CHAPTER 2.
PORT OF DUMAI

CHAPTER 2. PORT OF DUMAI

2.1. Management and Operation

2.1.1. General

Dumai Port is a natural harbour located in Riau Province, Sumatra Island, at lat. 01°41'14" N. and long. 101°27'42"E. It faces the Strait of Malacca and is sheltered from the open sea by Rupat Island. It was built up during the 1950s as a port for shipment of Sumatran crude oil, and is now one of the most important ports in Indonesia for shipment of crude oil.

Expansion and improvement of Dumai Port is now necessary due to regional population increases and industrial development caused in large part by the government sponsored transmigration program as well as government promoted oil palm and rubber plantation development and lumber industry development. A road expansion program to connect Dumai with its hinterland will be completed by 1988.

Dumai Port handled a total of 38,058,000 tons of port cargoes (foreign and domestic trade) in 1981, including 37,560,000 tons of petroleum.

2.1.2. Management and Operation

1) Organization

Until 1959, Dumai Port was under the jurisdiction of the First Maritime District of the Directorate General of Sea Communications (DGSC) with headquarters based in Medan. But as the result of jurisdictional reorganization, Dumai Port became headquarters for the newly created Second Maritime District of the DGSC in that year.

Dumai Port Administrator is, as is the case at other principal ports in Indonesia, under the authority of the Directorate of Port and Dredging, Directorate General of Sea Communications (DGSC), Department of Transport and Communications. At the same time, the Dumai Port Administrator works also for the Directorate of the Second Maritime District of the DGSC.

Organizational charts for the Directorate of Port and Dredgings, DGSC, are as shown in Figs. 2.1.1 and 2.1.2.

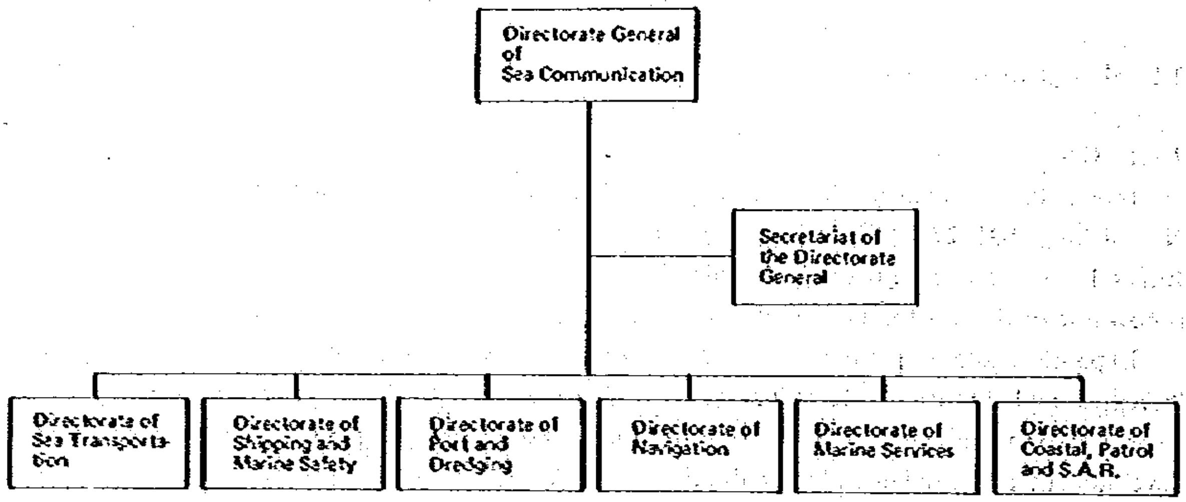

Fig. 2.1.1 Organization of Directorate General of Sea Communications (DGSC)

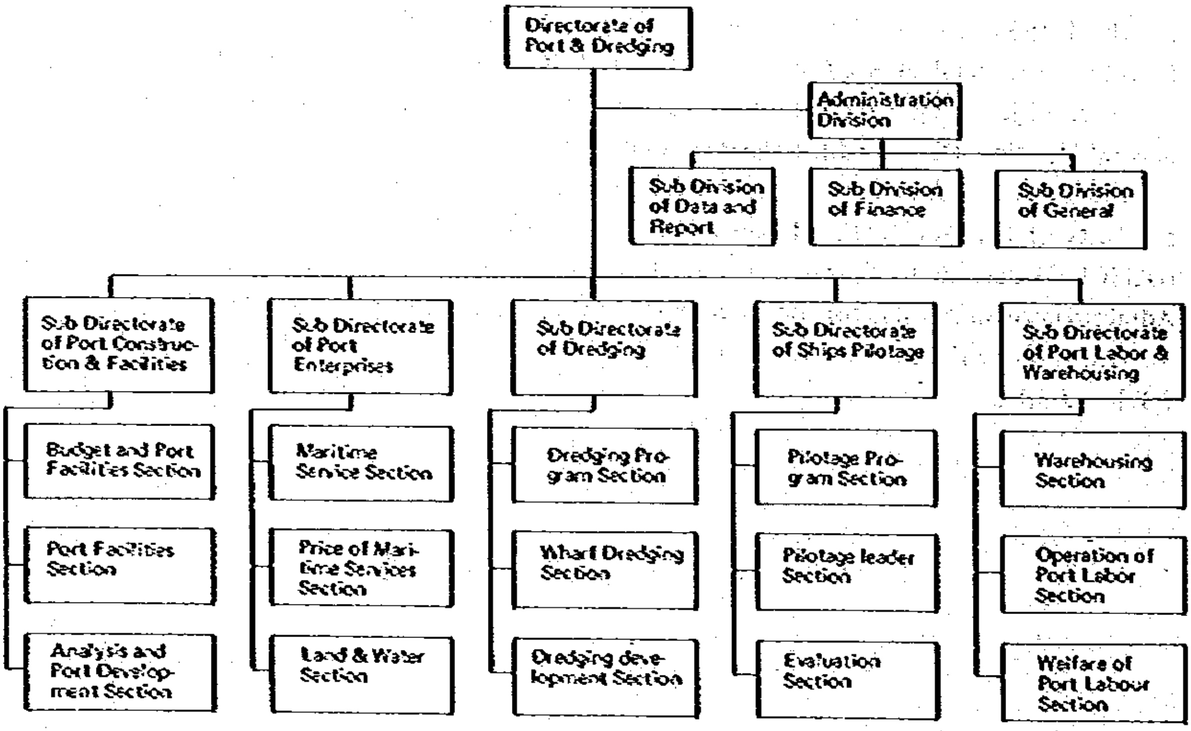

Fig. 2.1.2 Organization of Directorate of Port and Dredging

Dumai Port Administration is charged with the following main tasks:

(1) Control of ships in port and assignment of berths for each ship.
(2) Supervision and coordination concerning port operation and cargo handling.
(3) Administration and control concerning the maintenance, operation and technical work of port facilities.
(4) Pilot and communication services in the harbour area.
(5) Statistics on port activities.
(6) Preparation and control of financial statements, budgets and cost accounts.
(7) Collection of port dues and charges.
(8) Security and safety control in the port area.

As of November 1982, the Dumai Port Administration consisted of about 320 personnel. The Port Administration consists of the following divisions:

Secretariat
Traffic Division
Service Division
Finance Division
Technical Division
Pilotage Division
Port Security
Harbour Police

The organization chart for the Dumai Port Administration is shown in Fig. 2.1.3.

2) Port Tariffs

There are five categories of Indonesian Port Administrations, classified by the level of port tariffs that they impose. The first four categories apply respectively to the individual ports of Tg. Priok, Tg. Perak, Belawan, and Makassar. The last category applies to all other Indonesian Ports, including Dumai.

The charge system of Dumai Port is generally divided into charges for ships, charges for cargoes and other charges. (As of Jun. 1983)

Charges for ships consist of habour dues, and fees for berthage, pilotage, towage and ship water supply. These charges are set by hourly units or daily units, according to ship type and size.

Charges for cargoes include charges for use of transit sheds, open storage, wharfage, cargo handling equipment, etc. These are set by cargo type, using quantity as the unit.

"Other charges" are divided into fees for wharf land use, building use, entry and parking, etc.

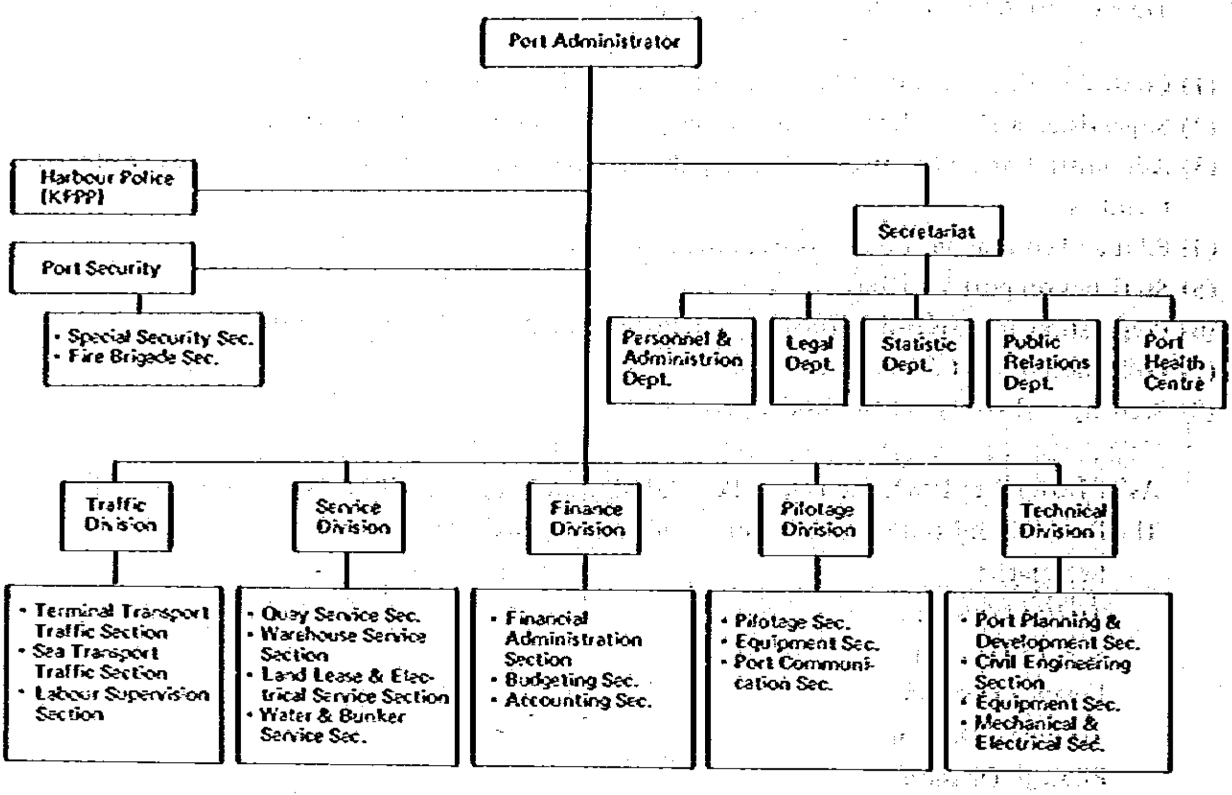

Fig. 2.1.3 Organization of Dumai Port Administration

(1) Ship Charges (for Ocean going vessels)

Item	Unit Charge	Remarks
Harbour Dues	0.07 US$/GRT/30 days	
Berthage	0.07 US$/GRT/24 hours	
Pilotage	49.10 US$/Ship	
	0.012 US$/GRT	Harbour Pilot
	0.017 US$/GRT	Sea Pilot (Rupat Strait)
	0.008 US$/GRT	Sea Pilot (Bengkalis Strait)
Towage	138 US$/Tugboat	2,200 to 2,500 Hp
	341 US/Hour	
Water Supply	0.867 US$/ton	

(2) Cargo Charges

Item	Unit Charge	Remarks
Wharfage	0.09 Rp/kg/day	Export Cargo
Transit shed	0.044 Rp/kg/day	
Open storage	0.022 Rp/kg/day	
Container	1,250 Rp/20 ft container box	load
Mobile Crane	6,000 Rp/hour	15 ton
Forklift	2,650 Rp/hour	3.5 to 5 ton

(3) Other

Item	Unit Charge	Remarks
Land Use	415 Rp/m²/year	
Entry Permit	50 Rp/man/once 250 Rp/truck/once	
Parking	150 Rp/truck/once	

3) Budget Charges

The budget of Dumai Port Administration is as follows:

(Million Rp)

Item \ Year		1981	1980	1979
Operating	Income	3,688	2,519	1,830
Operating	Expenditure	2,403	1,341	1,183
Operating	Surplus	1,285	1,178	647
Other	Income	36	82	113
Other	Expenditure	36	357	111
Net	Surplus	1,285	903	649

4) Port Labour and Cargo Handling Capacity

The number of registered port labourers working at Dumai Port is 300 (as of November 1982).

Port labour is supplied by the port labour association, known as the "Usaha Karya". This association operates under the guidance of the Dumai Port Administration and is used by various shipping companies.

The port labourers are thoroughly trained and work three shifts a day.

8:00 – 16:00
16:00 – 24:00
24:00 – 8:00

The gang organization for stevedores and longshoremen is as follows:

(1) Stevedoring per Gang

Head labour	1
Winch driver	2
Pilot	1
Labour	11
Total	15 persons

(2) Longshorage/Cargo Handling per Gang

Head labour	2
Labour	28
Total	30 persons

(3) Delivery/Receiving per Gang

Head labour	1
Labour	14
Total	15 persons

The per-gang hourly cargo handling capacity by cargo type is as follows:

(1) Stevedoring

Iron Ware	Pipe	15–18 ton
	Steel Structure	12–15
General Cargo		14–16
Cement		18–24
Timber		14–18
Rice		18–24
Rubber		16–18

(2) Longshorage/Cargo Handling/Delivery/Receiving

	Man power only	Assistance by Machine Equipment
Iron Ware	–	20 – 25 Ton
General Cargo	10 – 12 Ton	16 – 20
Cement	14 – 18	
Timber	10 – 12	15 – 18
Rice	14	
Rubber	10 – 12	16 – 20

2.1.3 Precautions on Management and Operation

By the end of 1988, when the short term plan is due for completion, conditions at Dumai Port are expected to have changed from the current state as follows.

- Both cargo volume and ship numbers will have increased by 200%.
- Wharf length will have increased by 200% and the wharf area will have been greatly expanded.

Accordingly, the Dumai Port Administration will have to be made more streamlined and rationalized than at present.

To accomplish this goal, the following points should be kept in mind.

1) Increased Efficiency for Port Cargo Handling

As cargoes are expected to increase rapidly, it will be necessary to increase port labour. Since prompt acquisition of skilled port labour will probably be difficult, it is desirable to compensate for this likely shortage by mechanization and rationalization of port cargo handling.

Efficient operation of the port entails mechanization with as little capital outlay by the Port Administration as possible. Rather, the goal is to encourage shipping companies to provide a maximum amount of the necessary machinery.

However, if shipping companies lack sufficient funds to complete the mechanization, then the Port Administration will arrange for banks and other financial organizations to extend loans to these companies.

2) Housing, Health Facilities, and Training Programs for Port Employees.

In order that the port function smoothly, a skilled and stable work force is necessary. However, it seems likely that such a work force will be in short supply. This problem cannot merely be solved by mechanization of the work place. It will be important to offer quality living conditions to the workers. Therefore housing should be provided for the workers and their families, and near the port there should be inexpensive restaurants, cafeterias, and showers for after work. Furthermore, there should be training programs for workers to continually up-date their knowledge. It is desirable that these services be implemented under the guidance of the Port Administration.

3) Facilities for Tugboats, Pilot Boats and Mooring Boats

As ship calls at the port become increasingly frequent, the number of tugboats, pilot boats and mooring boats provided by the Port Administration will also have to increase.

Tugboats normally not only assist the steering of large ships but are also equipped to fight ship fires at sea. Thus, it may be necessary for the port management body to operate the minimum number of tugboats sufficient to assure safety in the port. However, since private companies are already engaged in the towing business, it would be more efficient for the Port Administration to supervise and co-ordinate these available resources, rather than directly operate a separate fleet of tow boats.

4) Separation of Foreign and Domestic Cargoes

The volume of cargoes handled at the wharf is at present rather small and so handling of foreign and domestic goods at the same location has presented no problem. However, as cargo volume increases, it will be desirable to handle these cargoes at separate, specified areas for greater efficiency and for greater ease in conducting customs clearance work and bonding of foreign trade cargoes.

5) Criteria for Specialized Wharf Use and Separation by Ship Type

Given the fact that there are presently only two berths at Dumai it is inevitable that there is no specialized or selective pattern of berth use. Ships of all types and sizes use the same berths for loading and unloading. However, upon expansion and improvement of the facilities, it will be desirable to rationalize wharf use by separating ships according to type, size and sea route.

6) Handling of Special Cargoes and Mass Cargoes

At Dumai Port, cargoes such as palm oil fall into this category.

Efficient port operation calls for setting aside wharves for the exclusive use of such cargoes.

7) Safety Measures for Passengers

At Dumai Port, there is a clear division between areas for cargo handling and areas for passengers. In addition to this basic safety measure, further measures would be desirable concerning improvement of safety standards in the embarkation/disembarkation area.

8) Measures in Response to Changing Transport Methods (i.e. Containerization)

Open yards must be established and/or maintained in consideration of future transport systems particularly container transport systems.

2.2. Facilities and Utilization

2.2.1. Facilities

At Dumai Port, there are 9 wharves, excluding oil berths, owned by Caltex and Pertamina. The dimensions of the wharves are shown in Table 2.2.1. Cargo-I wharf was owned by Caltex but is now operated by the Administration of Dumai Port. This wharf is used for handling general cargoes. The east part of Cargo II was completed in March 1982, and the west part is under construction, with completion due for March 1983.

In addition to the wharves shown in Table 2.2.1, there are 5 more berths which are owned by Caltex and Pertamina. These berths are utilized for handling crude oil. The structure of the oil berths is of the dolphin type. Table 2.2.2. shows the dimensions and capacities of the oil berths.

The waterway to Dumai Port runs 22 miles through the Bengkalis Strait and 33 miles through the Rupat Strait with a width of 100 to 150 m and a depth of 18 m. Fig. 2.2.2 shows the navigation route to Dumai Port.

The working area of the Port is 1,650,000 m² (300 m in width and 5,500 m in length).

The cargo handling equipmentand vessels are shown in Table 2.2.3 and Table 2.2.4, respectively.

Dumai Port has 2 water supply tanks, each with a capacity of supplying 15 tons of water an hour.

The godowns and open storage are shown in Table 2.2.5.

The marine aids are shown in Table 2.2.6.

There is a floating dock owned by Pertamina in the west area of the Port. This is a repair dock with the capacity to dock a maximum 20,000 DWT ship.

Table 2.2.1 Wharves in Dumai Port

No.	Wharf Name	L	B	D	Remarks
1.	Cargo I	78	16	11	Access: two – 96 x 5 (m)
2.	Cargo II	80	16	6.5	Access: 112 x 8 Completion: March 1982
		85	16	6.5	Completion: March 1983
3.	Pandu	34	6	11	Pilotage, Access 132 (m)
4.	Pokala	40	7	6	Harbour Master Access: 148 (m)
5.	Local	60	8	6	Domestic
6.	Local	44	8	6	Domestic
7.	P-3	42	8.4	7	Navigation Access: 204 x 6.5 (m)
8.	Nelayan	N.A	N.A	N.A	Fishery Wooden Wharf, Very Small
9.	Pontoon Wharf	40	9	3.5	Under Construction

L: Wharf Length (m)
B: Wharf Breadth (m)
D: Water Depth (m)

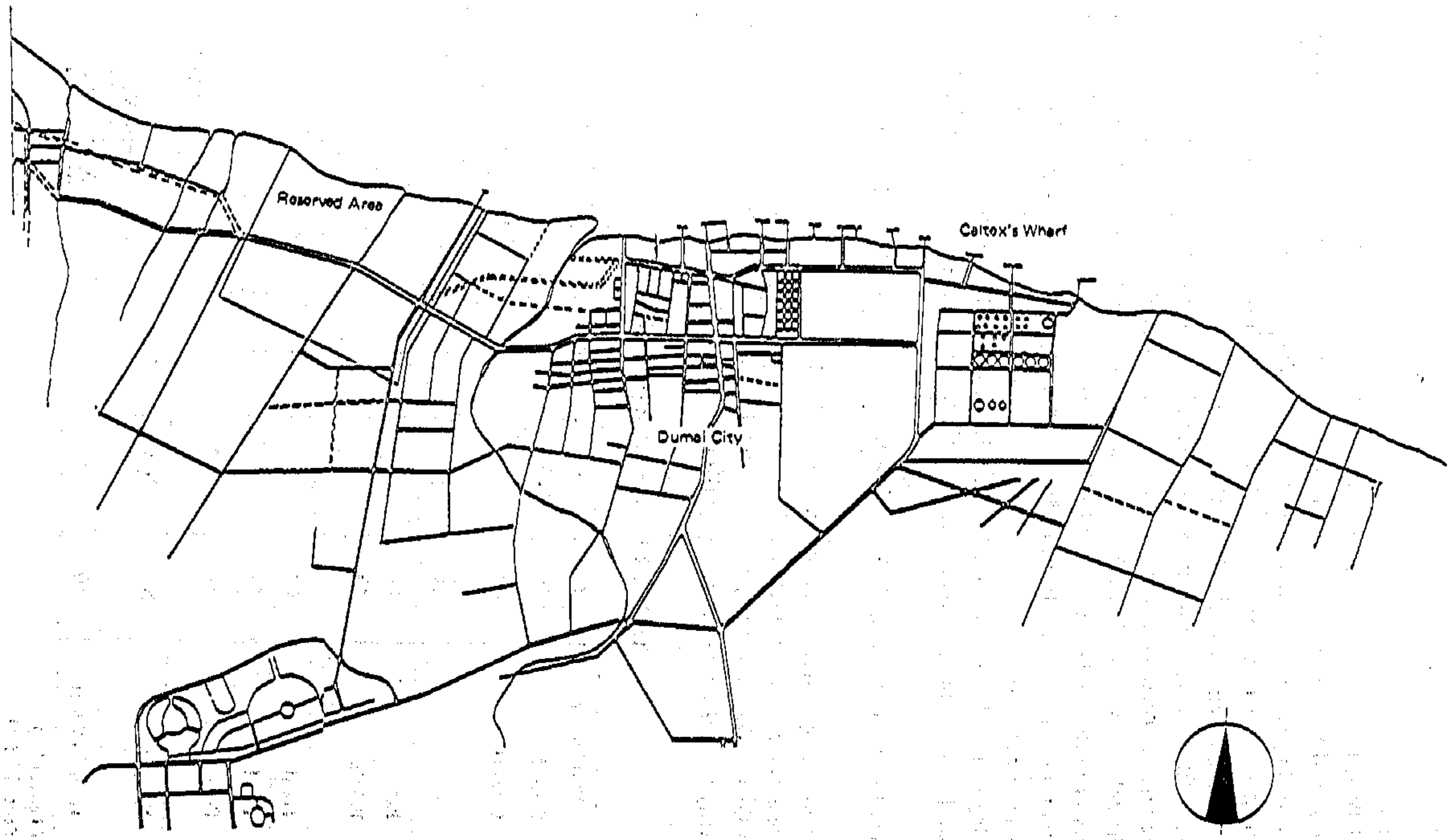

Fig. 2.2.1 Existing General Lay Out, Port of Dumai

Table 2.2.2 Oil Berths in Dumai Port

No.	Length (m)	Distance between Dolphins (ft)	Water Depth (ft)	Subject Ship (DWT)	Handling Capacity (BPH)	Operation Start	Remarks
1	137	1,200	57	150,000	60,000	Feb. 1968	
2	112	1,465	60	150,000	90,000	Feb. 1972	
3	40	1,170	51	84,000	60,000	Jul. 1958	
4	65	680	36	28,000	18,000		T-2 Wharf, for Domestic Tanker
5	100		63	100,000			

Table 2.2.3 Cargo Handling Equipment of Dumai Port

Forklift	Mobile Crane
10 ton x 1 7 ton x 1 5 ton x 3 2.5 ton x 1	18 ton x 1 15 ton x 1 5 ton x 1

Table 2.2.4 Vessels of Dumai Port

Kinds of Vessels	Capacity	Remarks
Pilot Boat	700 HP x 1 250 HP x 1 150 HP x 2 140 HP x 1	
Mooring Boat	111 HP x 1 82 HP x 3	
Harbour Master's Boat	1 (L = 14.3 m)	
Barge	1,300 ton x 2	
Tug Boat	3,200 HP x 4	Owned by Private Enterprise
Navigation Boat	553.5 DWT x 1 404.5 DWT x 1 3 other Small Boats	
KPLP's Boat (Sea and Coast Guard)	9 Small Boats (L = 8 ~ 19 m) 2 Motorboats	

Table 2.2.5 Godowns and Open Storage in Dumai Port

<table>
<tr><th colspan="2"></th><th>Area</th><th>Capacity</th></tr>
<tr><td rowspan="2">Godown</td><td>A</td><td>640 m² x 2
2,400 m²
3,000 m² x 3
200 m²
Total 12,880 m²</td><td>31,475 ton</td></tr>
<tr><td>B</td><td>Owned by Private Enterprise
3,000 m²</td><td>7,500 ton</td></tr>
<tr><td>Open Storage</td><td colspan="2">18,230 m²
4,020 m²
Total 22,250 m²</td><td>55,625 ton</td></tr>
</table>

Table 2.2.6 Marine Aids of Navigation in Dumai Port

<table>
<tr><td rowspan="5">Beacon</td><td>Malacca Strait</td><td>: 7</td></tr>
<tr><td>Bengkalis Strait</td><td>: 9</td></tr>
<tr><td>Rupat St. – Morong</td><td>: 26</td></tr>
<tr><td>Pakning River</td><td>: 4</td></tr>
<tr><td>Siak Indrapura River</td><td>: 3</td></tr>
<tr><td>Light House</td><td colspan="2">7</td></tr>
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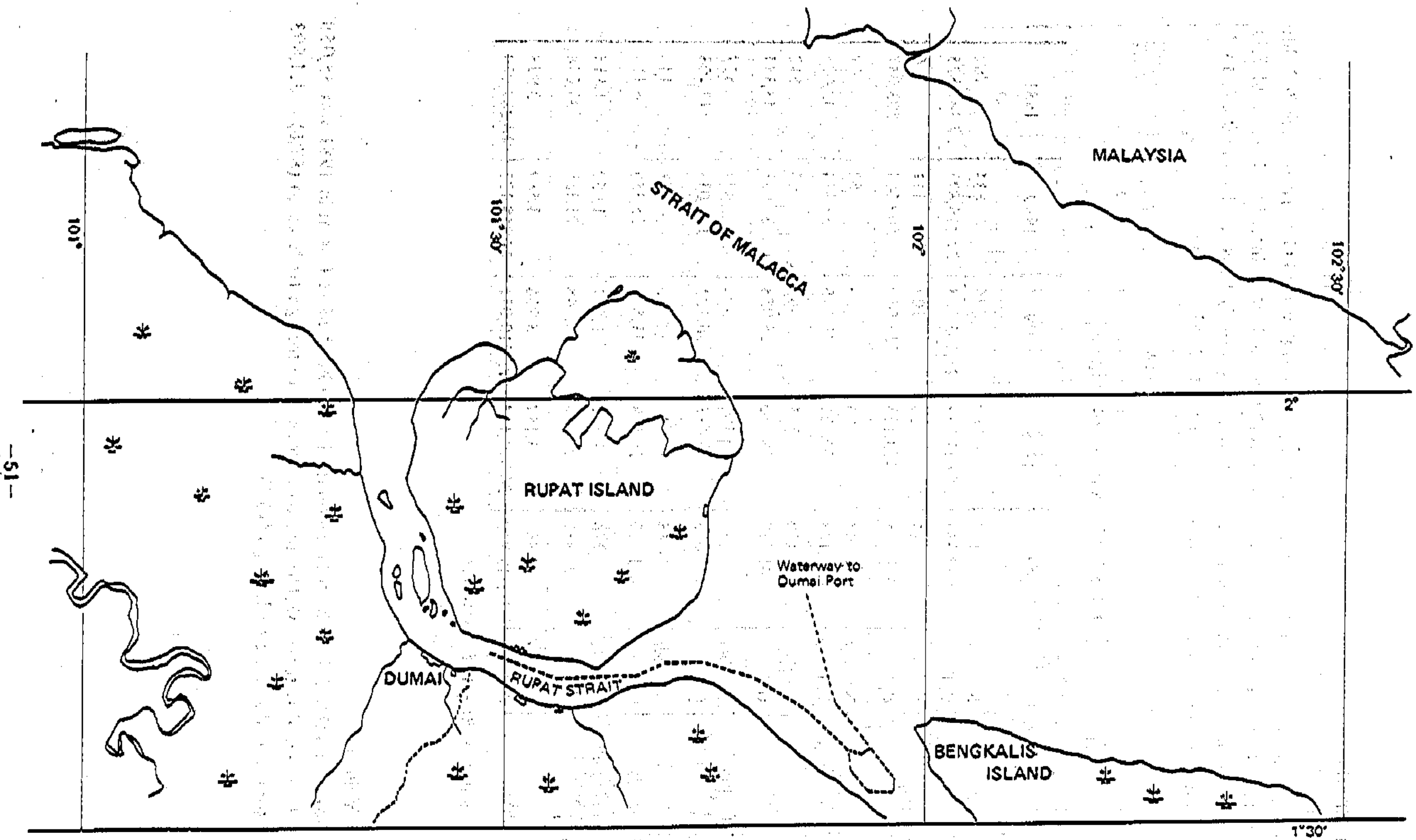


Fig. 2.2.2 Waterway to Dumai Port

2.2.2. Utilization

1) Ship calls

There were 3,978 ship calls in 1981, equivalent to 28,290 thousand G.T. There were 762 ship calls by tankers (19.2%), 116 by ocean going vessels (2.9%), and 69 by inter-island vessels (1.7%). The percentages of gross tonnage of these vassels were respectively 96.8%, 2.1% and 0.2%. Table 2.2.7 shows the number of ship calls at Dumai from 1977 to 1981.

Table 2.2.7 Number of Ship Calls

Ship Type \ Year		1977	1978	1979	1980	1981
Tankers	Number	839	782	876	834	762
	G/T	27,933,353	25,681,759	28,465,383	27,216,823	27,387,825
Ocean Going Vessels	Number	111	80	107	111	116
	G/T	513,825	453,125	558,062	509,569	593,037
Inter Island Vessels	Number	43	68	68	62	69
	G/T	23,173	30,401	31,195	35,984	42,603
Local Ships	Number	430	375	362	406	542
	G/T	45,239	28,260	28,958	32,953	43,384
Vessels for Special Industrial Shipping (Khusus)	Number	658	560	393	473	527
	G/T	157,675	93,688	76,134	112,033	113,908
Coaster (Lepas Pantai)	Number	55	41	43	51	148
	G/T	23,793	11,539	21,571	25,356	76,114
Ships for People's Shipping Service (Perahu)	Number	1,416	1,251	1,407	1,652	1,814
	G/T	22,881	20,695	28,748	25,388	33,058
Total	Number	3,552	3,157	3,256	3,589	3,978
	G/T	28,719,939	26,319,467	29,210,051	27,958,106	28,289,929

Source: Statistical Report of Dumai Port.

2) Cargo Volume

As shown in Table 2.2.8, the total amount of cargo handled at Dumai in 1981 was 38,058 thousand tons. Of this total, 33,165 thousand tons were foreign trade cargo (87%) and 4,893 thousand tons were domestic trade cargo (13%).

Table 2.2.8 Volume of Incoming and Outgoing Cargo at Dumai Port

(Unit: ton)

Contents		1977	1978	1979	1980	1981
Foreign Trade	Export	40,089,283	36,110,666	33,009,933	32,645,646	32,992,528
	Import	57,418	77,349	63,142	109,310	173,144
	Total	40,146,701	36,188,015	33,073,075	32,754,956	33,165,672
Domestic Trade	Shipment	4,081,607	2,303,064	3,778,550	4,178,619	3,581,771
	Receipt	448,930	2,535,669	1,555,205	1,332,224	1,310,983
	Total	4,530,537	4,838,733	5,333,755	5,510,843	4,892,754
Grand Total		44,677,238	41,026,748	38,406,830	38,265,799	38,058,426

Source: Statistical Report of BPP Dumai.

The volumes of mineral oil and dry cargo handled at Dumai amounted to 37,559 thousand tons (99%), and 499 thousand tons respectively (Table 2.2.9).

The volume of dry cargo, excluding logs, was 371,062 tons, of which 208,633 tons were foreign trade cargo and 162,969 tons domestic trade cargo. Foreign trade represented 56%, and domestic trade 44%.

Dry cargo commodities from 1977 ~ 1981, excluding logs, are shown in Table 2.2.10. Foreign cargo trade at Dumai, excluding mineral oil, mainly involved Japan, Taiwan and Singapore. Exports and Imports by nation, from 1977 to 1981, are shown in Table 2.2.11.

The value of exports, including petroleum and petroleum products at Dumai Port in 1981 was US$8,481 million, F.O.B. value. This accounted for 38% of Indonesia's total sea transport exports.

Table 2.2.9 Cargo Volume at Dumai Port

(Unit: ton)

Contents			1977	1978	1979	1980	1981
I Dry Cargo (Ex. Log)	Foreign Trade	Loading	676	1,521	23,223	30,079	39,334
		Unloading	57,418	77,349	63,143	102,862	169,299
	Domestic Trade	Loading	34,390	44,406	32,717	47,038	37,733
		Unloading	13,188	14,720	11,629	38,623	125,236
	Total		105,672	137,996	130,711	218,602	371,602
II Log	Foreign Trade	Loading	319,077	136,146	255,745	221,023	117,251
	Domestic Trade	Loading	–	–	–	6,448	9,879
	Total		319,077	136,146	255,745	227,471	127,130
Sub Total (I + II)			424,749	274,142	386,456	446,073	498,732
III Mineral Oil	Foreign Trade	Loading	39,769,530	35,972,999	32,730,965	32,394,544	32,835,943
		Unloading	–	–	–	–	3,845
	Domestic Trade	Loading	4,047,217	2,258,658	3,745,833	4,131,581	3,534,159
		Unloading	435,742	2,520,949	1,543,576	1,293,601	1,185,747
	Total		44,252,489	40,752,606	38,020,374	37,819,726	37,559,694
Grand Total (I + II + III)			44,677,238	41,026,748	38,406,830	38,265,799	38,058,426

Source: Statistical Report of BPP Dumai.

Table 2.2.10 Dry Cargo by Commodity at Dumai Port (Excluding Log)

(Unit: Ton)

Contents			1977	1978	1979	1980	1981
Foreign Trade	Loading (Export)	Sawn Timber	4	1,453	22,801	29,780	38,363
		Other Cargo	672	68	422	299	971
		Total	676	1,521	23,223	30,079	39,334
	Unloading (Import)	Rice	35,850	34,763	38,203	50,114	9,034
		Cement	5,595	6,986	3,793	–	–
		Pipe	4,658	23,307	7,968	29,420	108,293
		Car	–	2,152	671	2,148	7,581
		Other Cargo	11,305	10,141	12,507	21,180	44,391
		Total	57,418	77,349	63,142	102,862	169,299
	Sub Total		58,094	78,870	86,365	132,941	208,633
Domestic Trade	Loading	Rice	11,048	10,508	9,455	19,052	9,879
		Pipe	55	533	1,474	1,309	457
		Sawn Timber	1,381	6,750	5,599	9,656	4,967
		Other Cargo	21,906	26,615	16,189	16,991	22,430
		Total	34,390	44,406	32,717	47,038	37,733
	Unloading	Rice	931	5,172	6,296	29,562	43,832
		Stone	85	–	–	–	58,041
		Cement	563	2,774	1,321	–	10,027
		Pipe	791	–	330	114	5,423
		Other Cargo	10,418	6,774	3,682	8,947	7,913
		Total	13,188	14,720	11,629	38,623	125,236
	Sub Total		47,578	59,126	44,346	85,661	162,969
Grand Total			105,672	137,996	130,711	218,602	371,602

Source: Statistical Report of BPP Dumai.

Table 2.2.11 Export and Import by Nation of Origin/Destination at Dumai Port (Excluding Mineral Oil)

Country	Year	1977		1978		1979		1980		1981	
		Ton	%	Ton	%	Ton	%	Ton	%	Ton	%
Export	Japan	180,337	56	91,128	66	153,063	54	130,797	52	84,361	54
	Taiwan	89,643	28	27,875	20	74,606	27	94,191	30	38,013	24
	Singapore	33,471	11	7,198	5	29,464	11	18,858	7	10,910	7
	Korea	9,433	3	10,741	8	7,244	3	6,703	3	832	1
	Hongkong	3,600	1	–	–	–	–	3,183	1	4,157	3
	Other Nation	3,269	1	725	1	14,591	5	17,370	7	18,312	11
	Total	319,753	100	137,667	100	278,968	100	251,102	100	156,585	100
Import	Japan	1,361	2	22,154	29	5,654	9	29,090	28	99,357	59
	Singapore	16,627	29	17,893	23	14,608	23	20,981	21	51,361	30
	Burma	2,969	5	13,685	18	78	–	14,564	14	–	–
	Malaysia	–	–	–	–	78	–	330	–	–	–
	Europe	3,013	5	1,861	2	1,612	3	232	–	4,282	3
	Other Nation	33,448	59	21,756	28	41,112	65	37,675	37	14,299	8
	Total	57,418	100	77,349	100	63,142	100	102,862	100	169,299	100

Source: Statistical Report of BPP Dumai.

3) Passenger

In addition to the abovementioned ships and cargo, 55,683 passengers passed through this port in 1981. The number of passengers from 1977 to 1981 is shown in Table 2.2.12.

Table 2.2.12 Number of Passengers at Dumai Port

(persons)

Contents	Year	1977	1978	1979	1980	1981
Inter-Island	Embarking	18,740	18,210	21,231	21,971	24,618
	Disembarking	14,258	15,253	19,456	22,418	31,065
	Total	32,998	33,463	40,687	44,389	55,683
International	Embarking	1,609	49	1,079	934	–
	Disembarking	1,338	52	815	574	–
	Total	2,947	101	1,894	1,508	–
Grand Total		35,945	33,564	42,581	45,897	55,683

Source: Statistical Report of BPP Dumai.

CHAPTER 3.
NATURAL CONDITIONS IN DUMAI PORT

CHAPTER 3. NATURAL CONDITIONS

The Port of Dumai is located on the east coast of Sumatra at 0.1°41'N and 101°27'E.

Rupat Island is situated in front of the port, with the approach channel running between the island and the port. Behind the port is a large swampy area. The Dumai River flows into the channel in the vicinity of Dumai. The natural conditions survey was carried out by the Directorate General of Sea Communications (DGSC) of the Government of the Republic of Indonesia.

The field investigations were conducted as follows;

Items: Topographical Features
Oceanographical Conditions
Meteorological Conditions (data collection)
Geotechnical Conditions

Period: November 1, 1982 – December 8, 1982

Location: See Fig. 3.1.1

3.1. Topographical Features

3.1.1. Control Point Survey

Four control points were established by triangulation along the coast line, using two existing control points at Rupat Island coast. The coordinates of these control points are shown in Table 3.1.1. The control points are basic prerequisites in determining exact positions in other surveys and mappings.

Table 3.1.1 Control Point Co-ordinates

Point	Cordinate
*Batu Panjan (PAN)	01°42' 28.001N, 101°30' 41.754E
*Tg Kapal (KAP)	01°43' 23.549N, 101°27' 38.162E
**DOLP	01°41' 15.320N, 101°27' 17.735E
**NAH	01°42' 51.153N, 101°29' 30.723E
**DOK	01°41' 23.280N, 101°25' 42.763E
**PASIR	01°44' 10.537N, 101°26' 14.508E

Note: *Existing Control Points
**Additional Control Points

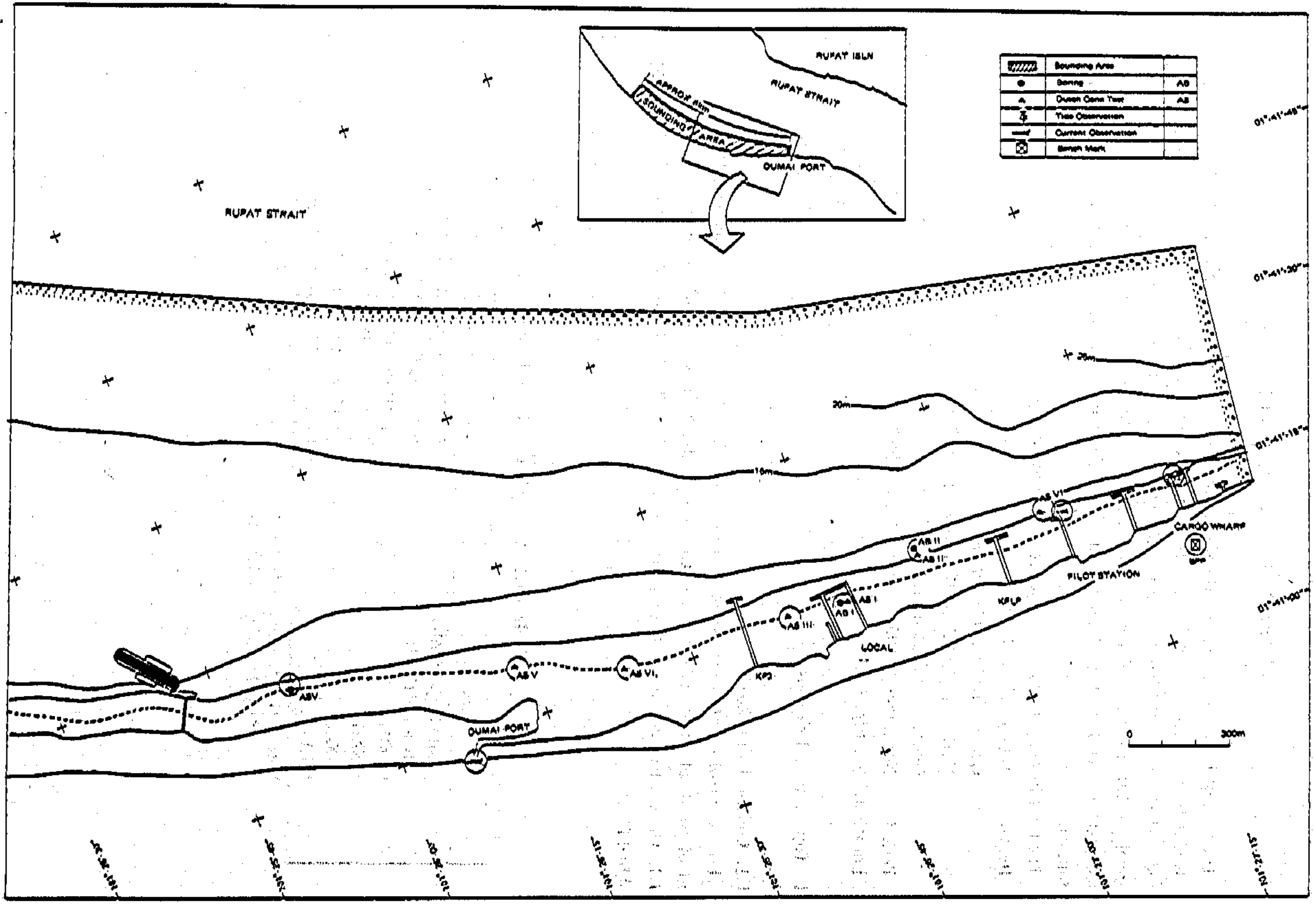


Fig. 3.1.1 Location of Natural Condition Survey

3.1.2. Coastal Survey and Sounding

Sub-control points at intervals of 100 to 200 meters along the coastal survey area were determined by traversing from control points. The height of the sub-control points was measured by leveling.

Sounding (continuous bathmetric survey) of sea bed topographical features was performed using an echo sounder (Type: PS-10). Sounding line intervals were 100 – 200 meters, the same as for the sub-control points.

The readings and sites of these soundings are shown in Table 3.1.2 and Fig. 3.1.1, and results are illustrated in Figs. 3.1.2 and 3.1.3.

The depths shown on the map are in decimeters below the datum level (D.L.), which is 170 centimeters below the Mean Sea Level (MSL: See Fig. 3.2.3)

The following features of coastal topography are notable:

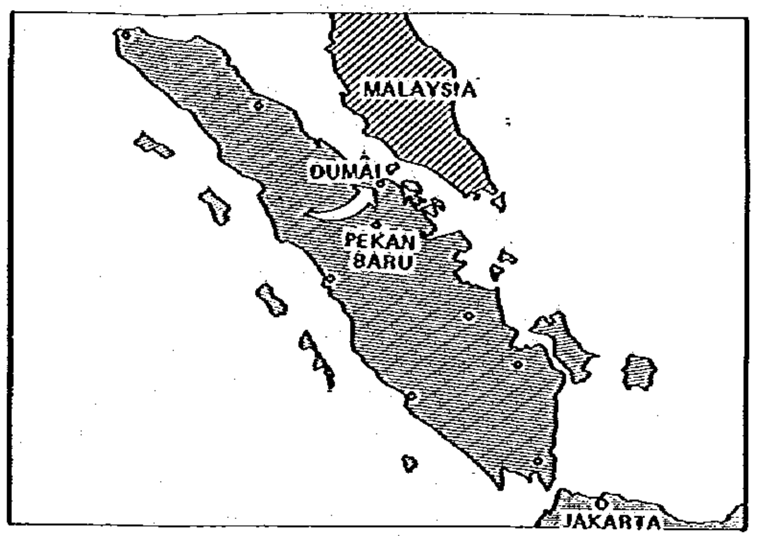
(1) Contour depth lines are generally simple, with an east to west directional trend along the shoreline.

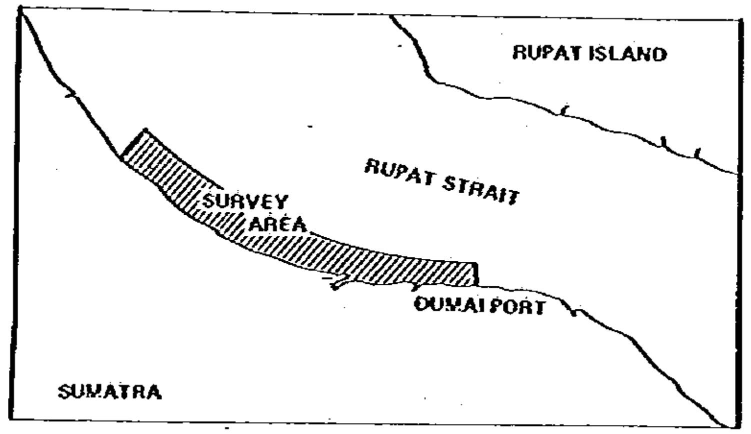
(2) The zero meter contour line is about 100 to 200 meters offshore, and the –10 meter contour line is about 200 to 400 meters offshore. For most of the survey area, the slope from shoreline to the zero meter line is gentle, with a gradient of less than 1/100. The slope from zero meters to 10 meters in depth is steep, with a 1/15 gradient. The slope past 10 meters in depth is also gentle, with a gradient less than 1/50.

Table 3.1.2 Contents of Topographic Survey

Items	Quantities	Remarks
Coastal survey	Total length: Approx 6 km of coastline Sub-control point intervals: 100 – 200 m	Base points for the survey – two existing control points at Rupat Island
Sounding	Survey area: Approx 6 km x 0.5 km Line Spacing: 100 – 200 m	Survey Area Boundaries: East: Caltex Jetty West: Jetty at Purnama II North: 15 meters in water depth South: Coast line

KEY MAP





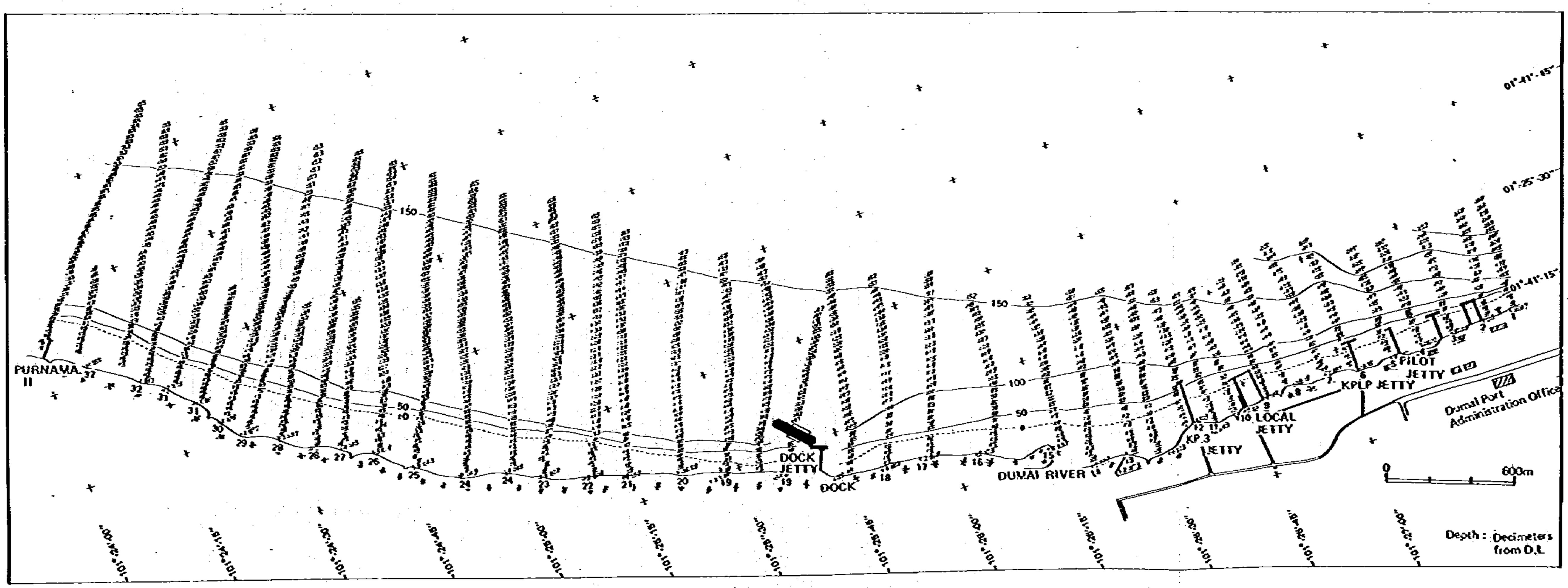


Fig. 3.1.2 Topographic Map

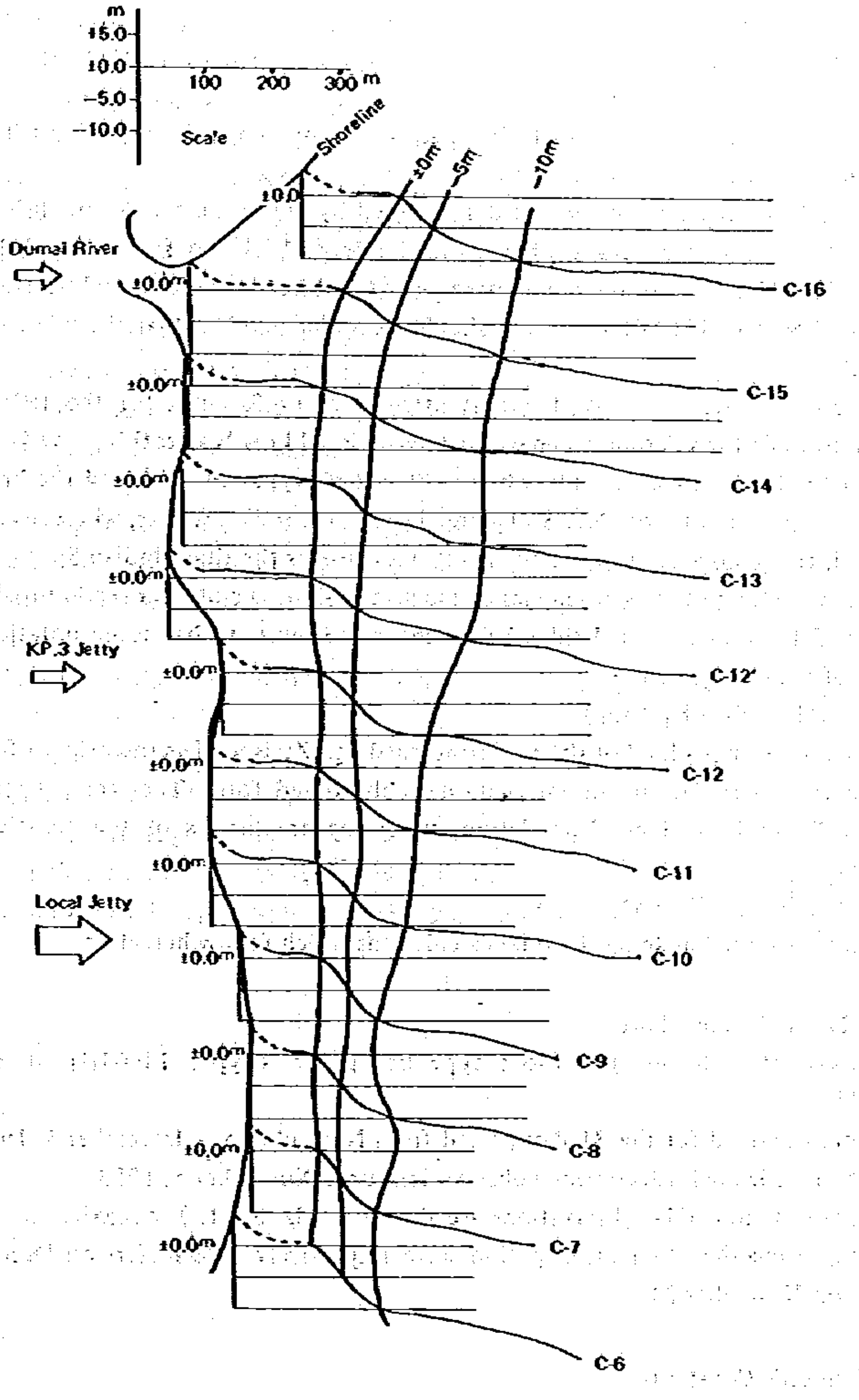


Fig. 3.1.3 Topographic Profile (course-6 ~ course-16)

3.2. Oceanographical Conditions

3.2.1. Tides

1) Determination of Datum Level*

Seamen of all nations prefer that charts show approximate minimum depths: a low water level is therefore used as the chart datum.

There is a lack of uniformity in the datums used by the nations which publish charts. These differences have long been regarded as undesirable and at the International Hydrographic Conference in 1926, the nations represented agreed, subject to certain qualifications submitted by the United States, that "Chart datum should be a plane so low that the tide will but seldom fall below it."

The 1926 resolution was not the first attempt at uniformity, for the 1919 Conference suggested a formula for a datum, to be called International Low Water; this proved impracticable. There is, in fact, no simple formula which will suit all types of tides and the best possible is probably that suggested by the late Sir George Darwin for Indian waters, where, as in other parts of the world, it has now been in use for many years under the title "Indian Spring Low Water". This datum is the sum of the semi-ranges of the principal lunar and solar semidiurnal tides and of the lunar and lumi-solar diurnal tides below mean sea level. In harmonic notation, using the amplitudes of the constituents;

$$So - (M_2 + S_2 + K_1 + O_1)$$

where So is the mean sea level of the area concerned and Zo is used as the height of the mean sea level above the chart datum, an international abbreviated form. Therefore, when the Indian Spring Low Water is used as chart datum, using the amplitudes of the constituents, Zo is expressed by

$$Zo = M_2 + S_2 + K_1 + O_1$$

These formulas are used in doing the tidal calculations which follow hereafter.

2) Datum Level at Dumai Port

Tides were observed using a Float type tide gauge (Type; LFT-III) at 01°41'15"N, 101°27'21"E.

Data were obtained for the 31 day period from November 5 – December 5, 1982. The Port Administration of Dumai will continue observations until November 5, 1983.

Data obtained from tidal observations are shown in Fig. 3.2.1. The maximum and minimum tidal heights during the observation period were respectively 2.86 meters on December 2, and 0.52 meters on November 24.

(1) Tidal Harmonic Constants

- Tidal harmonic constants are calculated using hourly data from the 31 day period, as shown in Table 3.2.1 with existing harmonic constants serving as reference.

  The tide type coefficient $(K_1 + O_1) / (M_2 + S_2)$ was 0.20, indicating a double day tide.

---

*A.T. Doodson and H.D. Warburg, Admiralty Manual of Tides Reprinted 1966; Provided that tidal observations covering at least a two week period are available, this method can be used to determine the datum level at any port.

(2) Tide Level

Fig. 3.2.2 shows variations in the monthly Mean Sea Level (MSL) at Tg. Medang during the year 1978 – 1979. According to this figure, the monthly MSL varies periodically, with a maximum range of variation of about 25 centimeters.

Fig. 3.2.3 shows tidal relations calculated by harmonic constants obtained from this survey. The tidal levels in this figure are as follows;

a) The yearly Mean Sea Level (MSL) is corrected by using the value for the harmonic constants of Annualy Tide (SA) and Semi-Annualy Tide (SSA) at Tg. Medang (See Table 3.2.1).

b) The Datum Level (DL) is decided in Zo centimeters below the MSL.

$$DL = MSL - Zo \; (= \text{Low Water Spring})$$

The Dumai Port Administration has been using 170 cm as Zo Value.

In this study, Zo is calculated as follows:

$$Zo = M_2 + S_2 + K_1 + O_1$$

Based on this, Zo for our observations was 154 cm.

As mentioned above, monthly MSL varies about ±12.5 centimeters from yearly MSL judging from Fig. 3.2.2, so that the value of 170 centimeters can be applied safely as Zo in this study.

c) Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) are calculated respectively as follows:

$$MHWS = MSL + (M_2 + S_2)$$

$$MLWS = MSL - (M_2 + S_2)$$

d) The Approximate Highest High Water is the highest predicted level for the two years 1982 – 1983, based on calculations using harmonic constants as shown in Table 3.2.1. This is regarded as the approximate maximum water level for Dumai Port.

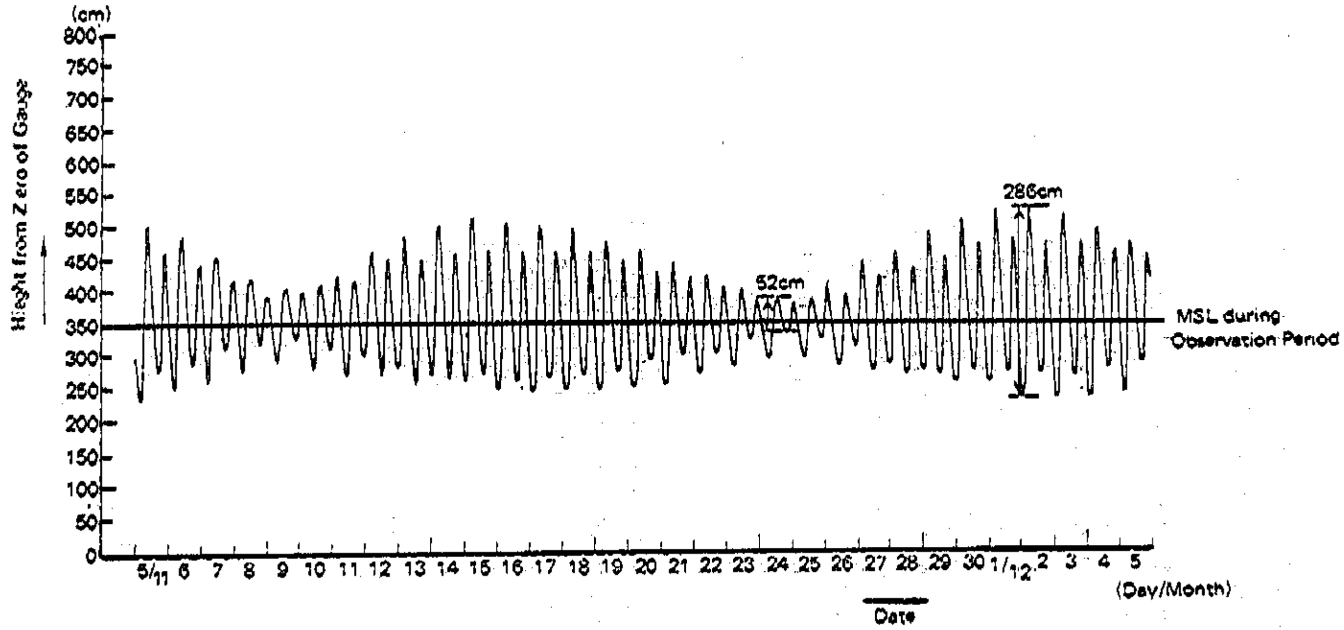
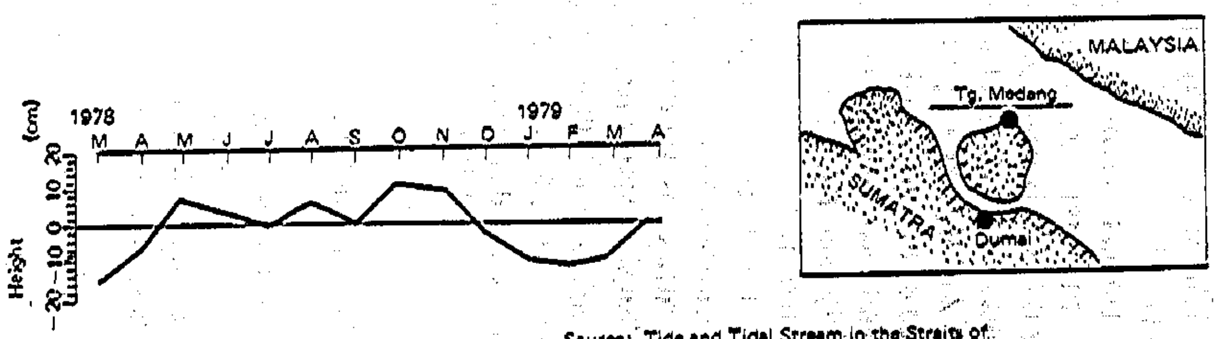


Fig. 3.2.1 Tide Curve



Source: Tide and Tidal Stream in the Straits of Malacca and Singapore, Hydrograhic Researchs, Japan

Fig. 3.2.2 Monthly Mean Sea Level at Tg. Medang

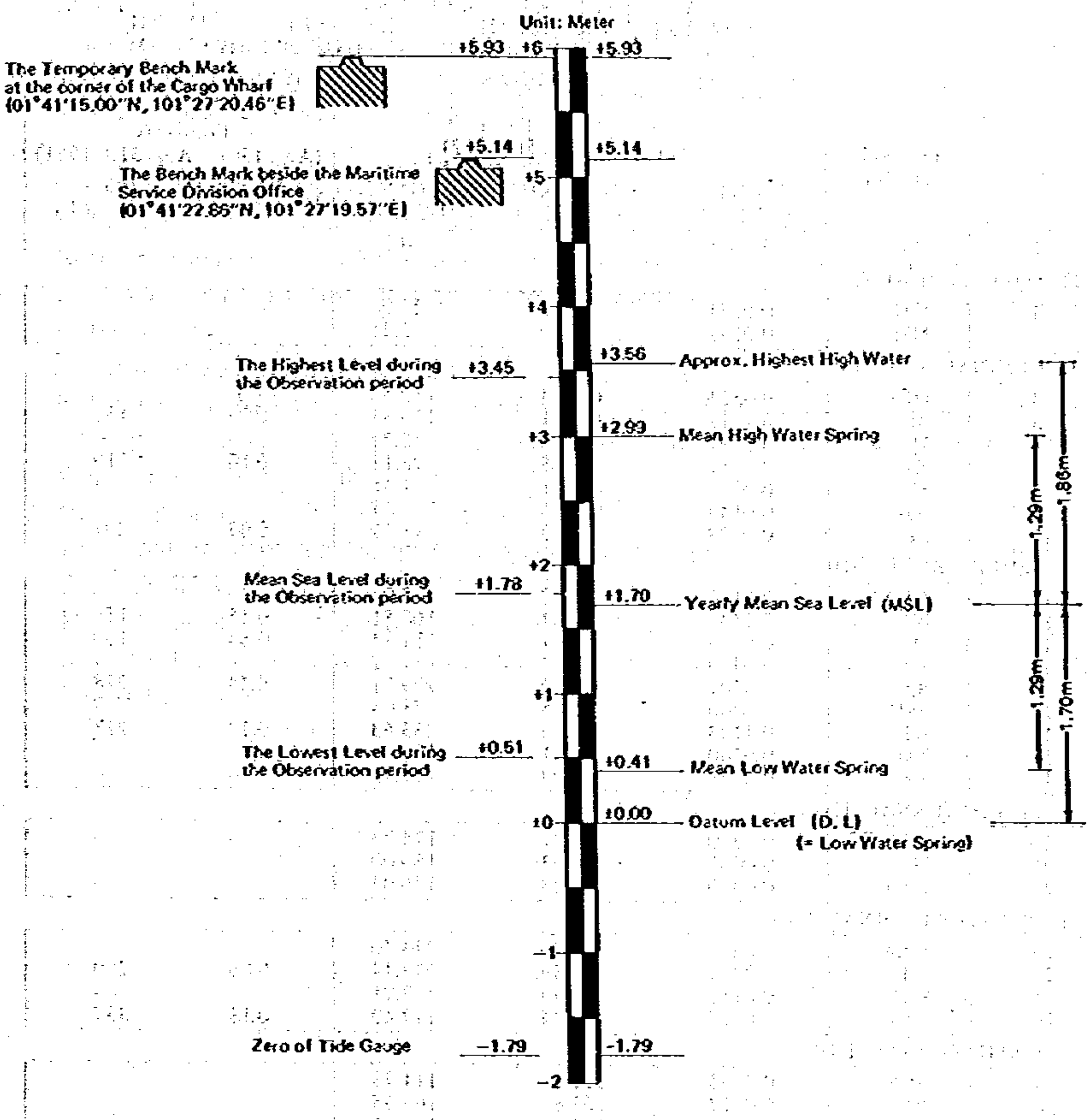


Fig. 3.2.3 Tidal Diagram

Table 3.2.1 Result of the Tidal Harmonic Analysis

STATION ** THE PORT OF DUMAI
LAT. 1-41-15 N, LONG, 101-27-21 E
DURATION ** ONE MONTH TIME KEPT ** -7 H
EPOCK ** 1982/11/20 00 00 UNIT OF HEIGHT ** M

** HARMONIC CONSTANT **

No.	CONSTI-TUENT	Harmonic Constants (Nov. 5th – Dec. 5th 1982)			Existing Harmonic*2) Constants (Aug. 15th – Aug. 31th 1981)	
		HEIGHT*3) (METER)	KAPPA (K)*3) (DEGREE)	G*3) (DEGREE)	Height (Meter)	G (DEGREE)
1	So	3.5686	0.0	0.0	–	–
1) LONG PERIOD TIDE						
2	MM	0.0251	22.15	25.96	–	–
3	MSF	0.0579	15.30	22.41	–	–
2) DIURNAL TIDE						
4	Q1	0.0324	120.24	112.58	–	–
5	O1	0.1872	134.71	130.85	0.27	152
6	M1	0.0171	16.38	16.37	–	–
7	K1	0.0687	92.35	96.18	0.10	219
8	J1	0.0063	113.81	121.45	–	–
9	OO1	0.0147	178.56	190.07	–	–
10	P1	0.0227	95.53	98.79	0.03	207
3) SEMI-DIURNAL TIDE						
11	MU2	0.0166	265.12	257.98	–	–
12	N2	0.1442	172.64	168.81	0.15	156
13	M2	0.8655	181.37	181.34	0.84	180
14	L2	0.0367	178.84	182.62	–	–
15	S2	0.4201	222.62	229.71	0.44	228
16	2SM2	0.0406	63.85	78.05	–	–
17	K2	0.1143	225.96	233.63	0.12	228
18	NU2	0.0280	173.81	170.49	–	–
19	T2	0.0248	220.97	227.77	–	–
4) THIRD-DIURNAL TIDE						
20	MO3	0.0370	178.21	174.33	–	–
21	M3	0.0065	180.03	180.00	–	–
22	MK3	0.0430	172.23	176.04	–	–
5) QUARTER-DIURNAL TIDE						
23	MN4	0.0277	228.26	224.40	–	–
24	M4	0.0764	227.49	227.44	0.06	260
25	SN4	0.0118	233.95	237.21	–	–
26	MS4	0.0707	270.34	277.40	0.18	337
6) SIXTH-DIURNAL TIDE						
27	2MN6	0.0295	115.61	111.73	–	–
28	M6	0.0423	105.82	105.75	–	–
29	MSN6	0.0169	104.64	107.87	–	–
30	2MS6	0.0705	155.14	162.19	–	–
31	2SM6	0.0243	219.29	233.45	–	–
7) ANNUALY AND SEMI-ANNUALY TIDE AT TG MEDANG*1)						
32	SA	0.0885	158.98	–	–	–
33	SSA	0.0615	113.55	–	–	–

YEARLY MEAN SEA LEVEL ABOVE ZERO OF GAUGE ZO° = 3.4910

Note: *1) See Fig. 3.2.2
*2) Existing Consts: using 15 days and Night Data
*3) Height – Amplitude of constituent
KAPPA – Phase lag used local time
G – Phase lag used Greenwich time

Source: *1) Tide and Tidal Stream in the Straits of Malacca and Singapole, Hydrographic Researches, Japan.
*2) Final Report Survey Hidrografi dan Penyelidikan Tanah di Perairan Pelabuhan Dumai August – September, 1981.

3.2.2. Currents

Current observation was performed with a current meter (Type CM-2) at the two stations shown in Fig. 3.1.1.

One of these stations is located at the end of Pilot Jetty, in water about 4 meters deep. The other station is on the bridge at the mouth of the Dumai River. Hourly data at each station was obtained for a period of 25 hours. Results of the current observation are shown in Figs. 3.2.4 and 3.2.5.

1) Current at the end of the Pilot Jetty

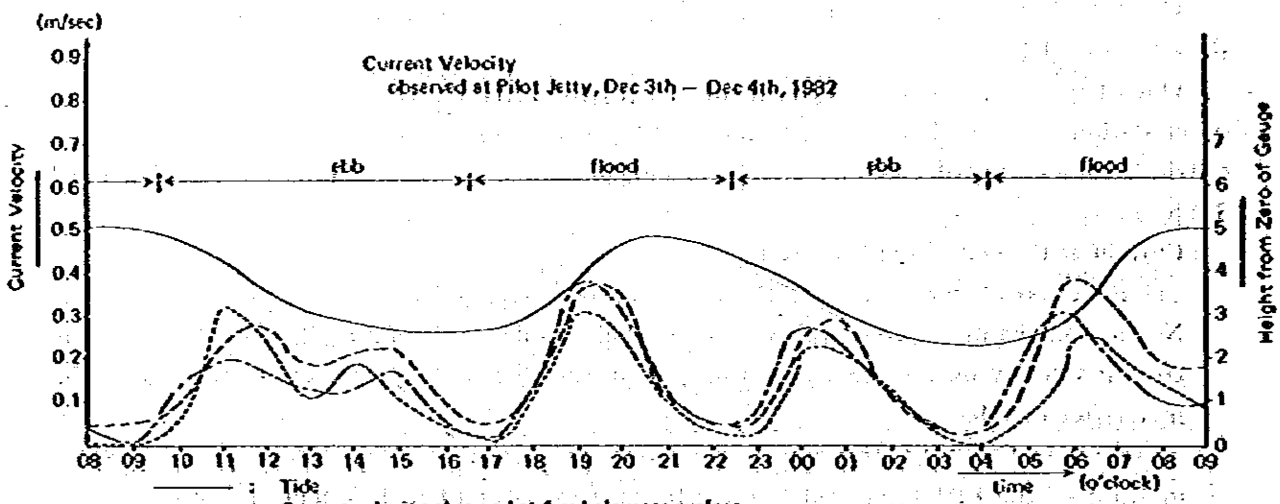
The direction of flood stream varies between 70 degrees and 110 degrees clockwise from the North, and the direction of ebb varies between 250 degrees and 300 degrees. The maximum current velocity during the observation period was 0.41 meters/sec in flood stream and 0.32 meters/sec in ebb.

As shown in Fig. 3.2.4, this current velocity is on average 50% less than observed by DGSC, in front of the KP3 Jetty 500 meters off shore in water 14 meters deep. The difference of velocity at the two stantions probably resulted from the difference in the distance from the shoreline, as well as from the difference in depth.

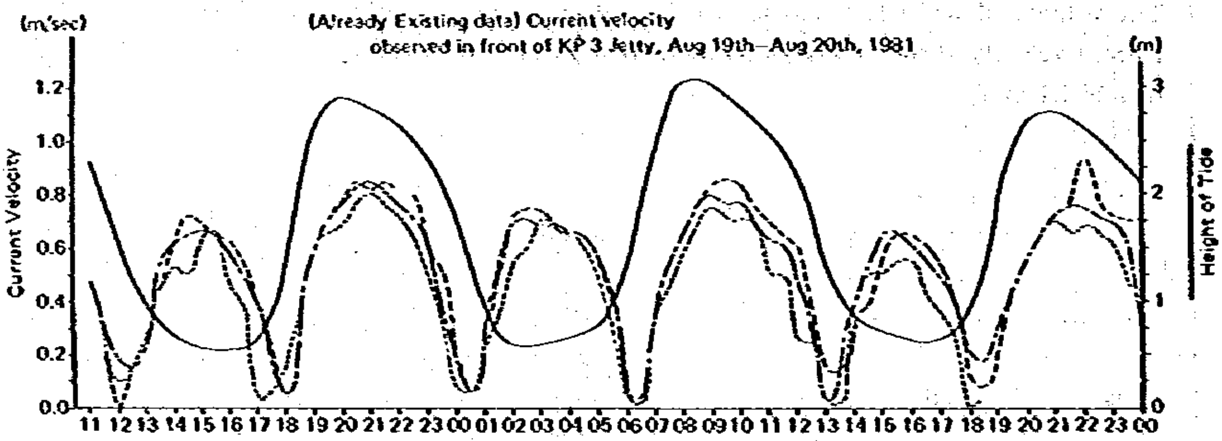
2) Current at the mouth of the Dumai River

The maximum current velocity during the observation period was 0.86 meters/sec with a direction of 337 degrees.

The volume of water flow has been caluculated using the hourly data of sectional area and current velocity at the observation point. As shown in Fig. 3.2.5, the average volume of water flow is 4.1 m³/sec.

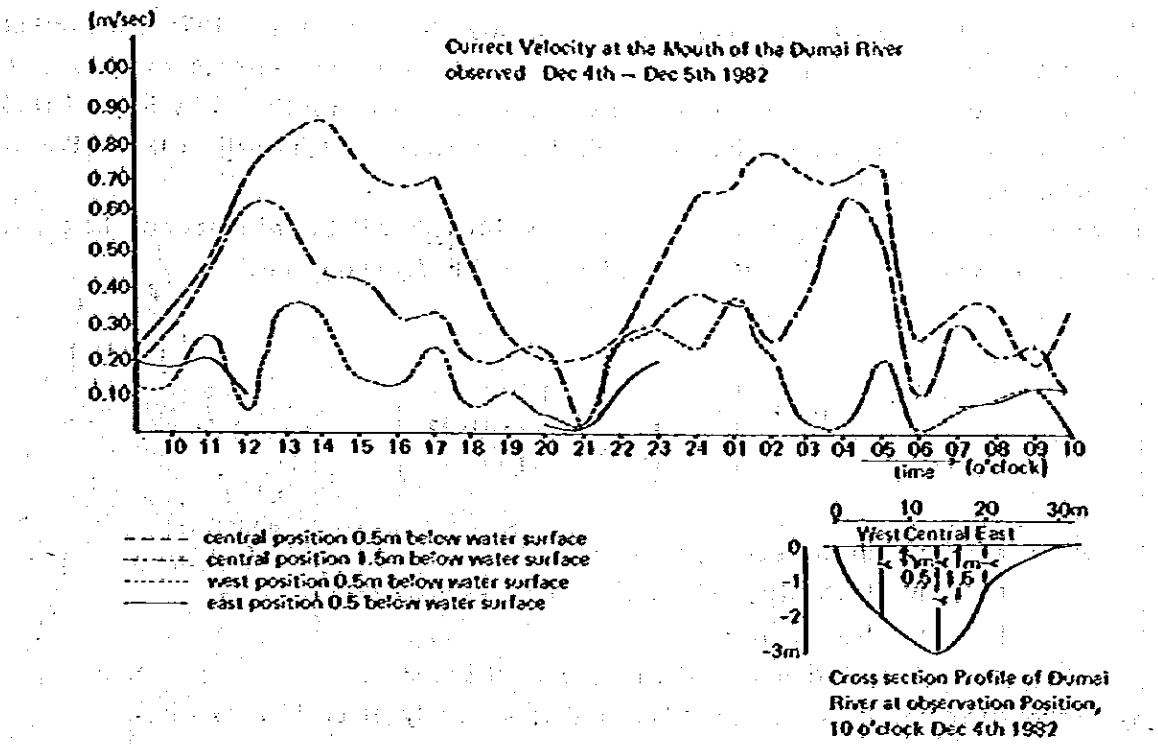


——— : Tide
------ : Current velocity observed at 1 m below sea surface
—·—·— : Current velocity observed at 3 m below sea surface
········· : Current velocity observed at 2 m above sea bed
flood : Current direction between 250 degrees and 300 degrees
ebb : Current direction between 70 degrees and 110 degrees



——— : tide
------ : Current velocity observed at 1 m below sea surface
— — — : Current velocity observed at half depth
········· : Current velocity observed at 1 m above sea bed
Source : Final Report Survey Hidrografi dan Penyelidikan Tanah di Perairan Pelabuhan Dumai August–September, 1981

Fig. 3.2.4 Hourly Variation of Current Velocity (Sea Area)



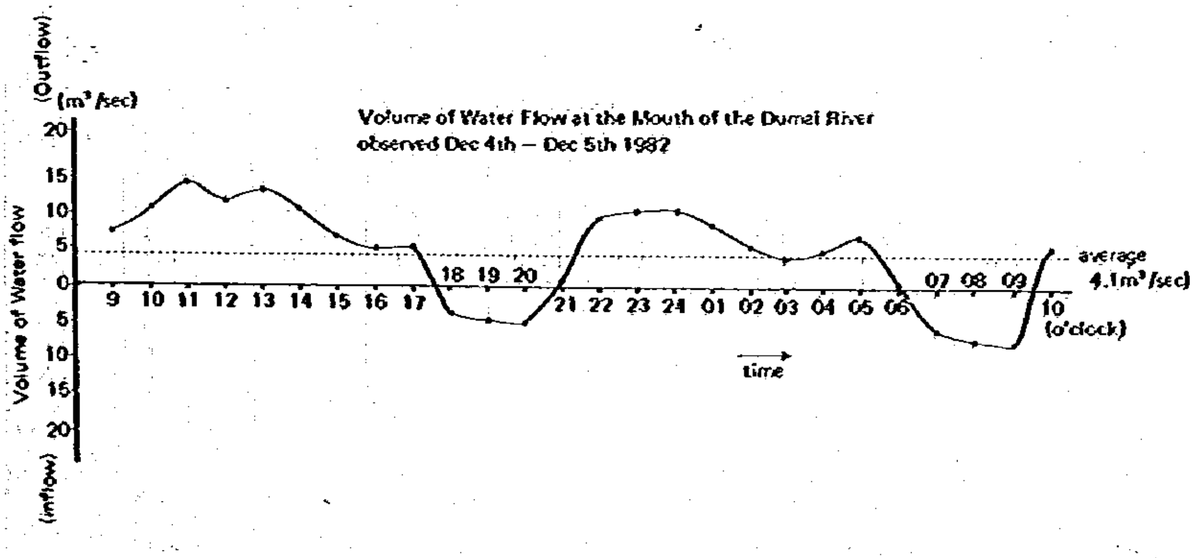


Fig. 3.2.5 Hourly Variation of Current Velocity and Volume of Water Flow (Mouth of the Dumai River)

3.2.3 Waves

As shown in Table 3.3.1, the maximum wind velocity observed between 1978 and 1980 at the Dumai Airport was 17–21 knots and the frequency of strong wind occurrence is very low.

Dumai Port is located along the narrow Rupat Strait and is well sheltered by Rupat Island from outer sea waves. As shown in Fig. 3.2.6, the longest effective fetch length at Dumai Port is northnorthwest and is 7.7 kilometers.

According to the following formula which is S-M-B method, the highest wave height is calculated at 0.63 meters using U = 10.8m/s(=21 knot) and F=7.7 kilometers.

$$\frac{gH_{1/3}}{U^2} = 0.30 \left[1 - \frac{1}{\left\{ 1 + 0.004 \left(\frac{gF}{U^2} \right)^{1/2} \right\}^2} \right]$$

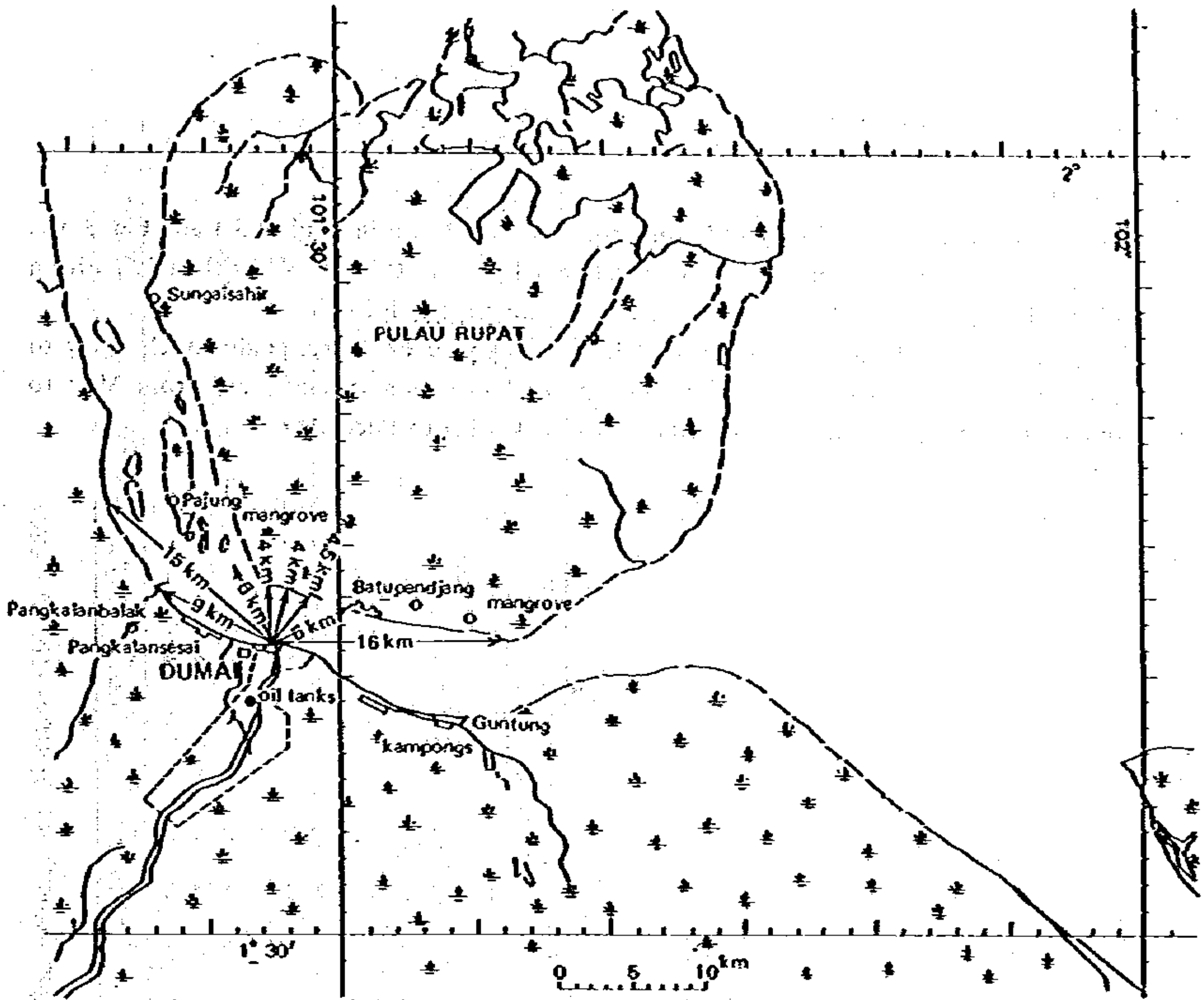
where $H_{1/3}$: Significant wave height (m)

U: Wind velocity at 10 meters above sea surface (m/s)

F: Fetch length (m)

g: Acceleration of gravity (m/s^2), $g = 9.8\ m/s^2$

As mentioned above, the water area of Dumai Port is scarcely affected by sea waves.



Direction	Fetch Length Fi (km)	Main Wind Direction E: COS θi	Main Wind Direction E: Fi×COS θi	Main Wind Direction ENE: COS θi	Main Wind Direction ENE: Fi×COS θi	Main Wind Direction NE: COS θi	Main Wind Direction NE: Fi×COS θi	Main Wind Direction NNE: COS θi	Main Wind Direction NNE: Fi×COS θi
E	16	1.000	16.0	0.924	14.8	0.707	11.3		
ENE	6	0.924	5.5	1.000	6.0	0.924	5.5	0.707	4.2
NE	4.5	0.707	3.2	0.924	4.2	1.000	4.5	0.924	4.2
NNE	4			0.707	2.8	0.924	3.7	1.000	4.0
N	4					0.707	2.8	0.924	3.7
NNW	6							0.707	4.2
NW	15								
WNW	9								
Σ(Fi×COS θi)		24.7		27.8		27.8		20.3	
Effective Fetch * Length (Km)		5.8		6.5		6.5		4.8	

Direction	Fetch Length Fi (km)	Main Wind Direction N: COS θi	Main Wind Direction N: Fi×COS θi	Main Wind Direction NNW: COS θi	Main Wind Direction NNW: Fi×COS θi	Main Wind Direction NW: COS θi	Main Wind Direction NW: Fi×COS θi	Main Wind Direction WNW: COS θi	Main Wind Direction WNW: Fi×COS θi
E	16								
ENE	6								
NE	4.5	0.707	3.2						
NNE	4	0.924	3.7	0.707	2.8				
N	4	1.000	4.0	0.924	3.7	0.707	2.8		
NNW	6	0.924	5.5	1.000	6.0	0.924	5.5		
NW	15	0.707	10.6	0.924	13.9	1.000	15.0	0.924	13.9
WNW	9			0.707	6.4	0.924	8.3	1.000	9.0
Σ(Fi×COS θi)		27.0		32.8		31.6		22.9	
Effective Fetch * Length (Km)		6.3		7.7		7.4		5.4	

* $\Sigma(Fi \times COS\ \theta i)/\Sigma COS\ \theta i = \Sigma(Fi \times COS\ \theta i)/4.262$

Fig 3.2.6 Effective Fetch Length at Dumai Port

3.3 Meteorological Conditions

3.3.1 Winds

The frequency of wind velocity and wind direction are shown in Table 3.3.1 and Fig. 3.3.1. According to this Table, the occurrence of wind velocity over 10 knots is less than 5%, with a maximum velocity of 17 – 21 knots. Generally, the wind velocity is low.

The prevailing wind direction is eastward from January to February, gradually changing to southward from March to April. The prevailing wind direction is southward from May to September, gradually changing again to eastward from October to December.

Table 3.3.1 Frequency of Wind Velocity and Direction (1978 – 1980)

Velocity

Month \ Velocity / Year	Calm			1–3 Knots			4–6 Knots			7–10 Knots			11–16 Knots			17–21 Knots			22–27 Knots			28–33 Knots		
	'78	'79	'80	'78	'79	'80	'78	'79	'80	'78	'79	'80	'78	'79	'80	'78	'79	'80	'78	'79	'80	'78	'79	'80
January	25	23	26	2	-	1	9	4	5	9	14	13	1	8	2	-	2	-	-	-	-	-	-	-
February	21	24	17	-	-	-	10	6	7	15	11	17	-	4	5	-	2	-	-	-	-	-	-	-
March	28	20	28	-	-	-	21	22	10	5	9	11	-	1	2	-	-	-	-	-	-	-	-	-
April	22	23	30	5	2	-	15	17	12	8	5	6	-	2	1	-	-	-	-	-	-	-	-	-
May	20	*	28	4	*	-	16	*	11	11	*	11	1	*	1	-	*	-	-	-	-	-	-	-
June	22	22	22	3	-	-	14	16	8	12	14	13	-	-	5	-	-	-	-	-	-	-	-	-
July	25	28	22	-	-	-	17	10	26	5	13	6	-	-	-	-	-	-	-	-	-	-	-	-
August	27	24	27	-	-	6	7	6	9	9	11	9	3	6	1	1	-	-	-	-	-	-	-	-
September	26	27	22	-	-	-	12	13	19	9	10	11	1	-	1	-	-	-	-	-	-	-	-	-
October	25	32	20	1	-	-	14	10	12	8	8	17	-	2	4	-	-	-	-	-	-	-	-	-
November	29	40	26	4	-	-	10	7	7	7	3	13	-	2	2	-	-	-	-	-	-	-	-	-
December	24	19	29	-	-	-	6	12	12	10	14	12	15	2	2	-	-	-	-	-	-	-	-	-
Average	24.5	25.6	24.8	1.6	0.2	0.6	12.6	11.2	11.5	9.0	10.2	11.6	1.8	2.5	2.2	0.1	0.4	-	-	-	-	-	-	-
(rate: %)	(49.4)	(51.1)	(48.9)	(3.2)	(0.4)	(1.2)	(25.4)	(22.4)	(22.7)	(18.1)	(20.4)	(22.9)	(3.6)	(4.9)	(4.3)	(0.2)	(0.8)	-	-	-	-	-	-	-

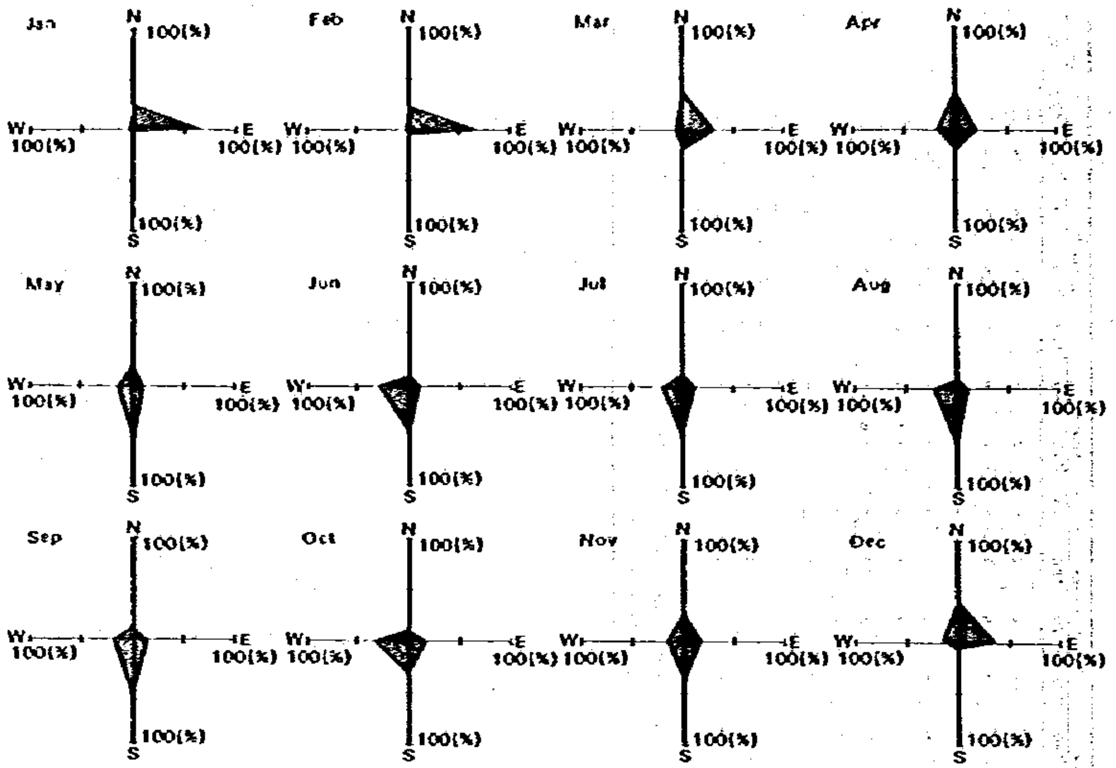
Direction

Month \ Direction / Year	315° – 45°			45° – 135°			135° – 225°			225° – 315°		
	'78	'79	'80	'78	'79	'80	'78	'79	'80	'78	'79	'80
January	7	5	6	13	21	14	1	1	-	-	2	1
February	1	5	13	19	17	16	3	-	-	1	1	1
March	6	18	10	15	5	7	3	8	5	3	1	1
April	10	9	9	5	5	5	5	9	-	5	3	5
May	7	*	5	3	*	3	17	*	12	5	*	3
June	4	*	1	3	*	2	14	*	13	9	*	9
July	5	-	4	4	2	4	8	14	17	6	6	4
August	3	-	2	-	3	4	9	17	14	9	3	5
September	3	1	4	2	3	5	13	13	16	4	4	6
October	6	1	1	2	2	11	8	4	14	7	13	7
November	7	1	6	4	2	3	4	7	10	6	1	2
December	13	8	9	4	17	5	-	-	5	4	3	3

Note: 1. 2 times observation per day at 07.00 and 12.00 o'clock

2. * no data

Source: Pinang Kampai Port, Dumai



Source: Pinang Kampai Port, Dumai

Fig 3.3.1 Wind Rose (1978~1980)

3.3.2. Rainfall

Monthly totals for rainfall from 1974 to 1979 are shown in Table 3.3.2 and Fig. 3.3.2. According to this table, rainfall is high in April and May and from September to November. The highest monthly rainfall is 246 millimeters in November and the lowest is 62 millimeters in January.

From 1974 to 1979, average yearly rainfall was 1729 millimeters.

Table 3.3.2 Rainfall (1974 – 1979)

Month	Year						Average
	1974 (mm)	1975 (mm)	1976 (mm)	1977 (mm)	1978 (mm)	1979 (mm)	1974 - 1979 (mm)
January	6	208	33	31.5	45	39	61.6
February	118	80	36	102.5	62	76.5	79.2
March	113	226	128	7.5	119	-	118.7
April	292	234	187	36.5	187	258.5	199.2
May	371	164	147	64	118	139.5	167.3
June	127	119	65	39	45	181	96.0
July	95	194	246	81	58.5	179	142.3
August	99.7	186	134	213.5	79	74	131.0
September	219	259	203	138.5	69	149	173.9
October	267	99	173	229	96	302.5	195.4
November	79	229	231	551.5	84	302.5	246.2
December	109	149	163.5	50	78	-	109.9
Total							1,719.7

Source: Agriculture Service, Dumai (1974 – 1978)
Agriculture Service, Riau Province (1979)

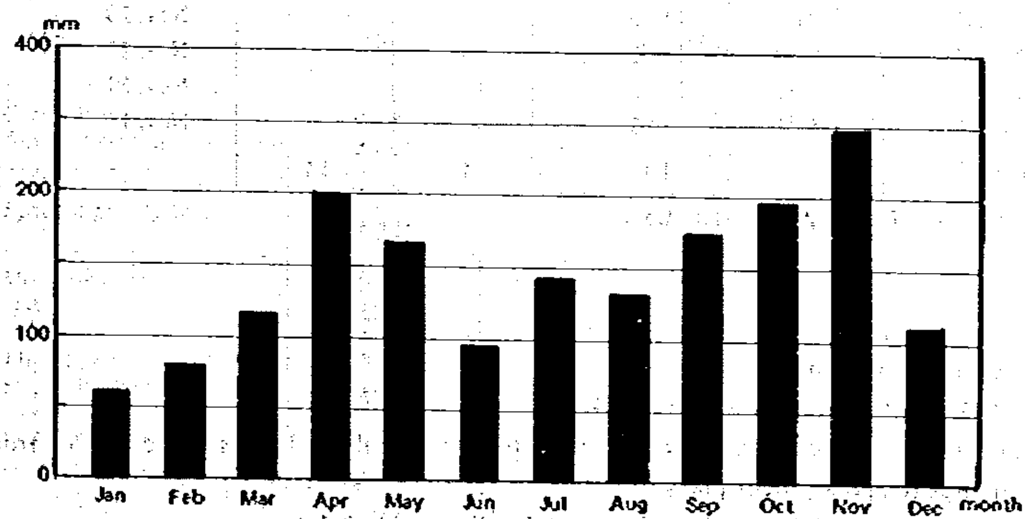


Fig 3.3.2 Average Rainfall (1974~1979)

3.4. Geotechnical Condition

3.4.1. Outline of Soil Survey

The soil survey was conducted by the DGSC team at 2 boring points and 6 dutch cone test points as shown in Fig. 3.1.1. The Standard Penetration Test (SPT) was carried out in conformity to Japan Industrial Standards at 2.0 m intervals and undisturbed-samples were gathered at N-Values with soil profiles of less than four using Thin-Walled Samplers with Fixed Pistons at 2.0 m intervals. One borehole and one dutch cone test were conducted using a platform. A pontoon was used for another borehole and five dutch cone tests. The location for each borehole and dutch cone was selected by the Teams' geotechnical engineer. Sea depth was revised to the LWS (=DL) based upon the tide table published by the survey team.

The outline of the on-site soil investigation is shown in Table 3.4.1.

Table 3.4.1 Outline of Soil Investigation

Site : The Port of Dumai, Riau, Indonesia
Period : From November 2, 1982 to December 7, 1982
Equipment : Rotary boring machine (ORV-100, Ono Sei Sakusho)
Casing pipe, JIS 97 mm
SPT JIS A 1219-1961 at every 2.0 m deep
Undisturbed Sampling at every 2.0 m deep

Borehole & Dutch Cone No.	Seadepth below LWS (m)	Depth below seabed (m)	SPT (blows)	Undisturb Sample (Pieces)	Period
AB – I	+0.71	50.00	22	6	Nov. 15 to Nov. 24
AB – II	–5.44	50.00	22	8	Nov. 26 to Dec. 4
AS – I	+0.71	34.40	–	–	Nov. 12
AS – II	–5.44	26.60	–	–	Nov. 16
AS – III	+0.02	24.60	–	–	Nov. 20
AS – IV	±0.00	33.60	–	–	Nov. 21
AS – V	–0.57	28.40	–	–	Nov. 22
AS – VI	–5.31	26.80	–	–	Nov. 18
Total		274.4	44	14	

Note: AB .... Boring, AS .... Ducth Cone.

3.4.2. Borehole Locations

Borehole locations are shown in Fig. 3.1.1.

Locations were selected in accordance with topographical conditions at the Port of Dumai as well with as port development plans.

The position of each borehole is shown in detail in Table 3.4.2.

Table 3.4.2 Detail Position of Each Borehole and Ducth Cone

Borehole & Ducth Cone No.	Longitude (East)	Latitude (North)	Remarks
AB – I AB – II	101-26-46.40 101-26-54.60	01-41-14.79 01-41-16.42	7 m off from Local Jetty by platform Between the Local Jetty and the Pokala Jetty by pontoon
AS – I	101-26-46.40	01-41-14.79	2 m off from AB-I Borehole by platform
AS – II	101-26-54.60	01-41-16.42	5 m off from AB-II Borehole by pontoon
AS – III	101-26-39.86	01-41-15.15	Between the Local Jetty and the KP. 3 Jetty by pontoon
AS – IV	101-26-23.00	01-41-16.30	Between the KP. 3 Jetty and the Dumai River by pontoon
AS – V	101-26-12.79	01-41-20.30	115 m to north from the Dumai River by pontoon
AS – VI	101-27-07.15	01-41-16.22	30 m to west from the Pilot Jetty by pontoon

3.4.3. Soil Tests

Soil tests, at AB-I and AB-2, included undisturbed Samples obtained using Thin-Walled Samplers with Fixed Piston, and disturbed Samples obtained using SPT.

The items and quantities for the soil tests are shown in Table 3.4.3.

Table 3.4.3 Soil Test

	Borehole No.	Undisturbed Sample		Disturbed Sample at the Jakarta	Total
		At the Dumai	At the Jakarta		
Grain size distribution analysis	AB-I	0	6	9	15
	AB-II	0	6	9	15
Specific gravity test	AB-I	0	6	9	15
	AB-II	0	6	9	15
Moisture content test	AB-I	6	6	0	12
	AB-II	5	6	0	11
Liquid and Plastic limit test	AB-I	0	6	0	6
	AB-II	0	6	0	6
Unconfined compression test	AB-I	6	6	0	12
	AB-II	5	6	0	11
Consolidation test	AB-I	0	6	0	6
	AB-II	0	6	0	6
Triaxial compression test	AB-I	0	1	0	1
	AB-II	0	0	0	0

3.4.4. Soil Structure

The soil structure along the coast near Dumai Port consists of Alluvium and Diluvium sedimentary soil.

The Alluvium and Diluvium strata decline gently towards the sea (Fig. 3.4.1). Where they meet the sea, a disparity of 10 meters in height has occurred due to erosion.

The soil profile section shown in Fig. 3.4.1 and Fig. 3.4.2 reveals that the lower layer of the Diluvium is divided into rowed layers consisting of hard-clay (DC2) and sandy-Clay (DC1) (from bottom to top). Its thickness is 3 to 9 meters and its consistency is stiff or hard with an N-value of 15 to 35 blows.

There is a strata of Alluvium composed of sandy soil (AS1) bordering the Diluvium Strata. Its consistency is loose with an N-value of 1 to 14 blows, and an angle of internal friction (ϕ) of 18° – 28°. The layers of clay in (AC2) consist of organic and very fine sand, with a thickness of 10 to 20 meters and very soft consistency (N=O). The top layer of clay (AC1) is still in the process of accumulation. It is very soft with a thickness of 2 to 4 meters.

3.4.5. N-Value

Distribution of N-values by depth is shown in Fig. 3.4.3. As can be seen, there is very soft clay down to LWS-19 meters below the sea floor. The clay becomes comparitively stable below LWS-22 meters.

3.4.6. Soil Test Results

Soil profils are shown in Figs. 3.4.4 and 3.4.5.

The index properties revealed by the soil test are shown in Table 3.4.4 for each layer respectively.

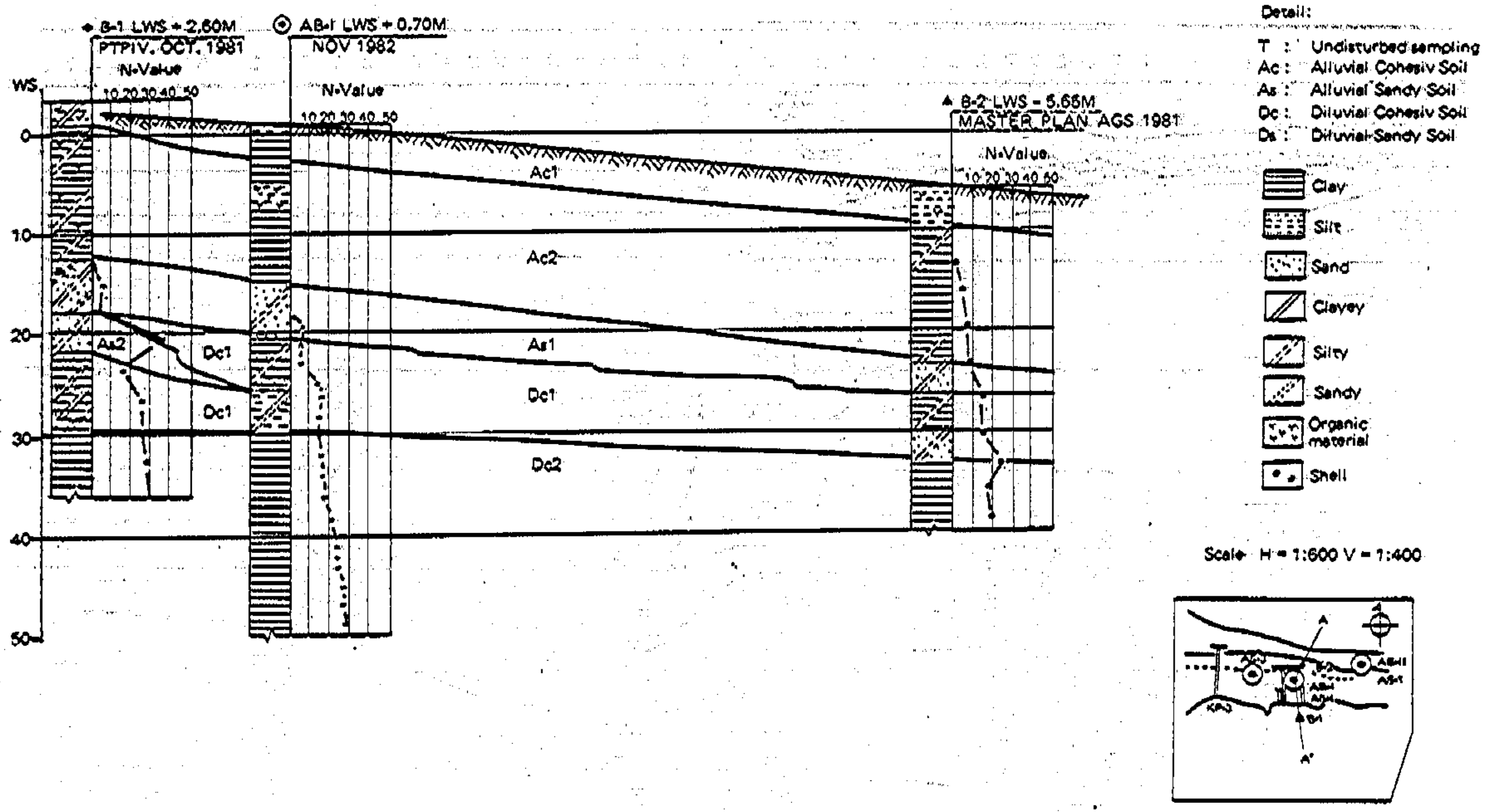


Fig. 3.4.1 (1) Soil Profile Section of A – A'

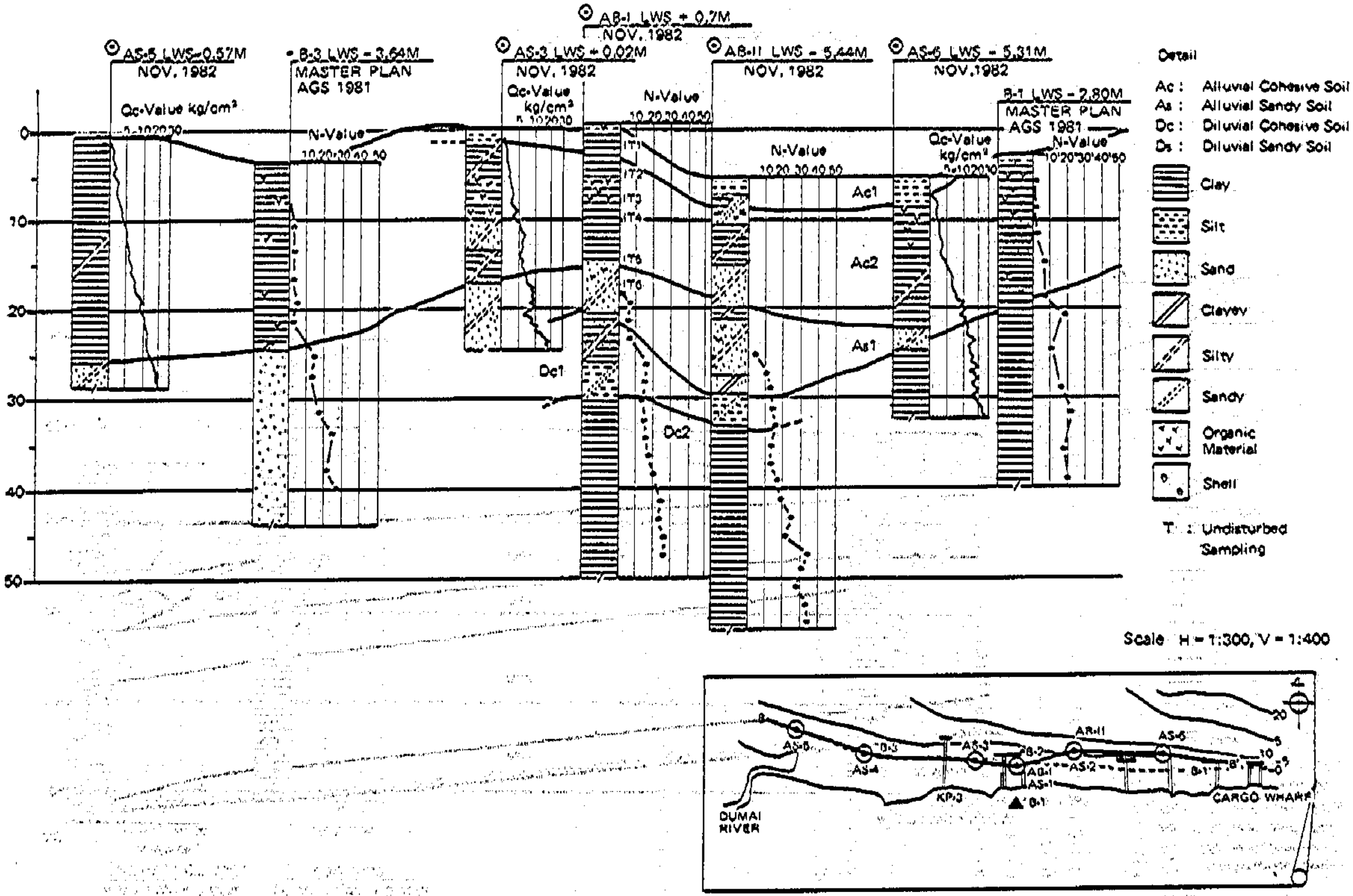


Fig. 3.4.1 (2) Soil Profile Section of B – B'

ELEVATION (LWS)	DEPTH	THICKNESS	SOIL CLASSIFICATION	COLOR	IN-PLACE CONSERVATION
-0.49	1.20	1.20	SILT	GREY	WITH ORGANIC
-5.09	5.80	4.60	CLAY	GREY	VERY SOFT
-8.09	8.80	3.00	CLAY AND ORGANIC	GREY	SOFT CLAY WITH MANY ORGANIC
-15.29	16.00	7.20	CLAY	LIGHT GREY	VERY SOFT MIX WITH SILT AND FINE SAND
-20.74	21.45	5.45	SILTY SAND	LIGHT GREY	MIX WITH LITTLE ORGANIC ON UPPER; FINE SAND WITH MANY TRACES OF CLAY
-25.79	26.50	5.05	SILTY CLAY WITH FINESAND	GREY	CLAY WITH MANY TRACES OF FINE SAND
-29.79	30.50	4.00	SANDY SILT	GREY	FINE SAND AND LITTLE COARSE SAND WITH TRACES OF SILT
-49.74	50.45	19.95	CLAY	GREEN GREY	CLAY WITH MANY CRACKING CONDITION

STANDARD PENETRATION TEST (BLOW TEST)

NO	DEPTH	N VALUE
1	3.15 ~ 3.45	0
2	6.15 ~ 6.45	0
3	7.15 ~ 7.45	0
4	11.15 ~ 11.45	0
5	13.15 ~ 13.45	0
6	19.15 ~ 19.45	1
7	20.15 ~ 20.45	2
8	22.15 ~ 22.45	5
9	24.15 ~ 24.45	6
10	26.15 ~ 26.45	14
11	27.15 ~ 27.45	15
12	29.15 ~ 29.45	15
13	31.15 ~ 31.45	14
14	33.15 ~ 33.45	15
15	35.15 ~ 35.45	16
16	37.15 ~ 37.45	18
17	39.15 ~ 39.45	22
18	42.15 ~ 42.45	23
19	44.15 ~ 44.45	23
20	46.15 ~ 46.45	26
21	48.15 ~ 48.45	26
22	50.15 ~ 50.45	28

UNDISTURBE

NO	DEPTH
T-1	2.00 ~ 2.80
T-2	5.00 ~ 5.80
T-3	8.00 ~ 8.80
T-4	10.00 ~ 10.80
T-5	15.00 ~ 15.80
T-6	18.00 ~ 18.80

Fig. 3.4.2 (1) Soil Profile of BH-I

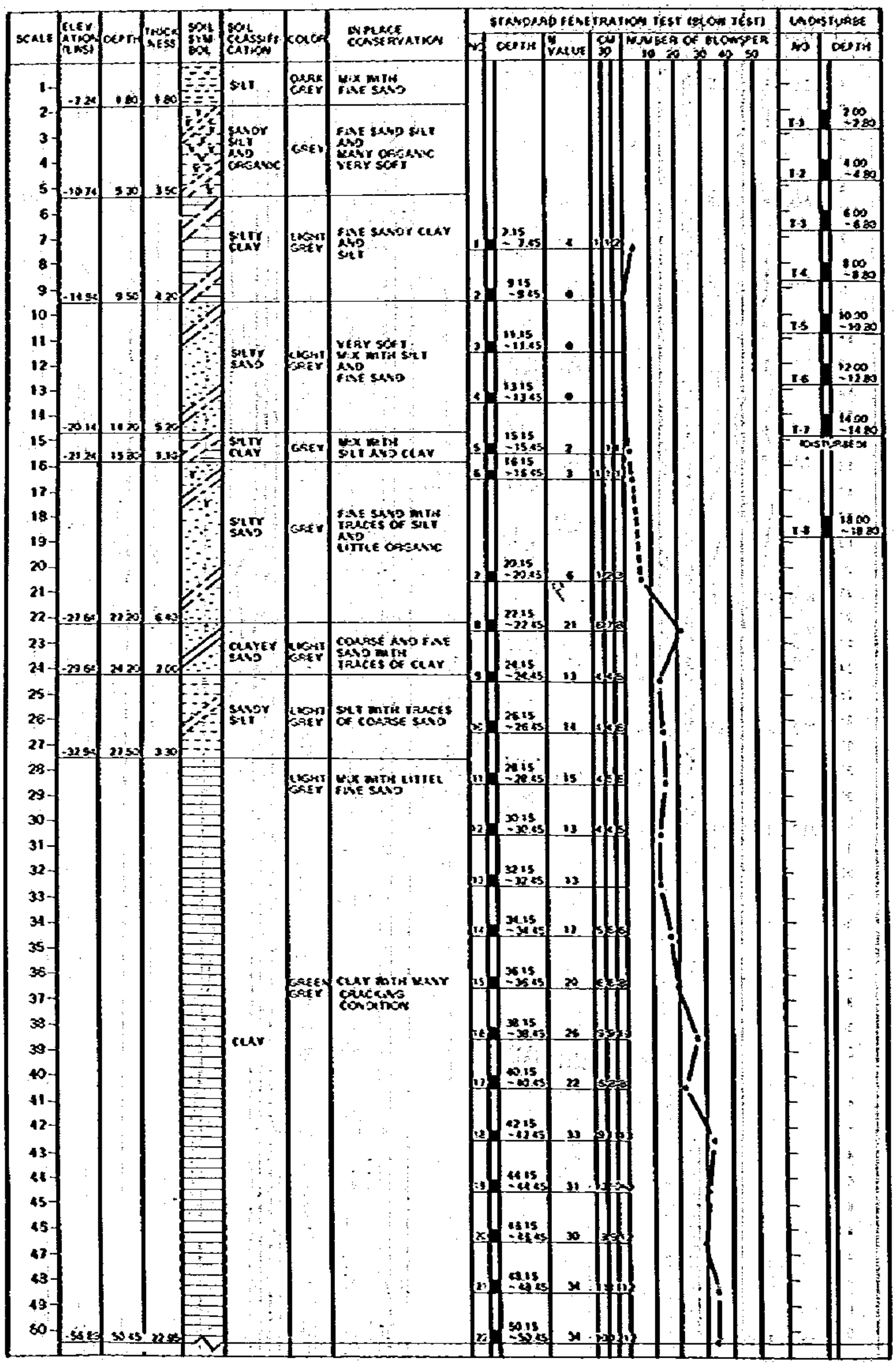


Fig. 3.4.2 (2) Soil Profile of BH-II

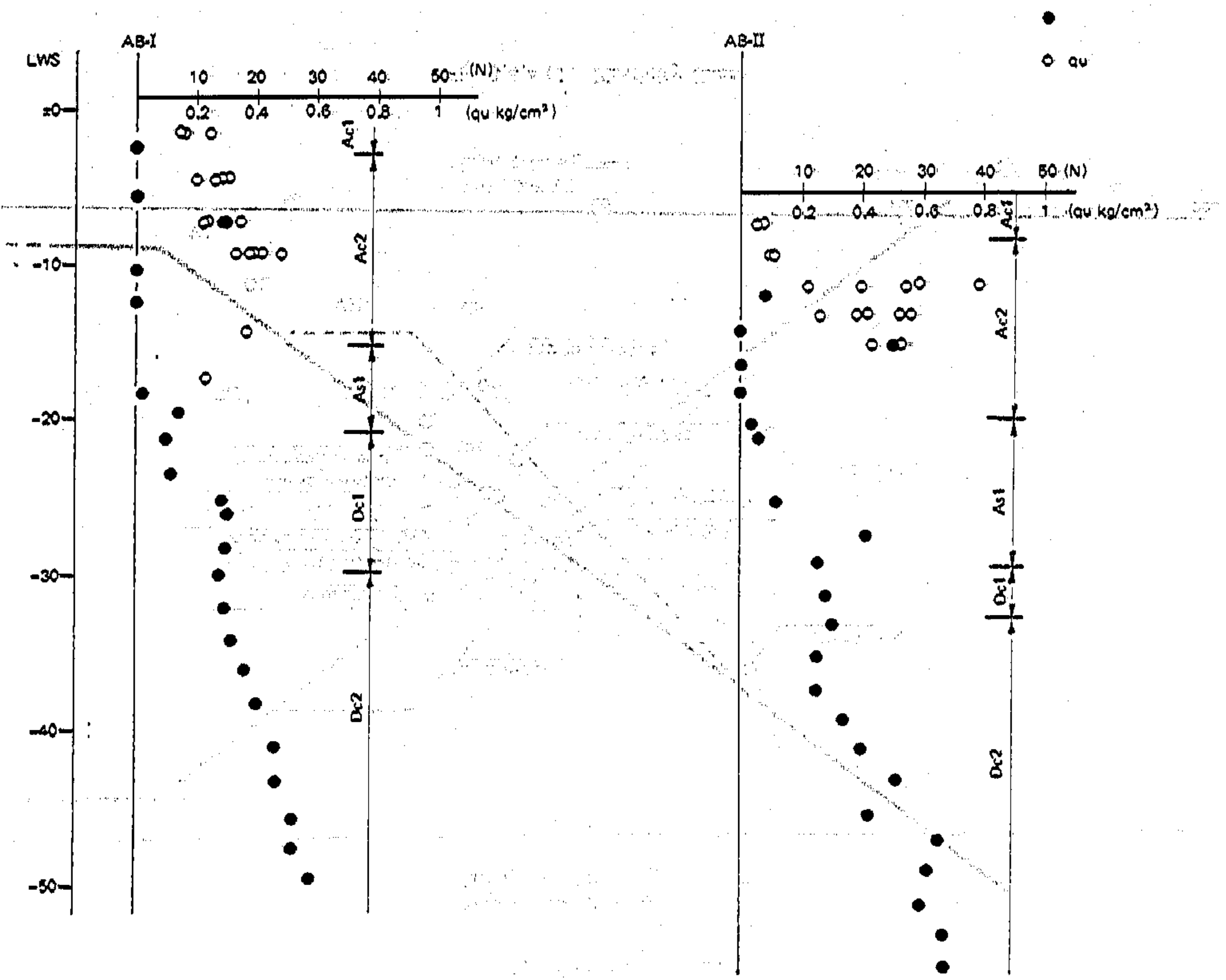


Fig. 3.4.3 Distrubution of N and Qu-Value

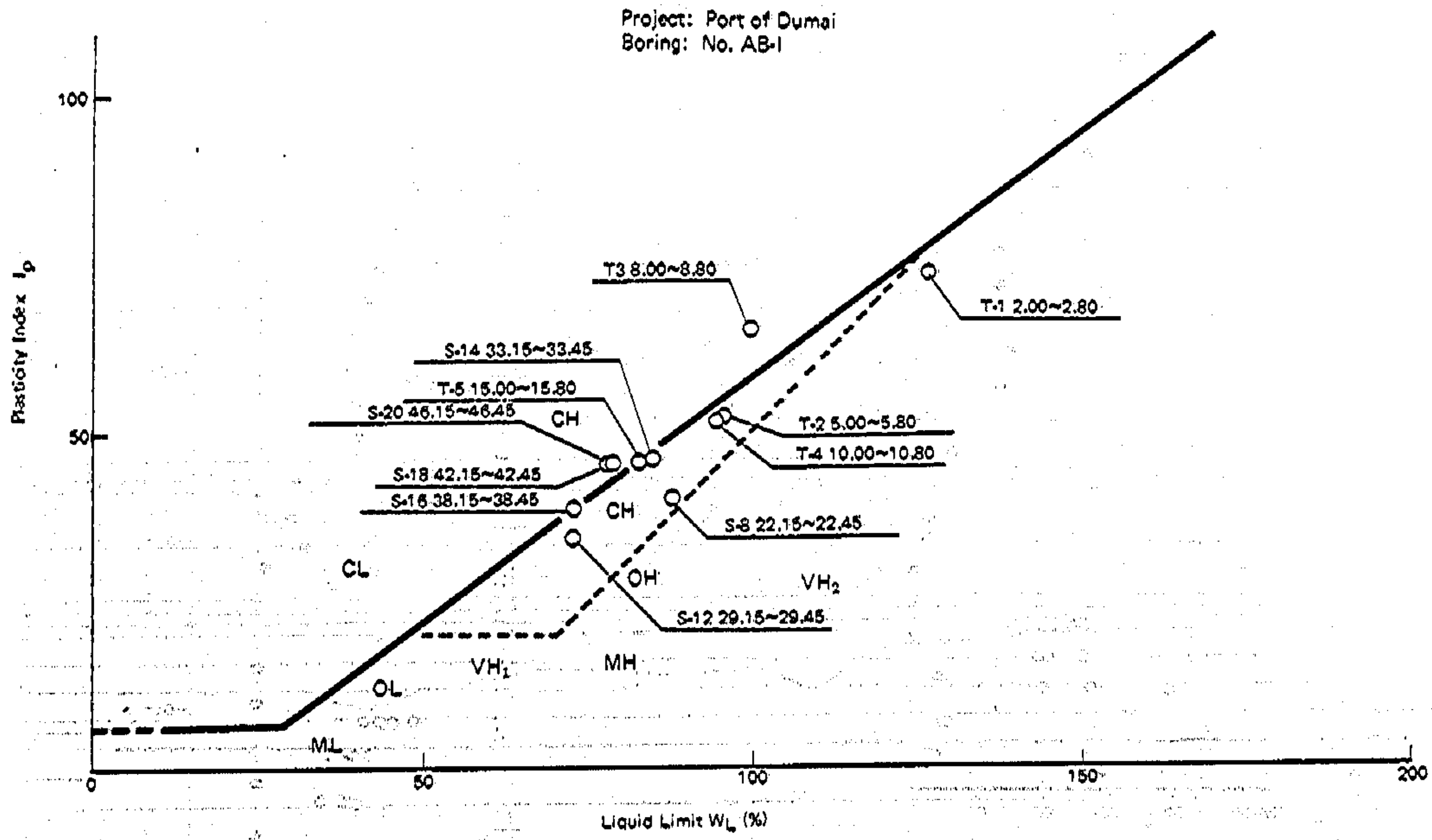


Fig. 3.4.4 (1) Plasticity Chart

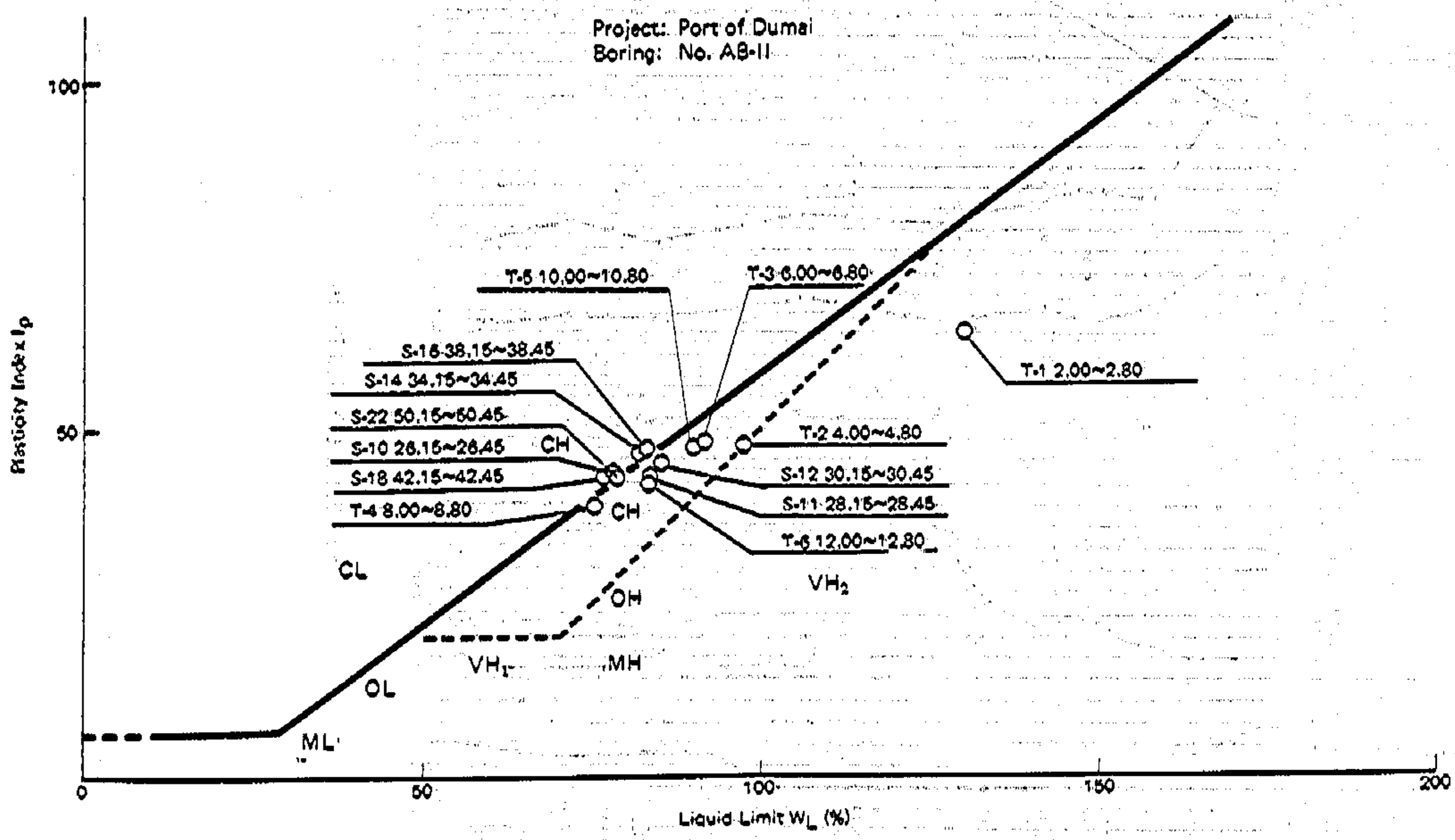


Fig. 3.4.4 (2) Plasticity Chart

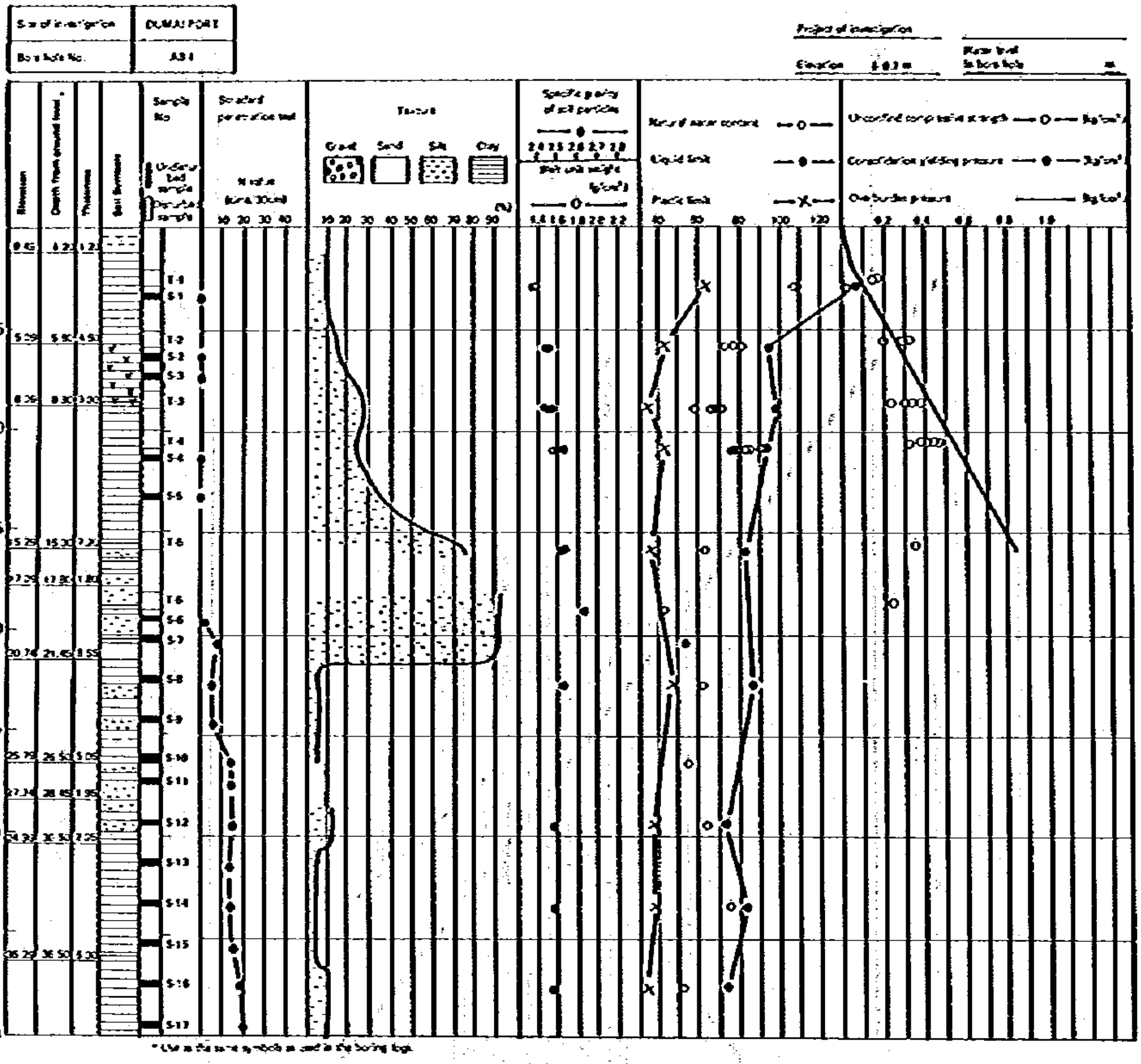


Fig. 3.4.5 (1) Soil Profile

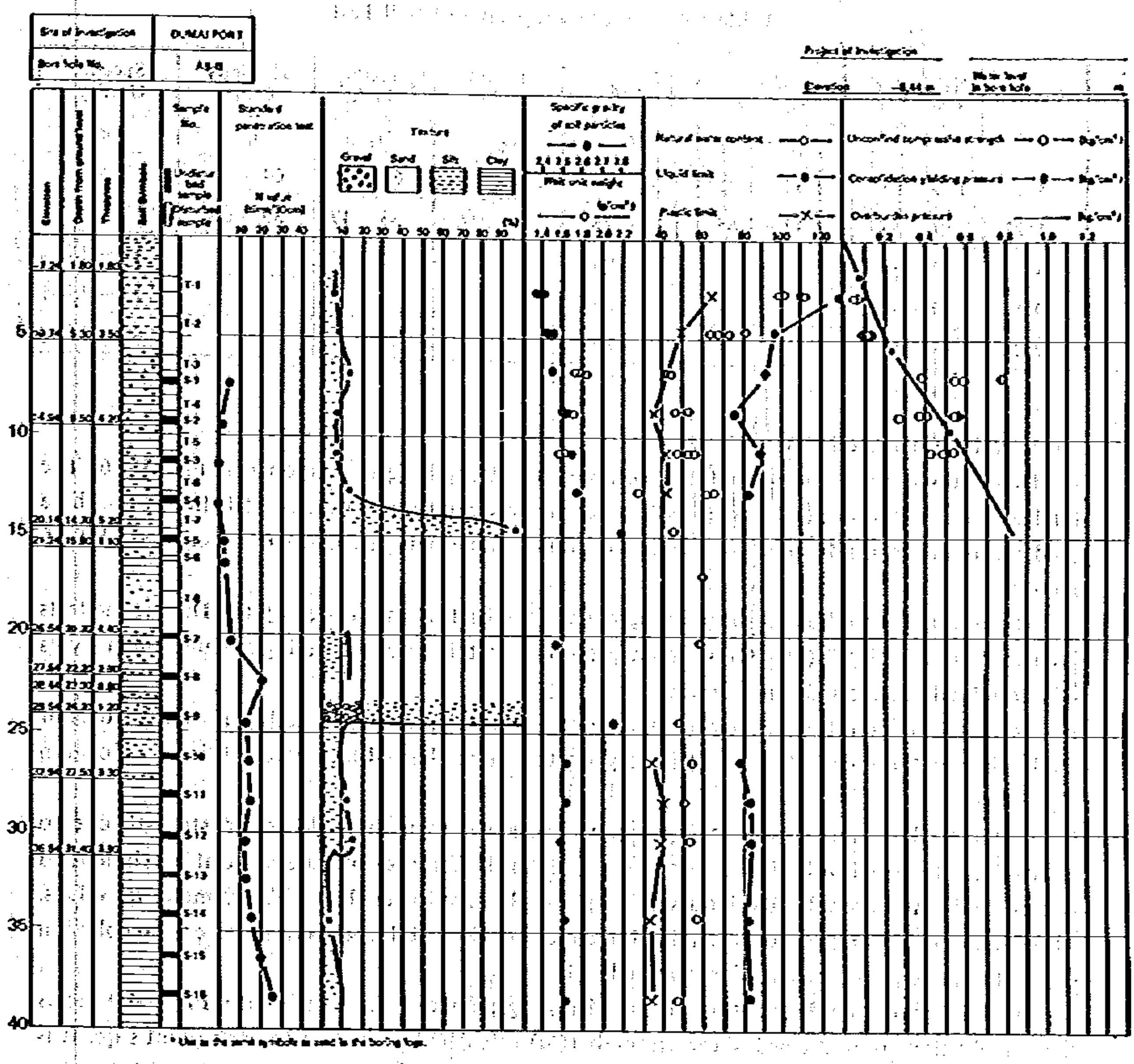


Fig. 3.4.5 (2) Soil Profile

Table 3.4.4 Index Properties of Soil Test

Stratum	Nat Water Contents	Wet Density	Sand	Liquid Limit	Plastic Limit	Plasticity Chart	Specific Gravity
	Wn %	γ_t t/m³	%	W_L %	Wp %	Ip	Gs
Ac1	100 – 134	1.32 – 1.36	6 – 9	129 – 136	63 – 65	64 – 74	2.37 – 2.40
Ac2	39 – 85	1.42 – 1.83	12 – 28	75 – 97	33 – 49	39 – 66	2.41 – 2.57
As1	42 – 63	1.66 –	77 – 94				2.54 – 2.78
Dc1	50 – 61		3 – 15				2.52 – 2.76
Dc2	48 – 75		4 – 15				2.48 – 2.52

1) Shearing Characteristics

Depth distribution of unconfined compressive strength (qu) is shown in Fig. 3.4.6. The qu-distribution lowers per layer according to the intermixture of organic soil. In AB-II, where sand layers occur, qu-distribution differs for every sample between LWS-10 meters and LWS-15 meters.

The results for undrained shear strength, Cu=(qc-Pb)/13.4 as revealed by the Dutchcone tests are shown in Fig. 3.4.7 (Pb: Overburden pressure). In this case, a lowering of Cu-value in layers of intermixed organic soil is not indicated.

The static-penetrating resistance value (qc) is very changeable in soils with admixtures of sand, whereas the distribution of qc in clay strata can be charted by a straight line, as shown in Fig. 3.4.6.

Unconfined comprehensive strength (qu) was lower than the field tested strength due to unavoidable factors involved in transporting samples. Differences of qu and qc at borehole AB-I can be seen. At borehole AB-II qu values appear that are lower than LWS-10 meter qc values. These values occur in layers of intermixed organic soil. Even at deeper layers, there is no cohesion due to the same phenomenon of intermixed soil.

Fig 3.4.6 shows qc distribution at seabed testing points of the same depth. Fig. 3.4.7 shows the distribution of undrained shear strength (Cu) calculated according to each point's qc. It is possible to delineate shear strength as a function of elevation qu and qc values listed below are based on the soil investigation data. The units for qu and qc are Kgf/cm² and Z (in meters), respectively.

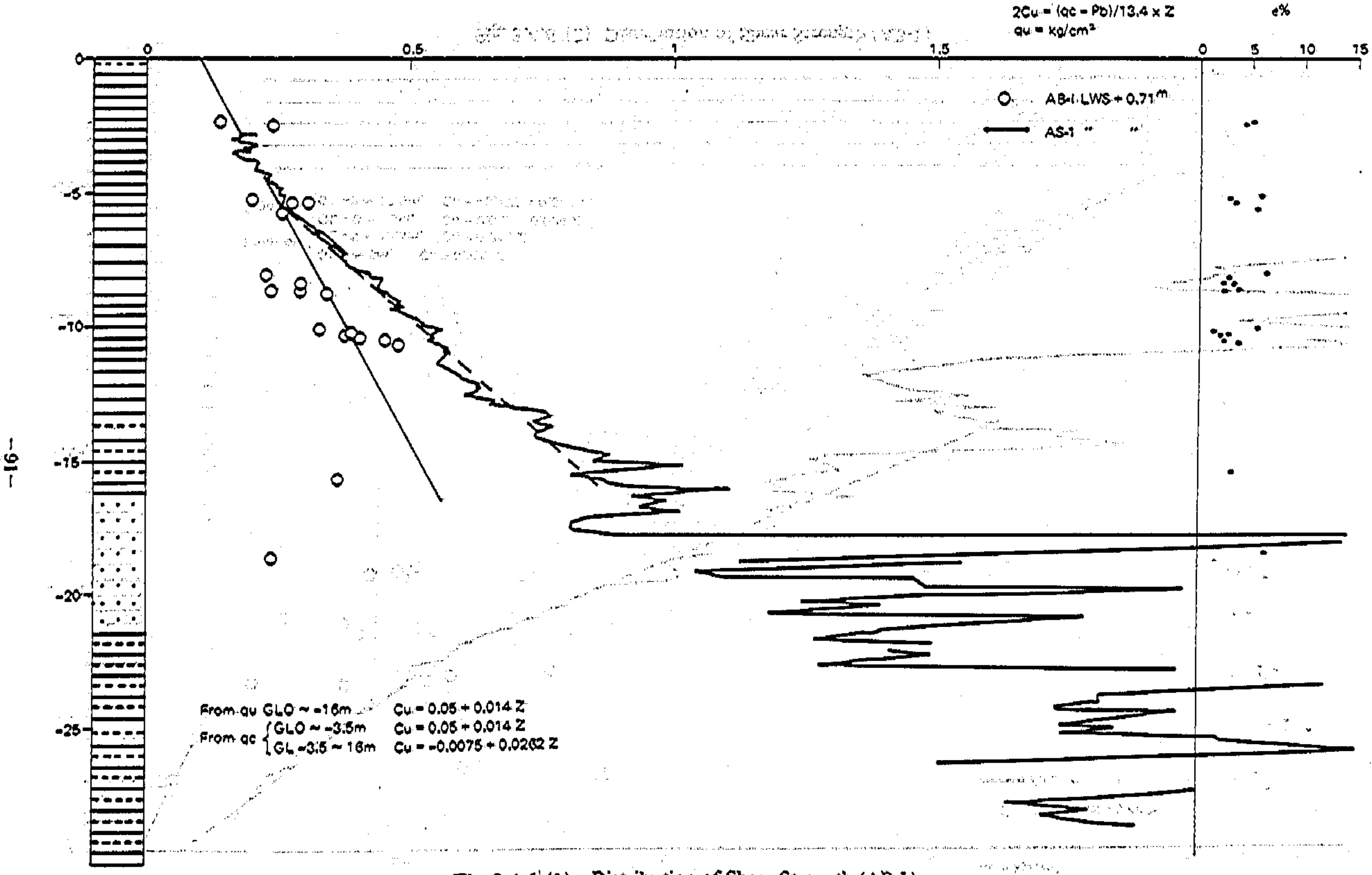


Fig. 3.4.6 (1) Distribution of Shear Strength (AB-1)

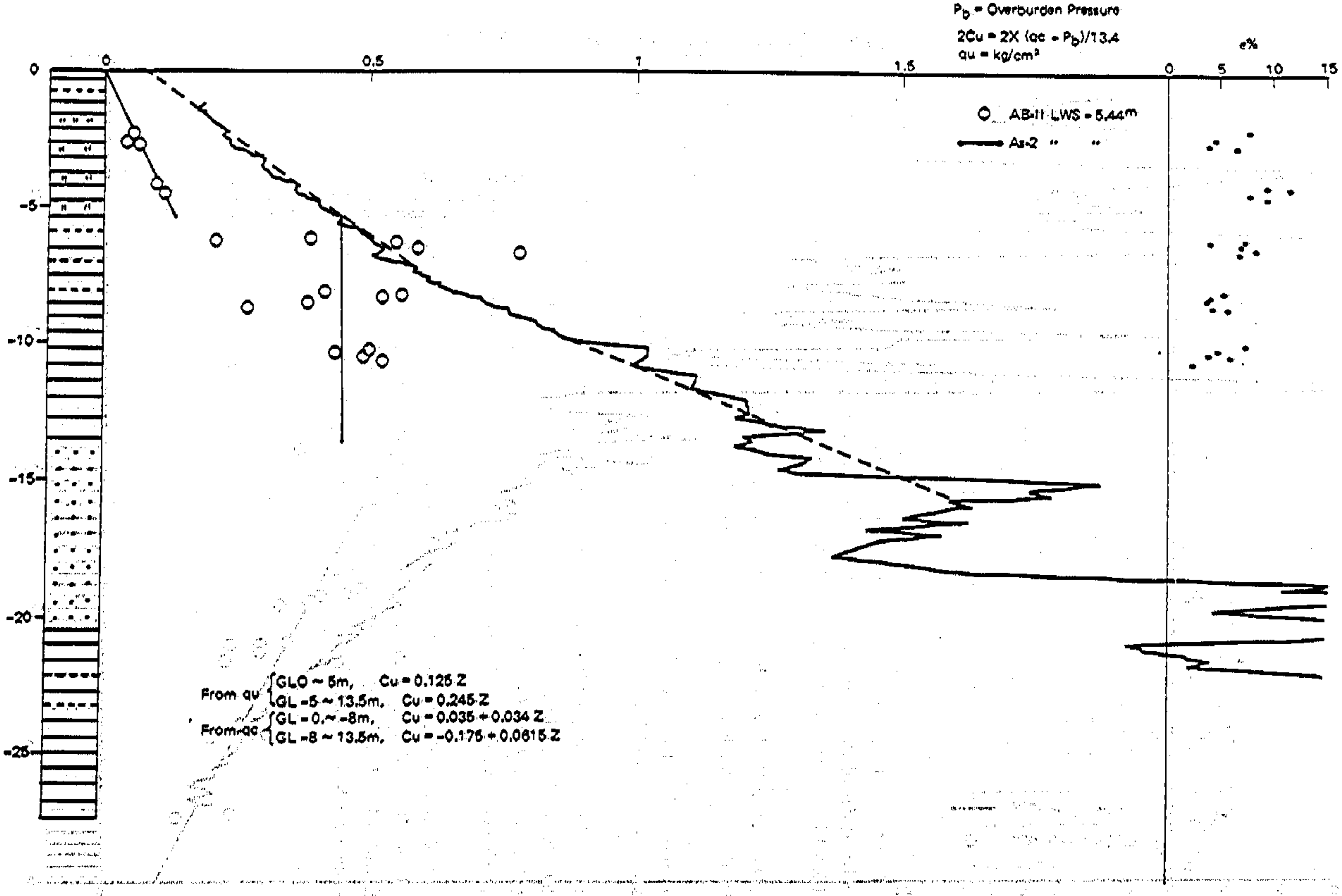


Fig. 3.4.6 (2) Distribution of Shear Strength (AB-1)

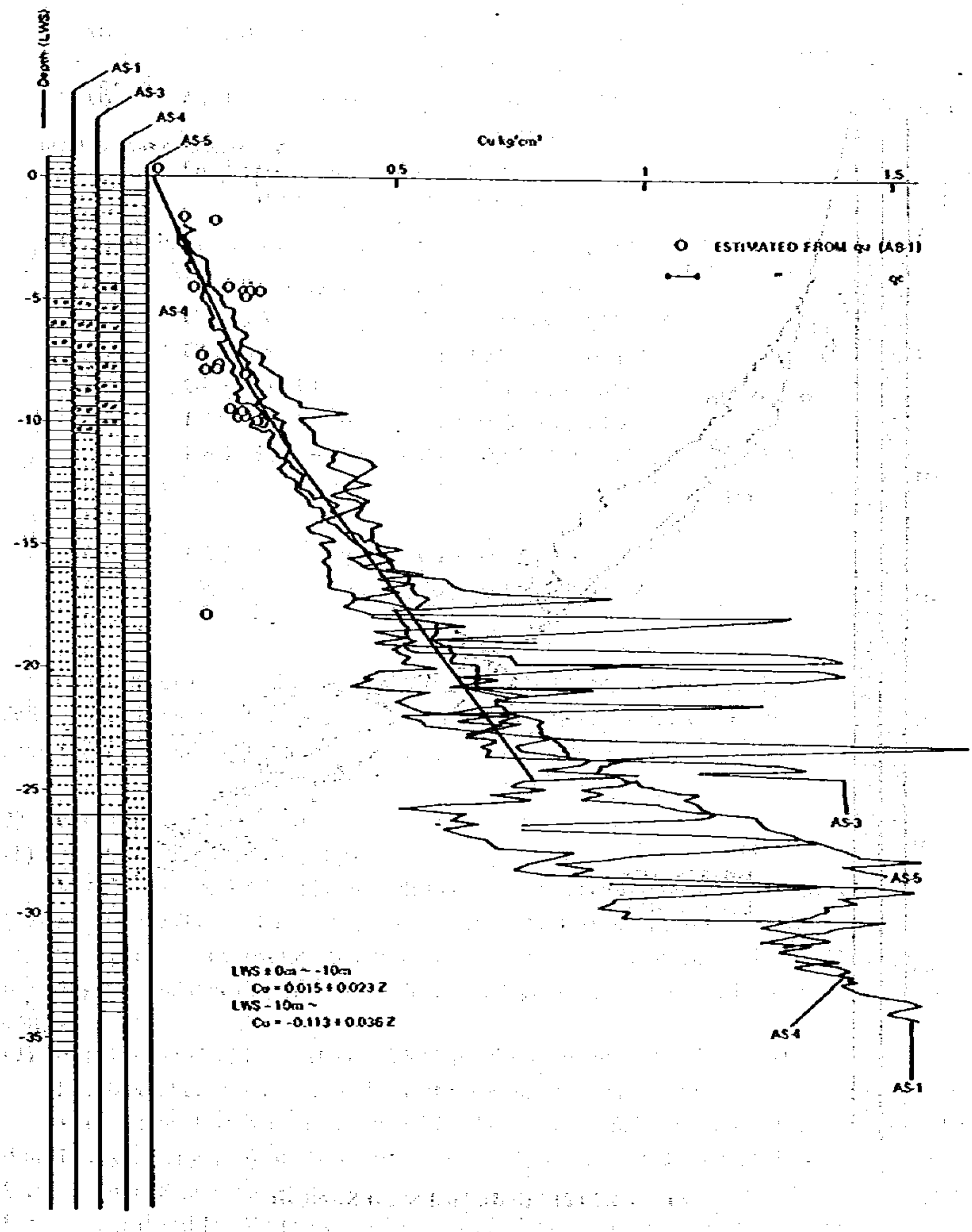


Fig. 3.4.7 (1) Undrained Shear Strength

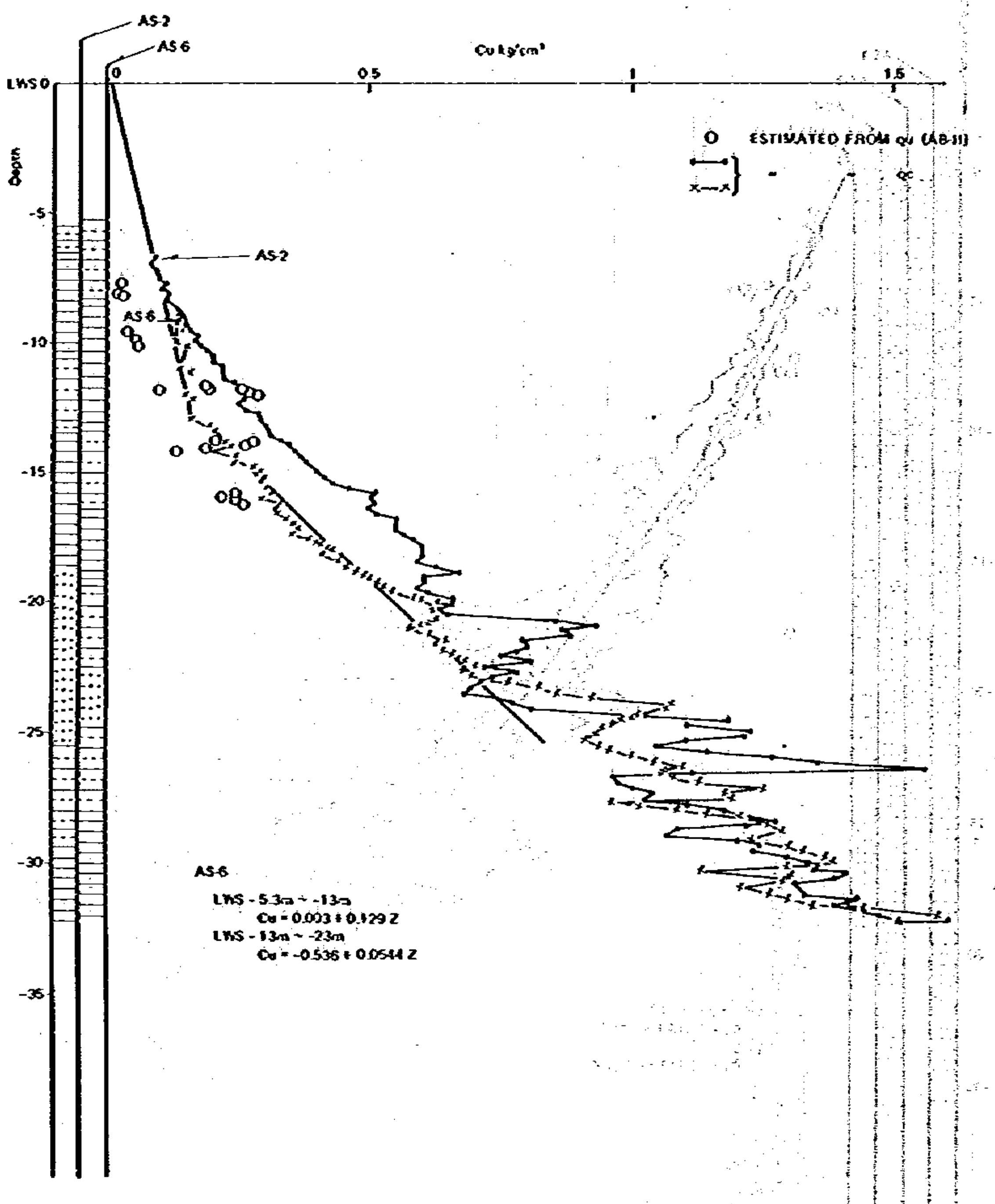


Fig. 3.4.7 (2) Undrained Shear Strength

Results of the unconfined compressive strength (qu) test are as follows:

AB-I	GL ± 0 ~ -16m	qu = 0.10 + 0.0278 Z
		Cu = 0.05 + 0.0139 Z
AB-II	GL ± 0 ~ - 5m	qu = 0.025 Z
		Cu = 0.0125 Z
	GL-5 ~ -13.5m	qu = 0.45
		Cu = 0.245

Results of the static penetration resistance (qc) test are as follows:

AS-1	GL ± 0 ~ -3.5m	Cu = 0.05 + 0.014 Z
	GL - 3.5 ~ -16m	Cu = -0.0075 + 0.0262 Z
AS-2	GL ± 0 ~ -8m	Cu = 0.0375 + 0.034 Z
	GL - 8 ~ -13.5m	Cu = -0.175 + 0.0615 Z
AS-6	LWS - 5.3 ~ -13m	Cu = 0.003 + 0.129 Z
	LWS - 13 ~ -23m	Cu = -0.536 + 0.0544 Z
Average:		
AS-1, AS-3, AS-4, AS-5	LWS ± 0 ~ -10m	Cu = 0.015 + 0.023 Z
	LWS - 10 ~ -25m	Cu = -0.113 + 0.036 Z

The result for Cu based on the field tested qc is reliable. Caution is suggested in drawing up designs based on strengths estimated from qu. Design values for Cu based on qc can be empirically reduced to 70%.

2) Consolidation Characteristics

(1) Consolidation Yield Stress (Py)

As shown in Fig. 3.4.8, it is difficult to carry out the consolidation yield stress (Py) based on the e-log $\bar{p}$ curve (Porosity ratio-logarithmic consolidation pressure).

But based on the overburden load and results of qu and qc tests, the Alluvium is in a normally-consolidated condition, and the lower layer of the Diluvium is in an over-consolidated condition.

(2) Consolidation Coefficient (Cv) and Volume Compressibility Coefficient (Mv)

The relation between Cv, Mv and average consolidation pressure ($\bar{P}$) is shown in Fig. 3.4.11.

As for the relation between log $\bar{P}$ and Cv shown in Fig. 3.4.9, the Cv of the over-consolidated domain is generally 1/10 of the Cv of the normally consolidated domain. In sandy soil, there is little difference in values for over and normally consolidated domains. As for the relation between log $\bar{P}$ and log Mv shown in Fig. 3.4.10, the regular value for the consolidated domain is Mv.$\bar{P}$, except in soil with a large admixture of sand. Based on the above geophysical characteristics, the depth distribution of Cv and Mv.$\bar{P}$ is shown as in Fig. 3.4.11. The relation between Cc and Wn is shown in Fig. 3.4.12.

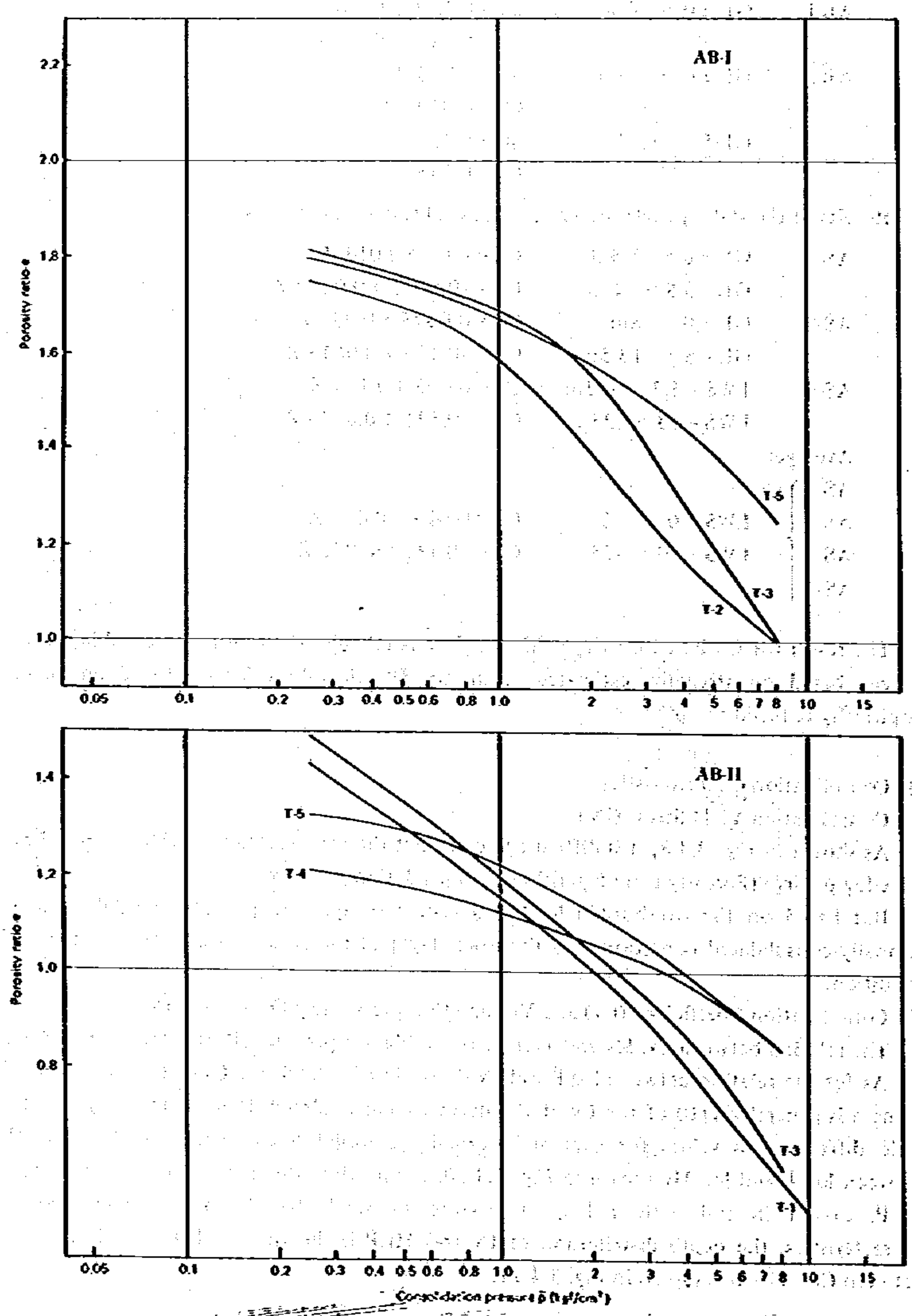


Fig. 3.4.8 e-Log p̄ Curve of AB-I and AB-II

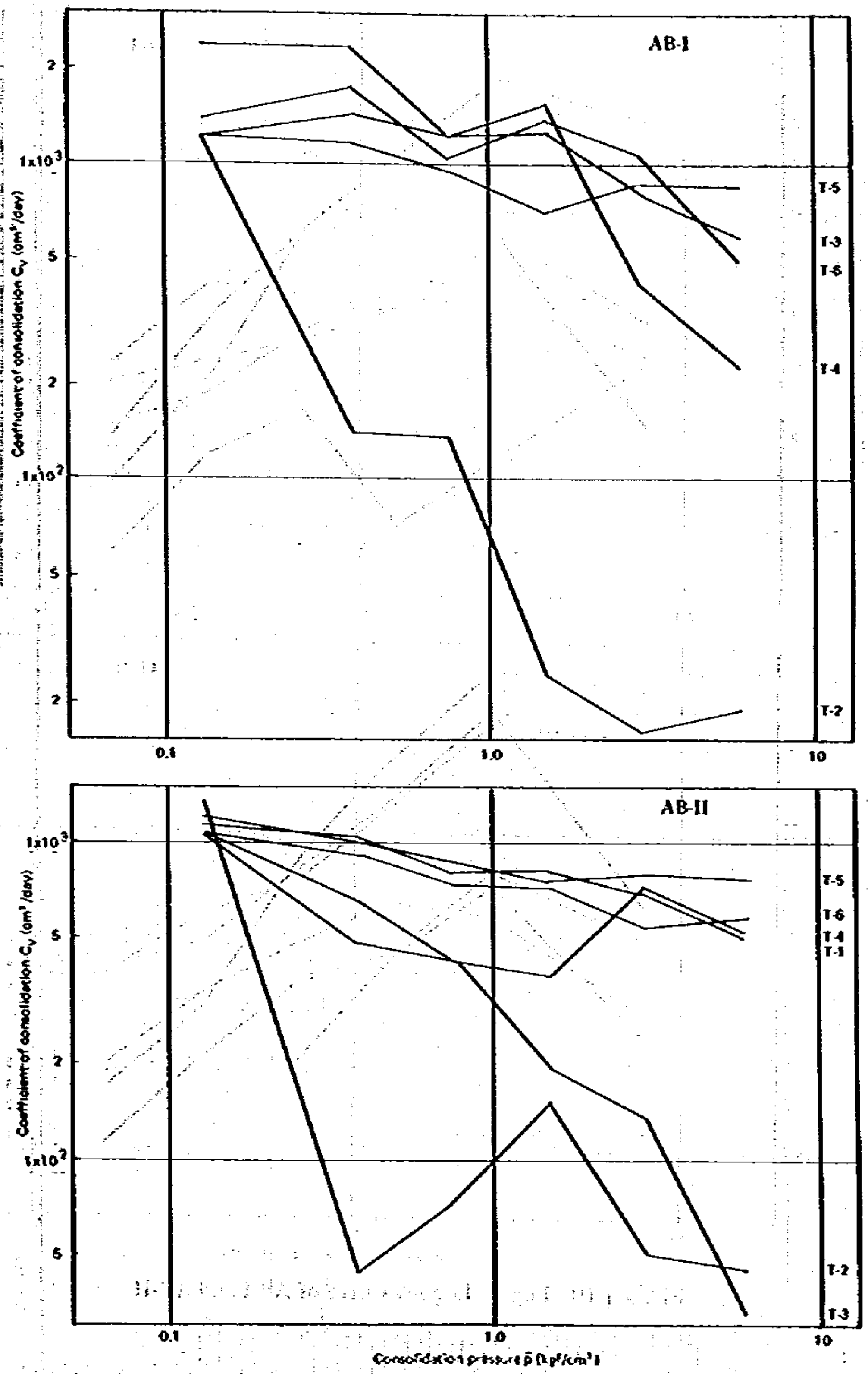


Fig. 3.4.9 Log $\bar{P}$-Log Cv Curve AB-I and AB-II

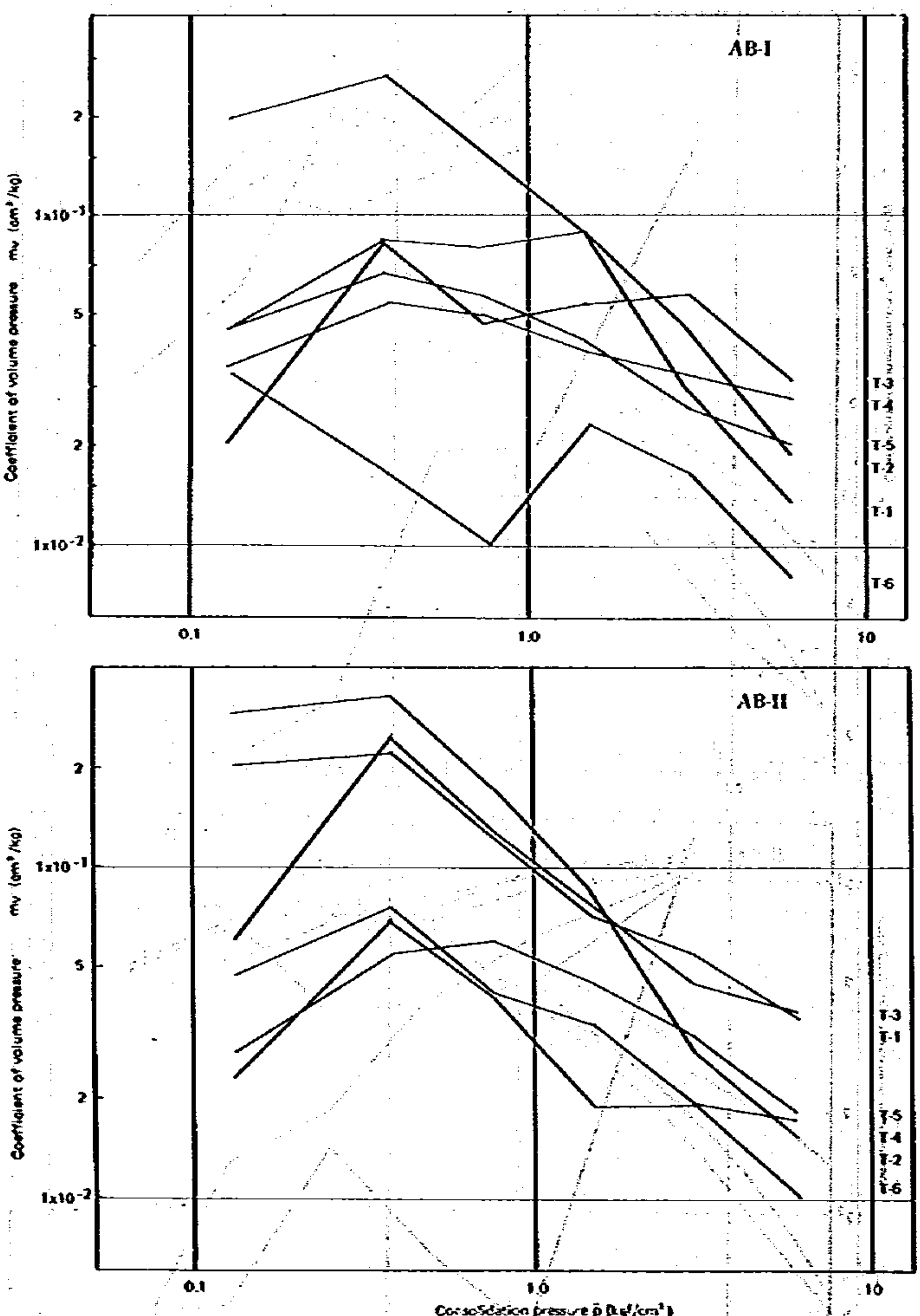


Fig. 3.4.10 Log $\bar{p}$ - Log mv Curve of AB-I and AB-II

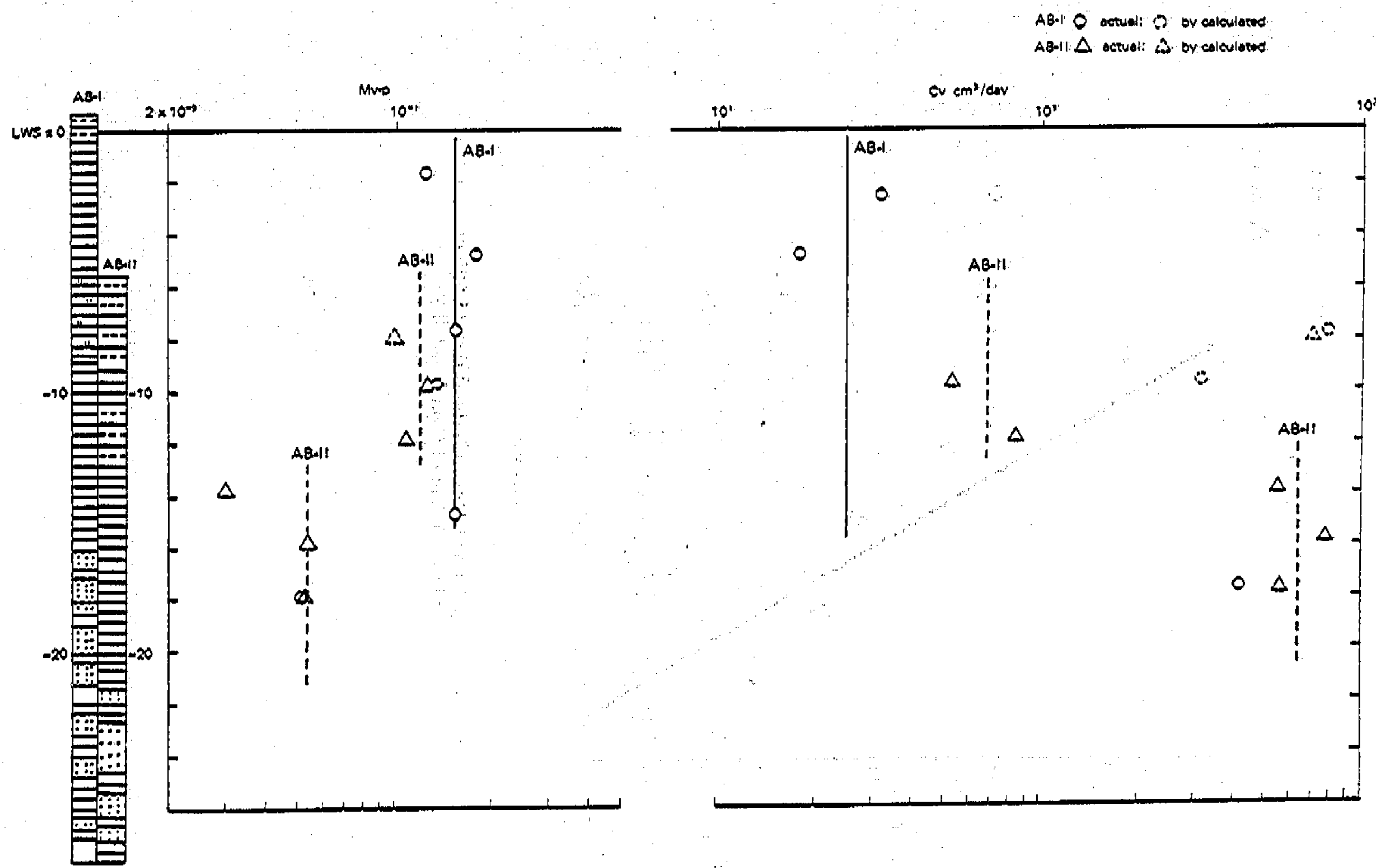


Fig. 3.4.11 Depth Distribution for Consolidation Characteristics

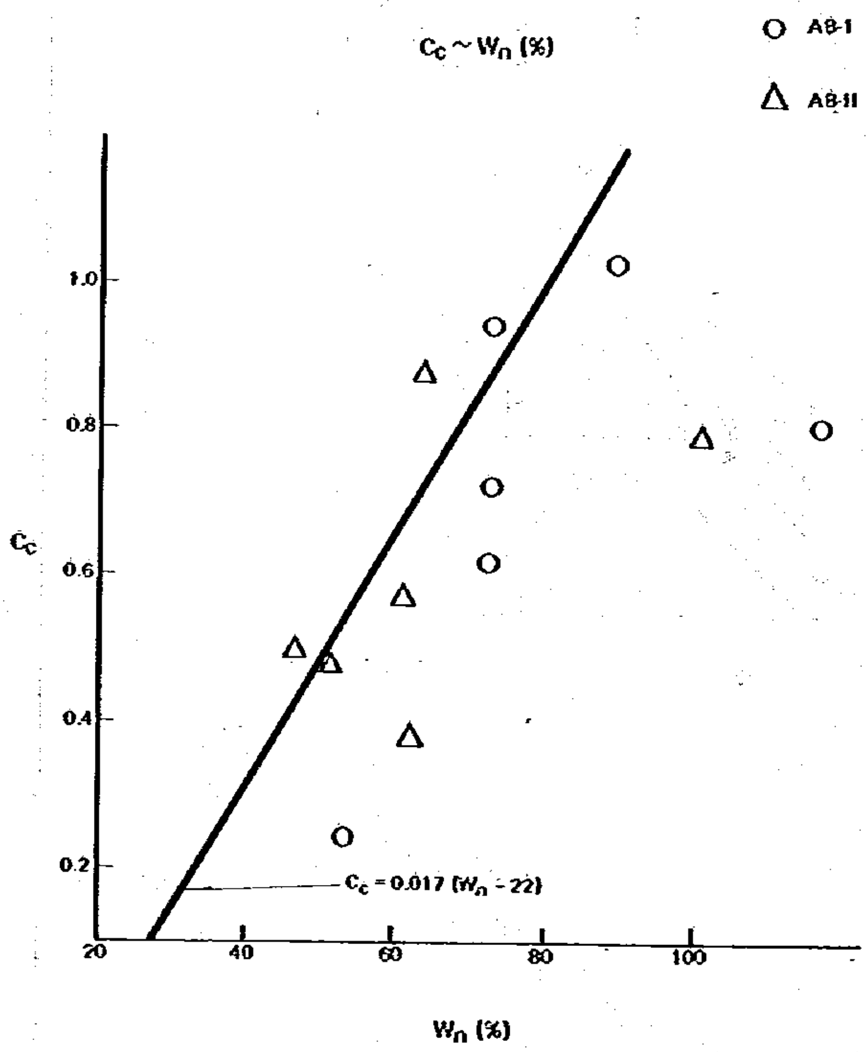


Fig. 3.4.12 Relation Between Natural Water Content and Coefficient of Compressibility

CHAPTER 4.
BASIC CONCEPTS UNDERLYING PORT DEVELOPMENT

CHAPTER 4. BASIC CONCEPTS UNDERLYING PORT DEVELOPMENT

4.1. Establishment of the Port Hinterland

This section will present a comparison of shipping patterns at various ports in Riau Province so as to establish a hinterland by commodity for Dumai Port.

4.1.1. In-coming Interinsular Trade

Table 4.1.1 shows figures for trans-shipment and unloading of interinsular cargo at 19 ports in Riau in 1981. As shown in the Table, a total of about 1.2 million tons of interinsular cargo (including oil) were trans-shipped or unloaded at ports in Riau. Of this total, Dumai Port handled about 76%, Pekanbaru-6%, Bagansiapi-api, Sineboi and Rengat-3%, Selat Panjang, Tembilahan, Dabo Singkep and Tg. Balai Karimum-2%. Dumai's overwhelming share is due solely to trans-shipment of oil related products. If such products are excluded, then Pekanbaru's share vises to 21% (mainly general cargo), Dumai-16%; Bagansiapi-api and Rengat-10%. The composition of major in-coming commodities in Riau Province is, excluding oil, general cargo-14%; construction material-11%; rice and logs-9%. For Dumai Port, the cargo composition is, excluding oil, construction material-57%; rice-23%; machinery-11%; and other goods-8%.

It can be inferred from the above figures that Dumai Port will assume an important role in helping Riau Province to overcome its rice shortage, and that Pekanbaru will continue to be the major port for handling rubber produced in the Province. Pekanbaru handles an overwheling share of general cargo because of the comparatively high population density in the port vicinity, and also because its hinterland includes areas that will in the future be assigned to the Dumai Port hinterland. In this regard, it is expected that in the future, Dumai Port will expand its hinterland for general cargo as traffic to/from plantation sites increases, and due to the fact that Pekanbaru Port will have trouble expanding its cargo handling capacity as it can receive ships no larger than 1,000 DWT.

4.1.2. Out-going Interinsular Trade

Table 4.1.2 shows figures for out-going interinsular cargo, tabulated in the same fashion as Table 4.1.1. As shown, total cargo volume in 1981 amounted to about 2.2 million tons, of which about 1.9 million tons or 89% were oil related products. The volume of non-oil cargo was about 230,000 tons, of which 7% was handled in Dumai (mainly rice); Bagansiapi-api (mainly fishery products) – 19%; Kuala Enok (mainly cooking oil) – 14%; and Pekanbaru – 4%. Out-going cargo by commodity was fishery products – 21%; cooking oil – 15%; forestry products – 23%.

The major commodities handled at Dumai Port were rice –10,000 tons, and logs-7,000 m^3.

4.1.3. Import Trade

A detailed breakdown of import trade by commodity is not available, although total tonnage by port is shown in Table 4.1.3 (a)–(b).

Total imports amounted to about 150,000 t, of which Dumai Port had an 82% share (120,000 t), and Pekanbaru had an 18% share. According to Dumai Port statistices, the major import commodities were rice and construction materials.

4.1.4. Export Trade

Table 4.1.4 shows export trade by port and commodity. Total export volume, excluding crude oil and related products, was about 0.7 million tons, of which 5% were rubber products and 78% were forestry products. Dumai Port exported about 80,000 m³ of logs. The dominance of forestry products in exports is, as clearly shown in Table 4.1.3, a main feature shared by several ports in Riau Province. It is expected that forestry product shipments from Riau Province will continue to be economically profitable for a considerable time in the future, so that in establishing the hinterland for Dumai Port, areas of forestry production should be definitely included its hinterland. As for rice shortages in Riau Province, Dumai Port has been disignated as the strategic base port for rice supply/storage for the whole province. All other districts in Riau will rely upon rice supplied through Dumai Port.

Future cargoes to be increasingly handled at Dumai Port include palm oil, palm kernel and fertilizers. These will account for a large share of the total future cargo volume through Dumai. The hinterland of Dumai Port for these cargoes is expected to be in both Riau and North Sumatra Provinces, as will be explained in detail in Chapter 5.

Table 4.1.1 Cargo Unloaded for Interinsuler Trade by Port and Commodity in Riau Province, 1981

(ton)

COMMODITY	PORT									
	PEKANBARU	DUMAI	SIAK SRI INDRAPURA	BAGAN SIAPI API	SINEBOI	PAMIPAHAU	SELAT PANJANG	RENGAT	TEMBILAHAN	SEI PAKNING
SALTED FISH	-	-	-	-	-	-	-	-	-	...
RICE	804	12,500	2	1,341	89	1	5,266	5,639	3,365	...
SUGAR CANE	10,578	-	-	757	52	110	1,383	1,400	3,698	...
SALTED	3,332	500	-	21,700	696	1,377	604	115	511	...
MAIZE	-	-	-	-	196	-	-	-	-	...
SAGO	-	-	-	-	-	-	-	-	-	...
COOKING OIL	7,327	-	-	385	18	42	126	10	-	...
SMALL WARES	-	-	-	-	96	12	-	-	-	...
FRESH SHRIMP	-	2	-	-	8	-	-	-	-	...
COPRA	-	-	-	-	-	-	-	-	-	...
COPRA CAKES	-	-	-	-	-	-	-	-	-	...
PEANUTS	25	-	-	11	0	-	-	-	-	...
RUBBER	11,287	-	-	-	-	-	-	151	-	...
CEMENT	60	-	-	137	5	5	891	16	1,173	...
BOARD	67	-	-	324	168	-	-	270 1)	-	...
OTHER CONSTRUCTION MATERIALS	4,686	31,495	-	54	1	69	387	-	-	...
KEROSENE	-	-	39	3,428	53	617	900	2,612	4,696	...
CRUDE OIL	-	307,343	-	-	-	-	-	-	-	...
OTHER FUEL	-	-	42	-	756	455	2,275	12,658	5,495	...
REF OIL	-	111,553	-	-	-	-	-	-	-	...
TIN ORE	-	-	-	-	-	-	-	-	-	...
MACHINERY	464	6,141	-	-	-	3	-	42	-	...
DRUM	-	-	-	-	-	-	-	-	-	...
RESIDUEL FUEL OIL	-	463,248	-	-	-	-	-	-	-	...
SAND	-	-	-	-	9	-	-	-	-	...
CHAR COAL	-	-	-	-	-	-	-	-	-	...
OTHER WOOD	700	-	-	-	-	-	-	-	-	...
SOAP	39	-	-	219	-	3	118	-	175	...
PAPER	-	-	-	126	-	4	-	-	-	...
WHEAT FLOUR	5,045	-	-	625	29	5	945	568	1,660	...
CIGARETTES	-	-	-	186	6	30	8	5	212	...
VEGETABLES	-	-	-	-	-	-	157	-	-	...
TEXSTIL	53	-	-	1	-	0	6	-	-	...
ICE BLOCK	-	-	-	-	8	398	-	-	-	...
GASOLINE	-	-	-	-	-	160	-	-	-	...
COTTON	-	-	-	-	-	1	-	-	-	...
FERTILIZER	1	-	-	-	-	-	-	992	-	...
ZINK ROOF	-	-	-	20	-	-	-	15	-	...
RATTAN	-	-	-	-	-	-	-	-	-	...
ASPHALT	9,838	165	-	-	-	-	-	15	-	...
LOGS	-	-	-	-	30,790	15	-	-	-	...
GENERAL CARGO	29,004	-	9	5,458	-	-	-	103	5,146	...
OTHER GOODS	45	4,706	-	376	197	584	6,732	11,734	78	...
T O T A L	9,358 1)	-	-	-	-	-	-	270 1)	-	...
	73,514	937,653	92	35,147	33,176	3,894	19,800	36,075	26,204	

Note 1): m^3

(Continued)

COMMODITY	PORT									TOTAL
	KUALA ENOK	KUALA MANDAH	SEI GUNTUNG	DABO SINGKEP	TARENPA	SERASAN	PULAU KIJANG	TG BALAI KARI-MUN-	PENUBA	
SALTED FISH	-	-	...	-	-	-	5	-	-	5
RICE	-	50	...	-	600	160	-	2,732	256	32,815
SUGAR CANE	-	2	...	-	133	66	530	458	71	19,233
SALTED	-	9	...	-	-	-	190	78	21	29,133
MAIZE	-	-	...	-	0	-	-	-	-	196
SAGO	-	-	...	204	27	-	-	-	-	231
COOKING OIL	-	-	...	-	0	-	-	42	-	7,950
SMALL WARES	-	4	...	-	19	-	-	-	-	132
FRESH SHRIMP	-	-	...	-	-	-	-	11	-	21
COPRA	6,350	5	...	-	617	-	-	-	-	6,972
COPRA CAKES	1,819	-	...	-	-	-	-	-	-	1,819
PEANUTS	-	-	...	-	-	-	-	-	-	37
RUBBER	-	-	...	-	-	-	-	-	-	11,438
CEMENT	-	-	...	160	20	7	-	3,418	10	5,902
BOARD	-	-	...	1,183	-	-	-	99	-	270 1,839
OTHER CONSTRUCTION MATERIALS	-	-	...	45	26	39	-	146	-	36,949
KEROSENE	-	60	...	-	1	38	1,114	2,218	40	15,815
CRUDE OIL	-	-	...	-	-	-	-	-	-	307,343
OTHER FUEL	3,191	239	...	7,879	-	3	703	8,299	63	42,059
REF OIL	-	-	...	-	-	-	-	-	-	111,553
TIN ORE	-	-	...	3,215	-	-	-	-	-	3,225
MACHINERY	-	-	...	-	1	-	-	45	-	6,695
DRUM	53	-	...	-	-	-	-	-	-	53
RESIDUEL FUEL OIL	-	-	...	-	-	-	-	-	-	463,248
SAND	-	-	...	-	-	-	-	-	-	9
CHAR COAL	-	-	...	-	4	-	-	-	-	4
OTHER WOOD	-	-	...	-	-	-	-	-	-	700
SOAP	-	-	...	-	2	0	-	25	-	581
PAPER	-	-	...	-	-	-	-	-	-	130
WHEAT FLOUR	-	-	...	-	64	34	306	152	46	9,478
CIGARETTES	-	-	...	-	1	-	-	-	-	448
VEGETABLES	-	-	...	-	-	-	-	-	-	157
TEXSTIL	-	-	...	-	-	-	-	-	-	62
ICE BLOCK	-	-	...	-	-	-	-	-	-	406
GASOLINE	-	-	...	-	-	-	-	4,861	-	5,021
COTTON	-	-	...	-	-	-	-	-	-	1
FERTILIZER	-	-	...	-	-	-	-	-	-	593
ZINK ROOF	-	-	...	-	-	-	-	-	-	35
RATTAN	-	-	...	-	-	-	-	-	-	-
ASPHALT	-	-	...	-	-	-	-	-	-	180 9,853
LOGS	-	-	...	-	-	-	-	-	-	30,304
GENERAL CARGO	489	43	...	4,948	-	113	417	4,215	-	49,944
OTHER GOODS	-	-		1,589	-	-	-	2,191	15	23,248
	-	-	...		-	-	-	-	-	10,128
TOTAL	11,902	412	...	19,223	1,518	468	3,265	28,990	522	1,231,855

Table 4.1.2 Cargo Loaded for Interinsular Trade by Port and Commodity in Riau Province, 1981

COMMODITY	PORT										
	PEKANBARU	DUMAI	KUALA MANDAH	SUNGAI PAKNING	BAGAN SIAPI-API	SENEBOI	SELAT PANJANG	SIAK SRI INDRAPURA	TEMBILAHAN	KUALA ENOK	RENGAT
SALTED FISH	-	-	-	...	16,598	739	1,074	-	-	-	-
RICE	480	10,774	-	...	-	-	-	2	-	-	-
SUGAR CANE	-	-	-	...	-	-	-	-	-	-	-
COOKING OIL	-	-	1,800	...	-	-	-	-	-	31,660	-
MAIZE	-	-	209	...	-	-	-	-	-	-	-
COCONUT	-	-	-	...	-	-	-	-	-	-	-
COPRA	-	-	26	...	-	-	-	-	9,171	-	-
WHEAT FLOUR	-	-	-	...	-	-	-	-	-	-	-
SAGO	-	-	22	...	-	-	22,281	-	-	-	-
ICE BLOCK	-	-	-	...	-	8	-	-	-	-	-
COPRA CAKES	-	-	2,343	...	-	-	-	-	-	1,711	-
RUBBER	-	-	-	...	-	-	2,815	35	-	-	-
CEMENT	6	-	-	...	-	-	-	-	-	-	-
OTHER FUEL	246	6,669	-	...	-	-	-	42	-	-	1,234
PLANK BOARD	-	-	-	...	-	-	-	-	-	-	-
...	5,670	2,985	-	...	-	-	817	-	-	-	-
CRUDE OIL	-	1,115,985	-	...	-	-	-	-	-	-	-
REF OIL	-	811,821	-	...	-	-	-	-	-	-	-
BRAND	-	-	-	...	-	-	-	-	-	-	-
CONSTRUCTION MATERIALS	86	-	-	...	-	-	-	-	-	-	-
KEROSENE	-	-	-	...	-	-	-	39	-	-	-
CLOVE	-	-	-	...	-	-	-	-	-	-	37
BOTTLE	458	-	-	...	-	31	-	-	-	-	-
DRUM	113	-	-	...	-	128	-	-	-	-	10,814
LOGS	-	7,294	-	...	-	-	-	-	-	-	-
..	-	-	-	...	-	30,790	-	-	-	-	-
TIN ORE	106	-	-	...	-	-	-	-	-	-	611
MACHINARY	336	1,788	-	...	-	-	-	-	-	-	-
PLYWOOD	760	-	-	...	-	-	-	-	-	-	-
SHRIMP FISH	-	-	204	...	35	99	-	-	-	-	-
PRESERVE	-	-	-	...	28,439	867	-	-	-	-	-
CHARCOAL	762	-	-	...	-	50	915	2	-	135	-
GENERAL CARGO	373	-	-	...	-	-	-	-	-	-	666
OTHER GOODS	929	246	-	...	141	316	1,271	-	-	-	-
	-	7,294 1)	-	...	-	-	-	-	-	-	12,047 1)
TOTAL	10,325	1,950,260	4,604	...	45,213	33,028	29,172	120	9,171	33,506	1,313

Note: 1) = m^3

Source: PORT ADMINISTRATOR

(continued)

(TON)

COMMODITY	P O R T								TOTAL
	DABO SINGKEP	TAREMPA	SERASAN	PLAU KIJANG	TANJUNG BALAI KARIMUN	PENUBA	PANIPAHAN	SUNGAI GUNTUNG	
SALTED FISH	-	-	6	-	-	6	1,138	-	19,562
RICE	221	55	-	1,690	-	1	-	-	13,223
SUGAR CANE	140	10	-	-	-	-	-	-	150
COOKING OIL	-	920	-	591	8	-	11	740	35,730
MAIZE	-	-	-	2,671	-	-	-	20	2,900
COCONUT	-	-	-	672	-	-	-	-	672
COPRA	-	161	87	4,688	-	6	-	312	14,450
WHEAT FLOUR	113	-	-	-	-	-	-	-	113
SAGO	339	-	-	-	-	727	-	444	23,813
ICE BLOCK	-	-	-	-	45	-	-	-	53
COPRA CAKES	-	880	-	384	40	-	-	488	5,846
RUBBER	-	234	8	567	50	434	-	-	4,143
CEMENT	280	-	-	-	-	-	-	-	286
OTHER FUEL	-	-	-	-	-	-	-	-	6,957
PLANK BOARD	-	-	-	-	-	-	-	-	1,234 1)
	1,937	-	-	739	-	130	-	5,181	17,459
CRUDE OIL	-	-	-	-	-	-	-	-	1,115,985
REF OIL	-	-	-	-	-	-	-	-	811,821
BRAND	-	-	-	550	-	-	-	-	550
CONSTRUCTION MATERIALS	566	-	-	-	-	-	-	-	652
KEROSENE	2,479	-	-	-	-	-	-	-	2,518
CLOVE	-	-	142	-	-	-	-	-	142
BOTTLE	-	-	-	-	-	-	-	-	526
DRUM	-	-	-	-	-	-	115	-	356
LOGS	-	-	-	-	-	-	-	-	18,108
	-	-	-	-	-	-	1,676	7,960	40,425
TIN ORE	1,644	-	-	-	3,937	-	-	-	5,687
MACHINARY	-	-	-	-	57	-	-	-	2,792
PLYWOOD	-	-	-	-	-	-	-	-	760
SHRIMP FISH	-	115	-	-	-	-	26	-	475
PRESERVE	-	-	-	-	-	-	2	-	29,308
CHARCOAL	-	-	-	-	-	-	-	-	1,727
GENERAL CARGO	2,209	-	-	-	703	-	-	-	3,422
OTHER GOODS	709	56	1	-	12	-	601	154	5,101
	-	-	-	-	-	-	-	-	19,342 1)
TOTAL	10,637	2,430	243	12,552	4,852	1,304	3,568	15,299	2,167,606

Table 4.1.3(a) Imports Unloaded of Trans-Shipped by Port and Month in Riau Province, 1981

(Ton)

NO.	MONTH	PORT					
		PEKANBARU	DUMAI	SENEBOI	PANIPAHAN	TG. BALAI	TOTAL
1	2	3	4	5	6	7	8
1.	JANUARY	1,705.000	12,380.000	36.000	50.000	-	14,171.000
2.	FEBRUARY	1,976.000	11,666.000	24.000	-	8.500	13,674.500
3.	MARCH	581.000	...	42.000	-	-	623.000
4.	APRIL	899.000	...	42.000	-	-	941.000
5.	MAY	1,112.000	...	36.000	-	14.000	1,162.000
6.	JUNE	1,934.000	...	24.000	-	243.000	2,201.000
7.	JULY	3,627.000	5,364.000	24.000	-	-	9,015.000
8.	AUGUST	754.000	8,081.000	30.000	-	-	8,865.000
9.	SEPTEMBER	5,954.000	8,512.000	30.000	-	-	14,496.000
10.	OCTOBER	2,500.000	...	30.000	-	-	2,530.000
11.	NOVEMBER	2,799.000	35,303.000	24.000	-	-	38,126.000
12.	DECEMBER	2,436.000	39,293.000	30.000	-	-	41,759.000
	TOTAL	26,277.000	120,599.000	372.000	50.000	265.500	147,563.500

Table 4.1.3(b) Imports Unloaded or Trans-Shipped by Commodity and Month in Riau Province, 1981

(Ton)

NO.	MONTH	COMMODITY							TOTAL
		BERAS	BHN BANGUNAN	BESI	PUPUK	GENCAR	MESIN/PIPA	LAIN-LAINNYA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	JANUARY	-	-	43.000	7,500.000	482.000	3,509.000	2,637.000	14,171.000
2.	FEBRUARY	3,000.000	212.000	-	-	265.000	4,053.500	6,144.000	13,674.500
3.	MARCH	-	-	-	-	-	581.000	42.000	623.000
4.	APRIL	-	264.000	-	-	608.000	27.000	42.000	941.000
5.	MAY	-	-	-	-	1,044.000	82.000	36.000	1,162.000
6.	JUNE	-	266.000	-	388.000	1,101.000	-	446.000	2,201.000
7.	JULY	-	130.000	-	-	1,247.000	3,741.000	3,897.000	9,015.000
8.	AUGUST	-	200.000	1,047.000	-	505.000	4,679.000	2,434.000	8,865.000
9.	SEPTEMBER	-	-	-	-	1,173.000	6,739.000	6,584.000	14,496.000
10.	OCTOBER	-	-	-	-	1,212.000	7.000	1,311.000	2,530.000
11.	NOVEMBER	-	186.000	22.000	-	1,592.000	33,407.000	2,919.000	38,126.000
12.	DECEMBER	6,034.000	-	-	-	769.000	30,510.000	4,446.000	41,759.000
	TOTAL	9,034.000	1,258.000	1,112.000	7,888.000	9,998.000	87,335.500	30,938.000	147,563.500

Source: Port Administrater

Table 4.1.4 Export Loading Volume in Tons by Port and Commodity for Riau Province, 1981

(Ton)

NO.	COMMODITY	PELABUHAN/PORT: PEKANBARU	DUMAI	SIAK	SEI PAKNING	SINEBOI	TANJUNG BALAI KARIMUN	SLT PANJANG	BAGAN SIAPI API	RENGAT	TEMBILAHAN	PARIPAHAN	JUMLAH/TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	IKAN/UDANG BASAH/FISH/FRESH SHRIMP	-	-	-	...	620,000	3,154,350	-	-	-	-	624,500	4,398,850
2.	BUNGKIL/COPRA CAKES	-	-	-	...	-	-	-	-	-	22,555,000	-	22,555,000
3.	ROTAN/RATTAN	571,000	-	-	...	-	40,000	-	-	3,458	-	-	614,458
4.	TEMBAKAU/ROKOK/TOBACCO	13,000	-	-	...	-	-	-	-	-	-	-	13,000
5.	GETAH JELUTUNG/JELUTUNG	985,000	-	-	...	-	-	-	-	434,615	-	-	1,419,615
6.	CRUM RUBBER	17,902,000	-	-	...	-	-	-	-	7,051,350	-	-	24,953,350
7.	KARET/RUBBER	4,772,000	-	-	...	-	326,600	-	-	-	1,764,000	-	6,862,600
8.	MINYAK MENTAH/REF OIL	-	17,514,867,000	-	...	-	-	-	-	-	-	-	17,514,867,000
9.	MOKY RISIDU/RISIDUEL FUEL OIL	-	1,763,807,000	-	...	-	-	-	-	-	-	-	1,763,807,000
								13,680.00(1)					13,680.00(1)
10.	KEPALA ARANG/COAL	-	-	-	...	-	7,194,000	-	-	-	-	-	7,194,000
			80,563.26(1)	10,960.63(1)	...			193,171.46(1)		4,270.43(1)	144,195.48(1)		433,161.26(1)
11.	KAYU BALAK/LOGS	-	-	-	...	-	1,002,000		5,097,000	-	-	-	6,099,000
12.	GAMBIR/GAMBIR	550,000	-	-	...	-	61,627	-	-	-	-	-	611,627
13.	KULIT MANIS/CASIAVERA	28,000	-	-	...	-	-	-	-	-	-	-	8,000
								21,526.76	-	136.07			21,662.83(1)
14.	PAPAN/BROTI/BOARD	9,032,000	102,920,000	-	...	-	21,771,420	-	-	-	-	-	53,723,420
15.	PLYWOOD	3,333,000	-	-	...	-	-	-	-	-	-	-	3,333,000
16.	KULIT/LEATHER	18,000	-	-	...	-	-	-	-	-	-	-	16,000
17.	LAINNYA/OTHER GOODS	69,100	908,000	-	...	-	66,902,200	-	-	-	-	-	67,879,300
	JUMLAH/TOTAL	-	80,563.26(1)	10,960.63(1)	...	-	-	228,378.22(1)	-	4,406.50(1)	14,419,548	-	468,504.09
		37,273,100	19,302,932,000	-	...	620,000	100,452,197	-	5,097,000	7,489,423	24,319,000	624,500	19,478,377,220

Note: (1) = m³

Source: PORT ADMINISTRATOR

4.1.5. The Extent of the Domestic Dry Cargo Transport Network centered on Dumai Port.

The movement of domestic dry cargo in Sumatra is shown in Table 4.1.5, as derived from the domestic origin/destination cargo flow data compiled by DGSC. Using this table, we can examine the quality and quantity of interregional cargo flow shipped by sea routes. Dumai Port is most closely related to the 12 ports of Riau Province I. The dry cargo exchanged with these ports total 98,500 tons. The feeder service routes into and out of Dumai exist mainly in Riau Province but also extend to several ports in Jambi Province.

4.1.6. Domestic Trade Flow of Major Commodities

1) Fertilizer

Fertilizer intended for consumption in Sumatra arrives mainly by sea routes from Palembang and Java.

Of the 307,300 tons of fertilizer received in 1981, 161,300 tons (52.5%) were shipped largely from Palembang (see Table 4.1.6). It can also be seen that Palembang is the largest fertilizer supply base in Indonesia. Sumatra consumes only a small portion of the interinsular fertilizer shipments, relying instead upon overland shipments from the Palembang factory and upon direct imports as shown in Table 4.1.7.

Dumai Port as well as the ports of Riau I handle none of the interinsular fertilizer shipments. Excepting direct imports, Riau relys largely upon land transportation from Medan and Padang. For example, about 13 thousand tons of fertilizer is transported overland from Padang, see Table 4.1.8.

Table 4.1.5 Inter-regional Cargo Flow in Sumatra (Dry Cargo)

(10³ tons)

From \ To	Aceh-I	Aceh-II	Belawan	N.Sumatra-I	N.Sumatra-II	W.Sumatra	Dumai	Riau-I	Riau-II	Riau-Island	Jambi	S.Sumatra-I	S.Sumatra-II	Bengkulu	Lampung	Total
1. Aceh-I		0.3		0.7						0.6						1.6
2. Aceh-II	6.9	10.7	23.1 [illegible]	8.8 [illegible]	7.8 [illegible]	2.5 [illegible]										59.8
3. Belawan	13.9 [illegible]	7.4 [illegible]	5.0	11.2 [illegible]	0.1	0.1	0.1 [illegible]	1.1 [illegible]	0.5 [illegible]	1.7	2.7 [illegible]	19.8 [illegible]	3.7		2.1	69.4
4. North Sumatra-I	0.3	0.3	31.9 [illegible]	22.9 [illegible]			0.1 [illegible]	18.3 [illegible]	1.5 [illegible]	9.1 [illegible]	3.6 [illegible]				0.1	89.5
5. North Sumatra-II	0.1	12.3 [illegible]	13.2 [illegible]	0.1	59.9 [illegible]	4.6 [illegible]		0.1								90.3
6. West Sumatra	16.4 [illegible]	91.5 [illegible]	294.2 [illegible]	1.0 [illegible]	20.6 [illegible]	8.4	6.7 [illegible]	0.4 [illegible]		4.0 [illegible]	10.9 [illegible]	0.2 [illegible]	36.3 [illegible]	34.7 [illegible]		565.3
7. Dumai			9.9 [illegible]				3.7 [illegible]	14.3 [illegible]	8.3 [illegible]	3.8 [illegible]	1.3 [illegible]					41.3
8. Riau-I			2.2 [illegible]	5.2 [illegible]	1.7		84.2 [illegible]	79.8 [illegible]	4.5 [illegible]	2.3 [illegible]	0.1	4.2 [illegible]	0.2		0.1	184.5
9. Riau-II			2.8	4.5				10.0 [illegible]	52.9 [illegible]	2.9 [illegible]	2.2 [illegible]	16.9 [illegible]	0.5		9.3	102.0
10. Riau Island-I		0.2	0.4	1.6		0.1		1.1	2.3	11.8 [illegible]	0.8	0.5		0.4		19.2
11. Jambi	0.3		0.3	0.1				0.2	3.1 [illegible]	1.7	13.5 [illegible]	13.7 [illegible]	0.9			33.8
12. South Sumatra-I			89.5 [illegible]	1.8		37.5 [illegible]	0.9 [illegible]	1.3 [illegible]	2.3	2.2	23.3 [illegible]	0.8	42.6 [illegible]	0.4	10.1 [illegible]	212.7
13. South Sumatra-II			4.6			0.2		0.1		4.8	0.3	3.1 [illegible]	25.1 [illegible]		1.9	40.1
14. Bengkulu						2.7									0.1	2.8
15. Lampung					0.2						0.6		0.2		0.1	1.1
Total	37.9	122.7	477.1	57.9	90.3	56.1	95.7	126.7	75.4	44.9	60.7	59.2	129.5	35.5	23.8	1,513.4

Remarks: (1) Livestock (2) Meat (3) Fish (4) Rice (5) Wheat Flour (6) Sugar (7) Maize (8) Coffee/Tea/Spices (9) Cigarette/Tobacco (10) Fooder (11) Other Food (12) Copra (13) Cooking Oil (14) Other Oil (15) Fertiliser (16) Other Chemicals (17) Rubber (18) Timber (19) Paper (20) Leather (21) Textile (22) Salt (23) Cement (24) Other Nonmetals (25) Precious Goods (26) Steel (27) Other Metals (28) Machineries (29) Other Miscellaneous Goods (30) Asphalt (31) Others

Note: Upper column indicates cargo volume, lower column represents the index number of commodity shown in remarks.

Source: DGSC, Lalu lintas angkutan laut menurut jenis barang & jenis perayanan, 1981

Table 4.1.6 Inter-island Transportation of Fertilizer in 1981

(1,000 tons)

Origin \ Destination	Ach-I	Ach-II	Belawan	North Sumatra-I	North Sumatra-II	West Sumatra	Dumai	Riau-I	Riau-II	Riau Is	Jambi	South Sumatra-I	South Sumatra-II	Bengkulu	Lampung	Sub Total	Tg Priok	Surabaya	Jawa Timur	Others	Total	Remarks
1. Ach-I																						
2. Ach-II																						
3. Belawan	9.3	3.6		5.1												18.0	1.1	1.2			20.3	
4. N.Sumatra I											0.1					0.1					0.1	
5. N.Sumatra II				0.5												0.5					0.5	
6. W.Sumatra													1.6			1.6	0.1				1.7	
7. Dumai																						
8. Riau-I																						
9. Riau-II																						
10. Riau Island																						
11. Jambi																						
12. S.Sumatra I			85.7			30.0				0.3	3.2		15.3		6.8	141.3	90.4	566.6	14.6	602.5	1,415.5	major port, Palembang
13. S.Sumatra II																		7.4			7.4	
14. Bengkulu																				0.3	0.3	
15. Lampung																						
Sub-Total	9.3	3.6	85.7	5.6		30.0				0.3	3.3		16.9		6.8	161.3	91.6	575.3	14.6	602.8	1,445.6	
16. Tg Priok			2.0			8.1						12.2			26.3	48.6		2.9	3.5	94.1	151.1	
17. Surabaya			1.3			1.8			0.4		0.5	4.3	1.1	1.0		10.6			22.2	47.4	80.2	
18. East Java	2.5		36.1							0.3		12.8	0.7		27.2	77.9				71.8	149.6	
19. Others						0.1			0.4		4.2	3.0	1.4		0.1	9.2	0.1	0.7		46.0	56.0	
Total	11.8	3.6	125.1	5.6		40.0			0.8	0.6	8.0	32.3	20.1	1.0	60.4	307.3	91.7	578.9	42.3	862.7	1,882.9	

Source: DGSC, Lalu lintas angkutan laut menurut jenis barang & jenis parayaran, 1981

Table 4.1.7 Imported Fertilizer by Unloading Region (1980)

(ton)

Province	Crude Fertilizer	Manufactured Fertilizer
D.I. Aceh	–	–
North Sumatra	3,060	239,717
West Sumatra	7,011	752
Riau	7,529	201
Jambi	–	86
South Sumatra	–	13,699
Bengkulu	–	–
Lampung	24	23,261
Sumatra	17,624 (86.3%)	279,716 (76.1%)
D.K.I. Jakarta	266	47,811
West Java	–	–
Yogjakarta	–	–
Central Java	–	6,373
East Java	25	17,741
Java	291 (1.4%)	71,925 (19.6%)
Nusa Tenggara	–	–
West Kalimantan	–	2,670
Central Kalimantan	–	–
South Kalimantan	–	5,400
East Kalimantan	2,500	3
Kalimantan	2,500 (12.3%)	8,073 (2.2%)
Sulawesi	–	7,930 (2.1%)
Others	–	–
Total	20,415 (100%)	367,644 (100%)

Source: Imports by Commodity and Country of Origin 1980.

Table 4.1.8 Cargo Flow from/to West Sumatra Province by Road

(ton)

Commodity		Riau Out flow	Riau In flow	Remarks
Livestock & Poultry		1,519.0	8.0	
Vehicle, Printing Equipment & Others		951.0	19.0	
Mining Products		5,739.2	1,805.8	Petrol
Construction Material		92,364.6*	7,996.5	* Cement, (82,027.7) Zinc, (4,606.8) Concrete iron, (2,153.5)
Fertilizer, Cigarettes, Beverages, Soap & Others		14,695.3**	392.0	** Fertilizer, Cigarettes, (12,788.1)
Cloth, Small Wares & Others		7,421.1	1,063.0	
Agricultural Products		8,846.0	19,765.9***	*** rubber = 18,808
Foods	Rice	42,355.4	–	
	Vegetables	20,357.2	25.0	
	Sugar cane	1,933.4	835.0	
	Cooking oil	1,472.1	5,252.0	
	Fruits	8,316.0	2,110.2	
	Others	4,251.2	1,661.0	
	Sub Total	78,685.3	9,883.2	
Total		210,220	40,931	

Source: Inspectorate of Road Traffic & Transportation Service of West Sumatra (1981)

Since fertilizer demands will surely increase as large scale plantations are developed in Riau, the transportation system will adopt different routes and carriers in accordance with cost comparison studies used to determine the most cost effective alternatives.

In order to illustrate transportation cost comparison technique, let us examine the case of transportation from the ASEAN Fertilizer factory at Lhokseumawe to Torgamba, a plantation area which in the future is likely to become part of Dumai Port distribution network. The sea route between Lhokseumawe and Dumai is 389 miles. Transportation costs for this route are calculated at 10,400 Rp per ton, including in-port handling costs for items such as stevedoring, longshore labor and delivery. The overland distance from Dumai Port to Torgamba is approximately 200 km, with overland transportation costing an estimated 15,800 Rp per ton, based on the unit price of 79 Rp per ton.km. Accordingly, the total cost by sea route via Dumai is about 26,000 Rp per ton. On the other hand, the overland route from Lhokseumawe to Torgamba is 645 km, and transportation cost by this route, using trucks exclusively, is estimated at 50,955 Rp per ton.

Thus, from this cost comparison we find that, in the future, fertilizer distribution in the Southern part of North Sumatra will most economically be done via Dumai Port.

2) Cement

The domestic shipment of cement by sea transportation is shown in Table 4.1.9. Sumatra is the destination for 49.4% (794,300 tons) of the total interinsular cement trade volume. Out of this figure 494,600 tons are due to intra-Sumatra cargo flows, mostly originating at Padang (Teluk Bayur) port. As seen in this table, Riau Province receives very little cement by sea routes. This is due to the fact that, of all the ports in Sumatra, those in Riau are the furthest from Padang by sea route, while they are the nearest by roads.

The amount of cement that is carried overland from West Sumatra Province to Riau is 82,000 tons in 1981, see Table 4.1.8.

Let us compare the transportation costs of the sea route via Dumai, with those for overland transportation by truck. Sailing in a clock wize direction around Sumatra from Teluk Bayur to Dumai the distance is approximately 1,080 miles. Shipping costs on this route are about Rp 16,500/ton including port cargo handling costs at both ends. The overland route from Dumai to Pekanbaru runs 178 km and its cost is estimated at about Rp 14,000/ton.

Including the shipping cost from the cement factory, P.T. Cemen Padang to Tulek Bayur Port, cement can be supplied by sea route for a total cost of Rp 31,500/ton.

On the other hand, the cost for transportation over the 312 km route from Padang to Pekanbaru is estimated at Rp 24,500/ton. Consequently, cement transport from the Padang factory to Riau Province will continue by means of land transportation.

However, when cement is directly imported as a construction material, it will be handled at Dumai Port.

Table 4.1.9 Inter-island Transportation of Cement in 1981

(100 tons)

Origin \ Distribution	Ach-1	Ach 2	Belawan	North Sumatra -I	North Sumatra -II	West Sumatra	Dumai	Riau I	Riau II	Riau Island	Jambi	South Sumatra -I	South Sumatra -II	Bengkulu	Lampung	Sub-Total	Java	Others	Total	Remarks
1. Ach 1																				
2. Ach 2																				
3. Belawan	1	1	1	9							1	1				14	1		15	
4. N.Sumatra 1								5		2						8			8	
5. N.Sumatra 2	1	5			3											9			9	
6. W.Sumatra	145	906	2,836	10	149	60	67	4		40	109	2	405	35		4,808		277	5,085	Padang (Teluk Bayur)
7. Dumai									1		1					2			2	
8. Riau 1													1			1			1	
9. Riau 2																				
10. Riau Island									1				4			5			5	
11. Jambi										3	2					5			5	
12. S.Sumatra 1								1	1	2	56		33			93			93	
13. S.Sumatra 2																				
14. Bengkulu																				
15. Lampung																				
Sub Total	147	913	2,837	20	192	60	67	10	[illegible]	47	169	[illegible]	443	35	0	4,946	2	277	5,225	
16. Java	20	6	1,380		[illegible]	2		38	34	231	354	356	374	23	177	2,996	189	4,975	8,160	from; Cilacap, Gresik, Ujung Pandang
17. Others										1						1		2,692	2,693	
Total	167	919	4,217	20	193	62	67	48	37	279	523	357	817	58	177	7,943	191	7,944	16,078	

Source: Lalu lintas angkutan laut menurut jenis barang & jenis pelayaran, 1981

3) Palm oil and other agricultural products

We now examine the case of transporting palm oil produced at the PTP IV plantation field in Torgamba to Dumai for export. This cost should be compared to the cost of transportation to Belawan, either by road or by a combination of road and railway.

As the distances from Torgamba to Dumai and to Belawan are respectively 158 km & 386 km and the cost in the case of exclusive use of trucks is directly proportional to distance, shipment to Dumai is obviously less expensive. However 290 km of the Torgamba – Belawan route can be covered using the railway from Rantau Prapat into Belawan.

Assuming that in the year 1990 the unit price on this railway will be 24 Rp per ton km, the total freight rate from Rantau Prapat to Belawan can be estimated at Rp 6,960 per ton. The cost from the Torgamba factory to freight terminal in Rantau Prapat by truck is estimated at Rp 7,500 for the 95 km distance. Thus the total cost for this route is estimated to be about Rp 14,500. It should be noted that on top of the freight costs for roadtanker and railway, there will be a cost for the transfer of the cargo from one to the other. There are also problems of delays during such transfer, due to delays and to the possibility of palm oil deterioration caused by turbulent exposure to air while filling the tanks.

Based on the assumptions that the capital cost for the construction of storage and loading facilities capable of accomodating a throughput of 200 thousand ton/year, is approximately 6,000 million Rp. and that the operating cost is 350 million Rp. per year and that the facilities life cycle is 10 yrs., the rough estimate of the effective transhipment cost is 5,000 ~ 6,000 Rp. per ton.

On the other hand, the cost of truck transportation for the 158 km distance to Dumai is estimated at about Rp 12,500 per ton.

Accordingly, the plantation area around Torgamba, belonging to PTP IV, shall be included in the distribution network centered on Dumai Port. The construction of storage tanks and loading facilities in the Dumai Port area has already begun.

Cargo movement through this hinterland will be facilitate by a well organized transportation network. At present, a road plan has already been launched so that smooth traffic between the port and hinterland can be attained, as described Chapter 1.

4.2. Characteristics of the Port

The basic policy for port development in Indonesia must be determined in accordance with the nation's overall economic and social requirements.

The geographical position that Indonesia occupies, scattered across an archepelago, has to an extent hindered the country's development. Improvement of the national transportation system is urgently required. Especially in those regions where development has lagged, complete transportation facilities are indispensable to the development of regional society and economy.

Transportation by sea of large volumes of goods is a basic necessity in a country consisting of thousands of islands.

Ports are in this sense, openings in the barrier posed by the sea.

At the same time, in areas with large hinterlands like Sumatra, ports are openings into the island's interior.

Furthermore, ports can also function as centers for economic growth and activity in slow developing regions.

In this regard, ports must not only have sufficient capacity to meet the demands of present and future marine transportation, but must also be able to cope with the development of hinterland economic activities.

The Dumai Port Development Project must be planned in terms of its topographical conditions as well as its present functions and future development possibilities so as to serve as a base for the economic and social development of Riau and its hinterland, covering much of the northern part of Sumatra.

4.2.1. Functions of the Present Port

After a large deposit of oil was confirmed in Riau, Dumai Port evolved from a mere berthing port for ships used by coastal fishermen into a port capable of carrying out the important function of exporting oil.

Dumai port's steady development since that time led to its being designated in 1965 as the Trunk Port for the Second Maritime District of the DGSC, with the added role of conducting foreign trade.

1) Present Cargo Traffic Conditions between Sumatra and Other Regions

Table 4.2.1. shows the percent of cargo traffic carried out in Sumatra (in which Dumai Port is located) as compared to the cargo traffic of Indonesia as a whole. Sumatra's share of Indonesia's total exports is 81.8%.

In particular, Sumatra takes a dominant share of the export of such bulk cargoes as oil and farm products.

As for domestic trade, goods are transported to many areas in Indonesia, with Sumatra and Java as points of origin. Sumatra boasts a 41.9% share of total domestic trade as shown in Table 4.2.2.

Conversely, imports into Sumatra comprise 15.7% of the national total, or 1,723 thousand tons. This cannot be compared to the 73% of total foreign trade (8,025 thousand tons) being shipped to points of destination in Java and Madura.

The import of necessities into Sumatra depends largely on interinsular transportation via Java.

Table 4.2.1 Foreign Trade by Region (1980)

(ton)

Region	Loading		Unloading		Total	
	Cargo Volume	%	Cargo Volume	%	Cargo Volume	%
Sumatra	49,331,000	81.82	1,723,000	15.69	51,054,000	71.63
Java & Madura	2,493,000	4.13	8,025,000	73.08	10,518,000	14.75
Bali & Nusatenggara	6,000	0.01	–		6,000	0.01
Kalimantan	4,357,000	7.23	525,000	4.78	4,882,000	6.85
Sulawesi	1,291,000	2.14	620,000	5.65	1,911,000	2.68
Maluku & Irian Jaya	2,818,000	4.67	88,000	0.80	2,906,000	4.08
Total	60,296,000	100	10,981,000	100	71,277,000	100

Source: Statistic Indonesia 1980/1981

Table 4.2.2 Domestic Trade by Inter-island in 1981

(ton)

Origin \ Destination	Sumatra			Jawa			Other Islands			Total		
	Volume	Row %	Column %	Volume	Row %	Column %	Volume	Row %	Column %	Volume	Row %	Column %
Sumatra	5,848,800	53.9%	60.7%	4,383,100	40.4%	44.0%	622,700	5.7%	9.9%	10,854,600	100%	41.9%
Java	3,460,000	33.0%	35.9%	3,923,600	37.4%	39.4%	3,102,700	29.6%	49.3%	10,486,300	100%	40.5%
Other Islands	330,800	7.3%	3.4%	1,657,100	36.4%	16.6%	2,562,400	56.3%	40.8%	4,550,300	100%	17.6%
Total	9,639,600	37.2%	100%	9,963,800	38.5%	100%	6,287,800	24.3%	100%	25,891,200	100%	100%

Note: Include oil; exclude cargoes to/from Singapore, Malaysia and Sabang
Source: DGSC/Lalu Lintas Angkutan Laut menurut Jenis Barang & Jenis Pelayaran 1981

However, Sumatra is itself the point of origin for many necessities sent to domestic eastern regions, including Java, also by means of interinsular transportation. These necessary goods include petroleum products, agricultural products such as palm oil, and forestry products such as plywood. Therefore, main trunk ports in Sumatra must be able to efficiently and economically ship large cargo volumes.

At the same time, ports must be located at appropriate distances from other ports and at sites allowing for convenient transportation to the hinterland of secondary industrial products and consumer goods supplied via interinsular transportation.

This means that in Sumatra the trunk ports must be located roughly in the center of hinterland service spheres and that they must be favored with advantageous conditions for inland transportation.

2) Location of Dumai Port

Dumai Port is located on the east coast of Riau Province, facing the Rupat Channel which adjoins the Strait of Malacca. The main ports located on the Malacca Strait side include, in addition to Dumai Port, the ports of Kuala Langsa, Belawan, and Tanjung Balai in North Sumatra, Pekanbaru in Riau and Jambi and Palembang in the adjacent provinces. Excepting Dumai Port, they are all river ports.

Belawan, the main port of North Sumatra, is designated as a gateway port in the new maritime policy of Indonesia. It is 700 km distant from Dumai Port. The ports of Kuala Tanjung, Tanjung Balai, and Labuhan Bilik lie between Belawan Port and Dumai Port.

In Riau Province, the ports of Bagansiapi-api and Sineboi are to the west of Dumai, Sei. Pakning and Sei Api are to its east, and Pekanbaru Port is located midstream on the Siak River. Also, on the Indragiri River running through the southern part of the province are the ports of Tembilahan and Rengat.

The sea route feeder function of Dumai Port extends as far as Jambi.

3) Relation of Dumai Port to Adjacent Ports

Commodity traffic for the mainland of Riau is mainly centred at its capital, Pekanbaru. Dumai and Pekanbaru share the function of base ports for the hinterland of Riau. However, since Pekanbaru Port is a river port, the maximum size of navigable ships is limited to 1,000DWT with a maximum length of 65 m. Therefore, as major roads are progressively constructed in the hinterland, it is expected that Dumai Port will come to serve as main base for quick shipment of farm products grown on the large scale plantations now under development in that same hinterland.

According to statistics for 1981, Belawan Port and Dumai Port have few ties in terms of marine transportation.

Rather, the feeder function for Dumai Port is carried out through trade with Bagansiapi-api and Sineboi to the west of Riau, Sei Pakning and Sei Api located along the Siak River, the island ports of Bengkalis and Selat Panjang, and the ports of Jambi Province.

Dumai Port is at present connected with Pekanbaru Port by a trunk road rather than by a sea route.

4.2.2. Future Characteristics of Dumai Port

The future characteristics and functions of the port will be determined by the form and scale of the social and economic development of the hinterland.

1) Deep-water Ports

Dumai Port is blessed with an excellent natural harbour, protected by Rupat Island. Waves need not be considered in port planning. The water depth of its seaway and mooring basin requires no improvement for the berthing of large ships to piers. A water depth of 10 m is found about 100 m off-shore, so that construction of piers should be simple.

There are no large rivers flowing into the Rupat Strait so the water depth of the waterway leading to Dumai Port should be only slightly affected by siltation. Maintenance costs should be minimal in comparison to the enormous maintenace and dredging costs at other major ports such as Belawan, Tanjung Priok and Sulabaya.

In order for large-scale future development to take place, it is indispensable that deep-water port construction be feasible. It is also important that studies be carried out concerning the full-scale operation of such a port.

2) Shipping Port for Large Scale Plantation Products

Specialized port functions will be developed for shipment of agricultural products such as palm oil, which will be produced at large plantations developed in the southeastern part of Riau, and for forestry products such as sawn timber.

If lot size is sufficiently large, then direct overseas shipment should be carried out rather than shipment via a gateway port. Also since palm oil solidifies at normal temperatures, storage facilities with heating equipment will be necessary. Sufficient storage facilities must be provided for forestry products as well.

3) Shipping Port for Crude and Refined Petroleum Products.

At present, the port mainly exports crude oil, and this function will continue in the future. The construction of a hydro-cracking plant is underway, so that in the future part of the crude oil can be converted into a refined petroleum product.

4) Dumai Port under Gateway Policy

Oil and palm oil will be shipped for export by large size, specialized carriers. If carried out on a large scale, such a direct export policy is naturally advantageous compared to re-routing through a second port.

Dumai Port happens to be the largest oil exporting port in Indonesia. In the future, Dumai will have to expand it's role as a specialized "gateway port", so that in addition to directly exporting crude oil as at present, palm oil and sawn timber will also be directly exported, provided shipments meet or exceed one ship-load in volume.

In addition to its important, though specialized role as an export port, Dumai must also perform the task of shipping miscellaneous small cargoes for export to an Indonesian gateway port, as this is fundamental to the national "Gateway Policy".

Dumai Port is designated as a collector port for the Port of Belawan. It is assumed that small cargoes for export will be transported from the collector to the gateway port. However the actual transport route chosen must be safe, fast, and inexpensive. A back-up transportation route is also highly desirable.

5) Nucleus Port Promoting Regional Development for the Hinterland

In terms of goods transported to Sumatra, the volume of goods shipped via inter-insular transportation from Java exceeds the volume of direct imports. To achieve the most economical transport of goods into the hinterland, Dumai Port must not only be equipped with port facilities, but also means to link the port area with the hinterland. In this case, the port's function expands to being a center of regional development.

Although main roads will be fully developed under REPERITA IV by the fourth 5-year plan, feeder services conducted by the Lokal and Prahu will be continuously required in swampy areas and for islands where road access is impossible.

6) Passenger Relay Port as Ferry Terminal

There are plans to develop an international ferry service (Dumai-Malacca) from Dumai Port, and there are also plans to develop a regular domestic liner service to carry passengers from Tanjung Priok to Tanjung Pinang and Dumai.

With the population in the hinterland increasing, and due to growing economic activities centered around large scale farming, it will become necessary to develop a passenger terminal that can accommodate the large vessels that will be needed in the face of increased future demands for passenger service.

CHAPTER 5.
CARGO FORECAST

CHAPTER 5. CARGO FORECAST

This chapter will be devoted to a forecast of future cargo volumes expected at Dumai Port. Future cargo volumes will be forecast for each commodity by taking into consideration various factors such as the large scale agricultural development plan, the transmigration program, other industrial development plans, population growth, possible changes in the socio-economic structure of the port hinterland, etc. As described in Chapter 1, the economy of Riau Province lags somewhat behind other districts in Indonesia. To improve this situation, a large scale regional development plan has been launched. This plan is expected to considerably change the socio-economic structure of Riau Province, and thereby, the role of Dumai Port. The present economic structure is characterized by the overwhelming predominance of the mining and quarrying sector: 83% in terms of Riau's gross domestic regional product in 1980 (see Table 1.1.7).

The agriculture sector occupies only about 4%. This situation will, in the not too district future, surely undergo considerable change due to the on-going agricultural development plan involving oil palm/rubber plantation development, transmigration and road improvement.

The most noteworthy feature of the predicted future composition of port cargo at Dumai is the sharply increasing share of palm oil and its by-product, palm kernel. Also, fertilizer, a prerequisite for plantation work, will occupy a considerable share. The various in-coming/out-going cargoes required for agricultural development will make use of both land and sea transportation. These two modes of transport will have to be well organized and well synchronized to keep pace with plantation production plans. Dumai Port, located strategically in relation to various plantation sites and blessed with favorable natural conditions will take the important role of handling cargo as the transfer point between land and sea transportation so as to secure smooth and economical cargo movement. In terms of land transport, improvement of roads connecting the port and plantation sites is now underway as mentioned in Chapter 1. The future large flow of plantation related cargoes along the roads to and from plantation sites is expected to stimulate the demand for and flow of other general cargoes as well. In this regard, neighbouring ports in Riau Province as well as those in other provinces are given consideration when setting the hinterland for Dumai Port, as described in Chapter 4. Another item of great potential for Riau Province is the forestry industry. Though the forestry sector is at present rather stagnant due to the worldwide economic recession, the shipment of forestry products from Dumai Port is expected to increase once the market has recovered. The governmental ban on log exports after 1984 will be taken into account in the forecast. As for rice, there has been a shortage in Riau Province which is being met by both imported and domestic supplies being shipped in to Dumai. In consideration of all the abovementioned factors, port cargo through Dumai is forecast at about 1.6 million tons in 1990 and 3.6 million tons in 2000, as detailed in the following sections.