Table-12 Dimensions of Proposed Berths

Kind of Berths	Ship Size (DWT)	Size of Berths	
		Length (m)	Water Depth (m)
General Cargo Berths			
For conventional ships	20,000	200	11.0
For special carriers	30,000	250	12.0
Container Berths	40,000	300	13.0
Grain Berths	40,000	300	13.0
Mineral Bulk Berths			
For cement	20,000	200	11.0
For other bulk	40,000	300	13.0
Domestic Trade Berths	10,000	170	9.0
	20,000	200	11.0

2-2-5 Required Number of Berths

As for the general cargo berths, the grain berths and the domestic trade berths, it is difficult to fix the appropriate number of berths only using the method considering the frequency of ship entry and handling capacity. So, the appropriate nubmer of these berths is determined using the method of simulation by queuing theory.

As a result, the number of berths required in 2000 is 12 berths in total: 10 berths for foreign trade and 2 berths for domestic trade, as shown in Table-13.

Table-13 Berths Proposed in the Master Plan

Type	Cargo Volume ('000 t)	Number of Berths	Size of Berths			Cargo Volume Handled per Meter (t/m)
			Length (m)	Water Depth (m)	Total Length (m)	
General Cargo Berths		1	180	11.0	180	
		1	200	11.0	200	
		2	200	12.0	400	
		1	250	12.0	250	
Sub-total	926	5			1,030	900
Container Berth	516	1	300	13.0	300	1,720
Grain Berths	705	2	300	13.0	600	1,175
Mineral Bulk Berths		1	200	12.0	200	
		1	300	13.0	300	
Sub-total	603	2			500	1,206
Domestic Trade Berths		1	170	9.0	170	
		1	200	11.0	200	
Sub-total	332	2			370	898
Total	3,082	12			2,800	1,100

2-2-6 Cargo Handling and Storage Facilities

(1) Storage facilities

The scale of storage facilities required in 2000 is estimated based on the cargo forecast for 2000 by type of cargo.

Table-14 shows the calculated required scale in 2000 for the storage facilities to be newly constructed.

Table-14 Scale of Storage Facilities to be Newly Constructed

(Unit: m^2)

Type of Cargo	Calculated Requried Scale in 2000
General Cargo	
General cargo	20,540
Heavy weight cargo	8,100
Agricultural Cargo	35,000 t Silo
Domestic Trade Cargo	6,850

(2) Cargo handling equipment

The types and quantities of equipment are selected and determined in consideration of the volume of handling cargo, working efficiency and the capacity of each piece of equipment.

The quantity of required equipment is shown in Table-15.

Table 15 Cargo Handling Equipment for the Master Plan

Kind of Equipment	Capacity	Quantity	Remarks
Conventional General Cargo			
Truck Crane	70 t	1	for handling heavy cargo
Wheel Crane	9 – 20 t	6	to be newly purchased: 3
Forklift	3 – 15 t	40	
Tractor		8	to be newly purchased
Flat Chassis	10 t	12	to be newly purchased
Dump Truck	15 t	5	to be newly purchased
Shovel Loader	3.5 m^3	1	
Container			
Gantry Crane	30.5 t	2	to be newly purchased
Straddle Carrier	30.5 t	6	to be newly purchased
Forklift	3 – 15 t	6	
Forklift (large size)	33 t	2	to be newly purchased
Trailer Head		2	to be newly purchased
Container Chassis	20', 40'	5	to be newly purchased
Grain			
Pneumatic Unloader	200 t/h	4	to be newly purchased
Belt Conveyor	440 t/h	2 lines	one line takes 650 m
Chain Conveyor	440 t/h	2 lines	one line takes 50 m
Hopper	200 m^3	3	to be newly purchased
Wheel Crane	9 – 20 t	1	
Shovel Loader	3.5 m^3	2	
Mineral Bulk Cargo			
Truck Crane	70 t	1	setting for hopper
Wheel Crane	9 – 20 t	2	
Hopper	50 m^3	6	
Shovel Loader	3.5 m^3	4	

2-3 Fishery Port

2-3-1 Size of Fishing Boats

Considering that one of the ultimate goals of the improvement of the fishing port is to promote offshore ocean-oriented fishery with emphasis placed on tuna fishery, the maximum size of fishing boats in 2000 will reach 500 G/T.

2-3-2 Scale of Basic Facilities and Functional Facilities

The scale of fishing ports is generally determined based on the concept of the "standard day".

It is estimated that the number of fishing boats per standard day will be 900 boats, and the

landing volume per standard day will be 1,168 tons. The scale of basic facilities and functional facilities is determined based on these figures. The calculated required berth length and the berth length proposed in the Master Plan are shown in Table-16. Similarly, the scale for the functional facilities is shown in Table-17.

Table-16 Fishery Wharf

(Unit: m)

Type of Wharf	Length of Wharf				Proposed Total Length
	Landing Wharf		Preparatory and Rest Wharf		
	Calculated	Proposed	Calculated	Proposed	
-4m	368	370	498	430	800
-7m	560	560	460	410	970

Table-17 Propsed Functional Facilities for the Fishery Port

(Unit: m^2)

Facility	Calculated Area	Proposed Area
Fish Handling Shed	15,573	16,900
Ice Making and Ice Storage Facility	1,900	14,300 (according to the ratio of land to buildings)
Cold Storage Facility	4,680	
Parking Lot	18,446	23,900

2-4 Passenger Terminal and Marina

2-4-1 Passenger Terminal

"Muelle Fiscal" in the outer port will be used as a berth for large cruising vessels. The vast majority of vessels cruising the Pacific Ocean are below 30,000 G/T. Considering the ship size of present cruising vessels, facilities for 30,000 G/T vessels will be sufficient to accommodate all cruising vessels which are likely to call at port.

The required area of the passenger terminal in the year 2000 is estimated as 1,920 m^2. The present transit shed with an area of 4,995 m^2 can be used effectively as a passenger terminal and shopping center.

2-4-2 Marina

According to the Touristic Bureau, a large-scale private marina at Santiago Bay is under consideration. The marina project is intended for launches in the outer port area. The number of vessels to be accommodated in the year 2000 is determined as 70 based on the forecast number of tourists. A 900 m promenade and launch moorings will be constructed along the shoreline from the touristic wharf to San Pedrito Seashore. The facility will be long enough to provide launch moorings in the future.

2-5 Harbour Facilities

Harbour facilities are a very important part of the Master Plan. In the case of Manzanillo Port, which has been developed utilizing the San Pedrito Lagoon, topographical restrictions have to be considered when planning harbor facilities.

The five zones which must be examined for planning harbour facilities at Manzanillo Port are shown in Fig.-10.

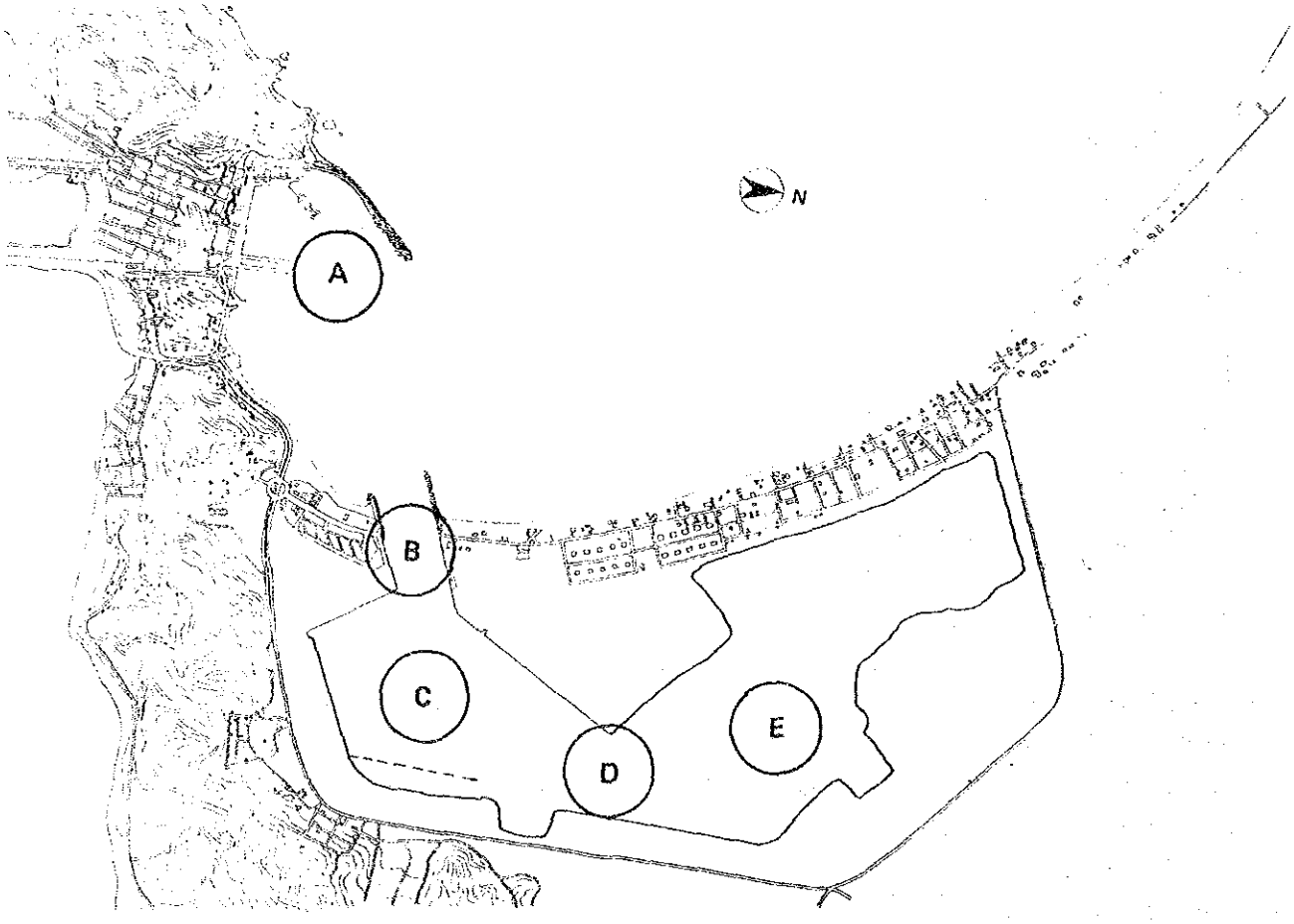


Fig.-10 Study Zones of Harbor Facilities Plan

2-5-1 Outer Port (A Zone)

Due to topographical limitations, the area for turning is extremely limited and tugboats will have to be utilized to a great extent.

Tourist vessels should try to utilize the berth facing the inner port as much as possible.

2-5-2 Entrance Channel to the Inner Port (B Zone)

Presently, the channel is 100 m wide at the bottom.

Considering that many large ships will pass through this channel in the future, it is desirable to enlarge the channel as much as possible.

Thus, we recommend that the seawalls be stabilized and the channel expanded to 200 m width.

2-5-3 Inner Port Basin (C and E Zones)

In these zones, tugboats will have to be used to turn vessels.

2-5-4 Narrowest Portion of the Inner Port (D Zone)

The problem in D zone is to secure safe passage through the zone and safe utilization of the mooring facilities located on one side of the zone.

Securing a width of 350 m in this sea area is proposed from the viewpoint of the safe passage of the largest ships.

3. Layout Plan

3-1 Outer Port

The Master Plan of the outer port is presented as Fig.-11.

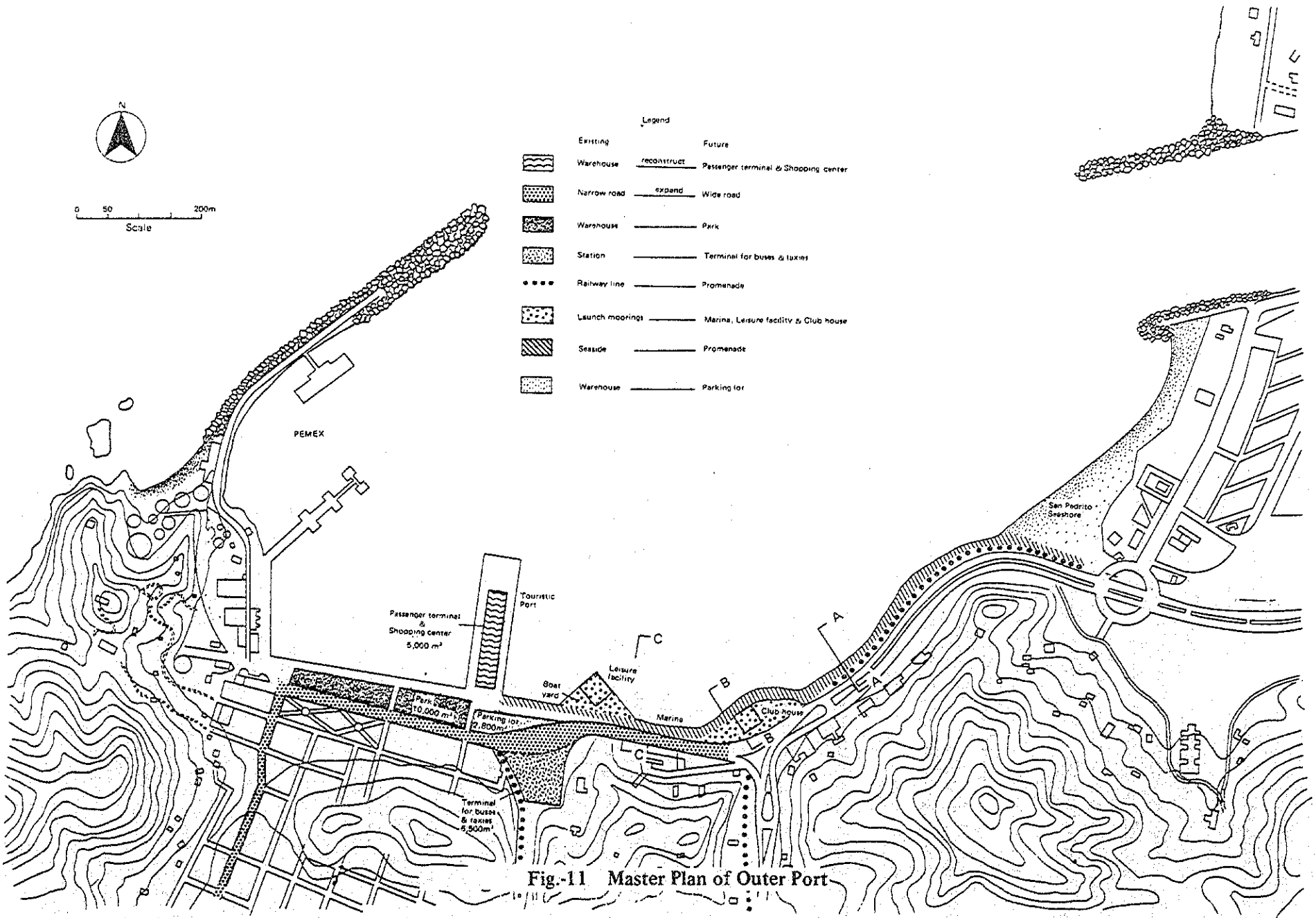


Fig.-11 Master Plan of Outer Port

3-2 Inner Port

3-2-1 Premises of the Commercial Port Facilities Layout

The layout plan of the commercial port facilities is made based on the following premises:

① Existing port facilities and port facilities under construction should be used effectively.

② The water depth of the present wharf cannot be increased, since it may well be that such an increase would create a structural problem.

③ The new facilities will all be located between the 600 m wharf currently under construction and the fishery facilities.

④ Since especially heavy cargoes and heavy weight cargo handling equipment like container cranes would cause structural difficulties at the existing wharf and at the wharf which is under construction, all the facilities for handling such cargoes will have to be located on the newly planned wharf.

3-2-2 Premises of the Fishery Port Facilities Layout

The face line of the fishery wharf is determined according to the drawings we obtained in Mexico.

The layout is indicated in Fig.-12.

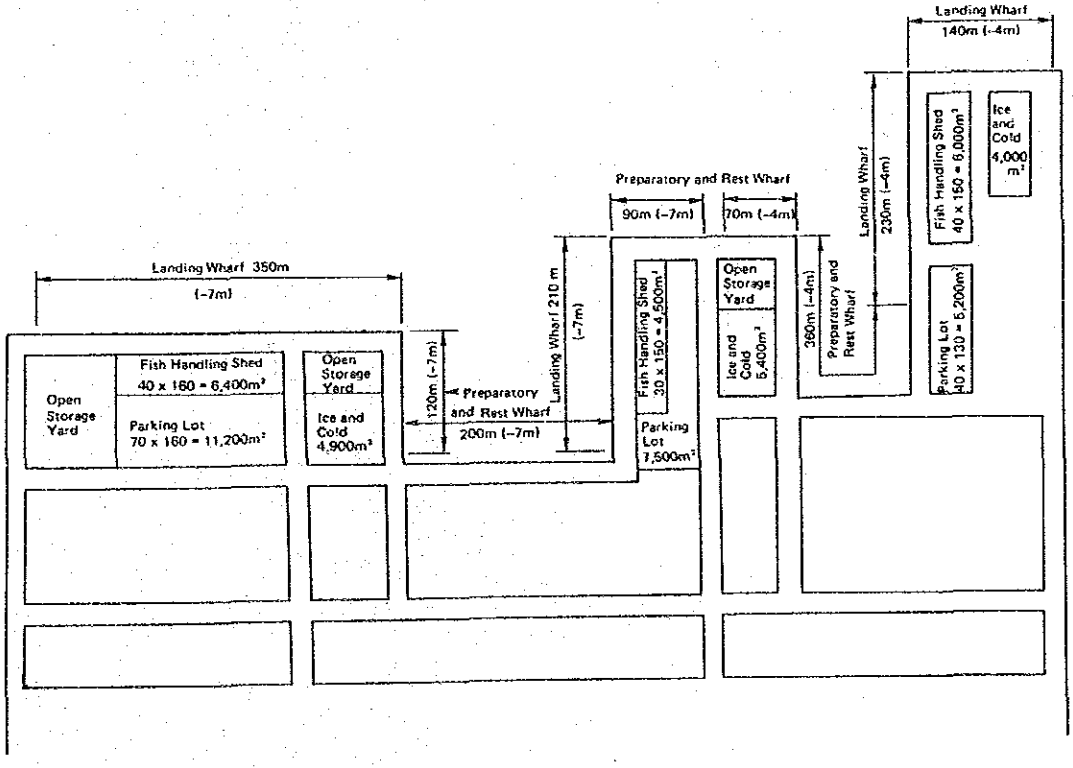
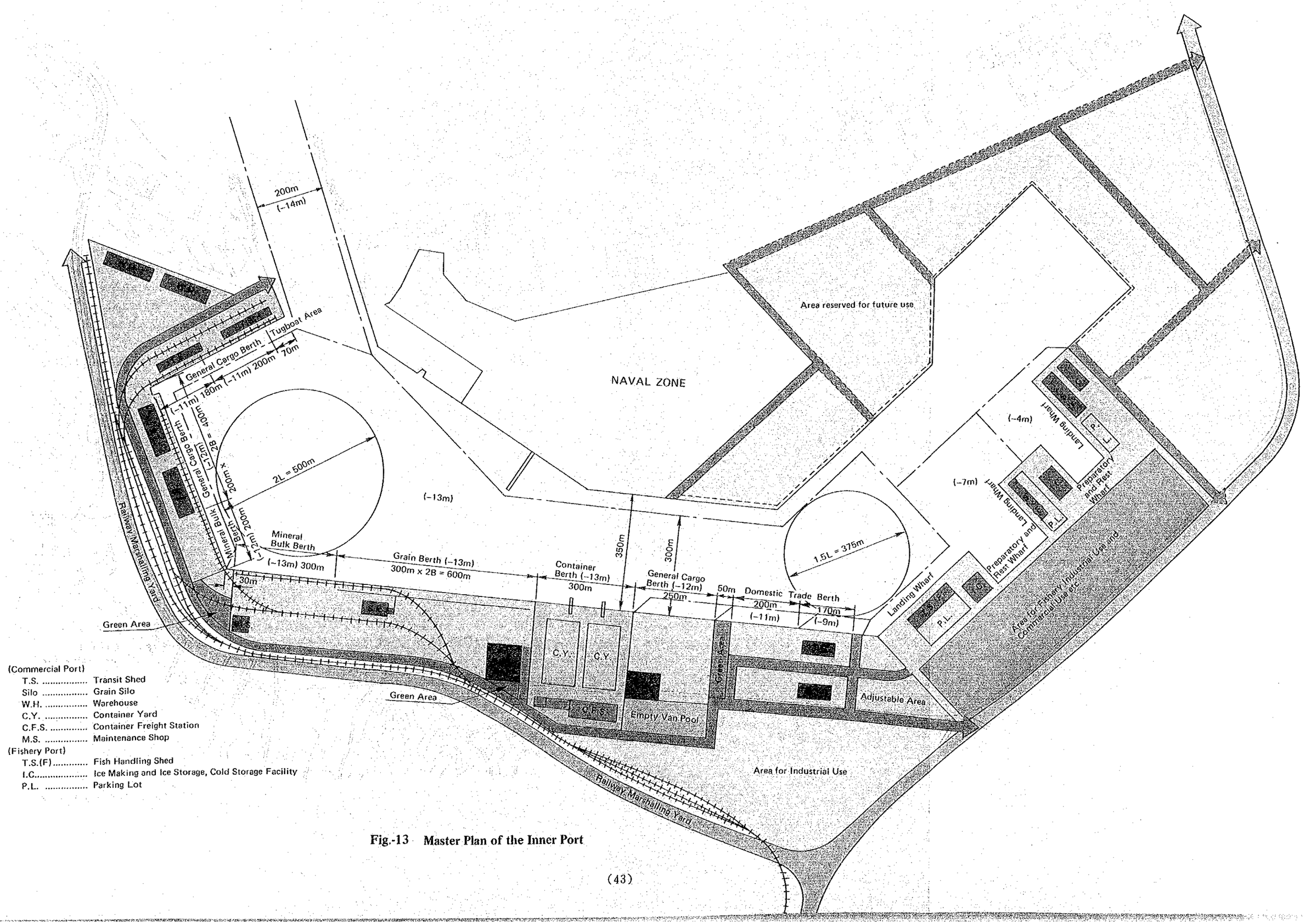


Fig.-12 Fishery Port Facilities Layout

3-2-3 Master Plan of the Inner Port

Fig.-13, the layout plan of the inner port, was made based on the above premises.



(Commercial Port)
- T.S. ..... Transit Shed
- Silo ..... Grain Silo
- W.H. ..... Warehouse
- C.Y. ..... Container Yard
- C.F.S. ..... Container Freight Station
- M.S. ..... Maintenance Shop

(Fishery Port)
- T.S.(F) ..... Fish Handling Shed
- I.C. ..... Ice Making and Ice Storage, Cold Storage Facility
- P.L. ..... Parking Lot

Fig.-13 Master Plan of the Inner Port

4. Other Facilities

4-1 Water and Electric Supply

The total water demand in the Manzanillo Metropolitan Zone in 2000 is estimated as 231,400 m^3/day. 43% of this total will be for industrial use.

The total potable water supply will be only 123,000 m^3/day. The estimated supply is almost enough to fulfill the estimated demand for drinking water and for fire fighting. However, the existing project clearly will not be able to supply water for industrial use. Supply for industrial use will have to come from other new projects. The total water demand of the commercial port is 1,400 m^3/day.

The total electric demand in the Manzanillo Metropolitan Zone is estimated at about 300 MVA including the demand for industrial use.

The electric supply will be far more than sufficient to satisfy the total local demand. The electric power demand in the commercial port is estimated at about 12.5 MVA. New sub-stations will have to be built or the existing sub-stations will have to be expanded.

4-2 *Aids to Navigation*

As for the aids to navigation in the year 2000, the required facilities will be two lighted marks, four lighted spar buoys, eight lighted buoys and two leading lights. Furthermore, it is assumed that the lighthouse and the light mark at the top of the breakwater are sufficient to accommodate the traffic in the target year.

5. Environmental Aspect

Various effects on the natural environment are expected due to the construction of the Port and the operation of industries in the Manzanillo Metropolitan Zone.

We study the amount of pollution that will be caused by the industries in the Manzanillo Metropolitan Zone, and the extent to which it is possible to minimize this pollution by means of control equipment. As factors affecting air quality, Sulfuric Oxide (SOx) and soot are investigated. As factors affecting water, Chemical Oxygen Demand (COD) and Suspended Solids (SS) are investigated.

The inner port of Manzanillo is almost a closed water area, and is seriously influenced by water pollution, so the spread of COD water pollution is estimated by means of numerical simulation using a computer.

The port area creates little air pollution, but a lot of water pollution. Then, the discharge water from the industrial area should be treated. The port operations will further pollute the water through discharge of ballast water, bilge, sewage and waste water from the wharves and other port facilities.

In order to minimize the water pollution from the Port, a standard for discharge water will have to be established and a monitoring system arranged in advance.

6. Design, Construction and Cost Estimate

6-1 Design

6-1-1 Design Conditions

The fundamental design conditions are listed in Table-18.

Table-18 Fundamental Design Conditions

Items	Design Conditions	
	Outer Port	Inner Port
Tidal Level	H.W.L. +0.272 m L.W.L. −0.398 m	
Offshore Waves	S direction 10.0 sec. Ho = 3.0 m SW direction 10.0 sec. Ho = 1.5 m	
Wave Height	70 cm at coast	0 m
Cope Height of Wharves	*	+3.40 m
Seismic Coefficient	0.15 g	
Surcharge	*	4.0 t/m^2 : General and agricultural and mineral bulk cargo wharf. 2.5 t/m^2 : Container wharf (not including load of containers)
Lifetime	*	50 years

Note: * There is no data for soil investigation, design and construction of several old facilities. Therefore, an inspection of parts of these facilities, especially aprons and foundations, will be necessary.

Furthermore, the soil conditions for design are assumed from the typical soil conditions. These conditions are shown in Fig.-14. In designing, soft organic soil or clay and clayey sand or sandy clay which have an N-value less than 30 are ignored.

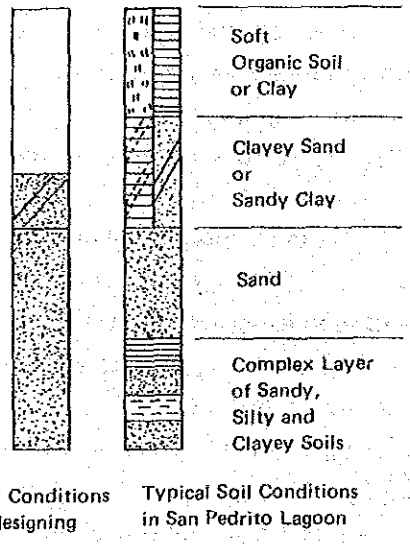
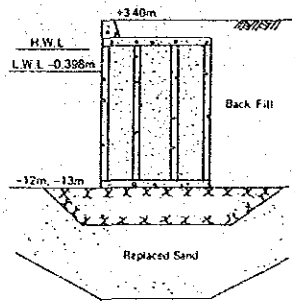
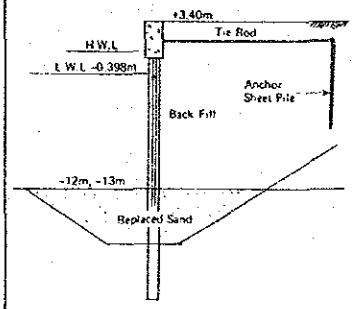
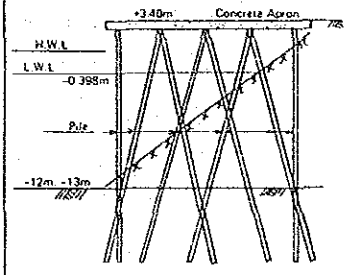


Fig.-14 Soil Conditions

6-1-2 Main Port Facilities

For the berths in the inner port, the following three kinds of structures shown in Table-19 are compared.

Table-19 Structural Comparison of Berths

Type of Berth	Gravity Wall (Caisson) Type	Sheet Pile Type	Pier Type
Cross Section			

From the comparison, we conclude that the adoption of gravity wall or sheet pile type berths is difficult in this project.

Two types of pier type structures, the reinforced concrete pile open type berth and the steel pipe pile open type berth, are considered for the mineral bulk and grain berths and for the container berths. Alternative plans are drawn up for these two berths. One of these plans, a reinforced concrete pile open type structure for the mineral bulk and grain berths is presented as Fig.-15.

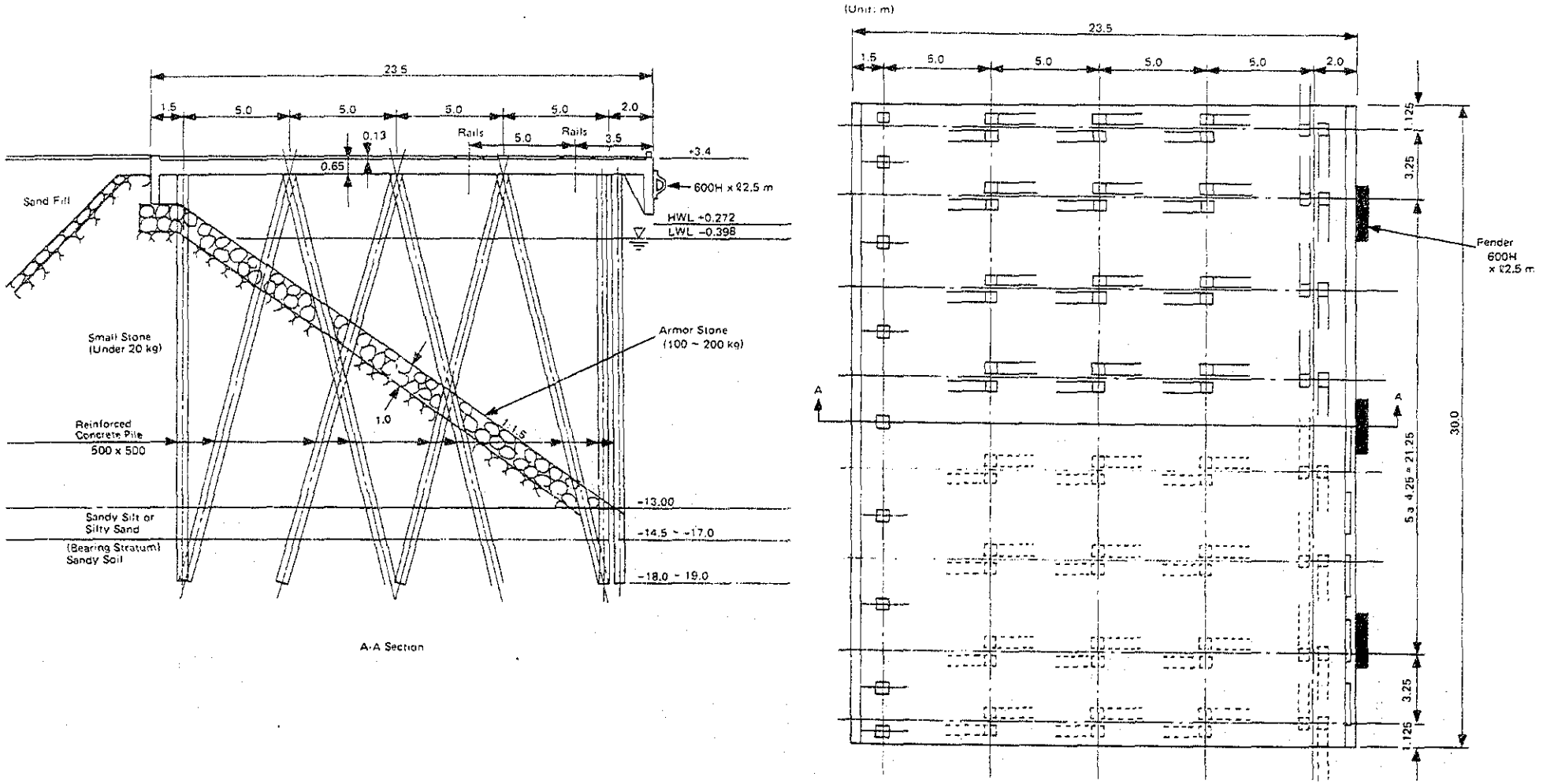


Fig.-15 Mineral Bulk and Grain Berth

6-2 Construction

The main materials needed for the construction works are listed in Table-20.

In the past, dredging using a high capacity dredger and consturction of wharves and other facilities have been executed of Manzanillo Port. The newly proposed facilities described in the Master Plan will be able to be constructed using the same methods as before. Equipment and labor for the construction work will be able to be obtained locally.

The industrial area will be developed by reclaiming the Tapeixtles Lagoon. Organic soil is distributed along the bottom of the lagoon with a thickness of 5 to 10 m. This organic soil has to be removed or improved for construction.

The old wharf in the outer port will be repaired for tourism. Data and information such as the design and soil conditions of this old wharf could not be located. Therefore, site surveys will be necessary.

Table-20 Main Construction Materials

Facilities		Main Materials					
Item	Sub Item	Steel (t)	Concrete (m^3)	Stone (m^3)	Gravel (m^3)	Asphalt (m^3)	Others
Commercial Port Facilities	1. Dredging	–	–	–	–	–	
	2. Quays	9,848	67,090	528,400	22,510	–	Rubber Fenders (124 sets) Bits (85 sets)
	3. Railway and Road	–	3,320	–	41,100	6,800	Ties (10,500 sets), Fence (1,500m) Lighting Poles and Lights (205 sets)
	4. Buildings, Transit Sheds and Warehouses	1,915	940	–	17,210	2,630	Truck Scales (2 sets)
	5. Land	–	172	–	255,500	37,900	Green Area (21,000 m^2)
	6. Water and Electric Supply, and Drainage	–	1,430	–	5,900	–	Tube (ϕ100, ϕ200), Valves, Pipe, Cable, Lighting Poles, Lights, etc.
	7. Aids to Navigation	–	–	–	–	–	–
	8. Cargo Handling Equipment for Containers	–	–	–	–	–	–
	9. Cargo Handling Equipment for General Use	–	–	–	–	–	–
Fishery Port Facilities	1. Anchorage	–	–	–	–	–	–
	2. Quays	2,970	19,650	–	5,890	–	Rubber Fenders (394 sets) Bits (155 sets)
	3. Wharf Lot	–	–	–	34,000	6,000	–
	4. Road	–	1,200	–	11,600	2,140	–
	5. Fishery Industrial Lot	–	–	–	–	–	–
Outer Port Facilities	1. Terminal	–	350	–	–	–	Rubber Fenders (20 sets) Bits (15 sets)
	2. Touristic Facility	43	2,705	39,940	6,470	130	Green Area (16,560 m^2)
Total		14,776	96,857	568,340	400,180	55,600	–

6-3 Cost Estimate

6-3-1 Estimate Conditions

Some limits for the estimation are as follows:

① The cost of the main port facilities in the Master Plan is estimated.

② Land rents, compensations and insurance costs are excluded from the estimation.

③ Existing port facilities are excluded from the estimation, except for the cost of the −13m berth which is under construction.

④ The cost of industrial lots only includes reclaiming and arrangement of the land. The construction cost of roads, water and electric supply, and drainage is excluded.

6-3-2 Estimate Results

A summary of the construction costs is presented in Table-21.

Table-21 Construction Costs (Commercial Port)

Facility	Construction Cost ('000 pesos)		
	Total	Foreign Portion	Local Portion
1. Dredging	4,031,400	1,286,000	2,745,400
2. Quays	3,281,000	105,200	3,175,800
3. Railway and Road	573,000	274,000	299,000
4. Buildings, Transit Sheds, and Warehouses	4,971,000	2,611,000	2,360,000
5. Land	1,096,000	–	1,096,000
6. Water and Electric Supply, and Drainage	1,491,000	482,000	1,009,000
7. Aids to Navigation	89,000	78,500	10,500
8. Cargo Handling Equipment for Containers	2,126,000	2,126,000	–
9. Cargo Handling Equipment for General Use	1,316,200	1,198,000	118,200
Sub Total	18,974,600	8,160,700	10,813,900
Tax	887,395	–	887,395
Total	19,861,995	8,160,700	11,701,295

CHAPTER VIII SHORT-TERM DEVELOPMENT PLAN FOR MANZANILLO PORT

1. Purpose of the Short-term Plan

The Short-term Development Plan (hereinafter referred to as the "Short-term Plan") for Manzanillo Port is a development plan for the target year 1990.

The following items have to be considered in formulating the Short-term Plan.

① The Short-term Plan is a stage plan to realize the Master Plan.

② The proposed short-term port facilities should have enough capacity to handle the forecast cargo volume in the target year 1990.

③ Existing commercial port functions in the outer port excluding the PEMEX oil facility will be abolished by the target year 1990.

④ In preparing the Short-term Plan, the actual situation of the Port has to be fully considered.

2. Site Selection

The new facilities for the commercial port will be located between the 600 m wharf currently under construction and the fishery port. As for the fishery port, new facilities will be located adjacent to existing wharves.

3. Scale of the Port Facilities

3-1 Commercial Port

3-1-1 Cargo Volume to be Handled in 1990

Table-22 is a summary of the forecast cargo volume in 1990 by package type.

Table-22 Summary of Cargo Movement (1990)

(Unit: '000t)

Package Type	Grand Total	Foreign Trade			Domestic Trade		
		Export	Import	Total	Out	In	Total
Agricultural Bulk	813	–	813	813	–	–	–
Mineral Bulk	477	180	154	334	36	107	143
Broken General Cargo	824	91	696	787	37	–	37
Container Cargo	190	66	124	190	–	–	–
Total	2,304	337	1,787	2,124	73	107	180

3-1-2 Required Number of Berths

The number of berths required in 1990 is determined using the same methods and procedures as for the Master Plan.

It is assumed that the foreign trade and domestic trade operations will not be completely separated by 1990.

In this calculation, as for the handling of the container cargoes, the following two calculation cases are proposed:

Case (A) – Using 1 container gantry crane

Case (B) – Using the present handling system

As a result, the number of berths required in 1990 is 8 or 9 berths in total: 5 or 6 berths as general and container berths, 2 berths as grain berths and one berth as a mineral bulk berth.

3-1-3 Cargo Handling and Storage Facilities in 1990

The necessary area of storage facilities and storeyards in 1990 is estimated using the forecast volume of cargoes passing through these facilities in that year.

Table-23 shows the calculated required scale in 1990 for the storage facilities to be newly constructed.

Table-23 Scale of Storage Facilities to be Newly Constructed

(Unit: m^2)

Type of Cargo	Calculated Required Scale in 1990
General Cargo	11,500

3-2 Fishery Port

The required scale of the fishery port in 1990 is determined by the same thinking and method as in the Master Plan.

The number of fishing boats and landing volume in 1990 is forecast as 220 boats and 612 tons.

The calculated required berth length and berth length proposed in the Short-term Plan are shown in Table-24.

Similarly, the scale for the functional facilities is shown in Table-25.

Table-24 Fishery Wharf

(Unit: m)

Type of Wharf	Length of Wharf				Proposed Total Length
	Landing Wharf		Preparatory and Rest Wharf		
	Calculated	Proposed	Calculated	Proposed	
-4m	169	170	231	130	300
-7m	340	340	303	280	620

Table-25 Propsed Functional Facilities for the Fishery Port

(Unit: m^2)

Facility	Calculated Area	Proposed Area
Fish Handling Shed	8,160	10,900
Ice Making and Ice Storage Facility	700	4,900
Cold Storage Facility	2,160	
Parking Lot	9,922	Utilize vacant land

4. Alternative Options for the Short-term Plan

In formulating the Short-term Plan, factors to be considered include:

① Efficient handling of various cargoes and fishes

② Minimizing the investment

③ Ensuring a smooth shift to the Master Plan

Judging from the shape of the Master Plan and the present situation, it is not only economical but also convenient to locate the new berths from the base of the existing 600 m wharf.

The alternative options are prepared as shown in Fig.-16 to -18.

Under Plan A, the total number of berths is 8, and one container gantry crane is installed on the deepest wharf.

The total number of berths in Plan B is 9. Instead of installing a container crane, one more berth is improved as compared with Plan A. In Plan C, the total number of berths is 8, the same as in Plan A. However, the wharf on which a container crane is installed in Plan C is the container terminal in the Master Plan.

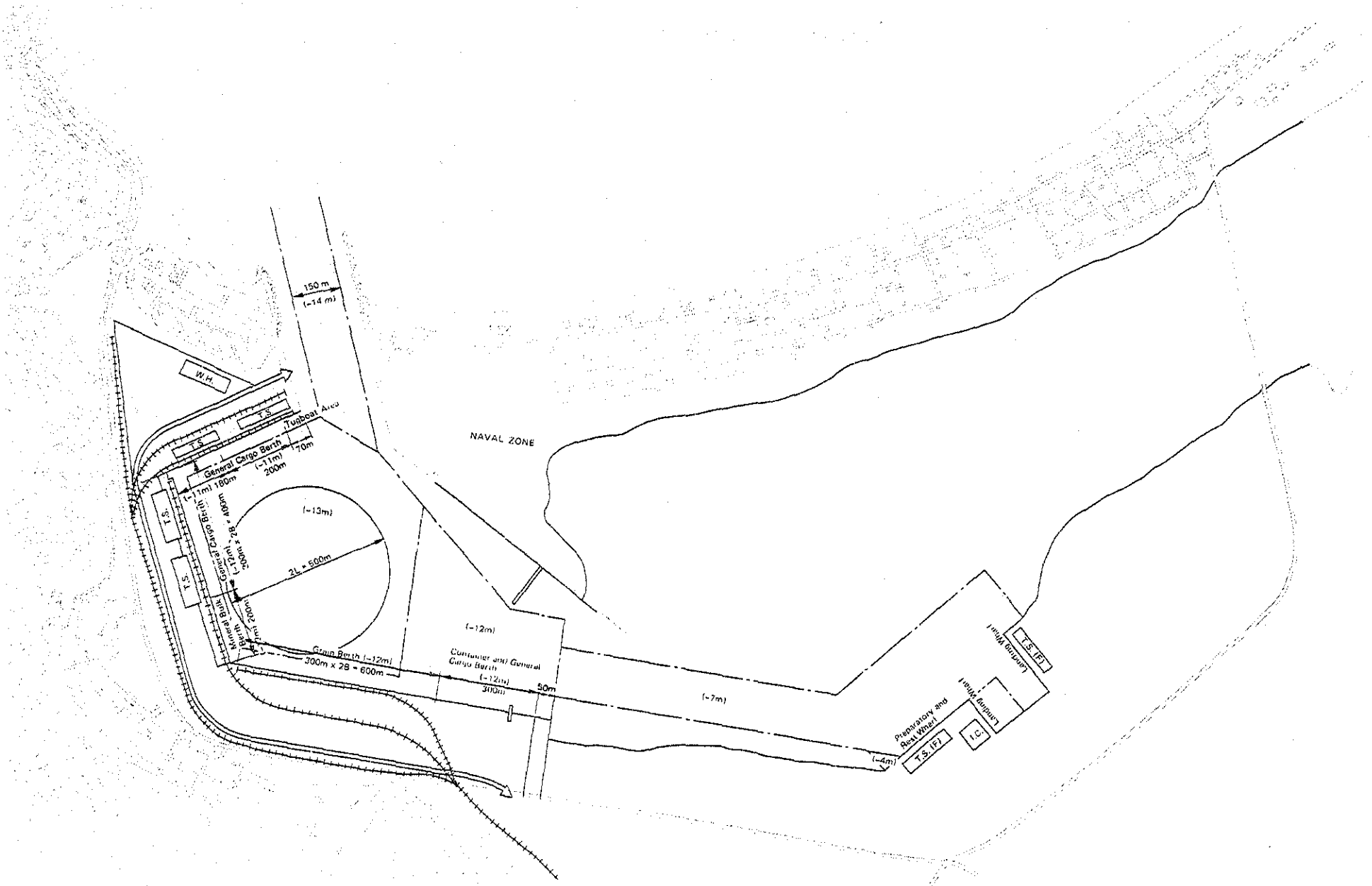


Fig.-16 Alternative Short-term Plan A

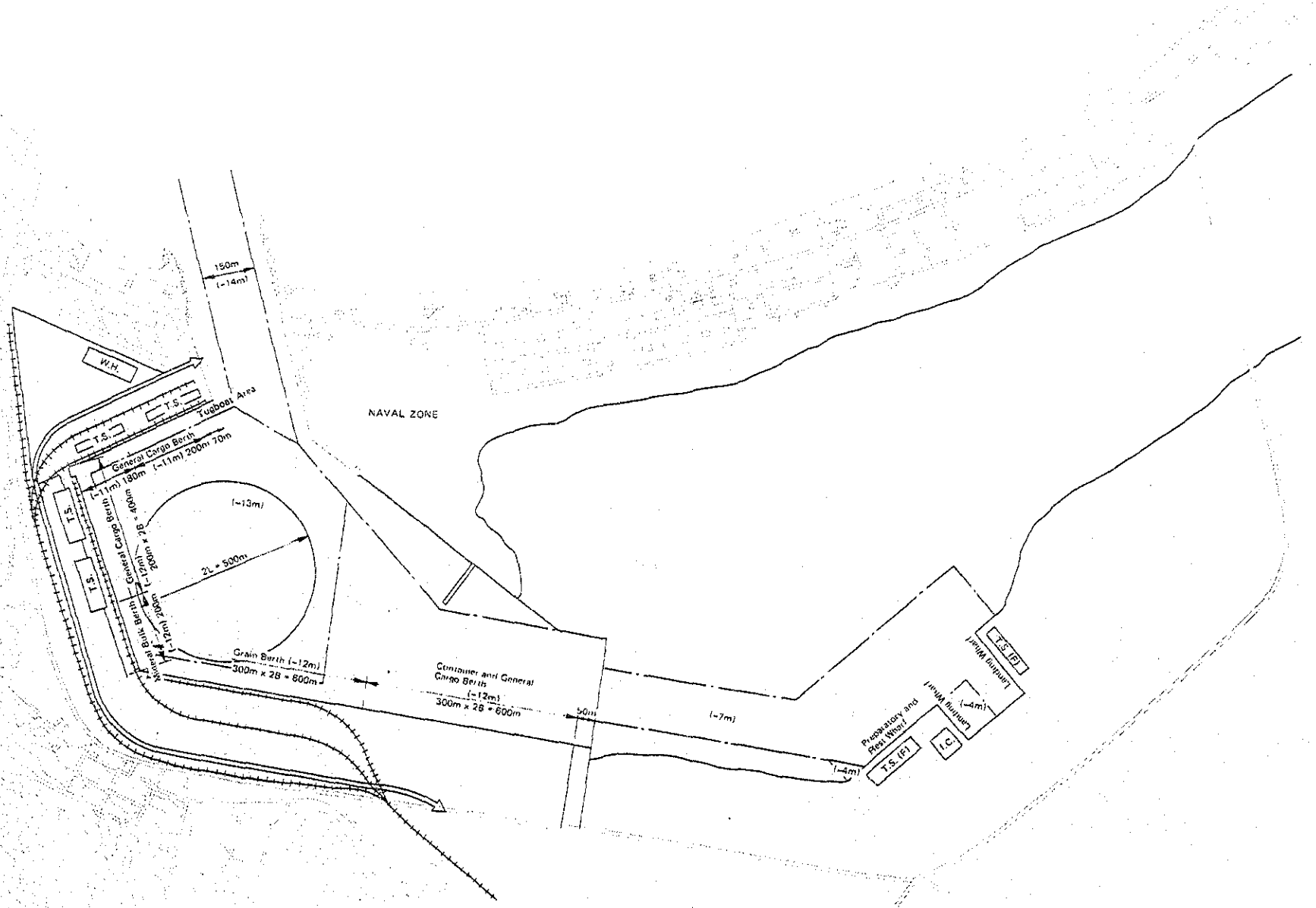


Fig.-17 Alternative Short-term Plan B

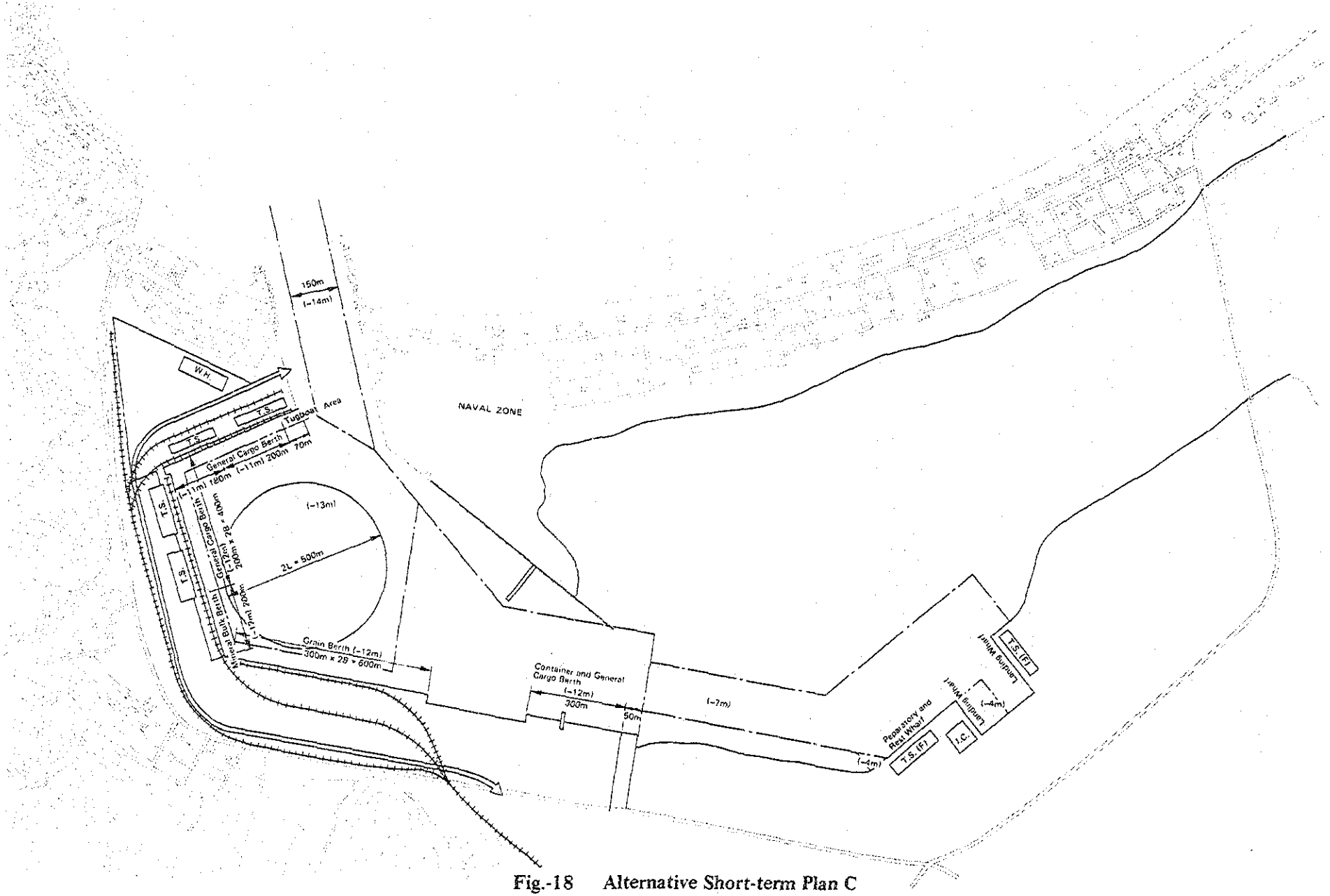


Fig.-18 Alternative Short-term Plan C

As for the fishery port, the layout plan in Fig.-19 is proposed from the viewpoint of minimizing the investment.

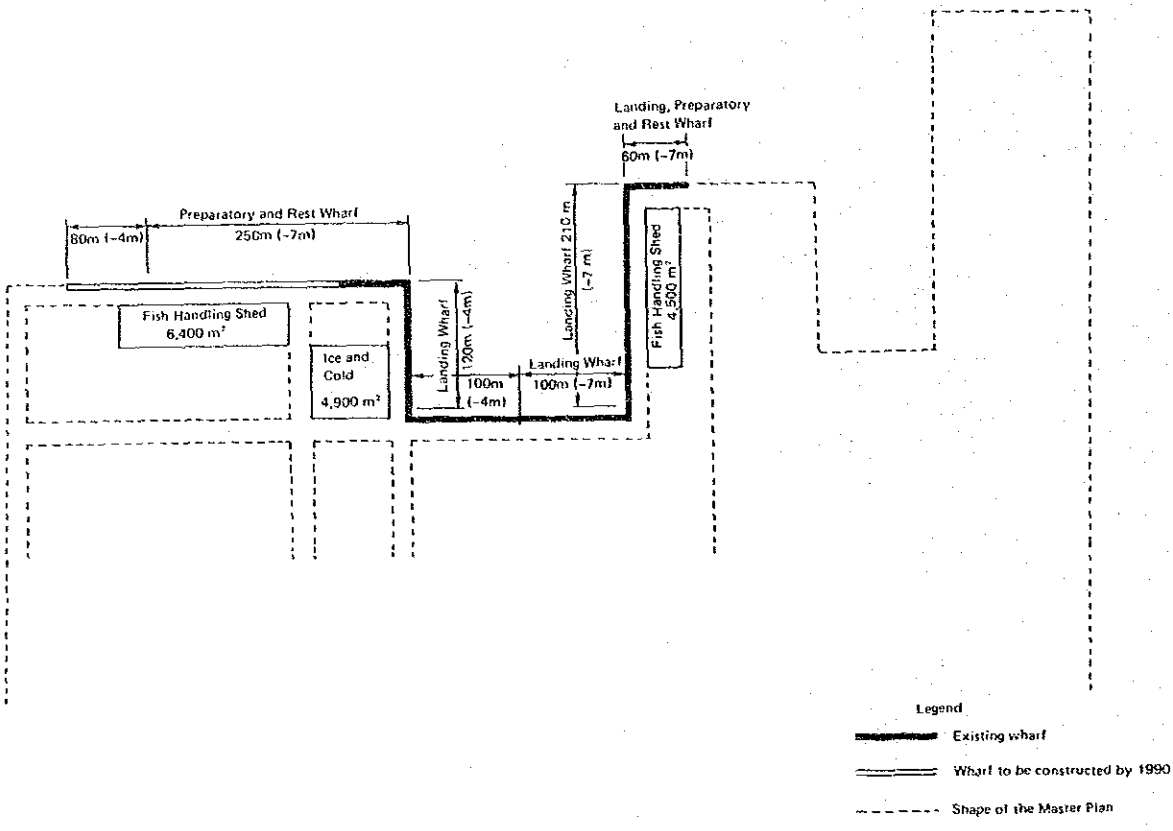


Fig.-19 Fishery Port Facilities Layout (1990)

5. Short-term Development Plan

The alternatives, Plan A, Plan B and Plan C are evaluated from the following viewpoints:

① Efficient use and operation of facilities
② Containerization
③ Continuity to the Master Plan
④ Relation to existing wharves
⑤ Possibility of early utilization
⑥ Amount of investment

Table-26 shows the results of this evaluation.

Table-26 Evaluation of Alternative Plans

Items of Evaluation	Evaluation		
	Plan A	Plan B	Plan C
(1) Efficient Use and Operation	◎	○	△
(2) Containerization	◎	△	◎
(3) Continuity to the Master Plan	○	◎	◎
(4) Relation to Existing Wharves	◎	◎	◎
(5) Possibility of Early Utilization	◎	○	○
(6) Investment			
• Amount of Investment (Unit: '000,000 pesos)	5,975	6,054	6,213
• Investment Efficiency	○	◎	△

Note: Ranking of evaluation ◎ Excellent ○ Ordinary △ Some problems

Judging from the above results of the assessment of the three alternative plans, Plan A is not only economical, but also has an advantage for handling containerized cargo.

Accordingly, Alternative Plan A is selected as the most appropriate Short-term Development Plan shown in Fig.-20.

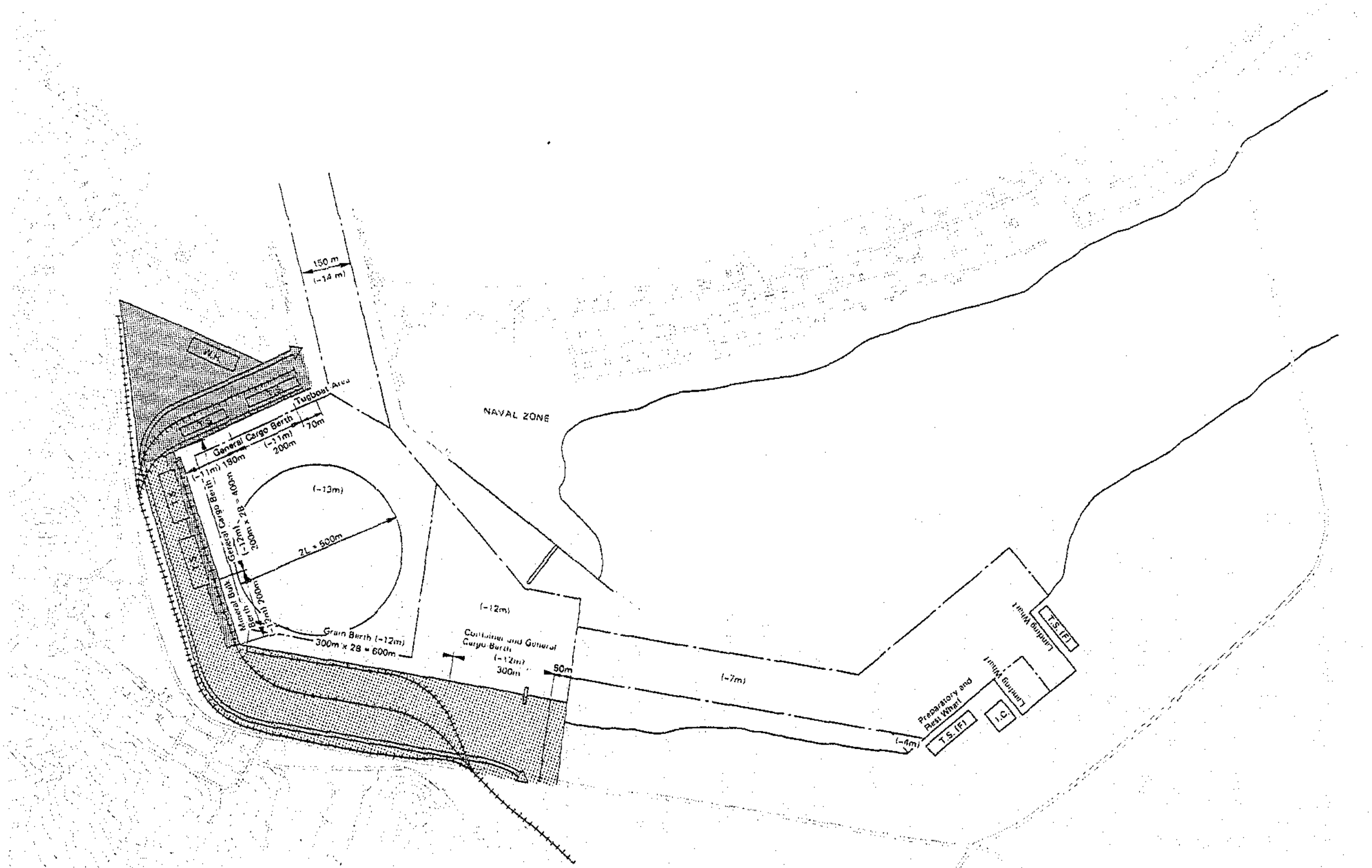


Fig.-20 Short-term Development Plan

CHAPTER IX ADMINISTRATION AND OPERATION

1. Present Administrative and Operational Problems

The present administrative and operational problems which cause time loss and other waste presented below are based on site surveys, analysis of data, and interviews with port officials and port users.

◎ Form and structure of the port administrative body

① There are many organizations related to the administration of the Port, and the relationships among these organizations is complicated.

② There is no timely information system, so the preparation for cargo handling and the proper arrangement of transfer vehicles is difficult.

③ The complicated administrative procedures and customs formalities delay the flow of cargo through the port.

④ There is no particular cargo handling tariff for container cargoes.

⑤ There are some cargoes which are left in transit sheds for an inordinately long period of time.

◎ Port facilities and operations

① There is a lack of berthing facilities and equipment for handling special cargoes.

② There is a lack of equipment to handle containers, and the container yard is too small.

③ The frequency of vessels calling at the Port is low, and there is no non-stop route linking Manzanillo with the west coast of U.S.A.

④ There is too much time lost during cargo handling due to unnecessary interruptions.

2. Administrative Recommendations

The Government of Mexico is now improving port administration and operations. The reform measures of the current execution program will help to improve port administration at the port of Manzanillo.

In addition, the following items are proposed judging from our analyses of the present situation and problems:

① Development of a timely information system

② Simplification of formalities and administrative procedures

③ Improvement of regulations and tariff for containers

④ Improvement of relations with persons and organizations concerned with port development

3. Proposed Operation System

To improve the productivity of the port operation, the most effective measure is to reduce

the time lost.

The cargo handling equipment shown in Table-27 is required to handle the cargoes for the Short-term Plan.

Table-27 Cargo Handling Equipment for the Short-term Plan

Kind of Equipment	Capacity	Quantity	Remarks
Conventional General Cargo			
Truck Crane	70 t	1	for handling heavy cargo
Wheel Crane	9 – 20 t	4	to be newly purchased: 1
Forklift	3 – 15 t	40	
Tractor		5	to be newly purchased
Flat Chassis	10 t	10	to be newly purchased
Dump Truck	15 t	3	to be newly purchased
Shovel Loader	3.5 m^3	1	
Container			
Gantry Crane	30.5 t	1	to be newly purchased
Truck Crane	70 t	1	
Straddle Carrier	30.5 t	3	to be newly purchased
Forklift	3 – 15 t	3	
Forklift (large size)	33 t	1	to be newly purchased
Trailer Head		2	to be newly purchased
Container Chassis	20', 40'	4	to be newly purchased
Bulk Cargo			
Truck crane	70 t	1	for setting hopper
Wheel Crane	9 – 20 t	2	
Shovel Loader	3.5 m^3	6	trimming work in ship hold
Forklift	3 – 15 t	4	
Hopper	50 m^3	6	to be newly purchased

CHAPTER X DESIGN, CONSTRUCTION AND COST ESTIMATE

1. Design

1-1 Basic Premises

Based on the Short-term Plan, the commercial port facilities are designed. These facilities conform with the layout of the Master Plan. The design makes the greatest possible use of the present facilities.

1-2 Design Conditions

The basic design conditions are listed in Table-28.

Table-28 Basic Conditions

Item	Grain Berth	Container and General Cargo Berth
Water Depth	-12 m (-13 m)	-12 m (-13 m)
Object Vessel	20,000 DWT Bulk Carrier (40,000 DWT)	20,000 DWT (40,000 DWT)
Cope Height	+3.4 m	
Number of Berths and Berth Length	2 Berths: 600 m (A 300 m Mineral Bulk Berth and a 300 m Grain Berth)	1 Berth: 300 m (A Grain Berth)
Surcharge	4.0 t/m^2	4.0 t/m^2 But that is 2.5 t/m^2 during operation of the container grantry crane.
Container Gantry Crane		Dead Load: 610 t Rated Load: 30.5 t Span: 20 m
Lifetime	50 years	

Note: The conditions in parentheses are those of the Master Plan.

Natural conditions and other conditions are almost the same as those of the Master Plan.

1-3 Design of Main Port Facilities

As for the main port facilities, reinforced concrete open type berths are investigated under various load conditions, and the design is performed to accommodate severe conditions. The calculations are performed based on the theory of elasticity.

One of the sections, the container and general cargo berth, is shown in Fig.-21.

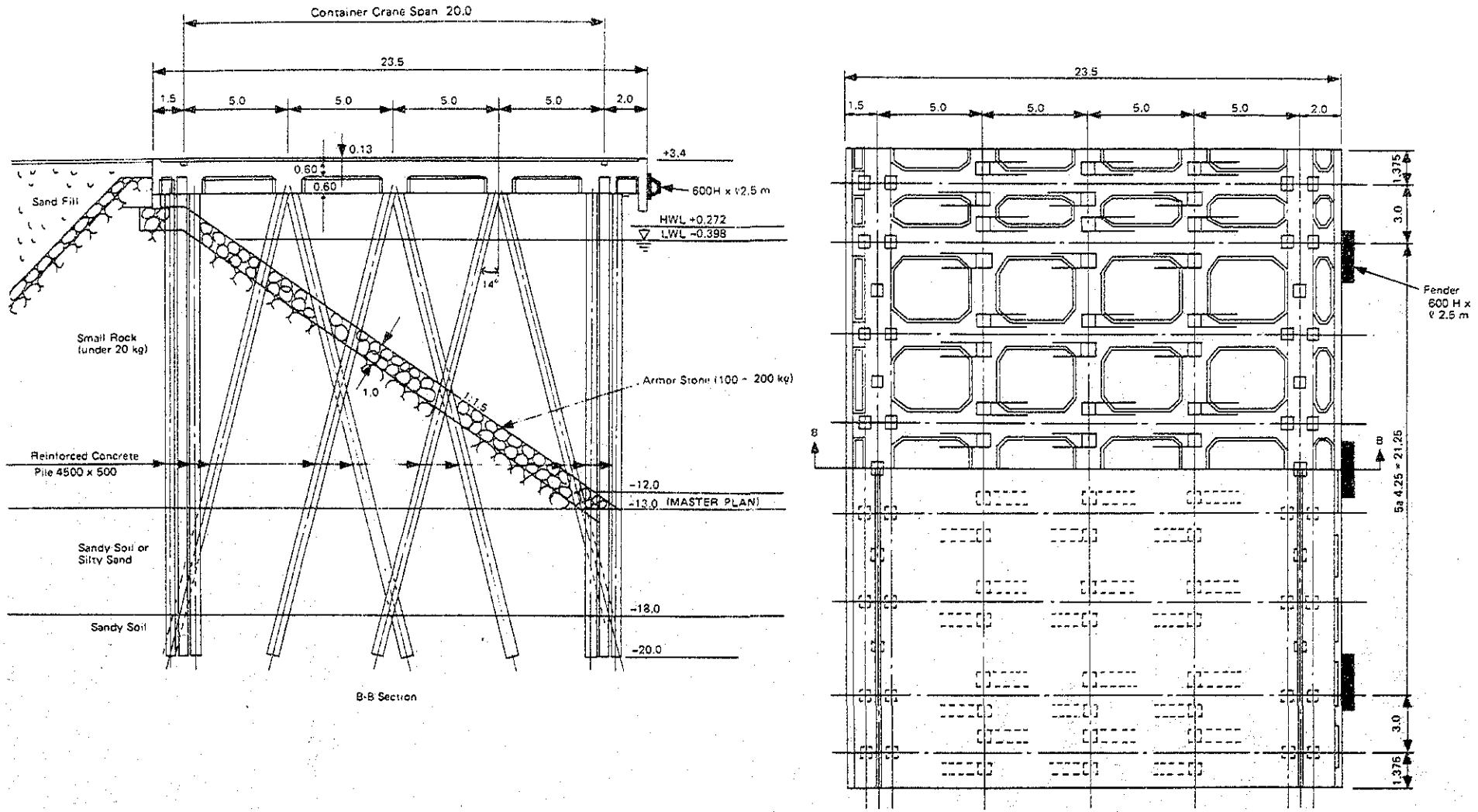


Fig.-21 Container and General Cargo Berth

2. Construction

The construction schedule for the commercial port facilities is shown in Table-29.

Concerning dredging, a high capacity dredger will be used. The dredged sand will be used for the reclamation works.

There is a shoal in the anchorage. This shoal has to be removed immediately because it will obstruct ship operations.

Table-29 Construction Schedule

Facility		Construction Year					
Item	Sub Item	1985	1986	1987	1988	1989	1990
1. Dredging	(1) Channel (-14m)						
	(2) Anchorage						
2. Quays	(1) -12m Mineral Bulk Berth						
	(2) The End of the Above						
	(3) -12m Grain Berth						
	(4) -12m Container and General Cargo Berth						
	(5) Temporary Working Yard						
	(6) Water and Electric Supply for Construction Work						
	(7) The End of the -12m Container and General Cargo Berth						
	(8) Temporary Seawall						
3. Railway and Road	(1) Railway						
	(2) Road						
	(3) Fence and Gate						
4. Transit Sheds	(1) Transit Shed (No. 3)						
	(2) Transit Shed (No. 4)						
5. Land	(1) Container Yard						
	(2) Wharf Lot						
	(3) Wharf Lot						
6. Water and Electric Supply, and Drainage	(1) Water Supply						
	(2) Drainage						
	(3) Electric Substration						
	(4) Electric Supply						
7. Aids to Navigation	(1) Lighted Spar Buoy						
	(2) Lighted Buoy						
	(3) Lighted Small Buoy						
	(4) Leading Light						
8. Cargo Handling Equipment for Containers	(1) Gantry Crane (30.5t)						
	(2) Forklift (33t)						
	(3) Straddle Carrier (30.5t)						
	(4) Trainer Head for Container						
	(5) Container Chassis (20')						
	(6) Container Chassis (40')						
9. Cargo Handling Equipment for General Use	(1) Wheel Crane (15t)						
	(2) Tractor						
	(3) Flat Chassis (10t)						
	(4) Dump Truck (15t)						
	(5) Hopper ($50m^3$)						

3. Cost Estimate

The cost of the main port facilities for the Short-term Plan are estimated. Estimation conditions for the Master Plan are also applied to the Short-term Plan.

The summary of the construction costs is listed in Table-30.

Table-31 shows the annual investment at the commercial port.

Table-30 Construction Costs (Commercial Port)

Facilities	Construction Cost ('000 pesos)		
	Total	Foreign Portion	Local Portion
1. Dredging	756,000	251,000	505,000
2. Quays	1,744,700	70,000	1,674,000
3. Railway and Road	117,400	60,000	57,400
4. Transit Sheds	610,000	50,000	560,000
5. Land	319,000	–	319,000
6. Water and Electric Supply, and Drainage	733,000	228,000	505,000
7. Aids to Navigation	76,000	66,100	9,900
8. Cargo Handling Equipment for Containers	1,176,000	1,176,000	–
9. Cargo Handling Equipment for General Use	442,500	390,000	52,500
Sub Total	5,974,600	2,291,100	3,683,500
Tax	328,605	–	328,605
Total	6,303,205	2,291,100	4,012,105

Table-31 Annual Investment at the Commercial Port

(Unit: '000,000 pesos)

Facility	1985			1986			1987			1988			1989			Total		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
1. Dredging				174.7	349.8	524	57.6	116.4	174	19.2	38.8	58				251	505	756
2. Quays	7.26	171.94	179.2	24.24	589.26	613.5	16.9	405.5	922.4	20.6	438.5	459.1	1	69.5	70.5	70	1,674.7	1,744.7
3. Railway and Road							6	2.4	8.4	30	28.7	58.7	24	26.3	50.3	60	57.4	117.4
4. Transit Sheds							12.5	140	152.5	12.5	140	152.5	25	280	305	50	560	610
5. Land				0	33.2	33.2	0	125.3	125.3	0	4.5	4.5	0	156	156	0	319	319
6. Water and Electric Supply, and Drainage				60	77.2	83.2	4.2	56.6	60.8	3.4	44.6	48	214.4	326.6	541	228	505	733
7. Aids to Navigation							66.1	9.9	76							66.1	9.9	76
8. Cargo Handling Equipment for Containers													1,176	0	1,176	1,176	0	1,176
9. Cargo Handling Equipment for General Use							30	1.5	31.5	162	8.4	170.4	198	42.6	240.6	390	52.5	442.5
Total	7.26	171.94	179.2	204.44	1,049.41	1,253.9	193.3	857.6	1,050.9	274.7	703.5	951.2	1,638.4	901.0	2,539.4	2,291.1	3,683.5	5,974.6
Tax	–	15.7	15.7	–	81.2	81.2	–	77.9	77.9	–	64.9	64.9	–	88.9	88.9	–	328.6	328.6
Grand Total	7.26	187.64	194.9	204.49	1,130.66	1,335.1	193.3	935.5	1,128.8	247.7	768.4	1,016.1	1,638.4	989.9	2,628.3	2,291.1	4,012.1	6,303.2

Note: F/C = Foreign Currency L/C = Local Currency

CHAPTER XI ECONOMIC ANALYSIS

1. Purpose and Methodology of Economic Analysis

In order to show whether or not the project is justifiable from the economic point of view, assessing its contribution to the national economy, the economic return is evaluated in terms of the Internal Rate of Return (IRR) based on cost benefit analysis using the Discount Cash Flow Method.

2. Benefits and Costs

2-1 Benefits

The following three benefits are evaluated monetarily in the analysis:

① Reduction in staying costs
② Reduction in cargo handling costs
③ Reduction in time costs

The following three benefits are intangible, so only a qualitative analysis in undertaken:

① Development of port related industries
② Increase in employment opportunities
③ Improvement of cargo handling safety

2-2 Costs

As for costs, construction costs and maintenance costs are estimated.

3. Shadow Pricing

"Shadow pricing" is used to examine the economic costs of labor, capital, and imported goods, as well as the benefits of development, to evaluate projects from the economic viewpoint. The market prices are changed to shadow prices using the following conversion factors after excluding transfer items:

① The standard conversion factor
② Conversion factor for consumption
③ Conversion factor for capital goods
④ Shadow wage rate

4. Results of Economic Analysis

4-1 Economic Profitability

The internal rate of return is calculated as IRR = 16.04% as shown in Table-32. It is generally considered that a project with an IRR of more than around 10% is economically feasible. Even though the economic calculation only takes into account the three items which are easily quantified, the IRR of the project is 16.04%. Therefore, the project is certainly feasible.

Table-32 Cost/Benefit and IRR (Shadow Price)

(Unit: '000,000 pesos)

Year	Cost	Benefit	Bnft.-Cost	P. Cost	P.Bnft.	P. Value
1985	136.00	0.00	-136.00	136.00	0.00	-136.00
1986	939.00	0.00	-939.00	809.21	0.00	-809.21
1987	841.00	220.00	-621.00	624.57	163.38	-461.19
1988	794.00	439.00	-355.00	508.16	280.96	-227.20
1989	2,364.00	661.00	-1,703.00	1,303.84	364.57	-939.27
1990	128.00	843.00	715.00	60.84	400.68	339.84
1991	128.00	895.00	767.00	52.43	366.60	314.17
1992	128.00	895.00	767.00	45.18	315.92	270.74
1993	128.00	895.00	767.00	38.94	272.26	233.32
1994	128.00	895.00	767.00	33.56	234.62	201.07
1995	128.00	895.00	767.00	28.92	202.19	173.28
1996	128.00	895.00	767.00	24.92	174.24	149.32
1997	128.00	895.00	767.00	21.48	150.16	128.68
1998	128.00	895.00	767.00	18.51	129.40	110.90
1999	128.00	895.00	767.00	15.95	111.52	95.57
2000	128.00	895.00	767.00	13.74	96.10	82.36
2001	128.00	895.00	767.00	11.84	82.82	70.97
2002	128.00	895.00	767.00	10.21	71.37	61.16
2003	128.00	895.00	767.00	8.80	61.51	52.71
2004	128.00	895.00	767.00	7.58	53.00	45.42
2005	128.00	895.00	767.00	6.53	45.68	39.15
2006	128.00	895.00	767.00	5.63	39.36	33.73
2007	128.00	895.00	767.00	4.85	33.92	29.07
2008	128.00	895.00	767.00	4.18	29.23	25.05
2009	128.00	895.00	767.00	3.60	25.19	21.59
2010	128.00	895.00	767.00	3.11	21.71	18.61
2011	128.00	895.00	767.00	2.68	18.71	16.03
2012	128.00	895.00	767.00	2.31	16.12	13.82
2013	128.00	895.00	767.00	1.99	13.90	11.91
2014	128.00	2,699.00	2,571.00	1.71	36.11	34.40
Total	8,274.00	25,447.00	17,173.00	3,811.25	3,811.26	0.00

Note: P represents the present value.
Bnft represents the benefit.

IRR (%) = 16.04

4-2 Sensitivity Analysis

A sensitivity test is made assuming that the growth rate of the GDP after 1986 is only 4.7%. The result is that the IRR is 11.03%. Therefore we conclude that the Short-term Development Project for the port of Manzanillo is feasible from an economic viewpoint, even if the GDP grows slowly.

CHAPTER XII FINANCIAL ANALYSIS

1. Purpose and Premises of Financial Analysis

The purpose of the financial analysis is to examine the financial soundness of the organization designated to execute the project, and the profitability of the project itself.

The financial viability of the organization is analyzed and evaluated using the projected financial statements.

The profitability of the project itself is analyzed through the Financial Rate of Return (FRR) using the Discount Cash Flow Method.

The following points are assumed for the analysis:

① Only the commercial port functions in the inner port are analyzed.

② The revenue is calculated based on the current port and stevedoring tariff rates authorized by the Mexican government.

③ As for fund raising, the domestic currency portion is disbursed from Government funds, and the foreign currency portion is covered by overseas loans with an annual interest rate of 4.75 percent and repayment terms of 25 years (with a 7 year grace period).

2. Results of Financial Analysis

2-1 Evaluation by Financial Statements

Based on the estimated financial statements (income statement, statement of source and application of funds and balance sheet) and analyses of various financial ratios calculated from the financial statements, the projected financial condition of the project is favorable.

The revenue will be sufficient to cover the operating costs, the interest on loans and depreciation expenses.

2-2 Evaluation by FRR

The Financial Rate of Return (FRR) using the Discount Cash Flow Method is estimated as 7.21%.

The desirable level of FRR varies, depending on time and place, and the expectations of the lender and borrower. For borrowers, the interest rate paid on funds raised is the lower limit. In this project, 1.72% is the weighted average interest rate for all the project funds.

Judging from this point of view, the project can be regarded as feasible, since the FRR of the project is 7.21%, well above the weighted average interest rate.

2-3 Sensitivity Analysis

The sensitivity analysis is conducted assuming an annual GDP growth rate of 4.7% after 1986.

Under this analysis, the financial statements are favorable and the FRR is 6.48%. Thus, the project will be financially sound, even at a reduced rate of GDP growth.

CHAPTER I. INTRODUCTION

CHAPTER I INTRODUCTION

1. Background and Objectives of the Study

1-1 Background

The economy of the United Mexican States grew favorably from 1976 to 1981 as shown by the 4% ~ 9% annual growth rate in the GDP. This growth was mainly due to increased exports of petroleum and industrial products.

From the middle of 1981 through 1983 the Mexican economy stagnated. Mexico entered into an economic crisis for the following reasons:

① Drastic fall of crude oil prices and the prices of other export commodities
② Heavy interest burden due to a high accumulation of debts and high international interest rates
③ Funding difficulties on the international money markets
④ Exodus of capital from Mexico

Consequently, the annual GDP growth rate became negative.

Since 1983, however, the Mexican economy has recovered to some extent. The rate of inflation has dropped, employment has increased, and GDP has been growing. Overall, economic and social activities have been expanding under "Plan Nacional de Desarrollo 1983 ~ 1988".

Mexico suffers from an extreme concentration of population, commerce, and industry in the central region around Mexico City. The Mexican government has been promoting a more balanced development through decentralization of population and commercial and industrial activities based on regional development plans.

One of the best ways to further regional development is by creating new productive centers along the coasts. The regional development of the Manzanillo area based on Manzanillo Port plays an important role in this policy.

1-2 Objectives

The study aims at formulating a Master Plan of the port of Manzanillo with a target year 2000, as well as preparing a Short-term Development Plan of the Port for the period up to 1990, including a feasibility study.

2. Circumstances

In April 1983, the Government of the United Mexican States requested the Government of Japan to carry out a feasibility study on the development project of the port of Manzanillo, Colima, the United Mexican States.

In response to the request, the Government of Japan decided to undertake the study and dispatched the Preliminary Study Team to Mexico in May, 1984 headed by Kouji Inoue, JICA.

The team had a series of discussions about the project with concerned Mexican officials.

The Scope of Work for the study was agreed upon on 8 June 1984 by Mr. Kouji Inoue, leader of the Japanese Preliminary Study Team, and Mr. Jaime Luna Trail, Vocal Coordinador Ejecutivo, CNCP, SCT.

Based on the Scope of Work, JICA organized a study team headed by Dr. Kazuo Kudo, Executive Director, OCDI.

The study team executed the study, including two field surveys, from September of 1984. The Interim Report was presented to JICA in February, 1985.

The Interim Report includes a Master Plan with a target year of 2000. The Master Plan includes an examination of the natural, social, and economic conditions of the region, and a demand forecast for Manzanillo Port, as well as suggestions concerning the desirable allotment of functions between the inner and outer ports, a land use plan, the types of industries which should be located in the inner port, and the necessary scale of port facilities.

After presenting the Interim Report, the study team amended the Master Plan based on comments from the Mexican government. The Final Report includes the amended Master Plan and a Short-term Development Plan for the Port with a target year of 1990.

3. Scope of the Study

In order to achieve the objectives mentioned above, the study includes the following:

◎ Examination of natural conditions
- ① Meteorology
- ② Waves
- ③ Tidal level and current
- ④ Soil
- ⑤ Littoral drift
- ⑥ Topography
- ⑦ Sounding

◎ Master Plan
- ① The proper role of the Port considering the desirable and possible social economic development in its hinterland
- ② Basic conception for the development of the Port
- ③ Projection of the port traffic including cargo traffic, landing of fish catch and demand for coastal sports and leisure activities up to the year 2000
- ④ Land/water area utilization plan
- ⑤ Basic layout plan of major port facilities
- ⑥ Basic layout plan of pertinent infrastructures such as access roads and environmental improvement facilities
- ⑦ Approximate cost estimation

◎ Short-term Development Plan

On the basis of the Master Plan above, a feasibility study is conducted for the Short-term Development of the Port up to the year 1990. Major items of the study are as follows:

① Consideration of the desirable and possible social and economic development in the hinterland of the Port
② Projection of the port traffic including cargo traffic, landing of fish catch and demand for coastal sports and leisure activities up to the year 1990
③ Preliminary structural design, cost estimation and implementation plan of the port facilities
④ Study of the environmental conditions
⑤ Port management and operation systems
⑥ Economic analysis
⑦ Financial analysis

4. Field Survey

4-1 Organization of the Study Team

The Japanese study team was comprised of eight specialists from OCDI, and a JICA representative.

Their names, duties and present positions are as follows:

	Duty	Name	Present Position
①	Leader, Overall Study	Kazuo Kudo	Executive Director, OCDI
②	Sub Leader, Demand Forecast	Tsutomu Kihara	Director, OCDI
③	Port Planning	Kiyoshi Sato	OCDI
④	Regional Planning	Takeo Suga	OCDI
⑤	Natural Conditions-II, Structural Design	Masami Kasuga	OCDI
⑥	Natural Conditions-II, Construction Plan, Cost Estimation	Hiroshi Okamoto	OCDI
⑦	Port Management, Financial Analysis	Keiki Yasutake	OCDI
⑧	Economic Analysis	Nobuyuki Motoishi	Senior Economist, OCDI
⑨	Coordinator	Takao Kaibara	JICA

4-2 Field Surveys

The field surveys were conducted as follows:

① First Survey, Progress Report, Sept. ~ Nov., 1984
② Second Survey, Interim Report, Feb. ~ Mar., 1985

4-2-1 First Survey (September 17th to November 4th, 1984)

During the first field survey, the study team visited related government and other public offices and private companies in Mexico in order to collect data and information necessary for the execution of the study. The study team made an on-site inspection at Manzanillo Port to understand the present situation in detail, and visited related ports in Mexico and U.S.A. to determine the relationship among these ports.

The rough itinerary of the first field survey is presented below.

Date	Activities
17th, Sept. ~ 22nd, Sept.	Visit to the related offices in Mexico City. Collect data and information.
23rd, Sept. ~ 28th, Sept.	Field survey in Manzanillo Port. Interviews at the related offices, collect data and information. Field survey of the port of Lázaro Cárdenas. Collect data and information at Colima.
29th, Sept. ~ 7th, Oct.	Survey of the hinterland and the influence area of Manzanillo Port. Interviews and data collection at Guadalajara.
8th, Oct. ~ 16th, Oct.	Survey at the ports of Lázaro Cárdenas. Acapulco and Veracruz. Interviews and data collection at the ports.
17th, Oct. ~ 18th, Oct.	Survey of the hinterland at Aguascalientes.
19th, Oct. ~ 29th, Oct.	Conduct interviews and collect data and information at Mexico City. Preparation of the progress report.
30th, Oct.	Explanation of the progress report. Sign the "Minutes of Discussion".
31th, Oct.	Visit to the related offices.
1st, Nov. ~ 4th, Nov.	Survey of the ports of Los Angeles and Oakland. Return to Japan.

4-2-2 Second Survey (February 25th to March 17th, 1985)

During the second field survey, the study team explained the Interim Report to Mexican government officials at Mexico City and at the port of Manzanillo. At the same time, the study team collected some additional data and information.

The rough itinerary of the second field survey is as follows'

Date	Activities
25th, Feb. ~ 3rd, Mar.	Visit to the related offices in Mexico City. Collect data and information.
4th, Mar.	Explanation of the Interim Report to the Mexican government officials at Mexico City.
5th and 6th, Mar.	Visit to the related offices at the port of Manzanillo. Collect data and information.
7th, Mar.	Explanation of the Interim Report to the Mexican government officials at Manzanillo Port.
8th and 9th, Mar.	Collect data and information at Manzanillo Port.
10th, Mar. ~ 13th, Mar.	Collect data and information at Mexico City. Discuss the Interim Report.
14th, Mar.	Sign the "Minutes of Meeting".
15th, Mar. ~ 17th, Mar.	Visit to the related offices. Return to Japan.

4-3 Counterparts

The United Mexican States counterparts are listed below.

Ing. Jaime Luna Trail
Vocal Coordinador Ejecutivo, CNCP

Ing. Héctor López Gutierrez
Director General de Sistemas Portuarios, CNCP

Ing. Antonio Moreno Gomez
Director de Puertos Especializados, CNCP

Ing. Jorge M. Lecona Ruiz
Jefe de Dpto. Pros. Especializados, DGSP, CNCP

And related persons at CNCP branch offices

CHAPTER II.
PRESENT SITUATION OF MEXICO

CHAPTER II PRESENT SITUATION OF MEXICO

1. Natural Conditions

1-1 Geography and Topography

The United Mexican States is a federal republic and its location is shown in Fig. II-1. It is bordered on the north by U.S.A. (the northern border runs from the Pacific Ocean to the Gulf of Mexico covering a distance of about 2,100 km), the Gulf of Mexico and the Caribbean Sea to the east (the eastern coastline is 2,780 km long), Belize and Guatemala to the southeast, and the Pacific Ocean to the south and west. The western coastline (including both sides of the Baja California Peninsula and the entire Pacific coast) is 7,360 km long.

The total area of Mexico is 1,972,544 km^2 and it is the third largest country in Latin America, after Brazil and Argentina.

Manzanillo lies roughly in the middle of the west coast. It is located at lat. 19°04'N, long. 104°20'W, facing the Pacific Ocean.

Mexico is mountainous, and more than 50% of the total area is highland between 1,500 m and 2,000 m altitude. The average altitude is more than 1,000 m, and almost 71% of the total land area lies at above 400 m above sea level.

As shown in Fig. II-1, the Sierra Madre Occidental and the Sierra Madre del Sur along the western coastline, and the Sierra Madre Oriental along the eastern coastline extend from northwest to southeast. In the isolated areas between these ranges lie several plateaus where the main portion of Mexico's administration, economy, culture and industry are located. The main cities of Mexico are located in these highlands. The basin of Mexico City is at 2,300 m altitude; Guadalajara is at 1,500 m altitude; and Toluca is at 2,600 m altitude.

Furthermore, the belt of high volcanic activity which surrounds the Pacific Ocean includes Mexico's mountain ranges. Mexico has many famous volcanoes: Mt. Orizaba (5,700 m), the nation's highest peak, Mt. Popocatépetl (5,452 m), and Mt. Colima (4,339 m) near Manzanillo. Also, about 480 km to the south of the Baja California Peninsula and about 720 km west of Manzanillo lie the Revilla Gigedo Islands, a group of volcanic islands.

With the exception of the Yucatan Peninsula, Mexico's mountains are bounded by narrow plains along the coast. The western coast on which Manzanillo is located may be divided into the following two portions with the exception of the Baja California Peninsula. The first is the coastal plain located between the Sierra Madre Occidental and the Gulf of California and the Pacific Ocean. This plain is widest in the north where it includes low hills and mountains, and numerous bays and lagoons. The second is the narrow coastal plain located between the Sierra Madre del Sur and the Pacific Ocean. It forms a narrow alluvial apron along the coast of Jalisco, Colima, Michoacan, Guerrero, Oaxaca, and Chiapas, and is about 1,750 km long. There are good natural harbours such as Manzanillo and Acapulco. Manzanillo lies near the northwest end of this plain in Colima State.

Indeed, the geography and topography of Mexico are quite complex. As shown in Fig. II-1, the Tropic of Cancer passes north of Mazatlan and across the center of Mexico. Mexico links

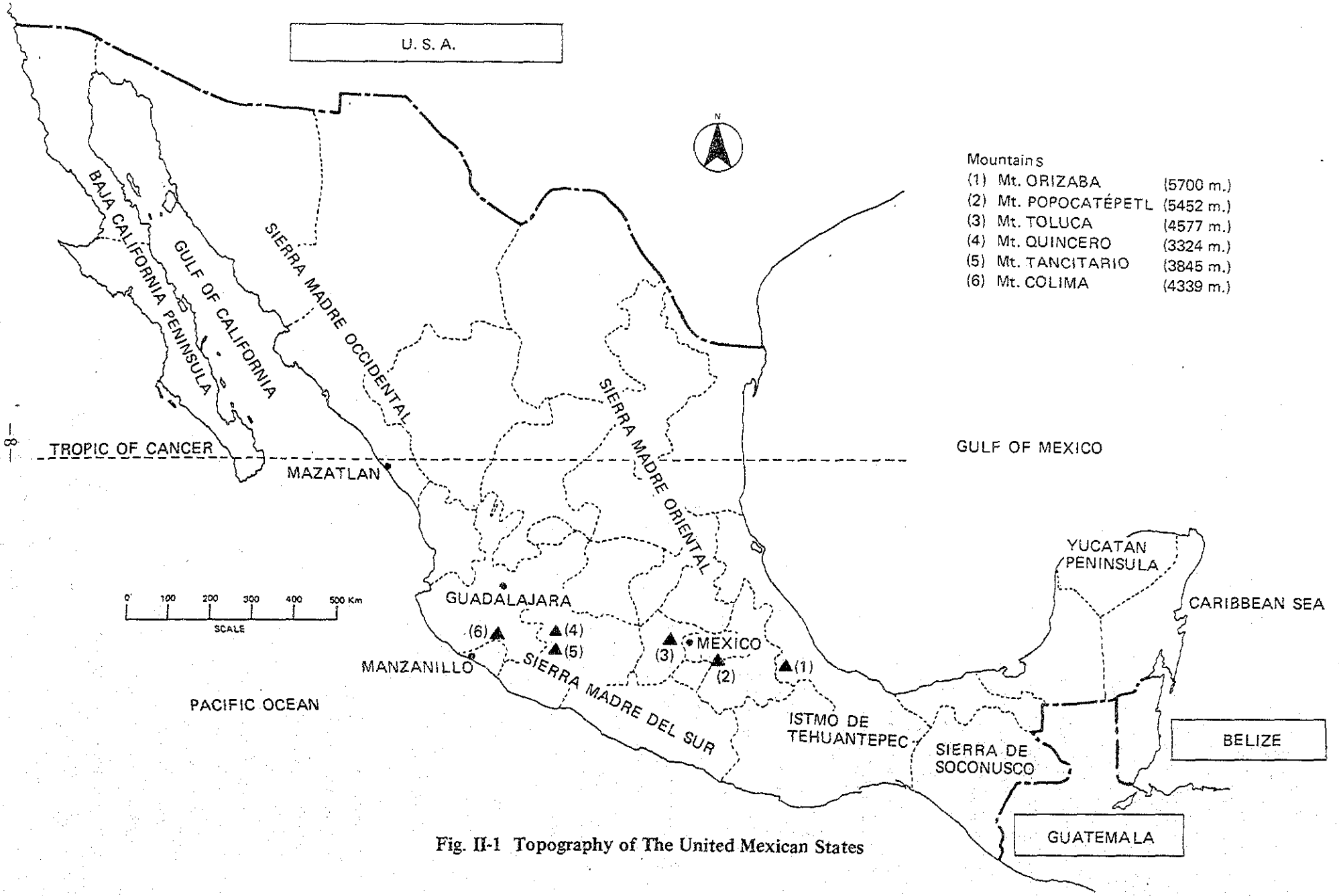


Fig. II-1 Topography of The United Mexican States

North America which has a temperature climate with Central America which is tropical. As Mexico is mountainous, the areas of benign temperate climate are primarily determined by altitude rather than by latitude.

A topographical map of Colima State is shown in Fig. II-2, and the level of altitude is classified by shade. The area of Colima State is 5,542 km^2 and it consists of 10 cities. The municipality of Manzanillo is located at the western edge of the State, and covers an area of 1,332 km^2. It is the largest municipality in the State.

As shown in Fig. II-2, highlands of over 100 m in altitude approach the coastline and border narrow coastal plains. The area behind Cenicero Bay, the Santiago area along the Punta de Agua, and the small areas around Manzanillo Port, Cuyutlan Lagoon, and Tecoman are backed by these highlands. In the northwestern portion of Manzanillo, lower highlands under 500 m altitude extend to the coastline. But about 4 km to northwest of Santiago Bay lies Mt. Toro (820 m) and 15 km to north of Manzanillo Bay lies Mt. Centinela (800 m).

There are steep peaks northwest of Manzanillo. Highlands over 500 m extend for about 10 km to the northeast. Mt. Ocote and Peon, from 1,500 m to 2,000 m in altitude, are about 30 km away, and peaks over 2,000 m high extend from about 50 km northeast of the City. To the east-southeast, a gently sloped plateau extends along the Armeria River. Colima City, the capital of Colima State, lies east-northeast of Manzanillo.

In sum, Manzanillo lies in the central portion of the Mexican western coastline. In this area, highlands approach the coastline and form narrow coastal plains, and there are few areas suitable for ports. From the geographical and topographical viewpoint, the port area of Manzanillo lies in one of most suitable areas for a port along the Mexican western coastline. It has good bays, Manzanillo and Santiago Bays, and has coastal plains behind it. However there are some problems. The plains are narrow and the Bay has no large river to supply required water.

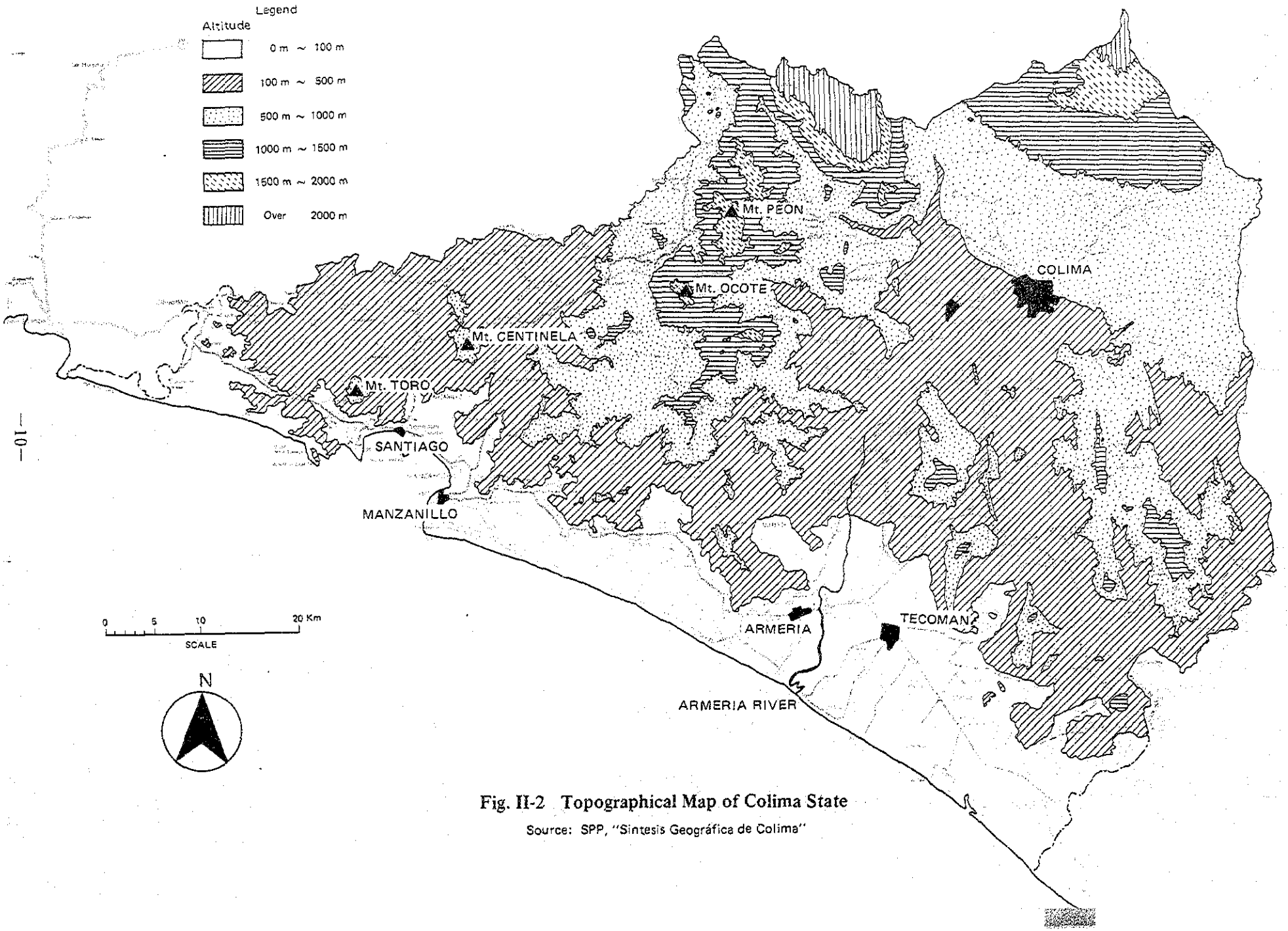


Fig. II-2 Topographical Map of Colima State

Source: SPP, "Sintesis Geográfica de Colima"

1-2 Climate

The climate of Mexico is diversified. The climatic regions can be roughly classified as shown in Fig. II-3.

This wide variety of climates is due not only to the latitudinal difference but also to differences in altitude. The gale called 'Nortes', from the north, caused by the northern anticyclone, and tropical cyclones called 'Hurricanes' further vary this diverse climate.

Accordingly, there is also a wide variety of vegitation: grass and cactus in the dry zone; oak, walnut, pine and firs on the mountain slopes and plateaus; rubber trees, cacao, mahogany, etc. in the tropical selva; pineapple, banana, coconut palm, potato and cereals in the tropical savanna; and mangroves in the tropical lowlands.

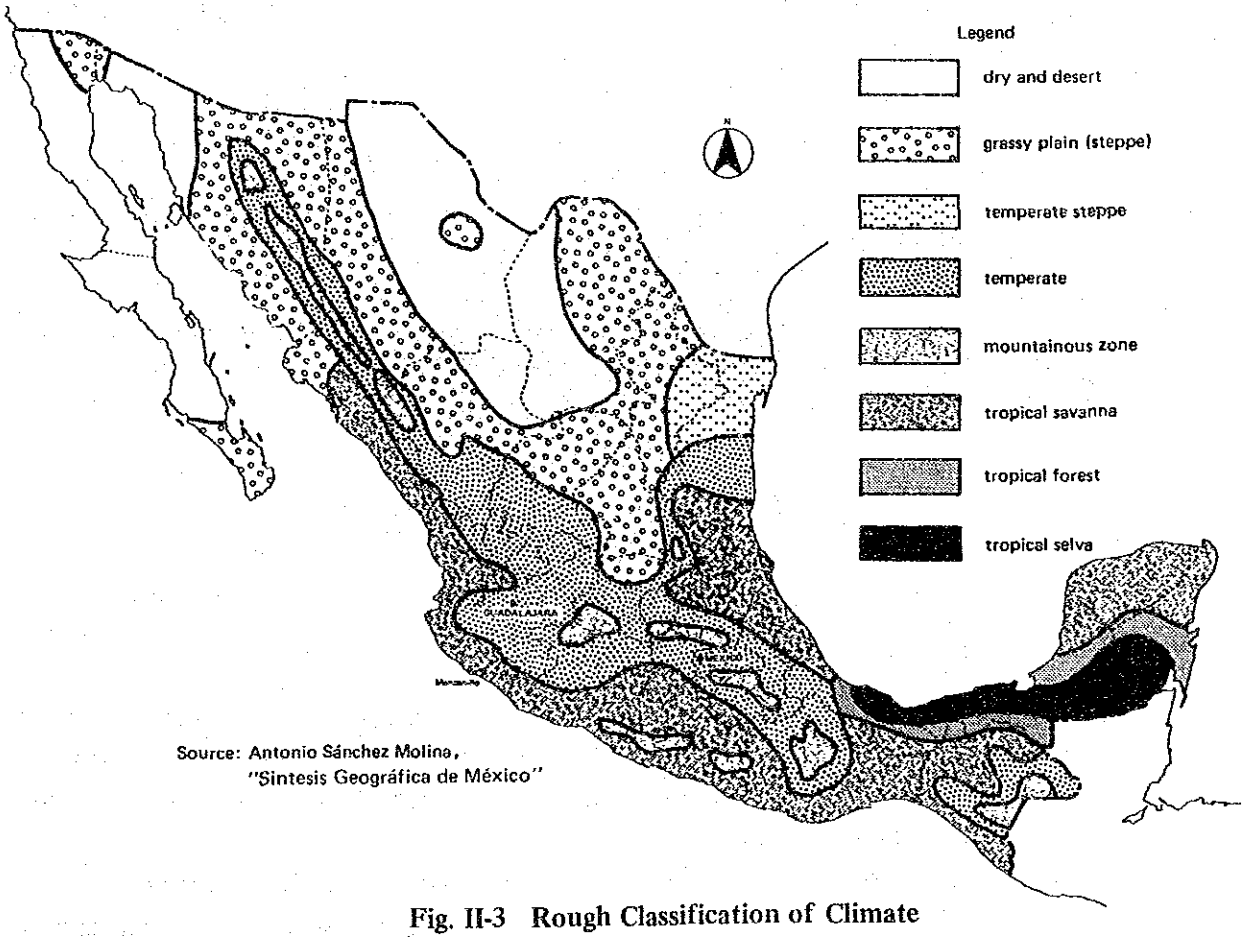


Fig. II-3 Rough Classification of Climate

Climatic differences influence human activity, and as a result, population is concentrated on the plateaus.

The coastal area from Mazatlan to the southern border of the west coast which is classified as tropical savanna, has a dry season from December to May, and a rainy season from June to November. Mean temperature is about 28°C in the summer season, and 24°C in the winter

season. It is hot and the temperature differential between summer and winter is small.

This zone is influenced by both the northeast tradewind of the northern hemisphere and the southeast tradewind of the southern hemisphere. The confluence is called the Inter-Tropical Convergence Zone (ITCZ) and a soft wind is usual there. This ITCZ moves south in the winter season and north in the summer season. Thus, northwest winds predominate in winter. The gale called "Nortes" from the north caused by the anticyclone in the northern part of Mexico sometimes blows in this season. On the other hand, southwest and southeast winds prevail in summer.

Manzanillo is located at the north end of the ITCZ, and therefore winds from WNW and W are predominant all year around.

The seasonal movement of the ITCZ is closely related to the ocean current in the east Pacific and migratory tropical cyclones. When the ITCZ goes to the north, which has warm and humid air in late spring and summer, cyclones appear, and when the ITCZ moves south in late autumn and early spring, the cyclones stop. The courses of cyclones in 1978 are shown in Fig. II-4. The number of cyclones is shown in Table II-1. These data show that the cyclones occur most frequently in July, August and September.

Table II-1 Number of Cyclones (1960 ~ 1980)

	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
Number	11	56	68	77	62	36	6

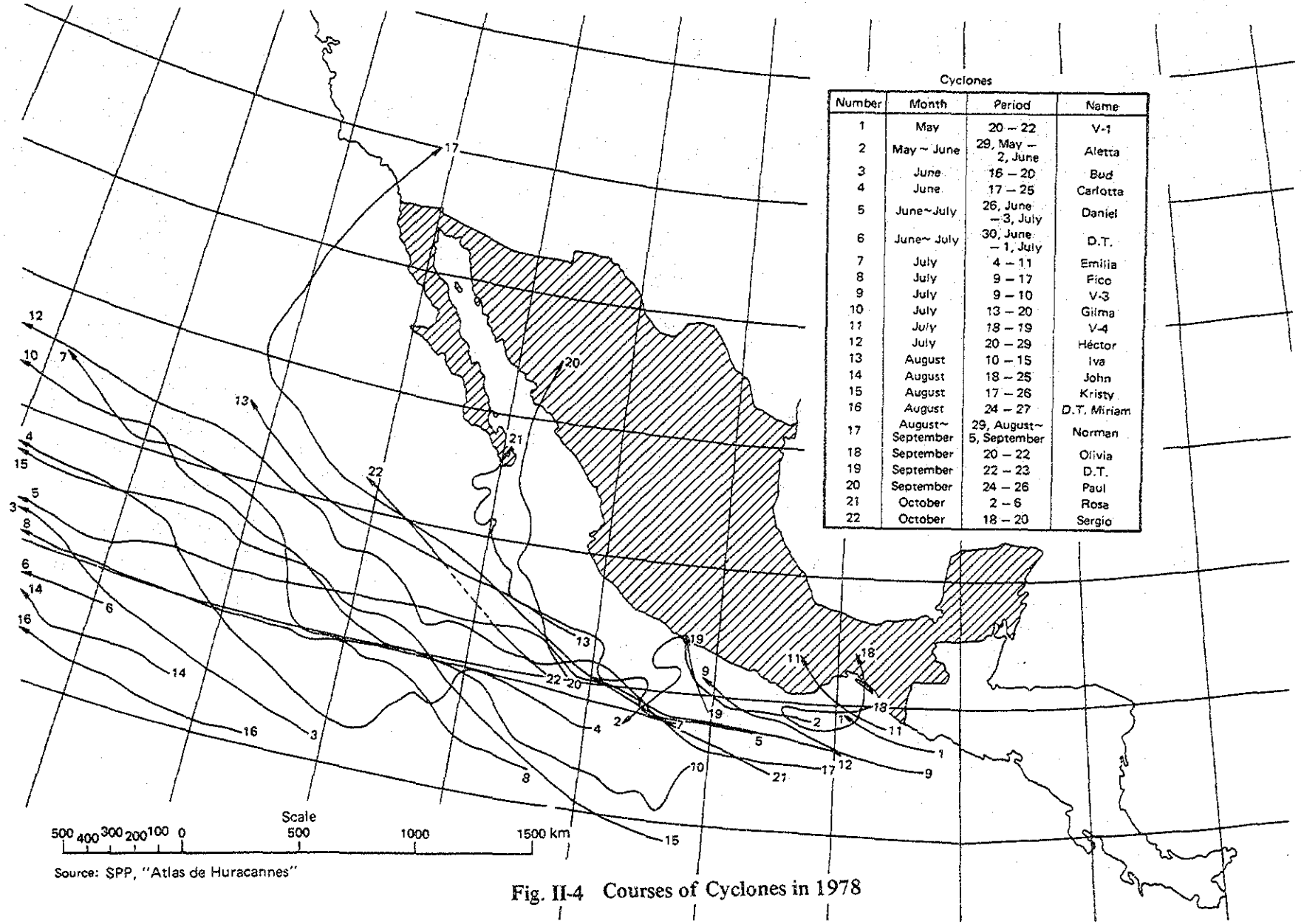
Note: The figures in this table show the number of cyclones in the Pacific Ocean from 1960 to 1980.
Source: SPP, "Atlas de Huracanes"

Cyclones in this area are called 'Hurricanes' when they become powerful. They are usually born off the south Pacific coast and they move north along the Pacific coast. Gales caused by the cyclones bring humid air from the ocean to the land areas. This causes large rainfall on the mountain slopes and coastal areas because the high Sierra Madre Occidental Range stops the humid air.

The mean annual precipitation around Manzanillo is about 900 mm and most of the rain falls from June to October. It usually falls in the afternoon with cloudbursts. The most rainy month of the year is September because of the frequent cyclones during that month. The precipitation in September reaches 220 mm.

The visibility of this area is usually good. There are less than 5 foggy days per year.

The vegitation of this area includes tropical plants such as coconut palms, pineapples, bananas, mangoes and sorghum. Mangroves grow in the tropical lowlands. The more inland areas include fields of maize, sugar cane, lemons, tomatoes and cattle farms.



Source: SPP, "Atlas de Huracannes"

Fig. II-4 Courses of Cyclones in 1978

2. Socio-Economic Conditions

2-1 Population

As shown in Table II-2 and Fig. II-5, the population of Mexico grew at an annual rate of about 3% from 1950 to 1980, and reached 67 million in 1980. This is primarily due to a radical decrease in the death rate, from 23.4 per thousand in 1940 to 7.4 per thousand in 1980. This decrease was brought about by social development and economic improvement. The explosive increase in population, however, induced serious social and economic problems such as over-crowding, insufficient housing, and poor food supply-demand adjustment. To limit population growth, the decrease of the birth rate was publicly promoted, and as a result, the population growth rate was reduced slightly from 3.4% in 1970 to 3.3% in 1980. The succeeding censuses indicate a steady decrease in the population growth rate: 2.7% in 1982 and 2.5% in 1983.

Table II-2 Population of Mexico

Item	Unit	1940	1950	1960	1970	1980
Total Population	(thousand persons)	19,654	25,791	34,923	48,225	67,383
Annual Increase Rate	(%)	1.7	2.7	3.1	3.4	3.3
Birth Rate	(per thousand)	44.5	45.6	46.1	44.2	34.4
Death Rate	(per thousand)	23.4	16.1	11.5	10.1	7.5
Share of Population (a)						
Urban Area	(%)	35.1	42.6	50.7	58.7	66.3
Rural Area	(%)	64.9	57.4	49.3	41.3	33.7

Source: Programación y Presupuesto, SPP, "Anuario Estadística de los Estados Unidos Mexicanas 1980"
(a) "Mexican Demográfico, Breniario 1979" y "X Censa"

Population ('000)	Annual Increase Rate (%)
13,607	0.7
15,160	1.1
14,335	-0.6
16,553	1.4
19,654	1.7
25,791	2.7
34,923	3.1
48,225	3.4
67,383	3.3

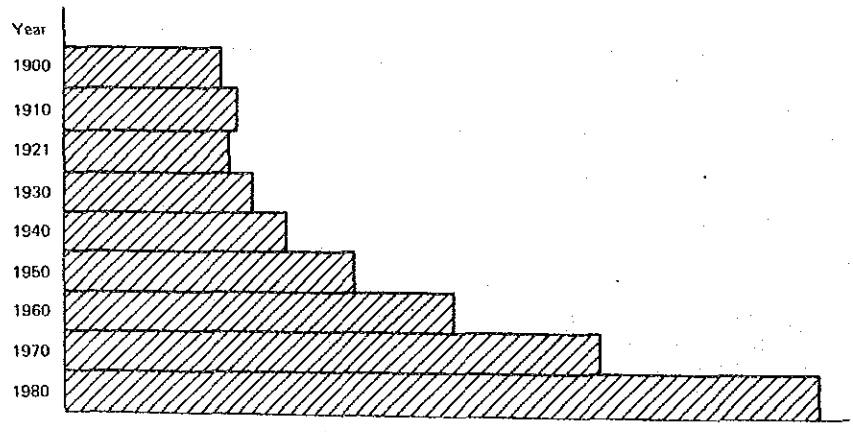


Fig. II-5 Population Growth

In addition, due to the topographic and climatic conditions of Mexico as well as to historical trends, population is concentrated in the central regions, as shown in Table II-3. The population density of the Federal District is remarkably high: 6,803 per km^2. Similarly, the population density of Mexico State, 401 per km^2, is also surprising when compared with the national average of 37.3 per km^2. The high population density in the central regions is shown graphically in Fig. II-7. This high density in the central region is a result of continuing migration towards the big cities. Table II-3 shows the situation clearly. Thus, the increased population in the urban areas is due to natural population increase (from the birth rate) and to continued migration into the big cities.

According to "Mercado Mexicano En Cifras", the total population growth rate, the natural growth rate, and the growth rate due to migration are, respectively, 3.5%, 1.8%, and 1.7% for Mexico City, 3.6%, 2.1%, and 1.5% for Monterrey City, and 4.4%, 2.3%, and 2.1% for Guadalajara City in 1982. The total population growth rate of each of those cities exceeds the national average, 2.7% in 1982. For reference, Fig. II-8 shows the location and population of major cities.

Table II-3 Population Density (1982)

District	Population ('000 persons)	Area ('000 km^2)	Population Density (persons/km^2)
National Total	73,011	1,958	37.3
North-West*	6,030	411	14.7
North*	4,959	518	9.6
North-East*	4,718	144	32.7
Central-North	3,558	142	25.1
Zacatecas	1,209	73	16.5
San Luis Potosi	1,793	63	28.4
Aguascalientes	556	6	101.6
Central-West	14,687	252	58.2
Jalisco	4,581	81	56.7
Colima	368	5	70.9
Guanajuato	3,295	31	108.1
Querétaro	802	11	70.0
Michoacán	3,281	60	54.7
Guerraro	2,360	64	36.7
Center	25,387	87	293.4
Distrito Federal	10,061	2	6,802.6
México	8,569	21	401.3
Tlaxcala	589	4	146.7
Morelos	1,021	5	206.3
Puebla	3,525	34	104.0
Hidalgo	1,622	21	77.9
South*	11,897	265	44.9
Peninsula*	1,775	139	12.7

Note: * – Each district is shown in Fig. II-6.
Source: Secretaría de Goberanación, "Consejo Nacional de Población"
SSP, "Instituto Nacional de Estadistica, Geografia e Infermática"

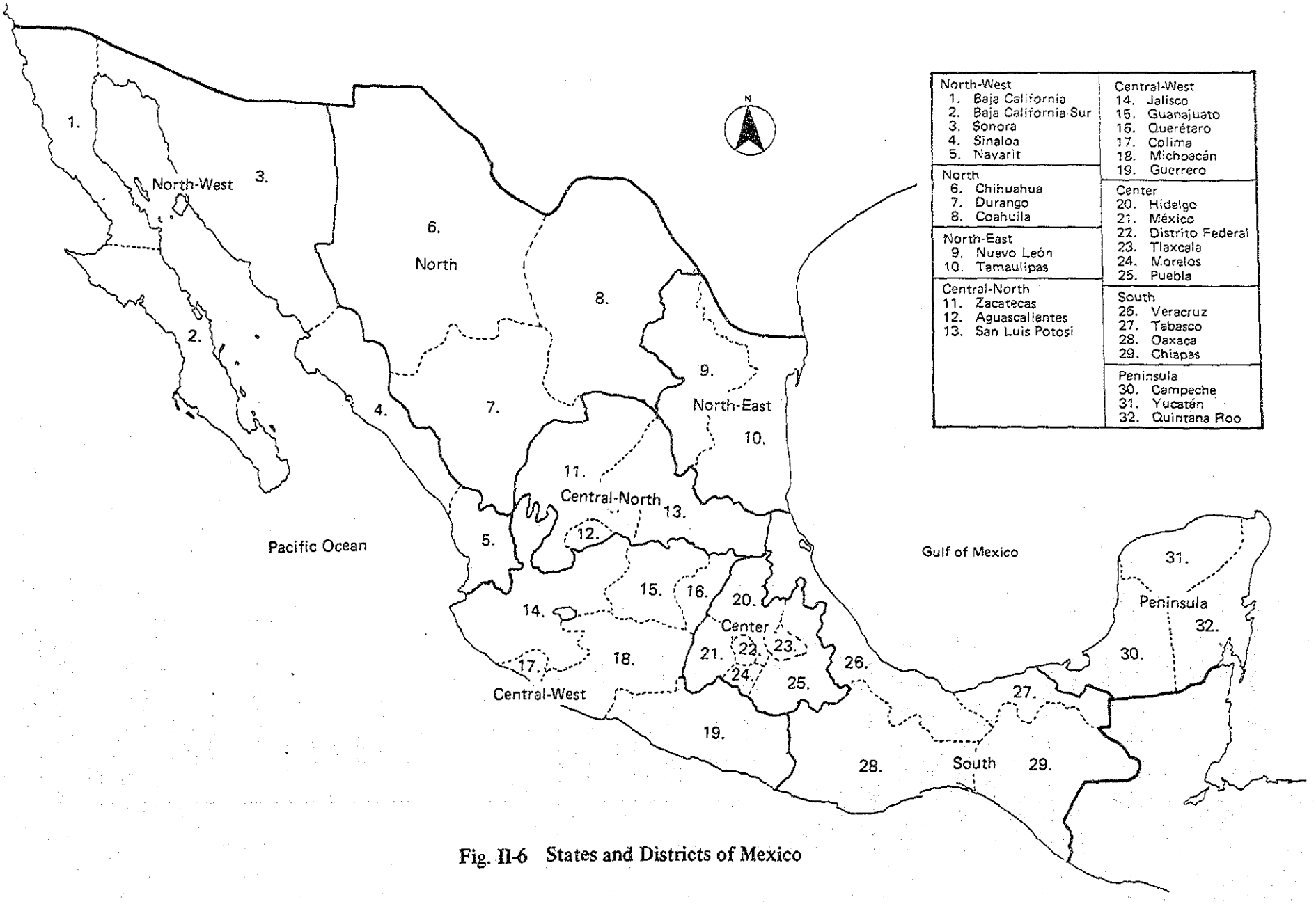


Fig. II-6 States and Districts of Mexico

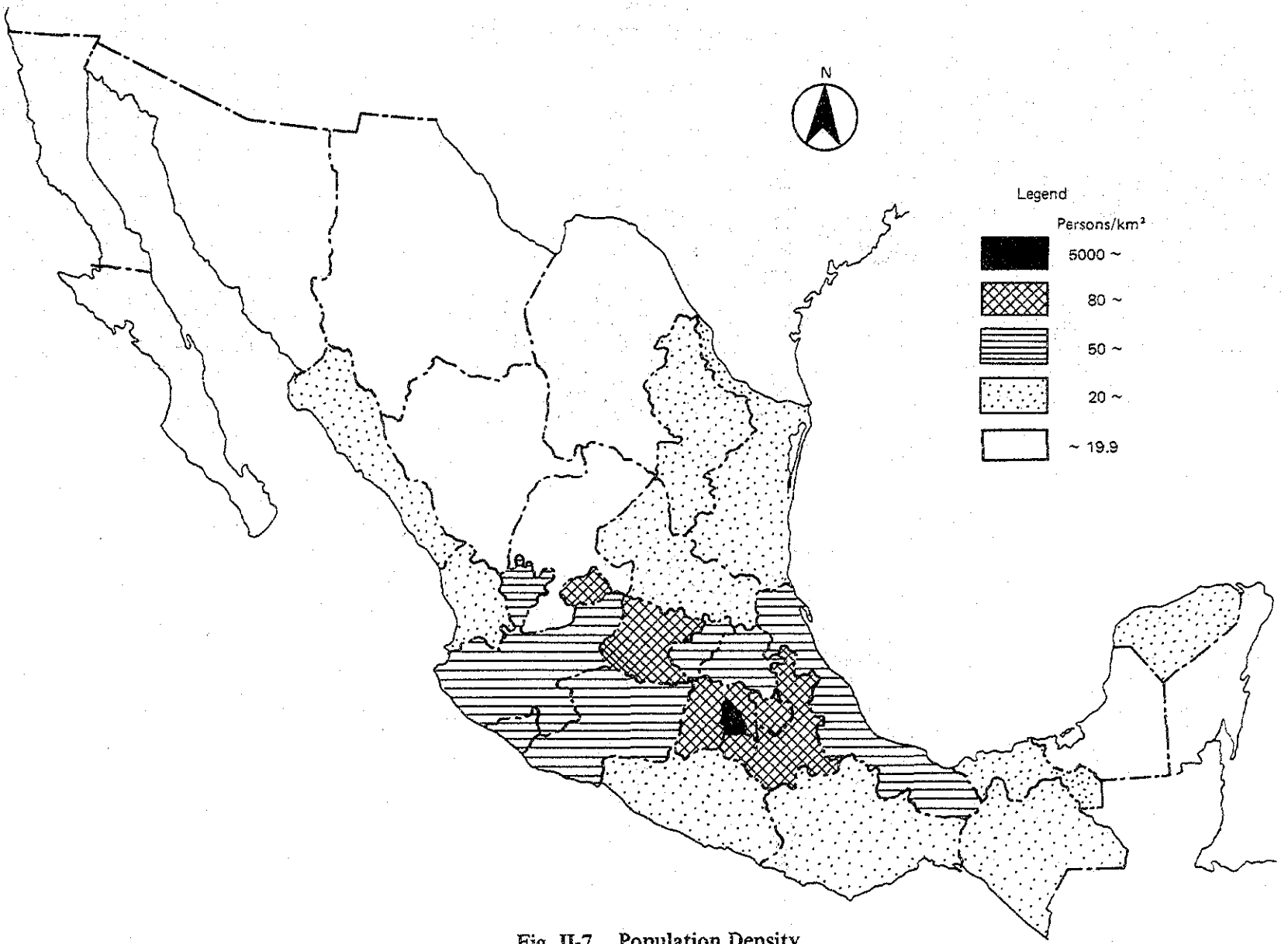


Fig. II-7 Population Density

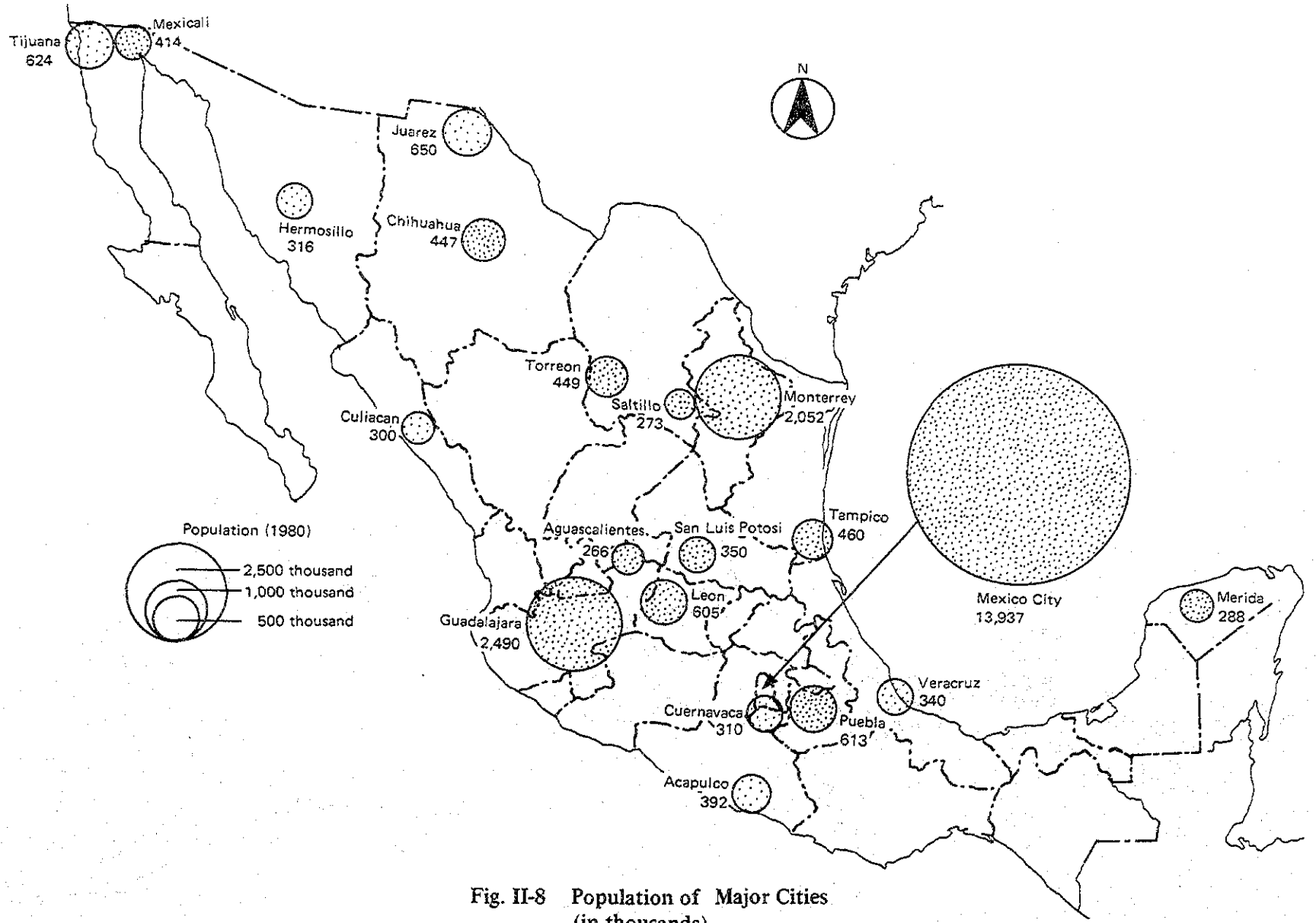


Fig. II-8 Population of Major Cities
(in thousands)

2-2 Economic Activities

Due to rich oil resources, Mexico was, economically, the most stable country in Latin America, and maintained a high level of economic growth with an annual growth rate of over 8% from 1978 through 1981 under the previous Portillo administration, as shown in Table II-4. During this period, the income received from oil exports and from loans from developed countries was used to promote industrialization. This supported rapid growth in mining, manufacturing, transportation, and construction. As shown in Table II-5, the growth of these sectors exceeded 10% per annum.

Table II-4 Gross Domestic Product by Sector in Constant (1970) Prices

(Unit: '000,000 pesos)

Sector	1976	1977	1978	1979	1980	1981	1982	1983
Total (Annual growth rate)	635,831 +4.2	657,721 +3.4	711,982 +8.3	777,163 +9.1	841,855 +8.3	908,765 +7.9	903,839 –0.6	861,769 –4.7
Agriculture, Forestry, Fishery	63,359	68,122	72,200	70,692	75,704	80,299	79,822	82,552
Mining	15,881	17,084	19,525	22,397	27,391	31,593	34,498	33,743
Manufacturing	155,517	161,037	176,816	195,614	209,682	224,326	217,852	201,937
Construction	34,310	32,494	36,532	41,297	46,379	51,852	49,259	42,196
Electricity	9,242	9,941	10,724	11,830	12,594	13,647	14,554	14,743
Transport, Communication	39,848	42,479	47,780	55,199	62,970	69,710	67,086	64,433
Commerce, Hotel, Restaurant	163,071	165,943	179,045	200,006	216,174	234,491	230,032	210,301
Other Service	154,603	160,621	169,360	180,128	190,961	202,847	210,736	211,864

Source: SPP, "Sistema de Cuentas Nacionales de México"

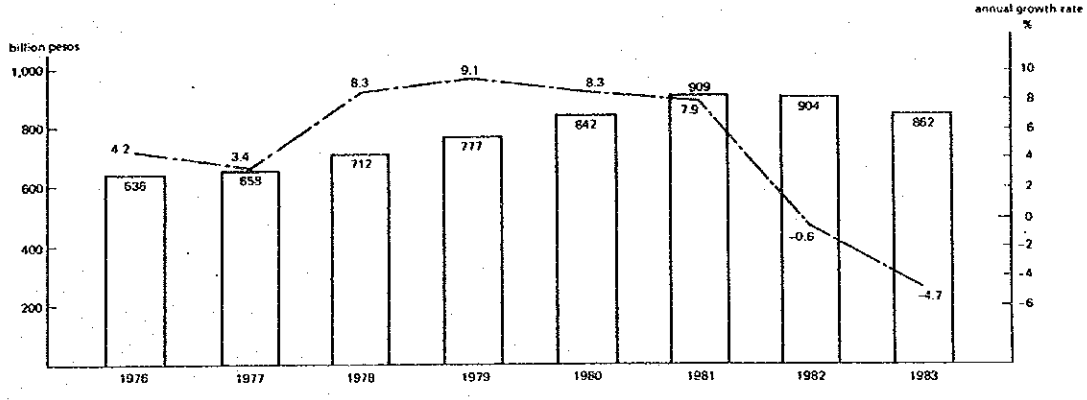


Table II-5 Growth Rate of GDP by Sector (1970 prices)

(Unit: %)

Sector	1976	1977	1978	1979	1980	1981	1982	1983
Total	+4.2	+3.4	+8.3	+9.1	+8.3	+7.9	-0.6	-4.7
Agriculture, Forestry, Fishery	+1.0	+7.5	+6.0	-2.1	+10.7	+6.1	-0.6	+3.4
Mining	+6.1	+7.6	+14.3	+14.7	+22.3	+15.3	+9.2	-2.2
Manufacturing	+5.0	+3.5	+9.8	+10.6	+7.2	+7.0	-2.9	-7.3
Construction	+4.6	-5.3	+12.4	+13.0	+12.3	+17.7	-5.0	-14.3
Electricity	+12.2	+7.6	+7.9	+10.3	+6.5	+8.4	+6.6	+1.3
Transport, Communication	+5.1	+6.6	+12.5	+15.5	+14.1	+10.7	-1.9	-8.6
Commerce, Hotel, Restaurant	+3.2	+1.8	+7.9	+11.7	+8.1	+8.5	-3.8	-4.0
Other Service	+5.0	+3.9	+5.4	+6.4	+6.0	+6.2	+3.9	+0.5

Source: SPP, "Sistema de Cuentas Nacionales de México"

However, in 1982 with the worldwide business recession, oil exports decreased substantially. The decreased oil demand and resultant decreased export income seriously impeded Mexico's economic growth. The industries which had been rapidly growing were seriously depressed, and the GDP became negative (see Table II-5).

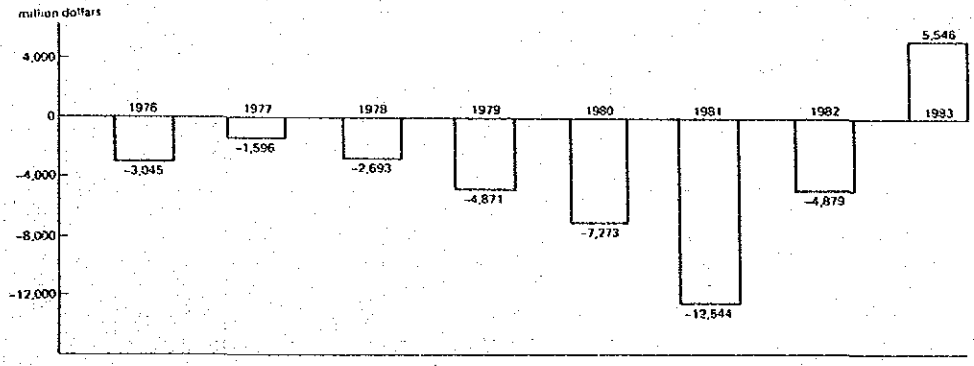
Furthermore, at the same time, the sharp increase in interest payments due to accumulated debts and increased interest rates further drained Mexico's resources. Foreign payment (net factor income) increased from 2.4 billion dollars in 1978 to 3.3 billion dollars in 1979, 5.0 billion dollars in 1980, 7.6 billion dollars in 1981, and 10.2 billion dollars in 1982, as shown in Table II-6.

Table II-6 Balance of Foreign Account in Current Prices

(Unit: '000,000 dollars)

Item	1976	1977	1978	1979	1980	1981	1982	1983
Total	-3,045	-1,596	-2,693	-4,871	-7,273	-12,544	-4,879	+5,546
Trade Balance	-2,714	-1,054	-1,854	-3,162	-3,747	-4,510	6,793	13,678
Export	3,316	4,650	6,063	8,818	15,109	19,419	21,230	21,399
Import	6,030	5,704	7,917	11,980	18,856	23,929	14,437	7,721
Travel (net)	453	536	602	729	626	189	618	1,183
Border Transactions (net)	558	394	732	679	592	186	* -141	* 170
Factor Income (net)	-1,919	-2,036	-2,383	-3,314	-4,953	-7,601	-10,158	-8,980
Others	577	564	210	197	209	-808	-1,991	-505

Note: * is calculated by the new method.
Source: Banco de México, "Informe Anual 1983"



Due to decreased income from oil exports, Mexico was no longer in a position to repay the long and short-term loans which had been used to cover the trade deficits caused by the import of raw materials and capital goods imported to promote the expansion of Mexican industries. Thus Mexico suffers a serious financial crisis.

2-3 Industrial Composition

As shown in Table II-7, sectoral constitution of GDP, the agricultural, forestry, and fishery sectors have been decreasing relatively while the mining, transport, and communication sectors have been increasing. In 1983, the manufacturing, commerce and service such as hotel and restaurant, and "other service" sectors each account for about a quarter of GDP while primary industry accounts for less than 10%.

As shown in Tables II-8 and II-9 the relative percentage of workers in the agricultural, forestry and fishery sector has also been decreasing while the percentage of workers in the construction and social and personal service sectors has been growing. According to 1982 estimates, employment in the agricultural, forestry, and fishery sector is about 5 million, or 25% of the labor force while employment in the social and personal service sector amounted to 30% of overall employment. Thus the ratio of employment in primary industries is still quite high.

Table II-7 Sectoral Composition of GDP (1970 prices)

(Unit: %)

Sector	1976	1977	1978	1979	1980	1981	1982	1983
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture, Forestry, Fishery	10.0	10.4	10.1	9.1	9.0	8.8	8.8	9.6
Mining	2.5	2.6	2.7	2.9	3.3	3.5	3.8	3.9
Manufacturing	24.5	24.5	24.8	25.2	24.9	24.7	24.1	23.4
Construction	5.4	4.9	5.1	5.3	5.5	5.7	5.5	4.9
Electricity	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.7
Transport, Communication	6.3	6.5	6.7	7.1	7.5	7.7	7.4	7.5
Commerce, Hotel, Restaurant	25.6	25.2	25.1	25.7	25.7	25.8	25.5	24.4
Other Service	24.3	24.4	24.0	23.2	22.6	22.3	23.3	24.6

Source: SPP, "Sistema de Cuentas Nacionales de México"

Table II-8 Labor Population by Sector

(Unit: '000 person)

Sector	1976	1977	1978	1979	1980	1981	1982
Total	15,550	16,238	16,844	17,676	18,795	20,043	19,863
Agriculture, Forestry, Fishery	4,472	4,897	4,891	4,736	4,901	5,189	5,035
Manufacturing	2,046	2,051	2,133	2,291	2,417	2,542	2,485
Construction	1,200	1,163	1,321	1,497	1,687	1,861	1,785
Commerce, Hotel, Restaurant	2,300	2,345	2,368	2,534	2,637	2,762	2,701
Social and Personal Service	4,350	4,557	4,831	5,208	5,561	5,927	6,074
Others	1,182	1,225	1,300	1,410	1,592	1,762	1,783

Note: P represents preliminary.
Source: SPP, "Sistema de Cuentas Nacionales de México" Banco de México, "The Mexican Economy"
Banco de México, "The Mexican Economy"

Table II-9 Composition of Employment

(Unit: %)

Sector	1976	1977	1978	1979	1980	1981	1982^P
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture, Forestry, Fishery	28.8	30.2	29.0	26.8	26.1	25.9	25.3
Manufacturing	13.2	12.6	12.7	13.0	12.9	12.7	12.5
Construction	7.7	7.2	7.8	8.5	9.0	9.3	9.0
Commerce, Hotel, Restaurant	14.8	14.4	14.1	14.3	14.0	13.8	13.6
Social and Personal Service	28.0	28.1	28.7	29.5	29.6	29.5	30.6
Others	7.5	7.5	7.7	7.9	8.4	8.8	9.0

Note: P represents preliminary.
Source: SPP, "Sistema de Cuentas Nacionales de México"
Banco de México, "The Mexican Economy"

2-4 Centralization

As described in Section 2-1, the population of Mexico is concentrated in the central regions. Economic activities are also concentrated in central Mexico. Table II-10 shows that in 1980 34.4% of the population and 41.6% of GDP are concentrated in the central area which represents only 4.4% of the total land area of Mexico. This centralizing trend is expected to continue. For example, the percentage of population in the central area increased to 34.8% of the total population in 1982.

In order to check excessive concentration of population and social and economic activities in the central area, the Mexican government is aggressively promoting decentralization of production and social activities through the "Plan Nacional de Desarrollo 1983 ~ 1988".

Table II-10 Socio-Economic Indices by District

(Unit: %)

District	Area	Population	GDP				Commerce
			Agriculture	Manufacturing	Service	Total	
North-West	21.0	8.2	18.2	4.4	8.6	8.3	10.8
North	26.5	6.9	11.6	6.1	6.5	7.2	7.7
North-East	7.4	6.5	6.7	12.2	8.5	9.4	9.1
Central-North	7.2	4.9	5.3	1.9	2.5	2.7	2.3
Central-West	12.9	20.2	25.5	13.1	14.4	15.4	12.9
Center	4.4	34.4	14.1	53.9	49.4	41.6	48.2
South	13.5	16.4	16.3	7.2	7.8	13.2	7.2
Peninsula	7.1	2.5	2.3	1.2	2.3	2.2	1.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Colima, Jalisco Aguascalientes	4.7	7.6	11.1	7.6	7.2	7.8	7.7

Source: SPP, "Sistema de Cuentas Nacionales de México"

3. Transportation

3-1 General View of Cargo Movement

In accordance with the progress of economic development, the total freight volume of Mexico increased remarkably at an average growth rate of 9.8% per annum from 1976 and reached about 433 million tons in 1980, as shown in Table II-11. According to "Programa Nacional de Comunicaciones y Transportes 1984~1988", the total freight volume reached about 488 million tons in 1983 and is projected to reach 520 million tons in 1984. However, the growth of freight volume in 1981 and 1982 was negative due to the stagnation of the Mexican economy.

As for the modal split of cargo movement, road transportation had the largest share of 58.5% in 1980, though the share of road transportation has been decreasing year by year, as shown in Table II-11. The share of railway transportation has decreased rapidly. On the other hand, marine transportation has grown remarkably. These trends are continuing, and the modal split of cargo traffic in 1983 became 57.0% by road, 12.7% by railway and 30.3% by ship; the projected figures for 1984 are 54.3% by road, 12.6% by railway and 33.1% by ship, according to the above mentioned "Programa Nacional de Comunicaciones y Transportes 1984~1988".

Table II-11 Cargo Movement in Mexico

Year	Volume of Cargo ('000 t)	Modal Split for Cargo Movement (%)			
		Road	Railroad	Marine	Air
1970	207,024	67.9	18.5	13.6	n.s.
1971	212,770	67.8	18.1	14.1	n.s.
1972	230,425	66.5	18.2	15.3	n.s.
1973	243,277	65.8	18.2	16.0	n.s.
1974	269,587	61.9	19.2	18.9	n.s.
1975	286,606	60.8	18.2	21.0	n.s.
1976	298,833	60.2	17.2	22.6	n.s.
1977	307,472	61.4	17.9	20.7	n.s.
1978	333,020	60.4	16.9	22.7	n.s.
1979	375,380	59.8	14.6	25.6	n.s.
1980	433,054	58.5	12.7	28.8	n.s.

Note: n.s. represents not significant.

Source: Dirección General de Autotransporte Federal, Dirección General de Ferrocarriles en Operación, Dirección General de Operación Portuaria and Aeropuertos y Servicies Auxiliares, Grencia General de Operación, SCT

Especially for foreign trade, the share of marine transportation has grown much higher. Marine transportation accounts for about 65% of import, 95% of export and 90% of total foreign trade, as shown in Table II-12 and II-13. However, total domestic cargo estimated at about 353 million tons, is transported mainly by road and railway. The volume of cargoes moved by ship is estimated at 59 million tons, 16.7% of domestic cargo.

Table II-12 Cargo Movement for Foreign Trade

(Unit: '000 t)

Year	Total Cargo Volume			Marine Cargo Volume		
	Export	Import	Total	Export	Import	Total
1970	14,183	8,865	23,048	9,705	3,316	13,021
1971	14,587	8,949	23,536	10,883	3,908	14,791
1972	15,874	11,565	27,439	11,314	5,635	16,949
1973	14,005	16,974	30,979	11,286	9,499	20,785
1974	16,501	16,907	33,408	12,767	8,247	21,014
1975	16,883	15,782	32,665	15,041	8,708	23,749
1976	17,604	11,353	28,957	15,110	7,158	22,268
1977	22,445	12,934	35,379	20,840	8,314	29,154
1978	33,670	14,720	48,390	30,010	10,103	40,113
1979*	43,020	17,930	60,950	39,773	10,938	50,711
1980*	56,817	23,404	80,221	52,536	13,520	66,056
1981*	59,680	23,450	83,130	55,799	14,982	70,781
1982*	92,633	16,248	108,881	88,555	12,267	100,822
1983*	96,339	16,948	113,287	91,710	11,301	103,011

Note: * Total Cargo Volume is estimated and does not include the exported volume of Natural Gas.
Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques 1983"

Table II-13 Share of Marine Transportation for Foreign Trade (percent of the national total)

(Unit: %)

Year	Export	Import	Total
1970	68.7	38.1	58.8
1971	74.6	43.7	62.8
1972	71.2	48.7	61.7
1973	80.5	55.9	67.0
1974	77.3	48.7	62.9
1975	89.0	55.1	72.7
1976	85.8	63.5	76.9
1977	92.8	64.2	82.4
1978	89.1	68.6	82.9
1979	92.4	61.0	83.2
1980	92.4	57.8	82.3
1981	93.5	63.8	85.1
1982	95.6	75.5	92.6
1983	95.2	66.1	90.9

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques 1983"

The modal split of cargo movement for the cross-boader trade cannot be indicated as the data are unavailable. However the total amount of the cross-boader trade was about 4.7 billion dollars in 1982 and 3.1 billion dollars in 1983, which comprise 13% and 11% of the total national account of foreign trade in each year respectively, as shown in Table II-14. Judging from the geographical conditions, most of these cargoes are most likely transported by road and railway.

Table II-14 Balance of Border Transactions

(Unit: '000,000 dollars)

Item	1982	1983
Border Trade		
Balance at Border	-141	170
Income	2,276	1,627
Expenditure	2,417	1,457
Total	4,693	3,084
Total Foreign Trade		
Total Trade Balance	6,793	13,678
Export	21,230	21,399
Import	14,437	7,721
Total	35,667	29,120

Source: Banco de México, "Informe Annual"

Finally, the share of air transportation for cargo movement is very small. Thus air transportation is not considered in this study.

3-2 Roads

The road and highway network of Mexico has been developed centering around the Mexican Plateau as shown in Fig. II-9.

Due to the geographical conditions, particularly the mountain ranges running from north to south, the road network liking the principal cities in the central region and the highway running longitudinally from the border of U.S.A. to the central region have been well developed, while there are few roads running horizontally across Mexico. However, as part of the development plan, the Mexican government is undertaking the construction of a transversal road which will connect the longitudinal highways in order to promote the decentralization of socio-economic activities.

The construction of roads was carried out at a remarkable pace during the 1970s, as shown in Table II-15. Especially from 1972 to 1975 the total length of the road network enlarged quickly to 2.6 times the total length in 1970. This period of rapid construction created the basis of the present road network. In 1982, the total length reached 214,000 km, of which paved roads amount to 69,000 km, 32.4% of the national total, and coated roads amount to 90,000

km, 42.1%. As mentioned above, the main arteries are wide, and well paved, but due to complicated topographical conditions, the time it takes to travel is quite long relative to the distance.

Table II-5 Constitution of the Road Network

(Unit: km)

Year	Imporved	Flat	Coated	Paved		Total	
				2 Lanes	4 Lanes	Length	Indication
1970	2,389	6,499	20,697	41,359	601	71,544	100.0
1971	2,132	6,206	21,921	43,272	620	74,151	103.5
1972	31,835	13,387	30,807	46,875	674	123,578	172.7
1973	38,087	12,317	55,494	50,111	714	156,723	219.1
1974	37,445	16,262	65,468	55,496	738	157,409	245.2
1975	37,514	17,290	71,947	58,637	850	186,298	260.4
1976	37,512	22,507	78,782	58,797	908	198,506	277.5
1977	37,052	24,509	81,208	60,569	899	204,237	285.5
1978	36,351	25,750	81,384	63,231	945	207,661	290.4
1979	35,908	24,103	85,447	64,810	978	211,246	295.4
1980	33,409	24,731	87,562	65,920	1,000	212,622	297.3
1981	31,497	24,601	88,728	67,336	1,026	213,188	298.0
1982[P]	30,431	24,105	90,143	68,216	1,178	214,073	299.3
	(14.2%)	(11.3%)	(42.1%)	(31.9%)	(0.5%)	(100.0%)	

Note: P represents preliminary data.
Figures in parentheses show the share of constitution in 1982.
Source: Dirección de Análisis de Inversiones, SCT

As for the number of registered vehicles, this figure has been increasing at a growth rate of over 12% per annum as shown in Table II-16, and surpassed 7 million in 1982. This is four times the 1970 figure. Especially the number of registered cars has grown rapidly, reaching over 5 million, three-fourths of the total number of vehicles in 1982. There are about 2 million registered trucks and trailers, around a fourth of the total. The growth of the number of buses has been lower: the 1982 figure is only about 2.5 times that of 1970, still about one percent of the total number of vehicles.

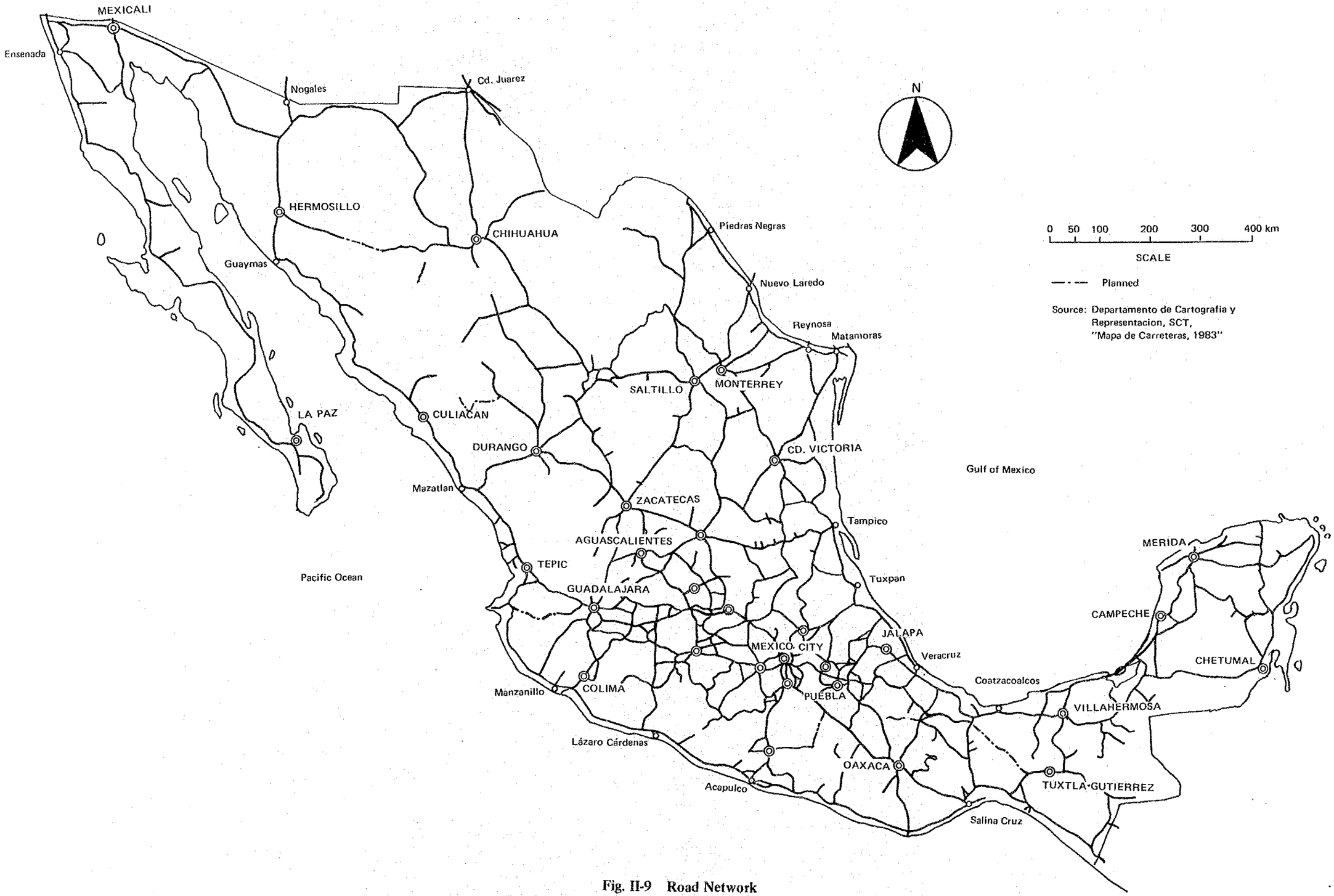


Fig. II-9 Road Network

Table II-6 Number of Registered Vehicles

Year	Cars	Buses	Trucks and Trailers	Total	
				Number	Indication
1970	1,233,824	33,059	524,985	1,791,868	100.0
1971	1,338,404	34,480	554,497	1,927,381	107.6
1972	1,520,144	35,723	592,772	2,148,639	119.1
1973	1,766,504	37,043	645,323	2,448,870	136.7
1974	2,053,241	41,053	728,965	2,823,259	157.6
1975	2,206,260	41,840	757,100	3,005,200	167.7
1976	2,580,426	52,693	987,995	3,621,114	202.1
1977	2,829,110	61,631	1,057,144	3,947,885	220.3
1978	3,359,973	73,772	1,273,419	4,707,164	262.7
1979	3,732,382	81,694	1,441,098	5,255,174	293.3
1980	4,254,480	83,800	1,489,143	5,827,423	325.2
1981	4,746,508	79,041	1,719,438	6,544,987	365.3
1982[P]	5,221,158	82,513	1,879,861	7,183,532	400.9
	(72.7%)	(1.1%)	(26.2%)	(100.0%)	

Note: P represents preliminary data.
Figures in parentheses show the share of vehicles in 1982.
Source: Dirección General de Estadística, SPP, 1970 "La Industria Automatriz en Mexico"
1971 ~ 1982 "Institute Nacional de Estadísticas, Gegrafia e Informática"

Daily traffic volume on existing main roads in the west part of central Mexico, including Manzanillo City, are shown in Fig. II-10.

The following routes play an important role as main arteries.

Mexico City ~ Queretaro ~ San Luis Potosi ~ Monterrey
Mexico City ~ Queretaro ~ Irapuato ~ Leon
Mexico City ~ Queretaro ~ Irapuato ~ Guadalajara
Mexico City ~ Cuernavaca ~ Acapulco

Moreover, the roads with great traffic volume are those centering on Guadalajara such as between Manzanillo and Guadalajara, Mazatlan and Guadalajara, Guadalajara and Lagos de Moreno, and the roads around Monterrey and Toluca.

Table II-17 shows the distance and average time taken in traveling by road from the major ports of the Pacific central region to the principal cities.

From this Table, the average time taken in traveling to Guadalajar is 6 hours from Manzanillo (the closest port), 10.5 hours from Lázaro Cárdenas and 11 hours from Mazatlan. Furthermore, the average time between Manzanillo and Guadalajara will shorten by a little over 2 hours when the new four lane highway which is currently under construction is completed.

As for the average time to Mexico City, the time from Acapulco is the shortest, about 10.5 hours. It takes about 15.5 hours from Lázaro Cádenas to Mexico City, and about 16.5 hours from Manzanillo to the capital. When the road from Zihuatanejo which is currently udner construction is completed, we estimate that the time from Lázaro Cádenas to Mexico City will be

reduced to about 12.5 hours. The average time from Manzanillo to Aguascalientes and to Monterrey is about 2.5 hours shorter than from Lázaro Cárdenas to these same destinations.

Table II-17 Transportation Time by Road

From	To	Approximate Distance (km)	Approximate Time (hours)	Via
Manzanillo	Guadalajara	320	6.0	
"	Mexico City	910	17.5	Guadalajara, Queretaro
"	"	790	16.5	Zamora, Queretaro
"	"	770	18.0	Zamora, Toluca
"	Aguascalientes	570	11.5	
"	Monterrey	1,090	22.0	Zacatecas
"	"	1,210	22.5	S.L. Potosi
Lázaro Cárdenas	Guadalajara	600	13.0	
"	"	520	10.5	Colima
"	Mexico City	690	15.5	Toluca
"	"	570	12.5	Zihuatanejo (under construction)
"	Aguascalientes	690	14.0	
"	Monterrey	1,270	25.0	Zacatecas
"	"	1,300	24.5	S.L. Potosi
Mazatlan	Guadalajara	520	11.0	
Acapulco	Mexico City	420	10.5	

Source: SCT, "Mapa de Tiempo de Recorrido"

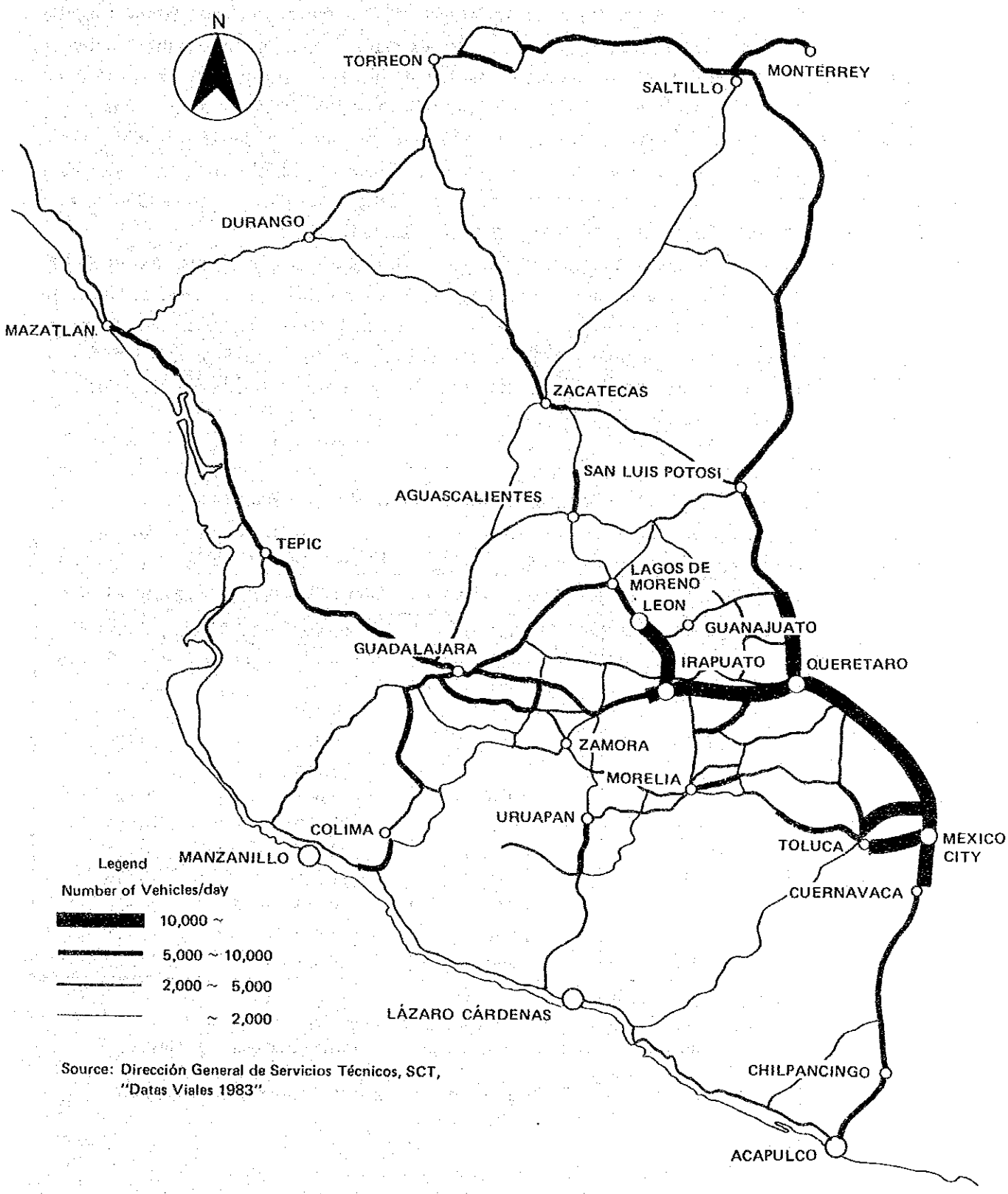


Fig. II-10 Traffic Volume on Main Roads in the Pacific Central Region

3-3 Railways

The existing railway network has been developed with numerous arteries connecting the principal cities of the central region with U.S.A. as its main frame. Thus the railway network does not covered the entire country as shown in Fig. II-11. The railway network is less comprehensive than the road network, and some state capitals do not have railway connections.

The main frame of the existing railway network was completed in the 1910's. Since then, new railway construction has taken place step by step. Since the 1970s, the progress of construction has advanced little, and the total length of railways in 1982 was about 25,000 km; only 1,000 km, or 4.1% longer than in 1970 as shown in Table II-18.

The rolling stock of Mexican railways improved during the early 1970s. About 1,900 locomotives, 51,900 cargo wagons and 800 passenger cars were being used in 1982 as shown in Table II-19. The number of passenger cars was extremely small. Most Mexicans travel by roads in accordance with the development of the road network and the increase in the number of private cars. According to SCT statistics, the modal split for passenger traffic was estimated as: 96.5% by road, 1.8% by railway, 1.6% by air and 0.1% by ship in 1979.

Table II-18 Total Length and Rolling Stock of Mexican Railways (1)

Year	Length (km)	Rolling Stocks (a)		
		Locomotives	Covered Cars (b)	Large Open Wagons
1970	24,468	830	17,435	4,749
1971	24,501	856	17,924	4,739
1972	24,700	901	18,206	4,929
1973	24,670	1,036	18,050	6,098
1974	24,864	1,014	20,918	6,104
1975	24,912	1,098	23,254	7,761
1976	24,952	1,070	23,603	9,804
1977	25,046	1,069	23,289	10,394
1978	25,101	1,108	23,236	10,268
1979	25,314	1,186	29,246	10,916
1980	25,510	1,444	30,513	10,956
1981	25,498	1,502	31,405	12,629
1982	25,475	1,600	29,339	13,239

Note: (a) – Only Nacionales de México.
(b) – Including wagons, freight cars, platform, tank and passenger cars.

Source: 1970 ~ 1977 Subgerencia de Planeación y Organización, Ferrocarriles Nacionales de Mexico, "Series Estadisticas"
1978 ~ 1982 Dirección General de Ferrocarriles, SCT, "Estadistica Ferroviaria Nacional 1982"

Table II-19 Rolling Stock of Mexican Railways (2)

Year	Locomotives	Goods Wagons	Large Open Wagons	Passenger Cars
1978	1,352	29,890	10,781	812
1979	1,440	35,978	11,385	817
1980	1,719	37,722	11,698	813
1981	1,811	39,566	13,392	827
1982	1,909	37,856	14,002	824

Note: Including Nationales de México, del Pacifico, Chihuahua al Pacifico, Unidos del Sureste and Sonora-Baja California.

Source: Dirección General de Ferrocarriles, SCT, "Estadistica Ferroviaria Nacional 1982"

Fig. II-12 shows the traffic volume by railway route. The routes from Mexico City to Monterrey, and from Mexico City to Guadalajara are the main arteries; and the railways connecting Mexico City with U.S.A. border and with Veracruz function as sub arteries.

Table II-20 shows the distance and average time taken in traveling by railway from the major ports of the Pacific central region to the principal cities. According to this Table, the average time from Manzanillo is shortest in the case of traveling to Guadalajara, but this still takes 12.5 hours, more than twice the time of traveling by road. (see Table II-17). As for the traveling time to Mexico City from both Manzanillo and Lázaro Cárldenas, it takes 31.5 hours, and to Monterrey it takes 37 ~ 38 hours from both ports. For reference, the average times taken in traveling between Mexico City and U.S.A. border are as follows: over 30 hours to Nuevo Laredo and Piedras Negras, more than 50 hours to Ciudad Juárez, and about 3 days to Mexicali.

Table II-20 Transportation Time by Railway

From	To	Distance (km)	Approximate Time (hours)	Via
Manzanillo	Guadalajara	353	12.5	
"	Mexico City	953	31.5	Queretaro
"	"	1,018	35.5	Toluca
"	Aguascalientes	833	26.0	
"	Monterrey	1,559	46.5	Aguascalientes
"	"	1,764	48.5	Torreon
"	"	1,374	37.0	Celaya
Lázaro Cárdenas	Guadalajara	676	24.0	
"	Mexico City	871	32.5	Queretaro
"	"	787	31.5	Toluca
"	Aguascalientes	752	27.0	
"	Monterrey	1,477	47.5	Aguascalientes
"	"	1,281	38.0	Celaya
Mazatlan	Guadalajara	590	16.5	
Mexicali	Mexico City	2,759	71.5	
Nogales	"	2,372	63.5	
Cd. Juárez	"	1,972	53.5	
Piedras Negras	"	1,286	34.0	
Nvo. Laredo	"	1,224	31.0	

Note: As actual running time data were not available, the above distance and time figures were calculated using rallway company timetables. The actual running time is probably somewhat longer.

Source: Ferracarriles Nacionales de México, Ferrocarril de Chihuahua al Pacifica, Ferrecarril del Pacifica and Ferrocarril Sonara Baja California, "Horario"

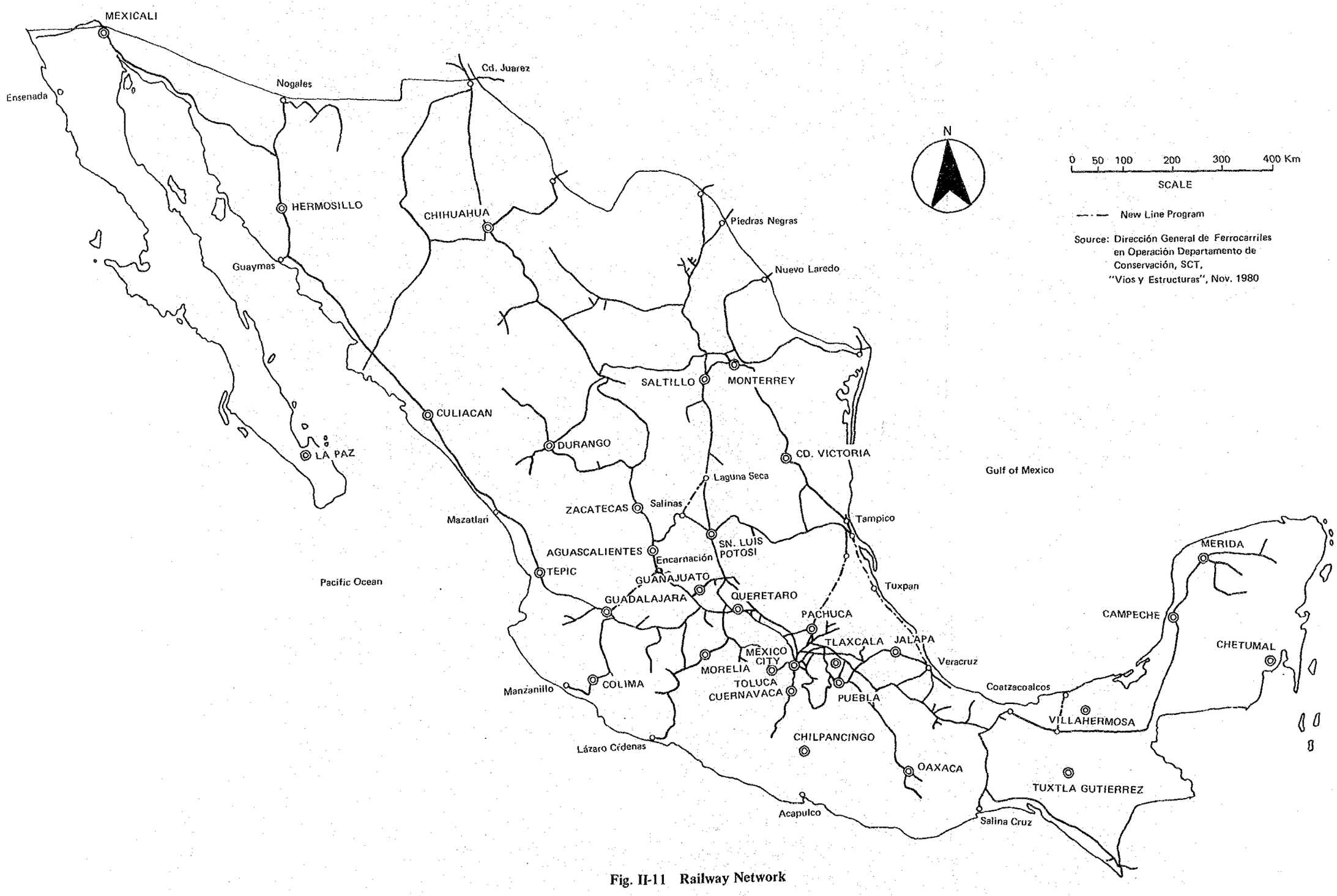


Fig. II-11 Railway Network

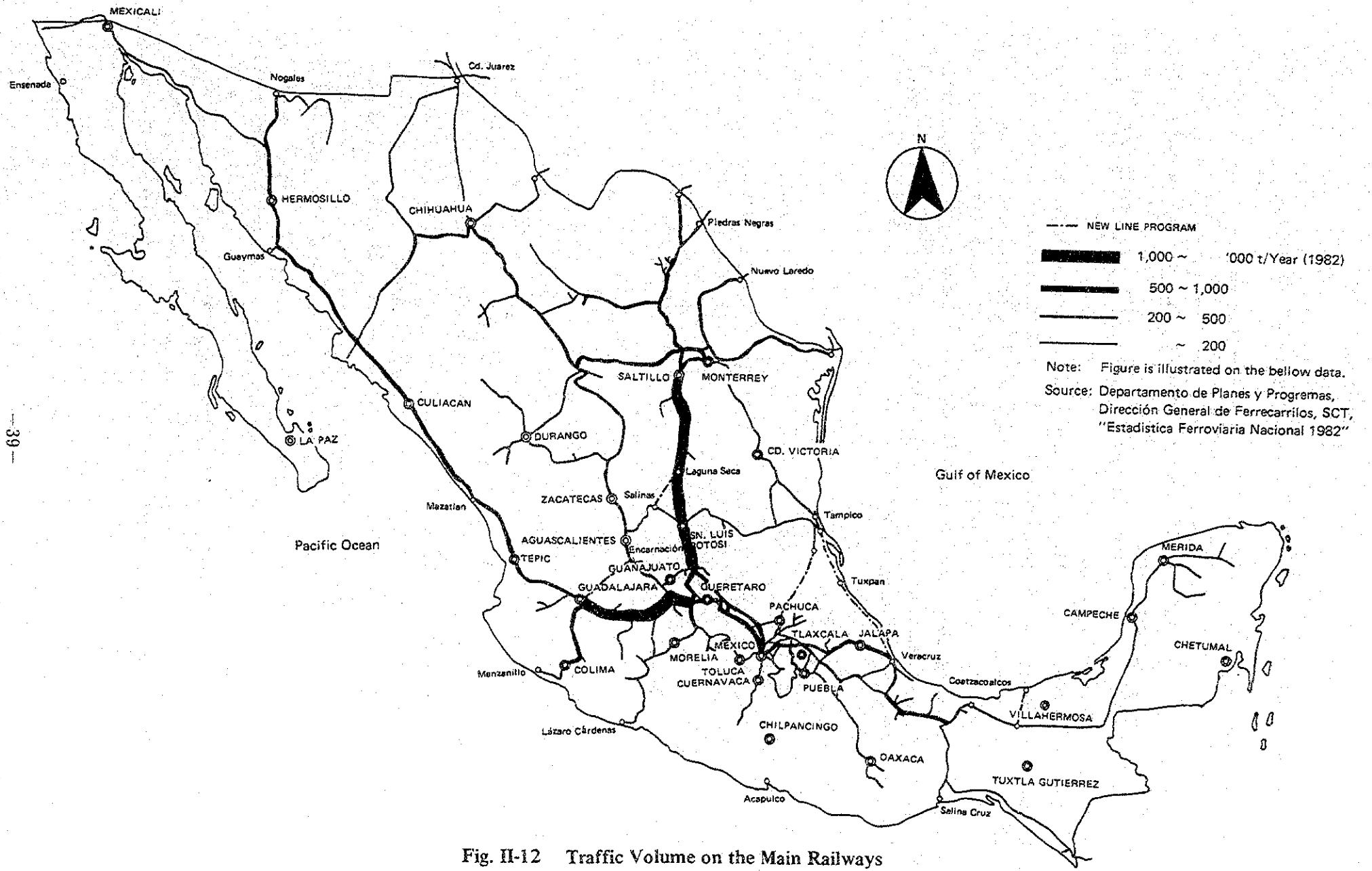


Fig. II-12 Traffic Volume on the Main Railways

3-4 Ports and Shipping

3-4-1 General Outline

In the United Mexican States, there are 41 principal ports, of which 10 major ports are considered essential for foreign trade.

Total length of quaywall amounts to approximately 59 km: 33 km on the Mexican Gulf coast and 26 km on the Pacific coast.

Fig. II-13 shows the locations of the major ports. The volume of cargoes handled at all Mexican ports increased at an average annual rate of 12.6% in the period from 1976 to 1983. This increase was mainly supported by the growth in the exported volume of crude oil. 148 million tons of cargoes which include 103 million tons of foreign trade were handled in 1983. Compared with 1982, total cargo volume decreased a little due to the decrease of imported and domestic cargoes with the stagnation of the national economy. Table II-21 and Fig. II-14 show the volume of cargo handled during last eight years.

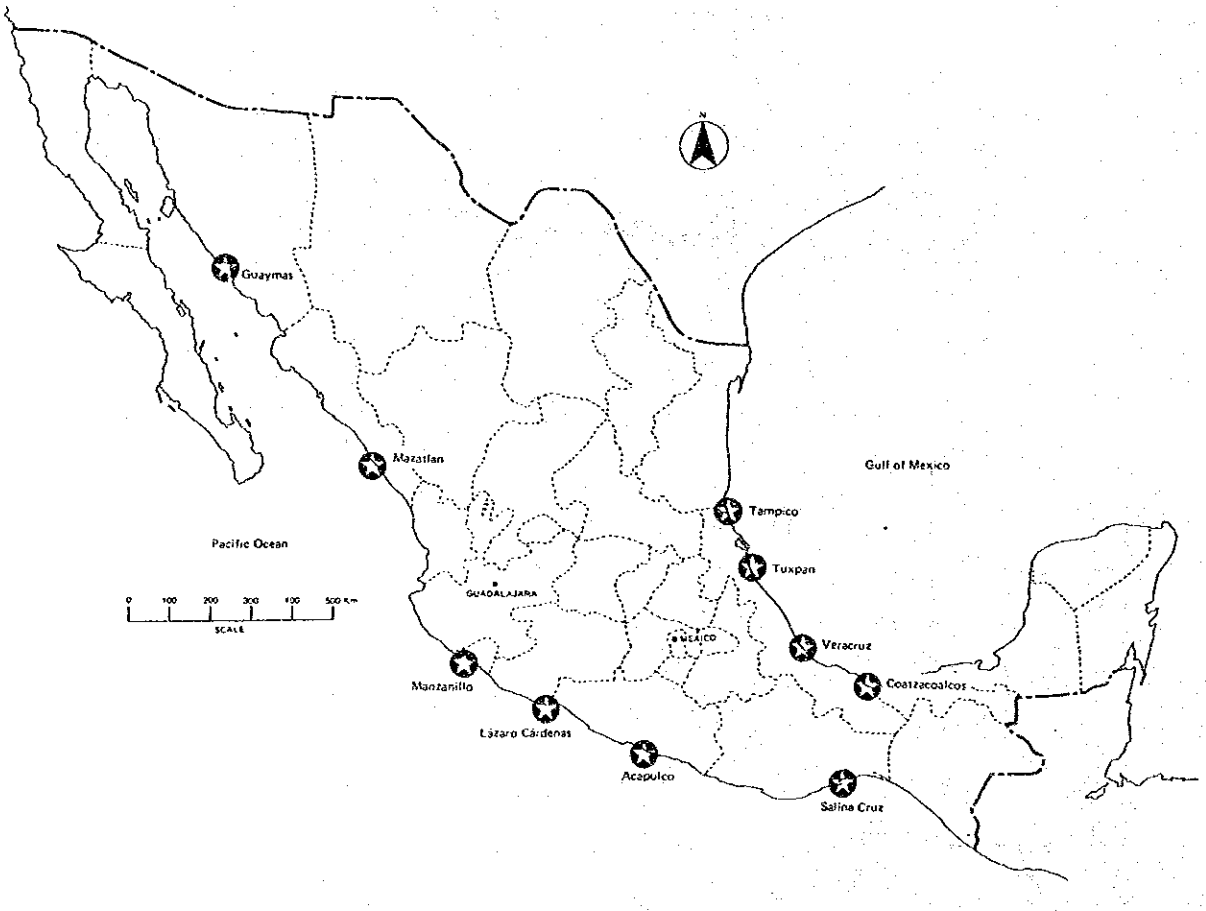


Fig. II-13 Locations of Major Ports

Table II-21 Volume of Cargo Handled at the Mexican Ports

(Unit: '000 t)

Year	Grand Total	Foreign Trade			Domestic Trade		
		Export	Import	Total	Out	In	Total
1976	67,436 (20,184)	15,109 ((5,226)	7,158 (2,663)	22,268 (7,889)	19,474 (4,057)	25,694 (8,238)	45,168 (12,295)
1977	63,437 (22,940)	20,840 (6,148)	8,314 (2,329)	29,154 (8,477)	14,313 (4,567)	19,970 (9,896)	34,283 (14,463)
1978	75,504 (26,071)	30,010 (6,875)	10,103 (3,501)	40,113 (10,376)	14,552 (4,754)	20,839 (10,941)	35,391 (15,695)
1979	96,036 (30,267)	39,773 (7,995)	10,938 (4,016)	50,711 (12,011)	19,291 (5,560)	26,034 (12,696)	45,325 (18,256)
1980	124,576 (36,918)	52,536 (7,841)	13,520 (4,587)	66,056 (12,428)	25,215 (8,602)	33,305 (15,888)	58,520 (24,490)
1981	131,038 (36,395)	55,799 (7,255)	14,982 (5,018)	70,781 (12,273)	25,996 (8,584)	34,261 (15,538)	60,257 (24,122)
1982	150,444 (36,741)	88,555 (9,038)	12,267 (3,282)	100,822 (12,320)	21,228 (8,471)	28,394 (15,950)	49,622 (24,421)
1983	147,913 (41,148)	91,710 (12,461)	11,301 (3,138)	103,011 (15,599)	20,481 (9,040)	24,421 (16,509)	44,902 (25,549)

Note: Figures in parentheses represent the volume handled at the Pacific coast ports.
Source: DGODP, "Estadisticas del Movimento Portuario Nacional de Carga y Buques"

The main shipping cargoes including foreign and domestic trade are petroleum and its derivatives (78% of total tonnage in 1983) and agricultural and mineral bulk cargoes (16%). Petroleum and its derivatives amount to approximately 90% of the total exported cargo, and over 75% of the imports are agricultural and mineral bulk.

As for domestic trade, about 75% is petroleum and its derivatives, and about 15% is mineral bulk cargo. Together these two major items account for 90% of the total domestic tonnage.

Table, II-22 and II-23 show the cargo volume of foreign trade by commodity type.

The trends of cargo movement by commodity type are as follows:

The import of general cargo has been decreasing since 1981. On the other hand, the export of general cargo has been increasing since that year. This is mainly due to the governmental economic policy, that is import are controlled to improve the balance of international payments, and the government promotes the export of industrial products.

The export of agricultural bulk is very small, and its import volume varies greatly year by year. The imported volume in 1983 was double the 1982 figure.

The export of mineral bulk has generally been around 7,000 ~ 8,000 thousand tons per year. 60 ~ 70% of it is salt which is exported at Isla de Cedros on the Pacific coast. The import of mineral bulk has been decreasing since 1981.

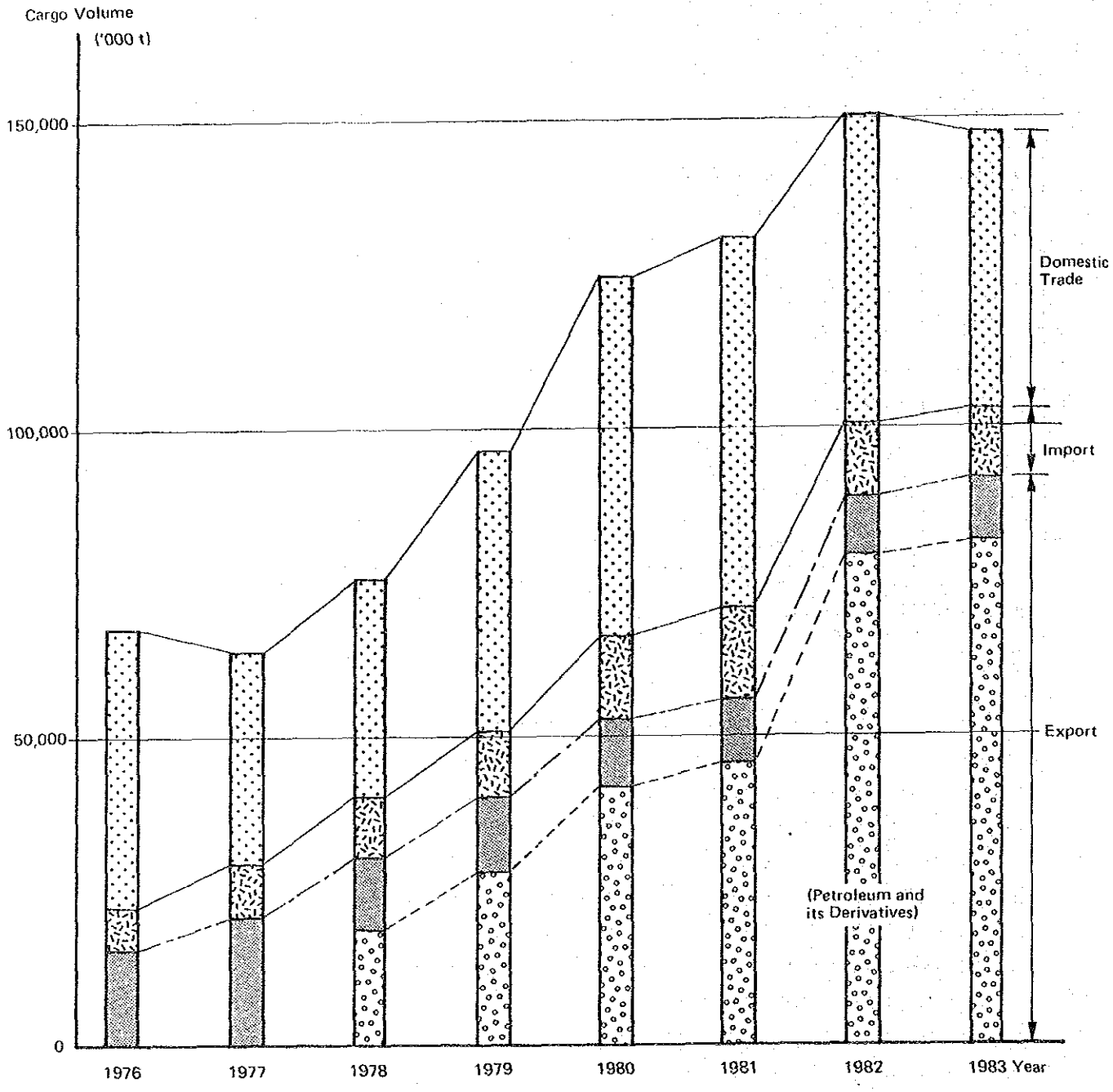


Fig. II-14 Cargo Volume Handled at the Mexican Ports

Table II-22 Volume of Export by Major Items

(Unit: '000 t, %)

Year	General Cargo		Agricultural Bulk		Mineral Bulk		Petroleum and its Derivatives		Other Liquid		Perishables	
1978	1,491 (641)	5.0 (9.3)	71 (–)	0.2 (–)	7,688 (6,059)	25.6 (88.1)	18,855 (55)	62.9 (0.8)	1,905 (120)	6.3 (1.8)	–	–
1979	1,421 (600)	3.6 (7.5)	30 (–)	0.1 (–)	8,528 (7,210)	21.4 (90.2)	27,871 (50)	70.1 (0.6)	1,923 (135)	4.8 (1.7)	–	–
1980	1,134 (394)	2.2 (5.0)	– (–)	– (–)	8,480 (7,341)	16.1 (93.6)	41,409 (16)	78.8 (0.2)	1,490 (74)	2.8 (1.0)	23 (16)	0.1 (0.2)
1981	1,040 (334)	1.9 (4.6)	– (–)	– (–)	8,006 (6,810)	14.3 (93.9)	45,549 (72)	81.6 (1.0)	1,186 (24)	2.1 (0.3)	18 (15)	0.1 (0.2)
1982	1,231 (380)	1.4 (4.2)	14 (–)	– (–)	6,965 (5,826)	7.9 (64.5)	79,180 (2,762)	89.4 (30.6)	1,151 (57)	1.3 (0.6)	14 (13)	– (0.1)
1983	1,535 (627)	1.7 (5.0)	28 (–)	0.1 (–)	7,920 (6,212)	8.6 (49.9)	81,259 (5,595)	88.6 (44.9)	950 (11)	1.0 (0.1)	18 (16)	– (0.1)

Note: Figures in parentheses represent the volume handled at the Pacific coast ports.
Source: GDODP, "Estadisticas del Movimento Portuario Nacional de Carga y Buques"

Table II-23 Volume of Import by Major Items

(Unit: '000 t, %)

Year	General Cargo		Agricultural Bulk		Mineral Bulk		Petroleum and its Derivatives		Other Liquid		Perishables	
1978	2,363 (370)	23.4 (10.6)	3,321 (1,702)	32.9 (48.6)	2,868 (581)	28.4 (16.6)	1,172 (848)	11.6 (24.2)	379 (–)	3.7 (–)	–	–
1979	2,321 (422)	21.2 (10.6)	3,622 (1,566)	33.1 (38.9)	3,407 (1,182)	31.1 (29.4)	1,428 (850)	13.1 (21.1)	161 (1)	1.5 (–)	–	–
1980	3,589 (723)	26.5 (15.8)	5,809 (2,899)	43.0 (63.2)	3,233 (940)	23.9 (20.5)	547 (24)	4.0 (0.5)	342 (1)	2.6 (–)	–	–
1981	4,808 (908)	32.1 (18.1)	5,491 (2,826)	36.7 (56.3)	3,637 (1,236)	24.3 (24.6)	607 (48)	4.1 (1.0)	438 (–)	2.8 (–)	1 (–)	–
1982	2,584 (573)	21.1 (17.5)	3,227 (1,180)	26.3 (36.0)	2,855 (956)	23.3 (29.1)	3,041 (567)	24.8 (17.3)	559 (6)	4.5 (0.1)	1 (–)	–
1983	1,916 (549)	17.0 (17.5)	6,523 (2,262)	57.7 (72.1)	2,035 (306)	18.0 (9.8)	650 (17)	5.8 (0.5)	177 (4)	1.5 (0.1)	–	–

Note: } Same as Table II-22.
Source: }

The majority of petroleum and its derivatives is handled at the facilities of PEMEX.

The volume of cargoes other than petroleum and its derivatives recorded a favorable increase at an average annual rate of 8.6% from 1978 to 1981, but dropped sharply in 1982 due to a sharp decrease of import cargoes. However, this volume made a quick recovery in 1983 with an 11.8% gain over 1982.

Table II-24 shows the volume of cargoes other than petroleum and its derivatives.

Table II-24 Cargo Volume Other than Petroleum and its Derivatives

(Unit: '000 t, %)

Year	Grand Total	Foreign Trade			Domestic Trade*		
		Export	Import	Total	Out	In	Total
1978	27,840	11,156	8,931	20,087	997	6,746	7,543
1979	30,473 (9.5)	11,902 (6.7)	9,511 (6.5)	21,413 (6.6)	1,205	7,855	9,060 (16.8)
1980	34,640 (13.7)	11,127 (-6.5)	12,973 (36.4)	24,100 (12.6)	1,883	8,657	10,540 (16.3)
1981	35,576 (2.7)	10,250 (-7.9)	14,375 (10.8)	24,625 (2.2)	2,308	8,643	10,951 (3.9)
1982	29,182 (-18.0)	9,375 (-8.5)	9,226 (-35.8)	18,601 (-24.5)	2,455	8,126	10,581 (-3.4)
1983	32,628 (11.8)	10,451 (11.5)	10,651 (15.4)	21,102 (13.4)	3,451	8,075	11,526 (8.9)

Note: Figures in parentheses show annual growth rate.

* Due to major statistical reporting error, the "Out" and "In" figures for domestic trade do not match. These incomplete figures are presented here only to show the overall growth and yearly fluctuations of total ("Out" + "In") domestic trade.

Source: DGODP, "Estadisticas del Movimiento Portuario Nacional de Carga y Buques"

The cargo volume with trading counterparts is shown in Table II-25. The most important counterpart for foreign trade is U.S.A. which currently accounts for about 60% of total trading volume, followed by European countries, the other American countries and Japan. Compared with five years ago, U.S.A., Japan and the other Asian countries have dropped their shares, while the European and the other American countries have increased theirs.

The marine transportation of Mexico was operated by 14,826 vessels in 1983. The number of ocean-going vessels recorded as calling at Mexican ports was 4,190 in 1983, including 319 Mexican flag vessels which transported about 4.2% of the foreign trade cargoes.

Table II-26 shows the number of ocean-going vessels.

Table II-25 Trade Partners

(Unit: '000 t, %)

Year	Item	USA		Other America		Japan		Other Asia		Europe		Africa		Oceania	
1978	Export	21,517		1,370		3,246		58		535		–		16	
	Import	4,728		988		629		29		1,099		978		174	
	Total	26,245	(74.2)	2,358	(6.7)	3,875	(11.0)	87	(0.2)	1,634	(4.6)	978	(2.8)	190	(0.5)
1979	Export	27,680		2,238		3,950		2,236		3,604		44		21	
	Import	5,812		2,017		422		88		1,525		918		156	
	Total	33,492	(66.0)	4,255	(8.4)	4,372	(8.6)	2,324	(4.6)	5,129	(10.1)	962	(1.9)	177	(0.3)
1980	Export	32,097		5,325		5,234		2,481		7,373		21		6	
	Import	8,199		1,963		511		220		1,613		899		116	
	Total	40,296	(61.0)	7,288	(11.0)	5,745	(8.7)	2,701	(4.1)	8,986	(13.6)	920	(1.4)	122	(0.2)
1981	Export	29,570		12,654		4,200		1,243		8,105		16		10	
	Import	7,231		3,491		612		211		2,358		985		95	
	Total	36,801	(52.0)	16,145	(22.8)	4,812	(6.8)	1,454	(2.1)	10,463	(14.8)	1,001	(1.4)	105	(0.1)
1982	Export	49,723		20,363		5,636		950		11,813		101		13	
	Import	6,178		3,011		456		320		1,358		885		59	
	Total	55,901	(55.4)	23,374	(23.2)	6,092	(6.0)	1,270	(1.3)	13,171	(13.1)	986	(1.0)	72	(0.1)
1983	Export	52,617		13,476		7,592		2,109		15,637		271		7	
	Import	7,559		1,300		129		266		1,135		791		122	
	Total	60,176	(58.4)	14,776	(14.3)	7,721	(7.5)	2,375	(2.3)	16,772	(16.3)	1,062	(1.0)	129	(0.1)

Source: DGODP, "Estadisticas del Movimiento Portuario Nacional de Carga y Buques"

Table II-26 Number of Oceangoing Vessels

Year	Total Number	No. of Mexican Vessels	Share of Mexican Flag
1979	3,769	283	6.6%
1980	4,175	282	3.9
1981	4,527	274	3.0
1982	4,544	373	5.7
1983	4,190	319	4.2

Note: Share of Mexican Flag means the percent of the volume of cargoes transported by Mexican vessels.
Source: DGODP, "Estadisticas del Movimiento Portuario Nacional de Carga y Buques"

The volume of container cargoes handled at all Mexican ports recorded a remarkable increase from 266 thousand tons in 1979 to 891 thousand tons in 1982, as shown in Table II-27. Although the 1983 volume was 853 thousand tons, a 4.2% decrease from the previous year, we can safely predict that containerization in Mexican ports will continue to grow because the government is promoting the export of products other than petroleum crude, especially industrial goods, and because some shippers are planning to introduce container systems in the near future. The percent of containerized cargo to general cargo is shown in Table II-28: containerization is advancing year by year. About 80% of container cargoes were handled at the Mexican Gulf ports in 1983. Table II–29 shows container cargo volume by major ports.

Table II-27 Container Cargo Handled at the Mexican Ports

(Unit: '000 t, units)

Year	Cargo Volume			Number of Units		
	Export	Import	Total	Export	Import	Total
1979	77	189	266	11,796 (5,969)	15,299 (14,053)	27,095 (20,022)
1980	138	357	495	20,705 (9,628)	28,845 (26,984)	49,550 (36,612)
1981	143	687	830	31,484 (9,737)	43,439 (41,950)	74,923 (51,687)
1982	393	498	891	41,993 (23,163)	36,133 (29,766)	78,126 (52,929)
1983	361	492	853	30,854 (20,820)	34,401 (21,761)	65,255 (42,581)

Note: Number of containers includes empty units, and figures in parentheses show number of loaded units.
Source: DGODP, "Estadisticas del Movimiento Portuario Nacional de Carga y Buques"

Table II-28 Percent of Containerized Cargo

(Unit: %)

Year	Percent of Container Cargo		
	Export	Import	Total
1979	5.4	8.1	7.1
1980	12.2	9.9	10.5
1981	13.8	14.3	14.2
1982	32.0	19.3	23.4
1983	23.5	25.7	24.7

Note: Percent of containerized cargo means the ratio of containerized cargo to general cargo.

Table II-29 Container Cargo Volume by Major Ports in 1983

(Unit: '000 t, units)

Port	Cargo Volume			Number of Units		
	Export	Import	Total	Export	Import	Total
Veracruz	46	239	285 (33.4)	3,432	12,353	15,785
Tuxpan	42	211	253 (29.6)	10,128	8,861	18,989
Tampico	127	28	155 (18.2)	8,178	8,555	16,733
Salina Cruz	91	2	93 (10.9)	5,344	1,885	7,229
Lázaro Cárdenas	23	9	32 (3.8)	1,669	1,228	2,897
Manzanillo	22	1	23 (2.7)	1,441	113	1,554
Other Ports	10	2	12 (1.4)	662	1,406	2,068
Total	361	492	853 (100)	30,854	34,401	65,255

Note: Figures in parentheses show percent to national total.
Source: DGODP, "Estadisticas del Movimiento Portuario Nacional de Carga y Buques"

3-4-2 Shipping Transportation on the Pacific Coast

In 1983, the Pacific coast ports handled about 41.1 million tons of cargo, 27.8% of the national total, of which 15.6 million tons were for foreign trade and 25.5 million tons were for domestic trade (see Table II-21).

As shown in Tables II-22 and II-23, the major commodities exported through the Pacific coast ports are mineral bulk, 66% of which is salt handled at the port of Isla de Cedros, and petroleum and its derivatives. The total share of both cargoes amounts to 95% of total exported volume. The cargo volume of general cargo for export took a share of 5%. The volume of general cargo increased 65% from the previous year.

As for the major commodity type of imports, agricultural bulk cargo took a share of 72% followed by general cargo (17.5%) and mineral bulk (10%).

The major commodity types for domestic trade were petroleum and its derivatives (66.3%) and mineral bulk (22.3%).

Table II-30 shows the volume of cargoes other than petroleum and its derivatives which is mainly produced in the Mexican gulf region. 57% of the total cargoes other than petroleum and its derivatives were handled at the Pacific coast ports in 1983.

Table II-30 Cargo Volume other than Petroleum and its Derivatives at the Pacific Coast Ports

(Unit: '000 t, %)

Year	Grand Total	Foreign Trade			Domestic Trade		
		Export	Import	Total	Out	In	Total
1978	16,113	6,820	2,653	9,473	779	5,861	6,640
1979	18,542 (15.1)	7,945	3,171	11,116 (17.3)	745	6,681	7,426 (11.8)
1980	20,827 (12.4)	7,825	4,563	12,388 (11.5)	1,041	7,398	8,439 (13.6)
1981	20,457 (-1.8)	7,183	4,970	12,153 (-1.9)	1,150	7,154	8,304 (-1.4)
1982	16,928 (-17.3)	6,276	2,715	8,991 (-26.0)	1,331	6,606	7,937 (4.4)
1983	18,599 (9.9)	6,866	3,121	9,987 (11.1)	1,852	6,760	8,612 (8.5)

Note: Figures in parentheses show annual growth rate.
Source: GDODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

There are six major ports on the Pacific coast. The volume of cargoes handled at each port is shown in Table II-31. These six major ports handled 63% of the foreign and domestic cargoes of the Pacific coast region. The rest were mainly handled at the port of Isla de Cedros for export and domestic trade of salt.

Table II-31 Cargo Handling Volume at the Major Pacific Coast Ports (1983)

(Unit: '000 t)

Port	Grand Total	Foreign Trade			Domestic Trade		
		Export	Import	Total	Out	In	Total
Guaymas	5,160	402	1,110	1,512	937	2,711	3,648
Mazatlan	2,784	40	740	780	217	1,787	2,004
Manzanillo	4,029	77	795	872	596	2,561	3,157
Lázaro Cárdenas	1,298	385	344	729	21	548	569
Acapulco	413	14	42	56	—	357	357
Salina Cruz	12,217	5,705	23	5,728	6,331	158	6,489

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

Fig. II-15 shows the trend of foreign cargo handling volume other than petroleum and its derivatives at the major six ports. As shown in this figure, Guaymas has enlarged its share by increasing the handling volume of agricultural and mineral bulk. On the contrary, the share of Manzanillo has been reduced with a decrease of imported cargo.

Table II-32 shows the volume of cargoes by commodity type handled at the six major Pacific ports in 1983. The characteristics of these six major ports are mentioned briefly as follows:

① Guaymas: handles bulk shipments and is equipped with a silo and unloading facilities for grain import, and with loading facilities for copper export.

② Mazatlan: handles mainly agricultural products for foreign trade, and partly functions as a tourist port and as the terminal of a ferry boat which runs to the Baja California peninsula.

③ Manzanillo: handles a large part of the general cargo for foreign trade with Lázaro Cárdenas, and a fourth of the agricultural bulk which comes through the Pacific coast.

④ Lázaro Cárdenas: is constructed as an industrial port, and possesses a container berth with a gantry crane; receives full container ships from U.S.A.

⑤ Acapulco: is a tourist port, and handles mainly general cargo.

⑥ Salina Cruz: is the main port for the export of petroleum and its derivatives from the Pacific coast.

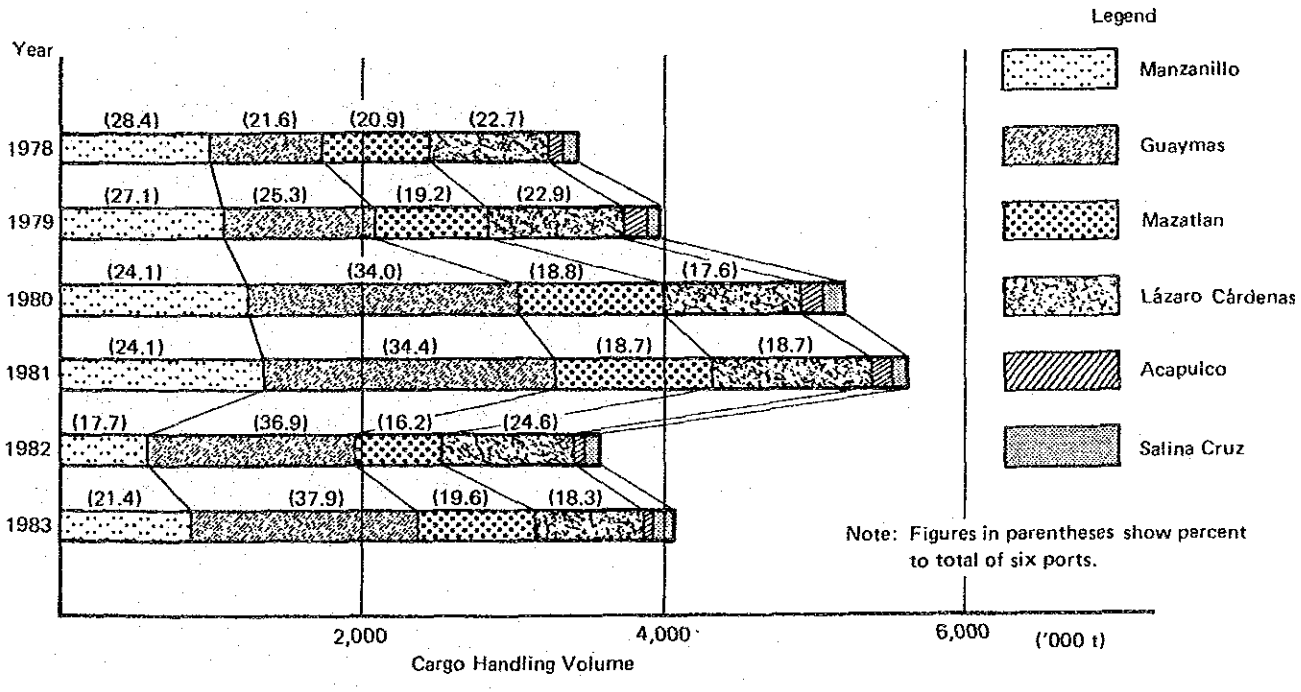


Fig. II-15 Foreign Cargo Handling Volume other than Petroleum and its Derivatives at the Six Major Pacific Coast Ports

Table II-32 Cargo Volume Handled at the Six Major Pacific Ports by Commodity Type (1983)

(Unit: '000 t)

Item	Guaymas	Mazatlan	Manzanillo	Lázaro Cárdenas	Acapulco	Salina Cruz
EXPORT	402	40	77	385	14	5,705
General Cargo	27	32	76	348	14	109
Agricultural Bulk	–	–	–	–	–	–
Mineral Bulk	375	–	–	24	–	–
Petroleum and its Derivaties	–	–	–	–	–	5,595
Other Liquid	–	–	–	11	–	–
Perishables	–	8	1	2	–	1
IMPORT	1,100	740	795	344	42	21
General Cargo	5	42	179	175	42	21
Agricultural Bulk	1,073	636	553	–	–	–
Mineral Bulk	32	62	42	169	–	–
Petroleum and its Derivaties	–	–	17	–	–	–
Other Liquid	–	–	4	–	–	–
Perishables	–	–	–	–	–	–
DOMESTIC TRADE OUT	937	217	596	21	–	6,331
General Cargo	75	195	43	17	–	7
Agricultural Bulk	502	–	–	–	–	–
Mineral Bulk	55	–	–	4	–	–
Petroleum and its Derivaties	305	–	553	–	–	6,323
Other Liquid	–	–	–	–	–	–
Perishables	–	22	–	–	–	1
IN	2,711	1,787	2,561	548	357	158
General Cargo	27	174	1	7	–	74
Agricultural Bulk	–	–	–	447	–	84
Mineral Bulk	64	59	192	–	–	–
Petroleum and its Derivaties	2,620	1,538	2,368	94	357	–
Other Liquid	–	–	–	–	–	–
Perishables	–	16	–	–	–	–

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"