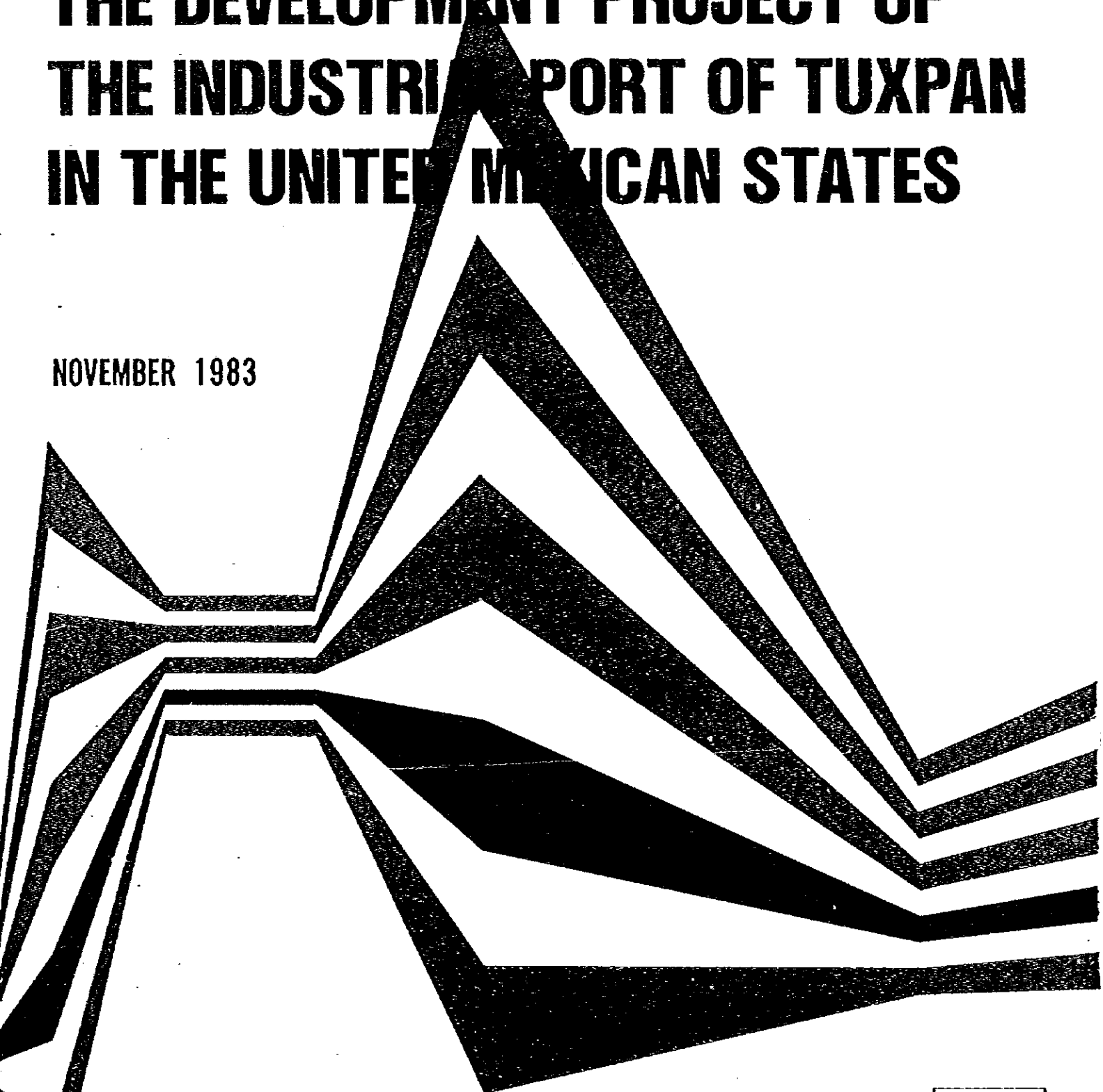


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No. 8

FINAL REPORT THE STUDY ON THE DEVELOPMENT PROJECT OF THE INDUSTRIAL PORT OF TUXPAN IN THE UNITED MEXICAN STATES

NOVEMBER 1983



JAPAN INTERNATIONAL COOPERATION AGENCY

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**FINAL REPORT
THE STUDY ON
THE DEVELOPMENT PROJECT OF
THE INDUSTRIAL PORT OF TUXPAN
IN THE UNITED MEXICAN STATES**

NOVEMBER 1983

国際協力事業団	
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PREFACE

In response to the request of the Government of the United Mexican States, the Government of Japan decided to conduct a study on the Project to develop the Industrial Port of Tuxpan and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Mexico a survey team headed by Mr. Yoshio Takeuchi, President of the Overseas Coastal Area Development Institute of Japan several times from July 1982 to September 1983.

The team exchanged views with the officials concerned of the Mexican Government over the Project, conducted field surveys and collected reference materials. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

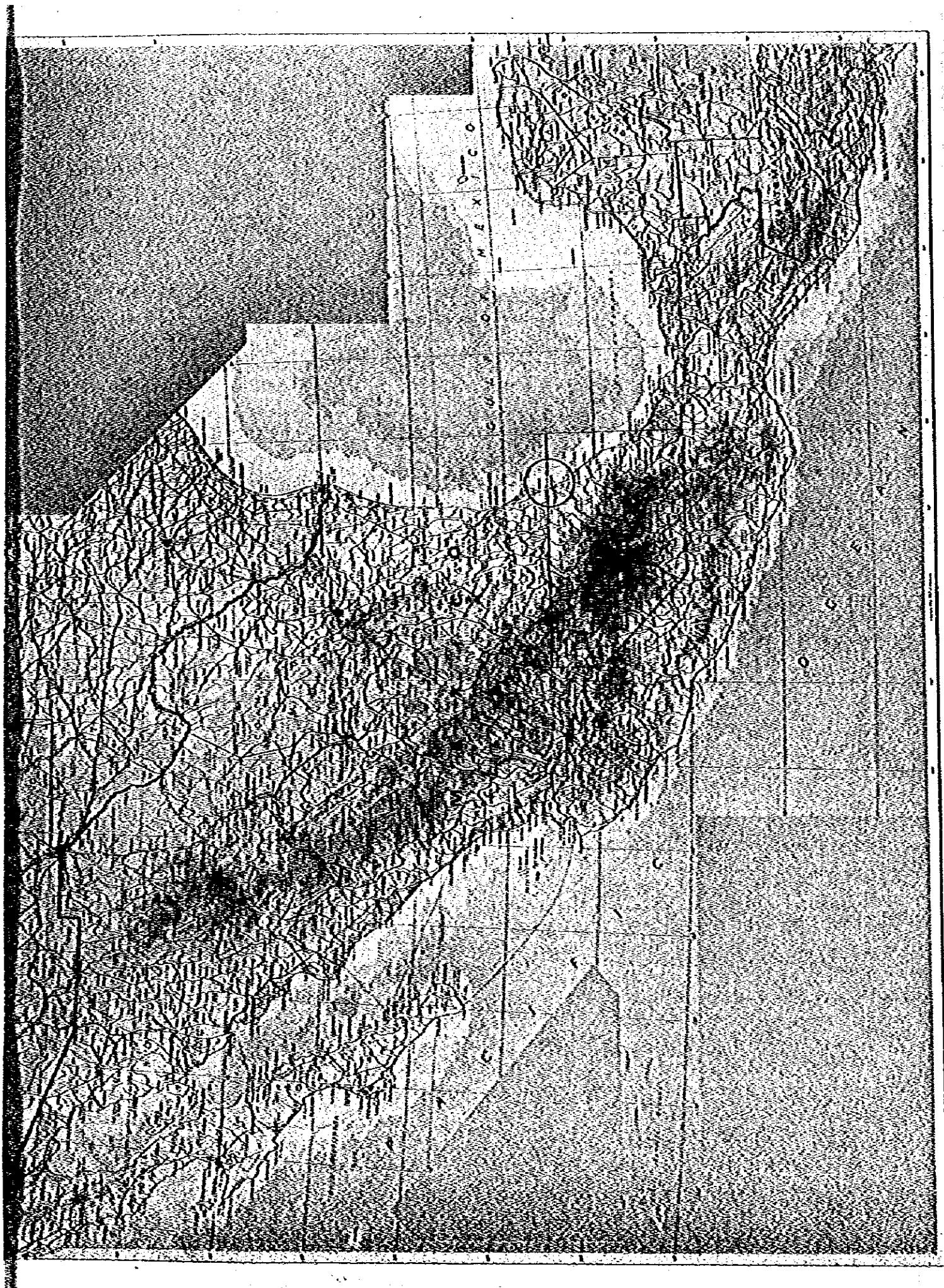
I wish to express my deep appreciation to all the officials concerned of the Government of the United Mexican States for their close cooperation extended to the team.

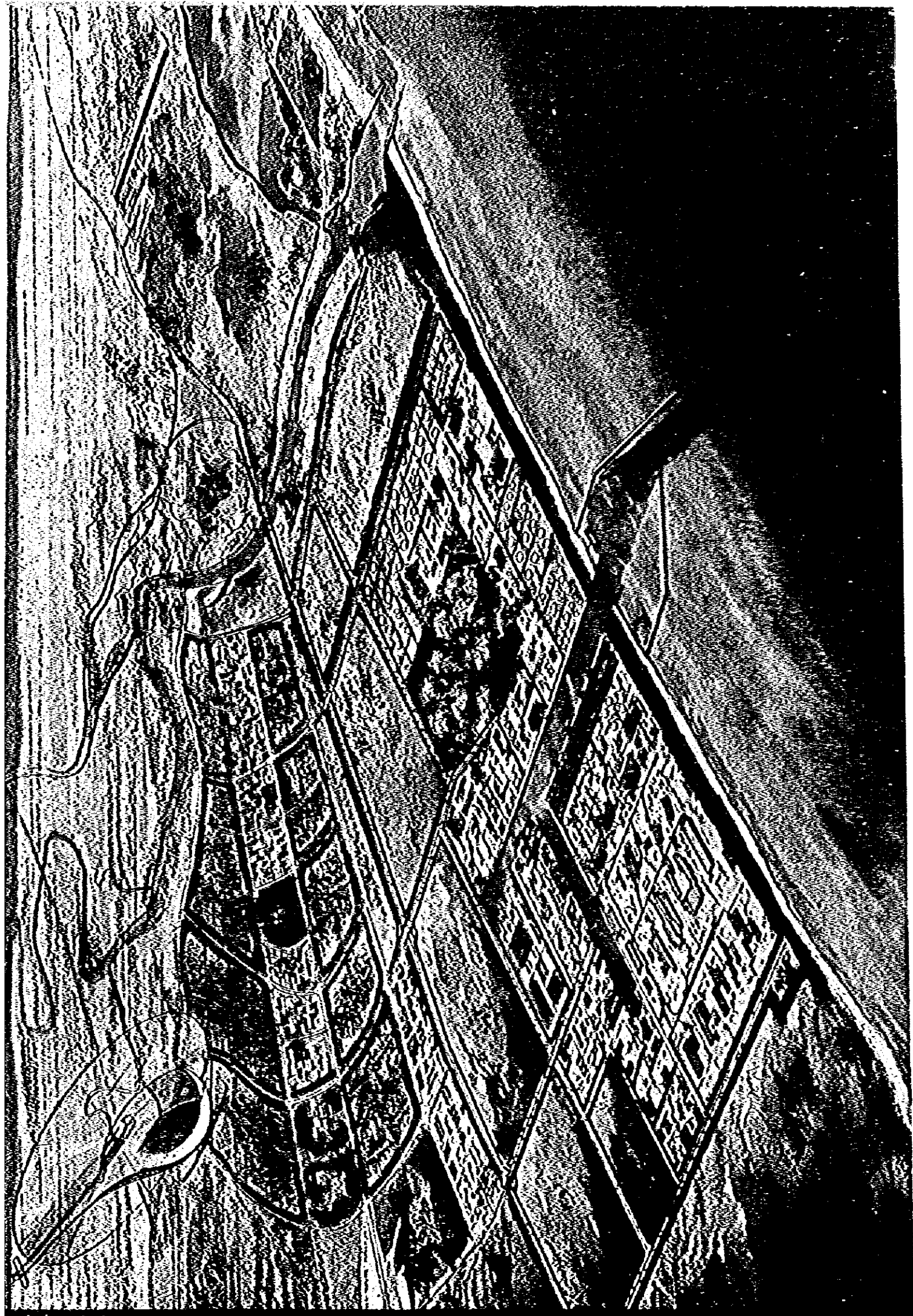
November, 1983

A handwritten signature in dark ink, appearing to read 'Keisuke Arita', written in a cursive style.

Keisuke Arita
President

Japan International Cooperation Agency





EXCHANGE RATE

US\$1.00 = M.N. 550 = 250 Japanese Yen

(As of April, 1982)

ABBREVIATION

(Term)

Area	DEVELOPMENT AREA
Project	TUXPAN INDUSTRIAL PORT DEVELOPMENT PROJECT

(National Plan)

PGD	PLAN GLOBAL DE DESARROLLO
PNDI	PLAN NATIONAL DE DESARROLLO INDUSTRIAL

(Government Organization)

CFE	COMISION FEDERAL DE ELECTRICIDAD
CNCP	COMISION NACIONAL COORDINADORA DE PUERTOS (After CPI)
CPI	COORDINACION GENERAL DEL PROGRAMA DE PUERTOS INDUSTRIALES
PEMEX	PETROLEOS MEXICANOS
PESCA	SECRETARIA DE PESCA
SAHOP	SECRETARIA DE ASENTAMIENTO HUMANOS Y OBRAS PUBLICAS
SARH	SECRETARIA DE AGRICULTURA Y RECURSOS HIDRAULICOS
SCT	SECRETARIA DE COMUNICACIONES Y TRANSPORTES
SDUE	SECRETARIA DE DESARROLLO URBANO Y ECOLOGIA (After SAHOP)
SPP	SECRETARIA DE PROGRAMACION Y PRESUPUESTO

(Industry)

BPSD	BARREL PER STREAM DAY
GM	GENERAL MOTORS (AUTOMOBILE COMPANY)
VW	VOLKS WAGEN (AUTOMOBILE COMPANY)

(Environment)

BOD	BIOCHEMICAL OXYGEN DEMAND
COD	CHEMICAL OXYGEN DEMAND
SS	SUSPEND SOLID

(Others)

GDP	GROSS DOMESTIC PRODUCT
IRR	INTERNAL RATE OF RETURN
TUM	TERMINAL DE USOS MULTIPLES

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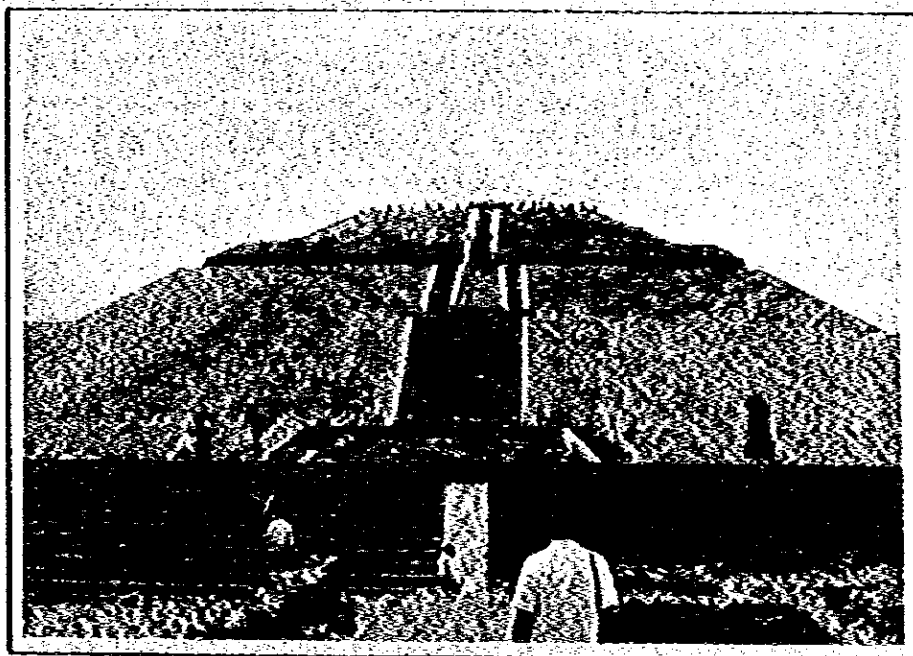
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CONCLUSIONS AND RECOMMENDATIONS



Pyramid in Teotihuacan

Conclusion and Recommendations

I. Conclusion

(1) Subject of Investigation

This report concerns the formulation of a master plan (target year 2000) for the development of a new industrial port at Tuxpan in Mexico, and the economic and financial analyses for the examination of the feasibility of the short-term development plan up to 1988. A master plan is prepared for the new city to be constructed around the port. Study of the transportation system including the apportionment of city functions to be developed in the hinterland of the port is also presented.

(2) Master Plan for the Industrial Port

We have reached the conclusion that, in view of the geographical and economic conditions of Tuxpan, this project should have three definite targets. They are:

- 1) Tuxpan must be developed on a long-term basis as one of the series of industrial zones along the Gulf of Mexico, which includes Altamira, Tampico, Tuxpan, Veracruz, Ostion, Coatzacoalcas and Dos Bocas.
- 2) Tuxpan must as soon as possible be given the functions of a commercial port, in order to transport goods to its hinterland including the metropolitan area of Mexico City, as a supplement to Veracruz and other ports.
- 3) This project must support and promote the Chicontepec-Tuxpan Project, which is particularly aimed at oil development.

Regarding the location of the new port, three points near the estuary of the Tuxpan river were explored. As a result, we dismissed Lake Tampamachoco and its vicinity on the left bank of the Tuxpan river as unsuitable for developing a port, and selected the relatively level area, measuring about 15 km north to south and 8 km east to west, on the right bank of the Tuxpan river. Three alternative plans were prepared and finally Master Plan B was selected as being the most suitable.

The reasons for rejecting Lake Tampamachoco and its vicinity are as follows: The land is low and swampy, so that large quantities of fill are necessary to reclaim the site. The ground is considered to be rather unsatisfactory from the view point of bearing stratum. The lake abounds in fishery resources and we decided that it would more effectively be used as a fishing place or as a tourist area, thereby preserving the environment of the whole area. Meanwhile, the area which we proposed as the project site is generally level except for the hills of Tumilco. A geological survey has disclosed that, though it includes some places with deep bearing stratum and highly plastic clay, most of the area is utilizable for plant sites. Further, we have concluded from past experiences (particularly, judging from Altamira Port) that the marine conditions make it possible to develop an artificially excavated port there.

Then we studied the possibility of industrial location around the port. We have carefully selected the types of proposed industries since this is the predominant factor to determine the dimensions of the industrial port.

At first, we selected 47 likely industries in light of the demand for, and the supply capacity of,

industrial products in the whole of Mexico, the apportionment between industries planned to locate at the industrial ports whose construction work has partially begun and those to be located at the industrial port of Tuxpan, and the geographical conditions of the industrial port. Of these we finally selected 12 industries. Further, we decided the production scale of these industries based on the trends in demand for each commodity, the scale merits of plants, and the production scale of model plants. The types and scale of industries thus selected which are most likely and desirable for construction at the industrial port of Tuxpan are as follows:

- ① Sea food products (Production scale: 100 t/year of processed fishery products; site area; 20 ha)
- ② Wheat flour (116,000 t/year), vegetable oil (26,000 t/year), feedstuff (120,000 t/year); 100 ha)
- ③ Paper and cardboard (500,000 t/year; 200 ha)
- ④ Petroleum refining (500,000 BPSD; 1,000 ha)
- ⑤ Petrochemicals (500,000 t/year in terms of ethylene; 500 ha)
- ⑥ Iron and steel (5,000,000 t/year of crude steel; 1,500 ha)
- ⑦ Fabricated metals for ocean use (24,000 t/year; 30 ha)
- ⑧ Construction machinery (4,000 unit/year including bulldozers; 60 ha)
- ⑨ Chemical machinery (50,000 t/year including chemical machines and boilers; 80 ha)
- ⑩ Heavy electrical machinery (including 80 large transformers a year; 30 ha)
- ⑪ Motor vehicles (360,000 a year; 220 ha)
- ⑫ Shipbuilding (250,000 DWT x 5 ships; 200 ha)

The total area of plant sites for these 12 industries is 3,940 ha. These plants shall be rationally arranged around the port.

The mass transportation of cargo is indispensable to plant production activities. The estimated volume of cargo to be consumed by these plants is about 51,522 thousand tons and the estimated volume of cargo to be generated by them is about 42.6 million tons. Of this consumption cargo to be transported by sea (foreign and domestic imports) totals 15.66 million tons, comprised of 10.6 million tons of foreign cargo and 5,060 thousand tons of domestic cargoes. Meanwhile, production cargo to be transported by sea (foreign and domestic exports) total 24.7 million tons, comprised of 21.6 million tons of foreign cargo and 3,100 thousand tons of domestic cargo. Thus, the estimated grand total is 40.36 million tons.

The cargo to be handled at the commercial port was estimated by presuming a hinterland, estimating its economic frame, studying changes in the future apportionment of functions among the ports, studying cargo shifted from U.S. ports on the Gulf of Mexico, and analyzing supply and demand separately for each type of cargo. In this connection, we referred to cargo estimates made for the whole of Mexico by the Le Harve port authority. Thus, we estimated cargo to be handled at the commercial port of Tuxpan in 2000 at a total of 4,860 thousand tons comprised of 4,290 thousand tons of foreign cargo and 570 thousand tons of domestic cargo. By type of packing, bulk cargo was estimated at 980 thousand tons, general cargo 1,130 thousand tons and container cargo 2,750 thousand tons. As for fishing port cargo, we estimated the amount to be handled at Tuxpan at about 100,000 tons -- including 60,000 tons for the new fishing port -- in consideration of the increase of incomes, the per-capita consumption of fish, and the distribution of resources.

In planning the marina, we assumed its accommodating capacity to be 500 vessels, in view of the number of tourists attracted, the population, per capita incomes, the number of pleasure boats possessed, and by referring, among other things, to the example of Acapulco.

(3) Port Plan

We decided to plan the port by artificial excavation because ① this port is to be constructed on a simple coast, ② there is level land in the coastal area ③ filling sand is necessary to provide industrial sites.

The breakwater layout was decided, by taking the following goals into consideration:

- ① To shield the port from wind waves of which the main direction is N ~ NE,
- ② To be able to accommodate 250,000-DWT tankers for exporting petroleum,
- ③ To surround the channels with the breakwaters to prevent channel siltation.

Thus, a total length of 3,400 m, the first 1,000 m normal to the coast and 2,400 m at an angle to this normal part, is proposed for the main (northern) breakwater. A total length of 2,200 m, including 1,000 m for the normal part and 1,200 m for the angled part, is proposed for auxiliary (southern) breakwater. As for the channels, a width of 500 m and a water depth of -22.0 m are proposed for the outer channel, a width of 500 m and a water depth of -19.0 m are proposed for the inner channel, and a width of 300 m and a water depth of -12.0 m are proposed for the auxiliary inner channel. The inner channel is accessible to 150,000-DWT iron ore carriers. In the industrial port, since a specialized (private) berth will be constructed and used exclusively by each plant, the plants are so arranged as to be able to secure the necessary length of waterline. When the number of specialized berths necessary for the volume of cargo, ship size and the frequency of ship calls was tentatively calculated, 30 large private berths totaling 7,095 m with water depths of -7.5 m or more were found to be necessary. These include three dolphin berths to be provided in the outer harbor to export crude oil.

The commercial port which is to be provided in the industrial port was planned similarly to other industrial ports in Mexico. It was found from our study that 12 large berths to handle 4,860,000 tons of cargo were necessary. Of these, three, including a container berth, are to be constructed by improving existing berths on the right bank of the Tuxpan river, while nine berths are proposed for the new port area. Of these, three are container berths, two are bulk cargo berths and four are general cargo berths. As for berth water depth, -12.0 m, for the full-load draft of 35,000~40,000-DWT (2,000~2,500 TEU) container ships, is planned for the time being, but the quay structure is designed so as to make depth increase to -13.0 m possible, enabling 3,000 TEU container ships to use the quays in the future. The wharf rear areas and roads were arranged similarly to the TUM (Terminal Usos Múltiples) plan (prepared by OCDI in 1981) for the five industrial ports where construction has already begun. Further, 192 ha (within the bounds of a 2,300 m x 900 m rectangle) is proposed as the area for the commercial ports on the assumption that the site of the port administration office, the symbolic green space, and the basin for small vessels are located together within the area.

Regarding the location of the fishing port, three alternatives were studied: ① the left bank of the Tuxpan river, ② the estuary on the right bank of the Tuxpan river and ③ the vicinity of the existing fishing port on the right bank of the Tuxpan river.

The new fishing port must be used to land fish mainly for processing and transport them

to fish processing plant. The right bank of the Tuxpan river was preferred, considering the location of the fish processing plant, and a suitable site near the existing fishing port was selected as the site of fishery port because the estuary on the right bank of the Tuxpan river is already set aside for the plan to construct a CFE (Federal Power Agency) tanker berth. A scale adequate to handle 60,000 tons a year is proposed for the new fishing port on the assumption that the existing fishery port will be expanded to increase its capacity by 40,000 tons. As the result of our study, we decided to divide the new fishing port between smaller fishing vessels (less than 20 tons) and larger fishing vessels, planned a 905-m landing wharf of -2.0 m, a 775-m wharf of -4.0 m, and a 165-m wharf of -4.5 m, and arranged the necessary functional facilities.

As for the location of the marina, its relation to the waters used by cruising pleasure boats must be first considered. At present, the beach in front of Lake Tampamachoco is used as a bathing resort and we decided that it must continue to be used for sea leisure, including the cruising of pleasure boats. So, we selected a suitable place for the marina in that vicinity. Besides this plan, we studied ① the case of constructing it on the beach providing a breakwater and a channel and ② the case of constructing it in the estuary on the left bank of the Tuxpan river. We dropped these alternatives because in the ① case, there are the problems of preventing waves and maintaining the channel in a hurricane, and the great cost of the necessary construction and in the ② case, there is a conflict with the use of PEMEX. We decided that the selected plan was suitable because the present water depth there is more than -3.5 m, there is no fear of waves in a hurricane, and there is land area to develop leisure facilities in the rear; although the approach to the sea is rather long and the existing bridge needs repairs.

A wharf of 520 m and two 90-m jetties, a clubhouse and other necessary functionary facilities are laid out as facilities for 500 pleasure boats.

The cost of constructing these facilities was estimated assuming a general design of the principal facilities and figured out by referring to past construction costs.

The results were:

Industrial port:	1,483,000,000 USD (including cost of preparing plant sites)
Commercial port:	252,000,000 USD
Fishing port:	58,000,000 USD
Marina:	19,000,000 USD

Besides, the approximate amount of plant equipment investment was estimated at 2,390,000,000 US dollars.

(4) Tuxpan Port City

From our various studies, the development area, namely, the area to be directly affected by, and increasingly developed along with the development of the industrial port of Tuxpan and its port city is an area of 8,285 km² including 12 towns (villages) with a population of about 730,000 (1980). And this area is expected to develop in the future with the cities of Tuxpan, Poza Rica, Papantla, Alamo and Cerro Azul as nuclei, each with its own characteristics, and we decided that it was important to strengthen the transport network connecting these cities and develop each city. Particularly, we ranked Tuxpan as the central comprehensive city of this area to which the industrial port is basic, namely, as being the core city of the locality. We planned it as a city containing advanced lifesphere facilities (universities, research institutes and artistic

and cultural facilities).

As the location of the new port city, we comprehensively studied two alternatives on the left bank of the Tuxpan river and three alternatives on the right bank and decided on this plan proposing a location adjacent to the industrial port and with easy access to National Highway No. 130.

Regarding the scale of the city, a population of 400,000 was estimated based on 43,000 jobs to be created at the industrial port. It covers an area of 6,200 ha, including roads, and will contain a commercial and business area, a cultural/educational area, a medical area, recreational areas, residential districts, and parks and green space. Details of the land use are tabulated below.

Residential districts	4,050 ha	65.3%
Commercial and business area	405	6.5
Public service and public facilities	392	6.3
Amusement and recreational area	118	1.9
Light industry	230	3.7
Roads	400	6.5
Parks and greens	605	9.8
Total	6,200	100.0

We have also planned in our study of the necessary road and railroad networks, a new 200-ha airport, and sewage, garbage disposal plants.

Regarding the idea of developing the periphery of the existing city of Tuxpan into a new city, we found the maximum available development area to be 2,700 ha and capable of housing about 120,000 people. We reached the conclusion that, although using the periphery of the existing urban districts is reasonable during the initial stage of development of the industrial port, it is more desirable, after that, to start developing a new city on our proposed site and to develop it as a long-term and phased project.

(5) Short-Term Development Plan

We prepared a development plan in keeping with the port demand in the period up to 1988.

From our study of the construction of industries, it seemed appropriate to construct nine of the total of 12 industries, in view of the types of industries and supply capacities necessary to maintain the supply/demand balance in 1988.

The production scale and the plant site areas necessary for the time being plant operation are as follows:

① Sea food products (45,000 t/year; site 9 ha)	45% of the total
② Wheat flour (60,000 t/year), feedstuff (60,000 t/year)	50 ha ... 50%
③ Paper and cardboard (150,000 t/year)	100 ha ... 60%
④ Petroleum refining (250,000 BPSD)	500 ha ... 50%
⑤ Iron and steel (2,500,000 t/year)	750 ha ... 50%
⑥ Fabricated metals for ocean use (24,000 t/year)	30 ha ... 100%
⑦ Construction machinery (2,000 pc/year)	60 ha ... 50%
⑧ Chemical machinery (Chemical machines, boilers, etc.: 50,000 t/year)	80 ha ... 100%

⑨ Heavy electrical machinery (Large transformers:

80 pc/year) 30 ha ... 100%

The number of workers is about 15,200 and the sum of the plant site areas is 1,609 ha, or 41% of that in Master Plan. The total volume of cargo is 20.17 million tons comprising about 14.99 million tons of foreign trade cargo and 5.18 million tons of domestic trade cargo.

As for commercial port cargo, the total volume is 1,193 thousand tons, namely, 859 thousand tons of foreign trade cargo and 334 thousand tons of domestic trade cargo. This total includes 523 thousand tons of bulk cargo, 413 thousand tons of general cargo and 257 thousand tons of container cargo.

We assumed that the proposed fishing port would in 1988 land 25,000 tons of the estimated total of about 40,000 tons. This represents about 40% of the proposed handling capacity.

The construction of the marina is proposed for the period after 1988 for the following reasons: ① The number of people using the marina will increase according to increases in the number of factory workers after 1989. ② Industrial basic facilities must be constructed first. ③ No sharp increases in the number of incoming tourists are likely for some time.

(6) Short-Term Port Plan

In planning the port, we took care that the effect of construction could contribute as soon as possible to the master plan and that the investment be held to the minimum that is necessary. We decided on a channel water depth of -16.0 m to enable ships with the maximum size of 100,000 DWT (in view of the annual volume of cargo handling and the amount of investment) to use the port and planned a water depth of -10.0 m for the inner harbor channels to accommodate ships of 15,000 DWT in the immediate future. Therefore, we planned a northern breakwater of 2,500 m and a southern breakwater of 1,400 m to protect the channels and anchorages areas from the normal small waves.

We studied the necessary number of larger quays in the same way as for the master plan and found that 15 large quays totaling 3,550 m were sufficient. This means construction of about 50% of the total, including two dolphins in the outer harbor area to be used for exporting petroleum.

In the commercial port, one container berth will be constructed on the right bank of the Tuxpan river and so, all that has to be constructed in the new port is three berths, namely, two bulk cargo berths and one general cargo berth, a basin for small crafts and a port administration area. As a result, the necessary wharf area (including roads) is 77.7 ha.

For the fishing port, a total of 775 m of wharf will be constructed including 320 m of -2.0 m landing wharf, 250 m of -4.0-m quay, and 205 m of -4.5-m quay, corresponding to the handled volume of 25,000 tons. Also, functional facilities to be located on the land are arranged on about 47,000 m². These represent about 40% of the total.

The cost of constructing these was determined to be as follows:

Industrial port	523,800,000 USD
Commercial port	78,000,000 USD
Fishing port	20,080,000 USD

The amount of investment on plant equipment is 840,000,000 USD.

As for the construction schedule, port facilities will be constructed in about three years and the construction of plants will be started in the third year of the project and will likely be completed in three years.

Regarding the new city, we studied the case of executing part of the master plan assuming a population scale of 190,000 people, and found that a total of 3,830 ha, namely, 1,900 ha for residential districts, 372 ha for public service and public facilities, 192 ha for commercial and business facilities, 716 ha for parks, greens and recreational facilities, 250 ha for light industry and 400 ha for roads was sufficient.

(7) Economic Analysis

For the short-term port development plan, we calculated the internal rate of return (IRR) by the method of cost-benefit analysis and studied profitability from the view point of the national economy. The objects of the analysis were the industrial port (new port) and the commercial port and the fishing port but the marina was not included.

The added value created by the located plants was used as a benefit for the industrial port. The reduction of transport cost through the shortening of transport distance and the reduction of ship port staying expenses through the increase of berths were used as benefits for the commercial port, and the increase of fish catches and of added value through the fish processing plant were used as benefits for the fishing port. As a result, the IRR for the industrial port was 13.9%, the IRR for the commercial port was 1.3% and the IRR for the fishing port was 29.1%. In our study combining the three functions, the IRR was 13.9%. Thus it was found that the economic effect of this project was sufficient and the project was economically feasible.

(8) Financial Analysis

Regarding the financial analysis in relation to the industrial port, we did not carry it out because the company operating each plant must perform this analysis. We assumed that the breakwaters and the channels, which require large initial investments, will be constructed with government subsidies, since they constitute the states social capital, along with the roads and railroads. As for the fishing port, we excluded it from our analysis presuming it is leased to, and operated by, the local fishery cooperative association. Thus, our analysis was concerned only with the commercial port.

We analyzed financial statements and studied the FRR. We assumed the domestic funds to consist of government subsidies and foreign funds to consist of soft loans (annual interest rate: 3%, term of repayment: 30 years: grace period: 10 years). As revenues, we assumed port dues, wharfages and stevedoring charges, etc. according to the current Mexican tariffs.

From the results of our analysis, we found that, collecting the entrance fees from ships entering the industrial port, there is no shortage of operating funds, the repayment of loans will be possible and the financial internal rate of return, the FRR will be 3.6% and thus the profitability of investment on this project was assured.

(9) Conclusion

From the above, we reached the conclusion that the project was feasible technically, economically and financially.

II. Recommendations

Planning, fund raising, detail design and construction for this project will hereafter be conducted in accordance with the plans studied in this report. Hereunder are recommendations concerning those matters we noticed while conducting this survey or drafting the plan which should be heeded when finalizing the plan.

(1) Relation Between Present Economic Situation and This Project

In July 1982 when this survey was started, the Mexican economy was growing smoothly and the Global Development Plan (Plan Global de Desarrollo 1978) estimated GDP in 2000 at 4,621 billion pesos (1970 price), or about 5.5 times the level of 1980. Further, under this overall plan there were the National Industrial Development Plan (Plan Nacional de Desarrollo Industrial 1979) in which the industrial production in 2000 is estimated to be about eight-fold of the level of 1979, and the National Urban Development Plan (Plan Nacional de Desarrollo Urbano 1978) proposing the development of local nucleus cities. But the problem of foreign debts surfaced after the devaluation of the peso in August 1982 and the economic growth rate in 1982 slumped to -0.2%. Economic confusion continued, involving the attempt to nationalize banks in order to strengthen exchange control and in 1982 the inflation rate was recorded at 98%.

It was under these circumstances that the National Development Plan (1983-1988) was announced on May 30, 1983, unfolding macroscopic economic prospects. According to it, the economic growth rate will increase 0-2.5% in 1984. In reformulating the port plan under these circumstances, it was desirable to adopt as current an economic frame as possible, however there was no choice but to base it on the old plan for the following reasons:

- ① The new National Development Plan contains nothing but macroscopic details and, moreover, lacks target values for 2000. No definite plans for industrial development or urban development have yet been announced.
- ② If prejudiced by fast changing economic situations of the present time and of the immediate past few years, one is liable to form a false long-term outlook. It is better to review the economic situation after it has somewhat stabilized.
- ③ Under the present conditions, it is unlikely that provision for funds for a short-term development plan and construction will be started immediately from 1984.

So, we studied the impact of the present economic situation on this project and found that the project would inevitably be delayed for six or seven years. It is, therefore, absolutely necessary to reassess the socio-economic frame that this plan presupposes and then review the details of the plan once more when the economy recovers and a long-term outlook has become possible. For the present, we wish to recommend that, in particular, the short-term plan be regarded and handled as a Phase I plan.

(2) Short Term Port Plan and Land Use

As stated already, three general points: ① the left bank of the Tuxpan river near Lake Tampamachoco, ② the right bank of the Tuxpan river and ③ the position in this plan were weighed in selecting a place suitable for the port planning.

We concluded that, of these, the left bank of the Tuxpan river should, in view of its relation

to Lake Tampamachoco, begin to be developed after 2000, if it should be developed at all. Industrial development and port construction may greatly change the natural environment and, unless something is done to preserve the environment, it will inevitably deteriorate.

So, we would like very much to recommend that, if possible, Lake Tampamachoco be left as a place to preserve the natural environment so that it can be used, as at present, for fisheries and as a tourist resource. In fact, pollution countermeasures should be taken preserving Lake Tampamachoco and its vicinity so as to maintain its present satisfactory natural environment. In this respect, measures must be taken to minimize motorboat noise resulting from the development of the marina and its impact on fisheries. It would be advisable to consider the use of the left bank of the Tuxpan river as a further expansion area only after making sure that the natural environment of Lake Tampamachoco can be maintained even when the new industrial port is completed and the new port city is formed.

The right bank of the Tuxpan river, meanwhile, is the ideal place to locate port functions quickly and rather economically. Definite planning of this was avoided as outside the scope of this study, but if the improvement and expansion of the existing fishing port, the improvement of the Tecomár SA and other existing public wharves, the improvement of the rear connecting roads (already planned and work has been started partly), the extension of the estuary breakwater and the improvement of channels are taken for granted, it probably is the time to take the right bank as a whole and study from a long-term point of view what should be done about it. In short, we would like very much to recommend that the improvement and development of the present Tuxpan port be planned as soon as possible. It is necessary to carefully assess the siltation of channels and the amount of soil in maintenance dredging.

(3) Conditions of Developing the New Port

① The most vital factor in developing an industrial port, decisive for the success of the development, is the attraction of industries. The types and scales of plants that can be located are, indeed, important. What is critical in this connection is, of course, preparing conditions necessary for the location of plants, but it is always equally important, to make political efforts. Plants must be induced even at a stage where locational conditions – particularly, life-related facilities – are still inadequate and the types of plants to be constructed must be combined so as to mutually transfer their materials and products. There is a strong demand for political efforts to induce the desired companies to set up their plants in this place.

② The first important infrastructure, to be prepared as an incentive to industrial location, is the railroad. According to the SCT plan, there is a route between Veracruz and Tampico where a new line will be opened by 1988 and this line will be constructed gradually, the Cardel-Nautla, Nautla-Tuxpan and Tuxpan-Magosal sections in this order. Further, the railway connection between Mexico City-Tuxpan, will be completed after 1988 when a new line will be laid between Tuxpan and Honey.

In Mexico, the railroad is, and will be, a vital means of freight transportation and we wish to strongly recommend the early development of railroad lines from the new port to its hinterland. Particularly, railroad contact with Mexico City must be realized earlier than the opening of the Tampico-Veracruz line. This will enable Tuxpan port to function

effectively as a commercial port.

- ③ Regarding the fishing port, we would like to recommend the exploitation of fishery resources for processing plants. At present, mainly shrimp, oysters and sardines – and several species of fish produced in small quantities – are caught in the Tuxpan fishery area. In view of the likely population increase in the future, the exploitation of the fish resources, represented by tuna and other types, for processing is desirable. The introduction of regular methods to culture shrimp, oysters and others is also necessary. In this survey, we predicted demand almost exclusively from the angle of consumption and used the forecast as a condition for planning the fishery port facilities. But it is earnestly desired that this will be carefully reviewed from the point of view of fishery resources and fish catches.
- ④ This survey does not cover the details of the present land use of the sites proposed for this project. Nor does it cover compensations for these sites. What we referred to was aerial photographs, topographical maps and the results of field inspection and no details of the land productivity or the area used pasturelands and farmlands were available to us. Also, we do not know the present population and number of households within the areas proposed as industrial development. So, it is necessary to make a special survey concerning these matters and relocate the present agricultural and stock raising users by finding substitute land for them, either nearby or far away. It is earnestly hoped that efforts will be made to prevent local agriculture from stagnating due to the development of the industrial port and to finalize allowances and measures for prospective movers at the stage of planning.

(4) Development of New Port City

We set the scale of 6,200 ha for the new port city as a regional central city with a population of 400,000. This survey did not include estimation of the cost of constructing the new city because it was aimed, primarily, to show the basic principles of the construction of the new city, namely, the main frame of the city and the land use plan.

The proposed new city is an ideal city and it cannot be expected that realistic actions will be readily taken according to this plan. It is a matter of course that, actually, the existing city of Tuxpan will receive workers or laborers and its infrastructures will be temporarily used at the stage of construction and initial operation of the new industrial port. But the existing urban infrastructures of Tuxpan city are inadequate at present, cannot withstand further expansion on the periphery and are, indeed, too poor for receiving population as it increases with the growth of the new industrial port. Thus, providing dispersed infrastructures will inevitably become necessary and, taken as a whole, concentrated investment on the new city, as proposed here, is clearly desirable. But our survey did not include the step of combining the new city with existing city or planning the new city on the periphery of the existing city. No determination of the new city site by comparisons of the construction cost of these alternatives were done. We wish, therefore, to recommend that after the socio-economic conditions are studied in detail the city plan and some substitute plans fully reflecting these conditions shall be compared, namely, that a feasibility study of the city itself shall be carried out by all means.

(5) Flood Countermeasures for Rivers and Measures for Rivers Utilization

The impact of this development on the flooding of the Tuxpan river was qualitatively studied in the report. We also mentioned the importance of formulating a comprehensive development plan for the three rivers of the Cazones, Tecolutla and Tuxpan with regard to flood countermeasures and water utilization.

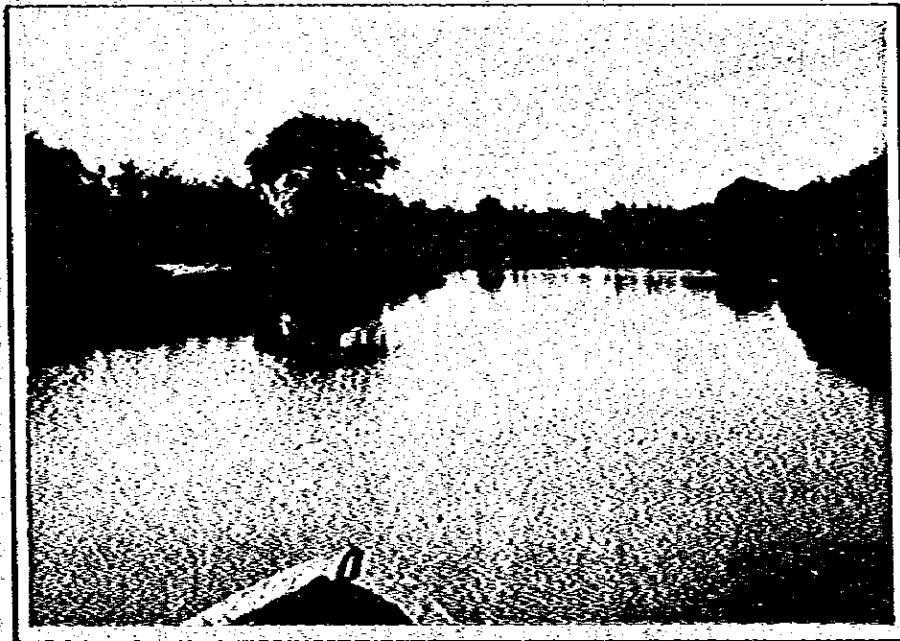
The scope of this survey was limited concerning this problem, too, and we had no choice but to confine ourselves to studies of the above mentioned extent. However, the construction of the industrial port and the development of the new city will probably have effects on flood water. Further, whereas the water supplying capacity of the Tuxpan river is estimated to be the order of 860 million tons yearly, the water volume required for this project (use of industrial plants and the new city) amounts to as much as 530 million tons. Under these circumstances, it is necessary to consider the amount of water to be required through the development of the basins of the Tuxpan river system.

These problems are vital, as they determine the possibilities for the scale of industrial development. Therefore, the comprehensive development plan including flood control, for the three rivers should be formulated in early occasion.

(6) Matters to be Investigated Hereafter

In order to clarify the above recommendations and this project we would like to recommend the execution of the investigation described in Chapter XIII as soon as possible.

SUMMARY



Around Project Site (Swampy Area)

Chapter I. Introduction

1. Background of the Survey

(1) Socio-economic situation

During the period from 1977 to 1980, Mexico rapidly increased its GDP at an annual rate of 8 – 9%, which resulted mainly from the increase of industrial production as well as mineral (notably petroleum) production.

Meanwhile, the nation's population increased at an annual rate of 3.3 – 3.4% and there occurred a remarkable influx of people from rural to urban areas. The concentration of population and industry in the metropolitan area amounts to 34% of the population and 57% of the industrial production while it occupies only 4.4% of the land area. Decentralization from the saturated metropolitan area is one of the tasks to be accomplished.

(2) Development plan

Mexico has such development plan as the Global Development Plan (PGD), National Industrial Development Plan (PNDI), National Urban Development Plan and so on in order to achieve further economic growth.

(3) Industrial port construction

Industrial complex construction in coastal districts is considered to be a most effective measure for industrial development. The Government of Mexico has a plan to construct nine industrial ports as shown in Fig. 1-1.

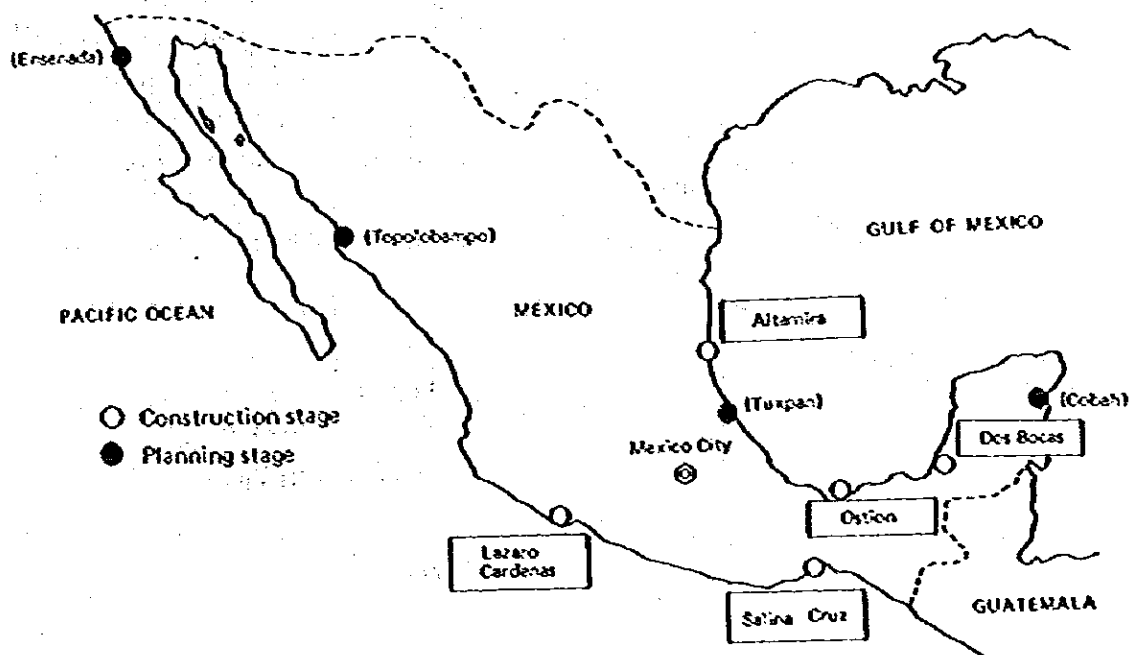


Fig. 1-1 Location of Industrial Port

2. Objective of Survey

- (1) The study aims at formulating a masterplan for the Industrial Port of Tuxpan with the target year around 2000 as well as preparing a short term development plan of the Port for the period up to 1988, including a feasibility study.
- (2) The study will also deal with the proper role of each port in Mexico on the basis of reviewing the policies for overall industrial development and the regional development in the country.

3. Influence of Latest Economic Situation on the Project

The Mexican economy which developed at a fast pace until 1980 was attacked by an economic crisis in the middle of 1981. Thus, economic growth aimed at in the aforementioned development plan has been impossible to maintain and the Government has been preparing a new plan to replace the old plan. The National Development Plan, announced in May 1983, contains the new prospects of economic growth for 1983 – 1988 but not the detailed figures necessary to review this project. So, we assess how the recent economic crisis will affect the project by estimating the delay of the target year. As is shown in Fig. 1-2, it was concluded that under the new plan there would be a delay of six to seven years in accomplishing GDP under the old plan. In other words, it will be necessary to regard the short term target year as about 1995 instead of 1988 and the long-term target year as around 2007 instead of 2000.

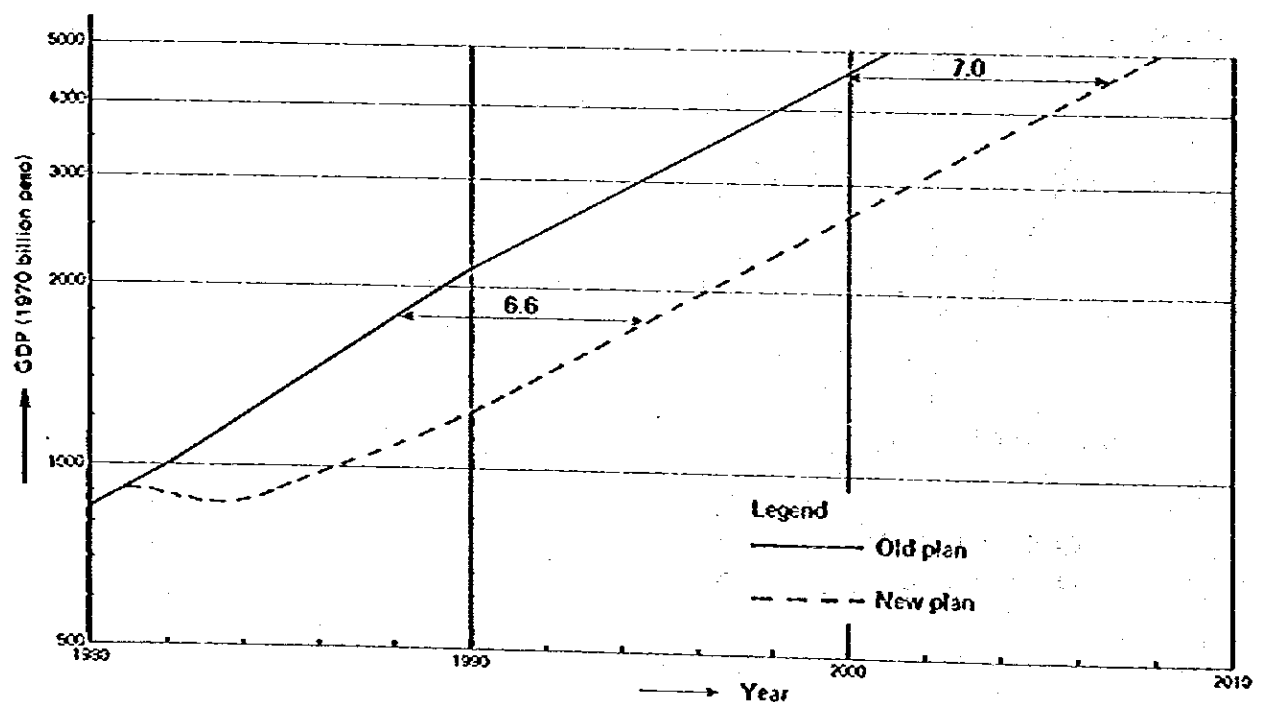


Fig. 1-2 Delay of the Project

Chapter II. Basic Policies for the Development of the Industrial Port of Tuxpan and the Port City

1. Objectives and Targets of Development

The main objective of the Tuxpan industrial port development project is to help achieve national targets prescribed in the national development plan such as PGD and PNDI.

Tuxpan is geographically the nearest port to the Metropolitan Area which includes Mexico City. Thus construction of a commercial port is a second objective. The industrial port of Tuxpan should be developed with following targets:

- (1) To be a part of the industrial zone along the Gulf of Mexico: Altamira, Tampico, Tuxpan, Veracruz, Ostion, Coastzacoalcos and Dos Bocas.
- (2) To supplement Veracruz port as a commercial port, mainly by handling cargo to and from the Mexico City metropolitan area.
- (3) To support and promote the "Chicontepec - Tuxpan project", which is mainly focused on crude oil development.

2. Setting of the Development Region

The area influenced by the development of Tuxpan Industrial port is classified into the following three parts.

Area I: The so-called "Project Site" in which a new port and a new city will be constructed.

Area II: Areas closely connected to Area I both economically and socially by such factors as people flow, and industries closely related to the Tuxpan industrial complex. This area is hereinafter called the Development Area (or simply the Area).

Area III: The so-called hinterland of the new industrial port, including Mexico City and Metropolitan Area.

In this report, the overall plans such as the port plan, and the new city plan are drafted for Area I. For Area II such items as economic frame, urban function of each city, and the traffic network are studied.

Area III is the area in which cargo volume is surveyed.

Chapter III. Present Situation of the Development Area

1. Outline of Natural Conditions

The development area is in the northern part of Veracruz state and has a total area of about 8,300 km², about 12% of the state.

The annual average temperature is 24 – 26°C and the climate is characterized by high temperature and high humidity.

Pastures, dense forests and temporary farmlands are the main land use categories in the development area.

2. Summary of Socio-Economic Conditions

The population of the Area was about 730,000 in 1980, as shown in Table 3-1, and the rate of population increase was 2.5% (1970 – 1980). This growth rate is considerably smaller than the growth rate of the nation.

Table 3-1 Population of Development Area

(Unit: 1,000 Persons)

Area \ Year	1950	1960	1970	1980
Mexico	25,791	34,923	48,225	67,382
Veracruz State	2,040	2,728	3,815	5,264
Development Area Total	243.8	377.2	567.3	729.6
Cazones	9.1	12.7	18.2	21.0
Cerro Azul	6.8	11.4	23.4	30.3
Coatzacoatlán	5.7	13.2	23.2	30.3
Chicontepec	31.4	35.7	46.6	57.8
Papantla	50.2	67.7	97.1	124.6
Poza Rica	28.5	71.8	120.5	161.5
Tamiahua	16.6	19.4	24.5	29.2
Teayo	4.9	8.2	13.6	16.7
Temapaché	30.0	44.2	63.3	89.8
Tepetzintla	7.2	10.8	10.4	12.3
Tihuatlan	16.8	32.4	55.4	67.5
Tuxpan	36.6	49.7	71.1	88.6

(Source: Compendio Estadístico 1980)

The GDP of the Area was 35.1 billion pesos in 1980, as shown in Table 3-2, and was 13.4% of the entire Veracruz State but less than 1% of the national total.

Table 3-2 GDP in Development Area

Unit: GDP: Billion Pesos
Per-capita GDP: 1,000 Pesos

Area	Index	1960	1970	1975	1980
Mexico	GDP (current prices)	160.1	444.3	1,100.0	4,276.5
	GDP (1970 prices)	225.9	444.3	610.0	841.9
	Per-capita GDP (1970 prices)	6.47	9.21	10.70	12.49
Veracruz State	GDP (current prices)	12.3	35.3	77.4	262.6
	GDP (1970 prices)	17.3	35.3	42.9	51.7
	Per-capita GDP (1970 prices)	6.34	9.25	9.57	9.82
Development Area	GDP (current prices)	/	5.16	10.79	35.13
	GDP (1970 prices)		5.16	5.98	6.92
	Per-capita GDP (1970 prices)		9.10	9.22	9.48

Note: 1) GDP of Veracruz State is estimated by Univ. of Veracruz (1960, 1970) and SPP (1980)

2) GDP of the Area is estimated by the assumption that GDP per sectoral population of economic activities is uniform in Veracruz State at 1970, 1975 and 1980.

(Source: SPP)

Regarding economic activities, agriculture has somewhat stagnated in recent years. Fishery is rather inactive in this area, with an annual catch of only about 2,000 tons (1981). The main species are shrimp and oysters.

As to industries, there is not much that is noteworthy except for the concentration of petroleum-related industries at Poza Rica. Diversified industrial developments are required in accordance with the future development of Chincontepéc. The same can be said of commerce and services and their concentration at Poza Rica is particularly large. As for tourism, few people visit the Area because it lacks major tourism resources but marine recreational activities will have to be largely developed there in the future.

3. Present Conditions of Cities

(1) Land use

The area percentage of farm land and pasture are relatively large while those of urban districts and forest are small.

(2) Industries

Cities except Poza Rica, Tuxpan and Cerro Azul are generally characterized by primary industries. Poza Rica is characterized by secondary and tertiary industries, while Tuxpan and Cerro Azul are characterized by tertiary industries.

(3) Transportation

The main ports in the Area are the ports of Tuxpan, Tamiahua and Cazes. Tuxpan port is a commercial port while the ports of Tamiahua and Cazes are small fishery ports.

The daily traffic volumes on main roads in the Area such as National Highway No. 130 and 180 are about 5,000 - 7,000 vehicles.

No railway exists in the Area. There is an airport located about 20 km north of Poza Rica, which has regular flights to Mexico D.F.

(4) Present condition of urban facilities

On the whole, urban facilities are still inadequate. They are relatively satisfactory only in the three cities of Poza Rica, Tuxpan and Cerro Azul.

(5) Urban characteristics of Tuxpan city

While this city is mostly situated in the flat land lying in the estuary of the Tuxpan river, hills of a height exceeding 100 m are located here and there in the south-western part of the city area. The annual growth rate of the population in the 1970 - 1980 period was low at 2.2 percent. The land use consists mainly of farm land and pasture. The transport condition is relatively good, as a private airport exists and the National Highway 130 and 180 are available. Accumulation of urban facilities is by no means satisfactory.

4. Present Cargo Traffic

In Mexico, industries are accumulated mainly in the inland sphere of Mexico City Metropolitan Area and hardly accumulated in the coastal areas. Due to this characteristic in the layout of industries, shipping plays a small role in the nation's cargo traffic system. Regarding the volume of port-handled cargoes, Tuxpan Port handled 7,210,000 tons in 1980, as shown in Table 3-3, and this total is comprised of 6,590,000 tons in domestic trade and 610,000 tons in foreign trade. Among the items of foreign trade, the volume of container cargoes was conspicuously large. The containerization ratio (ratio of container cargoes to all general cargoes) in 1980 was 74% for imports and 100% for exports. Among the items of domestic trade, the handling of petroleum products accounted for the largest part.

The hinterlands of the four ports of Tuxpan, Tampico, Veracruz and Coatzacoalcas were

analyzed from the inland flow of imported cargoes coming through these ports. According to this analysis, the hinterlands of the four ports overlapped in the Mexico City Metropolitan Area.

The volume of cargoes arriving in, or leaving, Mexico via U.S. Gulf ports (Houston, Corpus Christi, etc.) were estimated. This volume of cargoes was 418,000 tons for imports (1978) and almost nothing for exports.

Table 3-3 Cargo Volume at Tuxpan Port (1975 -- 1980)

(Unit: 1,000 Tons)

Year	Total	Foreign Trade			Domestic Trade		
		Imp.	Exp.	Total	In.	Out.	Total
1975	7,950	625	16	640	7,305	4	7,309
1976	6,012	226	20	247	5,762	3	5,765
1977	1,569	50	23	73	1,318	179	1,497
1978	2,350	232	153	385	343	1,622	1,965
1979	3,180	234	162	397	651	2,133	2,784
1980	7,208	550	63	614	5,971	623	6,594

(Source: SCT)

5. Present Situation of Tuxpan Port

The port of Tuxpan exists at present on both banks of the Tuxpan river, and has only small scale port facilities.

The public facilities are under the control of Residencia Obras del Puerto, a local branch of SCT. There are also a number of private facilities owned by PEMEX and TECOMAR S.A. (TECOMAR Shipping Company).

The waterways of the port are maintained at a water depth of 8.0 m near the port entrance and 6.0 m inside the port.

Chapter IV. Future of the Development Area

1. Socio-Economic Frame

The Area has two important tasks. One is the rapid industrialization necessary for the dynamic development of the Area and the other is accumulating various urban functions that will make the Area more attractive.

As the future frame of the Area, a population scale of 1,050,000 for 1988 and 1,570,000 for 2000 is assumed, as shown in Table 4-1, in consideration of the impacts of Chicontepec Development Plan and this project.

As to industries, their frame is considered for two indices: GDP (Table 4-2) and industrial production (Table 4-3).

Table 4-1 Population Frame (1988, 2000)

(Unit: 1,000 Persons)

Year Area	1950	1960	1970	1980	1988	2000	annual growth rate (%)		
							1970/ 1980	1980/ 1988	1988/ 2000
Mexico	25,791	34,923	48,225	67,382	84,190	100,249	3.4	2.8	1.5
Veracruz State	2,040	2,728	3,815	5,264	7,070	9,500	3.3	3.8	2.5
Development Area	243.8	377.2	567.3	729.6	1,051.1	1,574.3	2.5	4.7	3.4
Ratio to Veracruz State (%)	12.0	13.8	14.9	13.9	14.9	16.2	—	—	—

Note: Mexico and Veracruz State are based on the Mexico Demografico, Breviario 1979 - 1980.

Table 4-2 Forecast of GDP (Project Case)

(Unit: 1970 Billion Pesos)

Year Area	1970	1980	1988	2000	Annual growth rate (%)		
					1970/ 1980	1980/ 1988	1988/ 2000
Mexico	444.3	841.9	1,769.8	4,623.8	6.6	9.7	8.3
Veracruz State	35.3	51.7	110.8	425.5	3.9	10.0	11.9
Development Area	5.2	6.9	15.9	71.0	3.0	11.0	13.3
Ratio to Veracruz State (%)	14.7	13.3	14.4	16.7	—	—	—

Table 4-3 Forecast of Industrial Production (Project Case)

(Unit: 1970 Billion Pesos)

Area \ Year	1970	1975	1980	1988	2000	Annual growth rate (%)		
						1970/ 1980	1980/ 1988	1988/ 2000
Mexico	212.4	278.3	531.7	1,527.4	4,793.6	9.6	14.1	10.0
Veracruz State	8.7	11.3	21.4	63.2	314.2	9.4	14.5	14.3
Development Area	—	0.22	0.41	4.55	31.32	—	35.1	17.4
Ratio to Veracruz State (%)	—	2.0	1.9	7.2	10.0	—	—	—

Note: Excluding extraction and refinery of petroleum and basic petrochemical industry.

2. Future Image

The basic courses of regional development in the Area are as follows.

- (1) The area will be developed by the development of Tuxpan industrial port and Chicontepepec project.
- (2) In accordance with the policy of industrial dispersion based on the PNDI, the industrial development in the Area should be the keynote.
- (3) To realize the foregoing direction, positive efforts should be made for accumulation of the urban functions related to the industrial and living foundations.
- (4) In such regional development, special consideration should be given to protection of the comfortable environment, and to harmony with the primary industries such as agriculture, forestry, stock-farming and fisheries.

When the future of the main cities in the Area is stated according to the foregoing basic courses, their future image may be depicted as below.

1) Tuxpan:

- i) Comprehensive city with the large scale coastal industrial complex
- ii) Central city in the Area having regional control functions
- iii) City having a distribution business and marine recreational functions
- iv) Central city of an attractive regional sphere of life, having higher level facilities for the arts, culture, information, science, etc. (marine research institute, university, general hospital, etc.).

2) Poa Rica:

- i) Inland industrial city and the central city of the Chicontepepec petroleum development
- ii) Distribution business center
- iii) Central city in conjunction with Coatzintla and Papantla in the southern part of the

development area.

3) Alamo:

- i) Inland light industrial city
- ii) Strategic base for regional development in conjunction with Tuxpan and Poza Rica.

4) Papantla:

- i) Development of agro industry
- ii) Agriculturally productive city through effective use of farm land.

3. Future Transport Network

The highlights of the future transport network are as follows: new construction of a road along the Gulf by way of Tuxpan, a highway between Poza Rica and Mexico D.F., a bypass connecting Route 130 and 180 in Tuxpan and a road between Tuxpan and Alamo. Further, improvement of Route 130 and 180, new construction of railways along the Gulf and between Tuxpan - Poza Rica - Mexico D.F., and finally Tuxpan's new airport and the Tuxpan industrial port, complete the expanded system.

Chapter V. Natural Conditions of the Industrial Port of Tuxpan

1. Meteorology

Comparison of temperatures between Tuxpan and Mexico City showed that the average temperature is 5 – 10°C higher in Tuxpan than in Mexico City. But Tuxpan is not so hot as to negatively affect the development.

Strong winds whose velocity exceed 30 m/sec are occasionally observed. These are usually from the north. Further, this area is often attacked by hurricanes. Ordinary winds have a velocity of 4.5 – 7.5 m/sec, and are predominately between the north and east.

Annual rainfall in Tuxpan during the year 1977 – 1981 fluctuated considerably from 630 mm to 2,040 mm. The mean value for this period was about 1,270 mm. Precipitation from June to November is large.

2. Sea Phenomena

(1) Tide level and coastal current

According to tide tables, Tuxpan has a mean high water level of +0.219 m and a mean low water level of -0.284 m, above and below the mean water level. The expected extraordinary high water level caused by hurricanes was estimated at +1.6 m above the mean water level.

The longshore current flows toward south direction regardless of tide, and its speed is almost less than 0.35 m/sec.

(2) Waves

Deepwater waves estimated by the SMB method, using a model hurricane (wind velocity 35 m/sec., duration 6 hours, fetch 200 km), have a wave height of 9 m and a period of 13 seconds. When the deep water wave propagates towards the shore, it will be attenuated due to refraction, shoaling and breaking. Wave heights of 7.5 m at water depths of more than 12 m and 6.6 m at the water depth of 10 m were obtained.

3. Topography, Soil Conditions and Littoral Drift

(1) Topography

The land topography in the proposed site is generally flat and as a whole the elevation is about 0.5 – 1.0 m above sea level, however there are some scattered hills with heights in the 30 – 40 m range. The right bank of the Tuxpan river mouth and the area around the Tumilco drainage are swampy zones.

The undersea topography slopes gently and is free off reefs.

(2) Soil conditions and littoral drift

Most soils in the proposed site are classified as silty clay and clay, but judging from the N values, soil profiles and plastic conditions, the lowerlayer silty clay and the upperlayer clay are likely to be diluvium cohesive soil and alluvium cohesive soil.

Then, assuming that bearing strata of the structures must have an N value of more than 50, they exist 5 – 10 m below the ground surface in the vicinities of Tumilco and La Antigua, and at 10 – 15 m around the mouth of the Tumilco drainage and around Paisés Bajos in the western part of the site. In other places they exist below 25 m. Therefore, greater attention must be paid to bearing capacity and settlement, when constructing structures on a thick layer of clay.

The presumed direction of alongshore sand drift is from north to south.

4. Rivers and Estuary Siltation

Three rivers, the Tuxpan, the Cazonas and the Tecolutla flow through the development area. Table 5-1 shows their discharge characteristics. Since not only this project but also other project such as mining and agricultural developments are proposed for the development area, a vast amount of fresh water will be necessary. It is requested of course to construct a number of dams for water procurement.

The volume of siltation in the present Tuxpan Port is estimated to be on the order of 720,000 m³/year.

Table 5-1 River Discharge

River		Tuxpan (1960 – 77)	Cazonas (1950 – 77)	Tecolutla (1962 – 77)
Drainage	km ²	4,341 ¹⁾	1,600 ²⁾	7,112 ³⁾
Annual discharge	million m ³	2,869	1,371	5,817
Maximum discharge	m ³ /sec	1,905	1,448	3,053
Minimum discharge	m ³ /sec	4	3	27
Average discharge	m ³ /sec	89.70	43.47	184.47

Note: 1) Till Alamo station

2) Till Poza Rica station

3) Till Remolino station

(Source: Projects Chicontepec)

Chapter VI. Socio-Economic Condition of Tuxpan Industrial Port

1. Location of Industries

This section is to study and select the industries to be located in the Tuxpan Industrial port in accordance with the following procedures.

- (1) Reviewing the PNDI the basic strategic targets and Tuxpan's position in the national policy are clarified.
- (2) Reviewing the existing plan for the five key industrial ports, the significance of the Tuxpan Industrial Port development is clarified in light of the integrated industrial development policy in Mexico.
- (3) Based upon the above reviews, the basic concept of the Tuxpan Industrial Development is fixed as follows:
 - 1) Contribution to decentralization of socio-economic activities
 - 2) Contribution to innovation of industrial structure
 - 3) Utilization of local resources and encouragement of local industry
 - 4) Promotion of replacement of imports and expansion of exports
- (4) Industries located in the Tuxpan Industrial Port are selected by two processes. In the primary selection, regional conditions for industrial location are assessed and industries meeting these conditions are selected.

Table 6-1 Industries Located Around the Tuxpan Industrial Port

Type of Industry	Capacity of production	Area (ha)	Number of employees (persons)	Fresh water (1,000 m ³ /day)
Sea food products	100 × 10 ³ MT/Y	20	1,700	7
Wheat flour	116 × 10 ³ MT/Y			
Vegetable oil	26 × 10 ³ MT/Y	100	300	1
Feedstuff	120 × 10 ³ MT/Y			
Paper and cardboard	500 × 10 ³ MT/Y	200	3,500	340*
Petroleum refining	500 × 10 ³ BPSD	1,000	1,500	200**
Petrochemicals	500 × 10 ³ MT/Y	500	5,000	320**
Iron and steel	5,000 × 10 ³ MT/Y	1,500	7,500	340**
Fabricated metals for ocean use	24 × 10 ³ MT/Y	30	1,500	1
Construction machinery	4,000 UNIT/Y	60	1,500	2
Chemical machinery	50 × 10 ³ MT/Y	80	5,500	9
Heavy electric machinery	80 UNIT/Y	30	1,000	1
Motor vehicles	360 × 10 ³ UNIT/Y	220	10,000	17***
Shipbuilding	250 × 10 ³ DWT/Y × 5 ship/y	200	3,000	1
Total		3,940	42,000	1,239

Note: 1. We estimate that the construction of iron and steel, petrochemical factories should be started before 1988 since the construction will take a long time.

2. Retrieval ratio *: 40%, **: 80%, ***: 90%

- (5) In the secondary selection, the local conditions for industrial location are assessed and industries meeting these conditions and the basic concept are selected out of the primarily selected industries.
- (6) The production scale of plants, site area, number of workers, fresh water consumption are set in Table 6-1.
- (7) Finally, the volume of Tuxpan industrial port cargo is estimated by domestic and foreign trade. (see Table 6-2)

Table 6-2 Industrial Cargo Volume Handled at Tuxpan

(Unit: 1,000 MT/Y)

Commodity	Item	Type of packing	Foreign Trade			Domestic Trade			Total	Private or Public
			Imp.	Exp.	Total	In.	Out.	Total		
Agricultural and fishery products										
Fish		G				50		50	50	
Grain		B	324		324				324	O
Forestal products										
Chip		B				760		760	760	O
Petroleum products										
Oil		L.B		4,800	4,800		1,700	1,700	6,500	O
Petrochemical products										
Petrochemical products		L.B		100	100		100	100	90	O
Petrochemical products		B		45	45		45	45	90	O
Minerals and crude oil, etc.										
Salt		B				248		248	248	O
Crude oil		L.B		13,600	13,600	4,000		4,000	17,600	O
Iron ore		B	7,000		7,000				7,000	O
Coal		B	2,240		2,240				2,240	O
Limestone		B	760		760				760	O
Scrap iron		B	50		50				50	O
Scale		B	80		80				80	O
Iron and steel										
Steel		B		1,200	1,200		800	800	2,000	O
Consumer goods										
Sea food products		G		9	9				9	
Paper		G					50	50	50	
Capital goods										
Industrial machinery		G	3		3				3	O
Fabricated metals for ocean use		G					22	22	22	O
Machine equipment and parts		G	12		12				12	O
Construction machinery		G					33	33	33	O
Parts of chemical machinery		G	9		9				9	O
Chemical machinery		G					20	20	20	O
Parts of heavy electric machinery		G	2		2				2	O
Heavy electric machinery		G		2	2		6	6	8	O
Parts of motor vehicles		G	90		90				90	O
Motor vehicles		G		1,800	1,800		360	360	2,160	O
Parts of shipbuilding		G	42		42				42	O
Total			10,612	21,556	32,168	5,058	3,136	8,194	40,362	

Note: O: Handled on the private berths
 G: General Cargo
 B: Bulk Cargo
 L.B: Liquid Bulk Cargo

2. Demand Forecast

In forecasting the volume of commercial port cargoes, we employed the method of setting up the economic frame of the presumed hinterlands, analyzing supply and demand, cargo item by item, and thus determining the volume handled at Tuxpan Port. Simple mathematic models were used in analyzing the share of Tuxpan Port in the competitive hinterland of the Mexico City Metropolitan area and in estimating the volume of cargoes shifted from the U.S. Gulf ports.

Both part of Veracruz State and the Mexico City Metropolitan area are assumed to be in the hinterland of Tuxpan Port after full consideration of the completion of the preceding five major industrial ports. An economic frame is set separately for each hinterland on the basis of the national economic frame and considering also the impact of the policy of industrial dispersal mentioned in PGD. Indices for the economic frame are population, GDP and industrial production.

The analysis of supply and demand, cargo item by item, is done separately for bulk cargoes, general cargoes and container cargoes by reviewing the forecast results of Le Havre Port Authority and taking new information into account.

The results of the forecast of the volume of commercial port cargoes are shown in Table 6-3. According to this table, Tuxpan's cargo volume is 1,193,000 tons in 1988 and 4,860,000 tons in 2000.

As for fish catch, 86,000 tons in 1988 and 223,000 tons in 2000 are assumed for the Tuxpan fishery administrative region (see Table 6-4) since fish consumption is likely to increase in the future.

The number of tourists visiting the Tuxpan area cannot be accurately determined for lack of data but it is forecast as shown in Table 6-5 in view of expected increase of per-capita GDP and informations received from officials of the Ministry of Tourism.

Table 6-3 Cargo Volume of Tuxpan (2)

China (c. 1,000 Tons)													
	1976				1980				1985				Total
	Foreign Trade		Domestic Trade		Foreign Trade		Domestic Trade		Foreign Trade		Domestic Trade		
	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	
(1) Bulk Cargo	174	59	174	59	174	59	174	59	174	59	174	59	359
Nonferrous Ore													317
Fertilizer													300
Comest.													
(2) General Cargo	57	255	57	255	57	255	57	255	57	255	57	255	559
Iron & Steel													170
Steel Tubes & Pipes													131
Salt													86
Capital Goods	19	16	19	16	19	16	19	16	19	16	19	16	131
Consumer Goods	7	16	7	16	7	16	7	16	7	16	7	16	55
Agricultural Products	15	15	15	15	15	15	15	15	15	15	15	15	131
Container Cargo													
Capital Goods	29	209	29	209	29	209	29	209	29	209	29	209	154
Consumer Goods	67	143	67	143	67	143	67	143	67	143	67	143	2,492
Agricultural Products	19	19	19	19	19	19	19	19	19	19	19	19	101
Total	250	529	250	529	250	529	250	529	250	529	250	529	5,868

Table 6-4 Forecast of Fish Catch

Area	Use	(Unit: 1,000 Tons)			
		1976	1980	1985	2000
Mexico	Direct human consumption	280	560	1,032	1,751
	Processing	245	490	908	1,540
	Total	525	1,050	1,940	3,291
Veracruz State	Direct human consumption	-	69	135	350
	Processing	-	1	100	285
	Total	30	70	235	635
Tuxpan administrative region	Direct human consumption	-	-	41	128
	Processing	-	-	45	95
	Total	-	3	86	223

Note: -: no available data

Table 6-5 Forecast of Tourism Visitors

Nationality	Purpose	(Unit: Persons)						
		1977	1978	1979	1980	1981	1985	2000
Mexican	all purposes	336,566	352,149	368,015	384,004	400,000	426,000	482,000
	tourism	-	-	-	-	-	-	-
Foreigner	all purposes	5,932	5,932	5,932	5,932	5,932	5,932	5,932
	tourism	-	-	-	-	-	-	-
Total	all purposes	342,498	358,081	373,947	389,936	405,932	431,932	487,932
	tourism	-	-	-	-	-	-	-

Note: -: Based on the estimation (69.5 percent to all purposes in 1979 on the national base)