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UNITED MEXICAN STATES

FEASIBILITY STUDY ON THE REPAIR DOCKYARD IN LAZARO CARDENAS

FINAL REPORT

SUMMARY

MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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1. PREAMBLE

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 domestic 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.

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.

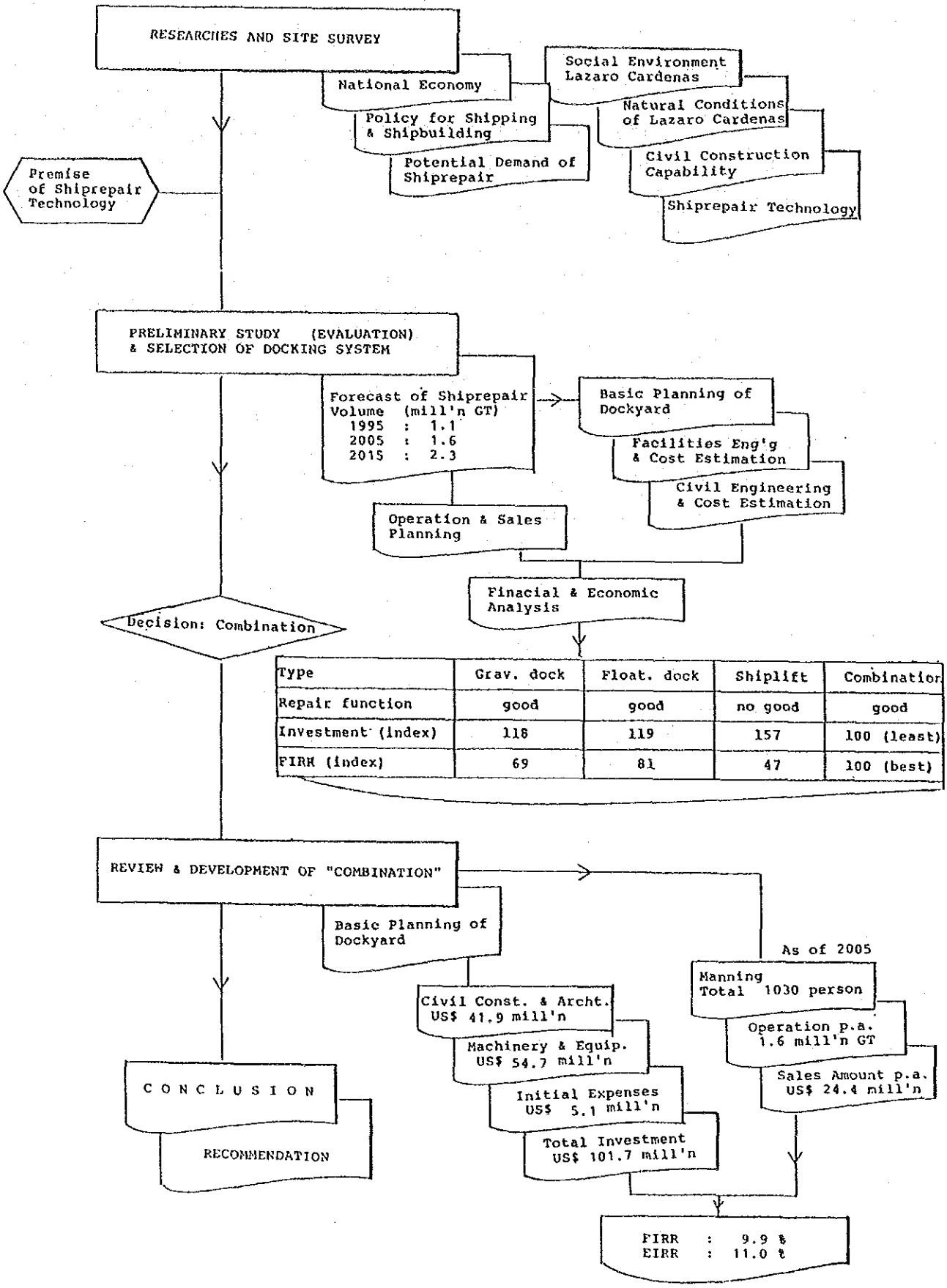


Fig. 1-1 FLOW & RESULT OF FEASIBILITY STUDY

2. FORECAST OF SHIPREPAIR DEMAND

2. FORECAST OF SHIPREPAIR DEMAND

2-1 Conditions assumed for demand forecasting

2-1-1 Premise

As general rule, the size of market expected for a given shiprepair yard is determined by the number of ships calling at neighboring ports, which number would, in turn, depend on such factors as volume of trade, activity of the petroleum industry, and the general economic situation of the country in question.

In the present instance, the alternative premises given below were assumed covering different cases currently foreseeable for the Mexican economy and the petroleum business:-

- 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.

2-1-2 Target year

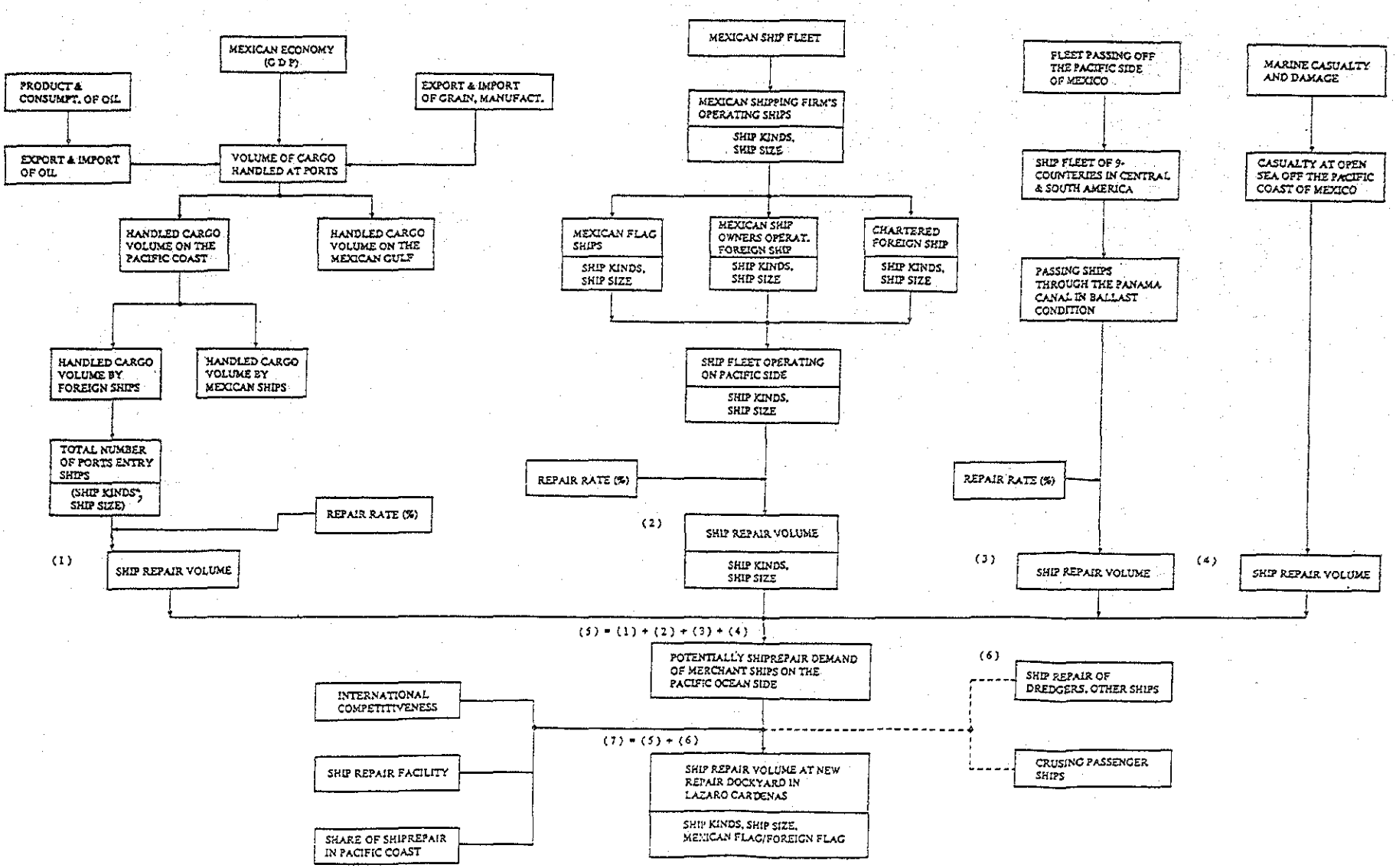
The base year is 1984 or '85, forecasts are made for the target years 1995, 2005 and 2015.

2-1-3 Forecasting method

In order to assess the tonnage potentially requiring repair work in Mexico, a research has been made concerning the trends of the various factors associated with demand for shiprepairing over the past five to ten years, analyzing the correlation between such demands and the volume of shiprepair work. And, potential demand for the volume of shiprepair work in the target years has been derived from the correlation between vessels owned by Mexican shipping firms, chartered foreign vessels, foreign ships trading in and out of Mexico and the volume of cargoes handled at ports, as well as from the vessels passing on the way to and from the Panama Canal or off the Mexican coast. Then the volume of shiprepair work at a repair dockyard in Lazaro Cardenas in the target years was forecast taking into account its competitiveness both in the international and in domestic markets.

These variable factors and their correlations as well as the flow of the forecasting method are shown in Fig. 2.1.

Fig. 2-1 New Shiprepair Yard Project in Lazaro Cardenas — Procedure Flow of Market Survey for Shiprepair Work



2-2 Sea-borne trade and maritime transport

The Mexican economy is currently depressed by such factors as accumulated foreign debt and stagnant oil price, but in the long run, it can be expected to revive in keeping with the recovery of world economy; gross domestic product is estimated to grow annually to 1995 at 1.0 to 3.0 percent, and thereafter at 1.5 to 3.0 percent. The low and higher values cited above represent the forecasts based on Cases B and A, respectively, and this will apply hereafter throughout this document, wherever upper and lower values are given for forecast data.

The growth of economic activity as forecast above will induce corresponding expansion of foreign trade, with the volume of cargo handled in Mexican ports increasing from the 152.2 million tons marked in 1985 to 169.9 - 227.5 million tons in 1995, to 212.2 - 337.7 million tons in 2005 and to 261.2 - 485.8 million tons in 2015.

Of the above volume, the rising share of the Pacific Coast trade will increase the portion of cargo handled in Pacific ports from the 45.5 million tons of 1985 to 58.2 - 74.1 million tons in 1995, to 74.5 - 120.7 million tons in 2005 and to 95.4 - 196.5 million tons in 2015.

The foregoing cargo will be carried in ships of Mexican flag numbering 86 in 1984, rising to 112 in 1995, 136 in 2005 and to 174 in 2015, while foreign vessels calling at Pacific Coast ports will increase from the 1,444 in 1985 to 1,655 - 2,120 in 1995, 2,065 - 3,180 in 2005 and to 2,800 - 4,900 in 2015.

For further detailed figures, see Table 2-1.

Other ships considered susceptible to repair on the Mexican Pacific Coast are those passing neighboring waters, particularly those of 8 Latin American countries that take the Panama Canal and pass these waters under ballast. These ships, counting 475 in 1984, are forecast to increase to 580 in 1995, to 690 in 2005, and to 825 in 2015.

Table 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	

2-3 Volume of shiprepair demand

2-3-1 Potential demand

The potential demand for shiprepair has been derived by considering the probable number of vessels needing repair among:-

- Ships flying Mexican flag
- Foreign ships calling at Mexican ports
- Specific types of ship passing the Panama Canal
- Ships involved in casualty on the Pacific Coast.

The resulting potential demand for shiprepair that amounted to 86 in 1984, is forecast to increase to 118 - 127 in 1995, to 146 - 165 per year in 2005 and to 186 -219 in 2015.

Actually, in 1984, however, only 34 --or less than half-- of the potential 86 ships cited above were repaired at Salina Cruz, on account of the poor competitive level of the existing shiprepair yards, the remainder having been repaired at yards in the Gulf Coast or abroad.

The foregoing forecast would indicate that, provided adequate competitiveness, a repair dockyard established on the Mexican Pacific Coast should be able to come by an ample volume of repair work (see Table 2-2).

2-3-2 Volume of market forecast for a repair dockyard established at Lazaro Cardenas

The potential demand for shiprepair work --as derived in the preceding Section-- is forecast to almost double in 20 years. Of this volume, the share to be expected for the envisaged Dockyard at Lazaro Cardenas is as derived below, assuming the Dockyard to present fair competitiveness in the international market, in terms of technological capability, working period and price of services furnished.

The resulting market expected for the envisaged Dockyard, including that for repair of both general cargo and special service vessels such as dredgers, would amount to 68 in 1995, rising to 94 in 2005 and to 131 in 2015, to cite values intermediate between the Case A and B (see Table 2-2 and Fig. 2-1).

It should be noted here that the foregoing figures represent the volume of repair work that can be secured by the envisaged Dockyard without depleting the existing shiprepair yards at Salina Cruz of its current custom.

2-4 Maximum size of ships to be repaired

The maximum size of the ships to be repaired at the envisaged Dockyard has been determined in consideration of such factors as:-

- World trend toward larger ship sizes
- Trend toward large sizes of ships belonging to the Mexican merchant fleet
- Trend toward larger sizes particularly of ships serving the Mexican Pacific Coast
- Plans for improving the Panama Canal.

The resulting judgment of suitable maximum size of ships to be repaired at the envisaged Dockyard corresponds to what is known as PANAMAX --the largest size of ships permitted to pass the Panama Canal-- measuring 32.2 m in breadth, and of approximately 60,000 DWT (approx. 40,000 GT) capacity.

Moreover, in anticipation of future increase in ship size, and of having to repair container ships, it is advised to provide for eventual extension of repair capacity, to the extent, say, of accommodating ships up to 80,000 DWT (approx. 50,000 GT).

Table 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.

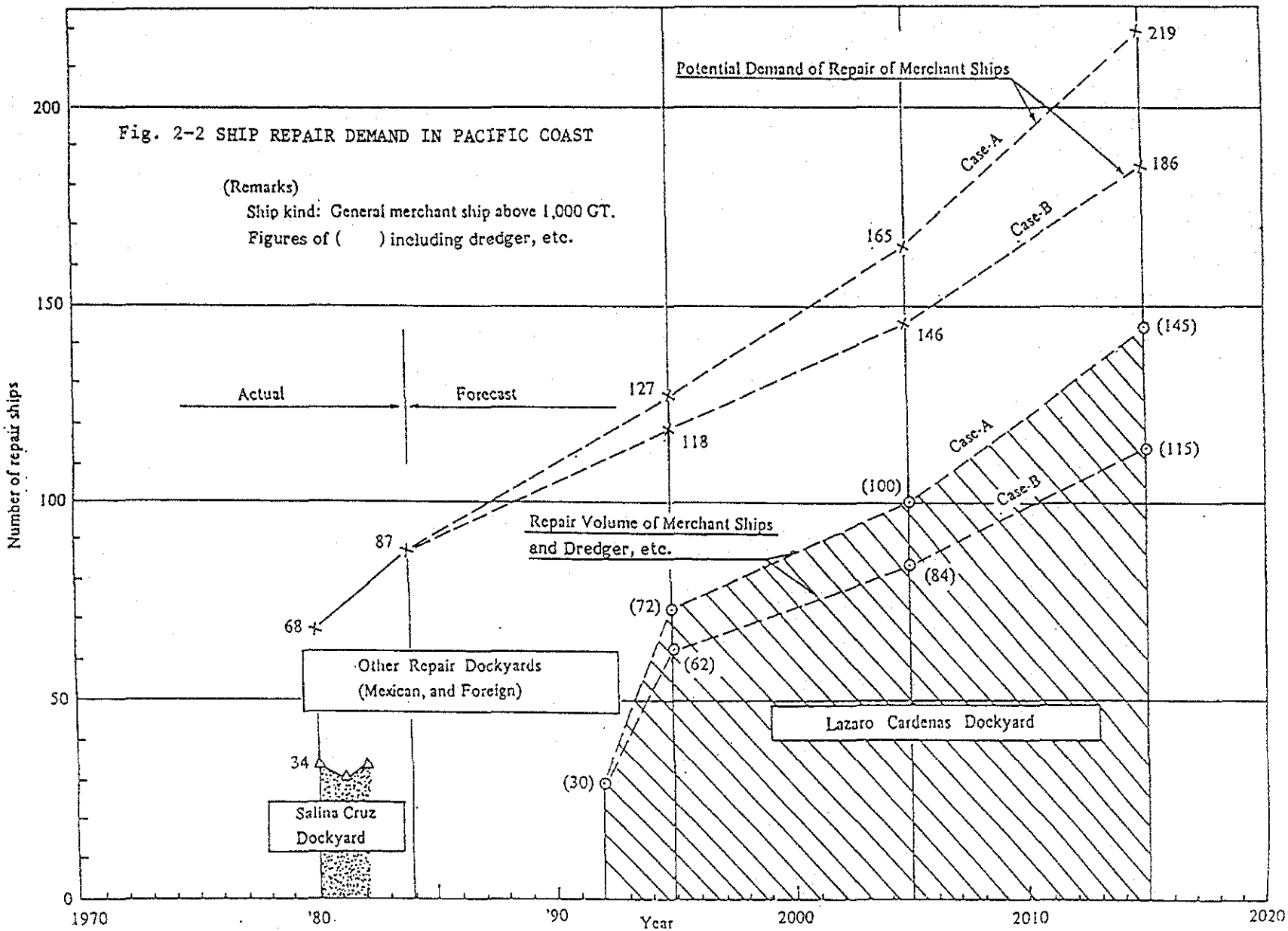


Fig. 2-2 SHIP REPAIR DEMAND IN PACIFIC COAST
(Remarks)
Ship kind: General merchant ship above 1,000 GT.
Figures of ( ) including dredger, etc.
Potential Demand of Repair of Merchant Ships
Case-A
Case-B
219
186
165
146
127
118
87
68
Actual
Forecast
Repair Volume of Merchant Ships and Dredger, etc.
(145)
(115)
(100)
(84)
(72)
(62)
(30)
34
Other Repair Dockyards (Mexican, and Foreign)
Salina Cruz Dockyard
Lazaro Cardenas Dockyard
Number of repair ships
Year
0
50
100
150
200
1970
'80
'90
2000
2010
2020

3. PROJECTED SITE

3. PROJECTED SITE

3-1 Natural environment

3-1-1 Geological/topographical conditions

(1) Geological conditions

The combination docking system that has been selected dispenses with the necessity of hauling heavy ships directly over ground, and this eliminates limitations on yard layout on account of the soil bearing power of the projected site, at least in respect of ship sizes currently envisaged to be repaired at the Dockyard.

It requires to be noted, however, that the projected site is located on alluvial soil of river delta, containing gravel and sand mixed with clay, which makes it difficult to adopt sheet piling for retaining the quay, although this would, if permitted, have been the most economical and time-saving mode of revetment.

(2) Banking

The Balsas River delta, on which the projected site is located, was originally a low-lying flatland of 2 - 4 m mean elevation, but in the course of water channel dredging, the excavated soil was disposed of on this site, to raise its elevation above 10 m in some parts. The envisaged elevation of the Dockyard is 4.3 m, and considering that additional surplus soil will be generated with progress of Dockyard construction, further disposal of soil on the site should be suspended.

3-1-2 Climate

The average yearly temperature at Lazaro Cardenas is 27°C, the maximum 34 - 37°C and minimum 11 - 13°C. The

average rainfall is around 1,200 mm, concentrated in the summer season from June to October, with almost no precipitation during the dry winter months.

The rain will, on occasion, fall in the form of tropical hurricane, but on the whole, the climate can be considered very mild and favorable for shiprepair operations, compared for instance with Japan.

3-1-3 Earthquakes

Lazaro Cardenas is located in a region susceptible to severe earthquakes. But unlike Mexico City, built on the poor subsoil of land reclaimed from lake, relatively slight damage was sustained in the disaster of 1985.

Nevertheless, the fact that the site is on sandy ground introduces the possibility --though quite small- of soil undergoing liquefaction phenomenon, and for this reason, further detailed soil survey would be advisable at the time of actual construction.

3-2 Lazaro Cardenas industrial port

3-2-1 Port facilities; industrial zone for large enterprises

Lazaro Cardenas Port is equipped with all the facilities of a modern harbor, including requisite means of transport and tug service, as well as a container yard. The hinterland industrial zone already has in operation a steelworks, a fertilizer plant, a petroleum product storage terminal, a large foundry, forge and machining works, as well as a large-diameter pipe mill. The steelworks is currently undergoing Phase - 2 extension that will double its annual production capacity to 2 million tons of steel plating. In addition, a grain terminal of 80,000 tons handling capacity will be completed to enter service in 1988. This is to be followed in 1989 by the start of construction of a 300,000 bbl refinery on the ground of the petroleum product storage terminal.

It can thus be expected that the economic activity of this industrial zone will continue its development, and that the establishment of a shiprepair dockyard in this locality will contribute a new link to the inter-industrial network that is constituted in the Lazaro Cardenas industrial zone.

3-2-2 Industrial zone for medium and small enterprises

From the outset, it was planned to establish on the Lazaro Cardenas hinterland also an industrial zone for medium and small enterprises, and a number of such enterprises have already started operation in this zone. Further development of the large enterprises in the adjacent zone should induce other smaller enterprises to follow suit in establishing themselves in this zone reserved to them, and this should greatly benefit the business operation of the envisaged Dockyard, which by nature depends for much of its operations on work subcontracted out to relatively small enterprises.

3-2-3 Technical instruction/training

An intermediate level technical school is already established at Lazaro Cardenas, and the Technical Training Center has already had a large number of trainees complete courses there. This would indicate that recruiting workers and mainstay technicians should present relatively little difficulty for the envisaged Dockyard to be newly established in the locality.

4. PLANNING OF DOCKYARD FACILITIES

4. PLANNING OF DOCKYARD FACILITIES

4-1 Basic principles

4-1-1 Guidelines adopted for planning

The Dockyard is envisaged to undertake shiprepair exclusively, and to be managed with maximum economy and efficiency. To this end, particular consideration is given in its planning to the following points:

(1) To keep investment in plant and equipment to the minimum level compatible with smooth productive activity; for this purpose, to utilize to maximum extent all services available from subcontractors and all equipment available by rental.

(2) To extend the Dockyard capacity only as and when justified by growing demand, in order to maximize return on investment.

(3) In anticipation of pursuing the above principle, to arrange from outset the Dockyard layout in such manner as to facilitate eventual additional installation of equipment or their replacement by equipment of higher performance, as and when justified by foreseen increases in shiprepair demand.

(4) To accord due consideration to preventing environmental pollution, with provision of all requisite equipment and devices.

Based on the conclusion reached consequent to Progress Report (II), of adopting the combination system, further detailed studies have been performed in respect of this system.

The reasons for selecting this system were the following:

(1) The combination system occupies the least extent of ground; it is little subject to limitations imposed by conditions of subsoil.

(2) The system permits container ships partly loaded with cargo to be repaired on floating dock, thus eliminating the risks accompanying their haulage over ground.

(3) Docking and painting work are vastly simplified on a floating dock, and its use in the combination system renders this system most efficient in operation.

(4) For repair jobs requiring extended docking, the combination system permits relatively easy installation and utilization of work bay, to avoid extended occupation of floating dock.

(5) Construction cost will be 15 to 35 percent lower than for the other alternative systems.

(6) On the other hand, the combination system will call for higher operation management techniques. While this will initially constitute a disadvantage, once the techniques are mastered, the resulting high productivity will contribute to enhancing the competitiveness of the Dockyard.

4-1-2 Planning the key facilities

(1) Determining dock size

It has been mentioned that the current market forecast for the envisaged Dockyard would place the maximum size of ships to be repaired at what corresponds to the PANAMAX, i.e., 220 m long x 32.2 m broad. In consideration, however, of the strong possibility of larger and fuller ships of economic

hull shape coming into service with progress of steelmaking and other industrial activities at Lazaro Cardenas, and with activation of exchanges around the Pacific Rim, and also in view of the large expected demand for repairing container ships, the choice has been given to a dock size of 230 m by 46 m, with lifting capacity of 33,000 tons.

(2) Berth water depth

A depth of 9 m has been chosen for the water in front of repair quay, to accommodate partly loaded container ships expected to require berthing. The maximum size of ships to be berthed alongside quay has been matched to that of the largest ships entering Lazaro Cardenas Port, i.e. 100,000 DWT (60,000 GT).

4-1-3 Number of docks, work bays, quays

To derive the requisite number of docks and quays, the waiting time for docking and berthing was estimated through simulation by Poisson distribution, for the volumes of shiprepair forecast for 1995, 2005 and 2015. The results are as given below.

Table 4-1 REQUIRED NUMBER OF DOCK AND QUAY

Item \ Year	1995	2005	2015
No. of dock required	1	2	2
Dock operation rate	94%	54%	61%
No. of quays required	2	2	2
Quay operation rate	88%	72%	86%
No. of ships to be repaired	68	94	131

4-2 Dockyard equipment

4-2-1 General layout

The general layout of the envisaged Dockyard has been determined with consideration given to the following points:

(1) To arrange the floating dock, work bay, quay and workshops close to each other, for easy distribution of utilities, as well as smooth circulation of personnel, materials and components.

(2) To arrange for smooth flow of materials and components in cases where block construction will have to be utilized to cope with large-scale hull repair on ships involved in casualty.

(3) To arrange for eventual addition of another work bay, to supplement the single bay considered to suffice for the time being --say until 2015.

(4) To arrange for 2 ships berthing --when necessary-- simultaneously along each of the 2 quays, which should suffice say until 2015.

4-2-2 Key equipment

(1) Manipulation of shafting and rudder

Hoisting and transferring equipment is to be arranged adequately to permit dismounting and transfer to workshop of shafting and rudder from ships of the following sizes:-

- Docked ships: Of largest size to be docked
- Ships moored alongside quay: Of PANAMAX size.

The workshops are to be equipped accordingly, to handle the shafting and rudders thus brought in for repair.

(2) Manipulation of large hull blocks

The workshops are to be equipped --together with ancillary handling/transferring facilities for fabricating hull blocks weighing up to 30 tons and transferring them to dock or work bay.

4-2-3 Floating dock

The floating dock is to be of the following principal specifications:

(1) Width between side walls to measure 46 m.

(2) Length to be initially 230 m, but arranged to be eventually extended as and when necessary in the future.

(3) Maximum draft of 8.5 m, and lifting capacity of 33,000 tons, in consideration of container ships having to be docked partly loaded.

(4) Work bay to accommodate repair ships of up to 17,000 ton displacement.

(5) Utilities --electric power, water, compressed air, gas-- to be supplied from land.

(6) Mooring by chain and anchor, to facilitate translation when necessary for transferred docked ship to work bay.

(7) Safe and rapid transfer from dock to work bay by means of computer-controlled ballast manipulation.

(8) Crane installed on wing wall, to permit overhauling and landing shafting, propellers, rudders, hatch covers and other large fittings of the largest ship to be docked.

(9) Travelling stage installed on inner face of wing wall.

(10) High-pressure washing system.

(11) Anti-corrosive processing of outer walls, to ensure service life of at least 30 years.

The general arrangement and specifications of the floating dock are presented in Fig. 4-1 and Table 4-2.

4-3 General layout of dockyard Facilities

The general layout of the Dockyard facilities is shown in Fig. 4-2.

4-4 Key equipment

The key equipment of the Dockyard are listed in Table 4-3, together with their principal specifications.

4-5 Dockyard construction

4-5-1 Construction schedule

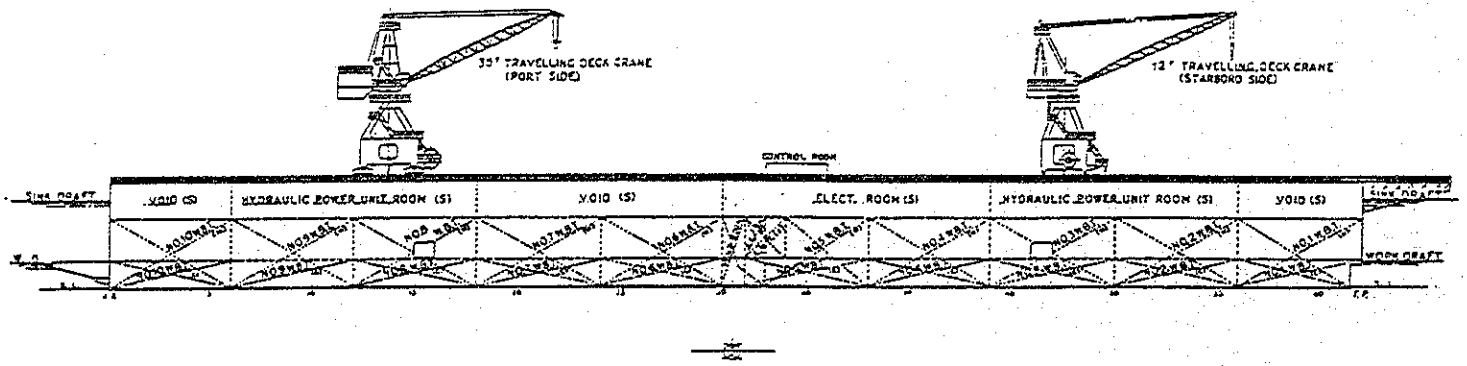
The construction schedule has been drawn up assuming the envisaged project to be approved by the Government of Mexico and other competent authorities by end 1989, to permit Project implementation to commence at beginning of 1990.

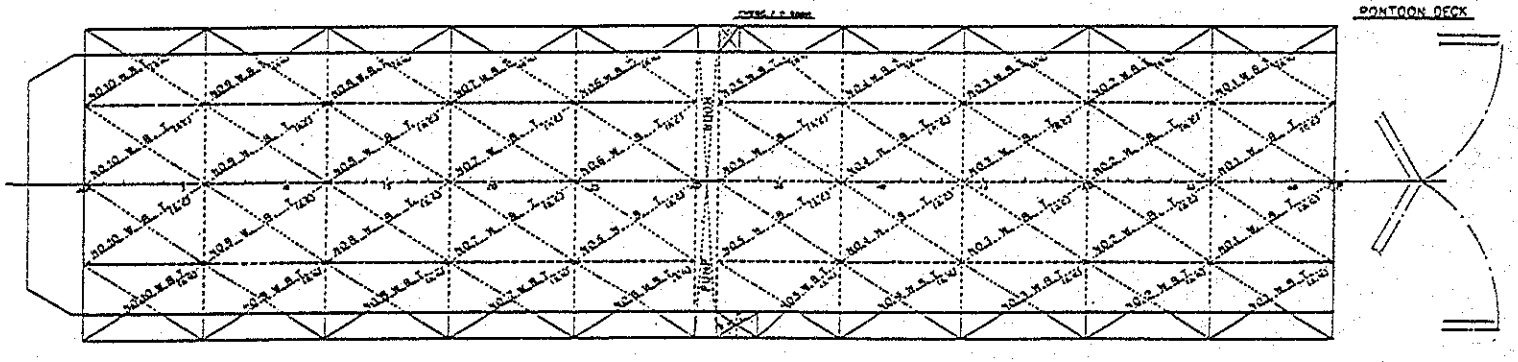
The master schedule is presented in Fig. 4-3, and is marked by key events timed as follows:-

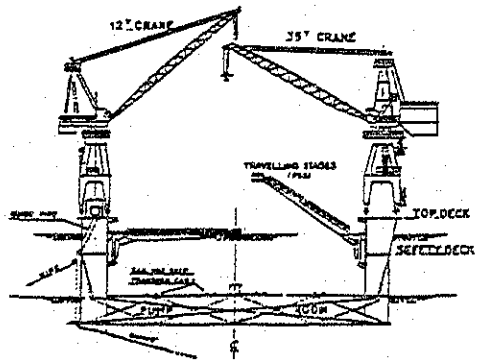
- January 1990 : Start of preparations for construction
- July 1990 : Start of construction - Phase I
- December 1992: Completion of construction - Phase I
- January 1995 : Start of construction - Phase II
- June 1996 : Completion of construction - Phase II.

4-5-2 Construction cost

The estimated cost for investment in Dockyard construction is as given in Table 4-4. The amounts indicated are based on the price level of June 1987.







SECTION

PRINCIPAL PARTICULARS

LENGTH OVERALL		230.00
LENGTH OVER PONTOON	(M.L.O.)	220.00
BREADTH BETWEEN OUTER WING WALLS	(M.L.O.)	55.00
BREADTH BETWEEN INNER WING WALLS	(M.L.O.)	46.00
DEPTH TO TOP DECK	(M.L.O.)	18.70
DRAFT AT WORKING	(M.L.O.)	6.50
DRAFT AT SINKING	(M.L.O.)	15.70
LIFTING CAPACITY		33000MT
BALLAST PUMP		2 SETS
TRAVELLING DECK CRANE (35T, 25.00m RADIUS)		1 SET
DO (12T, 25.00m RADIUS)		1 SET
TRAVELLING STAGE		2 SETS
HYDRO-JET PUMP	(300 m³/min × 160 m/min)	2 SETS

Fig. 4-1
GENERAL ARRANGEMENT OF
LIFTING CAPACITY 33000 MT FLOATING DOCK

Table 4-2 OUTLINE SPECIFICATION OF LIFTING CAPACITY 33,000 MT FLOATING DOCK

1. Type of Dock : Steel Caisson (1-piece) type with a steel platform on aft end.

2. Classification : NK or LRS or ABS

3. Lifting capacity : 33,000 metric tons at freeboard of 300 mm from pontoon deck.

4. Transfer capacity : 17,000 metric tons

5. Principal dimensions :

Length, overall	230.00 m
Length, over pontoon	220.00 m
Breadth, between outer wing walls	55.00 m
Breadth, between inner wing walls	46.00 m
Depth to top deck above base line	18.70 m
Designed working draft	4.60 m
Designed sinking draft	15.70 m
Water depth above keel blocks at sinking	9.00 m
Height of keel blocks	1.60 m

6. Electric power, fresh water, fire-fighting water compressed air and gases shall be supplied from on-shore facilities.

7. Mooring System : Chain, anchor and wire rope mooring system. Mooring windlasses and winches shall be equipped for dock translation.

8. Dockyard furnished equipment :
All connecting devices such as accesses, cables and hoses between shore and Dock.

9. Ballast piping system :

Ballasting & deballasting time :	within 3 hours
Ballast pump in a pump room :	2 sets
Ballast control :	Remote-control in control room

10. Computerized ballast operation system

1) Lifting and sinking mode
Dock shall be operated by instruction of computerized ballast operation using the data such as draft, trim, hull, diflection, ballast level.

2) Transfer mode
Dock shall be operated by instruction of computerized ballast operation using the sill load and ship position in addition to above data. As a result Dock can maintain flat level same as Work bay.

11. Major docking equipment :

Winches	Electro-Hydraulic type	
	15 t x 15 m/min, 2-drum	4 sets
	8 t x 15 m/min, 1-drum	4 sets
	Hyd. pump unit	4 sets

12. Corrosion protection :

Appopriate method for corrosion protection shall be taken for Dock to maintain good in use more than thirty years. Impossed current system shall be applied to outer surface below working draft.

13. Duty room etc. :
1-control room (air-conditioned)
2-toilets

14. Repair work equipments :

Travelling cranes 35 ton x 1, 12 ton x 1)	2 sets
Travelling stages	2 sets
High pressure water cleaning system with multi-nozzle and pump (300 kg/cm^2 x 160 l/min.)	2 sets
Flying gangway at fore end.	

Note:

1) Design, construction and tests shall be in accordance with Builder's standards and practices.

2) All materials and equipment shall be generally of Japanese make and in accordance with the Japanese Industrial Standard (JIS), the Builder's Engineering standards and/or the current Japanese manuafactures' standards.

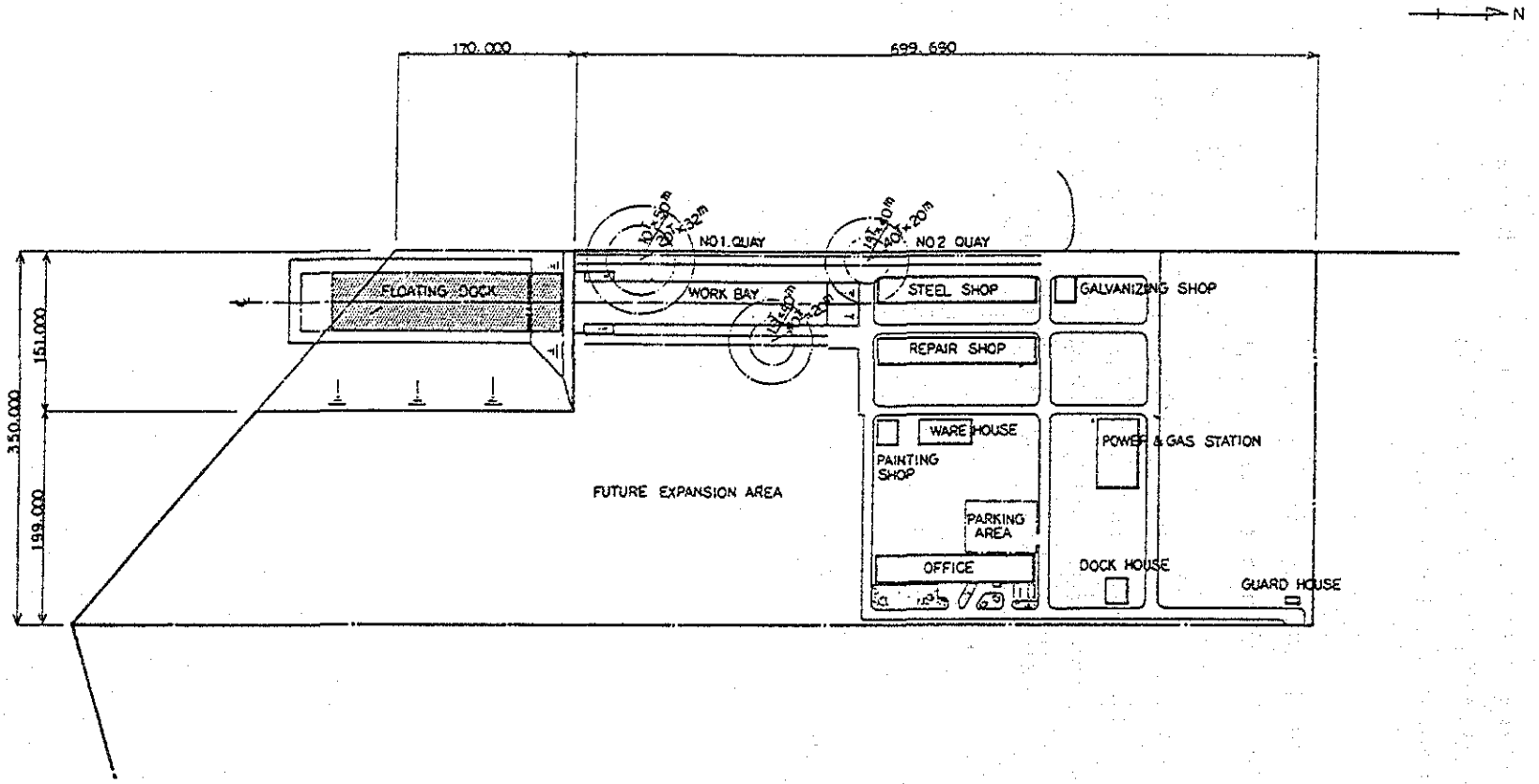


Fig. 4-2 GENERAL ARRANGEMENT OF REPAIR DOCKYARD

Table 4-3 OUTLINE SPECIFICATION OF FACILITIES

No.	Item	No.	Main Particulars
1.	Yard Area	1	362409 m^2
2.	Floating Dock	1	230m x 55m
			Lifting Capacity 33,000 MT
	Access Ladder	1	4m x 10m
3.	Transfer System	1	Transfer Capacity 17,000 MT
4.	Shiprepair Quay	1	460m
			Depth 9m & 6.5m
	Level Luffing Crane	1	40T x 20m/15T x 40m
		1	20T x 32m/10T x 50m
	Access Tower	2	3m x 4m x 10m
	Shore Ladder	2	
	Mooring Winch	2	10T x 20m
	Rubber Fender	20	V type
	Bitt	8	100T Bitt
	Welding Machine	60	500 Amp, 300 Amp
5.	Work Bay	1	230m x 40m
	Level Luffing Crane	1	40T x 20m/15T x 40m
	Welding Machine	60	500 Amp, 300 Amp
	Dogshore and Block for Ship	250	
	Towing Tractor	2	
6.	Steel Shop	1	150m x 25m
	Steel Storage Area	1	40m x 25m
	Fabrication Area	2	28m x 9m
	Hull Assembly Slab	1	43m x 9m
	Hull Outfitting Assembly Slab	2	10m x 9m
	Tools, Material Storage Place	1	10m x 7.5m
	Overhead Travelling Crane	2	10T x 25m x 9m
	Semi Gantry Crane	2	2T x 10m x 6m
	Hydraulic Press	1	500T
	Shearing Machine	1	6mm x 1.8m

No.	Item	No.	Main Particulars
	Bending Roller	1	20mm x 2.4m
	Bench Grinder	1	300ø SGE-T
	Bench Drilling Machine	1	19ø ASD-410
	Abrasive Cut off Machine	1	455ø HCW-18M
	Welding Machine	35	500 Amp. 300 Amp
	Semi Automatic Gas Cutter	8	
	Welding Rod Oven	1	
	Movable Shed	2	15m x 25m
7.	Repair Shop	1	150m x 25m
7-1.	Piping Shop	1	40m x 25m
	Pipe Storage Area	2	7m x 6.5m
	Assembly Slab for Template Pipe	1	5m x 3m
	Assembly Slab	2	3m x 3m
	Hydraulic Test Space	1	10m x 5m (Common Use)
	Overhead Travelling Crane	1	5T x 25m x 9m
	Abrasive Cut off Machine	1	455ø HCW-18M
	Pipe Bender	1	3" Ram Type
	Hydraulic Water Pump	1	500 kg/cm^2 x 19ℓ/min
	Threading Machine	1	1/4" - 2"
	Bench Grinder	1	300ø SGE-T
	Welding Machine	20	300 Amp
	Welding Rod Oven	1	
	Finishing Table with Vise	2	2m x 2m
	Wall Crane (Hoist)	2	0.5T x 8m
7-2.	Finishing Shop	1	35m x 25m
	Overhead Travelling Crane	1	25T x 25m x 9m
	Chemical Cleaning Equipment	1	4 Tank with Heating Equipment
	Hydraulic Jet Cleaning Equipment	1	2000 kg/cm^2 x 5.6ℓ/min
	Lapping Machine for Suction Valve	1	for Valve HK-150G
	Lapping Machine for Exhaust Valve	1	for Valve Seat EC-160
	Bench Drilling Machine	1	1/2 H

No.	Item	No.	Main Particulars
	Working Table with Vise	3	3m x 2m
	Tools, Material Storage Place	1	7.5m x 5m
7-3.	Machining Shop	1	30m x 25m
	Overhead Travelling Crane	1	25T x 25m x 9m
	Lathe	1	1m x 2m
	Lathe	1	0.6m x 3m
	Shaper	1	Stroke 600mm
	Slotter	1	Stroke 300mm
	Universal Fraise	1	350mm x 1.5m
	Radial Drilling Machine	1	
	Portable Drilling Machine	1	
	Portable Boring Machine	1	250ø x 9m
		1	150ø x 2m
	Dynamic Balancing Machine	1	800 kg
	Marking and Measuring Table	2	4m x 3m
	Machining Tools		
	Measuring Tools		
7-4.	Electric Shop	1	25m x 25m
	Dryer	1	
	Coil Winding Machine	1	
	Working Table	2	3m x 2m
8.	Galvanizing Shop	1	25m x 20m
	Caustic Soda Bath	1	3m x 1m x 1.2m
	Sulfuric Acid Bath	1	3m x 1m x 1.2m
	Washing Water Bath	2	3m x 1m x 1.2m
	Flux Bath	1	3m x 1m x 1.2m
	Galvanizing Bath	1	3m x 1m x 1.2m
	Quenching Water Bath	1	3m x 1m x 1.2m
	Overhead Travelling Crane	2	2T x 2 Hoist x 20m
	Control Room	1	
	Heating Equipment	1	

No.	Item	No.	Main Particulars
9.	Power and Gas Station	1	65m x 40m
	Electric Substation (Main)	1	2 sets of 13.8KV/6.6KV x 3,000KVA
	Aux Substation	1	6.6KV/440V/110V x 1,500KVA for Quay, Work Bay, Steel Shop
	Transmission Cubicle	7	for Repair Shop, office, Warehouse, etc.
	Invertor	1	380V x 50Hz x 100KVA for Ship's Supply
	Switch, Panels	1 set	
	Air Compressor	2	460KW, 7 kg/cm^2 x 44m^3/min
	Compressed Air Reservoir	2	7 kg/cm^2 x 14m^3
	Control Panel for Air Compressor	1	
	Industrial Water Pump	2	80m^3/h x 3.5 kg/cm^2
	Potable Water Pump	2	80 m^3/h x 3.5 kg/cm^2
	Overhead Travelling Crane (Hoist)	1	2T x 16m x 6m
	Industrial Water Storage Tank	1	500m^3
	Potable Water Treatment Plant	1	300m^3/day
	Gas Evaporator	1	(Rental)
	Oxygen Evaporator	1	(Rental)
10.	Warehouse	1	50m x 25m
	Overhead Travelling Crane	1	10T x 25m x 9m
	Shelf	15	1m x 3m x 4m
11.	Painting Shop and Store	1	25m x 20m
	Overhead Travelling Crane (Hoist)	1	2T x 20m x 6m
	Shelf	3	1m x 3m x 4m
12.	Vehicles		
	Truck	2	10T, 5T
	Fork Lift	2	3T, 2T
	Motor Truck	2	1T

No.	Item	No.	Main Particulars
	Trailer	1	40T x 12m x 3m
		1	15T x 10m x 2.6m
		2	5T
		2	2T
	Ambulance Car	1	
	Business Car	2	
13.	Stages		
	Stage Tower for Stern and Stem	2	2m x 4m x 8m
	Painting Stage	2	2m x 4m x 10m
	Stage Blank	1,000	50mm x 300mm x 4m, 2m
	Convertible Steel Pipe	200 set	
14.	Pollution Preventive Equipment		
	Waste Water Treatment	1	For Finishing Shop
	Equipment	1	For Galvanizing Shop
	Sewage Treatment Plant	1	
	Oily water Separating Tank	1	
	Oil Fence	1	1,200m
	Incinerator	1	2T/day
15.	Vessels		
	Work Boat	1	50HP
	Rubber Boat	1	
	Oil Barge	1	200T
16.	Piping		
	Industrial Water Line		150A x 4350m
	Fire Line		150A x 4350m
	Potable Water Line		100A x 3600m
	Compressed Water Line		150A x 3700m
	Oxygen Line		50A x 3600m
	Gas Line		50A x 3600mm

No.	Item	No.	Main Particulars
17.	Electric Wiring		
	Shiprepair Quay		
	Floating Dock		Total about 13,000m
	Work Bay		
	Work Shop		
	Power and Gas Station		Total about 7,500m
	Office		
18.	General		
	Welding Machine	150	500 Amp, 300 Amp
	Ventilating Fan	20	500ø
		40	Small Type 2KW
		10	Anti Explosion Type 7.5KW
	Chain Block	9	Air Chain Block, 10T, 5T, 2T
		6	Electric Chain Block, 20T, 5T, 2T
		12	Chain Block, 5T, 1T, 0.5T
	Hydraulic Water Test Pump	1	200 kg/cm^2
	Hydraulic Oil Test Pump	1	200 kg/cm^2
	Sea Water Ballast Pump	1	120m^3/h x 3.5 kg/cm^2
	Bilge Pump	6	
	Paint Spray Equipment	8	
	Vacuum Cleaner	5	
	Gas Header	50	
	Gas Hose	5,000	25m x 100 sets x 2 pcs
	Air Header	50	
	Air Hose	2,500	25m x 100 pcs
	Cabtire	10,000	20m x 500 pcs
	Temporary Light	200	Anti Explosion Type
		400	Ordinary Type
	Pallet	10	For Fitting 1.2m x 3m x 0.7m
		10	For Fitting 1.5m x 4m x 0.8m
		10	For Parts 1m x 1m x 0.7m
	Oil Jack	40	50T, 30T, 20T, 10T, 5T

No.	Item	No.	Main Particulars
19.	Others		
	Tools, Jigs, Measuring Equipment, etc.	1 set	
20.	Office Supplies		
	Copy Machine	1	
	Electro Copy Machine	1	
	Telefax Equipment	1	
	Telephone & Exchanger	1 set	
	Computor and Soft	1 set	
	Office's Furniture	1 set	

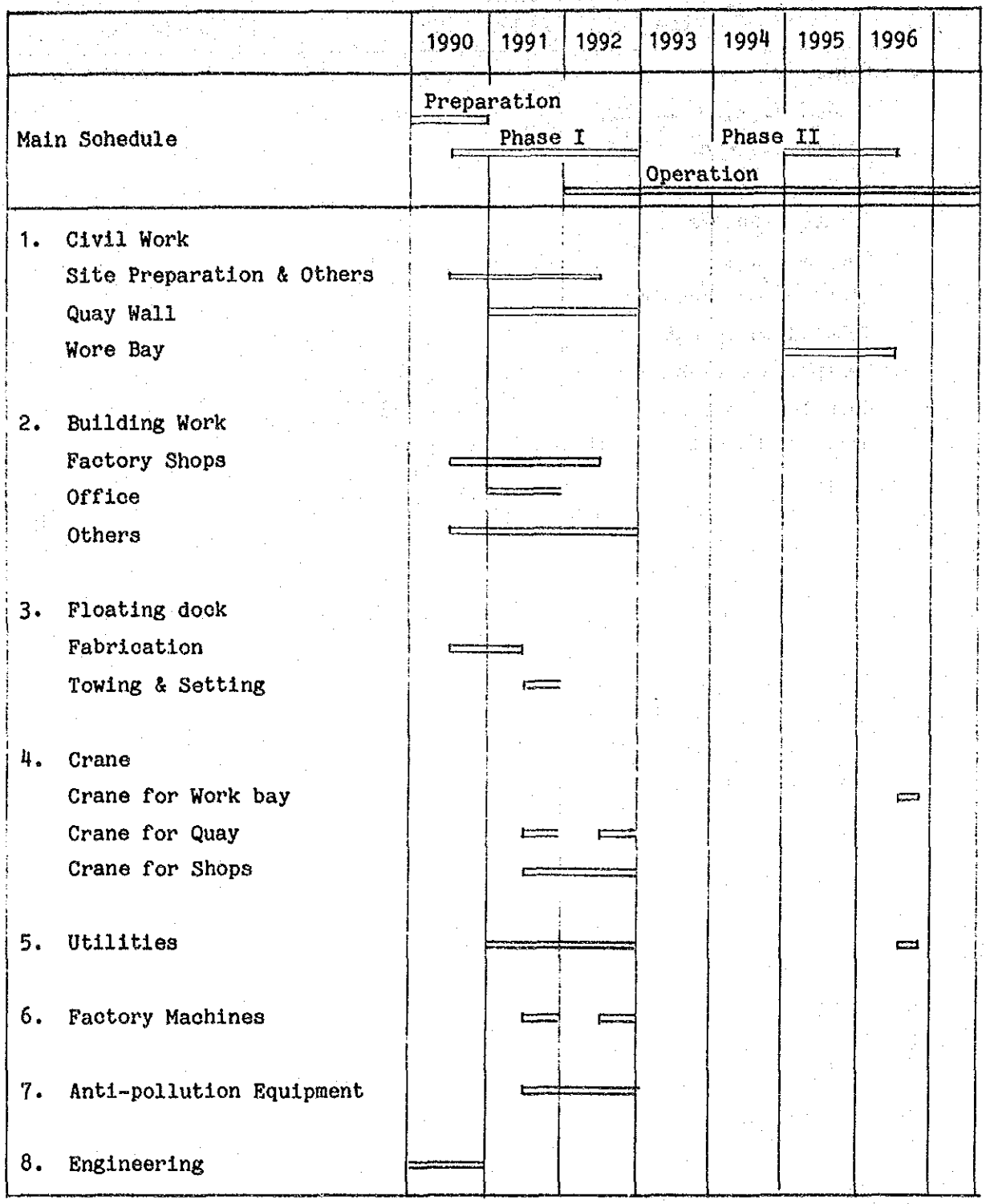


Fig. 4-3 CONSTRUCTION SCHEDULE

Table 4-4 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

5. PLANNING OF DOCKYARD MANAGEMENT

5. PLANNING OF DOCKYARD MANAGEMENT

5-1 Basic Principles

The Lazaro Cardenas Repair Dockyard is to be managed holding as basic aims:-

- To provide with repair service all ships of Mexican flag, as well as other ships calling at Mexican Pacific Coast ports, or passing adjacent waters.
- To contribute thereby to the economic and social progress of the Lazaro Cardenas district and of the Mexican nation at large, in such aspects as:=

  = Increase of employment opportunities
  = Inflow of foreign currency
  = Enhancement of technical capability in domains related to shiprepair
  = Development of associated industries.

The foregoing aims are to be realized by following a policy of:

(1) Striving to provide shiprepair services of level that will gain international recognition.

(2) Being equipped to provide, in principle, any and all kinds of shiprepair service that may be required by ships calling at Lazaro Cardenas.

(3) Operating efficiently with the minimum strength of direct and indirect personnel.

(4) Arranging for technical assistance to acquire the requisite managerial and technical know-how of repair dockyard operation along the lines prescribed above.

NOTE: The repair of small ships and of fishing boats is to be excluded from the scope of the envisaged

Dockyard, to avoid competition with existing small and medium shipyard.

5-2 Marketing

5-2-1 Scope of repair work to be undertaken

The envisaged Dockyard is to furnish shiprepair services to merchant ships and special service vessels such as dredgers. Naval vessels, as well as ships smaller than 1,000 GT, are to be excluded.

With particular respect to container ships, while their repair calls for application of advanced methods and skills, and for strict respect of stringent delivery periods, repair orders for this type of ship should be actively sought, in consideration of the fact that there is a container yard at Lazaro Cardenas, and that occasions for repairing container ships can be expected to increase in the years to come.

With respect to large special operations like main engine conversion and jumboizing, while they should eventually be included in the scope of work of the Dockyard, such operations are to be excluded for the time being, in consideration of limitations applying in the initial stages of Dockyard operation in such aspects as capability for design, availability of requisite materials, and capability for schedule control.

On the other hand, large casualty repairs --involving mainly the replacement of bottom plating --are to be actively sought, even at the cost of seeking assistance from outside consultants for their execution.

5-2-2 Modes of shiprepair operations to be practised

Shiprepair operations are to be performed at the envisaged Dockyard in the following modes:

(1) General repairs: Repairs performed with ship docked, or upon transfer to work bay --including periodical surveys, and casualty repairs.

(2) Repair alongside quay: Repair performed with ship moored alongside quay, without docking --including light casualty repairs.

(3) Running repairs: Repairs performed outside Dockyard --for instance, at the container yard-- by workers sent out for the purpose.

5-2-3 Repair charges

The price to be charged for shiprepair service covers a wide variety of items including work on hull, on machinery and on accommodation, and an infinite range in scope of work involved. Moreover, similar types of repair work will cost differently depending on type, size and age of ship, as well as on the part of ship on which the work is performed. In addition, the quoted prices of shiprepair work are largely influenced by the situation of shipping and shiprepairing markets prevailing at the time of quotation.

All the foregoing factors make it extremely difficult to forecast shiprepair prices, and in this instance, data from shipyards at Veracruz and Ensenada were treated by regression analysis along with Japanese statistics. The analysis resulted in estimates of US$17.80 per GT for general repair, and US$2.23 for repair alongside quay.

The forecast of work volume and sales for succeeding years of Dockyard operation is as presented in Table 5-1 and Table 5-2. In this forecast, no account has been taken of large casualty repairs, which can only be expected to contribute at most several percent to total sales, but which can be expected to bring high profit. Thus, in actuality, orders for such work can be expected to provide a contingency margin of profit over and above the estimated figures.

Table 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 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.

5-3 Plan of operation

5-3-1 General

Shiprepair capacity is to be increased in gradual steps, with due consideration given to maintaining reasonable capacity utilization with the input of work from market. Rashly increasing repair capacity is to be avoided, since it will adversely affect progress of productivity, which latter largely depends on familiarization/assimilation of skills by workers and on enhancement of managerial capacity by supervisory personnel.

On the other hand, shiprepair work is inherently subject to fluctuations in workload, and peaks in load should be absorbed by subcontracting out work to outside enterprises.

5-3-2 Preparatory work in readiness for start of Dockyard operation

The shiprepair Dockyard is envisaged to start commercial operation in January 1992. Preparatory work -- including construction of the Dockyard-- is to start in January 1990 as shown in Fig. 4-3.

The plan of Dockyard operation envisages repair work on about 30 ships averaging 15,000 GT to be repaired during the 1st year of operation, representing an aggregate tonnage of 390,000 GT performed in general repairs in dock or on work bay, and 60,000 GT in repairs alongside quay.

In order to accomplish this amount of shiprepair work to customer satisfaction in terms of workmanship and delivery date, the personnel organization for managing the Dockyard and worker skill will both need to be stably established by the time the Dockyard first enters commercial operation.

To this end, the personnel organization and worker training is to start with a lead time of 2 years, during which, occasion for familiarization by supervisory personnel with administrative techniques would be provided by managing the Dockyard construction, and for assimilation of skills by workers through participation in the fabrication of steel members to constitute workshop buildings and other structures. Following this, 6 months before start of commercial operation, actual participation in running repairs undertaken on ships berthed in Lazaro Cardenas Port will provide occasion for technicians and workers to gain experience in actual shiprepair work.

5-3-3 Stabilization of Dockyard operations

By 1995, the Dockyard operations are to be stabilized, with income covering expenses, stably maintained productivity of in-house operations, firmly established business relations with local enterprises through subcontracting and procurement connections.

Upon such stabilization --i.e. in 1995-- the volume of operations is to reach 2.6 times that of 1992, with 68 ships repaired aggregating 1,190,000 GT.

This stabilization could only be realized through intensive instruction and training administered during the initial years of operation, and this is to be attained by appointing experts from a country advanced in shipbuilding to key positions in the managerial and technical departments, to serve in establishing a stable and effective pattern of operation, and who will be gradually replaced by domestically recruited personnel as they come to assimilate the system of operation.

5-3-4 Maturation of Dockyard operations

By 2005 or by 2015 --respectively 13 and 23 years after start of commercial operation-- the Repair Dockyard will, through sustained effort spent in business

management and improvement, have gained full maturity, regularly earning stable profit. Upon such maturaltion, further rapid progress in productivity such as recorded during the initial years will no longer be possible, yet continued steady efforts in enhancing productivity will in the long run prove to result in significant enhancement of productive capacity without appreciable increase of personnel strength. Operations are envisaged to attain in 2005 a level of 94 ships repaired aggregating 1,600,000 GT and of 131 ships aggregating 2,300,000 GT in 2015.

5-4 Productivity; Staffing

5-4-1 Productivity observed in Mexican shipyards

Observations made by the Study Team at 4 Mexican shipyards visited in the course of their Study revealed average productivity to attain not more than a fraction of what would be expected in corresponding Japanese shipyards, not to speak of an instance of docking period exceeding 10 times what is current in Japan.

This is not to say that individual workers are incompetent or lazy: The shortcomings lie in the overall yard equipment and management, including layout, equipment and tooling availability, management techniques, work procedures, procurement practice, schedule control.

5-4-2 Productivity envisaged for the Lazaro Cardenas Dockyard

Table 5-3 gives the target values envisaged for productivity (workload per direct manhour applied) and for average periods required for completing a repair job. The targets might appear high in consideration of currently prevailing levels, but in the light of past experience of the Study Team, and with application of the latest managerial techniques, attainment of the target values should be quite feasible.

Operations in shop and on board are to be performed in 2 shifts, in order to shorten the period required for completing a job.

Table 5-3 ESTIMATION OF MANHOUR AND WORKING PERIOD FOR A16,500GT SHIP

		periodical survey	casual repair	afloat repair	remarks
1983	MH/GT	2.65			estimation based
1984	dock period (day)				on records of
	afloat period (day)				Veracruz Shipyard
	total working day				
1995	MH/GT	1.59	1.27	0.196	
	dock period (day)	6.0	4.5	—	
	afloat period (day)	7.5	6.0	7.5	
	total working day	13.5	10.5	7.5	
2005	MH/GT	1.33	1.07	0.164	
	dock period (day)	4.8	3.6	—	
	afloat period (day)	6.0	4.8	6.0	
	total working day	10.8	8.4	6.0	
2015	MH/GT	1.27	1.02	0.157	
	dock period (day)	4.0	3.0	—	
	afloat period (day)	5.0	4.0	5.0	
	total working day	9.0	7.0	5.0	

5-5 Personnel organization

5-5-1 Principles governing personnel organization

The personnel organization has been planned with a view to maximizing managerial efficiency for operating as a private enterprise, without consideration to following the pattern of existing Mexican shipyards.

The points held in view were:

(1) To minimize the strength of indirect personnel

(2) To establish clearcut lines of command

(3) To accord priority to ensuring high capability for job planning and for engineering

(4) To have operations in shop and on board performed in 2 shifts, where night work will not introduce risk of accident.

5-5-2 Management

The Dockyard is assumed to operate as a private enterprise. Such factors as constitution of stockholders, however, are beyond prediction, and it has been tentatively assumed that the Dockyard will be administered by a General Manager appointed and fully delegated by the stockholders, and who will administer the Dockyard in accordance with the policy drawn up in the hands of stockholder representatives.

5-5-3 Middle management

The Dockyard is to comprise 3 Departments --(a) Repair, (b) Business, and (c) General Affairs as shown in Fig. 5-1.

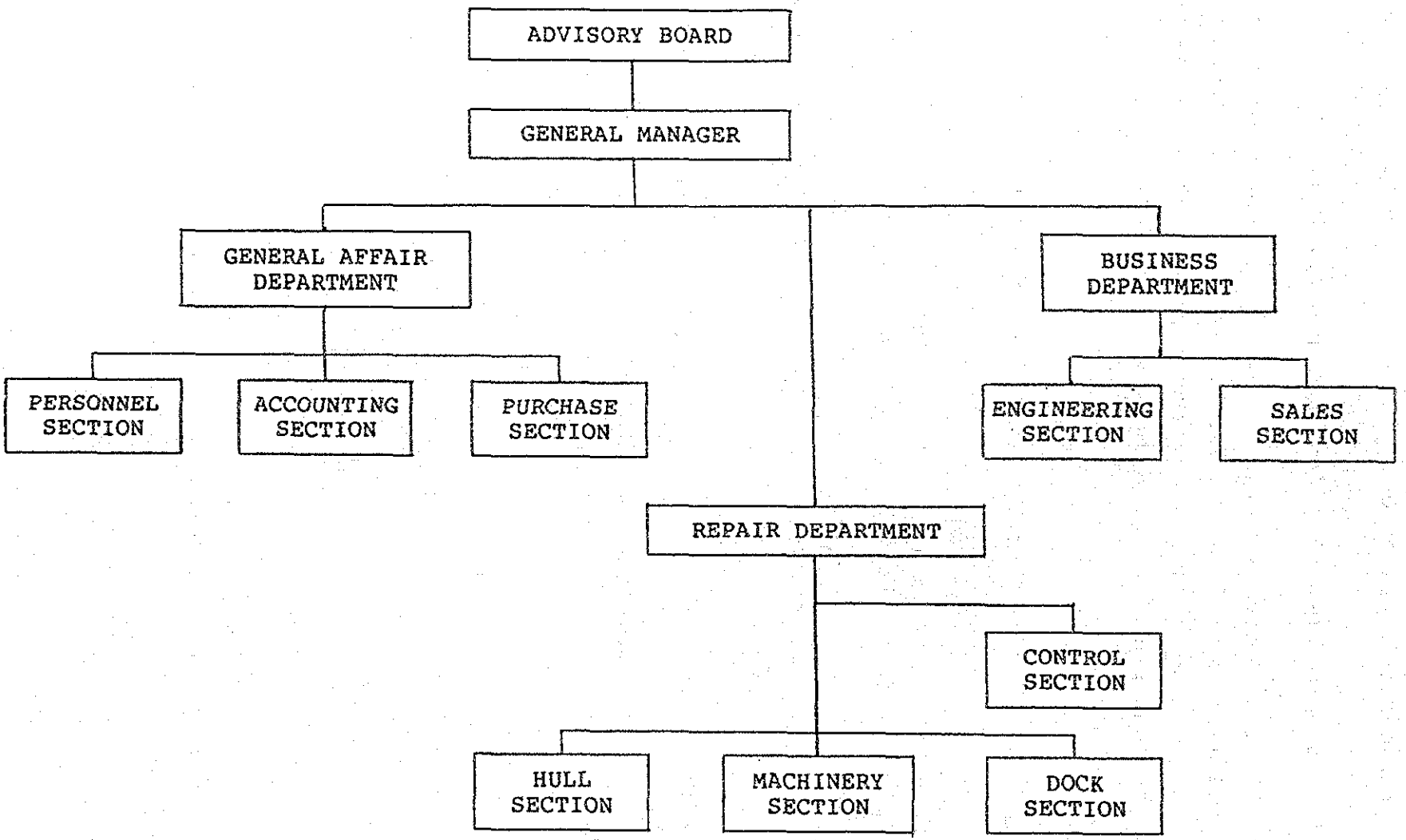


Fig. 5-1 ORGANIZATION CHART

(1) Repair department

The Repair Department is to comprise the Control Section and 3 line sections of (a) Hull, (b) Machinery, and (c) Dock.

- Control Section: This section serves the Department Manager as staff group, and also provides the line sections with such services as:=
  - = Procurement and storage of materials and components required for repair operations
  - = Survey of eligible suppliers and subcontractors
  - = Issue of orders for supplies/services on request from line sections.
- Line Section:=
  - = Hull Section: Charged with repair operations on hull, on hull fittings, on accommodation spaces
  - = Machinery Section: Charged with repair operations on (a) machinery and fittings in machinery space and (b) steering gear, as well as with (c) in-house pipe fabrication
  - = Dock Section: Charged with docking operations and painting.

All line sections are to execute their operations in accordance with relevant instruction documents, including work specifications, working budget and milestone schedules, all of which are drawn up and issued by the Technical Section of the Sales Department.

(2) Business department

The Business Department comprises the Engineering and Sales Sections.

Together with the Repair Department, the Business Department provides the driving force that generates profits for the Dockyard.

- Engineering Section: This Section represents the Dockyard's brain that devises measures for ensuring profit from jobs, which on the other hand, must be executed to customer satisfaction in terms of quality, delivery time and price. These measures are implemented through operations of estimating the cost of repair job, drawing up job specifications, work schedule control, and management of work budget.
- Sales Section: This Section takes care of the non-technical side of sales, including publicity directed toward shipping firms, assembly of information on potential repair jobs, attending to bidding procedures, collection of bills.

It is not envisaged at this time to consider the utilization of agents for the purpose of marketing, all such activity being to be undertaken directly by the Sales Section.

(3) General affairs department

The General Affairs Department ensures service activities, and comprises:-

- Personnel Section
- Accounting Section
- Purchase Section.

5-6 Technology transfer; Instruction/training

The technical factors governing the operating capability of a shiprepair yard are:-

- Skill of workers

- Engineering capability of technical personnel
- Managerial capability of administrative staff, including particularly the capability for schedule control,

all of which will depend largely on the knowledge and experience possessed individually by the personnel staffing these Sections.

It is envisaged to obtain the assistance of experts from a suitable foreign shipyard or consultant for letting the relevant personnel acquire the requisite proficiency in these domains.

In Fig. 5-2, the outline of technology transfer and training is shown for reference.

5-6-1 Transfer to managers and senior engineers of managerial techniques

While textbooks are available on the theory and practice of management in general, that of a shiprepair yard calls in addition for much that is acquired by experience. For this reason, it is envisaged to have recruited technical staff already conversant with general management techniques further master through actual experience at the Dockyard the practical techniques that are additionally necessary. In practice, on-the-job training is to be provided to this staff by experienced foreign managers and engineers, supplemented by assignments of relevant Dockyard personnel to periods of observation and study in advanced foreign shipyards.

What is to be mastered through this instruction and training system should comprise in essence the principles to be applied in shiprepair operations and the mode of dealing with unexpected situations. In respect of routine concrete managerial procedures, these could well be tansferred in the form of computer software package accompanied by instructions on the use of this package.

		90	91	92	93	94	95
General Theme		Guidance to set up Dockyard Organization					
		Fostering of Subordinates and Successors in Organization					
			Training to develop job knowledge and skill				
Trainee	Trainer	Schedule & Principal Theme					
Senior Engineer & Officer	Despatched Manager & Engineer		On the Job Training (OJT) for Management and Professional Competence				
					* *	* *	* *
Engineer	Despatched Manager & Engineer	OJT for Engineering and Control Technique of Shiprepair					
Foreman & Assist. Foreman	Competent Instructor		TWI for the development of supervising competence				
Worker in shops	Engineer & Foreman		Training of Basic Skill and job knowledge				
				Training for Special Skill (When it is required)			
Other worker	Manager, officer, etc.		OJT for develop Job Knowledge and skill				

Note) *: Training at an adequate overseas shipyards

Fig. 5-2 TECHNOLOGY TRANSFER AND TRAINING

5-6-2 Transfer of engineering capability

Even more than managerial capability, shiprepair engineering capability depends on practical experience, and technical transfer is to be provided by assigned foreign experts through on-the-job training on actual repair jobs, or by means of working drawings used in actual shiprepair.

Engineering at a shiprepair yard consists of devising the mode most economical and efficient for executing a given repair job, taking proper account of all the factors prevailing at the time relevant to the yard and to the customer, as well as of the conditions of the ship to be repaired. This calls for full knowledge and understanding of the basic principles of shiprepair operations, as well as practical experience.

To this end, it is envisaged to obtain the assistance of experts from a suitable foreign shipyard or consultants, supplemented by assignments of relevant personnel to periods of observation and study in advanced foreign shipyards.

5-6-3 Instruction/training of foremen and assistant foremen

It is envisaged to appoint foremen and assistant foremen, not by recruiting from outside, but by promotion from among in-house workers.

Experience as worker in the Dockyard itself, however short, is considered an essential qualification for this class of personnel, for the reason that they constitute front-line supervisors, and must in this capacity be capable not only of providing guidance in requisite skills but also to manage labor relations in line with corporate management policy, and to this end they must be able to understand house rules and also be familiar with the shop floor atmosphere.

Selection of persons meeting such requirements can only be made through evaluation extended over years of service in house.

Unlike assistant foremen, who spend a large part of their time with the front-line workers, foremen are full-time supervisors called upon to give full play to their abilities, and for this reason, foremen, as well as assistant foremen eligible for promotion to foremen, are to undergo training within industry by Mexican instructors.

5-6-4 Instruction/training of workers

Instruction and training of workers are to be administered separately for different categories, such as:-

- Instruction in basic knowledge
- Training in basic skills
- Training in specialized skills --operation of different kinds of machinery, cranes etc.,

to suit the experience and ability of the individual workers, and to impart the technical skills required in their positions.

6. FINANCIAL ANALYSES

6. FINANCIAL ANALYSES

The present financial analyses cover an examination of the financial soundness and profitability of the envisaged Repair Dockyard, when operated as a private enterprise, as well as the propriety of proceeding with implementation of the Project when viewed from financial aspects.

The first step is to derive financial projections, with which projected financial statements are made out. The second step is to use the projected financial statement for calculating various financial ratios, with which to examine the financial soundness of the Project. Also, for this latter examination, the break-even point will be analyzed, and the payback period of investment derived. The third step is to examine the profitability of the envisaged Project, using as criterion the financial internal rate of return (FIRR) derived by applying the discounted cash flow method. Further, the effect on FIRR of deviations from forecast of such factors as total sales, Dockyard construction cost, and operating expenses, is examined by a sensitivity analysis of FIRR on these factors.

6-1 Premises adopted for financial analyses

The present financial analyses are performed on the assumption of the following premises:

(1) All prices are in U.S. dollars at currency value as of June 1987. No consideration is given to inflation.

(2) Exchange rates adopted for conversion between currencies are:-

- Between Mexican peso and U.S. dollar: Peso 1,317 = US$1
- Between U.S. dollar and Japanese yen: US$1 = ¥150

(3) Project life is to be 30 years

(4) Value added tax is not taken into consideration

(5) Funding of construction cost is to be ensured as follows:-

- Sources: Long-term loan payable and capital, in 1:1 ratio
- Conditions governing long-term loan payable:
  - = Grace period: 2 years
  - = Term of repayment: 10 years
  - = Interest rate: 5% per annum
- Short-term loans to be obtained at 8% per annum interest rate, to cover working capital as necessary for operating the Dockyard

(6) Sales revenue to be collected in cash upon completion of the relevant job; payments to cover supplies and services to be settled in cash at time of relevant delivery or of completion of relevant service

(7) Stock inventory of materials and components to cover 2 months of operation, calculated from total relevant expenditures covering 12 months

(8) Cash on hand amounts to 4% of annual operating cost.

6-2 Financial projections

6-2-1 Forecast of sales revenue

The sales revenue is forecast as shown in Table 5-2 based on the unit prices per GT mentioned in Chapter 5-2.

6-2-2 Cost of Dockyard construction

The cost of constructing the Dockyard is presented in Table 6-1, broken down by item, and separately for items to be covered by domestic and by foreign currencies.

Table 6-1 ESTIMATION OF INVESTMENT FOR CONSTRUCTION (1/2)

(Unit: 1,000 US$)

Item \ Year	1990 (1)			1991 (2)			1992 (3)		
	Domestic	Imported	Total	Domestic	Imported	Total	Domestic	Imported	Total
1. Civil engineering works	1,600	165	1,765	13,700	165	13,865	4,800	165	4,965
Site preparation/dredging	1,200		1,200	4,100		4,100	200		200
Quay/foundation work				7,100		7,100	3,800		3,800
Work bay/foundation work									
Exterior	400		400	2,500		2,500	800		800
Supervisor		165	165		165	165		165	165
2. Construction works	2,500	248	2,748	7,600	248	7,848	3700	165	3,865
Factory	2,100		2,100	2,800		2,800	3,300		3,300
Office				4,200		4,200			
Other works	400		400	600		600	400		400
Supervisor		248	248		248	248		165	165
3. Floating dock & trans. sys.				70	35,200	35,270	30		30
4. Machinery & equipment		1,122	1,122	1,193	3,542	4,735	636	1,464	2,100
5. Crane				955	1,040	1,995	445	1,130	1,575
6. Anti-pollution equipment							265	222	487
7. Communication equipment				30	1,400	1,430	20	20	40
8. Office furniture				300		300			
9. Transportation equipment	35		35	56		56	157	103	260
10. Initial expense	287	1,808	2,095	1,778	989	2,767			
11. Working capital				46	184	230			
12. Total	4,422	3,343	7,765	25,728	42,768	68,496	10,053	3,269	13,322

Note: ( ) shows project year

Table 6-1 ESTIMATION OF INVESTMENT FOR CONSTRUCTION (2/2)

(Unit: 1,000 US$)

Item \ Year	1995 (6)			1996 (7)			Total		
	Domestic	Imported	Total	Domestic	Imported	Total	Domestic	Imported	Total
1. Civil engineering works	2,700	165	2,865	3,600	83	3,683	26,400	743	27,143
Site preparation/dredging							5,500		5,500
Quay/foundation work							10,900		10,900
Workbay/foundation work	2,700		2,700	2,800		2,800	5,500		5,500
Exterior				800		800	4,500		4,500
Supervisor		165	165		83	83		743	743
2. Construction works	100		100	200		200	14,100	661	14,761
Factory							8,200		8,200
Office							4,200		4,200
Other works	100		100	200		200	1,700		1,700
Supervisor								661	661
3. Floating dock & trans. sys.				350	1,700	2,050	450	36,900	37,350
4. Machinery & equipment				205	1,860	2,065	2,034	7,988	10,022
5. Crane				110	1,040	1,150	1,510	3,210	4,720
6. Anti-pollution equipment							265	222	487
7. Communication equipment							50	1,420	1,470
8. Office furniture							300		300
9. Transportation equipment							248	103	351
10. Establishment expense							2,065	2,797	4,862
11. Working capital							46	184	230
12. Total	2,800	165	2,965	4,465	4,683	9,148	47,468	54,228	101,696

6-2-3 Operating expenses

Expenses to cover operation of the Dockyard after entrance into commercial service have been derived as follows.

(1) Personnel expenses

Personnel expenses have been calculated using data contained in Table 6-2 below, giving the year-to-year personnel expenses for the different categories of staff, the figures for this Table having been derived from corresponding personnel expenses currently being paid at enterprises in operation in Lazaro Cardenas and at various Mexican shiprepair yards.

Table 6-2 PERSONNEL EXPENSES FOR DIFFERENT STAFF CATEGORIES

Unit: US$

Staff Category	Annual Expenses	Staff Category	Annual Expenses
Dockyard Manager	17,500	Senior office staff	4,100
Department Manager	10,200	Skilled worker	3,800
Section Manager	8,200	Typist	2,900
Engineer	6,200	Unskilled worker	2,300
Foreman	5,600		

Note: The above costs include welfare expenses.

(2) Material cost

The portion occupied by material cost in the price of a shiprepair job has been assumed to be 13.2 percent, based on data from Japanese sources and from Mexican shiprepair enterprises.

(3) Direct expenses

Direct expenses comprise:-

- Insurance premium to cover shiprepair operations

- Transportation charges
- Inspection charges
- Travel of personnel
- Other expenses.

These expenses have been assumed to amount to 3 percent of total sales, and to reduce to 2.5 percent 10 years after start of commercial operation, through enhancement of operation techniques.

(4) Manufacturing overhead

Manufacturing overhead comprises:-

- Expenses related to sales and production: Tug services, consumable tooling, utilities, personnel travel, communication etc.
- Expenses related to installed equipment: Depreciation, repairs, insurance premium.
  Expenses for repair of buildings and equipment have been assumed to be:=

  = During 2 years from completion: 0
  = 3rd - 7th year: 0.5% of acquisition cost
  = 8th - 12th year: 1% of acquisition cost
  = 13th - 17th year: 1.5% of acquisition cost
  = 18th - 30th year: 2.0% of acquisition cost

Rent covering land has been accounted for as fixed cost. Special expenses have further been allocated for instruction/training of personnel, covering 3 years from start of commercial operation.

Personnel expenses have been accounted for separately, under § 6-2-3(1).

(5) General administrative and selling expenses

Excluding personnel expenses, accounted for under § 6-2-3(1), general administrative and selling expenses comprise, mainly:-

- Depreciation of offices and office equipment
- Domestic travel
- Entertainment
- Conferences
- Communication
- Publicity
- Others

Excluding depreciation expenses covering offices and office equipment, the general administrative and selling expenses have been assumed to amount to 1 percent of total sales. These depreciation expenses have been accounted for under § 6-2-3(4).

(6) Non-operating income and expenses

- Interest expenses have been calculated with the mode of funding set forth in § 6-1.
- Amortization of deferred charges: Initial expenses to cover personnel instruction/training, interest and other general administrative expenses incurred prior to start of commercial operation have been accounted for as deferred charges, to be amortized with relevant cost included in non-operating expenses.
- Interest earned has been accounted for as non-operating income.

(7) Corporate tax; profit sharing; dividend

1) Corporate tax: This has been assumed to be levied at 42%, subject, however, to the following preferential measures:=

a) Investment tax credit: 20% of invested value subject to tax exemption during 5 years.

Table 6-3 PROJECTED INCOME STATEMENT (1/2)

Unit: 1000US$

ITEM\YEAR +/-	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
SALES AMOUNT +			5,956	10,659	13,152	17,303	17,984	18,702	19,394	20,104	20,813	21,523	22,234	22,943	23,663	24,378	25,435
MATERIAL COST -			920	1,328	1,735	2,284	2,375	2,469	2,560	2,654	2,747	2,841	2,935	3,028	3,124	3,218	3,357
DIRECT EXPENSE -			209	302	395	519	540	561	582	603	624	646	556	574	592	609	636
LABOR COST -			2,446	2,721	2,594	3,133	3,100	3,129	3,179	3,246	3,307	2,307	3,307	3,307	3,307	3,672	3,672
INDIRECT COST- -			4,356	5,396	5,845	6,835	6,429	6,824	6,874	7,282	7,370	7,395	6,623	6,361	6,769	6,856	6,742
G. PROFIT Sub			-563	312	2,582	5,332	5,559	5,719	6,199	6,319	6,765	7,334	8,813	9,673	9,877	10,023	11,028
A. & S. EXP. -			1,252	1,306	1,178	903	382	389	396	403	415	426	433	440	448	455	465
OP. PROFIT Sub			-2,215	-994	1,403	4,429	5,177	5,330	5,803	5,916	6,346	6,908	8,380	9,233	9,429	9,568	10,563
AMORTIZATION -			486	486	486	486	486	486	486	486	486	488					
INTEREST-STL -			32	150	250	149	-29	-147	-254	-388	-487	-544	-601	-721	-893	-1,066	-1,247
INTEREST-LTL -			2,053	2,125	1,918	1,731	1,660	1,545	1,302	1,048	794	539	295	146	99	68	38
OR. PROFIT Sub			-4,796	-3,755	-1,251	2,063	3,060	3,446	4,279	4,770	5,553	6,425	8,666	9,808	10,223	10,566	11,772
PROFIT SHAR. -						206	306	345	428	477	555	643	869	981	1,022	1,057	1,177
PROFIT B.T. Sub			-4,796	-3,755	-1,251	1,857	2,754	3,101	3,851	4,293	4,998	5,782	7,817	8,827	9,201	9,509	10,595
TAX -									445	1,786	2,047	2,072	2,989	3,707	3,864	3,992	4,398
PROFIT A.T. Sub			-4,796	-3,755	-1,251	1,857	2,754	3,101	3,406	2,507	2,951	3,710	4,828	5,120	5,337	5,517	6,197
DIVIDEND -										1,254	1,476	1,855	2,414	2,560	2,669	2,809	3,099
RETAINED EARNINGS			-4,796	-3,755	-1,251	1,857	2,754	3,101	3,406	1,253	1,475	1,855	2,414	2,560	2,668	2,808	3,098

Table 6-3 PROJECTED INCOME STATEMENT (2/2)

Unit: 1000US$

ITEM\YEAR	+/-	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SALES AMOUNT	+	26,508	27,580	28,637	29,709	30,783	31,839	32,911	33,986	35,076	35,076	35,076	35,076	35,076
MATERIAL COST	-	3,499	3,641	3,780	3,922	4,063	4,203	4,344	4,486	4,630	4,630	4,630	4,630	4,630
DIRECT EXPENSE	-	663	690	716	743	770	796	823	850	877	877	877	877	877
LABOR COST	-	3,672	3,672	3,672	3,672	3,672	3,672	3,672	3,672	4,912	4,912	4,912	4,912	4,912
INDIRECT COST	-	6,616	6,678	7,096	7,194	7,223	4,165	3,770	3,843	3,882	3,661	3,434	3,434	3,445
G. PROFIT	Sub	12,058	12,899	13,373	14,178	15,055	19,003	20,302	21,135	20,775	20,996	21,223	21,223	21,212
A. & S. EXP.	-	476	487	497	508	519	529	540	551	574	574	574	574	574
OP. PROFIT	Sub	11,582	12,412	12,876	13,670	14,536	18,474	19,762	20,584	20,201	20,422	20,649	20,649	20,638
AMORTIZATION	-													
INTEREST-STL	-	-1,439	-1,645	-1,861	-2,080	-2,287	-2,487	-2,589	-2,883	-3,059	-3,228	-3,398	-3,565	-3,735
INTEREST-LTL	-	11												
OR. PROFIT	Sub	13,010	14,057	14,737	15,750	16,823	20,961	22,451	23,467	23,260	23,650	24,047	24,214	24,373
PROFIT SHAR.	-	1,301	1,406	1,474	1,576	1,682	2,096	2,245	2,347	2,326	2,365	2,405	2,421	2,437
PROFIT B.T.	Sub	11,709	12,651	13,263	14,174	15,141	18,865	20,206	21,120	20,934	21,285	21,642	21,793	21,936
TAX	-	4,866	5,313	5,570	5,919	6,003	7,629	8,487	8,870	8,456	8,888	9,038	9,153	9,213
PROFIT A.T.	Sub	6,843	7,338	7,693	8,255	9,138	11,236	11,719	12,250	12,478	12,397	12,604	12,640	12,723
DIVIDEND	-	3,422	3,669	3,847	4,128	4,569	5,618	5,860	6,125	6,239	6,199	6,302	6,320	6,362
RETAINED EARNINGS		3,421	3,669	3,846	4,127	4,569	5,618	5,859	6,125	6,239	6,198	6,302	6,320	6,361

Table 6-4 PROJECTED BALANCE SHEET (1/2)

Unit: 1000US$

ITEM \YEAR +/-	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CURRENT ASSETS +		230	384	413	493	617	4,346	8,817	13,985	18,916	21,915	23,619	26,531	33,455	40,487	47,519	55,160
CASH ON HAND +			154	183	203	237	237	237	237	254	262	266	267	271	287	304	311
DEPOSIT WITH I. +							3,709	8,170	13,218	18,222	21,194	22,883	25,774	32,580	39,580	46,675	54,389
INVENTORIES +		230	230	230	290	380	400	410	430	440	460	470	490	505	520	540	560
FIXED ASSETS +	5,670	71,169	80,440	75,474	70,508	68,542	72,395	66,923	61,191	55,459	49,897	45,943	42,453	37,792	33,131	28,505	24,250
TANGIBLE F. A. +	5,670	71,169	84,491	84,491	84,491	87,491	96,695	96,955	96,955	96,355	97,125	98,906	100,378	100,378	100,378	100,413	100,674
A. DEPRECIATION -			4,051	9,017	13,983	18,949	24,300	30,032	35,764	41,496	47,228	52,963	57,925	62,596	67,247	71,908	76,424
DEF. CHARGES +	2,095	4,862	4,376	3,890	3,404	2,918	2,432	1,946	1,460	974	488						
INITIAL EXPENSES +	2,095	4,862	4,862	4,862	4,862	4,862	4,862	4,862	4,862	4,862	4,862	4,862					
ACC.AMORTIZATION -			486	972	1,458	1,944	2,430	2,916	3,402	3,888	4,374	4,862					
TOTAL ASSETS +	7,765	76,261	85,200	79,777	74,405	72,077	79,173	77,686	76,536	75,349	72,301	69,562	68,984	71,248	73,618	76,024	79,430
CURRENT LIABI. +			801	2,946	3,304	633	306	345	873	3,517	4,078	4,570	5,272	7,248	7,555	7,758	8,674
ACCOUNT PAYABLE +						206	306	345	873	3,517	4,078	4,570	5,272	7,248	7,555	7,758	8,674
SHORT TERM LOAN +			801	2,946	3,304	427											
LONG TERM DEBT +	3,882	38,130	44,403	40,590	36,111	33,115	33,210	28,583	23,499	18,415	13,331	8,245	3,551	2,279	1,674	1,069	461
SHAREHOLD. EQ. +	3,883	38,131	39,996	36,241	34,990	38,329	45,657	48,758	52,164	53,417	54,892	56,747	59,161	61,721	64,389	67,197	70,295
SHARED CAPITAL +	3,883	38,131	44,792	44,792	44,792	46,274	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848
A. R. EARNINGS +			-4,796	-8,551	-9,802	-7,945	-5,191	-2,090	1,316	2,569	4,044	5,899	8,313	10,873	13,541	16,349	19,447
TATAL LI. & EQ. +	7,765	76,261	85,200	79,777	74,405	72,077	79,173	77,686	76,536	75,349	72,301	69,562	68,984	71,248	73,618	76,024	79,430

Table 6-4 PROJECTED BALANCE SHEET (2/2)

Unit: 1000US$

# ITEM #\YEAR +/-	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CURRENT ASSETS +	63,155	71,983	80,692	89,741	97,517	106,038	113,989	121,706	128,431	135,422	142,154	149,020	155,896
CASH ON HAND +	317	324	342	350	357	362	369	377	421	421	421	421	421
DEPOSIT WITH I. +	62,258	71,049	79,720	88,741	95,480	104,977	112,900	120,579	127,240	134,231	140,963	147,829	154,705
INVENTORIES +	580	610	630	650	680	700	720	750	770	770	770	770	770
FIXED ASSETS +	20,150	15,790	11,430	-7,240	4,664	4,849	4,007	3,165	2,358	1,966	1,859	1,462	1,065
TANGIBLE F. A. +	100,934	100,934	100,934	101,104	102,885	104,357	104,357	104,357	104,392	104,653	104,913	104,913	104,913
A. DEPRECIATION -	80,784	85,144	89,504	93,864	98,221	99,508	100,350	101,192	102,034	102,687	103,054	103,451	103,848
DEF. CHARGES +													
INITIAL EXPENSES +													
ACC.AMOTIZATION -													
TOTAL ASSETS +	83,305	87,773	92,122	96,981	102,181	110,888	117,996	124,871	130,789	137,418	144,013	150,482	156,961
CURRENT LIABI. +	9,589	10,388	10,891	11,623	12,254	15,343	16,592	17,342	17,021	17,452	17,745	17,894	18,012
ACCOUNT PAYABLE +	9,589	10,388	10,891	11,623	12,254	15,343	16,592	17,342	17,021	17,452	17,745	17,894	18,012
SHORT TERM LOAN +													
LONG TERM DEBT +													
SHAREHOLD. EQ. +	73,716	77,385	81,231	85,358	89,927	95,545	101,404	107,529	113,768	119,966	126,268	132,588	138,949
SHARED CAPITAL +	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848	50,848
A. R. EARNINGS +	22,868	26,537	30,383	34,510	39,079	44,697	50,556	56,681	62,920	69,118	75,420	81,740	88,101
TATAL LI. & EQ. +	83,305	87,773	92,122	96,981	102,181	110,888	117,996	124,871	130,789	137,418	144,013	150,482	156,961

Table 6-5 PROJECTED CASH FLOW STATEMENT (1/2)

Unit: 1000US$

ITEM\YEAR +/-	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
SALES REVENUE +			6,966	10,459	13,152	17,383	17,994	18,702	19,394	20,104	20,813	21,523	22,234	22,943	23,669	24,378	25,435
OPERATING EXP. +			5,130	6,087	6,783	7,908	7,466	7,640	7,859	8,456	8,735	8,880	8,892	9,049	9,579	10,149	10,356
MATERIAL COST +			920	1,328	1,736	2,284	2,375	2,469	2,560	2,654	2,747	2,841	2,935	3,028	3,124	3,218	3,357
DIRECT EXPENSE +			209	302	395	519	540	561	582	603	624	646	556	574	592	609	636
LABOR COST +			2,444	2,721	2,594	3,133	3,100	3,129	3,179	3,246	3,307	3,307	3,307	3,307	3,307	3,672	3,672
INDIRECT COST +			305	438	879	1,069	1,069	1,092	1,142	1,550	1,638	1,660	1,661	1,780	2,188	2,195	2,226
A. & S. EXP. +			1,252	1,306	1,179	903	382	389	396	403	419	426	433	440	448	455	465
NON-OP. EXP. +	7,765	68,496	15,417	2,275	2,228	4,970	11,061	1,974	1,403	1,543	4,014	5,864	5,756	5,712	6,469	6,612	6,830
TANGIBLE F.A. +	5,670	65,499	13,322			3,000	9,204	260			170	1,781	1,472			35	261
WORKING CAP. +		230			60	96	20	10	20	10	20	10	20	15	15	20	20
DEF. CHARGES +	2,095	2,767															
INTEREST-STL +			32	150	250	149	-35	-147	-264	-388	-487	-544	-602	-721	-893	-1,066	-1,267
INTEREST-LTL +			2,063	2,125	1,918	1,731	1,668	1,545	1,382	1,648	794	539	295	146	99	68	-38
PROFIT SHAR. +							206	306	345	428	477	555	643	869	981	1,022	1,057
TAX +											645	1,786	2,047	2,072	2,989	3,787	3,864	3,892
DIVIDEND +												1,254	1,476	1,855	2,414	2,568	2,669	2,809
SURPLUS OR DE. +	7,765	68,496	-13,581	1,697	4,141	4,425	-533	9,088	10,132	10,185	8,064	6,779	7,586	8,182	7,621	7,617	8,249
FUND PROCURE. +	7,765	68,496	13,735	-1,668	-4,121	-4,391	4,242	-4,627	-5,084	-5,084	-5,084	-5,086	-4,694	-1,272	-605	-605	-608
CAP. INCREASE +	3,883	34,248	6,661			1,482	4,574										
L.T. LOAN PAY. +	3,882	34,248	6,661			1,483	4,574										
LTL REPAYMENT +			388	3,813	4,479	4,479	4,479	4,627	5,084	5,084	5,084	5,086	4,694	1,272	605	605	608
S.T. LOAN PAY. +			801	2,145	358	427											
STL REPAYMENT +						3,304	427										
SURPLUS CASH +			154	29	20	34				17	8	4	11	41	16	17	7
SURPLUS DEPOS. +							3,709	4,461	5,048	5,084	2,972	1,689	2,891	6,906	7,008	6,995	7,634

Table 6-5 PROJECTED CASH FLOW STATEMENT (2/2)

Unit: 1000US$

ITEM\YEAR	+/-	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SALES REVENUE	+	26,508	27,586	28,637	29,769	30,783	31,839	32,911	33,986	35,076	35,076	35,076	35,076	35,076
OPERATING EXP.	+	10,566	10,808	11,401	11,679	11,890	12,078	12,307	12,560	14,033	14,031	14,030	14,030	14,041
MATERIAL COST	+	3,499	3,641	3,780	3,922	4,063	4,203	4,344	4,486	4,630	4,630	4,630	4,630	4,630
DIRECT EXPENSE	+	683	690	716	743	770	796	823	850	877	877	877	877	877
LABOR COST	+	3,672	3,672	3,672	3,672	3,672	3,672	3,672	3,672	4,912	4,912	4,912	4,912	4,912
INDIRECT COST	+	2,256	2,318	2,736	2,834	2,866	2,878	2,928	3,081	3,040	3,038	3,037	3,037	3,048
A. & S. EXP.	+	476	487	497	508	519	529	540	551	574	574	574	574	574
NON-OP. EXP.	+	7,526	7,974	8,547	9,001	11,147	11,259	12,674	13,739	14,338	14,056	14,314	14,160	14,159
TANGIBLE F.A.	+	260			170	1,781	1,472			35	261	260		
WORKING CAP.	+	20	30	20	20	30	20	20	30	20				
DEF. CHARGES	+													
INTEREST-STL	+	-1,439	-1,645	-1,861	-2,080	-2,287	-2,487	-2,689	-2,883	-3,059	-3,228	-3,398	-3,565	-3,735
INTEREST-LTL	+	11												
PROFIT SHAR.	+	1,177	1,301	1,406	1,474	1,576	1,682	2,496	2,245	2,347	2,326	2,365	2,405	2,421
TAX	+	4,398	4,866	5,313	5,570	5,919	6,003	7,629	8,487	8,870	8,456	8,888	9,038	9,153
DIVIDEND	+	3,099	3,422	3,669	3,847	4,122	4,569	5,618	5,860	6,125	6,239	6,199	6,302	6,320
SURPLUS OR DE.	+	8,416	8,798	8,689	9,029	7,746	8,502	7,930	7,687	6,705	6,991	6,732	6,866	6,876
FUND PROCURE.	+	-461												
CAP. INCREASE	+													
L.T. LOAN PAY.	+													
LTL REPAYMENT	+	461												
S.T. LOAN PAY.	+													
STL REPAYMENT	+													
SURPLUS CASH	+	61	71	181	81	71	51	71	81	441				
SURPLUS DEPOS.	+	7,949	8,791	8,671	9,021	7,739	8,497	7,923	7,679	6,661	6,991	6,732	6,866	6,876

b) Tax credit for creating new employment opportunities: Amount equivalent to number of new jobs created multiplied by the legal minimum wage subject to tax exemption during 2 years.

2) Profit sharing: Set at 10% of before-tax profit.

3) Dividend: To be distributed when both retained earnings and current net profit are positive, and to an amount equivalent to 1/2 of current net profit.

6-2-4 Projected financial statements

Projections were derived of earnings and expenditures expected for the Dockyard upon operation in accordance with the plans for construction, for instruction/training, for staffing and for sales as set forth in the preceding pages, based on which the following projected financial statements have been drawn up:-

- Projected income statement: Table 6-3
- Projected balance sheet: Table 6-4
- Projected cash flow statement: Table 6-5.

6-3 Analyses of financial soundness and profitability

6-3-1 Analyses of financial soundness

(1) Financial ratios

The result of analyses is presented in Table 6-6.

Table 6-6 FINANCIAL RATIOS

Year	Current ratio (%)	Fixed assets to net worth ratio (%)	Debt service coverage ratio (%)	Turnover of total operating assets (Time)	Ratio of operating profit to net sales (%)
1992	50	200	73	0.08	-31
2002	400	72	202	0.32	38

(2) Break-even point

The break-even point has been derived using the formula Break-even point ratio

Ratio of fixed cost to net sales/(1-Ratio of variable cost to net sales) x 100

The results of calculation are presented in Table 6-7.

Table 6-7 BREAK-EVEN POINT RATIO

Year	Ratio
1992	185
1993	146
1994	112
1995	87
1996	81
1997	79
2002	57

(Reference data - The break-even point ratio of Japanese large shipyard and repair yard was 95% in 1984)

(3) Simple payback period of invested capital

The payback period represents the number of years required to recover aggregate invested capital.

In the present instance, the simple payback period has been found to be 13 years.

6-3-2 Analyses of profitability

(1) Financial internal rate of return

Profitability of the envisaged Project is evaluated using the financial internal rate of return (FIRR), which is the index normally adopted for this purpose on projects of extended life, involving large capital investment.

The calculation is presented in Table 6-8, which indicates that the FIRR for this Project is 9.9 percent.

Table 6-8 FIRR CALCULATION (1/2)

Unit: 1000US$

ITEM\YEAR +/-	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
SALES REVENUE +			6,966	10,059	13,152	17,303	17,994	18,702	19,394	20,104	20,813	21,523	22,234	22,943	23,669	24,378	25,435
LABOR COST R. -			1,746	2,198	2,594	3,133	3,100	3,129	3,179	3,246	3,307	3,307	3,307	3,307	3,307	3,672	3,672
LABOR COST A. -			117	140	147	160	202	202	202	202	211	211	211	211	211	211	211
O.COST(INC.DP) -			7,318	8,715	9,008	9,581	9,515	10,041	10,219	10,740	10,949	11,997	10,336	10,192	10,722	10,927	10,989
DEPRECIATION +			4,051	4,966	4,966	4,966	5,351	5,732	5,732	5,732	5,732	5,735	4,962	4,661	4,661	4,661	4,516
PROFIT SHAR. -							206	306	345	428	477	555	643	869	981	1,022	1,057
TANGIBLE F.A. -	5,670	65,499	13,322			3,000	9,264	260			170	1,781	1,472			35	261
DEFERRED EXP. -	1,998	1,717															
WORKING CAP. -		230	154	29	80	124	20	10	20	27	28	14	21	19	31	37	27
NET CASH F. REAL	-7,668	-67,446	-11,640	3,943	6,289	6,271	1,098	10,686	11,170	11,193	11,403	10,293	11,286	13,006	13,078	13,135	13,734

ITEM\YEAR +/-	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SALES REVENUE +	26,508	27,580	28,637	29,709	30,783	31,839	32,911	33,986	35,076	35,076	35,076	35,076	35,076
LABOR COST R. -	3,672	3,672	3,672	3,672	3,672	3,672	3,672	3,672	4,912	4,912	4,912	4,912	4,912
LABOR COST A. -	211	211	211	211	211	211	211	211	223	223	223	223	223
O.COST(INC.DP) -	11,943	11,285	11,878	12,156	12,364	9,482	9,266	9,519	9,740	9,519	9,292	9,292	9,303
DEPRECIATION +	4,360	4,360	4,360	4,360	4,357	1,287	842	842	842	623	397	397	397
PROFIT SHAR. -	1,177	1,301	1,406	1,474	1,576	1,682	2,096	2,245	2,347	2,326	2,365	2,405	4,858
TANGIBLE F.A. -	260			170	1,781	1,472			35	261	260		-1,065
DEFERRED EXP. -													
WORKING CAP. -	61	71	181	81	71	51	71	81	441				-1,191
NET CASH F. REAL	14,499	15,464	15,812	16,378	15,529	16,602	18,501	19,173	18,617	18,458	18,421	18,641	18,433

Table 6-8 FIRR CALCULATION (2/2)

Year\D.	Rate	N. C. F.	P. V.	C. P. V.
1990	1.000	-7,668	-7,668	-7,668
1991	0.910	-67,446	-61,354	-69,022
1992	0.827	-11,640	-9,632	-78,654
1993	0.753	3,943	2,968	-75,686
1994	0.685	6,289	4,306	-71,379
1995	0.623	6,271	3,906	-67,473
1996	0.567	1,098	622	-66,851
1997	0.515	10,486	5,405	-61,446
1998	0.469	11,170	5,237	-56,208
1999	0.427	11,193	4,774	-51,434
2000	0.388	11,403	4,424	-47,010
2001	0.353	10,293	3,633	-43,377
2002	0.321	11,206	3,598	-39,779
2003	0.292	13,006	3,799	-35,981
2004	0.266	13,078	3,475	-32,506
2005	0.242	13,135	3,175	-29,332
2006	0.220	13,734	3,019	-26,312
2007	0.200	14,499	2,900	-23,412
2008	0.182	15,464	2,813	-20,599
2009	0.165	15,812	2,617	-17,982
2010	0.151	16,378	2,466	-15,517
2011	0.137	15,529	2,127	-13,390
2012	0.125	16,602	2,068	-11,322
2013	0.113	18,501	2,097	-9,225
2014	0.103	19,173	1,976	-7,249
2015	0.094	18,617	1,746	-5,503
2016	0.085	18,458	1,575	-3,929
2017	0.078	18,421	1,429	-2,499
2018	0.071	18,641	1,316	-1,184
2019	0.064	18,433	1,184	0

Unit of N. C. F.: 1000US$
Discount Rate: 9.9302 %

(2) Sensitivity analyses

The purpose of sensitivity analyses is to determine the effect that would be brought by deviations from forecast values affecting prescribed key variables, such as sales revenue, investment cost, operating cost.

The result of sensitivity analyses applied to the present Project is given in Table 6-9.

Table 6-9 SENSITIVITY ANALYSES OF FIRR

Varying factor	Variation	FIRR (%)
Basis	-	9.9
Sales	10% up	11.7
	10% down	8.0
Initial investment & reinvestment	10% up	9.0
	10% down	11.0
Labor cost	10% up	9.6

(On the assumption that each variable fluctuates independently)

6-4 Evaluation

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 assets to net worth ratio, debt service coverage ratio, turnover of total operating assets and ratio of break-even point to net sales, because 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 analyses, show 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. ECONOMIC ANALYSES

A quantitative evaluation is made of the economic benefits expected to accrue to the Mexican nation as a whole from the construction and operation of the envisaged Repair Dockyard at Lazaro Cardenas. The index used for this evaluation is the economic internal rate of return (EIRR), derived from reassessment of benefit and cost in terms of opportunity cost.

A further analyses are conducted on the consequential economic benefits --increase of employment opportunities, diminution of foreign currency outflow, increase of foreign currency inflow, enhancement of managerial and technical capabilities, linkage effects on associated industries-- to be expected from implementation of this Project.

7-1 Premises adopted in conducting the economic analyses; EIRR

In calculating the EIRR, the market price is replaced by a shadow price --based on opportunity cost-- to derive the net profit, and the propriety of proceeding with the project is evaluated from comparison between the resulting EIRR and the opportunity cost of capital.

In the present instance, EIRR has been calculated excluding transfer items such as import duty, and with partial adoption of shadow price.

7-1-1 Exclusion of transfer items

Items excluded from expenses --for their being merely transfer items from the viewpoint of national economy-- are:

(1) Taxes on technical assistance contracts for consultation on construction work.

(2) Taxes on technical assistance contracts for transfer of ship repair technology.

(3) Import duties on materials imported for use in the repair of ships of Mexican flag.

7-1-2 Shadow wage rates

Currently, there exist no published statistical data on unemployment, but it can safely be supposed that a large portion of unskilled labor is in a state of underemployment. Consequently, it has been assumed that the unskilled workers to be recruited for the construction work on Dockyard and for shiprepair operations after completion of construction should come from this class of underemployed labor, and a shadow wage rate has been derived on these premises, as follows.

It has been assumed that the average value added per worker employed in a department pooling labor under a condition of underemployment is roughly equivalent to the legal minimum wage; it has further been assumed that the law of diminishing returns will apply to lower the marginal productivity to the level of 70 percent of average productivity. Thus:

- Average value added per person in condition of underemployment

  = Legal minimum wage

- Marginal productivity in condition of underemployment

  = 0.7 x (Average value added per person in condition of underemployment)

  = 0.7 x (Legal minimum wage).

- Shadow wage rate

  = 0.7 x (Legal minimum wage)
  = 0.7 x Peso 150 million
  = Peso 105 million
  = Approx. 1/3 times market wage.

7-1-3 Shadow foreign exchange rate

As a result of the economic crisis that affected Mexico in 1982, a dual foreign exchange system has been instituted, comprising a controlled and a free rate of exchange. Foreign exchange transactions are currently negotiated to 80 percent by controlled exchange rate, which is substantially devalued against the U.S. dollar every year, with the aim of improving the trade imbalance.

In connection with these facts, the shadow exchange rate was assumed to be peso 1,200 = US$1.0, through the discussion between the Study Team and the Counterparts, considering the foreign exchange policy of Mexican Government in July 1987.

Based on the new data obtained by the Study Team and the Counterparts, however, the shadow exchange rate has been set to be peso 1,389 to US$ one by the following calculation.

$$SER = \frac{OER}{SCF} = \frac{1.317}{0.948} = 1.389$$

where,
SER: Shadow exchange rate
OER: Official exchange rate
SCF: Standard conversion factor

7-1-4 Evaluation of benefits and costs of the Project

(1) Benefits

The benefits to be expected from Project implementation are considered along the following lines:

1) If the envisaged Project is not implemented, no restraint will be brought on this account to the outflow of foreign currency, and no chance will be provided for acquiring foreign currency on this account.

2) The price of shiprepair service adopted in the financial analyses has been set with account taken of expected international market price, on the premise that the envisaged Dockyard is to acquire full international competitiveness.

3) For the present economic analyses also, the same shiprepair price has been adopted.

(2) Costs

1) For the costs invested in construction and operation of the envisaged Dockyard, domestically procured goods have had their economic cost derived with application of the shadow exchange rate.

2) For labor cost invested in Dockyard construction that paid to unskilled workers has been assumed to represent 30 percent of total labor cost during the construction stage, and 10% of total direct workers has been assumed to be unskilled workers after start of commercial operation. The shadow wage rate was applied to derive the relevant economic cost.

Transfer items contained in costs were removed from costs.

7-1-5 EIRR

The EIRR for evaluating the economic benefits of the present Project has been derived from the benefits and costs determined using the shadow prices given in Table 7-1 for successive years. The resulting value of EIRR is 11.0 percent. As the cut-off rates used in some developemnt banks are around 10%, this project is considered to be feasible.

7-1-6 Sensitivity analyses

The sensitivity of EIRR to deviations in the same 5 factors as adopted for the FIRR sensitivity analyses has been found to be given as below.

10% increase of sales	- 12.8%
10% decrease of sales	- 9.1%
10% increase of initial investment and reinvestment	- 10.0%
10% decrease of initial investment and reinvestment	- 12.1%
10% increase of labor costs	- 10.7%

Table 7-1 EIRR CALCULATION (1/2)

Unit: 1000US$

ITEM\YEAR	+/-	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
BENEFIT	+			6,966	10,059	15,152	17,303	17,994	18,792	19,394	20,104	20,813	21,523	22,234	22,943	23,669	24,378	25,455
LABOR COST	-			1,686	2,121	2,478	2,986	2,997	3,022	3,069	3,129	3,193	3,193	3,193	3,193	3,193	3,526	3,526
OTHER COST	-			2,811	3,303	3,700	4,305	3,974	4,113	4,274	4,778	4,976	5,115	5,128	5,277	5,781	5,976	6,174
PROFIT SHAR.	-							195	290	327	406	452	526	610	824	950	969	1,002
TANGIBLE F.A.	-	5,236	63,499	12,460			2,729	8,852	246			161	1,688	1,395			33	247
DEFERRED EXP.	-	1,898	1,391															
WORKING CAP.	-		228	146	27	76	118	19	9	19	26	27	13	20	18	29	35	26
NET BENEFIT		-7,134	-65,118	-10,137	4,608	6,898	7,165	1,977	11,022	11,705	11,765	12,004	10,988	11,888	13,631	13,736	13,839	14,460

ITEM\YEAR	+/-	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BENEFIT	+	26,508	27,580	28,637	29,709	30,783	31,839	32,911	33,986	35,076	35,076	35,076	35,076	35,076
LABOR COST	-	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	4,656	4,656	4,656	4,656	4,656
OTHER COST	-	6,375	6,696	7,170	7,435	7,636	7,816	8,035	8,276	8,488	8,486	8,485	8,485	8,495
PROFIT SHAR.	-	1,116	1,233	1,333	1,397	1,494	1,595	1,987	2,128	2,225	2,205	2,242	2,280	4,605
TANGIBLE F.A.	-	246			161	1,688	1,395			33	247	246		-1,065
DEFERRED EXP.	-													
WORKING CAP.	-	61	71	171	81	71	51	71	81	421				-1,129
NET BENEFIT		15,239	16,208	16,591	17,182	16,432	17,502	19,356	20,048	19,632	19,482	19,447	19,655	19,514

Table 7-1 EIRR CALCULATION (2/2)

Year\D.	Rate	N. C. F.	P. V.	C. P. V.
1990	1.000	-7,134	-7,134	-7,134
1991	0.901	-65,118	-58,670	-65,804
1992	0.812	-10,137	-8,229	-74,032
1993	0.731	4,608	3,370	-70,662
1994	0.659	6,898	4,545	-66,117
1995	0.594	7,165	4,254	-61,863
1996	0.535	1,977	1,058	-60,806
1997	0.482	11,022	5,312	-55,494
1998	0.434	11,705	5,082	-50,411
1999	0.391	11,765	4,603	-45,809
2000	0.352	12,004	4,231	-41,578
2001	0.318	10,988	3,489	-38,088
2002	0.286	11,888	3,401	-34,687
2003	0.258	13,631	3,514	-31,173
2004	0.232	13,736	3,190	-27,983
2005	0.209	13,839	2,896	-25,087
2006	0.189	14,460	2,726	-22,360
2007	0.170	15,239	2,589	-19,772
2008	0.153	16,208	2,481	-17,291
2009	0.138	16,591	2,288	-15,004
2010	0.124	17,182	2,135	-12,869
2011	0.112	16,432	1,839	-11,030
2012	0.101	17,502	1,765	-9,265
2013	0.091	19,356	1,759	-7,506
2014	0.082	20,048	1,641	-5,865
2015	0.074	19,632	1,448	-4,417
2016	0.066	19,482	1,295	-3,122
2017	0.060	19,447	1,164	-1,958
2018	0.054	19,655	1,060	-897
2019	0.049	19,514	948	51

Unit of N. C. F.: 1000US$
Discount Rate: 10.991 %

7-2 Consequential economic benefits expected from project implementation

Consequential economic benefits expected to accrue from the construction and operation of the envisaged Dockyard are:

(1) Increase of employment opportunities

(2) Diminution of foreign currency outflow; increase of foreign currency inflow

(3) Enhancement of managerial and technological capabilities

(4) Linkage effects on associated industries.

7-2-1 Increase of employment opportunities

The National Program for Industrial Development & Foreign Trade, published by Secretarial de Comercio y Fomento Industrial (SECOFIN), mentions that the Mexican economy faces the challenge of 900,000 youths freshly joining the labor market every year, and the creation of opportunities for employment is a pressing social problem for the nation.

Table 7-2 gives the numbers of employment opportunities that will be created upon project implementation for the various categories of labor: It is indicated that, in 1991 --at the peak of Dockyard construction-- 1,300 jobs will be offered, and upon entrance into stable operation --for instance in 2015--the jobs established will number 1,400 approximately.

Implementation of the present Project will call for recruitment of a considerable number of non-skilled labor, to offer employment opportunities to underemployed labor not possessing special skills, and should thereby provide

Table 7-2 NEW EMPOLOYMENT CAUSED BY CONSTRUCTION AND OPERATION OF SHIPREPAIR DOCKYARD

(Unit: Number of person)

Item \ Year	1990	1991	1992	1993	1994	1995	2000	2005	2015
Construction									
Indirect worker	10	20	20			5	5		
Direct worker (skilled)	110	560	230			80	100		
Direct worker (unskilled)	130	650	260			90	120		
Total	250	1,230	510			175	225		
Operation									
Indirect worker	10	39	85	97	105	113	117	124	131
Direct worker (skilled)		36	370	471	559	687	679	814	1,117
Direct worker (unskilled)		4	41	52	62	76	75	90	124
Total	10	79	496	620	726	876	871	1,028	1,372
Grand Total	260	1,309	1,006	620	726	1,051	1,096	1,028	1,372

significant contribution to the national problem of unemployment.

7-2-2 Diminution of foreign currency outflow; increase of foreign currency inflow

Projects for Mexican industrial development should very desirably be of nature conducive to saving and acquisition of foreign currency --a question of prime importance for the nation.

As criterion for evaluating the worth of the envisaged Project in this respect, a calculation has been made of the Bruno ratio modified to discount basis --or "modified Bruno ratio"-- adopting the following premises:

(1) If the Project were not implemented, ships of Mexican flag that would have used the envisaged Dockyard would be repaired in a foreign country.

(2) Direct material costs would comprise foreign payments to the extent of 50 percent.

(3) Other costs of construction and operation would be governed by the same premises as adopted in the preceding analyses.

(4) Discount rate: Set at 10 percent.

The resulting modified Bruno ratio has proved to be 0.89, indicating the positive nature of the present Project in respect of its contribution to saving foreign currency outflow and to increasing its inflow.

Based on the premises, abovementioned, the concrete figure of total amount of both saving and foreign currency acquisition is estimated as follows:

Approximately US$17,303,000 in 1995
Approximately US$24,378,000 in 2005

Approximately US$35,076,000 in 2015

The net total amount of both saving and foreign currency acquisition throughout the project life, offsetting the amount of imported equipment for the dockyard construction and imported materials for the dockyard operation, become to US$603,282,000 which is valued as US$106,878,000 at present, applying the discount rate of 10%.

7-2-3 Enhancement of managerial and technological capabilities; linkage effects on associated industries

In order to realize the set aim of letting the envisaged Repair Dockyard acquire competitiveness in the international market, assistance is to be obtained of experts in relevant fields from countries advanced in shiprepairing. The techniques and know-how that will be transferred to the this repair dockyard will in turn diffuse to adjacent industries in the Lazaro Cardenas district, and to the Mexican shiprepair and associated industries in general, to contribute to enhancement of managerial capability and to technological level in industries related to machinery and steelwork fabrication.

Further consequential linkage effects on associated industries are to be expected from the input goods that will be supplied to this shiprepair enterprise, in forms as varied as with shipbuilding --an industrial activity that is known for its consisting of assembling a wide variety of materials and components purchased from an extensive range of associated industries.

Table 7-3 gives the inter-industrial relationships presented by the principal input goods supplied to the shiprepair industry in Japan. A similar presentation covering the Japanese construction industry is given in Table 7-4.

It is indicated from Table 7-3 that the input goods supplied to shiprepair industry include, among others,

Table 7-3 MAIN INPUT GOODS TO SHIPREPAIR INDUSTRY
(Japan, 1980)

(Unit: Mill. Yen)

Intermediate input goods	Price
Ropes and fish nets	9,311
Lumber	1,214
High-pressure gas	1,716
Paint, varnish and lacquer	19,831
Other final chemical products	3,141
Other glass and glass products	1,927
Hot rolled steel (ordinary steel)	38,615
Hot rolled steel (special steel)	1,011
Steel pipes and tubes (ordinary steel)	2,213
Steel pipes and tubes (special steel)	1,002
Cold-finished steel	2,334
Forged steel	1,768
Cast steel for machinery	2,652
Forged material for machinery	1,357
Other steel products	2,724
Cast and forged material for machinery (non-ferrous)	1,463
Metal doors and shutters	15,387
Other metal products for construction	20,643
Other metal products	1,694
Prime motors and boilers	41,093
Pumps and compressors	2,863
Conveyors	7,645
Other general industrial machinery and equipments	2,377
Other machinery and their parts	1,990
Transmission and distribution apparatus	2,274
Other industrial heavy electrical machinery	1,004
Other applied electronic equipments	1,371
Telecommunication machinery & related equipments	1,222
Electric power	1,750
Wholesale trade	29,077
Financial service private	13,850
Road freight transport	3,694
Self-research	1,067
Packing	1,061
Total of intermediate sectors	285,656
Total of final demand sectors	144,368
Total domestic products (gross outputs)	430,024

(Source: Input-output table 1980 by the Administrative Management Agency)

Table 7-4 MAIN INPUT GOODS TO CONSTRUCTION INDUSTRY
(Japan, 1980)

(Unit: Mill. Yen)

Intermediate input goods	Price
Gravel and building stone	229,710
Lumber	33,904
Plywood	35,644
Rubber products	40,046
Light oil	34,880
Other petroleum refinary products	11,677
Paving material	29,038
Fire bricks	105,336
Raw concrete	342,956
Other cement products	150,737
Other non-metallic mineral products	38,183
Hot rolled steel (Ordinary steel)	162,791
Metal products for construction	224,009
Repair of general machinery	200,276
Copper electric wires and cables	112,696
Wholesale trade	285,545
Transport by private motor cars	101,637
Civil engineering and construction services	146,271
Total of intermediate sectors	3,377,091
Total of final demand sectors	2,453,617
Total domestic products	5,830,708

(Source: Input-output table 1980 by the Administrative Management Agency)