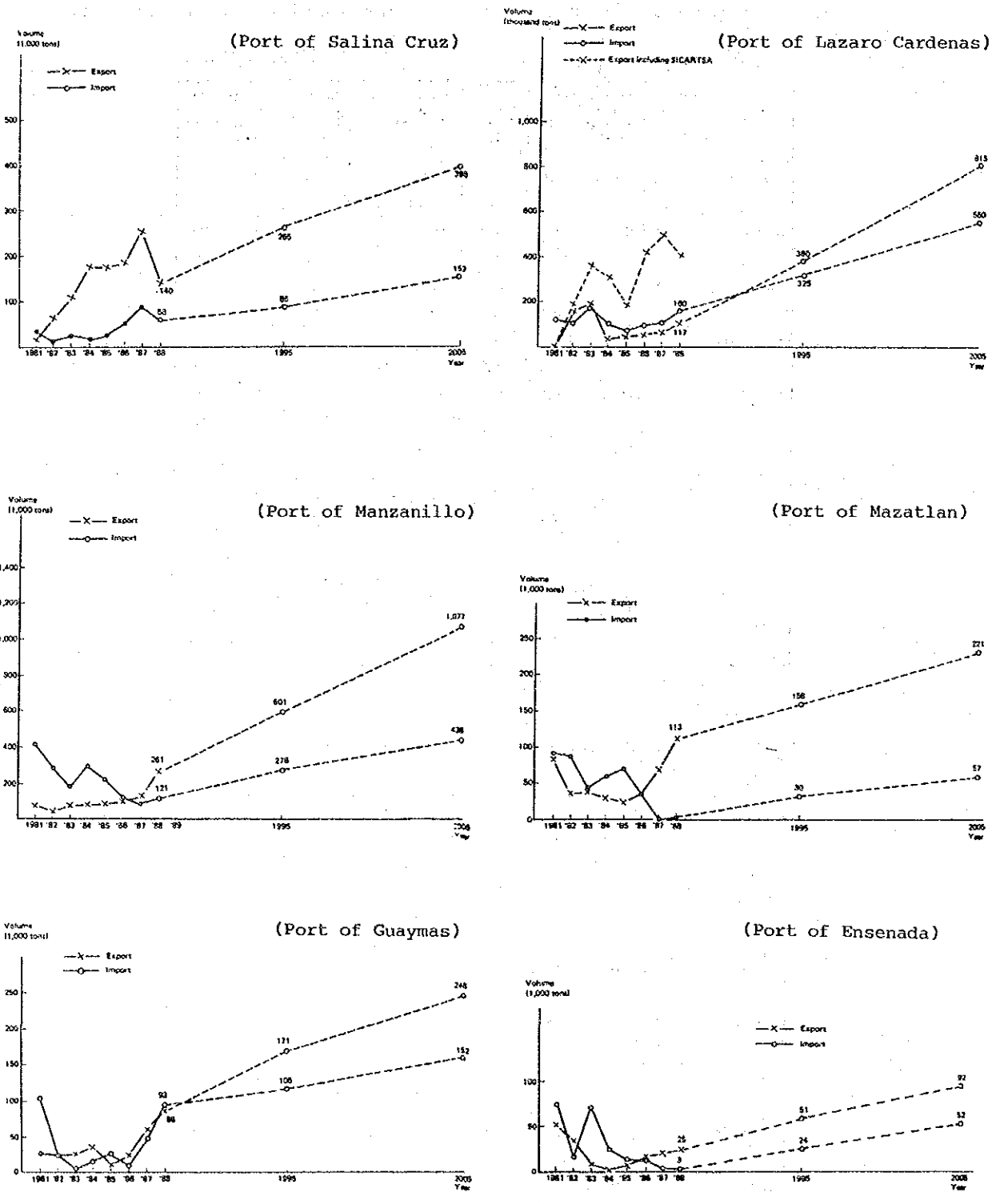


Fig.5.12 Historical Trend and Forecast of General Cargo

5.6 Forecast of Bulk Cargo Volume at Selected Ports

5.6.1 Forecast of Imported Agricultural Bulk Cargo Volume

The volume of imported agricultural products in a given year is greatly associated with the level of the domestic production in the previous year as shown in Fig.5.13.

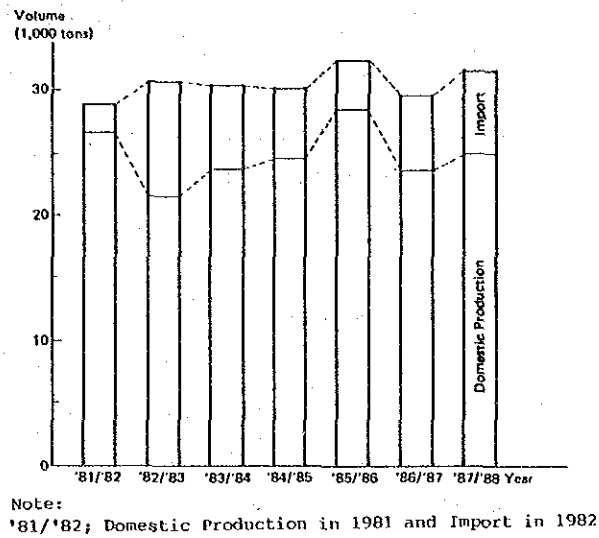


Fig.5.13 Trend of Domestic Production and Import of Agricultural Products

From this Figure, the total import volume, as well as the total domestic consumption, of agricultural products will not change greatly in the near future. At the same time, the share of the cargo volume imported through the Pacific coast ports will also not change greatly from the present situation in the short period.

Therefore, it would be reasonable to adopt the relatively large volume of the actual results in the past several years as the estimated total volume. Thus, the study team adopts 1,500 thousand tons as the estimated total volume of the agricultural bulk cargo through the Pacific coast ports in the target year of 1995.

The handling volume of Lazaro Cardenas and Manzanillo in 1995, using the estimated handling share in 1995 (See Fig.5.14), is estimated to be 200 and 660 thousand tons respectively, in case the cargo shift discussed below is considered.

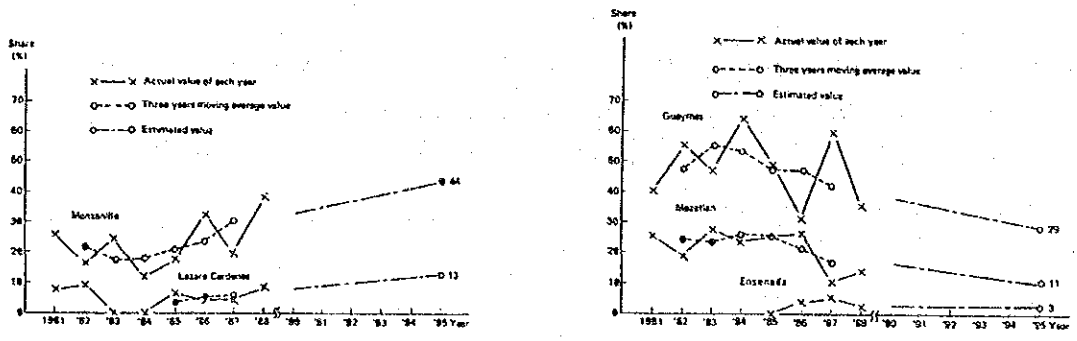


Fig.5.14 Trend and Estimated Value of the Share of Imported Agricultural Bulk

Considering their overlapping hinterlands, the cargo shift from Manzanillo to Lazaro Cardenas is naturally forecast with the commencement of the operation of the grain storage silo in Lazaro Cardenas.

The cargo volume of imported agricultural bulk is estimated according to two cases shown in Table 5.5.

Table 5.5 Results of the Estimation for the Cargo Volume of Imported Agricultural Bulk in 1995

(unit: thousand tons)

Case		Primary estimation	Cargo shift from Manzanillo to Lazaro Cardenas	Cargo shift from Gulf coast ports	Estimated cargo volume
Case 1	Lazaro Cardenas	200	+130	+30	360
	Manzanillo	660	-130	+40	570
Case 2	Lazaro Cardenas	200	+330	+40	570
	Manzanillo	660	-330	+30	360

Note: Case 1 Lazaro Cardenas: equipped with a grain storage silo.
Manzanillo: equipped with a storage facility.

Case 2 Lazaro Cardenas: equipped with a grain storage silo.
Manzanillo: equipped with no storage facility.

To determine the estimated cargo volume of Lazaro Cardenas and Manzanillo, such items as the storage capacity of the two ports, the requests for calling of larger size bulk carriers and the governmental policy for the functional allotment between the two ports must be examined.

5.6.2 Forecast of Other Bulk Cargo Volume at the Port of Lazaro Cardenas

Based on the examination of historical trends and the results of the interviews at the port, the handling volume of other bulk cargoes through the Port of Lazaro Cardenas in 1995 is estimated as follows:

i. Agricultural bulk	Domestic import	150	thousand tons
ii. Mineral bulk at the SICARTSA berth			
Coal and coke	Import	175	thousand tons
	Domestic import	75	"
Scrap iron	Import	400	"

5.6.3 Forecast of Other Bulk Cargo Volume at the Port of Manzanillo

Based on the examination of historical trends and the results of the interviews at the port, the handling volume of other bulk cargoes through the Port of Manzanillo in 1995 is estimated as follows.

i. Agricultural bulk	Domestic import	80	thousand tons
ii. Mineral bulk	Import	227	thousand tons
	Export	1,300	"
	(Cement)	(900)	"
	(Iron ore pellets)	(400)	"
	Domestic import	60	"

Chapter 6 Container Network and Long Term Development Policy

6.1 Examination of the Container Network

6.1.1 Container Mother Vessels and Feeder Service

a. The fundamental principle of operating container mother vessels is as follows:

   i. to pursue the volume scale merit by mass transport

   ii. to shorten the transit time of each voyage by limiting the number of calling ports

   iii. to minimize vessel operating costs by deploying larger vessels

   iv. to decrease time spent in port

   Further, a fixed day weekly service (FDWS) by vessel in the current and future competitive trade is necessary for better customer service.

b. Therefore, cargoes destined to and originated from some ports where container mother vessels do not directly call due to the ports' physical condition and the view-point of operating economy are transferred by feeder vessels. As smooth transshipment from/onto container mother vessels to/from feeder vessels is very important, feeder services would also be expected on a weekly basis.

6.1.2 Cargo Volume by Port and Trade Area in 2005 and Pivotal Base Ports

a. Table 6.1 is excerpted from the forecast figures in Chapter 5, which are calculated based on the current shares of the O/D investigations in 1985 and 1986.

   The total volume of 2,475,000 tons at Manzanillo and Lazaro Cardenas represents a 68.8% share of the six ports total, and the volume at each of these two ports is far larger than those of the other four ports. The cargo of the two trade areas of I (Japan, Far East) and II (U.S.A., Canada) total 2,635,200 tons which represents a 73.3% of the volume of the total trade area.

Table 6.1 Containerized Cargo Tonnage by Trade Area in 2005

(unit; 1,000 tons)

Port / Trade Area	Ensenada			Guaymas			Mazatlan			Manzanillo			Lazaro Cardenas			Salina Cruz			G. Total		
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total
I	39.0	64.0	103.0	59.0	21.2	80.2	24.3	21.7	46.0	281.2	471.1	752.3	174.8	374.9	549.7	70.4	307.6	378.0	648.7 (52.4)	1,260.5 (53.4)	1,909.2 (53.1)
II	-	-	-	31.6	-	31.6	11.6	-	11.6	46.0	58.1	104.1	262.9	205.8	468.7	57.5	52.5	110.0	409.6 (33.1)	316.4 (13.4)	726.0 (20.2)
III	-	-	-	20.5	-	20.5	0.1	1.2	1.3	56.6	193.1	249.7	-	28.4	28.4	1.6	5.1	6.7	78.8 (6.4)	227.8 (9.7)	306.6 (8.5)
IV	-	-	-	16.4	164.8	181.2	11.0	132.1	143.1	-	149.3	149.3	40.3	57.5	97.8	0.4	0.7	1.1	68.1 (5.5)	504.4 (21.4)	572.5 (15.9)
V	-	-	-	1.5	-	1.5	-	-	-	6.2	22.4	28.6	20.0	26.4	46.4	4.1	1.1	5.2	31.8 (2.6)	49.9 (2.1)	81.7 (2.3)
G. Total	39.0	64.0	103.0	129.0	186.0	315.0	47.0	155.0	209.0	390.0	894.0	1,284.0	498.0	693.0	1,191.0	134.0	367.0	501.0	1,237.0 (100.0)	2,359.0 (100.0)	3,596.0 (100.0)
	<3.2>	<2.7>	<2.9>	<10.4>	<7.9>	<8.8>	<3.8>	<6.6>	<5.6>	<31.5>	<37.9>	<35.7>	<40.3>	<29.4>	<33.1>	<10.8>	<15.5>	<13.9>	<100.0>	<100.0>	<100.0>

Remarks: (1) Trade Area: I. Japan, Far East (including NIES, ASEAN)
II. U.S.A., Canada
III. Central, South America (not via Panama Canal)
IV. Europe, Africa, Latin America (via Panama Canal)
V. Others (New Zeland, Australia via L.F., etc.)

(2) Figures are calculated from the data of Direccion de Puerto y Merina Mercant de SCT.

(3) Figures in ( ) and < > show the ratios by trade area and by port respectively.

(4) Ensenada is categorized in Trade Area I

b. Considering the present port conditions, the cargo volume forecast, the access to hinterland areas and the future port development policy, the two ports of Manzanillo and Lazaro Cardenas are appropriate to serve as pivotal base ports.

6.1.3 Container Network to Local Feeder Ports

a. Table 6.2 shows several patterns of feeder networks from pivotal base ports. As for the Port of Ensenada, mother container vessels would call directly at the port on navigational ocean route, the container feeder network is examined among the other five ports.

Table 6.2 Patterns of Feeder Network

Case	Number of Feeder Vessels	Base Port(s) (B)	Feeder Ports (F)	Rotation Patterns
I	1 Vessel	Manzanillo or Lazaro Cardenas	•Guaymas (G) •Mazatlan (M) •Salina Cruz (S)	• B→S→M→G→B • B→S→G→M→B • B→M→G→S→B • B→G→M→S→B
II	2 Vessels	Manzanillo or Lazaro Cardenas	•Guaymas (G) •Mazatlan (M) •Salina Cruz (S)	• B→M→G→B • B→G→M→B • B→S→B
III	2 Vessels	Manzanillo	•Guaymas (G) •Mazatlan (M)	• B→M→G→B • B→G→M→B
		Lazaro Cardenas	•Salina Cruz (S)	• B→S→B

b. Case III seems preferable for better customer service for of the following reasons:

i. to keep one round of voyage time at a speed of 15 knots within a week for each respective service.

ii. to shorten the total navigation mileage of a feeder vessel.

iii. to same preparation costs for cargo handling facilities by avoiding concentration in only one port.

iv. to save land transportation costs the total distances.

v. to leave customers the choice of a more convenient port.

vi. to provide good service for customers over a wide hinterland area.

vii. to leave sufficient open space in the two ports for new container facilities in future.

viii. it is preferable to divide the facilities in two locations considering the possibility of damage from natural disasters and from the viewpoint of overall national security.

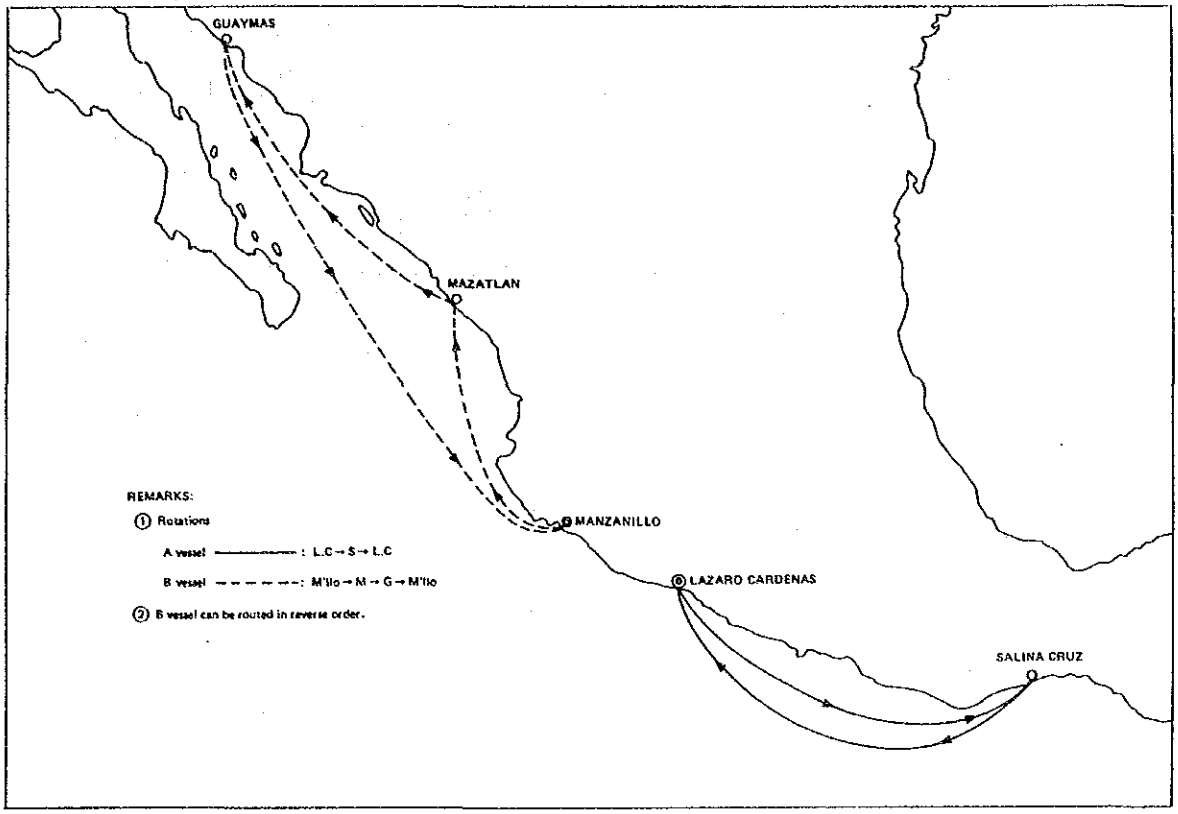


Fig.6.1 Feeder Vessel Rotations, CASE III

The above Fig.6.1 shows rotation map based on CASE III.