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THE STUDY ON THE DEVELOPMENT PROJECT OF DUMAI PORT IN THE REPUBLIC OF INDONESIA

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OCTOBER 1983

PREFACE

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a study on the Dumai Port Development Project and entrusted it to the Japan International Cooperation Agency (JICA). The JICA sent to Indonesia a study team headed by Mr. Masao Ohno, Executive Director of the Overseas Coastal Area Development Institute of Japan in October 1982.

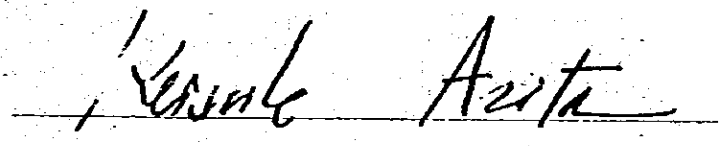
The study team conducted a field survey and had discussion on the project with the officials concerned of the Government of Indonesia and the representatives of the private sector.

After the survey in Indonesia, the study team returned to Japan where they made further studies, and the present report has been prepared.

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

I wish to express my deep appreciation to the officials concerned and to the representatives of the private sector of Indonesia for their close cooperation extended to the study team.

October 1983



Keisuke Arita
President
Japan International Cooperation Agency


MALAYSIA
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Kota Kinabalu
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TIMOR SEA
Spratly Islands
Halmahera
Ujung Pandang
Joseph Bonaparte Gulf

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Exchange Rate

1 US$ = 680 Rp = ¥250

Abbreviation, Acronyms & Indonesian Words

Ac	: Alluvial Cohesive Soil
As	: Alluvial Sandy Soil
ASEAN	: Association of South East Asian Nations
B	: Breadth
BAPPEDA	: Badan Perencanaan Pembangunan Daerah (Provincial Development and Planning Board)
BAPPENAS	: Badan Perencanaan Pembangunan Nasional (National Economic Development Board)
bbls	: barrels
B/C Ratio	: Benefit Cost Ratio
BPH	: Barrel per Hour
BPP	: Badan Pengusahaan Pelabuhan (Port Administration)
C and F	: Cost and Freight
CBS	: Central Bureau of Statistics (Biro Pesat Statistik)
Cc	: Compression index
CFC	: Conversion Factor for Consumption
C.I.F.	: Cost, Insurance and Freight
CPO	: Crude Palm Oil
Cu	: Undrained Shear Strength
Cv	: Consolidation Coefficient
D	: Depth
DAP	: Diammonium Phosphate
Dc	: Diluvial Cohesive Soil
DCF	: Discounted Cash Flow
Desa	: Village
DGSC	: Directorate General of Sea Communications
DL	: Datum Level
DLLAJR	: Direktorat Lalu-Lintas Angkutan Jalan Raya (Directorate of Traffic and Transportation)
Ds	: Diluvial Sandy Soil
DWT	: Dead Weight Ton
e	: Porosity Ratio
F	: Fetch Length
F.O.B	: Free on Board
FRR	: Financial Rate of Return
g	: Acceleration of Gravity
G/C	: General Cargo
GCBS	: General Council of British Shipping
GDP	: Gross Domestic Product
GRDP	: Gross Regional Domestic Product
GRT	: Gross Registered Tonnage
Gs	: Specific Gravity

GT	: Gross Tonnage
$H_{1/3}$	: Significant Wave Height
HP	: Horse Power
HWL	: High Water Level
Ip	: Plasticity Chart
IRR	: Internal Rate of Return
ISTS	: Integrated Sea Transport Study
JICA	: Japan International Cooperation Agency
K	: Kalium
KCL	: Potassium Chloride
K_1	: Lunar Declinational Diurnal Constituent
KANWIL	: Kanto Wilajah Perhubungan Laut (District Office of Sea Communications)
Kecamatan	: The Third (Sub-Kabupaten) Administrative District in a Province
Kh	: Horizontal Seismic Coefficient
Khusus	: Special Vessels
Kotamadya	: Special Designated City
KPLP	: Kesatuan Penjagaan Laut & Pantai (Coast Guard)
Kv	: Vertical Seismic Coefficient
L	: Length
LWS	: Low Water Spring
M_2	: Principal Lunar Semidiurnal Constituent
MHWS	: Mean High Water Spring
Mg	: Magnesium
MLWS	: Mean Low Water Spring
MOP	: Muriate of Potash
MSL	: Mean Sea Level
Mv	: Volume Compressibility Coefficient
N	: Nitrogen
NPK	: Nitrogen Phosphorous Potash
O_1	: Lunar Declinational Diurnal Constituent
$\bar{P}$	: Average Consolidation Pressure
Pb	: Overburden Pressure
Pelita III	: The Third Comprehensive National Development Plan
PERTAMINA	: Perusahaan Pertambagan Minyak dan Gas Bumi Negara (National Oil and Gas Enterprise)
P.T. PUSRI	: P.T. Pupuk Sriwijaya
PNP	: Perusahaan Negara Perkebunan
PTP	: Perseroan Terbatas Perkebunan
P.T.	: Perseroan Terbatas
Py	: Consolidation Yield Stress
qc	: Static Penetrating Resistance Value
qu	: UnconfinedCompressive Strength
γ_t	: Wet Density

RBD	: Refined Bleached Deodorized Oil
Repelita IV	: The Fourth Comprehensive National Development Plan
RP	: Rock Phosphate
Rp	: Rupiah
Sz	: Principal Solar Semidiurnal Constituent
Sa	: Solar Annual Constituent
SCF	: Standard Convertion Factor
SPT	: Standard Penetration Test
Ssa	: Solar Semi-Annual Constituent
SWR	: Shadow Wage Rate
TSP	: Triple Super Phosphate
U	: Wind Velocity at 10 meters above Sea Surface
UNCTAD	: United Nations Conference on Trade and Development
US$	: United States dollar
W_L	: Liquid Limit
W_n	: Natural Water Content
W_p	: Plasticity Limit
WPUA	: Wilayah Pembangunan Utama A
ϕ	: Internal Friction
¥	: Yen
Za	: Ammonium Sulphate

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Necessity for Port Development

The island of Sumatra lies on the western periphery of the Indonesia archepalago, its eastern side facing the Strait of Malacca, one of the most important shipping lanes in the world. In light of this strategic geographical setting, and through steady development of Sumatra's abandant natural resources, Sumatra has the potential to become the leading economic and cultural region in Indonesia. However, swampy areas and thick jungles occupy large portions of this island. Due to such natural conditions most of the island has been largely undeveloped, except for the notable exceptions of Deli Serdang District in the northern part of the island where large plantations have been promoted since the nineteenth century.

Recently though, the Province of Riau has undergone rapid modernization, driven primarily by the development of oil fields in the area centering around Minas, which were discovered shortly after Indonesian independance.

In 1969 Indonesia's first five year plan was instituted. One of the aims of this plan was to commence large scale development of Riau Province in the sectors of agriculture and forestry. This plan called for expansion of agricultural areas and oil palm plantations by means of improvement of the road network and transportation system as well as through implementation of a policy of transmigration.

Riau Province has thus been placed in the limelight, being designated along with the four northern provinces of Sumatra as a High Priority Development Area A (WPUA). In this connection, it is expected that Dumai Port will play an important role as both a loading port for crude oil, and also as a nucleus for development in Riau Province.

Target Year

Master and Short Term Plans have been formulated to cope with the cargo volume levels expected respectively in the years 2000 and 1990. As cargo volumes are expected to increase sharply in the near future, the Short Term Plan will be completed by the end of the Fourth National Five Year Plan in 1988.

Master Plan

In the Master Plan's target year of 2000, the hinterland of Dumai Port is expected to cover the northern part of Riau Province and the southern part of North Sumatra Province. Dumai Port will also provide a feeder function for the sea area that includes the islands of Riau Province, Riau's river ports, and ports in the Jambi Province.

The total annual volume of port cargo forecast under the Master Plan is 3.6 million tons. The increasing palm oil production at large scale plantations in the port's hinterland, is expected to provide 56% of this volume.

In addition, fertilizer required for plantation work and consumer goods needed by transmigrant plantation workers are expected to comprise an increasing share of the cargo handled at Dumai. To meet this increased traffic demand, construction of a total of eight new berths is planned. Two of these berths are dolphin berths (respectively 12 m, 10 m deep, max. ship size 35,000 DWT) for handling the port's major commodity, palm oil. The other six berths are general cargo berths (10 m deep, max. ship size 15,000 DWT) mainly to handle foreign trade in sawn timber, fertilizer and general cargoes.

Related on-shore storage facilities will be constructed in the form of warehouses and sheds. Additionally, the passenger transport plan calls for construction of one passenger berth (8.5 m deep, design ship size 8,000 GRT). Lastly, land for possible future storage of palm oil and forestry products has been set aside.

Short Term Plan

The Short Term Development Plan targetted for 1990 calls for port development that can meet the urgent demand for expanded cargo handling capacity required by such cargoes as palm oil from large scale plantation areas, construction materials for regional development, and consumer goods sent into the port hinterland. Construction of a storage facility for palm oil has already begun in the port area. By 1988, a 500 m pile type jetty (scheduled for completion in 1985), one dolphin berth (12 m deep) for palm oil loading and three multi-purpose berths (10 m deep) will have been constructed under the Short Term Plan in order to meet the predicted cargo volume of 1.52 million tons.

In back of the quaywall, room for a 25 m wide apron and ample cargo handling space is reserved. There, in order to further increase cargo handling efficiency, room for warehouses and an open storage area is also reserved.

Construction Costs

The total construction cost for the master plan has been estimated at US$125 million, of which US$55 million will count towards implementation of the short term plan, and of which 57.5% will come from foreign financed loans. The whole construction period is planned at five years. This includes detailed design and bidding negotiations which will be carried out in order to complete the entire short term plan.

Economic Analysis

According to the economic analysis, the Internal Rate of Return for this project of 15.0% has been calculated based on direct benefits stemming from reduced costs for ship waiting time and cargo handling. The Dumai Port Development Project can thus be assured as fully feasible. In addition to these direct benefits, this project will provide a base for regional socio-economic activities, thereby exerting a positive influence on the overall development of Riau Province.

Financial Analysis

According to the financial analysis, assuming that new investments are made, the financial soundness and profitability of the port can be assured. The Financial Rate of Return has been calculated at 8.90%.

RECOMMENDATIONS

1. The Gateway Port Policy as it relates to Dumai Port:

Dumai Port has been designated as a collector port under the gateway port of Belawan. However, when cargo lots are larger than a single shipload, direct importation or exportation of foreign cargoes through the collector port is more efficient and economical, due to reduced transportation costs.

The major cargo items at Dumai Port – palm oil, forestry products, fertilizer, rice and palm kernels – are forecast to exceed the single shipload criterion. Therefore it is recommended that future port development planning be made flexible enough to allow for the possibility of handling foreign cargo directly through Dumai Port.

2. Implementation of the development plans:

According to the demand forecast, shipments of palm oil are expected to start arriving at Dumai Port in the near future. The volume of palm oil loaded at the port is expected to increase sharply from that time forward. In order to cope with this increased volume and as a prerequisite for implementation of the short term plan (scheduled for completion in 1988), it is necessary that the separately planned 500 m jetty-type berth now under construction be completed by the year 1985.

The short term plan should also be formulated to accommodate the increasing volume of cargo at the port by including 2 berths to be in service by the beginning of 1988 and a third by the end of that year, without any delay.

The planning done under the long term plan, targetted for the year 2000, should consider thoroughly the trends in cargo increase after 1988, as well as the effect of future socio-economic conditions on its own implementation.

3. Structural examination of wharf types:

Soil conditions in the Dumai Port area are structurally poor. Bearing strata along the planned faceline of the wharf lies at a relatively deep level under the soft upper layer.

Therefore during the detailed design stage a comparative study of structural types, based on the results of a precise soil investigation, should be conducted to select the wharf type.

4. Wharf utilization:

The wharf should be planned not only to ensure maximum efficiency of cargo handling, but also to be flexible enough to handle transhipment cargo passing through Dumai Port to/from its feeder ports. Construction of facilities for handling future bulk fertilizer cargoes must be taken into consideration. It is also important to reserve sufficient space for a stacking yard to handle increasing volumes of container cargoes. At the same time, development plans should be flexible enough to adapt to changing trends in the progress of containerization.

5. Port related areas to be reserved around the harbour:

As the port develops, industries that make heavy use of imports or exports will wish to locate as conveniently as possible. Therefore it is imperative that enough space adjoining the harbour be secured, so as to allow for development of such industries.

In order to facilitate smooth cargo handling operations, the plan must allow room for road and railroad construction needed to provide proper access to the port.

6. Detailed investigation of natural conditions:

As the wharf is being planned as a reclamation type prior in-depth studies of ground subsidence contermeasure based upon the results of additional soil investigations should be undertaken. As the stage of engineering service of the quaywall structure the precise ground conditions, especially along the planned face line, should be analyzed through on-side investigation, by carrying out a new comprehensive series of borings.

At present Rupat Strait is sufficiently deep for the passage of all vessels expected at the expanded port. However, the water depth of this strait may in the future become adversely affected by siltation from local rivers, so it is advisable to make arrangements as soon as possible for the regular observation of this situation. As a concrete example of regular observation, it is recommendable to monitor the siltation at the areas recently dredged in Dumai Port and its vicinity, and to take regular soundings in the water area, especially on both sides of the reclaimed land at least once a year before and after the reclamation work.

SUMMARY

SUMMARY

I. Basic Concepts underlying Port Development

1. A large scale regional development plan for Riau Province is currently in progress under the national five-year plan in order to develop the Province's full potential in the agricultural and forestry sectors. The plan includes programs for palm oil plantation development, transmigration of agricultural workers, and improvement of the land transportation network. The development of Dumai Port, a collector port under the Gateway Port Policy, is a key feature of the development plan for Riau. Dumai Port is located conveniently to plantations in both Riau and North Sumatra Provinces, and has sufficient water depth to accomodate large cargo vessels. In addition to agricultural products, Dumai Port is expected to handle increasingly large volumes of other incoming and outgoing dry cargoes, as plantations and other associated economic activities in the hinterland develop. In this regard, the future boundaries of Dumai Port's hinterland have been forecast taking into account hinterland and cargo data of such nearby ports as Pekanbaru, Rengat, and Tg. Balai. A network of highways between the various parts of Dumai's projected hinterland and Dumai Port is now under construction, with the main sections, linking areas with plantations to the port, soon due for completion. Finally, Dumai Port will also serve as a regional nucleus port, a vital point in Indonesia's sea transportation network.

2. Dumai Port's future sea transport activities shall consist of the following functions:
   (1) Direct export of large volumes of palm oil and forestry products
   (2) Loading/unloading of large volumes of domestic cargo, fertilizers and general cargo
   (3) Stimulus to regional economy through the above functions (1) and (2).

II. Cargo Forecast in Dumai Port

Future cargo volume at Dumai Port has been forecast for the target year 1990 (short term plan) and the target year 2000 (master plan). Future port cargo volume by commodity and shipping route is shown in Table II.1. The total cargo volume forecast for 1990 is 1,517,000 t and for 2000 is 3,657,000 t, increasing at an annual growth rate of about 9%. The outstanding feature concerning future port cargo at Dumai is the large share occupied by palm oil, increasing from 696,000 t in 1990 to 2,054,000 t in 2000. The total volume of other dry cargo is forecast at 821,000 t in 1990 and 1,693,000 in 2000.

As for these other dry cargo, plam kernels will increase from 107.000 t in 1990, a 13% share of the total dry cargo, to 343,000 t in 2000. Fertilizer which will account for 33% of the total dry cargo in 1990, 271,000 t, will increase to 438,000 t in 2000. Forestry products including sawn timber and plywood are forecast at 139,000 m^3 in 1990 and 250,000 m^3 in 2000. The total in/out volume of rice is forecast at 122,000 t in 1990 and 189,000 t in 2000, increasing annually at a rate of 5%. General cargo, including imports of construction materials and exports of rubber, account for 22% of the total dry cargo (182,000 t) in 1990, increasing to 383,000 t in 2000.

Table II.1 Cargo Forecast in Dumai Port by Commodity/Trade

('000 t)

Commodity	1990					2000				
	Foreign Trade		Domestic Trade		Total	Foreign Trade		Domestic Trade		Total
	In	Out	In	Out		In	Out	In	Out	
Crude Palm Oil		427		209	636		1,378		616	1,994
RBD		60			60		60			60
Palm Kernel		64		43	107		206		137	343
Fertilizer										
Urea			96		96			146		146
Rock Phosphate	56				56	91				91
MOP	68				68	118				118
Others	33		18		51	59		24		83
Forestry Products		125		14	139		225		25	250
Rice	56		46	20	122	87		71	31	189
Rubber		19			19		79			79
Construction Material	35				35	35				35
General Cargo	69	1	39	19	128	145	3	81	40	269
Total	317	696	199	305	1,517	535	1,951	322	849	3,657

III. Port Congestion Analysis and Cargo Handling

Simulation tests have been carried out in order to forecast future congestion at the port, so as to ascertain whether planned berth allotment is sufficient. The simulation is based upon the assumptions that Erlang's distribution will apply to ship arrivals, and that the ships can be classified into fifteen categories according to cargo size and type.

Simulation tests were carried out based on the following four phased stages of construction schedule:

1) a 500 m jetty berth will be in service starting in 1985
2) a dolphin wharf is constructed in 1987
3) two quaywalls are opened in 1988
4) the last quaywall is completed by the end of 1988

The average waiting times per ship have been calculated as shown in Fig. III.1, and as summarized below:

1) When the dolphin berth for palm oil handling is opened in 1987, average ship waiting time will be reduced to a possible minimum of sixteen hours, as compared to 4.4 days without the berth.
2) When all four berths proposed for the short term development plan are completed in 1988, average ship waiting time will be reduced to a possible minimum of approximately six hours in 1989.
3) After 1989, average waiting time will gradually increase, reaching a length of 16 days in 1997.
4) Present port capacity is not sufficient to meet increasing traffic demands, so the total combined length of the port's berths should be expanded to 500 m by 1985.

In order that ship waiting time does not exceed the maximum acceptable limit of 24 hours, the number of multi-purpose berths for the short term plan has been set at three. However, if only two berths are built, then this maximum acceptable limit will clearly be exceeded, as shown in Fig. III.1.

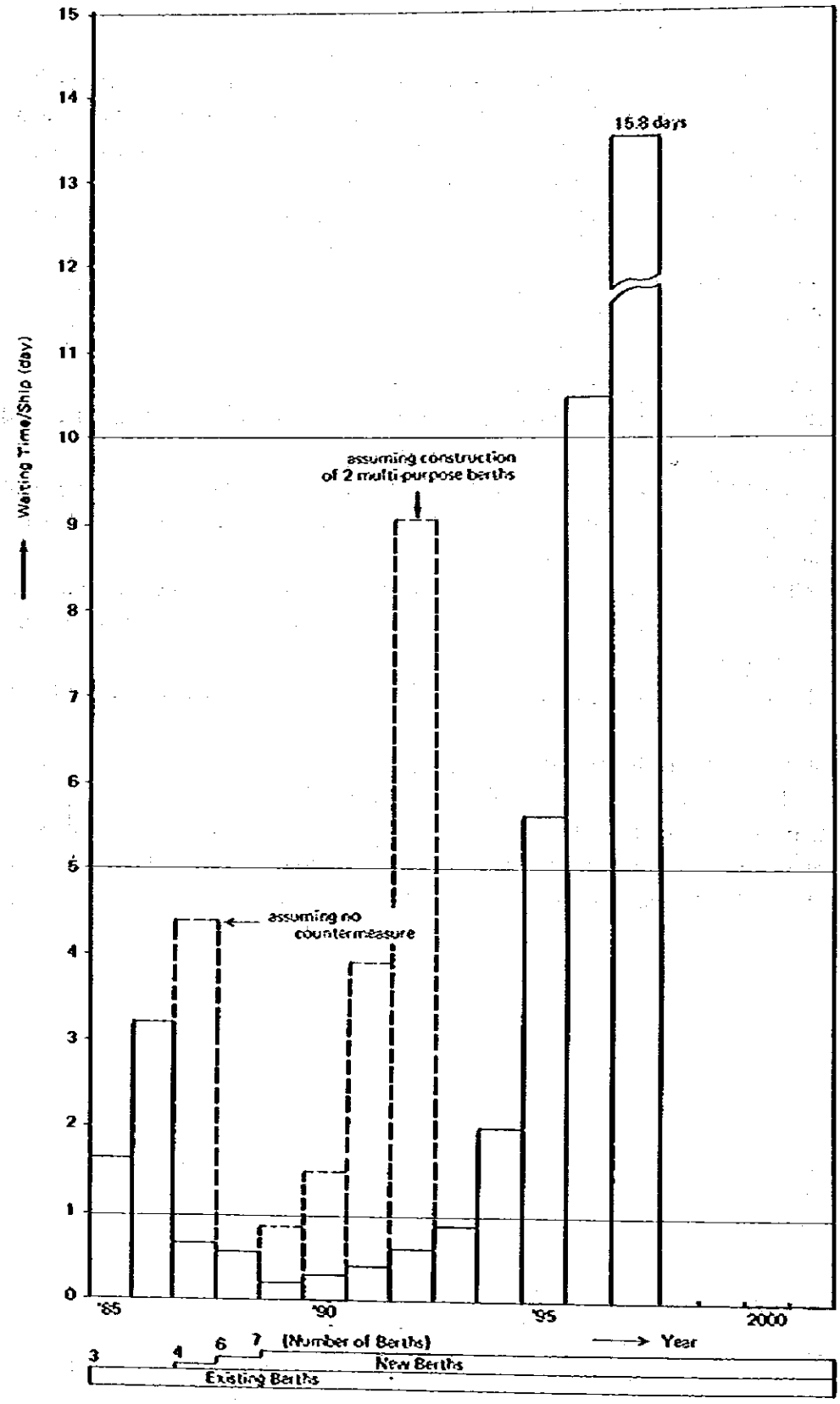


Fig. III.1 Average Waiting Time

IV. Master Plan and Short Term Development Plan

1. In order to meet the estimated cargo traffic demand as shown in Table IV.1 and IV.2 the Master Plan (Fig. IV.1) calls for construction by 2000 of eight berths including two dolphin berths and the Short Term Development Plan (Fig. IV.2) calls for construction by 1990 of four new berths, including one dolphin berth.

2. Dolphin berths will be used exclusively for loading palm oil.

3. The face line of the berth should be aligned as nearly as possible with the −10 m contour line in order to minimize the required soil work.

4. Port management facilities for customs and port security as well as a passenger terminal and facilities for the coast guard will be located separately in the western section of the port.

Table IV.1 Berth Allotment in 1990

Commodity	Cargo Volume ($\times 10^3$ tons) (A)	Vessel Size (DWT)	Depth (m)	Handling Capacity (t/m) (B)	Required Berths	
					m (A/B)	Number of Berths
(New Berth)						
Palm Oil	427	26,000 10,000	−12			1 (exclusive berth)
Sawn Timber	139	12,000		1,400	100	
Fertilizer	271	8,000	−10	1,100	247	3
Palm Kernels & Rubber	126	10,000		1,050	120	(multi-purpose berth)
General Cargo	45	10,000		800	56	545 m
Sub Total	1,008				523	4
(Jetty Berth)						
Palm Oil	269	2,300			165	3
General Cargo	118	3,000	−6.5 ~ −10	720	164	(multi-purpose berth)
Rice	122	8,000		765	159	500 m
Total	1,517				1,011	4 (planned) 3 (existing)

Table IV.2 Berth Allotment in 2000

Commodity	Depth of Berth (m)	Handling Volume per Year (ton)	Remarks
(New Berth)			
Palm Oil	−12 −10	1,524,000	2 Dolphin Berths (exclusive berth)
Sawn Timber	−10	250,000	6
Fertilizer		438,000	(multi-purpose berth)
Rubber		79,000	
Palm Kernel		343,000	1,045 m
General Cargo		223,000	
Sub Total		2,857,000	8
(500 m Jetty Berth)			
Palm Oil	−6.5	530,000	3
General Cargo	−10	81,000	(multi-purpose berth)
Rice		189,000	500 m
Grand Total		3,657,000	11 8 (planned) 3 (existing)

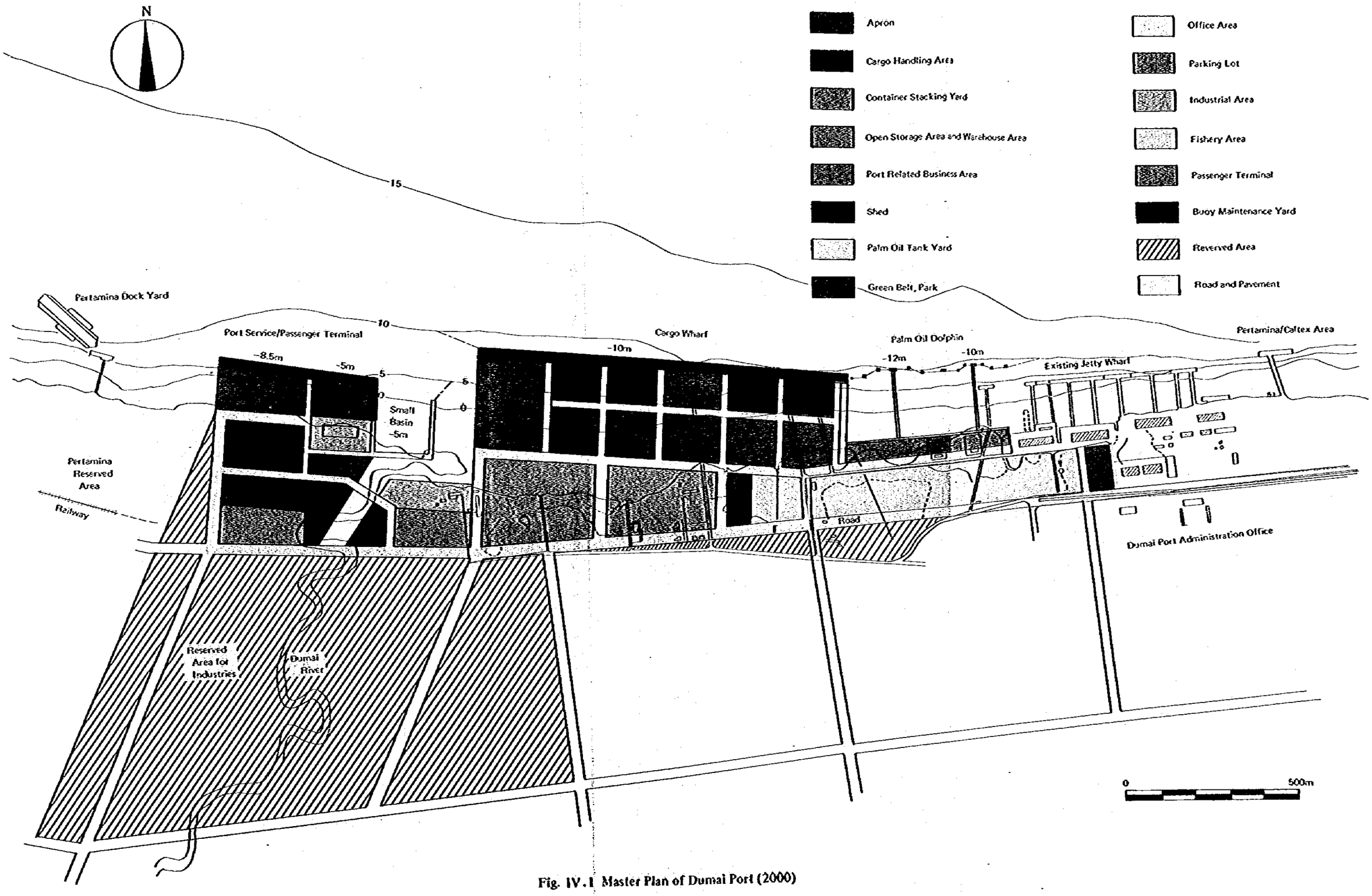


Fig. IV.1 Master Plan of Dumai Port (2000)

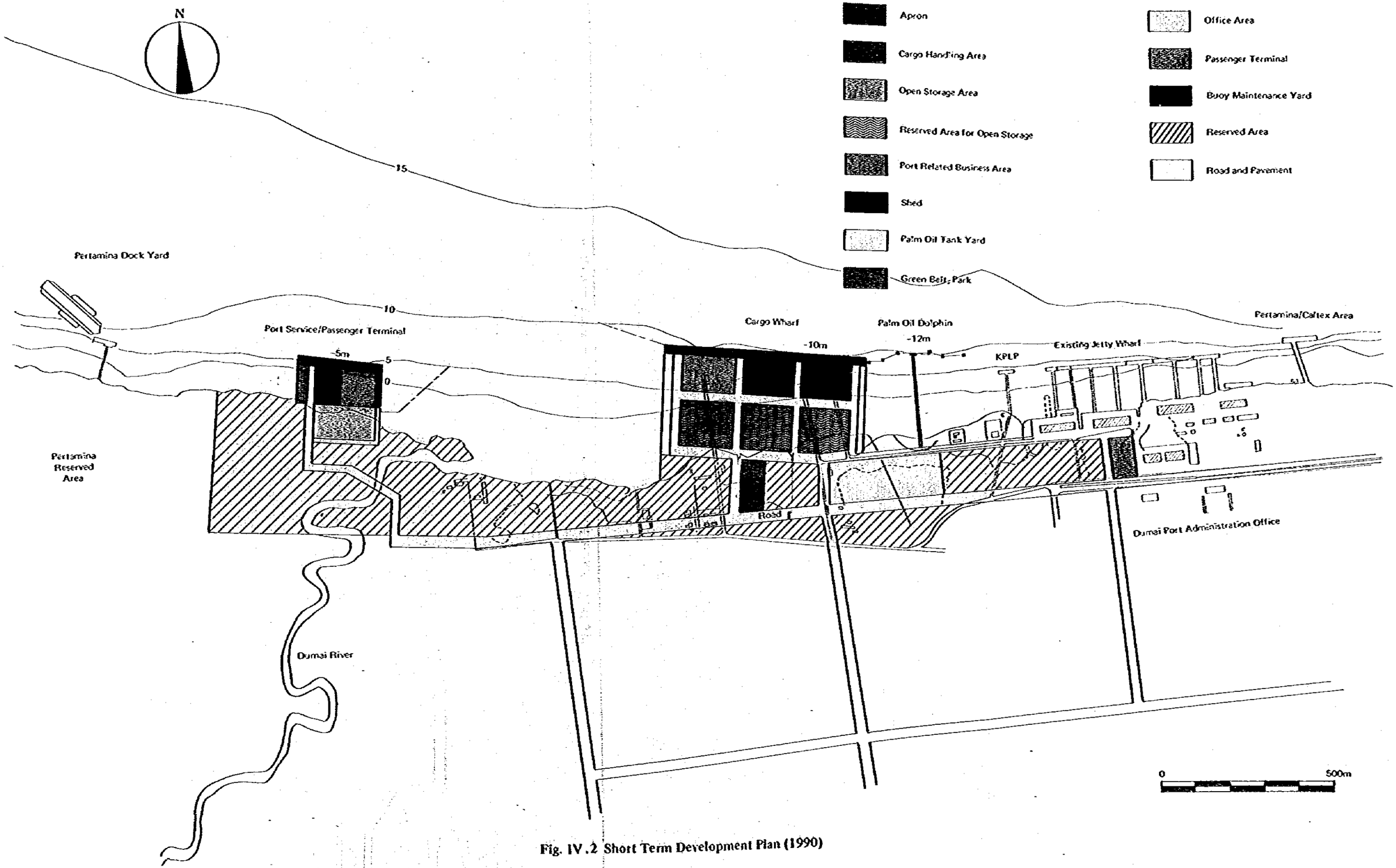


Fig. IV.2 Short Term Development Plan (1990)

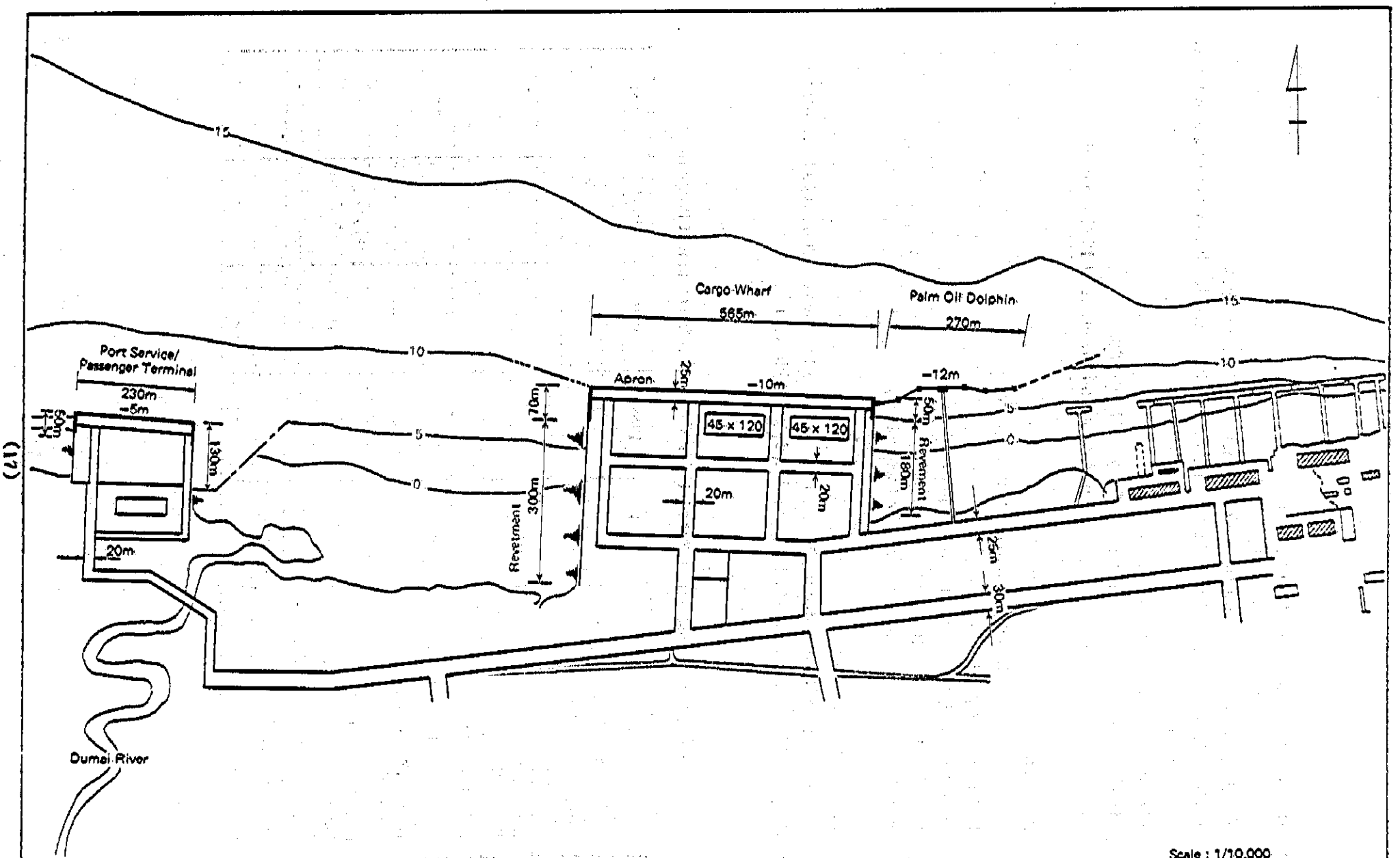


Fig. IV. 3 Plan of Port Facilities for Short Term Development Program

V. Design, Construction and Cost Estimate

1. Fundamental Conditions for Design, Construction and Cost Estimate

(1) The elevation of top of the wharf is +4.5 m and the water depth in front of the wharf is −10.0 m.

(2) Reclamation is made by pump dredger.

(3) The construction period is 5 years, from 1984 to 1988.

(4) The exchange rate is 1 US$ = 680 Rp. = ¥250 and the prices of 1982 are used.

2. Structural Type of a New Wharf

Three alternative plans have been mutually compared.

(Plan A) sheet pile type quaywall

(Plan B) open-type wharf with vertical piles

(Plan C) caisson type quaywall

Plan A is adopted for reasons of cost and workability.

3. Construction Schedule

The Short Term Plan under the Master Plan targetted for the year 2000 is to be constructed by the year 1988 according to the following schedule. (Table V.1)

Table V.1 Construction Schedule for Short Term Development Program

Item	1984	1985	1986	1987	1988
Dredging, Sand Pile, Replacing					
−10 m Wharf, −5 m Wharf, Palm Oil Dolphin					
Revetment Reclamation					
Road, Pavement					
Transit Shed, Building					
Drainage, Water Supply, Electric Supply					
Cargo Handling Equipment Navigation Aids					
Mobilization/Demobilization					
Engineering Study					
Supervision					

4. Construction Cost

The project cost under the Master Plan has been estimated at about 124,938 thousand US$ (Table V.2), of which 55,820 thousand US$ is appropriated for the construction of the Short Term Development Plan targetted for the year 1988 (Table V.3)

Table V.2 Construction Cost of Master Plan

Item	Description	Unit	Quantity	Unit Price (US$)	Amount ('000 US$)
1	−10.0 m Wharf	m	1,190	18,710	22,265
2	−8.5 m Wharf	m	280	11,817	3,309
3	−5.0 m Wharf	m	440	6,022	2,650
4	Palm Oil Dolphin (−12 m)	sum	1		2,540
5	Palm Oil Dolphin (−10 m)	sum	1		2,209
6	Small Basin Jetty	sum	1		1,493
7	Dredging	m^3	1,200,000	2.1	2,520
8	Sand Pile	m^2	193,000	16.5	3,185
9	Replacing	m^2	766,000	2.5	1,915
10	Reclamation	m^3	2,820,000	2.5	7,050
11	Revetment	m	1,840	1,986	3,654
12	Road	m^2	255,000	36	9,180
13	Pavement	m^2	320,000	30	9,600
14	Pavement (Container)	m^2	52,000	48	2,496
15	Green Area	m^2	49,000	6.5	319
16	Transit Shed	m^2	22,800	326	7,433
17	Building	m^2	6,000	343	2,058
18	Drainage	sum	1		955
19	Water Supply	sum	1		1,142
20	Electric Supply	sum	1		1,123
21	Cargo Handling Equipment	sum	1		580
22	Navigation Aids	sum	1		102
23	Port Service Vessels	sum	1		1,162
24	Others	sum	1		1,360
25	Mobilization/Demobilization	sum	1		11,821
	Total				102,121
	Sales Tax (5%)				2,170
	Physical Contingency (15%)				15,643
	Engineering Fee				5,004
	Grand Total				124,938

Table V.3 Construction Cost of Short Term Development Program

Item	Description	Unit	Quantity	Amount ('000 US$)		
				Local Currency	Foreign Currency	Total
1	Dredging	m^3	600,000	420	840	1,260
2	Sand Pile	m^3	78,000	234	1,053	1,287
3	Replacing	m^3	410,000	205	820	1,025
4	-10 m Wharf	m	685	5,034	7,782	12,816
5	-5 m Wharf	m	410	915	1,554	2,469
6	Palm Oil Dolphin	sum	1	1,060	1,480	2,540
7	Revetment	m	554	772	328	1,100
8	Reclamation	m^3	1,350,000	675	2,700	3,375
9	Road	m^2	143,530	4,650	517	5,167
10	Pavement	m^2	61,750	1,173	679	1,852
11	Transit Shed	m^2	10,800	1,069	2,451	3,520
12	Building	m^2	4,900	470	1,210	1,680
13	Drainage	sum	1	415	0	415
14	Water Supply	sum	1	175	367	542
15	Electric Supply	sum	1	202	276	478
16	Cargo Handling Equipment	sum	1	0	120	120
17	Navigation Aids	sum	1	5	39	44
18	Others	sum	1	151	319	470
19	Mobilization/Demobilization	sum	1	1,532	3,939	5,471
	Total			19,157	26,474	45,631
20	Sales Tax (5%)			957	0	957
21	Physical Contingency (15%)			3,017	3,971	6,988
22	Engineering Study	sum	1	376	690	1,066
23	Supervision	sum	1	234	944	1,178
	Grand Total			23,741	32,079	55,820
				(42.5%)	(57.5%)	(100%)

VI. Economic Analysis

1. Economic analysis of this project has assumed that construction costs will amount to US$54,863,000, and that the benefits listed below will accrue. Economic feasibility of the project is evaluated by means of Internal Rate of Return (IRR) and Cost Benefit Ratio (B/C Ratio).

2. The following benefits are expected from this project:
   1) Reduced waiting time and staying costs for ships
   2) Reduced cargo handling costs through improved port efficiency
   3) Stimulus to regional development
   4) Increased employment opportunities and higher regional incomes

3. Evaluation of the project

Incorporating items 1) and 2) listed above, the IRR and B/C Ratio for this project have been calculated at respectively 15.0% (15.8% by shadow pricing) and 1.21 (1.27 by shadow pricing) at 12% of discounted rate, figures which indicate project feasibility. Further, the effects of the project are not limited merely to the quantitative effects measured in the IRR and the B/C Ratio. The project will benefit the national economy of the Republic of Indonesia in various ways and aid regional development in such fields as agricultural production. From a purely quantitative point of view, as well as from a broader perspective, this project is considered to be fully feasible.

VII. Financial Analysis

1. The purpose of financial analysis is to ascertain the impact of investments under the present project, on the condition of financial control by port management bodies or to determine whether financial healthiness can be ensured.

Financial analysis of the Port of Dumai will be based on the following premises:

(1) Its revenue will be calculated based on the current port tariff rates authorized by DGSC.

(2) Its accounting will be according to the business accounting system.

(3) The funds necessary to execute this project are to be raised as follows:

i) Domestic currency portion (42.5%): National Development Fund without interest.

ii) Foreign currency portion (57.5%): Loans from a foreign country under the following loan conditions:

Rate of interest	3.5% per annum.
Grace period	10 years
Prepayment period	30 years
Term of loan	40 years

(4) Surplus funds

After depreciation and payment of interest, 45% of the Net Profit will be deducted for tax and 30.3% for payment to the National Development Fund – (Net profit 100% – Tax 45%) x 55%. The surplus is to be retained as internal reserve.

2. Financial ratio analysis is as follows.

Financial Ratios (%)

Item	Annual average from 1994 to 1998
(1) Working Ratio	45
(2) Operating Ratio	88
(3) Return on Net Fixed Assets	4
(4) Interest Earned Ratio	218
(5) Debt Service Coverage	263

3. The result obtained for the FRR is 8.90 percent.

4. As shown by the foregoing financial ratios, based on data from the three financial statements and the FRR, there is no problem in balancing revenues and expenses or in fund raising. That is, with the new investment executed, the financial healthiness of the port is easily secured and, with financial viability clearly demonstrated.

OUTLINE OF THE STUDY

OUTLINE OF THE STUDY

1. Background

In the hinterland surrounding Dumai Port in Riau Province, largescale regional development plans for agricultural and forestry products, transmigration, etc. are now being worked out. Implementation of these plans is expected to bring considerable change to the present economic structure of Riau Province, and to the activities of Dumai Port. Of the eight provinces in Sumatra, Riau Province lags considerably behind the others in terms of its socio-economic situation. This is due mainly to the geographical disadvantage of its low lying swampy land, which covers large parts of the eastern half of Sumatra.

The major product in Riau Province is and will very likely continue to be crude oil, which makes up an overwhelming share of the cargo handled at Dumai Port. Compared to crude oil, the other dry cargo at Dumai Port are considerably smaller in volume. Reflecting this composition of port cargo, Dumai Port has two small wharves for handling general cargo, and four wharves for crude oil shipment.

In the next few years, however, increasing exports of agricultural and forestry products generated in the hinterland will necessiate expansion of the Dumai Port capacity. These are the background and primary considerations motivating the present feasibility study for the Dumai Port Development Project.

Under these circumstances, the Government of the Republic of Indonesia has requested the Government of Japan to conduct a study on the development project of Dumai Port. The Japan International Cooperation Agency organized a preliminary study team and dispatched it to the Republic of Indonesia in August 1982, followed in October by the Study Team.

2. Objectives

The Study aims at formulating the Master Plan for the Development Project of Dumai Port with the target year around 2000 as well as at conducting a feasibility study on the Short Term Plan targetted for 1990.

3. Major Study Items

The main contents of the study are as follows:

1) Technical Investigation of Natural Conditions
2) Port Activities Forecast
3) Port and Harbour Planning
4) Design, Construction Method and Cost Estimate
5) Port Management and Operation
6) Economic Analysis
7) Financial Analysis

4. Participants in the Study

1) Study Team

Project Manager	Mr. Masao OHNO	The Overseas Coastal Area Development Institute of Japan
Port Planning	Mr. Hiroshi SATO	The Overseas Coastal Area Development Institute of Japan
Cargo and Traffic Forecast, Economic Analysis	Mr. Hisanori KATO	The Overseas Coastal Area Development Institute of Japan
Cargo and Traffic Forecast	Mr. Tadahiko YAGUYU	The Overseas Coastal Area Development Institute of Japan
Structural Design	Mr. Mikio UEMATSU	The Overseas Coastal Area Development Institute of Japan
Construction Plan and Cost Estimate	Mr. Masayuki FUJIKI	The Overseas Coastal Area Development Institute of Japan
Port Management and Operation, and Financial Analysis	Mr. Osamu TAKEDA	The Overseas Coastal Area Development Institute of Japan
Natural Condition Analysis, Topographic and Hydrographic Investigation	Mr. Yukio KOGA	The Overseas Coastal Area Development Institute of Japan
Soil Investigation	Mr. Makoto YAMAMOTO	The Overseas Coastal Area Development Institute of Japan
Coordinator	Mr. Susumu NARUSE	The Japan International Cooperation Agency

2) Counterparts

Drs. Mugiatno	DGSC	Economist
Ir. Suwandi Saputro	DGSC	Civil Engineer
Ir. Winarso Trisalyono	DGSC	Civil Engineer

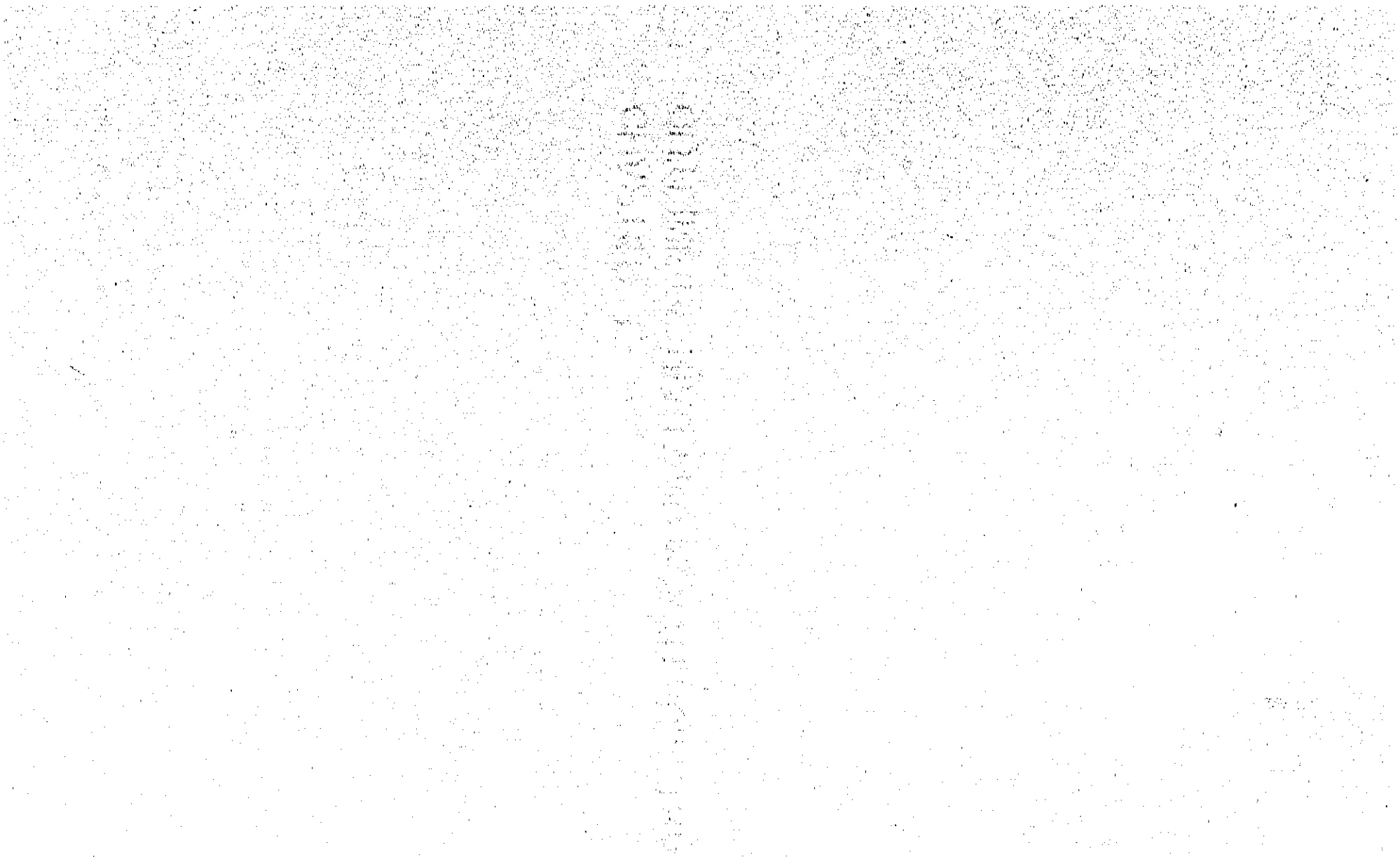
5. Organizations Visited by the Team

The methods of investigation can be generally classified into three types: interviews, field observations and collection of informative materials. For these purposes the Study Team has visited the following cities, authorities and organizations, listed below:

City	Authorities and Organizations
Jakarta	Sea Communications, Transport and Communications Department
	Central Bureau fo Statistics
	Team Khusus Proyek Kerjasama
	P.T. Pusri
	Departemen Pertanian
	Jakarta Lloyd
	Tanjung Priok Port Administration
	Pertamina Head Office
	Advisory Team Japan
	Tokyo Senpaku Kaisha, LTD
	Bahtera Adhiguna Shipping Company
	Bimoli Shipping Company
Dumai	Dumai Port Administration
	Second Maritime Bureau (Kanwil II)
	P.T. Samudera Indonesia
	Kepala Cabang Dinas Kehutanan/KPH Dumai
	Dumai City Office
	Pertamira Dumai Office
	Caltex Dumai Office
	Trade Office
	Land Transport Office
	PLN (Electric Company)
	Forest Office
Pekanbaru	Pekanbaru Port Administration
	BAPPEDA, Ridu
	Kantol Cipta Karya
	Dinas Perkebunan Propinsi Daerah Tingkat
	Kapala Cabang PTP V Riau
	Kepala PLN Exploitasi III Cabang
	Kantor Sub P4S
	Lalu Lintas Angkutan Jalan Raya Daerah Tingkat I Riau
Padang	P.T. Semen Padang
	Teluk Bayur Port Administration
Medan	First Maritime Bureau (Kanwil I)
	PTP-V Office
	Belawan Port Administration
	P.T. Pupuk Sriwidiaja

	P.T. Indonesia Asahan Aluminium Smelter Construction Office
	Tanjung Balai Port Administration
Rengat	Rengat Port Administration
	Indragiri Hulu Office
	PTP-IV Rengat Office
	PABRIC KELAPA SAWAT (Palm Oil Company)
	P.T. Tunggal Perkasa Plantations

CHAPTER I.
OUTLINE OF RIAU AND NORTH SUMATRA



CHAPTER 1. OUTLINE OF RIAU AND NORTH SUMATRA

The provinces of Riau and North Sumatra are situated in the central part of Sumatra Island, as shown in Fig. 1.1.1, 1.1.2. Riau Province has an area are of 94.5 thousand km^2 and a population density of 23 persons per km^2 (Table 1.1.1). The local administrative system in Riau, like other provinces in Indonesia, consists mainly of the Kotamadya (cities), Pekanbaru, Kota ADM Dumai, 5 Kabupatens, 69 Kecamatans and 1,110 Desa (Fig. 1.1.3, 1.1.4).

North Sumatra Province has an area of 70.7 km^2 and its population density is 118 persons per km^2. The local administrative system consists of 6 Kotamadya and 11 Kabupatens, 182 Kecamatan and 5,636 Desa (Fig. 1.1.5).

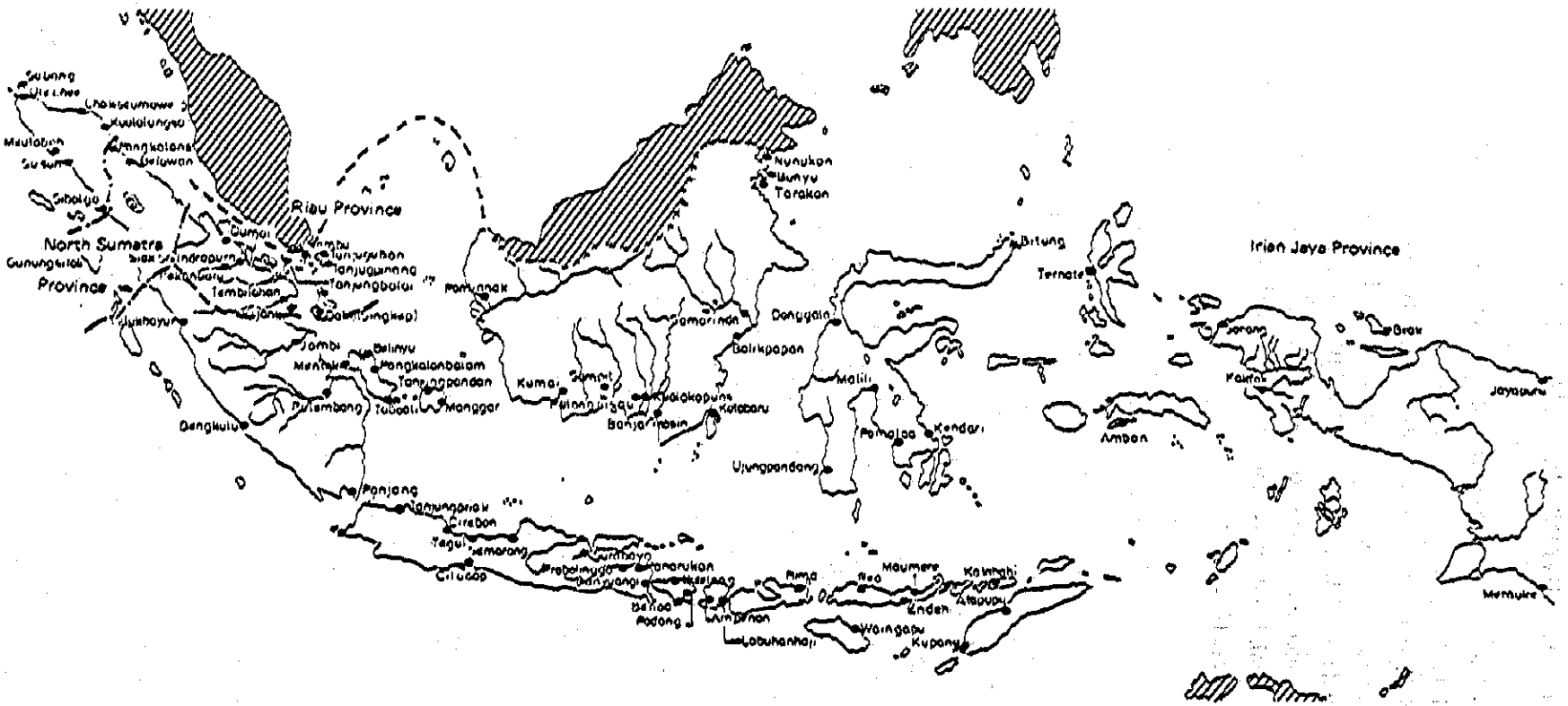


Fig. 1.1.1 Location of Riau and North Sumatra

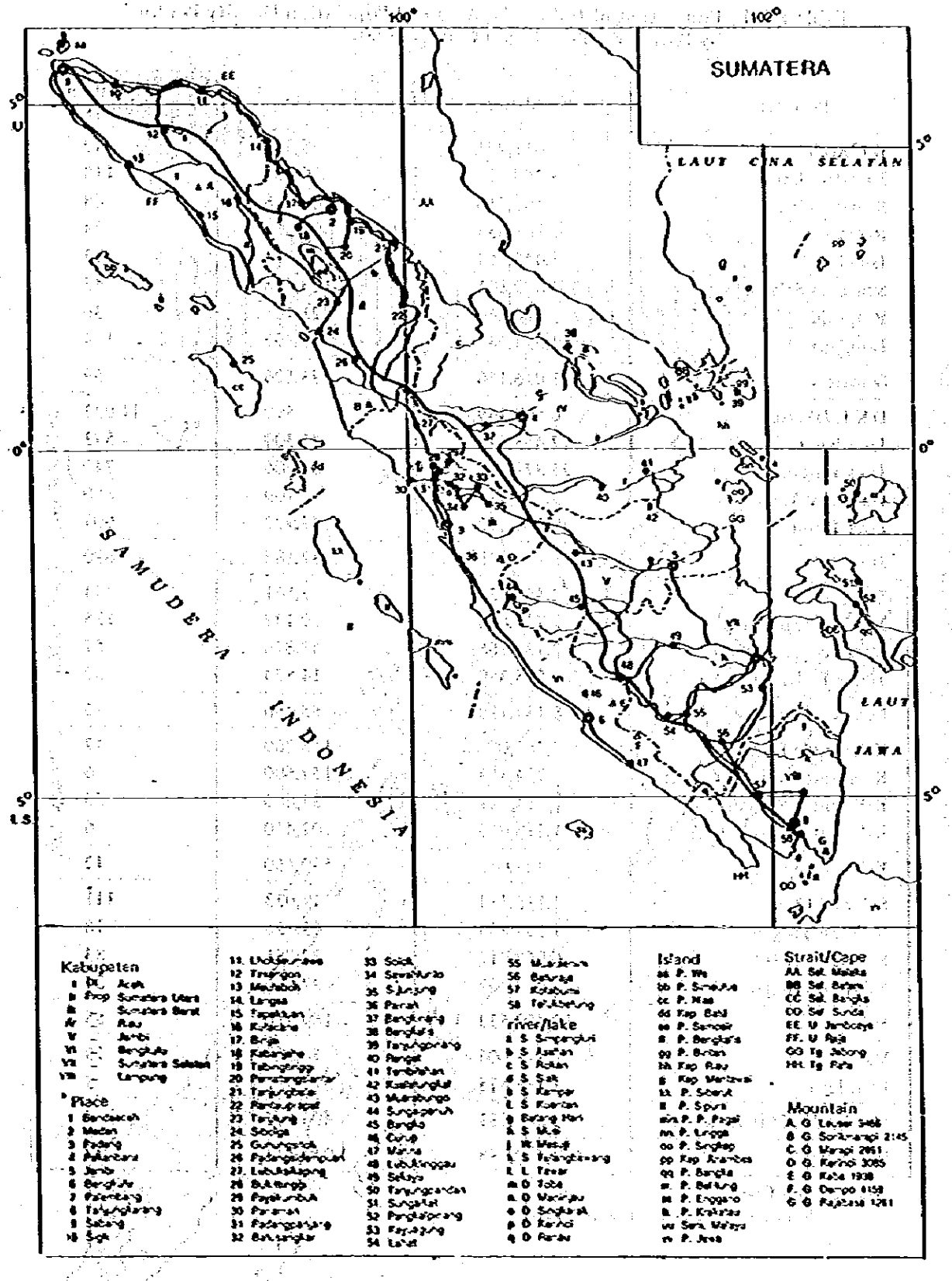


Fig. 1.1.2 Topographical Conditions in Sumatra

Table 1.1.1 Population of Indonesia, Area and Population Density Per-km² by Provinces (Population Census 1980)

Province	Population	Area km²	Population Density /km²
D.I. Aceh	2,611,271	55,398	47
Sumatera Utara	8,360,894	70,787	118
Sumatera Barat	3,406,816	49,778	68
Riau	2,168,535	94,562	23
Jambi	1,445,994	44,924	32
Sumatera Selatan	4,692,801	103,688	45
Bengkulu	768,064	21,168	36
Lampung	4,624,785	33,307	139
Sumatera	28,016,160	473,606	59
D.K.I. Jakarta	6,503,449	590	11,023
Jawa Barat	27,453,525	46,300	593
Jawa Tengah	25,372,859	34,206	742
D.I. Yogyakarta	2,750,813	3,169	868
Jawa Timur	29,188,852	47,922	609
Jawa	91,269,528	132,187	690
Bali	2,469,930	5,561	444
Nusa Tenggara Barat	2,724,664	20,177	135
Nusa Tenggara Timur	2,737,166	47,876	57
Timor Timur	555,350	14,874	37
Nusa Tenggara	8,487,110	88,480	96
Kalimantan Barat	2,486,068	146,760	17
Kalimantan Tengah	954,353	152,600	6
Kalimantan Selatan	2,064,649	37,660	55
Kalimantan Timur	1,218,016	202,440	6
Kalimantan	6,723,086	539,460	12
Sulawesi Utara	2,115,384	19,023	111
Sulawesi Tengah	1,289,635	69,726	18
Sulawesi Selatan	6,062,212	72,781	83
Sulawesi Tenggara	942,302	27,686	34
Sulawesi	10,409,533	189,216	55
Maluku	1,411,006	74,505	19
Irian Jaya	1,173,875	421,981	3
Maluku dan Irian Jaya	2,584,881	496,486	5
Indonesia	147,490,298	1,919,443	77

Source: BPS/CBS
Riau Dalam Angka in Figures, 1981.

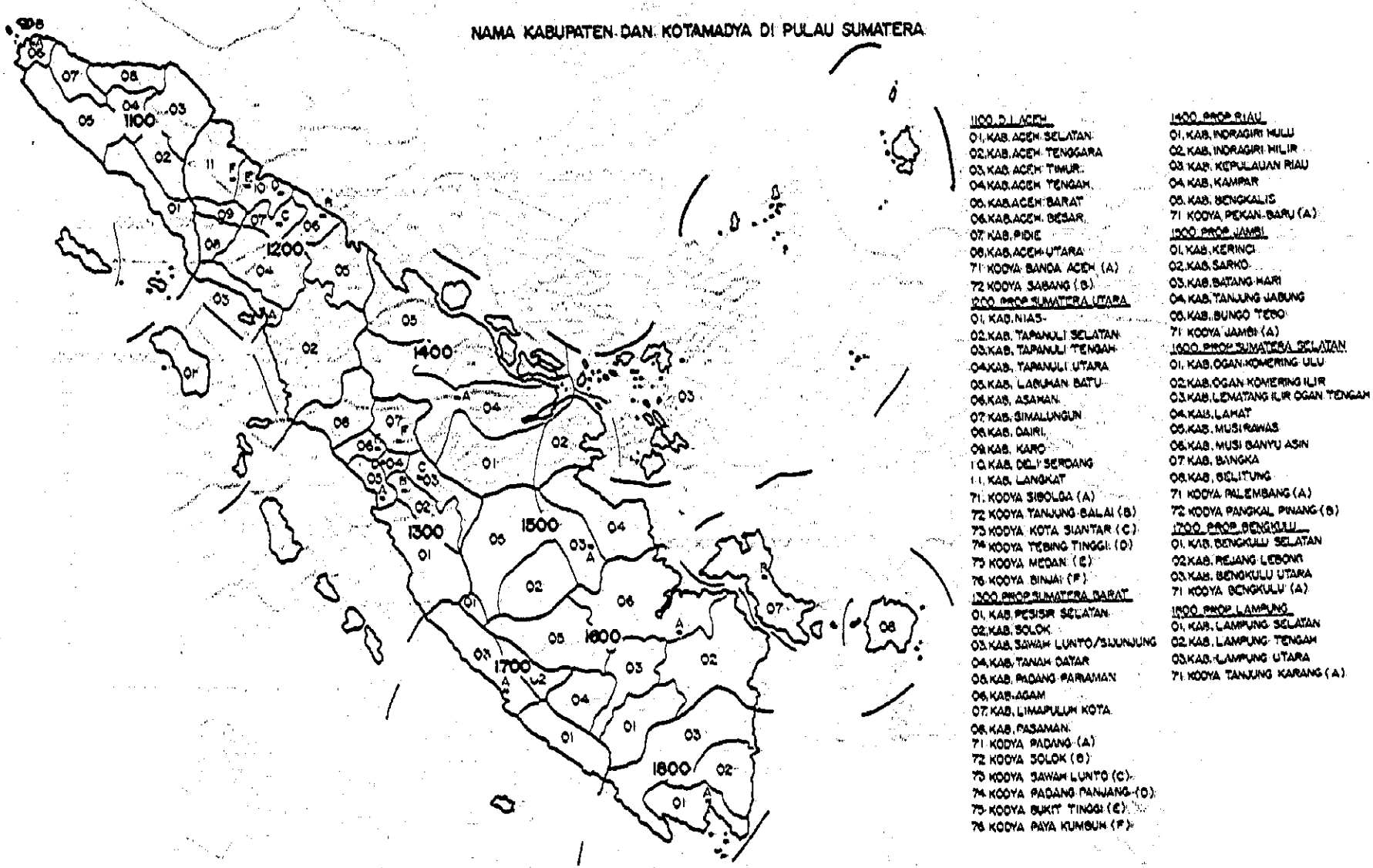


Fig. 1-1-3 Name of Kabupaten and Kotamadya in Sumatra Island

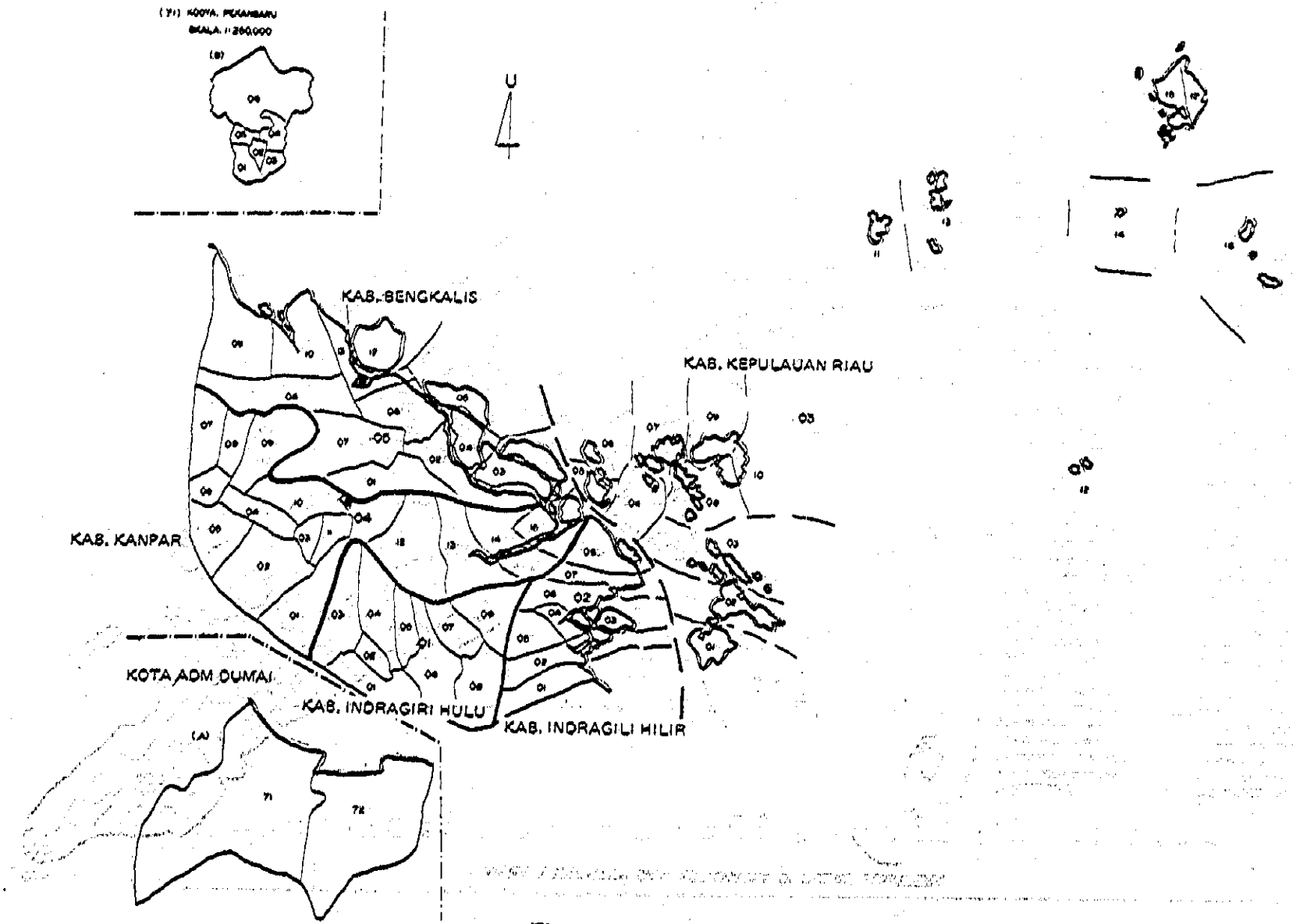


Fig. 1.1.4 Administrative Area of Riau

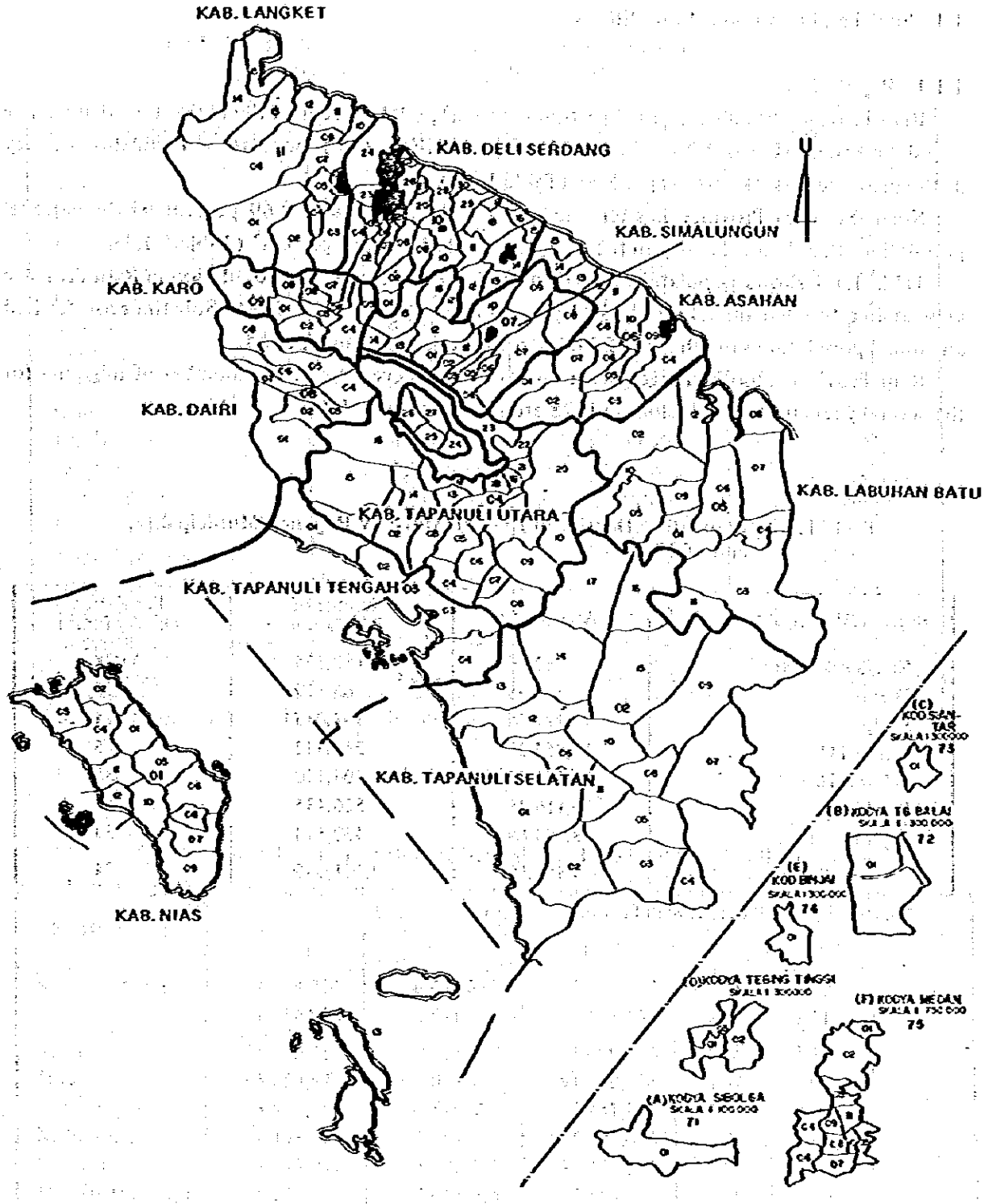


Fig. 1.1.5 Administrative Area of North Sumatra

1.1. Social and Economical Conditions

1.1.1. Population

Riau Province has an area of 94.5 thousand km², 4.93 percent of the national land area. The population in 1981 was 2.2 million, 1.47 percent of the national population. Population density in the province was 24 persons per km² (Table 1.1.2).

North Sumatra Province has an area of 72.9 thousand km², 3.69 percent of the national population. Population density in the province was 115 persons per km² (Table 1.1.3).

Table 1.1.4 shows population growth over the past decade. The Population in Riau Province grew at an estimated annual rate of 3.11 percent from 1971 ~ 1980. North Sumatra Province had an annual population growth rate of 2.60 percent during the same period.

Riau Province absorbed migrants from Jave almost every year. The number of migrants for the several years up to and including 1978 are shown in Table 1.1.5.

Table 1.1.2 Population Density in Riau Province by Regency/Municipality, end of 1981

Regency/Munkipality	Area (km²)	Number of Population	Population Density (km²)
Kodya Pekanbaru	62.96	189,365	3,008
Dumai	530.38	66,879	126
Kampar	28,291.86	394,045	14
Indragiri Hulu	15,854.29	245,322	15
Indragiri Hilir	11,605.97	408,520	35
Bengkalis	30,116.45	526,435	17
Kepulauan Riau	8,099.69	430,514	53
Total	94,561.60	2,261,080	24

Source: Statistical Office, Riau Province.

Table 1.1.3 Population Density in North Sumatra Province by Regency/Municipality, 1980

Regency/Municipality	Area (km^2)	Number of Population	Population Density (km^2)
Nias	5,554	468,021	84
Tapanuli Selatan	16,985	754,961	44
Tapanuli Tengah	2,300	167,161	73
Tapanuli Utara	13,795	682,412	49
Labuhan Batu	6,970	547,171	79
Asahan	4,681	774,980	166
Simalungun	4,199	759,024	181
Dairi	3,442	241,785	70
Karo	2,126	219,201	103
Deli Serdang	6,211	1,241,057	200
Langkat	6,309	701,380	111
Kodya Sibolga	11	59,466	5,406
Kodya Tg. Balai	2	41,776	20,888
Kodya Pem. Siantar	12	150,296	12,525
Kodya Tebing Tinggi	31	92,068	2,970
Kodya Medan	265	1,373,747	5,184
Kodya Binjai	20	76,444	3,822
Total	72,913	8,350,950	115

Source: Statistical Office, Province of North Sumatra.

Table 1.1.4 Population Growth 1961/1971, 1971/1980

Province/Island	Population Census			Growth rate (%)		Notes
	1961	1971	1980	61/71	71/80	
Sumatera Utara	4,964,734	6,621,831	8,360,894	2.95	2.60	
Riau	1,234,984	1,641,545	2,168,535	2.92	3.11	
Sumatera	15,739,363	20,808,148	28,016,160	2.86	3.32	
Jawa	63,059,575	76,086,327	91,269,528	1.91	2.02	
Nusa Tenggara	5,557,656	6,619,074	8,487,110	1.78	2.01	
Kalimantan	4,101,475	5,154,774	6,723,086	2.34	2.96	
Sulawesi	7,079,349	8,526,901	10,409,533	1.90	2.22	
Maluku, Irian Jaya	1,547,930	2,013,005	2,584,881	2.69	2.79	
Indonesia	97,085,348	119,208,229	147,490,298	2.10	2.32[1]	

Source: Statistical Yearbook of Indonesia.
1) Excluding Timor-Timur.

Table 1.1.5 Number of Transmigrations to Riau Province 1971/1972 – 1981/1982

Year	Families	Adult			Children			Grand Total
		Male	Female	Total	Male	Female	Total	
1971/1972	–	–	–	–	–	–	–	–
1972/1973	150	224	212	456	218	81	299	735
1973/1974	150	183	172	355	201	178	379	734
1974/1975	150	165	135	300	155	160	315	615
1975/1976	50	60	62	122	49	45	94	216
1976/1977	–	–	–	–	–	–	–	–
1977/1978	500	563	529	1,092	449	478	927	2,019
1978/1979	1,347	1,592	1,467	3,059	1,393	1,288	2,681	5,740
1979/1980	5,864	6,983	6,598	13,536	5,662	5,286	10,948	24,484
1980/1981	3,136	3,753	3,545	7,298	3,081	2,418	5,499	12,797
1981/1982	8,757	9,792	9,362	19,154	8,928	8,361	17,289	36,443

Source: Rep. Office of Dit. Gen. Transportation, Riau Province.

1.1.2. GRDP in Riau and North Sumatra Province

As shown in Tables 1.1.7 and 1.1.8, the GRDP of Riau Province is considerably higher than that of North Sumatra Province. This is due to the high GRDP in the petroleum sector. In 1980, excluding the petroleum sector, the agricultural sector represented, 39.0 percent and 29.2 percent of the GRDP of Riau and North Sumatra Provinces respectively. Thus, it can be said that the major industry in both provinces is agriculture.

As shown in Table 1.1.6, the Per Capita GRDP for both provinces was nearly the same in 1979, if the petrolium sector is excluded.

Table 1.1.6 Per Capita GRDP (1975 Constant Prices)

(Rupiah)

	1975	1977	1979	1980
Riau	927,660 (83,122)	862,476 (88,747)	758,279 (92,969)	730,243 (98,334)
Sumatra Utara	95,581	103,647	118,135	–

Source: Riau Dalam Angka in Figures, 1981.
Statistik Sumatera Utara Dalam Angka Tahun 1980.
Note: Figs. in ( ) shows values excluding the petrolium sector.

Table 1.1.7 Gross Domestic Regional Product of Riau Province at Constant 1975 Market Prices by Industrial Origin

(Million Rupiah)

Industrial Origin	1975	1976	1977	1978	1979	1980
Agriculture	51,158.13	55,824.98	60,270.52	60,182.04	60,992.04	67,793.19
Minning and Quarrying	1,597,792.59	1,611,483.71	1,550,045.61	1,427,770.70	1,409,413.25	1,376,732.94
Manufacturing Industries	23,566.50	24,502.20	28,122.30	30,150.76	25,396.20	31,024.43
Electricity and Water Supply	38,430.63	36,430.63	42,744.75	33,708.76	50,571.40	52,188.50
Construction	4,020.55	4,154.43	4,200.67	4,318.57	4,468.34	4,605.45
Trade, Hotel and Restaurant	61,659.12	63,126.87	70,453.86	68,391.64	80,949.40	84,987.87
Transport and Communication	21,537.28	23,151.32	25,317.46	27,947.90	29,450.28	33,485.78
Banking and Other Financial Intermediaries	1,344.63	1,372.10	1,220.54	1,357.45	1,834.13	2,430.88
Ownership Dwelling	14,827.87	15,290.50	15,661.20	15,856.92	16,423.35	17,845.34
Public Administration	6,998.13	6,840.31	7,858.84	11,522.70	11,740.49	12,488.75
Services	1,776.20	1,954.77	2,316.00	2,724.25	3,131.16	3,190.99
Gross Domestic Regional Product	1,800,083.78	1,819,974.57	1,780,482.69	1,654,248.93	1,669,484.90	1,656,540.25

Source: Statistic Office, Riau Province.

Table 1.1.8 Gross Domestic Regional Product of North Sumatra Province at Constant 1975 Market Prices by Industrial Origin

(Million Rupiah)

Industrial Origin	1975	1976	1977	1978	1979
Agriculture	278,135.42	307,919.78	322,025.96	318,066.87	372,265.63
Minning and Quarrying	80,402.02	91,309.81	64,133.35	99,647.83	97,669.16
Manufacturing Industries	41,836.73	46,020.02	51,753.65	59,261.23	61,433.57
Electricity and Water Supply	2,995.37	3,550.14	4,114.94	5,210.14	5,708.76
Construction	19,667.37	19,907.96	50,264.61	59,452.02	60,620.77
Trade, Hotel and Restaurant	86,908.46	88,760.32	99,458.95	105,320.24	116,768.81
Transport and Communication	61,939.29	66,583.74	69,485.51	78,815.38	82,437.83
Banking and Other Financial Intermediaries	9,937.01	10,527.20	10,205.82	14,912.24	14,668.62
Ownership Dwelling	43,337.35	44,494.12	45,681.69	46,901.08	48,152.95
Public Administration	46,148.23	53,834.05	54,544.90	61,321.92	67,323.02
Services	17,004.12	20,965.21	22,702.13	24,433.11	25,424.25
Gross Domestic Regional Product	688,347.37	753,872.45	794,371.51	873,332.06	953,473.37

Source: Statistic Office of North Sumatra Province.

Table 1.1.9 Gross Domestic Regional Product of Riau Province at Constant 1975 Market Prices by Industrial Origin (Excluded Petroleum)

(Million Rupiah)

Industrial Origin	1975	1976	1977	1978	1979	1980
Agriculture	51,158.13	55,824.98	60,270.52	60,182.04	60,992.04	67,793.19
Minning and Quarrying	13,154.00	12,089.66	12,761.34	12,469.49	14,222.51	15,154.67
Manufacturing Industries	8,821.99	8,508.86	9,691.67	10,135.26	10,749.90	12,528.46
Electricity and Water Supply	253.10	345.35	393.24	468.00	556.06	690.56
Construction	4,020.55	4,154.43	4,200.67	4,318.57	4,468.34	4,605.45
Trade, Hotel and Restaurant	43,821.30	46,523.17	51,158.21	54,050.42	58,085.29	61,489.43
Transport and Communication	21,537.28	23,151.32	25,317.46	27,947.90	29,405.28	33,485.78
Banking and Other Financial Intermediaries	1,344.63	1,372.10	1,220.54	1,357.45	1,834.13	2,430.88
Ownership Dwelling	14,827.87	15,290.50	15,661.20	15,856.92	16,423.35	17,845.34
Public Administration	6,998.13	6,840.31	7,858.84	11,522.70	11,740.49	12,488.75
Services	1,776.20	1,954.77	2,316.00	2,724.25	3,131.16	3,290.99
Gross Domestic Regional Product	167,713.26	176,055.45	190,849.69	201,033.00	211,608.55	231,803.50

Source: Statistic Office, Riau Province.

Table 1.1.10 Index Number of Gross Domestic Regional Product of Riau Province at Constant 1975 Market Prices by Industrial Origin (Excluded Petroleum)

Industrial Origin	1975	1976	1977	1978	1979	1980
Agriculture	30.51	31.71	31.58	29.94	28.82	29.23
Minning and Quarrying	7.84	6.87	6.69	6.20	6.72	6.54
Manufacturing Industries	5.26	4.83	5.08	5.04	5.08	5.40
Electricity and Water Supply	0.15	0.20	0.21	0.23	0.26	0.30
Construction	2.40	2.36	2.20	2.15	2.11	1.99
Trade, Hotel and Restaurant	26.12	26.42	26.80	26.89	27.45	26.53
Transport and Communication	12.85	13.15	13.26	13.90	13.90	14.45
Banking and Other Financial Intermediaries	0.80	0.78	0.64	0.68	0.87	1.05
Ownership of Dwelling	8.84	8.69	8.21	7.89	7.76	7.70
Public Administration	4.17	3.88	4.12	5.73	5.55	5.39
Services	1.06	1.11	1.21	1.35	1.48	1.42
Gross Domestic Regional Product	100.00	100.00	100.00	100.00	100.00	100.00

Source: Statistical Office, Riau Province.

1.1.3. Main Products

1) Production of food crops

As shown in Table 1.1.11, paddy production was very high in North Sumatra Province as compared to Riau Province. The average annual growth rate in Riau Province was a low 6.9 percent (1978 – 1980).

The production of food stuffs in Riau and North Sumatra Provinces is shown by crop in Table 1.1.12.

Table 1.1.11 Harvested Area and Paddy Production in Riau and North Sumatra Province

	Province	1978	1979	1980
		Area (ha)	Area (ha)	Area (ha)
		Production (M.T)	Production (M.T)	Production (M.T)
Wet Paddy Land	Riau	86,377 196,254	83,889 176,012	87,084 213,443
	Sumatera Utara	426,539 1,349,125	423,502 1,346,208	417,111 1,297,215
Dry Paddy Land	Riau	46,772 45,135	40,733 48,920	47,494 62,597
	Sumatera Utara	103,903 165,933	109,733 181,389	115,086 183,447
Total	Riau	133,149 241,389	124,622 224,932	134,578 276,040
	Sumatera Utara	530,442 1,515,058	533,235 1,527,597	532,197 1,480,662

Source: Statistical Yearbook of Indonesia, 1980/1981.
1) Dry unhusked rice.

Table 1.1.12 Production of Food Stuffs by Crop Item in Riau and North Sumatra Province

(M. ton)

Crops	Province	1978	1979	1980
Maize	Riau	8,034	6,028	6,918
	Sumatera Utara	47,566	54,237	52,272
Cassava	Riau	89,590	39,686	48,499
	Sumatera Utara	287,700	296,048	296,559
Potatoes	Riau	11,302	12,652	12,724
	Sumatera Utara	183,826	197,192	200,757
Peanuts	Riau	504	492	640
	Sumatera Utara	14,354	12,890	13,521
Soya beans	Riau	199	198	168
	Sumatera Utara	7,865	10,013	5,838

Source: Statistical Yearbook of Indonesia, 1980/1981.

2) Estate crop production

Estate crop production is shown in Table 1.1.13. Rubber and Coconut are very important crops in both provinces. Production of these in Riau Province in 1981 was 68 thousand tons and 101 thousand tons respectively, while production in North Sumatra Province in 1979 was 94 thousand tons and 59 thousand tons respectively.

Table 1.1.13 Production of Small Holders & Estate Crop

(ton)

Crops	Province	1976	1977	1978	1979	1980	1981
Rubber	Riau	69,602	63,610	64,693	86,606	66,989	68,009
	Sumatera Utara	68,073	91,692	95,887	94,735	–	–
Coconut	Riau	87,195	95,433	97,707	100,255	101,401	101,114
	Sumatera Utara	57,488	57,302	59,058	59,295	–	–
Clove	Riau	543	400	295	226	498	498
	Sumatera Utara	869	1,460	1,398	1,415	–	–
Coffee	Riau	468	302	795	334	704	759
	Sumatera Utara	5,252	6,709	7,807	9,464	—	–
Sugar Cane	Riau	623	294	294	441	251	251
	Sumatera Utara	200	210	222	65	–	–
Benzoin	Riau	953	423	1,181	1,298	1,257	1,259
	Sumatera Utara	3,156	2,997	2,902	4,551	–	–

Source: Riau Dalam Angka/in Figures, 1981.
Statistik Sumatera Utara Dalam Angka Tahun 1980.

3) Forestry

As shown in Table 1.1.14, forestry is an important industry in both provinces. Production of logs and sawn wood in Riau Province was 1.47 million m^3 and 207 thousand m^3 respectively in 1980. The average annual growth rate for sawn wood in Riau was a high 95.9 percent (1977 ~ 1980), as shown in Table 1.1.15.

The export of principal forest products in shown in Table 1.1.16. The average annual growth rate for logs and sawn wood in Riau Province was 14.4 percent and 36.3 percent respectively (1978 ~ 1981).

Table 1.1.14 Forest Area by Function, 1980

(1,000 ha)

	Total Area	Protected Forest	Production Forest	Nature Conservation	Reserved Forest
Riau	6,600	376	6,078	146	–
Sumatera Utara	4,350	1,140	1,261	254	1,695
Sumatera	28,420	4,087	18,491	2,680	3,162

Source: Statistical Yearbook of Indonesia 1980/1981.

Table 1.1.15 Principal Forest Production in Riau Province

(M3)

	1977	1978	1979	1980
Logs	1,500,483	1,070,962	1,799,944	1,474,509
Sawn Wood	27,625	95,518	200,523	207,763

Source: Forestry Service, Riau Province.

Table 1.1.16 Export of Principal Forest Products

	Province	Logs (M3)	Sawn Wood (M3)
1978/1979	Riau	778,281	48,262
	Sumatra Utara	446,537	38,979
1979/1980	Riau	1,254,071	80,402
	Sumatra Utara	669,841	75,271
1980/1981	Riau	1,019,999	89,787
	Sumatra Utara	398,057	57,901

Source: Forestry Service Riau Province
Statistik Sumatera Utara Dalam Angka Tahun 1980.

4) Fishery

As shown in the Table 1.1.17, the amount of fish production in both provinces was approximately equal. Fishing is important to Sumatra as a whole, as Sumatra's fishing production amounts to 31.3 percent of the national total.

Riau and North Sumatra Provinces comprise 26.9 percent and 30 percent of Sumatran fishing production.

Table 1.1.17 Fishery Production, 1978

(ton)

	Total	Marine Fishery	Inland Fishery
Riau	139,257	121,996	9,261
Sumatra Utara	155,317	141,299	14,018
Sumatra	516,171	423,637	92,534

Source: Statistical Yearbook of Indonesia, 1980/1981.

5) Livestock

Livestock population by type is shown in Table 1.1.18. As shown in Table 1.1.19, the production of meat in Riau Province is lower than in North Sumatra Provice. Riau Province imported 5.1 thousand tons of meat in 1979 from other provinces.

Table 1.1.18 Livestock Population by Kind, 1979

Province	Cattle	Buffalo	Horse	Goat	Sheep	Pig
Riau	11,006	11,929	11	62,391	1,808	29,620
Sumatera Utara	149,570	140,465	11,593	164,316	31,284	639,839

Source: Statistical Yearbook of Indonesia, 1980/1981.

Table 1.1.19 Production of Meat 1974 – 1978

(ton)

Province	Cattle	Buffalo	Horse	Goat	Sheep	Pig
Riau	225.9	859.4	–	93.5	–	1,801.6
Sumatera Utara	2,810.0	2,827.8	110.6	1,193.2	151.0	19,242.4

Source: Statistical Yearbook of Indonesia, 1980/1981.

6) Mining

The most important resources mined in Riau Province are crude oil petroleum, bauxite and tin ore. Mining is the most important industry in Riau Province, with the petroleum sector accounting for 83.1 percent of its GRDP.

Crude oil production in Riau Province totals 150 million bbls, accounting for 25.8 percent of total Indonesian production (Table 1.1.20).

Table 1.1.20 Crude Oil Production 1975 – 1979

(1,000 BLLS)

Province/Area	1975	1976	1977	1978	1979
Riau Daratan					
Minas	136,952.7	128,432.7	128,968.5	129,414.3	120,509.9
Duri	10,557.7	12,266.5	12,885.9	12,793.7	16,118.5
Pematang	15,086.0	13,799.5	11,239.6	9,330.7	7,725.0
Lirik	7,150.8	6,188.1	5,905.3	5,847.2	5,655.0
Sumatera Utara	15,785.4	17,931.0	12,455.0	19,408.7	8,654.5

Source: Statistical Yearbook of Indonesia, 1980/1981.

7) Manufacturing

The number of large and medium scale manufacturing industries in 1980 amounted to 91 units, with a total man power of 5,991 workers, as shown in Table 1.1.21.

Table 1.1.21 Number of Large and Medium Scale Manufacturing Industries, Establishment, Person Engaged in Riau Province

	1978				1980			
	Units	Production	Others	Total	Units	Production	Others	Total
Food Manufacturing	31	787	230	1,017	28	824	218	1,042
Manufacture of Wearing Apparels	2	37	6	43	2	157	20	177
Manufacture of Wood, Wood Products	32	1,635	317	1,952	39	2,029	381	2,410
Printing	2	34	20	54	3	56	29	85
Manufacture of Rubber Products	14	1,969	265	2,234	11	1,748	239	1,987
Manufacture of Bricks	4	45	1	46	2	42	1	43
Non Metalic Mineral Products	1	20	20	40	1	50	4	54
Aluminium Manufacture of Metal Products	1	26	6	32	4	107	35	142
Transport Equipment	1	45	5	50	1	46	5	51
Total	88	4,598	870	5,468	91	5,057	932	5,991

Source: Statistical Office, Riau Province
Riau Dalam Angka in Figures, 1979.

1.2. Natural Conditions

1.2.1. Riau Province

Riau Province extends from 1° South to 2° North and from 100° to 105° East. The province faces the Malacca Strait and South China Sea (Fig. 1.2.1). It spreads over the main island and many lesser islands. Of the total area, 94,562 km² is land, 1,176,530 km² is sea. The sea districts of Bengkalis, Kampar, Indragiri Hilir and Kepulauan Riau stretch over 3,214 islands. There are no mountains in Riau Province.

The climate of Riau Province is generally wet and tropical, with an average rainfall of between 1,500 ~ 3,000 mm per year. During the dry season (March ~ August), average monthly rainfall ranges between 100 to 200 mm. In the rainy season (September ~ February), average monthly rainfall ranges between 200 ~ 300 mm.

The area with the highest amount of rainfall for 1981 was Sungai Apit, which registered 3,214 mm as shown in Table 1.2.1, while the lowest was 480 mm at Teluk Pinang.

Temperatures at Pekanbaru in 1981 ranged from 34.1C° (maximum) to 20.2C° (minimum), as shown in Table 1.2.2.

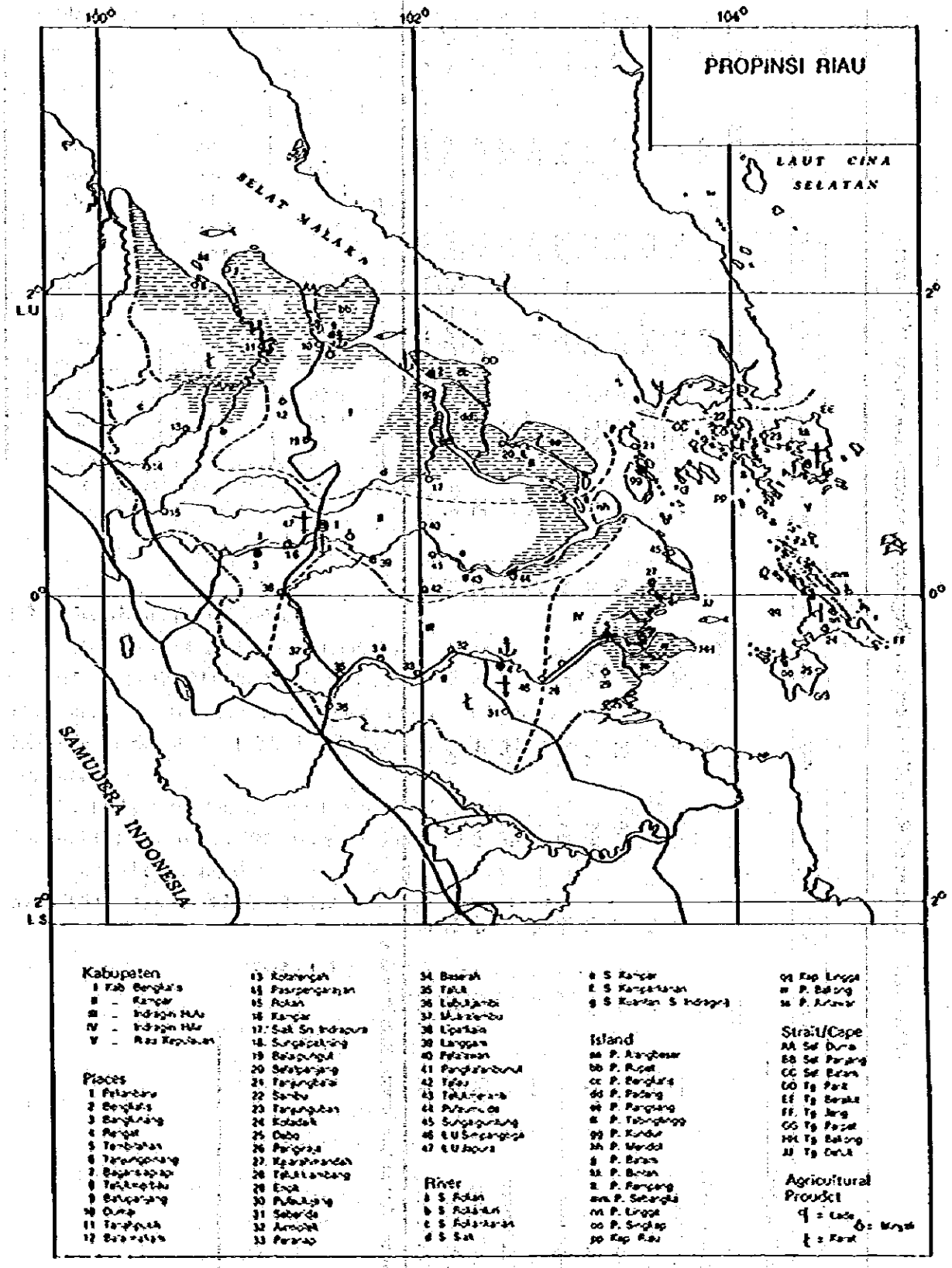


Fig. 1.2.1 Topographical Conditions in Riau Province

Table 1.2.1 Amount of Rainfall in Bengkalis Regency at Selected Locations, 1981 (mm)

Location	Month												Total
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Dati II Bengkalis													
Bengkalis	58	107	1	287	269	37	166	179	385	290	189.5	117.5	2,086
Bagan Siapi-Api	82	100			59				59	190	210	546	1,246
Selat Panjang	92	34	7	85		106	85	41	230	147	147	119	1,093
Siak	27	72	82						113.5	243.5	129		667
Sepuruk	27	45	10	49	59	10	140	25	176	371	245	173	1,330
Dumai	121	92	29	305	209	85	101	142	220	287	241	174	2,006
Sungai Apit		36	165	414	295	99	65	71	549	558	416	546	3,214
Duri	164		40	206			21	38		690	216	249	1,624
Teluk Merbau	11	1	0.5	182	164	22	10	70	120	105	329	326	1,340.5
Batu Panjang	162	112	48	191	64	197	125	24	98	257	107	76	1,461
Sei Pakning	68	99	54	125	181	81	41	37	205	204	201	246	1,542
Teluk Belitung	82	211	78.5	292	262	32	196	85	159	320	448	220	2,385.5

Source: Agriculture Service, Riau Province.

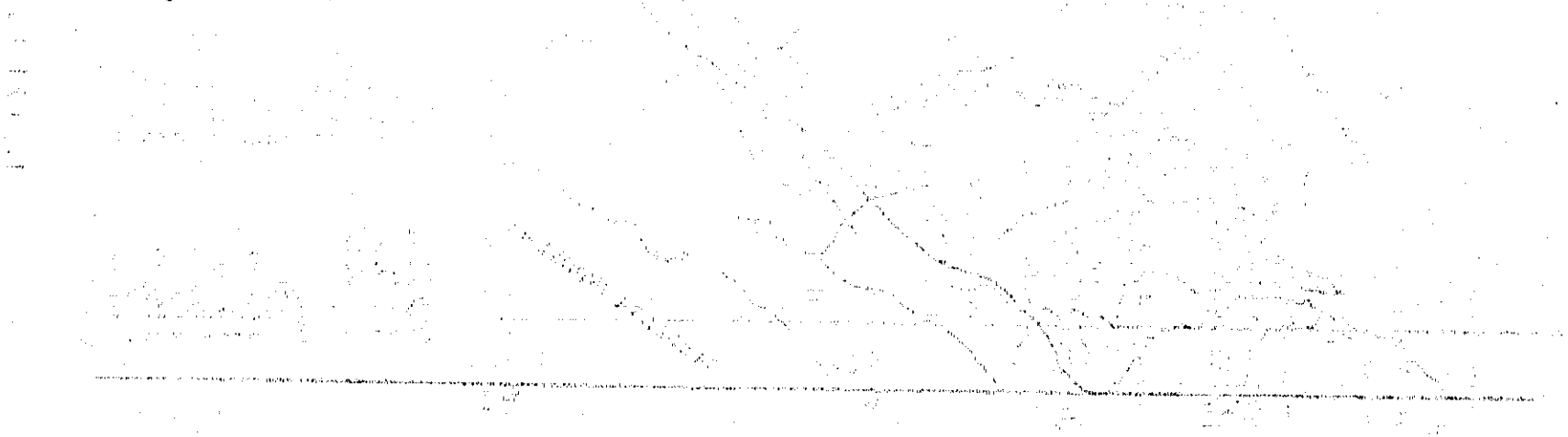


Table 1.2.2 Temperature, Atmospheric Pressure and Wind in Pekanbaru Municipality, 1981

Month	Temperature (C°)		Atmospheric Pressure		Prevailing Direction	Wind Velocity (km/hour)
	Maximum	Minimum	Maximum	Minimum		
January	30.9	20.5	1,013.5	1,009.3	North East	07
February	32.4	20.2	1,012.9	1,008.0	"	07
March	33.1	20.7	1,014.7	1,007.2	"	06
April	33.2	20.5	1,012.2	1,006.7	North West	06
May	32.8	—	1,011.1	1,005.9	South	06
June	34.1	—	1,011.9	1,007.2	"	06
July	33.1	21.8	1,011.0	1,006.5	"	07
August	33.4	21.4	1,011.3	1,007.9	"	08
September	32.8	21.6	1,011.2	1,008.5	"	06
October	32.9	22.4	1,011.5	1,008.0	"	06
November	32.3	21.9	1,011.3	1,007.6	North West	07
December	31.2	21.9	1,013.1	1,008.2	"	06

Source: Meteorology Station, Simpang Tiga Airport.

1.2.2. North Sumatra Province

North Sumatra Province extends from 0° to 4° North and from 98° to 100° East. The province faces the Malaka Strait and the Indian Ocean (Fig. 1.2.2). Its area covers 70,787 km². There are many flat areas and few mountains. However, these few mountains are quite high, over 2,000 m in elevation. Table 1.2.3 shows the altitude of some selected cities in North Sumatra Province.

The highest rainfall among the selected stations in 1980 was 4,593 mm per year at Pinang Sori and the lowest was 396 mm at Medan Putri, as shown in Table 1.2.4.

Among the several stations in 1980, the maximum temperature was 35.4 C°and the minimum was 10.5 C°, as shown in Table 1.2.5.

Table 1.2.3 Altitude of Some Selected Cities in North Sumatra Province

City	Height (m)
Medan	14
Pematang Siantar	400
Tanjung Balai	0
Binjai	28
Pangkalan Brandan	4
Kebon Jahe	1,208
Prapat	920
Sidamanik	1,000
Seribe Dolok	1,418

Source: Statistik Sumatra Dalam Angka Tahun 1980.

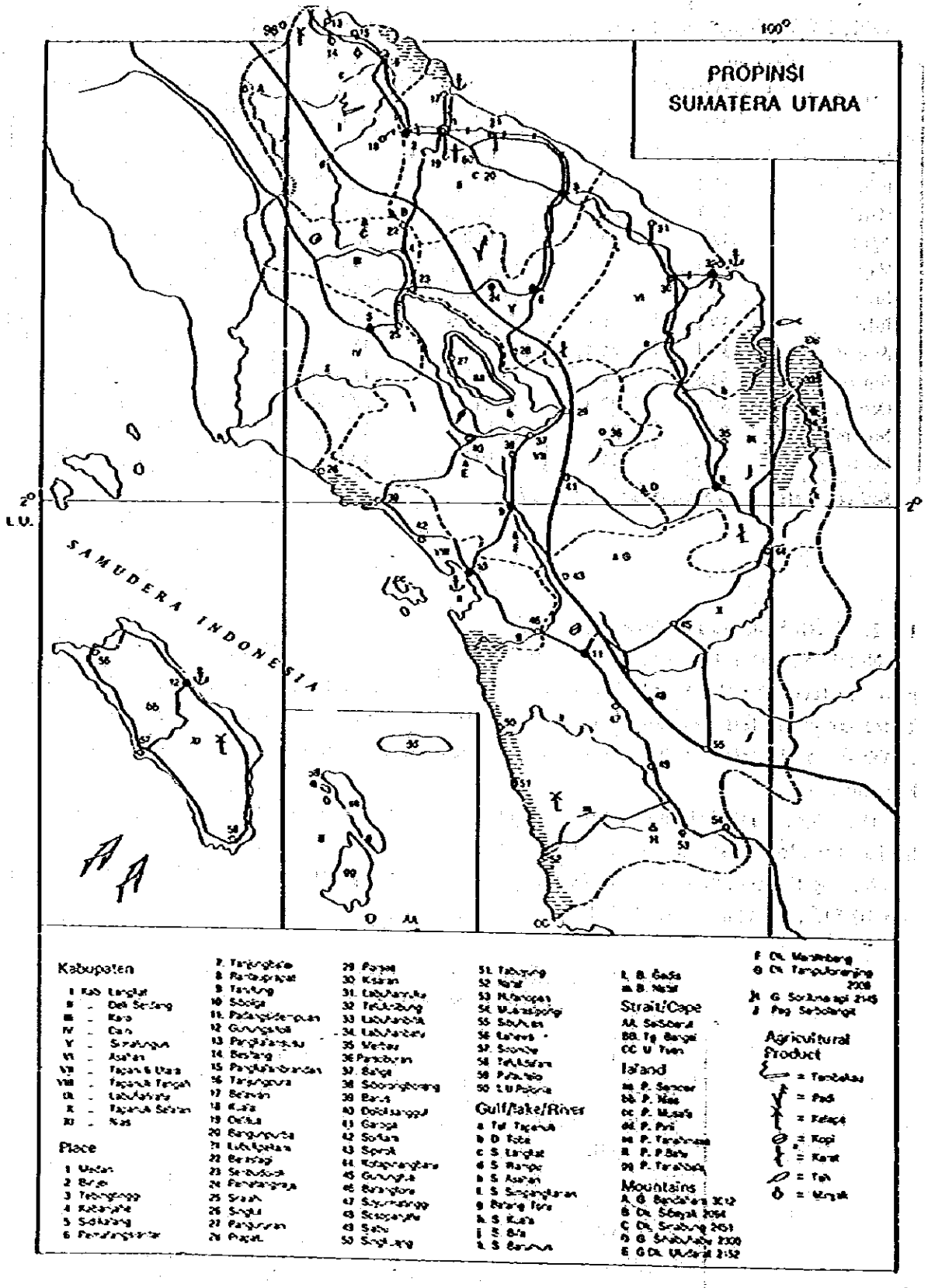


Fig. 1.2.2 Topographical Conditions on North Sumatra Province

Table 1.2.4 Rainfall at Selected Stations in North Sumatra, 1980

Station	Quarterly				Total
	I (mm)	II (mm)	III (mm)	IV (mm)	
Polonia	285	486	851	888	2,610
Medan Putri	36	207	153	–	396
Pinang Sori	934	1,080	984	1,595	4,593
Gurgur Balige	462	305	157	460	1,384
Kuta Gading	138	172	2,211	525	1,157
Narihat R.C	629	770	632	879	2,910
Labuhan Haji	188	512	1,294	873	2,867
Binanga	839	145	–	–	984

Source: Meteorology, Geophysics Institute.

Table 1.2.5 Temperature and Sunshine at Several Stations in North Sumatra, 1980

Station	Temperature (C°)					Sunshine
	07.00	13.00	18.00	Maximum	Minimum	
Polonia	23.4	30.5	28.5	35.0	–	37
Sampali	23.6	30.6	27.5	36.0	19.8	54
Tg. Morawa	23.3	31.7	28.8	–	–	–
Marihat RC	21.4	28.9	25.6	33.5	17.0	70
Sei Dadap	23.5	31.0	27.8	34.5	20.0	–
Gurgur Balige	17.0	20.2	19.4	28.0	13.2	–
Kuta Gading	15.7	22.7	19.0	27.0	10.5	56
Pinang Sori	22.6	30.8	27.6	35.4	19.0	60
Sipalangka	20.3	28.9	23.9	32.0	17.0	–
Binaka	23.1	28.8	27.5	33.3	19.7	49

Source: Meteorology, Geophysics Institute.

1.3. Transportation

1.3.1. Sea Transportation

On Sumatra Island, as the land transportation system is not well developed, sea and river transport are very important for the conveyance of agricultural products, daily consumer goods and general cargoes. In the vicinity of Dumai City, there are no large ports except for Belawan Port, located in North Sumatra. Therefore Dumai Port plays a major role in the sea transportation of Riau Province.

To determine the boundaries of the hinterland of Dumai Port and to ascertain cargo transportation activities in the vicinity of Dumai Port, the following ports have been surveyed.

Pekanbaru Port in Riau Prov.

Rengat Port in Riau Prov.

Belawan Port in North Sumatra Prov.

Teluk Bayur Port in West Sumatra Prov.

In this section, the above-mentioned port facilities and their activities are examined. The activities of Dumai Port are examined in the next chapter.

The layouts of the ports are shown in Fig. 1.3.1 ~ Fig. 1.3.4. The cargo volumes handled in the above-mentioned ports, from 1975 to 1981, are summarized in Table 1.3.1 and Table 1.3.2. Table 1.3.1 deals with foreign trade and Table 1.3.2 deals with domestic trade. Table 1.3.3 ~ Table 1.3.5 show port facilities, such as wharves, cargo handling equipment and storage area.

Pekanbalu Port is a river port, located along the Siak River 200 km above the river mouth. From the river mouth to the Port, it takes about 24 hours by ship. At the Pekanbaru Port, a lot of cargoes are handled, as shown in Table 1.3.1 and Table 1.3.2, but its activities are limited by the river width and depth. The maximum size of ships that reach the port is about 65 m in length or 1,000 DWT. There is no siltation problem, excepting east of the mouth of the Sago River.

Rengat Port is also a river port. It is located along the Indragiri River (Kuantan River), about 120 km from Tembilahan at the river's mouth. In the hinterland of Rengat Port, there are many rubber and oil palm plantations. It is estimated that the cargo volume handled in Rengat Port will increase rapidly in the next few years, so Rengat Port Administration is planning to construct a new port at Kuala Cenaku. This port will be about 22 km downstream from Rengat Port on the Indragiri River.

Belawan is the largest port in North Sumatra and the 3rd largest in Indonesia. The port is located at the mouths of the Belawan and Deli Rivers, and is connected to the Malacca Strait by a dredged channel. The channel is about 12 km long, 300 m wide and 10 m deep. However, it is subject to massive siltation caused by the rivers and sea current. About 4 million m^3 are annually dredged from the channel to maintain appropriate water depth. Port expansion would be difficult due to the topographical limitation near the present port facilities.

Teluk Bayur is located on the west coast of West Sumatra Prov., about 8 km south of Padang City. The port faces the Indian Ocean and is protected from waves by 900 m and 274 m long breakwaters. The amount of dredging is small. Some cargoes (cement, daily necessities, etc.) are transported from Teluk Bayur to Riau Prov. by trucks. However, it is expected that Teluk Bayur will not have much influence on the activities of Dumai Port, because of the very steep mountains that separate the Provinces.

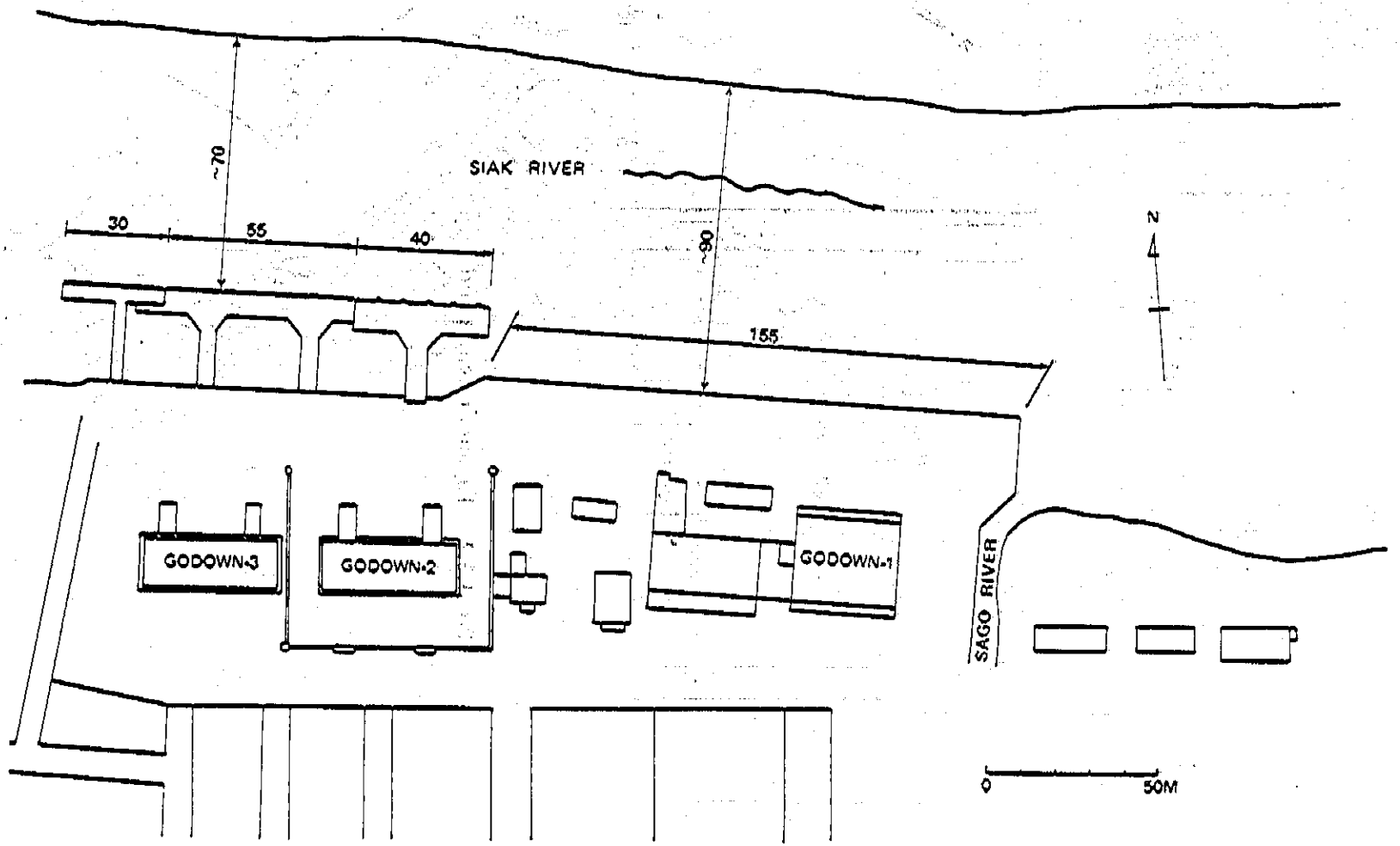


Fig. 1.3.1 Layout of Pekanbaru Port

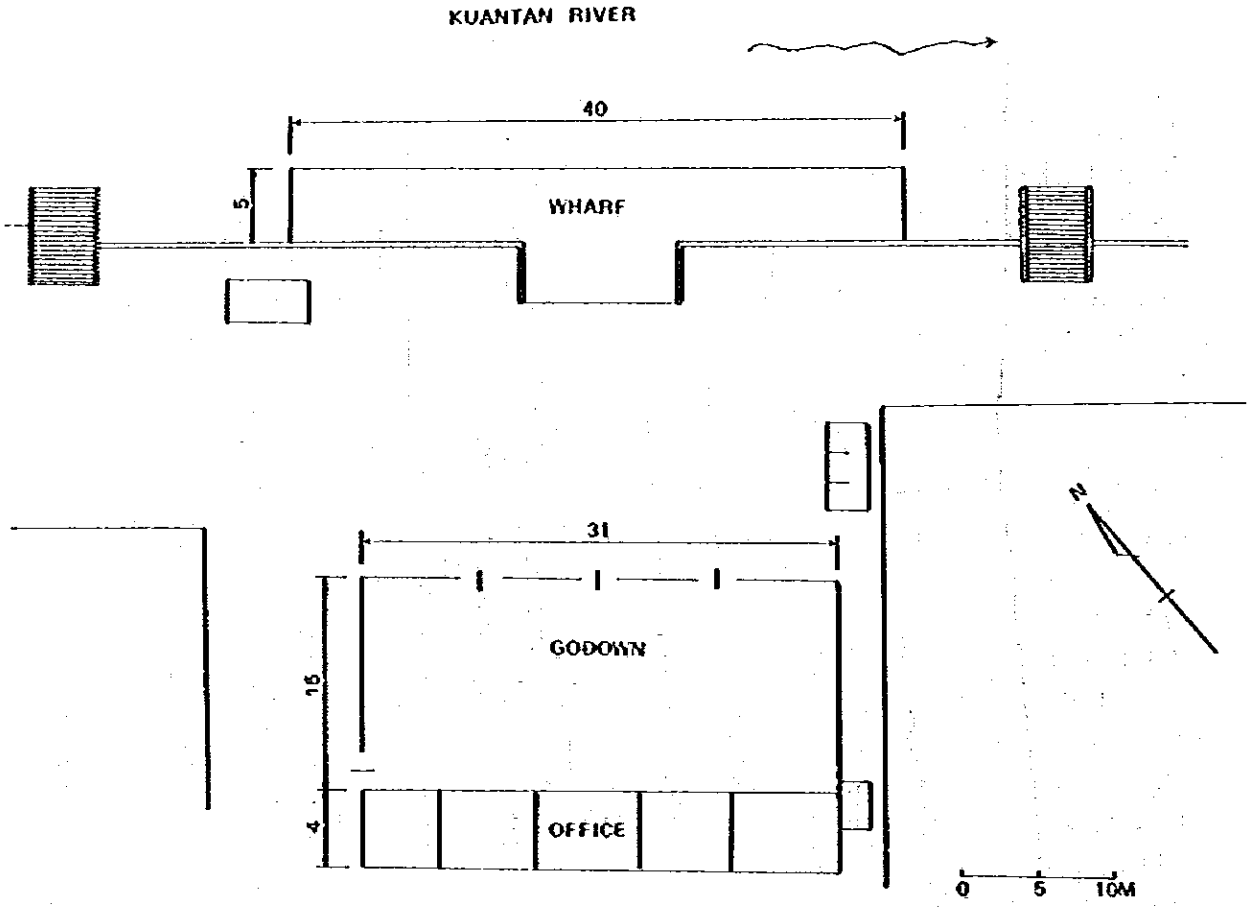


Fig. 1.3.2 Layout of Rengat Port

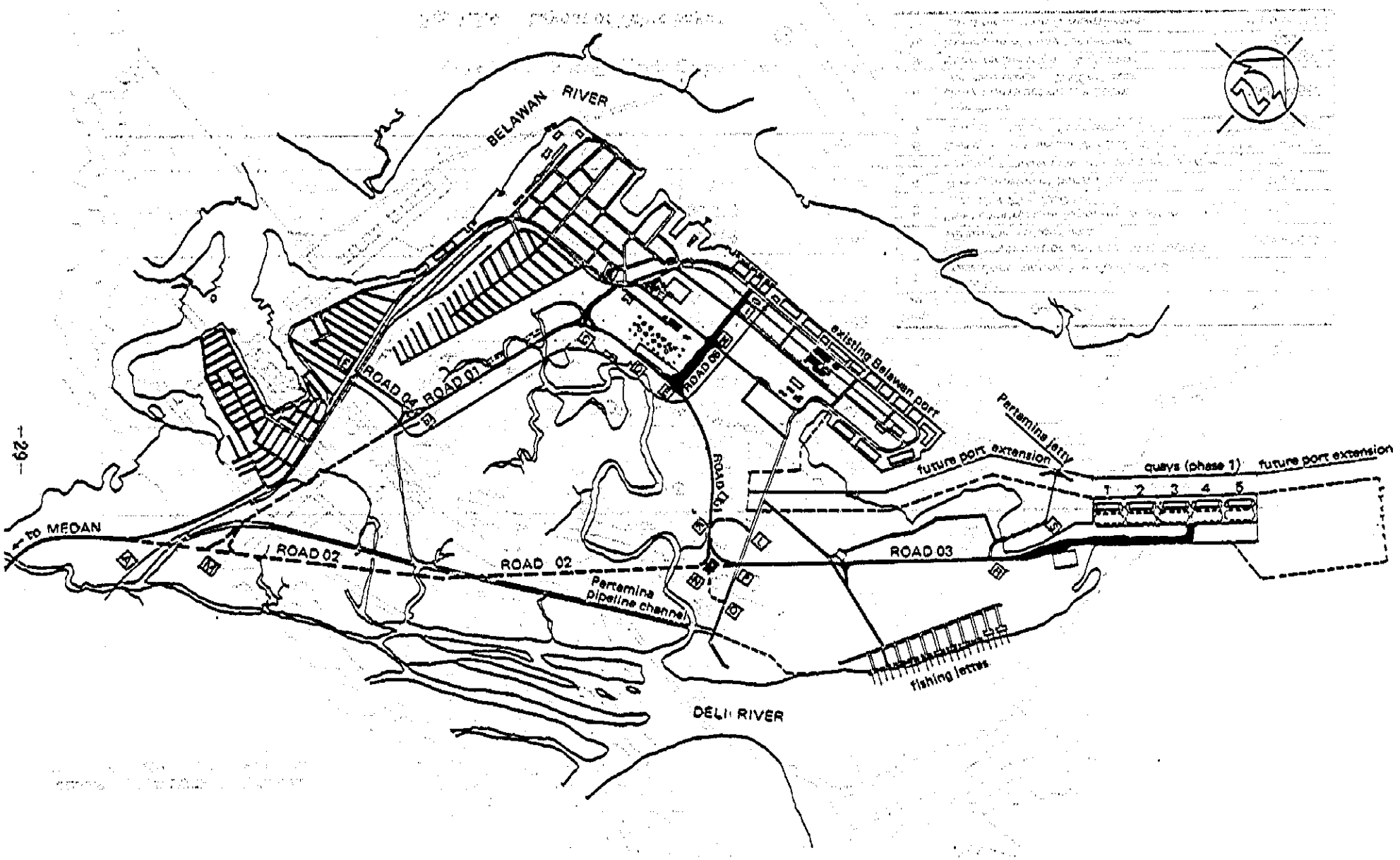


Fig. 1.3.3 Layout of Belawan Port

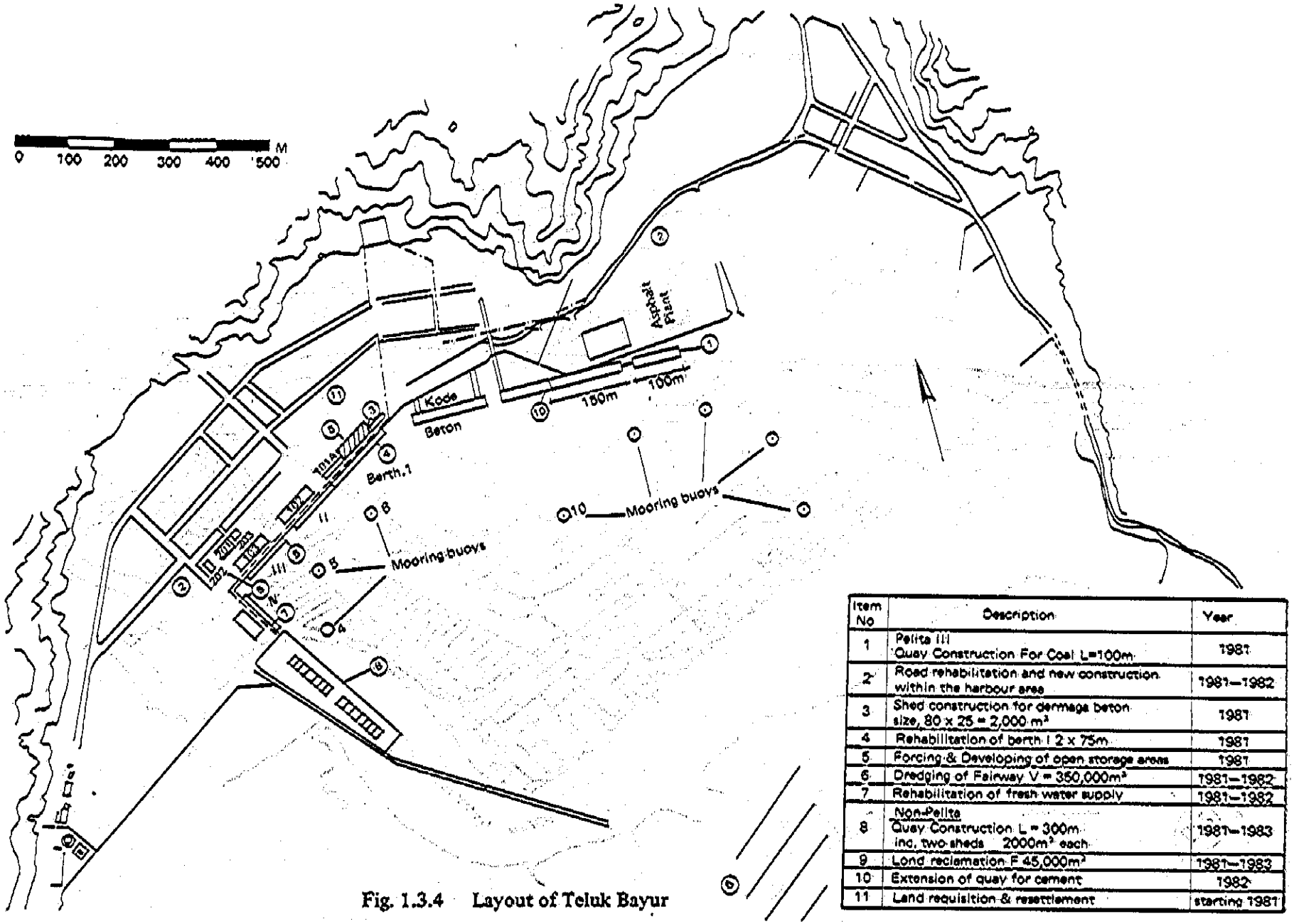


Fig. 1.3.4 Layout of Teluk Bayur

Item No	Description	Year
1	Pelita III Quay Construction For Coal L=100m	1987
2	Road rehabilitation and new construction within the harbour area	1981—1982
3	Shed construction for dermaga beton size, 80 x 25 = 2,000 m²	1987
4	Rehabilitation of berth I 2 x 75m	1987
5	Forcing & Developing of open storage areas	1987
6	Dredging of Fairway V = 350,000m³	1981—1982
7	Rehabilitation of fresh water supply	1981—1982
8	Non-Pelita Quay Construction L = 300m inc. two sheds 2000m² each	1981—1983
9	Land reclamation F 45,000m²	1981—1983
10	Extension of quay for cement	1982
11	Land requisition & resettlement	starting 1981

Table 1.3.1 Foreign Trade Cargo Flows of the Related Ports

(ton)

Port		1975	1976	1977	1978	1979	1980	1981
Pekanbaru	Unload	4,380	8,487	7,846	7,729	11,058	20,279	27,792
	Load	21,527	34,810	33,260	35,985	69,936	47,024	43,024
	Total	25,907	43,297	41,106	43,664	80,994	67,303	70,816
Rengat	Unload	–	–	–	–	518	581	–
	Load	10,892	13,734	14,496	10,345	13,814	12,984	–
	Total	10,892	13,734	14,496	10,345	14,332	13,565	–
Teluk Bayur	Unload	158,352	80,140	89,806	92,994	116,746	130,507	171,901
	Load	329,745	406,514	413,259	418,375	461,306	363,003	282,868
	Total	488,097	486,654	503,065	511,369	578,052	493,510	454,769
Belawan	Unload	872,472	883,172	956,991	909,983	834,349	1,022,160	1,242,263
	Load	900,893	953,771	966,366	984,797	1,143,061	1,170,829	870,883
	Total	1,773,365	1,836,943	1,923,357	1,894,780	1,977,410	2,192,989	2,113,146

Table 1.3.2 Domestic Trade Cargo Flows of the Related Ports

(ton)

Port		1975	1976	1977	1978	1979	1980	1981
Pekanbaru	Unload	22,994	36,638	40,889	45,432	63,371	89,240	88,453
	Load	8,172	8,726	12,285	8,435	11,390	10,498	10,716
	Total	31,166	45,364	53,174	53,867	76,761	99,738	99,169
Rengat	Unload	15,311	19,653	32,456	33,347	36,751	45,460	–
	Load	956	307	357	635	381	607	–
	Total	16,267	19,960	32,813	33,982	37,132	46,067	–
Teluk Bayur	Unload	73,939	64,171	91,837	159,858	215,140	229,627	320,441
	Load	215,994	171,356	160,532	112,294	94,670	373,641	467,932
	Total	289,933	235,527	252,369	272,152	309,810	603,268	788,373
Belawan	Unload	935,126	1,029,868	1,202,562	1,672,753	2,062,032	2,468,281	2,378,253
	Load	198,343	233,756	251,349	342,881	418,050	512,694	751,736
	Total	1,133,469	1,263,624	1,453,911	2,015,634	2,480,082	2,981,975	3,129,989

Table 1.3.3 Wharves in the Related Ports

Port	Geophisical Position	No.	Dimensions of Wharf (m)	Water Depth (m)	Type of Structure	Completion Year	Max. Ship Size	Remarks
Pekanbaru	00°28' N 101°27' E	1.	40 x 7.5	4 – 7	Concrete	1978	1,000 DWT (L = 65 m)	River Port No. 3 Used for Passengers River Width: 70 m
		2.	55 x 7		Wood			
		3.	30 x 5		Wood			
		4.	100		Steel Sheet Pile	1983		
Rengat	00°23' S 102°32' E	1.	40 x 5	5	Steel and Wooden Piles, Concrete Slab	1975	100 DWT	River Port Water Depth in Dry Season: 1 m River Width: 300 m
Teluk Bayur	01°00' S 100°21' E	1.	108 (Length)	8 – 12	Wooden Pier			
		2.	108					
		3.	96					
		4.	10					
		5.	150		Concrete Wharves			
		6.	100					
		7.	75					
		8.	10					Oil Jetties
		9.	6					
Belawan	03°47' N 98°41' E	1.	1,188 (Length)	10				Ocean Going Inter Island Liquid Cargo Facility Special General Cargo
		2.	1,561					
		3.	243					
		4.	2,515					

Table 1.3.4 Cargo Handling Equipment and Vessels of the Related Ports

Port	ForkJift	Mobile Crane	Floating Crane	Pilot Boat	Tug Boat
Pekanbaru	6 (2 – 7.5 ton)	7 ton x 4	0	4 (motors broken)	0
Rengat	5 ton x 1	0	0	N.A.	0
Teluk Bayur	2.5 ton x 3 5 ton x 4 7 ton x 2 10 ton x 1	1	0	235 HP x 2 82 HP x 1	1700 HP x 1 1200 HP x 1
Belawan	15 ton x 2 7.5 ton x 3 5 ton x 3 Non BPP 134 Units (2.5 – 10 ton)	25 ton x 2 20 ton x 1 15 ton x 2	40 ton x 1	Pilot Boat 275 HP x 2 240 HP x 1 140 HP x 1 102 HP x 1 Mooring Boat 145 HP x 1 90 HP x 2	2400 HP x 1 1900 HP x 1 1700 HP x 2 1200 HP x 1 1080 HP x 1 800 HP x 2

Table 1.3.5 Storage Area

Port	Godown	Open Storage
Pekanbaru	750 m² 600 m² 560 m² Total 1,910 m²	2,000 m²
Rengat	600 m²	
Teluk Bayur	1,180 976 2,000 x 2 1,954 1,074 321 320 Total 9,875 m²	987 850 1,003 1,588 880 Total 5,308 m²
Belawan	Total 54,299 m²	Total 80,302 m² (Contained Container Yard 17,303 m²)

1.3.2. Land Transportation

Transportation facilities in Riau Province are poor compared to those in North Sumatra Province. This is due to the presence of formidable swamp and jungle areas that have little economic significance. On the other hand, in North Sumatra Province plantations were begun around the middle of the nineteenth century and rapidly developed as centers of tobacco production. The infrastructures of this region (ports, roads and railways) have all been built since the end of the last century to serve the requirements of the plantations.

1) Roads in Riau

The total length of roads constructed by 1980 is 4,268 km, as shown in Table 1.3.6. Road density in Riau, as shown in the same table, is only 4.5 km/100 km² in 1980, which is the smallest value among the provinces of Sumatra. Roads are divided into four types: pavement asphalt, gravel, earth and unspecified. Table 1.3.7 compares the length of each type of road in North Sumatra and Riau Provinces.

Table 1.3.6 Length of Road and Road Density in Indonesia

Province	Area (km²)	Length of Road (km)		Road Density (km/100 km²)	
		1978	1980	1978	1980
1. D.I. Aceh	55,392	6,277	6,464	11.3	11.7
2. North Sumatra	70,787	9,778	11,600	13.8	16.4
3. West Sumatra	49,778	5,383	5,330	10.8	10.7
4. Riau	94,562	2,903	4,268	3.1	4.5
5. Jambi	44,924	3,039	3,812	6.8	8.5
6. South Sumatra	103,688	10,428	8,319	8.4	8.0
7. Bengkulu	21,168	–	2,566	–	12.1
8. Lampung	33,307	2,405	3,373	7.2	10.1
9. D.K.I. Jakarta	590	2,990	–	508.5	–
10. West Java	46,300	11,917	11,553	26.0	24.9
11. Middle Java	34,206	11,972	13,068	37.4	38.2
12. Jogyakarta	3,169	1,860	1,996	58.3	62.0
13. East Java	47,992	12,096	12,779	25.2	26.7
14. West Kalimantan	146,760	3,565	3,726	2.4	2.5
15. Middle Kalimantan	152,600	2,230	2,255	1.5	1.5
16. South Kalimantan	37,600	2,733	3,348	7.3	8.9
17. East Kalimantan	202,440	1,197	1,750	0.6	0.9
18. North Sulawesi	19,023	4,179	3,401	22.0	17.9
19. Middle Sulawesi	69,726	4,739	5,398	6.8	7.7
20. South Sulawesi	72,781	8,903	11,493	12.2	15.8
21. South East Sulawesi	27,686	2,640	3,630	9.5	13.1
22. Bali	5,561	2,344	3,587	42.2	64.5
23. West Nusatenggara	20,177	2,635	3,248	13.1	16.1
24. East Nusatenggara	47,876	7,934	8,600	16.6	18.0
25. Maluku	74,505	1,806	2,514	2.4	3.4
26. Irian Jaya	421,981	1,138	2,912	0.3	0.7
27. Timor Timur	14,873	–	1,374	–	9.2
INDONESIA	1,919,443	127,089	142,314	6.7	7.4

Source: CBS/Statistic Indonesia (1980 ~ 1981)

Table 1.3.7 Comparison of Surface Type of Road between Riau and North Sumatra

(km)

Province	Type of Surface				Total
	Asphalt	Gravel	Earth	Unspecified	
Riau	432	559	3,261	16	4,268
	10.1	13.1	76.4	0.4	100%
North Sumatra	5,271	1,860	3,349	1,120	11,600
	45.4	16.0	28.9	9.7	100%

Source: CBS/Statistic Indonesia (1980 – 1981)

Table 1.3.8 also shows road conditions in Riau and North Sumatra Provinces. Existing main roads for all of Riau are shown in Figure 1.3.5, including the three new routes which, by decreasing transportation time and costs, will greatly improve transportation between the hinterland and Dumai. An artery road from Dumai to Rengat via Pekanbaru is almost complete and will be paved with asphalt. However, this road has only two lanes, excluding certain parts in cities, so its traffic capacity is only around 650 cars/hour. There are plans to upgrade and rehabilitate existing regional roads by the end of the fourth five-year plan as shown in Table 1.3.9. As all these routes will have important roles in transporting agricultural products from plantation areas to Dumai Port, the construction program must be completed as soon as possible.

Table 1.3.8 Comparison of Road Condition in Riau and North Sumatra

(km)

Province	Road Condition					Total
	Good	Moderate	Damage	Heavy Damage	Un-specified	
Riau	430	1,763	969	1,045	61	4,268
	10.1	41.3	22.7	24.5	1.4	100%
North Sumatra	2,380	4,101	1,921	2,927	271	11,600
	20.5	35.4	16.6	25.2	2.3	100%

Source: CBS/Statistic Indonesia (1980 – 1981)

2) Railways

Railways are not existent in Riau.

3) Air ports

There are nine air ports in Riau, eight of which are on the mainland.

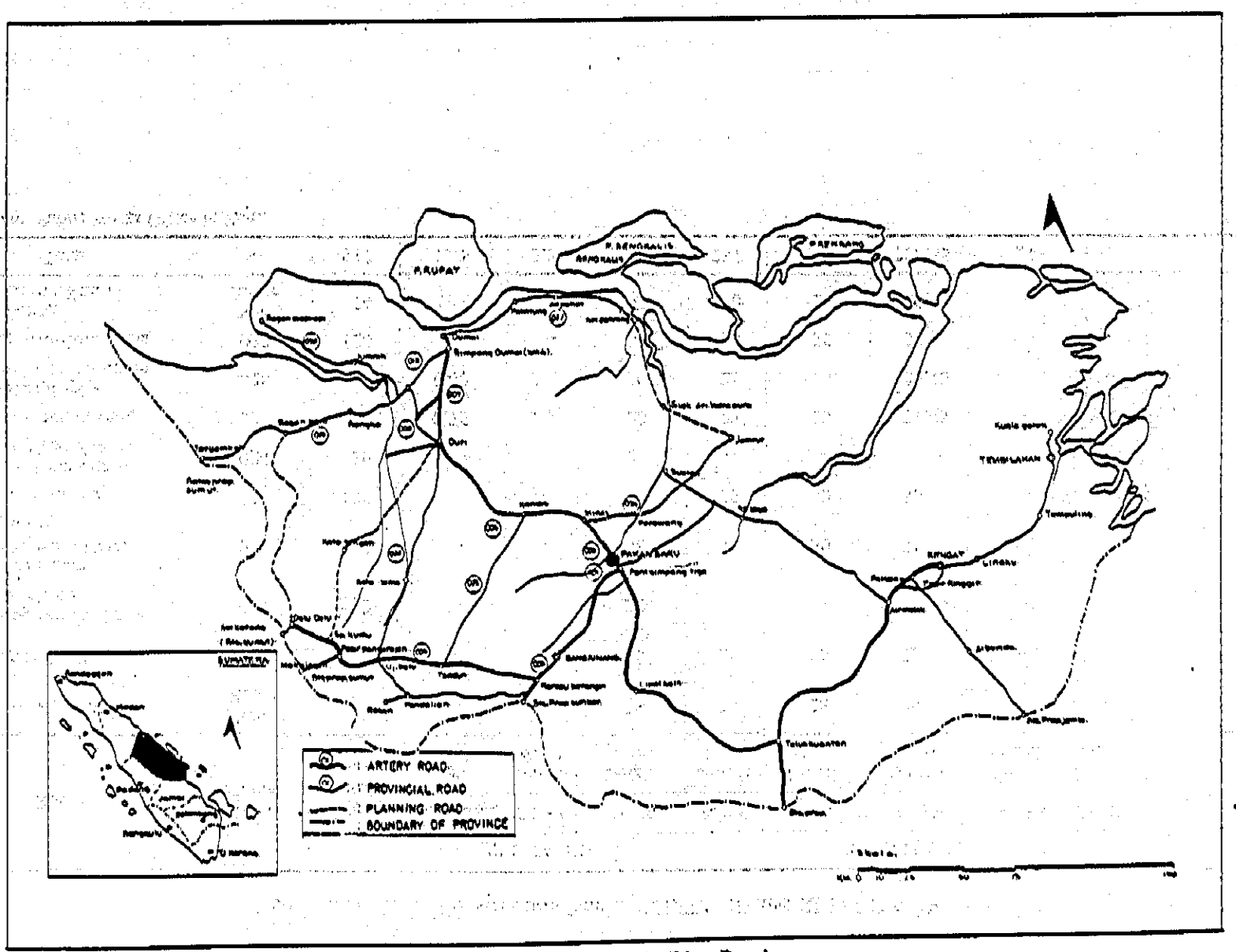


Fig. 1.3.5 Road Net Work in Riau Province

Table 1.3.9 Road Construction Plan in PELITA III and REPELITA IV

Route	Route Number	Total Length (km)	PELITA III			REPELITA IV					Remarks
			1981/1982	83/83	83/84	84/85	85/86	86/87	87/88	88/89	
			Length (km)	Length (km)	Length (km)	Length (km)	Length (km)	Length (km)	Length (km)	Length (km)	
Simpang Kumu-Duri	New Route	113	–	–	28	28	28	29	–	–	
Dalu-dalu-Bg. Batu	New Route	100	–	–	25	25	25	25	–	–	
Simpang Dumai Km. 4 – Simpang Kulim	018	32	–	–	32	–	–	–	–	–	
Simpang Kulim – Batas Sumatra Utara (Torgamba)	019	129	–	–	38	30	30	31	–	–	
Tandun – Kandis	023	105	–	–	20	25	30	30	–	–	
Minas – Perawang – Simpang Tiga Km. 11	024	59	–	–	28	31	–	–	–	–	
Dumai – Sei. Pakning	027	90	0.75	1.8	20	23	23	21.45	–	–	
Bagan Siapi-api – Jumrah – Tl. Barumun	028	95	0.60	2	20	25	25	22.40	–	–	
Ujung Batu-Kota Lama	032	120	–	–	30	30	30	30	–	–	
Sei Pakning – Siak Jamrut Km. 11	New Route	74	–	–	241	20	20	20	14	–	
Total	–	917	1.35	3.8	241	237	211	208.85	14	–	

Source: Public Works Office in Riau.