# PART I KELANTAN'S CONDITIONS FOR PORT DEVELOPMENT



# CHAPTER 1 GENERAL

the release to the control of the property of the property of the control of the

#### 1-1 Natural Conditions

# 1-1-1 Geographical and Topographical Conditions

The State of Kelantan is situated in the northeastern part of Peninsular Malaysia. Its limits are lat. 4°32" N. to 6°15" N. and long. 101°20" E. to 102°40" E. It adjoins Thailand and the State of Perak on the west side, the State of Pahang on the south side and the State of Trengganu and the South China Sea on the east side. Fig. 1-1 shows the location of the State of Kelantan.

It has the length about 190 km north to south and 130 km east to west and its area is approximately 15,000 km<sup>2</sup>.

By districts, it has the following topographical characteristics: The northern coastal area is an alluvial plain due to Sg. Kelantan. This plain is so flat that it seldom exceeds 15 m in altitude anywhere. The coastline is 80 km and the estuary of Sg. Pengkalan Datu — the former estuary of Sg. Kelantan — protrudes most. The sea is shallow to a great distance from the shore, and the seabottom gradient is  $1/1500 \sim 1/1000$ .

There is a range of high mountains on the southern border of the state. Mountains of higher than 500 m run north to south on the west side and mountains of about 1,000 m high run north to south on the east side. On the south side lies the mountainous area of Taman Negara.

The State of Kelantan has Sg. Kelantan and its tributaries whose basin covers about 85% of the total area of the state, Sg. Kemasin and Sg. Semerak in the coastal area, and Sg. Golok which forms the border with Thailand. According to Kelantan River Basin Study, the river bottom gradient is only 0.015% in the lower part of the river. This fact may be one of the causes of the floods that bring heavy damage almost every year. The estuaries of these rivers are all but blocked by drift sand.

# 1-1-2 Geological Conditions

The oldest rocks in the State of Kelantan are the Mesozoic shale and limestone in the central and southern parts. The Mesozoic granite intrudes into these rocks to form mountains. Scarcely any Tertiary rocks are found. They are eroded by rivers and sedimented in the lower reaches of the rivers as alluvial formations. The ground in the coastal plain is composed of the layer of clay, silt, sand and gravel brought by the rivers. This layer is thin in the inland but thick as 180 m in the coastal area.

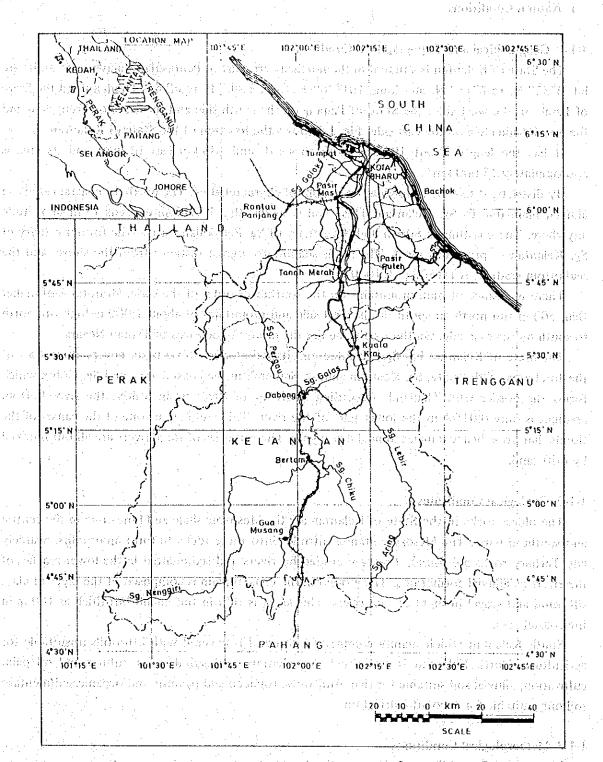
South Kelantan which mainly comprises forestland is covered with lithosoils unsuitable for agriculture. North Kelantan is composed of sedentary soil suitable for rubber and oil palm cultivation, alluvial soil suitable for rice, fruit trees, tobacco and peanuts and oceanic sedimentary soil only suitable for coconut cultivation.

# 1-1-3 Meteorological Conditions

Meteorology in the State of Kelantan is affected by the tropical climate, the oceanic climate by the South China Sea, and two monsoons, namely, NE monsoon and SW monsoon. There are great meteorological differences between the northern coastal plain and the southern highland area.

Fig. 1-1 Location of The State of Kelantan

GRESMEN 'Y DEFRACT



ottaglalistu navonij vali oju amerija ja planstreni prostopis ostinosti prostonaciji "Sourceti Kelantan River Basin Study" navojvas CVI navodreti in 1867. in osancija osmojski ostinosti prostopanama navistojeni sekstigini sedalije k navodrija i grandstrancija is kan navog navonom trajenim ostanom navod ostanom kalastem proposana, prope In the northern coastal plain, the annual average rainfall is 3,000 mm and 50% of the total occurs in the NE monsoon season from November to February. In 1979, a daily maximum rainfall of more than 810 mm was recorded. NE or ENE winds of 7 ~ 14 km/h blow during the NE monsoon season. Gales of a maximum wind velocity of 35 km/h was recorded. The annual average temperature is 26.7°C, and the maximum and the minimum are about 35°C and 20°C, respectively. The monthly average temperature is 25 ~ 28°C and there is no great difference by months.

In the southern area, there is no clear distinction between the wet and dry seasons. The skies are usually cloudy in the daytime and there often is a thunderstorm in the afternoon. Rainfall is great in April—May and October—November. The annual average rainfall differs by areas, ranging from 2,200 to 3,400 mm. Winds blow during the monsoon periods at a velocity of  $3 \sim 10 \text{ km/h}$  but there are sometimes strong winds of 20 km/h.

Fig. 1-2 shows the annual average rainfall for Kelantan.

# 1-1-4 Oceanographical Conditions

On and about the shores of the State of Kelantan, waves are largest in the NE monsoon season as they are developed by the NE winds of the South China Sea. In the SW monsoon season, the sea is very calm as winds blow from the land side.

The sea current of the east coast of Pehinsular Malaysia flows in the SE direction in winter and flows in the NW direction in summer. It is imagined that the coastal current along the shore of the State of Kelantan flows in the same direction with the sea current.

There is active sand drift on the seashore due to the oceanographical condition, and the earth and sand brought by Sg. Kelantan.

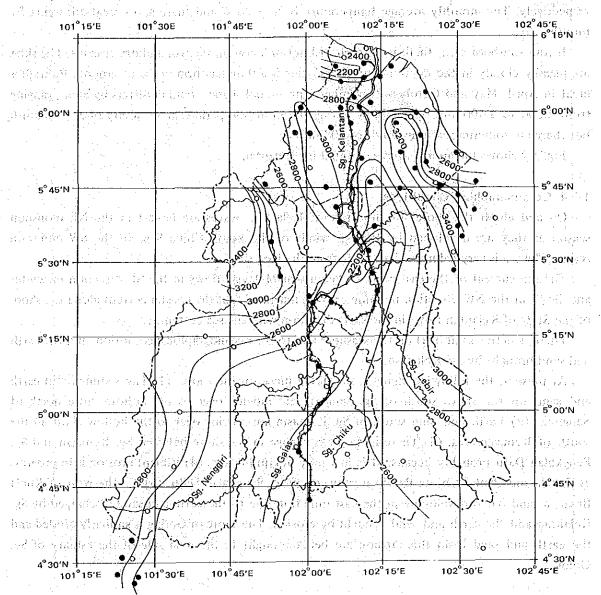
At present, the following changes are taking place on the shore: (1) The sediments of earth and sand on the shore south of Sg. Semerak are moving over to the hollow shore north of Semerak. (2) Earth and sand south of Sg. Kemasin are moving over to the hollow shore in the south of Kemasin area. (3) There is no great change in the shore between Sg. Kemasin and Sg. Pengkalan Datu probably because it is in a state of equilibrium. (4) Violent erosion is in progress at Sabak and Pantai Chinta Berahi northwest of Sg. Pengkalan Datu. (5) To the west of Kuala Besar, a sand bar is developing in the east direction due to the earth and sand discharged by Sg. Kelantan and the earth and sand brought by erosion. The shore of Geting is similarly eroded and the earth and sand from this erosion are being brought to the west side of the estuary of Sg. Golok.

## 1-1-5 Hydrological Conditions

Sg. Kelantan has four tributaries: Lebir, Galas, Pergau and Nenggiri. According to Kelantan River Basin Study, water flowing from these tributaries averages at 590 m³/sec in volume at Guillemard Bridge, and the maximum and the minimum are 21,000 m³/sec and 100 m³/sec, respectively. Water level of Sg. Kelantan rapidly rises in the case of continuous heavy rainfall. Sg. Kemasin and Sg. Semerak have small basins, and usually flow by the range of tide. These two deep rivers rapidly swell in time of heavy rainfall.

In the State of Kelantan, the natural disaster is usually caused by floods. It suffers flood damage almost every NE monsoon season as the result of local heavy rain in its plains or rainfall

in the page 30 kills from their grant Coulon, and the engineering a small containing for each contained and contai



Source: Kelantan River Basin Study

RILOMETERS: Emission of the state of the state

and the state of t

landit eriffin i i specif në logges stanin ë marenje,fendin në si in i fi ku si të bite di të cit. Bitulë në mare di që një partitoril të dhelsi nët së nëzros urazinin kët gran tundi ogualje. in the basins of its rivers.

It is reported that a coastal area of more than 1,500 km<sup>2</sup> was inundated more than 300,000 people suffered heavy damage and 55 were drowned by the flood of 1967.

Fig. 1-3 shows the state of inundation in the flood of 1967.

In the coastal area, there are several aquifers totaling a depth of 180 m on the shores but these aquifers mostly disappear at the end of the plains. Ground water from them is used to supply water for Kota Bharu and other cities.

# 1-1-6 Earthquakes

Fig. 1-4 shows the seismic intensity distribution for Peninsular Malaysia. There is no record of earthquake in the State of Kelantan, so it should not be taken into account in designing the port facilities, etc. For references, the design seismic coefficient of zero is used for the port structures of the Port Kelang located on the west coast of Peninsular Malaysia.

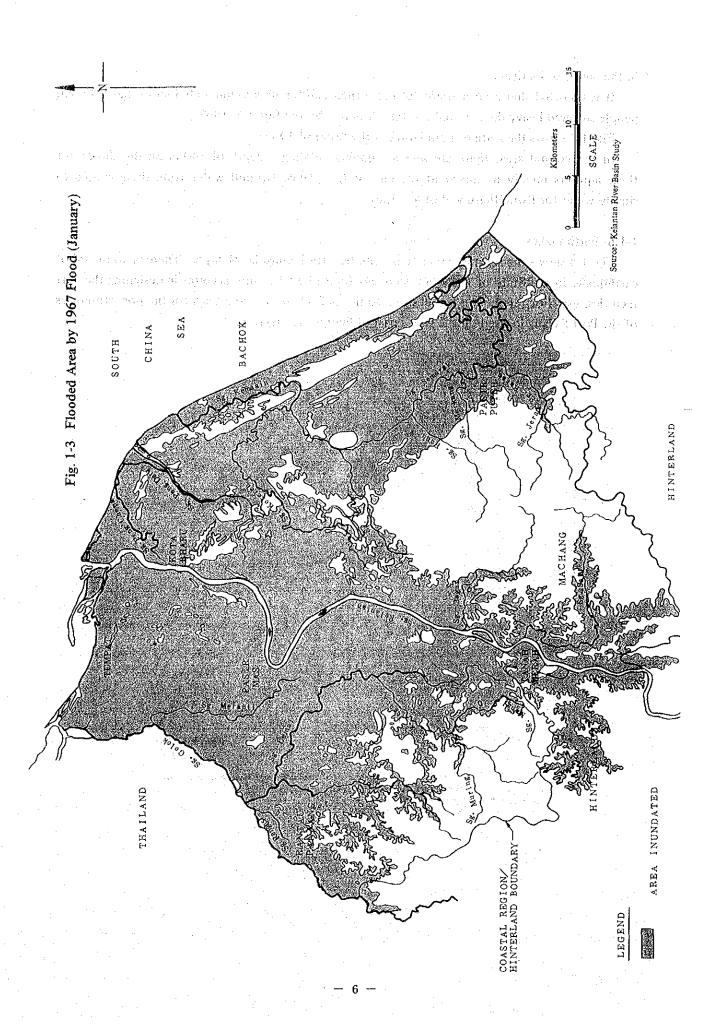
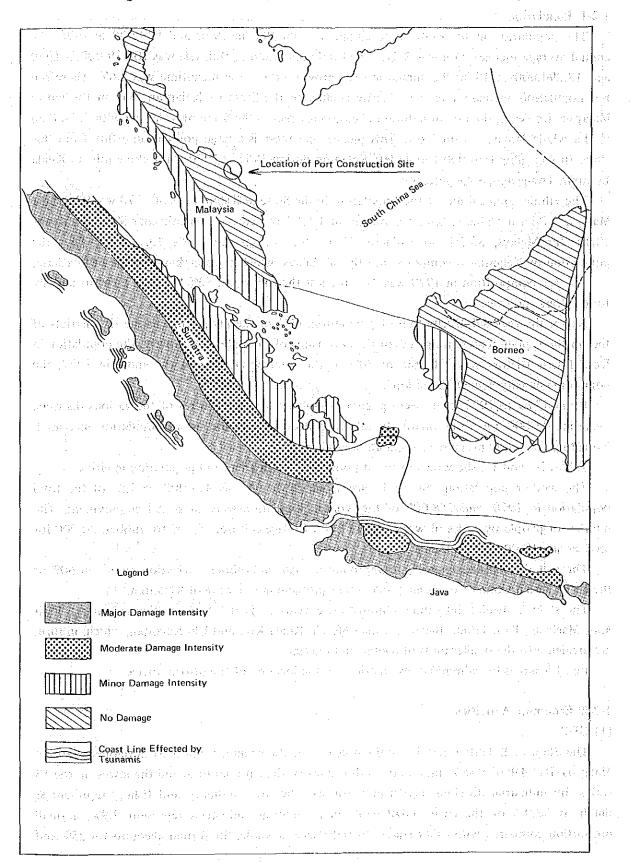


Fig. 1-4 Seismic Intensity Distribution for Peninsular Malaysia

ryakijani kalmoro - Sirakijar Val



# 1-2 Social and Economic Conditions

#### 1-2-1 Population

The population in the State of Kelantan was 686,000 in 1970 and 844,000 in 1978; the annual average increase rate was 2.4%. The total population of Malaysia was 10,439,000 in 1970 and 13,294,000 in 1978; the annual average growth rate in the meantime was 2.6%. Therefore the population increase rate was slightly smaller in the State of Kelantan than in the entire Malaysia. However, the rate of natural increase was larger in the State of Kelantan with 2.7% than in the whole Malaysia with 2.6%. This means that there is a large population efflux from this state. In fact, about 56,000 people left Kelantan during 1957 ~ 1970 for seeking jobs to Kuala Lumpur, Trengganu, Singapore, etc.

The ethnic composition of the population in the State of Kelantan as of 1970 was 92.4% for Malays, 5.7% for Chinese, 0.8% for Indians and 1.1% for others. In Peninsular Malaysia, it was 53.1% for Malays, 35.5% for Chinese, 10.6% for Indians and 0.8% for others. Thus the population of Kelantan is composed mostly of Malays, which gives a characteristic of this state.

The age composition in 1970 was 44% for less than 15 years, 52% for  $15 \sim 64$  years and 4% for 65 years and over.

As for the regional distribution of population, 80% of the people live in the six districts of the northern plain representing 16% of the entire area of the state. Particularly, the population in Kota Bharu District was 250,000, or 30% of the total population of the state, in 1977, the population density being 610 per km<sup>2</sup>.

From 1970 to 1975, there were population increases in the centres of the various districts, including 11,000 for Kota Bharu. In all, 20,000 or 20% of the urban population increased, indicating the steady progress of population urbanization.

Tables 1-1 and 1-2 show the change of population by districts and population in cities.

The worker population ranging in age from 15 to 64 was 357,000 or 52% of the total population in 1970, and 258,000 of the worker population were in actual employment. The number of people by types of work was 111,000 for rice culture, 55,000 for rubber, 20,000 for services and 18,000 for commerce.

The fact that farmers engaging in unproductive padi and rubber cultivation, represent 60% of the entire actual workers, poses an employment problem in the State of Kelantan.

The state is divided into nine administrative districts (jajahan): Kota Bharu, Tumpat, Pasir Mas, Machang, Pasir Puteh, Bachok, Tanah Merah, Kuala Krai and Ulu Kelantan, which, in turn, are divided into the smaller units of daerah and mukim.

Fig. 1-5 shows the administrative district and the location of the district office.

# 1-2-2 Economic Activities

#### (1) GDP

The State of Kelantan may be counted as one of the economically least developed states in Malaysia. Its GDP of M\$531 million in 1978 is 2.4% of the national total and the lowest in the 13 states. By industrial divisions, agriculture, forestry, livestock industry and fishery represent as much as 38.9% of the entire GDP while manufacturing industries represent 7.9%, a small proportion compared with other states. In Malaysia as a whole, the former accounts for 25% and

Table 1-1 Population by District Annual Control of the Population of the District of the Population of

District	Area (km²)	1970	1977
Kota Bharu	409.2	207,837	249,490
Tumpat - Tumpat	1/9.1	73,050	85,154
Pasir Mas	578.6	100,689	119,233
Machang	\$44,7	51,636	63,065
Pasir Puteh	433.6	71,133	84,085
Bachok	264.7	62,182	72,869
Tanah Merah	1,487,4	57,925	76,168
Kuala Krai	2,938.1	49,313	64,676
Ulu Kelantan	8,108.0	12,496	16,169
Total	14,931.4	686,266	830,909

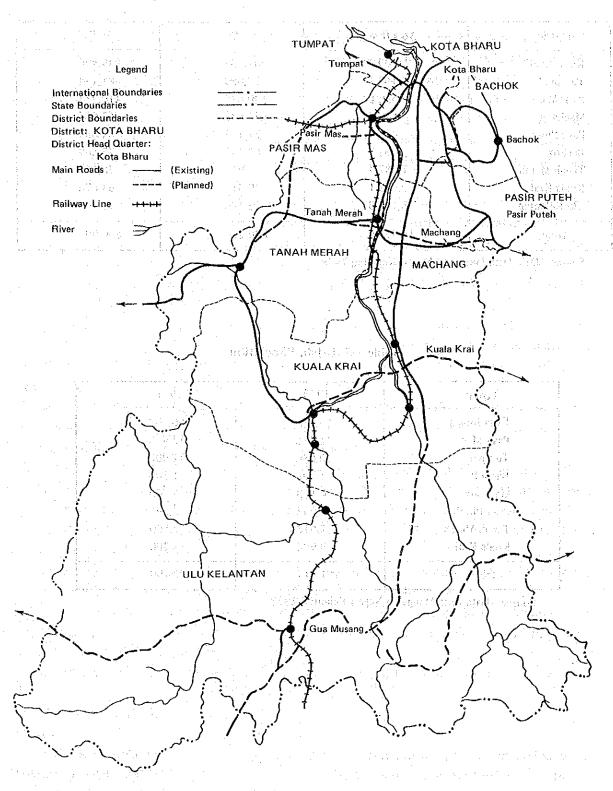
Source: Data Data Mengenai Negeri Kelantan 1978

Table 1-2 Urban Population

Town	1970	1977
Kota Bharu	55,113	66,200
Pasir Mas	11,236	13,400
Tumpat	10,680	11,900
Bachok	1,396	1,500
Machang	4,193	5,700
Pasir Puteh	3,093	3,690
Tanah Merah	7,012	9,500
Kuala Krai	8,994	10,300
Total	101,717	122,190

Source: Data Data Mengenai Negeri Kelantan 1978

Fig. 1-5 Districts and Places of District Head Quarters



the latter 20%. The per-capita GDP is the lowest at 38% of the national average. Generally speaking, the present economy of the State of Kelantan gives an economic image typical of a developing country where agriculture is centered and industrialization is lagged.

Table 1-3 shows the Malaysian GDP in 1978 by state and industry of origin.

# (2) Agriculture

In 1978, agriculture including forestry and fishery in the State of Kelantan amounted to M\$207 million or 40% of the all-industry GDP of M\$531 million. Since this section accounts for 25% of the total GDP of Malaysia, the proportion of agriculture in the State of Kelantan is remarkably high.

The staple agricultural products in this state are rubber, rice, tobacco, fruit, peanuts, coconuts, vegetables, bananas, and oil palms.

Below is the description of the present production of rubber, rice and oil palm that may be handled at the proposed new port in the future.

### (1) Rubber

Rubber may be considered to be the most important agricultural product of the State of Kelantan. A large number of the smallholders and labourers engaged in rubber cultivation belong to the poor class, as in the case of rice farmers. It is, therefore, natural that the increase of productivity in rubber cultivation is included among the main targets of socio-economic development.

In 1976, there were 68 estates cultivating rubber in the State of Kelantan and, of these, 54 or 79% were in the three southern districts. The cultivated area was 1,174 km<sup>2</sup> including 195 km<sup>2</sup> estates representing only 17% of the total. The remaining 83% was owned by smallholders.

As for production, estates and small holders account for 36% and 64%, respectively. The production has not changed much during the past several years. Hereafter, it is expected to increase gradually in the short term through the replacement with high-yield varieties and the increase of fertilization. In the long term, the production will considerably increase through the accomplishment of targets under the FELDA scheme.

Most of the rubber now produced is exported from the Port Klang.

#### (2) Rice

Rice is also one of the most important agricultural products in the State of Kelantan. A total of 111,000 farmers, mostly Malay peasants, engage in rice culture and 80% of them own their cultivated lands of less than 9,000 m<sup>2</sup>. The local rice production was steady at about 200,000 tons during the past several years.

There are wet padi and dry padi, but the former is overwhelmingly predominant at 99% in output. As for the cultivated area, main-season padi accounts for 66,00 ha, off-season padi accounts for 23,000 ha, and dry padi accounts for only 3,000 ha. In the future the rice production is expected to increase with the progress of flood control and irrigation projects, the expansion of double cropping, increased fertilization, and the use of high-yield rice verieties.

About 25% of rice produced in this state is transported to the States of Trengganu, Pahang and Johor.

#### ③ Oil Palm

Oil palm has not been cultivated and produced on a large scale in the State of Kelantan not

State and Industry of Origin, 1978 (MS million in constant 1970 prices) 3 Malaysia: Gross Domestic Product by St. 14 Pie 13 Pie 14 Pie 14

<del></del>	r					·		
Total Malaysia	5,531	1,083	968	22,284	13,294	1,676.3	1.00	(ii) A suppose that is a first of a suppose that is a suppose t
Treng- ganu	223.0	57.5	190.0	528.9	526	1,005.5	09.0	[4] A.
Selangor	544:3	211.5	375.0	6,776.4	2,198	3,083.0	1.84	estendirez ez Mendekei es musetak eta Jenetik di Zuel dun a zila sitzen a asasak 1990 je
Sarawak	460.0	134.0	92.0	1,538.7	1,208	1,273.8	0.76	The paints of the conservation of the later
Sabah	847.0	181.3	78.0	1,811.3	824	2,198.2	1.31	general oversees on a first can general experience of a decision first case oversees and a second
Pulau Pianng	168.2	4.5	72.2	1,817.0	956	1,900.6	1.13	t si gun in Claudin e per tettak 1907 - Propinsi Santa Santa 1908 - Santasa Santa Santasa
Perak	658.3	307.7	68.5		1,927	1,414.1	0.84	n se esta como esta conficiente de la conficiencia de la confisiona de la conficiencia de la conficiencia de la conficiencia de
Pahang	458.2	25.6	54.1	1,239.1	712	1,740.3	1.04	The first of the second control of the charge of the first of the charge
Negeri Sembilan	337.7	4.3	18.0	914.7	615	1,482.4	0.88	iza en especiere y <sup>1</sup> de light a kippeti. Nº 1 Al 19 de lean da la Agaderia agus e Al C 18 de lean de la Carleira agus e Al C
Melaka	143.4	3.2	13.3	620.0	209	1,218.1	0.73	
Kelantan	206.8	1.6	9.5	531.3	844	629.5	0.38	e en ar veneral en
Kedahl Perlis	581.0	9.2	19.1	1,197.6	1,330	5.006	0.54	nd communications; trade; ice; n and defence; ngs and real estate; Malaysia-Plan (1976—11
Johor	903.1	15.9	78.3	2,587.0	1,645	1,572.6	0.94	ge and comi trail trade; urance; ation and de vellings and ird-Malay sia
Sector State.	Agriculture, forestry, Livestock and Fishing	Mining and Quarrying Manufacturing	Construction Construction Construction	nestic Product (G.D.P.)	Population (000)	Per Capita G.D.P. (MS)	Ratio to Malaysian Average	1 Includes Federal Territory 2 Includes— (a) Utilities; (b) Transport, storage and communications; (c) Wholesale and retail trade; (d) Banking and insurance; (e) Public administration and defence; (f) Ownership of dwellings and real estate; (g) Other-services.  Source: Mid-Term Review of the Third-Malaysia Plan (1976)

only because the local geology is unsuitable for oil palm but because oil palm is unsuitable to cultivate on steep sloped lands are well and a result of the control of the

According to 1976 statistics, the State of Kelantan has 12 oil palm estates and four mills.

The area under oil palm cultivation in 1977 was 115 km<sup>2</sup> including estates accounting for about 50% and FELDA accounting for 40%.

The production of FFB (fresh fruit bunches) in 1976 was 105,000 tons. In 1975, estates and RISDA accounted for 86% and 14%, respectively, of the production, and the production of the production of the production.

In the future, the production is expected to increase in spite of some adverse natural conditions because palm oil has many applications and is a highly profitable agricultural product and because oil palms cultivated under the FELDA Plan will soon be ripening.

Crude palm oil is now exported after refined as mills near the Port Kelang.

# (3) Forestry of the little density and may the rest exhibit principles and otherwise the properties

The State of Kelantan abounds in forest resources as 11,200 km<sup>2</sup> or 75% of the total area of the state are forests. Especially, the Southern Kelantan is mostly mountainous and covered with forests, the total area of the state are forests.

A CAN analy many Co. A. A. Carlotta. A property of the Co. A. Capture for the comment of the Co.

In 1970, 1,600 people were engaged in forestry work including sawmill work, which was a standard and the same and the same

The production of logs was 390,000 tons in 1976 and 450,000 tons in 1977. Sixty percent of the produced logs were transhipped into other states to be processed at sawmills, etc.

Industries based on forestry will play a key function to the future economic development of the State of Kelantan, and forestry will become more important than ever. Forest roads have been improved, and other measures to cope with the increased timber production are to be taken. However, since, forests are being managed so as to restrict cutting as a matter of policy with a view to the protection of forest resources and flood control for Sg. Kelantan, there will be a certain limit to timber production in the future.

#### 

Hishery in the State of Kelantan, like agriculture in this state, is considerably less productive than in other states because of the delay in introducing modern techniques. The state government makes a point of eliminating poverty for fishermen in view of their low income level, where the state government makes a point of eliminating poverty for fishermen in view of their low income level, where the state government makes a point of eliminating poverty for fishermen in view of their low income level, where the state government makes a point of eliminating poverty for fishermen in view of their low income level, where the state government makes a point of eliminating poverty for fishermen in view of their low income level, where the state government makes a point of eliminating poverty for fishermen in view of their low income level, where the state government is the state government of the state government in view of the state government in vi

In 1978, there were 6,475 fishermen in 13 fishing villages located in the four districts of Kota Bharu, Tumpat, Bachok and Pasir Putch. Among the language and the passage of the state of

boats with outboard engine, and 282 nonpowered boats. They were distributed as follows: 376 at Kota Bharu, 671 at Tumpat, 434 at Bachok and 77 at Pasir Putch. Seventy percent of all powered boats were small vessels of less than 10 G.R.T.

The principal types of fishing methods used are seine-net fishing, drift/gill-net fishing, lift-net fishing, lift nets are used for horse mackerel and mackerel, drift/gill nets are used for Spanish mackerel, lines are used for bonitoes and trawling is used for bream, shrimps and flatfish. Fishing activities peak in August to October and fish catches are small in the NE monsoon period from November to March. In recent years, catches have gradually increased with the exception of 1977 with 6,500 tons and amounted to 14,519 tons in 1978.

# (5) Manufacturing Industry White heart happy has not additional or a specific at particular security of the

Manufacturing industry in the State of Kelantan in 1978 amounted to M\$41.9 million in terms of GDP, or 8% of the M\$531 million GDP of all industries. In the entire Malaysia, the share of manufacturing industry is 19%. The development of manufacturing industry is clearly delayed in this state.

From the 1973 census on manufacturing industry, the type and the scale of manufacturing industry, and the characteristic of the form of ownership in Kelantan are as follows:

There were 424 manufactories in this state and, of which, 77% produced foodstuffs, tobacco, furniture, lumber, wooden products and textiles. As for value added, lumber, wooden products, products related to petroleum and coal, foodstuffs and tobacco accounted for 80% of the M\$28 million value added for all manufactories. Further, these items represented 87% of all sales.

Regarding the scale of enterprises, 255 manufactories, or 60% of all, sold more than M\$50 million a year. Manufactories employing fewer than 10 workers numbered 273 or 64%.

Malays owned 411 manufactories or 97% of all, and these manufactories accounted for 82% of all sales or him contains a transfer of all sales or him to be a sale of all sales.

391 manufactories were distributed in the six districts of the northern plain including Kota Bharu. They represented 92% of all manufactories in the state and sold M\$87 million worth or 80% of all sales.

On the whole, manufacturing industry in the State of Kelantan is run by small manufactories owned by Malays, and producing primary-industry products with low value added of the state of Kelantan is run by small manufactories.

To raise the economic level of this state in the future, it is necessary positively to develop new industries while expanding existing manufactories at the same time. Fig. 1-6 shows the industrial estates that are going to be developed in the State of Kelantan in accordance with the Third Malaysia Plan.

constant with a special attack the dependent for the sit whether,

#### (6) Construction Industry

Construction industry in the State of Kelantan in 1978 amounted to M\$9.5 million in terms of GDP, or only 1.8% of the total GDP. Its share in the construction industry of the entire Malaysia was 1% the lowest share among the 13 states.

According to 1974 statistics, the number of construction companies was 28 including 11 companies of housing and they were all small companies.

Since the Third Malaysia Plan and subsequent development projects stress the improvement of infrastructures and other works closely related to construction industry, this sector is expected to develop in the future. This means that the consumption of steel, cement, concrete products, lumber, sand and limestone will increase, and ports and other infrastructures suitable for mass transportation will become more necessary than ever.

र करोती, बोर्चाएको प्राथमिको मार्च र क्षेत्रको प्रमाणको हर एक विकास स्थानका र सुपनार्थी पर स्वार्धन करा । वेला सार्व

# (I) Mininguing result had been as been seed from the relative regularise had equivalent and recorded

GDP in mining sector in 1978 is M\$1.6 million, only 0.3% of all industries.

Iron ore was once exported from Tumpat Port to Japan but it was discontinued due to exhaustion of resources. Sand, gravel (as road construction materials), barite, and limestone are produced but their quantities are small. Limestone in the mountain area is expected to be used as raw materials for cement production in the future. In accordance with the Third Malaysia Plan,

the Central Belt Project is presently being carried out to survey mineral resources, and there will be a possibility of mining of manganese, gold and lead for which their presence were already confirmed. In addition, possibility of development of off-shore natural gas in the South China Sea is also being examined.

the temperature representation of a new property graph takes the first term of takes are alter Fig. 1.6 New Industrial Estates in Kelantan agreement of the patient of a stati ve to mi potovije (v) o tiljelovanj melitiklje vi i Testeloga i SOUTH CHINA SEA Pengkalan Chepa Airport Pengkalan Chepa Industrial Estate Phase I **THAILAND** Pengkalan Chepa Kota Bachok Industrial Estate Phase II /Mas Bharu Asian Highway Lundang Industrial Estate Tanah Merah Industrial Estate Puteh Tanah Merah Machang To Kuantan Port East West Highway To Penang Port Kuala Lumpur Port Kelang Industrial Estate Singapore Kuala Krai **PERAK** TRENGGANU Dabong Kemubu KELANTAN Gua Musang Gua Musang Industrial Estate Legend To Kuala Lumpur Port Kelang Singapore Road Under Construction Railway Industrial Estate

Source: Kelantan Investment Brochure (1979) State of Kelantan

### 1-3 Present Conditions of Infrastructures

#### (1) Port

In the State of Kelantan, there is Tumpat Port at the estuary of Sg. Kelantan. This port formerly functioned in the export of iron ores to Japan but can no longer be used because sand and soil from Sg. Kelantan accumulated to make the anchorage shallow, drift sand made the estuary of the river shallow, and sand bars rapidly developed westernly in recent years. Without immense dredging, the port would be inaccessible to coastal and ocean-going ships in the future as at present. Therefore it would be economically impossible to keep Tumpat Port available for use by large ships.

Though the State of Kelantan has a coastline of about 80 km, at present there are no port that can replace Tumpat Port. Hence, the development of a new port as an infrastructure is essential to the economic development of the State.

Fig. 1-7 shows the location of ports of Peninsular Malaysia.

#### (2) Roads

The road network in the State of Kelantan is composed of the following main roads:

- ① Asian Highway No. 18, namely, Route III which, running through Kota Bharu, links Thailand to the north with Trengganu to the south and Johor Bharu located further south.
- ② Federal highway running north to south between Kota Bharu and Kuala Krai.
- (3) Federal highway linking Jeli, Tanah Merah, Machang and Pasir Puteh and joining Route III.
- 4 Federal highway linking Kota Bharu and Pengkalan Chepa.
- (5) Federal highway linking Jeli and Dabong.

This road network is joined by state roads.

There are the East-West Highway and the Kuala Krai-Gua Musang-Kuala Lipis Highway as federal highways either under construction or already planned to be constructed. The completion of these speedways will greatly increase the possibility of economic development in the State of Kelantan.

Further, a plan of a road crossing South Kelantan is now examined.

Fig. 1-8 and 1-9 show the road and railway networks in Peninsular Malaysia and the State of Kelantan.

#### (3) Railways

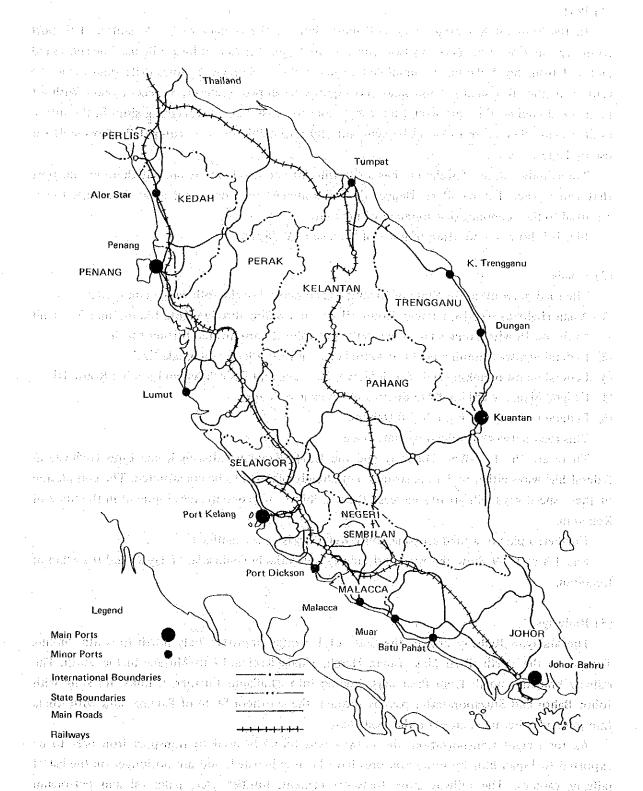
The Malayan Railway crosses the State of Kelantan approximately north to south, linking Tumpat in the north, Pasir Mas, Tanah Merah, Kuala Krai and Gua Musang in the south. The railway branches north from Pasir Mas, leading into Thailand. Further, it links this state with Johor Bahru and Singapore after passing through the southern State of Pahang, and with Kuala Lumpur and other main cities on the west coast.

As for freight transportation, the railway was formerly used to transport iron ores to be exported to Japan but, by now, iron ores have been exhausted, and are no longer on the list of railway cargoes. The railway now transport cement, lumber, rice, palm oil and petroleum products, etc.

Railway transportation is losing to motor transportation as the result of the improvement of

Fig. 1-7 Ports of Peninsular Malaysia

Colored to the Service of the Servic



to trainward probability the street of the tiple transportance is to an employed paractic again a signer of

Fig. 1-8 Road and Railway Network of Peninsular Malaysia

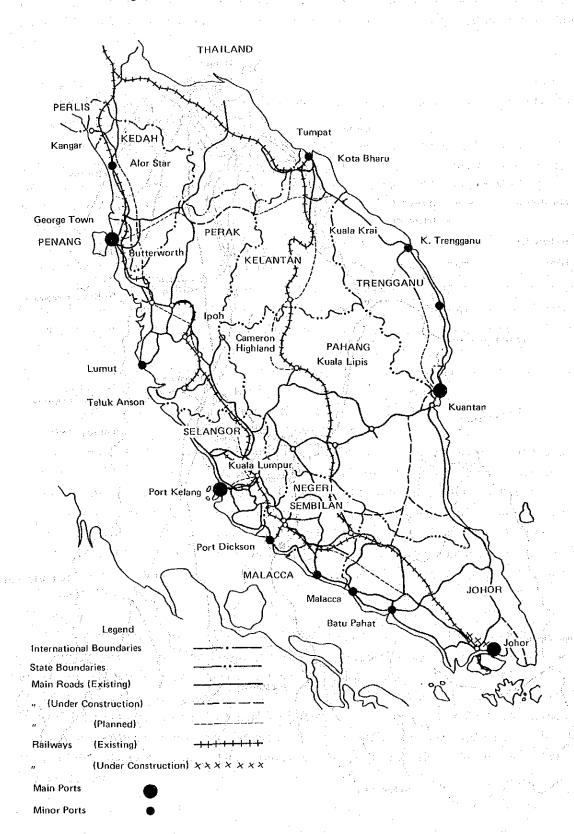
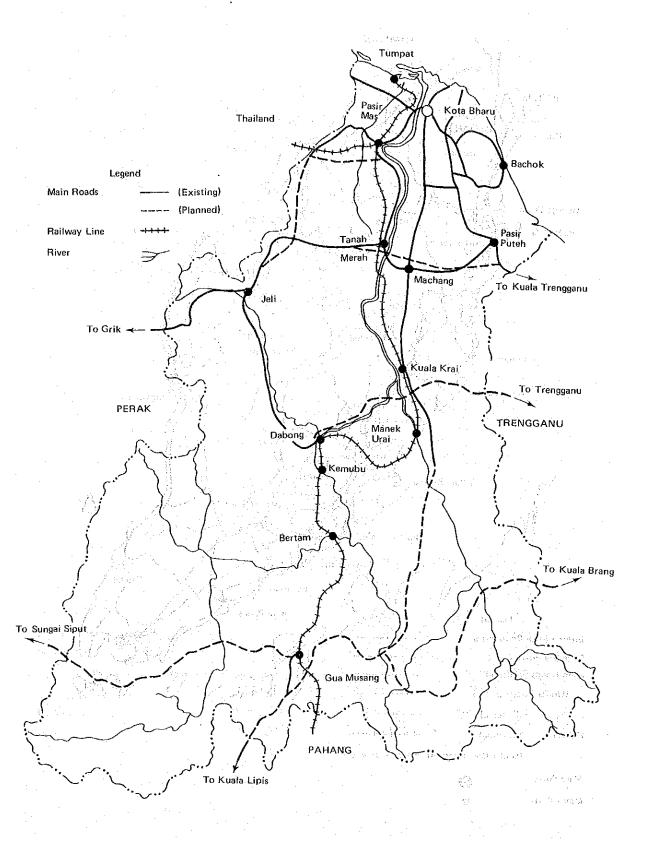


Fig. 1-9 Road and Railway Network in Kelantan



roads and the increase of automobiles. Judging from the fact that the government stresses roads in the improvement of infrastructures, the present decline of railway transportation will continue unless there are mass freights in which railway transportation has the advantage over motor transportation.

physicians, also call the explicate field has a line to be a line of the control of the physicians and the file

# (4) Airports of the selection before a page of the common and the grade of the selection and the common terms of the common selection of the common se

In the State of Kelantan, there is Kota Bharu Airport (Pengkalan Chepa Airport) 15.5 km east-northeast of Kota Bharu.

At present, airline services connecting Kota Bharu with Kuala Lumpur, Penang, Alor Star and Ipoh are available. Air passengers are increasing because of the time taken to move to cities on the west coast by road or railway. The existing runway can be used by aircraft of the B727 class but the government is studying to expand it under the Thrid Malaysia Plan so as to use for the B747 class aircraft.

and the solution of the property of the property of

both at the compensy left somegonate.

# (5) Electricity

Electricity in the plain in the State of Kelantan is supplied not only from the Lundang and Lemal Thermal Powerplants but from 16 smaller powerplants which supply the rural areas. The power generating capacities of the Lungdang and Lemal Thermal Powerplants are 24MW and 5 MW, respectively.

The power supply network is divided into several areas. The main trunk network is of 33 KV, and secondary trunk network of 11 KV branch from it.

The state, as a whole, is not yet adequately electrified, and the electrification of rural villages is being actively propelled under the Third Malaysia Plan.

From 1982, electricity will be supplied by the national grid from the hydraulic powerplant at Temmengor in the State of Perak. Thus the power situation in the State of Kelantan will drastically improve, depending on the improvement of the local power supply network.

In the State of Kelantan itself, surveys are being conducted with a plan to construct multipurpose dams involving hydraulic power generation by Sg. Kelantan and its tributaries. If this plan is realized, it will be easy to develop big scale industrial complexes consuming large amounts of power in this state.

# (6) Waterworks

The present waterworks in the State of Kelantan are inadequate. But the local waterworks have been improved under the Thrid Malaysia Plan. The water resources consist of ground water, and the present demand can be sufficiently met by drilling wells.

In the future, large quantity of industrial water will become necessary as the result of industrial development to be vigorously carried out in different parts of the State. In such case, not only the surface water of Sg. Kelantan but also its underflow may well be used. Besides, if multipurpose dams are constructed on the tributaries of this tiver, considerable water will become available.

เมาะหน้าจากสหหรับเหมาะ เกิดเมาะหรับ ใช้เมาะให้สมาชาว สมาชิกให้ เราะสมองกระไม่คู่ ค.สั

Same k<mark>anga ng Park</mark>arit Maliparat na salah ara an artiki atap tertuan pasipa magap <mark>pitipiti saran. M</mark> Salam kambangan Sagrah salah salah ang kanan atau katik saran tan kana Sajira dan katika salah menanggan pan

# 1-4 Development Policies and Plans and the second method to believe the first of them with the others

# 1-4-1 Outline of Malaysian Development Plans and Present Development Situation

# (1) New Economic Policy

The New Economic Policy is a basic policy of the Third Malaysia Plan for the socio-economic development of Malaysia. This New Economic Policy was propounded as policy targets when the Second Malaysian Plan was established in 1970. With the "Eradication of Poverty" and the "Restruction of Society" as its two major objectives, the policy is ultimately aimed to unite the nation.

are and the contract of the first form for a first of the contract of the contract of the contract of the con-

auchte a Macauthari, aché carma teachtaí é baile a bailtígean Teathraí de há taoin, ag cara mataga

# (2) Overall Perspective Plan (1886) of the contract of the second of the

The Overall Perspective Plan was established at the Mid-Term Review of the Second Malaysia Plan and envisages the socio-economic frame for 1990 as the guideline for five-year socio-economic development plans — Malaysia Plans — and with the object of accomplishing the two major targets of the New Economic Policy.

Table 1-4 and Table 1-5 show GDP by sector of origin and state in 1970 and 1990

# (3) Outline of The Third Malaysia Plan and Major Projects

The Third Malaysia Plan was established in 1975 as phase two of the development activities designed to realize the New Economic Policy. It is a five-year plan with 1980 as the target year and its costs totaled M\$18,550 million.

This plan was reviewed in 1979 and, it was modified as follows;

- (1) The total costs were increased to M\$32,076 million by increasing development expenses 73%.
- ② The annual average growth rate of the real GDP was cut to 8.3% from 8.5%, as originally planned.
- 3 The annual average growth rate of exports was increased from 13.6% to 17.3%.
- 4) The increase rate of consumer prices was raised from 5.0% a year to 5.2%.
- (5) The increase rate of private investments was cut from 9.9% to 8.5%

Table 1-6 shows the modified expenditure of public development for transportation and communications including ports. Table 1-7 shows expenditures related to transportation in states where major Malaysian ports are located.

# 1-4-2 Outline of Development Plans of the State of Kelantan and Present Development Situation

# (1) Purpose of Development in the State of Kelantan and Initiatives of Development

The purpose of development in the State of Kelantan is to realize the national targets: "Eradication of Poverty" and "Restruction of Society". The State Government of Kelantan mentioned the following development targets in "Kelantan: An Economic Survey and Implementation Programme" announced in 1979:

- ① To make a point of reducing the poverty of small farmers, fishermen, young unemployed people and poor people living in cities and villages.
- ② To promote development of certain areas as centers of rapid economic growth.
- 3 To create highly productive jobs that will bring incomes of, at least, the level of incomes used as a target under the Third Malaysia Plan and, at the same time, increase the productivity of

Table 1-4 Malaysia: GDP by Sector of Origin and State, 1970 (MS million in 1970 prices)

	-												
Sector	Johor	Kedah/	Kelantan	Malacca	Negeri	Pahang	Penang	Perak	Saban	Sarawak	Selangor <sup>2</sup>	Trengganu	. Malaysia
		Total			Schichan								
Agriculture, förestry, fishing etc.	489.6	426.3	139.6	105.4	181.9	224.0	155.0	486.2	405.0	319.0	399.4	100.8	3,432
Mining and quarrying	26.9	4.0	0.4	0.2	2.4	\$5.0	1.1	301.7	2.0	30.0	154.6	34.6	613
Manufacturing	166.7	46.5	17.9	19.8	75.9	38.5	101.2	142.4	19.0	81.0	586.0	12.4	1,307
Construction	24.2	37.2	19.2	8.4	27.6	11.5	45.9	39.8	48.0	46.0	172.4	8.4	481
Utilities	23.9	6.5	4.0	8.3	11.1	5.6	24.8	59.0	10.0	11.0	78.7	1.6	245
Transport, storage and communications	70.6	26.4	25.0	15.7	31.8	25.5	59.6	.99	36.0	.56.0	183.1	10.1	909
Wholesale and retail trade	130.1	41.7	35.6	77.5	45.4	36.9	212.5	187.7	79.0	116.0	443.1	17.2	1,423
Ownership of dwellings, banking, insurance and real estate	84.3	56.8	29.6	27.3	33.7	40.3	77.1	114.2	58.0	0.99	220.6	27.8	836
Public administration and defence	89.4	.46.1	28.4	36.9	43.4	46.0	34.0	83.0	. 40.0	45.0	280.9	21.2	794
Other services	88.2	51.8	29.9	38.6	36.5	28.7	83.5	117.8	73.0	0.06	217.9	18.6	874
Statistical discrepancy	i	1	1	1	1	1	1	1	ı	i		1	+67
Gross domestic product (GDP)	1,193.9	743.3	329.6	334.5	489.7	512.0	7.94.7	1,598.2	770.0	860.0	2,736.7	249.1	10,7083
Population (000)	1,326	1,117	712	419	200	525	805	1,629	654	976	1,693	421	10,777
Per capita GDP (MS)	900.4	665.4	462.9	798.3	979.4	975.2	987.2	981.1	1,177.4	881.1	1,616.5	591.7	93.6
Ratio to Malaysian average	0.91	0.67	0.47	0.80	0.99	0.98	0.99	0.99	1.19	68.0	1.63	09.0	1.00
The contract of the contract o		A STATE OF STREET		\$ 1 1 1 1 E		- 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			The second second	The second second second			

1 Kedah and Perlis are two distinct States but are shown together here because much of the available statistical data for the two States are combined.

<sup>2</sup> Includes the Federal Territory of Kuala Lumpur.

Source: The Third Malaysia Plan (1976~1980) The Third Malaysia Plan (1976 or general Property of States of States and States of States o <sup>3</sup> The GDP for individual States do not add up to the total of Malaysia because of the statistical discrepancy of MS97 million

Table 1-5 Malaysia: GDP by Sector of Origin and State, 1990 (MS million in 1970 prices)

Agriculture, forestry, fishing, 14893 968.9 474.2 238.2 613.4 1,445.1 299.9 1,467.8 914.0 812.0 786.6 784.5 9888 Mining and quarrying 1,775.9 824.9 461.8 3.46.1 1,759.3 1,175.9 824.9 1,105.0 269.0 241.0 1118 1,280 Construction 196.5 1,175.9 824.9 461.8 3.46.1 1,128 1,128.0 1,106.0 3,164.6 4,127 1,134.4 1,128.0 1,112 1,128.1 1,129.3	Sector	Johot	Kedah/ Perlis <sup>1</sup>	Kelantan	Malacca	Negeri Sembilan	Pahang	Penang	Perak	Sabah	Sarawak		Selangor <sup>2</sup> Trengganu	Malaysia	
ying 42.5 98.8 9 444.2 238.2 613.4 1,445.1 299.9 1,067.8 914.0 812.0 786.6 784.5 ying 42.5 20.4 5.6 6.3 11.7 40.8 11.9 423.5 195.0 269.0 241.0 11.8 11.8 11.8 1.75.9 84.9 146.8 346.1 865.8 908.1 1,533.7 452.0 1,106.0 269.0 241.0 11.8 11.8 11.8 1.89.3 1,533.7 452.0 1,106.0 3,104.6 11.8 1.89.3 1,133.7 452.0 1,106.0 3,104.6 1.80.6 318.0 209.0 3,104.6 11.8 1.89.3 11.8 1.89.3 1,137.7 185.1 365.4 448.0 2,25.0 3,123.0 887.5 82.5 11.9 1.91.6 11.9 2,22.9 301.0 309.5 334.5 656.9 826.4 460.0 318.0 2,014.5 167.4 161.7 185.8 206.7 282.2 444.2 2,28.0 2,90.0 3,01.0 10.4 1.90.6 161.0 2,08.3 1,106.7 386.7 485.6 361.0 4,24.0 3,01.0 165.9 165.7 161.7 185.8 206.7 2,28.0 2,25.0 1,23.0 1,23.0 1,22.2 ancy.  413.6 239.3 165.7 161.7 185.8 206.7 2,22.2 444.2 2,28.0 2,90.0 3,00.2 1,22.2 ancy.  413.6 239.3 165.7 161.7 185.8 2,00.7 2,28.2 444.2 2,28.0 2,90.0 1,28.2 1,22.2 ancy.  413.6 2,23.3 165.7 161.7 185.8 2,29.3 1,76.3 4,20.4 2,21.0 2,20.0 1,45.7 1,104.4 6,20.2 1,20.2 1,22.2 ancy.  413.6 2,23.3 165.7 161.7 1,65.3 4,4176.8 6,086.8 3,38.0 4,23.0 1,38.4 6,2,37.0 1,38.9 2,20.2 1,23.2 1,	A controllation formation flation						1	1:-							7
ying         425         204         5.6         6.3         11.7         40.8         11.9         423.5         155.0         269.0         241.0         11.8           1,775.9         824.9         461.8         346.1         565.8         908.1         1,593.3         1,533.7         452.0         1,106.0         3,164.6         412.7         1           198.5         180.7         106.9         96.4         140.8         128.7         214.3         223.0         209.0         374.9         76.3           silt ride         191.6         111.2         72.3         72.3         83.0         244.7         61.0         71.0         375.8         47.1           silt ride         424.5         274.6         180.6         97.2         137.7         185.1         365.4         448.0         225.0         310.4.5         167.4           fillings, bank         740.8         411.9         252.9         301.0         309.5         326.2         444.2         258.0         290.0         370.4         474.5         167.4         474.6         518.0         200.0         300.0         1014.5         167.4         185.1         186.7         188.7         488.6         460.0	etc.	1,489.3	6.896	474.2	238.2	613.4	1,445.1	299.9	1,067.8	914.0	812.0	786.6	784.5	9,858	
yring 47.5 2.04 5.06 6.13 11.7 40.8 11.9 42.35 1155.0 2695.0 241.0 11.8 11.8 11.8 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	· · · · · · · · · · · · · · · · · · ·							3.5 <b>(</b>						(	correct.
1,775   824.9   461.8   346.1   565.8   908.1   1,593.3   1,533.7   452.0   1,106.0   3,164.6   412.7   198.5   150.7   106.9   98.4   140.8   128.7   214.3   212.5   235.0   209.0   574.9   76.3   191.6   111.2   72.3   72.3   83.0   93.4   189.9   244.7   61.0   71.0   375.8   47.1   6 and   424.5   274.6   180.6   97.2   137.7   185.1   365.4   448.0   225.0   373.0   887.5   82.	Mining and quarrying	47.5	4.07	o. 0	5.9	11.7	8.04	11.9	423.5	0.561	769.0	241.0	11.8	1,280	****
191.6 111.2 72.3 72.3 83.0 98.4 140.8 128.7 214.5 212.5 235.0 209.0 574.9 76.3 and a mindle form and 424.5 274.6 180.6 97.2 137.7 185.1 85.4 448.0 225.0 323.0 887.5 82.5 and mindle state 740.8 411.9 252.9 301.0 309.5 334.5 656.9 826.4 460.0 518.0 2,014.5 167.4 1100. and 463.6 239.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 100. and 463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 120.0 208.3 1,069 1,380.7 2,439.9 2,734.0 2,407.7 3,784.6 2,737.0 110.4 13.0 2,228 1,657 1,104 652 833 1,069 1,380. 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 1.20.6 1.20.8 1	Manufacturing	1,775.9	824.9	461.8	346.1	565.8	908.1	1,593.3	1,533.7	452.0	1,106.0	3,164.6	412.7	13,144	
1916 111.2 72.3 72.3 83.0 93.4 189.9 244.7 61.0 71.0 375.8 47.1 eand.  1916 111.2 72.3 72.3 83.0 93.4 189.9 244.7 61.0 71.0 375.8 47.1 eand.  424.5 274.6 180.6 97.2 137.7 185.1 365.4 448.0 225.0 323.0 887.5 82.5 all traide 740.8 411.9 522.9 301.0 309.5 334.5 656.9 826.4 460.0 518.0 2,04.4.5 167.4 ellipse bank-real exarte 740.8 411.9 252.9 301.0 309.5 134.5 282.2 444.2 258.0 290.0 920.2 120.6 tool and 463.6 239.3 165.7 161.7 185.8 206.7 282.2 444.2 221.0 290.0 920.2 120.6 tool and 463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 east coduct (GDP) 6,117.8 3,588.5 2,073.7 1,658.4 2,480.4 3,778.4 4,176.8 6,086.8 3,822.0 4,252.0 11,384.2 1,899.5 5 and coduct (GDP) 6,117.8 3,588.5 2,073.7 1,658.4 2,804.8 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 in average 0.99 0.78 0.68 0.92 1.08 1.28 1.12 0.88 0.99 0.87 1.37 0.39 1.110.4 east coduct (GDP) 6,118.4 2,539.0 2,977.7 3,534.5 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 in average 0.99 0.78 0.68 0.92 1.08 1.28 1.12 0.88 0.99 0.87 1.37 0.39 1.110.4 east coduct (GDP) 6,118.4 2,539.0 2,977.7 3,693.9 2,734.0 2,407.7 3,784.6 2,737.0 in average 0.99 0.78 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.5	O 4 a 4 to 5 to	900	1507	1060	¥ 00	0 07	t c			0360	000	0 773	25.3	2346	
e and         424.5         274.6         180.6         97.2         137.7         185.1         365.4         448.0         225.0         323.0         387.5         47.1           ain trade         740.8         411.9         252.9         301.0         309.5         334.5         656.9         826.4         460.0         518.0         2,014.5         167.4           sings, bank         740.8         411.9         252.9         301.0         309.5         334.5         656.9         826.4         460.0         518.0         2,014.5         167.4         167.4           sion and fion and distant         463.6         239.3         165.7         161.7         185.8         206.7         282.2         444.0         258.0         290.0         290.0         167.4         167.4         167.4         239.3         176.3         430.4         221.0         230.0         1,457.0         110.4         665.2         826.7         485.6         361.0         290.0         110.4         665.1         110.4         4176.8         6088.8         3,382.0         4,240.0         962.1         1,220.0         110.4         652.2         297.7         3,784.6         2,734.0         2,409.7         3,784.6         2,737.0	Construction	7.86.7	/.ner	7.00.7	4.0	140.8	1.68.1	6,414	7777	0:007	0.402	y.4.	6.0	6,540	
antrade 740.8 411.9 252.9 301.0 309.5 334.5 656.9 826.4 460.0 518.0 2,014.5 167.4 lilipsy bank-real exate 577.5 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 110.4 483.6 239.3 165.7 161.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 433.6 293.3 188.0 161.0 208.3 196.7 386.7 485.6 361.0 424.0 962.1 122.2 ancy. 2228 1,657 1,104 652 833 1,069 1,350 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 0 average 0.059 0.78 0.68 0.052 2.0 3.0 2.0 3.0 2.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3	Utilities	191.6	111.2	72.3	72.3	83.0	93.4	189.9	244.7	61.0	71.0	375.8	47.1	1,613	
ait trade 740.8 411.9 252.9 301.0 309.5 334.5 656.9 826.4 448.0 225.0 323.0 887.5 82.5 82.5 milkings bank. Trad estrate 377.5 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 10.0 and 463.6 239.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 110.4 113.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 anc.y. — — — — — — — — — — — — — — — — — —	Transport, storage and	-										÷ .			
illings; bank.  Fig. 377.5 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6  Fig. 377.5 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6  Fig. and 463.6 299.3 165.7 173.2 224.4 239.3 176.3 430.4 2210 230.0 1,457.0 110.4  413.6 293.3 188.0 161.0 208.3 196.7 386.7 485.6 361.0 424.0 962.1 1122.2  ancy.  coduct (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 1,899.5 5  2,228 1,657 1,104 652 833 1,069 1,350 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 1,384.2 1,377 0,99  43.6 2.0 2.0 2.2 2.2 2.2 2.6 3.6 2.6 2.2 3.2 3.2 3.0 2.9 2.5 2.5 1,377  Fig. ancy.  2,24. 2.6 2.0 2.2 2.2 2.2 2.6 3.6 2.6 2.2 3.2 3.2 3.0 2.9 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	communications	424.5	274.6	180.6	97.2	137.7	185.1	365.4	448.0	225.0	323.0	887.5	82.5	3,631	
linings, bank.  377.5 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 from and 463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 from and 413.6 293.3 188.0 161.0 208.3 196.7 386.7 485.6 361.0 424.0 962.1 122.2 ancy.  cduct (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 1,899.5 solution and 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1 average 0.99 0.78 0.68 0.92 1.08 1.28 1.12 0.88 0.99 0.87 1.37 0.99	Wholesale and retail trade	740.8	4119	2529	3010	300 5	2.5 7.5 7.	6 959	876.4	460.0	518.0	2.014.5	167.4	6 994	
Hings, bank- 377.5 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 treal exate treal exate treal exate treal exate tion and 463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 110.4 110.4 110.7 1.00.7		?	7.11	.,	2		) }	3	1.070	2	2	7,7,7	:		
treal estate 3775 263.3 165.7 161.7 185.8 206.7 282.2 414.2 258.0 290.0 920.2 120.6 filting and 463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4 ancy  -	Ownership of dwellings, bank-														
tion and 463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4  413.6 293.3 188.0 161.0 208.3 196.7 386.7 485.6 361.0 424.0 962.1 122.2  ancy  oduct (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 1,899.5 5  2,228 1,657 1,104 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1  (S) 2,745.9 2,147.6 1,878.4 2,539.0 2,977.7 3,534.5 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 1  ancy  ancy  2,228 1,657 1,104 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1  and an average of the control of	ing, insurance and real estate	377.5	263.3	165.7	161.7	185.8	206.7	282.2	414.2	258.0	290.0	920.2	120.6	3,646	***
463.6 239.3 165.7 173.2 224.4 239.3 176.3 430.4 221.0 230.0 1,457.0 110.4  ancy  -	Public administration and					:								:	,, c <del>.</del>
ancy ancy ancy begin{tabular}{l l l l l l l l l l l l l l l l l l l	defence	463.6	239.3	165.7	173.2	224.4	239.3	176.3	430.4	221.0	230.0	1,457.0	110.4	4,131	· • • • • • • • • • • • • • • • • • • •
ancy  educt (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 1,899.5 5  cduct (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 1,899.5 5  2,228 1,657 1,104 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1  45) 2,745.9 2,147.6 1,878.4 2,539.0 2,977.7 3,534.5 3,093.9 2,734.0 2,407.7 3,784.6 2,737.0 6,99 6,78 6,099 6,78 1,37 6,99 6,79 1,108 1,128 1,128 1,12 6,78 6,99 6,87 1,37 6,99 1,114 6,79 1,114 6,79 1,114 6,79 1,37 6,79 1,114 6,79 1,14 6	Other services	413.6	293.3	188.0	161.0	208.3	196.7	386.7	485.6	361.0	424.0	962.1	122.2	4,203	
ancy cduct (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 1,899.5 5 cduct (GDP) 6,117.8 1,657 1,104 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1 45) 2,745.9 2,147.6 1,878.4 2,539.0 2,977.7 3,534.5 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 0,99 0,78 0,68 0,92 1,08 1,128 1,12 0,88 0,99 0,87 1,37 0,99 1,114.6 2,6 2.6 2.2 2.6 2.6 2.2 3.0 2.9 2.5		V L	-			• •						4 3 7 44 1			
oduct (GDP) 6,117.8 3,558.5 2,073.7 1,655.4 2,480.4 3,778.4 4,176.8 6,086.8 3,382.0 4,252.0 11,384.2 11,899.5 5  2,228 1,657 1,104 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1  (S) 2,745.9 2,147.6 1,878.4 2,539.0 2,977.7 3,534.5 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 0.99  (a) 2,68 0.99 0.87 1.37 0.99  1.112 0.88 0.99 0.87 1.37 0.99  1.114.6 2.0 2.2 2.6 2.2 2.6 2.2 2.6 2.2 2.6 2.2 3.0 2.9 2.5	Statistical discrepancy	133			1	1 -	1,	1 2	1	1 -	1	1	1:	-749	·
45) 2,228 1,657 1,104 652 833 1,069 1,350 2,505 1,237 1,766 3,008 694 1 1,350 2,745.9 2,745.9 2,147.6 1,878.4 2,539.0 2,977.7 3,534.5 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 1,37 0.99 0.58 0.59 0.687 1.37 0.99 1.112 0.88 0.99 0.87 1.37 0.99 1.114e, 2.6 2.6 2.2 3.6 2.2 3.0 2.9 2.5	Gross domestic product (GDP)	6,117.8	3,558.5	2,073.7	1,655.4	2,480.4	3,778.4	4,176.8	6,086.8	3,382.0	4,252.0	11,384.2	1,899.5	50,0973	
45) 2,745.9 2,147.6 1,878.4 2,539.0 2,977.7 3,534.5 3,093.9 2,429.9 2,734.0 2,407.7 3,784.6 2,737.0 m average 0.99 0.78 0.68 0.92 1.08 1.28 1.12 0.88 0.99 0.87 1.37 0.99 1.11 0.99 1.11 0.99 0.87 1.37 0.99 1.11 0.99 0.87 1.37 0.99 1.11 0.99 0.87 1.37 0.99 0.89 0.89 0.89 0.89 0.89 0.89 0.89	Domination (OO)	0,0		Š	5		0,0	0.00			, , ,	600 €			
2.745.9     2,147.6     1,878.4     2,539.0     2,977.7     3,534.5     3,093.9     2,429.9     2,734.0     2,407.7     3,784.6     2,737.0       0.39     0.78     0.68     0.92     1.08     1.28     1.12     0.88     0.99     0.87     1.37     0.99       2.6     2.0     2.2     2.6     2.6     2.2     3.0     2.9     2.5	ropulation (000)	977,7	1,657	1,10	700	650	1,009	0,550	CDC,2	1,52,1	7, / 06	2,00,0	44	501,81	
0.99         0.78         0.68         0.92         1.08         1.12         0.88         0.99         0.87         1.37         0.99           2.6         2.0         2.2         3.6         2.6         2.2         3.0         2.9         2.5		2,745.9	2,147.6	1,878.4	2,539.0	2,977.7	3,534.5	3,093.9	2,429.9	2,734.0	2,407.7	3,784.6	2,737.0	2,767.3	
2.6 2.0 2.2 3.6 2.6 2.5 3.6 2.5	Ratio to Malaysian average	66.0	0.78	99.0	0.92	1.08	1.28	1.12	0.88	66.0	0.87	L.37	6.0	1.00	
	Population growth rate,	, y	0.0		2.3	7.0	ν,	7,6	2.3	, u	ď	0,0		<i>3 C</i>	
		<b>2.</b>	70.7	7	7.7	2.7	0.0	7.0	7.7	7.7	0.0	2.7		0.7	_

1 Kedan and Perlis are two distinct States but are shown together here because much of the available data for the two States are combined.

2 Includes the Federal Territory of Kuala Lumpur.

<sup>3</sup> The GDP for individual States do not add up to the total for Malaysia because of the statistical discrepancy of M\$749 million. Source: The Third Malaysia Plan (1976  $\sim 1980$ )

Table 1-6 Malaysia: Public Development Expenditure for Transport and Communications, 1976–80

tion for the contest of the problem of the artificial for the contest of the cont

(M\$ million)

		The second second	1		
	Original TMP allocation, 1976–80	Estimated expenditure, 1976–78	Achievement, (%)	Revised TMP allocation, 1976–80	Balance to complete, 1979–80
Roads <sup>1</sup>	1,532.34	1,429.77	93.3	3,089.74	1,659.97
Peninsular Malaysia	1,172.34	1,039.65	88.7	2,344.36	1,304.71
Sabah	180.00	256.82	142.7	456.01	199.19
Sarawak	180.00	133.30	74.1	289.37	156.07
Railways <sup>2</sup>	200.00	101.09	<b>50.5</b> ≒ ∮	350.00	248.91
Ports and Marine	630.31	412.63	65.5	982.26	569.63
Peninsular Malaysia	475.25	364.55	76.7	618.86	254.31
Sabah	55,05	29.10	52.9	86.58	57.48
High Sarawak, Hop Learn High	100.01	18.98	19.0	276.82	257.84
Civil Aviation	211.00	129.07	61.2	446.69	317.62
Peninsular Malaysia	118.40	78.40	66.2	264.93	186.53
Sabah	46.70	27.16	58.2	109.28	82.12
Sarawak	45.90	23.51	51.2	72.48	48.97
Telecommunications	1,080.00	865.00	80.1	2,000.00	1,135.00
Peninsular Malaysia	960.63	758.10	78.9	1,773.60	1,015.50
Sabah	61.64	47.50	5 1. <b>7.7.1</b> ; 48% -	101.08	53.58
esser Sarawako Hilyen oyarejin 👍	57.73	59.40	102.9	125.32	65.92
Postal Services	36.00	13.05	36.3	41.35	28.30
Peninsular Malaysia	30.79	9.68	31.4	35.09	25.41
Sabah	0.92	0.36	39.1	1.77	1.41
Sarawak	4.29	3.01	70.2	4.49	1.48
Meteorological Services	8.53	4.34	50.9	10.42	6.08
Peninsular Malaysia	6.66	3.76	. <sup>53,4</sup> <sup>136</sup> 56.4 <sup>136</sup>	7.47	#3.71 E
Sabah	0.80	0.44	55.5	2.01	2 : 2 : 1.57
Sarawak, 1960 Sandasie,	2,22 5,1 <b>1,07</b> , 41	0.14	13.1	0.94	0.80
Broadcasting	67.50	32.82	48.6	86.50	53.68
Total	3,765.68	2,987.77	79.3	7,006.96	4,019.19

<sup>1</sup> Federal roads including PWD plant and equipment.

Source: Mid-Term Review of the Third Malaysia Plan

pod in amount? I make the property which is not early a site, or a

West immersion and result appears to a discharge of with the expectation of precompletion

The limit and the light to be a first the sec

<sup>2</sup> Malayan Railway

Table 1-7 Transportation Investment (1976  $\sim$  80)

Park the story	professions	colle base over	Gardt dhadi.	Langeren S	CONTROL
	P. Penang	Selangor	Malacca	Johor	Pahang
Roads and Bridges	91.12	180.31	25.93	264.57	357.76
Plant and Equipment	2.28	7.83	1.70	7.48	19.70
Railways	0.85	0.85	11. Hally (1.1.)	30.00	16.00
Ports and Marine	149.28	164.46	8.00	41.60	205,34
Civil Aviation	65.64	83.21	1.22	11.31	3.10
Total 148, 70%	309.17	436.66	36.85	354.96	601.90

Source: Ibid

P. Penang - Penang Port

Selangor - Port Klang

Málacca - Malacca Port

Johor - Johore Port

Pahang – Kuantan Port

existing jobs so as to enable them to bring more incomes.

- (4) To generally assign Kota Bharu as the site of export-oriented industries not using local materials and raw materials.
- (5) To assign areas distant from cities as sites of industries serving the interests of the state and other local interests if this is economically and technically possible. However, these industries should be located in settlements where labor is readily available.
- 6 In the southern part of the State of Kelantan, stress will be laid on the improvement of infrastructures required by primary and secondary industries.
- (7) In the coastal plain, stress will be laid on water management, demarcation and the rationalization of rural population, and industries based on agriculture.
- 8 In education, stress will be placed on vocational training.
- To accomplish these targets of development following initiatives are being taken about industries, local development and infrastructures;
- 1 To increase the productivity of agriculture through the satisfactory management and supply of water
- ② To construct large fishing boats for the purpose of exploiting abundant pelagic fishery resources, improve littoral and pelagic fishing techniques and cause inland-water fishermen to swith to other jobs because inland water fishery resources are being exhausted.
- 3 To suppress population increase to prevent them from reducing per-capita production incomes from agriculture and manufacturing industry.
- (4) In southern Kelantan where rubber, oil palms and forestry are basic to economy, ecological and evrironmental destruction must be avoided in settling and developing estates. The target population in southern Kelantan is 200,000.
- (5) Large, labor-intensive industries must be rapidly developed by inducing foreign capital. Products from manufacturing industries based on agriculture and forestry will be sold to the ASEAN countries.
- 6 Tourism will be developed, taking advantage of seashores, jungles and handicraft products.
- (7) Manufacturing industries must be actively developed at Kota Bharu (Pengkalan Chepa). Also, industry-oriented medium-scale settlements (Machang, Tanah Merah, Gua Musang and Jeli)

and service-oriented medium-scale settlements (Eastern Ulu Kelantan, Pasir Putch, Kuala Krai and Jeli) must be developed.

- ® To improve epidemics prevention, medical care, vocational training and technical education.
- (9) To improve and expand infrastructures.
  - o In improving infrastructures, stress must be laid on the construction, improvement and maintenance of branch roads providing access to highly productive agricultural areas.
  - O Completely equip all dwelling areas with waterworks by 1990.
  - Proceed with the electrification of rural villages.
  - O Cause the east-coast railway to continue in operation.
  - Step up overall development of the state of Kelantan by constructing the East-West Highway and the Kuala Krai-Kuala Lips Highway.

# (2) Main Projects Under the Third Malaysia Plan

It was first expected that M\$1,020 million would be invested in the development of the state of Kelantan under the Third Malaysia Plan but the amount was later increased to M\$1,740 million when the Plan was reviewed in 1979. This increase rate of 72% was higher than in any other state of the country.

Table 1-8 shows the projects in Kelantan under the Third Malaysia Plan.

Table 1-8 Projects in Kelantan under The Third Malaysia Plan  $(1976 \sim 1980)$ 

Allocation (M\$ Million)

No.	Item	Kelantan	Malaysia
I	Economic Sector	1,316.83	21,501.37
Α	Agricultural and Rural Development	550.88	7,585.23
В	Mineral Resources Development	4.80	20.00
C	Commerce and Industry	218.28	3,205.48
<b>D</b>	Feasibility Study	15.14	91.58
E	Transportation	358.00	5,017.30
F	Communications	44.63	2,138.27
G	Utilities	125.10	3,443.50
II	Social Sector	219.53	5,561.00
Α	Education and Training	85.93	2,116.23
В	Health and Population Health	57.43	529.72
С	Social and Community Service	76.17	2,915.15
III	General Administration	84.69	1,229.32
ſ٧	Security	123.02	3,784.00
	Total	1,744.07	32,075.68

Source: Mid Term Review of the Third Malaysia Plan

CHAPTER 2 NATURAL CONDITIONS

OF THE PROPOSED

PORT DEVELOPMENT SITES

# CHAPTER 2 NATURAL CONDITIONS OF THE PROPOSED PORT DEVELOPMENT SITES

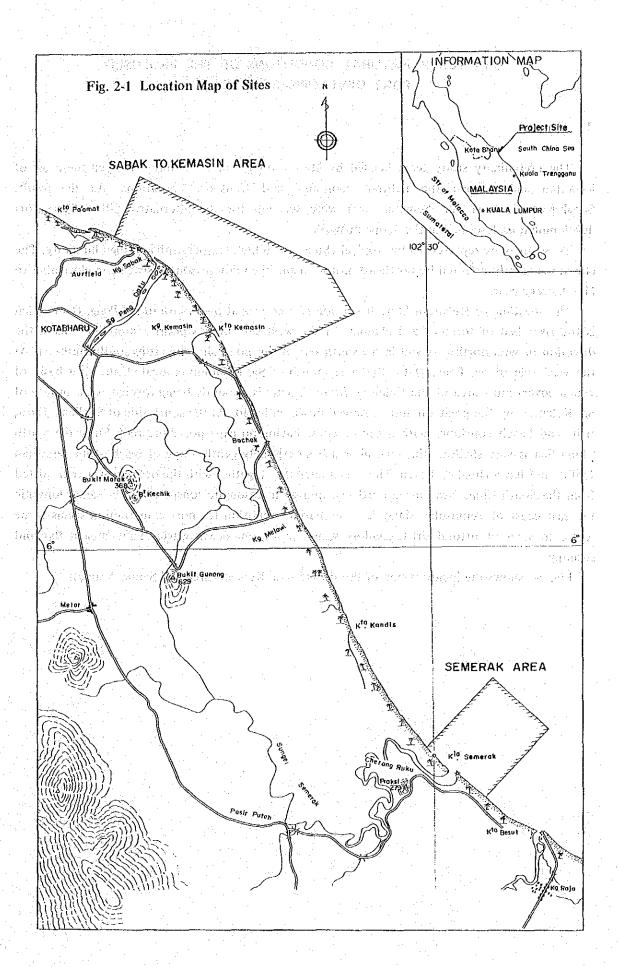
#### 2-1 General

The preliminary study team headed by Mr. Akio Ogo, in 1979 May, surveyed the coast of Kelantan and grasped the natural, economic and transport conditions. As the result, Sabak-Kemasin area and Semerak area were selected for the alternative sites of the port development as described in the Scope of Work.

These areas are represented by tropical climate with high temperature and high humidity. The climate is greatly affected by northeast monsoon and the rainy season persists from November to March every year.

The coastline of Kelantan State has a point of convex at the mouth of Sg. Peng. Datu which is the river bed of former Sg. Kelantan. In the west side of this point a shoreline runs in the direction of west-northwest and in the south side of this point shoreline runs south-southeast. At the west side of Sg. Peng. Datu, the river mouth of Sg. Kelantan is located, the river basin of which covers most area of the Kelantan State. A delta is presently being formed at the mouth of Sg. Kelantan by the great amount of flowed down sediment. At the south side of Sg. Peng. Datu, rich sand beach continues with a simple coast having no cape nor shore reef. Since the South China Sea is very shallow, this coastal area has extremely gentle slope of sea bottom, less than 1/500, and has a shoaling beach. These characteristics together with the ocean waves transmitted from the South China Sea during northeast monsoon season are considered to be same alongside the east coast of Peninsular Malaysia. The marine condition for port construction seems to be severe in view of littoral drift, shallow water depth and ocean waves. Land area is flat and swampy.

Fig. 2-1 shows the location map of the sites (Sabak-Kemasin area and Semerak area).



### 2-2 Meteorological Conditions

### 2-2-1 Temperature and Humidity

In Sabak-Kemasin area and Semerak area, meteorological observation date have not been collected. Therefore, the meteorological condition in these areas can be comprehended from the observation data obtained at Kota Bharu Aerodrome. It is located about 6 km away from the center of Kota Bharu to the direction of northeast, about 10 km away from the river mouth of Sg. Kemasin to west northwest, and also about 3 km away from coastline toward land.

The annual mean temperature is 26.7°C and almost uniform temperature continues throughout the year. The annual mean humidity is 81.3%.

### 2-2-2 Rainfall

The records of rainfall and rainy days are shown in Table 2-1. The annual mean rainfall for 27 years (1951 ~ 1977) is 2,760 mm. The rainfall exceeds 300 mm per month in October, November and December, and particularly in November and December, a monthly mean rainfall of about 600 mm was sometimes recorded. More than 20 rainy days per month are recorded in NE monsoon season.

From May to September in SW monsoon season, the monthly mean rainfall is within the range between 100 mm and 200 mm. The minimum rainfall and the smallest number of rainy days per month occur in February or March.

The maximum rainfall per hour is 111.8 mm and the maximum rainfall per day is 467.9 mm, both of which were recorded on November 30, 1969.

#### 2-2-3 Wind

The mean wind velocity per hour taken 24 times per day throughout the year is shown in Fig. 2-2. The wind direction between east and northeast due to NE monsoon is the most prevailing (about one-third of all frequency distribution), followed by the wind direction between south and southwest (about one-fifth of all frequency distribution). The percentage of appearance of calmness is 30.4%.

The frequency distribution of strong wind indicates that wind direction between east and northeast due to NE monsoon is the most prevailing, and the strong wind is not appearing during SW monsoon.

The characteristics of the wind based upon other statistic data are as follows:

- (1) It is calm during the night throughout the year, especially in the SW monsoon season.
- (2) The wind direction in the morning is different from that in the afternoon.
- (3) Particularly in the afternoon, the wind blowing from the direction between east and northeast becomes prevailing and the wind velocity increases.
- (4) Because Kota Bharu faces to the South China Sea, the influence of NE monsoon is much greater than that of SW monsoon.
- (5) From November to March as the influence of NE monsoon dominates the climate, the wind mainly from E direction is prevailing throughout the day.
- (6) During SW monsoon season, the wind blowing from the direction between south and southwest is prevailing from midnight to morning. And this direction is reversed in the afternoon.

Table 2-1 Records of Mean, Highest and Lowest of Monthly and Annual Rainfall

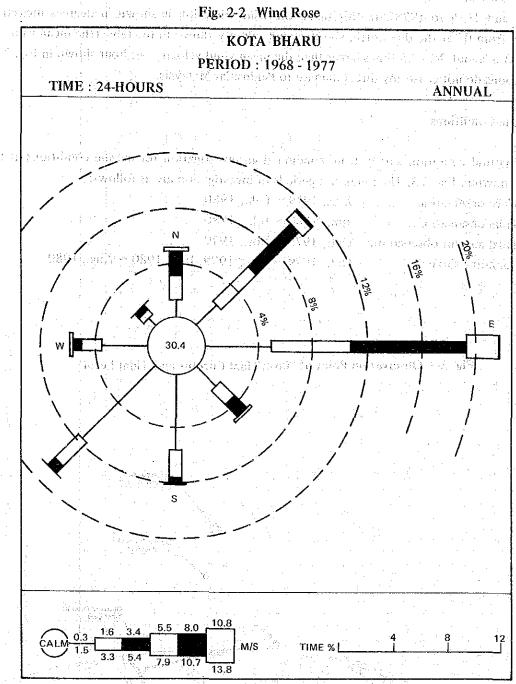
o taka <b>n</b> ahiliberahan bakana. Sebesah	<b>93</b> '	to out 2 in the military access apply a confine
	Aug.	338.8 338.8 325.1 325.1 328.8 338.8
od. Annua	Jul.	1954 1954 46.2 1955 1955 1955 1971 18
outhly and	Jun.	137.3 137.3
owest of Monthly	May	117.3 247.6 1951 4.6 1963 1966 5 5
	Apr.	1970, 1977, 1937, 1937, 1937, 1937, 1937, 1937, 1937, 1937, 1963, 1964,
n, Highest and	Mar.	296.0 296.0 5.33 8.33 8.33 8.33 8.00 1936 1936 1936 1936 1936
Records of Mean.	Feb.	1964 1188 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
Records gkalan Chepa	Jan.	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
Table 2-1		The second of the second secon
tharu'Aer	jod	- 518218888 11 1 2 18 18 18 18 18 18 18 18 18 18 18 18 18
ion: Kota B 6 10, 5: 102 1	Period	Rainfall (mm)  Mean Highest Year of Highest Year of Lowest Number of Rainy D Mean Highest Year of Highest Year of Highest
Station: F. Lat: Long: Hr. above	inion more	Mean Highest Year of H Lowest Number of Mean Highest Year of Highest Year of Highest
		-32-

2759.5 3989.6 1936

Annual

and the arriver

all real closer side



The record of strong winds are shown in Table 2-2. The observation period is 26 years (1939 to 1941, and 1956 to 1978). In this table, the wind direction is shown in degrees measured clockwise from 0° at the due north, and the wind yelocity shown in the table (the mean value of 2 seconds) is about 2 to 2.5 times larger than the mean wind yelocity per hour shown in Fig. 2-2.

Typhoons do not cause any direct damage to Peninsular Malaysia.

#### 2-3 Marine Conditions

The natural condition survey team conducted an investigation for marine conditions at the location shown in Fig. 2-3. The items and periods of investigation are as follows;

O Wave observation:

Dec., 1979 ~ Feb., 1980

O Tidal observation:

Jun., 1980 ~ Jul., 1980

O Tidal current observation:

Oct., 1979 Nov., 1979

O Sounding survey:

Oct., 1979 ~ Nov., 1979, Jun., 1980 ~ Aug., 1980

Observed Point of Wave, Tidal Current and Tidal Level

Observed Point of Wave Recorder

Observed Point of Tidal Level

- 34 -

y	-											····			:		:				<del></del>	<del></del>	<del></del>		- 1345	j., t	-
grandas, a Mārina sada	2. <b>2</b> 8)	7	គ្នា :::	بر	و	9	တ္ႏ	J 177	୍ଦ	· m	9)	<b>-</b> 40,	<b>∞</b>	∞ .	g «	نع د	e,	0,	Ф. у	י ע	e int	: :	e o Nai				- 1
i de de de la compania de la compani La compania de la co	Extreme	310/19.7	290/27.3 N A	340/25.5	270/24.6	230/25	050/22.8	280/27	290/21.0	270/18	280/21:9	080/24	200/26.8	250/26.8	300/20.8	260/21	250/27.0	220/25.0	130/23.6	790/23 6	260/24	360/23	N.A.	280/27			1061
() 2 2 1 6 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Dec		080/12.5	100/13.9	0.71/090	060/13.9	060/17.0	100/15.6	040/16.1	070/13.9	080/16.1	070/21.0	060/26.4	040/17.9	0.01/060	040/17.7	070/15.8	070/19.6	130/23.6	000/10.0	050/15.6	120/19.5	N.A.	060/26.4			1066
e en 15 ma <del>n</del> Esta en esta esta		نگرفتان ا	<u> </u>			7114	<u> </u>	10 (I)	11.		<u> </u>	\$23×	- 1	<u> </u>				<u> </u>	11.1.	12.51	<u> </u>	11	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4.2.4		<u>ane</u> Ga	
en dig epok tier and an een in derwere ger	Nov.	320/12.5	050/11.2	070/16.5	070/15.6	120/17.4	050/22.8	540/13.9 080/13.4	070/11.6	070/14.7	300/15.2	060/16.1	300/17.0	040/18.3	130/18.0	310/17	330/14.0	100/14.8	350/15.8	116/17	070/15.8	= 110/13.0	320/15.7	050/22.8	na Mil Ma i	ii Ii Mi	0.00
, kudok oplaz 190	Oct.	290/15.6	310/17.9	060/13.9	120/16.5	270/15.2	270/15:6	290/16.5	300/16.1	260/14.3	260/19.7	270/16.5	200/26.8	300/18.8	140/15.6	320/14:3	260/27.0	160/15.1	330/20.7	340/193	270/17.3	270/15.7	340/21.6	260/27.0	er (	(d): (d):	1.071
teries in norther Committee (200	Sep.		4.00			<u>:::::::::::::::::::::::::::::::::::::</u>		<u>f D</u> .	111.	7 1	<u> </u>		4 1	<u> 11.31</u>	<u>, i                                    </u>			<u>917.</u>		1117	274	1117	1111	<u> 120</u> 11.	<u>Tag</u> Selfe		
<b>ng</b> iayang Japangi	Sej	270/12:5	200/19.7	260/20:6	280/1759	300/18:3	230/165	230/18.3	270/19.2	270/18:3	270/18:8	240/19.7	250/17:0	180/17.9	270/203	260/217	260/14.3	260/21.5	320/20:4	350/19-1	260/20.8	360/23:3	310/24.3	310/24.3	i, a <u>astr</u>	ý:	1070
urface Winding (S)	Aug	1591/091	290/27:3	250/20.6	270/24.6	220/18.8	260/18:8	280/22.3	320/18.3	270/179	280/21:9	280/16.1	270/17.9	310/21.5	330/19.8	300/17.7	220/16.7	220/16.5	300/20.3	330/18.5	300/193	060/18.3	300/19.8	280/27.7	) () [44] <u>() ()</u>	42 10 40	1.041
aximum S es/Speed i	Jul.	320/18.3	320/18:3	340/25.5	270/22:3	230/25.5	230/20:6	300/19/2 270/16/1	290/21:0	190/17.9	260/18.8	260/19.2	270/18.3	250/19.2	310/16.3	310/215	250/27.0	220/25.0	320/21.6	270/173	260/24:1	020/23:0	330/15.6	250/27:0		elig Dje	1001
Records of Maximum Surface Wind ction in Degrees/Speed in m/s)	Jun.	300/15.6	320/20.1	350/17.9	360/13.9	230/25.5	330/17.9	240/18.8	270/19.2	270/18.3	240/16.1	300/21.0	290/21.5	250/26.8	200/17.5	240/21.3	280/17.4	240/17.3	320/19.1	290/23 6	230/16.3	320/18.5	280/17.6	250/26.8	7.4		1067
2-2 Director of particular	Мау	310/19.7	080/13.4	320/16.5	240/11.2	280/14.7	230/16.1	300/12.5	250/17.0	280/13.0	220/17.4	290/15.2	080/18.3	230/15.6	2/0/19.4	290/15.1	320/17.5	270/17.0	330/11.1	300/21.6	230/17.9	260/18.6	260/19.1	030/22.5			10.77
AN CHEP	Apr.	110/17.0	090/10.3	270/17.9	140/11.6	080/13.0	200/13.0	150/18.8	230/12.1	090/17.0	150/14.3	110/15.6	260/14.3	090/12.5	130/157	080/13.0	110/10.8	080/16.3	0.020/11.0	260/13.6	060/14.1	100/12.3	250/11.0	130/18.8	An Lu Que		1060
THE CHECK	Mar.	090/12.1	100/ 8.9	090/13.0.	180/13.9	080/16.5	100/13.0	070/12:1	060/12.5	080/12.1	0.71/070	090/13.9		: -	080/15.0		1	080/11.5	060/13.7	010/103	090/12.2	090/15.6	180/13.6	070/17.0	ilings It inc	os Visa Car	1964
KOTA BHARU AERODROME (PENGKAI 102° 17'E MSL: 5m.	Feb.	120/11.2	060/11:2	080/13.4	100/14.3	070/14.7	090/13.9	0/0/14.3	080/12.1	090/12.1	090/17.9	080/24.1	060/12.5	060/15.6	110/15.4	110/12.7	070/12.5	330/16.0	120/15.5	090/15.8	080/11.5	.090/17.6	110/12.0	080/24.1			1066
KOTA BHARU 6°10'N 102°17'E MSL: 5m.	Jan.	070/16:5	090/11.6	090/13.9	090/15.6	070/18.8	070/15.6	060/15.6	080/14.3	070/11.1	090/16.1	110/14.3	040/24.6	040/20.6	100/16.8	070/16.9	070/20.7	090/12.6	130/12	100/12:1	100/13.2	100/12.8	090/16.2	040/24.6	s .	W	1066
Station: KOTA BH Lat: 6°10'N Long: 102°17'E Ht. above MSL: 5m.	Year	1939	1940	1956	1957	1958 -	1959	1961	1962	1963	1964	1965	1966	1967	1969	1970	1971	1972	1972	1975	1976	1977	1978	Extreme	(1939–1941)	(1956–1978)	Year of

#### 2-3-1 Waves

The ocean waves were observed by using the pressure type wave recorder at the point where water depth is about -6 m offshore of Tawang. The wave observation period were as follows;

Dec. 10, 
$$1979 \sim Dec. 18, 1979$$

Dec. 25, 
$$1979 \sim Jan$$
, 2,  $1980$ 

The wave height frequency distribution by period is shown in Table 2-3. The percentage of appearance for the period of 8 sec is the highest and most waves have periods between 7.1 sec and 9.0 sec (percentage of appearance is about 70%).

The maximum wave height (Hmax) during the observation period was 2.84 m observed at 18:00 on December 13, and the maximum significant wave height (H1/3) was 1.61 m observed at 20:00 on December 13. According to the visual observation, waves in the direction between northeast and east-northeast were prevailing during the period.

For estimating the design wave height by using all data recorded in the observation period, the values of maximum waves are abstracted from a series of significant waves of 20 minutes as shown in Table 2-4.

Calculations for the probable wave height shall be performed by the Petruaskas Aagaard's method. The subject period of calculations is assumed to be K months and N-numbers of maximum waves larger than a certain limit value which were generated during this subject period. Then after sorting these wave heights, the order "m" shall be given from the largest wave height. Basing upon these data, the probability of nonexceedence shall be calculated from the following formula:

$$P(H \le X_{m,n}) = 1 - \frac{m - \alpha}{N + \beta}$$
 (1)

where,  $X_{m,n}$  is m-th maximum wave height (m = 1,2,3,......N) of N-numbers of maximum wave heights, and the values of  $\alpha$  and  $\beta$  shown in Table 2-5 should be determined by the assumed distribution function.

For the selection of the distribution functions, the double exponential distribution (Gumbel distribution) and seven kinds of exponents ranging from 0.75 to 2.00 of Weibull distribution shall be applied, and the optimum value shall be selected after reviewing appropriateness. The distribution function is given by the following formula:

Double exponential distribution:

$$P(H \le X) = \exp\left[-\exp\left\{-\left(\frac{X-B}{A}\right)\right\}\right]$$
 (2)

Weibull distribution:

$$P(H \le X) = 1 - \exp\left[-\left(\frac{X - B}{A}\right)^{k}\right]$$
 (3)

For applying the distribution function,  $P(H \le X)$  is converted to variable  $\gamma_v = (X - B)/A$  by using the following equations, and the relation between X and  $\gamma_v$  shall be changed linearly as shown below to estimate coefficients A and B.

$$X = \hat{A}\gamma_{v} + \hat{B} + \varepsilon \tag{4}$$

where, mark "" means that the value is an assumed value. Also, "e" indicates the portion that is unable to explain by using  $\hat{A}\gamma_v + \hat{B}$ , and this is called error term. Both X and e are probability variables.

The return period  $R_p$  of maximum wave height shall be calculated by using probability of nonexceedence  $P(H \le X)$  in the following formula:

$$R_{p} = \frac{K}{N} \frac{1}{1 - P(H \le X)} \tag{5}$$

Distribution parameters  $(\alpha,\beta)$  for distribution type is shown in Table 2-5. Weibull's distribution type (K=2.00) which gives the heighest correlation coefficient of 0.98266 between measured value and assumed value, was adopted and the probability of nonexceedence and the return period for the measured values were calculated as indicated in Table 2-6.

The values of probable wave heights for the required return period should be derived by the following procedure:

- ① Probability of nonexceedence  $P(H \le X)$  for required return period  $R_p$  should be calculated by using Eq. (5)
- ② The conversion probability  $\gamma_v$  should be calculated by using the following formula. Weibull's distribution

$$\gamma_{v} = [-1_{n} \{1 - P(H \le X)\}]^{1/k}$$
 (6)

③  $\gamma_v$  calculated in step ② should be substituted in Eq. (4) to estimate X, then X shall become probable wave height corresponding to  $R_p$ .

This probable wave height for each return period was calculated and the results are shown in Table 2-7.

The sea has relative high waves only in the NE monsoon season of 5 months from November to March, but the sea is rather calm in the season excent for this. If 5 months of return period of waves is considered to be equivalent to one year, the probable wave height for 50 years will become  $H_{1/3} = 2.15$  m. Taking the proper allowance into account,  $H_{1/3} = 2.50$  m and T = 8.0 sec should be adopted for the design wave height and period. As the observation data used for the calculations are insufficient, it should be required to review the values of probable wave height when further data would become available in future.

44		
ori,	Height and I	
374 374	Table 2-3	* = 1;
40 s.		€ 1 No.

va Alis m divel	Total		(0.2)	65 (15.7)	183 (44.3)	110 (26.6)	47 5 (4.14)	(H2)	(0.5)	413 E (100.0)	्र १८६६ अनेत्र (१८५० - ) प्राचीत्र (१८५०
	1.71										Feb., 29, 1980
e Passaga M	1.61 5.70 1.70		(6)	14 - A	(0.2)	in and the second of the secon	e de la composición dela composición de la composición de la composición dela composición dela composición dela composición de la composición dela comp	in the page of	Kara	(0.2)	ı
	1.51 ? 1.60	Artinia de la composición del composición de la			2 (0.5)				in Nie G in in der	2 (0.5)	224.1980 1992 1993 1993 1993 1993 1993 1993 1993
	1.41				2 (0.5)	r Arrigot				2 (0.5)	12 <b>6</b> 7 1177
	1.31	: :							11 11. 13.		– Feb., 2, 1980
Period	1.21	77.5	anting j		10 (2.4)	(0.2)	vii (C)	ng grapak		11 (2.7)	1980] 1980] - Ee
ght and	1.20		रहरीय छ। सर्वेद्धिके स्थापन क	3 (0.7)	15 (3.6)	6 (1.5)		evenções evilintes diament	in Militaria Majoritaria Maria Anton	24 (5.8)	6 <b>%</b> 69,833 • <b>••</b>
Distribution of Wave Height and Period	70.1 01.10		n tun int	3 (0.7)	13 (3.1)	(1.7)	2 (0.5)	(0.2)	: 4:45 : 2:1	26 (6.3)	1980; Jan
ou other	0.91		elegis de	1 (0.2)	20 (4.8)	10 (2.4)	3.5 (0.7)	nd n	ti, te setji	34 (8.2)	Jan., 2,
istributi	0.90	[2] <b>6</b> [1]			(2.7)	11 (2.7)	(1.7)	y, iizk	ji diri. 199≹‡	29 (7.0)	2 <b>- 61 (6.)</b> 2 - 61 (1997) 2 - 7 (1997)
	0.71			(0.5)	20 (4.8)	23 (5.6)	8 (9.19)	254 2014		53 (12.8)	1979 Dec., 25
Table 2-3	0.61		angia a ta	8 (1.9)	25.	26 (6.3)	10	al (S) Pois a	qua si kecipis	. 69 (16.7)	(8) 1979
\$1841 gas4	0.51		人表现	(0.2)	17 (4.1)	19 (4.6)	11 (2.7)	(0.5)	(0.2)	51 (12.4)	1 Dec 1
- Vijene sve Glij svensk - Heve bakt	0.50 0.50	regres Nations Iversity		(0.5)	10 (2.4)	(0.2	3 (0.7)	(0.5)	<del>Tario</del> H <sub>e</sub> iz s	18 (4.4)	10, 1979 times/day
168 (188) 1982 (188)	0.00 0.40 (m)		(0.2)	45 (10-9)	37 (9.0)	(1.5)	3 (0.7)	igijas jagas o	1, (0.2)	93 (22.5)	ij. Dec., 2
(ilveloc)		(c)	415 ( 513 41	-14°35 (85.)	Fill des v		idandi Pistos	di patri Parasiri	odina Piowa	1995 BF	on period
	Wave Pediod (T)	0.0~5.0	5.1 ~ 6.0	6.1~7.1	7.1 ~ 8.0	8.1 ~ 9.0	9.1 ~ 10.0	$10.1 \sim 11.0$	~ r·II	Total	Note: Observation period; Dec., 10, 1979 — Dec., 18, Observation frequency, 24 times/day

:- 38---

Table 2-4 List of Maximum Waves

No.	Wave Height	Wave Period		Observation
NO.	H1/3 (m)	T1/3 (sec)	Time	de d'ana Date
	1.610	7.3	20	Dec. 13, 1979
2	1.300	8.0	. 12	Dec. 15, 1979
3 7 VIII	1.300	9.0	22	Dec. 25, 1979
4 5	1.300 1.250	7.7: 8.0	6	Jan. 19, 1980
6 1/4	1.170	7.7	4	Dec. 14, 1979 Dec. 16, 1979
7	1.170	7.2	6	Dec. 17, 1979
8	1.110	7.4	6	Dec. 18, 1979
9	1.090	9.4	10	Dec. 26, 1979
10	1.060	7.2	10	Dec. 13, 1979
11	1.010	8.1	12	Dec. 10, 1979
12	0.940	7.1	18 8	Jan. 26, 1980
13	0.900	9.4 9.0	e de la granda de la companya de la	Jan. 21, 1980
15	and the second s		14 20	Dec. 12, 1979 Jan. 22, 1980
16		8.3	22	Dec. 11, 1979
17	0.830	7.6	10	Dec. 11, 1979
18	0.770	7.3	20	Jan. 23, 1980
19	0.710	7.5	16	Jan. 24, 1980
20	0.710	9.4	2	Dec. 28, 1979
21	0.670	7.6	8	Dec. 31, 1979
22	0.640	7.9	12	Jan. 25, 1980

Table 2-5 Distribution Parameters

r.lagrasii

Type of distribution	er ere i <b>à</b>	β
Gumbel	0.44	0.12
Weibull (K=0.75)	0.54	0.64
(K=0.85)	0.51	0.59
(K=1.00)	0.48	0.53
(K=1.10)	0.46	0.50
(K=1.25)	0.44	0.47
(K=1.50)	% j <b>0:42</b>	0.42
(K=2.00)	0.39	0.373
7.A7.4 (A.A.)	1027	\$1. W.Y

Table 2-6 Probability of Nonexceedence and Return Period (Weibull's Distribution Type K = 2.00)

			The state of the content of the cont	
No.	Wave Height H1/3 (m)	Conversion Probability	Probability of Nonexceedence	Return Period
1	1.610	1.89790	0.97273	1.66692
2, ,	1.300	1.62219	0.92803	0.63156
3	1.300	1.46573	0.88333	0.38959
4, .	1,300	1.35056	0.83862	0.28167
5	1.250	1,25678	0.79392	0.22057
6,	1.170	1.17608	0.74922	0.18125
7,5,5,	1.170	1.10415	0.70451	0.15383
8	1.110	1.03839	0.65981	0.13362
9,44	1.090	0.97714	0.61511	0.11810
10	1.060	0.91919	0.57041	0.10581
11.	1.010	0.86367	0.52570	0.09584
12	,0.940	0.80985	0.48100	0.08758
13	0.900	0.75712	0.43630	0.08064
14	0.890	0.70492	0.39160	
15,	0.860	0.65270	0.34689	0.06960
16-	0.850	0.59984		0.06514
17	0.830	0.54563		0.06122
18	0.770	0.48914	0.21278	0.05774
19	0.710	0.42898	0.16808	0.05464
20	0.710	0.36288	0.12338	0.05185
21	0.670	0.28626		0.04934
22	0.640	0.18592	0.03397	0.04705

Table 2-7 Probable Wave Height for Return Period

No.	Return Period (Month)	Conversion Probability	Probable Wave Height H1/3 (m)	Remarks
1 2 3 4 5 6 7	1.0 2.0 3.0 4.0 5.0 10.0	1:75814 1.94530 2.04686 2:11597 2.16806 2:32242 2:40813	1.49298 1.59743 1.65411 1.69267 1.72174 1.80788 1.85571	l ýear
9 10 11 12	20.0 23.0 50.0 100.0 250.0	2.46714 2.51196 2.64633 2.77421 2.93471	1.91365 1.98864 2.06000 2.14957	10 years 50 years

### 2-3-2 Tidal Levels

The tidal observation was performed using a pressure type tide gauge (Type: LPT-3) at the point with about 2.5 m water depth off Kemasin as shown in Fig. 2-3. This tide gauge records continuously the height of sea water.

The record was obtained for thirty three days and nights continuously from June 26, to July 29, 1980. Fig. 2-4 shows the tide diagram.

The Reduce Level, (R.L: the level for on-land survey in Peninsular Malaysia) is 0.957 m above the Datum Level (D.L: Chart Datum).

The maximum flood level observed during a big flood occurred in 1967 was as follows; Sabak D.L + 4.45 m, Kemasin D.L + 3.51 m, Semerak D.L + 3.70 m

### 2-3-3 Tidal Current

The observation for tidal current was conducted at a point 1 m above the sea bottom by using Ono-type current meter in the area about -8 m deep offshore of Tawang as shown in Fig. 2-3. The period of observation is between October 23 and November 10, 1979 and the records of consecutive observation throughout 18 days and nights were obtained. Table 2-8 and Fig. 2-5 show the frequency of wave occurrence by direction and relocity.

Prevailing current direction is generally parallel with shoreline; SE to SSE during south current (current direction flows to SE or SSE) and NW to NNW during north current.

Table 2-9 shows the maximum current speed, current direction and observation time. According to this table, the maximum current speed was 0.60 m/sec, the current velocity had a tendency to increase during the southward current, and the speed of southward current is higher than that of northward current.

### 2-3-4 Sounding Survey

Fig. 2-6, Fig. 2-7 and Fig. 2-8 show the sounding maps of Sabak Kemasin area (survey in 1979), Semerak area (survey in 1979) and Sabak Kemasin area (survey in 1980) respectively.

All water depth are given based on the Datum Level.

titale de la litale paper espanoj com prop**rig. 2-4** m**Tide Diagram** manare, un comencial de callie equicalumno representation de la litale producer de acceptanced finales plus dissembles espanojn actual en que, c callingua en la litale de la litale producer de acceptanced finales plus dissembles en discription de la comencial de la litale de la comencial del comencial de la comencial de la comencial del comencial del comencial de la comencial de la comencial del come

with the of the formation of the properties in the large plants of the filling of the state of the st The transfer and the contraction -+2.000 m Highest High Water Level (H.H.W.L) + 1.927 m earth of Avida Calendric States of Astronomic Lands on the Avida States of Calendaria Calendaria Calendaria agantal draw'r 340 eu of gerschodr Start Bully of the A. R. P. C. of the progress actions and a getting between Communication Communication TYPE CONTROL OF A inche and by the same +1.000 m Reduce Level (R.L) +0.957 m Tory acid to twit it aim and retrieved that help a contract of the month of the properties are second to be the last and represented by the fi adag Gargi ang at manal filipina ang akang at ayan ang at tang akkina ang kangan akang ak itang To Decree with broth the thirt is improved by a fire constraint of with the following the state of Lowest Low Water Level (L.L.W.L.) +0.187 m arrife secuence particle agreementing Datum Level (Chart Datum; D.L), ±0.000 m (±0.000 m)

the graph 1982 of the pullburies and deligner valuesing in a first the leaf gifting of the value of the first party of the leaf of the first party of the first o

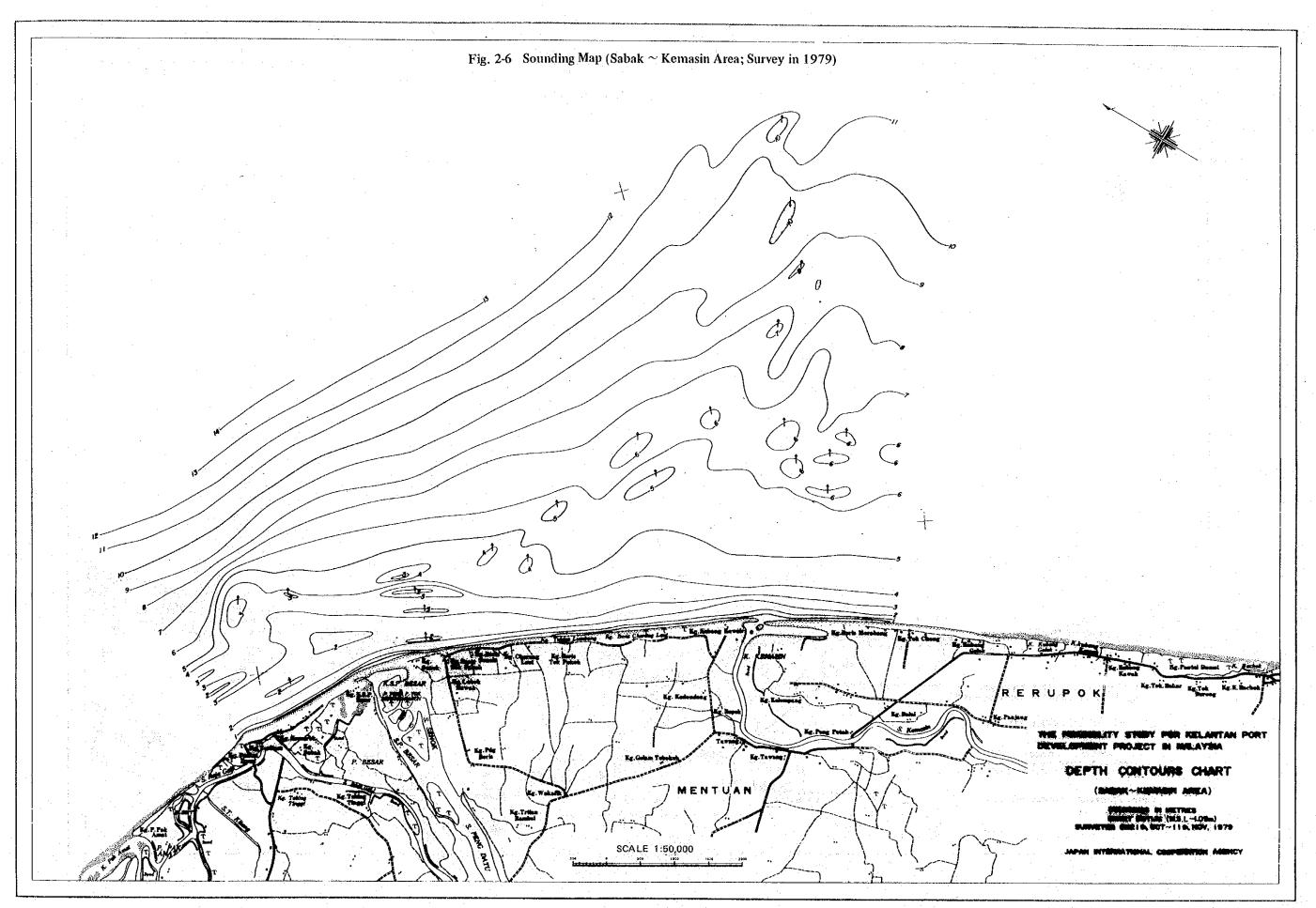
The first vertex in Fig. 2-5 is Frequency of Occurrence for Current Direction. We said the state of the state

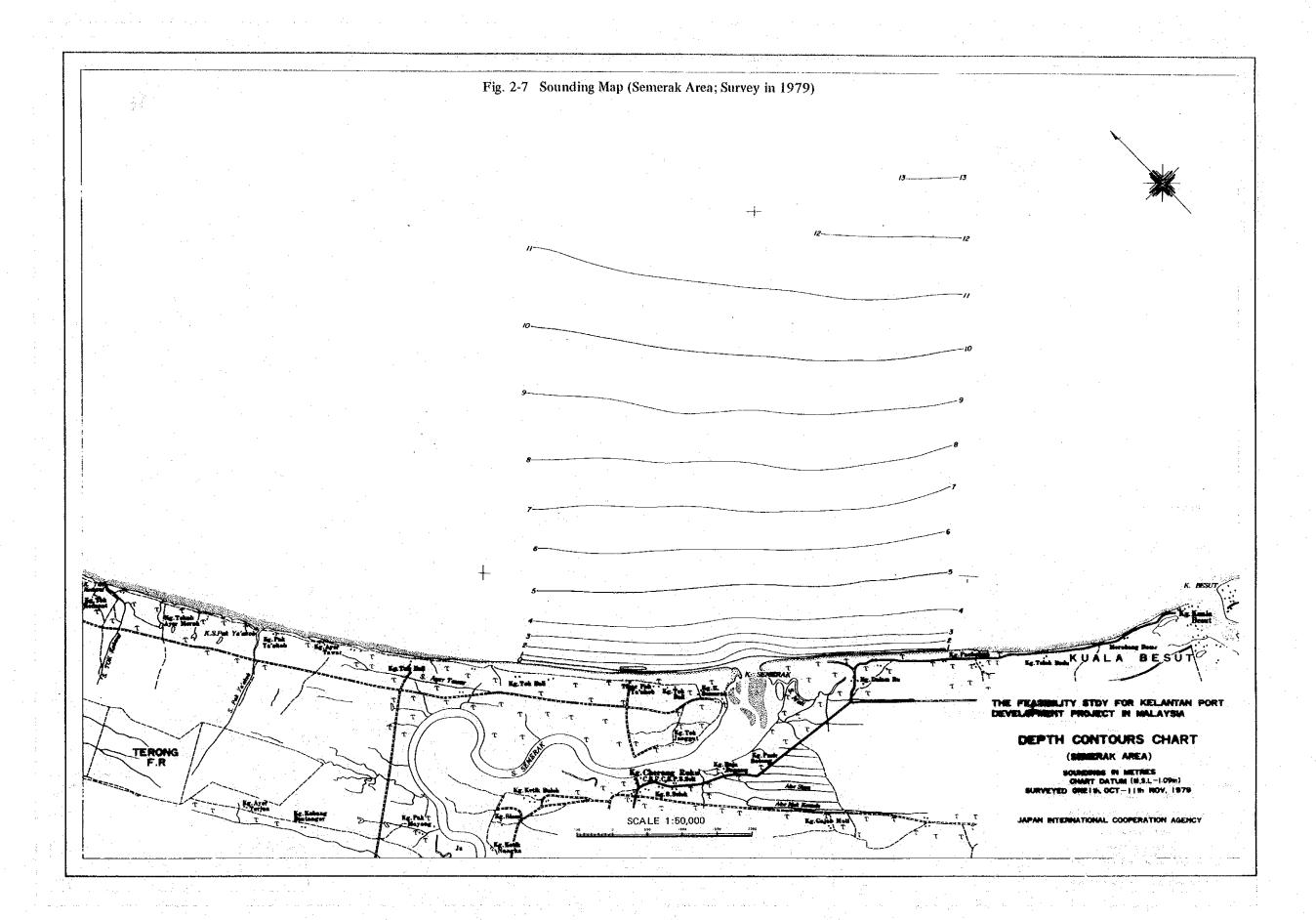
Table 2-8 Frequency of Occurrence for Current Velocity

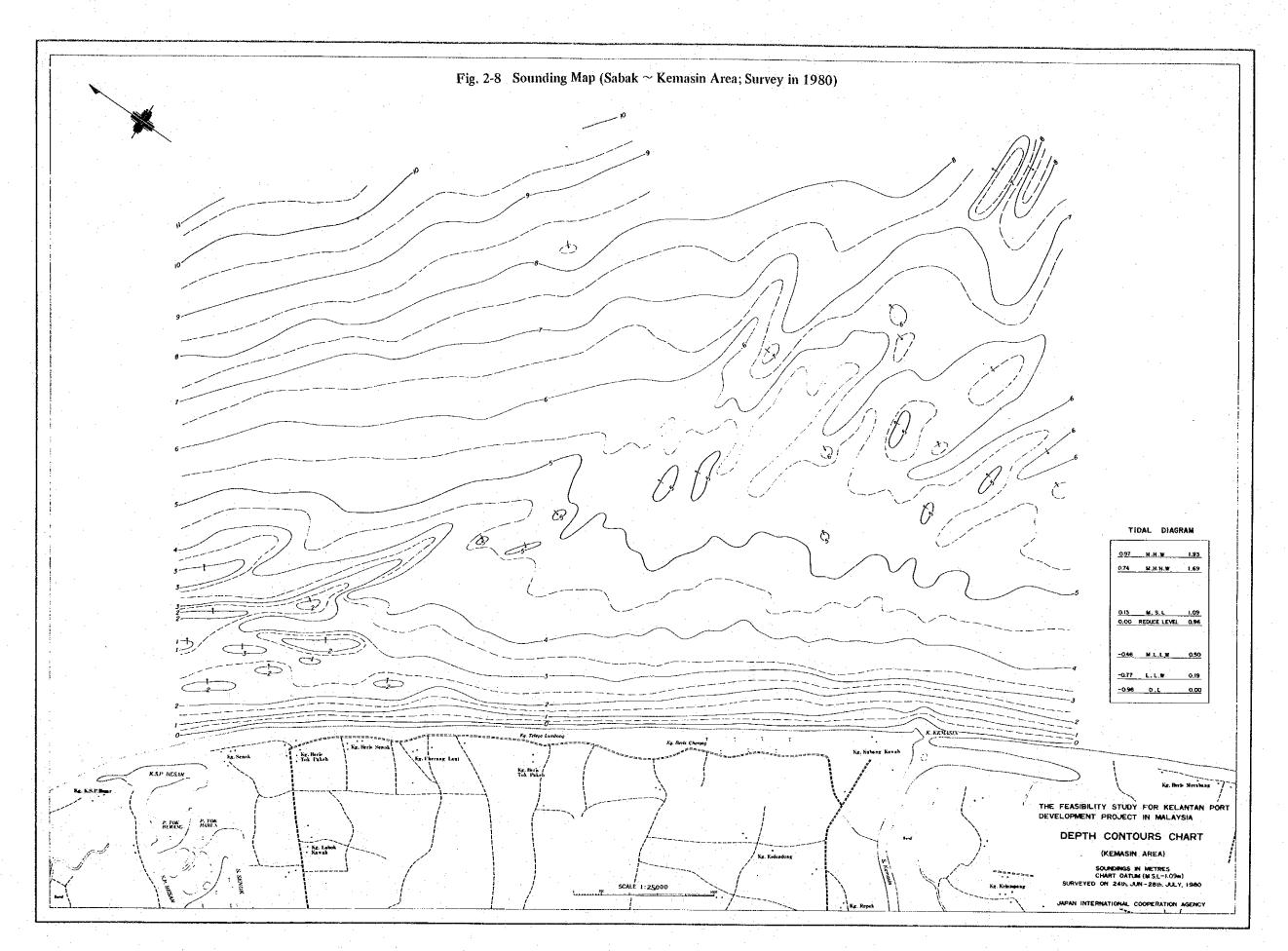
1													T
oottom)	Total	226 (9.0)	(9.5)	283 (11.2)	(10.8)	(12.1)	(14.0)	274 (10.9)	186 (7.4)	132 (5.2)	149 (5.9)	101 (4.0)	2,520 (100%)
ove sea l	NNW	34 (1.3)	54 (2.1)	(3.9)	108 (4.3)	(4.4)	115 (4.6)	(3.5)	36 (1.4)	T (6)	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	era kirili yizi	646 (25.6)
1.0m (Ab percentas	WN.	38 (1.5)	45 (1:8)	68 (2.7)	81 (3.2)	110 (4.3)	162 (6.4)	(3.5)	45 (1.8)	(0.9)		* \$4.6\$	660 (26.2)
Depth: 1.0m (Above sea bottom) Unit: - percentage	WNW	(0.4)	(0.2)	(0.2)	(0)	731 mil 1347 f. f.	· 1	0.		VIII. Militi		1.101	20 (0.8)
9750 (4) (4)	M	3. (0.1)	(0.2)	(0.4)				110 j	,			10) 25 <sup>1</sup>	16 (0.6)
179	WSW	6 (0.2)	5 (0 <u>.2</u> )	(0.5)	; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	(A.)			:	(ab	:		23 (0.9)
i ja sa Santa	ЖS	9 (0.4)	10 (0.4)	(0.1)		1117		i ažų	: : :	. t - 3-			21 (0.8)
	MSS	(0.3)	3 (0.1)	(1)	)- - - - 	e distriction		12.1	(- )	O <sub>ny</sub> ()			10 (0.4)
Ohn. Wat	S	26. (1.0)	22 (0.9)	َو (0.4)	-(6)	28.85 as (s)		755 1		1 4 34	3	)	58 (2.3)
g († 17.	SSE	(1.2)	45 (1.8)	44 (1.8)	(2.3)	58 (2.3)	46 (1.8)	(2.7)	71 (2.8)	(2.6)	(3.7)	(3.2)	658 (26.1)
	SE	18 (0.7)	23 (0.9)	(0.7)	14 (0.6)	(0.8)	26 (1.0)	27. (11)	33 (1.3)	43.	51 (2.0)	20 (0.8)	291 (11.5)
Ni.	ESE	(0.5)	14 (0.6)	(0.5)	(0.3)	(0.2)	(0.2)	(0.2)	(0)	5: x1	(0.2)		66 (2.6)
	ற	8 (0.3)	(0.1)	(0.1)		(1) (1)		28 to 100		eksi. <del></del>			12 (0.5)
11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ENE	(0.2)	(0)	0)		. :>> -				r Vilaj	-		(0.3)
64 5 60 56 - 606 - 606 - 1	NE	4 (0.2)	(0.1)	(0)				4. T		ind St			7 (0.3).
	NNE	(0.3)	(0.1)	(0)				,				<b>;</b>	11 (0:4)
	Z .	8 (0.3)	(0.1)	(0.1)	(0)				Zelviai ir	edsteentr	al aragi	Karona Ji	14. (0.6)
	Direction Velocity	0.0 ~ 0.04 (m/sec)	0.05 ~ 0.09	0.10 ~ 0.14	$0.15 \sim 0.19$	$0.20 \sim 0.24$	$0.25 \sim 0.29$	$0.30 \sim 0.34$	$0.35 \sim 0.39$	$0.40 \sim 0.44$	$0.45 \sim 0.49$	$0.50 \sim 0.74$	Total

		Te	ible 2-9 Li	st of the Daily N	dax. Current		
		Sc	outhward cur	rent	N	orthward cur	rent
	Date	Max. current speed	Current direction	Observation time	Max. current speed	Current direction	Observation time
1	10/23	m/s 0.46	° 150	h m 15:20	m/s		h m
2	24	0.57	150	18:00	0.30	332	7:20
3	25	▲0.60	154	17:40	0.19	339	8:00
4	26	0.52	155	18:00	0.39	331	8:40
.5	27	0.56	156	17:00	0.36	337	8:40
6	28	0.50	154	18:00	0.28	338	4:00
7	29	0.50	125	21:00	0.40	314	5:20
.8	30	0.47	145	20:40	0.38	316	5:40
9	31	0.25	148	21:40	0.33	314	5:40
10	11/ 1	0.31	147	21:40	▲0.41	318	6:00
11	2	0.19	162	12:40	0.22 0.16	312 316	5:20 19:20
12	3	0.32	153	12:00	0.33	312	5:00
13	4	0.41	148	13:00	0.20	315	5:40
14	5	0.42	148	15:20	0.23	333	7:20
15	6	0.45	148	16:00	0.36	329	1:00
16	7	0.53	150	17:20	0.32 0.30	322 325	2:20 9:20
17	8	0.54	141	19:40	0.27 0.26	314 309	3:40 9:20
18	9.	0.49	136	21:40	0.30 0.33	322 323	6:00 11:40
19	10	_	_	_	0.29	324	7:40

Note; A; maximum current speed







### 2-3-5 Littoral Drift

The littoral drift of Kelantan coast is qualitatively described hereinafter. The coastline of Kelantan State can be generally devided into two areas. They are the west side and the south side of Sg. Peng. Datu which was the river bed of former Sg. Kelantan. In the west side of the river mouth of Sg. Peng. Datu, the littoral drift tends to move westerly because of the relationship between waves and their angle against the coastline during NE monsoon season. Since the river mouth of Sg. Kelantan shifted to west side, Sg. Peng Datu does not discharge sand and soil as the source of the littoral drift any more. Thus, the west coast of Sg. Peng. Datu tends to be eroded in overall viewpoint. This phenomenon is outstanding at the Pantai Chinta Berahi. In addition, farther westward of Sg. Kelantan has presently a tendency that sediments flown down from Sg. Kelantan and littoral drift from the beach move toward west in a large quantity, because of the relationship between the coastline and the angle of incident waves. This movement has contributed to the development of sand spits in front of Tumpat and the river mouth of Sg. Golok. At present, since the sand spit in front of Tumpat has completely closed except a few portions, it is considered that the inner water basin has been silted by sediment from Sg. Kelantan and a delta is developing there.

On the other hand, in the south side of Sg. Peng. Datu, littoral drift seems to be not so large, since the angle of incident waves to the shoreline is not so large, and there is no river as large as Sg. Kelantan.

The river mouth of Sg. Peng. Datu is completely closed by the littoral drift, and river mouths of both Sg. Kemasin and Sg. Semerak are presently very shallow. However, the north beach of the mouth of Sg. Kemasin has some local and progressing erosion.

As reported in "The Kelantan River Basin Study" by ENEX, Sabak-Kemasin area seems to be the neutral zone of littoral drift, because the amount of littoral drift from parallel direction and perpendicular direction to the coast maintains a delicate balance as a whole.

In Semerak area, the northward littoral drift becomes prevailing because of beach deformation at the river mouth of Sg. Besut adjacent to this area.

According to the aerial photograph survey by Dr. John Kuna Raj (Lecturer, Geological Department, University of Malaya), coastal change of Kelantan for last 25 years (1949 to 1974) can be outlined as follows:

The sediment flowed from the river mouth of Sg. Kelantan is deposited as a huge permanent sand spit offshore of Tumpat by the stable wave direction during NE monsoon season, and this spit is gradually moving westerly. It is gradually approaching to the beach each year and Tumpat Port is closed. The deformation of sandspit in front of Tumpat is shown in Fig. 2-9. Sabak area has been subjected to erosion and deposition repeatedly, in a range of several meters to hundred meters, this repetition occurs every several years, and its coastline is gradually moving backward. On the other hand, the coastline between Kemasin and Semerak hardly changes and has been stable throughout these years.

The above description of the littoral drift is qualitative understanding, so the more detailed periodic investigation should be carried out in order to grasp the littoral drift quantitatively.

### alvertacion på Aster

hale drawn all trace of the more than youth it is allow what to distribute attendance it and recognized as et vitred) lin solic time calculate se tradest, Est vence i an best et est esprephiere e est especte est que Films professors at at the theory add to detail a change of the form occasion to assist a High modell and to characters a Maria Con Maria and Laborati the following of their appropriate of within the and winds got much gives orbitation settlemen of on infollowing more d mangal tao albor jatahraha asi hanga meta termah dan kabupatan dahir dahir d and by the His ida ing malaka kabah ban mangaisa as Viete (i) incre route (ii)

the sufficient but the replication of the subsequence of the control of the contr

്**ട്** ഗ**മ്**രായ അന്ത്രളത്തെയുന്ന ആദ്യത്ത Control 18 (6)

advision (No. 1800) (No. 1801) (No. 1801) (No. 1801) m**Š**Cyllaner manadėli aktiva il la er<del>g</del>enest siemen toplum frager n. :

A≨ndežindil ve bytaven ≥A . 50 Professional Company of the Com an<mark>ge</mark> salitani nobas ais valandias ansa,

o**⊈ince** wit park your eff hi ne<mark>\$</mark>% get be divinge come sit in a di to<mark>≣</mark>η bereas onto or variocs,γΛ ្ស៊ីស្រែ បែក្សាក់ទៅក្រុងពេលប្រុស

tavolice of baseflets of its

ារស្ត្រី លោក ដល់សភាព សេស្តរាំងរបស់វិទី earl region of the second for they been Afternos muyem effectiva a delega ha and equation and character a most addieses all den i paliki sin pil) secreta result and from the ethics.

If this to the figure also although will a

า เองวิสาร์ส**เด็**ม อาเมลิ ave here oral ot some that E. P. Soget in sevents it is grant to have the fig to the go the wife of the State of the contract of th Bucy Addignivy ag Albinov og sinniðuskir grif fauð þeissa í hanssor þei sa græðin millitager sínli þagnann arred out ben addition rate of Auto, told had sugared for your

, Brainstatanap 1905 lamatur oli amagiga balik ay tarahis ara or alimah arampany so plasiang

### 2-4 Soil Conditions . A Meanwardley Valetaking or Alignary Sus dedictions, on the advisor of their

The natural condition survey team conducted boring tests, using a rotary type boring machine, at the locations shown in Fig. 2-10, Fig. 2-11 and Fig. 2-12. The number of bore holes and survey periods were as follows; Christal Big College

od bostorijska od klimak, manomica bak iliha kiri, su jevajajaki, kuralija sami je sami sekizisenski seliti.

Saback to Kemasin Area (No. Al ~ No. A8, Oct., 1979 ~ Nov., 1979)

Semerak Area (No. A9 ~ No. A12, Oct., 1979; Nov., 1979) takes tradered to the contract of

Saback to Kemasin Area (No. B1 ~ No. B6, Jun., 1980 ~ Aug., 1980)

Subsoil sonic prospecting by using sparker was conducted on the sea at the same time as sounding survey along the traces shown in Fig. 2-13 and Fig. 2-14, to investigate the soil layer below the sea bottom.

Sampling of sea bottom soil was conducted at the locations shown in Fig. 2-13, Fig. 2-14 and Fig. 2-15, to investigate the grain size of bottom material. And and the size of the size of bottom material.

support of the second of the second of the second second of the second o

# 2-4-1 Boring Tests posed to add that with other which the contempt of the manufacture of the contempt of the c

Drilling logs are shown in Fig. 2-16, Fig. 2-17 and Fig. 2-18.

The standard penetration test was done at every one meter or every 2 meters for each bore holes and anabased to discountify secretarial and analysis accordingly to be the secretarial

Undisturbed sampling was carried out by using the thin wall sampler for the cohesive soil. Using the undisturbed samples and samples of the standard penetration tests, the laboratory tests (physical test, unconfined compression test, consolidation test and triaxial compression test) were performed. 接触 的过去时的现在形式 机玻璃铸铁矿 电影像点

Judging from the drilling logs of No. A1. No. A12, the soil compositions of the layer are similar although the thickness varies in a weath multitudes for an one thought has started by the last started as

tude not**Existing seathed**ra Artistud at artificially cult manufations at more season and accept the contraction

186 for A. It Istolayer: cogsile and Sandy soil North Octo 20 of anythe market with the control of the control of the

ાં જેવામાં અંચીવીલી layers હૈયુક્તા હોય Cohesive soil (silt); N≔3πο 4સ્ત્રામાં જેવાનો પ્રાપ્ય પ્રાપ્ય માત્રા માત

ate (att) in 3rd layer: to put the Cohesive soil (clay); N ≠210 to 20% mas at the aterial the lager

As bore holes were close to river mouths, the influence of river erosion was seen; particularly at Sabak area and Semerak area, unconformity between the 2nd silty layer and the 3rd clay layer is outstanding.

The specific gravity of sandy soil is mainly 2.6. The grain size distribution curve are shown in Fig. 2-19. The layer of sandy soil can be divided into 2 layers, and the mean grain size D<sub>50</sub> of upper layer distributes between 0.5 mm and 1.00 mm, the D<sub>50</sub> of lower layer distributes between 0.09 mm and 0.3 mm.

Layer of cohesive soil is soft clayey layer including silt.

The relationship between natural water content for void ratio and wet density are shown in Fig. 2-20 and Fig. 2-21. They indicate that the natural water content is within the range from 35% to 55%, and the void ratio distributes from 0.85 to 1.45. Thus, the values of wet density indicate relatively large about 1.8 t/m<sup>3</sup>.

Fig. 2-22 shows the relationship between the depth and the unconfined compressive strength. It shows some dispersion but the value of qu tends to increase as the depth becomes larger, so that the soil will be regarded as the normally consolidated cohesive soil.

The increasing rate of unconfined compressive strength and cohesion should be expressed by the following equations;

Takin begi hemata na officialis. Paga takin ili garak kana atala ya tariha ya tariha da paga baraha jiya

1967年(1867年),1967年(1987年),1967年(1967年),2017年)

三次电路 西洋铁路 斯普

um on of our encoding

i de gela dava ar en

an Kalabatan b

```
qu = 0.03Z + 0.18 \text{ (kg/cm}^2\text{)}

C = 0.15Z + 0.9 \text{ (t/m}^2\text{)}
```

where qu; Unconfined compressive strength (kg/cm<sup>2</sup>)

- C; Cohesion (t/m²) where the confidence of the control of the cont
- The Hill of Z; Depth, Z=0 is equal to the ground level of the state who are a selection

Fig. 2-23, Fig. 2-24 and Fig. 2-25 show the results of consolidation test.

### 2-4-2 Subsoil Sonic Prospecting (1494-1718 all the first care observed a rate of the constrained).

According to the on-shore boring test, the soil configuration below the sea bottom in Sabak-Kemasin area is similar to that of the on-shore, and the thickness of the 1st-layer becomes thinner as the location approaches to Sg. Peng. Datu, while the 2nd-layer becomes thicker.

Soil configuration below sea bottom in Semerak is approximately the same as that of Sabak-Kemasin. However, when the water depth exceeds -5 m, the 1st-layer gradually deminishes, and the 2nd-layer appears on the sea bottom. The depth of boundary between alluvial and diluvial strata is distributed between -15 m and -25 m, in extremely complicated shapes.

### 2-4-3 Sampling of Sea Bottom Soil

Fig. 2-26 shows the grain size distribution curves by area.

Specific gravity and mean diameter of subsoil are shown in Table 2-10 and Table 2-11.

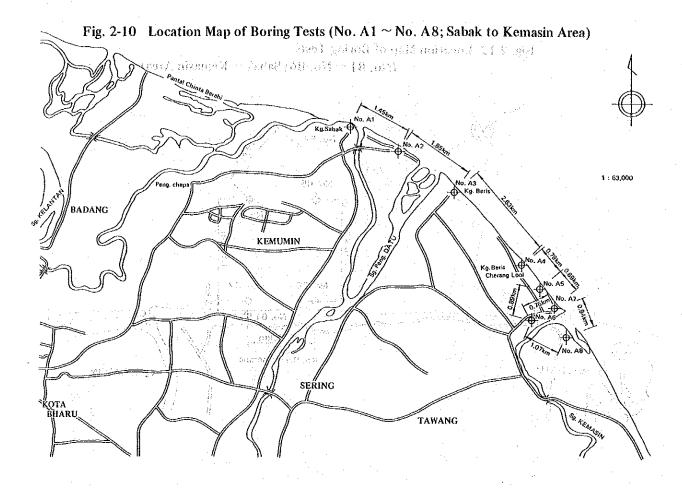
The grain size of the bottom materials near the shoreline in Sabak-Kemasin is larger than that of the offshore area. The mean diameter  $(D_{50})$  has a considerable dispersion but it is about 0.1 mm at the mouth of Sg. Kemasin and the offshore of intermediate point of Sabak-Kemasin, and about 0.4 mm to 0.7 mm at the offshore of Sabak. In Semerak, the mean diameter  $(D_{50})$  is 0.025 mm to 0.035 mm. The grain size is one-order smaller than that of Sabak-Kemasin. The specific gravity of Semerak is slightly smaller than that of Sabak-Kemasin.

ns avantana ura el mentria de el secretorio el 1000 y glabero el facegione, so estre el filosog estre el 2000 y de el 2000

ar out 2015 that will be a room Cornell and was all the captures about their discussional against an example a

for the state of t

alimpet, ovikouspros, lignitupans alo tras rapis att roomset philopedjimati svetis fil 1 og i i as legget kameliki i itiplijant och lanska i 1 kmal yn hellendig att ant melveskis anna kame. M



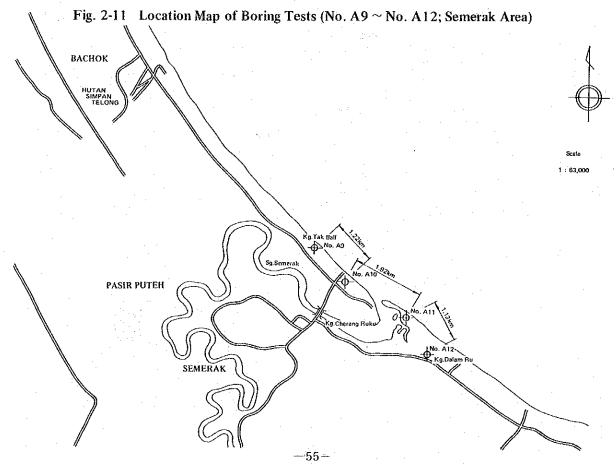
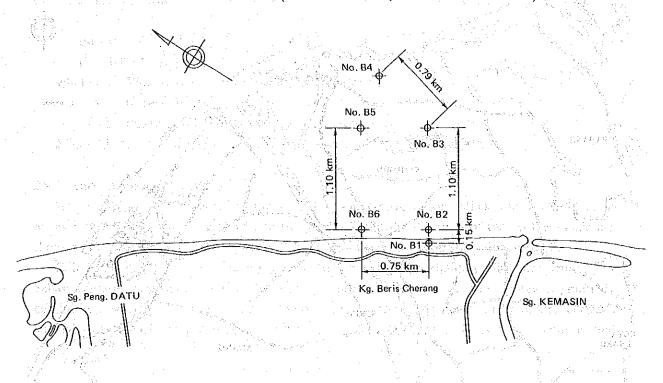
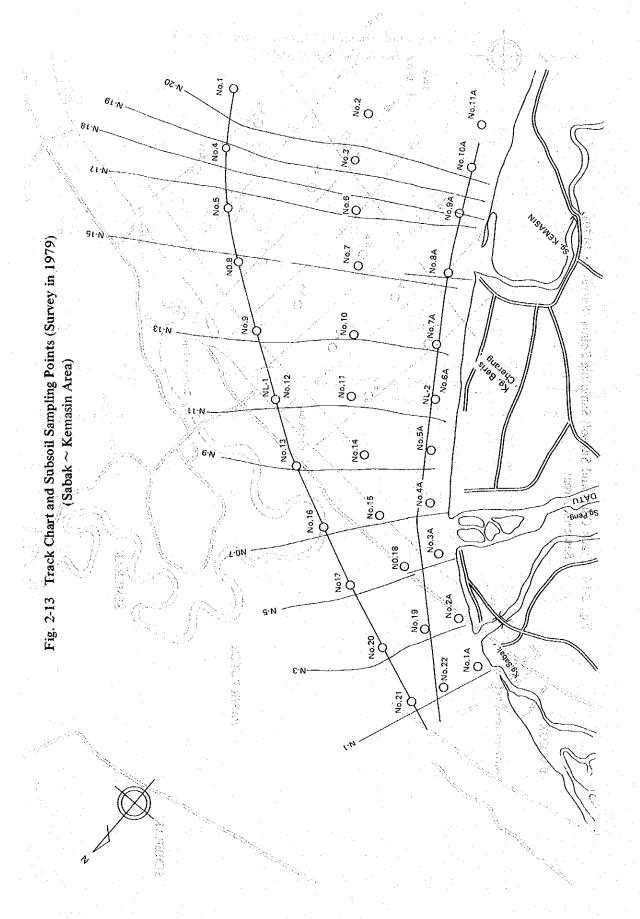


Fig. 2-12 Location Map of Boring Tests: (No. B1 ~ No. B6; Sabak ~ Kemasin Area)





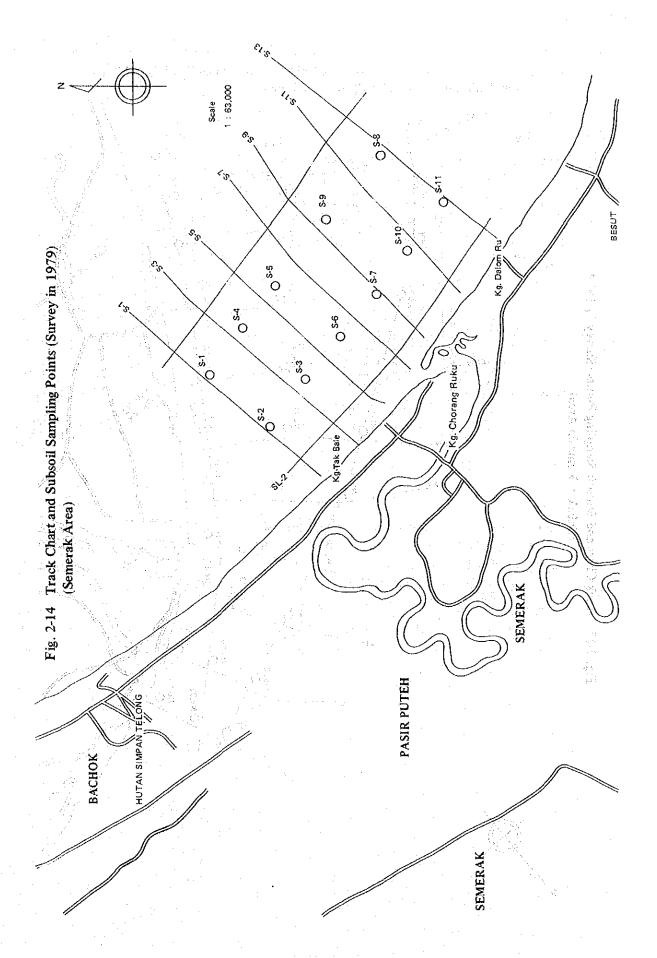


Fig. 2-15 Subsoil Sampling Points (Survey in 1980)
(Sabak ~ Kemasin Area)

			(Sab	ak ~ Kemasin Area)		
	× (	general de				
						and the state of the section of the
	O D-21	O D-20		D-18 A-22	) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 ) (16 )	O-15
			TOTAL CARRY OF CARRY		)-17	
5	era kwa kwa Najirika					
. :	O D-8	Ŏ	O D-10		O )-12 Ø D-13	O D-14
:				Francis Colorens	D-13	
1						
	0	O D-6	0	0	O O D-3 D-2	.0
-	D-7	D-6	D-5	I smaller had not	4 9	D-1
: شد						?
	$\supset$ $\mathbb{I}$			Kg. Beris Chera	ing	
	Sg. Peng. DAT	U				Sg. KEMASIN
				And the second of the second		
) : :		1		The second transfer of the second sec		
1 3						
÷						
:				glam and the color of the color. But they have been been as		
: : :						
5.0			I to the second of the second			
				1 8 1		
:			A Company of the Comp			
3						
				ing diagram and the second of		

(3831 - 3 - 20 as Fig. 2-16 ⊗Drilling Log to 2 de tablet de ⊗ (Sabak ~ Kemasin Area)

	(Oabak	Romashi Aira)	***************************************	
			Remarks	ν
The Feosibility 5	nuty for Kelantan Port roject in Mataysia	Type of Drilling Rotary		
Hole Number No. A-7	Elevation DL +13/ m	Date Oct 1979		
erd and	Water Table - 1.60 m	Driller 81 G	<u>lana</u>	

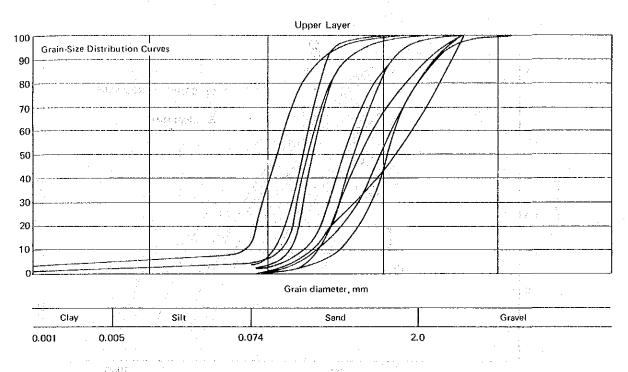
	- E	T	·											-						
ε	Beaton in m	E	12		38		કું	<b></b>	S	iondord			4.5			or C	016	Recove	ry	
ء ۔	Į.	5 6	Thickness	2	lype of Soll		Relative Dersity or Consistency	General	f.	Sempling for Lab	Motor N	Bk	M/S	Per			ZM.	Volue		
S	ă	6	Ž	bussend	9	3	# 8 8 8 8 B	<u> </u>	ge E	Εĕ	> 1	0	ייטנ ווס	lio		10				50
	1.75.2							***************************************			2 8	<u> </u>	Ġ.	-		4	ф	ф	9 <b>0</b> . R	χ̈́λ
١. ا	37 K - 1			00	coarse	dark	loose	with pebble gravel of guartz and felspar	(3)	1 1		-					Cone	Récove	<b>my</b> ≥	-
-		·		0.	sand	grey		gravel of guartz		•						·			ļ	. <b>}</b> -
2				00				φ2~4mm	2.15	ļ	ĺ									-
										ļ <u>.</u> .	8	2	3	3	٠.	;	T			
3				. 0				,	2.45	l						ļ	<del> </del>	-[	<del> </del>	.
4.		]					ľ		4,15				١.							
<b>│</b>	- 3.09	4.40	4.40			-	<u>.</u>	<del></del>	4.45	1	9	2	3	4	- 4	-			\$ 4	Γ.
2				0.1	silty	dark	mediun	with tiny	4.43							<b>/</b>				
6	- -				fine sand	grey		shell fragment	6.15			l	:-		L	Μ.	ì		ļ.	-
-				://	**				6.45		15	4	5	6		Ι.				
7	200		1.0%	$\mathcal{N}_{L}$					0.43		ŀ						ļ	ļ	ļ	ļ
. <u> </u>			11 (21)	$ \vec{j}_{\vec{k}} $		1.11	1414 341	region to the control of the control	8.15											
	1 41	3246		1:0	1			·  -	8.45		18	5	6	7		[ ]		ि	ųΙ,	
9_	8 20	9.70	5 30	<i>["</i>					0.43							<del>/</del> -	<u> </u>	<del></del>		
0	70.33	3.70	3.30	] <u>ō</u> _				<u> </u>		10.00				4		/ <sub>~</sub>				18
.~	Ç .			_9_	silt	dark grey	soft	with many shell fragment								/				
쁘						grey	į	Shell Haginein		10.90		٠,	,		/	}	ļ.::	ļ		
12								with mica	12.15										A.,	
				8		·			12.45	i .	3	1	1	1	7-7		ļ	1		1
15									12.43							- ,	ļ			
14				8					14.15						1.0			1		
								1	14.45		4	1	1	2	Ţ		]			
臣				e_				·	14.43								ļ	ļ		
16	14.49	15.80	6.10						16.15					1				1 .		
				-0-	silt	dark	mediun	with low water	16.45	1 1:	6_	2	2	2	1	-				
	er e			7.0		grey	stiff	content	10.43				1				<u> </u>		<b> </b>	
18				- <b>a</b>	·			with orgnic	18.15				1.							1
-			1					matter and tiny shell fragment	18.45	2.4	7_	2	2	3		· · · · ·		1		
2				1_		,		SHOR HUBINOIN	10.43	1.1					∤-		ļ			ļ
20		2.5	7.4	3-					20.15											1
_	19.14	20.45	19	7/1	<u> </u>	-			20.45		9	3	3	3	1			1		
21			1. 1	Ŋ		1.00			20.43								ļ	ļ		ļ
22	]			'-		3.5						ĺ			•					-
																[		1		
[ 23_				,		*												ļ	· 	ļ]
2년																100		'		-
1 .																	<b> </b>	†		<b> </b>
<b>3</b> 2.				.21														ļ		}
26				3.0							.				٠٠.					-
1 -			, A <sup>2</sup>		* -		'													
77			1.7					1	4,5								····			ļ <b>1</b>
28	<u>L</u>									<u></u>							L			1
						-			-		_	_		_						أحسبوا

# Fig. 2-17 Drilling Log (Semerak Area)

			, 67 1763	188	1 3 5 3 3 3 3 3 3 3 3	23 			Err.	¥ 1	4.			tyri	l LB	emari	ä			
: <u> </u>	me of	Project	The Fe Devek	osibili opmen	ly Study for Project	r Kela In Ma	nton Po loysia	rt Type of Dr	illing )	Rötary				- 1						
<u>H</u>	ole Nur	nber		. A-1	L Elevor	ion D	L +1.90	m Daile N	lov. 19	79								4 :		3 }
					Water	Table	-0.30	m Driller	<del>-</del>			8,+ .A.			.L.					
E	5	E			3	dağır kı	ઇ જ		S	andard	Per	në tr	oti	on .	Test	or C	ye R	ecove	ry.	
Ç	Bearlon in	Ceptin in m	Thickness	parage 7	5	Colour	Relative Dersity or Consistency	General	£E	Sampling	Sign volue	Bk Ex	MA MA	er oon		, y	(N	Value		
Scale	ជំ	ð	Æ	3	<u>\$</u>	3	2.28	84	S E	हुङ	2 8	ίģ	ig.	Q.		- 1 - 1	20 3	10	ю 5	o
		. :		o.	coarse sand	yello	wish	with high water			71							Seconds.	NY TY	0%
		1.		· o. · ·	Sailti	grey		content			117	1		23 12				}··		
3							mediun to	with pebble gravel of	2.15		18	6	6	6				10 a 45	16	
3							loose	guartz	2.45							١)	ļ			8
•						1			4.15		23	.7	7	9			\ 		ļ	3.
3			: :			4. 1		E 4 1	4.45			Ĺ	Ė				<u> </u>		ļ	
6		6.00		Q	silty fine	dark	122.2		6.15		,				برينا	/_				
7	-4.80	6.70	0.70		sand -	dark grey	loose	with shell fragmen	6.45	7.00	3	1	1	T	í			f ji.		
8					silt	dark grey	soft	with shell fragment												
9				<u>.                                    </u>			14 (A.F.)		9.15	7.90					1					1.
ю		:						with little fine sand	9.45	ļ	3	1	1			••				-
				&_		.l			17.75	regge	3.3	;;\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	ă.		-				1	737
11	-			70			1- 20. 20.		11.15		3	1	1	1	-∤					الماسية
!2									11.45	1. A.L.			ŀ		_/	ļ	ļ			الداا
13	10.90	12.80	6.10		clay		n stiff	stiff clay	13.15		19	6	6.	7	· ·.	1				
! <b>4</b>			:		Clay	and light	1 30111	mixed colours of brown and	13.45			Ĭ	Ť							
15						grey		light grey	15.15		١,,	٨					ļ 		ļ	1 y 5 T
16			:		1	, ;			15.45	<b></b>	21	-/-	7.	/				,		;,'-
17		1.			į.			L.	17.15											32%
16		1							17.45	]	19	5	7	7		,				
-	16.80	18.70	5.90					1												
19				r	silt	dark grey	mediun stiff	with much organic matter	19.15		9	3	3_	3		/		1		774
20		4.		~ ~ ~		ri.		organic matter	19.45		:					- <del>2 - 1</del> -				
<u>21</u>	19.55	21.45		ン こ エ エ					21.15		10	3	3	4						
<b>Z</b> 2				_ ′	15				21.45									<u> </u>		
23			e e Service														ļ			
24												Ì								!
25		<u>.</u> .				1														120
26					<u> </u>								,		:	Ī		. 7 .		
-									1	1								İ		

			:	15 N 5 Number		ollon Sabak e 27 1980	~ Kemasin Area ~ 7. 8. 1.980	<del></del>	∜ofa .∗	र्वस्थ स		Tabl	D, L, . ← €	4.94.	<u>m</u>		
Scale in m	Elevation in m	Depth in m	Thickness	puača	S S	Type of soil	General Remorks	Relative Density or Consistency	10 A.S.	Star	Blows Re Each low IO IO IC on concor	Pene			Test	, K	Sampling Depth in m
A Company of the Comp		* * * * * * * * * * * * * * * * * * *		8 6 8	grey	fine sand	very loose sand layer with shell fragments and high water con- tents, clayey at a depth of 20,		115	<sup>2</sup> ∕30	<b>∤₅</b> ∤₅		Core	X	bvery		
3	844	0.02	2.60 0.90	00000	grey grey	coarse sand with gravels silty fine	with high water conte and shell fragment with quartz pebble with high water con- tent	nt Santalinas	245 315 345 415	350	1 1 1 1 1 1		Carrier and Artis				
5	- 999 -1044	505 550	1.55 0.45	) (P	grey grey	silty medium sand silty fine sand	with shell fragments and biotite flakes with shell fragment with medium water con tent and a little shell fragment, with	<u>, 11 21, 11</u> + 11 21, 1 = 11 1 414	445 515 545 615		1 1 1		Appendix of the property				
7.			and the second second	0 // // 0		Sallu	shell fragment, with biotite flakes		6.45 7.15 7.45 815	3-30	1 1 1 L		The state of the S				
9	14.79	9.85	4.35	// /θ θ	grey	fine ∿ medium	with high water con-		945 915 945 1015	4/30	1 1 2	l V	A Commence of the commence of		igas gri		-  -  -  -
12	And the second second second			9 .		sand	tent with shell fragment and pebble of quartz with biotite flakes pebble is 3mm in	t gran	10.43 11.15 11.45 12.15	8/30	2 3 3		A Company		-		
13		1415		6			maximum diameter	er ji V er Age Elekeri Li Z	1245 1315 1345 1415	6.50	2 2 2		the second of the second of the second				
and the second state of	19.64	1 (60	0.45		grey	organic silt	with much organic mat with organic matters and mica flakes very soft layer with high water	Lers	1414 1515 1545 1615	1/30	1 1 2 2 2 2		A CONTRACT OF THE PARTY OF THE				
17.							content	an Sea An Sea Sea Sea	1645		V V V		en a contrar		53.	OA.	17.50
19.							10 A M	en dila 140 Septi 1	1915 2015	%30	0. 0. 2		A CONTRACTOR OF THE PARTY OF TH				18/10
21	2654	21.60	700		light grey	clay	with less water con- tent medium stiff		2045 21.15 2145 2215	%0 %0	1 2 2		,				
23	28.04	2310	150	0 0	light grey	fine to coars	with less water con- tent yery stiff layer		2345 2400	50/17	17 20 13 <u>4</u> 26 244	51			1971		- \ - \ - \
<b>25</b>	30.09	25.15	2.05	o 1 6			with peoble of quart2	संस्कृतक 	2500	14/5	28 225		in the second second				
27										The second second				The Array of the Array			
30		**************************************										the state of the s		and the state of t			the Water and the Labor
de la constant		1					L		<u> </u>			<u> </u>	1: ] 				
( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	1.		e i Le estate	<u></u>	da, e	i i i jaka sa mili Kabupatèn Marata	and the second seco	12.28.00	i Sanga	) 	. j j	er l George	And the second s				
							<del>-6</del> 2										

Fig. 2-19 Grain-Size Distribution Curves of Sandy Layer



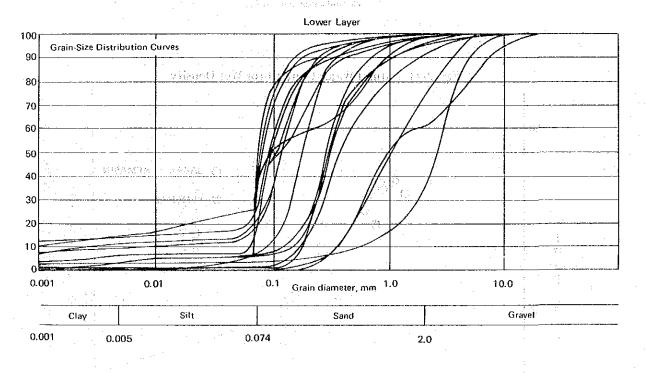
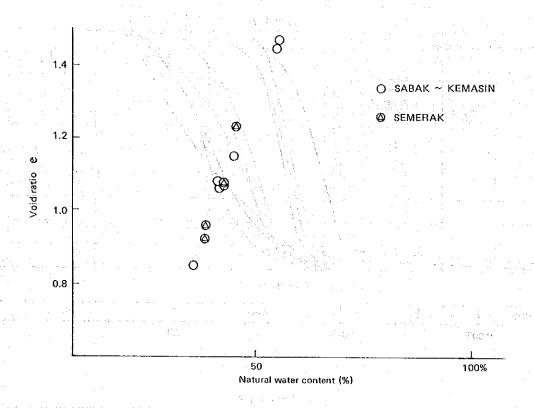


Fig. 2-20 Natural Water Content for Void Ratio



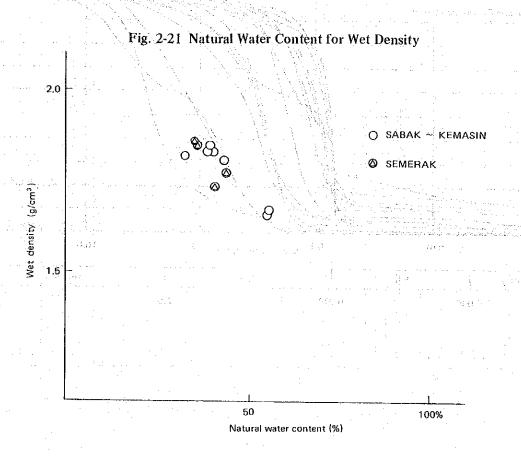
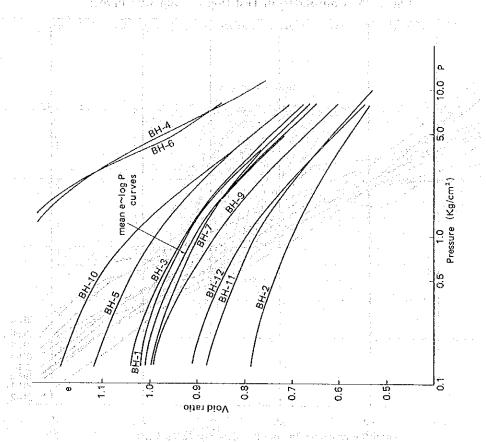


Fig. 2-23 Consolidation Test (e ~ log P Curves)



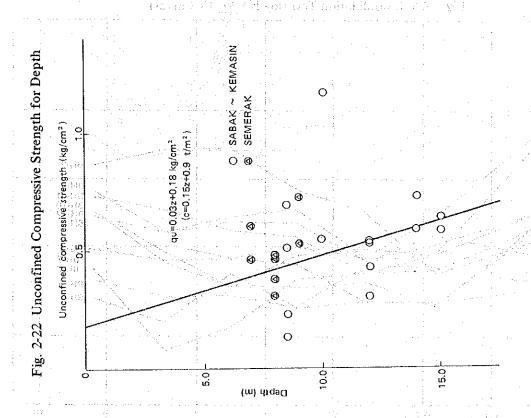


Fig. 2-24 Consolidation Test (log  $\overline{P} \sim \log Mv$  Curves)

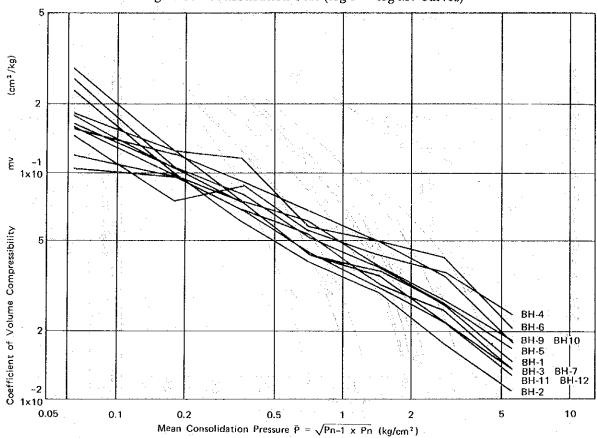


Fig. 2-25 Consolidation Test (log  $\overline{P} \sim log$  Cv Curves)

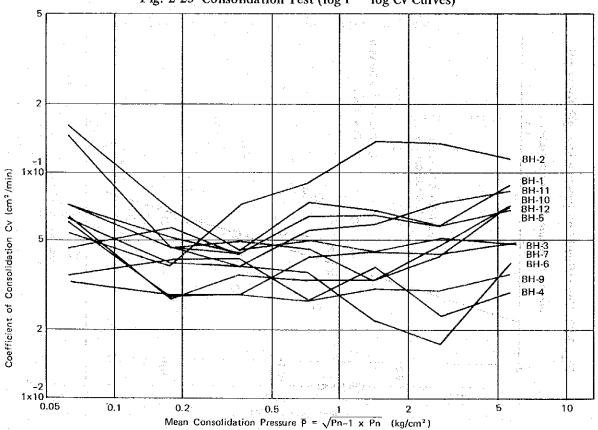


Fig. 2-26. Grain-Size Distribution Curves by Area (Subsoil Sample)

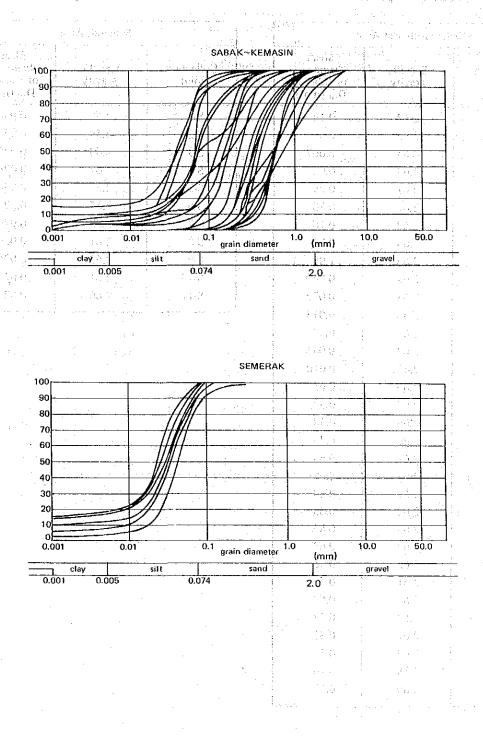


Table 2-10 Specific Gravity and Mean Diameter of Subsoil (Survey in 1979)

Sat	oak – Kemasin Are	a
Collection point	Specific gravity	Mean diameter of subsoil D <sub>50</sub> (nim)
1	2.63	0.14
2	2.62	0 072
3	2.65	0.067
4	2.64	0.62
5	2.61	0.24
6	2.63	0.70
7	2.62	0.18
8	2.63	0.38
9	2.63	1.00
10	2.62	0.040
11	2.65	0.072
12	2.58	0.073
13	2.62	0.20
14	2.62	0.046
15	2.65	0.040
16	2.63	0.65
17	2.65	0.38
18	2.66	0.38
19	2.65	0.43
20	2.61	0.64
21	2.63	0.68
22	2.61	0.40
1A	2.62	0.83
2A	2.63	0.87
3A	2.62	0.62
4A	2.63	0.36
5 <b>A</b>	2.61	0.62
6A	2.63	0.62
7 <b>A</b>	2.59	0.53
8 <b>A</b>	2.62	0.32
9 <b>A</b>	2.62	0.57
10A	2.58	0.18
11 <b>A</b>	2.60	0.17

	Semerak Area	· . :
Collection point	Specific gravity	Mean diameter of subsoil D <sub>50</sub> (nnm)
S-1	2,57	0.034
S-2	2.59	0.022
S-3	2.63	0.025
S-4	2.62	0.028
<b>S</b> -5	2.57	0.030
S-6	2.57	0.027
S-7	2.58	0.024
S-8	2.61	0.029
S-9	2.62	0.026
S-10	2.61	0.026
S-11	2.60	0.022

Table 2-11 Specific Gravity and Mean Diameter of Subsoil (Survey in 1980)

		Sabak ~ Kemasin Are	;a	
Collection Point	Specific Gravity	Mean diameter of Subsoil D50 (mm)	Diameter of Subsoil D25 (mm)	Diameter of Subsoil D75 (mm)
D-1	2.68	0.05	0.037	0.063
D-2	2.57	0.05	0.042	0.059
D-3	2.65	0.053	0.043	0.066
D-4	2.68	0.046	0.033	0.058
D-5	2.65	0.053	0.033	0.074
D-6	2.64	0.53	0.034	0.88
D-7	2.67	0.50	0.38	0.66
D-8	2.70	0.047	0.033	0.065
D-9	2.66	0.052	0.034	0.25
D-10	2.66	0.048	0.037	0.063
D-11	2.66	0.35	0.05	0.55
D-12	2.71	0.42	0.056	0.66
D-13	2.67	0.32	0.26	0.40
D-14	2.67	0.32	0.26	0.40
D-15	2.65	0.50	0.31	0.63
D-16	2.67	0.45	0.17	0.63
D-17	2.66	0.30	0.05	0.50
D-18	2.67	0.057	0.046	0.35
D-19	2.67	0.046	0.040	0.055
D-20	2.65	0.24	0.040	1.05
D-21	2.65	0.048	0.034	0.06



### CHAPTER 3 SITE SELECTION - CAMPAGE AND A CONTROL OF THE SELECTION - CAMPAGE AN

Two areas of Sabak-Kemasin and Semerak were selected for the proposed sites of the port development as described in Scope of Work (S/W). Technical evaluation and socio-economic evaluation are executed in order to select the most suitable site.

ti, kodjeljek alionitike poj divlagiste, dobija nji kolija izviji je izviti strenje primi i vijikaj

the property of the contract o

In the Confirmal Association for the first of the Association.

### 3-1 Technical Evaluation

The comparison is made between both areas on the following comparative items;

### (1) Length of Breakwaters

The water depth of Sabak-Kemasin area and semerak area is so shallow that the necessary length of breakwaters becomes long, and this will cause the increase of the construction cost of the port project. The necessary length of breakwaters under the First Phase Development Plan is estimated approximately as follows;

Sabak-Kemasin area; L=1.810 m+2.250 mSemerak area; L=2.050 m

### (2) Amount of Capital Dredging the control of the c

The amount of capital dreging under the First Phase Development Plan is estimated approximately as follows;

Construction of the participation of the participation of the construction of the cons

Sabak-Kemasin area;  $V = 1,800,000 \text{ m}^3 - 2,300,000 \text{ m}^3$ Semerak area;  $V = 2,900,000 \text{ m}^3$ 

### (3) Soil Conditions for the state of the sta

There are no outstanding difference of the soil conditions between Sabak-Kemasin area and Semerak area, but the grain size of sea bottom materials of Semerak area is one-order smaller than that of Sabak-Kemasin area. (Reference should be made to "2-4. Soil Conditions")

### (4) Land Use for a Port Area and the state of the state o

A sufficient area of flatland is necessary for port development. The hinterlands of Sabak-Kemasin area and Semerak area are swampy and were inundated by the flood in 1967. To use these lands as a port area, the ground level should be raised by earth filling.

where  $k_{i}$  is  $k_{i}$  . We have the state of the energy of the contract  $p_{i}$  , which is given by  $p_{i}$  ,

en en deplesado de control de Mercana de Lordon de Legaron do Lordon de Aporte de Labora de Lordon de Lordon d La defenda per meno de legar de Mercana de Lordon La ferta política de la marca de descripción de la composiçõe de Lordon de La production de Lordon de Lordon d

### 3-2 Socio-Economic Evaluation (Mathematical Annual Control of the 
The comparison is made between Sabak-Kemasin area and Semerak area on the following comparative items;

and the second of the companies of the companies of the second of the companies of the comp

Removal Ref. 1. The HOLL BODY of the processing of the Allender

### (1) Geographical Conditions

Sabak-Kemasin area is located in the center of Kelantan coast and adjoins the densely populated coastal plain where the state capital of Kota Bharu is located. The straight distance from Kota Bharu approximately 10 km. Semerak area, meanwhile, is located near the boundary of the States of Kelantan and Trengganu, 40 km from Kota Bharu, this is a geographical disadvantage as the site of Kelantan Port.

# (2) Land Transport Conditions and the state of the conditions of the state of the s

# ora 🛈 t Roads, plantik i na mto vyješ pografijem ano naziskopi štvo apportogas, protectaš objedynog pod oboli

The present road network in the State of Kelantan spreads radially from Kota Bharu. Roads in the coastal plain, particularly the east part of Sg. Kelantan, are well-developed, compared with other areas. So, Sabak-Kemasin area is favourable if goods are transported to consuming areas from the port by the existing road network. However, some improvements such as widening the existing roads are necessary to cope with the increase of the cargo transportation in the future.

### ② Railways

The present railway, running through the central part of the Peninsular Malaysia, passes through the State of Kelantan and its branch reaches to Tumpat. Extending this railway directly to the port is unpractical because the immense investment for a bridge construction, etc. are necessary for this purpose.

of railway transportation combined trucks and railways may be available to make effective use of railway transport. In this case also, Sabak-Kemasin area has an advantage because of its proximity to the existing railway.

The shortest distances from two areas to the existing railway are approximately as follows: Frankling in the state of the existing railway are approximately as

### (3) Relationship to Other Development Projects

The development projects for the transportation, the industrial estates, the south Kelantan region, etc. may be mentioned as development projects related to the port project.

### ① Transportation Projects

In the State of Kelantan, the projects of the North-South Highway from Kuala Krai to Kuala Lumpur and Port Kelang via Gua Musang, and the East-West Highway are in progress.

The shortest distances from two areas to East-West Highway are approximately as follows:

Sabak - Kemasin - Sabak - Sokm - Semerak - 15 km

No railway projects are planned at present.

As for the airport, the existing airport of Kota Bharu is now being expanded.

es and define after a trage of the consequence of the first substance of the second section is a second

# 17 (2) Industrial Estates Projects and the same of the arms of the arms of the first temporal temporal

Industrial estates projects are being planned and constructed at Pengkalan Chepa, Tanah Merah, Jeli and Gua Musang. These industrial estates consist mainly of light industries, and efforts of inducing for manufacturing companies are now being made. In the future, it will be expected that some products will be transported by sea from the port.

Sabak-Kemasin area has an advantage of the short distance from the industrial estate of Pengkalan Chepa, which adjoins Kota Bharu and is the largest of the four.

The road distances from two areas to those industrial estates are approximately as follows:

<ul> <li>A depositive on the contract of t</li></ul>			
Pengkalan Chepa	7 km	Land Carlotte	70 km
Tanah Merah	65 km	1 - 4	55 km
Jeli	120 km		100 km
Gua Musang	190 km		185 km
on the contribution of the Spanish of the Contribution of the Cont	A Garage Barrier	. 1 10 25 417	Sport of the following

South Kelantan Development Project
Semerak area has an advantage of short distance from South Kelantan.

### (4) Kemasin-Semerak Integrated Rural Development Project

The survey on the Kemasin-Semerak Integrated Rural Development Project is being conducted by the study team of SCET International. The report submitted by this team says that irrigation and drainage projects are being planned to accelerate agricultural development in Kemasin-Semerak area, and the construction of training walls is being planned for the estuaries of Sg. Pengkalan Datu, Sg. Kemasin and Sg. Semerak. If this project is carried out in the future, it is better to use the training wall as a part of seawall. But to achieve such dual-purpose utilization of facilities, it is necessary to adjust the schedule of both projects.

Streets are already assessment to the explaination of the contraction of the contract of the c

### (4) Distance to the Consuming Area was dequested by the season with the many control of the consuming Area was a season o

The consuming area is located in the northern part of the State of Kelantan. Sabak-Kemasin area has an advantage of the short distance from the consuming area.

there is a fall his train. Where it is a fall it is a fall in the little manager of the real training and a second and the second

### (5) Distance to the Producing Area

According to Census of Manufacturing Industries, Peninsular Malaysia 1973 Vol. 1, 70% of industrial products of the State of Kelantan was produced in Kota Bharu area and 90% in the north-western part of the state around Kota Bharu. But these proportions will change if, in the future, the inland industrial estates start production. Since, however, the industrial estate of

Pengkalan Chepa occupies about 50% of their total area, the change of the proportion will be rather small.

# (6) Distribution of Fishermen

The total number of fishermen in the State of Kelantan is 6,475 and a half of them live around Tumpat. In Tumpat area, fishing port facilities are being constructed at Geting in order to improve the life of local fishermen.

There are many fishing villages at the north side of Kota Bharu and Bachok area. For these fishermen, Sabak-Kemasin area is closer than Semerak area and they will be able to remove there easily.

### (7) Competition with Other Fishing Ports and the same that the same and the same an

Other fishing ports which have the possibility of competition with this fishing port are Geting and Besut of the State of Trengganu. In particular, Besut is only 7 km from Semerak area and may compete with the proposed new fishing port. Therefore, Sabak-Kemasin area is the most favorable site for the fishing port. As for the Geting port, it will be possible to develop by itself, because there is sufficient distance from Kota Bharu and that is located on the opposite side of Sabak-Kemasin area.

### (8) Distribution of Laborers

The population of the State of Kelantan is concentrated around Kota Bharu. The development of Kelantan Port can provide the opportunities of employment to the unemployed and workers in unproductive industries.

If the port is constructed in Sabak-Kemasin area, many workers can go to work from existing dwelling places.

# (9) Distribution of Natural Resources Control of the Control of th

In the future, with the progress of mining in inland, export-oriented industries using these natural resources may start near the port.

Since natural resources are distributed mainly in the mountainous southern part of the state, Semerak area has an advantage of short distance.

the temporal Community and the first of the community of

### (10) Prospect of Future Development the analysis of the control of

Sabak-Kemasin area is located approximately in the central part of the Kelantan coast and is closer to the state capital of Kota Bharu than Semerak area. It is expected that this area will be developed further as one of the economic centers of the State of Kelantan. There is a great possibility of the future development in Sabak-Kemasin area.

t o spolit tillfæri ett kriver på som ett menet i liver ellegt kriver og er videt kommer tilke jandelsjalle. Som de komt trenget fra krædt sid Mille som bleng er kladet i kriver ellegt ellegt er tillfære, flankræde kriv Som kriver krivere kriver og krædt med men menet ellegt er er blet til er tillfære kriver ellegt er skriver kr

### 3-3 Overall Evaluation

Table 3-1 shows the comparison of Sabak-Kemasin area and Semerak area as a port development site. The evaluation is expressed by the following marks;

Very good:

AAA

Good:

ΑA

Not so good:

Α

From the result of overall evaluation, Sabak-Kemasin area is selected as the most suitable site for a proposed port.

Table 3-1 Comparison of Sabak ~ Kemasin Area and Semerak Area as A Port Development Site

Item No.	Comparative Items	Sabak ~ Kemasin Area	Semerak Area
1	Technical Evaluation		
1-1	Length of breakwater	A <sup>1)</sup>	A <sup>1)</sup>
1-2	Amount of capital dredging	A	A
1-3	Soil conditions	AA	A
1-4	Land use for a port area	AAA	AA
2	Socio-Economic Evaluation		
2-1	Geographical conditions	AAA	Α
2-2	Land transport conditions	AAA	AA
2-3	Relationship to other development projects	AAA	AA
2-4	Distance to the consuming area	AAA	Α
2-5	Distance to the producing area	AAA	AA
2-6	Distribution of fishermen	AAA	Α
2.7	Competition with other fishing ports	AAA	Α
2-8	Distribution of laborers	AAA	A
2-9	Distribution of natural resources	' <b>A</b>	AA
2-10	Prospect of future development	AAA	, <b>A</b>

Note: 1) This evaluation A means that the required length of the breakwater in Kelantan Port is much longer than that of a usual port in order to secure the calm basin.