

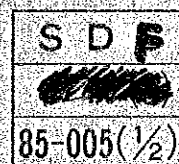
KINGDOM OF THAILAND

INDUSTRIAL ESTATE AUTHORITY OF THAILAND

**FINAL REPORT**  
**FOR**  
**THE STUDY ON THE DEVELOPMENT PROJECT**  
**OF LAEM CHABANG COASTAL AREA**  
**MAIN REPORT**

FEBRUARY 1985

JAPAN INTERNATIONAL COOPERATION AGENCY





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国際協力事業団	
受入 月日 '86. 2. 26	122
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## PREFACE

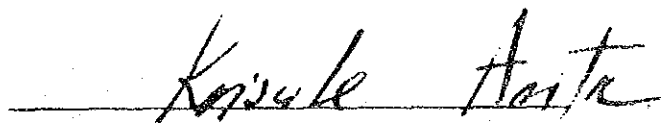
In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct "The Study on the Development Project of Laem Chabang Coastal Area" and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Thailand a survey team headed by Dr. S. Iijima comprising experts of Nippon Koei Co., Ltd., Japan Industrial Location Center, The Overseas Coastal Area Development Institute of Japan, Regional Planning International Co. and Central Consultant Inc. for three times during the period from January to November 1984.

The team had discussion with the officials concerned of the Government of the Kingdom of Thailand over the project and conducted a field survey in and around the Laem Chabang Area. 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 the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

February, 1985

A handwritten signature in dark ink, appearing to read 'Keisuke Arita', is written over a horizontal line.

Keisuke Arita

President

Japan International Cooperation Agency





February, 1985

Mr. Keisuke Arita  
President  
Japan International Cooperation Agency  
Tokyo, Japan

Dear Sir,


LETTER OF TRANSMITTAL

We are pleased to submit to you the Final Report of "The Study on the Development Project of Laem Chabang Coastal Area" for the Kingdom of Thailand.

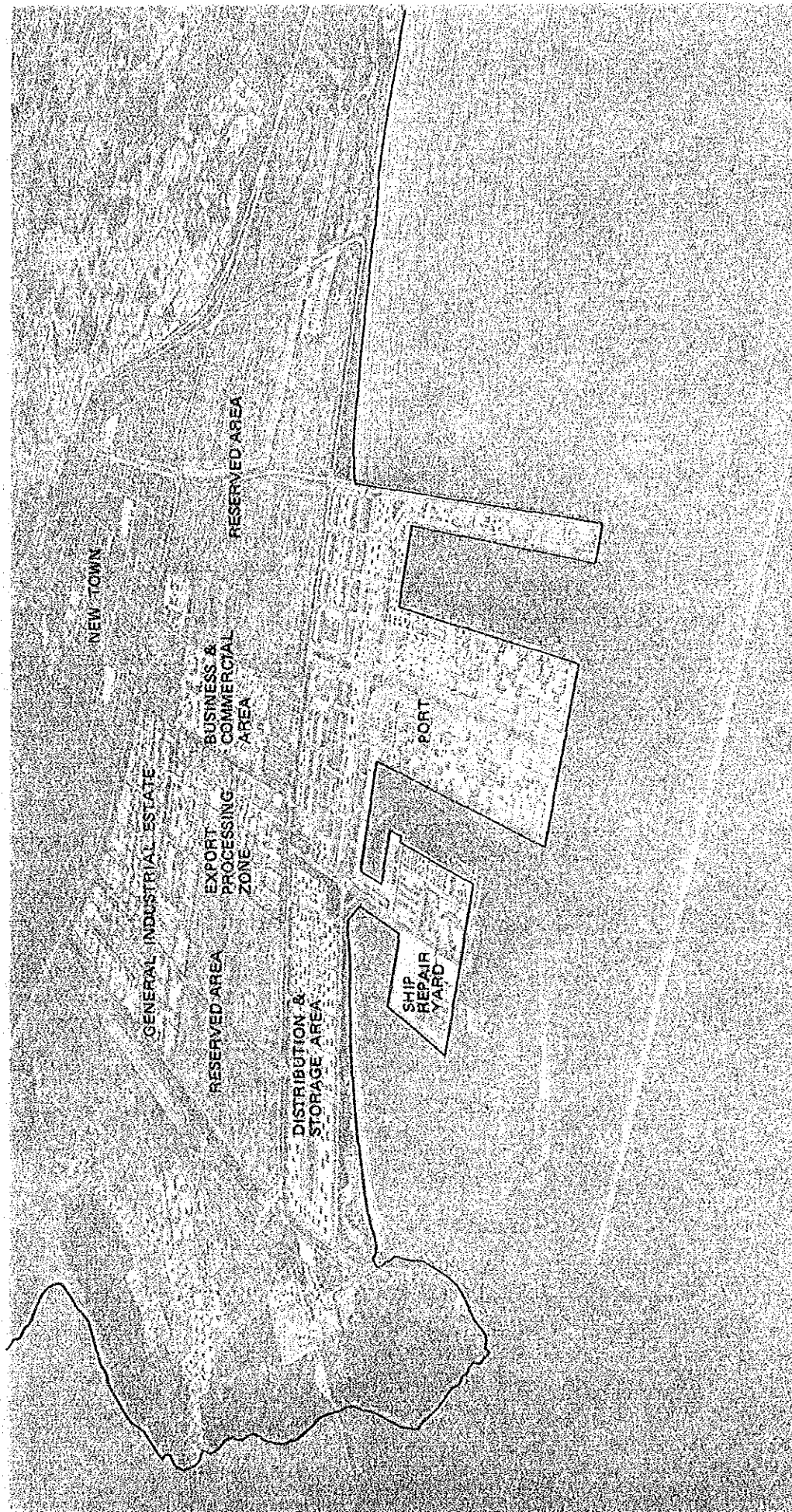
The study was performed during the period from January 1984 to February 1985 including three field surveys in Thailand. The Study Team made every effort to formulate the best development plan of the Laem Chabang Complex from socio-economic and technical points of view. We are convinced that the development of Laem Chabang will contribute much to the further economic development of Thailand and we hope that the Thai government will now be able to take a prompt action to implement the project in accordance with the principles set out in the report.

All members of the Study Team wish to express their grateful acknowledgement to the personnel of your Agency, Advisory Committee, and Japanese Embassy in Thailand as well as to officials of the Government of Thailand for their kind assistance and cooperation extended to the Study Team.

Very truly yours,

  
Sadakazu Iijima  
Team Leader





THE DEVELOPMENT PROJECT OF LAEM CHABANG COASTAL AREA

NEW TOWN

GENERAL INDUSTRIES JARNEED

AREA CEVVERSEER

AREA EDAROTS

SHIP RIASER GRAY

TROPE

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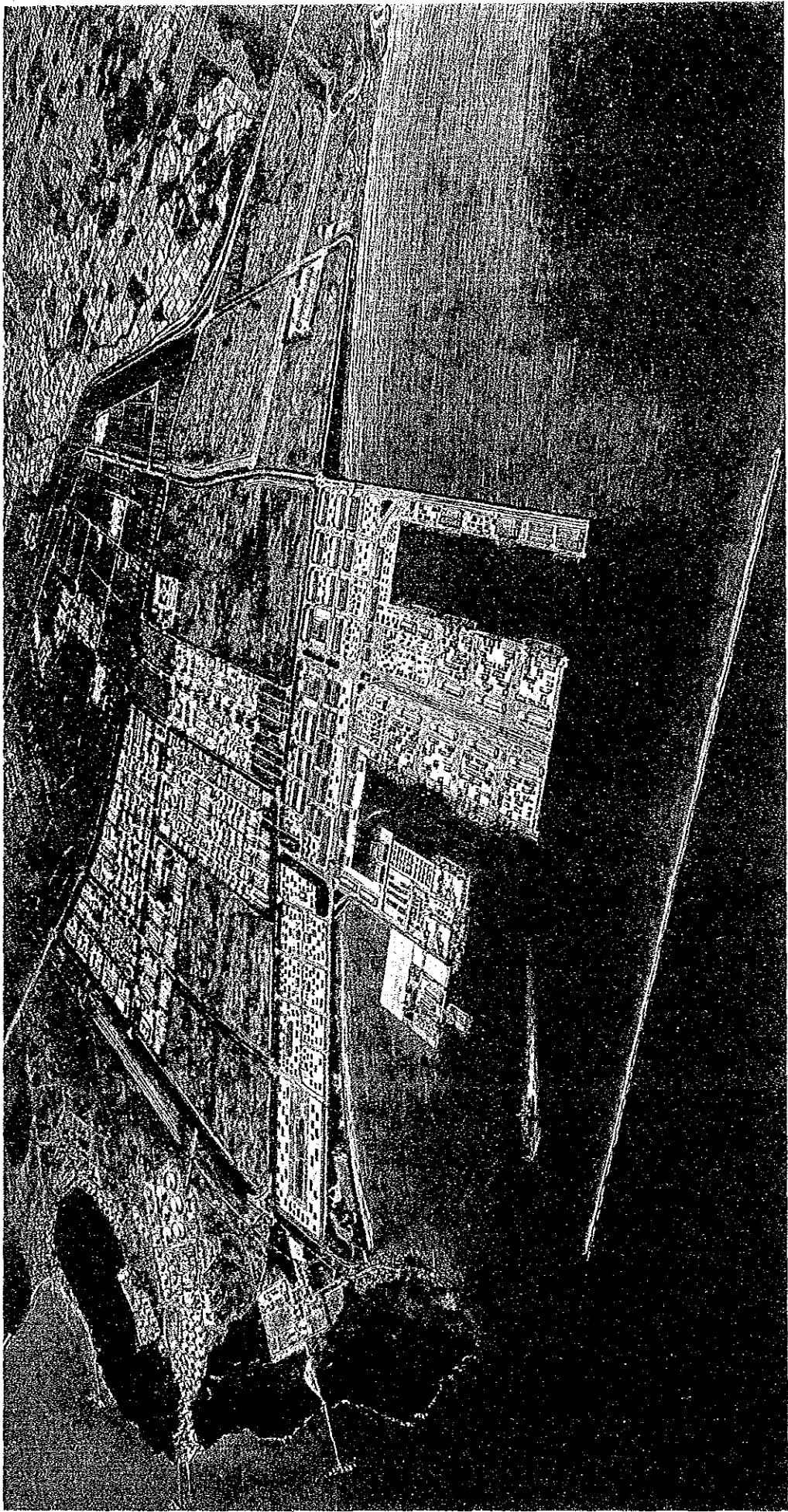
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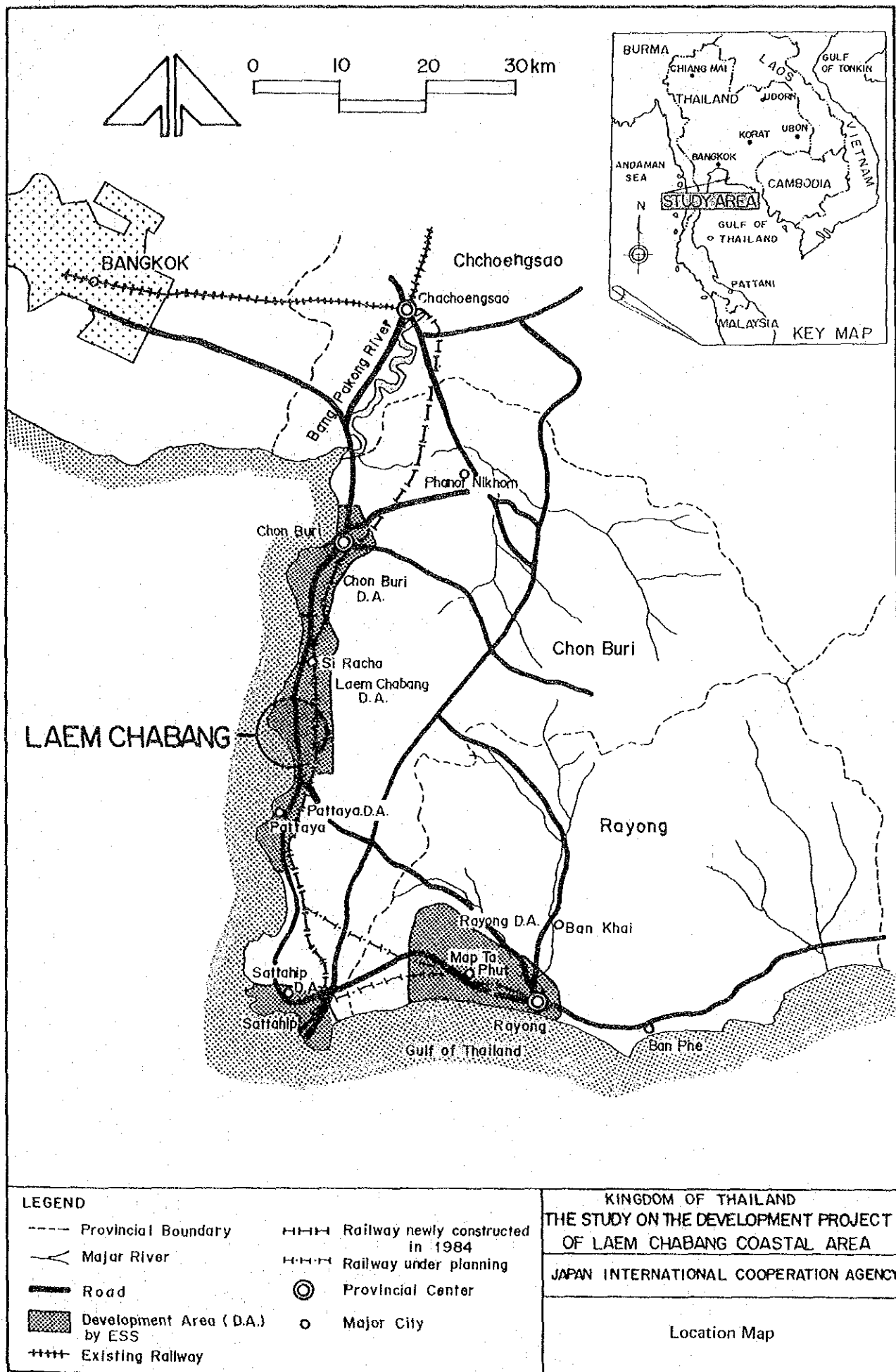
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General aerial View of Laem Chabang Coastal Area



Aerial view of Laem Chabang Coastal Area showing site of port.





Panoramic view of Laem Chabang area from Laem Chabang Cape.



Proposed site for new town development.



## SUMMARY AND RECOMMENDATION

### 1. GENERAL

- 1) The Laem Chabang Development Plan, which has so much to contribute to the further economic development of Thailand and which has a history of more than 10 years of study since its inception, finally seems ready for implementation.
- 2) The main objective of the Development Plan in its present form will be the creation of a new marine gateway to Thailand which will allow large vessels to call instead of Klong Toey river port which limits the size of vessels to the maximum 10,000 DWT. Recent industrial and urban development plans now presume the establishment of the new port.
- 3) In the past 10 years manufacturing industry has pushed the periphery of the economic influence zone outward from Bangkok. It has already reached Si Racha. The construction of the highway from Bangkok, the Sukbunvit Highway, can be seen to have been a major factor.
- 4) The Leam Chabang area is located outside of the alluvial plain of the Chao Phraya river, and possesses superior geological characteristics. Topographical and other conditions both at sea and on land, are suitable for the port construction.
- 5) It is important that a coherent organic mechanism should promote the implementation of the commercial port, industrial estates, residential communities, business and commercial zone, and supporting infrastructure under a comprehensive plan in the most efficient manner.
- 6) Land for the port and the industrial estate has already been acquired by the government, even for the project's long term requirements. Implementation of these elements of the project should therefore meet little difficulty. Land for the residential areas, however, has not yet been secured. It is desirable that the government should now take prompt action.

- 7) Thailand will enter new era with completion of the new commercial port at Laem Chabang, which will compare favorably with deep sea ports in other ASEAN countries.

## 2. INDUSTRIAL DEVELOPMENT

### 1) Objectives of the project are as follows:

1. To help sustain the past high rate of industrial growth in the country.
2. To help restructure the country's economic base for more stability.
3. To help diversify the country's exports to improve its international balance of payments.
4. To help create job opportunities for the ever increasing young labour force.
5. To help control excessive growth in the Bangkok Metropolitan Area and to help regional development of the Eastern Seaboard to achieve balanced development.

### 2) Candidate types of industry has been identified as follows.

#### - General Industrial Estate (GIE)

Category /1	Type /2	Composition
Consumer related group	Foods, textile, apparel, wood, wood products, furniture, rubber & plastic products, leather products, mis. products	10% (22.8 ha)
Basic material group	Chemicals, ceramics, non metallic minerals, iron & steel, non-ferrous metals	30% (71.1 ha)
Processing & assembly group	General machinery, electrical machinery, transportation equipment, precision instruments	60% (139.1 ha)

- Export Processing Zone (EPZ)

Category / <u>1</u>	Type / <u>2</u>	Composition
Consumer related group	Foods, textile, apparel, wood, wood products, furniture, rubber & plastic products, leather products, mis. products	40% (33.6 ha)
Basic material group	Chemicals, ceramics, non metallic minerals, iron & steel, non-ferrous metals	15% (12.8 ha)
Processing & assembly group	General machinery, electrical machinery, transportation equipment, precision instruments	45% (38.0 ha)

/1 Refer to Sectoral Report, Appendix I-109.

/2 Prepared by Industrial Census (International Standard Industrial Classification)

- 3) It is proposed to set the industrial area for planning at 2,800 rai for the year 2001: 700 rai for EPZ and 2,100 rai for GIE respectively following the recommendations of Eastern Seaboard Study (ESS) and Industrial Opportunities Identification Study (IOS) and the size of the existing EPZs in other East Asian countries.
- 4) Based on the industrial composition, the employment opportunities at full development were estimated as below. An adjustment was made in the numbers for EPZ following the analysis for 18 EPZs in Asia (6 in Malaysia, 3 in the Philippines, 4 in Singapore, 3 in Taiwan, 1 in Korea and 1 in Thailand. Detailed information on this is given in Sectoral Report I). The operation of EPZ was assumed to be on double shifts on the average.

	Total	Density
(1) EPZ	19,000 workers	36 workers/net rai
(2) GIE	15,500 workers	11 workers/net rai

- 5) Based on the planning framework established for the long term plan and a number of discussions held with officials of the concerned agencies of the RTG on the land sale projection, it was agreed to set the short term industrial framework as shown below.



# SHORT TERM INDUSTRIAL FRAMEWORK

Item	GIE	EPZ	Total
1. Area (rai)			
gross	1,367	423	1,790
net	900	288	1,188
2. Employment	9,900	10,370	20,270
3. Area in operation	40%	52%	47%
4. Workers (active)	4,040	5,430	9,470

- 6) In order to create an attractive environment in the area while maintaining functional integration, the entire estate should be surrounded by green belt as a buffer.

To accelerate foreign investments at an early stage, it is necessary to allocate some area to so-called standard factory buildings. It is proposed 10% of the space be allocated for this purpose.

- 7) The success of GIE and EPZ development will depend entirely on how fast and effectively the country can attract industrial investors. However, fully serviced physical facilities alone cannot function efficiently in this regard without the necessary support of policy measures. Major points to be considered are as follows.

- To establish workable guidelines for standardization of automotive and machinery parts and components to help such industries to increase production to bring about cost reduction to the extent that they can export a part of their production. Continued efforts are required for materialization of the ASEAN industrial cooperation program in this field.
- To streamline the taxation system to encourage the establishment of easier contractor-subcontractor relations in the manufacturing field.
- To effectuate quick tax rebate for export producers.

- To provide credit facilities on more liberal terms to local export producers and to small and medium scale industries that wish to relocate themselves from Bangkok.
- To enhance the vocational school in Sattahip or to locate another specific trade oriented technical training center in Laem Chabang to meet the requirement of industries being established there.

### 3. PORT DEVELOPMENT

- 1) The shallow depth and narrow width of Klong Toei Port limit the size of vessels calling at the Port to approximately 10,000 - 12,000 DWT for dry bulk carriers and cargo ships.

The Port requires constant and very costly maintenance dredging to keep the present depth.

Channel restrictions particularly affect the large volume export of agricultural products, the main export commodities of Thailand. The cramped layout of Klong Toei Port, which has been developed very close to the central urban area, has resulted in a relatively inefficient working environment for port activities, especially for container terminal operations.

Land transportation in the Bangkok Metropolitan area suffers from evergrowing traffic congestion, which may be one of the worst among those in capital cities in Southeast Asia in spite of the efforts made by the concerned authorities.

In view of this the extension and rehabilitation of the facilities in the immediate vicinity of Klong Toei Port is considered to be very difficult and undesirable.

- 2) The projected traffic volume is summarized in the table below. Figures in parentheses indicate medium projections, which are the average of the high and low projections.

(Unit: 10<sup>6</sup> ton)

Commodity		Total volume in Bagkok and Laem Chabang ports		Capacity of Bangkok Port	Potential Demand of Laem Chabang Port	
		1991	2001		1991	2001
Containers	Total	5.3- 6.3	8.1-13.1	3.0	2.3-3.3	5.1-10.1
	Import	2.7- 3.1	4.2- 6.8		(2.8)	(7.6)
	Export	2.6- 3.2	3.9- 6.3			
Break Bulk	Total	4.7- 5.0	5.7- 7.3	4.5	0.2-0.5	1.2- 2.8
	Import	4.4- 4.7	5.3- 6.6		(0.4)	(2.0)
	Export	0.3- 0.3	0.4-0.7			
Break Bulk	Domestic	0.23	0.86		0.23	0.86
Tapioca	Export	7.9- 8.1	7.9- 8.4		4.5	4.5
Sugar	Export	2.3- 3.0	3.1- 4.0	2.2	0.1-0.7 (0.4)	0.9- 1.8 (1.4)
Molasses	Export	0.9- 1.2	1.1- 1.7	0.9	0 -0.3 (0.2)	0.2- 0.8 (0.5)
Total		21.3-23.8	26.7-35.3		7.3-9.5 (8.5)	12.7-20.8 (16.8)

3) The number of berths required for the expected cargo volume was calculated as shown in the following table.

Number of Berths in 1991 and 2001

Commodities	Ship Size (DWT)	Number of Berths	
		1991	2001
Container	33,000 (2,000 TEU)	3	7
Break Bulk (foreign)	40,000 -15,000	1	7
(domestic)	1,500	280 m	1,100 m
Tapioca	142,300	1	1
Sugar/Molasses	20,000	1	1

- 4) The layout plan of the port facilities was based on an analysis on natural conditions at the construction site such as wave direction, currents and water depth, and to ensure the following:
  - a) The security of port activities
  - b) Efficient operation of port activities
  - c) Flexible for future development
  - d) Economical in the construction cost
- 5) General outlines of Laem Chabang Port are summarized below.

Items	Short-term Development Plan	Master Plan
Number of Berth (Foreign Trade Wharf)	6	16
Domestic Wharf (m)	280	1,100
Land Area (ha) (Wharf Area)	116	258
Length of Breakwater (m)	2,400	3,070
Rough Construction* Cost (¥ 10 <sup>6</sup> )	6,000	13,000

\* The cost includes provision for public facilities for the public and private wharves. The public wharf excludes secondary handling/removal equipment in the container terminals. The private wharf includes only the basic infrastructures such as quaywalls, revetments and filling (reclamation).

- 6) Laem Chabang Port is expected to become the main gateway to Thailand and therefore the Port should be fully equipped with modern cargo handling equipment backed up with an efficient port operation and management system from its opening.

The Study Team proposes the following:

- that PAT should prepare the minimum necessary infrastructure for the container terminals and lend them to shipping companies or a private terminal operator.

- that the agribulk berths should be financed by private companies.
- that the container and agribulk terminals operation should be carried out by private operators.

The new port activities at Laem Chaband will produce substantial economic benefits to the nation itself and for this reason the RTG should prepare a wide variety of commercial incentives to those enterprises to develop new businesses in the port.

7) The following recommendations on port planning are proposed by the Study Team.

- The short-term development plan should be implemented as soon as possible. Specially priority should be given to the construction of container terminals.
- Systems of port operation by the private sector should be introduced to Laem Chabang Port to help develop efficient port activities there.
- The various commercial functions necessary for the new port should be introduced smoothly and in time for the successful operation of Laem Chabang Port.

#### 4. URBAN DEVELOPMENT

- 1) Two locations for the new urban development for the year 2001 are proposed as explained below.

- Site A

The area is located adjacent to and east of the industrial estate and port, where the Eastern Seaboard Study recommended siting the Urban Development Area. This is the site proposed for the New Town.

- Site B

The area is located between Chachoengsao - Sattahip railway track on the east and the foot of a hill on the west. The northern part of the area will be adjacent to the existing Siracha built up area. This is the site proposed for private residential development.

- 2) The projected population for the New Town is based on the direct and induced employment in industrial estate, port area and elsewhere. The land area requirement for the year 2001 is roughly based upon a population density of 125 persons per ha (20 persons per rai). For the short-term plan, the land requirement was based on the number of persons to live in a housing unit and the area per housing unit. The land requirements so calculated are as follows:

Item	Short-term Development	Master Plan
Population in New Town	24,000 persons	120,000 persons
Area requirement	115 ha (720 rai)	930 ha (5,810 rai)

- 3) Types and numbers of housing units were estimated following the NHA's method as shown below.

Type of Housing	Average Plot Size (m <sup>2</sup> )	No. of Houses		Income Groups
		Short-term Development (1991)	Master Plan (2001)	
1. Row House (Single storey or Double storey)	100-140	4,048	20,140	Low & Middle
2. Semi-detached (Single storey)	180-120	198	3,340	Middle
3. Semi-detached	180-200	608	1,150	Middle & High
4. Detached	240-400	99	530	High
5. Shop House	56-64	180	940	High
Total	-	5,133	26,100	-

4) The land use plan was formulated in accordance with the following principles.

- The residential area in the new town should accommodate the estimated housing requirements zoned into several income groups.
- The commercial center (new town center) will be expected to serve not only the new town but also the whole surrounding area with easy reach of all residential areas in and around Laem Chabang.
- The transport system and road network should be designed to integrate all forms of transport and should be based on a clearly defined hierarchy of roads and public transport routes.
- The development should be based upon a series of neighborhood areas from which extraneous traffic should be excluded. These should be based on a maximum walking distance of about 500 - 800m to primary schools, shops, public transport (e.g. bus stop) and other facilities.



- Pedestrians and vehicles should be separated as much as possible. Well-defined pedestrian networks should be achieved throughout the new town, linking residential quarters with other facilities.
- The buffer zone should be placed along the inter- and intra-urban primary roads to protect residential environment from noise and air pollution.
- Sufficient parks and open spaces (district parks, neighborhood parks, playgrounds, malls and lots) should be provided.

Land Use	Short-term Development (1991)			Master-plan (2001)		
	(rai)	(ha)	(%)	(rai)	(ha)	(%)
1. Residential Use	381	61	52.9	3,025	484	52.0
2. Commercial Use	27	4	3.7	206	33	3.5
3. Schools	97	15	13.5	387	62	6.7
4. Parks	55	9	7.6	350	56	6.0
5. Roads	160/1	26	22.3	1,280	205	22.0
6. Canal	-	-	-	56	9	1.0
7. Others/2	-	-	-	506	81	8.8
Total	720	115	100.0	5,810	930	100.0

/1 Area of offsite road (Main road) 92 Rai (15 ha) is not included

/2 Buffer, green etc.

## 5. TRANSPORTATION PLANNING

- 1) The integrated system of transport facilities should aim to accommodate various types of traffic with a minimum level of conflict at the least overall cost.
- 2) Transport costs represent only a small fraction of the total cost of most goods. A shipper's choice of transport mode will not be influenced by pricing policy alone. A package of transport policies, mostly institutional and covering all modes, will be required to obtain the desired distribution of traffic between modes in this region.
- 3) Within the bounds of the Laem Chabang area, the layout and design of transport facilities, e.g., avenues and streets, railway right-of-way and stations, parking lots, bus stops, and so on, will not only be decisive factors shaping the visual appearance of the Area but will also be one of the major factors influencing the siting of urban activities in the Area. Therefore, they should be considered as tools for shaping and guiding the urban development of the Area. The planning and designs of facilities and services have been made with the above considerations in mind.
- 4) Transport of containers to and from the port was assumed to be equally split between the railway and the road transport. A substantial portion of the traffic in bulk goods is expected to be borne by convoys of barges taking advantage of the new port.
- 5) The car ownership level will vary depending on the income level of the household. A relatively high level of car ownership is expected. Provision of good bus services, however, is expected to keep the traffic at a manageable level.
- 6) The recommended road network consists of a ring road and minor roads forming a grid pattern taking into account functions and characteristics of the road, future land-use and future development potentials.

- 7) Roads are clasified into 7 categories,  $V_1$  through  $V_7$ . A  $V_1$  road is planned as a bypass of the existing Route 3.
- 8) Intersections with the  $V_1$  road are planned to be grade separated intersection and intersections with the other roads are planned as grade intersections with traffic signals.
- 9) Staged construction is proposed for road network construction for the short term plan.

## 6. UTILITY DEVELOPMENT

### Water Supply

- 1) Water for industrial and domestic use will be supplied from Nong-Kho reservoir by water pipeline.

Future water demand in terms of source water demand are summarized below. The projection was made on the basis of anticipated types of industries, the projected number of workers and population, unit consumption volume per capita and industrial net area.

(Unit: $10^6 \text{ m}^3/\text{Yr}$ )		
Water Use	1991	2001
Industrial Use	7.0	10.0
Port	0.7	2.2
New town (domestic)	1.8	9.6
Outside area (domestic)	3.0	7.0
Consumer water demand	12.5	28.8
Source water demand	16.2 <sup>/1</sup>	37.3

<sup>/1</sup> Calculated with unaccounted for water of 15% and 10%  
(12.5/0.85) x 1.1 = 16.2

The water demand ( $16.2 \times 10^6 \text{ m}^3/\text{year}$  in 1991 or  $37.3 \times 10^6 \text{ m}^3/\text{year}$  in 2001) is 1.6 times or 3.7 times of the supply capacity of Nong-Kho reservoir of  $10.2 \times 10^6 \text{ m}^3/\text{year}$ . Therefore the deficit must be supplemented by inter-basin water diversion from the Rayong river basin.

- 2) A filtration plant and a service reservoir for industrial and domestic water are planned for construction within the new town. 12 ha (75 rai) and 4 ha (25 rai) have been allowed for in the long-term and short-term plan respectively.

### Sewerage System

- 1) The sewage volume is assumed to be 90% of water consumed by users.

- 2) Sewage from the industrial estate, the port and the new town would be conveyed by gravity through separate sewers to a comprehensive sewage treatment plant for collective treatment.
- 3) The sewage treatment plant would be equipped with an "oxidation ditch" to ensure high effluent quality and for easy removal of nitrogen and in view of the need for environmental protection in the Gulf of Thailand and around Pattaya resort in particular.
- 4) The sewage treatment plant would be a comprehensive system to receive and treat sewage from the industrial estate, new town and port. Separate treatment systems were judged to be more costly.

#### Drainage System

- 1) The stormwater drainage facilities would be provided by an open channel system for low cost and simple maintenance.

Main design criteria were as follows:

- (1) A 5 year return period was taken as the interval of storm recurrence.
- (2) The design water elevation of the outlet to the sea should be M.S.L. + 1.75m (H.H.W.).

To avoid flooding by high tide, part of the low land in the port and industrial areas must be built up to M.S.L. + 3.0m.

#### Solid Waste Disposal

- 1) Solid waste generated from the industrial estate, the port area and the new town, except for any hazardous poisonous ingredient should be transported by garbage truck to the reserved area in the port area to be filled in the solid waste tip.

Solid waste volumes were projected to be  $210 \times 10^3 \text{ m}^3$  up to 1991 and  $1,450 \times 10^3 \text{ m}^3$  up to 2001 thus needing respectively 10 ha (63 rai) and 70 ha (438 rai) of tip area with 2m depth.

### Power Supply System

- 1) Power for the Laem Chabang Complex can be supplied through the 115 kV transmission line from the Ao Phai Substation situated about 5 km north of the center of the development area.
- 2) Estimated power demand in each area are summarized below:

(Unit: MW)

Area	Power Demand	
	1991	2001
New Town	9.1	41.8
Industrial Estate	58.6	96.0
Port	20.8	50.8
Total	88.5	188.6

- 3) Two new 115/22 kV substations should be provided each with a capacity of 80 MVA by EGAT in the new town and the Industrial estate area over the long-term. In the short-term, the substation planned for the industrial estate area should be given priority due to the higher power demand in that area.
- 4) A 22 kV overhead distribution line along the trunk road from the said substation to consumers should be constructed by PEA as well as 220V low tension lines to dwelling units.

### Telecommunication System

- 1) The telephone and telex demand in the Laem Chabang Complex were estimated as follows:

Demand Area	Number of Telephones		Number of Telex Terminals	
	1991	2001	1991	2001
New Town	1,270	8,740	-	-
Industrial Estate	808	1,364	18	36
Port Area	541	3,390	14	28
Public booths	52	270	-	-
Total	2,671	13,764	32	64

- 2) A new local exchange with a capacity of 3,000 lines and 15,000 lines in 1991 and 2001 respectively should be installed by TOT in the telephone office to be established in the business and commercial area.
- 3) A double 16 lines telex concentrator should be installed by CAT in 1991 and fourfold 16 lines in 2001 at the new post office located within the business and commercial area.

#### Land Preparation Plan

- 1) A large amount of earth work will be required in the port area and part of industrial estate to avoid flooding by high tide waves.
- 2) Approximately  $2,600 \times 10^3 \text{ m}^3$  of land fill will be required for the short-term development and an additional  $3,000 \times 10^3 \text{ m}^3$  for the master plan.

Material for land fill can be supplied from high places in the port area for the short-term development but for the master plan materials will have to be supplemented from outside of the Laem Chabang Complex.

#### 7. INVESTMENT COSTS

- 1) Investment costs for the short-term development were estimated at 1984 price levels as shown below.

(Unit: $\text{¥ } 10^6$ )			
Item	Foreign Currency	Local Currency	Total
1. Industrial Estate	478	636	1,114
2. Port (Wharf)	2,985	2,963	5,948
3. Port (Hinterland)	265	415	680
4. New Town	297	713	1,010
5. Others (Power and Telecommunication)	179	190	369
Total	4,204	4,917	9,121

Note: Engineering cost and physical contingency are included

The total investment cost for the master plan development was roughly estimated to be  $\text{¥ } 24.2 \times 10^9$  including the short-term development cost.

- 2) The disbursement schedule for the short-term development of the industrial estate and the new town with all the components including power and telecommunication facilities would be as shown below in accordance with the established project implementation schedule.

(Unit: $\text{¥ } 10^6$ )		
Fiscal Year	Industrial Estate	New town
1985	38	90
1986	101	40
1987	506	120
1988	338	380
1989	345	274
1990	-	104
1991	-	82
Total	1,328	1,090



## 8. FINANCIAL EVALUATION

### 1) General

Financial viability of the industrial estate and new town is evaluated by Financial Internal Rate of Return (FIRR). Both FIRR to investment and to responsible agency (IEAT or NHA) are calculated. Furthermore, income statement and cash flow are prepared to foresee future financial balance with assumed foreign loan.

### 2) Industrial Estate

The total investment cost and operation and maintenance (O&M) cost at full operation stage are estimated to be  $\text{P} 1,328 \times 10^6$  and  $\text{P} 33.1 \times 10^6$  respectively. O&M costs are for water supply, sewerage system, road, drainage, standard factory building and estate management.

Revenue of the industrial estate is derived from land sale, lease, estate management and utility charge. Land sale prices of factory lots are proposed to be  $\text{P} 560,000$  per rai and  $\text{P} 480,000$  per rai for GIE and EPZ respectively from the viewpoints of cost recovery and competitiveness with other industrial estates. Following conditions are assumed to estimate revenue from land sale.

- (i) All the GIE land and half the EPZ land are sold.
- (ii) Hirepurchase and cash payment are 50 per cent each.
- (iii) Hirepurchase conditions are 25% downpayment, 15% interest and 3 years repayment.
- (iv) Land sale and operation plan is as assumed in the Table 4.8.2.

Rental charge is assumed to be  $\text{P} 69,600$  per rai and  $\text{P} 1,225$  per square meter for EPZ land and standard factory building (SFB) respectively.

Utility charges are assumed to be  $\text{P} 6.9/\text{m}^3$ , and  $\text{P} 7.1/\text{m}^3$  and  $\text{P} 0.2/\text{kwh}$  for water, sewage and power respectively.

On the basis of costs and revenue thus estimated, FIRR to investment and to IEAT are calculated as below:

(Unit: %)

Condition	FIRR to Investment	FIRR for IEAT
Standard	8.4	8.0
Cost 10% up	6.4	5.1
Revenue 10% down	6.2	4.8
1 year delay in sale	6.5	5.7

These figures confirm the sound financial feasibility of the industrial estate.

### 3) New Town

The total investment cost and the annual O&M cost at full development of the new town are  $\text{¥ } 1,090 \times 10^6$  and  $\text{¥ } 20.6 \times 10^6$  respectively. O&M costs are for water supply, sewerage system, roads, drainage and new town management cost.

Revenues of the new town are derived from sale of housing units, utility charge and new town management charge.

Sale price of housing units are set to recover the investment cost and to be within the affordable range for purchasers. On the basis of the development cost estimated in the present study, prices of housing units are assumed so as to make the monthly payment under the assumed hirepurchase condition stay within 20 per cent of purchaser's monthly income. Sale prices so estimated are as follows.

Type	Monthly Income (Ø)	Total Cost (Ø)	Monthly Payment (Ø)	Percentage (%)
A	- 5,000	74,595	794	20
B	5,001 - 9,000	131,428	1,400	20
C	9,001 -	271,601	2,892	19
D	9,001 -	271,742	2,894	19

Same rates as the industrial estate are employed for utility charge. New town management charge is set at Ø 150 per housing unit per month.

FIRRs for the new town are calculated as follows.

Condition	FIRR to Investment	FIRR for NHA
(1) Standard	4.8	11.0
(2) Cost 10% up	3.3	9.2
(3) Revenue 10% down	3.2	9.0
(4) 1 year delay in sale and operation	-	7.5

Relatively low FIRR to investment is due to such non-revenue generating facilities as educational and community facilities, parks and main roads accounting for about 27% of the total investment cost. Without these, FIRR to investment is obtained as 11.4 per cent.

Either FIRR confirms the high financial feasibility of the new town.

#### 4) Income Statement and Cash Flow

Income statement and cash flow are prepared for the industrial estate and new town respectively to foresee the future financial balance of the project. Two cases are assumed for foreign loan: one with 3.5 per cent interest and 30 years repayment including 10 years grace period and the other 11 per cent interest and 20 years repayment with

grace period of 5 years (industrial estate) and 7 years (new town)  
which are equivalent to construction period.

## 9. ECONOMIC EVALUATION

Economic feasibility of the project was assessed for the industrial estate and the new town as one combined unit on the ground that the new town may be regarded as one of the infrastructure facilities to support the industrial activities.

For calculation of economic internal rate of return (EIRR), the financial cost was adjusted to reflect economic value by employing the standard conversion factor of 0.92 to the domestic portion of the investment cost. The foreign currency portion of the financial cost was deemed to reflect border price since it did not include any transfer payments. The total economic investment cost is estimated to be  $\text{¥ } 1,656.2 \times 10^6$ .

The value added generated by production in the industrial estate was taken as a benefit of the project. Value added was estimated on the basis of the number of workers and the average value added per worker in industries to be located in Laem Chabang. Generation of value-added due to the provision of the site and services of the industrial estate was broadly taken to be 16% of the total value-added based on empirical data in Japan. For GIE, 10% of the value-added was assumed to have been generated by industries relocating from Bangkok. This was excluded from the benefit since this portion would be generated even without the project. The annual benefit at the full operation stage was estimated to be  $\text{¥ } 595.6 \times 10^6$ . In calculating the EIRR, production foregone of cassava amounting to  $\text{¥ } 3.3 \times 10^6$  was subtracted from the benefit stream.

Based on economic cost and benefit estimated as above, EIRR was computed as follows.

Condition	EIRR (%)
Standard	19.2
Cost 10% up	17.5
Benefit 10% down	17.4
1 year delay in benefit generation	16.3

These figures indicate high economic feasibility of the Project.

In view of the high economic and financial feasibility, the Project is worthy of early implementation for the economic development of the nation.

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## ABBREVIATION

### A. ABBREVIATION OF MEASURES

(1) Length	mm	= millimetre
	cm	= centimeter
	m	= metre
	km	= kilometre
(2) Area	m <sup>2</sup>	= Square metre
	ha	= hectare = 10 <sup>6</sup> m <sup>2</sup>
	rai	= 0.16 ha
(3) Volume	lit, l	= litre = 1,000 cm <sup>3</sup>
	kl	= kilolitre = 1 m <sup>3</sup>
	m <sup>3</sup>	= cubic metres
(4) Weight	kg	= kilogramme
	t	= ton = 1,000 kg
(5) Time	s	= second
	min	= minute
	h	= hour
	d	= day
	yr	= year
(6) Money	฿	= Baht (Thai currency US\$ 1 = ฿ 22.9 as of October 1984)
	\$	= US dollar
	¥	= Japanese Yen
(7) Electric Measures	kV	= kilovolt
	kW	= kilowatt
	MW	= megawatt = 1,000 kW
	kWh	= kilowatt hour
	kVA	= kilovolt Ampere



(8) Other Measures

ppm	= parts per million
ppb	= parts per billion
%	= per cent
o/oo	= per millage
pH	= scale for acidity
°C	= degree centigrade
$10^3$	= thousand
$10^6$	= million
$10^9$	= billion (milliard)

B. OTHER ABBREVIATIONS

GDP	= gross domestic products
GRP	= gross regional products
El.	= elevation
H.W.L	= high water level
L.W.L	= low water level
G.L	= ground level
M.S.L	= mean seawater level
L.L.W	= lowest low level
BOD	= biochemical oxygen demand
CDD	= chemical oxygen demand
SS	= suspended solids
T-N	= total nitrogen
T-P	= total phosphorous
ESS	= Eastern Seaboard Study
IOS	= Industrial Opportunities Identification Study

C. ABBREVIATION OF ORGANIZATIONS

BOI	= Board of Investment
CAT	= Communication Authority of Thailand
CIPO	= Center for Integrated Plan of Operation
DOH	= Department of Highway
DTCP	= Department of Town and Country Planning
EGAT	= Electricity Generating Authority of Thailand
ETO	= Express Transportation Organization of Thailand
IEAT	= Industrial Estate Authority of Thailand
IFCT	= Industrial Finance Corporation of Thailand
LDD	= Land Development Department
MEA	= Metropolitan Electricity Authority
MOC	= Ministry of Communication
MOI	= Ministry of Industry
MOE	= Ministry of Education
NESDB	= National Economic and Social Development Board
NHA	= National Housing Authority of Thailand
NSO	= National Statistical Office
PAT	= Port Authority of Thailand
PEA	= Provincial Electricity Authority
PWD	= Public Works Department
PTT	= Petroleum Authority of Thailand
PWWA	= Provincial Water Works Authority
RID	= Royal Irrigation Department
TOT	= Telephone Organization of Thailand
SRT	= State Railway of Thailand

D. LOCAL TERMS

Changwat	= Province
Amphoe	= District (Township)
Tambon	= Township (Town)
Muban	= Village
Muang	= Administrative Center of Province
King Amphoe	= Sub-district
Mae Nam	= River
Khwa	= Main tributary of a river
Huai	= Stream, creek or small tributary
Khlong	= Canal

## LIST OF REPORTS

MAIN REPORT

SECTORAL REPORT

- I. INDUSTRIAL DEVELOPMENT PLAN
- II. PORT DEVELOPMENT PLAN
- III. URBAN DEVELOPMENT PLAN
- IV. TRANSPORTATION DEVELOPMENT PLAN
- V. UTILITY DEVELOPMENT PLAN
- VI. COST ESTIMATION





## 1. INTRODUCTION

In response to the request of the Royal Thai Government (hereinafter referred to as "RTG"), the Government of Japan has decided to conduct the Study on the Development Project of Laem Chabang Coastal Area (hereinafter referred to as "the Study") in accordance with the Agreement on Technical Cooperation between both Governments.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, was assigned to undertake the Study in close cooperation with the authorities concerned of RTG.

The Industrial Estate Authority of Thailand (hereinafter referred to as "IEAT") was assigned as counterpart agency to the Japanese Study Team and also as coordinating body in relation with other organizations concerned.

The scope of work of the Study was finalized in an agreement signed by the representatives of the IEAT, the Office of the Eastern Seaboard Development Committee, and JICA on September 6, 1983.

Actual study work commenced in January 1984 by the arrival of JICA experts in Thailand. Since then, the study was carried out both in Thailand and in Japan including five months field survey in Thailand.

In the course of the Study Inception Report, Progress Report I, Interim Report, Progress Report II and Draft Final Report were submitted to RTG. In addition numerous formal presentations, informal sessions of working groups involving officials of RTG and advisors, and ad hoc discussions and consultations were made. Comments were given by RTG and further discussion were made. This final report is finalized incorporating the results of all these surveys and discussions.

The Report describes the Master Plan and the Short-Term Plan with their planning target years of 2001 and 1991 respectively. The scope of

Short Term Plan was determined by the steering committee of RTG for this study in August 1984.

This Report consists of two volumes; the Main Report which aims to present a general framework and logic of the whole study, and the Sectoral Report in which information is given in more detail for the following components:

- (1) Industrial Development Plan
- (2) Port Development Plan
- (3) Urban Development Plan
- (4) Transportation Development Plan
- (5) Utility Development Plan
- (6) Cost Estimation

List of counterpart members and the concerned personnel are shown in Table 1.1.1 and 1.1.2.



Table 1.1.1 LIST OF COUNTERPART PERSONNEL

	Name	Position
1. <u>IEAT</u>	Mr. Wanchak. V	Governor
	Mr. Prateeb. C	Deputy Governor
	Mr. Jaroen. V	Project Manager
	Mr. Pricha. V	Deputy Project Manager
	Mr. Teerawat. I	Environmental Planning
	Mr. Pramuan. H	Urban/Industrial Planning
	Mr. Manat. C	Utilities Planning
	Mr. Saksit. S	Financial Planning
	Mrs. Wantana. T	Economic Planning
	Mr. Boonyok. T	Coordinator
	Miss Porncharas. A	Foreign Relations
	Mr. Sataporn. P	Draftman
	Miss Rarintip. P	Clerk/Typist
2. <u>STEERING COMMITTEE</u>		
<u>CIPO</u>	Mr. Kamropluk. P	Industry & Urban
<u>PAT</u>	Cdr. Paisarn. V	Director, Marine Survey Division
	Mrs. Medhinee. S	Senior Civil Engineer
<u>MOC</u>	Mrs. Krishanee. V	Director, Economic Division
	Mr. Kovit. K	Director, Planning Division
<u>NHA</u>	Mr. Pree. B	Deputy Governor
	Mr. Boonfaung. P	Director, Policy & Planning Office
	Mr. Narin. S	Deputy Director, Policy & Planning Office
	Mr. Chawalit. R	Policy & Planning Office
	Mr. Komson. S	Policy & Planning Office

<u>DTCP</u>	Mrs. Charasri. T	Director, Comprehensive Planning Division
	Mrs. Yosavadee. B	Comprehensive Planning Division
	Mr. Tadapong. P	Comprehensive Planning Division
<u>SRT</u>	Mr. Siri. P	Super Intending Construction Engineer
	Mr. Aporn. P	Planning & Survey Section
<u>PTT</u>	Mr. Adul. L	Deputy Director, Policy and Planning Department
<u>PWD</u>	Mr. Niyom. N	Director, Provincial Water Supply Division
	Mr. Tanede. D	Provincial Water Supply Division
<u>Advisors</u>		
	Mr. Aitken	IEAT
	Mr. Brudy	IEAT
	Mr. Zinell	IEAT
	Dr. Chakrabarty	IEAT
	Mr. Kugler	CIPPO
	Mr. Van Den Dole	CIPPO
	Mr. Miyota	CIPPO
	Mr. Rae	CIPPO
	Mr. Kampmann	CIPPO
	Mr. Gibbs	CIPPO/PWD

---

Note: Abbreviations of government agencies are given at the beginning of the Report.

Table 1.1.2 LIST OF PERSONNEL CONCERNED

1. JICA ADVISORY COMMITTEE

Chairman	Mr. Hajime Sato	MODI
Port	Mr. Ikuhiko Yamashita	MOT
Industry	Mr. Itsuro Misumi	MITI
Urban	Mr. Koji Murayama	MOC
Coordination	Mr. Akira Murata	JICA
do	Mr. Eiji Tomita	JICA

2. EMBASSY and JICA in Bangkok

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MODI : Mutsu-Ogawara Development Inc.  
 MOT : Ministry of Transport  
 MITI : Ministry of International Trade and Industry  
 MOC : Ministry of Construction  
 JICA : Japan International Cooperation Agency  
 NK : Nippon Koei Co., Ltd.  
 JLC : The Japan Location Centre  
 OCDI : The Overseas Coastal Area Development Institute of Japan  
 RPI : Regional Planning International Co., Ltd.  
 CC : Central Consultant Co., Ltd.





## 2. BACKGROUND

### 2.1 Previous Study and Plan

#### The Fifth National Plan (1982 - 1986)

Economy of Thailand, which had been stagnant for many decades, marked a remarkable progress since 1960's. GDP growth registered annual average growth rate of 8.2% and 7.8% in 1960's and 70's respectively, surpassing most of other developing countries. This rapid economic growth was brought about by a substantial increase in agricultural production and by the development of import substituting industries.

Since the oil crisis in 1973, however, economy of Thailand has come to show some difficult problems such as listed below as a result of severe turn-around in the world economic situation and over-concentration of activities in Bangkok.

- Increase in trade and budget deficit
- Deterioration of natural environment and rise of urban congestion, particularly in Bangkok Metropolis
- Social problems related to security, education, health etc.
- Poverty in backward rural areas

The present Fifth National Economic and Social Development Plan, 1982 - 86 (The Fifth National Plan) advocates several objectives and targets in order to overcome problems mentioned above and to promote economic progress while preserving a national harmony.

Major objectives include,

- (1) Improvement of economic and financial position
- (2) Restructuring of the key productive sectors to raise economic efficiency
- (3) Provision of social services, especially to backward rural areas
- (4) Poverty alleviation in backward areas
- (5) Coordination of economic development activities with national security management

- (6) Adjustment of administrative system and distribution of ownership pattern.

Development targets of the Fifth National Plan include annual growth rates of 6.6%, 7.6% and 4.5% for the economy as a whole, the industrial sector and the agricultural sector respectively. It is strongly expected and emphasized that Thailand will grow to be a "semi-industrialized country" by the end of the Fifth National Plan by promoting import substitution of consumer goods and export of commodities of high value added by fully utilizing local natural resources such as natural gas in the Gulf of Thailand.

#### Eastern Seaboard Development Programme

The Eastern Seaboard Development Programme (ESDP) is a long range as well as large scale development program covering a period of more than 20 years and involving wide range of fields from the industrial development to the development of various supporting infrastructure and utility facilities.

The Eastern Seaboard comprises three provinces of Chonburi, Rayong and Chachoengsao, with a total area of approximately 13,000 km<sup>2</sup> and a population of 1.6 million. The Eastern Seaboard is regarded to be the most essential development area in the implementation of the Fifth National Plan with several favorable conditions for development. It is located adjacent to the Bangkok Metropolis facing the Gulf of Thailand and next to the Northeastern Region from which abundant supply of labor force and various raw materials can be expected. It is provided with reasonably good infrastructure facilities such as communication facilities, road network and port. The pipeline, with a total length of 425 km, the longest under sea pipeline in the world, also comes ashore near Map Ta Phut to convey natural gas produced in the Gulf of Thailand to the Eastern Seaboard and further to Bangkok.

ESDP is to be implemented with an emphasis placed on the two major target areas of Laem Chabang and Map Ta Phut, while development in moderate scale is planned in Pattaya and Sattahip.

Development of Laem Chabang Complex consists of three components, namely a deep sea port, an industrial estate including an export



processing zone and a new town. Industries to be introduced are planned to be small scale, labor intensive and non-polluting type in line with the national development objectives such as generation of employment opportunities, export promotion and mitigation of congestion in the Bangkok Metropolis area. Most of the area for the industrial estate and the port, which cover 450 ha and 1,100 ha respectively, has been acquired by the government already. The deep seaport is scheduled to start operation in between 1987 and 1990.

Development of the Map Ta Phut Complex also comprises a port, an industrial estate and a new town. Natural gas related basic industries are under planning for development, which include gas separation, fertilizer and petrochemical plants.

Total investment cost for ESDP is roughly estimated to be US\$4,350 million for the initial development according to a document by RTG.

## 2.2 Present Conditions of Study Area

### 2.2.1 Administrative Boundaries and Socio-Economic Characteristics

#### 1) Administrative Boundaries

The Laem Chabang Complex is located in the Chonburi Province (Changwat Chonburi) about 120 km from Bangkok (see Location Map after the cover) to the southeast. It is situated over the two townships of Tung Sukhla and Bang Lamung of Siracha District (Amphoe Siracha) and Bang Lamung District (Amphoe Bang Lamung) as shown in Fig. 2.2.1.

#### 2) Population

Population of Chonburi Province was approximately 725,000 in 1980 accounting for about 4.5% of the population of the Central region and 1.5% of the population of Thailand (Fig. 2.2.2). Population of Amphoe Siracha was 100,129 in 1980 accounting for about 14% of the Chonburi Province (Fig. 2.2.3). Population of the Tambon Tung Sukhla and Bang Lamung were around 13,800 and 7,900 respectively in 1981 and the sum of

the two townships accounted for about 3% of the population of the Chonburi Province (Fig. 2.2.4, Table 2.2.1). Annual average growth rate of the population of the two Tambons was 1.8% in recent five years indicating a high growth rate compared with the growth rates of Chonburi Province and nation as a whole each of which indicated 1.2% and 1.3% during the same period.

Numbers of households in the two Tambons were 2,150 and 978 indicating an average household size of 6.4 and 8.1 respectively. The average figures for Thailand and Chonburi were 6.2 and 6.5 respectively.

### 3) GPP and GDP

Gross Provincial Product (GPP) of the Chonburi Province in 1982 was  $\text{฿}42,206 \times 10^6$  in current price and  $\text{฿}10,992 \times 10^6$  in 1972 constant price representing 4.9% of the Gross Domestic Product (GDP) in current prices. An average annual growth rate of GPP was 5.6% in real terms in the recent five years coinciding with the annual growth rate of GDP. Per capita GPP in 1982 was  $\text{฿}14,122$  in 1972 constant price which is more than double of per capita GDP of  $\text{฿}6,688$ . Per capita GPP in real terms grew at an annual growth rate of 2.1% between 1978 and 1982, while the growth rate of per capita GDP was 3.3% during the same period.

The total GPP of  $\text{฿}10,992 \times 10^6$  in 1982 is composed of  $\text{฿}2,078 \times 10^6$ ,  $\text{฿}3,641 \times 10^6$  and  $\text{฿}5,273 \times 10^6$  or 18.9%, 33.1% and 48.0% from agriculture, manufacturing and other sectors respectively as shown in Table 2.2.2. It is indicated by these figures that Chonburi Province is relatively advanced in industrialization compared with the nation as a whole. Share of each sector in GDP represented 24.0%, 21.0% and 55.0% for agriculture, manufacturing and the other sectors in 1982.

An average annual growth rate of each sector of GPP was -3.3%, 8.6% and 8.2% for agriculture, manufacturing and other sectors respectively. Economic development of the Chonburi Province was brought about mainly by the expansion of manufacturing and service sectors.

### 4) Employment

Expansion of industrial and service sectors can also be observed in the employment structure. As shown in Table 2.2.3, manufacturing and other sectors whose majority derives from service and commercial activities, shared 40% of the total economically active population in 1970 and grew to account for 49% in 1980 in Chonburi Province. Average annual growth rate during the period was 5.3% and 4.8% for manufacturing and other sectors respectively. On the other hand, the share of agriculture sector fell to 51% in 1980 from 60% in 1970, though actual number of employment increased at an annual growth rate of 1.4%.

#### 5) Existing Industries

There are several large industries in the Study Area at present. They are Thai Oil Refinery (TORC) and ESSO Oil Refinery which are located in the north of the planned industrial estate, and Siracha Industrial Park Estate (SIPE) situated about 7 km east of the Ao Udom Town. TORC is a joint venture of Thai government and Shell Company producing petroleum product of  $3,456 \times 10^6$  lit. in 1980. It plans to increase its production capacity from the present  $65 \times 10^6$  barrel/day to  $120 \times 10^3$  barrel/day by 1986 and an approval from the government was already given. ESSO Oil Refinery is located adjacent to TORC. It produced  $2,489 \times 10^6$  lit. of petroleum products in 1980 with the production capacity of  $45 \times 10^3$  barrel/day. It also had a plan to augment its production capacity to  $63 \times 10^3$  barrel/day by the end of 1984.

Siracha Industrial Park Estate is a private industrial estate run by Sahapatanapibul Co., Ltd. At present six firms are operating in the estate producing such products as canned fruits and rubber products. Locations of above mentioned and other factories are shown in Fig. 2.2.5.

#### 6) Present Land Use

Fig. 2.2.6 illustrates the present building use around Laem Chabang Area. At present around 450 houses are scattered in the Laem Chabang coastal area with a temple and school in their center. Major populated areas are found in Sirach and Ao Udom. Siracha is the center of socio-economic activities in this area with commercial, administrative and