JICA

FEASIBILITY STUDY REPORT ON
THE ESTABLISHMENT OF INTEGRATED CEMENT
FACTORY IN KELANTAN, MALAYSIA

Feb. 82

J I C A

FEASIBILITY STUDY REPORT
ON
THE ESTABLISHMENT OF INTEGRATED CEMENT FACTORY IN KELANTAN, MALAYSIA

February, 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

FEASIBILITY STUDY REPORT

ON

THE ESTABLISHMENT OF INTEGRATED CEMENT FACTORY IN KELANTAN, MALAYSIA

February, 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of Malaysia, the Government of Japan decided to conduct a survey on the Establishment of a Cement Factory in Kelantan and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to Malaysia a survey team headed by Mr. H. Sugiura from May 11 to June 6, 1981.

The team had discussions with the officials concerned of the Government of Malaysia and conducted a field survey. 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 Cement Industry in Malaysia 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 Malaysia for their close cooperation extended to the team.

February, 1982.

Keisuke Arita
President
Japan International Cooperation Agency

[illegible]

[illegible]

[illegible]

[illegible]

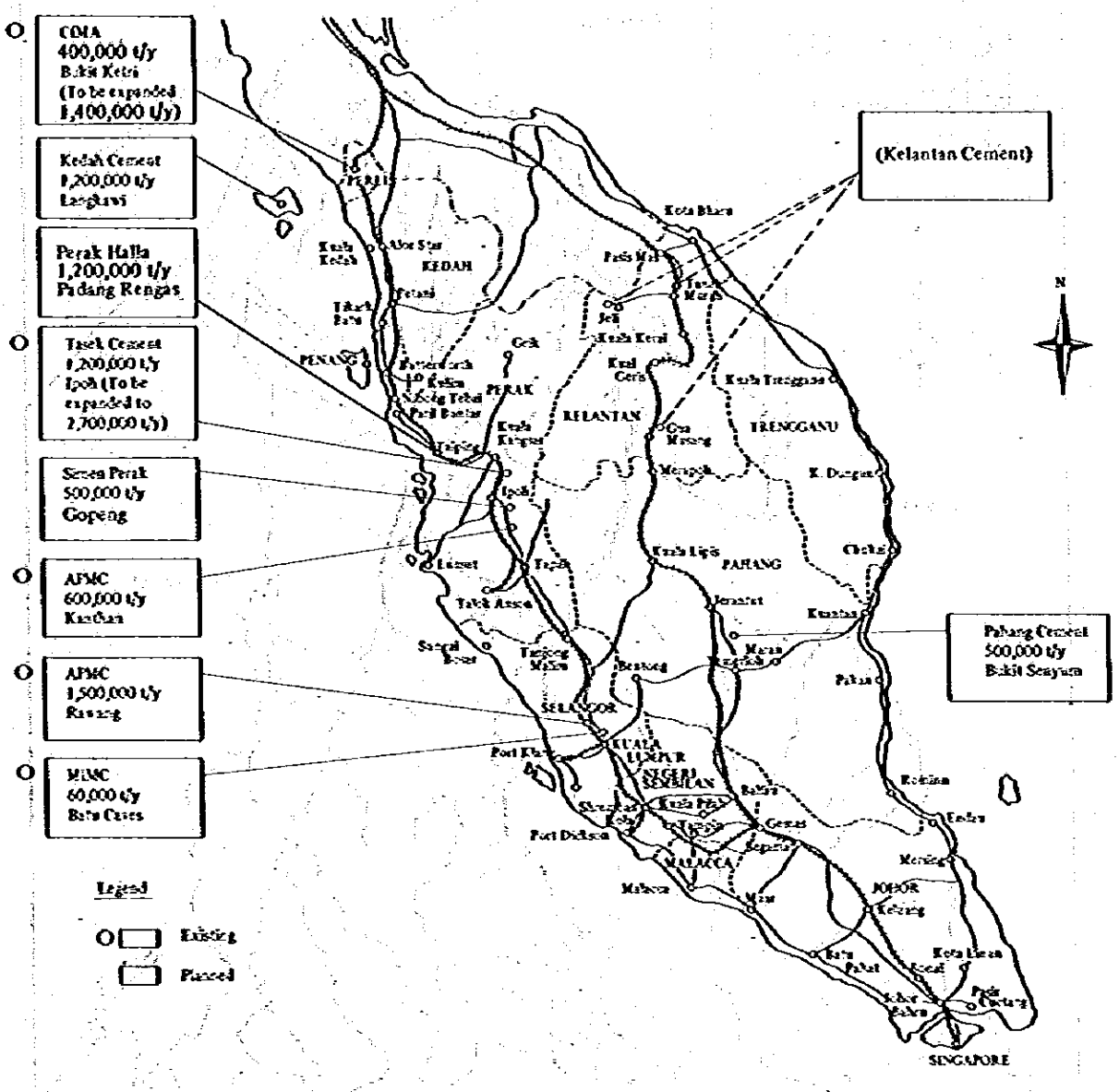
[illegible]

[illegible]

[illegible]

[illegible]

Location of Existing and Planned Cement Plant in Peninsular Malaysia



The Field Survey Location Map of Cement Raw Material in Kelantan

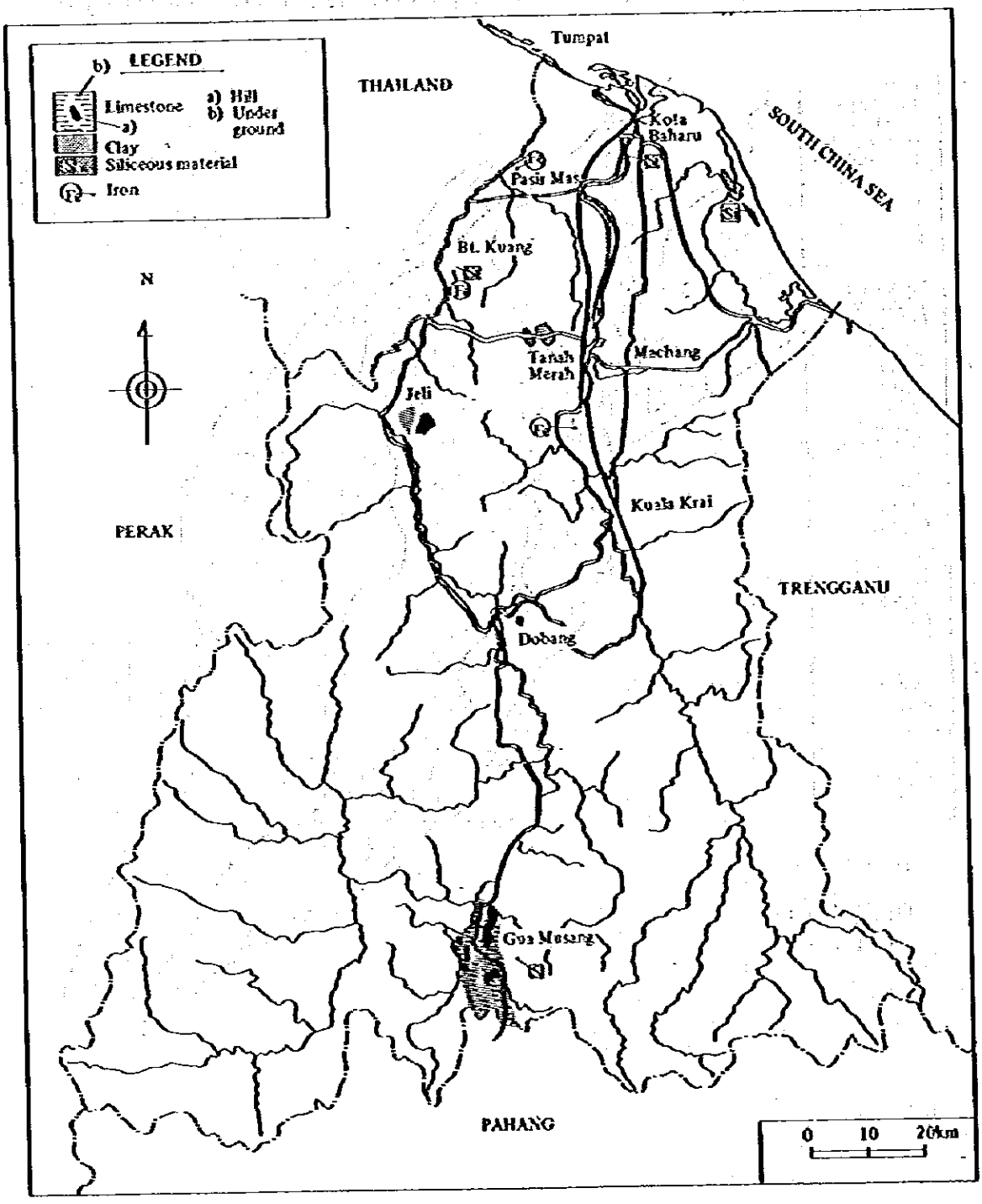


TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

VISITS BY THE STUDY TEAM

[Kuala Lumpur]

- Economic Planning Unit, Prime Minister's Department
- Ministry of Trade and Industry
- Ministry of Public Enterprises
- Ministry of Finance
- Ministry of Housing
- Ministry of Science, Technology and Environment
- Malaysia Industrial Development Authority
- Statistics Department
- Malayan Railway
- Federation of Malaysia Manufactures
- Associated Pan Malaysia Cement Sdn. Bhd. / Rawang Works
- Malaysia Industrial & Mining Corporation

[Kelantan]

- State Economic Planning Unit, State Secretariat
- State Economic Development Corporation – Kelantan
- Kelantan Selatan Development Authority
- National Electric Board
- Public Works Department
- MTI Enforcement Division
- Department of Irigation and
- Department of Agriculture
- Malaysian Meteorological Service
- Wakaf Bharu Railway Station
- Kuala Krai Railway Station
- Geological Survey Department
- Telecommunication Department
- Kota Bharu Town Board
- Tanah Merah District Office
- Gua Musang District Office
- Land and Mine Office, Kelantan
- Quarry Indera
- JKR Quarry
- Timor Borat Quarry
- Italian – Thai-Kenneriron J.V.
- Lorry Malaysia
- USAHA NIAGA KELANTAN
- BABENA

[Trengganu]

- State Economic Planning Unit
- State Economic Development Corporation – Trengganu

[Pahang]

- State Economic Planning Unit
- Port Authority of Kuantan

[Perak]

- Geological Laboratory
- TASEK Cement
- APMC Kanthan Works

[Perlis]

- Cement Industries of Malaysia

ABBREVIATION

ϕ, dia.	Diameter	GDP	Gross Domestic Product
%	Percent	GNP	Gross National Product
AMSL	Average Mean Sea Level	H	Hight
Ac, AC	Acres	ha	hectare
approx.	Approximately	hr., Hr.	hour
¢	Cent	Hz	Herts
°C	Centigrade Degree	IRR	Internal Rate of Return
cf.	Confer	Kg, kg	Kilogram
C & F	Cost and Freight	Kg cℓ'	Kilogram clinker
CIF	Cost, Insurance and Freight	Kℓ	Kiloliter
cm	Centimeter	km	Kilometer
Cu., cu.	Cubic	Kcal	Kilocalorie
Dept.	Department	Km^2	Square kilometer
db	Decibel	KV, kV	Kilovolt
DC	Direct Current	Kgf	Kilogram force
E.	East	KW, kw	Kilowatt
°F	Fahrenheit Degree	KWH, kwh	Kilowatt-Hour
Fig.	Figure	ℓ	Liter
FOB	Free on Board	L., l	Length
FOR	Free on Rail.	Lb, lb	Pond
F/S	Feasibility Study	L.O.I.	Loss of Ignition
ft.	foot, feet	m	Meter
g	gram	mm, m/m	Millimeter

M	Thousand
mA	Milliampere
MM	Million
m^2	Square meter
m^3, cu. m	Cubic meter
Max.	Maximum
Min.	Minimum
MT, M. tons	Metric ton
MVA	Megavolt-Ampere
MW	Megawatt
N.	North
Nm^3	Normal cubic meter
No.	Number
P.	Page
ppm	Parts per million
PVC	Polyvinyl Chloride
Q'ty	Quantity
S.F.	Safty Factor
S.L.	Sea Level
sq.	Square
μ	Micron
μm	Micron meter
μR	Micron resistance
μV	Micron volt
t, T	Ton
t-cl	Ton clinker
UAE	United Arab Emirates
UK	United Kingdom
USA	United State of America
US$	United States dollars
M$, $	Malaysian dollers
V	Volt
W	West, Width
¥	Yen
wt.	Weight
/Day, /d, /day, /D	Per day
/ha	Per hectare
/m	Per meter
/M, /m, /month	Per month
/min	Per minute
/M. Month, /Man Month	Per man month
/t-cement	Per ton cement
/t, cl	Per ton clinker
/Y, /Yr.	Per year
/week	Per week

MEMBERS OF THE JAPANESE STUDY TEAM

First Stage

Mr. Hiroshi	SUGIURA	Team Leader
Mr. Ryutaro	NODA	Assistant Team Leader
Mr. Tetsuya	HIRONAKA	Economist
Mr. Hideo	YASUKI	JICA

Second Stage

Mr. Nobuyoshi	HANDA	Project Engineer
Mr. Kenji	ARITA	Mining Engineer
Mr. Seishyo	TAKAHASHI	Geologist
Mr. Masafumi	OHKUBO	Project Engineer
Mr. Hiroki	TATENO	Economist
Mr. Toshimichi	SUZUKAWA	Geologist

SCHEDULE OF THE JAPANESE STUDY TEAM

May 11 (Mon)	P.M.	Arrival of First Stage Team at Kuala Lumpur
May 12 (Tue)	A.M.	Visit to JICA and Japanese Emabssy
	P.M.	Steering Committee at Prime Minister's Dept.
May 13 (Wed)	A.M.	Steering Committee at EPU
May 14 (Thu)	A.M.	Visit to MIDA
	P.M.	Visit to EPU
May 15 (Fri)	A.M.	Visit to Federation of Malaysian Manufacturers
		Visit to MTI
	P.M.	Visit to MIDA and APMC
May 16 (Sat)	A.M.	Visit to EPU, JICA and Dept. of Statistics
	P.M.	Visit to APMC Rawang Cement Factory
May 17 (Sun)	P.M.	Arrival of Second Stage Team at Kuala Lumpur
May 18 (Mon)	A.M.	Kuala Lumpur to Kota Bharu Internal Meeting with all the members
	P.M.	Field Survey of Aggregate Quarry at Bt. Marah Kemasin and Proposed Mini Port at Kemasin
May 19 (Tue)	A.M.	Technical Committee at SEPU Visit to KESEDAR and LLN (NED)
	P.M.	Visit to JKR and SEPU Field Survey of Iron Ore Quarry at Temangan Courtesy Visit to Chief Minister Dinner Party with State Government Officials
May 20 (Wed)	A.M.	Visits to SEDC, MIDA, Dept. of Agriculture, Geological Survey Dept. and JKR
	P.M.	Visits to SEPU, MIDA, Dept. of Agriculture
May 21 (Thu)		Field Survey at Gua Setir
		Field Survey of Tanah Merah and Jeli Industrial Estates
		Visits to SEPU and MTI (Enforcement Div.)
May 22 (Fri)		Field Survey at Gua Musang
		Field Survey of Gua Musang Industrial Estate Construction Sites for Gua Musang-Kualan Kari Highway and Gua Musang-Kuala Betis Highway
		Visit to MIDA (Pahang State)
May 23 (Sat)		Field Survey at Gua Musang (East side I)
		Visits to Gua Musang District Office, LLN Gua Musang Office, Italian-Thai-Kenneiron J.V., JKR Gua Musang Office and Malayan Railway Kuala Kral Office

	Visits to SEPU (Pahang State), and SEPU and SEDC (Trengganu State)
	Field Survey of Semanbu Industrial Estate, Gebong Industrial Estate and Old Kuanan Port (Pahang State)
May 24 (Sun)	Field Survey at Gua Musang (East side 2 and West side)
	Visits to MPKB, SEDC and DID
	Field Survey of Tumpat Station and Port
	Visits to SEPU and JKR (Trengganu State)
May 25 (Mon)	Field Survey at Gua Musang (Center)
	Field Survey of Italian Thai Road
	Visits to Telecommunication Dept., DID and MINCO (local consultant)
	Visits to MIDA and USAHA
	Visits to Dept. of Statistics, MIDA and APMC (K.L.)
May 26 (Tue)	Field Survey at Gua Musang (West side 1) and Tanah Merah
	Visits to Dept. of Agriculture, KESEDAR and Land and Mine Office, Kelantan
	Visits to SEPU, Meteorological Office (Kota Bharu) and LLN
	Field Survey of Pengkalan Chepa Industrial Estate Phase I and Phase II
	Visits to Dept. of Statistics (K.L.) MIDA and APMC
	Visits to JETRO and JICA (K.L.)
May 27 (Wed)	Field Survey at Gua Musang (West side 2) and Sungai Kelantan
	Visits to Kuala Krai Railway Station and Quarry Indera
	Visits to Tanah Merah Industrial Estate, Tanah Merah District Office and SEDC
	Visits to Dept. of Statistics (K.L.) MIDA and JICA (K.L.)
May 28 (Thu)	Field Survey at Dabong and Bachok
	Visit to Tasek Cement Factory
	Visit to CIMA Cement Factory
	Visit to Tasek Packing Dept. (K.L.)
May 29 (Fri)	Internal Meeting

May 30 (Sat)	Visit to Wakaf Bharu Railway Station
	Visit to MTI (Enforcement Div.) and USAHA
May 31 (Sun)	Visits to JKR Quarry and Timor Barat Quarry
	Visit to SEPU
June 1 (Mon)	Visit to Pasir Mas District Office
	Visit to MTI (Enforcement Div.)
June 2 (Tue)	State Technical Committee at SEPU
	Visits to SEDC, USAHA and Lori Malaysia
June 3 (Wed)	Kota Bharu to Kuala Lumpur
June 4 (Thu)	Steering Committee at EPU
	Visits to Dolomite Quarry, MIMCO, APMC and Buildcon
	Visits to MSTE (Environmental Div.) and Dept. of Statistics
	Visit to MTI (Domestic & Trade Div.)
June 5 (Fri)	Visits to Ipoh Geological Lab. and APMC Kanthan Works
	Visits to Malayan Railway and Malaysian Meteorological Service
	Visits to JKR (Development Div.), MIDA, EPU (Construction Material Supply Committee), Ministry of Housing, Dept. of Statistics and Lori Malaysia
	Visit to Japanese Embassy and JICA
June 6 (Sat)	Leave Kuala Lumpur to Tokyo

I SUMMARY OF THE STUDY

I. SUMMARY OF THE STUDY

I-1 Background Information of the Project

(1) General Information of the Kelantan State

The State of Kelantan lies in the north-east of Peninsular Malaysia. The State faces on the South China Sea in the north-east, and borders Thailand on the west and Perak on the west, Pahang on the South, Trengganu on the east. The total area of the State is 14,391 sq. km. The southern part of the State is mountainous and hilly, which is about 80% of the area of the State, and is covered by forest.

In general the Kelantan State has a tropical climate characterized by uniform and high temperatures, high relative humidity, abundant precipitation and little wind. There are two rainy seasons in the southern hilly area, April to May and October to December, while in the northern plain, there is only one rainy season-October to January, and is affected by the monsoon from the ocean.

The Kelantan River with its many distributaries drains a total area of 12,867 square kilometers, comprising 85 percent of the State's surface area, and has very gentle slope of about 1/6,000 in its down streams. The recorded maximum flood was in 1926, and the biggest flood during the post 30 years was in 1967. The proposals to construct dams in order to control the flood water of the river on S. Galas and S. Lebir are now reviewing.

Only 9.5% of the people are living in two districts of Ulu Kelantan and Kuala Krai, which cover about 74% of the State's surface area, and more than 90% of the State's population are living in the rest northern districts.

(2) Infrastructure

The road networks are well developed in the paddy field area at the northern part of the State and there is no access road passing through the forest area at the southern part of the State. The bridge between Kota Bharu and Wakaf Bharu is only a road bridge crossing the Kelantan River at this stage and the other bridge is for railway but available for cars between Tanah Merah and Machang. The lack of bridge is the bottle neck of road transportation of the Kelantan State. The completion of the East-West Highway will have an important influence on the State. It will open the way to the principal commercial and industrial cities as well as the principal commercial ports at the western part of the Peninsula. The highway between Kuala Krai and Gua Musang is under construction. This is a strategically important road contribution to the development of the southern hinterland area as the first access road to this area. The other highway systems are under planning.

The Malayan Railway in the Peninsula originates from Singapore and passes through the southern part and reaches Gemas, then it branches off to the western part and to the central part of the Peninsula. The Government has an improvement program to increase train speed, the number of locomotives and wagons including the improvement of telecommunication system and switch yard facilities.

The entire length of the east coast of the Peninsula is a sandy beach and there is no big port along the east coast. The construction of Port Kuantan was suspended due to unexpected

troubles. Port Kemaman is also under construction for the supply base and has an expansion plan. The port of Tumpat in the State of Kelantan have encountered the serious problem of silting and shoaling and lost its function.
A feasibility study of Port Kuala Kemasin in Kelantan State has been completed. This port will serve as the entrance port of the State and contribute to the economic and industrial development of the State.

Kota Bharu will soon be the third international airport among the 8 air ports in the Peninsula.

A 275 KV high tension line is planned to link Tanah Merah by 1982-83. A 132 KV high tension line is planned to link Gua Musang by 1985-86.

The water supply and telecommunication to the cities, towns and the industrial estates are provided and have an expansion program.

(3) Industrial Estates

The Kelantan State Government has planned to develop the industrial estates at four places in order to accelerate economic and industrial development in the State as well as to give impetus to the people to have more chances for employment.

Kelantan State Economic Development Corporation (SEDC) is the main executing agency and has been executing, by its own investment fund, land clearing, land reclamation, arrangement of lots, construction of road and drainage networks of the Estates and to provide necessary infrastructure facilities such as electric power, water, telecommunication, etc. to the Estates.

a) Pengkalan Chepa Industrial Estate
This Estate consists of Phase I, Phase II and Free Trade Zone. Industries of labour intensive industries having the merits of air transportation, light industries with less pollution are to be introduced.

b) Tanah Merah Industrial Estate
The Malayan Railway and a highway run besides the Estate. Wood-based industries are recommended. All the developed land had been occupied and 3 sawmills are under operation.

c) Jeli Industrial Estate
The rapid development can be expected in this area because of the tremendous development scheme being made by KESEDAR. The wood-based industries are indicated to be allocated in this Estate.

d) Gua Musang Industrial Estate
The integrated development program by KESEDAR is under way in South Kelantan, and Gua Musang is located at the central area of the development plan. Gua Musang 2000 is a big programme including government complex, commercial center, industrial complex, housing, recreation and tourism, and is expected to be completed by the year of 2000.

I-2 Marketing

(1) Overview of the Malaysian Economy

After the outburst of racial conflict in Malaysia in 1969, the New Economic Policy, a socio-economic policy was designed, which aims to achieve national unity through eradication of poverty irrespective of race and restructuring society to eliminate the identification of race with economic function.

During the decade of 1970s two Five Year Economic Plans were made and practiced. The actual performance of GNP growth in 10 years made an average annual growth rate of 7.8% which is higher than the original plan of 7.6%.

This remarkable achievement was realized mainly due to larger consumption and investment performances than the planned ones. The actual trade balance was more import instead of the more export as was planned. By sector of Origin, Agriculture which used to be the largest sector of GDP (32% in 1970), accounts now for 22.9% of GDP at factor cost in 1980. On the other hand, the Manufacturing sector and the whole sale and retail trade, etc. have made a higher growth rate than the planned ones.

The Fourth Malaysian Plan sets the growth rate at 7.9% under the rather unfavorable circumstances in the world wide. Important elements of development strategies for 1980s are; increasing productivity of agriculture, the expansion and the diversification of industrial base, modernization of the financial and service sectors, diversifying the source of growth, export promotion by new sources of export, import substitution, balanced socio-economic development among the regions, protection of environment. It is planned that growth rate of investment is to be made moderate for the present decade and there will be more private investment than public, because there will be more expenditure by government on defence and internal security. The growth in both the agricultural and industrial sectors calls for rapid growth of a number of supporting sectors such as transport, wholesale and retail trade, financial and business services and government services.

The construction sector recorded a rapid increase in the past decade, largely due to the construction boom in 1976-80. In the present decade, it will expand slightly less than the post decade, but measures will be taken to lower the cost of dwelling units through curbing speculation in real estate transactions, improving administrative procedures, and encouraging adequate supplies of construction materials and skilled labor.

(2) The Cement Industry

This industry's growth of the value added and share of GDP in the lost decade are 7%, 5.4% in 1971 ~ 75 and 15.2%, 4.9% in 1976 ~ 80. As the Fourth Malaysian Plan points out, the growing demand for building materials to meet the public and private sector construction programs will require expanded domestic supplies of construction materials and considerable emphasis will be placed on the expansion of industries related to the manufacture of construction materials.

The consumptions of cement in Malaysia and Peninsular Malaysia in 1980 were 3,050.4 thousand metric tons and 2,608.4 thousand metric tons respectively. It has grown at an average rate of 8.8% per annum during the period between 1962 and 1970, and 12.4% per annum during the period of 1971 and 1980, while it in Peninsula has grown at 10.0% and 12.1% during the respective periods.

There have been five portland cement manufacturers in Malaysia, one of which is the grinding mill (CMS) located in Sarawak and the remaining four are located in Peninsular Malaysia. Cement production in Malaysia in 1980 was 2,607 thousand tons. The growth rate of cement production in Malaysia between 1971 and 1975 was 7%. It was 12.5% between 1976 and 1980 mainly due to CMS's starting. There has been long delay of inplementation by the two approved projects. Expansion of 1.2 million tons per year plant by APMC was completed.

The consumption of cement in Malaysia has always exceeded production and the gap has been filled by import since 1961.

Malaysian Industrial Development Authrority estimates demand and Supply forecast till 1988 at the assumption of three cases.

1-3 Assessment of Raw Materials

(1) Geological Investigation

a) Limestone

Prior to undertaking the field survey, the Team had a meeting with the Geological Survey Department, Kota Bharu to select appropriate limestone deposits to survey and decided to pick up Gua Setir, 4 limestone hills near Dabong and Gua Panjang. The first two has been reported already, but Gua Panjang is surveyed virginally at this time. As for preliminary study described in Appendix I, all deposits are considered to supply limestone to the nearest proposed plant site, however in this main report, only Gua Panjang is utilized for the case study. The limestone deposits around Dabong will be surrounded by water if Dabong dam project is implemented. The quality and reserve of Gua Panjang is suitable for the cement manufacturing, while all deposits show good quality.

b) Clay

Clay itself is very common in the nature and easily found close to the limestone deposit or the Industrial Estate. Three deposits are surveyed and all samples show an adequacy for cement production. Especially Tanah Merah west contains high SiO_2, which can save to add silica sand to raw material mix preparation.

c) Silica sand

There is no studies reported anything on siliceous materials for cement manufacturing. After the discussions with the Geological Survey Department, five deposits are surveyed. All samples show good quality for cement manufacturing, however, Kelantan river sand is utilized for the study because of easy handling. It shall be surveyed again around Gua Musang to get siliceous material to save transportation cost.

d) Iron ore

The history of iron ore deposit in the State of Kelantan began at Temangan in 1921. Untill 1965, 6,050,000 tons of iron ore were mined, but the resultant shortage of reserve caused the mine to be closed. For the Study, Bukit Lata iron ore is utilized, but further study is recommended.

e) Gypsum

Reports describing gypsum deposits in Malaysia are not available. Cement factories in Malaysia are importing Thailand gypsum today, therefore the Study is using imported gypsum.

(2) Raw Material Quarry

Gua Setir deposit forms a narrow hill surrounded by steep walls. Therefore the mining road is difficult to construct, so blasted limestone is pulled down to the foot of hill, then transported to the crusher plant. The deposits near Dabong and Gua Musang are developed as bench cut system with mining roads. Crushed lime stone is transported by truck or railway to the proposed plantsite, but Gua Musang plant can receive lime-stone directly by the belt conveyor.
The rest raw materials such as clay, silica sand and iron ore are simply quarried and transported by truck and rail. Gypsum is transported by rail from Thailand.

(3) Quality of Raw Materials

Gua Setir and Dabon limestone have more than 52% CaO and less than 2% MgO, and other minor compositions are less then the allowable limits. Gua Panjang deposit shown the different quality depending upon the blocks, however two blocks in the central and west side are good and still have huge reserves. The other materials have no difficulty to use.

I-4 Basic Study of Plant

(1) Study on the Demand and Supply Situation of the Cement in Malaysia and Peninsular Malaysia

Four equations for estimating the cement demand in Malaysia were formulated by (a) Correlation with GDP between 1970 and 1980, (b) Correlation with Fixed Capital Formation between 1973 and 1980, (c) Growth curve (Logistic curve) based on the pen capita cement consumption (five year moving average) between 1967 and 1978, and (d) Elasticity of cement demand growth against Construction sector growth between 1970 and 1980. The estimate (b) shows a lower figure because of the lower Fixed Capital Formation estimated by the Fourth Malaysian Plan. After the reasonable correction to (b), it is concluded that 11.5% annual growth rate of the cement consumption is accepted up to 1990, which is 9,158 thousand tons in 1990. MIDA has made the estimate of 15% annual growth rate and the Cement Industry is saying 10 ~ 12% annual rate. The demand in Peninsula in 1990 was estimated by the proportion to GDP and logistic curve, but finally the most likely estimate is used the annual growth rate of 11.5%.

The import of cement is still 321 thousand tons in 1980 due to delay of the approved project on one side and the increase of the demand on the other side. The export of cement should not be more than some 10% or some more of the total sales, so as to maintain the profitability and stability of plant operation.

The following can be said as a whole.

a) It becomes important for the Government to check the exact progress of the implementation program, otherwise there will be shortage of cement.

b) This will serve as one of the main reason why the two expansions and the new project were approved this year.

c) There will be room for new entry by the Kelantan Cement of 740 thousand ~ 1200 thousand ton per year in 1989 at the view point of the total Malaysia.

d) If we look it from the viewpoint of the Peninsula only, Kelantan Cement may enter the industry in 1990.

e) On the other hand, if one of the approved projects fails to implement for any reason, the Kelantan Cement can start earlier.

f) The cement were exported to East Malaysia in the past and there also will be the chance in the future.

(2) Local Demand Forecasts in Eastern Coast States

There has been overall shortage of cement in Peninsula between 1979 and the first half of 1981. In Kelantan and Trengganu this shortage was declined most, because there were shortage of wagons and locomotive power for transportation of cement from the plants to these States, and secondarily because there were least incentives for the manufacture to supply cement to these States which are farthest away from the plant. The eastern three states consumed some 235 thousand tons in 1979 and some 332 thousand in 1980. Each State has shown remarkable growth of cement consumption from 1979 to 1980, some 19% in Trengganu to some 44% in Kelantan and some 96% in Pahang.

As the actual consumption in these States for the past ten years was not known. The future consumption in the States is estimated as it will be proportionate with GDP in each state in 1990. For the estimates up to 2000, the per capita cement consumption is applied.

(3) Determination of the Local Market

If the Pahang Cement is implemented in 1986, it is natural for them to try to sell all their cement within the nearest market from the plant. If the local market for the Kelantan Cement is selected from the viewpoint of less transportation cost, Kelantan State, Trengganu State will be its area and size. This is concluded from the midpoint of the road and railway from the competitive west side cement manufactures. The possibility of Kelantan Cement's entry into the local market is no problem for 740 thousand ton per year plant in 1989 and 1990. However, in case of 1200 thousand ton per year plant in a few years it has an excess capacity. There are some idea to overcome these.

a) To sell the excess amount in the partial market of Pahang.

b) To sell the excess amount for export.

c) To reduce the production.

(4) Determination of Study Case

In preliminary, nine cases are determined to cover three levels of the plant capacity at three proposed plant sites. The results of these studies are described in Appendix I in this report.
The best case is screened out from these nine cases, which is the rated capacity of 740 thousand tons per year plant at Tanah Merah. This is called as Case A. Case B in this section is newly added to improve the profitability proposing a large plant at Gua Musang.

Case A (Tanah Merah Plant) has to receive limestone from Gua Musang because of difficulty to develop Dabong deposits as described before. Clay can be supplied near both for Case A and Case B. Silica sand for Gua Musang is supplied from the Kelantan river, for Tanah Merah from its clay. Iron ore is considered to utilize Bt. Lata for both cases. Gypsum is imported from Thailand.

Electric power is possible to be supplied from 275 KV national grid under construction for Tanah Merah and 132 KV for Gua Musang now in planning stage.

Water can be supplied from river or underground for both cases.

(5) Process and fuel study

The differences between SP and NSP process are mainly explained by the Kiln design. Heat duty of the kiln in the NSP process is decreased by means of an additional firing at the calciner. This merit becomes bigger at the case of large capacity such as Case B in saving refractory maintenance and reducing electricity consumption due to the relatively smaller size kiln. In Case A, the capacity is in a permissible range of standard SP process in any aspects and it is expected to be able to operate the plant easily.
For fuel, coal is the most inexpensive now, but it is difficult to get locally in Malaysia. Indonesian coal is imported these days, however, it seems more stable to get coal from Australia even its cost being higher.

(6) Quality of cement and mixing proportion of raw materials

The quality of ordinary portland cement in this study is assumed to satisfy the following three quality requirements.

a) To satisfy the standards of ordinary portland cement in B.S. and portland cement Type-I in ASTM.

b) To be equal or superior to the quality of cement produced in Malaysia at present.

c) To be able to export to the Southeast Asian market.

Moduli of cement is determined as follows.
Hydraulic modulus: 2.1
Silica modulus: 2.6
Iron modulus: 1.8

(7) Outline of the Plant

Design basis of the plant is fixed from the capacity and mixing proportion of raw materials. The operating hours for each equipment are considered. Specification of main machinery and equipment, flow sheet and layout plan are also attached. Organization and personnel requirements are discussed in this report. General description of the process is described.

Environmental influences of the cement industry are dust, SOx, NOx, weste water, noise and traffic increase. Dust is easily collected by a proper equipment, and SOx is fixed in the product. The others have to make measures as described.

Supporting industries to be necessary are as follows.

a) Raw materials mining industries
b) Fuel and other material supplying industries
c) Transportation industry
d) Cement sales industry
e) Electric power industry
f) Consumables and spare parts industries
g) Repair and maintenance industries

(8) Capital requirements and financing plan

Project capital requirements are estimated in million M$ as follows.

	Case A	Case B
Plant cost	193	272
Pre-operating expenses	9	13
Initial working capital	19	31
Interest during construction	18	26
Total	240	342

Tentative financing plan is as follows.

	Case A	Case B
Equity (30%)	72	102
Debt (70%)	168	240
long term loan (80% p.a.)	149	209
short term loan (10% p.a.)	19	31
Total	240	342

(9) Financial analysis

a) Production and sales

Commercial operation of the plant will be started in 1989, and the plant has an economic life-span of 15 years after the start up.

The rate of net capacity utilization will be 70% for the first year, and 100% for the subsequent years.

For Case B, the penalty of decreasing the plant capacity at the first few years is calculated in.

b) Production cost (M$/ton)

	Case A	Case B
100% production at the first year	159	146
Average production cost in 15 years	145	134
Rato of profit on sales	25%	30%

c) Break-even point (average in 15 years) 45% 38%

d) Pay-out period (years) 5.3 4.7

e) Internal rate of return

	IRR on investment		IRR on equity	
	Case A	Case B	Case A	Case B
Before tax	16.1%	19.4%	-	-
After tax				
No incentives	10.8%	13.1%	12.0%	16.0%
ITC 35%	11.9	14.2	14.1	18.2
ITC 60%	12.5	14.9	15.3	19.6
Pioneer 7 years	14.8	17.9	19.1	24.5

As a result of further analysis, a cement plant in Gua Musang can be said to be in the range of promising level from the view point of profitability on equity and can be said to be in the range of acceptable level from the view point of profitability on investment. If the market will be sufficient to sell all products in Case B, it will be more favourable as shown in the above.

f) Sensitivity Analysis

If the interest of long term loan is 10% p.a., production cost increases 5 M$/ton and IRR on equity decreases 1.3% for both cases.

If the sales price of cement changes 10%, IRR on investment after tax changes 3%, but if coal price and plant cost change 10%, IRR on investment after tax changes only 0.4% and 1% respectively.

(10) Economic analysis

The economic analysis is carried out in two aspects.

The economic benefits are explained as follows.

a) Creation of employment opportunities
b) Maximum utilization of natural resources
c) Improvement of technological level
d) Linkage effects on related industries
e) Advanced regional development

Economic internal rate of return is calculated as follows.

Economic Price	Case A	Case B
190 M$/ton cement	17.5%	21.8%
180 M$/ton cement	14.9%	19.2%

I-5 Conclusion

a) Raw materials deposits in the Kelantan State have suitable quality and enough reserves for cement production.
Especially Gua Panjang near Gua Musang has a huge reserve.

b) From the viewpoint of marketing, 1200 thousand tons per year plant at Gua Musang can be entered into the industry in 1989.

c) As the adequate cement process, Case A is to adopt SP and Case B is NSP. Fuel to the plant shall be coal which has to be imported.

d) Case B Gua Musang of 1200 thousand tons per year plant is in the range of acceptable level from the view point of profitability under the ITC incentives.

I-6 Recommendations

This Project requires a large amount of investment and will be a one of the biggest industry in the State of Kelantan, therefore, it is recommended to study more details and to prepare the sufficient program to implement the Project as follows:

(1) Since cement is bulk material, it requires to prepare the sufficient transportation media to distribute it such as road, railway and port. Fortunately they are under construction and planning in the State of Kelantan, so these program shall be implemented as scheduled.

(2) It is recommended to survey more details at Gua Panjang to assure its quality and reserve. It may be necessary to have a boring test around the proposed quarry area to clarify the vertical distribution of quality.

(3) Silica sand from the Kelantan river is used in Case B because of the difficulty to find the adequate one around Gua Musang. It is recommended to survey siliceous material around there to save the transportation cost and to get more profitability in Case B.

(4) Iron ore is planned to be supplied from Bt. Lata in this study for all cases. To have more stable supply to the plant, it is recommended to survey iron ore reserves in and outside of the State.

(5) Negotiation for long term procurement with Thailand and Australia shall be started to get gypsum and coal steadily.

(6) On the demand estimation of cement in the eastern three States, it is recommended to prepare the necessary statistical data for the micro analysis.

(7) As for the export of cement, it is necessary to make further investigation of the export possibilities to the neighbor countries in details.

(8) Since the Project will be a large and heavy industry, it is required to have the engineers and officers in advance and to set up the training program for them.

(9) It is recommended to develop the required supporting industries around Gua Musang in the early stage.

(10) It is recommended to appoint a technical consultant to execute the Project favourably. He will carry out the basic design of the plant and the preparation of tender document for international competitive bid and so on.

(11) Since the project requires a huge investment, the financial study on the foreign and international funds shall be investigated.

II BACKGROUND INFORMATION OF THE PROJECT

II. BACKGROUND INFORMATION OF THE PROJECT

II -1 General Information of Kelantan State

II-1-1 Location and Physical Features

The State of Kelantan lies in the north-east of Peninsular Malaysia. As shown in Fig. II-1-1, the State faces on the South China Sea in the north-east, and borders Thailand on the west and Perak on the west, Pahang on the south, Trengganu on the east.

The State is situated between lat. 4°32'N and lat. 6°15'N with the longest distance of about 190 km on the north-south line and between long. 101°20'E and long. 102°40'E with the longest distance of about 140 km on the east-west line. The total area of the State is 14,931 sq. km.

The southern part of the State is mountainous and hilly, as is shown in Fig. II-1-2, and the mountain range having the elevation of 1,000 m to 2,000 m runs along the southern border of the State. The highest mountain is Tahan Mountain of which the elevation is 2,187 meters.

This hilly area at the southern part of the State covers about 80% of the area of the State, and is covered by forest.

The limestone hills are scattered over this forest area.

The Kelantan River, which originates from the southern mountainous area, flows down to the north dividing the state into two parts, and empties into the South China Sea after passing through the northern plain. The Kelantan River and its principal tributaries of Sg. Galas, Sg. Pergau, Sg. Nenggiri and Sg. Lebir, have a total drainage area of 12,867 square kilometers comprising about 85% of the State's surface area.

About 2,300 sq. km of the northern coastal plain expanding at the downstream of the Kelantan River is very flat and is developed as an agricultural area (mainly paddy field).

The Golok River draining over 1,500 sq. km. forms the international boundary between Thailand and Kelantan State. The coastal line of the State extends about 80 km. This shoaling beach is influenced with seasonal ocean current of the South China sea and monsoon, and occurred erosion and sedimentation is recurring. The small rivers or streams are meandering along the eastern coastal plain and many swamps have formed in this area.

Fig. II-1-1 Location of Kelantan State

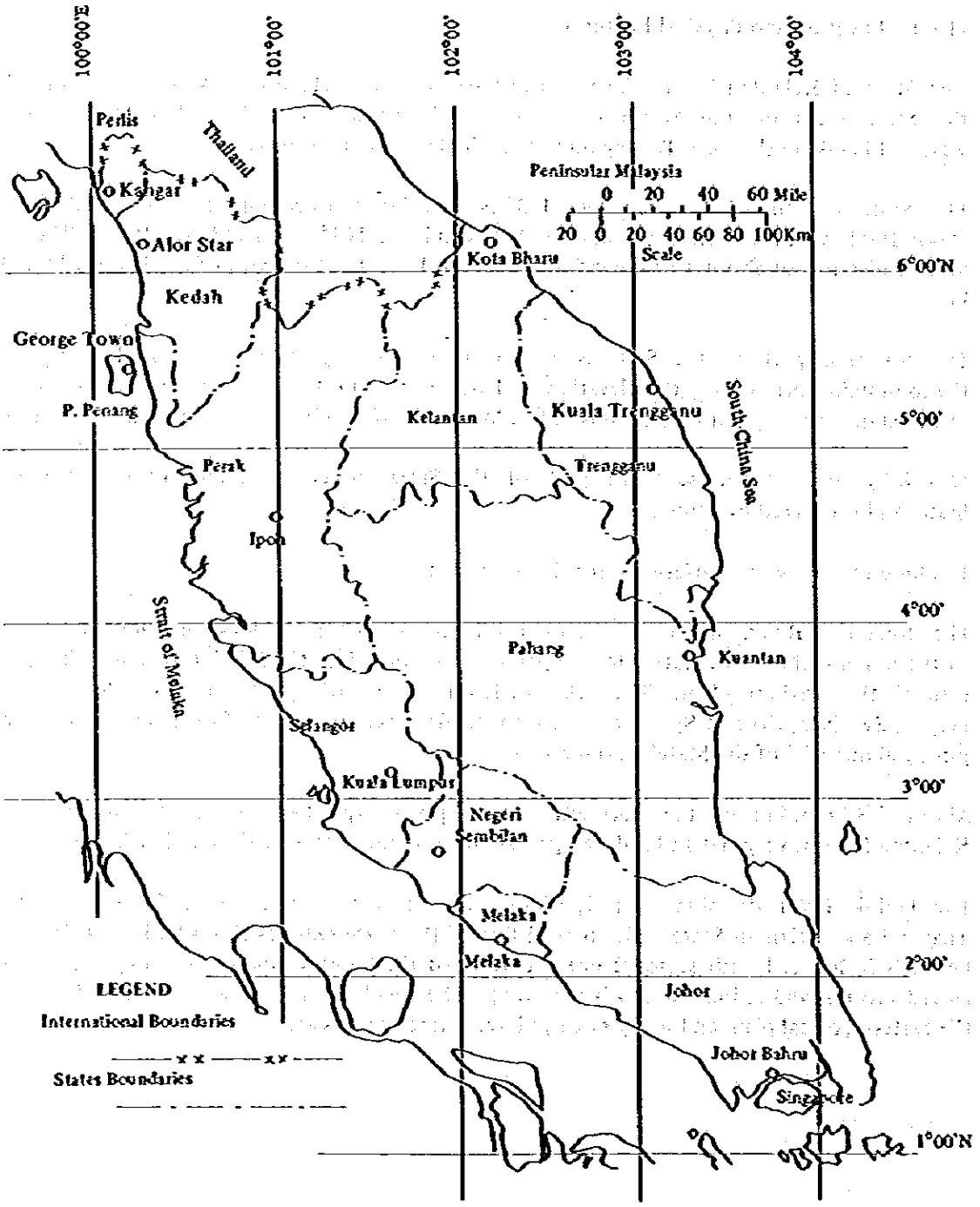
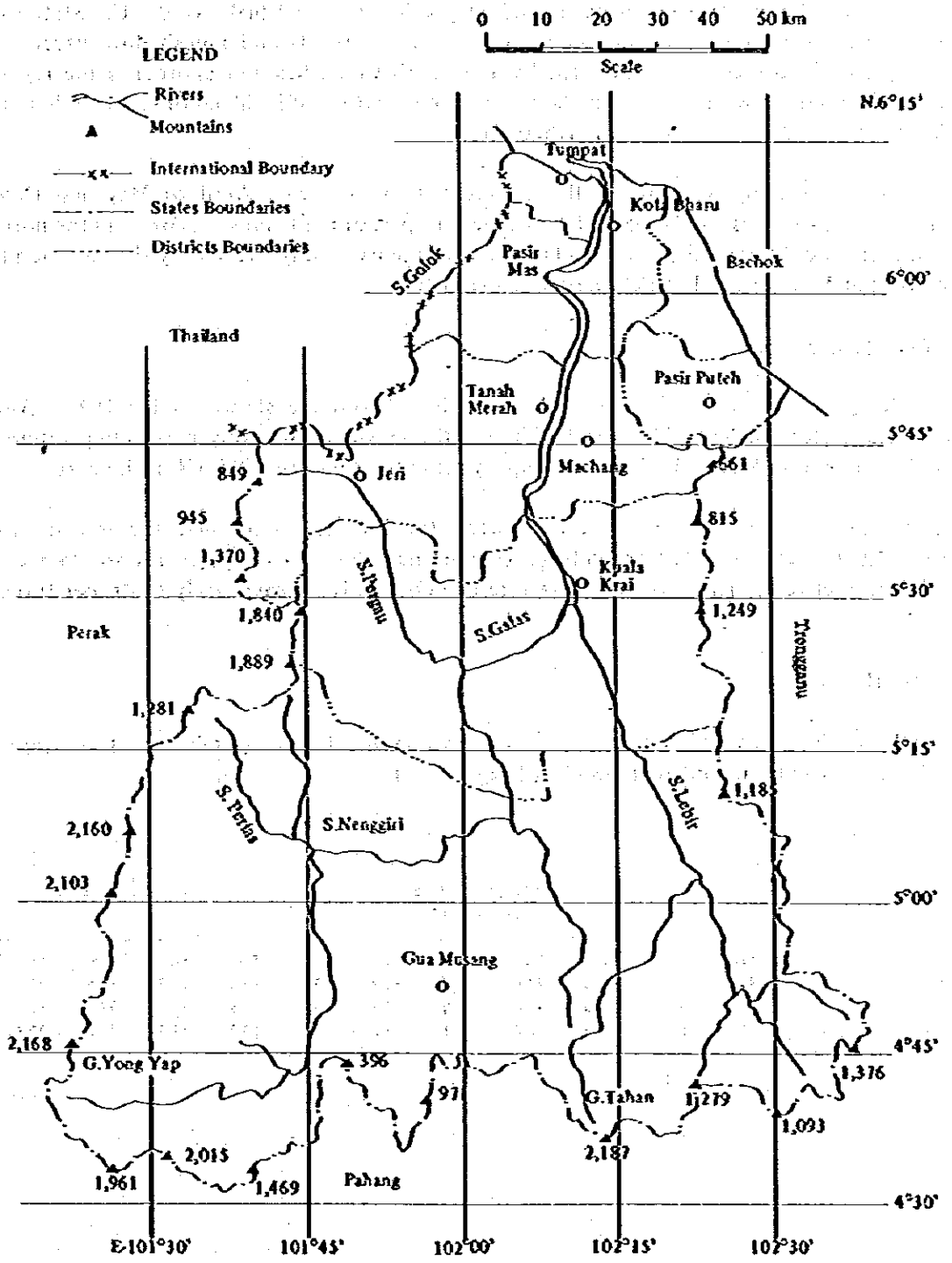


Fig. II-1-2 Physical Feature of Kelantan State



II-1-2 Climate

In general the Kelantan State has a tropical climate characterized by uniform and high temperatures high relative humidity, abundant precipitation and little wind. The State can be divided into two climatic regions in accordance with altitude and rain-shadow effects. One is a region of northern plain affected by the South China Sea and another is the region of southern hinterland with higher elevations. The temperature of highland of southern hinterland is lower compared with that of the northern plain.

There are two rainy seasons in the southern hilly area i.e., April to May and October to December, which is similar to that of the western part of the Peninsula. While in the northern plain, there is only one rainy season - October to January, and is affected by the monsoon from the ocean and a dry period of February to September.

(1) Temperature

Mean temperatures from 1968 to 1980 at Kota Bharu are shown in Fig. II-1-3. Annual mean temperature in Kota Bharu is 26.7°C and the maximum monthly mean temperature was recorded at 28°C in May and minimum monthly mean temperature at 25.5°C in January.

The difference of mean temperature between the highest month and the lowest month is only 2.5°C. The recorded absolute maximum and minimum temperatures are 35.8°C and 18.3°C, respectively. The adiabatic lapse rate in Kelantan is approximately 0.6°C per 100 m of altitude.

(2) Humidity

The relative humidity of the State is, as shown in the following table, uniform throughout the seasons and is recorded at 80-85% (24 hrs mean).

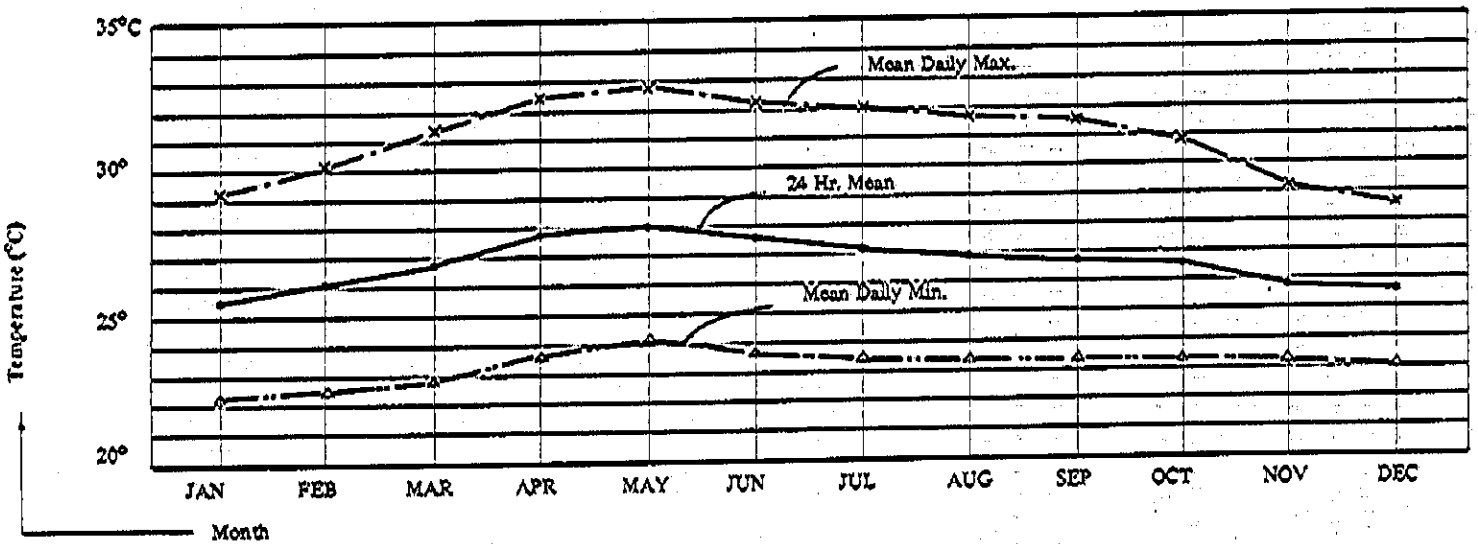
Relative Humidity (%) at Kota Bharu Station
1968-1980: 13 years

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
24 Hr. Mean	81.5	80.1	80.1	80.2	80.6	81.4	81.9	83.0	83.2	84.8	87.5	85.3	82.5
Mean Daily Max.	95.3	95.0	95.7	96.0	95.8	96.0	96.2	96.7	96.8	97.2	97.7	96.2	96.2
Mean Daily Min.	65.1	61.5	59.3	58.0	58.1	59.3	59.1	60.5	60.7	64.7	71.6	70.7	62.4

Fig. II-1-3 Mean Temperature (°C) at Kota Bharu Station (Pengkalan Chepa)

Period: 1968 – 1980, 13 Years

Lat: 06°10'N
Long: 102°17'E
Height: A.M.S.L 4.6m



	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
24 Hr. Mean	25.5	26.1	26.8	27.8	28.0	27.5	27.1	26.9	26.8	26.6	25.8	25.7	26.7
Mean Daily Max.	29.2	30.1	31.3	32.4	32.8	32.3	32.0	31.8	31.6	30.9	29.2	28.7	31.0
Mean Daily Min.	22.2	22.4	22.9	23.7	24.1	23.8	23.5	23.4	23.3	23.4	23.2	23.1	23.3
Highest Max.	31.8	33.2	34.7	35.0	35.8	34.8	34.6	35.2	34.0	33.2	32.8	31.7	35.8
Year of Highest Max.	Sev.	1978	1979	1975	1979	1973	1972	1974	1977	1975,1976	1973	1972,1974	1979
Lowest Min.	18.3	19.2	18.8	21.3	21.5	21.4	21.3	20.8	21.0	21.5	21.4	20.0	18.3
Year of Lowest Min.	1972	1976	1968	1976	1977	1968,1975	1977	1977	1968	1980	1969,1976	1973	1972

(3) Rainfall

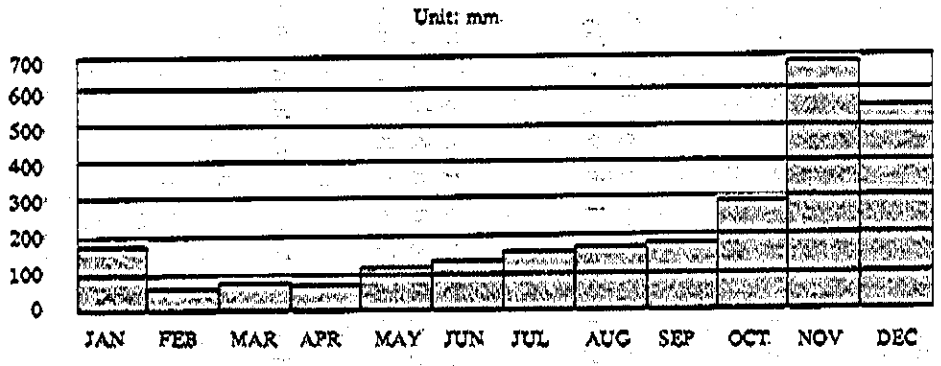
The annual mean rainfall during 30 years from 1951 to 1980 in Kota Bharu is 2,735 mm and the maximum rainfall is about 3,700 mm per year and the minimum is about 1,800 mm per year.

The abundant rainfall of about 3,400 mm per year occurs in the areas of Pasir Puteh and Pasir Mas at which the coastal mountain ranges intercept the north-easterly monsoon air stream from the South China sea. The rainfall at southern hinterland is comparatively small in the State and is about 2,400 mm per year to 2,600 mm per year.

As shown in Fig. II-1-4, the north-east monsoon dominates the northern districts in which the rainy season from October to January is clearly differentiated from the dry period from February to September. About 50-70% of annual rainfall occurs during four months of the wet season.

There is no big variation in monthly rainfall amount depending upon the seasons at the districts of southern hinterland, in contrast to the northern districts. The bigger amount of rainfall compared with other months occurred in two seasons - April to May and October to January in these districts.

Fig. II-1-4 Mean Monthly Rainfall and Raindays at Kota Bharu Station (Pengkalan Chepa)



Lat: 06°10' N
Long: 102°17' E
Height: A.M.S.L. 4.6m

Period: 1951 – 1980 30 years

Rainfall (mm)	Period	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Mean	1951–1980	280.4	62.6	89.7	84.3	116.0	139.2	155.7	168.7	191.4	301.0	687.9	558.3	2735.3
Highest	1951–1980	1398.0	227.1	296.9	282.2	247.7	294.6	321.6	338.8	404.9	595.9	1387.6	1214.6	3717.2
Year of Highest		1967	1953	1973	1970	1951	1965	1954	1972	1957	1968	1976	1973	1973
Lowest	1951–1980	0.3	0.5	1.4	0.3	4.6	41.7	46.2	52.1	70.1	109.7	226.3	87.9	1810.7
Year of Lowest		1965	1962	1979	1971	1963	1970	1955	1953	1974	1972	1957	1958	1963
Number of Raindays														
Mean	1951–1980	13	8	7	7	11	12	14	15	16	21	23	21	167
Highest	1951–1980	22	18	15	13	20	16	22	20	23	29	28	30	204
Year of Highest		1953 1975	1964	1973	1956 1972	1966	Sev.	1979	1971	1968	1966	1961	1965	1966
Lowest	1951–1980	1	2	2	1	5	5	8	9	9	15	16	11	149
Year of Lowest		1965	1962 1968	Sev.	1963 1971	1963	1964	1971	1961	1969	Sev.	1968	1979	1976

Thirty (30) rainy days were recorded at Kota Bharu in December 1965, and the maximum intensity of rainfall occurred in Kota Bharu is as follows:

KOTA BHARU	DURATION (HOURS)	1/2	1	2	6	12	24	48	72
1929-1941 1948-1979	Amount (mm)	66.5	111.8	167.6	293.4	432.8	685.3	1030.5	1185.2
No. of years 45	Data	21st Nov. 1958	30th Nov. 1969	30th Nov. 1969	17th Nov. 1938	6th Jan. 1967	6-7 Jan. 1967	5-7 Jan. 1967	4-7 Jan. 1967

(4) Sunshine

The northern lowland and southern highland differ in sunshine characteristics apparently because of the difference in altitude and greater cloudiness around the southern hilly districts.

Daily values of sunshine in Kota Bharu are about 7 hours/day as shown in the following table:

Mean Daily Values of Sunshine at Kota Bharu Station
1968-1980: 13 Years

(Unit: hours)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
7.39	8.24	8.62	8.91	8.01	6.77	6.99	6.98	6.67	5.77	4.41	4.68	6.95

Daily hours of sunshine are shorter by about 5 hours in monsoon season from November to December as compared with about 8 hours of sunshine hours during February to May.

(5) Wind

The north-east monsoon is dominant during November to April at the northern districts, and south-west wind is dominant during May to November at southern highland. Even the maximum 35 km/hr of wind speed was recorded at Kota Bharu, the State is very calm with an average wind speed of 3 km/hr.

At the time of monsoon, average 19 km/hr of wind is recorded in northern coastal area and average 7 km/hr at the southern hilly area.

II-1-3 Surface Water

The Kelantan River with its many distributaries drains a total area of 12,867 square kilometers, comprising 85 percent of the State's surface area, and has very gentle slope of about 1/6,000 in its downstreams. The average runoff of Kelantan River at Guillemard Bridge which is located at about 53 km upstream of Kota Bharu is approximately 600 cu.m/sec.

The recorded maximum flood amount was 21,000 cu.m/sec in December 1926 and 16,300 cu.m/sec of flood was recorded in January 1967 which is the biggest flood during the past 30 years.

This flood occurred in January 1967, which covered more than 80% of the northern lower districts including Tanah Merah, Pasir Mas, Kota Bharu, Tumpat, Pasir Puteh and Bachok districts were damaged by this inundation.

Probable maximum flood of Kelantan River at Guillemard Bridge is calculated to be 28,000 cu.m/sec based on the "Report of The Kelantan River Basin Study" and the areas which are safe against the flood damages are as follows:

Area	Elevation to be safe
Pengkalan Chepa	above 4 m
Tanah Merah	above 24 m
Kuala Krai	above 36 m
Jeli	above 80 m
Gua Musang	above 120 m

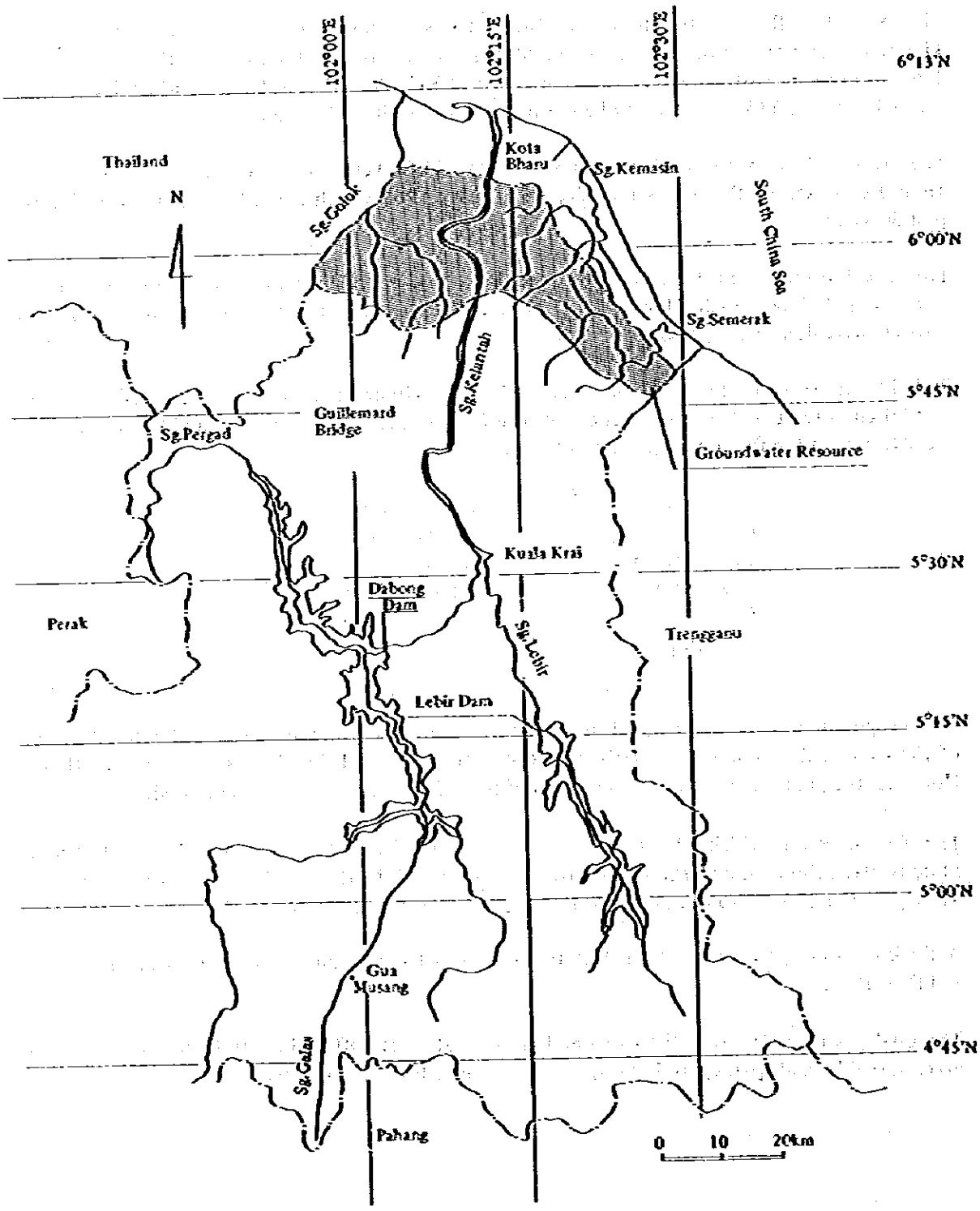
The proposals had been prepared to construct dams in order to control the flood water of the river at the tributaries on Dabong at Galas River and on Lebir river as shown in Fig. II-1-5. However, the programme of implementation of these dams has not yet been decided.

The Golok River which flows down along the border between Thailand and Kelantan State is often flooded, and the smaller rivers flow down into the area between Kota Bharu and Trengganu State have also been causing damages to the paddy fields, roads, etc.

A thick aquifer has been confirmed at the area of 10 km to 20 km width between Pasir Mas and Pasir Puteh.

The qualities of water from the rivers and groundwater are soft and neutral and have generally no remarkable inadequancy as drinking water as well as for industrial use.

Fig. II-1-5 Surface Water and Ground Water in Kelantan



II-1-4 Population

The population of Malaysia is 13,435,588 of which the population of the Peninsular Malaysia is 11,138,227 according to the 1980 Population and Housing Census of Malaysia.

The populations of Kelantan, Trengganu and Pahang States and its percentage against the Peninsular population are as follows:

State	Population	Rate
Kelantan	877,575	7.9%
Trengganu	542,280	4.9%
Pahang	770,644	6.9%
Total (Peninsula Malaysia)	11,138,227	100%

The population of each state of Malaysia in 1980 and 1970 is shown in the following. The rates of increase of population during the past 10 years in the above three states are as follows.

	Increase Rate per 10 years	Annual Increase Rate
Kelantan	28.2%	2.48%
Pahang	52.6%	4.23%
Trengganu	33.8%	2.91%
Peninsular Malaysia	26.4%	2.34%
Malaysia	28.7%	2.52%

The population of each district in Kelantan State in the years 1957, 1970 and 1980 is as follows:

Districts	1957	1970	1980
Bachok	52,513	62,182	76,774
Kota Bharu	150,903	207,837	281,161
Machang	39,443	51,636	59,194
Pasir Mas	82,834	100,689	122,246
Pasir Puteh	53,848	71,138	84,321
Tanah Merah	32,098	57,925	81,414
Tumpat	60,359	73,050	89,344
Kuala Krai	26,956	49,313	67,869
Ulu Kelantan	7,488	12,041	15,252
Total	505,445	685,811	877,575

Table II-1-1 Population by States, 1980 and 1970 in Malaysia

State	1980			1970		
	Total	Man	Woman	Total	Man	Woman
Johor	1,601,504	803,847	797,657	1,277,180	641,558	635,622
Kedah	1,102,200	544,090	558,110	954,947	480,643	474,304
Kelantan	877,575	430,792	446,783	684,738	339,002	345,736
Melaka	453,153	220,364	232,789	404,125	197,650	206,475
Negri Sembilan	563,955	280,511	283,444	481,563	241,725	239,838
Pahang	770,644	400,833	369,811	504,945	261,786	243,159
Pulau Pinang	911,586	448,796	462,790	776,124	387,619	388,505
Perak	1,762,288	871,811	890,477	1,569,139	786,677	782,462
Perlis	147,726	73,704	74,022	121,062	60,566	60,496
Selangor	1,467,441	741,212	726,229	982,090	499,607	482,483
Trengganu	542,280	271,923	270,357	405,368	201,044	204,324
Wilayah Persekutuan	937,875	482,315	455,560	648,276 *	336,768 *	311,508 *
SEMENANJUNG MALAYSIA	11,138,227	5,570,198	5,568,029	8,809,557	4,434,645	4,374,912
Sabah	1,002,608	524,319	478,289	653,604	339,714	313,890
Sarawak	1,294,753	653,449	641,304	976,269	491,731	484,538
MALAYSIA	13,435,588	6,747,966	6,687,622	10,439,430	5,266,090	5,173,340

South: 1980 Population and Housing Census of Malaysia

The areas, populations and densities of population of the districts of Kelantan State in 1980 are as follows:

Fig. II-1-6 Districts of Kelantan State

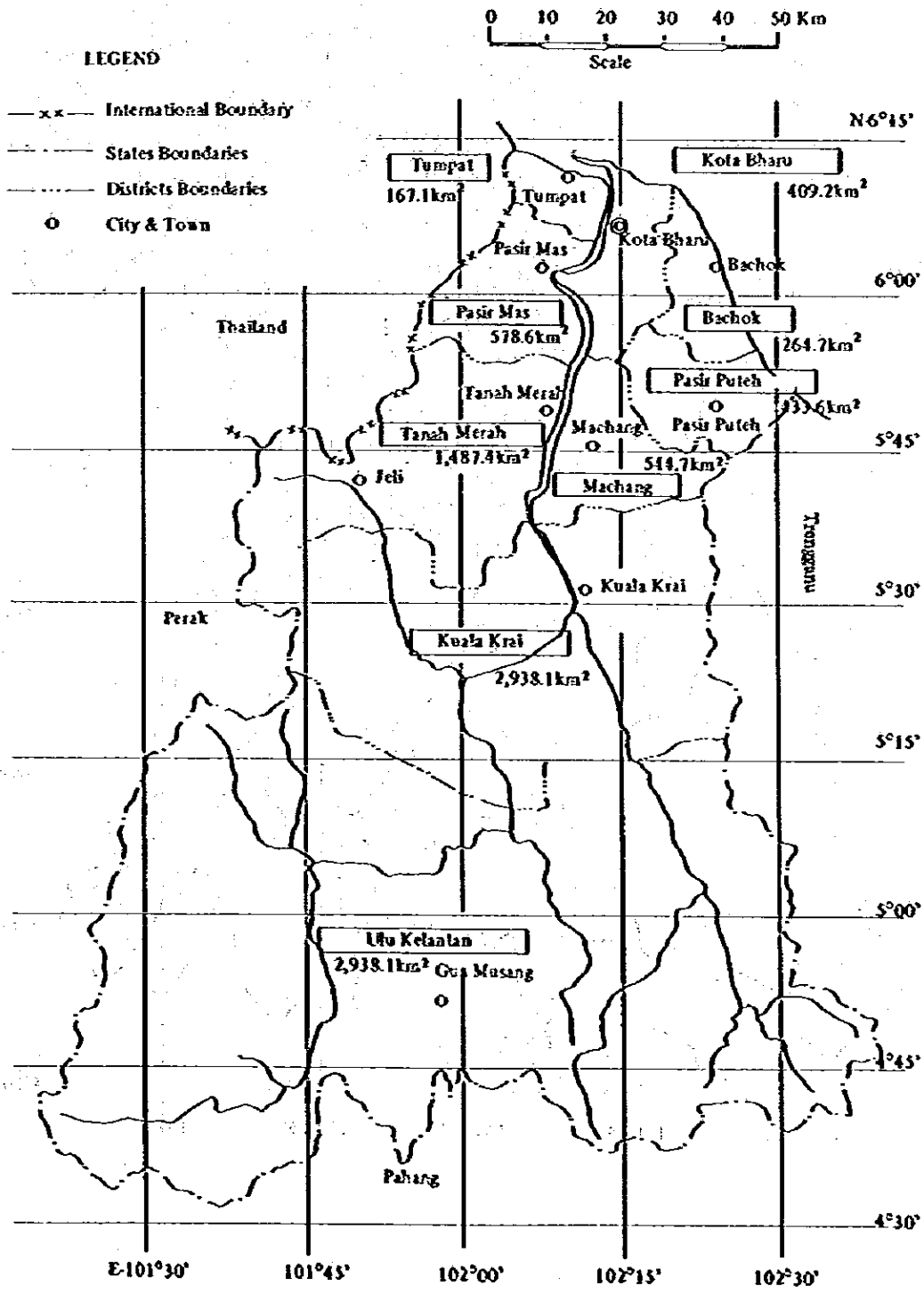
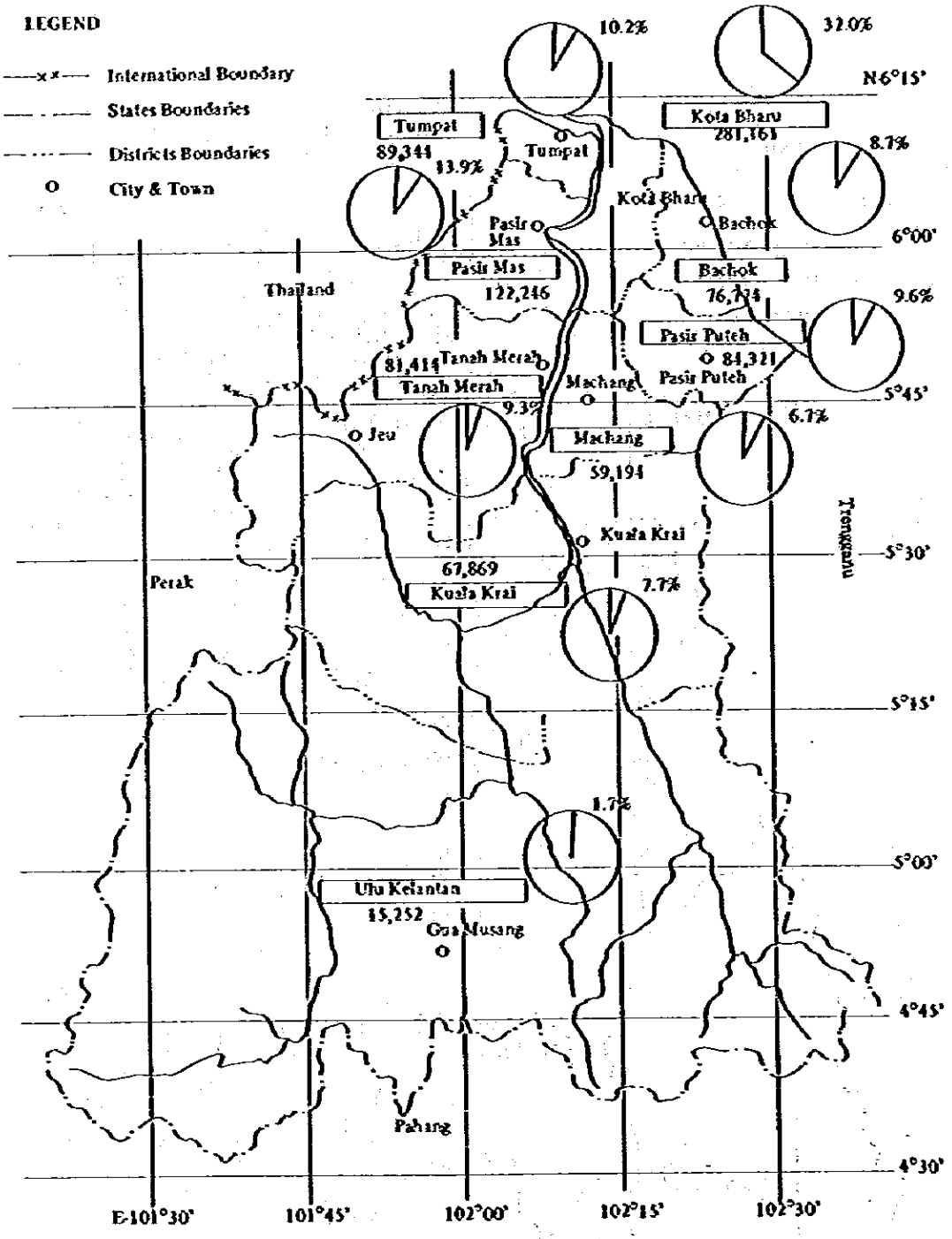


Fig. II-1-7 Population of Kelantan State



District	Area (Sq.km)	Population	Rate	Density of Population
Bachok	264.7	76,774	8.7%	290
Kota Bharu	409.2	281,161	32.0%	687
Machang	544.7	59,194	6.7%	109
Pasir Mas	578.6	122,246	13.9%	211
Pasir Puteh	433.6	84,321	9.6%	194
Tanah Merah	1,487.4	81,414	9.3%	55
Tumpat	167.1	89,344	10.2%	535
Kuala Krai	2,938.1	67,869	7.7%	23
Ulu Kelantan	8,108.0	15,252	1.7%	2
Total	14,931.4	877,575	100%	59

As is clear in the above Table, only 9.5% of the people are living in two districts of Ulu Kelantan and Kuala Krai, which cover about 74% of the State's surface area, and more than 90% of the State's population are living in the northern districts which cover only 26% of the State's area.

The population of the cities relating to the industrial districts are as follows:

Kota Bharu	about 70,000
Tanah Merah	" 28,000
Jeli	" 3,000
Gua Musang	" 5,000

The remarkable fact is that the population of Gua Musang has increased by about 70% during the past 5 years.

II-2 Infrastructure

II-2-1 Road

(1) Road networks in Peninsular Malaysia

The major cities in Peninsular Malaysia are mainly situated on the western coast of the peninsula and the road networks particularly the western part have been also developed.

Trunk Highway of Johore Bahru-Kuala Lumpur-Ipoh-Butterworth-Alor Star runs through the western Peninsular Malaysia, and other road networks and access roads linking the cities, towns and main ports cover the western coastal areas of the peninsula.

Kuala Lumpur-Kuantan Highway is the only road crossing the peninsula from east to west at present, and the East-West Highway connecting Butterworth-Gerik-Jeli-Tanah Merah is now under construction at northern part of the peninsula and is expected to be completed in 1982. This highway will contribute to the development of the states of Kelantan and Trengganu after completion.

Another trunk line, Kota Bharu-Kuala Trengganu-Kuantan-Johore Bharu Highway runs through the eastern coastal area of the peninsula, however, linking road networks of this highway is still under development.

Central mountainous area of the peninsula has very poor road networks at present. Kuala Krai-Gua Musang Highway is under construction and highway between Gua Musang and Kuala Lipis is under planning.

The distance between Kota Bharu and principal cities of the peninsula is as follows:

To	Kuala Trengganu	166 km
	Kuantan	385 km
	Kuala Lumpur	660 km
	Port Kelang	702 km
	Penang	1,006 km

(2) Road Networks in Kelantan State

(i) Existing Road Networks

The road networks in Kelantan State are shown in Fig. 2-2. The highway between Kota Bharu and Kuala Trengganu via Pasir Mas is the most important road of the state. It is the gateway to other states of the peninsula.

As regards the other principal highways, Kota Bharu-Machang-Kuala Krai and Kota Bharu-Pasir Mas-Tanah Merah highways are existing.

The road networks are well developed in the paddy field area at the northern part of the state and there is no access road passing through the forest area at the southern part of the state.

The bridge between Kota Bharu and Wakaf Bharu is only a road bridge crossing the Kelantan River at this stage and the other bridge crossing the river is railway bridge between Tanah Merah and Machang which is being used as a road bridge. The lack of crossing bridges in the Kelantan River (only 2 bridges as aforementioned) is the bottleneck of road transportation of the Kelantan State.

(ii) East-West Highway

The completion of the East-West Highway will have an important influence on Kelantan State. It will open the way to the principal commercial and industrial cities as well as the principal commercial ports at the western part of the Peninsular Malaysia.

The East-West Highway between Gerik and Jeli, which is under construction, is scheduled to be completed in 1982.

The construction of Jeli-Tanah Merah-Machang-Pasir Puteh including a new road bridge over the Kelantan River and the Jeli-Rantan Panjan highway, will be started following the completion of East-West Highway as the distribution road networks. And at the western part of the East-West Highway, the construction of supporting highway of Gerik-Kupang-Butterworth will also be commenced.

After the completion of East-West Highway, the distance from Butterworth and Ipoh to the major cities at Kelantan State is as follows:

Butterworth (Penang)	- Jeli	approx. 240 km
	- Tanah Merah	approx. 290 km
	- Kota Bharu	approx. 330 km
Ipoh	- Jeli	approx. 280 km
	Tanah Merah	approx. 330 km
	Kota Bharu	approx. 375 km

Fig. II-2-1 Road Network in Peninsular Malaysia

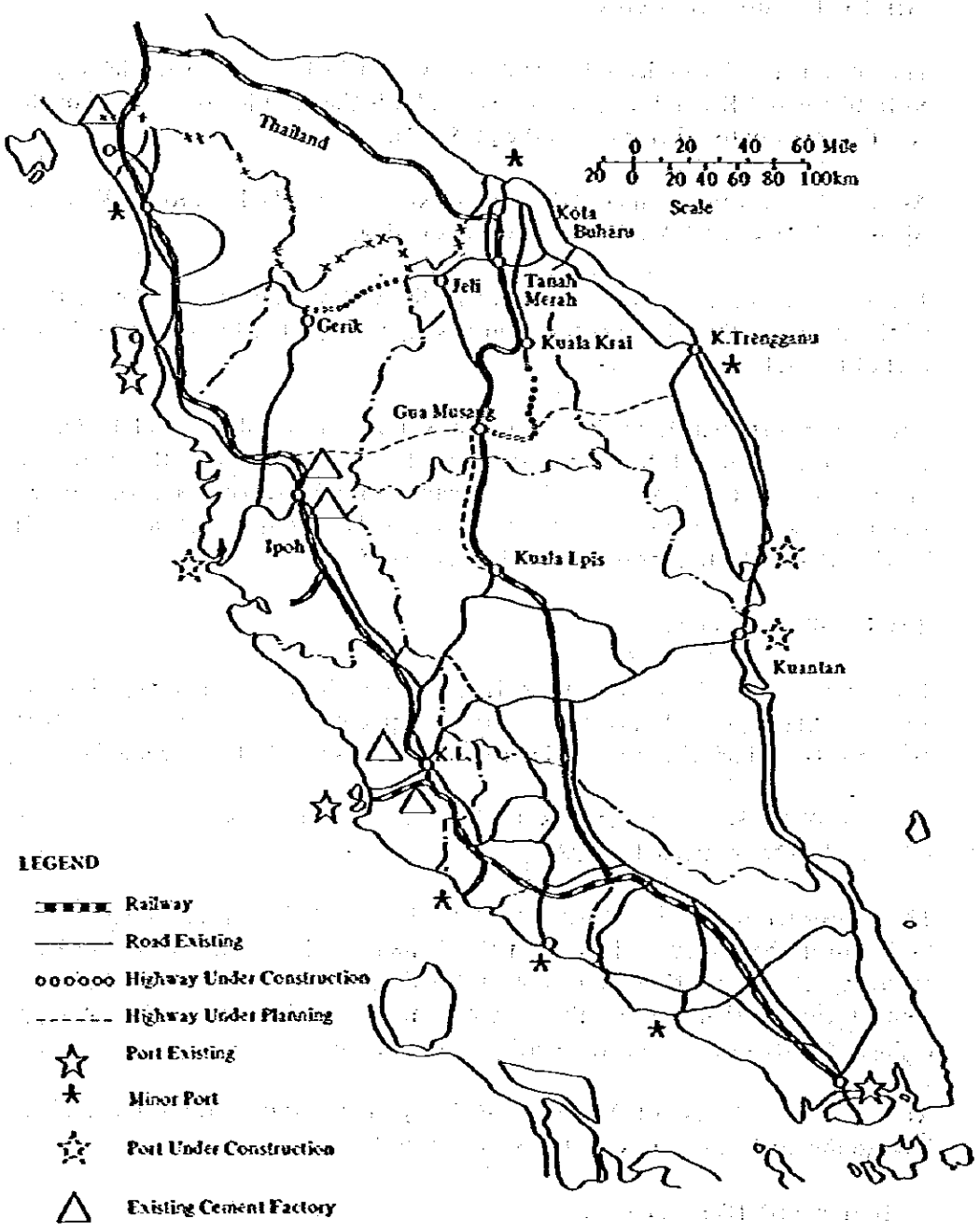
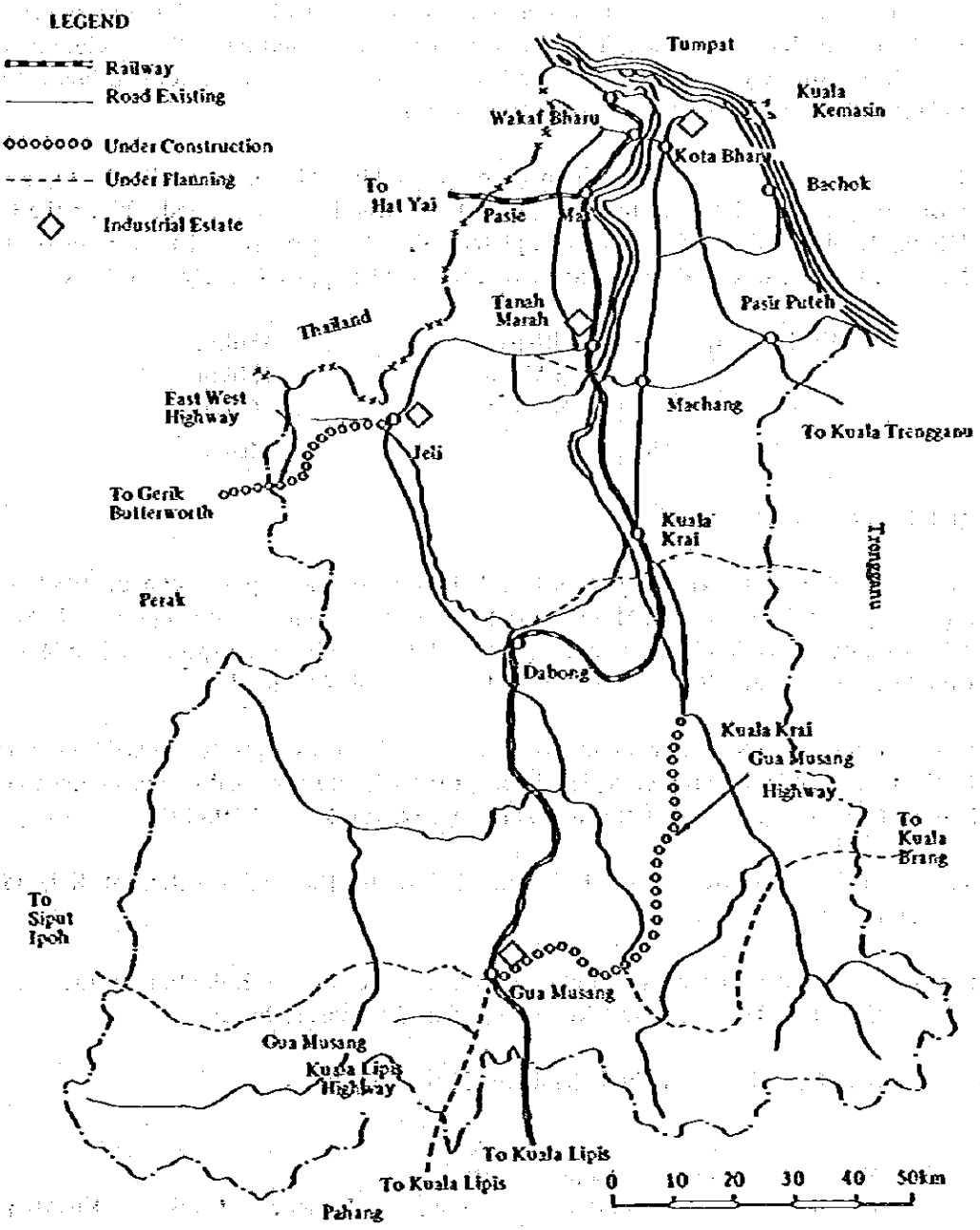


Fig. II-2-2 Railway, Ports and Main Road Networks in Kelantan



(iii) Kuala Krai-Gua Musang and Gua Musang-Kuala Lipis Highways

The highway between Kuala Krai and Gua Musang passing through southern forest area of the State is under construction and is scheduled to be completed by the end of 1982. This highway is a strategically important road contributing to the development of agriculture, forestry, commerce and industries at the southern hinterland area of the Kelantan State, as the first access road to this area.

The feasibility study on the highway between Gua Musang and Kuala Lipis has been completed and the commencement of construction is expected. When the Gua Musang-Kuala Lipis Highway is completed, the distance from Kuala Lumpur and Kuantan to the cities of Kelantan State by road will be approximately as follows:

Kuala Lumpur -	Kota Bharu	450km
–	Tanah Merah	420km
–	Gua Musang	260km
Kuantan - Gua Musang		340km

(iv) Other New Road Scheme

The new Jeli-Dabong Highway is scheduled to be opened by the end of 1983, and a new highway between Gua Musang and Siput at Perak State has been proposed. Since no feasibility study has been executed, the road distance between Ipoh and Gua Musang would be only about 140 km at the time of opening this new road.

Being in the same situation as the above, a new highway between Gua Musang and Kuala Brang in Trengganu State has been proposed, and the road distances from Gua Musang to Kuala Trengganu and Chukai are approx. 160 km and 195 km, respectively.

(v) Road Distance from each Industrial Estate to the Major Cities of Kelantan, Trengganu

The transportation distances from each industrial estate in Kelantan to the major cities of Kelantan, Trengganu and Kuantan in Pahang are as follows:

Case I - After Completion of Kuala Krai-Gua Musang Highway

	Kota Bharu	Kemasin	Pasir Puteh	Kuala Trengganu	Dungun	Chukai	Kuantan
Gua Musang	190km	200km	170km	300km	380km	455km	515km
Tanah Merah	40	50	35	165	245	320	380
Jeli	90	100	85	215	295	370	430
Pengkalan Chepa	6	10	45	175	255	330	390

Case II - After completion of Gua Musang-Kuala Lipis Highway

	Kota Bharu	Kema sin	Pasir Puteh	Kuala Treng-ganu	Dungun	Chukai	Kuantan
Gua Musang	-	-	-	-	-	400km	340km

Case III - After Completion of Gua Musang-Kuala Brang Highway

	Kota Bharu	Kema-sin	Pasir Puteh	Kuala Treng-ganu	Dungun	Chukai	Kuantan
Gua Musang	-	-	-	160km	240km	315km	375km

II-2-2 Railway

(1) Malayan Railway in Peninsular Malaysia

The Malayan Railway in Peninsular Malaysia originates from Singapore and passes through the southern part of the peninsula via Johore Bharu and reaches Gemas. Then, the railway branches off into two directions (1) to western part of Peninsular Malaysia and (2) to the central part of the peninsula. The western line starts from Gemas and passes through Seremban, Kuala Lumpur, Ipoh, Alor Star, Kangar up to Thailand. This western line branches off to the major ports such as to Port Dickson from Kuala Lumpur, to Telok Anson from Tapah Road, to Port Weld from Taiping and to Butterworth from Bukit Mertaian.

The cental line starts from Gemas and reaches to Tumpat at the eastern coast State via Jerantut, Kuala Lipis, Gua Musang, Kuala Krai, Tanah Merah, and Pasir Mas. This line also branches off at Pasir Mas to Thailand.

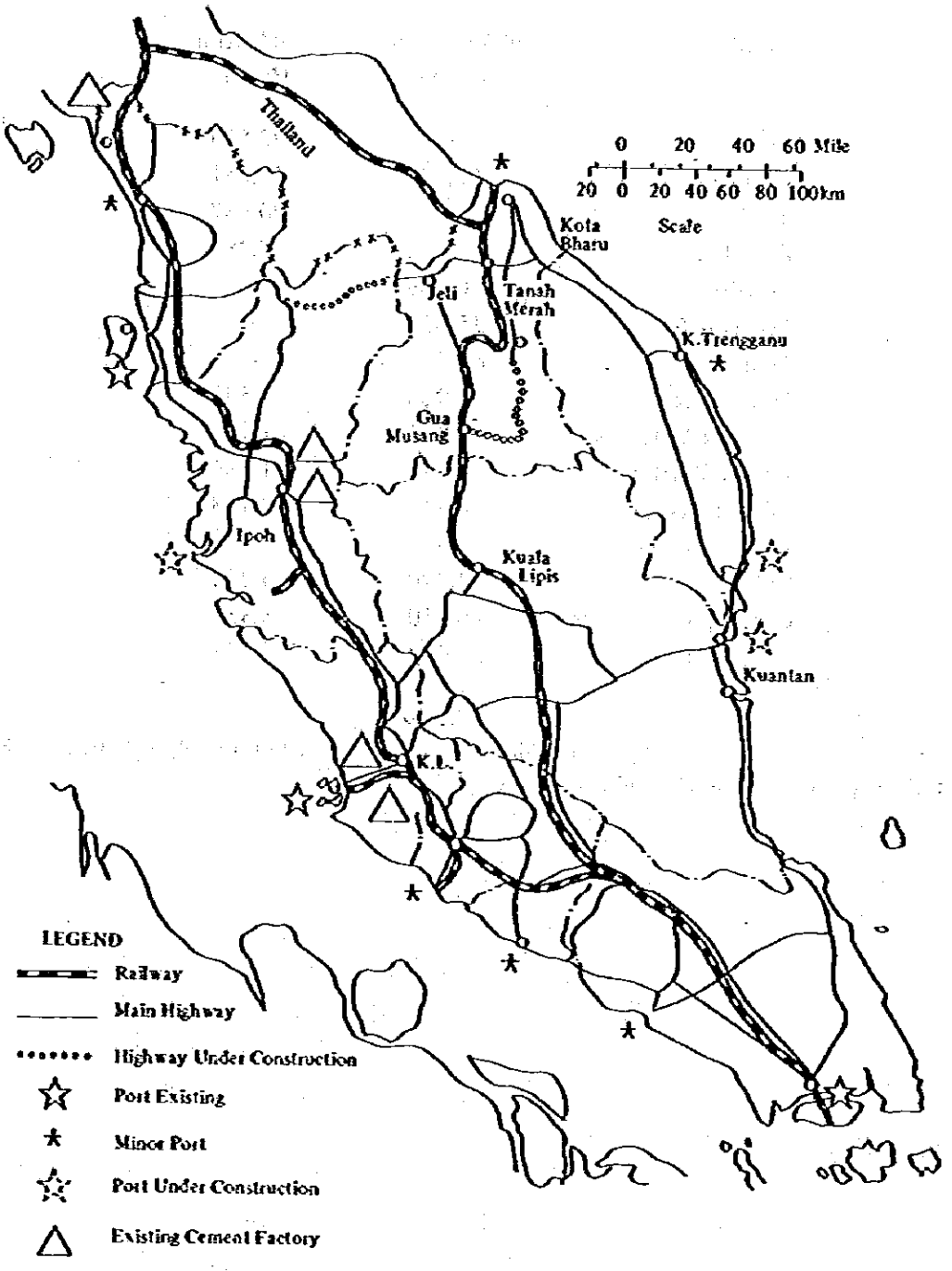
These west and east lines join again at Hat Yai in Thailand.

These railways are the narrow single truck and the rails are 60 pounds/yard (30 kg/m). The diesel locomotive draws the maximum 35 tons wagons.

The Malaysian Government has a big improvement programme of Malaysian Railway on its 4th Malaysia Plan, including the improvement of telecommunication system and switch yard facilities. Increasing train speed, aiming at 30 miles/hr (48 km/hr) to an average of 40 miles/hr (64 km/hr), is one of the main improvement programmes, and increase of the number of locomotives and wagons is planned in order to achieve this speed. The possibilities of electrification with double trucking are also under study.

	Wakaf Bharu	Tanah Merah	Gua Musang
Tumpat	14km	50km	204km
Wakaf Bharu	-	36	190
Pasir Mas	10	26	180
Tanah Merah	36	-	154
Kuala Krai	68	32	122
Dabong	124	88	66
Gua Musang	190	154	-
Kuala Lipis	285	249	95
Jerantut	338	302	148
Gemas	515	479	325
Singapore (Johore Bharu)	735	699	545
Kuala Lumpur	690	654	500
Port Kelang	733	697	543
Ipoh	899	863	709
Butterworth	1,083	1,047	893
P. Besar	1,253	1,217	1,063

Fig. II-2-3 Railway Network in Peninsular Malaysia



The amounts of loading and unloading goods at Wakaf Bharu station and Kuala Krai station in 1980 are as follows:

Goods	Wakaf Bharu (tons)	Kuala Krai (tons)
Logs	-	492,515
Rubber	12,735	29,951
Timber	-	20,837
Palm Oil	-	8,289
Fertilizer	6,966	-
Foodstuffs	15,628	-
Cement	61,374	-
Machineries	964	4,530
Building Materials	9,098	3,764
Empty Bottles	2,799	1,586
Tobacco Leaves	4,418	4,433
Household goods	326	476
Paddy	2,370	4,234
Other miscellaneous	16,750	8,837
Total	133,428	579,452

The monthly amounts of loading and unloading goods in 1980 on Wakaf Bharu (Kota Bharu) station are as shown in the following page.

Table II-2-1 Arrival of Goods at Wakaf Bharu Railway Station in 1980 Unit : Tons

DESCRIPTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Fertilizer	748	165	630	587	120	340	211	440	560	1,291	931	927	6,950
Food stuffs	1,361	780	1,622	1,687	1,671	1,154	1,453	1,112	1,193	2,069	954	1,410	15,468
Cement	2,865	5,595	6,633	3,335	4,065	4,990	4,342	5,124	6,920	5,335	6,390	5,780	61,374
Heavy Machineries	185	-	75	199	55	8	10	-	28	35	20	-	615
Building Materials	945	480	1,500	690	1,890	1,200	240	30	120	210	60	30	7,395
Machinery Goods	325	82	-	-	-	-	-	-	-	-	-	-	407
Beer, Soft Drinks	140	112	112	227	56	224	127	56	204	168	168	211	1,805
Miscellaneous	947	1,362	872	1,160	896	1,825	1,208	876	1,376	974	1,368	1,010	13,874
Total	7,517	8,576	11,444	7,885	8,753	9,741	7,591	7,638	10,402	9,082	9,891	9,368	107,888

Table II-2-2 Forwarding of Goods at Wakaf Bharu Railway Station in 1980 Unit: Tons

DESCRIPTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Heavy Machineries	8	22	42	49	43	87	24	4	38	13	19	-	349
Building Materials	83	110	66	270	140	109	195	75	120	120	212	203	1,703
Bottles	83	94	74	118	88	98	62	60	105	70	99	43	994
Household Utensils	28	6	8	18	27	15	7	4	6	2	118	87	326
Military Goods	216	-	-	-	-	-	-	-	-	-	-	-	216
Paddy	112	230	80	148	69	50	1,090	116	49	66	248	112	2,370
Rubber	1,175	1,004	705	1,386	1,146	1,474	1,055	1,005	252	937	1,109	1,087	12,735
Miscellaneous	37	177		358	204	112				147	121	260	2,136
Foodstuffs	-	18	73	80	4	-	-	-	-	-	20	25	160
Oil	-	7	-	-	-	-	-	-	-	-	-	-	
Tabacco	-	-	770	966	645	210	393	565	670	199	-	-	4,418
Fertilizer	-	-	16	-	-	-	-	-	-	-	-	-	16
Livestock	-	-	-	-	25	-	-	-	-	-	-	-	25
Total	1,742	1,668	1,928	3,327	2,391	2,155	3,163	1,939	1,510	1,554	1,946	8,217	25,540

II-2-3 Port and Airport

(1) Port in Peninsular Malaysia

There exist seven (7) ports along the west coast of Peninsular Malaysia, of which Port Kelang (max. depth: 12 m) and Penang (max. depth: 10 m) handle international traffic while Port Dickson is used exclusively for petroleum products. The Lumut port now being under construction will become an international port having industrial estate in its backyard. The other ports including Batu Pahat, Malaka, K. Kedah (Alor Star) are fishing ports and handle the small coastal shipping traffic.

Port of Johore (max.depth: 11 m) is located at the southern tip of the peninsula and has the facilities handling international cargo.

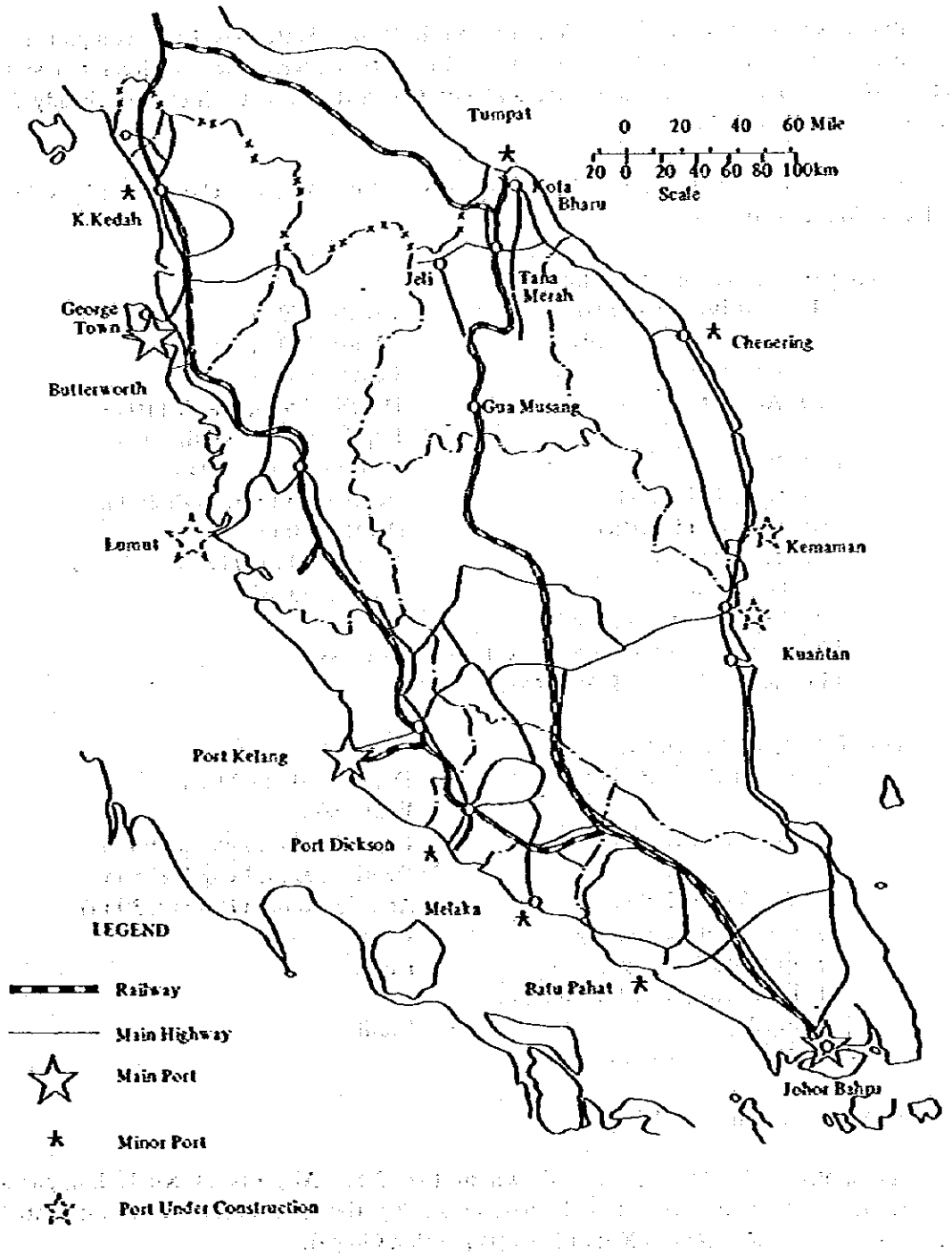
The entire length of the east coast is a sandy beach and there is no big port along the east coast. As the only one commercial port on the east coast, construction of Port of Kuantan (max. depth: 13 m) has been under way, however, the construction was suspended due to unexpected troubles.

Port of Kemaman (Chukai) which is also under construction is the supply base of offshore oil and gas development platforms, and this port has an expansion plan to have the port facilities capable of handling ships of more than 100,000 displacement tons in order to meet the necessity of import of raw materials and the integrated industrial estate which is planned to be located just behind Kemaman Port.

A fishing port has been constructed at Chenering (Kuala Trengganu) and the construction of another fishing port has recently been started at K. Besut of Trengganu State.

The Port of Tumpat in the State of Kelantan have encountered the serious problem of silting and shoaling and lost its function.

Fig. II-2-4 Ports in Peninsular Malaysia



(2) Plan of Port Kuala Kemasin at Kelantan

A feasibility study of Port Kuala Kemasin in Kelantan State has been completed. This Port which will contribute to the economic and industrial development of Kelantan State will serve as the entrance port of the state and not the Port Tumpat which has already lost its functions as mentioned above.

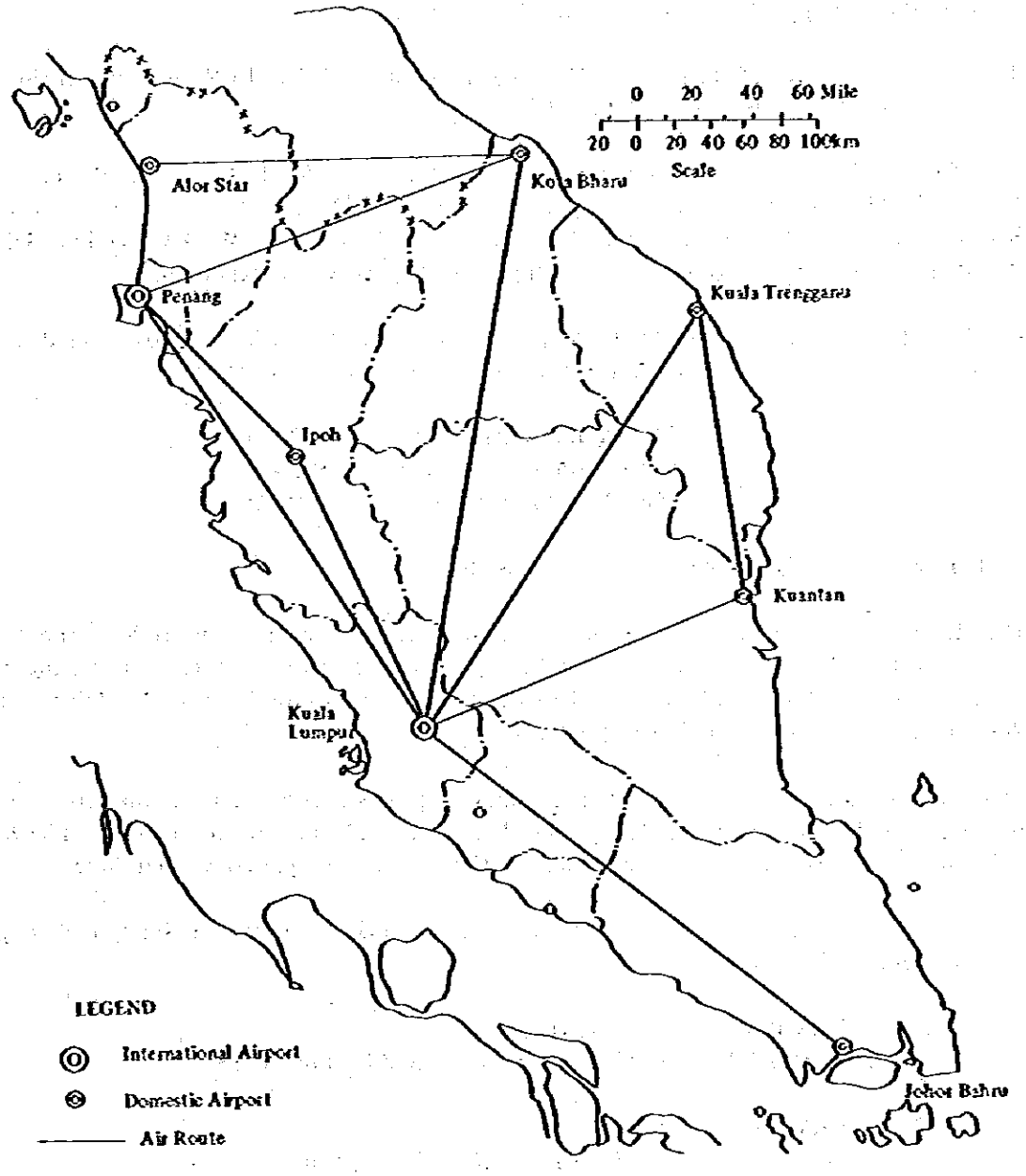
Kuala Kemasin is located about 13 km east from Kota Bharu. The planned facilities of Port Kemasin are as follows:

(i) Commercial Port Facilities	
1) East Breakwater (i)	Length 970 m
(ii)	Length 840 m
2) Groin	Length 570 m
3) Access Channel	Depth - 7.5 m, Width 110 m
	Depth - 5.0 m, Width 60 m
4) Basins	Depth - 7.5 m - 5.0 m
5) Quay (2 berths)	Depth - 7.5 m, Length 260 m
6) Dolphin (1 berth)	Depth - 5.0 m
7) Transit Shed	Area 4,800 m² (120 m x 40 m)
8) Open Storage	Area 4,400 m²
9) Palm Oil Storage Tanks	4 tanks
10) Petroleum Product Storage Tank	15 tanks
11) Access Road and Port Road	
(ii) Fishing Port Facilities	
1) Channel and Basin	Depth - 3.0 m - 2.0 m
	Width 80 m
2) Mooring Facilities	Depth - 3.0 m, Length 290 m
	Depth - 2.0 m, Length 175 m
3) Wholesale Market	Area 3,000 m² (100 m x 30 m)
4) Cold Storage Facility	1 unit
5) Freezing Facility	1 unit
6) Ice Factory and Ice Storage Facility	1 unit
7) Access Road and Port Road	

(3) Airports in Peninsular Malaysia

Major ports in Peninsular Malaysia are shown in Fig. 2-5. Airports of Kuala Lumpur and Penang are the only two international airports among the 8 airports. New international airport will soon be constructed at Kota Bharu (Pengkalan Chepa).

Fig. II-2-5 Airports in Peninsular Malaysia



II-2-4 Electric Power

(1) Power Supply Networks in Peninsular Malaysia

The electric supply of Peninsular Malaysia is controlled by LLN and the main power transmission networks are shown in Fig. II-2-6.

A 275KV high tension line is planned to link the cities of Kuala Lumpur-Ipoh, Tempengor-Jeli-Tanah Merah-Kenir-Paka-Kuala Lumpur. This 275KV link line will branch off from Kuala Lumpur to Port Kelang, and also from Kuala Lumpur to Malaka via Port Dickson. Another branch line will extend from Temengor to Alor Star via Butterworth.

The high tension transmission lines are planned to cover the cities and towns in Peninsular Malaysia, and the total lengths of those transmission lines are as follows:

275 KV transmission line	:	372 km
132 KV transmission line	:	1,595 km
66 KV transmission line	:	540 km

(2) Power Supply Networks in Kelantan State

The electric power supply networks in Kelantan State are shown in Fig. II-2-7. The 275 KV peninsular link line is planned to pass through the state from east to west having a sub-station at Tanah Merah. The extent of this 275 KV high tension line between Jeli and Tanah Merah is scheduled to be completed by 1982-1983.

After the completion of the high tension lines, the construction of other stretch of 275KV line between Tanah Merah and Kenyir via Machang is planned to commence. The Kenyir hydro-generating dam which is under construction will be completed at that time.

The total plan of the high tension power line networks in Kelantan State, including the existing lines is as follows:

a) 275 KV (under construction)
Temengor-Jeli-Tanah Merah to be completed by 1982-1983

b) 275 KV (under planning)
Tanah Merah Machang-Pasir Puteh-Kuala Trengganu

c) 132 KV (under construction)
Tanah Merah-Kota Bharu to be completed by 1982-1983

d) 132 KV (under planning)
Tanah Merah-Machang-Pasir Puteh-Kuala Trengganu to be completed by 1982-1983

Tanah Merah-Kuala Krai to be completed by 1981-1982

Kuala Krai-Gua Musang-Kuala Lipis to be completed by 1985-1986

e) 33 KV (existing)
Link line of Pengkalan Chepa (Kota Bharu)
Pasir Mas-Tanah Merah-Machang-Pasir Puteh-Bachok

Pasir Puteh-Kuala Trengganu

Machang-Kuala Krai

f) 33 KV (under construction)

Tanah Merah-Jeli to be completed by 1982-1983

Kotah Bharu-Backok-Pasir Puteh to be completed by 1981-1982

Kota Bharu-Pasir Mas-Golok to be completed by 1983-1984

LLN (National Electric Board) has a plan to supply the electric power to each industrial estate, which has been developed and managed by SEDC (State Economic Development Corporation), including Pengkalan Chepa (Kota Bharu) Industrial Estate, Tanah Merah Industrial Estate, Jeli Industrial Estate, and Gua Musang Industrial Estate.

LLN is the body responsible for the supply of electricity to the substation located at each lot of the industrial estates:

The charges levied for industrial use are:	Cents per unit
Rates	
The first 200,000 units per month	23
Each additional unit per month	25
Tariff E High Voltage Industrial	
Rates	
Each kw of maximum demand per month	$12.00
Each unit per month	17

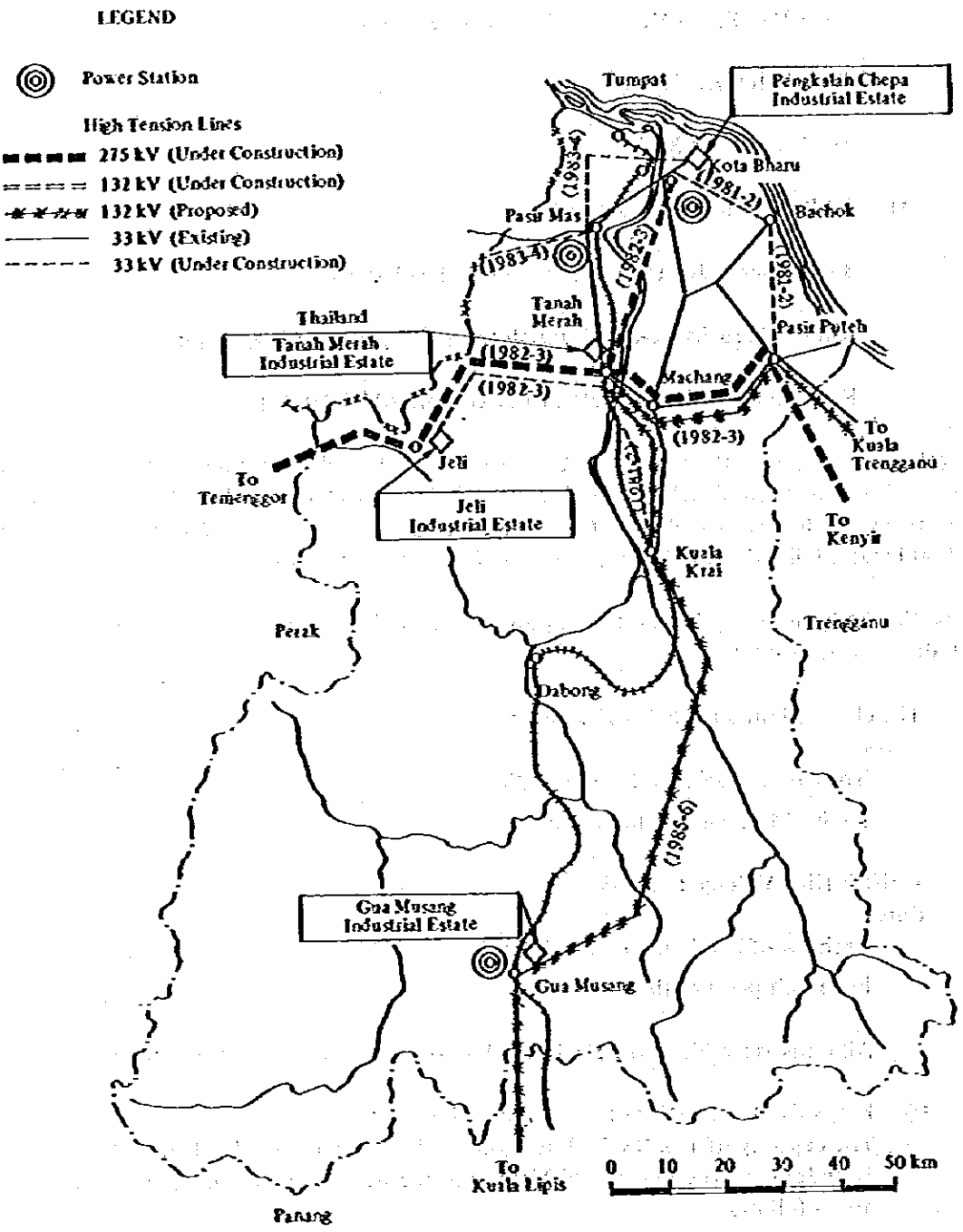
All units are subject to a Fuel Cost Variation charge at 2.6 cents per unit.

(i) Pengkalan Chepa (Kota Bharu) Industrial Estate
The capacity of 132 KV high tension line between Tanah Merah-Kota Bharu, which is under construction, is 280 MVA, and the transformers at Kota Bharu Substation are as follows:

2 sets x 45 MVA
2 sets x 30 MVA) Total 150 MVA

The consumptive use of electricity at Kota Bharu district is recently about 40 MW, and the consumption is estimated to be about double in 3 years' time taking into consideration the increased rate of consumptive use of electricity during the past several years in this district.

Fig. II-2-6 Electric Power Supply System in Kelantan



(ii) Tanah Merah Industrial Estate

The line capacity of 275 KV transmission which is under construction, is 580 MVA and the capacity of transformer at Tanah Merah is 360 MVA (2 sets x 180 MVA).

(iii) Jeli Industrial Estate

A 33 KV transmission line is also under construction between Tanah Merah and Jeli and the transformer capacity at Jeli is 15 MVA (2 x 7.5 MVA).

(iv) Gua Musang

The planning of 132 KV transmission line between Tanah Merah and Kuala Lipis via Kuala Krai and Gua Musang has been completed and the completion of the construction is scheduled by 1985-1986.

About 1 MW of diesel generators supply electricity to Gua Musang city at present. The construction will commence as soon as the consumption would become more than 15 MW at Gua Musang district.

II-2-5 Water Supply in Kelantan State

The water supply in Kelantan State is provided and administered by JKR (Public Works Department).

The total capacity of about 35,000 cu.m per day of water is treated by 13 treatment plants and is supplied for domestic and industrial use at present. Five new plants which are under construction will provide additional capacity of about 56,000 cu.m/day of treated water by early 1982.

The big cities in Kelantan State such as Kota Bharu and Tanah Merah, have urban water supply networks, and at present, improvement or new construction works of water supply facilities including pipeline are under way at the cities of Kota Bharu, Laut China (Bachock), Pasir Puteh, Pasir Mas, Tanah Merah, Machang, Ulu Kelantan, Kuala Krai, Jeli and Gua Musang.

The situations of water supply system at the cities related to the industrial estate are as follows:

a) Water supply at Kota Bharu
The water supply system including pipeline, intake wall, service reservoirs, treatment facilities are under construction in Kota Bharu districts (including Pengkalan Chepa) and is scheduled to be completed by the end of 1983.
The amount of treated water will be about 48,200 cu.m/day.

b) Water supply at Tanah Merah
The water supply system at Tanah Merah is also under construction and is scheduled to be completed by the end of 1983. About 20,500 cu.m/day of pumped water from Kelantan River will be treated and delivered.

c) Water supply at Jeli
About 3,000 meters of pipeline has been completed and about 150-200 cu.m/day of treated water will be supplied.

d) Water supply at Gua Musang
A reservoir and pipeline system are being constructed at present and is scheduled to be completed by the end of 1982.

II-2-6 Telecommunication

(1) Existing Telephone System in Kelantan State

82-trunk telephone lines exist between Kota Bharu and Kuala Lumpur, and the number of telephone circuit between Kota Bharu and principal cities in Peninsular Malaysia are as follows:

Kota Bharu-Kuala Lumpur	:	111	circuits
-Petaling Jaya	:	16	"
-Kuala Trengganu	:	27	"
-Kuantan	:-	30	"
-Ipoh	:	10	"
-Penang	:	27	"
-Singapore	:	14	"

The capacities of telephone circuits for the above cities in Kelantan States are as follows:

Kota Bharu	:	6,000
Bachok	:	200
Besuit	:	400
Kuala Krai	:	400
Jerteh	:	400
Machang	:	450
Pasir Mas	:	400
Pasir Puteh	:	400
Pengkalan Chepa	:	400
P. Chongdong	:	200
Panjang	:	200
Tanah Merah	:	400
Tumpat	:	200
Gua Musang	:	60
Ayer Laus	:	60

(2) Expansion Plan of Telephone System to the Industrial Estate

The expansion programme of telephone circuits at the cities related to the industrial estates in Kelantan State is as follows:

City	Circuits to be Expanded	Scheduled Completion Date
Kota Bharu	5,000	1981
Pengkalan Chepa	1,000	1982
	5,000	1983
Tanah Merah	2,000	1983
Jeli	400	1982
Gua Musang	400	1982
	1,000	1984
Wakaf Bharu	400	1982

(3) Telex

The capacity of 50 lines of telex exists at present in Kota Bharu and 48 lines are already occupied.

II-3 Industrial Estates in Kelantan

The Kelantan State Government has planned to develop the industrial estates at four places of Pengkalan Chepa, Tanah Merah, Jeli and Gua Musang in Kelantan, in order to accelerate economic and industrial development in the State as well as to give impetus to the people to have more chances for employment.

SEDC (Kelantan State Economic Development Corporation) of the State Government is the main executing agency for this development plan.

SEDC has been executing, by its own investment fund, land clearing, land reclamation, arrangement of lots, construction of road and drainage networks of the Estates and to provide necessary infrastructure facilities such as electric power, water, telecommunication, etc. to the Estates.

The Estates will be leased to the investors and/or owners of industrial factories, after the land is prepared and the necessary infrastructures are provided. The land premium for the investors is decided by SEDC taking the invested costs for the development into consideration of each estate, and lease period will be 33 years or 66 years depending upon the Estates.

Many advantages are given to the investors in order to promote the programme and at the same time, the investors are strictly selected by a Screening Committee of SEDC.

The locations of four industrial estates of Pengkalan Chepa Estate, Tanah Merah Industrial Estate, Jeli Industrial Estate and Gua Musang Industrial Estate are shown in Fig. II-3-1.

Pengkalan Chepa Industrial Estate is one of the well-developed estates among the four, and the Phase I area of the Estate has been completely occupied by some factories, of which some of them are already under operation. The Phase II area has also been prepared and the necessary infrastructures are provided, ready for factories' operation.

The land development of Tanah Merah Industrial Estate has been mostly completed and the investors of wood-based factory have been already selected for all the lots of the Estate. There are 3 - 4 timber factories which are already under operation. At present, there is no plan for expansion on this Estate.

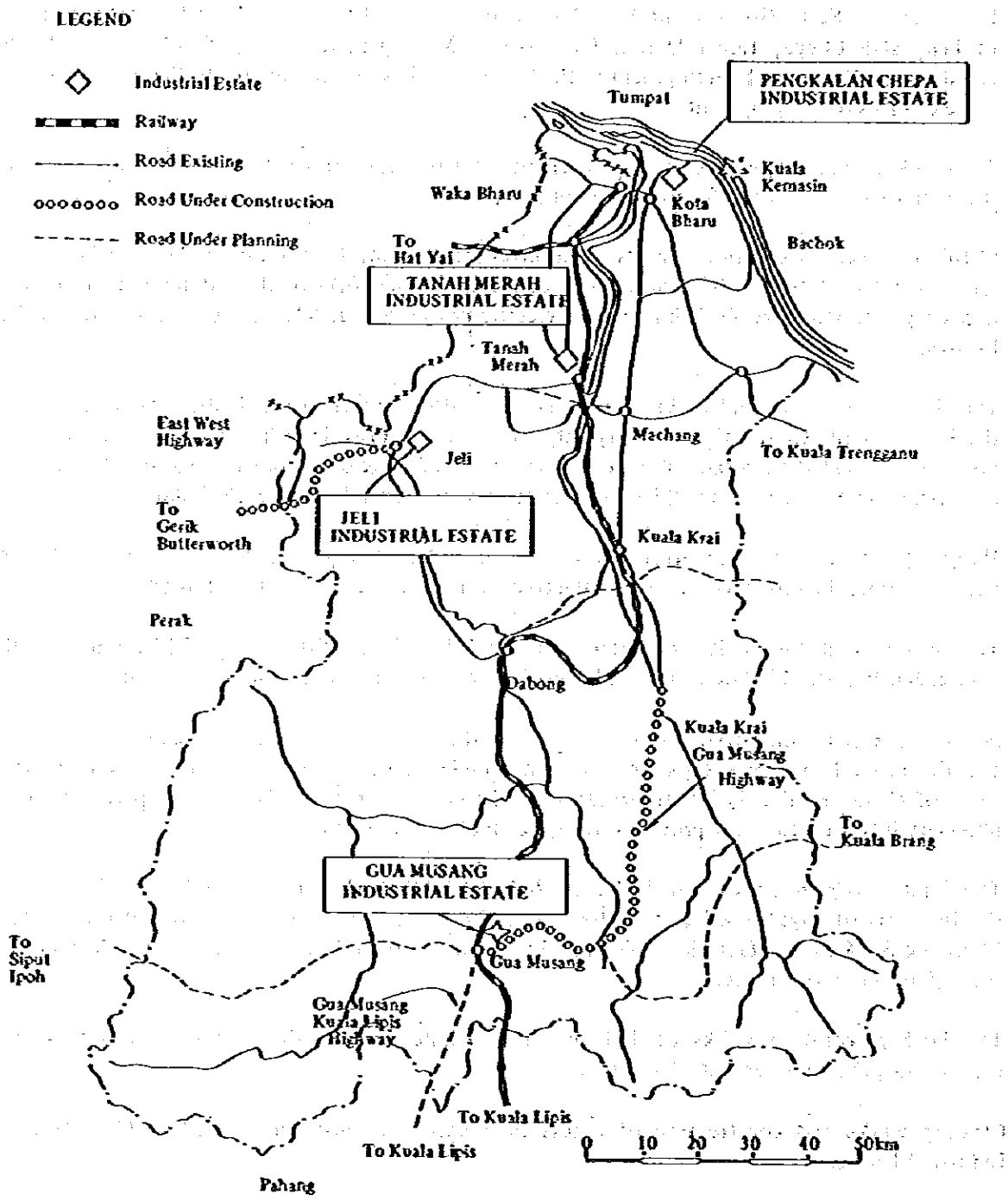
The land preparation works of Jeli Industrial Estate are on-going and some investors are constructing their timber factories at this Estate.

Clearing works and construction of access road have been just commenced on Gua Musang Industrial Estate.

These four industrial estates shall be studied, and the proper site from which the proposed cement plant shall be selected under this Feasibility Study.

The information of each industrial estate is delineated in the following paragraph.

Fig. II-3-1 Industrial Estate in Kelantan



II-3-1 Pengkalan Chepa Industrial Estate

Pengkalan Chepa Industrial Estate consists of three estates; namely, Pengkalan Chepa Industrial Estate-Phase I, Pengkalan Chepa Industrial Estate-Phase II, and the Free Trade Zone which is located at a part of Phase II area.

The characteristics of this industrial estate are as follows:

a) The distance from Kota Bharu, state capital, to the Estate is only about 10 km by paved road. Therefore, the availability of labour force is good and transportation of raw materials and goods will be convenient.

b) Convenience of air transportation is expected because of short distance (a few kilometers) from the new international airport planned at Pengkalan Chepa.

c) Possibility of sea transportation could be expected from New Kelantan Port at Kemasin of which the feasibility study had been completed and distance to the Estate is only about 10 km.

d) The soil foundation is sandy silt and is expected to be approx. 20-30 tons/sq. m of bearing capacity. The underground water level is high.

e) The level of the Estate is approximately 5 m, however, there was no experience of flood damage during the past 100 years.

f) Following are types of industries to be introduced:

- o Industries of labour intensity type
- o Industries having the merits of air transportation (export and import)
- o Light industries with less pollution.

Other information of each estate is as follows:

(1) Pengkalan Chepa Industrial Estate-Phase I

This was the first estate developed in Kelantan and is complete with infrastructural facilities. All industrial land has been taken up and the factory buildings have been built.

Distance from Kota Bharu Town	: 10 km
Total area saleable	: 8.5 ha
Total area allocated	: 8.5 ha
Land premium (per sq.ft.)	: M$0.60 (M$6.5/sq.m)
Quit rent per acre per year	: M$250.00 (M$618/sq.m.)
Lease period	: 33-60 years

Types of Industries:

Footwear and leather goods
Soft drinks bottling
Soya bean sauce
Bus & Truck bodies

Textiles
Furniture manufacture
Sewing Machine assembly

Power	:	0.7 MVA of power is available
Water	:	1 million gallons (4,546 cu.m) of treated water per day available
Telephone	:	200 lines available
Telex	:	available

(2) Pengkalan Chepa Industrial Estate-Phase II

This Industrial Estate covers an area of about 400 ha to be developed in 4 phases. 80 ha will be ready in early 1980.

Distance from Kota Bharu Town	: 10 km
Total area saleable	: 271 ha
Land premium (per sq.ft.)	: M$1.50 (M$16/sq.m)
Quit rent per acre per year	: M$250.00 (M$618/ha)
Lease period	: 66 years
Types of industry preferred	: light and medijm

Power	:	2.8 MVA is available with an additional 7.5 MVA to be installed in 1983.
Water	:	1 million gallons (4,546 cu.m) of treated water per day available, to be increased to 2 m.g.d. (9,092 cu.m/day) by 1981.
Telephone	:	200 lines available - 2,000 lines will be available by 1982
Telex	:	available

The areas for low cost flat and housing scheme as well as 13.4 ha of the industrial technical institute are allocated in this Estate.

In addition to the above, a housing estate of about 200 ha is under construction near this Estate.

(3) Free Trade Zone (FTZ)

Beside Industrial Estates, the State has also developed the export processing area known as Free Trade Zone, specially for export-oriented industries. Factories or industries sited within FTZ will enjoy (in addition to the usual facilities to be found in industrial estate) minimum customs formalities and duty free imports of raw materials, component parts and machineries which are required directly in the manufacturing process and the export of finished or semifinished articles.

An area of 188 ha is being developed for Free Trade Zone as a part of Pengkalan Chepa Industrial Estate-Phase II.

Fig. II-3-2 Pengkalan Chepa Industrial Estate, Phase I

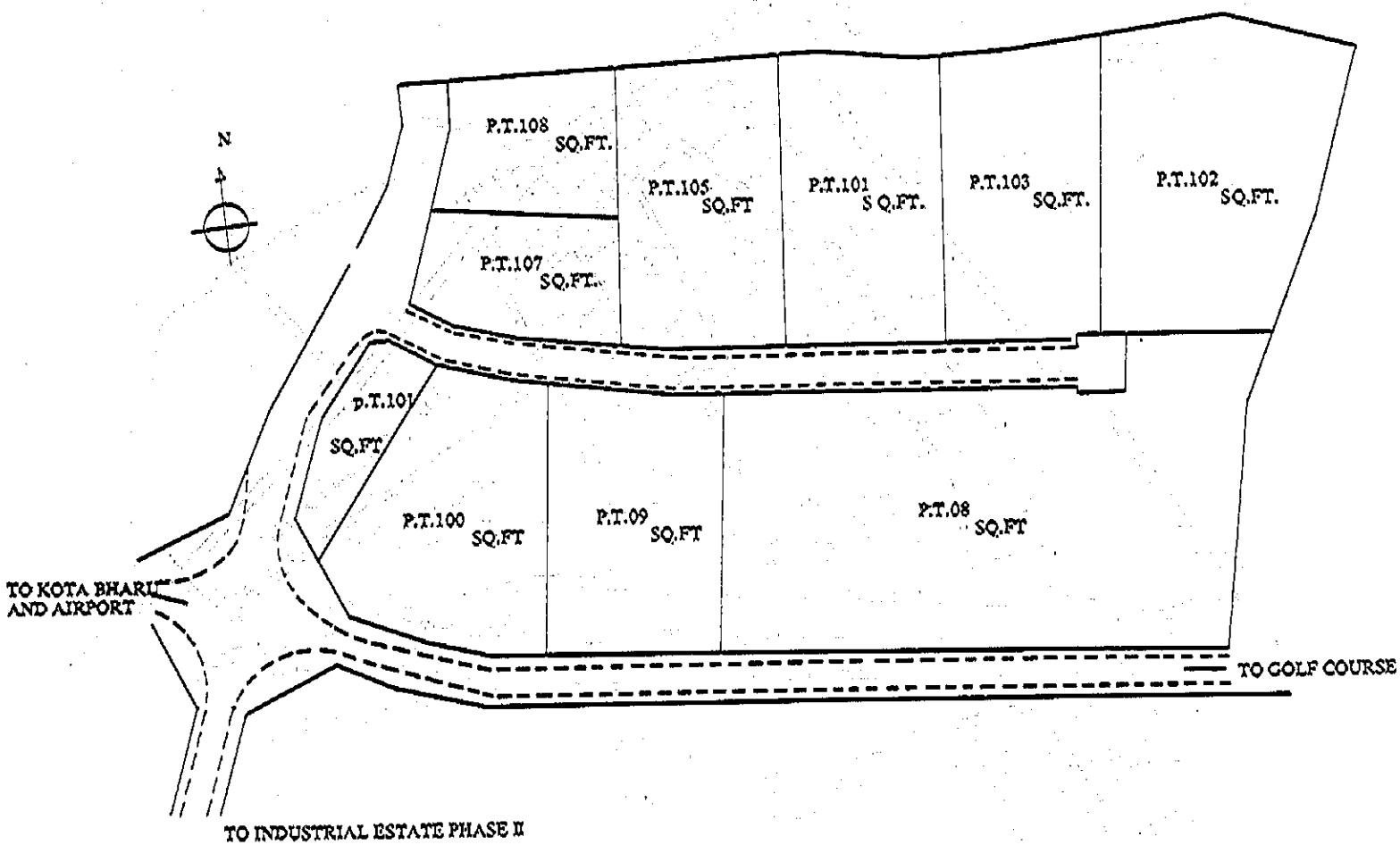
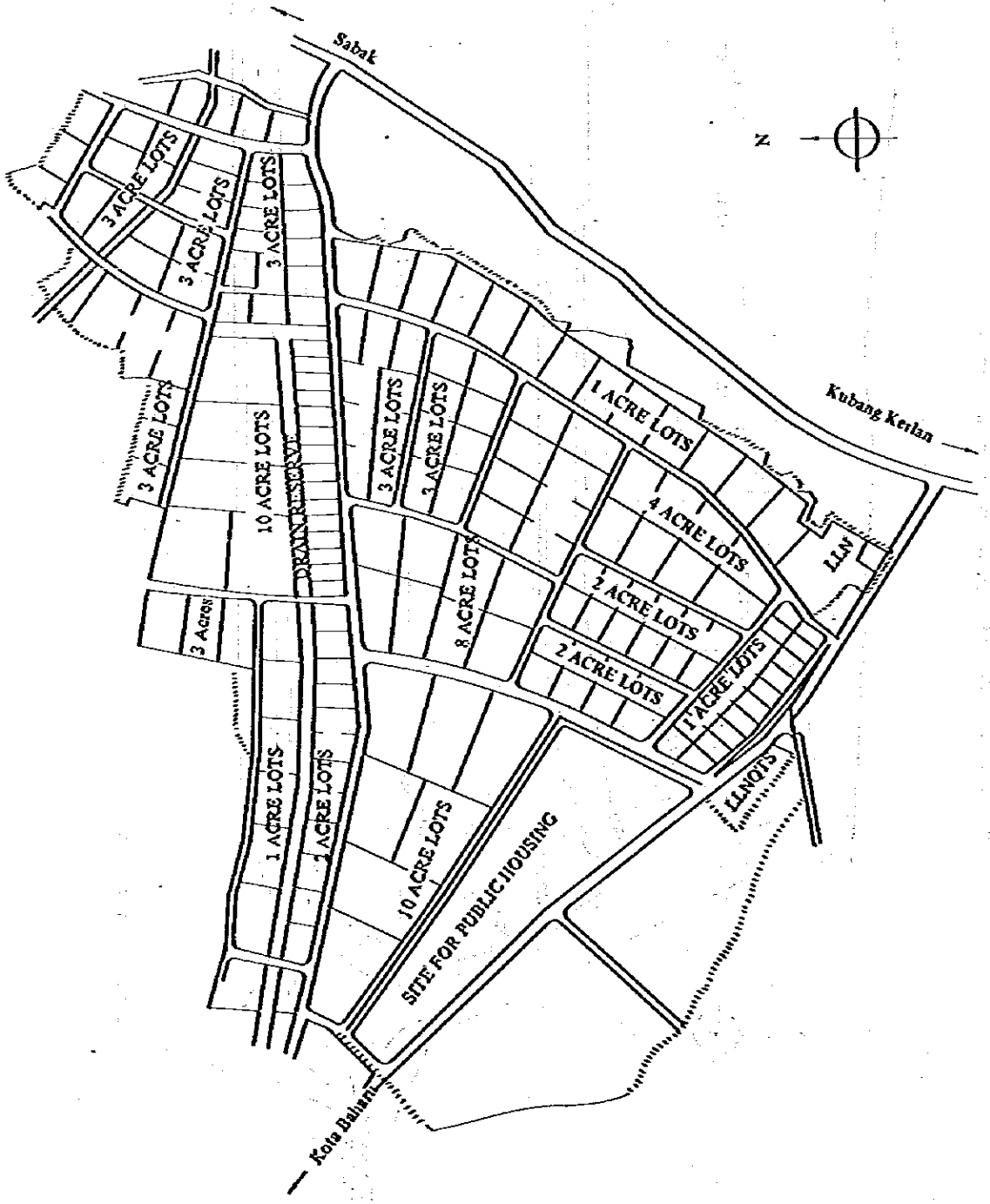


Fig. II-3-3 Pengkalan Chepa Industrial Estate, Phase II and Free Trade Zone



II-3-2 Tanah Merah Industrial Estate

The characteristics of Tanah Merah Industrial Estate are as follows:

a) This Estate is located about 2 km from Tanah Merah City which has about 28,000 population, therefore, the availability of labour force is relatively good.

b) The Malayan Railway runs beside the Estate and it is quite easy to construct a sidetrack. The transportation of raw materials, fuel and products will be very convenient for the factories located.

c) The Estate is also located beside Tanah Merah-Pasir Mas highway, which is planned to expand the road width to 40 m. Road transportation will be also convenient.

d) Wood-based, industries are recommended in this Estate.

e) Elevation of the Estate is about 30 m. Foundation soil is granular material with a few boulders and may have enough bearing capacity for plant foundation.

f) Many housing projects are under way near the Estate and there are no difficulties in finding the housing accommodation for the factory workers.

g) The Kelantan river is flowing down at the backside of the Estate, therefore, it is easy to get the industrial water.

h) All the developed land of the Estate had been occupied by investors and 3 saw-mills are under operation.

i) Other information is as follows:

Area	: 84 ha
Distance from Kota Bharu	: 51 km
Total area saleable	: 73 ha
Land premium (per acre) undeveloped	: M$18,000 (M$44.480/ha)
Quit rent per acre per year	: M$250.00 (M$618/ha)
Lease period	: 66 years
Type of industry	: wood-based

Power : 7.5 MVA available by 1983
Water : 200,000 gallons (909 cu.m) of treated water available 4.65 million gallons (21.140 cu.m) per day to be available in 1982.
Telephone: 400 lines available 1000 lines to be available in 1981
Telex : available in 1981.

Distance from Kota Bharu	: 10 km
Total area saleable	: 150 ha
Land premium	: M$1.50/sq.ft (M$16/sq.m)
Ready-built factory	: 37 units
Ready-built factory saleable	: 12 units
Average selling price per unit	: Semi-detached M$384,000.00
Rental per month	: terrace M$261,000.00
Rental per month	: semi-detached M$6,000.00 terrace M$4,080.00
Quit rent per acre per year	: M$250.00 (M$618/ha)
Lease period	: 68 years
Types of industry	: light and medium

Power	:	2.8 MVA is available with an additional 7.5 MVA to be installed
Water	:	1 million gallons (4.546 cu.m) of treated water per day available, to be increased to 2 m.g.d. (9,092 cu.m/day) by 1981
Telephone	:	200 lines available - 2,000 lines will be available by 1982
Telex	:	available

Fig. II-3-4 Location of Tanah Merah Industrial Estate

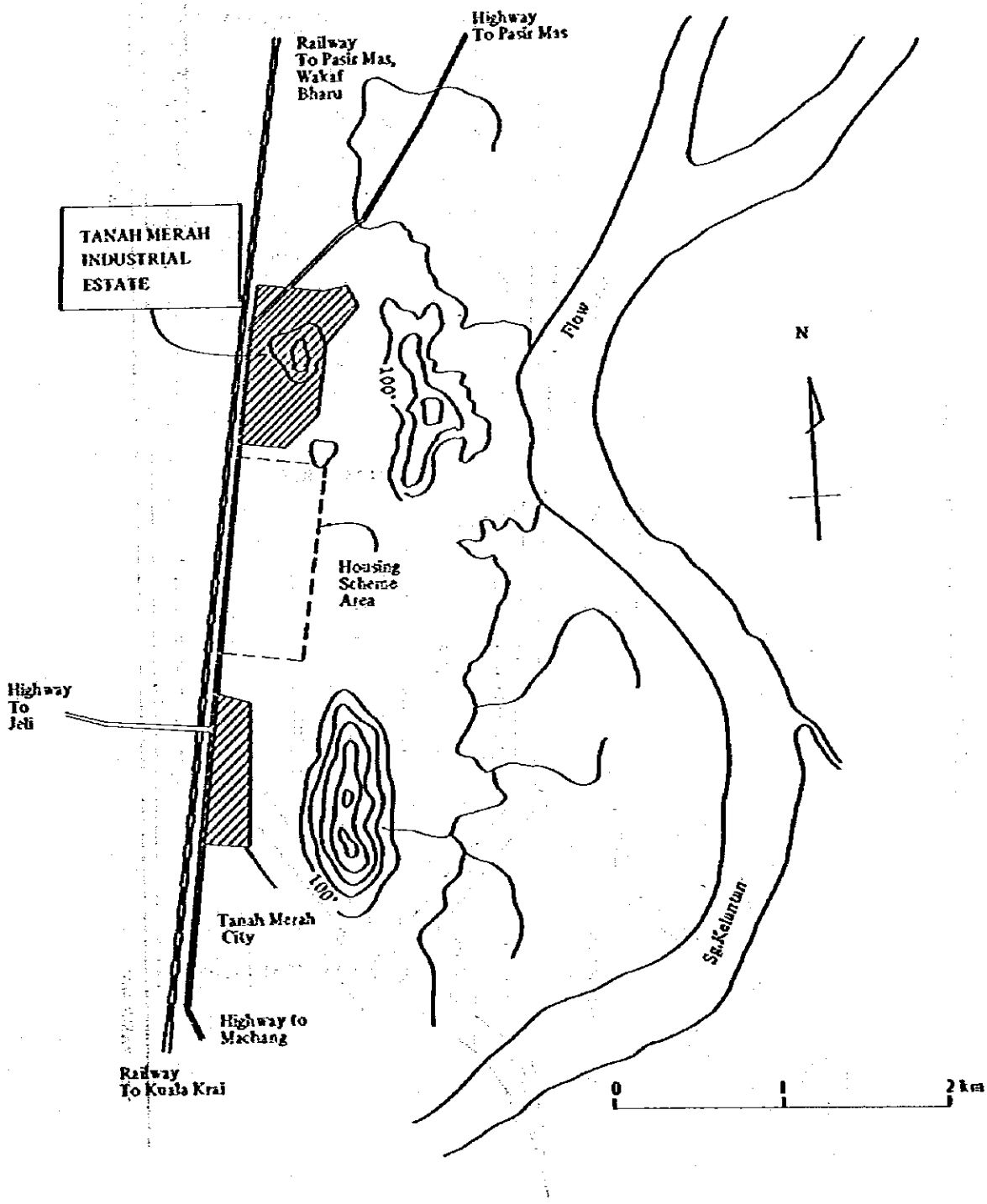
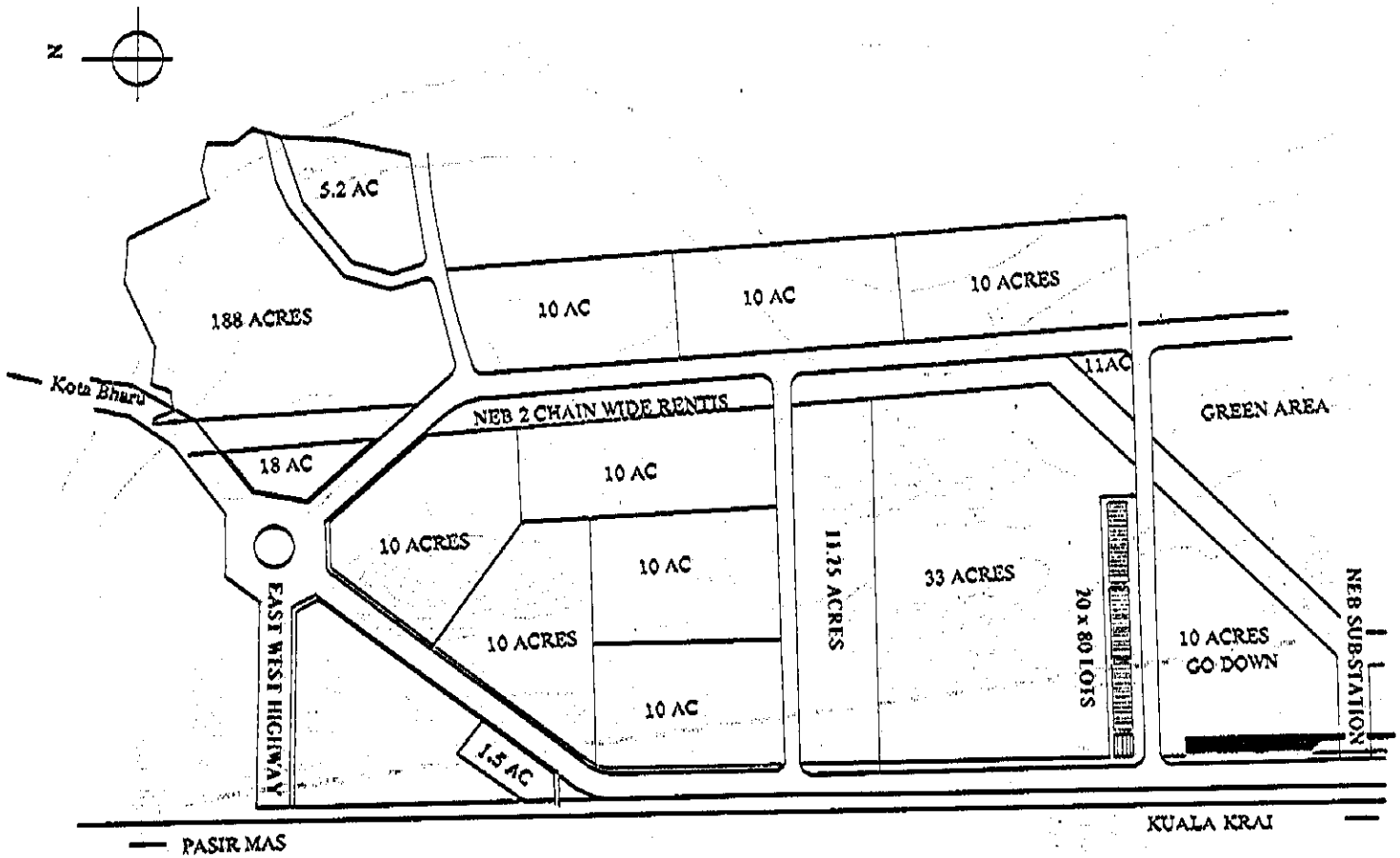


Fig. II-3-5 Tanah Merah Industrial Estate



II-3-3 Jeli Industrial Estate

Jeli and Gua Musang Industrial Estates have been planned as a part of the integrated district development programme by KESEDAR and are now being promoted and executed by SEDC.

The general plan of Jeli development programme by KESEDAR is shown in Fig. II-3-6. This development scheme includes town planning, agriculture development, industrial development, and so forth. The total area of the scheme is about 3,200 ha, of which 94 ha of industrial area is allocated near the Jeli town.

The characteristics of the Estate are as follows:

a) The population of Jeli town is only about 3,000 and there exists no basic industries in this district. Moreover, required labor force for the factories is imported from other districts and/ or other states.

b) However, rapid development can be expected in this area because of the tremendous development scheme being made by KESEDAR as stated above. Therefore, poor availability of labor force can be solved in the near future.

c) This industrial estate is located at the eastern end of East-West Highway and is a strategic point of road transportation between the eastern states (Kelantan/ Trengganu) and the western states (Perak, Penang, Kedah, etc.) of the Peninsular Malaysia. After completion of the East-West Highway, the distance to Butterworth and Ipoh from Jeli will be 240 km and 280 respectively.

d) The distance between Jeli and Gua Stir, one of the limestone deposits, is approximately 13 km.

e) The wood-based industries are indicated to be allocated in this Estate.

f) The elevation of the Estate is about 80 m, and silty clay of foundation soil may have enough bearing capacity for factory foundation.

g) Pergau river is flowing down behind the Estate and it will be easy to get the industrial water, either surface water or groundwater.

h) There exists additional 400 ha as expansion programme of this Estate in Phase II.

i) Other information is as follows:

Area	: 32 ha
Distance from Kota Bharu town	: 97 km
Total area saleable	: 29 ha
Total area allocated	: 29 ha
Land premium (per acre) undeveloped	: M$4,000-M$5,000 (M$9.880/ha-M$12.360/ha)

Quit rent per acre per year	:	M$250.00 (M$618/ha)
Lease period	:	66 years
Types of industry	:	wood-based

Power	:	3 MVA available by 1983
Water	:	80,000 gallons (364 cu.m) of treated water per day available
Telephone		50 lines available 200 lines to be available by 1982
Telex	:	Not available

Fig. II-3-6 Jeli Development Scheme by KESEDAR

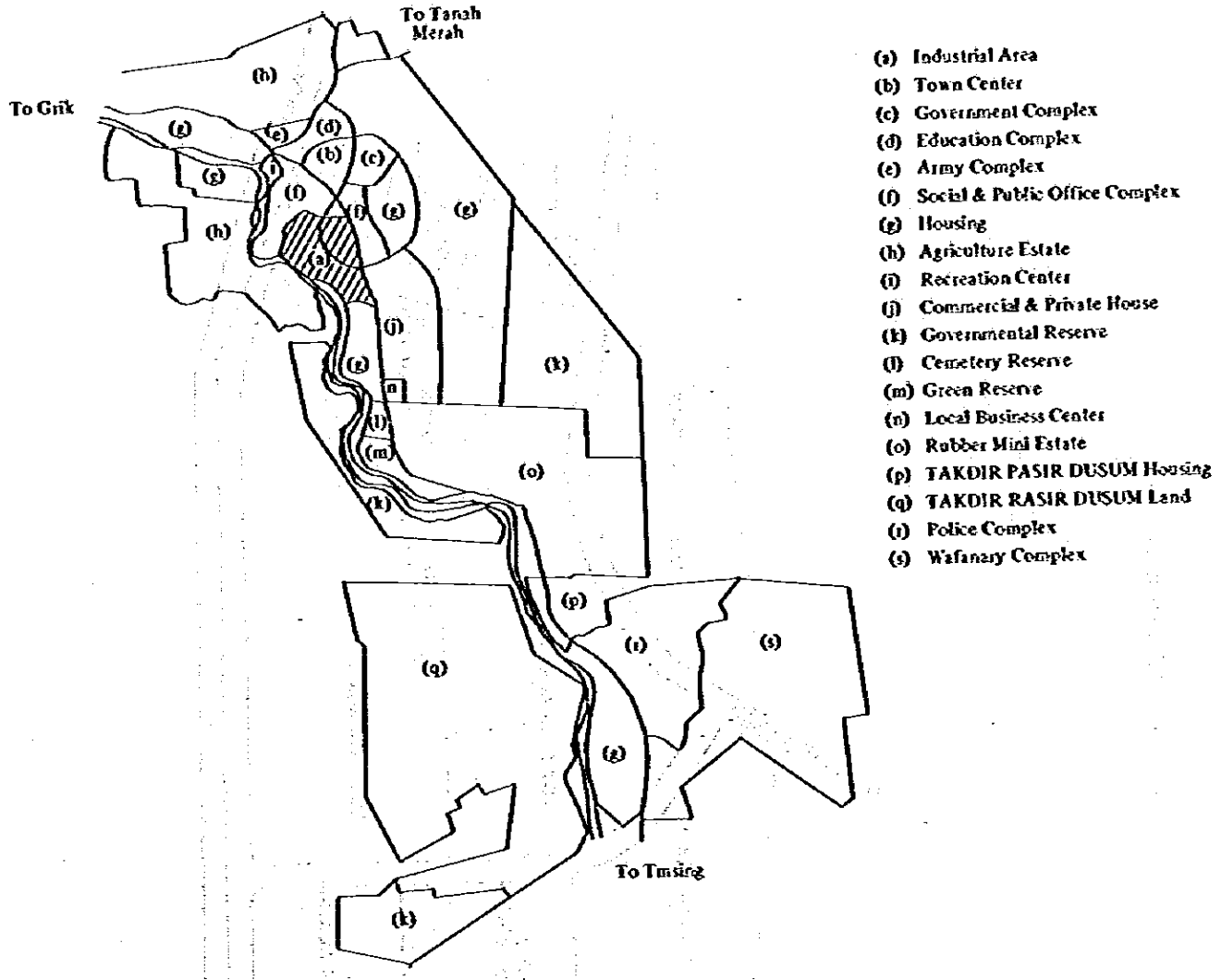
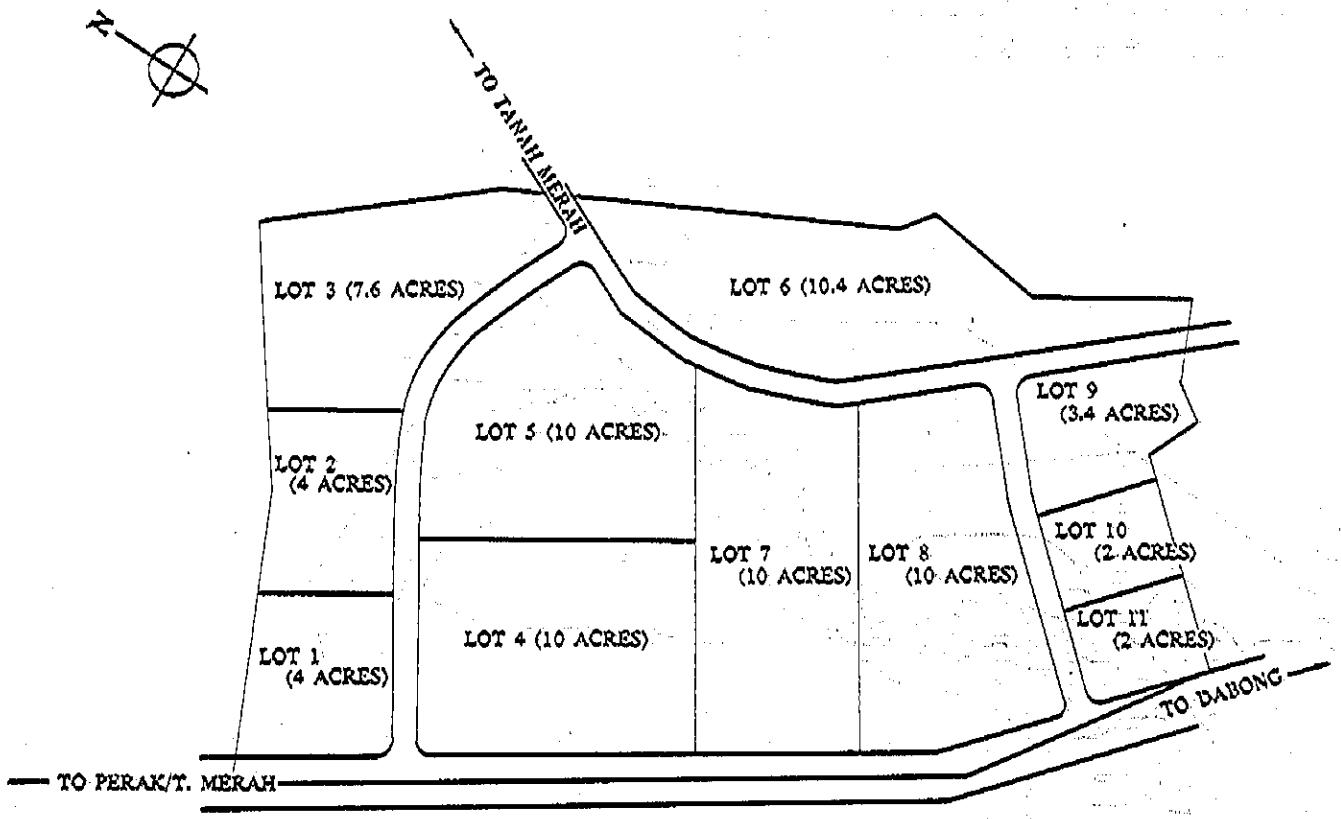


Fig. II-3-7 Jeli Industrial Estate



II-3-4 Gua Musang Industrial Estate

The integrated development programme by KESEDAR is under way in South Kelantan as above stated, and Gua Musang is located at the central area of the development plan. Various development programmes for agriculture, forestry, new town, industry and so forth are being executed in and around Gua Musang.

The Federal Government as well as the State Government have been investing and will invest a huge amount of budget for the improvement of infrastructures around Gua Musang, such as the construction of highways Gua Musang-Kuala Krai and Gua Musang-Kuala Lipis.

The development programme of Gua Musang, named as Gua Musang-2000, is a big integrated development programme including the development programmes of government complex, commercial center, industrial complex, housing, agriculture, recreation and tourism, and is expected to be completed by Year 2000.

About 910 ha for industrial complex site and 1,970 ha for the limestone industry site are allocated at the foothill of big limestone deposit, which is existing at a few kilometers north of Gua Musang city.

Based on this KESEDAR's development programme, SEDC has started the land preparation works of 47 ha of the industrial estate-Phase I which is scheduled to be completed by the end of 1983.

The characteristics of Gua Musang Industrial Estate are as follows:

a) Wood-based, agro-based and limestone-based industries are recommended in this estate.

b) There are very poor infrastructure facilities around Gua Musang and only 5,000 people are living at Gua Musang at present. There exist very few basic industries and very small labour force resources.

c) Notwithstanding the above facts, rapid development of infrastructures and sharp increase of population are expected in near future on this area in view of the said integrated development programme by KESEDAR.

d) Malayan Railway runs through just beside the Estate and the construction of siding shall be easy. Raw materials as well as products for the industries could be transported by the railway.

e) Gua Musang will be a strategically important point for the road transportation between the capital Kuala Lumpur and Kota Bharu, when the highways Gua Musang-Kuala Krai and Gua Musang-Kuala Lipis.

   The distance between Gua Musang and Kuala Lumpur will be about 260 km at that time, and ways to main ports of Port Kelang and Kuantan are about 270 km and about 340 km in distance, respectively.

f) A big limestone quarry exists beside the Estate

g) Elevation of the Estate is approx. 120 m and the limestone foundation is existing under a thin overburden at the foundation.

h) Other information is as follows:

Area	: 47 ha
Distance from town centre	: 6 km
Quit rent per acre per year	: M$250.00 (M$618/ha)
Lease period	: 66 years
Types of industry	: all types

Power	: 2 MVA available by 1983
Water	: 500,000 gallons (2,270 cu.m) of treated water per day available by 1981
Telephone	: 60 lines will be available
Telex	: Available

Fig. II-3-8 Gua Musang Development Scheme by KESEDAR

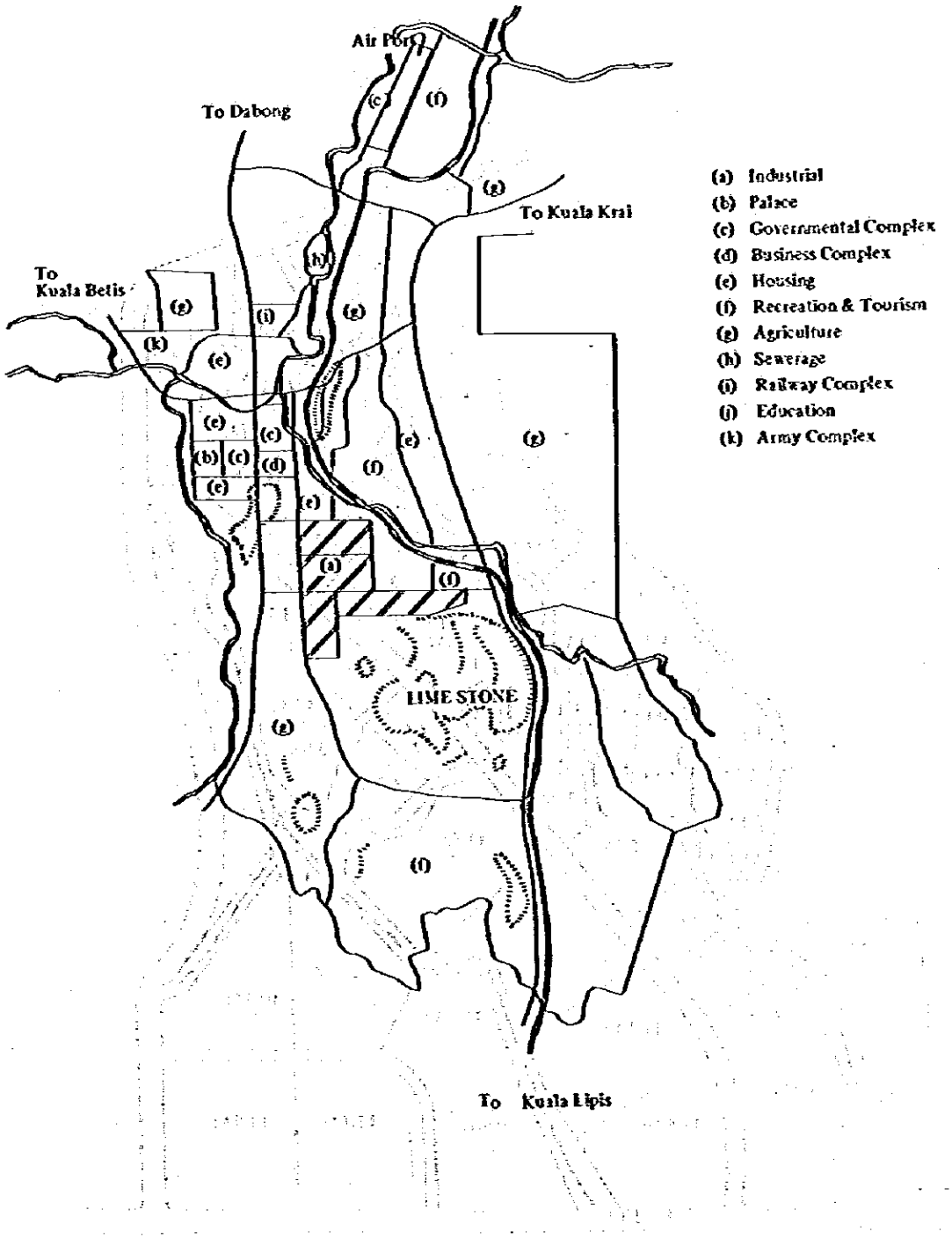


Fig. II-3-9 Gua Musang Industrial Estate