Chapter 5. Demand Forecast

5.1 Scope and Principal Policy for Demand Forecast

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

i. Demand forecast of general cargo and containerized cargo to formulate the long-term development policy of each port in the target year of 2005.
ii. Demand forecast of containerized cargo and bulk cargo for the short-term improvement plans of the "selected ports" in the target year 1995.

First, the total volume of general cargo for foreign trade through the ports on the Pacific coast is forecast. Then, taking into consideration the future prospective progress in the containerization of general cargo in these ports, a forecast is carried out for the total volume of containerized cargo. The forecast of general cargo and containerized cargo of each objective port is executed referring to the projection of the total cargo volume at the Pacific coast ports.

Utilizing the result of the forecast containerized cargo of each port, the "selected ports" which play key roles in the transportation network for containerized cargo on the Pacific coast are identified. A bulk cargo forecast is to be carried out at the selected ports.

The wide scope of the cargo forecast and the limited social and economic data available, especially the lack of accurate projections in the long term, together with the large fluctuation in the recent maritime cargo movement inthe long term, in Mexico make it difficult to prepare a detailed forecast. Therefore, the forecast in this study of necessity, is carried out in a relatively simplified way.

For the forecast of general cargo and containerized cargo, because of the same reasons mentioned above, the forecast is first carried out for the year 1995. Then the throughout in the target year 2005 is estimated based on the cargo volume forecast for the year 1995.

5.2 Forecast of Total Volume of Export and Import General Cargo

5.2.1 Forecast of Export General Cargo Volume in 1995

(1) Actual Situation and Historical Trend

In the port statistics of Mexico (Movimento de Carga y Buques), seabone cargo is classified into six categories, that is, general cargo, agricultural bulk, mineral bulk, petroleum and its derivatives, fluids other than petroleum and its derivatives and perishables. Among these, perishables are usually categorized as general cargo. Also some of the fluids other than petroleum and its derivatives, although the volume is very small, are handled as general cargo. So in this study, all these general cargoes including perishables and some fluids other than petroleum and its derivatives are dealt with together as general cargo.

Table 5.2.1 shows the breakdown of import/export general cargoes at the Pacific coast ports and the Gulf coast ports in 1986. From this table, the main commodity groups of import general cargo at the Pacific coast ports are machinery and parts, mining and metal, forestry and derivatives and vehicles and parts. As for the export cargoes, the main commodity groups are iron and steel, chemicals, agricultural products, food and beverages and tobacco.

The Gulf ports handle considerably different percentage of each commodity group compared with the Pacific ports. But the general tendency of the main commodity groups can be said to be the same for both coasts.

Fig. 5.2.1 and Table 5.2.2 show the historical trend of export general cargo volume from 1981 to 1988. The iron and steel products produced from SICARTSA account for a significant share of the export cargo movement through the ports on the Pacific coast. So the general cargo excluding that of SICARTSA is presented separately in Fig. 5.2.1 and Table 5.2.2.

As shown in the Figure and Table, the total volume of exported general cargo in Mexico dropped sharply in 1985 followed by a rapid recovery in 1986 and 1987. The total general cargo in the Pacific shows the same trend as the national total showing a slight decrease in 1986 caused by the decrease of SICARTSA cargo.

This fluctuation in export cargo movement was mainly caused by the economic recession in Mexico in the 1980s. But it should be noticed that there seems to be no direct relation between the fluctuation of overall seaborne cargo movement and the economic recession and recovery. This will be discussed in detail later on.

Table 5.2.1 Volume of General and Perishable Cargo by Commodity (1986)

(1) Pacific coast ports

(unit; tons, %)

Commodity Group	Imports	%	Exports	%	Total	%
1. Agricultural Products	14,612	4.1	69,984	9.0	84,596	7.5
2. Livestock	1,968	0.6	9	0.0	1,977	0.2
3. Fishery	100	0.0	10,148	1.3	10,248	0.9
4. Food Bev. & Tobacco	5,335	1.5	68,530	8.8	73,865	6.5
5. Minerals	729	0.2	15,070	1.9	15,799	1.4
6. Textiles & Leather	3,567	1.0	7,583	1.0	11,150	1.0
7. Forestry & Derivatives	54,059	15.2	11,710	1.5	65,769	5.8
8. Petrochemistry	1,165	0.3	11,625	1.5	12,790	1.1
9. Chemistry	23,634	6.7	161,174	20.8	184,808	16.4
10. Industrial Products	10,964	3.1	6,710	0.9	17,674	1.6
11. Iron & Steel	40,062	11.3	359,888	46.5	399,950	35.4
12. Mining & Metal	63,525	17.9	29,922	3.9	93,447	8.3
13. Machinery & Parts	67,610	19.1	7,365	1.0	74,975	6.6
14. Vehicles & Parts	42,294	11.9	7,794	1.0	50,088	4.4
15. Electrical Parts	7,645	2.2	284	0.0	7,929	0.7
16. Other	17,526	4.9	6,855	0.9	24,381	2.2
Total	354,795	100.0	774,651	100.0	1,129,446	100.0

(2) Gulf ports

(unit; tons, %)

Commodity Group	Imports	%	Exports	%	Total	%
1. Agricultural Products	78,130	6.6	112,108	9.6	190,238	8.1
2. Livestock	705	0.1	468	0.0	1,173	0.0
3. Fishery	812	0.1	2	0.0	814	0.0
4. Food Bev. & Tobacco	90,844	7.7	66,514	5.7	157,358	6.7
5. Minerals	8,625	0.7	101,862	8.8	110,487	4.7
6. Textiles & Leather	7,117	0.6	41,389	3.6	48,506	2.1
7. Forestry & Derivatives	80,189	6.8	23,788	2.0	103,977	4.4
8. Petrochemistry	4,635	0.4	105,849	9.1	110,484	4.7
9. Chemistry	242,941	20.5	262,304	22.6	505,245	21.5
10. Industrial Products	81,247	6.8	107,255	9.2	188,502	8.0
11. Iron & Steel	216,856	18.3	123,831	10.7	340,687	14.5
12. Mining & Metal	49,460	4.2	106,409	9.2	155,869	6.6
13. Machinery & Parts	189,443	16.0	10,457	0.9	199,900	8.5
14. Vehicles & Parts	78,824	6.6	58,297	5.0	137,121	5.8
15. Electrical Parts	10,077	0.8	3,097	0.3	13,174	0.6
16. Other	47,103	4.0	38,784	3.3	85,887	3.7
Total	1,187,008	100.0	1,162,414	100.0	2,349,422	100.0

Source: Figures were summed up by processing the data of General Direction of Ports and Merchant (Direccion de Puerto y Marina Mercant de S.C.T.)

Table 5.2.2 Historical Trend of Export General Cargo Volume in Mexico

(Unit: tons)

	1981	1982	1983	1984	1985	1986	1987	1988
Ensenada	52,868	35,366	7,694	932	8,002	16,686	21,172	24,912
Guaymas	105,585	23,506	27,382	37,617	12,815	24,225	60,926	85,815
Mazatlan	73,443	37,705	39,776	31,398	23,618	38,400	70,823	113,395
Manzanillo	75,166	39,757	76,613	76,037	77,970	101,838	126,558	261,081
Lazaro Cardenas (Excluding SICARTSA)	6,939 (6,939)	179,254 (157,106)	360,975 (191,664)	309,930 (38,080)	185,069 (47,704)	415,673 (68,070)	507,101 (71,620)	409,035 (116,545)
Acapulco	15,989	6,217	14,042	8,308	10,229	8,710	11,981	19,258
Salina Cruz	14,528	73,025	110,470	175,986	175,364	183,934	256,617	139,936
Sub-Total (Excluding SICARTSA)	344,518 (344,518)	394,830 (372,682)	636,952 (467,641)	640,208 (368,358)	493,067 (355,702)	789,446 (441,863)	1,055,178 (619,697)	1,053,432 (760,942)
Other Pacific Ports	9,390	18,603	17,081	16,992	12,905	20,521	9,463	*10,000
Pacific Total (Excluding SICARTSA)	353,908 (353,908)	413,433 (391,285)	654,033 (484,722)	657,200 (385,350)	505,972 (368,607)	809,987 (441,384)	1,064,641 (629,160)	1,063,432 (770,942)
Gulf Total	708,351	851,983	909,646	1,014,531	940,661	1,274,152	1,841,820	N.A
Mexico Total	1,062,259	1,265,416	1,563,679	1,671,731	1,446,633	2,084,139	2,906,461	N.A

Source: SCT Movimiento de Carga y Buques
Note: * (Assumed value)

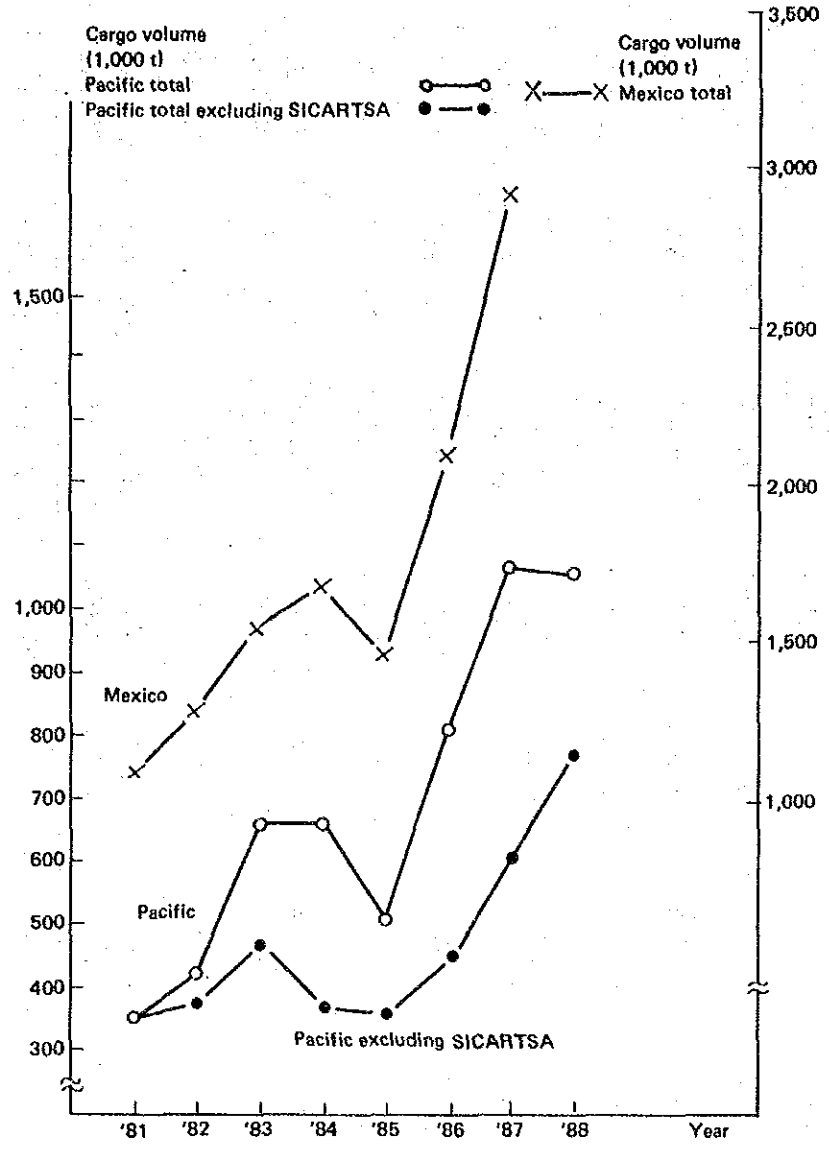


Fig. 5.2.1 Historical Trend of Export General Cargo Volume in Mexico

(2) Forecast Methodology

The main object of the general cargo forecast is to estimate the containerized cargo volume in the future to examine the transportation network of containerized cargo on the Pacific coast ports. The cargoes produced from SICARTSA and exported through the Port of Lazaro Cardenas are iron and steel products which are not expected to be containerized. The total export cargo volume of the Pacific coast ports has been showing greater variation in recent years compared with the cargo volume excluding SICARTSA, and this is caused by the yearly fluctuation of the cargo volume by SICARTSA (Refer to Fig. 5.2.4).

Therefore the forecast of export general cargo is carried out fundamentally for the cargo excluding SICARTSA cargo. while the estimation of the export cargo volume by SICARTSA is carried out separately.

Table 5.2.3 shows the historical trend of both the economic indices such as gross domestic product and total value of shipments and the export general cargo volume. As is understood by comparing the annual growth rate of cargoes with that of the economic indices, no significant correlation between the maritime export cargo movement and the economic indices is observed. Thus correlation analyses between the export cargo volume and the gross domestic product or total value of shipments, which are often adopted for the macro forecast of maritime cargoes, cannot be utilized for the forecast in this study.

Exceptionally, there is a close correlation between the exported general cargo volume and the export of non-petroleum goods. Therefore an analysis of this correlation is executed as one method for the forecast of export general cargo.

A time series analysis which analyzes the historical trend of cargo movement is also carried out, although the time period may not be long enough for a reliable forecast because of the fluctuation of the cargo movement.

The cumulative total volume of the roughly estimated cargo volume of each port is also referred to as one forecast value of the total export general cargo.

Table 5.2.3 Historical Trend of the Relation between Economic Indices and Export General Cargo Volume

		1981	1982	1983	1984	1985	1986	1987	1988
Gross Domestic Product	Value (billion Pesos)	4,862.1	4,831.7	4,628.9	4,796.1	4,919.9	4,725.3	4,792.9	N.A
	Growth Rate (%)	+8.8	-0.6	-4.2	+3.6	+2.6	-4.0	+1.4	N.A
Total Value of Shipments	Value (billion Pesos)	1,052.7	1,023.8	943.5	990.9	1,051.1	991.3	1,016.7	1,038.7
	Growth Rate (%)	+6.4	-2.7	-7.8	+5.0	+6.1	-5.7	+2.6	+2.2
Total Export General Cargo (Mexico)	Volume (thousand tons)	1,062.3	1,265.4	1,563.7	1,671.7	1,445.4	2,084.1	2,906.5	N.A
	Growth Rate (%)	N.A	+19.1	+23.6	+6.9	-13.6	+44.2	+39.5	N.A
Total Export General Cargo (Pacific minus SICARTSA)	Volume (thousand tons)	353.9	391.3	484.7	385.4	367.4	462.1	629.2	770.9
	Growth Rate (%)	N.A	+10.6	+23.9	-20.5	-4.7	+25.8	+36.1	+23.8

Source: 1. INEGI Sistema de Cuentas Nacionales de Mexico Cuentas Consolidados de la Nacion 1987
2. SCT Movimiento de Carga y Buques

Note: Gross National Product and Total Value of Shipments is in constant 1980 prices

(3) Forecast

1) Time series analysis -1-

As shown in Fig. 5.2.1, the export general cargo volume excluding SICARTSA before 1984 varied year by year and seems to have no definite connection with the cargo movement after 1985. So the effective data period for a time series analysis will be from 1985 to 1988.

In a time series analysis, the cargo volume is assumed to be expressed as:

$$V = a + bt$$

where V: Cargo volume at year t
t: Year
a,b: Constants

The constants are decided by the least squares method and the following formula is obtained for the future total cargo volume of exports at the Pacific coast ports.

$$V = -11,358.8 + 137.8t \qquad (r = 0.995)$$

where V: Export general cargo volume excluding SICARTSA (thousand tons)
t: Year (85 for year 1985)
r: Correlation coefficient

Calculating by this formula, the export general cargo volume in the target year 1995 is estimated to be 1,728 thousand tons.

2) Time series analysis -2-

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

The total export volume of sugar through Mexican ports in recent years has been as follows:

Table 5.2.4 Export Volume of Sugar through Mexican Ports

(1,000 tons)

Year	1985	1986	1987	1988	1989
Total Export Volume	105	219	105	933	0

Mexico exports surplus sugar production, the volume of which remained at a rather low level before 1988. But in 1988, because of the abundant harvest of sugar in the previous year, Mexico recorded an extraordinary export volume totaling 933 thousand tons. Sugar had been exported through the Gulf coast ports, mainly through the Port of Veracruz. But, because of the large exported sugar volume, such ports on the Pacific coast as Mazatlan, Manzanillo and Lazaro Cardenas were used for the export of 127 thousand tons of sugar in 1989 which was the first case in the 1980s. On the contrary, the drought in 1988 resulted in a turn toward the import of sugar in 1989. Considering the situation up to now and referring to the interviews with the persons concerned, it is concluded that sugar will generally not be exported through the ports on the Pacific coast.

From the above examination, a time series analysis eliminating the exported volume of sugar in 1988 was executed and the following correlation formula was obtained.

$$V = -8,092.4 + 99.63t \qquad (r = 0.961)$$

where V: Export general cargo volume
t: Year (85 for year 1985)
r: Correlation coefficient

Using this formula and adding 127 thousand tons as the probable volume of export sugar in the future, the export general cargo volume in the target year 1995 is estimated to be 1,499 thousand tons.

3) Correlation analysis with value of exports -1-

In this forecast method, the effective data period is from 1984 to 1988 considering the correlation between the export cargo and the value of exports of non-petroleum goods. The volume of exported sugar in 1988 was

excluded for the reasons mentioned above.

In a correlation analysis with social or economic indices, cargo volume is assumed to be expressed as:

$$V = a + bx$$

where V: Cargo volume
x: Social or economic index
a, b: Constants

The constants are decided by the least squares method and the following correlation formula is obtained for the future export cargo volume. Fig. 5.2.2 shows the correlation between the export general cargo volume and the value of exports of non-petroleum goods.

$$V = 79.1 + 0.0523x \qquad (r = 0.960)$$

where V: Export general cargo volume (thousand tons)
x: Value of export of non-petroleum goods in constant 1980 prices (million dollars)
r: Correlation coefficient

Table 5.2.5 presents the trend of the value of non-oil exports which has been showing sustained progress, while the total export value shows a gradual decline. According to the results of the interview with the officials concerned of SECOFI, Mexican non-oil exports are expected to grow annually at a rate of 20 - 25% for the next few years. Taking into consideration the fairly long period until the target year 1995, the study team assumes a 20% average annual growth rate from 1988 to 1995.

Then calculating by the above correlation formula and adding 127 thousand tons of sugar export volume, the export general cargo volume in the target year 1995 is estimated to be 2,314 thousand tons.

4) Correlation analysis with value of exports -2-

In this method, three-year moving average values are used for both the cargo volume and the value of exports to eliminate yearly variations. Data from 1983 to 1988 are used to obtain three-year moving average values from

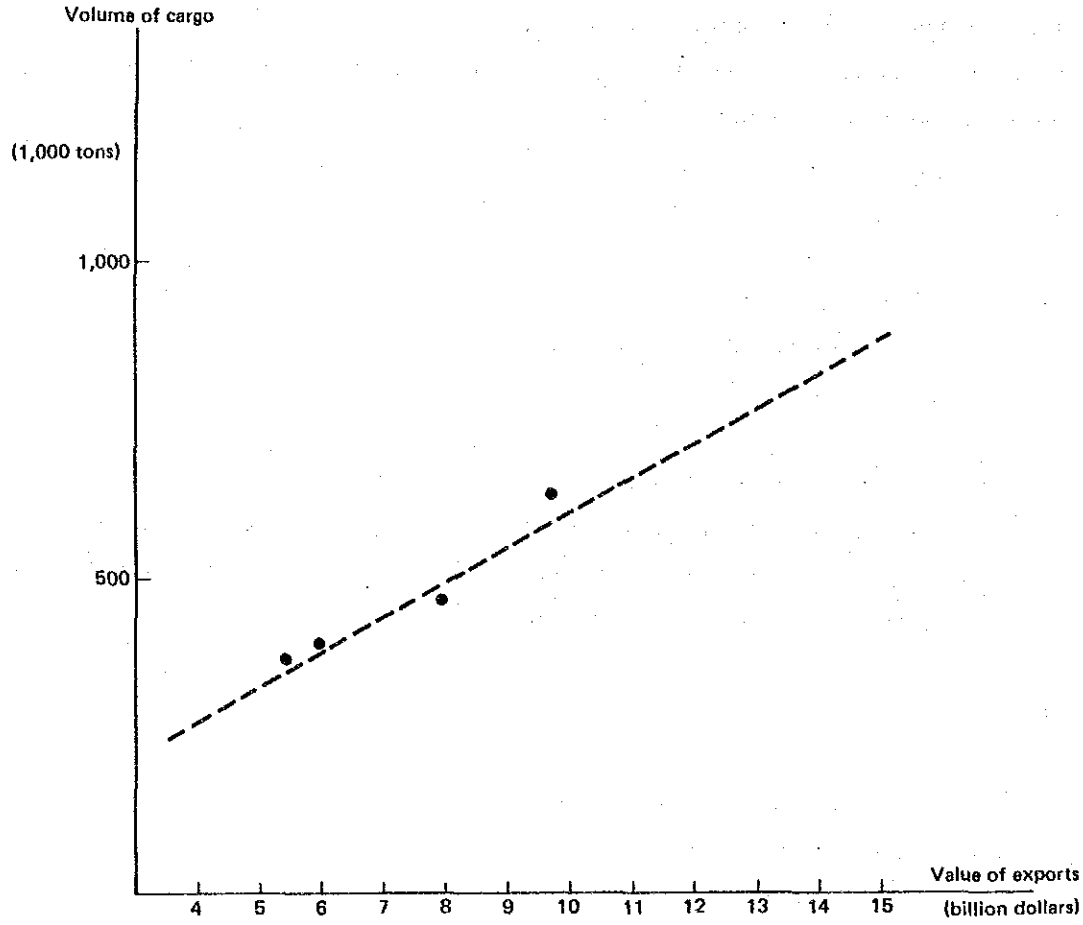


Fig. 5.2.2 Correlation between Export General Cargo Volume and Export Value of Non-Petroleum Goods

Table 5.2.5 Value of Non-Oil Exports (1980 prices)

(unit: million dollars)

Year	Total Exports	Non-oil Exports (Nominal)		Non-oil Exports (Real)
1982	21,230	(20.0)	4,251	3,739
1983	22,312	(25.9)	5,771	4,997
1984	24,196	(29.2)	7,056	5,995
1985	21,664	(29.5)	6,387	5,363
1986	16,031	(57.5)	9,214	7,849
1987	20,656	(55.4)	11,451	9,550
1988*	20,678	(66.8)	13,823	11,247

Note: * The value of 1988 is estimated from the value of January - November.
* ( ); The share of non-oil exports (%)

Source: Boletin Trimestral de Informaccion Economic No.4 Volumen 1

1984 to 1987.

The correlation formula in this case is as follows:

$$V = 111.4 + 0.0514x \qquad (r = 0.974)$$

where V: Export general cargo volume (thousand tons)
t: Value of exports of non-petroleum goods in constant 1980 prices (million dollars)
r: Correlation coefficient

Using this correlation formula, the export general cargo in 1995 is estimated to be 2,184 thousand tons.

Here, a change of the elasticity value of the cargo volume to the value of exports should be considered. Although the value of exports of non-petroleum goods is expected to grow steadily in Mexico, the export of general cargo through the Mexican ports will not necessarily increase in proportion to the increase of the value of exports. One reason for this is the relative increase of higher value-added export goods. Another reason is the development of the Maquiladora program, which will increase the cross border land transportation between the U.S.A. and Mexico.

Thus, the elasticity of cargo volume to the value of exports is predicted to decline in the future as compared with the elasticity value calculated from the above correlation formula. If a 20% decline in the elasticity is assumed, the estimated export general cargo volume will be 1,790 thousand tons.

5) Forecast of cargo volume of each port

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

6) Adopted value for the forecast in 1995

Fig. 5.2.3 shows the estimated cargo volume in 1995 by each forecast method. The forecast values by each method present a considerablly wide distribution. Considering that the correlation analysis with the value of exports, when the decline of elasticity is not considered, may give a rather excessive result, the study team adopts 1,710 thousand tons, which

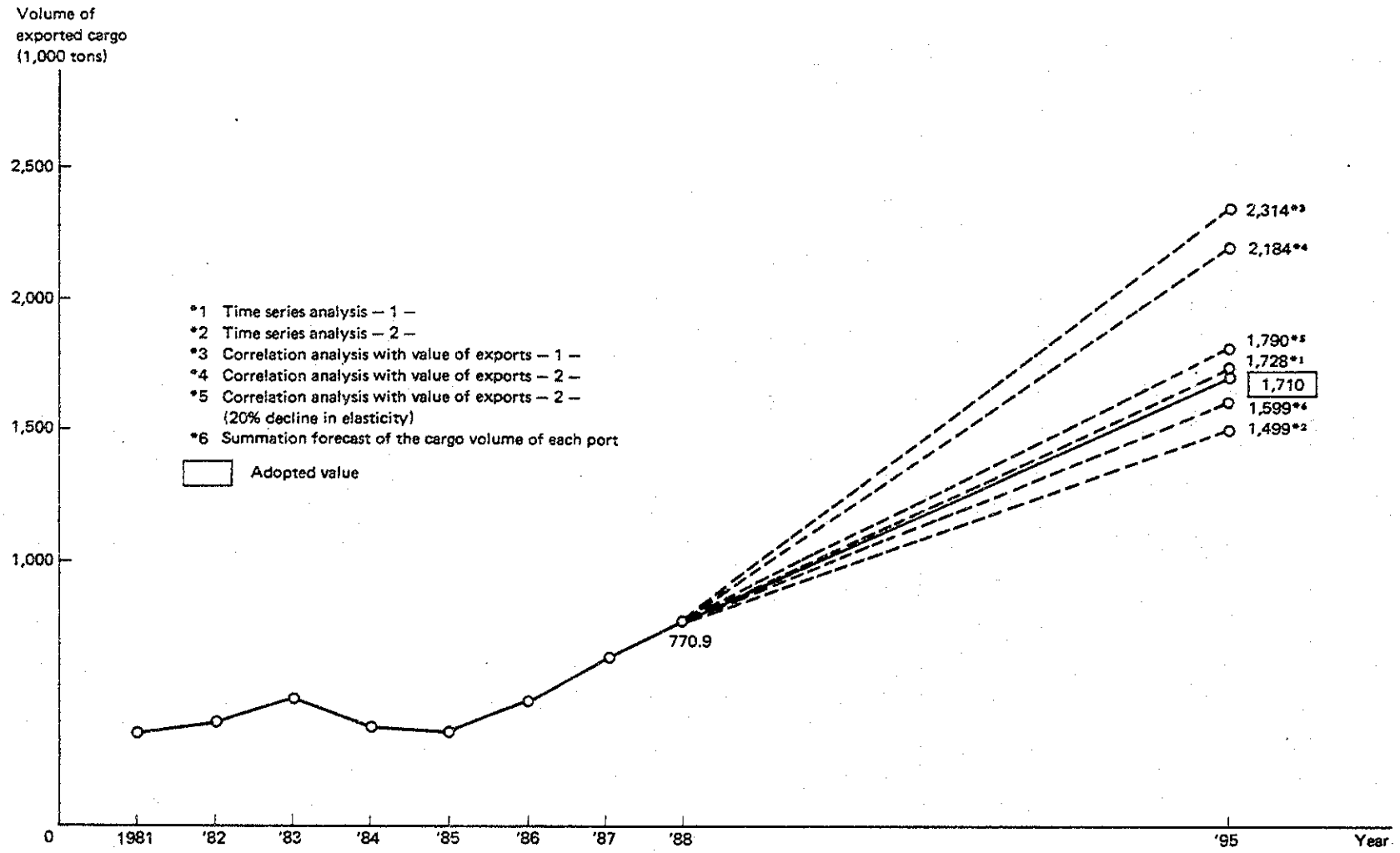


Fig. 5.2.3 Results of Forecast by Each Method (Export General Cargo in 1995)

is the average value of *1, *5 and *6 in Fig. 5.2.3, as the estimated total volume of export general cargo (excluding SICARTSA) through the Pacific coast ports.

7) Estimation of SICARTSA cargo

Fig. 5.2.4 represents the historical trend of export cargo by SICARTSA through the port of Lazaro Cardenas. According to the interviews with SICARTSA's personnel and the available data, the maximum volume of export cargo until 1995 is around 1,300 thousand tons. Therefore, this value is adopted as the estimated volume of export general cargo by SICARTSA in 1995.

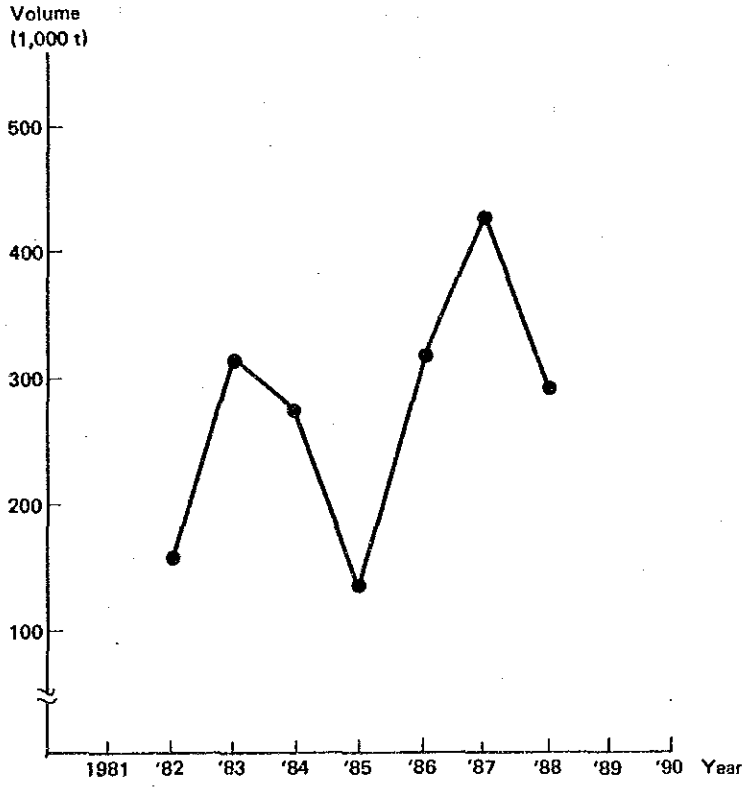


Fig. 5.2.4 Historical Trend of Export Cargo Volume by SICARTSA

5.2.2 Forecast of Export General Cargo Volume in 2005

(1) Forecast Methodology

As mentioned in section 5.1, because of the lack of forecast long term social and economic indices and the recent fluctuation in the cargo movement through the Mexican ports, the total export volume of general cargo through the Pacific coast ports in 2005 is forecast based on the estimated cargo volume in 1995.

(2) Forecast

1) Extend value of the estimated cargo volume in 1995

Assuming that the same tendency of the cargo increase from the present to 1995 will continue until 2005, the export general cargo volume is forecast to be 3,050 thousand tons in 2005.

According to this result, the 12.1% average annual growth rate for the period from 1988 to 1995 will decline to 6.0% for the period from 1995 to 2005.

2) Forecast of cargo volume of each port

A forecast of the exported general cargo volume is roughly carried out as described later. According to this forecast the total cargo volume in 2005 is estimated to be 2,826 thousand tons.

3) Adopted value of the forecast

The study team adopts the value of 3,050 thousand tons as the estimated total volume of export general cargo (excluding SICARTSA) through the Pacific coast ports in 2005.

4) Estimation of SICARTSA cargo

SICARTSA seems to have no definite program on the export of its iron and steel products beyond the year 2000. But according to the data offered by SICARTSA, the projected export volume during 1995 to 2000 shows a considerable reduction of the export volume compared with the previous five years, which is deemed to be caused by the increase of domestic for SICARTSA's products. Judging from this, the study team projects the export cargo volume by SICARTSA in 2005 to be 1,300 thousand tons, which is equal

to the estimated value in 1995.

5.2.3 Forecast of Import General Cargo Volume in 1995

(1) Historical Trend

Table 5.2.6 and Fig. 5.2.5 show the historical trend of import general cargo volume from 1981 to 1988. The total import general cargo volume in Mexico recorded a peak value of 4,808 thousand tons in 1981. Since that year, the cargo volume has shown a continuous decline except for 1984. This movement of import general cargo is greatly affected by the economic crisis in Mexico in the 1980s and the following governmental policy to restrict imports.

As for the Pacific coast ports, the general tendency of the movement of import general cargo is the same as that of the national total. However, with the recovery of the Mexican economy and the government decision to release the import controls, the import general cargo recorded a rapid increase in 1988.

Table 5.2.7 shows the import volume of sugar and rice through the Pacific coast ports from 1981. The sugar and rice had occupied a significant share of the import cargo volume of these ports until 1986, as seen in Table 5.2.7. After 1986, however, the import of sugar and rice stopped and sugar was exported as mentioned before. The dotted line in Fig. 5.2.5 shows the imported general cargo volume excluding sugar and rice through the Pacific coast ports. From this Fig. a general tendency toward an increase of imports can be seen after 1984. Therefore the import volume of general cargo can be expected to grow steadily from now on.

Table 5.2.6 Historical Trend of Import General Cargo Volume in Mexico

(Unit: tons)

	1981	1982	1983	1984	1985	1986	1987	1988
Ensenada	74,703	14,969	70,898	24,604	12,545	13,921	3,435	2,578
Guaymas	29,971	23,506	4,530	15,482	24,485	10,320	49,562	92,995
Mazatlan	91,298	87,204	42,187	61,896	70,970	33,625	-	1,758
Manzanillo	404,782	275,394	182,636	295,579	223,210	118,409	86,441	121,351
Lazaro Cardenas	121,589	103,340	174,313	97,771	70,276	90,910	111,071	159,810
Acapulco	118,626	59,944	41,879	56,582	56,376	31,930	19,822	28,405
Salina Cruz	32,816	13,042	22,400	13,506	26,149	50,868	86,787	57,894
Sub-Total	873,785	577,399	538,843	565,420	484,011	349,983	357,118	464,791
Other Pacific Ports	33,921	1,694	14,302	2,012	10,888	20,299	11,026	*11,000
Pacific Total	907,706	579,093	553,145	567,432	494,899	370,282	368,144	475,791
Gulf Total	3,900,913	2,013,224	1,367,572	1,542,296	1,547,251	1,214,480	932,341	N.A
Mexico Total	4,808,619	2,592,317	1,920,717	2,109,728	2,042,150	1,584,762	1,300,485	N.A

Source: SCT Movimiento de Carga y Buques
Note: * (Assumed value)

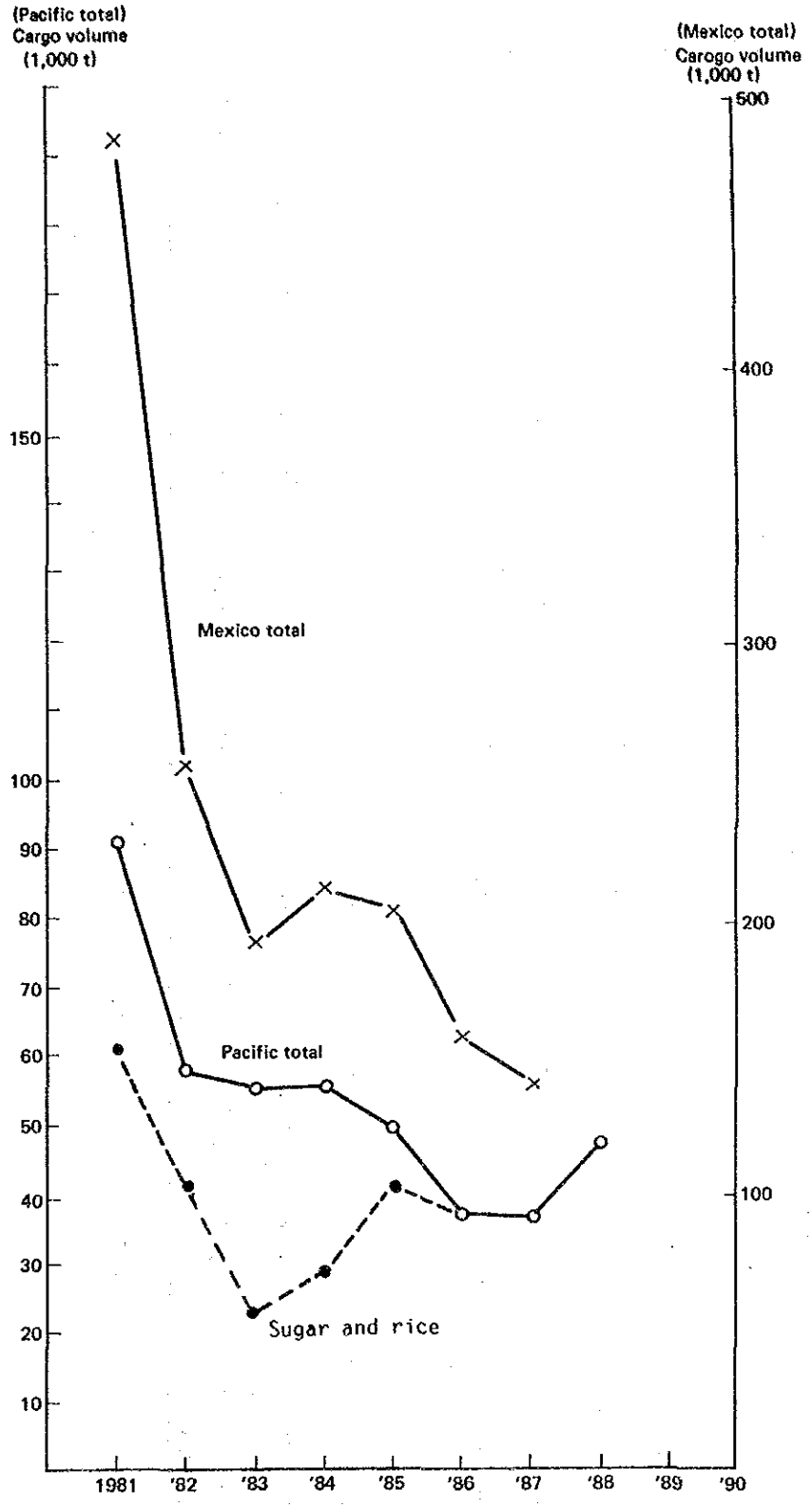


Fig. 5.2.5 Historical Trend of Import General Cargo Volume in Mexico

Table 5.2.7 Volume of Imported Sugar and Rice in General Cargo

(Unit: tons)

	1981	1982	1983	1984	1985	1986	1987	1988
Ensenada	69,426	11,974	61,979	12,706	-	-	-	-
Guaymas	-	-	-	-	-	-	-	-
Mazatlan	67,679	31,402	37,896	60,799	25,233	-	-	-
Manzanillo	98,029	59,440	111,256	175,639	58,783	-	-	-
Lazaro Cardenas	61,313	62,644	120,472	31,341	-	-	-	-
Salina Cruz	-	-	-	-	-	-	-	-
Sugar and Rice Total	296,447	165,460	331,603	280,485	84,016	-	-	-
Other Goods Total	611,259	413,633	221,542	286,947	410,883	370,282	368,144	475,791
Pacific Coast Total (General cargo)	907,706	579,093	553,145	567,432	494,899	370,282	368,144	475,791

Source: SCT Movimiento de Carga y Buques

(2) Forecast Methodology

The volume of import general cargo continued to decline during the 1980s and this movement seems to have no definite relation with economic indices such as the gross domestic product. Therefore it seems to be difficult to forecast the future volume of import general cargo.

However, as mentioned before, the import general cargo volume excluding sugar and rice has been showing an upward tendency from 1984. Therefore a time series analysis of this cargo movement shall be analyzed for the period from 1984 to 1988.

The estimation of the cargo volume of each port is also referred to as one method of forecasting the export general cargo.

(3) Forecast

1) Time series analysis -1-

A time series analysis of import general cargo volume is carried out using the imported value excluding sugar and rice. The effective period for the analysis is from 1984 to 1988. However the value of 1985 is eliminated as it is considered to be an abnormal value against the trend of cargo movement.

The correlation formula is obtained as follows:

$$V = -3,278.0 + 42.36t \quad (r = 0.934)$$

where V: Import general cargo volume (thousand tons)
t: Year (84 for year 1984)
r: Correlation coefficient

Using this formula, the import general cargo volume in the target year 1995 is estimated to be 746 thousand tons.

2) Time series analysis -2-

The movement of import general cargo volume may show an exponential trend for the coming period.

Therefore an exponential type correlation formula is analyzed and obtained as follows:

$$V = 0.01781 \cdot e^{0.1151t} \qquad (r = 0.952)$$

where V: Import general cargo volume (thousand tons)
t: Year (84 for year 1984)
e: Correlation coefficient

Using this formula, the import general cargo volume in 1995 is estimated to be 1,012 thousand tons.

3) Forecast of cargo volume of each port

A forecast of the import general cargo volume of each port is roughly carried out in the same way as for the export cargo. According to this results, the total volume in 1995 is estimated to be 935 thousand tons.

4) Adopted value for the forecast

Fig. 5.2.6 shows the estimated cargo volume by each forecast method. Considering that the correlation coefficient of 2) above is better than that of 1), the study team adopts 920 thousands tons as the estimated total volume of import general cargo through the Pacific coast ports in 1995.

The adopted value of 920 thousand tons represents the weighted average value of the results of 1) and 2), weighting 1 to 1) and 2 to 2). And this value is very close to the result of 3).

According to this estimated value, it follows that the import general cargo volume in 1995 shall recover the peak level recorded in 1981.

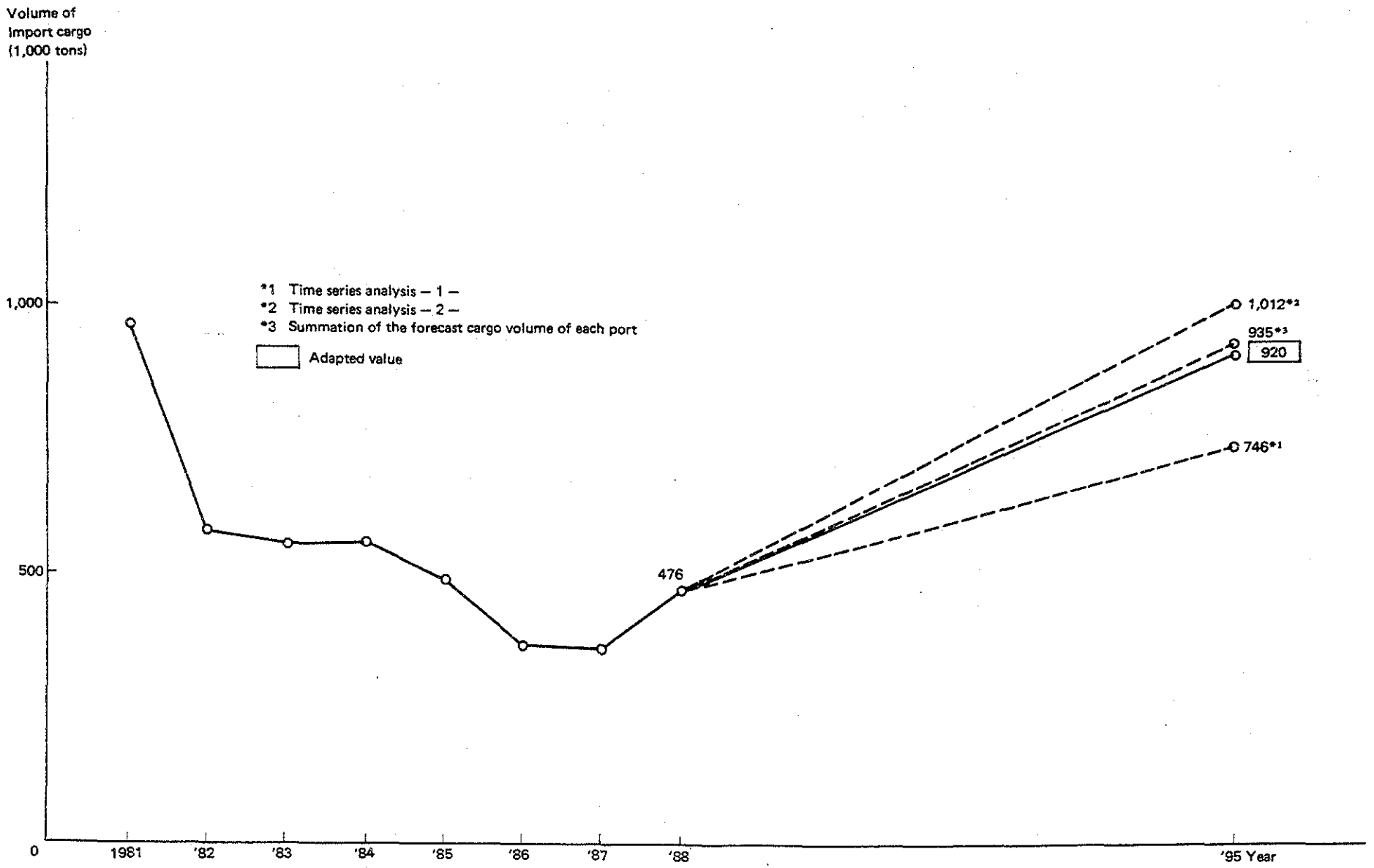


Fig. 5.2.6 Results of Forecast by Each Method (Import General Cargo in 1995)

5.2.4 Forecast of Import General Cargo in 2005

(1) Forecast methodology

The forecast methodology for the import general cargo volume in 2005 is the same as that for export general cargo volume.

(2) Forecast

1) Extrapolation of the estimated cargo volume in 1995

Assuming that the same tendency of cargo movement from the present to 1995 will continue until 2005, the import general cargo volume is forecast to be 1,550 thousand tons in 2005.

Under the forecast, the 9.9% average annual growth rate from 1988 to 1995 is estimated to decline to 5.4% for the period from 1995 to 2005.

2) Forecast of cargo volume of each port

According to the result of the forecast for each port, the total volume of import cargo in 2005 is estimated to be 1,623 thousand tons.

3) Adopted value of the forecast

The study team adopts the value of 1,550 thousand tons as the estimated total volume of import general cargo of the Pacific coast ports in 2005.

5.2.5 Summary of the Forecast Results

The results of the forecast of total general cargo through the Pacific coast ports are summarized in Table 5.2.8 and Fig. 5.2.7. The total general cargo volume including SICARTSA is estimated to increase from 1,539 thousand tons in 1988 to 3,930 thousand tons, around 2.6 times as compared with the present volume in 1988 and to 5,900 thousand tons in 2005, around 3.8 times the present volume.

Table 5.2.8 Summary of the Forecast Results of General Cargo
(Total Volume of the Pacific Coast Ports)

(unit: thousand tons, %)

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

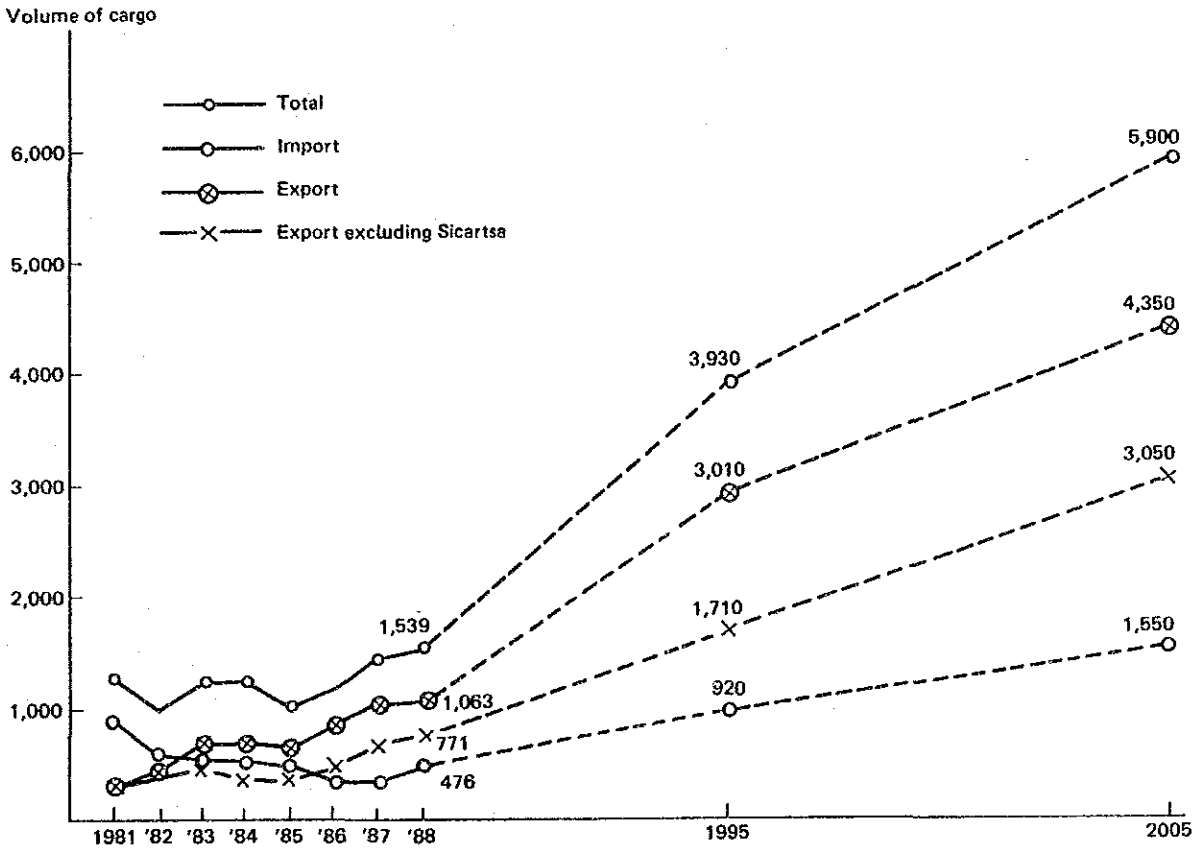


Fig. 5.2.7 Summary of the General Cargo Forecast Results
(Total Volume of the Pacific Coast Ports)

5.3 Forecast of Total Volume of Containerized Cargo

5.3.1 Actual Situation and Historical Trend

(1) Containerized Cargo

Table 5.3.1 shows the containerized cargo by commodity at the Mexican ports in 1986. For the import cargo through the Pacific coast ports, the main commodity groups of containerized cargo are vehicles and parts, machinery and parts and chemicals. For exports,chemicals, food beverages and tobacco, and agricultural are the main commodities. The Gulf side shows similar characteristics of the main commodity groups for containerized cargo, although the share of each commodity group differs to a considerable extent.

Table 5.3.2, 5.3.3 and Fig. 5.3.1 show the historical trend of the containerized cargo in Mexico. Both the Pacific and the Gulf ports have been recording a remarkable growth in the handling volume of containerized cargo. The Pacific coast ports recorded 226 thousand tons of export and 420 thousand tons of import containerized cargo in 1988. The shares to the national totals are 27% for imports and 37% for exports in this year.

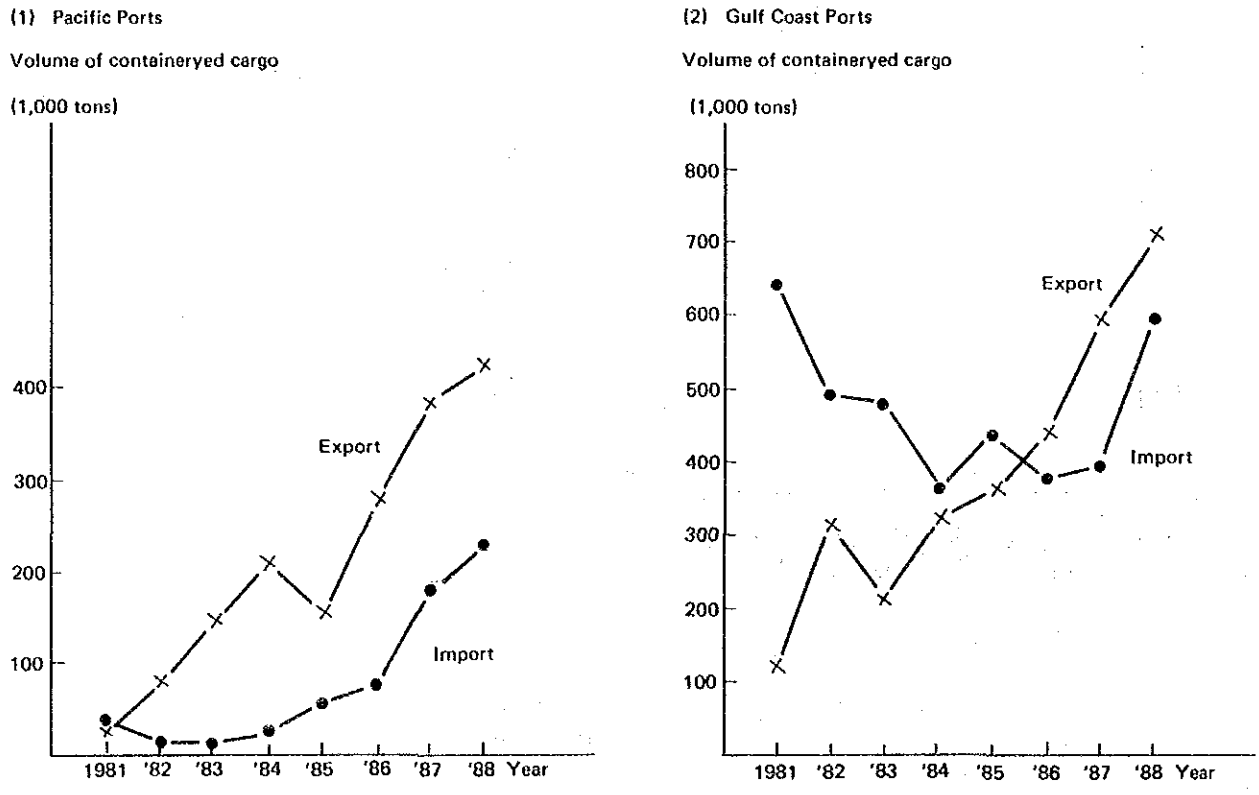


Fig. 5.3.1 Historical Trend of Containerized Cargo in Mexico

Table 5.3.1 Container Cargo Handled at the Mexican Ports by Commodity and Containerized Ratio (1986)

(1) Pacific Ports

(unit; tons, %)

Commodity Group	Imports	%	Containerized Ratio	Exports	%	Containerized Ratio	Total	%	Containerized Ratio
1. Agricultural	1,625	2.0	11.1	26,700	9.6	38.2	28,325	7.9	33.5
2. Livestock	252	0.3	12.8	-	-	-	252	0.1	12.8
3. Fishery	-	-	-	454	0.2	4.5	454	0.1	4.5
4. Food Bev. & Tobacco	452	0.6	8.5	50,338	18.1	73.5	50,790	14.1	68.8
5. Minerals	131	0.2	17.9	4,142	1.5	27.5	4,273	1.2	27.0
6. Textiles & Leather	3,258	4.0	91.3	5,008	1.8	66.0	8,266	2.3	74.1
7. Forester & Derivates	672	0.8	1.2	5,127	1.8	43.8	5,799	1.6	8.8
8. Petrochemicals	488	0.6	41.9	7,193	2.6	61.9	7,681	2.1	60.1
9. Chemicals	6,543	8.0	27.7	150,111	53.9	93.1	156,654	43.5	84.8
10. Industrial Products	2,322	2.8	21.2	3,776	1.4	56.3	6,097	1.7	34.5
11. Iron & Steel	3,269	4.0	8.2	581	0.2	0.2	3,850	1.1	1.1
12. Mining & Metal	947	1.2	1.5	13,448	4.8	44.9	14,395	4.0	15.4
13. Machinery & Parts	19,724	24.1	29.2	1,075	0.4	14.6	20,799	5.8	27.7
14. Vehicles & Parts	24,577	30.0	58.1	4,089	1.5	52.5	28,666	8.0	57.2
15. Electrical Parts	1,476	1.8	19.3	212	0.1	74.5	1,688	0.5	21.3
16. Other	16,130	19.7	92.0	6,017	2.2	87.8	22,148	6.1	90.8
Total	81,865	100.0	23.1	278,271	100.0	35.9	360,137	100.0	31.9

(2) Gulf Ports

(unit; tons, %)

Commodity Group	Imports	%	Containerized Ratio	Exports	%	Containerized Ratio	Total	%	Containerized Ratio
1. Agricultural	2,159	0.5	2.8	26,546	6.7	23.7	28,705	3.6	15.1
2. Livestock	528	0.1	75.0	220	0.1	47.0	748	0.1	63.8
3. Fishery	704	0.2	86.7	-	-	-	704	0.1	86.7
4. Food Bev. & Tobacco	19,598	4.9	21.6	44,184	11.2	66.4	63,782	8.0	40.5
5. Minerals	4,709	1.2	54.6	15,310	3.9	15.0	20,020	2.5	18.1
6. Textiles & Leather	2,467	0.6	34.7	38,297	9.7	92.5	40,764	5.1	84.0
7. Forester & Derivates	12,591	3.1	15.7	14,800	3.7	62.2	27,391	3.4	26.3
8. Petrochemicals	2,712	0.7	58.5	18,826	4.8	17.8	21,538	2.7	19.5
9. Chemicals	75,156	18.7	30.9	137,583	34.8	52.5	212,739	26.7	42.1
10. Industrial Products	21,156	5.3	26.0	11,964	3.0	11.2	33,119	4.2	17.6
11. Iron & Steel	42,507	10.6	19.6	645	0.2	0.5	43,152	5.4	12.7
12. Mining & Metal	2,831	0.7	5.7	1,342	0.3	1.3	4,173	0.5	2.7
13. Machinery & Parts	90,639	22.6	47.8	7,022	1.8	67.2	97,661	12.3	48.9
14. Vehicles & Parts	75,630	18.8	95.9	49,858	12.6	85.5	125,488	15.7	91.5
15. Electrical Parts	4,529	1.1	44.9	765	0.2	24.7	5,294	0.7	40.2
16. Other	43,700	10.9	92.8	27,976	7.1	72.1	71,676	9.0	83.5
Total	401,616	100.0	33.8	395,338	100.0	34.0	796,954	100.0	33.9

Table 5.3.2 Historical Trend of Containerized Cargo in Mexico (Import)

(unit: tons)

	1981	1982	1983	1984	1985	1986	1987	1988
Ensenada	0	239	372	0	0	0	0	0
Guaymas	0	0	25	33	4	5,617	47,582	67,444
Mazatlan	96	300	920	27	0	0	0	62
Manzanillo	36,806	6,564	1,307	2,528	8,177	7,408	12,853	21,193
Lazaro Cardenas	867	3,684	9,384	15,159	29,209	17,742	33,175	92,100
Acapulco	1,094	986	195	1,291	5,296	3,090	3,321	10,087
Salina Cruz	0	197	1,702	2,729	11,946	34,534	66,908	35,498
Pacific Total	38,863	11,970	13,905	21,767	54,632	68,391	163,839	226,384
Gulf Total	647,782	485,543	478,254	360,243	432,061	375,031	390,363	593,067
Mexico Total	686,645	497,513	492,159	382,010	486,693	443,422	554,202	819,451

Source: SCT Movimiento de Carga y Buques

Table 5.3.3 Historical Trend of Containerized Cargo in Mexico (Export)

(unit: tons)

	1981	1982	1983	1984	1985	1986	1987	1988
Ensenada	0	799	1,204	0	0	0	0	0
Guaymas	0	196	125	0	0	3,667	31,718	66,216
Mazatlan	0	64	5,084	3,038	555	7,737	3,446	21,328
Manzanillo	22,282	7,788	21,580	37,097	32,798	41,110	56,152	142,308
Lazaro Cardenas	1,409	4,463	23,060	25,934	37,953	43,365	55,314	62,299
Acapulco	247	180	23	277	742	1,126	1,983	2,874
Salina Cruz	0	65,957	91,111	140,931	102,435	178,273	232,847	125,435
Pacific Total	23,938	79,447	142,187	207,277	174,483	275,278	381,460	420,460
Gulf Coast Ports	118,920	314,021	219,088	321,132	363,833	434,068	598,009	718,263
Total	142,858	393,468	361,275	528,409	538,316	709,346	979,469	1,138,723

Source: SCT Movimiento de Carga y Buques

(2) Containerized Ratio

Fig. 5.3.2 shows the historical trend of the containerized ratio of the general cargo volume in Mexico. As for the exports of the Pacific coast ports, the containerized ratios are presented for both the total general cargo volume and the general cargo volume excluding SICARTSA cargo.

The containerized ratio in Mexico has been showing a steady increase since the early 1980s. In 1988 the containerized ratio at the Pacific coast ports reached 47.6% for the imported general cargo and 54.5% for the exported general cargo excluding SICARTSA. This considerably high ratio shows the remarkable development of containerization in the Pacific coast ports as well as the fact that containerizable general cargo accounts for a large percentage of the total general cargo except for SICARTSA cargo.

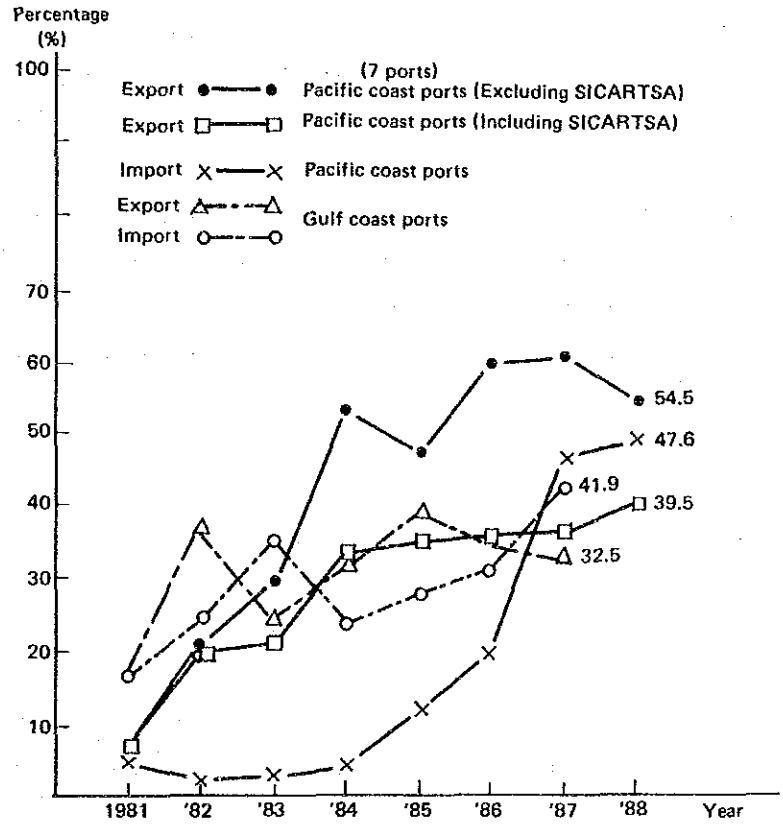


Fig. 5.3.2 Containerized Ratio for General Cargo

5.3.2 Forecast

(1) Containerized ratio

The remarkable increase of the containerized cargo volume through the Pacific ports has been achieved through the rapid progress of containerization as seen in Fig. 5.3.2. The containerized ratio for export general cargo began to rise sharply in accordance with the increase of the containerized chemical products in the Port of Salina Cruz from 1982. On the other hand, the recent progress in the containerization of automobile parts has also contributed greatly to the rapid increase of the containerized ratio for the import general cargo.

When the future progress of the containerized ratio is estimated, the containerizable cargo ratio, which represents the ratio of cargo which can theoretically be containerized to the total general cargo has to be examined. In Table 5.2.1 which lists the general cargo volume by commodity group, some of the machine/parts and iron/steel can not be containerized because of its size and weight. In addition to this, it must be noted that the Mexican port statistics sometimes include empty containers which are not essentially a port cargo to be counted. Taking these factors into consideration and referring to the detailed commodities of the general cargoes of each port, the ratio of containerizable cargo is supposed to be around 95% for the total import general cargo excluding SICARTSA. Judging from the commodity shares, the containerizable ratio of export cargo is estimated to be a little greater than that of import cargo.

The future containerized ratio of total general cargo shall be estimated based on the trend of containerization and the ratio of containerizable cargo examined above. Taking into account these factors and considering that some of the Pacific coast ports are not expected to have container ship service, the containerized ratio in 2005 will be from 80 to 85%.

Here, the balance between import and export containers also has to be considered. At present there are significantly more export containers than import containers. And according to the result of the demand forecast, the export general cargo is estimated to increase at a higher growth rate than the import general cargo, raising the possibility toward a further imbalance between imported and exported containers. This can be a serious issue for shipping companies as it requires the transportation of empty

containers. Thus, this imbalance might result in both a certain hindrance in the progress of the containerization of export cargo and promotion of the containerization of import cargo. It is said that the tolerable limit of the balance between the number of import and export containers can be no more than a factor of two from the shipping companies' point of view. That is to say that if there are more than twice as many export containers than import container, the route may no longer be sufficiently profitable due to the burden of the carrying coasts of empty containers.

Taking the above factors into consideration, the projected containerized ratios of the import and export general cargo in 1995 and 2005 are estimated as shown in Table 5.3.4 and Fig. 5.3.3. The containerized ratio of import general cargo is estimated to increase at a higher rate than that of export cargo.

Table 5.3.4 Estimated Containerized Ratio of General Cargo in the Pacific Coast Ports

	Actual result (%)	Estimated Containerized Ratio (%)	
	1988	1995	2005
Import	47.6	70	85
Export	55.3	70	80

Note: Export general cargo excludes SICARTSA cargo.

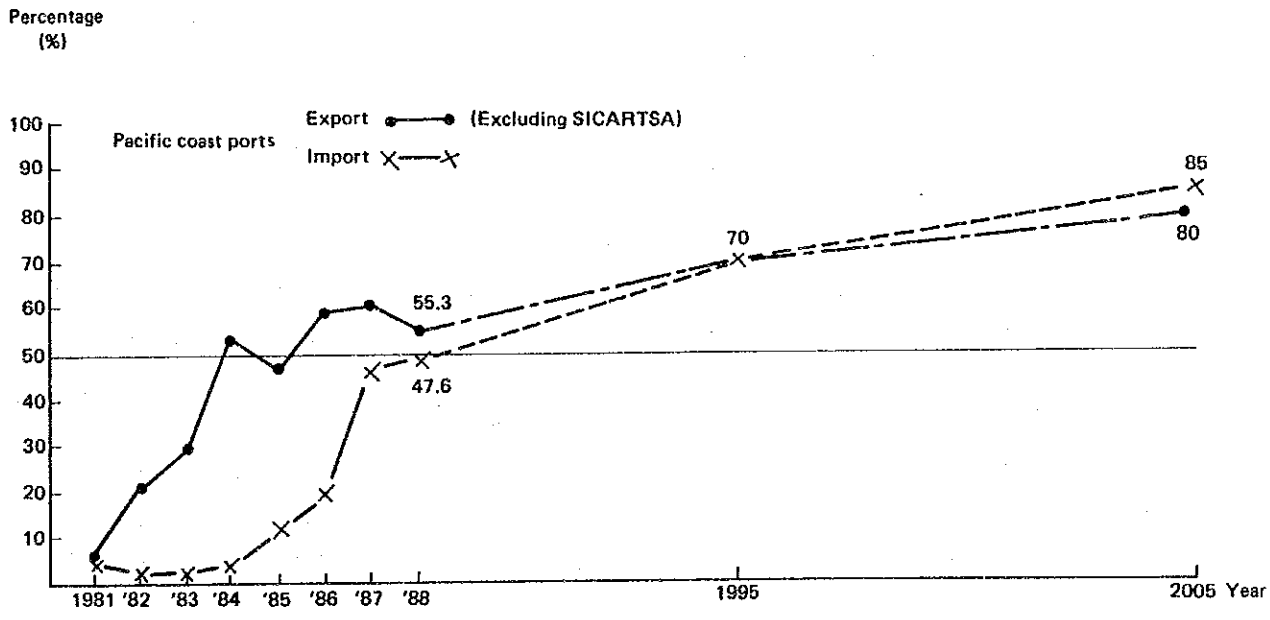


Fig. 5.3.3 Estimated Containerized Ratio of General Cargo in the Pacific Coast Ports

(2) **Containerized Cargo Volume**

Using the estimated general cargo volume shown in Table 5.2.8 and the estimated containerized ratio shown in Table 5.3.4, the total import and export containerized cargo volume through the Pacific coast ports in 1995 and 2005 is forecast as shown in Table 5.3.5.

As seen in the Table, the total import/export containerized cargo is estimated to increase from 647 thousand tons in 1988 to 1,904 thousand tons in 1981 which is an increase of approximately 2.8 times with a 16.1% average annual growth rate, and to 3,758 thousand tons in 2005 which is equal to around 6 times the volume in 1988 with a 7.4% average annual growth rate for the period from 1995 to 2005. The containerized cargo volume for export is around two times of that for import. This imbalance in handling volume between the exported and imported containerized cargo is considered to be within the allowable level, taking into account that the unit weight of exported containers is much heavier than that of imported containers in the Pacific coast ports.

It must be mentioned here that the export general cargo by SICARTSA is assumed not to be containerized because of its commodity characteristics. This assumption is also considered to be reasonable from the result of the interview with the personnel of SICARTSA. If some of the SICARTSA cargo could be containerized in the future, it would cause an increase in export containerized cargo. Even in that case, the volume of containerized cargo by SICARTSA is supposed to remain small.

One other factor which must be considered is the probable increase of cross border transportation of container cargo between the U.S.A. and Mexico, which is to be described in detail in the next Chapter. According to the investigation carried out by the study team, 43 thousand tons of imported and 22 thousand tons of exported containerized cargo from/to the Far East area and Japan passed through the ports on the west coast of the U.S.A. and were transported to/from Mexico by land in 1987. These containerized cargoes crossing the border are equal to 26% of the imported and 6% of the exported containerized cargo volume passing through the Pacific coast ports in 1987.

It should be noticed that this cross border transportation of containerized cargo by land is likely to increase, because an economical double stack train system is scheduled to be introduced in the railway transportation between the west coast ports of the U.S.A. and the main

cities in Mexico. Thus, this may significantly reduce the containerized cargo volume through the Pacific coast ports.

Table 5.3.5 Results of Forecast of Conatainerized Cargo Volume

(Unit; thousand tons, %)

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

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

5.4 Origin and Destination Analysis

5.4.1 Maritime Cargo Flow in Mexico

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

As mentioned below, some characteristics of the cargo flow in Mexico are observed through the investigation.

(1) Total Cargo Volume from the States of Mexico (foreign and domestic trade)

a. The cargo volume handled at the Gulf coast and the Pacific coast ports is shared at the ratio of around 6:4. This shows the active foreign trade with the U.S.A. through the Gulf coast ports.

b. Among the main ports of Mexico the Ports of Tampico, Veracruz and Manzanillo have large hinterlands that extend widely over the country. But the other ports are considered to have regionally limited hinterlands.

c. The states in northern and central Mexico mainly depend on the Gulf coast ports such as Tampico and Veracruz. In particular, the Distrito Federal depends on Veracruz for 85% of the total cargo volume.

d. The states of the Peninsula district such as Compeche and Yucatan mainly depend on the Gulf coast ports except for unloading domestic cargo which passes through Salina Cruz.

(2) Loading Cargo Originated from the States

a. About 73% of the total volume of exported cargo and domestic loading cargo is handled at the Gulf coast ports, and 27% is handled at the Pacific coast ports.

b. As for the exported cargo, 79% of it is through the Gulf coast ports, 40% of which is loaded at the ports in the state of Veracruz.

The Ports of Tampico, Veracruz and Manzanillo gather cargoes from many states of the country. As for the other ports, the origin

states for the export are limited to the states where the ports are located and the neighboring states.

c. As for the volume of the domestic loaded cargo, the origin states are generally limited to the states where the ports are located except for the port of Manzanillo.

(3) Unloading Cargo Destined to the States

a. The volume of imported and domestic unloaded cargo is shared 52% at the Pacific coast port, and 48% at the Gulf coast ports. At the ports of Manzanillo, Tampico and Veracruz a large volume of cargo is unloaded and transported to many states in the country. But the destinations of the other ports are limited to the states where the ports are located and their neighbouring states.

b. About 60% of the imported cargoes are handled at the Gulf coast ports, 49% of which are destined to the Distrito Federal.

Table 5.4.1 Major Ports on which Each State Depends Import and Export 1986 (tons)

State	Ensenada	Guaymas	Mazatlan	Manzanillo	L. Cardenas	Acapulco	S. Cruz	Tampico	Tuxpan	Veracruz	Coatza	Total
Aguascalientes			104	25,306	1,496	8	648	8,045		456		36,063
Baja California	949,262	16,422		206				811		13		966,714
Baja California Sur	179			29		8		30				246
Campeche					470		7,278	1,772		1,074	1,003	11,597
Chihuahua		2,917	2,678	3				30,074		38		35,710
Chiapas				28	1,875		5,420		724	23,823	17,632	49,502
Coahuila		18,953	5,196	20,816				276,893		676		322,534
Colima				54,239	4,362	45		334		439		59,419
Distrito Federal		34	55,178	76,863	130,075	35,641	25,430	148,995	62,474	1,665,922	7,702	2,208,314
Durango			21,922	12,431		3		43,995		23		78,374
Guerrero				116	3,758	40		10,717		751		15,382
Guanajuato			4,121	62,293	11,452	2		106,008	3,943	13,283		201,102
Hidalgo			300	982	3,695	2		150,190	13,253	3,463		171,885
Jalisco		4,935	169,389	790,356	18,969	11		154,958	492	11,597		1,150,707
Mexico				27,067	13,414	1,810	3,153	119,854	163,957	46,438	91,735	467,428
Michoacan			300	24,221	1,383,933	390		44,723		2,461	2,526	1,458,554
Morelos				515	4,099	2,379	25,615	3,316	12	4,209		40,145
Nuevo Leon		269	16,569	22,501	99	56		386,741		3,570		429,805
Nayarit			23,267	6,617				3,763	2,970	214		36,831
Oaxaca				1	125		18,377	1,184		9,236	17,482	46,405
Puebla			206	12,913	24,488	25	11,865	33,880	104,226	108,592	44,832	341,027
Quintana roo							150	8		183		341
Queretaro			33,679	8,294		22		17,745	7	10,539		70,286
Sinaloa		26,083	698,677	3,527	959			7,761		2,158		739,165
San Luis Potosi				21,519	15,790	33		2,154,571		1,250		2,193,165
Sonora		1,287,808	22,144	1,185	447	1		5,629		3,385		1,320,599
Tabasco				76			92,825	118	726	7,319	96,367	197,431
Tamaulipas		1	42	1,702			14	500,167	15,834	4,760	8	522,528
Tlaxcala				266		49	489	2,199		2,887		5,890
Veracruz			19	632	16,326	66	167,674	240,224	54,210	1,343,369	1,702,255	3,524,775
Yucatan				5	5,245	8	67,707	3	7,983	12,794	19,782	113,527
Zacatecas			1,884	1,999				134,991		97		138,971
T o t a l	949,441	1,357,422	1,055,675	1,176,708	1,641,077	40,599	426,645	4,589,699	430,811	3,285,019	2,001,324	16,954,420

Table 5.4.2 Domestic Loading Unloading for Each State by Port Year: 1986

(unit; tons)

State	Ensenada	Guaymas	Mazatlan	Manzanillo	L. Cardenas	Acapulco	S. Cruz	Tampico	Tuxpan	Veracruz	Coatza	Total
Aguascalientes	0	0	0	0	1,248	0	0	50	0	0	0	1,298
Baja California	887,661	16,360	0	0	0	0	0	0	0	0	0	904,021
Baja California Sur	179	0	0	0	0	0	0	0	0	0	0	179
Campeche	0	0	0	0	470	0	7,177	0	0	0	0	7,647
Chihuahua	0	0	178	0	0	0	0	1,026	0	0	0	1,204
Chiapas	0	0	0	0	1,875	0	327	0	0	0	2	2,204
Coahuila	0	0	366	0	0	0	0	1,593	0	0	0	1,959
Colima	0	0	0	45,859	0	0	0	0	0	0	0	45,859
Distrito Federal	0	0	54,962	2,693	29,993	0	0	617	0	2,700	0	90,965
Durango	0	0	6,422	0	0	0	0	359	0	0	0	6,781
Guerrero	0	0	0	0	80	0	0	0	0	0	0	80
Guanajuato	0	0	3,898	49,281	8,263	0	0	9,203	0	0	0	70,645
Hidalgo	0	0	0	0	3,695	0	0	168	0	0	0	3,863
Jalisco	0	2,000	97,517	159,186	9,583	0	0	9,905	0	0	0	278,191
Mexico	0	0	0	0	1,515	0	0	0	0	0	0	1,515
Michoacan	0	0	0	884	34,685	0	0	1,973	0	0	0	37,542
Morelos	0	0	0	0	1,130	0	0	0	0	0	0	1,130
Nuevo Leon	0	0	16,569	0	0	0	0	87,498	0	0	0	104,067
Nayarit	0	0	3,984	0	0	0	0	0	0	0	0	3,984
Oaxaca	0	0	0	0	0	0	2,142	0	0	0	12,373	14,515
Puebla	0	0	206	9,840	24,220	0	9,172	0	0	0	0	43,438
Queretaro	0	0	0	0	0	0	0	28	0	0	0	28
Sinaloa	0	12,094	331,877	0	0	0	0	2,410	0	0	0	346,381
San Luis Potosi	0	0	0	2,088	15,790	0	0	152,115	0	0	0	169,993
Sonora	0	617,013	0	0	0	0	0	0	0	0	0	617,013
Tabasco	0	0	0	0	0	0	92,646	0	0	0	864	93,510
Tamaulipas	0	0	42	0	0	0	0	82,085	0	0	0	82,127
Veracruz	0	0	19	0	16,315	0	13,856	20,887	39,549	92,313	287,874	470,813
Yucatan	0	0	0	0	5,245	0	66,541	0	0	0	0	71,786
Zacatecas	0	0	20	0	0	0	0	1,730	0	0	0	1,750
T o t a l	887,840	647,467	516,060	269,831	154,107	0	191,861	371,647	39,549	95,013	301,113	3,474,488

5.4.2 Hinterland of the Six Ports for General Cargo for Foreign Trade

The main hinterlands and origin/destination counties for import/export general cargo are briefly analyzed port by port.

The result of the analysis is also presented in figures by port. The notes for the figure are as follow:

i. Cargo volume expresses the total volume in 1985 and 1986.
ii. The hinterland states which cover around 95% of the handling cargo volume of the port are illustrated in the figure.
iii. The origin and destination counties in the figure, also cover around 95% of the handling cargo volume of each port.

(1) Port of Salina Cruz

a. As shown in Fig. 5.4.1 and Fig. 5.4.2, its hinterland is mainly the southern and central district of Mexico. One particular role of this port, especially in export, is as a connection point with the states on the Gulf side coast such as Veracruz.
b. Imported cargo is mainly transported to the central district such as the states of Morelas, the Distrito Federal, Puebla and to Oxaca where the port is located. A major share of the cargo at Morelas represents automobile parts to the factory of Nissan Mexicana S.A. de C.V. in Cuernavaca.
c. The destination and origin countries are mainly the Far East such as Japan, China, Taiwan and South Korea followed by the U.S.A.

(2) Port of Lazaro Cardenas

a. Its hinterland, as shown in Fig. 5.4.3 and Fig. 5.4.4 is mainly such states as Michoacan, the Distrito Federal, Morelos and Guerrero. But most of the imported and exported cargoes are transported to and from Michoacan and the Distrito Federal.
b. More than half of the imported general cargoes are transported to the Distrito Federal.
c. Around 80% of the exported general cargo from the state of Michoacan is mostly produced by SICARTSA which is located within the port area.

Other main origin states are the Distrito Federal, Colima, Chiuahua and Jalisco.

(3) Port of Manzanillo

a. As shown in Fig. 5.4.5 and Fig. 5.4.6, the port has a vast hinterland ranging from the state of Coahuila in the northern district, Veracruz on the Gulf coast and Guerrero on the Pacific coast.
   The hinterland for the exported general cargo is not so wide as compared with that of imported cargo.
b. The imported general cargoes are mostly destined to the Distrito Federal and the states of Jalisco, Mexico and Aguascalientes, among which Guadalajara, Mexico city and Aguascalientes have about a 45% share of the total general cargo.
c. The main origin states for the exported general cargo are Jalisco, San Luis Potosi, the Distrito Federal and Coahuila. The states of Colima and Michoacan which utilize the Port of Manzanillo, do not provide much general cargo.
d. A large volume of general cargo is imported and exported from and to Japan (78 and 24 thousand tons respectively in 1986). The sum of both countries accounts for about 60% of the total foreign trade.
e. A lot of general cargo is exported to Latin American countries such as Colombia, Costa Rica, Ecuador, Chile and Peru. The share of these countries is about 40% in 1986.

(4) Port of Mazatlan

a. Its hinterland is regionally limited to the states in the northwest of Mexico on the Pacific coast and a few inland states as shown in Fig. 5.4.7 and Fig. 5.4.8.
b. The imported general cargo is carried mainly to the state of Sinaloa followed by Sonora and Coahuila.
c. The exported general cargo is carried from the state of Nayarit, Sonora and Sinaloa.
d. The main destination countries from Mazatlan are Spain, Cuba and

Italy, and the main origin countries are Thailand, China, Rumania and France.

(5) Port of Guaymas

a. Its hinterland is regionally limited to Sonora, Baja California, Sinaloa and Chiuahua as shown in Fig. 5.4.9 and Fig. 5.4.10.
b. Most exported and imported general cargo is to or from Shinaloa, followed by Baja California for the imports and by Sonora and Chiuahua for the exports.
c. The destinations are mostly Mediterranean counties such as Spain, Egypt, Turkey, Israel, Algeria and Greece. On the other hand, the main import origin counties are Japan, Canada and South Korea.

(6) Port of Ensenada

a. Its hinterland is regionally limited only to state of Baja California as shown in Fig. 5.4.11 and Fig. 5.4.12.
b. The main import origin countries are South Korea, Canada, Japan and Honduras, and the export destination countries are Italy, Thailand, Puerto Rico and Japan.

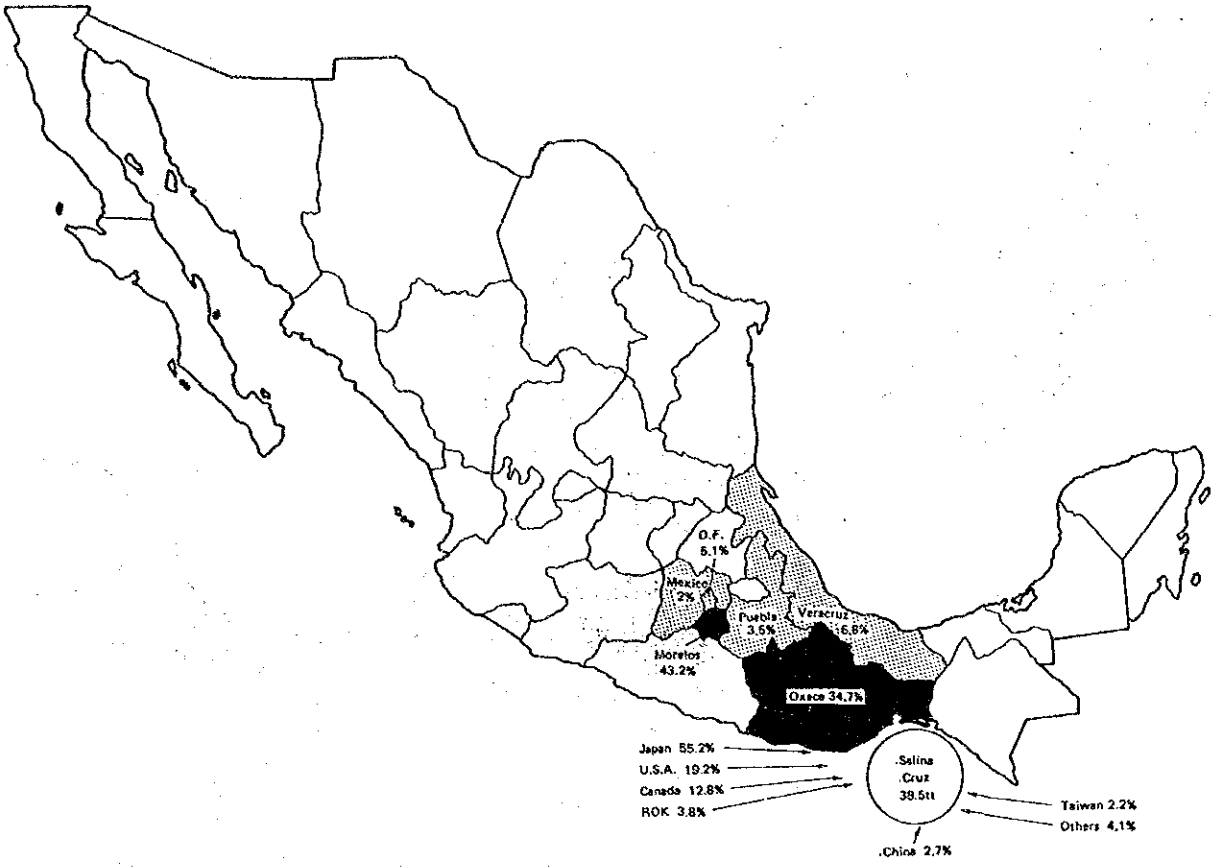


Fig. 5.4.1 Hinterland of Salina Cruz for Imported General Cargo

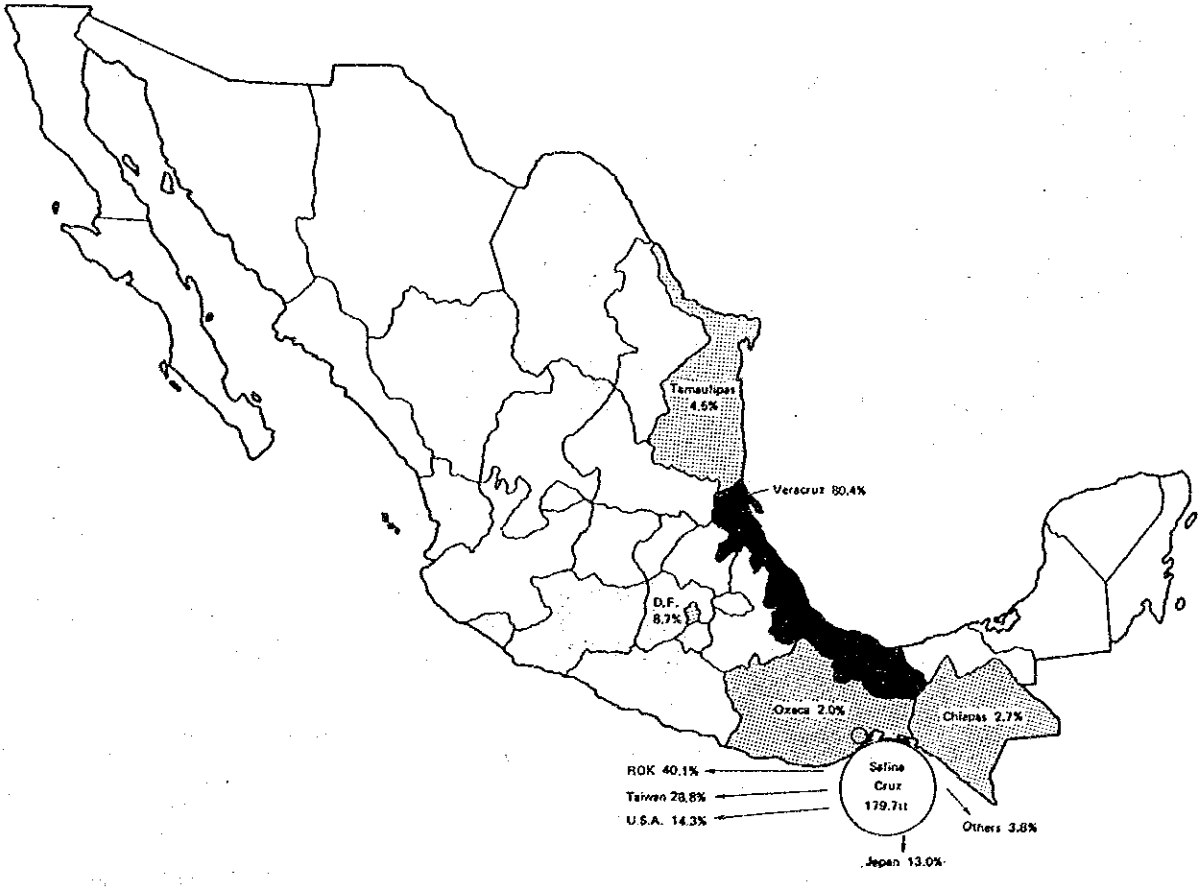


Fig. 5.4.2 Hinterland of Salina Cruz for Exported General Cargo

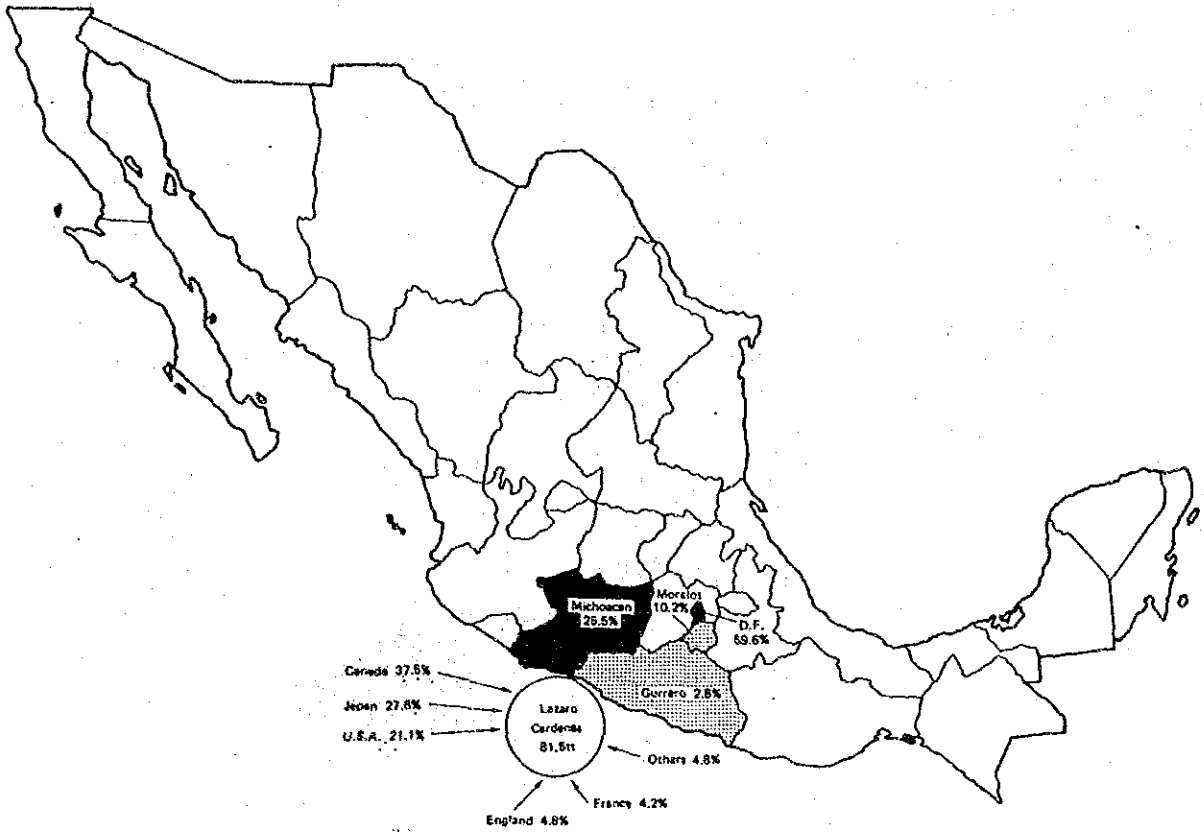


Fig. 5.4.3 Hinterland of Lazaro Cardenas for Imported General Cargo

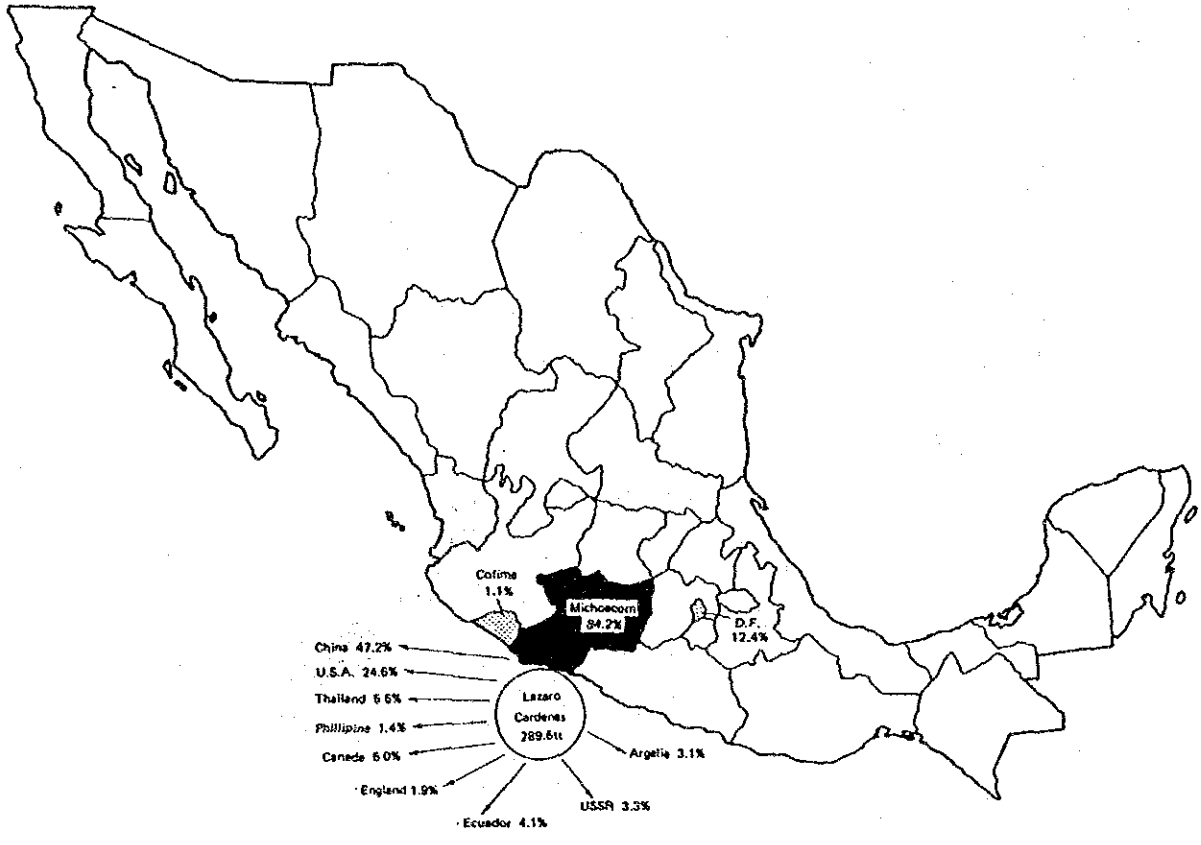


Fig. 5.4.4 Hinterland of Lazaro Cardenas for Exported General Cargo

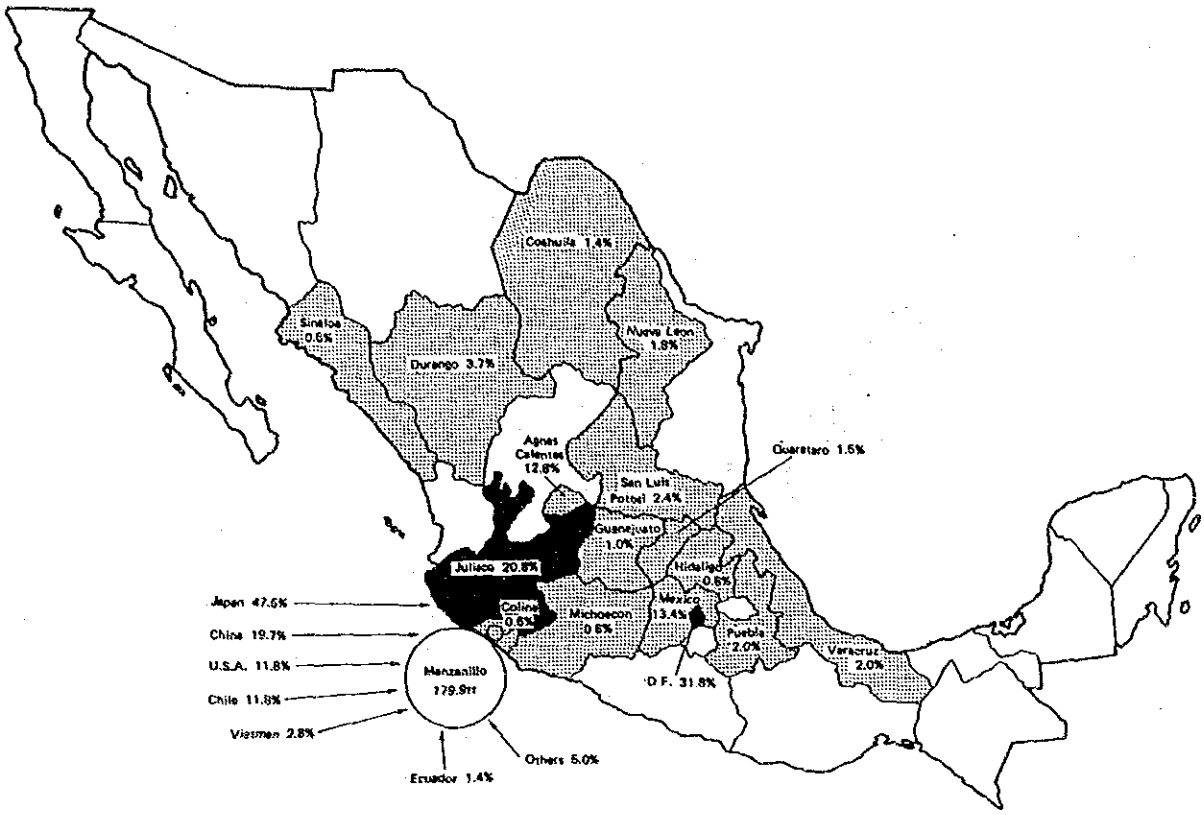


Fig. 5.4.5 Hinterland of Manzanillo for Imported General Cargo

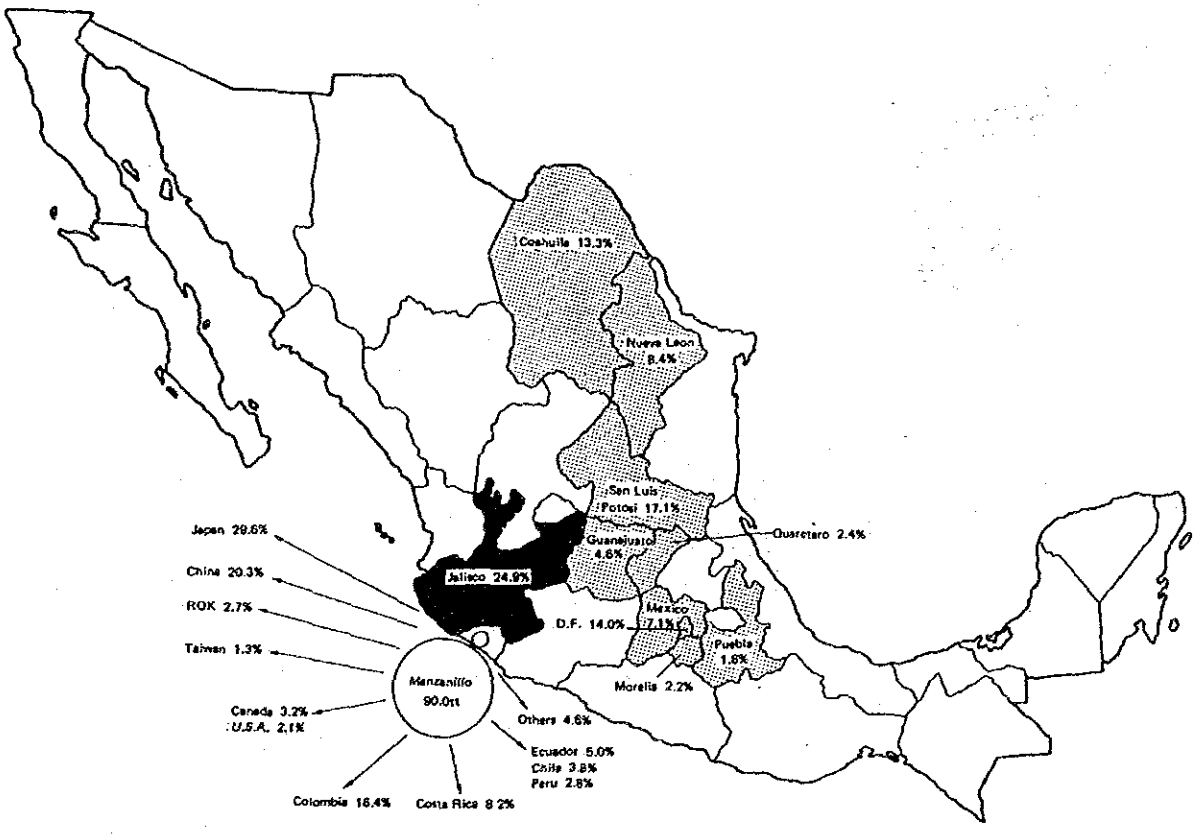


Fig. 5.4.6 Hinterland of Manzanillo for Exported General Cargo

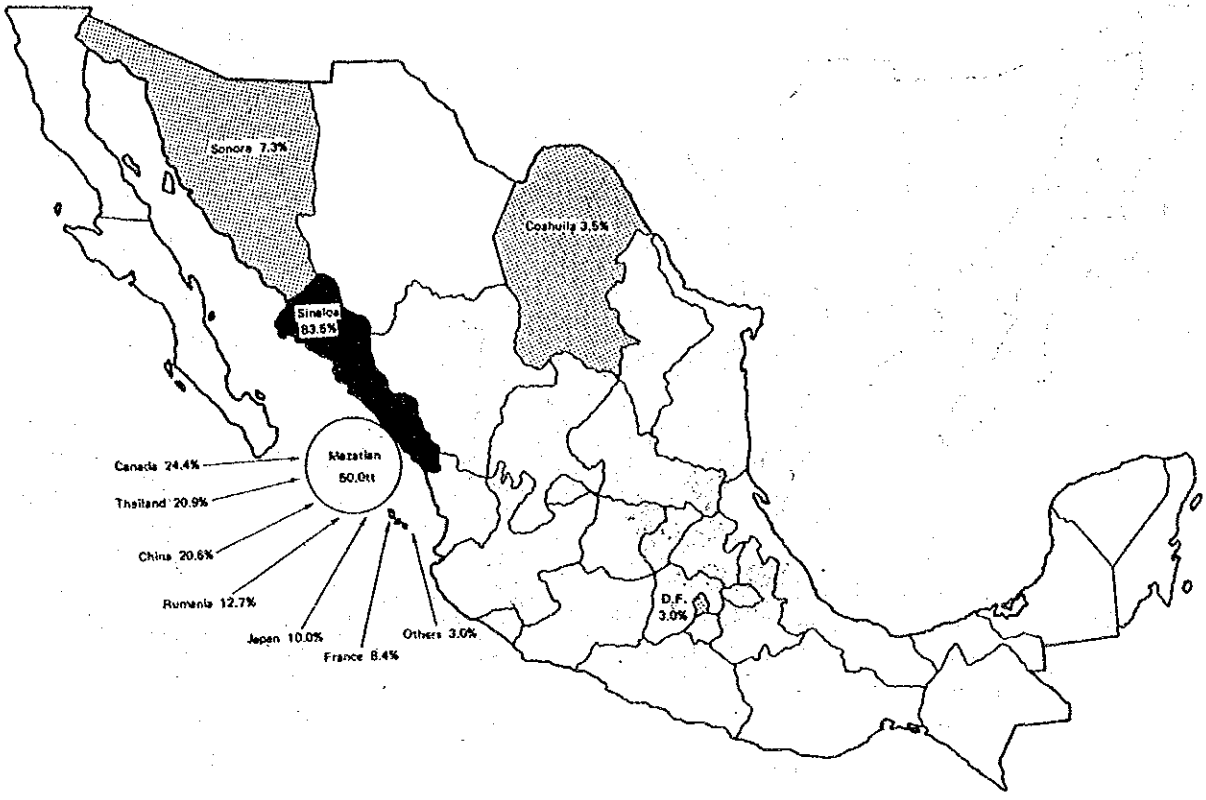


Fig. 5.4.7 Hinterland of Mazatlan for Imported General Cargo

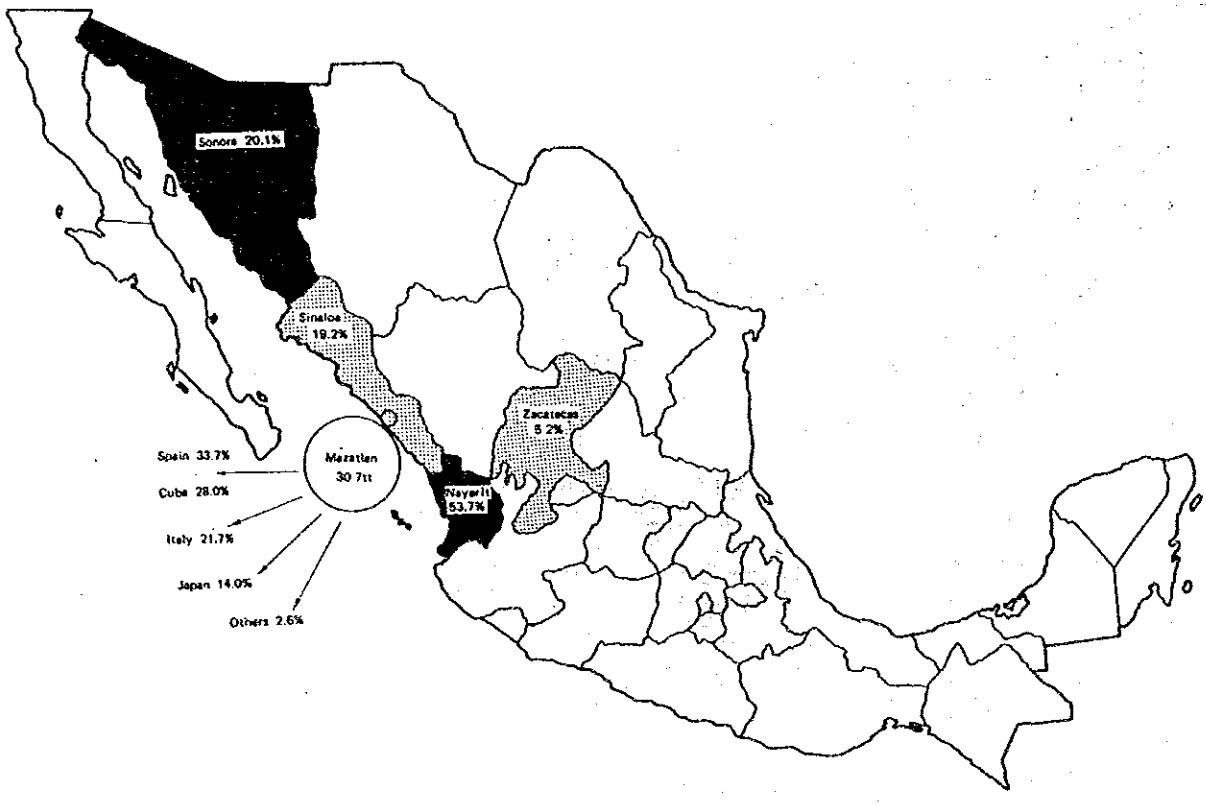


Fig. 5.4.8 Hinterland of Mazatlan for Exported General Cargo

Fig. 5.4.9 Hinterland of Guaymas for Imported General Cargo

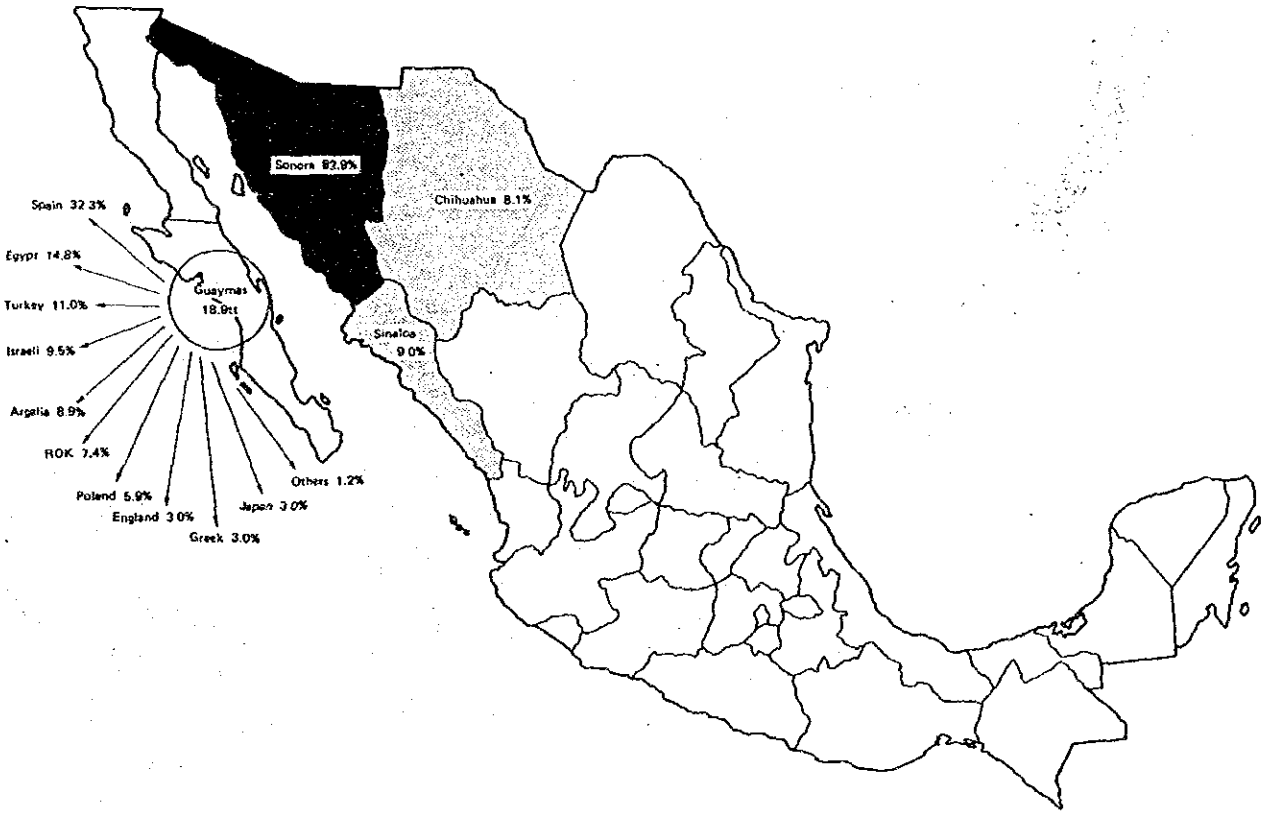


Fig. 5.4.10 Hinterland of Guaymas for Exported General Cargo

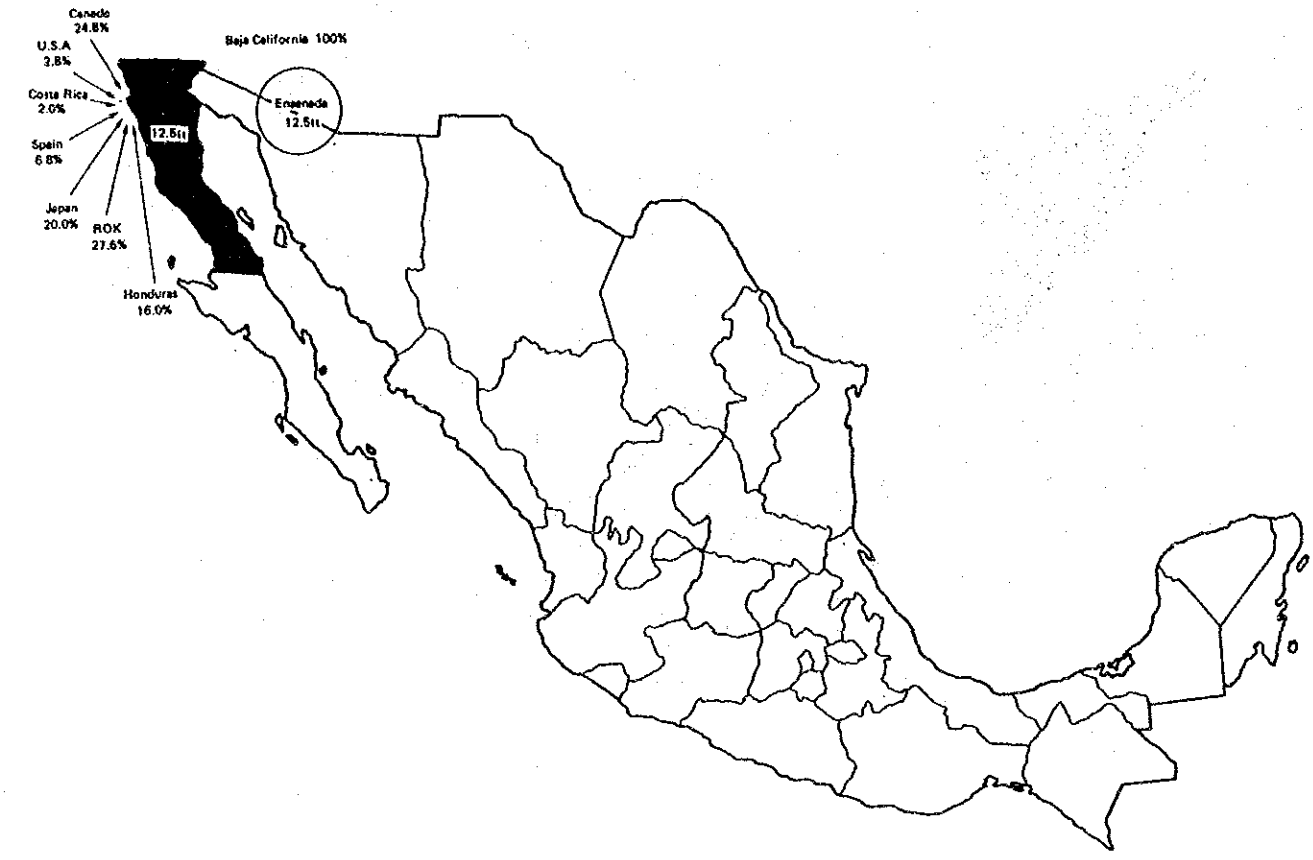


Fig. 5.4.11 Hinterland of Ensenada for Imported General Cargo

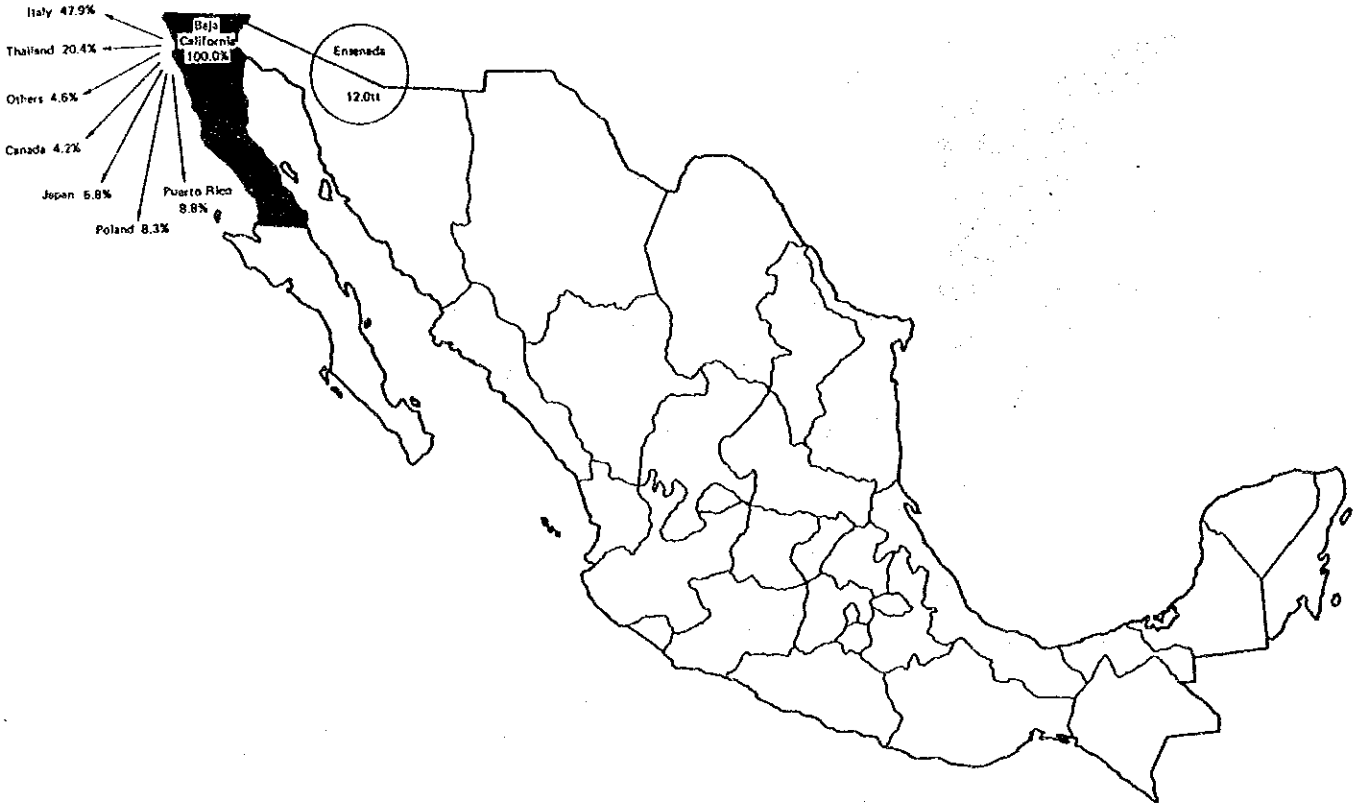


Fig. 5.4.12 Hinterland of Ensenada for Exported General Cargo

5.4.3 Hinterland for Imported Agricultural Bulk of the Six Ports

a. As shown in Fig. 5.4.13 - Fig. 5.4.17, agricultural bulk handled at the six ports is imported from Argentina, Canada, the U.S.A., Australia and China.

b. A large volume of this cargo is handled at Guaymas, Mazatlan and Manzanillo, which account for 200 - 250 thousand tons in 1986. Ensenada and Lazaro Cardenas handle a little of the cargo. Among the six port, Salina Cruz imports little agricultural bulk cargo.

c. Manzanillo has a particularly wide hinterland for this kind of bulk cargo, while the other ports do not have so large a hinterland, and are relatively limited to the states where the ports are located and the neighbouring states.

d. Although Manzanillo has such a large hinterland as mentioned above, part of it overlaps with Mazatolan, Lazaro Cardenas and Guaymans as shown in Table 5.4.3.

e. More than 98% of the imported agricultural bulk cargo to the Distrito Federal passes through the Port of Veracruz. Therefore the role of the Pacific coast ports for the Distrito Federal in the transportation of imported agricultural bulk is negligiblly small. On the other hand, around 55% of the same cargo to Guadalajara passes through the Pacific ports, mainly Manzanillo.
Accordingly, it should be noted that the largest hinterland of the Pacific coast ports is Guadalajara as far as the imported agricultural bulk cargo is concerned.

Fig. 5.4.13 Hinterland for Import Agricultural Bulk (Ensenada)

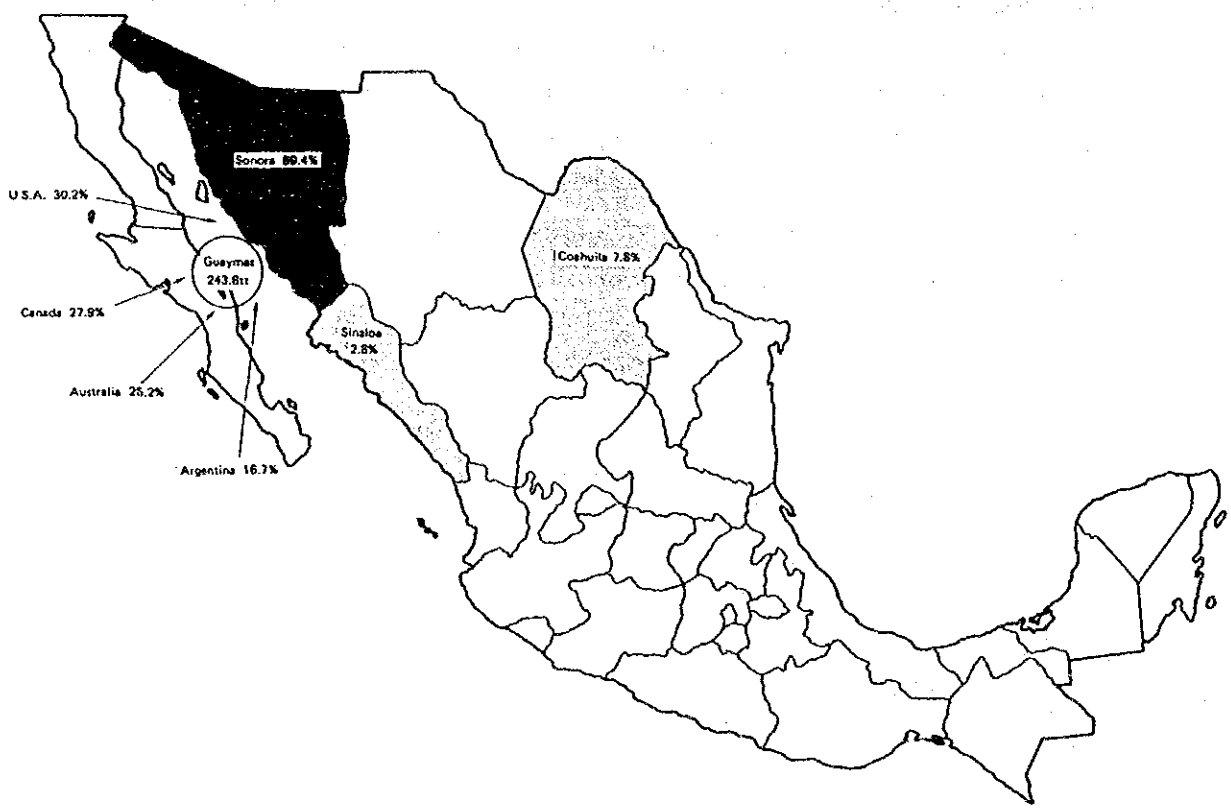


Fig. 5.4.14 Hinterland for Import Agricultural Bulk (Guaymas)

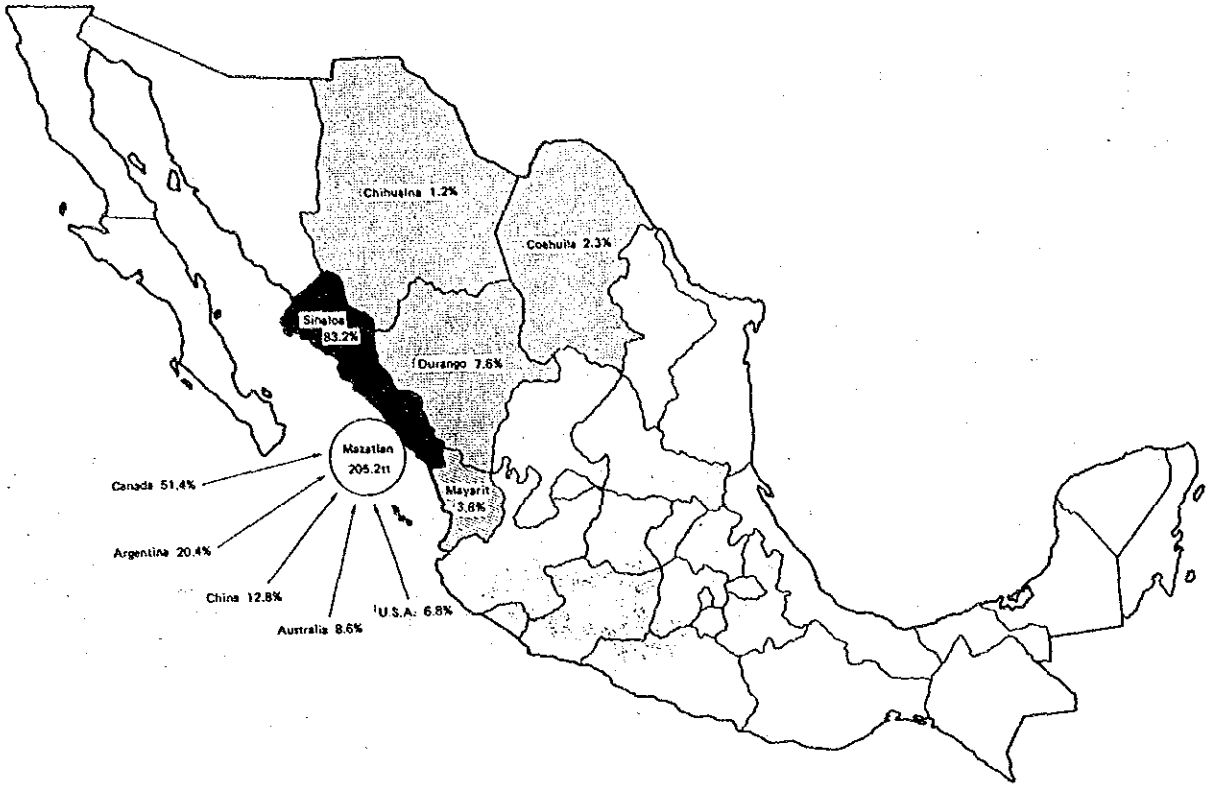


Fig. 5.4.15 Hinterland for Import Agricultural Bulk (Mazatlan)

Fig. 5.4.16 Hinterland for Import Agricultural Bulk (Manzanillo)

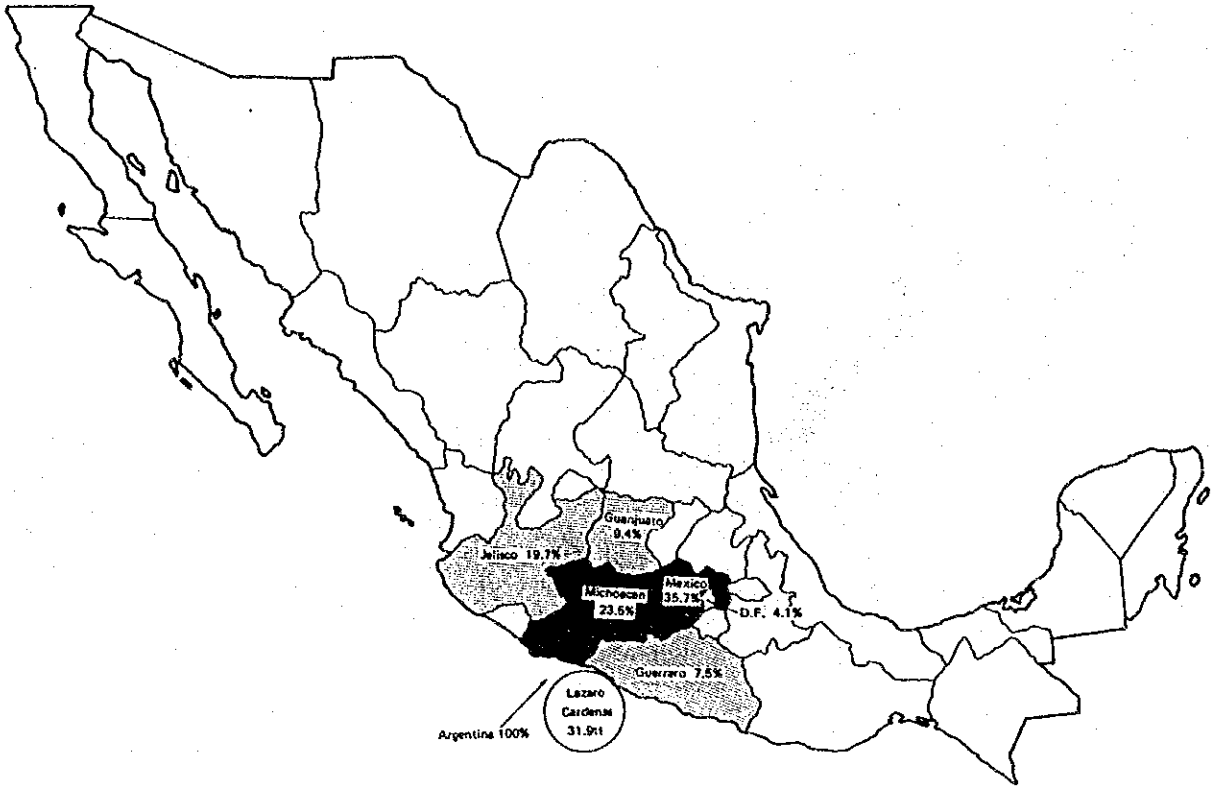


Fig. 5.4.17 Hinterland for Import Agricultural Bulk (Lazaro Cardenas)

Table 5.4.3 Overlapping Hinterlands of Import Agricultural Bulk among the Ports

(unit; thousand tons, %)

States / Ports	Jalisco	Durango	Michoacan	Distrito Federal	Mexico	Coahuila	Nayarit	Guanajuato	Total
Manzanillo	152.1 (93.7)	11.6 (42.8)	18.3 (70.9)	11.3 (89.7)	8.5 (42.7)	7.7 (24.4)	6.5 (45.8)	3.7 (55.2)	219.7 (73.2)
Lazaro Cardenas	6.3 (3.9)	- (-)	7.5 (29.1)	1.3 (10.3)	11.4 (57.3)	-	-	3.0 (44.8)	29.5 (9.8)
Mazatlan	3.9 (2.4)	15.5 (57.2)	-	-	-	4.8 (15.2)	7.7 (54.2)	-	31.9 (10.6)
Guaymas	- (-)	- (-)	-	-	-	19.0 (60.3)	-	-	19.0 (6.4)
Total	162.3 (100)	27.1 (100)	25.8 (100)	12.6 (100)	19.9 (100)	31.5 (100)	14.2 (100)	6.7 (100)	300.1 (100)

Source: Processed and arranged from the data of Direccion de Puerto y Marina Mercant de SCT.

5.5 Forecast of General and Containerized Cargo Volume of Each Port

5.5.1 Forecast Methodology

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

The methodology for the rough estimation of the cargo volume of each port is summarized as follows:

1) Referring to the results of the forecast of total general cargo volume

When the general cargo volume of each port is examined for the estimation, the results of the forecast of total general cargo volume are referred to. The general tendency of the cargo movement of the objective ports in the future should follow the results of the total cargo forecast as a whole, although the future cargo movement differs greatly port by port.

2) Examination of the related information

All the information regarding the cargo volume forecast of each port is considered, such as the existing liner routes, the future cargo movement, the inland transportation and related infrastructure and other port conditions. The information was gathered through the site surveys of each port and the interviews and discussions with the governmental offices concerned, the shipping agents, the freight forwarders, the main shippers and consignees and the inland transportation enterprises at each port.

The results of the origin and destination survey which are described in the previous section of this chapter are also referred to for the examination of the hinterland of each port.

3) Selection and examination of specific cargo commodities

Among the commodities of each port, there are some specific commodities which should be separated from other commodities and examined individually for the forecast.

These commodities are classified as follows:

a. Specific commodities with a large quantity

This kind of commodity is a cargo such as exported terephtal acid at the Port of Salina Cruz which already has a large quantity at present and will not show, in general, a remarkable increase in the future.

b. Specific commodities not expected in the future

This kind of commodities are such commodities as imported sugar and rice which were handled in large volumes at some ports in the past. These cargoes are not expected to be handled to a meaningful extent at the ports in the future and should be excluded from the forecast.

c. Specific commodities considered to have a growth limit

Such commodities as fishery products and some agricultural products belong to this group which is supposed to have a certain growth limit as exported cargoes because of the domestic production limit and the increasing domestic consumption.

d. Specific commodities handled irregularly

Such commodities as some construction materials and some agricultural products belong to this group which is fairly large in volume but is rarely handled at the ports.

The handling volume of these kinds of cargoes is estimated by assuming an appropriate growth rate or setting an adequate value in the target years.

4) Other cargo commodities

Other cargo commodities at each port are considered to form a group and are forecast all together. The volume of these commodities is relatively stable and shows a certain trend in general. Therefore the forecast of the handling volume of these cargoes at each port is executed based on an analysis of their historical trend.

5) Projected new cargo commodities

The projected cargo from Nissan Mexicana S.A. de C.V. is a typical example of this group. Nissan Mexicana has a definite project to construct and operate a new factory at Aguascalientes. The expected volume of import auto parts is added to the handling cargo volume at the Port of Manzanillo.

6) Cargo handling allocation among the ports

As mentioned in the previous section of this chapter, the hinterlands of the Ports of Mazatlan, Guaymas and Ensenada are relatively restricted to the states where the ports are located and their neighboring states. This situation is not expected to change in the future.

On the other hand, the hinterlands of the three other ports spread over wide areas, some of which, the metropolitan area in particular, are common to two or three of these ports. Some of the maritime cargo flow in these hinterlands is predicted to shift from one port to another.

Among the three ports, Lazaro Cardenas is located closest to the metropolitan area. Therefore some portion of the cargoes from and to the hinterlands now common to these ports, is considered to shift gradually from Salina Cruz and Manzanillo to Lazaro Cardenas. But it will not be likely for all these cargoes to shift to Lazaro Cardenas, because it is difficult and takes a long time to change the cargo flow due to the established trade routes and commercial patterns. In addition, for a drastic shift of cargo to Lazaro Cardenas, it would be necessary to improve the road and railway network connecting Lazaro Cardenas with the metropolitan area, which is not presently planned by the government.

Taking into consideration this situation and the long time span until 2005, it is assumed in this report that one third of the cargo volume at Salina Cruz and Manzanillo from/to the above mentioned competitive hinterlands shall shift to Lazaro Cardenas in 1995 and half of the cargo shall shift in 2005.

It should be pointed out that the shifting cargo volume would vary greatly depending on the improvement the land transportation system between Lazaro Cardenas and the metropolitan area.

7) Share of the cargo volume handled at Acapulco and other ports

The share of the general cargo volume handled at Acapulco and other Pacific coast ports to the total general cargo volume of the Pacific coast ports is plotted in Fig. 5.5.1.

Referring to the historical trend and considering that the share will increase slightly with the development of these ports, the study team estimates the percentage of the share of import general cargo volume of these ports to the Pacific total in 1905 and 2005 as 8% and 9% and, as for export cargo share, 5% and 6.5% respectively.

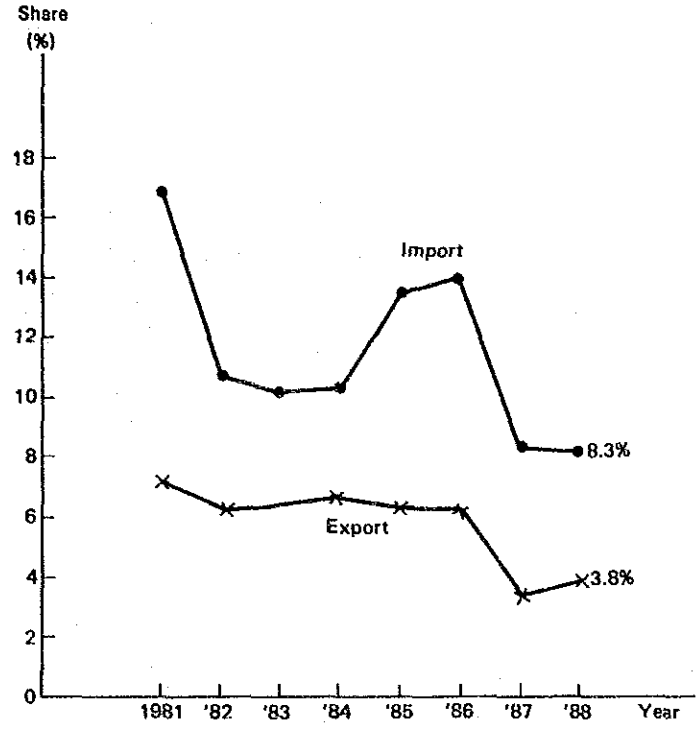


Fig. 5.5.1 Historical Trend of the Share of the General Cargo Volume of Acapulco and Other Pacific Coast Ports

8) Modifying by the estimated volume of total general cargo

The total volume of general cargo through the Pacific coast ports estimated and described in section 5.2 is regarded as the adopted value of total cargo volume. Accordingly the estimated volume of each port is modified so that the summed up value of the estimated cargo volume of each port may be equal to the adopted total volume of cargo.

It should be mentioned here that the forecast of the cargo volume of each port which is used in sections 5.2 and 5.3, refers to the estimated cargo volume of each port before this modification is carried out.

9) Containerized cargo of each port

The progress of containerization at each port is supposed generally to follow the estimated containerized ratio as investigated in section 5.2. In addition to this, other factors such as the commodity characteristics and the future container network system examined in Chapter 6 are considered to determine the containerized ratio of each port in the target years 1995 and 2005. Multiplying the estimated general cargo volume by

this containerized ratio, the volume of containerized cargo through each port is obtained.

5.5.2 Result of the forecast

Tables 5.5.1 and 5.5.2 show the results of the forecast of the general and containerized cargo volumes through each port in 1995 and 2005.

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

(1) Port of Salina Cruz

1) Import cargo

The import general cargo volume is estimated to grow from 58 thousand tons in 1988 to 86 thousand tons in 1995 and 152 thousand tons in 2005.

Characteristic points of the forecast and cargo movement are as follows:

i. The auto parts to Nissan Mexicana in Cuernavaca which made the import cargo volume grow in the recent years have shifted to Lazaro Cardenas and are not expected to be handled at this port in the future.

ii. Other cargoes excluding auto parts, mainly chemical products and machinery, have been showing a trend of considerably rapid increase from 1982 to 1988. So the volume of these cargoes are estimated to grow, although the growth rate will decline compared with the present.

iii. The share of cargo volume (excluding auto parts) going to the hinterland common with Lazaro Cardenas is around 20%. Some portion of these cargoes are supposed to shift to Lazaro Cardenas as mentioned before.

iv. The containerized ratio is already at a high level at present and will continue to increase.

v. Container movement to Guatemala by land and to foreign countries through Salina Cruz/Coatzacoalcos might increase in the future.

Table 5.5.1 Estimate of General Cargo and Containerized Cargo Import

(unit; 1,000 tons, %)

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

Note: ( ); Share to the Pacific Coast Total

Table 5.5.2 Estimate of General Cargo and Containerized Cargo Export

(unit; 1,000 tons, %)

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

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

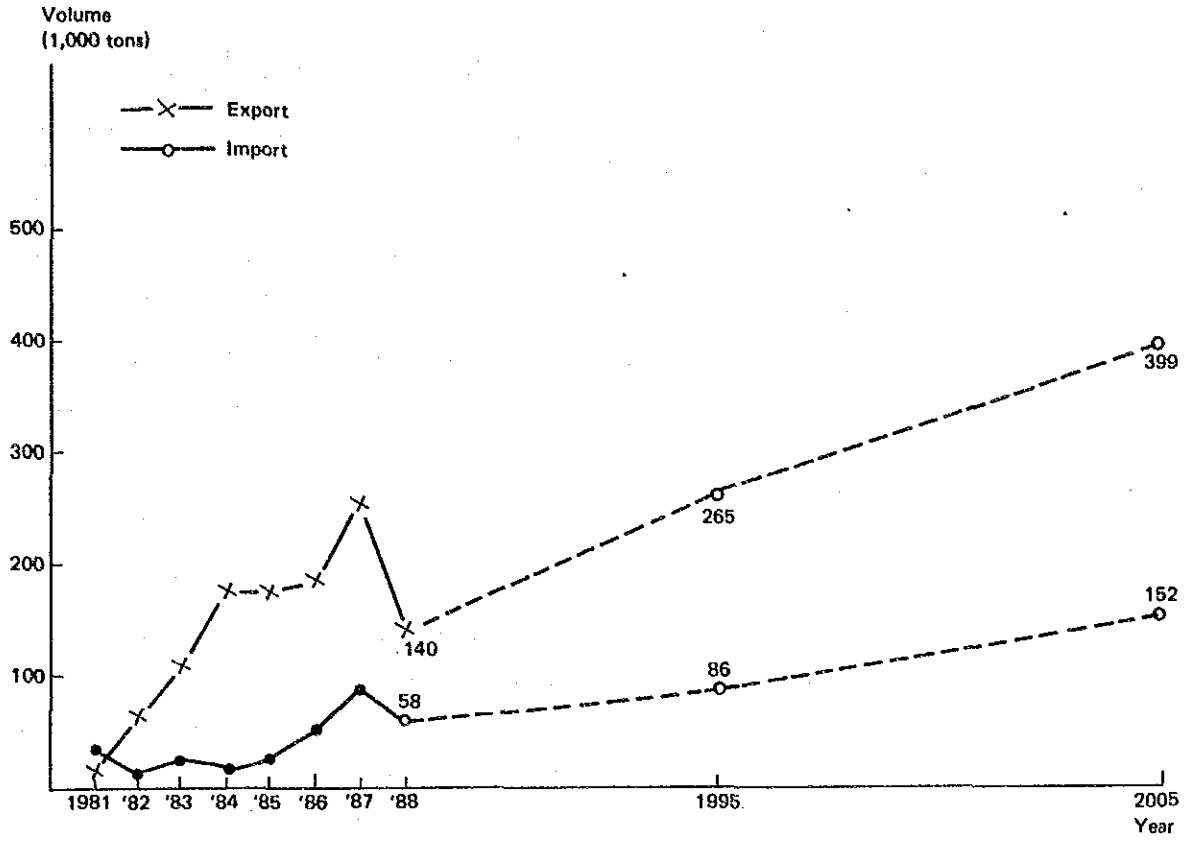


Fig. 5.5.2 Historical Trend and Forecast of General Cargo (Port of Salina Cruz)

2) Export cargo

The export general cargo volume is estimated to grow from 140 thousand tons in 1988 to 265 thousand tons in 1995 and 399 thousand tons in 2005. The growth rate will be a bit less than the average value among the Pacific coast ports.

The characteristic points of the forecast are as follows:

i. The volume of terephthal acid, which is the main export cargo at this port, has remained nearly constant for some years and is not expected to increase at a high growth rate hereafter.

ii. Other cargo, mainly chemical products, had showed a high speed of increase until 1987, followed by a sudden and large reduction in 1988. These cargoes may be expected to recover gradually.

iii. The cargo volume from the competitive hinterland with Lazaro Cardenas is only 9%. Therefore the effect of the cargo shift to

Lazaro Cardenas will be small.

iv. The containerized ratio at this port is at the highest level among the six ports at present. This position is expected to continue considering that almost all cargoes handled at the port are containerizable. The great imbalance between import and export containerized cargo volume, which is observed at present, is forecast to continue hereafter.

v. So called land bridge transportation of containers might increase in the long run, as well as the transport of imported containers.

(2) Port of Lazaro Cardenas

1) Import cargo

The import general cargo volume is estimated to increase from 160 thousand tons to 325 thousand tons in 1995 and 560 thousand tons in 2005, showing a high growth rate. The share of the handling volume of import general cargo to the Pacific total is expected to grow from 33.4% in 1995, the highest of the six ports, to 35.3% in 1995 and 36.1% in 2005.

The characteristic points of the forecast are as follows:

i. The automobile parts shifted from Salina Cruz to this port are the main reason for the recent increase of import cargo. But the volume of automobile parts will stop increasing after the shift to this port is finished, and remain constant until Nissan Mexicana prepares a new program to expand its production capacity, which might be expected in the long term.

ii. Import cargo other than automobile parts and sugar, mainly machinery, chemical products and forestry products, have been showing a gradual increase in volume. But it must be noted that the growth rate is not very high.

iii. The largest hinterland of Lazaro Cardenas is the Federal District having around a 60% share of the total import cargo volume. As mentioned before, some of the cargoes handled at Salina Cruz and Manzanillo heading for the Federal District and the neighboring states are supposed to shift to Lazaro Cardenas in the future. The shifted cargoes, especially from Manzanillo, are estimated to form a great portion of the increase of cargo volume. But it should be

mentioned again that this shift of cargo depends greatly on the improvement of the inland transportation network. In case this inland transportation network is not improved to a sufficient level, only a small volume of cargo may actually shift to this port.

iv. The ratio of containerizable cargo is considered rather low, because this port handles machinery and empty containers. But containerized ratio at this port is estimated to grow rapidly because of its important position in the container network system along the Pacific coast, as is mentioned in the next chapter.

2) Export cargo

The export general cargo volume excluding SICARTSA is estimated to increase from 117 thousand tons in 1988 to 380 thousand tons in 1995 and 815 thousand tons in 2005. The growth rate of this port is estimated to be the greatest among the six ports, leading Lazaro Cardenas to become a main gate for export in the future along with Manzanillo.

The characteristic points of the forecast are as follows:

i. The export of sugar in 1988 is an abnormal phenomenon as mentioned in 5.2.1.

ii. Other cargoes, mainly food and beverages and chemical products, and excluding sugar and construction material, which showed extreme variations in 1982 and 1983, have been increasing steadily from 1981. The volume of these cargoes is expected to increase hereafter at a considerably high growth rate.

iii. Presently, the hinterland of Lazaro Cardenas for export general cargo is not wide enough compared with Manzanillo. In the future, however, the cargo shift from Salina Cruz and Manzanillo is supposed, resulting in the widening of its hinterland, to the Metropolitan area and neighboring states in particular. The volume of export general cargo expected to shift from Manzanillo is considered to be larger than that of import general cargo due to the higher growth rate of export general cargo.

iv. The export of vehicles from the factory of Nissan Mexico in Cuernavaca is scheduled to shift from Acapulco to Lazaro Cardenas.

v. The containerization of this port is expected to progress steadily for the same reason as the import cargo.

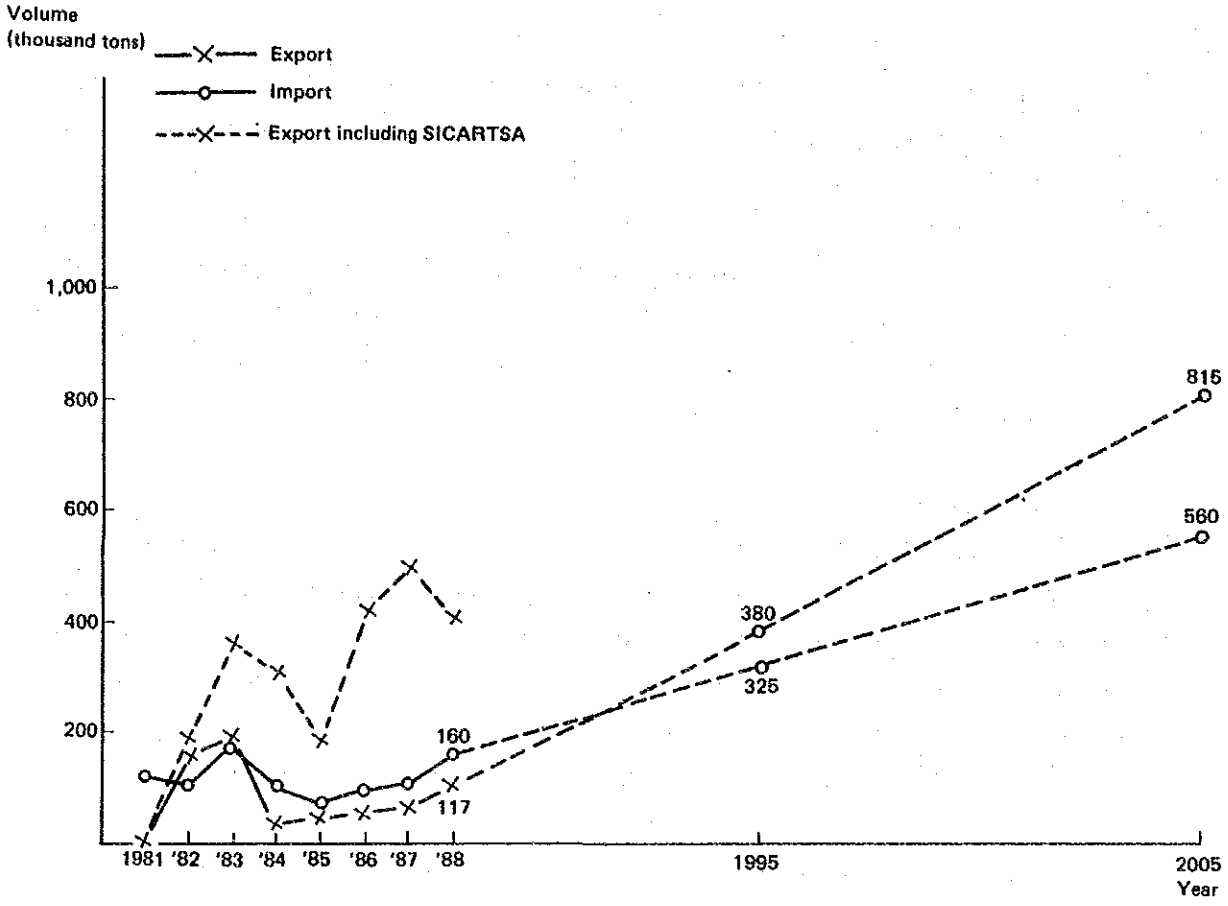


Fig. 5.5.3 Historical Trend and Forecast of General Cargo
(Port of Lazaro Cardenas)

(3) Port of Manzanillo

1) Import cargo

The import general cargo volume of this port is estimated to grow from 121 thousand tons in 1988 to 276 thousand tons in 1995 and 438 thousand tons in 2005. Even taking into consideration the fairly large volume of shifted cargoes to Lazaro Cardenas, the import general cargo volume is expected to increase at a high growth rate. As a result, this port will continue to function as a center for import cargo together with Lazaro Cardenas.

The characteristic points of the forecast are as follows:

i. The handling of sugar and rice, which had occupied a large share of the cargo volume at this port until 1985, was ceased in 1986. Sugar and rice are not expected to pass through this port in the future.

ii. Other cargoes, mainly steel plate, chemical products and machinery, have been showing a gradual increase in volume. Commodities of import general cargos handled at this port range over a variety of fields due to its wide hinterland.

iii. About 50% of the import cargo volume at this port is to be hinterland common to Lazaro Cardenas. The cargo volume projected to shift to Lazaro Cardenas amounts to around 40 thousand tons in 1995 and 100 thousand tons in 2005.

iv. According to the result of the interview with Nissan Mexicana, the new car manufacturing factory in Aguascalientes is scheduled to launch operations around 1992. The auto parts for this factory will be handled at the Port of Manzanillo.

v. The commodities other than some machinery are considered to be containerizable. The containerized ratio of this port is estimated to show a steady growth, judging from its position in the container network along the Pacific coast.

2) Export cargo

The export general cargo volume is estimated to increase from 261 thousand tons in 1988 to 601 thousand tons in 1995 and 1,077 thousand tons in 2005. Even excluding the large volume of cargo supposed to shift to Lazaro Cardenas, the cargo handling volume of this port is expected to grow at a fairly high ratio of increase, so Manzanillo will remain as a leading port for the exports among the Pacific coast ports.

The characteristic points for the forecast are as follows:

i. The handling volume of lead ingot showed a remarkable increase from 3 thousand tons in 1987 to 41 thousand tons in 1988. This cargo will most likely show a relatively moderate growth from now on.

ii. The handling of sugar in 1988 is to be considered as abnormal as mentioned before.

iii. The cargoes other than lead ingot and sugar, mainly chemical product, mineral products and food and beverages, have been showing

a steady and stable increase since 1982.

From this historical trend, these cargoes are expected to grow hereafter at a considerably high ratio of increase.

iv. About 34% of the cargo volume of this port comes from hinterlands that are competitive with Lazaro cardenas. The supposed cargo volume shift from Manzanillo to Lazaro Cardenas amounts to around 80 thousand tons in 1995 and 220 thousand tons in 2005.

It should be pointed out that Manzanillo has a wider hinterland for export cargo than Lazaro Cardenas. One reason for this is that Manzanillo presently plays a role as the last port in TMM's liner service route along the Pacific coast of Mexico.

v. Almost all of the export cargoes are containerizable and the containerization will continue to progress.

There exists presently a great imbalance between import and export containerized cargo volume. This imbalance is forecast to improve as the import containers will increase at a higher growth rate, but the imbalance in the future will still be fairly large. For this reason, the containerized ratio for the exported cargo is estimated a little bit smaller than that of Lazaro Cardenas.

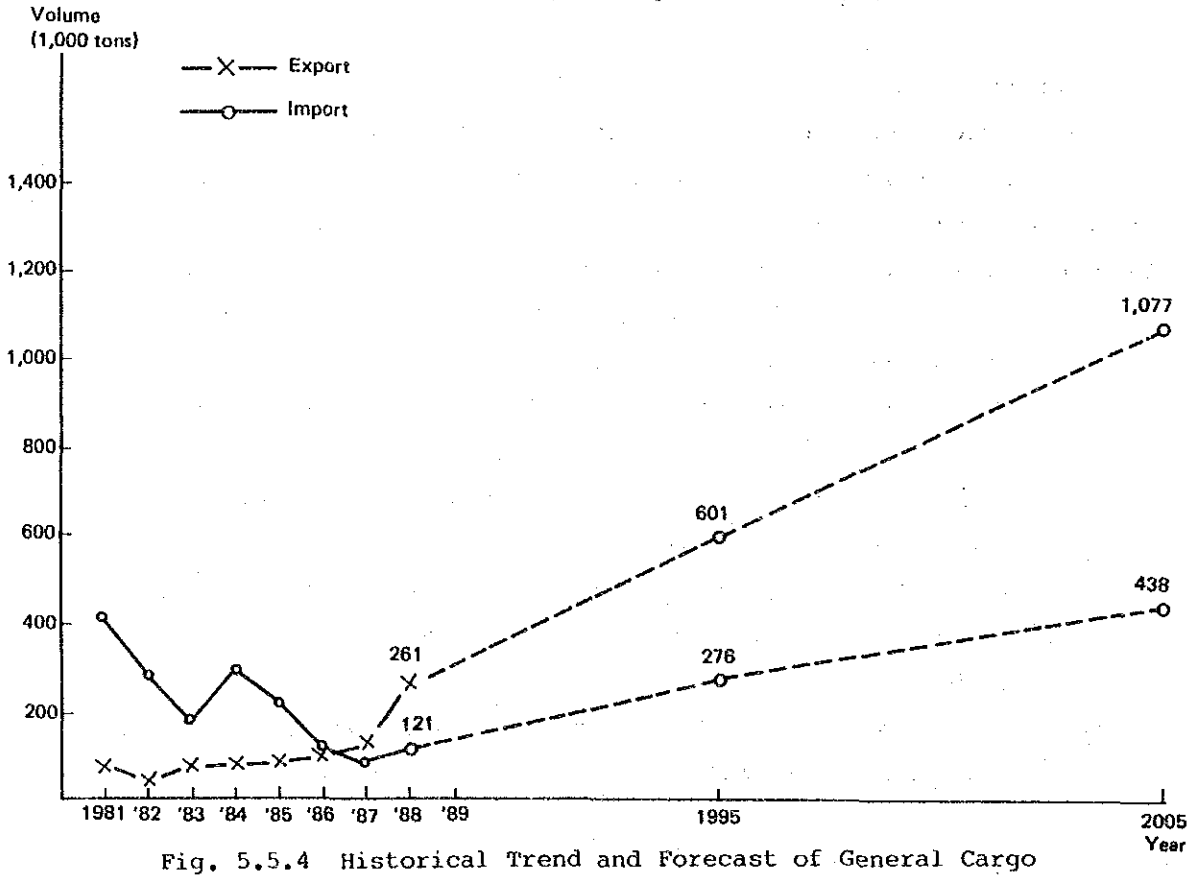


Fig. 5.5.4 Historical Trend and Forecast of General Cargo (Port of Manzanillo)

(4) Port of Mazatlan

1) Import cargo

The import general cargo volume at this port is estimated to grow from 2 thousand tons in 1988 to 30 thousand tons in 1995 and 57 thousand tons in 2005. Because of the low growth rate of cargo handling volume, the handling share of this port will continue to decline.

Characteristic points of the forecast are as follows:

i. The handling of sugar and rice, which had been the main imported cargoes of this port until 1985, has not taken place since 1986.

ii. The volumes of cargoes other than sugar and rice remain at a very low level and might be said to have fallen down to almost zero in the last two years.

iii. Such cargo commodities as sesame and urea are occasionally handled in a significant volume in the recent years. This kind of cargo handling may be expected hereafter.

iv. At present, d'AMICO Line is the only liner service provided at Mazatlan. In the long run, as the total cargo volume passing through the Pacific coast ports grows, a new liner service may be provided at this port which might result in the recovery of the cargo handling volume at this port.

v. Considering that almost all the cargoes handled at present as well as in the past are containerizable, the containerized ratio will grow in the long run.

2) Export cargo

The export general cargo volume is estimated to grow from 113 thousand tons in 1988 to 156 thousand tons in 1995 and 221 thousand tons in 2005. The share of cargo handling volume among the six ports is estimated to decline gradually.

The characteristic points of the forecast area as follows:

i. The handling of sugar in 1988 is considered to be an abnormal phenomenon.

ii. The main commodities for export through this port are garbanzo bean and tuna fish, which have increased greatly in the last few years.

These cargoes are, as mentioned before, supposed to have a certain growth limit as an export cargo because of the domestic production limit and the increasing domestic consumption. Therefore, the growth ratios for these cargo should remain comparatively low.

iii. There are no other meaningful commodities in terms of handling volume for export cargo at this port.

iv. New cargo handling might be expected in the long term.

v. The containerized ratio will be relatively small in the middle term. A great imbalance between import and export containerized cargo volume will continue to exist in the future. This is estimated to result in an obstacle to increase the containerized ratio at this port.

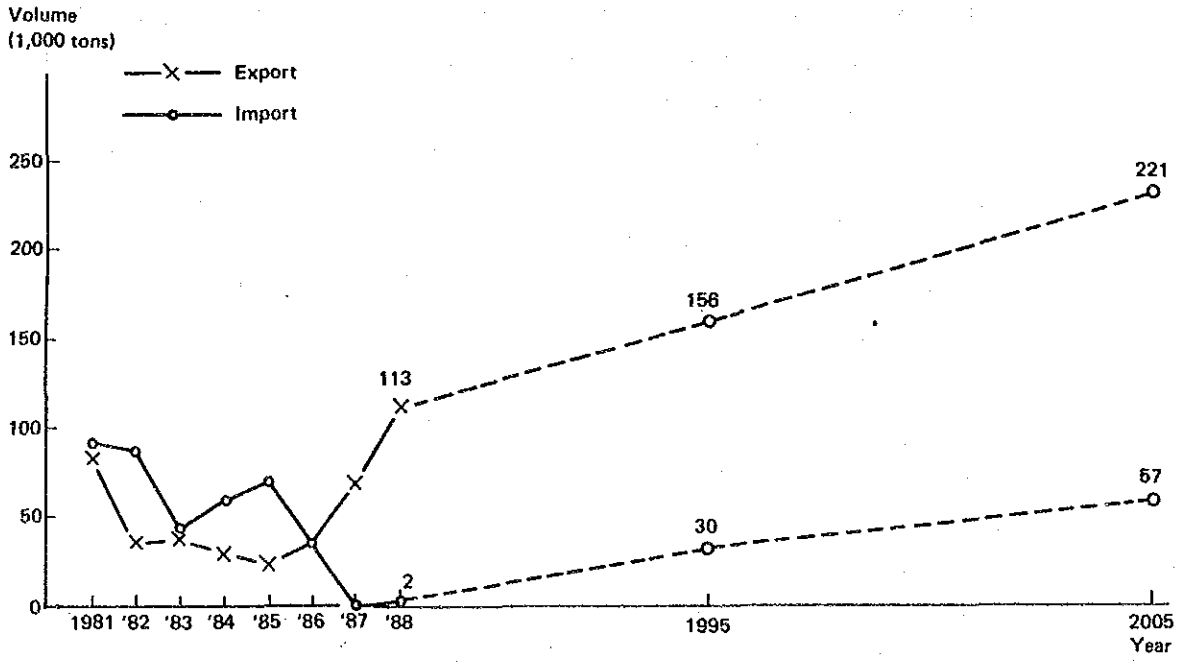


Fig. 5.5.5 Historical Trend and Forecast of General Cargo (Port of Mazatlan)

(5) Port of Guaymas

1) Import cargo

The import general cargo volume at this port is estimated to show an increase from 93 thousand tons in 1988 to 105 thousand tons in 1995 and 152 thousand tons in 2005. The share of cargo handling volume among the six ports will continue to decline.

The characteristic points of the forecast are as follows:

i. The volume of automobile parts for the Ford factory in Hermosillo has decreased recently and is expected to become smaller.
ii. Forestry products, which came to be handled in 1988 for the first time at his port, are not expected to increase at a high growth rate.
iii. Other cargo commodities fluctuate greatly year by year showing a slight increase as a whole.
iv. The containerized ratio is expected to continue to grow as far as liner service is provided at this port.

2) Export cargo

The export cargo volume is estimated to increase from 86 thousand tons in 1988 to 171 thousand tons in 1995 and 248 thousand tons in 2005. The share of the cargo handling volume among the Pacific port is expected to decline in the future.

The characteristic points of the forecast are as follows:

i. The export of cotton, which has been the main cargo of this port, is not expected to increase greatly in the future.
ii. The volume of cellulose showed a remarkable increase in 1988. This cargo may increase hereafter, but it is expected to grow at a relatively moderate growth rate.
iii. Other cargo of mainly agricultural products fluctuate greatly year by year showing no specific caracteristis.
iv. Almost all the cargoes handled at this port are considered to be containerizable. However, a great imbalance between the imported and exerted containerized cargo in the trade to/from Europe and Africa may hinder the increase of the containerized ratio at this port.

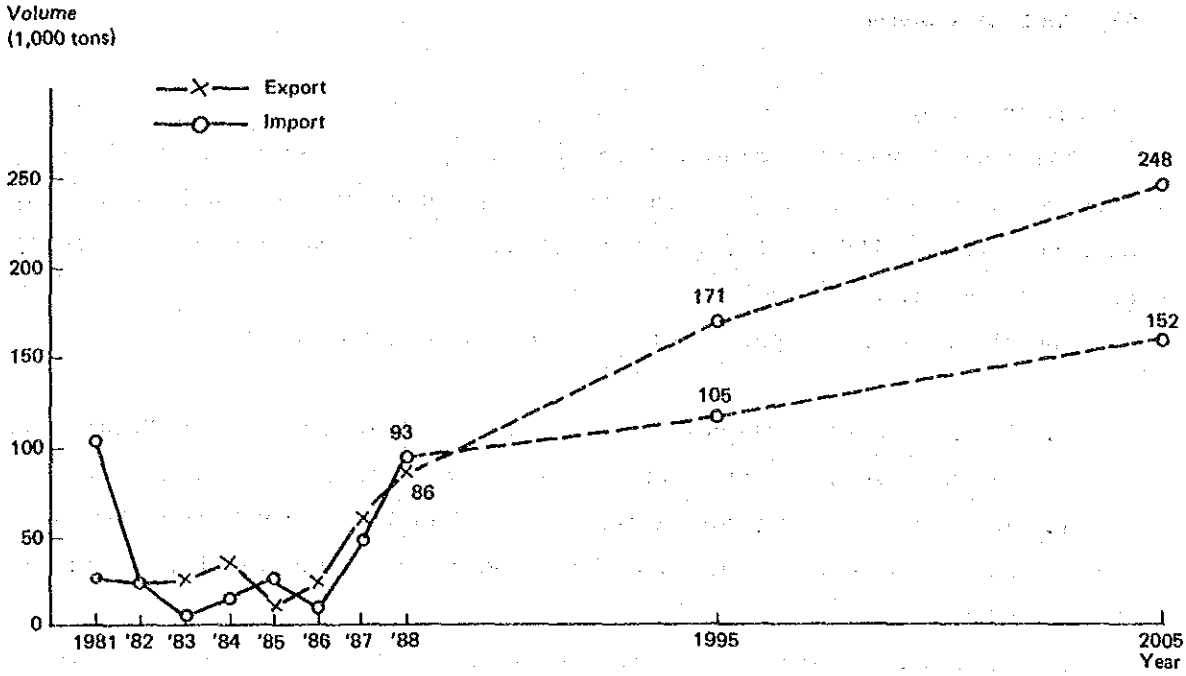


Fig. 5.5.6 Historical Trend and Forecast of General Cargo (Port of Guaymas)

(6) Port of Ensenada

1) Import cargo

The import general cargo volume is estimated to increase from 3 thousand tons in 1988 to 24 thousand tons in 1995 and 52 thousand tons in 2005. The cargo handling volume will increase at high growth rate, although the volume will be at a low level.

The characteristic points of the forecast at as follows:

i. Sugar, which was handled until 1984, will not be handled in the future.

ii. Other cargoes have been at a low volume, showing a declining trend.

iii. The handling of such new cargoes as related Maquiladoras may be expected in the future, resulting in increasing the cargo throughput at the port.

iv. A liner service may be expected as the cargo handling volume at this port grows, because the Port of Ensenada is located on the maritime route between Mexico and the U.S.A.

2) Export cargo

The export general cargo volume at this port is estimated to grow from 25 thousand tons in 1988 to 51 thousand tons in 1995 and 92 thousand tons in 2005. The level of cargo handling volume will remain the lowest among the six ports.

The characteristic points fo the forecast are as follows:

i. The export volume of tuna fish is showing a considerable increase in the last few years. But tuna fish production is considered to increase at a moderate growth ratio, as mentioned in section 5.5.1.

ii. There is no significant export cargo other than tuna fish at present.

iii. The handling of new cargo may be expected in the future.

iv. A liner service, as well as the handling of containers, may be expected as mentioned above.

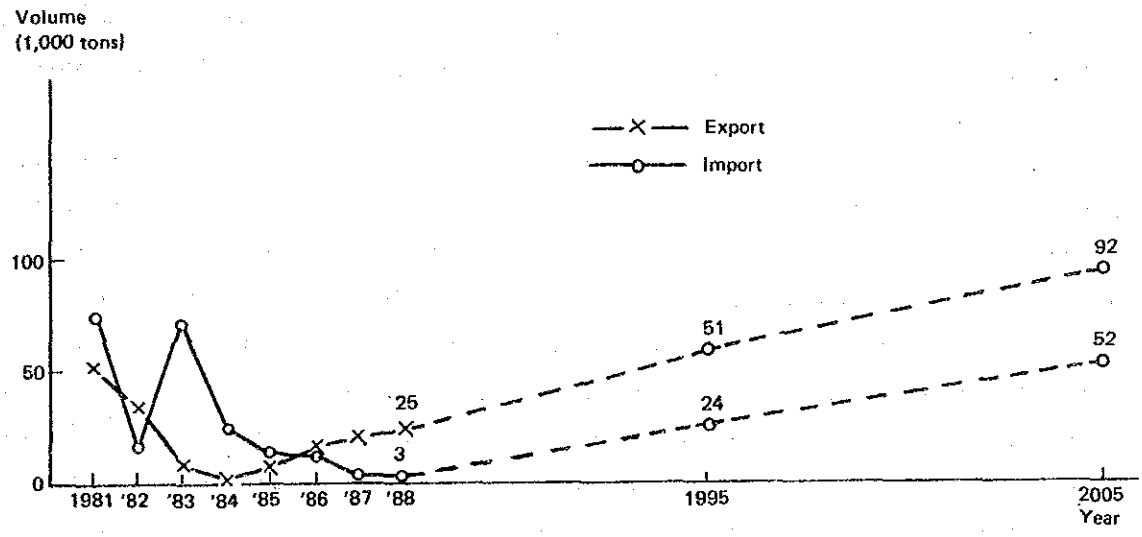


Fig. 5.5.7 Historical Trend and Forecast of General Cargo (Port of Ensenada)

5.6 Forecast of Bulk Cargo Volume at Selected Ports

5.6.1 Principal Policy and Methodology

(1) Scope and Principal Policy

The bulk cargo volume in the target year 1995 is forecast for the selected ports. The Ports of Lazaro Cardenas and Manzanillo are chosen as the selected ports, as examined and described in Chapter 6.

The objective bulk cargoes for the forecast are those cargoes handled at the objective public berths which are defined in Chapter 3 of this report. Therefore, those bulk cargoes passing through the private berths of the selected ports are out of the scope for the forecast.

(2) Forecast Methodology

Among a variety of bulk cargoes, imported agricultural bulk is considered to be the most significant for the forecast, judging from the present problems of bulk cargo handling at each port.

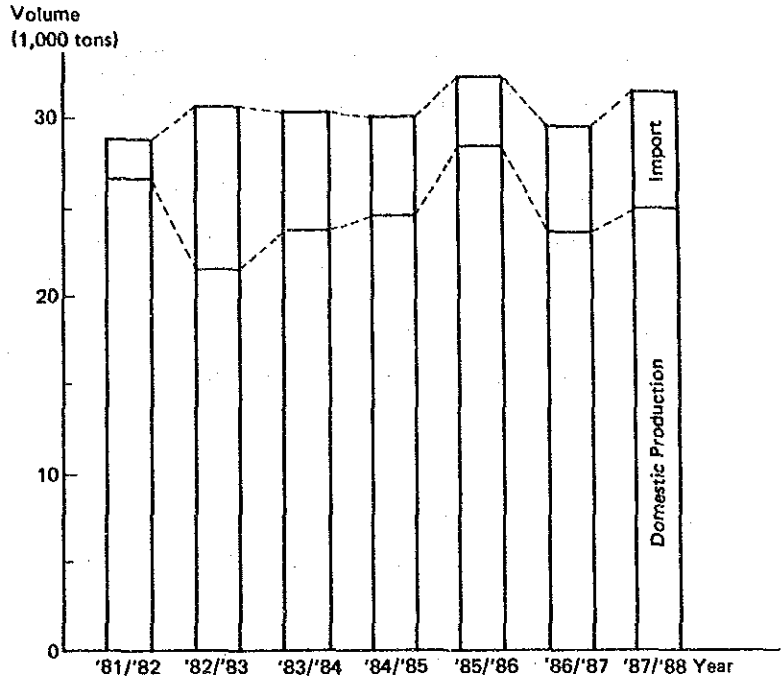
Imported agricultural bulk unloaded at the ports is distributed widely throughout the country. In addition, the volume of imported agricultural bulk, mainly grains, is greatly affected by the amount of the domestic grain production.

Accordingly, the historical trend of the imported agricultural bulk cargo volume should be analyzed in connection with the domestic production. Secondly, the present situation on the domestic distribution of the agricultural bulk cargo unloaded at each port should be examined to decide the future hinterland of each port. In particular, the change of the hinterlands will have to be investigated, which might take place by the launching of operation of the grain storage silo in the Port of Lazaro Cardenas. Thirdly, a certain amount of the cargo volume of the imported agricultural bulk presently passing through the Gulf coast ports and transported to the Pacific coast area, may be shifted to Lazaro Cardenas and Manzanillo. This shifting volume is estimated below.

Through the stages mentioned above, the imported volume of agricultural bulk cargo in 1995 is estimated for the two ports.

As for other bulk cargoes, mainly imported and exported mineral bulk, the hinterlands are comparatively small. Therefore, these bulk cargoes volume is estimated by examing the historical trend as well as referring to

the results of interviews to the port users and shippers/consignees at the ports.



Note:
'81/'82; Domestic Production in 1981 and Import in 1982

Fig. 5.6.1 Trend of Domestic Production and Import of Agricultural Products

5.6.2 Forecast of Imported Agricultural Bulk Cargo Volume

(1) Volume of Domestic Production and Import

The volume of imported agricultural products in a certain year is greatly associated with the level of the domestic production in the previous year. Table 5.6.1 and Fig. 5.6.1 show this relation clearly.

As seen in Fig. 5.6.1, total domestic consumption of agricultural products, which is the sum volume of domestic production and imports, remains almost constant during the 1980s, at around 30 million tons. In the long range, the total domestic consumption will grow, as the population is supposed to increase as well as the per capita consumption of agricultural products.

On the other hand, the domestic production fluctuates greatly year by year mainly because of the meteorological conditions of each year, although

it appears to show a slight increase during the 1980s. In the long run, the total domestic production is also supposed to grow considerably in Mexico.

Thus, the imported volume of agricultural products, which represents the amount of the domestic shortage, varies greatly year by year showing no definite tendency during the 1980s.

From the above examination, it can be judged that the total import volume of agricultural products as well as the domestic consumption will not change greatly in the short term such as the target year 1995, although in the long time span, the total import volume is estimated to grow*.

Examining the imported volume by commodity in Table 5.6.1, some comments are pointed out as follows:

i. Main commodities in terms of volume for the import are maiz and sorgum, which account for about 66% of the total import volume in 1988.

ii. The import volume, as well as the total consumption volume, of wheat has been growing with a sharp increase in 1988.

iii. Agricultural commodities other than maiz, sorgum, wheat and soybeans are very small in quantity and can be neglected.

(2) Share of the Pacific Coast Ports in the Import Volume

The shares of the imported volume of agricultural bulk cargo by transportation mode are listed in Table 5.6.2. The average share of land transportation from 1983 to 1988 is around 38%, although there exists a small fluctuation year by year.

The share of maritime transportation is said to be influenced by the level of the maritime rate level. One reason for the sharp drop in the share of maritime transportation in 1988, especially in the case of the Pacific coast ports, is considered to be the rise of the maritime tariff for agricultural bulk cargo.

Nevertheless, the share of imported agricultural bulk volume through the Pacific coast ports can be said to be around 20% as a whole, which is the average value for the 1983-1988 period. This share of the Pacific

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* Refer to P195 of the report "The Study on the Development Project of the Port of Manzanillo in the United Mexican States", 1985, JICA.

Table 5.6.1 Domestic Production and Imported Volume of Agricultural Products

(unit; tons, %)

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
(1) Rice	652,169	511,360	586,112	683,546	810,084	563,209	591,996
(Product)	651,947	511,137	415,667	484,014	809,085	545,150	591,099
(Import)	222	223	170,445	199,532	999	18,059	897
	(0.0)	(0.0)	(2.6)	(3.5)	(0.0)	(0.3)	(0.0)
(2) Bean	1,476,861	944,467	1,400,476	1,151,653	1,083,619	1,123,779	1,054,152
(Product)	1,331,305	943,309	1,281,706	973,563	905,530	1,084,830	1,023,575
(Import)	145,556	1,158	118,770	178,090	178,089	38,949	30,577
	(6.3)	(0.0)	(1.8)	(3.1)	(4.7)	(0.6)	(0.4)
(3) Maiz	14,800,009	14,774,215	15,489,086	14,606,146	15,743,560	15,293,671	14,721,916
(Product)	14,550,074	10,129,083	13,061,208	12,931,644	13,956,560	11,721,468	11,606,928
(Import)	249,935	4,645,132	2,427,878	1,674,502	1,787,000	3,572,203	3,114,988
	(10.9)	(50.2)	(36.3)	(29.6)	(47.4)	(59.4)	(45.3)
(4) Sorgum	7,201,239	8,047,322	7,157,634	6,788,886	7,306,013	5,574,859	7,739,992
(Product)	6,086,490	4,716,868	4,846,337	4,974,035	6,550,466	4,832,535	6,298,011
(Import)	1,114,749	3,330,454	2,311,297	1,814,851	755,547	742,324	1,441,981
	(48.5)	(36.0)	(34.6)	(32.0)	(20.0)	(12.3)	(21.0)
(5) Wheat	3,504,114	4,863,197	3,804,580	4,825,533	5,431,051	5,171,326	5,634,216
(Product)	3,192,954	4,462,139	3,460,242	4,505,546	5,206,956	4,769,731	4,445,391
(Import)	311,160	401,058	344,338	319,987	224,095	401,595	1,188,825
	(13.5)	(4.3)	(5.2)	(5.7)	(5.9)	(6.7)	(17.3)
(6) Soybean	1,184,677	1,530,897	1,994,718	2,161,388	1,752,342	1,773,627	1,916,065
(Product)	706,697	647,650	686,456	684,899	927,893	708,724	828,210
(Import)	477,980	883,247	1,308,262	1,476,489	824,449	1,064,903	1,087,855
	(20.8)	(9.5)	(19.6)	(26.1)	(21.9)	(17.7)	(15.8)
(7) Sunflower	4,556	12,856	4,601	3,930	22,219	71,156	8,253
(Product)	4,556	12,856	4,601	3,930	22,219	6,213	8,151
(Import)	-	-	-	-	-	64,943	102
						(1.1)	(0.0)
(8) Turrip	-	-	-	-	-	113,060	4,518
(Product)	-	-	-	-	-	-	-
(Import)	-	-	-	-	-	113,060	4,518
						(1.9)	(0.1)
Total	28,823,625	30,684,314	30,437,207	30,221,082	32,148,888	29,684,687	31,671,108
(Product)	26,524,023	21,423,042	23,756,217	24,557,631	28,378,709	23,668,651	24,801,365
(Import)	2,299,602	9,261,272	6,680,990	5,663,451	3,770,179	6,016,036	6,869,743
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: SARH

Note: 1981/1982(Product 1981. Import 1982), ( ) ;Share to the total imported volume

Table 5.6.2 Imported Volume of Agricultural Bulk by Transportation Mode

(unit: volume; tons; share; %)

	Maritime Transport						Land Transport		Total	
	Pacific Coast		Gulf Coast		Sub-Totaol					
	Volume	Share	Volume	Share	Volume	Share	Volume	Share	Volume	Share
1982	1,171,072	30.5	1,816,655	47.3	2,987,727	77.8	851,130	22.2	3,838,857	100
1983	2,251,883	21.1	4,128,950	38.6	6,380,833	59.7	4,308,777	40.3	10,689,610	100
1984	1,700,176	19.9	3,741,550	43.7	5,441,726	63.6	3,108,945	36.4	8,550,671	100
1985	1,690,839	25.1	2,660,725	39.5	4,351,564	64.6	2,385,072	35.4	6,736,636	100
1986	768,449	17.5	1,993,810	45.3	2,762,259	62.8	1,636,264	37.2	4,398,523	100
1987	1,301,074	20.0	2,771,169	42.6	4,072,243	62.6	2,437,828	37.4	6,510,071	100
1988	1,101,361	15.2	2,950,351	40.8	4,051,712	56.0	3,186,518	44.0	7,238,230	100

Source: CONASUPO

coast ports is expected to increase in accordance with the development of the storage facilities at the ports, especially at Lazaro Cardenas.

(3) Forecast of Total Volume through the Pacific Coast Ports

Table 5.6.3 shows the historical trend of the imported agricultural cargo volume in Mexico. The total volume through the Pacific coast ports, as well as that of the Gulf coast ports, varies greatly year by year, showing no obvious tendency.

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

Taking into account the above mentioned matters, it would be reasonable to adopt the relatively large volume of the actual results in the past several years as the estimated total volume through the Pacific coast ports in 1995.

Referring to Table 5.6.3, the study team adopts 1,500 thousand tons as the estimated total volume of the agricultural bulk cargo through the Pacific coast ports in the target year of 1995.

(4) Primary Forecast of the Cargo Volume of Lazaro Cardenas and Manzanillo

Fig. 5.6.2 and 5.6.3 show the historical trend of the handling share of each port to the total agricultural bulk cargo through the Pacific coast ports.

The Port of Manzanillo has been showing an increasing tendency as a whole, in spite of the annual variation. The Port of Lazaro Cardenas is considered to retain a slight trend toward increase. The handling shares of the Ports of Mazatlan and Guaymas are observed to be gradually decreasing.

This general change in the handling shares among the ports is considered, for one thing, to be caused by the relatively increasing demand in the metropolitan area and other large urban area, as is also estimated from a sharp increase of the imported wheat volume in 1988.

Considering the historical trend in Fig. 5.6.2 and 5.6.3, the handling share of each of the Pacific ports in 1995 is estimated as shown in the same figures.

Table 5.6.3 Historical Trend of Agricultural Bulk (Import)

	1981		1982		1983		1984		1985		1986		1987		1988	
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
Ensenada	-		-		-		-		-		39,992	4.1	72,846	5.5 <4.0>	28,210	2.5
Guaymas	1,144,820	40.5	657,515	55.7 <47.8>	1,073,493	47.5 <55.7>	1,007,439	64.1 <53.6>	771,870	49.5 <48.5>	243,742	31.9 <47.1>	798,179	60.0 <42.6>	401,683	35.9
Mazatlan	729,693	25.8	225,717	19.2 <24.4>	635,525	28.1 <23.8>	379,000	24.1 <26.3>	414,123	26.5 <25.8>	205,173	26.8 <21.3>	138,918	10.5 <17.1>	158,134	14.1
Manzanillo	730,574	25.9	189,861	16.1 <22.2>	553,303	24.5 <17.5>	184,007	11.8 <18.0>	274,778	17.6 <20.8>	252,264	33.0 <23.4>	259,509	19.5 <30.4>	434,059	38.8
Lazaro Cardenas	221,122	7.8	106,444	9.0	-		-		98,702	6.4 <3.5>	31,839	4.2 <5.0>	58,700	4.5 <5.8>	97,318	8.7
Acapulco	-		-		-		-		-		-		-		-	
Salina Cruz	-		-		-		-		-		-		-		-	
Other Pacific Ports	-		-		-		-		-		-		-		-	
Pacific Total	2,826,209	100.0	1,179,537	100.0	2,262,321	100.0	1,570,446	100.0	1,559,473	100.0	764,010	100.0	1,328,152	100.0	1,119,404	100.0
Gulf Coast Total	2,664,410		2,047,676		4,261,164		3,610,053		2,684,014		1,818,871		2,604,197		N.D.	
Mexico Total	5,490,619		3,227,213		6,523,485		5,180,499		4,243,487		2,582,881		3,932,349		N.A.	

Source: SCT Movimiento de Cargo y Buques
Note: < > Three years moving average value of the share to the Pacific Total.
N.D. No Data
N.A. Not Available

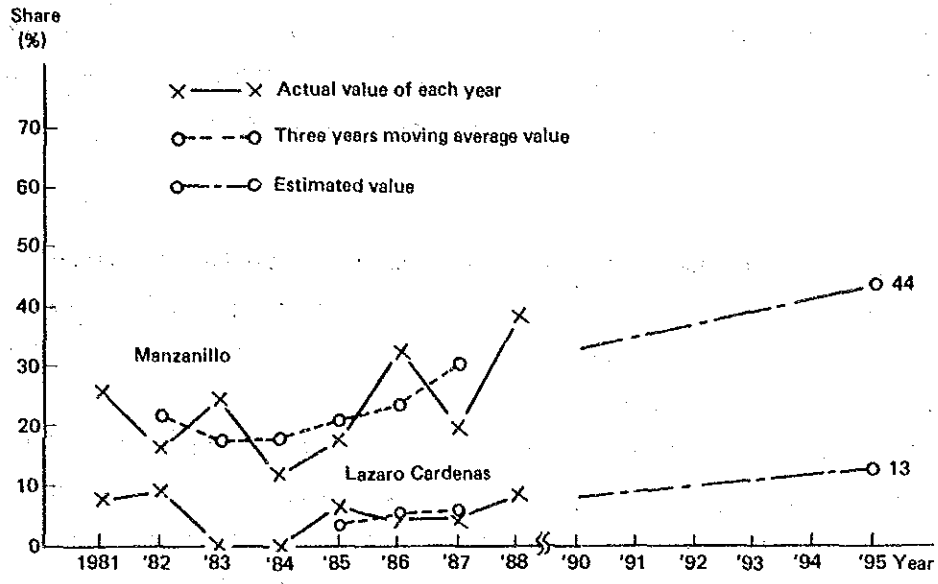

Fig. 5.6.2 Trend and Estimated Value of the Share of Imported Agricultural Bulk (Manzanillo and Lazaro Cardenas)

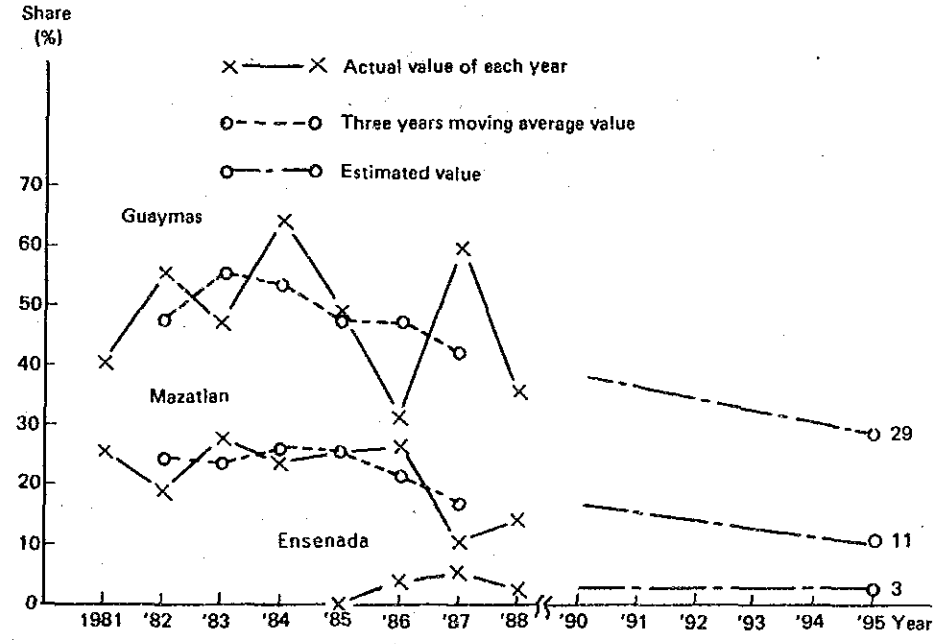

Fig. 5.6.3 Trend and Estimated Value of the Share of Imported Agricultural Bulk (Guaymas, Mazatlan, and Ensenada)

Thus the handling volume of Lazaro Cardenas and Manzanillo in 1995 are estimated, using the estimated handling share in 1995, to be 200 and 660 thousand tons respectively, in case the cargo shift discussed below is not considered.

(5) Estimation of the Cargo Shift from Manzanillo to Lazaro Cardenas

As described in section 5.4.3 of this chapter, the hinterlands of Mazatlan, Guaymas and Ensenada are limited to the states where the ports are located and their neighboring states.

On the other hand, the hinterlands of Lazaro Cardenas and Manzanillo overlap to a considerable extent. Therefore, the cargo shift from Manzanillo to Lazaro Cardenas is naturally forecast with the commencement of the operation of the grain storage silo in Lazaro Cardenas.

The shifting of the agricultural bulk cargo shall be affected by the following factors.

i. Time and cost necessary for the transportation of agricultural bulk cargo from the port to the hinterland.
ii. Size and quality of the wharfs, the depth of the berths in particular, and the capacity of storage facilities.
iii. Trading and commercial patterns.
iv. Policy of the governmental organizations concerned.

Among the above factors, i. and ii. will be most fundamental and essential. According to the origin and destination survey mentioned in section 5.4.3, the hinterland of Manzanillo can be classified into the following three groups with regard to the distance from Lazaro Cardenas.

Group A; States which are closer to Lazaro Cardenas than to Manzanillo, such as Distrito Federal, Michoacan and Mexico (18%).
Group B; States which are closer to Manzanillo than to Lazaro Cardenas but do not belong to the group C, such as Durango, San Luis Potosi and Coahuila (16%).
Group C; States which are far closer to Manzanillo than to Lazaro Cardenas, such as Jalisco, Colima and Nayarit (66%, Jalisco only: 60%).

Note:(%) expresses the share of handling volume of each group to the Manzanillo total.

The judgment of consignees on which one of the two ports to use would basically depend on the cost and time which would be necessary to transport goods from the port to their factories or stocking facilities. Thus, cost and time analysis are required for a detailed examination. However, roughly talking, the following estimation could be given considering the storage facility projects in these two ports.

Case 1 (Lazaro Cardenas: equipped with a grain storage silo, Manzanillo: equipped with the necessary capacity of storage facilities such as warehouses)

In this case, most of Group B and C would continue to use Manzanillo, while most of Group A would gradually shift to Lazaro Cardenas. Thus, the cargo volume supposed to shift to Lazaro Cardenas would be around 20% of the Manzanillo total. Then, multiplying the estimated cargo volume by this share, the shifting cargo volume of import agricultural bulk from Manzanillo to Lazaro Cardenas is estimated to be around 130 thousand tons in 1995.

Case 2 (Lazaro Cardenas: equipped with a grain storage silo, Manzanillo: equipped with no storage facilities as at present)

Group A would shift to use Lazaro Cardenas within a short period, while around half of Group B, and around one third of Group C, might gradually shift to Lazaro Cardenas.

Thus, the share of the cargo volume supposed to shift to Lazaro Cardenas might reach about 50%. Then, the shifting cargo volume of import agricultural bulk from Manzanillo to Lazaro Cardenas might be 330 thousand tons in 1995.

(6) Estimation of the Cargo Shift from the Gulf Coast Ports to Lazaro Cardenas and Manzanillo

A certain amount of the cargo volume of imported agricultural bulk destined to the Pacific coast area is estimated to pass through the Gulf coast ports at present because of the lack of storage facilities at the Port of Lazaro Cardenas and Manzanillo. These cargoes probably originate from Argentina.

Table 5.6.4 shows the cargo volume of imported agricultural bulk cargo passing through the Gulf coast ports and transported to the Pacific coast areas.

Assuming that the share of the cargo volume originated from Argentina to the total cargo volume handled at the ports can be applied to the cargo volume transported to the states listed in Table 5.6.4, the shifting cargo volume can be calculated.

Then, the shifting cargo volume from the Gulf coast ports to Lazaro Cardenas and Manzanillo in 1995 is estimated for the two cases mentioned before as follows:

Case 1;	Lazaro Cardenas	40 thousand tons
	Manzanillo	30 thousand tons
Case 2;	Lazaro Cardenas	40 thousand tons
	Manzanillo	30 thousand tons

Table 5.6.4 Volume of Imported Agricultural Bulk Cargo Passing through Gulf Coast Ports and Transported to the Pacific Coast Areas

(unit: tons)

States / Port	Jalisco	Michoacan	Nayarit	Colima	Guerrero	Total	Remarks
Veracruz	-	-	-	-	-	-	<276,730> 754,409
Tampico	79,362 (76,607)	18,665	-	-	-	98,027 (76,607)	<64,798> 449,526
Tuxpan	-	-	-	-	-	-	< -> 146,141
Coatzacoalcos	-	2,526	-	-	-	2,526	<127,178> 249,140
Total	79,362 (76,607)	21,191	-	-	-	100,553 (76,607)	

Source: Processed and arranged from the data of Direccion y Marina Merecant de SCT.
Note: ( ) in Jalisco represents the cargo volume to Guadarabara.
Values in the remarks represent the total volume of the agricultural bulk cargo through the port., < > expresses the cargo volume for Argentina, among the total (data in 1986)

(7) Forecast of Cargo Volume of Lazaro Cardenas and Manzanillo

Finally, the estimated cargo volume of imported agricultural bulk of the two ports in 1995 is summarized in Table 5.6.5.

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

In the examination of the short-term improvement plan of the Port of Manzanillo, which is described in the section 10.4, the Case 1 in Table 5.6.5 is considered.

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

(1) Agricultural Bulk Cargo

Table 5.6.6 shows the historical trend of the agricultural bulk cargo volume at the Port of Lazaro Cardenas.

As for the imported cargo, the forecast of which was conducted for the target year of 1995 in the previous section of this chapter, the only commodity handled at present is wheat. In addition to the increase of wheat, other commodities are estimated to come to pass through this port from the beginning of the operation of the grain silo.

Lazaro Cardenas has been handling wheat as domestic inward agricultural bulk. As seen in Table 5.6.6 the handling volume of wheat has been nearly constant during the past 4 years. Judging from this, the study team supposes 150 thousand tons as the handling volume of the domestic inward wheat in 1995.

Table 5.6.5 Results of the Estimation for the Cargo Volume of Imported Agricultural Bulk in 1995

(unit: thousand tons)

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

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

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

Table 5.6.6 Historical Trend of Agricultural Bulk (Port of Lazaro Cardenas)

(unit; thousand tons)

	Year	1981	1982	1983	1984	1985	1986	1987	1988
Foreign Trade	Import Total	221	106	-	-	99	32	59	97
	Maize (Corn)	173	22	-	-	48	32	-	-
	Soy Beans	-	-	-	-	19	-	-	-
	Wheat	48	84	-	-	-	-	59	97
	Seeds	-	-	-	-	32	-	-	-
	Export Total	-	-	-	-	-	-	-	-
Domestic Trade	Inward Total	54	247	447	201	124	127	120	132
	Wheat	47	247	447	201	124	127	120	132
	Maize (corn)	7	-	-	-	-	-	-	-
	Outward Total	-	-	-	-	-	-	-	-

There has been neither export cargo nor domestic outward cargo of agricultural bulk in this port during the 1980s. The same situation is supposed to continue until the target year 1995.

(2) Mineral Bulk Cargo

Table 5.6.7 shows the historical trend of the mineral bulk cargo handled at the Port of Lazaro Cardenas.

All mineral bulk cargoes at this port handled at either SICARTSA berth or FERTIMEX private berth. The FERTIMEX berth is outside the scope of this study.

As for the mineral bulk cargo handled at the SICARTSA berth, the cargo volume in 1995 is assumed to be as follows, based on the collected data and the interviews with SICARTSA personnel.

Coal and Coke	Import	175 thousand tons
	Domestic Import	75 thousand tons
Iron ore (Pellet)	Import	800 thousand tons
Scrap iron	Import	400 thousand tons

Note: The handling volume of iron ore is the projected value in 1994.

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

(1) Agricultural Bulk Cargo

Table 5.6.8 lists the handling volume of agricultural bulk at the Port of Manzanillo during the 1980s.

The forecast of imported agricultural bulk cargo is as described in section 5.6.2. The cargo commodities are comprised of maiz, soy beans, wheat and seeds, each of which is generally showing an increasing trend.

Manzanillo has been handling wheat as a domestic inward agricultural bulk cargo since 1984. The handling volume of wheat, as seen in Table 5.6.8, fluctuates greatly year by year, showing no clear tendency. Therefore, the study team assumes the handling volume of domestic inward wheat in 1995 to be 80 thousand tons which is equal to the average value

Table 5.6.7 Historical Trend of Mineral Bulk
(Port of Lazaro Cardenas)

(unit; thousand tons)

Commodities \ Year		1981	1982	1983	1984	1985	1986	1987	1988
Foreign Trade	Import Total	697	491	169	315	686	924	633	1,547
	Sulfur	-	-	-	-	50	164	238	307
	Coal	697	491	169	315	520	277	-	232
	Coke	-	-	-	-	110	55	-	-
	Potassium Chlorid	-	-	-	-	-	-	22	25
	Phosphate Rock	-	-	-	-	6	321	373	693
	Iron Ore	-	-	-	-	-	107	-	25
	Iron Ingot	-	-	-	-	-	-	-	234
	Scrap Iron	-	-	-	-	-	-	-	31
	Export Total	-	-	25	-	95	24	-	25
	Cast Iron	-	-	25	-	-	-	-	-
	Ore	-	-	-	-	-	24		
	Coal					95			
	Phosphate Ammonium	-	-	-	-	-	-	-	25
Domestic Trade	Inward Total	23	-	-	-	-	-	411	213
	Phosphate Rock	23	-	-	-	-	-	411	162
	Iron Ore	-	-	-	-	-	-	-	51
	Outward Total	4	26	4	4	-	6	189	128
	Coke	4	26	4	4	-	6	-	-
	Phosphate Ammonium	-	-	-	-	-	-	189	128

Table 5.6.8 Historical Trend of Agricultural Bulk
(Port of Manzanillo)

(unit; thousand tons)

Year		1981	1982	1983	1984	1985	1986	1987	1988
Foreign Trade	Import Total	731	189	553	184	275	252	260	434
	Maize (Corn)	710	125	533	142	150	102	124	227
	Soy Beans	21	37	-	42	40	23	-	80
	Wheat	-	-	20	-	67	67	22	59
	Seeds	-	27	-	-	18	60	114	68
	Export Total	-	-	-	-	-	-	-	-
Domestic Trade	Inward Total	-	-	-	103	87	206	64	66
	Wheat	-	-	-	103	87	206	64	66
	Maize (corn)	-	-	-	-	-	-	-	-
	Outward Total	-	-	-	-	-	-	-	-

from 1984 to 1988 except for 1986.

There has been no export or domestic outward agricultural bulk cargo handled at this port. The same situation is supposed to continue until the target year 1995.

(2) Mineral Bulk Cargo

Table 5.6.9 shows the historical trend of mineral bulk cargo volume handled at the Port of Manzanillo.

1) Import

The imported mineral bulk cargoes are considered to be mainly materials for fertilizer. The handling volume of the mineral bulk has been showing a definite increasing trend as shown in Fig. 5.6.4.

Therefore, a time series analysis is carried out and the following correlation formula is obtained.

$$V = -1,189.8 + 14.91t \qquad (r = 0.943)$$

where V: Handling volume of imported mineral bulk cargo
t: Year (83 for year 1983)
r: Correlation coefficient

Using this formula, the handling volume in 1995 is estimated to be 227 thousand tons.

2) Export

Most of the handling volume of exported mineral bulk is the cement produced by Cements Toltecas. Based on the interview with Cements Toltecas personnel, the handling volume of cement by this enterprise in 1995 is assumed to be 840 thousand tons.

Considering this prospect by the cement producing company and adding some allowance the handling volume of cement export in 1995 is estimated to be 900 thousand tons.

As is described below, Pena Colorada, an iron ore pellet producing company, is making every efforts to begin to export its iron ore pellets instead of the domestic export which is in prospect of suspension by 1995. In view of the present producing level, some portion of the iron ore

Table 5.6.9 Historical Trend of Mineral Bulk
(Port of Manzanillo)

(unit; thousand tons)

	Year	1981	1982	1983	1984	1985	1986	1987	1988
Foreign Trade	Import Total	123	106	42	71	87	84	96	132
	Sulphate Ammonium	18	-	21	41	20	21	-	-
	Perphosphoric Acid	-	46	-	-	29	63	-	-
	Phosphate Ammonium	80	39	-	-	-	-	-	-
	Sulfure	-	-	-	-	-	-	96	56
	Potassium Chloride	25	21	21	30	17	-	-	42
	Phosphate Rock	-	-	-	-	-	-	-	34
	Potassium	-	-	-	-	21	-	-	-
	Export Total	-	-	-	-	64	342	430	407
	Cement	-	-	-	-	64	328	415	397
	Concentrated Zin	-	-	-	-	-	14	15	10
Domestic Trade	Inward Total	22	81	192	142	131	19	40	33
	Phosphate Rock	22	81	192	101	24	-	-	2
	Urea	-	-	-	33	98	19	21	-
	Perphosphoric Acid	-	-	-	-	9	-	-	-
	Salt	-	-	-	8	-	-	-	-
	Phosphate Ammonium	-	-	-	-	-	-	19	31
	Outward Total	-	-	-	-	2	-	-	50
	Cement	-	-	-	-	2	-	-	-
	Iron Ore	-	-	-	-	-	-	-	50

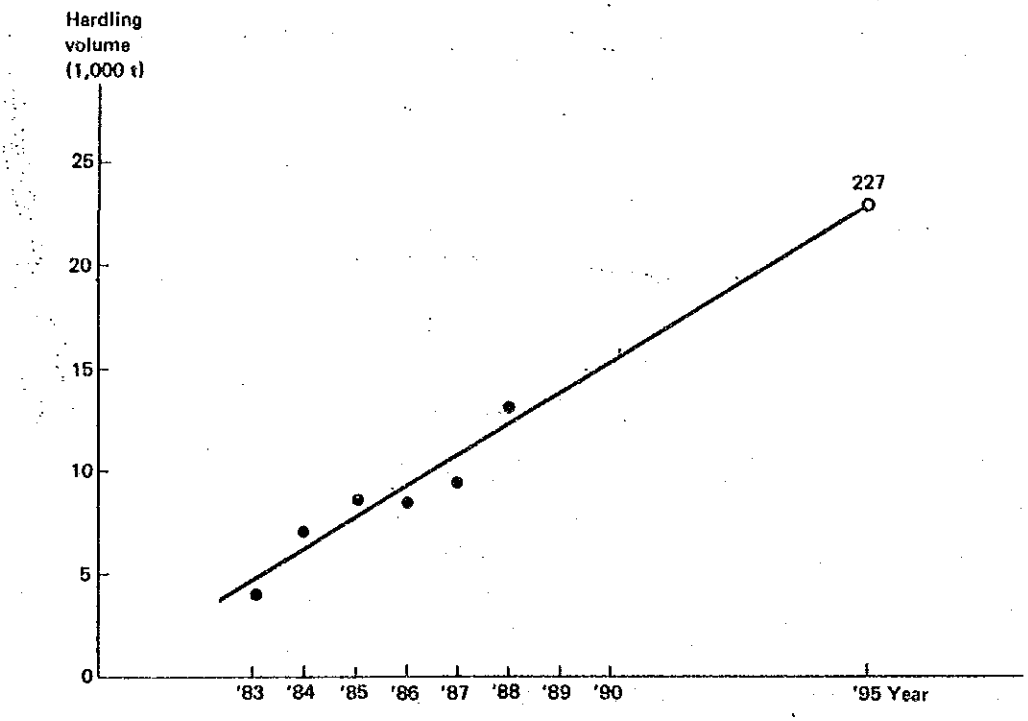

Fig. 5.6.4 Forecast of the Volume of Mineral Bulk at Manzanillo

pellets which are going out presently to the Port of Lazaro Cardenas are expected to be exported to foreign countries. Thus, around 400 thousand tons of iron ore pellets export is assumed in 1995.

3) Domestic inward cargo

As seen in Table 5.6.9, Manzanillo has handled several kind of domestic inward mineral bulk cargoes, such as phosphate rock and phosphate ammonium. The phosphate rock which had been handled at this port in a considerable volume until 1985 seems to have shifted to Lazaro Cardenas and phosphate ammonium is presently the main commodity handled at the port. Since the volume of these cargoes has not shown any specific trend, the study team assumes the handling volume in 1995 to be 60 thousand tons, which is equal to one and a half times the volume handled in 1987.

4) Domestic outward cargo

The only mineral bulk cargo going outward domestically from Manzanillo is the iron ore produced by Pena Colorada which is an iron ore pellet producing company located two kilometers from the port. This company has a pellets producing capacity of three million tons per year, and provides the steel mills in Mexico with its product by both rail and ship. From the Port of Manzanillo, the pellets are transported to SICARTSA plant located in the Port of Lazaro Cardenas. According to the interviews with the personnels of both Pena Colorada and SICARTSA, however, SICARTSA is now considering to complete own iron pellet producing factory in Lazaro Cardenas using the iron ores transported from the mine which is located around 20km away from the factory. Then the transportation of iron ore pellets from the Port of Manzanillo will be stopped.

Judging from this, the handling volume of domestic outward iron ore pellets is assumed to fall to zero.

Chapter 6. Container Network and Long Term Development Policy

6.1 Basic Conditions

6.1.1 Port of Salina Cruz

a. The Port of Salina Cruz is located in the border area with Guatemala and connected by railway and roads to Coatzacoalcos on the Mexican Gulf Coast, which is a major oil production area, and the port is a gateway to the Yucatan Peninsula from the Pacific Coast and also to Guatemala.

b. As analyzed in section 5.4.2, the hinterland for the imported general cargo covers the state of Oaxaca where the port is located the Gulf coast area such as Veracruz, the central area such as Mexico City and Puebla and the Uucatan Peninsula area such as Campeche. While, the hinterland for the exported general cargo is mainly Veracruz, followed by Mexico City. In addition, transhipment containers to Guatemala pass through this port.

Thus, the hinterland of Salina Cruz is spread over a relatively wide area of southern Mexico. But it can be said that salina Cruz does not have a large demand area for port cargoes in its vicinity.

c. The distance on road from the port to the main cities in the southeastern part of Mexico are as follows;

Oaxaca: 269km, Coatzacoalcos: 302km, Tapachula (at border of Guateala): 439km, Mexico City: 855km via Coardoba.

d. The most important role of this port is as a base to load petroleum and its derivatives for export and domestic use on the Pacific Coast. The products from this region such as coffee, beer and trepthal acid are exported, and the consumer goods such as wheat, construction materials and assemblies, are discharged at the port. And the transit cargoes to and from Guatemala are also handled.

e. The land transportation connecting the port with its hinterland depends on trucks except for the transportation of terephthal acid, while the transportation of liquids is carried out through pipelines. While the road conditions to the main hinterlands are not so bad, the distance to

Mexico City is farther than from other ports such as the Port of Lazaro Cardenas and Veracruz, because the shortest route to Mexico via Oaxaca is not suitable for heavy trucks.

f. As analyzed and described in section 5.5.2, the volume of imported and exported general cargo at this port in the future is expected to grow comparatively steadily, although the handling share of the cargo volume will decline gradually because of the higher increases at the Ports of Lazaro Cardenas and Manzanillo.

g. But, the decline of the handling volume of both import and export cargo in 1989 and 1989 should be carefully examined. Also, the handling volume of container is supposed to increase at a considerably high ratio with a high containerized ratio of both import and export general cargo.

h. As for the foreign origin areas of the import general cargo, the Far East including Japan, and the U.S.A. and Canada share the general cargo volume at present, while the imported cargo volume from other countries is negligibly small. On the other hand, the Far East including Japan has about an 84% share of the exported cargo volume, followed by the U.S.A.

Thus, the main liner routes are those connecting this port with the Far East and the U.S.A.

i. It is assumed that the present situation and role of the port will not change so much, because the location of the port is far from the center of economic activities in Mexico. And there are still many items to be studied to realize the so-called alpha-omega plan.

j. The development area of the port itself is limited in both the water area and the land area, because the possible remaining development area is only in the estern part of the port adjacent to the container terminal. As for the container handling, the present scale of the main facilities such as quays and yards is considered to be sufficient to accommodate the future demand.

k. Another basic condition to realize the development of the port is the possiblity of ship entrance to the port at night in the future which would

require the widening of the entrance channel.

6.1.2 Port of Lazaro Cardenas

a. The Port of Lazaro Cardenas has been developed as an industrial port in Mexico, but it has been also developed as a commercial port because of its location. It is the nearest port from Mexico City on the Pacific Coast of Mexico except for the Port of Acapulco which is mainly operated as a tourist port.

b. As analyzed in section 5.4.2, the hinterland of this port for imported and exported general cargo is mainly the central area, Mexico City in particular, and the states where the port is located and neighboring states such as Michoacan and Colima.

The hinterland of Lazaro Cardenas is presently much smaller compared with that of Manzanillo, while it is expected to gradually become wider as the cargo handling volume increase.

c. The distances on road from the port to the main cities in the central region are as follows:

Colima: 330km, Aguascalientes: 788km, Toluca: 620km, Cuernavaca: 679km, Mexico City: 764km via Acapulco.

d. This port has two main roles. The one is for handling cargo for the industries located in the port area including raw materials such as sulfur and phosphorous rock and industrial products such as fertilizer and iron products. The other is for loading/discharging the cargoes for use and consumption in the central region such as auto parts in containers and agricultural bulk.

e. The land transport to its hinterland is carried out by two traffic modes, trains and trucks. The trains are used frequently, though the service level is not sufficient, because the condition of the roads connecting with Mexico City is not good. Especially the road via Altamirano which is the shortest way, is not suitable for heavy vehicles. There is presently no plan for the construction of new roads. So, the fundamental improvement of the transportation by road connecting the port with Mexico City can not be expected for the time being, while in the long

term it may be possible.

f. As described in section 5.5.2, the handling volume of general cargo is projected to increase rapidly. Especially the export cargo volume which is now at a relatively low level, is expected to grow at a high rate of increase.

However, a significant part of the increase in the cargo handling volume is due to the shift of cargo from Manzanillo, and is largely dependent on the improvement of the related land transportation infrastructure.

g. The handling volume of containerized cargo is also expected to grow at a high rate of increase.

h. The handling volume of imported agricultural bulk cargo is forecast to increase with the completion of the grain storage silo in the port. However, it should be noted that Lazaro Cardenas is rather far from the main hinterlands of the agricultural bulk cargo as compared with Manzanillo.

i. The main origin/destination areas in the import and export of general cargo are Japan, the U.S.A. and Canada, while Europe and Africa via the Panama Canal occupy around 8% in the import and export.

j. A large scale development area of the port is reserved for industry and port facilities. The development of new commercial berths will require the replacement of the existing access road.

k. Another basic factor is the construction plans of the private cargo handling facilities of the factories.

6.1.3 Port of Manzanillo

a. The Port of Manzanillo has been developed as a commercial port, because it is a gateway to Guadalajara which is the second largest city in Mexico, and is also easily connected to the central region.

b. Manzanillo has vast hinterland area for both import and export general cargo, showing the history of the port as a gateway for foreign trade on the Pacific coast.

The hinterland of Manzanillo overlapps with that of Lazaro cardenas to a considerable extent.

The most important hinterland is, of course, the State of Jalisco followed by the State of Colima and the State of Aguascalientes.

c. The distances on road from the port to the main cities in the hinterland area as follows:

Colima: 105km, Guadalajara: 357km, Aguascalientes: 626km,
Mexico City: 984km.

d. The main roles of the port are classified as follows:

i. To supply consumer goods, fuel oil and materials and assemblies for industry
ii. To export non-oil goods, specially general cargo and containerized cargo

e. Both railway service and trucks are available as land transportation. The road connecting the port with Guadalajara is improved and most of it has four lanes. The condition of the railway is the same as at other ports, but a Department of Operation was established at Manzanillo under the direct control of the Guadalajara Pacific Regional Office in May 1989 to improve the arrangement of freight cars and locomotives.

f. According to the result of the forecast, the handling volume of imported and exported general cargo is expected to increase rapidly, even excluding the comparatively large cargo volume which is supposed to shift to Lazaro Cardenas.

g. The volume of containerized cargo will also increase along with the increase of general cargo.

h. The handling volume of imported agricultural bulk cargo is estimated to increase steadily as Manzanillo is located close to Guadalajara, one of

the main demand areas for agricultural products.

However, the amount of this cargo will depend on the storage capacity for grain at the port.

i. The main origin/destination areas for the import/export cargoes are the Far East including Japan, and the U.S.A. and Canada, while the handling volume to and from other countries is negligibly small. Especially, the cargo to the Far East comprises around 84% of the exports.

j. The development area of the port is still sufficient in the San Pedrito Lagoon which is being utilized as the inner port.

k. Other basic conditions are the construction schedule of wharf C which consists of berths No. 7 to No. 9 and the land use plans of main users in the port area.

6.1.4 Port of Mazatlan

a. The Port of Mazatlan is located to the south of the California Gulf, across from Cabo San Lucas at the southern tip of Baja California.

b. The hinterland of this port are regionally limited to such states as Sinaloa and Sonara for the imported general cargo and such states as Nayarit, Sonara and Sinaloa for the exported general cargo.

c. The distances on road from the port to the main cities in western Mexico are as follows:

Culiacan: 223km, Los Mochis: 430km, Tepic: 293km, Guadalajara: 519km.

d. The main roles of this port are classified as follows:

i. To supply fertilizers for agriculture in the hinterland
ii. To load the agricultural products and fish products
iii. As a gateway to Baja California

Besides the above roles the port has been included into the cruising route on the west coast of the American Continent. Recently the calling of

cruising ships has become important among the port activities, for the promotion of tourism is one of the most important policies in this region. Then the cruising ships have priority in berthing.

e. Both railway service and trucks are available as land transportation. The railway service is from the U.S. border to Guadalajara, which is one of the main lines. Most of the roads connecting the port with the main cities are two lane carriages.

f. The handling volume of the imported general cargo has decreased to almost zero recently and is estimated not to grow greatly in the future. While the exported general cargo, mainly garbanzo beans and tuna fish, are estimated to grow moderately.

g. The future trend of the movement of the containerized cargo is estimated to be similar to that of the general cargo. It will be affected by the new liner services which might be provided at this port in the future.

h. The handling volume of the imported agricultural bulk cargo is estimated to decline slightly in the future.

i. The main destination areas for the exported general cargoes are currently Europe and Latin America via the Panama Canal, which occupy around 85% of the total export volume. On the other hand, the origin areas for the imported cargo are the Far East Including Japan, the U.S.A., Canada and Europe.

j. The future development area of the port for cargo handling is limited, because of the ferry terminal and PEMEX berth at the entrance and the fishing industries at the inner part of the port. The land area is narrow and surrounded by the urban area.

Over the very long term, a development area may be provided in the farthest inner area of the port.

6.1.5 Port of Guaymas

a. The Port of Guaymas is located in the middle of the California Gulf and is a link to the sea for northwest Mexico. And it is also a gateway to Baja California via ferry services.

b. Most of the imported and exported general cargoes are transported to and from the state of Sonora where the port is located, although a small volume of cargo is transported to Baja California for imports and from Sinaloa and Chihuahua for exports.

c. The distance from the port to the U.S. border is about 420km, and the port is connected with the U.S.A by railway and road.

The distances on road from the port to the main cities in the hinterland are as follows:

Hermosillo: 143km, Nogales: 420km, Ciudad Obregon: 130km,
Los Mochis: 351km

d. The main roles of this port are classified as follows:

i. To supply consumer goods, feed and fuel oils and assemblies
ii. To load agricultural products and mineral products
iii. As a gateway to Baja California

e. As for land transportation, both railway and truck are available, but most of the cargoes depend on trucks, because the hinterland of the port is relatively close and the railway service is not available to most origins and destinations.

f. The handling volume of the imported and exported general cargo is estimated to grow at a relatively moderate rate of increase as described in section 5.4.2.

g. The movement of the containerized cargo at this port hereafter will be similar to that of the general cargo.

The import of automobile parts, which is now the main containerized cargo at the port, might be shifted to land transportation via the U.S.

border.

h. Guaymas is expected to continue to retain an important role as a base port for the import of agricultural bulk cargo, although the share in the handling volume is estimated to decline gradually.

i. The main destination areas for the exported general cargo are presently Europe, Africa and Latin America via the Panama Canal, while the origin counties for the imports are Japan, Canada, Honduras and Spain.

j. The future development potential at the present port area is limited. However, the Port of Guaymas may not require a large development area hereafter, because most of the bulk cargoes are located through specific handling systems.

6.1.6 Port of Ensenada

a. The Port of Ensenada is located at the northern part of Mexico and faces the Pacific Ocean. It is about 110km from the port to the U.S. border.

b. The hinterland of Ensenada is limited within Baja California for both the imported and exported general cargo.

c. The distances on road from the port to the main cities in the hinterland are as follows:

Tijuana: 110km, Mexicali: 300km, San Luis Rio Colorado: 370km.

d. The port was a base for the export of cotton which was produced around Mexicali until the early 1980's. But the export route has been changed to the West coast ports of U.S.A. Then the present main roles are;

i. To handle fish and fish products,
ii. To supply fertilizers to the agriculture in the hinterland, and
iii. To supply consumer goods to Cedros Island

But the calling of cruising ships has become important among the port

activities recently, because they call regularly.

e. The land transportation between the port and its hinterland is carried out only by trucks, the supply of which has not become a problem because of the relatively small cargo volume.

f. Considering the port activities, especially the movement of the general foreign trade cargo, the competition between the Port of Ensenada and the ports on the west coast of U.S.A. such as Long Beach and Los Angeles should be considered. The cargoes related to Maquiladora factories located around the border are transported directly on road to and from the U.S.A.

g. The imported general cargo volume has continued to decrease to the lowest level within the six ports, but is expected to increase in the future at a significant growth rate.

As for the exported general cargo, the handling volume is recently showing a gradual increase due to the increasing export of tuna fish, and is estimated to grow at a considerable rate of increase in the future, although remaining at a low level in terms of the volume handled.

h. New calling of liner vessels, consequently the handling of containers, will be expected at this port in the future. However, the calling of liner vessels is considered to be unstable because of the reason mentioned in f.

i. The main destination areas for the exported general cargo are Europe and the Far East including Japan, while the origin areas for the imports are the Far East including Japan, Canada and Central America.

j. The future development area in the port will be sufficient, considering the future demand of this port.

k. Another basic condition is the repair of the breakwater to reduce the cargo damage by sea water and to increase the calmness of the basin.

6.2 Present Situation of International Container Trade

6.2.1 Characteristics of the Trade

a. The standard type of container terminal is composed of four main areas for basic container handling operations, which are: vessel operation, storage operation, interchange operation and operation in the container freight station. Each operation is executed at a separate area.

The vessel operation is usually executed by gantry cranes at an apron area. The storage operation is done at the container yard. The interchange operation is executed at the gates where containers are received from or delivered to customers. The container freight station is used for stuffing cargo into containers and unloading cargo from containers.

b. Considering the above basic components of the container terminal, there are no international standard type container terminals at the ports on the Pacific coast of Mexico. Most of the ports use conventional general cargo terminals for container handling. Basic facilities such as CFS and gates are not set up at some ports and the cargo handling equipment such as yard tractors, trailers, fork lifts and transfer cranes are not sufficient at every port. As for gantry cranes especially, they are only installed at the Port of Lazaro Cardenas and Salina Cruz. As the other four ports have no gantry cranes, the vessels calling at these port have to use ship gear for loading and unloading.

c. As described in Chapter 3 and 5, the containerized ratio of general cargo is about 50% of total cargo movement and the remaining general cargoes are carried in break bulk. Therefore, the types of vessels calling at the ports are mostly container-bulker (COMBO) or multipurpose, the holds of which are designed to accommodate bulk commodities, general cargo in break bulk and container cargo. Only two full container vessels with cell-guides are assigned for this trade.

d. The container mother vessels on the major container trunk lines are operating on the basis of a fixed day weekly service (FDWS) at every calling port in order to provide good customer services. The sailing

intervals in this trade, however, are one to three sailings per month and the actual calling data is not always so punctual.

e. Almost all the shippers and consignees are located in the urban areas of the central region. Thus, the arrangements for transporting the export cargoes from shippers and delivering the import cargoes to consignees are executed by the freight forwarders at each port. The status of the freight forwarders is a hereditary right and they work as license holders at the respective ports.

6.2.2 Present Container Service Routes to the Pacific Coast Ports

(1) The Far East, Japan/Mexico

1) TMM (Transportacion Maritima Mexicana)

TMM deploys 6 COMBO type vessels of 26,000 - 31,000 G/T with container capacities of 1,502 TEU up to 2,069 TEU at a speed of 15 - 17 knots. The service pattern is 3 sailings per month. The calling ports are as follows:

(Guaymas) → Lazaro Cardenas → Salina Cruz → Manzanillo → Long Beach → ports in Japan and the Far East → Long Beach → (Guaymas) →

TMM's vessel regularly called at the Port of Guaymas up to the middle of July 1989. However, in connection with the decrease of their main container cargo, they are said to be planning to suspend calling at Guaymas in the near future.

2) CACTUS (Japanese shipping companies consortium)

The consortium consists of Japanese four shipping companies. They deploy multipurpose type vessels of about 13,000 G/T with a schedule of 2 sailings per month. Their service pattern is one way service from the Far East, Japan to Mexico and Central America. The calling ports are as follows:

Ports in the Far East → 3 or 4 ports in Japan → Manzanillo → Acapulco → ports in Central America → (off hire) 30 - 40 America →

(2) The West Coast of America/Mexico

1) Gran Colombia Line

They assign multipurpose type vessels with 18,000 G/T on a schedule of 1 sailing per month. They handle 40 - 50 TEUs of containers per vessels. The calling ports are as follows:

Ports on the west coast of America → Manzanillo → Salina Cruz → ports in Central America → Buenaventura → ports in Central America →

2) Canadian Tropical Line

They operate multipurpose type vessels with an interval of 1 sailing per month and handle 20 - 30 TEU of containers at Mexican ports. The calling ports are as follows:

Vancouver → San Francisco → Los Angeles → (Manzanillo) → Lazaro Cardenas → ports in Central America → Lazaro Cardenas

They call at the port of Manzanillo subject to cargo movement.

(3) Other Countries/Mexico

1) d'AMICO Line

They deploy 2 full container vessels with a capacity of 1,140 TEU, 2 semi-container vessels and 1 bulker with an interval of 22 days. The calling ports are as follows:

Ports in Italy, Spain → (Panama Canal) → Mazatlan → ports in the U.S.A. and Canada → Mazatlan → (Panama Canal) →

The vessel discharges about 50 empty containers at the Port of Mazatlan on the north-bound voyage and makes a second call at the Port of Mazatlan on the south-bound voyage to load the stuffed garbanzo beans and refrigerated tuna in those containers.

2) TMA (Transport Maritimo Argentina)

They operate multipurpose type vessels which call at Mexican ports bimonthly. The vessel size is about 18,000 G/T with a container capacity of 50 TEU. The calling ports are as follows:

Port in Argentina → (the Magellan) → ports in Chile →
Manzanillo → the west coast of the U.S.A. →(the Magellan)
→ Ports in Argentina →

(4) Non-Direct Service to Mexican Ports

1) Nedlloyd Line

They stopped calling directly at the Ports of Manzanillo and Acapulco since March, 1989 and started a new feeder service from the port of Puerto Quetzal, Guatemala last April. The container mother vessels come monthly from the West African ports and ports in the Far East and Japan to Puerto Quetzal as the hub port in Central America, where they discharge and load all container cargoes which are to/from the following ports in Central America. They deploy their own feeder vessel by the name of "Nedlloyd Loire" with a container capacity of 379 TEU at 14 turn-round days.

The calling ports and rotation are as follows:

Puerto Quetzal, Guatemala → Manzanillo → Acapulco → Acajutla,
El Salvador → San Lorenzo, Honduras → Puerto Caldera,
Costa Rica → Puerto Quetzal →

6.3 Examination of the Container Network

6.3.1 The Operation of Container Mother Vessels

a. The fundamental principle of operating container mother vessels is to pursue the volume scale merit by mass transport, to shorten the transit time of one voyage by limiting the number of calling ports, to minimize vessel operating cost by deploying larger vessels and to decrease time in port. Further, a fixed day weekly service (FDWS) by the container mother vessel in the current competitive trade is necessary factor for better customer service.

b. In general, when a shipping company makes a decision to have a container mother vessel call directly at port, the following points are deeply examined.

i. Demand forecast of container cargo volume in the future
ii. Balance of in/out container cargo movement considering the origins and the destinations
iii. Total cargo volume and ocean freight gross revenue per call
iv. Geographical location of the port on the way or by deviation
v. Port and berth faciliteis and ancillary service level so that a vessel can call safely and smoothly
vi. Systematic and effective flow of container handling operation in the port
vii. Smooth arrangement of land transportations to/from the hinterland

6.3.2 Concept of the Feeder Service

a. Cargoes destined to or originated from some ports where container mother vessels do no directly call are transferred by feeder vessels and transshipped from or onto mother vessels at appropriate mother vessel calling ports. The reasons why container mother vessels do not directly call at some ports and instead arrange transshipment by feeder vessel service are summarized in two categories. One is that the feeder port is not appropriate for calling by a mother vessel due to the physical inadequacy of the port facilities such as channel, turning basin, wharf,

cargo handling equipment, etc. Another is the view-point of economy, namely it may be impossible for gross freight revenue from calling at the feeder port to cover the total expenses of the mother vessel's cost, bunkering cost, port charges, cargo handling charges, etc.

b. There are three service operating procedures of feeder vessels. One is to use a common feeder on a commercial basis. Another is a cooperating feeder service by a consortium of mother vessel operating companies or their affiliated companies. The third is an independent exclusive feeder service by the mother vessel operating company or its affiliated company.

c. In case a local port is covered by a feeder vessel instead of direct calling at the port by a container mother vessel, the cost relations between a container mother vessel and a feeder vessel have to be satisfied, in general, by the following equation.

Mother vessels costs > Freight revenue for feeder vessels > Feeder vessels costs

The calculation is to be executed on the basis of the annual average per voyage in order to eliminate the fluctuating number of containers by voyage.

The details of each item are as follows:

i. Mother vessels costs
   - port charges at the feeder port including pilotage and towage
   - fuel charges to the feeder port and from the feeder port to a hub point in the direction of the next calling base port

ii. Freight revenue for feeder vessels
   - freight for export containers
   - freight for import containers
   - freight for empty containers in case a common feeder serves on a commercial basis

iii. Feeder vessel costs
   - port charges at the feeder port and the base port including pilotage and towage at both ports
   - fuel charges from the base port to the feeder port and from the

feeder port to the base port

- container handling charges for loading and discharging at the feeder port

d. Generally speaking, the optimum size and type of feeder vessel is a vessel of 200 - 500 TEU with self-sustained ship gear at a speed of 13 -15 knots. The size is, of course, selected by the estimated container cargo volume at the feeder ports. The operating pattern and rotation of a feeder vessel are decided by considerations to minimize deviation, to save bunkering cost, to connect with the schedule of the mother vessel in a timely manner, etc.

The most important point for good customer service is to arrange smooth and quick transshipment by a punctual schedule of the feeder vessel.

6.4 Formulation of the Container Network System

6.4.1 Containerized Cargo Volume by Port and Trade Area in 2005

a. Table 6.4.1 is excerpted from Tables 5.5.1 and 5.5.2 in Chapter 5 and the figures in the trade area are calculated based on the current shares of the O/D investigations in 1985 1986. Therefore, these forecast figures by trade areas in Table 6.4.1 may change in the future.

b. The total volume of 2,475,000 tons at Manzanillo and Lazaro Cardenas represents a 68.8% share of the six port total, and the volume at each of these two ports is far larger than those of the other four ports. The cargo of the two trade areas of I. (Japan, Far East) and II. (U.S.A., Canada) total 2,635,200 tons which represents 73.3% of the volume of the total trade area. Trade area IV. (Europe, Africa, Latin America via Panama Canal) comprises a 15.9% of the total. However, the import volume is only 13.5% of the export volume.

Table 6.4.1 Containerized Cargo Tonnage by Trade Area in 2005

(unit; 1,000 tons)

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

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

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

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

(4) Ensenada is categorized in Trade Area I

Table 6.4.2 Top 10 Containerized Volume by Week in 2005

(unit: TEU)

No.	Trade Area	Port	Import	Export	Total
1	I	Manzanillo	601	755	1,356
2	I	Lazaro Cardenas	374	601	975
3	II	Lazaro Cardenas	562	330	892
4	I	Salina Cruz	150	370	520
5	III	Manzanillo	121	309	430
6	IV	Guaymas	35	264	299
7	IV	Manzanillo	0	239	239
8	IV	Mazatlan	24	212	236
9	II	Salina Cruz	123	63	186
10	IV	Lazaro Cardenas	86	92	178
T O T A L			2,076	3,235	5,311

Remarks: (1) The number of TEUs is calculated on the basis of 9 tons per TEU for Import and 16 tons per TEU for Export at Salina Cruz and 12 tons per TEU for other Exports.

(2) Trade areas I - IV are the same as in Table 5.4.1

c. The top 10 containerized volumes by port and by trade area are shown in Table 6.4.2 on a weekly TEU volume basis. The top three total 3,223 TEUs and occupy 60.7% of the total. The weekly volume of No. 4 and 5 is around 500 TEUs, however, the imbalance between imports and exports is remarkable.

This means some arrangement to provide empty containers for export cargo has to be studied. The volumes of No. 6, 7 and 8 are quite substantial. However, considering the low import volume, it may be difficult for all export cargo to be containerized due to a shortage of empty containers.

6.4.2 Examination by Trade Area for Feeder Network System

(1) Trade Area I

a. The total volume in 2005 is estimated at 1,909,200 tons per year or about 37,000 tons per week, which would motivate a few shipping companies to make their container mother vessels of 2,500 - 3,000 TEU call at all these ports directly on a weekly basis. However, as for the ports of Guaymas and Mazatlan by considering the cost relation equation in 6.3.2.c, it seems unwise for a container mother vessel calling directly at the ports.

b. There seems to be no possibility to install gantry cranes at the Ports of Guaymas and Mazatlan due to the large amount of investment, and without such cranes there would be high operation costs due to the slow cargo handling operation. TMM's intention of skipping the port of Guaymas is a typical example caused by a decrease of cargo volume.

(2) Trade Area II

a. The total cargo volume of 726,000 tons per year comprises 20.2% out of the total trade volume and the Ports of Manzanillo, Lazaro Cardenas and Salina Cruz are three big ports. It seems very difficult for a container mother vessel to call at the Port of Guaymas directly because of the small volume of import cargo and the estimated high deviation cost.

b. Further, because of the imbalance between imports and exports, too many empty containers would be piled at the Port of Lazaro Cardenas, especially. A container-measures to use these empty containers even for other trade areas might be studied by the shipping companies.

(3) Trade Area III

a. The cargo volume of both imports and exports is concentrated at the Port of Manzanillo, the annual volume of which represents 88% of the trade in this area. The average volume per week of the other ports might be less than 50 TEU, so it seems that no container mother vessel would call

directly at these ports.

(4) Trade Area IV

a. The 88.1% of the total annual volume is export cargo. The excessive imbalance between import and export cargo would cause some trouble for arranging empty containers for export. The d'AMICO Line's operating procedure in 6.2.2 (3) 1) might be an idea to solve the positioning of empty containers for stuffing export cargo.

b. As this trade area increases the three regions of Europe, Africa and Latin America via the Panama Canal, the number of mother vessels calling at these ports is not likely to be so large.

(5) Trade Area V

a. The cargo is mainly to/from New Zealand and Australia via Los Angeles. Therefore there is some possibility of transferring these cargoes to mother vessels deployed in trade area II. In that case, cargo will be transshipped at the Port of Lazaro Cardenas.

6.4.3 Selection of the Pivotal Base Ports

(1) Necessity of Pivotal Base Ports

a. By the cost relations between a container mother vessel and feeder vessels as mentioned in 6.3.2.c, the operation costs of feeder vessels service are supposed to be cheaper than those from direct calling by mother vessels at all the ports. When common feeder vessels on a commercial basis are assigned to the ports with rather small cargo volume, even a small number of containers to/from several trade areas can be collected at the pivotal base parts where the mother vessels of each trade area call directly.

b. By relocation of empty containers which might not be used at some feeder ports upto the pivotal base ports by common feeder vessels, a shipping company can use them in other trade areas and further, can lease

the empty containers to other shipping companies. The effective use of empty containers by such arrangements would promote the containerization of general cargo on the Pacific coast ports.

c. By selection of the pivotal base ports, it may be possible to make concentrated investments for the ports facilities and equipment in order to improve the port services.

d. Based on the above, one or two pivotal base ports among the six ports should be selected and other ports should be covered by feeder vessels service.

(2) Pivotal Base Ports

a. As shown in Tables 5.5.1, 5.5.2 and 6.4.1 the containerized cargo volume between imports and export at the Ports of Guaymas and Mazatlan is unbalanced. The port of Guaymas, particularly, lost its main container cargo of CKD from Japan since the latter half of 1989 because the user changed the transport route of this cargo to cross boader shipments via Los Angeles.

b. Although a gantry crane is installed at the Port of Salina Cruz, and further, there is a substantial volume of cargoes in trade areas I and II, the imbalance between imports and exports is rather remarkable. In addition to the above, the total cargo volume might be said to be rather small compared with the volumes at Manzanillo and Lazaro Cardenas.

As for port facilities at the Port of Salina Cruz, ship entry/exit at night time is presently prohibited due to the narrow channel. However, as construction works for expanding the channel are already started and are expected to be completed shortly, a permission of ship entry/exit at night time would be examined by the pilots concerned. Another problem is the strong wind blowing from the Gulf of Mexico over the Isthmus of Tehuantepec, which sometimes interrupts cargo handling operations.

c. Considering the present port conditions, the cargo volume forecast and the future development policy described in section 6.5 of this Chapter, the two ports of Lazaro Cardenas and Manzanillo are appropriate to serve as the

pivotal base ports on the Pacific coast.

Furthermore, as for the land transportation to/from the ports, both railway and trucks are easily available for the following cities in the hinterland;

Guadalajara, Morelia, Colima, Monterrey, Aguascalientes, Cuernavaca, Mexico DF, etc.

It should be noted that the Port of Salina Cruz could serve as an ancillary base port next to the two ports, judging from the containerized volume level and geographic condition of the Port of Salina Cruz.

6.4.4 Container Network to Local Feeder Ports

a. Smooth transshipment from/onto container mother vessels to/from feeder vessels is very important. Although the present mother vessel calling intervals at the pivotal base ports are 2 or 3 sailings per month, a FDWS which is the typical service pattern of container mother vessels in major trunk line routes would be introduced on this trade in the future. Therefore, feeder service from the pivotal base ports would also be expected on a weekly basis.

b. As for the Port of Ensenada, mother vessels call directly at the port considering that the port location is on navigational route. And as cargoes to/from the Port of Ensenada seem not to affect the other ports trade, the container feeder network system is examined among the other five ports.

c. Table 6.4.3 shows nautical distance between port and necessary navigating times at each speed. In case of feeder vessel from the base port of Lazaro Cardenas calls at all the feeder ports of Guaymas, Mazatlan and Salina Cruz, it takes 7 days, 5 hours, 36 minutes at a speed of 15 knots. If is assumed that port stay time is 10 hours at each port, it takes 8 days, 21 hours and 36 minutes per one round voyage.

Table 6.4.3 Distance and Necessary Times

Ports	Nautical Mileage	Feeder Vessel's Speed				
		10 knots	13 knots	15 knots	17 knots	20 knots
		(D-H-M)	(D-H-M)	(D-H-M)	(D-H-M)	(D-H-M)
Guaymas	377	1-13-42	1-05-00	1-01-08	0-22-11	0-18-51
Mazatlan	303	1-06-18	0-23-18	0-20-12	0-17-49	0-15-09
Manzanillo	175	0-17-30	0-13-28	0-11-40	0-10-18	0-08-45
Lazaro Cardenas	462	1-22-12	1-11-32	1-06-48	1-03-11	0-23-06
Salina Cruz						

Source: World-Wide Distance Chart, 1982
(Japan Navigating Officers' Association)

This means only one feeder vessel at a speed of 15 knots is not sufficient for covering all the feeder ports within a week unless a faster feeder vessel is deployed at a higher speed of about 20 knots or a few feeder vessels are assigned with an interval of less than one week.

d. Table 6.4.4 shows several patterns of feeder networks. Also, Fig. 6.4.1, Fig. 6.4.2 and Fig. 6.4.3 show rotation maps based on Table 6.4.4.

Table 6.4.4 Patterns of Feeder Network

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

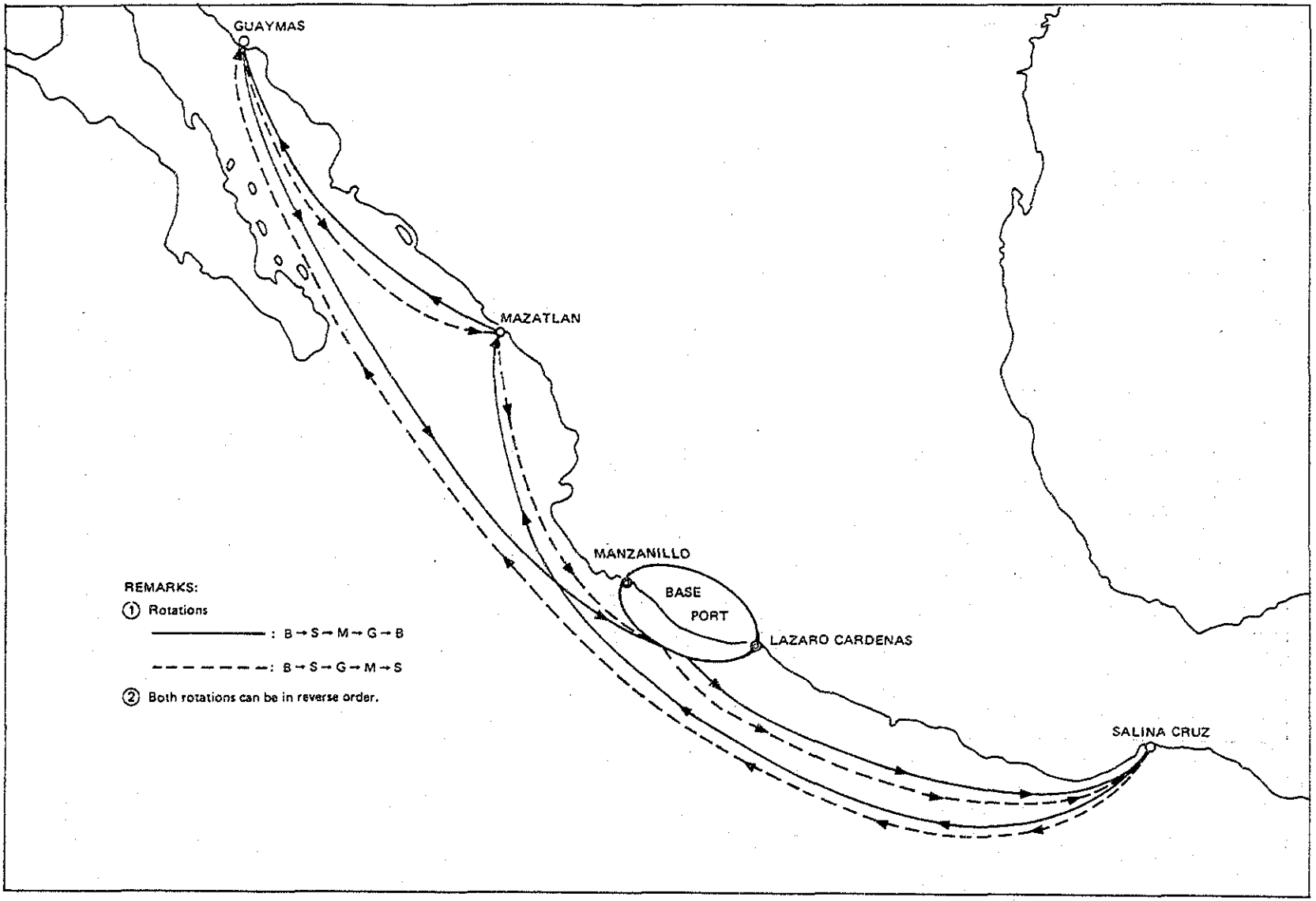

Fig. 6.4.1 Feeder Vessel Rotations, CASE I

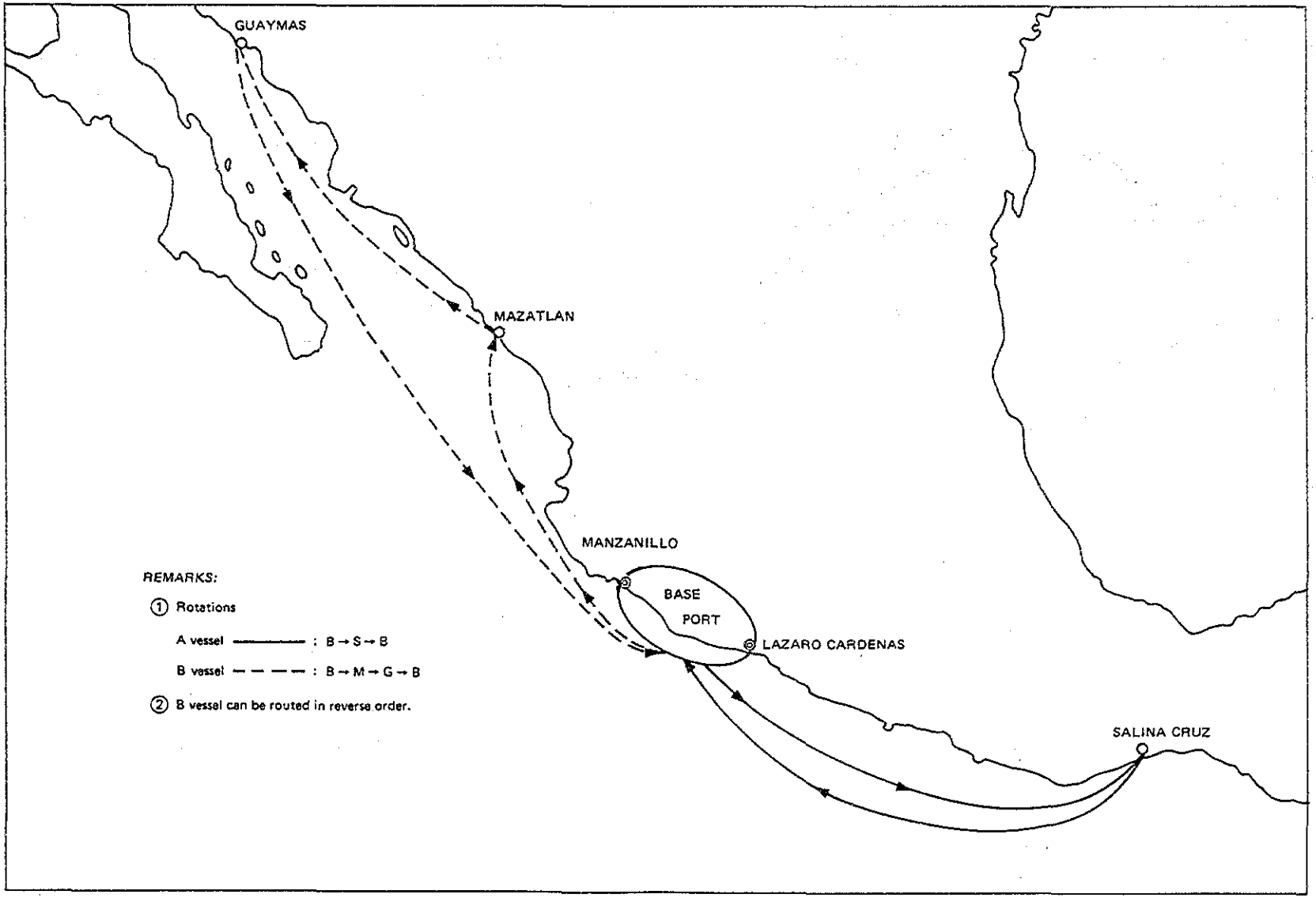

Fig. 6.4.2 Feeder Vessel Rotations, CASE II

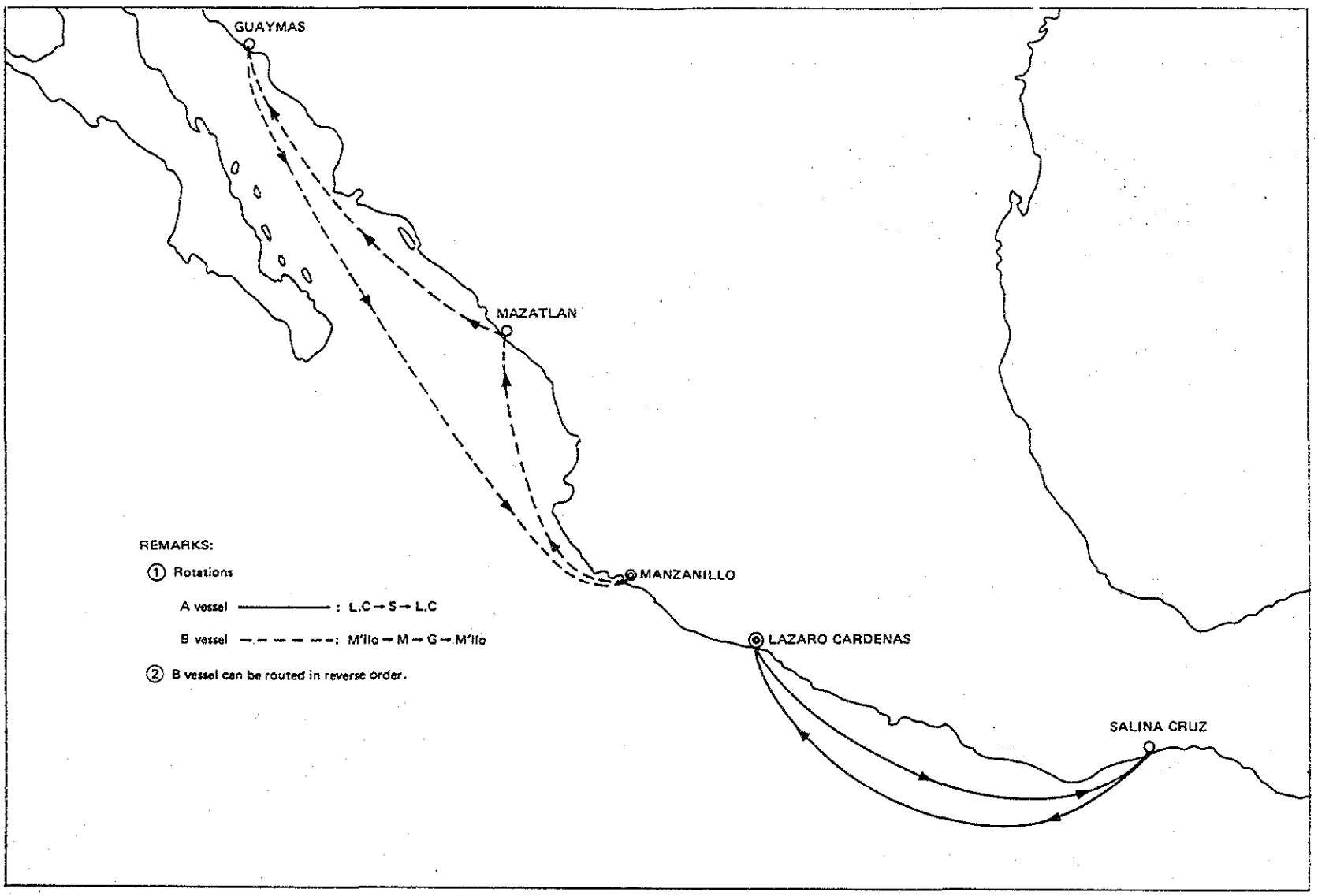

Fig. 6.4.3 Feeder Vessel Rotations, CASE III

The assignment of 2 vessels in CASE I may be another pattern. However, taking a carefully thought out measure, CASE III seems preferable for better customer service because of the following reasons:

i. By separate service, the navigation mileage of a feeder vessel can be shortened; e.g.

Case I		2,634 miles
Case II	A	924 or 1,274 miles
	B	1,360 or 1,710 miles
Case III	A	924 miles
	B	1,360 miles

ii. When only one base port is selected, the port has to prepare more port facilities and equipment in order to handle the entire container cargo including cargoes to other feeder ports.

iii. The total distances for land transportation from the port get bigger and a certain improvement of road conditions, especially between Manzanillo and Lazaro Cardenas, would be required for a large volume of container traffic to/from the port.

iv. There is no choice for customers to select a more convenient port for them if there is only one pivotal base port, so this does not respect the long-term relations between the customers and their forwarders.

v. As cargo origins and destinations are scattered over a wide hinterland area, it seems difficult to concentrate container cargo to/from either of the two ports.

vi. Both the ports have sufficient space for developing a new container terminal. Even if only one port is selected for the construction of a new container terminal, the construction costs will not be much lower compared with the total costs of two separate container terminals at the two ports. Furthermore, there might be some trouble with the long-term terminal construction scheme, if the base container terminal is concentrated at one port.

vii. There is not such a big time loss for a mother vessel to call directly at the two ports.

viii. Considering the possibility of damage from earthquakes storms and

other natural disasters as well as the viewpoint of overall national security, it is always preferable to divide the facilities into two locations.

e. Under the feeder vessels operations in Case III, while one feeder vessel serves from the Port of Manzanillo to the Ports of Mazatlan and Guaymas, the other serves from the Port of Lazaro Cardenas to the Port of Salina Cruz. In this case, one round voyage time at speed of 15 knots including 10 hours stay time at each port is 5 days, 0 hours and 40 minutes for the former and 3 days, 9 hours and 36 minutes for the latter. When the total container volume per shipment is not enough to justify a feeder vessel call at the feeder ports, irregular schedule service is another possibility. Land transportation by truck is also to be studied for a small number of transshipment containers.

f. Considering the location of the Port of Ensenada at the Pacific coast side of northern Baja California, it seems not so feasible for the port to be included the above feeder netwrok system.

6.4.5 Some Other Comments on the Container Network on the Pacific Coast

(1) Trans Pacific Container Trade and Cross Border Movement

a. As of the end of 1988, the following numbers of full container vessels were assigned on the three biggest trade routes in the World:

i. The Far East, Japan/the West coast of the U.S.A. and Canada
-- 245 vessels, 531,571 TEU

ii. The Far East, Japan/Europe, Mediterranean Sea
-- 226 vessels, 446,379 TEU

iii. The East coast of the U.S.A. and Canada/Europe
-- 184 vessels, 326,864 TEU

Especially, the route from the Far East and Japan to the West coast of the U.S.A. and Canada was the most competitive trade in scale and transit time. Major shipping companies deployed larger size full-containers vessels with a capacity of 2,500 - 3,000 TEU at a high speed of 22 - 23

knots. Most of the containers discharged at the West coast ports were immediately transferred to the Mid West, Atlantic and Gulf areas using double stack trains. The transit time of container vessels from Yokohama/Tokyo to Los Angeles/Long Beach is 9 days, thence by transloading on DST it takes 5 days to Chicago, 7 days to New York and 6 days to Houston.

b. Some container cargoes destined to or originated from Mexico are carried across the border of the U.S.A. from/to the Far East and Japan in stead of discharging or loading at ports on the Pacific coast of Mexico. Cargo to Maquiladora factories in Tijuana, Mexicali, Ciudad Juares and Nuevo Laredo is a main source of cross border shipments. Some major shipping companies report that they may start a new container service using their double stack trains from the U.S.A. to a few cities in Mexico such as Monterrey, Guadalajara and Mexico City. Some volume of auto parts in containers destined to a factory in Hermosillo will be carried on double stack trains from Detroit this autumn. Table 5.4.5 shows cross border cargo volume in 1987.

c. As for the merits of cross border container movements, the following points are considered:

i. Faster transit time than via the Pacific coast ports of Mexico
ii. Punctual frequency
iii. Safer transport from door to door
iv. Savings in storage costs and interest on goods
v. Through transport rates for sea and land
vi. Simplified customs procedures

The development in container cargo flow to Mexico via the border of the U.S.A. should be carefully watched and studied before a container network system is established for the ports on the Pacific coast of Mexico.

(2) Development of the Port of Topolobampo

Puertos Mexicanos has a project to develop the Port of Topolobampo, which is now used for domestic maritime transportation, as a container port with the cooperation of the state of Sinaloa. The study team learned the outline of the project from Puertos Mexicanos and visited the port during

Table 6.4.5 Cross Border Cargo Volume by State, 1987

(unit: tons)

States	Import		Export		Total	
	Volume	%	Volume	%	Volume	%
Aguascalientes	433	1.0	-	-	433	0.7
Baja California	17,887	41.2	423	1.9	18,310	27.8
Baja California Sur	58	0.1	261	1.2	319	0.6
Campeche	-	-	29	0.1	29	0.0
Chihuahua	4,834	11.1	50	0.2	4,884	7.4
Chiapas	10	0.0	-	-	10	0.0
Coahuila	190	0.4	505	2.2	695	1.1
Colima	23	0.1	12	0.1	35	0.0
Distrito Federal	13,091	30.2	5,909	26.3	19,000	28.9
Durango	33	0.1	18	0.1	51	0.0
Guerrero	180	0.4	-	-	180	0.3
Guanajuato	616	1.4	114	0.5	730	1.1
Hidalgo	27	0.1	-	-	27	0.0
Jalisco	744	1.7	104	0.5	848	1.3
Mexico	458	1.1	206	0.9	664	1.0
Michoacan	230	0.6	202	0.9	432	0.7
Morelos	166	0.4	539	2.4	705	1.1
Nuevo Leon	1,188	2.7	10,593	47.2	11,781	17.9
Nayarit	-	-	-	-	-	-
Oaxaca	-	-	-	-	-	-
Puebla	51	0.1	1	0.0	52	0.0
Quintana Roo	90	0.2	17	0.1	107	0.2
Queretaro	7	0.0	-	-	7	0.0
Sinaloa	145	0.3	250	1.1	395	0.6
San Luis Potosi	164	0.4	19	0.1	183	0.3
Sonora	1,149	2.6	665	3.0	1,814	2.8
Tabasco	-	-	-	-	-	-
Tamaulipas	467	1.1	250	1.1	717	1.1
Tlaxcala	45	0.1	-	-	45	0.0
Veracruz	369	0.9	20	0.1	389	0.6
Yucatan	1	0.0	-	-	1	0.0
Zacatecas	28	0.1	910	4.1	938	1.4
not specified	691	1.6	1,365	6.1	2,056	3.1
Total	43,375	100.0	22,462	100.0	65,837	100.0

Source: Processed and arranged from the data of the Journal of Commerce, 1987

the first site survey in Mexico. Some comments on the project, based on the data as far as the study team have been informed, are as follows:

i. The hinterland of Topolobampo is not presently considered to have a potential to be an origin or destination of a large volume of containerized cargo. The handling volume of the containerized cargo at the port would greatly depend on the development of the

industrial park which is planned to be implemented in line with the port development. Thus, the possible volume of the containerized cargo produced at the factories in the industrial park should be carefully investigated.

ii. As a part of this project there is a plan to transport containers between the port and the U.S.A. by Chihuahua Railway. It may be difficult to realize this idea taking into consideration the maritime transportation time to Topolobampo and the present situation of the highly progressed land transportation system by double stack trains in the U.S.A. Therefore, to examine the possibility of the concept, a cost and time analysis would have to be carried out in detail together with an examination of the certainty and frequency of the transportation which are also significant points to attract customers.

iii. The Port of Topolobampo is considered to have a few unfavourable natural conditions for port development. Especially, the strong tidal current at the port would have a considerable effect on the maneuvering of container vessels. Therefore, the present situation of the tidal current and its change according to the implementation of the projected reclamation would have to be investigated to realize the degree of its effect on ships maneuvering.

iv. If the Topolobampo handled a considerable volume of containerized cargo, it would be reasonable to connect this port with the base port of Manzanillo by the feeder transportation network which was examined in this chapter, because Topolobampo is located on the feeder route.

For the further development of the port, the above mentioned points will have to be studied.

6.5 Long Term Development Policy of Each Port

Based on the results of the demand forecast and the proposed container network system as well as the analyses of the present situation, the fundamental matters for the long term development policy of each port are summarized in this section, with emphasis on the development policy related to the container network.

6.5.1 Port of Salina Cruz

(1) Fundamental Roles and Functions of the Port in the Future

i. A base for the import/export of general cargoes to/from a relatively wide area including the Gulf coast and the Yucatan Peninsula.
ii. A container terminal for both mother and feeder vessels to pass the containerized cargo to/from the hinterland and to Guatemala.
iii. A base to load petroleum and its derivatives for export and domestic distribution to the Pacific coast area.
iv. To load and discharge other agricultural and mineral bulk cargoes for foreign and domestic trade.
v. To discharge domestic general cargoes to the Gulf coast and the Yucatan Peninsula.
vi. A base for fishing boats.

Among the above roles and functions, items i, ii, iii are considered to be most important.

(2) Long Term Development Policy of the Port

1) Container terminal

i. Considering the future handling volume, the construction of a new container berth as well as a large expansion of the container yard is not considered necessary.
ii. Another gantry crane as well as the cargo handling equipment in the yard should be installed.

iii. A CFS will be needed in the future.

iv. The effective management and operation of the container terminal is required.

2) Others

. Widening of the entrance channel to secure ship's entrance at night.

. Widening of the channel connecting the outer port with the inner port.

. Rehabilitation of the general cargo wharves.

. Dredging of the turning basins.

. Improvement of the railway in the port.

. Installation of necessary cargo handling facilities/equipment and a maintenance shop.

(3) Items to be investigated

. Possibility of the so-called alpha-omega plan in the long term.

. Future demand for transshipment containers to Guatemala.

. Countermeasures against the strong wind at the port.

6.5.2 Port of Lazaro Cardenas

(1) Fundamental roles and functions of the port in the future

i. A base on the Pacific coast for the import/export of general cargoes to/from a wide hinterland.

ii. A pivotal base port on the Pacific coast for the container vessels.

iii. A base for the distribution of imported agricultural bulk cargo to a wide hinterland.

iv. To load and discharge other agricultural and mineral cargoes for foreign and domestic trade, especially cargoes relating to the enterprises located within the port.

v. Discharging petroleum and its derivatives from Salina Cruz and distributing them.

vi. A role as a large port-oriented industrial complex with many private berths.

All of the above roses and functions are considered to be significant

at the port.

(2) Long Term Development Policy of the Port

1) Container terminal

i. Based on the future forecast of the handling volume of the containerized cargo including feeder cargo, another container berth is necessary, as described in Chapter 9.

ii. The present container berth should be equipped with another gantry crane and adequate yard cargo handling equipment.

iii. The new container terminal should be installed by a set of modernized facilities/equipment.

iv. A CFS and empty container yard for both berths is required.

v. The effective management and operation of the container terminal is required.

2) Grain storage silo

The grain storage silo, which was damaged by the earthquake in 1985, should be repaired and completed as soon as possible.

3) Others

i. Planning and implementation of the new access road to the container terminal and general cargo wharves in line with the future development plan of the port.

ii. Utilization of the yard with the incomplete CFS which is not used at present.

iii. Installation of necessary cargo handling facilities/equipment and a maintenance shop.

(3) Items to be investigated

i. Further investigation on the reasonable allotment of functions for container and imported agricultural bulk cargoes handling with the Port of Manzanillo.

ii. Investigation on the improvement of the road network connecting the

port with the metropolitan area with the cooperation of the governmental organizations concerned.

6.5.3 Port of Manzanillo

(1) Fundamental Roles and Functions of the Port in the Future

i. A base on the Pacific coast for the import/export of general cargoes to/from a wide hinterland.
ii. A pivotal base port on the Pacific coast for container vessels.
iii. A base for the distribution of imported agricultural bulk cargo to a wide hinterland.
iv. To load and discharge other agricultural/mineral bulk cargoes and fluids for foreign and domestic trade.
v. Discharging petroleum and its derivatives from Salina Cruz and abroad, and distributing them.
vi. A calling port for cruising ships in the future.
vii. A base for fishing boats.

All of the above roles and functions are considered to be significant at the port.

(2) Long Term Development Policy of the Port

1) Container terminal

i. Based on the forecast of the handling number of containers including feeder containers, two exclusive container berths are necessaryb in 2005, as deseribed in Chapter 9.
ii. This new container terminal should be provided with a set of modernized facilities/equipment including container cranes, container yards, yard cranes and CFS.
iii. The effective management and operation of the container terminal is required.

2) Grain storage facility

Based on the result of the forecast of the imported agricultural bulk cargo volume, a grain storage facility is considered to be necessary. In

the long term, a grain storage silo is deemed to be required.

3) Others

i. Implementation of the exclusive tourist port plan in the outer port.
ii. Completion of the berths under construction including reclamation behind the berths.
iii. Construction of the new port access road from the northern side, together with improvement of the roads within the port.
iv. Installation of necessary cargo handling facilities/equipment and a maintenance shop.

(3) Item to be Investigated

Further investigation on the reasonable allotment of functions for container and imported agricultural bulk cargo handling with the Port of Lazaro Cardenas should be investigated.

6.5.4 Port of Mazatlan

(1) Fundamental Roles and Functions of the Port in the Future

i. To load and discharge the import/export general cargoes to/from its regional hinterland.
ii. A feeder port in the container network on the Pacific coast.
iii. To load and discharge other agricultural/mineral bulk cargoes and fluids for foreign and domestic trade.
iv. Discharging petroleum and its derivatives from Salina Cruz and abroad, and distributing them.
v. A based for the ferry boat service to La Paz, Baja California.
vi. A calling port for cruising ships from the U.S.A.
vii. A base for fishing boats and the export of fish such as tuna.

Among the above roles and functions, items ii, v, vi and vii are considered to be most important.

(2) Long Term Development Policy of the Port

1) Facilities for container handling

i. A pier side container crane will not be requested.
ii. Development and improvement of the container yard should be implemented together with the installation of yard cargo handling equipment.
iii. Enough equipment for refrigerated containers will be necessary to accommodate the export of tuna fish.
iv. The effective management and operation of the container terminal is required.

2) Others

i. Widening and deepening of the entrance channel.
ii. Rehabilitation of the wharves.
iii. Dredging of the water area.
iv. Expansion and development of the cruising ship berth and related facilities to meet the future demand.
v. Utilization of the old ferry boat berth which is not being used at present.
vi. Construction and rehabilitation of the facilities for fishing boats.
vii. Installation of necessary cargo handling facilities/equipment and a maintenance shop.

(3) Item to be Investigated

Future demand of the calling of cruising ships should be investigated.

6.5.5 Port of Guaymas

(1) Fundamental Roles and Functions of the Port in Future

i. To load and discharge the import/export general cargo to/from the regional hinterland.
ii. A feeder port in the container network on the Pacific coast.

iii. To load and discharge agricultural and mineral bulk cargoes for foreign and domestic trade.

iv. Discharging petroleum and its derivatives from Salina Cruz and abroad, and distributing them.

v. A base for the ferry boat service to Santa Rosalia of Baja California.

vi. A base for fishing boats

Among the above roles and functions, items ii and iii are considered to be most important.

(2) Long Term Development Policy of the Port

1) Facilities for container handling

i. A pier side container crane will not be requested.

ii. Development and improvement of the container yard should be implemented together with the installation of yard cargo handling equipment.

iii. The effective management and operation of the container terminal is required.

2) Others

i. Improvement and utilization of No. 1 berth

ii. Removal of unused railway tracks for the effective use of the yard.

iii. Rehabilitation of the wharves.

iv. Installation of necessary cargo handling facilities/equipment and a maintenance shop.

(3) Item to be investigated

The future movement of the import of automobile parts should be investigated.

6.5.6 Port of Ensenada

(1) Fundamental Roles and Functions of Port in the Future

i. To load and discharge the import/export general cargoes to/from its regional hinterland.
ii. A relatively small container terminal for the mother vessels to pass the containerized cargoes to/from the same hinterland as i.
iii. To load and discharge agricultural and mineral bulk cargoes for foreign and domestic trade.
iv. A base of the domestic liner service connecting with the Cedros Island.
v. Calling port of the cursing ships from the U.S.A.
vi. A base for fishing boats and the export fish such as tuna fish.

Among the above roles and functions, items ii, v and vi are considered to be most important.

(2) Long Term Development Policy

1) Facilities for container handling

i. Pier side container crane will not be requested
ii. Development of the container yard should be implemented together with the installation of yard cargo handling equipment.
iii. Equipment for refrigerator container will be necessary to accommodate the export of tuna fish.
iv. The effective management and operation of the container terminal is required.
v. In case the container handling volume increase greatly, a new container terminal will be required.

2) Others

i. Development of the berths for cruising ships as well as pleasure boats facilities to accommodate the future demand.
ii. Rehabilitation of the wharves.

iii. Expansion and improvement of the breakwaters.

iv. Installation of necessary cargo handling facilities/equipment and a maintenance shop.

(3) Items to be Investigated

i. Prospect of the competition between the Port of Ensenada and the ports on the west coast on the U.S.A.

ii. Stability of calling of liner ships and container handling at the port in the future, together with the measures to promote liner ships calling.

iii. Investigation of the water quality in the port, which is becoming a issued at Ensenada and may limit the possible use of the port for cruising ships and pleasure boats.

Chapter 7. Improvement Plans of Each Port by the Mexican side

According to the contents and procedures specified in the progress report of the study, which were prepared by the study team during the first site survey, the improvement plans for each port were prepared by the Mexican side with the cooperation between Puertos Mexicanos and each ESP.

The contents of the improvement plans were discussed between the Mexican side ant the study team and were referred to by the study team for preparing the recommendation of the improvement plans which are described in the next chapter. While the contents of each improvement plan are different for each port, each plan generally consists of the following items:

1. Land Use
   - 1-1 Measures to Promote New Usage
   - 1-2 Measures to Utilize Unused Area
   - 1-3 System of Coordination Among Interested Bodies

2. Port Administration and Management
   - 2-1 Improvement of Services
   - 2-2 Improving Personnel Functions and Number in Each Section
   - 2-3 Cost Accounting of Individual Tariffs
   - 2-4 Port Finances
   - 2-5 Cargo Handling Union
   - 2-6 Statistics

3. Arrival and Dispatching Procedures and Customs Formalities
   - 3-1 Procedural Simplifications
   - 3-2 Creation of a Coordinating System

4. Land Transportation
   - 4-1 Coordination System among Interested Bodies
   - 4-2 Storage Systems and Installations

5. Cargo Handling

5-1 Measures to Improve Cargo Handling Productivity

5-2 Equipment and Machinery

5-3 Cargo Handling Plan

5-4 Gang System

5-5 Worker Training

6. Cargo Handling Machinery and Equipment and Maintenance Systems

6-1 Maintenance Policy and Methodology

6-2 Improvement in the Maintenance Workshop

6-3 Spare Parts

6-4 Disposal Equipment

6-5 Amounts of machinery and Equipment

7. Installation

7-1 Rehabilitation

7-2 Construction

8. Others

8-1 Enviromental Protection

Each improvement plan is attached to the VOL.3 Appendix.