UNITED MEXICAN STATES

FEASIBILITY STUDY ON THE REPAIR DOCKYARD IN LAZARO CARDENAS

FINAL REPORT

MAIN REPORT

MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

It is with great pleasure that I present this "FEASIBILITY STUDY ON THE REPAIR DOCKYARD IN LAZARO CARDENAS" to the Government of the United Mexican States.

The report embodies the results of the study which was carried out from March 1987 to January 1988 by a Japanese Study Team commissioned by the Japan International Cooperation Agency following the request of the Government of the United Mexican States to the Government of Japan.

The Study Team headed by Mr. Shigeshi Umesato, Overseas Shipbuilding Cooperation Centre, had a series of discussions on the Study with the Mexican counterparts, conducted a wide-ranging field survey and has prepared the present report.

I hope that this report will be useful as a basic reference for development of the Project and contribute to the promotion of friendly relations between our two countries.

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

March, 1988

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International
Cooperation Agency

Mr. Kensuke Yanagiya
President
Japan Internatioal
Cooperation Agency
Tokyo

March 1988

Dear Sir,

LETTER OF TRANSMITTAL

We have the pleasure of submitting to you a Final Report of "FEASIBILITY STUDY ON THE REPAIR DOCKYARD IN LAZARO CARDENAS".

This report is the results of the feasibility study for the Repair Dockyard which the Government of Mexico plans to construct at the industrial port of Lazaro Cardenas on the Pacific coast.

The report consists of three volumes: the Summery Report which states the essential points of the whole reports, the Main Report which covers all items of the study and describes the results of the study in detail, and the Supporting Report which contains the basic data collected for the implementation of the project.

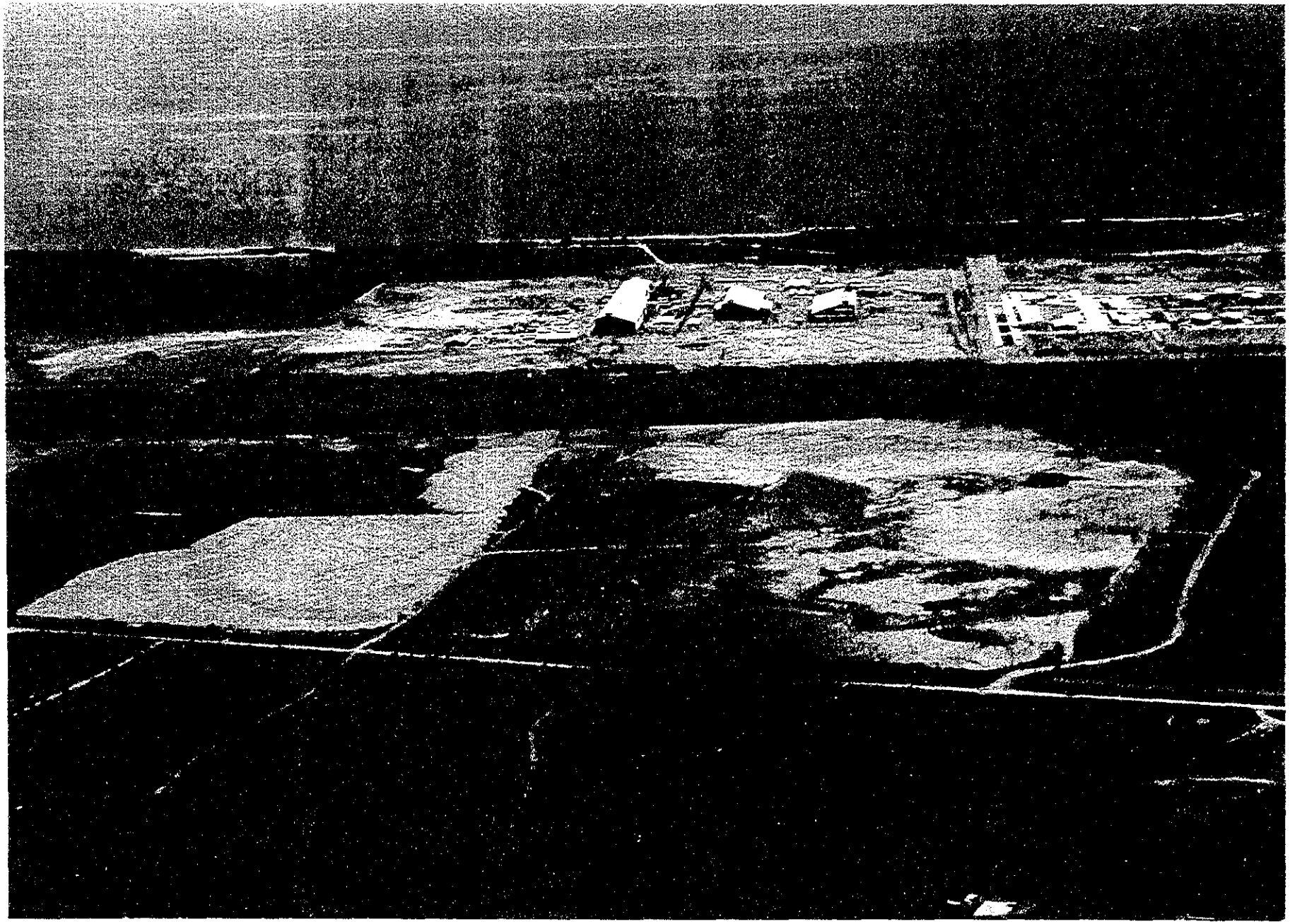
All members of the Study Team wish to express grateful acknowledgement to the personnel of the Advisory Committee, Ministry of Foreign Affairs, as well as officials and individuals of Mexico for their kind assistance extended to the Study Team.

In conclusion, the Study Team sincerely hopes that the study results will contribute to the future development of shipbuilding industries and to the socio-economic development in Mexico.

Yours sincerely,

S. Umesato

Shigeshi Umesato
Team Leader of
the Feasibility Study for
a Repair Dockyard of
Lazaro Cardenas in the
United Mexican States



BIRD'S-EYE VIEW OF THE LAND FOR ENVISAGED REPAIR DOCKYARD IN LAZARO CARDENAS

CONTENTS

LIST OF TABLE

LIST OF FIGURE

I. SUMMARY

I. SUMMARY

1. Preamble

1-1 Introduction

In line with a decision made in 1986 by the Government of Japan to respond positively to a request submitted by the Government of the United Mexican States of undertaking a Feasibility Study on the establishment of a repair dockyard at Lazaro Cardenas, the Japan International Cooperation Agency, entrusted with the execution of the Feasibility Study, assigned a Study Team to visit Mexico once in April, and for a second time in June-July 1987, to collect data and information on such items as:-

- National economy in general
- National policy on shipping, shipbuilding and shiprepair
- Views held by shipping enterprises on the shipping and on the projected repair dockyard
- Potential demand for shiprepair
- Social and natural environment of Lazaro Cardenas
- Law and regulations governing civil and building construction
- Technological capability of civil and building contractors
- Technological capability of shiprepair work in existing domestic shipyards
- Availability in the domestic market of requisite articles for Dockyard construction and for shiprepair.

Upon completion of the Survey, Progress Report (I) was submitted to the competent authorities and organizations interested, supplemented by oral presentation of additional information on progress made on the Feasibility

Study, and by discussions on the prerequisites for proceeding further with the Study.

Subsequently, the information resulting from the survey was made the object of an Interim Feasibility Study, in which 4 alternative docking systems were evaluated for mutual comparison, to determine which of the systems should be the most suitable and economical for the envisaged shiprepair operations at Lazaro Cardenas.

The results of the foregoing Interim Feasibility Study were compiled into Progress Report (II), which served as basis for further discussion in September 1987 with the competent authorities and organizations interested. It was decided to adopt for the projected Dockyard the combination docking system incorporating floating dock and work bay facility recommended in Progress Report (II). The interim plans for dockyard construction and operation were further reviewed and developed envisaging the above combination system, for inclusion in the Final Report.

The present Report contains the results of the foregoing review and development, aimed at deriving the most feasible plan for implementing the Repair Dockyard Project.

The essential points of this Report are indicated in the form of a flow chart in Fig. 1-1-1.

Grateful acknowledgment is expressed to the Government of Mexico, SOMEX and other competent authorities and organizations interested, for their unreserved cooperation and assistance accorded to the Study Team, without which the present Feasibility Study would not have been possible.

1-2 Conclusion

The Repair Dockyard envisaged to be established at Lazaro Cardenas Industrial Port can be considered one of the very few highly eligible locations for newly establishing a shiprepair yard remaining under the current conditions of the internatioal shiprepair market. Provided that adequate capabilities are acquired in dockyard management and in shiprepair technology, and that the environmental infrastructure is duly completed, including waterway and land approaches, the market for the envisaged Dockyard is forecast to amply attain about 1.1 million GT (gross tons) in 1995, 1.6 million GT in 2005, and 2.3 million GT in 2015, thus indicating bright prospects for the Project upon implementation.

For the docking system --constituting the key factor of shiprepair yard arrangement and mode of operation-- a combination system incorporating floating dock and work bay facility has been selected. This combination docking system permits operation with high efficiency and calls for the least capital investment, and has thus been judged the most highly suited in consideration of the prevailing local conditions including natural environment and the associated industries established in the vicinity at Lazaro Cardenas.

Earnings from Dockyard operation have been estimated using as reference the corresponding records realized at Veracruz Dockyard, as well as Japanese data.

Basing on the aforesaid premises, the forecast of operating performance to be expected from Project implementation indicate:-

- Investment capital totaling approx. US$101.7 million, comprising :

Dockyard construction	: Approx. US$41.9 million
Equipment, incl. floating dock	: Approx. US$54.7 million
Initial expenditures to cover disbursements prior to start of commercial operation	: Approx. US$5.1 miilion

- Total earnings :

In 1995	: Approx. US$17.3 million
In 2005	: Approx. US$24.4 million
In 2015	: Approx. US$35.1 million

Adding to the foregoing investment capital the estimated operating and other expenses, and assuming 30 years project life, the financial and economic internal rates of return (FIRR and EIRR) have been found to amount to 9.9 and 11.0 percent respectively. Further, sensitivity analyses have shown that, in the event of an unfavorable development of circumstances resulting for instance, in 10 percent negative deviation of total earnings from the forecast, FIRR would still be 8.0 percent, and EIRR 9.1 percent.

The foregoing analytical results range within the highest values that could be expected for a newly established shiprepair yard.

The interest on deposit, deemed to be indicative of the minimum level of opportunity cost of capital, proves currently to be 3 - 4 percent, leaving inflation out of account, and cutoff rate prevalent under the projects financed by development banks is around 10 percent

Consequently, implementation of the envisaged Project can be considered duly justified.

Upon implementation, the Project will further contribute to increase of employment opportunities in the locality --to the extent of approximately 1,400 in the final stage of Project life. Moreover, 30 to 40 percent of earnings will account for services rended to foreign ships, thus contributing also to acquisition of foreign currency. Furthermore, modern managerial techniques and shiprepair technology transferred to the Repair Dockyard will contribute significantly to promotion of the Mexican shipbuilding industry and associated industries.

The envisaged Project can thus be conclusively evaluted as highly advisable for implementation.

1-3 Recommendations

The envisaged Repair Dockyard can be expected to present ample viability for operating profitably as a private enterprise, without seeking assistance from Government beyond minimum extent.

It is premised, however, that the requisite environmental infrastructure --access channels to Dockyard by water and by road, water supply, etc.-- is adequately provided by public works. Also, as measures to permit the Dockyard to secure orders for shiprepair work on equal footing with foreign shipyards, it should be necessary to request the Government authorities to provide the requisite business environment --e.g. exemption of indirect sales tax (VAT) on all earnings from shiprepair work, and of import duty on materials and components purchased from abroad.

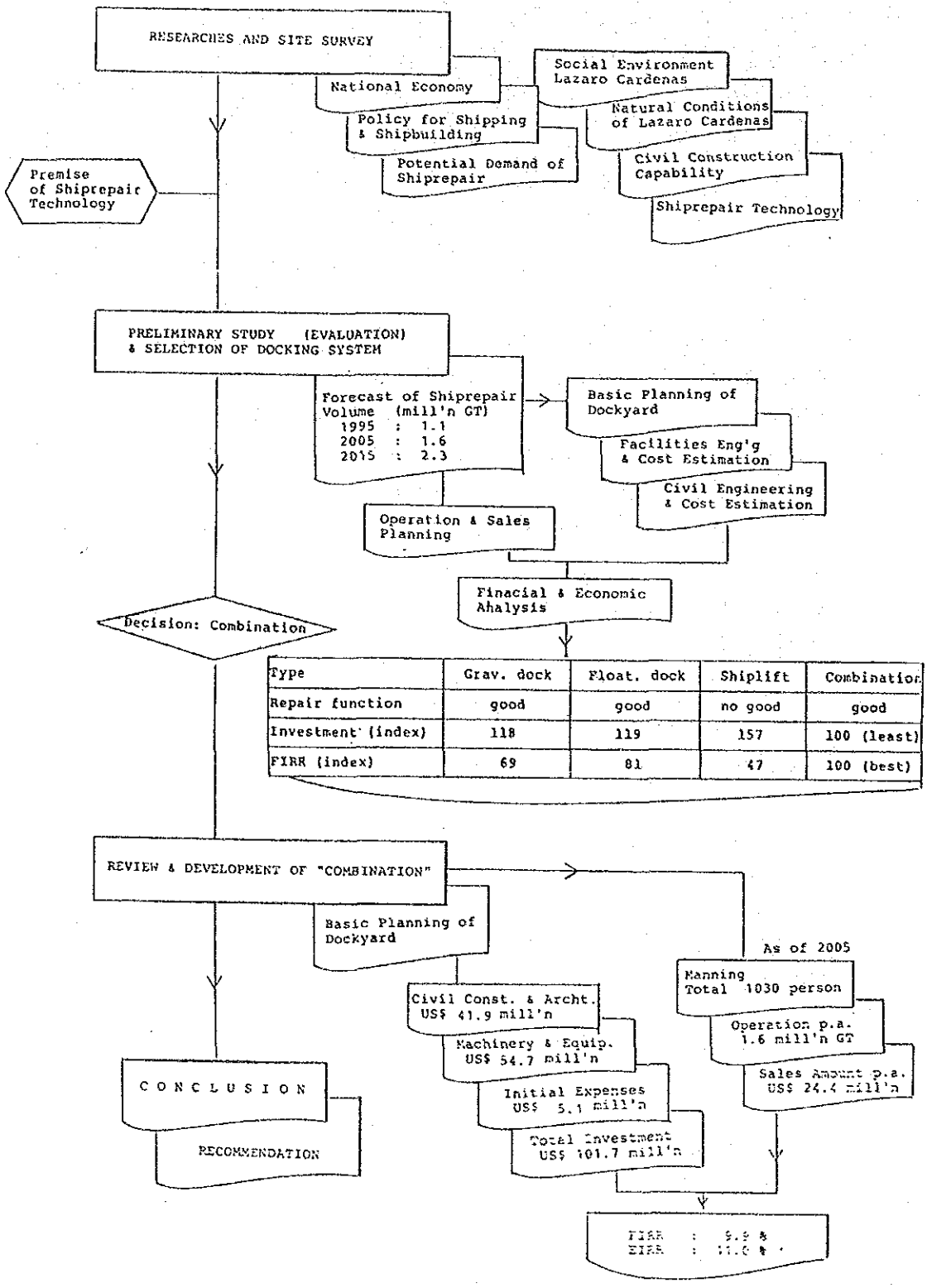


Fig. I-1-1 FLOW & RESULT OF FEASIBILITY STUDY

2. Forecast for Shiprepair Demand

2-1 Volume of Cargo Handled and Ships to be Repaired

With the growth of economic activities in Mexico, foreign trade and volume of import and export cargo will be expanded, inducing an increase in number of Mexican flag ships and foreign flag ships calling at Mexican ports. Some of these ships can be considered to be potential demand for drydocking and repairs at the projected repair dockyard. Ships passing off the pacific coast of Mexico, among others, those with registry in eight Latin American countries sailing on ballast to and from the Panama Canal, may be added to the number of prospective ships.

Table I-2-1 shows volume of cargo traded and number of ships for repair with the growth of economic activities.

2-2 Volume of Ship Repair

Volume of Ship Repair Volume of ship repair work as potential demand for repair is characterized as below:

- Ships flying Mexican flag
- Ships flying foreign flag calling at Mexican ports
- Ships of specific types sailing on the way to and from the Panama Canal in ballast condition
- Ships sustaining casualties off the Pacific coast

The forecasted results are given in Table I-2-2.

Most of potential ships were, in reality, repaired at foreign repair dockyards on account of non-competitiveness and inadequate facilities at existing shiprepair yards.

Assuming that a new repair dockyard is internationally competitive in terms of ship repair technology, delivery and prices, the volume of shiprepair work will amount to be 68 ships in 1995, 94 ships in 2005 and 131 in 2015. This outlook represents an average, not very optimistic not very pessimistic, for which Figure I-2-1 is to be referred to.

Table I-2-1 ECONOMY, TRADING VOLUME AND OPERATING SHIPS ON PACIFIC SIDE OF MEXICO
(Case B – Case A)

Item \ Year	1985 (Actual)	1995 (Forecast)	2005 (DO)	2015 (DO)	Remarks
GDP (1980 price, bill. peso)	4,625	5,109–6,229	5,930–8,371	6,882–11,250	
Handled cargo volume on ports (mill. ton)	152.2	169.9–227.5	212.2–337.7	261.2–485.8	
Handled cargo volume on Pacific coast side (mill. ton)	45.5	58.2–74.1	74.5–120.7	95.4–196.5	
Operating ships by Mexican shipping firms (Number of ships)	'84 86	112	136	174	
Entry foreign ships on Pacific side ports (Number of ships)	1,444	1,655–2,120	2,065–3,180	2,800–4,900	
Passing ships off Mexico and Panama canal	'84 475	580	690	825	

Table I-2-2 SHIP REPAIR DEMAND IN PACIFIC COST

(Case B – Case A)

(Unit: Number of Ships)

Item \ Year	1995	2005	2015	Remarks
Potential Demand of Repair of Merchant Ships				
Operating Ships by Mexican Shipping Firms	84	102	131	
Entry Foreign Ships on Pacific Side Ports	24–32	31–48	42–73	
Others	10–11	13–15	13–15	
Total	118–127	146–165	186–219	
* Ship Repair Volume of Repair Dockyard in Lazaro Cardenas ( ) Average	62–72 (68)	84–100 (94)	115–145 (131)	

Remarks: *; Including dredger etc.

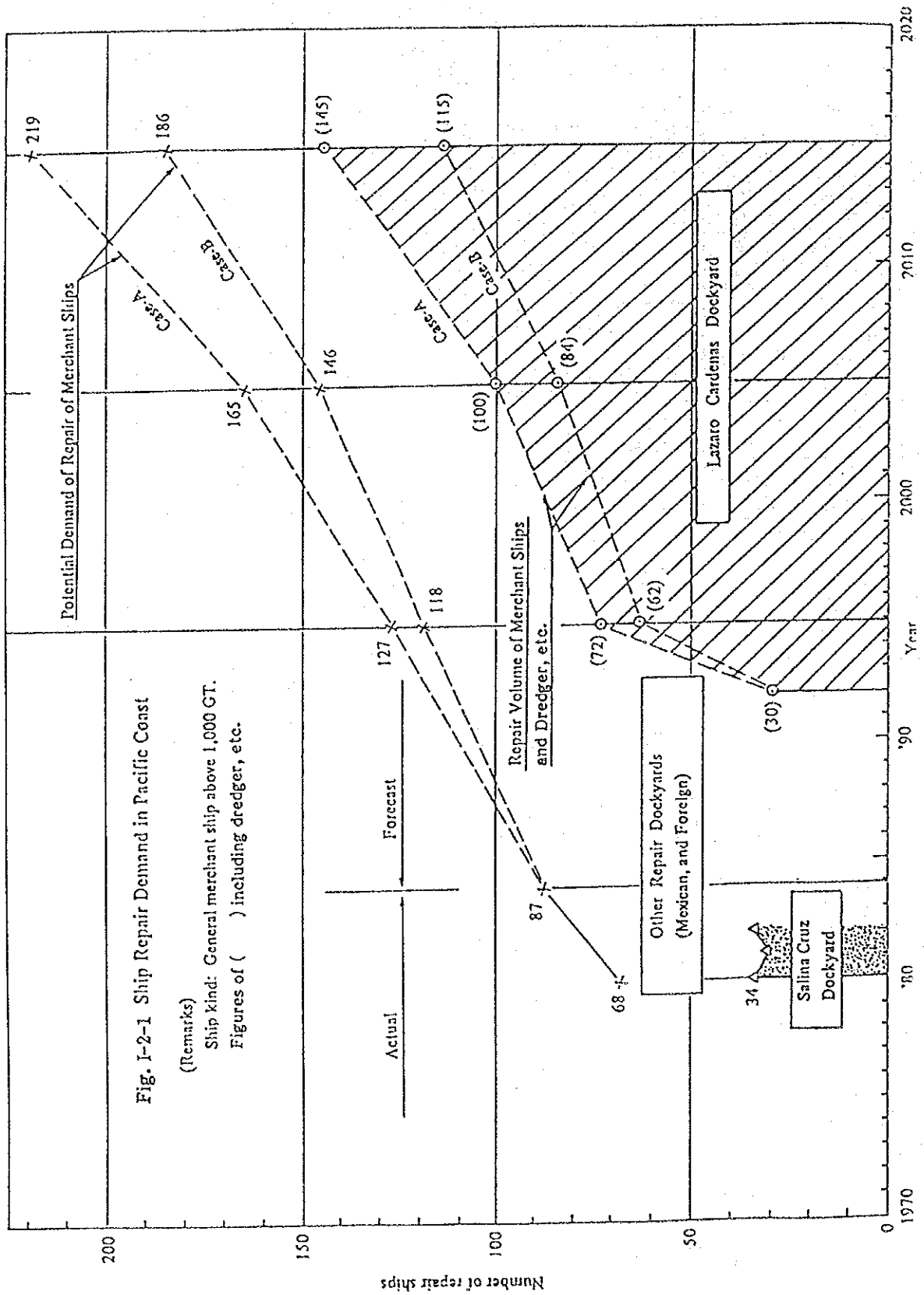


Fig. I-2-1 Ship Repair Demand in Pacific Coast

(Remarks)
Ship Kind: General merchant ship above 1,000 GT.
Figures of ( ) including dredger, etc.

3. Outline of the Project Site

3-1 Natural Conditions

The proposed site of repair dockyard faces a canal and is well sheltered from the swell of the Pacific Ocean and the stream of the River Balsa, with the climate more favorable and suitable to ship repair business than in Japan.

As a means of docking and lifting ships, the combination system was selected for this project. Although the system is not much affected by the soil condition, caution will better be exercised prior to construction, because Lazaro Cardenas is an area of the most frequent earthquakes which could lead to land liquefaction and other relative casualties.

3-2 Industrial Port of Lazaro Cardenas

As the repair dockyard is located in the industrial park at the port, effective interrelation between industries will be expected to improve ship repair operations.

The port, while gradually equipped with modern facilities and environmental infrastructure, is providing professional training system. Such social and industrial surroundings are particularly advantageous to dockyard's entry into the area.

Figure I-3-1 shows the projected location of repair dockyard at the port.

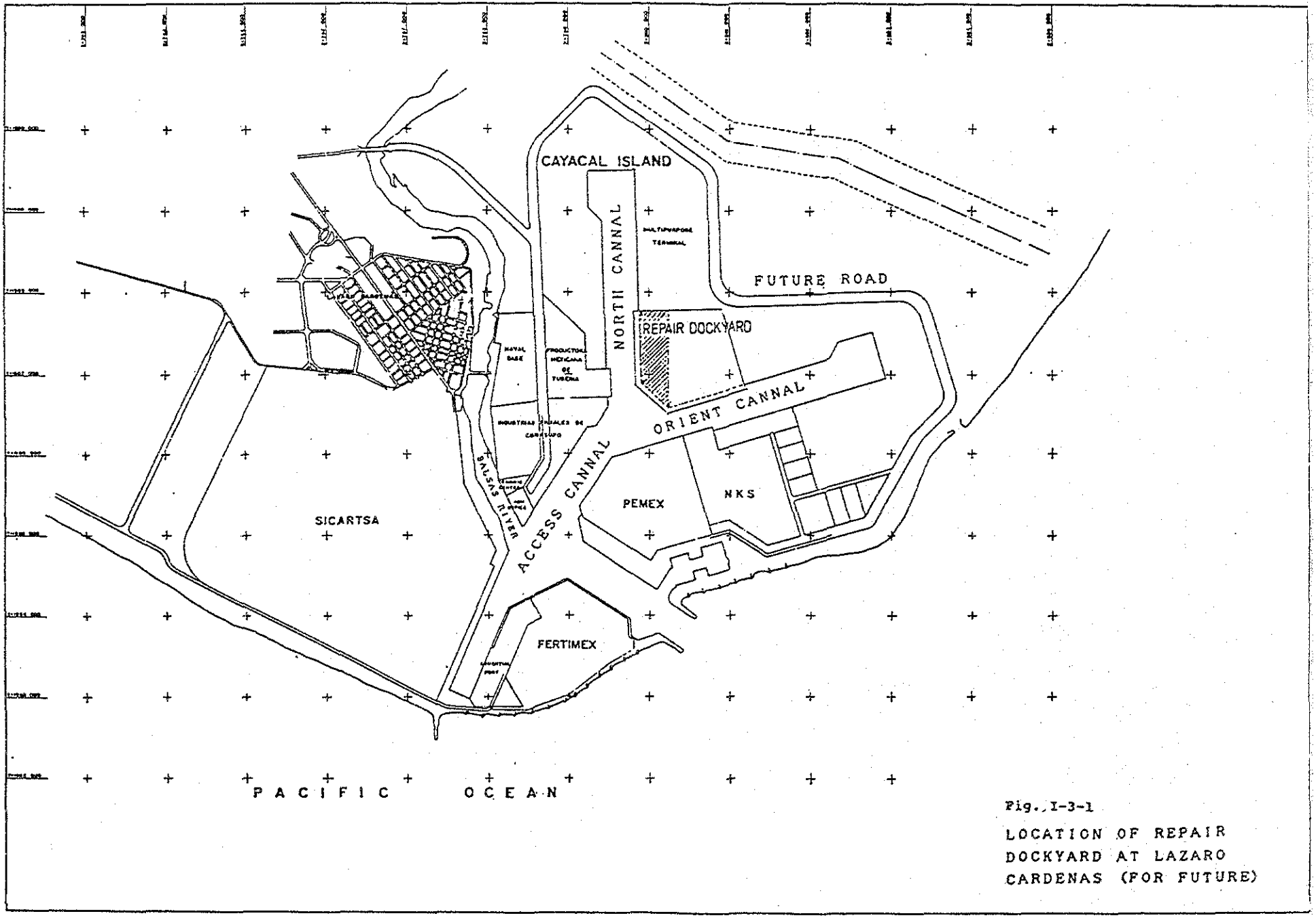


Fig. I-3-1
LOCATION OF REPAIR DOCKYARD AT LAZARO CARDENAS (FOR FUTURE)

4. Envisaged Facilities and Equipment

4-1 Facilities Planning

Principal particulars of dockyard facilities are as follows:

1)	Total area of the dockyard	362,000 m^2
2)	Nominal dimensions and lifting capacity of floating dock	230m x 46m x 33,000 ton
3)	Work-bay dimensions	230m x 40m
4)	Repairing quay	2 quays x 230m
5)	General layout of dockyard	See Fig. I-4-1

4-2 Implementation Planning

4-2-1 Time schedule

1)	Start of preparation for construction	Jan. 1990
2)	Start of 1st stage construction	July 1990
3)	Start of dockyard operation	Jan. 1992
4)	Completion of 1st stage construction	Dec. 1992
5)	Start of 2nd stage construction	Jan. 1995
6)	Completion of 2nd stage construction	Dec. 1996

4-2-2 Project cost

The estimated costs for yard construction are given in Table I-4-1, which represent the amounts evaluated at the price level of June, 1987.

Table I-4-1 INVESTMENT PLAN

(Unit: 1,000 US$)

No.	Description	Total	Domestic currency portion	Foreign currecy portion
1	Civil work	25,823	25,080	743
2	Building work	14,056	13,395	661
	Sub total (1) and (2)	39,879	38,475	1,404
3	Floating dock and transfer equipment	37,320	420	36,900
4	Cranes	4,498	1,442	3,056
5	Utilities equipment and pipe lines	1,365	772	593
6	Electric equipment	2,281	471	1,810
7	Vehicles and vessels	1,653	307	1,346
8	Factory machines	4,649	694	3,955
9	Anti-pollution equipment	421	209	212
10	Office supplies	1,689	336	1,353
	Sub total (3) - (10)	53,876	4,651	49,225
11	Engineering fee	1,500		1,500
12	Initial expenses and working capital	3,592	2,111	1,481
13	Contingency	2,849	2,231	618
	Total (1) - (13)	101,696	47,468	54,228

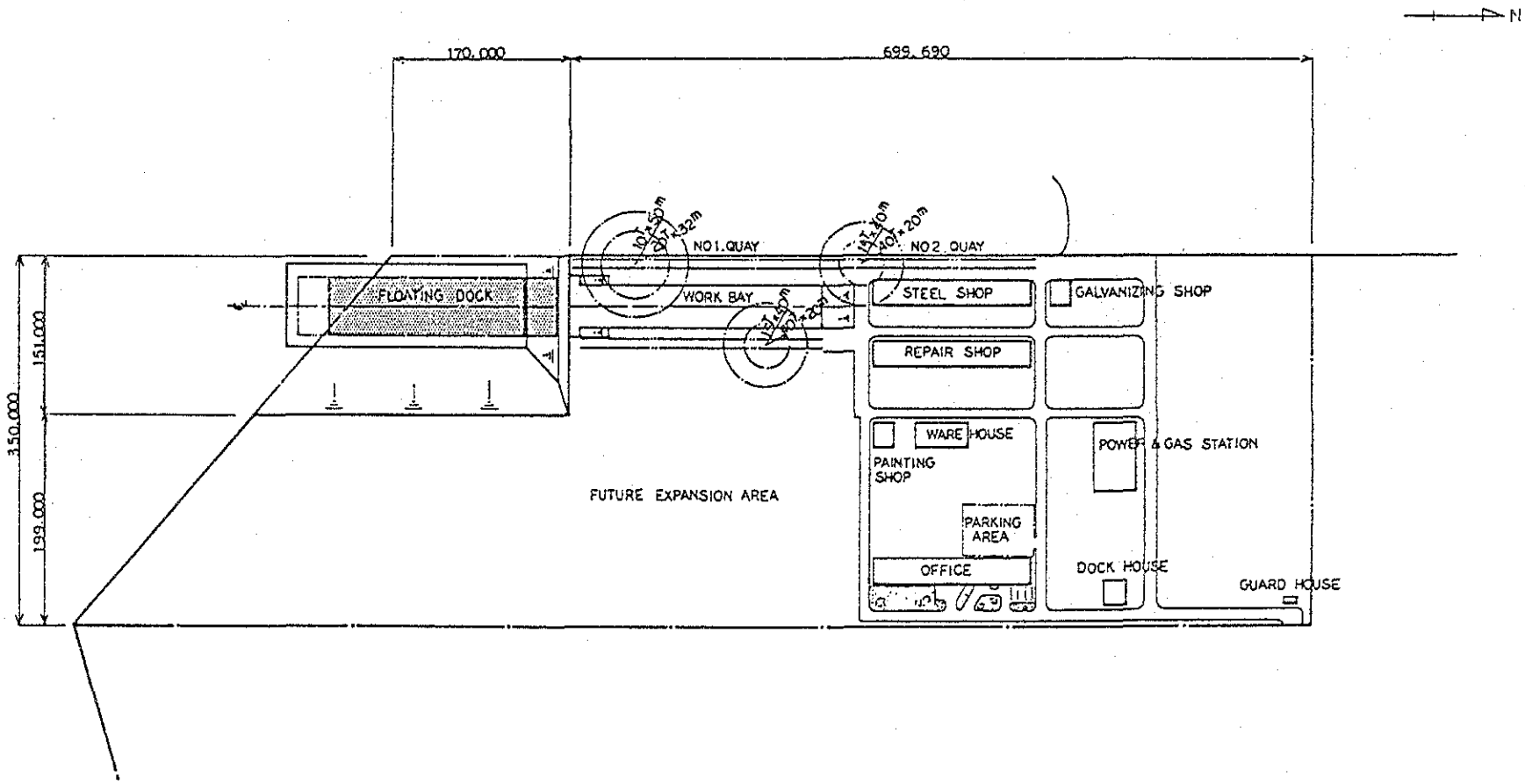


Fig. I-4-1 GENERAL ARRANGEMENT OF REPAIR DOCKYARD

5. Operation Planning

The shiprepair amount envisaged for the project life is presented in Table I-5-1 and I-5-2, which are estimated by referring to the data of Veracruz Shipyard and those of Japanese shipyards.

The dockyard operation will call for about 500 employees at the start of operation in 1992 and about 1,400 personnel in 2015.

Table I-5-1 OPERATION PLAN

Project life	Year	General repair			Afloat repair			Total	
		(x1,000 GT)	Hr/GT	(x1,000 Hr)	(x1,000 GT)	Hr/GT	(x1,000 Hr)	(x1,000 GT)	(x1,000 Hr)
1	1990								
2	1991								
3	1992	383	2.10	804	67	0.263	18	450	822
4	1993	553	1.85	1,023	97	0.231	22	650	1,045
5	1994	723	1.68	1,215	127	0.210	27	850	1,242
6	1995	951	1.57	1,493	168	0.196	33	1,119	1,526
7	1996	989	1.49	1,474	175	0.186	33	1,164	1,507
8	1997	1,028	1.45	1,491	181	0.181	33	1,209	1,524
9	1998	1,066	1.42	1,514	188	0.177	33	1,254	1,547
10	1999	1,105	1.40	1,547	195	0.174	34	1,300	1,581
11	2000	1,144	1.38	1,579	202	0.172	35	1,346	1,614
12	2001	1,183	1.36	1,609	209	0.170	36	1,392	1,645
13	2002	1,222	1.35	1,650	216	0.168	36	1,438	1,686
14	2003	1,261	1.34	1,690	223	0.167	37	1,484	1,727
15	2004	1,301	1.33	1,730	229	0.166	38	1,530	1,768
16	2005	1,340	1.32	1,769	236	0.164	39	1,576	1,808
17	2006	1,398	1.31	1,831	247	0.163	40	1,645	1,871
18	2007	1,457	1.30	1,894	257	0.162	42	1,714	1,936
19	2008	1,516	1.29	1,956	267	0.162	43	1,783	1,999
20	2009	1,574	1.29	2,030	278	0.161	45	1,852	2,075
21	2010	1,633	1.28	2,090	288	0.160	46	1,921	2,136
22	2011	1,692	1.27	2,149	298	0.159	47	1,990	2,196
23	2012	1,750	1.27	2,223	309	0.159	49	2,059	2,272
24	2013	1,809	1.27	2,297	319	0.158	50	2,128	2,347
25	2014	1,868	1.26	2,354	330	0.157	52	2,198	2,406
26	2015	1,928	1.26	2,429	340	0.157	53	2,268	2,482
27	2016	1,928	1.26	2,429	340	0.157	53	2,268	2,482
28	2017	1,928	1.26	2,429	340	0.157	53	2,268	2,482
29	2018	1,928	1.26	2,429	340	0.157	53	2,268	2,482
30	2019	1,928	1.26	2,429	340	0.157	53	2,268	2,482

Note: General repair includes periodical survey, annual survey, marine casualties.

Table I-5-2 SALES AMOUNT

Project life	Year	General repair		Afloat repair		Total	
		(x 1,000 GT)	(x 1,000 US$)	(x 1,000 GT)	(x 1,000 US$)	(x 1,000 GT)	(x 1,000 US$)
1	1990						
2	1991						
3	1992	383	6,817	67	149	450	6,966
4	1993	553	9,843	97	216	650	10,059
5	1994	723	12,869	127	283	850	13,152
6	1995	951	16,928	168	375	1,119	17,303
7	1996	989	17,604	175	390	1,164	17,994
8	1997	1,028	18,298	181	404	1,209	18,702
9	1998	1,066	18,975	188	419	1,254	19,394
10	1999	1,105	19,669	195	435	1,300	20,104
11	2000	1,144	20,363	202	450	1,346	20,813
12	2001	1,183	21,057	209	466	1,392	21,523
13	2002	1,222	21,752	216	482	1,438	22,234
14	2003	1,261	22,446	223	497	1,484	22,943
15	2004	1,301	23,158	229	511	1,530	23,669
16	2005	1,340	23,852	236	526	1,576	24,378
17	2006	1,398	24,884	247	551	1,645	25,435
18	2007	1,457	25,935	257	573	1,714	26,508
19	2008	1,516	26,985	267	595	1,783	27,580
20	2009	1,574	28,017	278	620	1,852	28,637
21	2010	1,633	29,067	288	642	1,921	29,709
22	2011	1,692	30,118	298	665	1,990	30,783
23	2012	1,750	31,150	309	689	2,059	31,839
24	2013	1,809	32,200	319	711	2,128	32,911
25	2014	1,868	33,250	330	736	2,198	33,986
26	2015	1,928	34,318	340	758	2,268	35,076
27	2016	1,928	34,318	340	758	2,268	35,076
28	2017	1,928	34,318	340	758	2,268	35,076
29	2018	1,928	34,318	340	758	2,268	35,076
30	2019	1,928	34,318	340	758	2,268	35,076

Note: General repair includes periodical survey, annual survey, marine casualties.

6. Financial Analyses

6-1 Premises Adopted in Conducting Financial Analyses

The assumptions and premises adopted in the study are the following:

1) All prices expressed in currency values prevailing as of June, 1987. Inflation is not taken into account.
2) Exchange rates adopted for conversion between currencies are :-
   - Between Mexican peso and U.S. dollar :
     Peso 1,317 = US$ 1.00
   - Between U.S. dollar and Japanese Yen :
     US$ 1.00 = ¥ 150
3) Project life is to be 30 years.

6-2 Financial Analyses

Projected income statement, balance sheet and cash flow statement were derived from the plans for construction, for dockyard operation, for staffing and for sales, based on which the financial soundness and profitability have been analyzed. The financial soundness of the project at the start of operation in 1992 is not very promising in the light of five indexes of financial ratio, such as current ratio, fixed asset to net worth ratio, debt service coverage ratio, turnover of total operating assets and ratio of break-even point to net sales, because of a limited amount of sales, deficit in revenue and borrowing of the short term loan to make up for the deficit.

However, the soundness will be improved gradually in accordance with improvement of productivity and increase in sales. In 2002 (after 10 years of operation), the indices of soundness are found excellent.

The financial internal rate of return (FIRR) indicating the profitability of the project is 9.9%. Sensitivity analysis, shows that in case of 10 percent

negative deviation of projected sales and in case of 10 percent positive deviation of projected investment, 8 percent and 9 percent of FIRR can be kept respectively.

The foregoing results of financial calculation proves the envisaged Project to be worth implementing in view of deposit rate of 3 to 4 percent prevailing in Mexico.

7. Economic Analyses

7-1 Premises Adopted in Conducting Economic Analyses

1) Exclusion of transfer items

Taxes and duties are excluded from expenses as they are merely transfer items from the viewpoint of national economy.

2) Application of shadow wage rate

It has been assumed that shadow wage rate is 70% of minimum wage and it is applied to the economic cost of unskilled worker.

3) Application of shadow exchange rate

Taking foreign exchange policy in Mexico and inflation rate in Mexico and the U.S.A. into account, the shadow exchange rate is assumed to be Peso 1,389 = US$ 1.00.

7-2 Economic Internal Rate of Return (EIRR)

EIRR of this project is 11%.

The result of the sensitivity analysis shows that, even in case of 10% decrease in the projected sales amount and 10% increase in the projected investing amount, 9% and 10% of EIRR can be kept respectively.

Considering that cut-off rates used in the development banks are generally around 10% and that under-mentioned consequential economic benefits are expected from project implementation, the projected dockyard will efficiently make use of the country's resources and is economially viable.

7-3 Consequential Economic Benefits Expected from Project Implementation

Consequential economic benefits expected to accrue from the construction and operation of projected repair dockyard are :

- o Increase of employment opportunities
- o Increase of foreign currency inflow
- o Enhancement of managerial and technological capabilities
- o Linkage effects on associated industries.

This project will offer the 1,300 jobs in 1991 -- at the peak of dockyard construction and 1,400 jobs in 2015 --at the initial stable operation.

The modified Bruno ratio of this project has proved to be 0.89, indicating the positive nature in respect of its contribution to increasing foreign currency inflow.

The techniques and know-how transferred to this shiprepair dockyard will diffuse to adjacent industries in the Lazaro Cardenas district and associated industries, thus contributing to enhancement of managerial and technological capability in industries related to machinery and metalworking.

Furthermore, consequential linkage effects on associated industries are to be expected from the input goods supplied to this shiprepair dockyard.

II. BACKGROUND OF THE PROJECT

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1. Circumstances of the Feasibility Study

1-1 Background of Study

The Mexican economy maintained a high level of growth with industrialization as the axis of economic development during the period from the end of the Second World War until the latter part of 1970s, although the course was not without some difficulties. As a result, the proportion of industrial sector to national economy has become the third largest in the Latin American countries after Argentina and Brazil. Mexico also has become a newly industrialized country having a scale of economy following that of Brazil. Moreover, Mexico has rich natural resources such as petroleum the confirmed reserves of which are ranked in the fourth place in the world and can be considered as one of the cuntries with a large potential economic power and a large potentiality of growth in the Pacific region.

However, after the latter part of 1970s, various problems originating from the rapid growth in the past were actualized, putting the country in a very difficult situation with a large amount of debts in the midst of economic stagnation due to the inverted oil shock.

Such problems included =

* dependence of industries on domestic market without international competitive power
* concentration of industries in specific regions
* many industrial sectors remain under-developed and exports had been made in a low level of processing since the production aimed at substituting the import of consumer goods.

* excessive concentration of economic activities in large enterprises, imbalance of development between cities and rural areas, underemployment, etc.

Under such economic situation, the Mexican government first announced in March, 1979, a national development program (1979 - 1988) aiming at solving the problems. Later, the government worked out a new national development program (1983 - 1988) to cope with the economic crisis which worsened from the year 1983 and further announced a program of economic promotion by industrial sector. Since 1983, the Mexican economy has been finding its way, though slowly, to the solution of various problems through the implementation of the said programs.

The construction of the coastal industrial complex of Lazaro Cardenas where the present project is planned is large-scale regional development project to be continued until around the year 2000 aiming at promoting regional developments and an increase of employment opportunities, etc. through decentralization of industries. The first phase of the works was started in 1970s and the project was handed down to the national development program for the period of 1979 - 1982 and to the national development program for the period 1983 - 1988. Some Japanese companies are already operating there in the form of joint ventures. At the time of completion of all the project, this area is expected to be transformed into a gigantic coastal industrial zone including heavy and chemical industries (steel, fertilizer, shipbuilding) and light industries. Moreover, the port of Lazaro Cardenas is positioned as the largest strategical port on the Pacific coast to play the role of a commercial port as the gate on the Pacific ocean of the Metropolitan area of Mexico City.

In spite of the long coastline of the country, the shipping industry of Mexico is not very active (the share of the ships of Mexican flag in the transportation of

seaborne goods was 3.0% for overseas service and 53% for coastal service in 1981). The vessels are old and most of them are small in size. The Mexican ports are inadequately equipped on the whole at the present moment. However, the Mexican government established the Marine Transportation Promotion Act in 1981, and started operations such as expansion of its commercial fleet, reservation of seaborne goods for national ships, etc.

On the other hand, the shipbuilding industry of Mexico was originally engaged mostly in the building and the repair of small fishing boats, coastal ships and work ships and therefore was not capable of building real ocean-going ships. However, the Mexican government started to develop the nation's shipbuilding industry at the end of 1970s to cope with an growing demand for tankers due to the prosperity of oil industry, the shortage of ships resulting from the development of other industries and the increase in foreign trade as well the necessity of building of fishing boats for the promotion of fishing industry.

In 1981, the government decided a program for the promotion of the shipbuilding industry and adopted the policies such as:

* integration of existing shipyards,
* introduction of various subsidizing measures based on the promotion program of shipbuilding industry,
* construction of shipyards under investment and technical cooperation from abroad, etc.

These basic policies were succeeded by the Administration of President M. De La Madrid who came into power at the end of 1982 but generally much progress was made in the operations because of the dislocation caused by a crisis of the national economy and a shortage of funds.

There are currently 106 shipyards in Mexico, of which only the following 8 dockyards operating under the management of United Shipyard Co. (AUSA), the Ministry of Navy and the Mexican Petroleum (PEMEX) are the major shipbuilding facilities in this country.

	Major Shipyards in Mexico
1.	Veracruz Shipyard (AUSA)
2.	Guaymas Shipyard (AUSA)
3.	Mazatlan Shipyard (AUSA)
4.	Ensenada Shipyard (AUSA)
5.	Tampico Naval Dockyard
6.	Salina Cruz Naval Dockyard
7.	Acapulco Naval Dockyard
8.	Ciudad Madero Shiprepair Yard (PEMEX)

In Mexico, there are only 2 repair dockyards (Ensenada, Salina Cruz) for medium-sized ships on the Pacific coast and 2 repair dockyards (Ciudad Madero, Veracruz) for large vessels on the coast of the Mexican Bay, but there is no repair dockyard for large vessels on the long coastline extending as long as 3,500 km on the Pacific coast. Therefore, it is believed that only a small portion of the repairs of ocean-going vessels are performed by the dockyards in Mexico and the major part of such repairs are done by the dockyards of neighbouring countries of Latin America such as Panama, Curacao, etc. as well as by those of Mexico's main trade partners such as European countries, Japan, etc.

Under such circumstances, the construction plan of the repair dockyard in the port of Lazaro Cardenas is deemed as one of the measures for the development of ship repairing industry of Mexico and also for the promotion of development of the Lazaro Cardenas region.

1-2 Purpose of Study

The purpose of the present study is to make, in relation to the construction of a repair dockyard in Lazaro Cardenas, studies on the background and environmental conditions, demand forecast, natural conditions (geography, topography, soil, ocean, meteorology, earthquake, etc.), and infrastructure condition, and examine the feasibility of construction of a reapir dockyard through technical analysis, financial and economic analyses. It further aims at making suggestions on the various important aspects of the construction and the management of the repair dockyard.

1-3 Particulars of Study

In 1985, the government of the United Mexican States requested the Japanese government to carry out a study for the construction plan of a repair dockyard in the port of Lazaro Cardenas. The Japanese government, in compliance, decided to make a study and despatched in October, 1986, a preliminary study team led by Mr. Nobutaka Nambu to Mexico and reached an agreement on the scope of work (S/W) for the present study with the Mexican counterpart, namely Mr. Julio R. Moctezuma Cid, Director General of Banco Mexicano SOMEX.

Based on this agreement, feasibility study teams were despatched to Mexico twice in April and June-July, 1987 to make field survey.

In addition, an advisory committee and a study team were dispatched to Mexico in September, 1987, and in January, 1988, and had discussions with the Mexican counterpart on the progress report (II) and the draft final report, respectively.

1-4 Scope of Study

To achieve the above-mentioned purpose, studies were made on the following:

1-4-1 Collection and analyses of data

Data concerning the following items have been collected and analyzed:

(1) Data of studies already made by the people concerned of the Mexican side (Astilleros Unidos S.A., Comision Nacional Coordinadora de la Industria Naval, etc.) concerning the construction of a repair dockyard in Lazaro Cardenas.

(2) State of demands at existing repair dockyards.

(3) Socio-economic conditions surrounding the present project.

1-4-2 Demand forecast

A demand forecast was carried out for future repairs of ships (ships of Mexican flag and those of foreign flags) in Lazaro Cardenas after studying the current situation of the repair market of ships in Mexico.

1-4-3 Study of social environments

(1) Situation of infrastructure and environments surrounding the dockyard site.

(2) Availability of input materials required for construction and operation of the dockyard.

1-4-4 Technical analyses

(1) Study of natural conditions

(2) Designing of a dockyard having the optimal scale and layout.

(3) Constructon and operating plan of the dockyard.

1-4-5 Financial & economic analyses

(1) Estimation of investment amount required for the establishment of the dockyard and estimation of sales amount and operating cost.

(2) Analysis of financial soundness and profitability of the present Project.

(3) Analysis of the effect of the present Project on the Mexican economy.

1-4-6 Suggestions for implementation of the Project

The matters which should be paid special attention for the implementation of the envisaged project were discussed and recommendations were proposed based on this discussion.

1-5 Field Survey and Field Work

The field survey and the field work were conducted in two steps and in three steps respectively. The second field survey and the first field work were carried out simultaneously in June-July, 1987.

The first field survey was made during the period from 30th March to 26th April, 1987, and covered the explanation of the Inception Report to the parties concerned the general arrangement of the study, collection of existing study data and other related data as well as surveys relating to the demand forecast.

The second field survey and first field work were conducted during the period from 8th June to 22nd July, 1987, covering the following subjects:

* Supplementary survey for demand estimation
* Type and facilities of repair dock
* Infrastructure
* Matters relating to construction of repair dockyard
* Matters relating to management of repair dockyard
* Matters relating to civil engineering design
* Matters relating to financial and economic analyses

Moreover, in the second field survey, Study Team prepared the Progress Report (I) as the first field work covering both the first field survey and the second field survey and discussed with the people concerned of the Mexican side.

The second field work was conducted during the period from 14th Spetember to 24th September, 1987. On that occasion, the Progress Report (II) covering demand forecast, system of dockyards and preliminary financial and economic analyses based on the results of the first and the second field surveys, was presented, discussed and mutually agreed.

The third field work was conducted during the period from 11 January to 21st January, 1988. The draft final report was presented, discussed and mutually agreed.

1-6 Project Members

The members of the present Project consisting of the Japanese and the Mexican parties concerned are as follows:

1-6-1 Japanese members

(1) JICA advisory committee members

Name / Assignment	Post
Nobutaka Nambu	
Chairman	Director International Affairs Office Shipbuilding Division Maritime Technology and Safety Bureau Ministry of Transport
Shigeo Ogura	
Demand Forecast	Special Assistant to the Director International Shipping Division International Transport and Tourism Bureau Ministry of Transport
Hidenori Imade	
Facility Planning	Chief Inspection and Measurement Division Maritime Technology and Safety Bureau Ministry of Transport
Tasuku Hirabara	
Facility Planning	Chief Safety Standards Division Maritime Technology and Safety Bureau Ministry of Transport
Fumio Kikuchi	
Coordination	Social Development Cooperation Department Japan International Cooperation Agency

(2) JICA study team

Name / Assignment	Post
Shigeshi Umesato Team Leader	Staff Overseas Shipbuilding Cooperation Center
Shigeru Oshima Subleader Operation Planning	Staff Overseas Shipbuilding Cooperation Center
Seizi Nagatsuka Demand Forecast	Research Director Maritime Research Institute
Masaaki Kasama Dockyard Construction	Staff Overseas Shipbuilding Cooperation Center
Isao Kobayashi Workshop's Facility Design (I)	Staff Overseas Shipbuilding Cooperation Center
Hiroshi Akiyoshi Workshop's, Facility Design (II)	Staff Overseas Shipbuilding Cooperation Center

Katsushi Miyamoto
Economic & Financial Analyses
Staff
Ishikawajima-Harima Heavy Industries Co., Ltd.

Hisashi Kagawa
Survey for Soil & Civil Work (I)
Staff
Ishikawajima-Harima Heavy Industries Co., Ltd.

Seiichi Sakurai
Survey for Soil & Civil Work (II)
Staff
Ishikawajima-Harima Heavy Industries Co., Ltd.

1-6-2 Mexican members

Julio Rodolfo Moctezuma Cid.,
Director General, BANCO MEXICANO SOMEX, S.N.C.

Eduardo Pontones Chico,
Asesor Director General, BANCO MEXICANO SOMEX, S.N.C.

Juan Jose Domene Berlanga,
Director, BANCO MEXICANO SOMEX, S.N.C.

Jose Luis Terrones Lopez,
director Ejecutivo de Operacion Industrial, BANCO MEXICANO SOMEX, S.N.C.

Roberto Rojas Flores,
Director de la Division de Proyectos, BANCO MEXICANO SOMEX, S.N.C.

Rolando Velazquez Gonzalez,
Director Ejecutivo de Proyectos Industrial de Servicios, BANCO MEXICANO SOMEX, S.N.C.

Jesus Andrade Pulido,
Director de Proyectos Industrial de Servicios, BANCO MEXICANO SOMEX, S.N.C.

2. Mexican Economic Situation

2-1 General Economic Situation

Blessed with rich oil reserves, Mexico accomplished high economic growth at an average annual rate of about 6.7% during the period from the second half of the 1970s to 1981, supported by the oil industry which kept increasing oil production year after year.

However, in 1982, the Mexican economy was driven into a situation whereby the then government was compelled to enforce the peso currency devaluation several times and then to implement the overall exchange control regulations, because of the depressed world economy since 1981 and the increased foreign debts due to the globally maintained high level of interest rates. And, this caused the arrears of foreign debts amounting to some $80 billion and even the fears of this playing the trigger role in inviting a world monetary crisis.

As a result, the GDP growth rate over the preceding year turned out negative for the first time to mark -5.3% in 1983, eloquently endorsing the emergence of a severe economic situation.

For this reason, the new De La Madrid administration which started in 1982, positively pushed forward measures aimed at improving fiscal deficits, such as contraction of public works, drastic cut in subsidies, hikes in public utilities charges and the like. Furthermore, in accordance with the IMF recommendations, the government directed efforts toward improving the balance of trade by means of drastic restraint of fiscal expenditures, and implementation of stringent import controls. As a result, it managed to overcome the critical situation in 1984, as reflected by the positive GDP growth rate of +3.5%.

Subsequently, the ratio of the revenues generated from petroleum exports fell by about 60% in 1986 due to the

fall in oil prices, necessitating the government to enforce retrenchment policy in both fiscal and financial sides. As a result, in 1983, the GDP growth rate dropped to -3.7% in 1986 due to the declined consumption and investment.

The movements of the Mexican economy as mentioned above are shown below in terms of the GDP growth rate:

Table II-2-1 GROWTH RATE OF GROSS DOMESTIC PRODUCT

Year	GDP (1980 values)	Growth rate compared with the previous year (%)
1970	2,257	
1975	3,099	
1980	4,277	8.3
1981	4,616	7.9
1982	4,591	0.5
1983	4,349	5.3
1984	4,500	3.7
1985	4,625	2.8
1986 (Forecast)	4,455	3.7

(Sources: IMF Statistics)

Average GDP growth rate by period is as follows:

1970 - 1981	6.7%
1982 - 1986	0.75%
1980 - 1985	1.6%

Progress of percentage shares contributed to GDP by difference sectors in recent years are shown in Table II-2-2 and Table II-2-3.

It is revealed that the share of manufacturing sector in the overall GDP has been around 25% which is at a level with the commerce sector.

It is also indicated that top 3 sectors (manufacturing wholesale and retail trade, and banking and financing) have contributed 60% of total GDP.

Employment structure by different sectors of economic activity is given in Table II-2-4. As is seen in this Table, the percentage of labor force engaged in the primary sector had fallen from 37.5% of 1970 to 32.0% of 1980, but absorption of a large number of labor force had depend on Agro-forestry & fishing sector.

Under such economic situations as above mentioned the emphasis of economic policy are placed on the structural changes of national economy such as steady economic growth to create more opportunity of employment, sound public finance, slow-down of the inflation, and reorganization and modernization of Government industrial sector.

Future development of Mexican economy will be great influenced by crude oil prices, nevetheless, it is foreseen that Mexican economy will take a favourable turn from the long-run point of view through the improvement of trade balance and reduction of accumulated foreign debts brought about by diversification of export industry heavily depending on oil at present.

2-2 Mining and Manufacturing Industry

Mexico is one of the leading mineral producing countries in Latin America and is blessed with various kinds of mineral resources, such as gold, silver, coal, iron ore, sulphur and so on. However, the government considers, in principle, these resources as being the raw materials to be used for domestic industries. As a consequence, the growth rates of both production and exports are low.

Table II-2-2 GROWTH RATE OF GDP BY ECONOMIC SECTORS IN REAL TERMS

(Unit: %)

Sector \ Year	1980	1981	1982	1983	1984	1985	1986(P)
Agriculture, forestry & fishing	7.1	6.1	-0.6	2.9	2.5	3.8	-2.1
Mining (including oil)	22.3	15.3	9.2	-2.17	1.8	-0.7	-5.8
Electricity, gas, water supply	6.5	8.4	6.6	0.7	7.4	8.3	4.7
Transportation and communication	14.1	10.7	-3.8	-4.8	6.4	2.3	-2.1
Banking and financing	4.6	4.8	2.9	2.1	2.9	2.5	1.1
Construction	12.3	11.8	-5.0	-18.0	3.4	3.0	-5.1
Manufacturing	7.2	7.0	-2.9	-7.3	4.8	5.8	-5.6
Wholesale and retail trade	8.1	8.5	-1.0	-10.0	2.9	1.7	-5.5
Others	7.5	7.7	4.4	-0.3	3.3	-0.8	-1.0
Gross domestic product	8.3	7.9	-0.5	-5.3	3.7	2.8	-3.7

(Source: Mexico - JETRO Mexico)

Table II-2-3 PERCENTAGE SHARES OF GDP BY ECONOMIC SECTORS IN REAL TERMS

(Unit: %)

Sector \ Year	1980	1981	1982	1983	1984	1985	1986(P)
Agriculture, forestry & fishing	9.0	8.8	8.8	9.6	9.5	9.6	9.7
Mining (including oil)	3.2	3.5	3.8	3.9	3.8	3.7	3.6
Electricity, gas, water supply	1.5	1.5	1.6	1.7	1.8	1.9	2.0
Transportation and communication	7.5	7.6	7.4	7.4	7.6	7.6	7.7
Banking and financing	9.8	9.5	9.8	10.6	10.5	10.5	10.9
Construction	5.5	5.7	5.5	4.7	4.7	4.7	4.4
Manufacturing	24.9	24.7	24.1	23.6	23.9	24.5	24.0
Wholesale and retail trade	25.7	25.8	25.5	24.2	24.0	23.8	23.3
Others	12.9	12.9	13.5	14.3	14.2	13.7	14.4
Gross domestic product	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(Source: Mexico - JETRO Mexico)

Table II-2-4 DISTRIBUTION OF LABOR FORCE IN DIFFERENT SECTORS OF ECONOMIC ACTIVITY

(Unit: Thousand)

	1970		1980	
	Number	Share(%)	Number	Share(%)
Total	13,343	100.0	19,951	100.0
Primary industry	5,004	37.5	6,384	32.0
Secondary industry	3,083	23.1	5,187	26.0
Mining	97	0.7	150	0.8
Energy	143	1.1	349	1.7
Construction	592	4.4	997	5.0
Manufacturing	2,251	16.9	3,691	18.5
Tertiary industry	5,256	39.4	8,380	42.0
Transportation communication	371	2.8	698	3.5
Whole sale/retail trade	1,212	9.1	1,995	10.0
Government	431	3.2	998	5.0
Other services	2,287		3,791	19.0
Others	955		894	4.5

(Source: Basic data of Mexico - JETRO Mexico)

2-2-1 Petroleum

Mexico is the largest oil producing country in Latin America, and according to the BP statistics, the oil reserves as of now in 1987 is about 7.6 billion tons, thus making Mexico one of the prominent oil producing countries. In this respect, the PEMEX has been in charge of exploration, production, refining, sales, and exports of petroleum and natural gas since 1938 when the nationalization policy of the oil industry was adopted.

According to the BP statistics, the oil production in Mexico increased from 39.3 million tons in 1975 to 150.4 million tons in 1984. In 1986, however, the volume of oil output slowed down, because the nation sided with OPEC's production control policy geared to pushing up oil prices.

However, if oil prices go up hereafter, then its output will increase, resulting in an increase in exports to Japan and the Far East Asia as well as U.S.A..

Table II-2-5 MEXICAN PETROLEUM OUTPUT

(Unit: million tons)

Year	Output
1975	39.3
1980	107.3
1981	128.3
1982	149.4
1983	146.6
1984	150.4
1985	149.7
1986	135.4

Source: BP statistics

2-2-2 Other industries

Among countries in Latin America, Mexico ranks second only after Brazil in the manufacturing of iron and steel. In Mexico, there are presently about 30 steel manufacturing companies in operation, of which five are integrated steel manufacturers with their share accounting for about 85% of the total Mexican steel output.

The demand for iron and steel is expected to increase in the future, leading to an increase in its production in Mexico, but imports of iron ore and coal cannot be much expected for the present with some exceptions, because most of them can be domestically produced.

Besides, particularly worthy of note is the marked development in the mid-1980s of the Maquiladora located near the U.S. - Mexico national border, where various kinds of foreign capitalized assembly plants associated with such industries as automobiles, electric and electronics have been constructed and in operation. Thus, this area is becoming one of the leading export industries in Mexico.

2-3 Current Situation of Trade

Mexican exports, which registered only $1.28 billion in 1970, have grown to the $20 billion in 1982 with the increasing volume of oil exports. Since then to date, a level of about $22 billion worth of exports has been maintained on an average annual basis. Much of such an increase in exports is due to increased exports of petroleum related products such as crude oil and natural gas. Specifically, the share of crude oil exports in terms of value against the total exprots increased from 16.4% of 1976 to 74.3% in 1982, with the effect of all the more increasing its dependence on oil exports. However, the tumbling oil prices since 1984 caused oil exports to decline, thereby bringing down the export share in the total exports.

As a result, in 1986, the total export value declined to $15.8 billion, or a decrease of 28% from the previous year, while, at the same time, the total oil export value likewise decreased to $6.3 billion, accounting for about 40% share of the total export value. (Refer Table II-2-6)

The characteristics of Mexico's exports are the changes in its export structure, as typified by the fact that exports of agricultural products - such as cotton, coffee, sugar and corn - which used to be its traditional export products until around 1970 had declined because of the stagnation of agricultural production, and the population increase. While oil is a typical export product resulting from such changes, the local developments of processing and assembling industries in the Maquiladora as already mentioned will have significant effects on Mexico's future exports.

Table II-2-6 OIL IN MEXICAN EXPORTS

(Unit: $ million)

Year	Total Exports (FOB)	Oil Exports	%
1979	8,818	3,975	(45)
1980	15,132	10,441	(69)
1981	19,420	14,573	(75)
1982	21,230	16,477	(78)
1983	22,317	16,017	(72)
1984	24,054	16,601	(69)
1985	21,500	14,800	(68)
1986	15,800	6,300	(40)

(Source: Indicadores Economicos, Banco de Mexico)

While oil related exports will continue to account for the major portion of Mexico's exports, it is expected that exports of semi-manufactured products related to such industries as automobiles, electric and electronics in the Maquiladora will increase in the future and that exports of agricultural, stock farming, and marine products will

stay at the same level as at present. Table II-2-6 shows export value of oil in recent years.

As for imports, on the other hand, heavy and chemical industrial products such as machinery and tools, chemical goods are the main constituents of imports due to Mexico's peculiar industrial structure, while grain imports including the recent increase in corn imports from Argentina, are estimated to increase in the future following the population increase.

Imports of mineral and industrial products were on the decline mainly because of the government's restrictions on financial expenditure. Meanwhile, imports of spare parts, composites and other half-processed indiustrial products will be expected to increase with the development, notably in 1985 and 1986, of processing and assembling industries in the Maquiladora.

3. Industrial Development Programs of Mexico

The National Program of Industrial Development and Foreign Trade 1984 - 1988 (Programa Nacional de Fomento Industrial y Comercio Exterior 1984 - 1988) prepared by SECOFIN (Secretaria de Comercio y Fomento Industrial) sets the structural problems of Mexican economy and the target of development program to solve such problems as indicated in Table II-3-1 and Table II-3-2.

Currently, a fairly large part of the ships of Mexican flag are repaired abroad such as in Europe because of a shortage of competitive power of the Mexican repair dockyards, thus spendig the precious foreign exchange of the country. However, if the present Project starts a full-scale operation, it will contribute not only to prevent an effluence of foreign exchange but also to gain foreign exchange and to the solution of the basic problem pointed out by the industrial development program (lack of balance between industrial development and foreign trade).

Moreover, the said industrial development program points out the regional concentration of industries as one of the structural problems of the Mexican economy and, at the same time, sets decentralization of industrial activities as the target of the development program and specifies several areas and 4 industrial ports (Altamira, Salina Cruz, Coatza-coalcos, Lazaro Cardenas) as the points of development for the decentralization. Lazaro Cardenas where the present Project is planned is given particularly high priority as industrial port together with Altamira.

From this point of view, the present Project well meets the intention of the said industrial development program and, therefore, is believed to greatly contribute to the regional development and development of Lazaro Cardenas as an important industrial port.

In addition, as the industrial development program also pointed out, the Mexican economy is facing the challenge of a new labour force of 900 thousand per year and therefore it is an urgent necessity to create new employment opportunities. The industrial development program aims at realizing an equalization of distribution of incomes through "continuous creation of employment opportunities". Since the ship repairing industry is a typical labour-intensive industry, it can absorb more labour in comparison with capital-intensive industries such as oil refining industry, etc. Therefore, the present Project is considered to be in line with the program of industrial development from viewpoint of "creation of employments".

Lastly, regarding the aspect of technological development, the industrial development program maintains the strategy of developing its own technology. It is believed that not only the repairing technology but also that of management control will be rooted in Mexico through the technical assistance from advanced countries in the repair business of ships in the initial stage of the present Project.

The present Project is closely related to the existing industries of Lazaro Cardenas and has a large labour absorbing capacity and therefore is believed to greatly contribute to the realization of the target of the regional development program of the area, though the relation between the present Program and the regional development program of Lazaro Cardenas is not explained here since the subject is treated in II-6 hereafter.

Table II-3-1 STRUCTURAL PROBLEMS OF MEXICAN ECONOMY

1.	Fundamental problem
	1) Lack of balance between industrial development and foreign trade
2.	Specific problems
	1) Technological dependence
	2) Ineffective industrial organization
	3) Regional concentration of industry
	4) Insufficient coordination among different economic entities
	5) Insufficient creation of employment and insufficient satisfaction of people's basic needs

(Source: Program for Industrial Development and Foreign Trade - SECOFIN)

Table II-3-2 TARGETS FOR STRUCTURAL RENOVATION OF MEXICAN ECONOMY

Objectives (1)

1) Effective and competitive industrialization, for the achievement of an autonomous growth.

2) National development through independence of industrial technology and full exploitation of industrial plants.

Objectives (2)

1) Industrial development under the leadership of the central government.

2) Decentralization of industrial activities and utilization of human and natural resources.

Objectives (3)

1) Equalization of distribution of income through the following means:

- Continuous creation of employment opportunities

- High production of basic goods

(Source: National Program of Industrial Development and Foreign Trade 1984 - 1988 - SECOFIN)

4. Mexican Ports and Shipping

4-1 General Economic Situation

4-1-1 Ports

Facing both the Pacific and the Atlantic, Mexico has costal lines totaling as long as about 9,900 km. For this reason, the seaborne transport is very important to Mexico, while the role for the shipping to play in Mexico's trade has increased year after year to mark 95% in 1985 from 59% of 1970.

Notwithstanding such a long coastal line, however, Mexico has not been favored with large-scale ports and harbors, because its geographical features prevented industrial districts or large commercial towns and/or cities from being developed in locations adjacent to its seaside areas.

Among major ports and harbors situated on the Pacific coast side are Ensenada, Guaymas, Mazatlan, Manzanillo, Lazaro Cardenas, Acapulco, Salina Cruz, etc.

These ports, each having its own development history and the intended purpose which are unique and different from others, are being developed in accordance with the nation's Port and Harbor Development Plan.

In particular, the National Committee for Adjustment Ports and Harbors has accelerated the improvement of ports and harbors, placing emphasis on the development of large-scale ports such as Lazaro Cardenas and Salina Cruz, thereby giving birth to ports equipped with modernized capacities and facilities on the Pacific coast.

However, since, unlike Lazaro Cardenas, most ports in Mexico don't have large industrial or urban districts behind them, they are simply functioning as an intermediate window of large towns and cities situated in inland areas far apart.

4-1-2 Volume of cargoes handled at ports

The total volume of cargoes handled at these major ports, which registered only 36.13 million tons in 1970, increased to 124.58 million tons in 1980, or roughly 3.4 times, while the volume handled for foreign trade increased from 13.08 million tons of 1970 to 66.06 million tons in 1980, or about 5.1 times.

And, as of 1985, the total volume of cargoes handled at ports in Mexico reached about 152.23 million tons. Of these cargoes handled at ports, the volume of those handled on the Pacific coast, which stood at about 20.18 million tons in 1976, or 30% of about 67.44 million tons in 1976, increased to about 45.48 million tons in 1985, or about 2.25 times. The average annual growth rate between 1979 and 1985 posted about 9.4%, but it fell drastically in 1986 partly due to decreased oil exports.

Of these cargoes handled at ports on the Pacific coast, the component ratio between ocean going cargoes and coastal cargoes stood at about 39% or about 17.81 million tons and about 61%, or 27.66 million tons respectively in 1985.

Furthermore, of these ocean going cargoes, the ratio of those handled by foreign vessels represents about 93% with the remaining 7% accounting for the cargo-handling ratio of domestic ships, indicating the very low loading ratio of national flag vessels.

Besides, of the coastal cargoes, the loading ratio of foreign vessels is 38% as opposed to that of domestic vessels being 62%. In this instance, too, the loading ratio of foreign vessels is unexpectedly high.

Of the volume of cargoes handled at ports, the majority of the cargoes being handled at Salina Cruz represent oil related cargoes, while those handled at Cedros Island pertain to rock salt, indicating some distinct characteristics of cargo which vary according to

ports. In particular, Salina Cruz, one of the two largest industrial districts on the Pacific side, is not only the terminal of the pipelines transporting crude oil and petroleum products from the Mexican Gulf side, but also the location of large-scale oil refinery plants. Thus, it is a very important port playing a role as the domestic base supplying crude oil and petroleum products to various points on the Pacific coast side of Mexico. Besides, it is not only the starting point of the landbridge connecting with Coatzacoalcos situated on the Mexican Gulf side, but also a base for container transports.

Lazaro Cardenas, which will become a base of the new ship repair dockyard, is, just like Salina Cruz, an important industrial port being developed pusuant to the National Development Plan based on the Government's industrialization policy. Lazaro Cardenas has at its back a large iron ore mine with a production capacity accounting for about 20% of the total output in Mexico. In this snese, it is a port favored with the most advanced infrastructure for the heavy and chemical industry, such as the iron and steel industry, oil refinery plants and the like. Whereas the volume of cargoes handled at Lazaro Cardenas increased only slightly from about 1.01 million tons of 1979 to 1.39 million tons in 1985, it is expected to develop hereafter as a commercial port, playing the role of the Pacific side's entrance door of Mexico City, following the development of Mexico's industrialization.

Next, the number of vessels traded in and out of these ports on the Pacific coast side in 1985 registered about 5,630 ships as against about 6,000 ships of 1980, namely, decreased rather than increased. This appears to be due primarily to the global trends toward larger ship size.

In terms of the total covering both sides of Mexico, the number of ships traded in and out of ports increased along with an increase in the volume of cargoes handled. (See Table II-4-1)

Table II-4-1 VOLUME OF CARGO HANDLED AT PORTS IN MEXICO AND NUMBER OF VESSELS TRADED IN AND OUT OF PORTS

Year	Mexico Total		Pacific Coast	
	Million tons	No. of ships traded in and out	Million tons	No. of ships traded in and out
1979	96.04	12,600	30.27	5,335
1980	124.58	13,782	36.92	6,013
1981	131.04	14,420	36.39	5,939
1982	150.44	15,499	36.74	6,030
1983	147.91	14,826	41.15	5,670
1984	153.08	16,949	43.32	5,811
1985	152.23	20,089	45.48	5,627

At any rate, since vessels to be targeted for repairing at the new ship repair dockyard are mainly those of both domestic and foreign flag which are trading in and out of ports on the Pacific side, they will be significantly affected by the volume of cargoes handled at these ports, as well as the number of vessels trading in and out of these ports.

4-2 Mexican Shipping

4-2-1 Fleet tonnage

According to Lloyd's statistics, the fleet of Mexican flag vessels of 100 GT and above, which stood at only 274 ships totaling 575,000 GT in 1975, increased to 642 ships with 1.52 million GT in 1986, or a 2.6-fold increase in terms of tonnage over the past 11 years. Of this increase, the most conspicuous ship type in terms of the number of ships is the fishing vessel sector which increased from 139 of 1975 to 405 in 1986. The growth of tankers has been not so significant, namely from 26 with 306,000 GT of 1975 to 34 ships with 555,000 GT in 1986, while that of liquefied gas carriers has been remarkable - from 2 with 11,000 GT to 8 ships with 182,000 GT.

On the other hand, the bulk carrier sector has grown from 54 with 153,000 GT in 1975 to 71 ships with 516,000 GT in 1986. Although the Government is generally trying to increase the loading ratio of national fleet, the tonnage of vessels owned by domestic owners has not grown to the level targeted because of the problems associated with funding, competitive edge, etc.

Consequently, although of the Mexican flag vessels which were available in 1978, about 19% were aged above 20 years, the percentage share of ships aged above 20 years as of 1986 declined to about 9% due to some tonnage increase resulting from replacement. Generally speaking, however, the average age of Mexican flag vessels is high.

In terms of ship size, a particularly notable trend toward larger vessels has been observed in the tanker and bulk carrier sectors over the past ten years, shown in Table II-4-2.

Table II-4-2 AVERAGE SIZE OF MEXICAN FLAG VESSELS BY SHIP TYPE

(Unit: 1,000 GT)

Year	Oil tanker	Liq. gas carrier	Bulk carrier	General cargo ships
1975	11.77	5.5	16	2.33
1980	13.13	21.83	21.6	2.35
1985	14.46	22.75	24.8	2.85
1986	16.30	22.75	23.9	2.55

(Source: Lloyd's statistics)

Besides vessels of Mexican registry, the Mexican merchant ship fleet normally includes convenience flag vessels which, though ships of foreign registry, are actually owned and operated by Mexican shipping firms; hence, ships falling under these two categories may be classified as ships owned and operated by Mexican shipping firms. Besides these, there are chartered foreign ships.

So, the Mexican merchant fleet as used here comprises all of these three categories.

As of 1984, such Mexican merchant ship fleet consisted of 108 vessels with a total tonnage of 1,577,000 GT, of which 53 ships totaling 733,000 GT, or about 46% in terms of GT were in operation in the Pacific side. In addition to these, there were 78 chartered foreign vessels totaling 1,730,000 GT and of which 33 with 330,000 GT correponding to 19% were in service in the Pacific side. With all these combined, the total vessels which were operating in the Pacific side in 1984 stood at 88 ships with 1,062,000 GT, of which 25 ships were tankers and 32 were bulk carriers.

Table II-4-3 VESSELS OPERATED BY MEXICAN SHIPPING FIRMS (1984)

Type of ship	Total		Ships in operation in the Pacific side	
	No. of ships	1,000 GT	No. of ships	1,000 GT
Tanker	43	888	19	264
Chemical tanker	5	62	-	-
LPG carrier	8	182	2	52
Bulk carrier	30	395	23	320
General cargo ship	22	166	9	97
Total	108	1,694	53	733

(Source: Communication and Transport Ministry of Mexico)

4-2-2 Mexican shipping firms as operators

As for Mexican operators, there are big shipping firms such as PEMEX who is mainly dealing with tankers, TMM and NAVIMIN, as well as about 15 medium- to small-size firms.

The tanker tonnage owned by PEMEX accounts for about 50% of the total tonnage owned by Mexico. PEMEX is a state-owned enterprise, while TMM is a semi-state- owned firm.

(1) PEMEX

While PEMEX has been striving for the expansion of its fleet, as typified by its order placed in bulk for 14 tankers with Japanese shipyards in 1966, it is moving in recent years toward increasing dependence on chartering foreign vessels rather than newbuilding of its own ships because of financial and monetary problems, as well as union issues. As such, even after the turn of 1987, the firm has been unable to take a drastic expansionary measure. Thus, the only plan being pursued by them is to see some improvement in making the average ship size of its tanker fleet somewhat larger by way of tonnage replacement. At present, the operation of its own fleet is limited to those vessels being domestically operated. Since oil exports are being contracted on FOB basis whereby buyers are required to arrange for ships, no new building plan for ships like VLCC other than those for replacement is currently being envisaged. It is, however, thought that on the long-term it will become necessary for Mexico to use its own large tankers for its oil exports.

(2) TMM (Transportacion Maritima Mexicana S.A.)

TMM, being positioned as the core of the Mexican Shipping Industry, built bulk carriers of the 60,000 DWT class in 1982 and, even at present, is considered as the most active shipping company in Mexico insofar as bulk cargo transports are concerned. In particular, TMM is the only semi-state-owned enterprise in Mexico operating its vessels on regular foreign trade routes, and is functioning as the driving force of the existing Mexican Shipping Industry.

The tonnage distribution by ship type of the fleets owned by these major shipping firms in Mexico are shown below.

Table II-4-4 DISTRIBUTION OF TONNAGE OWNED BY MAJOR MEXICAN SHIPPING FIRMS

(Unit: 1,000 GT)

Shipping firms	Oil tanker	Bulk carrier	General cargo ship	Others	Total
PEMEX	416	-	-	182	598
TMM	-	125	87	-	212
NAVIMIN	-	53	-	-	53
PETRO FLOTA	64	-	-	-	64

4-2-3 The shipping policy

As the shipping policy of the Mexican Government, there are three basic measures - namely, aid by foreign investment law, preferential treatment on the taxation system, and priority on the national fleet. In particular, in regard to the maintenance of the loading ratio of the national fleet, the Mexican Government intends to secure cargoes for Mexican shipping firms.

However, in view of the growing trends toward favoring chartered foreign ships of convenience flag because of the need for funding for newbuildings or operations, the measures aiming at the expansion of the national fleet are not always being strongly pursued by the Government.

In order for Mexico to help prevent the outflow of foreign currency it is certainly worthwhile considering to increase the national fleet's tonnage on the long-term. And, it seems likely that the need for transporting oil and pertroleum products for exports will become increasingly amplified.

5. Shipbuilding and Repairing Industry in Mexico

5-1 Shipbuilding Policy

The shipbuilding industry, including both newbuilding and ship repair sectors, or the basic industry of Mexico was positively promoted in 1970 in accordance with the nation's industrialization policy.

The nationalization of the Guaymas shipayrd, as well as the measures aiming at the expansion of the shipping industry centering on newbuilding of fishing vessels were implemented, and in 1981, the decision was made by the President on the Promotion Plan of the Shipbuidling Industry.

As a result, the integration of the existing shipyards, and introduction of foreign capital and technology were accelerated, bringing about the technological advancement as well as the rationalization and modernization of plant and equipment.

5-2 Shipbuilding Facilities

In the past, general shipyards are primarily intended for small-size vessels or fishing ships. With the turn of the 1980s, it became possible to build large-size ships by construction of two sets of building berth with a capacity of 25,000 DWT in the Guaymas Shipyard and one building dock with a capacity of 80,000 DWT in the Veracruz Shipyard.

Besides these the Salina Cruz shipyard has a synchro-lifting equipment with a capacity of 2,500 tons which was initially intended to do mainly repair work, has recently increased volume of newbuildings of naval vessels by utilizing this lifting equipment, and one repair dock with a capacity of 25,000 DWT.

There are also shipyards such as Ensenada with a 2,500 tons synchro-lift, Mazatlan with a 1,500 DWT berth, etc.

on the Pacific coast side. It is inferred from the statistics of shipbuidling record (Table II-5-1), indicating very small number and tonnage of newbuildings in Mexico as compared with the number of the country's existing shipyards, that the Mexican shipbuilding industry and its associated industries might have some problems as to technology, administration, sales and other aspects of activities.

Table II-5-1 TONNAGE OF NEW SHIPBUILDING IN MEXICO

Year	No. of ships	000' GT
1980	1	399
1981	14	2,645
1987	15	3,721
1983	2	280
1984	-	-
1985	-	-
1986	1	14,228

(Source: Lloyd's statistics)

5-3 Ship Repair Industry

The ship repair industry in Mexico is being administered by AUSA, or a state-run shipbuilding corporation, the Navy Department, and a state-run petroleum corporation. While of these ship repair works, large-sized yards have newbuilding sectors as well; most of other small-sized works specialize in repairing only.

The international competitiveness of Mexico's ship repair industry as it stands now is yet to be improved in terms of repairing cost, techniques and technologies, work period, quality, supply of parts, etc.

Consequently, many ocean-going Mexican flag vessels are being docked and repaired at foreign repair yards outside of Mexico.

5-3-1 Ship repairing facilites

As major ship repair facilities in Mexico, there are two on the Mexican Gulf side - Veracruz and Tampico, and five on the Pacific coast side - Salina Curuz, Guaymas, Ensenada, Mazatlan and Acapulco, totaling only seven yards.

Among these, the Veracruz shipyard, equipped with one floating dock capable of accommodating 45,000 DWT class vessels, and two drydocks, is in operation as an important ship repair yard on the Mexican Gulf.

On the Pacific coast, the Salina Cruz repair yard, equipped with one drydock with a capacity of 25,000 DWT, is in operation along with a repair yard in Ciudad Madero which is exclusively in use for PEMEX fleet. However, it is reported that the Salina Cruz repair yard has recently been compelled to decline some of commercial ship for repairs due to the increased volume of newbuildings of naval ships.

Other three repair yards in Ensenada, Mazatlan and Acapulco, all being small in scale and centered on fishing boats or small-sized ships, are unable to accommodate ocean-going vessels for repairing.

Table II-5-2 shows main repair dockyard in Mexico.

Table II-5-2 FACILITY OF MAIN SHIPREPAIR DOCKYARD

DOCK YARD		SHIP REPAIR FACILITY		SHIP BUILD . FACILITY
		DOCK , LIFT ,	MAX. CAP .	
PACIFIC OCEAN SIDE	SALINA.CRUZ(NAVY)	Syncro lift (102.5m×22m)×1 Dry Dock (206m×24.6m)×1	2,500t 26,000DWT	Syncro lift to be used for Shipbuilding.
	G U A Y M A S	Floating Dock(61m×13.4m)×1	1,016t	
	M A Z A T L A N	Slip way (60m)×3	1,500t,750t 300t,	Build.Berth (66m×28m)×1
	E N S E N A D A	Syncro lift ×1 Floating Dock(73m)×1	2,500t 1,422t (300GT)	
	MANZANILLO(NAVY)	Floating Dock(127m)×1	3,550t	
	ACAPULCO(NAVY)	Slip way (50m,67m) each 1	203t,254t	Build.Berth × 3
MEX.GULF SIDE	V E R A C R U Z	Floating Dock(178m×30.4m)×1 Floating Dock(119m×14.8m)×1 Dry Dock (157m×19.5m)×1 Dry Dock (54m× 9.6m)×1	13,000t 3,400t 45,000DWT	Build.Dock 80,000DWT×1
	CD.MADERO(PEMEX)	Dry Dock (250m×40m)×1	55,000DWT	

5-3-2 Actual results of the ship repair work

Shown below are the actual results of the repair work undertaken by the Veracruz shipyad, and Salina Cruz shipyard, both of which are typical and important repair yards in Mexico:

Table II-5-3 SHIPREPAIR RECORD OF VERACRUZ SHIPYARD

(Unit: 1,000 GT)

	1983	1984	1985	1986
Mexican flag ships	(31) 90.1	(28) 79.0		
Foreign ships	(12) 42.3	(8) 32.2		
Total	(43) 132.4	(36) 111.2	(44) 185.0	(69) 246

( ) shows number of ships

Table II-5-4 SHIPREPAIR RECORD OF SALINA CRUZ SHIPYARD

(unit: number of ships)

Ship type	1980	1981	1982
Mexican flag tankers	8	10	31
Ships controlled by Communication and Transport Ministry	9	11	8
Others	27	21	26
Navy ships	34	35	31
Total	78	77	74

5-4 Shipbuilding Associated Industries

It is generally thought that, while Mexico has a certain level of production capacity in terms of the technical industrial standards, except specific types of marine engines, other machinery and tools, it has some problems in relation to delivery, prices, etc.

Consequently, a lot of major equipment and machinery and tools for fittings necessary for newbuilding and ship repairing are imported from abroad.

Since it is particularly important to ship repair sales that work is done as quick as possible, speedy supply of spare parts as well as rapid repair of machinery and tools is always a key to success.

Therefore, it will become increasingly important for Mexico to foster shipbuilding related industries, such as steel materials, main engines, other machinery, electric equipment and tools.

A new repair dockyard in Lazaro Cardenas may, initially, relay on imports of ship related material and parts. However, it will become necessary in the future to take steps to encourage and develop ancillary industries with the industrialization of the surrounding areas so that most of materials, machinery and equipment for repairs can be procured locally.

6. Current Situation of Lazaro Cardenas and Regional Development Program

Lazaro Cardenas is an industrial city of the State of Michoacan located 340 km to the southwest of the Mexico City. (Fig. II-6-1)

6-1 Outline of the State of Michoacan

Morelia is the capital city of the State of Michoacan. The population of the State is approximately 3,000,000 (1986), of which one third lives in urban areas. The surface area of the State is 59,928 km^2.

Of the active population in economy, approximate 40% is engaged in the industries of the primary sector (agriculture, forestry, fishery), 9% in the public sector and 8% in the commercial sector (1980).

On the other hand, the percentage of production by sector (1980) is the following:

Agriculture, forestry & fishery	23.71
Mining	2.30
Manufacturing	11.58
Construction	6.44
Electricity	1.38
Commerce	33.03
Other services	21.56
Total	100.00

Obviously, agriculture, forestry and fishery show a high ratio in both labor population and production.

The percentage of the State of Michoacan to the national production of Mexico is 2.46% (1980). The strategy of the industrial development program of the State of Michoacan is to develop an economic corridor linking the port of foreign trade and the Pacific Valley and, more concretely, the industrial development of Contepec, Morelia, Uruapan and Lazaro Cardenas.

6-2 Regional Development Program

Mexico faces the problems such as excessive concentration of population and economic activities in the Metropolitan area around Mexico City, excessive decentralization of agricultural population as a consequence and differences of income in different areas. To solve those problems in line with the national development plan 1983 - 1988, SEDUE (Secretariat of Urban Development and Ecology) is planning to promote decentralization by developing 59 cities of medium size (of a population from 100 thousand to 1 million) to play an important role for the economic growth (industry, agriculture, tourism, etc.).

Lazaro Cardenas where the present Project is currently planned has a population of approximately 250,000 and is developing as a nucleus city of the regional development program.

SEDUE's development program of the Lazaro Cardenas area intends to transform this area, which used to be a mere agricultural area of stagnation until the 1970s, into a city having a population of 600,000 in the year 2000 as shown in Table II-6-1 and eventually of 1 million. This program subdivides the Lazaro Cardenas area into an industrial area, a living area, a tourism area, city center area, service area and environmental protection area and aims at developing the city into a balanced medium-size city maintaining harmony among the different areas. This program is slightly behind the original schedule but is advancing steadily.

In the industrial area, several enterprises are already in operation. The present Project is a labour-intensive project and, for that reason, has a larger absorbing capacity of labour in comparison with a capital-intensive oil project. Therefore, it is believed to employ approximately 900 workers when it is put into operation and

support the living of several thousand people including the families and thus contribute to the achievement of the development program of this area.

The industrial area is located on the islands of Cayacal and Palma surrounded by the two streams of the Balsas shown in Fig. I-3-1, and provides a space of approximately 2,660 ha. for large-scale industries. The projected site of dockyard is a V-shaped space surrounded by Y-shaped canals and has a surface area of approximately 120 ha.

The conditions of operation and construction of each project are as shown in Table II-6-2. It seems that the industries welcomed there are those making the best use of regional characteristics such as:

* industry deriving from the existing industries,
* industry which utilizes local resources of this area,
* industry which gives vigour to the industrial development of this area,
* complementary industry

The present Project will be closely related with the existing industries in terms of its operation and therefore can be regarded as an industry which makes the best use of the characteristics of this area.

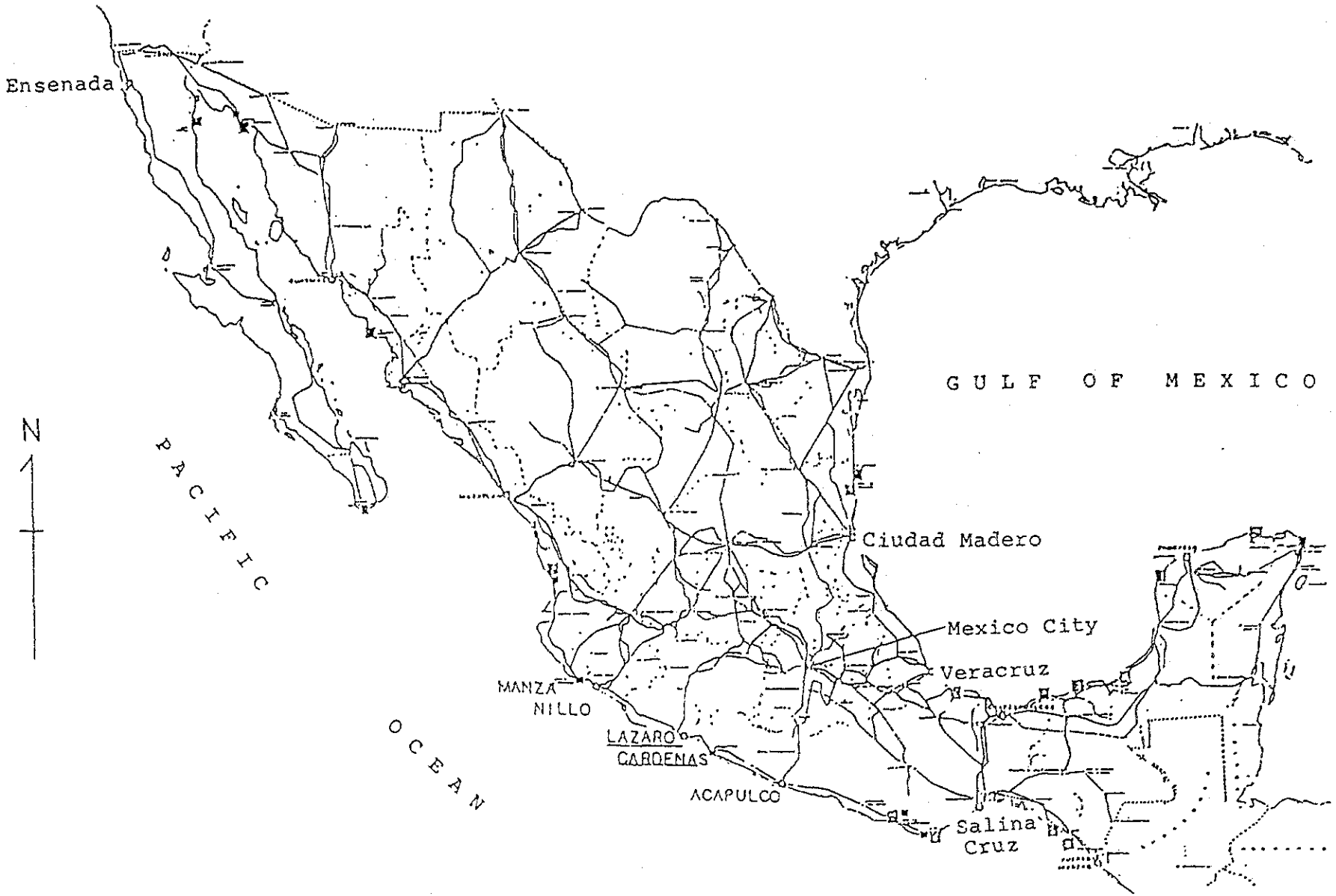


Fig. II-6-1 LOCATION OF LAZARO CARDENAS

Table II-6-1 Industrial Development and Population of Lazaro Cardenas

Alternative	Number of Industries			Coefficient	Population		
	Large	Medium	Small		1982	1988	2000
1	5	20	60	0.9	74,258	186,268	434,086
2	5	20	60	1.5	103,094	135,613	562,909
3	10	30	70	0.9	72,336	188,967	478,554
4	10	30	70	1.5	99,183	286,431	641,480
5	15	40	100	0.9	78,477	232,075	558,998
6	15	40	100	1.5	103,374	305,481	735,682
7	10	30	70	0.9 - 1.5	77,088	189,339	632,185

(Source: 3 years 86 · 88 Program Action Priorities of Lazaro Cardenas - SEDUE)

Table II-6-2 Main Projects of Industrial Port of Lazaro Cardenas

Project name	Current situation	Program for future
SICARTSA - Steel production	Annual production capacity - 1 million tons (steel bar) Number of employees - 7,000	Second phase of the works under construction Annual production - 1.5 million tons (steel sheet) Number of employees - 6,000
FERTIMEX - Production of fertilizer	Annual production capacity - 1.7 million tons of fertilizer and 2 million tons of intermediate products Number of employees - 2,000	
P.M.T. - Production of large steel pipe	Annual production capacity - 400 tons Number of employees - 700	
N.K.S. - Production of cast steel & forged steel	Annual production capacity - 55,000 tons Number of employees - 1,800	
CONASUPO - Storage & distribution center of grains	Capacity - 80,000 tons Number of employees - 127	
PEMEX - Storage & distribution center of petroleum products	Storage capacity - 750,000 BBL Number of employees - 120	

Project name	Current situation	Program for future
A plant for asphalt emulsion		Under construction Monthly production capacity - 13,000 tons Number of employees - 43
MICARE - Storage & distribution center of coal		Under construction Monthly capacity - 310,000 tons Number of employees - 200
PEMEX - Oil refinery plant		Under planning Daily consumption - 200,000 barrels Number of employees - 3,000

III. STUDIES OF THE PROJECT

III. STUDIES OF THE PROJECT

1. Demand Forecast of Shiprepair Work

1-1 Presupposition and Forecasting Method

The presupposition and forecasting method used in this demand forecast are shown below.

1-1-1 Presupposition

With the turn of the 1980s, the Mexicn economy has become deteriorated due to the accumulated debts and fallen oil prices. The changes it has undergone so far are so phenomenal that it is difficult to predict factors which will cause changes in the future econnomy.

Accordingly, we have selected the following presupposition within the scope foreseeable at this point in time as practically possible in respect to these factors.

Case-A: The Case A is relatively optimistic, assuming that while the situation surrounding the Mexican economy and oil will be severe on the short-term, but that the economy will gradually pick up on the long-term, aided by recovery (or rise) in oil prices, thereby increasing the volume of trade and, in turn, the volume of ship repair work.

Case-B: The Case-B is rather pessimistic assuming that the Mexican economy and oil situation will continue to be as severe as at present, leaving the growth rates of the economy and volume of trade low and slow; hence the growth rate of the volume of ship repair work, though tending to grow on the long-term, will be at a level of half of that of the Case-A.

1-1-2 The Period covered by the forecast

With the year 1984 or 1985 fixed as the base year, the years 1995, 2005 and 2015 have been determined to be the target years of the forecast.

1-1-3 Forecasting method

In order to forecast the volume of ship repair work at the Lazaro Cardenas repair dockyard located on the Pacific coast of Mexico, a research has been made toward finding the trends of the various factors associated with the demand for repair work over the past five to ten years, analyzing its growth rate and correlations among these factors.

More specifically, the data have been examined concerning volumes of cargoes handled at ports on the Pacific coast of Mexico, numbers of foreign vessels trading in and out of these ports, ships operated by Mexican firms, and specific types of vessels passing through the Panama Canal and sailing from the Pacific coast of Mexico, as well as ships in distress (or ships sustaining marine casualties) off the Mexican coast.

The potential demand for ship repair work in the target years has been forecast, and then, the likely volume of ship repair work at the new ship repair dockyard in Lazaro Caldenas based on the assumption that it will have gained and maintained international competence throughout the period being forecast.

The correlations among these factors taken into account as well as the flow of the forecasting method adopted are shown in Fig. III-1-1. (See Fig. III-1-1)

1-1-4 Target ship for repairing

The types of target ships for repairing at the new ship repair works in Lazaro Cardenas and the contents of repair work are as shown below:

(1) Target ships

General merchant ships of 1,000 GT and above

- o General cargo ships and container ships
- o Bulk carriers
- o Tankers (Crude oil tankes, Product tankers and Chemical tankers)
- o LPG Carriers
- o Ferries and others

In principle, work ships (such as dredgers), barges, and ocean liners, etc. have been excluded from the target ship, although reviewed for reference purpose.

(2) Kinds of ship repair work

The term "repair work" in this report includes the following:

1) Scheduled Survey (Periodical Survey)

Special survey : periodical survey and repair at intervals of four years generally.

Interim survey : periodical survey and repair at intervals of two years (Mid-term survey) generally.

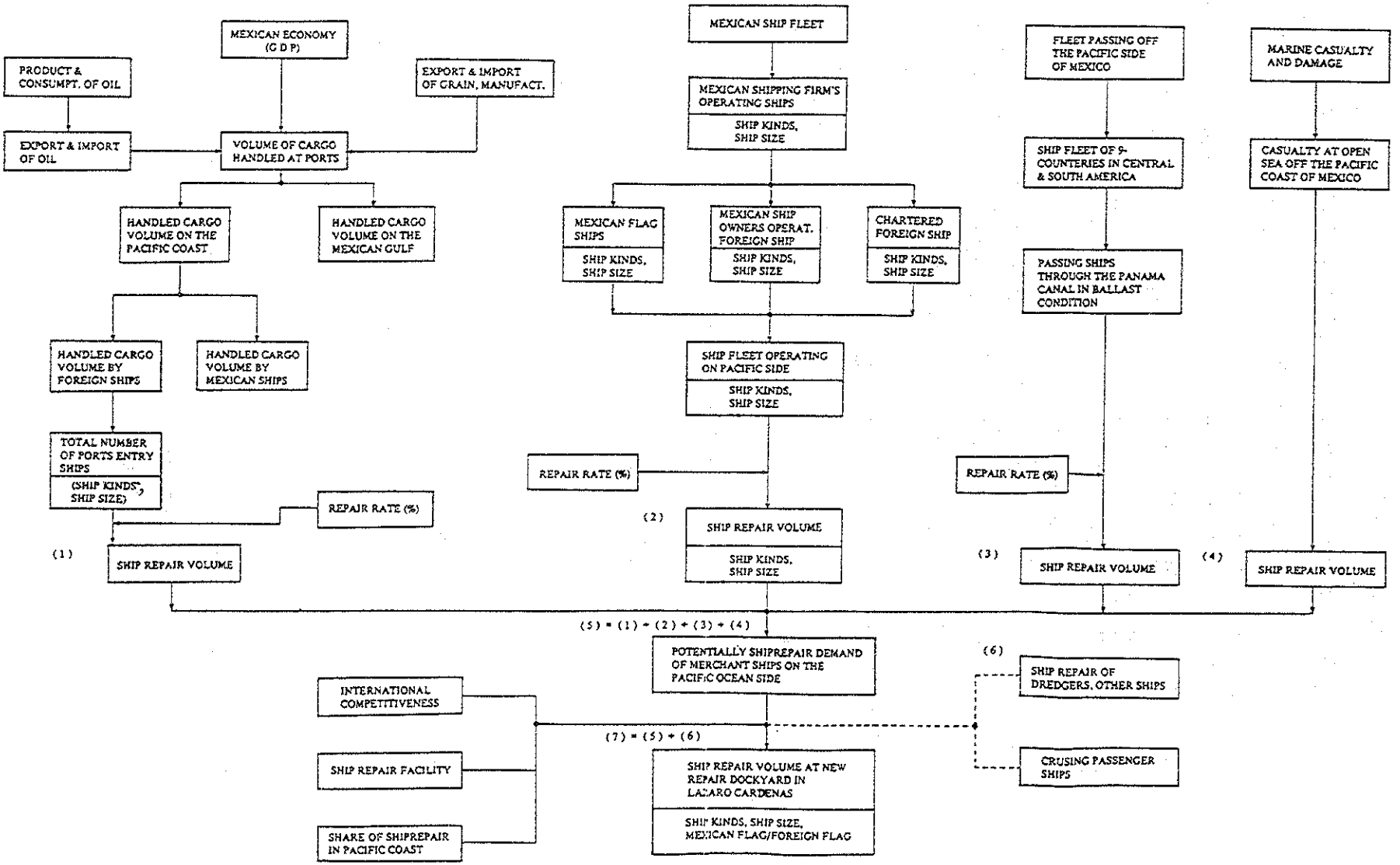
2) General Repair

This is generally maintenance repairs independent of the above periodical survey such as renewal of corroded parts of fitting, painting of shell plating, and etc.

3) Repairing of Marine Casualty and Damage

Repairing of marine casualty and damage in such cases as fire, collision, grounding, etc.

Fig. III-1-1 New Shiprepair Yard Project in Lazaro Cardenas — Procedure Flow of Market Survey for Shiprepair Works



1-2 Future Mexican Economy and Trade

1-2-1 Economy

As already stated, the Mexican economy developed at an average annual rate of around 6.6 during the period 1970-1980. During the period 1982-1983, however, because of heavily accummulated debts, its GDP growth rate dropped below zero. While it recovered slightly in 1984 and 1985, it again posted a growth rate of -3.7%.

While the GDP growth rates projected by Japan - Mexico Economic Conference for the coming several years were 6%, the future GDP growth rate is estimated to plunge into a level of as low as about 1.0% according to the forecast in Case-B which we assumed from a medium-term viewpoint.

In the long run, that is, ten to thirty years from now, or in 1995, 2005 and 2015, however, it is generally anticipated that a favorable turn in world economy will bring about at least 2 to 3% growth rate in developing industialized countries like Mexico. As it is more than likely that the demand for oil will increase in the 1990s, accompanied by a rise in oil prices, it is expected that Mexico's oil industry will surely recover and develop.

Taking such factors into account, we have forecast Mexico's future GDP gworth rates as follows:

Table III-1-1 MEXICO'S GDP GROWTH RATES

Period	Average Annual GDP Growth Rate (%) (Case-B - Case-A)
1980 - 1986 (Actual)	0.7
1986 - 1995 (Forecast)	1.0 - 3.0
1995 - 2005 (Forecast)	1.5 - 3.0
2005 - 2015 (Forecast)	1.5 - 3.0

1-2-2 Industry and Trade

As regards the shares of Mexico's major industries in GDP, as of 1983, the tertiary industry, such as commerce, hotel, and restaurant, account for about 49% and the manufacturing industry about 23%. When Mexico's industrial policy and an increase in its population are taken into account, the demands for consumer goods and housing are estimated to increase in future, a bright future of such industrial sectors as manufacturing and housing in the coming thirty years.

Particularly noteworthy are the increasing volume of production by such industrial sectors as automobiles, electric and electronics being undertaken by foreign capitalized enterprises in the Maquiladora located near the U.S. -Mexico national border. As a result, imports of related materials from abroad are steadily on the increase.

Furthermore, the oil industry in Mexico has continued to grow year after year since the early 1970s, bringing oil production from about 39 million tons in 1975 to about 150 million tons in 1984. Exports of crudes oil and petroleum products also increased from about 0.1 million B/D in 1975 to about 1.6 million B/D in 1983.

While 47% and 15% of these oil exports are destined to the United States and Japan respectively, the oil production in Mexico has been placed under the quantitative control in agreement with OPEC; hence, oil exports, too, have been hovering around over the past two years 1986 - 1987.

Viewing that oil productions in Alaska and the North Sea are expected to slow down after the peak in the 1990s, the oil supply capacity of Mexico, with relatively rich oil reserves, is increasing its share in the world oil supply. Thus, an increase in Mexican oil production is expected not only by the U.S. but also by other oil

consuming nations throughout the world. Oil exports are, therefore, estimated to increase in future.

Consequently, oil exports from Mexico will reach a level of about 197 million tons in 2005, involving such destinations as the U.S., Western Europe and the Far East and Southeast Asia including Japan.

Table III-1-2 OIL PRODUCTION AND EXPORT VOLUME IN MEXICO

(Unit: million ton)

Year	Oil production	Oil export	Seaborne trade volume (coastal and export)
1975	39.3	5.0	30.36
1980	107.3	43.6	92.23
1981	128.3	58.0	97.50
1982	149.4	76.4	123.53
1983	146.6	80.7	117.49
1984	150.4		122.23
1985	149.6		120.23
1986	135.4		
1995			147.00
2005			197.00
2015			265.00

(Source: BP statistics, seaborn trade: Ministry of Comunication and Transport of Mexico)

Next, Mexican agriculture is closely associated with seaborne cargo movements. Becuase the nation has sufficient agricultural land to feed its swelling population, the consumption of grain will go up along with increasing population, thus calling for an increase in grain imports. Since the country is adjacent to the United States, a well-known grain producing country, much of grain imports are being transported by land. However, it is hoped that imports by sea will increase in future.

The volume of bulk cargo including grain, salt, lumber and other materials, which stood at about 24.5 million tons in 1984, is expected to increase to about 45.6 million tons in 2005.

The movements of general cargo have been relatively smaller in volume and lower in growth rate when compared with those of oil or bulk cargoes. In the 1990s, however, imports of semi-finished goods will increase, as the industrialization progresses aided by the domestically invested foreign capital. Exports of manufactured goods will also increase, but most of the goods will be transported by land to the U.S.A.

In general, the worldwide toward containerisation of cargoes, regardless of the means of transportation either by land or by sea, is considered to be further accelerated. It is therefore expected that the volume of trade in general cargoes will increase between the Far East, South East Asia and the Pacific coast of Mexico and between Western Europe and the Gulf of Mexico.

1-3 Seaborne Cargo Movements and Vessels in Operation

1-3-1 Volume of cargoes handled at ports

The volume of Mexican trade will increase in future with the development of Mexican economy and industry. Seaborne trade has shown a marked increase in recent years. Namely, the ratio of seaborne to the total transports for export and import increased from about 59% in 1970 to about 92% in 1985. In particular, the ratio of seaborne export transports posted as much as 95%, which is indicative of the importance of seaborne trade in the Mexican economy.

Analyzing the relationship between GDP and volumes of cargoes to be handled at ports, and investigating their average annual growth rates and moduli of elasticity and forecast the total volume of cargoes to be handled at ports in future is forecast as mentioned hereinafter.

In 1985, Mexico's total volume of cargoes handled at ports, including exports, imports, and domestic coastal transports, stood at about 152.2 million tons.

And, because of the developments of such factors as already stated, the total volume of cargoes handled at ports in Mexico will increase, under Case-B -Case-A, to about 169.9 - 227.5 million tons in 1995, about 212.2 - 337.7 million tons in 2005, and about 261.2 -485.8 million tons in 2015. (See Fig. III-1-2)

Of these, the volume of cargoes handled on the Pacific coast, which used to represent a little over 30% of the total volume handled in Mexico over the past ten years, will continue to have a similar share in future.

Specifically, the volume of 45.5 million tons in 1985 is projected to increase, under Case-B -Case-A, to about 58.7 - 74.1 million tons in 1995, about 74.5 - 120.7 million tons in 2005, and about 95.4 and 196.5 million tons in 2015. (See Table III-1-3, Fig.III-1-3)

A review of trends of ratios of major cargoes, namely, oil, bulk cargo, and general cargo against the total cargoes handled, reveals that the volume of petroleum handled, namely, petroleum products of crude oil - accounted for about 79% in 1985, while volume of bulk cargo and general cargo handled represented about 17% and 4.4%, respectively. (See Table III-1-4)

The cargo volume handled by foreign ships in the Pacific ports of Mexico was about 27.0 million tons in 1985. Under Case-B -Case-A, the volume will be increased to about 38.4 - 52.5 million tons in 1995, about 53.1 - 94.4 million tons in 2005, and about 71.9 -162.5 million tons in 2015. (See Table III-1-3, Fig. III-1-4)

1-3-2 Vessels engaged in the transport of seaborne cargoes in Mexico

Next, the type and number of vessels to be engaged in the future transport were studied on the basis of actual data on the volume of cargoes at ports in Mexico and vessels engaged in the transport.

According to Lloyd's statistics, the fleet of Mexican flag vessels of 100 GT and above as of July, 1986 stood at 642 ships with a total tonnage of 1,520,000 GT, of which tankers numbered 47 with 823,000 GT, and the combined fleet of bulk and general cargo carriers 71 with 516,000 GT.

The ships being targeted by this forecast are mainly domestic vessels of 1,000 GT and above, and ocean-going foreign vessels of 10,000 GT and above. According to our analysis of the said cargo-handling at ports, the share of cargoes handled by foreign vessels at ports on the Pacific coast increased from 41% in 1979 to 59% in 1985. And it is assumed that this share will increase in future with the increasing trade volume in the Pacific areas.

The total number of vessels, both domestic and foreign, which traded in and out of ports on the Pacific

coast in 1985 stood at 5,627 ships, of which the total number of foreign vessels, 1,444 in 1985, is projected to in crease under Case-B - Case-A, to about 1,655 - 2,120 in 1995, about 2,065 - 3,180 in 2005 and about 2,800 - 4,900 in 2015.

The growth rate of such total number of ships' port entries over the past several years was lower than that of volumes of cargoes handled. This is considered due to the effects of the trend toward larger ships. The ship size seems to have reached its peak worldwide except a few types. However, as far as ships trading in and out of Mexican ports are concerned, this trend toward larger sizes seems likely to be further accelerated with the development of Mexican ports. (See Fig. III-1-5)

Next, as for the domestic vessels operated by Mexican shipping firms, there are two categories. Namely, Mexican flag vessels owned by the firms and chartered foreign ships operated by the firms as if flying Mexican flag.

The number of ships operated by Mexican firms, which stood at 86 in 1984, is expected to increase to 112 in 1995, 136 in 2005 and 174 in 2015.

However, the growth rate of domestic ships is lower than that of foreign ships. This is because shipping firms are more or less following the Communications and Transport Ministry's policy, placing more emphasis on chartering foreign ships than bulidng Mexican flag vessels. (See Table III-1-5, III-1-6)

In regard to the breakdown of these vessels by ship type, it is expected that, besides increase in general cargo ships and container ships, petroleum product tankers, LPG carriers, etc. will increase in future as demand for oil goes up.

Crude oil transport from the Pacific coast of Mexico to the Far East and Southeast Asia are expected to increase. From a medium-term viewpoint, however, it

would be difficult to expect PEMEX to have large-sized tankers, becuase oil importing countries, such as Japan, South Korea, Taiwan, etc. own their large-sized tankers including VLCC.

In the 21st century, when demand for transport of petroleum products to the Far East is expected to increase, it is likely that 80,000 DWT class petroleum product tankers will be needed and cause an increase in the Mexican flag fleet.

Generally speaking, the tonnage of medium- to small-size petroleum product tankers, LPG and crude oil tankers for the purpose of coastal transport will grow because of an increase in the domestic demand for oil. (See Table III-1-4)

1-3-3 *Vessels sailing off the Mexican coast*

As already stated, vessels operated by Mexican shipping firms for the transport of cargoes on the Pacific coast, as well as foreign ships trading in and out of Mexican ports will be potentially requiring repair services at the new ship repair works on the Pacific coast of Mexico.

Also considered to have such potential demand for repairs are vessels passing off the Pacific coast of Mexico. Most of these ships are those taking the course to the Atlantic via the Panama Canal or those going in the opposite direction. Although the number of the under 60,000 DWT class vessels passing through the Panama Canal stands at some 12,000 ships on an average annual basis, vessels owned by advanced industrialized countries are not likely to seek repair services from mexican repair works, since their needs for repairing are normally met by repair yards located either in their own or other advanced countries.

Therefore, the vessels to be targeted are considered to be those owned by eight countries in the Central and

South America which are not possessed of suitable repair yards, namely, Argentina, Brazil, Chile, Columbia, Ecuador, Panama, Peru and Venezuela, as well as those passing through the Panama Canal in ballast conditions. The number of these target vessels, which stood at about 475 totaling about 5.92 million GT in 1984, is estimated to increase to about 580 in 1995, about 690 in 2005, and about 825 ships in 2015.

Of vessels passing off the Pacific coast of Mexico, those reasonably conceivable as target vessels will be American tankers, including VLCCs, being engaged in the transport of Alaskan crude oil to ports in California or oil discharging terminal near the Panama Canal.

However, in accordance with the U.S. Marine Act, these tankers are, in principle, required to be repaired at U.S. repair yards, unless otherwise specifically provided in the said Act; hence, they cannot be targeted as potential demand for repairs in Mexico.

Other vessels conceivable as the target are those encountered with marine casualty or damage off the Pacific coast of Mexico, specifically, within the geographical range between lat. 35° N. and lat. 15° S. Included in these marine casualty or damage are submersion, sinking, fire, collision, grounding, etc. The average number of such marine disasters occurred over the past nine years 1975 - 1983 was 9 ships per year.

As seen above, we have surveyed and studied the status of operation for each category of ships trading in the Pacific side of Mexico. These ships carry with them potential demands for repairing at the new repair works.

Table III-1-3 TRADING VOLUME OF MEXICO

(Case B – Case A)

Item / Year	(1) Handled cargo volume on ports in Mexico (million ton)	(2) Handled cargo volume on Pacific coast side (million ton)	Share (2)/(1)	(3) Handled cargo volume by foreign ships on Pacific coast side
1985 (Actual)	152.2	45.5	30%	27.0
1995 (Forecast)	169.9–227.5	58.2–74.1	34–33	38.4–52.5
2005 (DO)	212.2–337.7	74.5–120.7	35–36	53.1–94.4
2015 (DO)	261.2–485.8	95.4–196.5	37–40	71.9–162.5
Remarks	Case-A 4.0% Case-B 2.0%	Case-A 5.0% Case-B 2.5%		

Table III-1-4 HANDLED CARGO VOLUME IN MEXICO'S PORTS
(by Cargo Kinds)

(Unit: 1,000 ton, (%))

Year / Kinds of cargo	1970	1980	1985	Remarks
Oil	12,978 (49.6)	92,232 (74.0)	120,197 (79.0)	
Bulk cargo	10,879 (41.6)	25,522 (20.5)	25,244 (16.6)	
General cargo	2,298 (8.8)	6,822 (5.5)	6,788 (4.4)	
Total	26,155 (100%)	124,576 (100%)	152,229 (100%)	

Table III-1-5 OPERATING SHIPS ON PACIFIC SIDE OF MEXICO

(Unit: Number of Ships)

Item / Year	Operating ships by Mexican shipping firms			Entry foreign ships on Pacific side ports	
	Mexican flag ship	Chartered foreign ships	Total	Total number	Net number
1985 (Actual)	'84 53	'84 33	'84 86	1,444	'84 265
1995 (Forecast)	62	50	112	1,655–2,120	368–465
2005 (DO)	72	64	136	2,065–3,180	460–700
2015 (DO)	85	89	174	2,800–4,900	620–1,080
Remarks	Including the special foreign ships which are actually operating by Mexican Shipowners.			Annual Growth Rate Case-A 4.2% Case-B 2.2%	

Table III-1-6 FLEET VOLUME OF MEXICAN SHIPPING FIRM'S OPERATING SHIPS IN PACIFIC OCEAN SIDE

(Unit: Number of ships)

Year	Ship Kinds	Ship Size (x 1,000 GT)						
		1.0–5.0	5.0–10.0	10.0–20.0	20.0–40.0	40.0–50.0	Total	Remark
1984	G. Cargo		7	5	–	–	12	
	Cont. Ship		2	6	–	–	8	
	Bulk C.		1	12	6	1	20	
	Tanker		7	21	3	–	31	
	LPG. C.		1	3	1	–	5	
	Ferry		9	–	–	–	9	
	Other		1	–	–	–	1	
	Total		28	47	10	1	86	
1995	G. Cargo		10	9	–	–	19	
	Cont. Ship		4	10	1	–	15	
	Bulk C.		1	14	6	1	22	
	Tanker		8	24	4	–	36	
	LPG. C.		1	5	1	–	7	
	Ferry		12	–	–	–	12	
	Other		1	–	–	–	1	
	Total		37	62	12	1	112	
2005	G. Cargo		10	14	–	–	24	
	Cont. Ship		4	11	3	–	18	
	Bulk C.		1	14	10	1	26	
	Tanker		8	26	6	2	42	
	LPG. C.		1	6	2	–	9	
	Ferry		15	–	–	–	15	
	Other		2	–	–	–	2	
	Total		41	71	21	3	136	
2015	G. Cargo		12	18	–	–	30	
	Cont. Ship		5	18	5	–	28	
	Bulk C.		1	15	15	2	33	
	Tanker		10	28	10	3	51	
	LPG. C.		1	7	4	–	12	
	Ferry		15	2	–	–	17	
	Other		3	–	–	–	3	
	Total		17	88	34	5	174	

Fig. III-1-2 Handled Cargo Volume in Ports
(Pacific Side and Mexican Gulf Side)

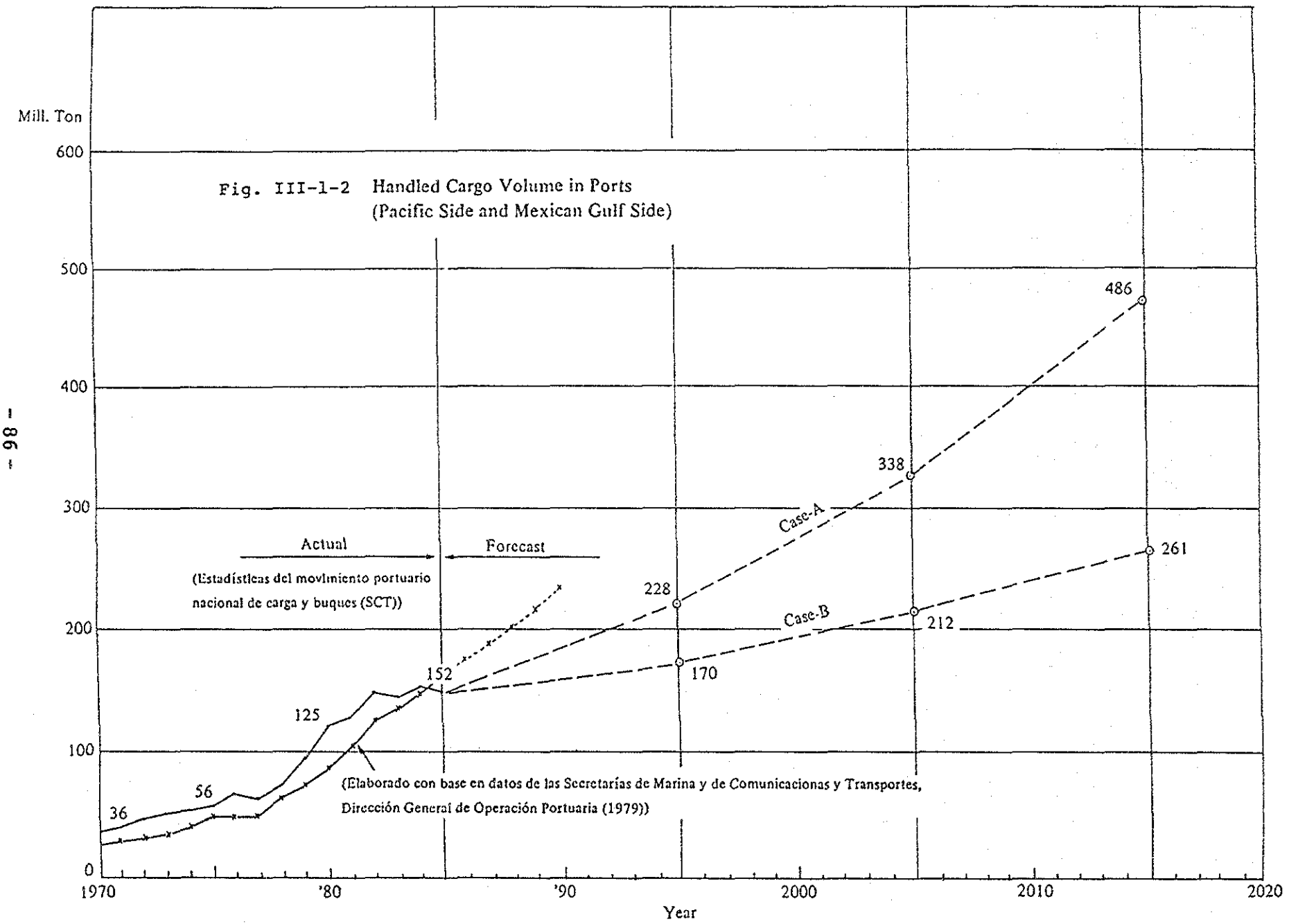


Fig. III-1-3 Handled Cargo Volume on the Pacific Side

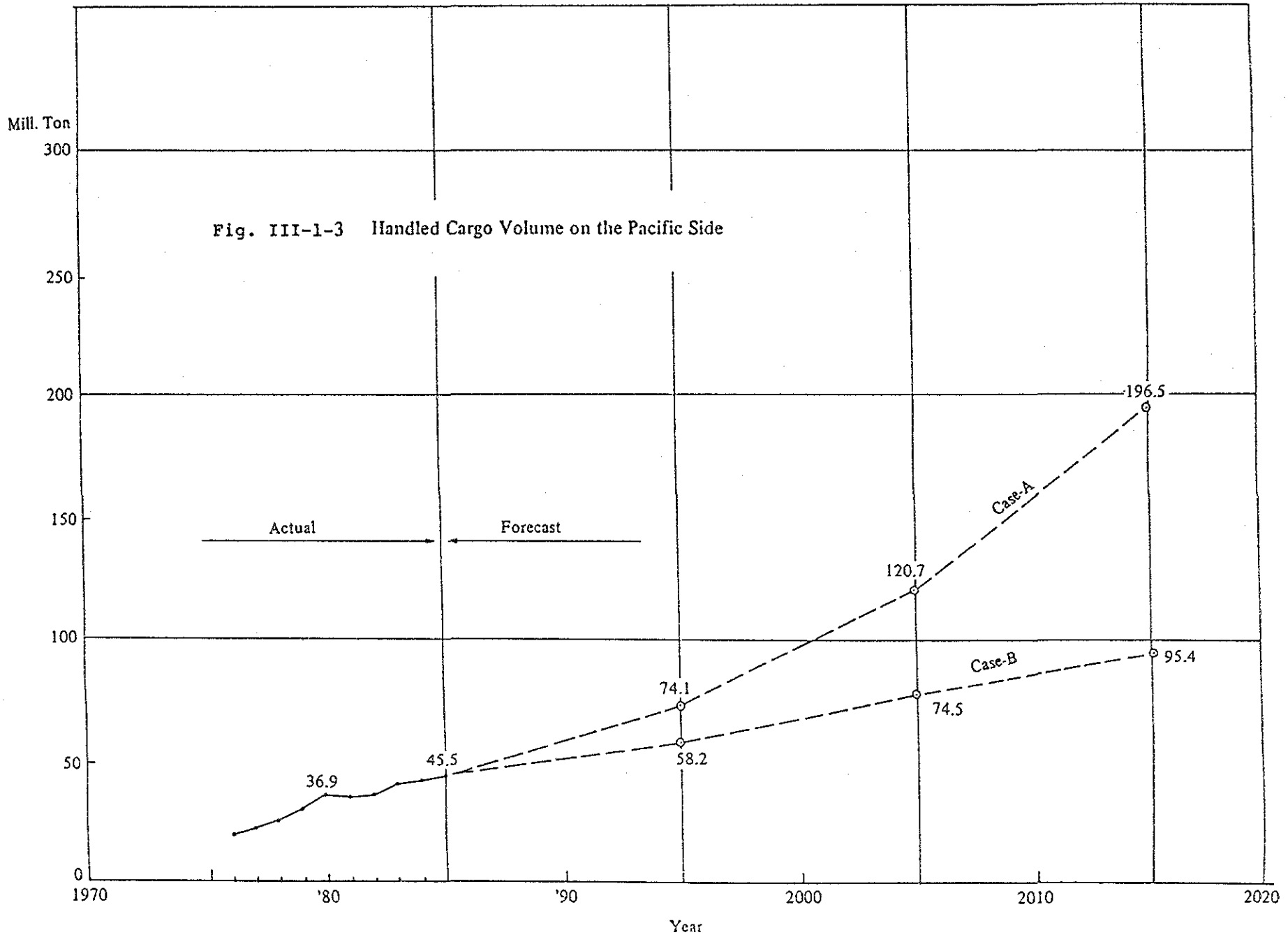


Fig. III-1-4 Handled Cargo Volume by Foreign Ships (Pacific Side)

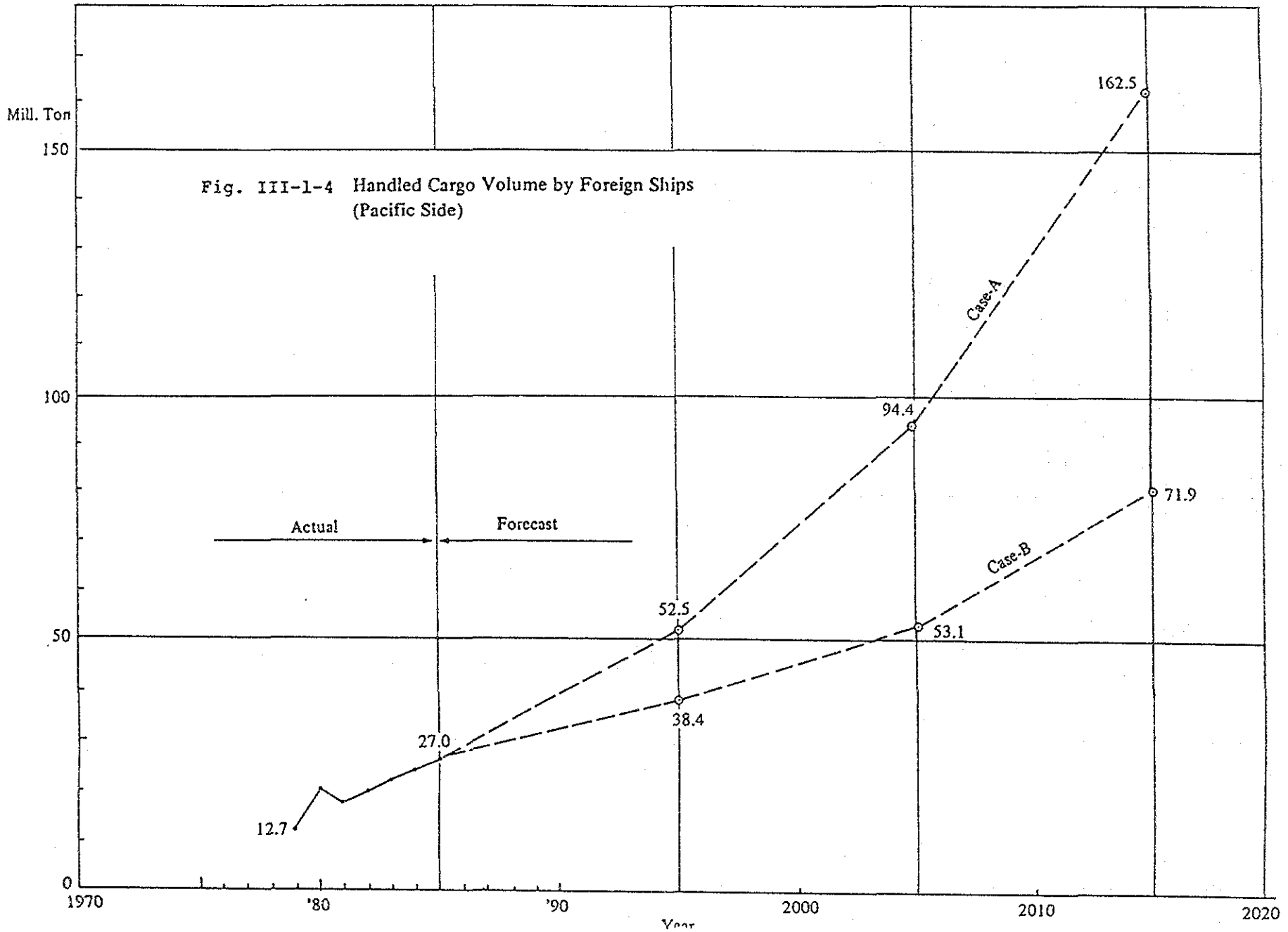
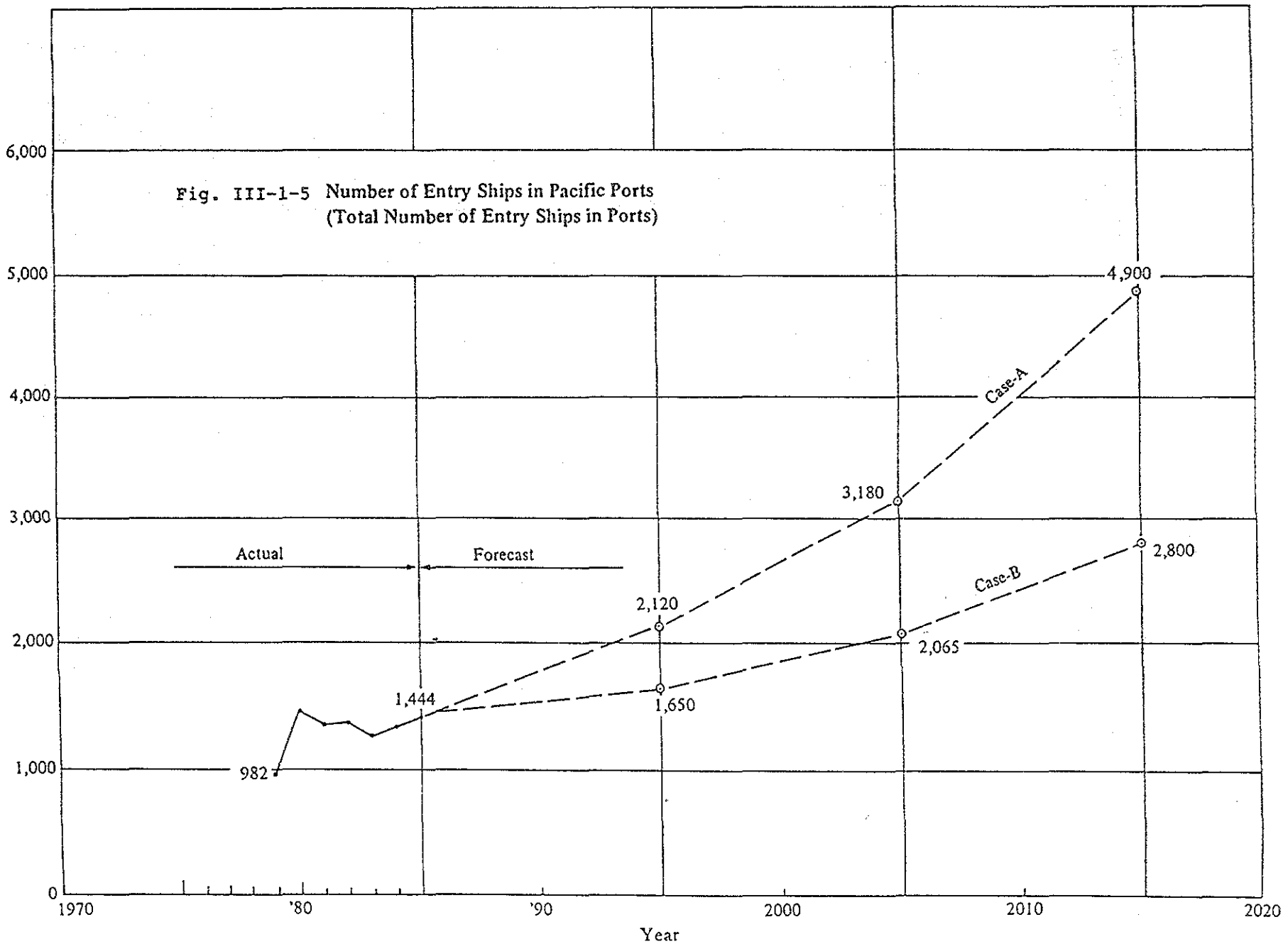


Fig. III-1-5 Number of Entry Ships in Pacific Ports
(Total Number of Entry Ships in Ports)



1-4 Volume of Shiprepair Work

1-4-1 Potential demand

Vessels to be targeted for repairing at the new ship repair dockyard on the Pacific coast of Mexico are classified into the following four categories as already stated above:

(a) Ships operated by Mexican shipping firms in the Pacific coast side of Mexico;

(b) Foreign vessels trading in and out of ports on the Pacific coast side of Mexico;

(c) Vessels of the eight countries in the Central and South America which are passing off the Mexican coast via the Panama Canal in ballast condition;

(d) Vessels encountered with marine casualty or damage off the Mexican coast.

Taking into account the respective repairing characteristics of these categories, we have looked into volumes of repair work in terms of the number of vessels. The result of the study are shown below.

As for the first category of vessels operated on the Pacific coast of Mexico, there were 86 ships in 1984. If these vessels undergo a periodic survey once every four years, then it means that one quarter or 25% of the total vessels will be repaired year after year.

By the same token, if they undergo an interim (or mid-term) survey once every two years, then it means that each year about half of the total vessels will be drydocked for drydocking and repairs. And, besides these scheduled surveys, there are annual drydocking and surveys not scheduled such as partial

repairs or others. Therefore, this means that 75% of the total vessels are repaired at least once a year either in the form of periodic or interim (mid-term) survey. (However, there is a growing tendency among advanced industrialized countries toward extending the length of docking intervals with the ever-advancing improvements in the durability of paints as well as machinery and tool.)

With these being taken into account, the potential demand is forecast as 65 ships in 1984, 83 ships in 1995, 102 ships in 2005 and 131 ships in 2015.

As for the second category, namely, foreign vessels trading in and out of ports on the pacific Coast, the majority of them have a strong tendency toward drydocking for repairing at yards in their own countries.

However, this does not preclude possibilities of these vessels, at times of their being on light-load conditions following the discharge of cargo, seeking repair services in Mexico. For instance, in the case of Japan, of foreign vessels trading in and out of Japanese ports, those which undergo repairs in Japan, namely the repair ratio accounted for about 6% in the 1970s and 3% in the 1980s. In the case of Veracruz repair yard, the repair ratio was about 2%. For the purpsoe of the new repair yard, we set up the level of 1% for the present and 1.5% for the future.

As a result, the foreign vessels' potential demand for repairing is forecast as 14 ships/year in 1985, 24 - 32 ships/year (under Case-B - Case-A, hereinafter the same) in 1995, 31 - 48 ships/year in 2005 and 42 - 73 ships/year in 2015.

As regards the third category of vessels passing off the Mexican coast, those considered to have high potentialities for repairing are ships passing through

the Panama Canal on ballast conditions, because vessels in full-load conditions will never be drydocked for repairs. Of vessels satisfying this condition, those of the eight countries in the Central and South America will be targeted in relation to only one way each of their trades. The repair ratios used for the computation of demand are 0.5% under Case-B and 0.75% under Case-A.

As a result, the potential demand for repairing is forecast as 2 - 3 ships/year in 1995 under Case-B - Case-A and 3 - 5 ships/year in 2005 and 2015.

As for the fourth category, namely ships in distress, either marine casualty or damage, at open sea in the Pacific off the Mexican coast, there were eight marine disasters/year on an average within the geographical range between lat. 35° N and lat. 15° S, according to the Lloyd's Casualty Return.

Even when accout is taken of an increasing volume of seaborne trades, an increase in the number of such ships in distress would be only a few: thus, the demand is forecast as a level of 10 ships/year in 2005 and 2015.

To sum up, with the respective repairing characteristics of the categories classified as above being taken into account, volumes of repair work for general merchant ships in the Pacific have been calculated as shown below.

The total volume, which stood at 87 ships in 1984, is forecast to increase 118 - 127 ships/year in 1995 under Case-B - Case-A respectively, 146 - 165 ships/year in 2005, and 186 - 219 ships/year in 2015. (See Table III-1-7)

The potential demand for repairing general merchant ships as broken down by ship type and size-range is shown in Table III-1-8, while the pattern of ship operation by Mexican shipping firms, etc. as

classified by type and size of ships is shown in Table III-1-9.

While the potential demand for the future ship repair work on the Pacific coast side of Mexico is as stated above, what is important is whether the new repair yard will be really able to secure new repair orders out of such demand.

It is by all means necessary for the new repair yard to have an ability sufficient enough to receive orders from both domestic and foreign vessels through an international competitiveness capable of competing with other repair yards.

The international competitiveness as used here pertains to the matters of price, technology, time of delivery, location, marketing which are explained in detail as follows:

(1) Competitiveness in price

Competitiveness in price means capability of quoting a shiprepair price lower than other yards for the same scope and quality of work furnished. This capability is premised essentially on a low prime cost. In the case of shiprepair work, the ptime cost is determined largely by unit labor cost and manhours consumed on a repair job.

Consequently, capability of completing a shiprepair job within a reasonable range of manhours, minimixed through rationalization of facilities and procedures, would be the key to maintaining competitiveness in price.

Another aspect that needs to be kept in view is the current international practice of quoting shiprepair prices in U.S. dollars in general, and this calls for further capability to support a certain amount of fluctuation in the exchange rate between domestic currency and U.S. dollar.

(2) Technological capability

Technological capability means ability to complete to stipulated quality --and within the stipulated time--any shiprepair job undertaken -- whether as part of periodical survey on hull or on machinery or for heavy repairs following a casualty. A shiprepair job will involve work on sheet metal, in welding, in machining, in carpentry, in tiling, in painting and many other trades, all of which mus be coordinated and directed to achieve the target set for the job: This calls for management capability to control work progress, to procure and make available in good time the requisite materials and components, to engineer and design the parts to be repaired on the hull or machinery.

(3) Time of delivery

A vital factor affecting shiprepair work is time of delivery of the repaired ship. Merchant vessels represent a considerable amount of investment on the part of shipowner, who will for this reason have interest in minimizing the period during which his ship will be out of commission for repairs, and who will consequently consider the quoted time of delivery of the repaired ship as a factor of importance equal to price and technological capability, in his choice of yard for repairing his ship.

(4) Facilities and equipment

The primary factors to be considere drelevant to the facilities and equipment of a shiprepair yard are:-

- Whether the docking capability is adequate for the ships envisaged to be repaired
- Whether the quay is adequately equipped, and the water sufficiently deep, for the ships envisaged to be repaired

- Whether machine tools and tooling are adequate for the envisaged repairs on machinery.

In the present instance, the ships envisaged for repair should cover most of the ships serving the Mexican Pacific coast and the Dockyard should have enough facilities and equipment susceptible to repair those ships for international competitiveness.

(5) Location

A shiprepair yard would desirably be located close by a port where ships call for unloading, or along a shipping lane widely used by vessels plying under ballast, for the convenience of having ships docked in light condition for repair.

(6) Marketing

A dockyard possessing all the prerequisites of a capable shiprepair facility will still need the patronage of clientele in order to operate successfully. To this end, the yard must have adequate marketing capability for gaining due recognition by ship owners and operators of the capabilities possessed by the yard and of the advantages they would gain by ordering on the yard.

In the present instance, an essential prerequisite for successful operation would be to secure constant orders for repair from PEMEX, TMM and other leading domestic shipowners: Marketing activities aimed at these key potential customers should be undertaken not only by the marketing personnel but also by top members of the dockyard management and of investor groups.

Table III-1-7 SHIP REPAIR DEMAND ON PACIFIC SIDE OF MEXICO

(Potentially Requiring Repairs)

(Case B – Case A)

(Unit: Number of Ships)

Item / Year	Mexican shipping firm's operating ship	Foreign ships of entry ports	Passing ships through off Mexican coast	Ships of marine casualty and damage	Total
1984	65	13	2	7	87
1995	84	24–32	2–3	8	118–127
2005	102	31–48	3–5	10	146–165
2015	131	42–73	3–5	10	186–219
Remarks					

Table III-1-8 SHIP REPAIR DEMAND IN PACIFIC COAST
(by Ship Size)

(Unit: Number of Ships)

Item \ Ship Size (DWT)		Potential Demand of Repair of Merchant Ships						Ship repair vol. of new ship repair yards	Remarks
		1,000 –10,000	10,000 –30,000	30,000 –60,000	60,000 –100,000	100,000 –	Total		
1984	Operat. Ships by Mexico Shipp. Firms	20	34	9	2	–	65		
	Foreign Ships	5	6	2	–	–	13		
	Passing Ships off the Mexico and Panama Canal	0	1	1	–	–	2		
	Casualty and Damage	2	3	2	–	–	7		
	Total	27	44	14	2	–	87		
1995	Operat. Ships by Mexico Shipp. Firms	26	41	15	2	–	84	Average 65	
	Foreign Ships	20–26		3–5	1–1	–	24–32		
	Passing Ships off the Mexico and Panama Canal	1–2		1	–	–	2–3		
	Casualty and Damage	2	4	2	–	–	8		
	Total	94–101		21–23	3–3	–	118–127		
2005	Operat. Ships by Mexico Shipp. Firms	30	49	18	4	–	102	Average 90	
	Foreign Ships	26–39		4–7	1–2	–	31–48		
	Passing Ships off the Mexico and Panama Canal	2–3		1	0–1	–	3–5		
	Casualty and Damage	2	5	2	1	–	10		
	Total	114–128		25–28	6–8	1–1	146–165		
2015	Operat. Ships by Mexico Shipp. Firms	36	60	25	7	3	131	Average 130	
	Foreign Ships	35–60		6–10	1–2	0–1	42–73		
	Passing Ships off the Mexico and Panama Canal	2–3		1	0–1	–	3–5		
	Casualty and Damage	2	5	2	1	–	10		
	Total	140–166		34–38	9–11	3–4	186–219		

Table III-1-9 DEMAND OF SHIP REPAIR OF MEXICAN SHIPPING FIRM'S OPERATING SHIPS IN PACIFIC OCEAN SIDE
(Average Value of Case B and Case A)

(Unit: Number of sips)

Year	Ship Kinds	Ship Size (x 1,000 GT)						
		1.0–5.0	5.0–10.0	10.0–20.0	20.0–40.0	40.0–50.0	Total	Remark
1984	G. Cargo		5	4	–	–	9	
	Cont. Ship		1	5	–	–	6	
	Bulk C.		1	9	5	–	15	
	Tanker		5	16	2	–	23	
	LPG. C.		1	2	1	–	4	
	Ferry		7	–	–	–	7	
	Other		1	–	–	–	1	
	Total		21	36	8	–	65	
1995	G. Cargo		7	6	–	–	13	
	Cont. Ship		3	8	1	–	12	
	Bulk C.		1	11	5	1	18	
	Tanker		6	18	2	–	26	
	LPG. C.		1	3	1	–	5	
	Ferry		9	–	–	–	9	
	Other		1	–	–	–	1	
	Total		28	46	9	1	84	
2005	G. Cargo		7	11	–	–	18	
	Cont. Ship		3	8	2	–	13	
	Bulk C.		1	11	7	1	20	
	Tanker		6	20	4	1	31	
	LPG. C.		1	4	1	–	6	
	Ferry		12	–	–	–	12	
	Other		2	–	–	–	2	
	Total		32	54	14	2	102	
2015	G. Cargo		9	14	–	–	23	
	Cont. Ship		4	14	4	–	22	
	Bulk C.		1	11	11	1	24	
	Tanker		7	21	7	2	37	
	LPG. C.		1	5	3	–	9	
	Ferry		12	2	–	–	14	
	Other		2	–	–	–	2	
	Total		36	67	25	3	131	

1-4-2 Volume of repair work at the new ship repair yard in Lazaro Cardenas

Setting the time for the start-up of this repair yard as from 1982, and assuming that through technological assistance from advanced overseas shipyard, as well as its own corporate efforts, it will have established by 1995 such system or potentiality as will enable it to secure a certain level of international competence, the volume of ship repair work has been realistically studied.

Among the new existing ship repair yards on the Pacific coast of Mexico, excepting the Salina Cruz shipyard which is capable of accommodating ships of upto 25,000 DWT as already stated, there is none which is capable of repairing ships which are larger than the middle-sized.

At Salina Cruz shipyard, the average anual volume of repair work for general merchant ships other than navy vessels stands at 34 ships. As it entered the second half of the 1980s, the volume of new orders for navy ships has appreciably increased. As a result, the yard has of late been put into a situation where it is obliged to decline the demand for repairing merchant ships.

So, if the present level of repair work, namely about 34 ships a year is maintained hereafter at the Salina Cruz shipyard, then it is assumed that not a little orders for repair work which are now being undertaken by the Veracruz shipyard on the Gulf of Mexico, as well as foreign yards (in Western Europe, the Far East, including Japan) may be acquired by the new repair works.

Since the major portion of the volume of such repair work pertains to vessels - including those of Mexican registry - operated by Mexican shipping firms, it is expected that these firms will tend to reduce

that portion of their repair orders which hitherto was given to foreign repair yards, and instead, give that much of the repair orders to the new repair works in Mexico. The above is based on the assumption that 1) the start-up of construction of the new repair works pursuant to the Lazaro Caldenas Repair Dockyard Project will take place in 1990 or so, 2) the actual ship repair work will be started as from 1992, then becoming fully operative in 1995, and 3) in the meantime, the new yard will have acquired the international competence as already stated.

With the repairing capacity of the new repair works and its international competitiveness as seen above taken into account, the volume of repair work for general merchant ships is projected to be 55 - 65 ships (Case-B - Case-A) in 1995, 74 - 90 ships in 2005, and 100 - 130 ships in 2015. If other ships, such as dredgers and other large fishing vessels are also taken into account, then the annual volume of repair work at the new repair works in Lazaro Cardenas is estimated to be 62 - 72 ships (in average 68) in 1995, 84 - 100 ships (in average 94) in 2005 and 115 - 145 ships (in average 131) in 2015. (See Table III-1-10, Table III-1-11, Fig. III-1-6)

Furthermore, by ship type and ship size in respect of the above averages, repair ships will be mainly composed of tankers and bulk carriers in the years upto 2005, while containerships will become much expected in 2015.

In terms of ship size, the greater part of repair ships will be occupied by the less than 20,000 GT (35,000 DWT) class upto 1995, while as it emerges into the 2000s, the 20,000 - 50,000 GT (35,000 - 80,000 DWT) class will come to be expected as well. Thus, most likely, this new yard would then be assuming a mighty role as the only large-scale repair yard on the Pacific coast side of Mexico.

Table III-1-10 FORECASTED VOLUME OF SHIP REPAIR WORK AT NEW SHIP REPAIR DOCKYARD IN LAZARO CARDENAS (Case B - Case A)

(Unit: Number of Ships)

Item / Year	Ship repair volume		Total ship repair volume (Merchant ship and Others) ( ): average	Share to potential demand of merchant ships (%)
	Merchant Ships	Others		
1995	55–65	7	62–72 (68)	(47–51%)
2005	74–90	10	84–100 (94)	(51–55%)
2015	100–130	15	115–145 (131)	(54–59%)
Remarks		Dredger and etc.		

Table III-1-11 DEMAND OF SHIP REPAIR OF NEW SHIP REPAIR DOCKYARD IN LAZARO CARDENAS (Average Value)

(Unit: Number of Ships)

Year	Ship Kinds	Ship Size (x 1,000 GT)						
		1.0–5.0	5.0–10.0	10.0–20.0	20.0–40.0	40.0–50.0	Total	Remark
1984	G. Cargo							
	Cont. Ship							
	Bulk C.							
	Tanker							
	LPG. C.							
	Ferry							
	Other							
	Total							
1995	G. Cargo	1	1	12	3	–	17	
	Cont. Ship	–	1	3	–	–	4	
	Bulk C.	–	–	9	4	2	15	
	Tanker	2	1	11	1	4	19	
	LPG. C.	–	–	1	1	–	2	
	Ferry	3	1	–	–	–	4	
	Other	7	–	–	–	–	7	
	Total	13	4	36	9	6	68	
2005	G. Cargo	1	1	17	5	–	24	
	Cont. Ship	–	2	4	1	–	7	
	Bulk C.	–	–	11	7	3	21	
	Tanker	2	1	14	2	4	23	
	LPG. C.	–	–	2	1	–	3	
	Ferry	4	2	–	–	–	6	
	Other	10	–	–	–	–	10	
	Total	17	6	48	16	7	94	
2015	G. Cargo	1	3	23	3	–	30	
	Cont. Ship	–	2	10	2	–	14	
	Bulk C.	–	–	11	12	5	28	
	Tanker	1	3	17	6	5	32	
	LPG. C.	–	–	3	2	–	5	
	Ferry	3	3	1	–	–	7	
	Other	15	–	–	–	–	15	
	Total	20	11	65	25	10	131	

1-4-3 Maximum ship size accommodated at repair yard

The volume of ship repair work at the new repair yard in Lazaro Cardenas is as stated above. The maximum ship size which can be accomodated for docking is studied in the light of the capacities of the floating dock and incidental facilities.

Demand of ship repair work was forecast in terms of not only the number of ships, but also ship type and ship size. However, the future trends of type and size of ships will appreciably vary according to the flow of the world seaborne trade.

The first, as for oil tankers, any noticeable increase in VLCCs - which used to play an important role for long haul trades as large-sized tankers - cannot be expected, and, instead, the Pacific transports by petroleum product tankers will come to increase. As regards the size of such tankers, the demand for 40,000 - 60,000 DWT or 80,000 DWT will increase, in addition to the size of 20,000 - 40,000 DWT which was hitherto regarded as the standard.

The second, as for bulk cargo carriers, since the U.S. will continue to exist as a major grain supplier in the world, grain transports from the Gulf of Mexico to the Far East and Southeast Asia via the Panama Canal will continue to increase as heretofore. Transports from the U.S. Pacific Coast to Mexico are also conceivable. And, in these transports, the most typical Panama-Passable type, 60,000 DWT will play a major role.

The third relates to the proposed expansion plan of the Panama Canal, or the construction of the "Second Panama". Taking into account that the growth rates of the world economy and trade as they stand now are not likely to reach the levels of the past high growth economy period, the investment efficiency will tend to decline in the future; hence, the "Second Panama" is unlikely to be realized.

The fourth concerns with container ships. With the containerization growing at a marked tempo in trade routes throughout the world, the trends for the same are likewise actively seen in progress in Mexico and both on its Pacific and Mexican Gulf coast sides. And, as time emerges from the end-1990s to the 21st century, ocean-going container ships, each having an approximately 2,000 TEU capacity will come to be in service, as the domestic transport system becomes firmly established.

Viewing as above, and also taking into account the geographical conditions of Lazaro Cardenas, we deem it reasonable to consider the ship size up to the 60,000 DWT class as the first phase of the project, and up to the 80,000 DWT class as the second phase.

The global trends toward larger ships are shown below for your reference.

Table III-1-12 TRENDS OF AVERAGE SHIP SIZE BY SHIP TYPE
(Percentage Share against the Total Number of Ships)

DWT	TANKER		BULK CARRIER		
Year	10 - 60	60 - 100	10 - 40	40 - 60	60 - 80
1977	54	16	78	13	6
1978	51	16	77	12	6
1979	49	16	76	12	7
1980	48	17	77	12	7
1981	48	18	76	12	8
1982	48	19	75	12	9
1983	49	19	73	12	10
1984	50	19	72	12	10
1985	50	19	72	12	10
1986	51	20	71	13	10
1987	52	20	70	13	11

(Source: Fedrnley "Bulk Fleet")

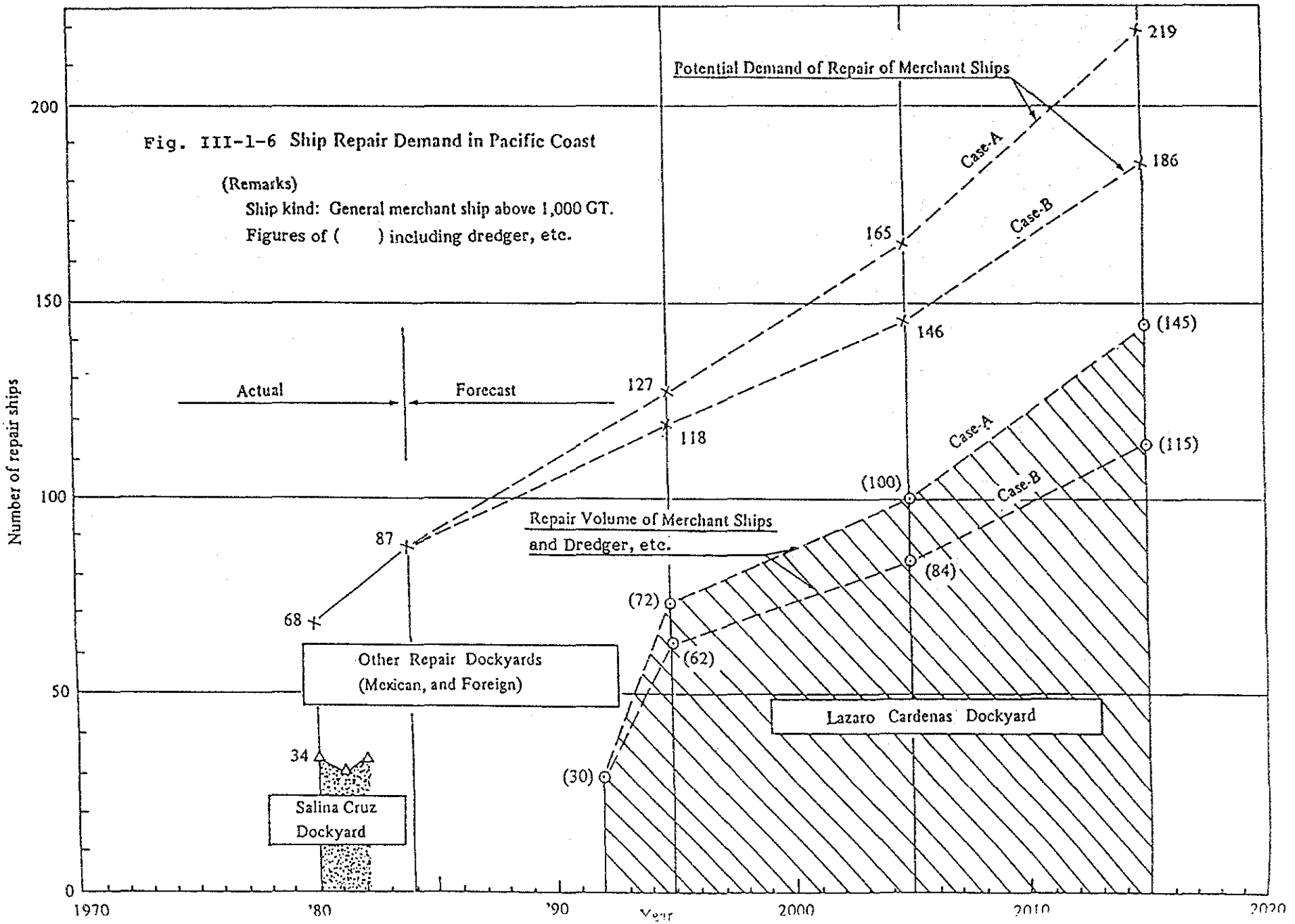


Fig. III-1-6 Ship Repair Demand in Pacific Coast

(Remarks)

Ship kind: General merchant ship above 1,000 GT.

Figures of ( ) including dredger, etc.