ECONOMIC PLANNING UNIT

MALAYSIA

FEASIBILITY REPORT

ON

KUANTAN PORT CONSTRUCTION PROJECT

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GOVERNMENT OF JAPAN

Preface

The Government of Japan, in response to the request from The Government of Malaysia entrusted the Overseas Technical Cooperation Agency to conduct a feasibility survey for Kuching Port Development Project.

Therefore, the Overseas Technical Cooperation Agency dispatched a survey mission consisting of seven technical experts headed by Dr. Y. Watanabe, Professor of Musashi Institute of Technology to Malaysia during the period from 15, March to 22, June, being fully aware of the signficance of the mission for the economic growth of the country caused by the development of Kuching Port.

This survey was focused on the feasibility study of constructing a new wharf and deciding the location of it in considering the present situation of the transportation at Kuching Port.

Fortunately, the spot survey work by the mission in Malaysia was carried out amicably through a kind assistance by the people of the Government concerned, hence this report has been completed at this time successfully.

Nothing would be more gratifying to our Agency than if this report could be of any help for the development of Kuching Port and, also for promoting closer relationships as well as economic interchange between Malaysia and Japan.

In conclusion, our Agency takes this opportunity to express its hearty thanks for the kind cooperation and assistance extended to our mission by the Government of Malaysia and it's agencies during the mission's stay there.

September 1967

Shinichi Shibusawa
Director General
Overseas Technical Cooperation Agency

Letter Of Conveyance

September, 1967

Mr. Shinichi Shibusawa

Director General,
Overseas Technical Cooperation Agency

Sir,

I have the honour of presenting to you a report on the investigation on the Kuching Port Construction Project of Malaysia.

This Investigation Team was despatched by the Overseas Technical Cooperation Agency to make an investigation into the Port Construction Project at Kuching, Sarawak, Malaysia, over the period of three months from March, 1967.

Upon consultation with the Malaysian Government, the Team collected data, carried out technical and economic investigation and topographical and geological survey of the proposed site for construction of a new port. After returning to Japan, the team, based on the data collected, examined the port construction project and made designs for port structures, and has finished preparing the report.

The Kuching Port Authority manages and operates Tanah Puteh Wharf. By the Kuching Port Construction Project, the Authority intends to build a new wharf at Pending Point, which lies east of Tanah Puteh. The new wharf will make it possible to handle efficiently and economically external trade goods which are expected to show sharp increases in the future. In the event of its realization, the project will, we believe, contribute a great deal to the economy of Sarawak.

The project will take about three years' time and cost M$ 20,008,000.

Kuching Port is currently operating well over its capacity, taking in too many vessels and handling too large a volume of goods for its facilities to handle smoothly. This situation, we believe, necessitates prompt implementation of the project.

In concluding this report, I should like to avail myself of this opportunity to offer our heartfelt thanks to the Malaysian Government officials concerned, the staff members of the Japanese Embassy at Malaya, the officials concerned of the Japanese Foreign and Transportation Ministries and the firms concerned for the esteemed and unsparing assistance rendered to us.

Very sincerely yours,

Yasaku Watanabe,

Yasaku Watanabe,
Head of the Survey Team
on
The Kuching Port Construction Project

ECONOMIC PLANNING UNIT

MALAYSIA

FEASIBILITY REPORT
ON
KUCHING PORT CONSTRUCTION PROJECT
SARAWAK, MALAYSIA

SEPTEMBER 1967

GOVERNMENT OF JAPAN

CONTENTS OF THE REPORT

CHAPTER Ⅰ INTRODUCTION

CHAPTER I INTRODUCTION

1-1 Objectives of Investigation

Kuching is a commercial port in Sarawak, Malaysia. Besides Kuching Port, there are many ports in Sarawak. They are Sibu, Tanjong Mani, Sarikei, Binatang, and Miri. By far the most important of these is Kuching Port with the capital Kuching in the background. It plays the most important role in the development of Sarawak, but its facilities are too limited in capacity and its scale is too small to fulfil its role, throwing may obstacles in the way of handling cargos. Hence cries for its improvement.

In these circumstances, the Government of Malaysia requested the Japanese Government to undertake investigation of the port. In response to this request, an investigation team was organized by the Overseas Technical Cooperation Agency. The present investigation was carried out in order to study and examine the economic and technical feasibility of Kuching Port and work out a plan for its construction.

1-2 Items of Investigation

In order to study and examine the economic and technical feasibility of the port and work out a construction plan, investigation was conducted with emphasis placed on the following items:

(1) Collection of existing data on natural conditions, such as weather, tide, rivers, etc.

(2) Topographical survey and measurement of depth of water of the proposed site of the port.

(3) Geological survey of the proposed site.

(4) Investigation of the existing port facilities.

(5) Investigation of the use made of the existing facilities.

(6) Economic investigation of the hinterland of the port.

(7) Examination of the terms of execution of work.

(8) Examination of port planning and terms of designing.

(9) Drafting a plan for the port.

(10) Preliminary designing of port structures.

(11) Examination of the economic feasibility.

1-3 Organization of the Survey Team

The survey team was organized as follows:

Head of the Team: Yasaku Watanabe (Dr. of Engineering & Professor of Musashi Institute of Technology)
Responsible for general supervision of investigation.

Members: Tadao Haruta (Japan Port Consultants, Ltd.)
Responsible for investigation of existing port facilities & examination of the terms of designing.

Hirotomo Fujii (Planning Section, Port & Harbour Bureau, Ministry of Transportation)
Responsible for investigation of port economy and terms of planning.

Teruo Sakai (Japan Port Consultants, Ltd.)
Responsible for investigation of natural conditions & examination of terms of execution of work.

Kazuaki Matsumoto (Port Technology Research Institute, Ministry of Transportation)
Responsible for supervision of topographical and geological survey.

Yoji Mizutani (Goyo Construction Company)
Responsible for topographical and geological survey.

Shoichi Inagaki (Overseas Technical Cooperation Agency)
Responsible for accounts & liaison.

Topographical and geological surveys were conducted by the Goyo Construction Company and the preliminary designing of port structures by Japan Consultants, Ltd., being entrusted by Overseas Technical Cooperation Agency.

1-4 Progress of Investigation

On its arrival at Kuching, the team had an opportunity to hear about the general situation of Kuching Port from the Minister of Communication & Works and the General Manager of the Kuching Port Authority.By their explanations and the data supplied to us, it was confirmed that, with too many vessels coming in, the port had been operating beyond its capacity, resulting in increasing lost hours waiting for berths and confusion in handling cargos and that Tanah Puteh and Biawak were incapable of accommodating large vessels due to restrictive conditions of the river.

Judged by the explanations given by the Development Officer, the Directors and the officers in charge of the Agricultural, Forest, and Geological Survey Departments and from the statistical data on industry and external trade, it was foreseen that the volume of cargo to be handled at Kuching Port would go on increasing in the future.

It was also made clear by the data obtained from the Public Works, Land & Survey, Drainage & Irrigation, and Marine Departments that the range of tides was very wide, the water level of the river was subject to big changes, a heavy rainfall sometimes caused a flood, and wind sometimes blew at an extraordinary velocity.

As soon as soil survey was started, the surveyors had to face rockbeds lying shallow and largely changed and complicated layers in some places, and they had to make some alterations in their survey schedule. Seen as a whole, the natural conditions were marked with peculiar features, which it will be necessary to take into full consideration in working out a plan and a design for the port.

The results of the spot investigation mentioned above were enough to provide us with almost sufficient data on which to examine economic and technical phases of the new project of Kuching Port.

CHAPTER II CONCLUSION AND RECOMMENDATION

CHAPTER II CONCLUSION AND RECOMMENDATION

2-1 Conclusion

As the result of the spot investigation and the examination and study made in Japan, we have come to the following conclusion on the Kuching Port Project:

(a) Kuching Port, with the capital Kuching in the background and with its close relations with the industry in the hinterland, is the most important port in Sarawak. Of all its facilities, Tanah Puteh Wharf used for general cargo in external trade has been managed and operated in the most efficient manner by the Kuching Port Authority (hereinafter referred to as K.P.A.).

The examination of the actual use made of the wharf in the past years shows that the number of incoming vessels and the volume of cargo handled have been continuing to increase in recent years with the result that the berth occupancy figures stand very high with 80 - 100 %, lost hours waiting for berth are well over 10,000 hours a year and the volume of cargo handled per foot of the length of berth is larger than the normal standard of the world's ports and harbours. The cargo handling capacity of a wharf has in general certain limitations in terms of marine transport economy. It is judged that Tanah Puteh Wharf is now overworking in excess of the economic limit of its capacity, causing losses and inconveniences to owners and shippers and affecting Sarawak economy adversely.

With the growth of population, development of industry, and improvements of living standards in the hinterland, it is presumed that external cargo to be handled at Kuching Port will go on increasing every year and sundry goods will run up to 560,000 tons in 1977 and 650,000 tons in 1980, rapid and remarkable increases as compared with 380,000 tons in 1966.

The river leading to Tanah Puteh is narrow and shallow, proving a limiting factor to vessels making use of K.P.A.'s wharf---vessels of over 430ft in length and over 17ft draft cannot make use of it. Since some of the vessels currently making use of Kuching Port are even larger, Tanah Puteh wharf is too small in capacity in respect of its facilities as well. Generally speaking, the greater the distance covered by a voyage and the larger the volume of cargo carried, the more economical it is for larger vessels. It is quite probable, therefore, that Kuching Port will also see larger vessels coming in the future.

In order to cope with future anticipated increases in the volume of goods handled and larger vessels coming in and thereby to expand external trade and to promote the economy of Sarawak, it is of urgent necessity to construct a new wharf for general cargo.

(b) As a site for the new wharf, it is concluded after checking all candidate sites that the left bank of the Kuap at Pending is the most suitable. Its connection with the city area and land transport services, a wide area of land available for use associated with the port, the depth and width of the river, possibility of future expansion of facilities, the lay of the land---in all these respects it surpasses all the rest.

(c) The scale and contents of the plan for the wharf are as follows:

Annual volume of cargo handled	....		350,000 tons of general cargos
Planned depth alongside	....		-27ft (-8.23m)
Wharf length	....		800ft (243.8m)
Length of vessels to be moored:			
500ft (153m) (12,000D.W.) & 190ft (58m) (1,000D.W.),			one each
or 300ft (91m) (3,000D.W.)	....		2 vessels
or 220ft (67m) (1,500D.W.)	....		3 vessels
Transit shed: for imports	....		$60,000ft^2$
for exports	....		$16,000ft^2$
Warehouse for dangerous goods	.. ..		1
Land as site for the port	....	about	$620,000ft^2$
Other ancillary facilities			

(d) The volume of general cargo to be handled in 1980 has been taken as the target in the planning of the new wharf. However, it is only too obvious that the volume will continue to grow after that. It is necessary, therefore, to be fully prepared for the future need of expansion of the wharf. To meet this need, the new wharf can be expanded by 400ft upstream, to the ultimate length of 1,200ft. It is advisable to see that much space be at once secured and reserved for the purpose and that at the same time a reasonable space be also secured in the hinterland for use associated with the port. Planning for re-expansion should be undertaken, it is viewed, several years before 1980.

(e) Results of the Geological Survey: Rock-beds have been found lying shallow in the river-bed, which make it difficult for the anchor to hold firm. The river runs swift at spring tide. These combine to make it difficult to work a vessel in getting it alongside and off the wharf. To help work a vessel smoothly, two powerful tugboats should always be kept ready.

(f) The construction of the new wharf at Kuching Port is estimated to cost

$M18, 308, 000, of which $M12, 586, 000 are to be met by foreign fund and $M5, 722, 000 by domestic fund internally. It will take three years.

(g) Study was made as to how to repay the said loan, and it has been found that it is possible and feasible to repay it out of the port revenue of K.P.A.

(h) There will be rapid increase in the demand for oil in the future as is the case with general cargo. Oil tankers, in particular, tend to grow larger in size to save transport charges. Larger tankers than those currently employed are now desirous of being allowed in, while Biawak oil berth, although it has at present enough lroom in capacity to handle more, has to refuse them only because the river is not deep enough.

For larger oil tankers in the future, it is desired that a dolphin-type berth will be constructed on the shore opposite the new general cargo wharf, and from the berth to the existing oil tanks, oil is to be transported through a pipeline.

Cost of construction of this oil tanker berth have been separately reckoned, and are estimated at M$1, 700, 000, excluding those of the pipeline.

2-2 Recommendation

As stated in the Conclusion above, the Kuching Port project is a pressing matter which has much to do with Sarawak economy. Since it is feasible both economically and technically, preparations should be quickly pushed forward and work started.

It is further desired that in connection with the present plan, the following matters will be taken up for examination:

(1) The right bank of the River Sarawak is subject to heavy erosion, causing the land to recede and the navigation passage to deteriorate. In order to safeguard the site for the new wharf of the port and to stabilize the navigation passage, there is pressing need for carrying out bank protection work and getting erosion under control.

(2) Promotion of town and road planning side by side with this plan.

(3) Establishment of an idea as to future port planning after completion of the present plan.

(4) To carry out dredging of the sea off the river mouth and to study how to maintain the navigation passage, thereby to cope with the growing size of vessels.

In addition to the above points, it is desired that the following items be undertaken in carrying out this project:

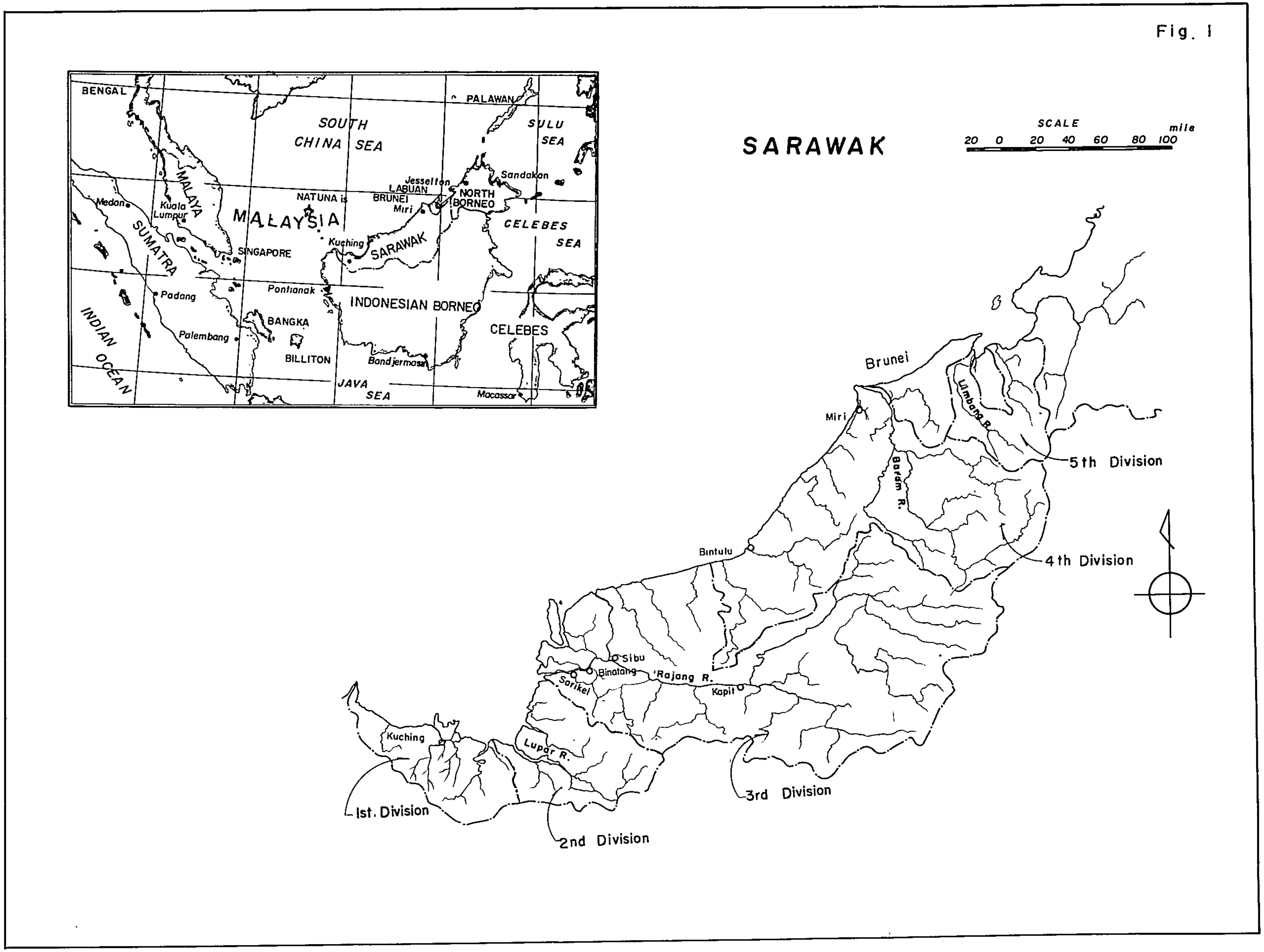
(1) To carry out promptly observation of the water level of the construction site at Pending.

(2) Our recent boring tests have revealed that the soil nature of the site is more complicated than was expected and shows a remarkable deformation in stratification. To ensure the execution of work, further boring is to be carried out at several points either prior to the commencement of work or in parallel with the execution of work.

(3) In the evaluation of tenders, care should be taken to select the contractor who is highly experienced in port construction work and has high technical ability.

CHAPTER III OUTLINE OF SARAWAK

Fig. 1


SARAWAK
SCALE
mile
20 0 20 40 60 80 100
Brunei
Miri
Limbang R.
Baram R.
5th Division
Bintulu
4th Division
Sibu
Binatang
Sarikei
Rajang R.
Kapit
Kuching
Lupar R.
1st. Division
2nd Division
3rd Division
BENGAL
PALAWAN
SOUTH
CHINA SEA
SULU
SEA
Jesselton
LABUAN
Sandakan
NATUNA is
BRUNEI
NORTH
BORNEO
Miri
MALAYA
Medan
Kuala
Lumpur
MALAYSIA
CELEBES
SEA
SUMATRA
Kuching
SARAWAK
SINGAPORE
Pontianak
Padang
INDONESIAN BORNEO
BANGKA
CELEBES
INDIAN
OCEAN
Palembang
BILLITON
Bandjermasin
JAVA
SEA
Macassar

CHAPTER III OUTLINE OF SARAWAK

3-1 Geographical Features and Weather Conditions

Sarawak lies between N. lat. 0°50' and N. lat. 5° on one hand and E. long. 109°30' and E. long. 115°40' on the other. It occupies a greater part of the north-western part of Borneo Island which faces the South China Sea. At its longest part, it is about 460 miles from the north-eastern to the south-western tips, at its widest about 160 miles and at its narrowest about 40 miles. It has an area of about 48, 250 square miles, which is one-sixth of Borneo Island. (See Fig. 1)

Sarawak borders Indonesian Borneo on the south, with the Kapoeas ranges between them forming the watersheds. On the northeast, it borders Sabah, which forms two enclaves into the territory of Brunei in the north.

The land of Sarawak is divided into three, namely, an interior mountainous section, a low swampy plain section of alluvial soil, and a hilly section between the two.

The interior mountainous section consists of a chain of mountains of more than 5,000 feet high, highlands, and gorges, and is covered with untapped forests. The highest moutain is Mt. Murud, which rises 7, 950 feet above the sea level.

Contiguous to this mountainous region lies a hilly region, where most of the natives of Sarawak live. The plain section stretching along the sea coast is one mile wide at the narrowest part and something more than 100 miles at the widest part.

This plain region of Sarawak is a swampy alluvial low land with peat deposits. Low hills and plateaux stretch across the plain in some places as for as the seashore, where they form sea cliffs. Where layers of peat are thin, the plain is arable.

The rivers are generally a succession of rapids along their upper reaches, but lower down in the plains along the sea coast they flow in an unusually zigzag way. The main rivers are the Sarawak, the Lupar, the Rajang, the Baram, and the Limbang, the Rajang being the longest with a length of 350 miles. It is navigable by small coasting vessels for 150 miles as far as Kapit. The Sarawak is navigable by ocean-going vessels as far as Kuching some 20 miles upstream from the mouth.

Other rivers are also an important transportation means in Sarawak, where a highway system still remains undeveloped.

The coast of the South China Sea is generally monotonous and the sea is shallow for some distance from the shore and there is no good natural harbour in sharp contrast with the coast line of Sabah, which is blessed with good ones, such as Kudat and Sandakan.

The climate is one of a tropical monsoon type and is characterized by high temperature, high humidity and abundant rainfall all the year round.

This high temperature and abundant rainfall without dry seasons throughout the year offers the optimum conditions for plant growth. Hence three quarters of the whole area of Sarawak are covered with forests.

3-2 Population, Races and Towns

The population of Sarawak is estimated to have been 820,000 as at the end of June, 1964. The recent annual ratio of growth of population is about three per cent.

The racial composition of the population is given below (Table 3-2). Here in Sarawak, unlike Malaya, aborigines, including Sea Dayak, account for one half of the total population.

Table 3-2 Population of Sarawak by Races

Race	Population	%
Chinese	244,486	31.5
Sea Dayak	241,544	31.1
Malay	136,232	17.5
Land Dayak	60,890	7.8
Melanau	45,876	5.9
Other Aborigines	39,262	5.1
Other Races than Aborigines	6,914	0.9
European	1,737	0.2
Total	776,990	100.00

Source: Census taken in July, 1964.

Sea Dayaks, otherwise called Ibans, form the majority of aborigines.

Most of the aborigines are engaged in farming or fishery on a small scale. In the interior, they grow upland rice---after harvesting, they burn up their fields and move on to new ones. In coastal regions they grow paddy rice or gum-trees, which bring them cash earnings. Some of the Sea Dayaks in the coastal regions are working as clerks, teachers and Government officers.

Many of the Chinese people live in towns and carry on commerce or trade.Some have found their way into the interior. Their economic power is very great.

Languages spoken are Malay, English, Chinese and Ibanese. Malay and English are official languages, but English to cease to be one from 1967 and on.

There are three forms of religion the people believe in, namely, Buddhism, Islam and Christianity.

The density of population of Sarawak is only 16.4 per square mile, which is remarkably low as compared with Malaya's 156 per square mile, Asia's 166 per square mile and world's 56 per square mile. Moreover, the inhabitants are thinly dispersed.

The City of Kuching, the capital of Sarawak, is situated in the western-most part of Sarawak and lies on the River Sarawak, 21 miles upstream from the mouth. With a population of 60,000, it is the largest city in Sarawak and is the center of administration, government and economy.

Sibu is a city in the central part of the country and lies on the River Rajang, the longest river in Sarawak, some 70 miles upstream from its mouth. It has a population of about 30,000 and is the center of industry and government in the central district.

Miri is in the northern part of Sarawak and faces the South China Sea. It is the center of the oil refining industry which treats crude oil from Sarawak oil fields and from Brunei. It is also the center of government in the northern part of Sarawak. It has a population of about 13,000.

Among other smaller towns are Simanggang, Limbang, Sarikei and Binatang.

In terms of regional distribution of population, the 1st and 2nd Divisions with Kuching as the center is the most populous, accounting for about 45 per cent of the total, or 360,000 inhabitants, followed by the 3rd Division with Sibu as the center with about 35 per cent, of 260,000 inhabitants.

3-3 Economy and Industry

(a) Economy

The national gross product of Sarawak was M$618 million in 1965, or M$737 per head. This per-head figure represented 79 per cent of Malaysia's M$862 and compared very poorly with Malaya's M$952 and Sabah's M$862.

This poor national gross product is explained on the one hand by the fact that while Sarawak has an area almost equal to that of Malaya, its population is only one-tenth of that of Malaya, leaving most of the land dormant economically, and on the other, by backwardness in the development of highways and roads which constitute the foundation of industrial development.

The recent economic growth of Sarawak, despite Stagnancy in exports of the staple agricultural products, rubber and pepper, but supported by an export boom of timber and increasing investment in development projects, has continued to show a high ratio of 7 per cent annually.

Of total national production, agriculture and forestry account for 45 per cent. Exports of timber, rubber and pepper account for more than 80 per cent of total exports in value. These exports pay for imports of goods and commodities essential to people's life, production and construction, such as foodstuff, clothing, light oil, fertilizer, machinery, and so forth.

By way of giving a side view of Sarawak's industrial structure, let us have a look at the employment structure of labour power. Of the employed population of about 300,000 in 1960, 82 per cent were engaged in the primary industry, chiefly growing rice for their own consumption, 6 per cent in the secondary industry and 12 per cent in the tertiary industry.

Thus it is clear that Sarawak economy is wholly dependent upon agriculture.

(b) Agriculture

Farmland is mainly found in river valleys of alluvial soil and in the districts with good irrigation along the seashore. 24 per cent of the total area of land is under cultivation. Of the total acreage under cultivation, 6 per cent is by the settled cultivation system and 18 per cent by the shifting cultivation system. The remaining 76 per cent of the land is covered with unexploited forests.

Staple agricultural products are rubber, rice, coconuts, sagos, and pepper, in order of the size of acreage of plantation.

Those for exports are rubber, pepper, sagos and coconuts, of which the first two are very important.

Exports of rubber amounted to 40,334 tons in 1965 and 33,589 tons in 1966, coming out first in value of all agricultural products exported. In terms of quantity, however, its exports have been a gradual decline since 1960, when the peak was reached.

Seen regionally, the 1st and 2nd Division with Kuching as the center turns out some 40 per cent of total production of rubber and the 3rd Division with Sibu as the center about 50 per cent.

In the production of pepper, Sarawak ranks second in the world next to India. Exports of pepper ran up to 17,614 tons in 1965 and 12,954 tons in 1966, and came out second in value next to rubber exports. Quantities of its exports remain almost static since 1961.

Seen regionally, those districts around Kuching produce about 60 per cent of total production of pepper and those around Sibu about 30 per cent.

Coconut and sago palms are also grown. Recent growth in sago starch exports has been remarkable.

Rice occupies a large proportion of acreage under cultivation and absorbs a large proportion of farm workers. But most of them are petty farmers, growing rice for their own consumption, and therefore, their production can only meet half the demand of Sarawak---about 60, 000 tons---and the other half has to be imported from Thailand and the Republic of China.

In coping with this stagnant agricultural production and to prevent prices of agricultural products from falling, the First Malaysian Plan has worked out various countermeasures based on the following guide-lines:

(1) Rubber: To encourage cultivation of new high-yield strains to replace the present ones and to improve quality; to expand rubber plantations and increase rubber planters in number.

(2) Rice: To place priority on paddy rice and increase the acreage of paddy fields by carrying out irrigation and drainage works and to increase yield of rice.

(3) Coconut : To encourage increased production to meet increase in demand now anticipated both at home and abroad.

(4) Oil palm: To encourage its cultivation. Although it is not cultivated at present, the soil of Sarawak is suited to its cultivation. It gives promises of becoming a good article of export. In addition, its cultivation has proved successful in Malaya and Sabah.

(5) Pepper: It is subject to sharp price fluctuations and no increase in demand is expected. Efforts are to be made to improve its quality and reduce cost.

(6) Other kinds of fruit, vegetables and livestock are to be improved in quality. Fresh-water fishery is to be encouraged and the spread of agricultural education is to be striven for.

(c) Forestry

Forestry is one of the key industries of Sarawak. Mountainous districts of

Sarawak produce woods both for home consumption and for exports, such as selangan batu, kapur, keruing, resak and meranti.

Forests on peat swamps in the coastal regions produce ramin and jangkong, which combine to account for the greater portion of export woods.

Due to world-wide shortage of wood resources, exports of timber have kept on increasing year after year. In 1966 wood exports amounted to 1, 070, 000 tons in the log and 160, 000 tons in the timber, ranking second in value of exports next to oil.

The larger portion of these woods are produced in the 3rd and the 4th Divisions.

Study has recently been made of tips as materials for paper and pulp manufacturing. It will not be long, it seems, before they begin to be exported.

(d) Mining

Oil, bauxite, gold, lime stone, clay and coal constitute the mineral resources of Sarawak. Most important of these is oil. Sarawak oil field in Miri gives an annual yield of about 50, 000 tons although there is a gradual decline in yield. The Shell Company owns an oil refinery in Miri and imports Burnei oil, refines it and re-exports it.

Bauxite ores are mined near Sematan in the western part of Sarawak. Their exports, at peak time, ran up to 290, 000 tons. Due to drain on deposit, however, the mine had to cease to operate in 1965.

Gold is mined at Bau near Kuching. Being small in quantity, gold produced is intended for home consumption.

As for coal, near the frontier between Sarawak and Indonesian Borneo and about 90 miles from Kuching, there is a coal field which is claimed to have deposits of estimated 28, 000, 000 tons of bituminous coal. Over the period from 1959 to 1962, investigation was carried out by the hands of Japan Caol Mining Company and Yawata Iron Works.

(e) Manufacturing Industry

Manufacturing industry still remains in its incipient stage of development. The manufacturing industry of Sarawak is broadly divided into two categories---one is the primary processing industry which turns out goods for exports and the other is intended to produce consumer goods for home consumption. To the former belong oil refining, lumbering, sago and copra flour milling and processing of pepper, and those which produce foodstuffs, drinks and beverages, textile, earthenware, wooden vessels and other daily necessaries belong to the latter. Most of these industires were established only recently and are of small scale. Their manufactures are competitive with those imported from advanced countries, Malaya and Singapore. To cope with this situation, the Government has taken various countermeasures, such as tax exemption, subsidies to pioneers, establishment of a traffic network and the like which constitute the foundation of industry, exploitation of land for factory sites, establishment of a credit system, institution of a guarantee system for external loans, and so forth.

3-4 External Trade

Sarawak economy is dependent upon its external trade. The recent trade performance is given on Table 3-3. Due to stagnant production in the agricultural and mining sections, export performance was below that in 1950, which was an alltime high, while imports showed increases reflecting increased investment in development projects and improved living standards. The result was an excess of imports over exports.

Table 3-3 Performance of External Trade in Recent Years

Unit : $M million

Year	Exports	Imports	Balance
1960	488.3	444.9	43.4
1961	397.2	411.7	-14.5
1962	407.2	400.7	6.5
1963	373.8	396.5	-22.7
1964	381.0	429.8	-48.8
1965	433.7	484.8	-51.1
1966	463.6	525.7	-62.1

Note (1) Import value is based on C.I.F. and Export value on F.O.B. Both include re-exports.

(2) Trade with West Malaysia and Sabah is also included.

Sarawak's external trade performance classified by merchandise is given on Table 3-4 below.

Table 3-4 Performance of External Trade by Merchandise

Unit: M$

Merchandise	Exports		Imports	
	1965	1966	1965	1966
Foodstuff	49.2	39.5	89.3	93.3
Beverage & tobacco	0.1	0.2	12.5	11.4
Raw material (not for food)	146.9	161.5	7.2	7.0
Mineral fuel & lubricating oil	218.5	241.5	212.4	237.7
Animal & vegetable oil & fat	1.8	2.1	0.7	0.6
Chemical Products	0.2	0.2	19.6	23.6
Products of manufacturing industry	6.8	8.8	45.6	53.3
Machinery & transport equipment	1.1	2.9	68.0	68.8
Miscellaneous Industrial Products factures	0.1	0.9	18.8	19.9
Others	8.1	6.0	10.7	10.1
Total	433.7	463.6	484.8	525.7

The quantities and values of major items of exports are given on Table 3-5, which is marked by rapid increases of timber and stagnation of agricultural products.

Table 3-5-1

PRINCIPAL EXPORTS, 1954 - JUNE, 1966

Year	Plantation Rubber		White Pepper		Black Pepper		Sago Flour	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
		$		$		$		$
1954	23,182	31,087,822	2,714	9,529,122	12,747	34,177,391	12,540	2,828,635
1955	39,402	78,744,880	2,333	5,922,457	13,960	25,702,343	9,869	2,006,735
1956	41,224	68,635,041	2,759	4,498,486	17,054	20,111,645	12,573	2,422,702
1957	40,991	73,301,798	2,298	3,872,794	11,439	13,359,187	12,777	2,088,559
1958	38,533	60,430,509	5,136	9,986,059	4,588	5,157,561	16,504	2,345,107
1959	43,826	94,898,236	6,561	15,616,475	1,788	2,481,345	17,775	2,399,769
1960	49,949	122,440,482	3,393	15,180,009	705	2,020,197	19,683	2,788,335
1961	46,904	83,256,933	7,051	19,634,680	3,902	9,010,855	24,449	3,298,398
1962	43,796	72,597,147	7,082	16,100,259	4,496	7,786,593	31,614	4,169,921
1963	44,834	69,575,265	8,326	17,664,368	3,115	4,726,336	39,634	5,593,065
1964	42,959	60,132,673	7,732	16,288,426	4,382	7,376,021	57,515	8,083,037
1965	40,034	59,453,489	7,119	19,192,760	10,495	22,538,819	44,155	5,813,029
1966	33,589		7,094		5,960		37,319	

* Ton of 50 cubic feet.

Table 3-5-2

PRINCIPAL EXPORTS, 1954 - JUNE, 1966

Year	Jelutong		Illipe-nuts		Round Timber		Sawn Timber		Bauxite	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
		$		$		$		$		$
1954	1,148	3,130,801	16,043	12,631,295	80,787	3,800,555	82,672	10,079,397	-	-
1955	451	915,854	1,457	873,213	85,137	4,366,624	124,906	17,595,457	-	-
1956	591	1,560,825	158	92,198	80,752	3,511,928	116,337	15,552,507	-	-
1957	370	1,106,967	-	-	81,900	3,168,815	119,717	16,389,745	-	-
1958	481	1,633,611	6,204	7,119,738	87,015	3,834,364	107,939	15,734,178	92,840	1,488,388
1959	397	1,557,073	22,000	19,967,395	192,542	11,794,528	124,702	19,245,943	202,925	3,842,537
1960	263	800,791	-	-	195,693	12,879,018	165,970	30,728,070	260,120	4,995,202
1961	838	1,750,666	15	14,101	278,511	18,401,260	137,363	23,196,042	256,442	5,545,854
1962	548	1,761,978	19,878	16,011,630	385,764	23,777,280	129,287	17,058,084	198,698	4,076,863
1963	604	1,720,845	-	-	487,823	30,761,267	146,658	22,955,990	172,181	3,115,482
1964	1,227	1,823,460	-	-	480,220	30,356,471	184,179	31,855,625	165,903	3,024,758
1965	571	842,503	503	371,797	672,712	47,289,655	191,452	35,183,561	164,609	2,840,046
1966					1,071,407		156,524			

* Ton of 50 cubic feet.

Importing countries vary in importance according to the items of export goods. Japan is by far the largest importer of woods in the log and Britain, West Germany and Australia are large importers of timber.

Rubber and pepper are almost all exported to Singapore according to the long-standing commercial practices. Sago mostly goes to Japan, Singapore and Australia.

As for imports. the largest both in value and in quantity is Brunei's crude oil, which is piped from Brunei to Miri, there to be refined at the refinery. Among other imports are foodstuff, such as rice, milk and sugar, and construction materials, such as metals and cement. Clothing, motor cars and machinery are also imported.

As exporting countries, Brunei stands topmost in value, followed by Britain, Singapore, China, Japan, the United States and Thailand. In quantity, Brunei also ranks first, followed by Singapore, Hongkong, China and Britain.

Major items of import goods and their value are given on Table 3-6.

Table 3-6

VALUE OF SELECTED IMPORTS INTO SARAWAK, 1960-1965

Item	1960 $	1961 $	1962 $	1963 $	1964 $	1965 $
Milk	4,334,771	4,318,014	4,707,679	4,915,515	6,906,724	7,350,871
Rice	14,140,607	20,526,986	22,067,642	22,348,341	22,354,042	21,672,614
Wheat Flour	1,907,213	2,037,105	2,337,708	2,429,784	2,703,847	2,900,326
Sugar and Honey	5,472,771	5,247,418	4,240,954	9,168,630	8,627,257	5,516,153
Alcoholic Beverages	2,996,565	2,839,349	2,774,185	4,331,541	5,791,817	4,643,286
Tobacco Manufactures ...	6,519,631	6,183,556	6,331,215	7,320,343	9,062,575	7,051,393
Crude Fertilizers	943,824	1,412,422	1,508,860	1,396,291	1,436,361	1,669,771
Petroleum Products	10,304,333	11,056,473	11,902,189	12,553,513	13,176,229	22,110,652
Fertilizers, Manufactured ...	2,788,148	2,919,687	2,208,484	1,965,632	1,846,553	2,463,499
Cotton Fabrics	5,237,880	5,333,728	5,558,839	5,473,547	4,719,274	5,040,945
Textile Fabrics	1,039,055	992,661	790,460	509,619	615,044	855,436
Lime, Cement and Fabricated Building Materials ...	2,291,075	2,579,333	2,459,647	2,631,780	3,433,958	4,773,704
Iron and Steel and Alloys of Iron except Cerium Alloys	5,660,340	5,900,607	5,292,184	8,183,423	6,393,425	9,641,729
Manufactures of Metals ...	5,607,338	5,750,759	6,016,601	7,185,545	9,334,271	10,371,045
Power Generating Machinery	5,293,714	4,161,960	4,135,754	3,922,932	4,959,988	5,630,999
Agricultural Machinery and Appliances	1,194,943	1,492,055	3,356,807	6,309,826	1,474,491	993,279
Office Machinery	399,597	498,981	455,543	748,996	1,173,103	731,407
Metal-Working Machinery ...	250,359	239,676	422,404	326,025	177,596	198,083
Industrial and Other Machinery	6,886,201	9,450,388	11,400,137	10,646,916	18,920,032	17,774,125
Electric Machinery, Apparatus and Appliances ...	5,044,679	4,611,225	6,077,522	7,019,995	10,208,372	13,660,969
Road Motor Vehicles ...	4,841,319	6,211,716	6,332,573	7,837,931	9,832,706	15,946,600
Ships and Boats	720,865	664,312	738,162	1,272,276	507,120	476,480
Clothing	3,767,804	4,291,899	4,415,412	4,085,178	3,922,054	4,805,827

3-5 Transport

Sarawak is a long strip of land, facing the sea. The land is characterized by low swampy plains, mountainous regions and many large rivers. Three quarters of the total area is covered with untapped dense forests.

Its population is small and is thinly dispersed over the wide area, and its economy is dependent upon external trade. Naturally it follows that Sarawak is largely dependent upon the seaway, inland waterways and the air routes for transportation. Road transport occurs only in and around cities and towns.

(a) Sea Transport

There are established ocean lines between Sarawak's port, Kuching, Sibu, Tanjong Mani and Miri and Australia, Bangkok, Hongkong, Japan, Singapore, Formosa, Britain and the United States.

The coastline of Sarawak is generally monotonous and the sea is shallow for some distance from the shore, and in addition the north-eastern monsoon brings with it a protracted period of stormy weather. On top of it, development work has been concentrated mainly along rivers. For these reasons, most ports are found on rivers. The chief commercial ports of Sarawak, Kuching, Sibu and Sarikei, are all well upstream from estuaries.

The volume of goods handled at the chief ports of Sarawak are given on Table 3-7. Kuching and Sibu, both of which are equipped with up-to-date facilities, handle agricultural products for exports and miscellaneous import goods. Miri is an oil exporting port and Tanjong Mani is a berthing place for timber export. Other ports are small-scaled and handle timber exports and miscellaneous imports.

The volume of exports and imports of Sarawak by countries is given on Table 3-8. Oil set apart, Japan, Hongkong and Britain are major importers, chiefly of timber and Singapore is another chiefly of agricultural products. Imports are mostly from Singapore, Hongkong, China, Britain and Thailand.

Increase in the volume of goods handled and growth in size of incoming vessels at these main ports in recent years are making shortage of facilities both in capacity and quality very keenly felt, calling for their expansion and improvement.

(b) Inland Waterways Transport

Inalnd waterways transport by making use of both sea and rivers is the most important medium of internal transportation of goods and passengers.

The chief cities have developed along major rivers and many villages are also

Table 3-7

Volume of Export & Imports at the Port of Sarawak 1966

(Unit : Ton)

Ports	Imports		Export	
	General Cargo	Bulk Oil	General Cargo	Bulk Oil
Kuching	231,034	71,445	34,476	738
Other First and Second Divisions Ports	-	-	81,791	
Sibu	119,413	9,735	39,896	
Sarikei	13,284	-	7,074	
Binatang	5,851	-	4,507	
Kuala Mukah	-	-	8,927	
Tanjong Mani	562	-	603,509	
Other Third Division Ports	62	-	-	
Miri	36,243		2,460	4,501,295
Bintulu	419	-	48,631	
Baram	2,376	-	2,282	
Limbang	2,195	423	7,207	
Lawas	2,531	349	36,301	
Sandar	761	423	7,884	
Total	414,731	82,375	884,945	4,502,033

Table 3-8

Volume of Exports & Imports at the Post of Sarawak by Countries (1966)

(Unit : Tons)

Country	Import		Export	
	General Cargo	Bulk Oil	General Cargo	Bulk Oil
Australia	9,424		19,448	682,976
Belgium	1,692		5,147	
Brunei	2,210		424	738
Burma	320		-	145,048
Canada	117		22	
China	44,370		-	
Denmark	298		1,530	
Formosa	6,380		-	
France	525		5,864	
Germany	4,096		20,166	
Hong Kong	73,211		131,945	
India	624		-	
Iraq	-		1,002	
Italy	1,103		50,604	
Japan	9,034		461,318	94,216
Netherlands	1,566		14,024	171,705
New Zealand	48		106	103,963
Norway	56		1,225	
Philippines	-	7	8	598,352
Sabah	3,905	70	11,303	10,549
Singapore	186,809	71,581	56,707	2,197,367
South Africa	436		432	-
Sweden	102		1,098	
Thailand	19,912		21	30,606
United Kingdom	28,442		64,752	76,914
U.S.A.	602		34,773	-
West Malaysia	19,186	9,139	90	389,599
Spain	24		733	-
Korea, South	-		803	-
Finland	109		31	
Other Countries	130	-	1,369	-
Total	414,731	82,375	884,945	4,502,033

found along rivers. Between these cities ply vessels at regular intervals. Outboard-motored speedboats and longboats are being made the best use of for private and business purposes.

(c) Road Transport

Except in cities and in the outskirts of Kuching, Miri and Sarikei, roads and highways remain undeveloped.

Total milage of roads, except in those in cities, is 657 miles. One half of them are arterial roads, most of which are unpaved, however.

The Government has been in recent years devoting itself preferentially to establishing a road system by way of expediting industrial development. An arterial road is going to be completed between Kuching and Sibu in 1967 and road planning is under way between Miri and Bintulu and between Kuching and Lundu. (See Fig. 2)

A remarkable increase was seen in recent years in the number of motor cars, which doubled between 1961 and 1965. With progress of industrial development, further improvement of living standards, and establishment of a road system, there will be still larger increases in their number.

(d) Air Transport

The Malaysian Singapore Airway operates scheduled services between Kuching and Singapore, Kuala Lumpur and Brunei every day. It also operates local regular services, serving the main cities, such as Kuching, Sibu, Lutong Marudi and Bintulu.

The arrivals and departures of airplanes at Kuching Airport in 1965 totalled 3,700, carrying a total of 76,000 passengers. Both figures have been growing year after year.

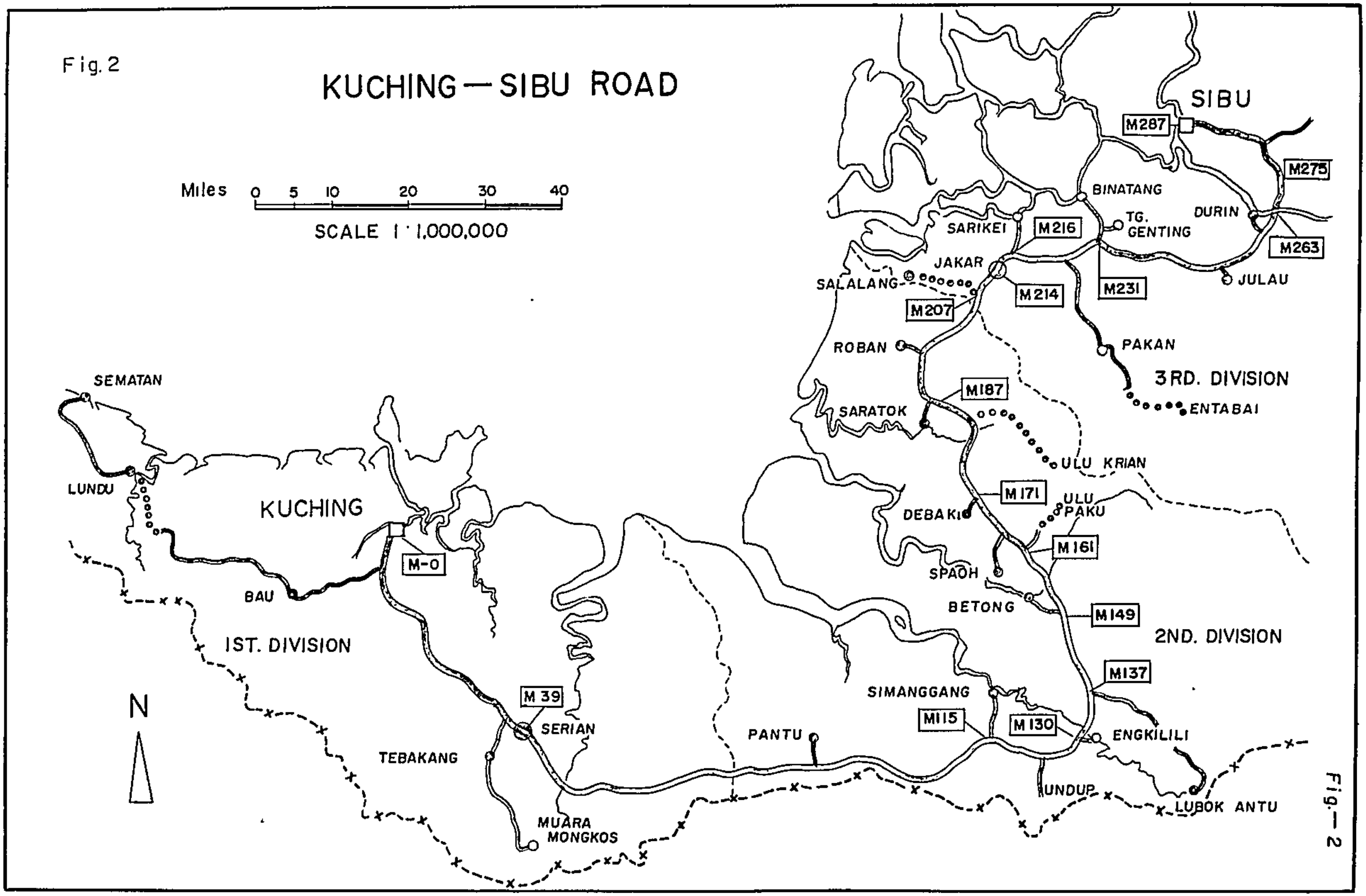
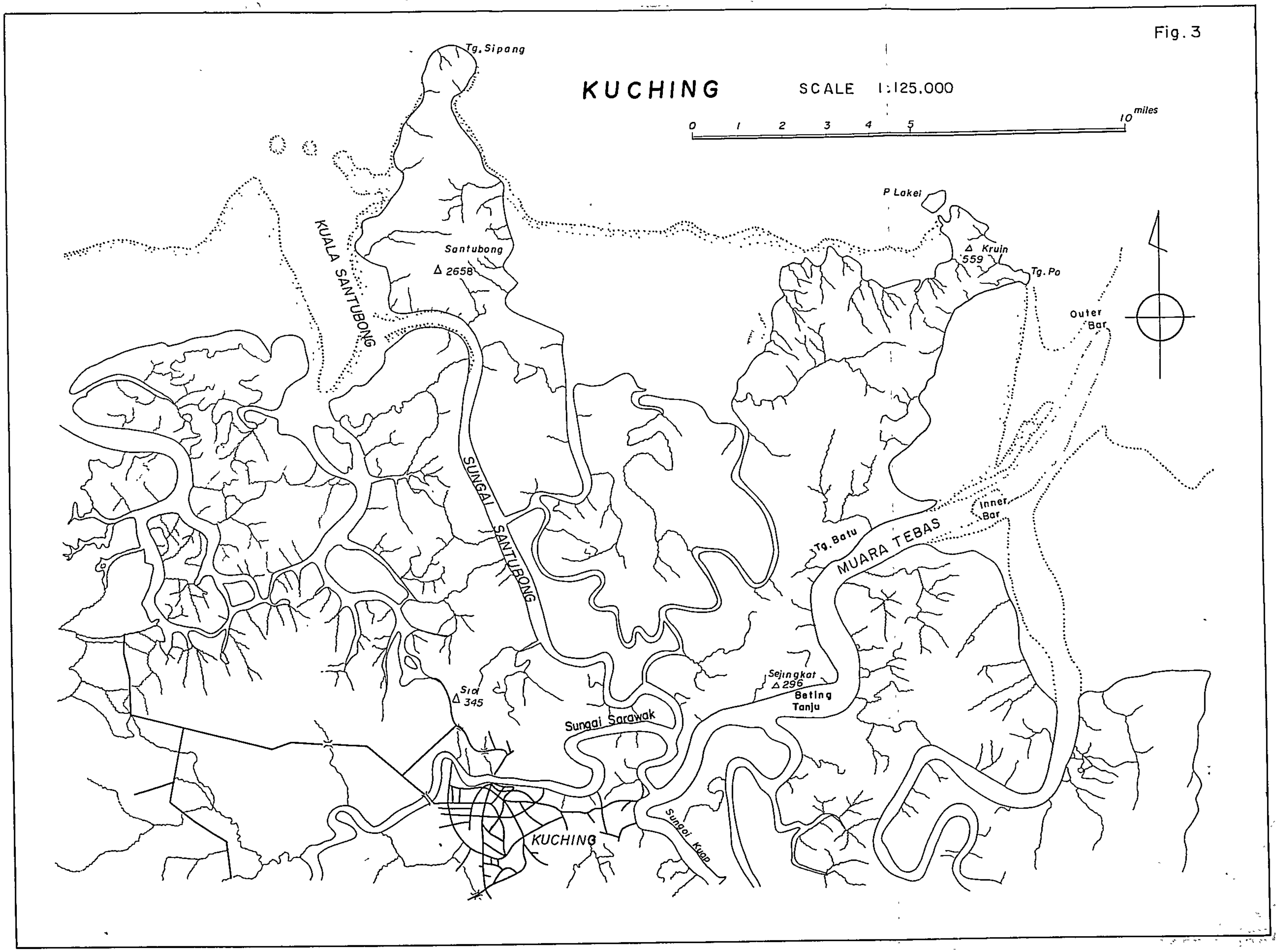


Fig. 2
KUCHING — SIBU ROAD
Miles 0 5 10 20 30 40
SCALE 1 : 1,000,000
SIBU
M287
M275
BINATANG
DURIN
TG. GENTING
M263
SARIKEI
M216
JAKAR
JULAU
SALALANG
M214
M231
M207
ROBAN
PAKAN
3RD. DIVISION
ENTABAI
SEMATAN
M187
SARATOK
ULU KRIAN
LUNDU
KUCHING
M171
ULU PAKU
DEBAKI
M-0
M161
SPAOH
BAU
BETONG
M149
2ND. DIVISION
IST. DIVISION
M137
SIMANGGANG
N
M39
SERIAN
M115
M130
PANTU
ENGKILILI
TEBAKANG
UNDUP
LUBOK ANTU
MUARA MONGKOS
Fig.— 2

CHAPTER Ⅳ PRESENT STATE OF KUCHING PORT

Fig. 3



KUCHING
SCALE 1:125,000
0 1 2 3 4 5 10 miles
Tg. Sipang
KUALA SANTUBONG
Santubong
2658
SUNGAI SANTUBONG
P Lakei
Kruin
559
Tg. Po
Outer Bar
Inner Bar
Tg. Batu
MUARA TEBAS
Sejingkat
296
Beting Tanju
Sioi
345
Sungai Sarawak
Sungai Kuap
KUCHING

CHAPTER IV PRESENT STATE OF KUCHING PORT

4-1 Location of the Port

Kuching Port is located in the City of Kuching, the capital of Sarawak, Malaysia. It is a river port on the Sarawak and is situated at 1°33' North latitude and 110°22' East longitude. The City of Kuching lies on the right bank of the Sarawak, some 20 miles upstream from the estuary.

The port can be approached by two ways: one, called Santubong Entrance, is to enter the River Santubong from south-west of Cape Sipang and then into the Sarawak River to the port; the other, known as Muala Tebas Entrance, is to enter the Sarawak from east of Cape Po, and to go past Pending Pt. to the port. Large vessels take the latter course. (See Fig. 3)

There are four ports in Kuching city which are located at different places. In the frontage of the central part of the city are found many facilities for use by coastal vessels. Some 3 miles downstream at Tanah Puteh, there is a berth for external trade of dry cargos. Five miles further downstream at Biawak, there is an oil berth. At Sejingkat, midway between Pending Pt. and the river mouth, the river is deep enough to give safe berthing for large vessels. (See Fig. 4)

4-2 Present State of Port Facilities

4-2-1 Facilities for Small Coastal Vessels

On the River Sarawak, in the frontage of the central part of the city, are found many facilities for small coasting vessels. This part of the city and vicinity have from of old been used as a port area and the facilities there are a conglomeration of the old, the new and the remodelled. This part of the port is solely concerned with internal trade in such goods as foodstuff and other daily necessaries and construction materials. These goods are transported by vessels from Kuching to the countryside and vice versa. Most efficient use is being made of the facilities.

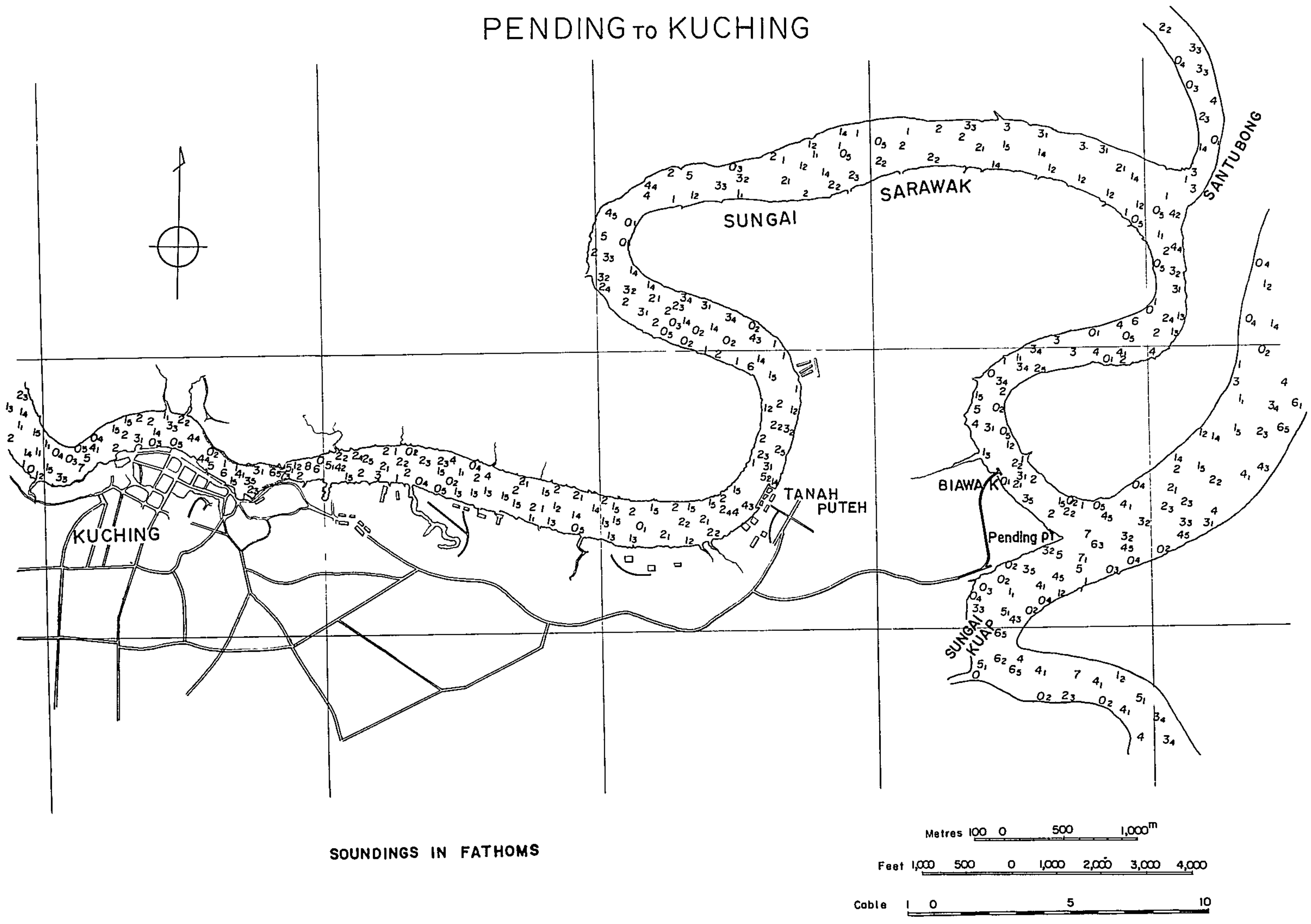
(a) Berths

These are the berthing facilities for use by small coastal vessels:

Berths	Length	Least Depth Alongside
Sarawak Steamship Co. Wharf	191ft.	9ft.
Ban Hock Wharf	244ft.	8ft.
Main Bazaar (Coastal)	820ft.	Dries at upstream end
Lorna Doona	128ft.	Dries at downstream end
Boat Jetty	138ft.	4ft.

Fig. 4.

PENDING TO KUCHING



SOUNDINGS IN FATHOMS

The river is shallow and narrow in many places and large vessels cannot enter this part of the port even by availing themselves of high tide.

(b) Other Facilities

West of Ban Hock Wharf is the Government-owned Brooke Dock Yard.

There are small ferry-boat services which link Kuching City with the opposite side of the Sarawak at five points. The facilities at the landing places are very simple.

About 600 yards upstream from Tanah Puteh is a jetty for coastal oil tankers, from which diesel oil brought from Lutong is piped to the Sarawak Electricity Supply Corporation.

4-2-2 Facilities at Biawak

(a) Berth

About 700 yards upstream from Pending Point is a berth for exclusive use by oil tankers which bring oil from Singapore, Dickson on the western coast of Malaya and other places. The berth is 176ft long and its least depth alongside is 21ft.

At about 300 yards away from this jetty, there are 13 oil tanks owned by the Shell and Esso Oil Companies. The tanks are linked with the jetty by pipe-lines.

(b) Conditions of the River

Where it forms a large curve near Biawak, the Sarawak is about 700ft wide. The river bed is hollowed deep in front of the berth to the depth of -25ft to -33ft, but up to Pending Pt., the river, a little to the right bank, is -12ft to -24ft deep while a little to the left, it is shallow and is -9ft to -1.7ft deep.

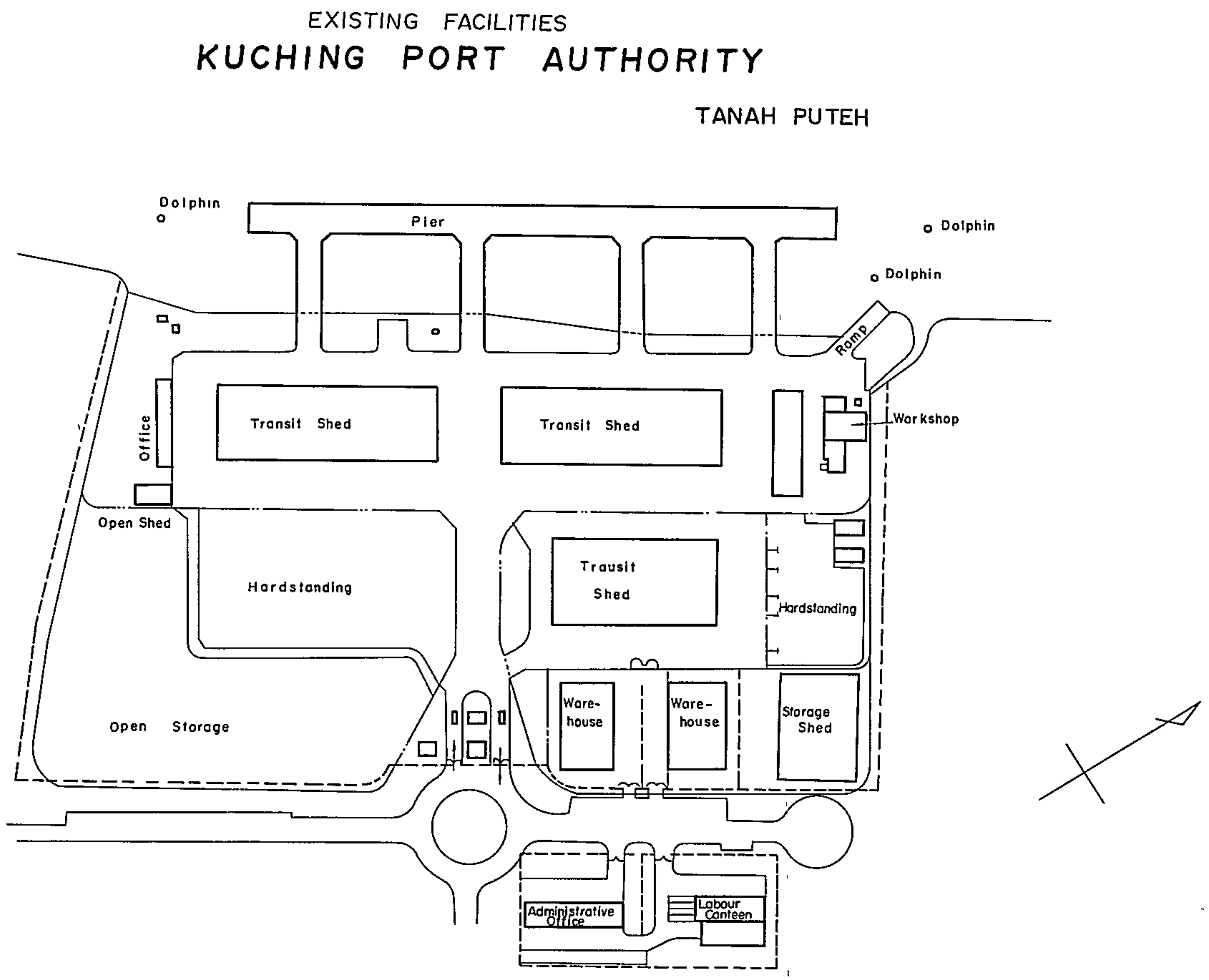
Under such conditions, large oil tankers have to time their entry into the port to high tide. G-3 type tankers (length: 402ft., full loaded draft: 22ft., G.R.T.: 5,739 tons) are currently making use of this berth regularly. But it is difficult to berth larger vessels.

4-2-3 Facilities at Tanah Puteh

(a) Berths

At Tanah Puteh about 5 miles upstream of the Biawak oil berth, there is a port area for exclusive use of external trade. The pier here has a length of

Fig. 5



EXISTING FACILITIES
KUCHING PORT AUTHORITY
TANAH PUTEH
Dolphin
Pier
Dolphin
Dolphin
Ramp
Office
Transit Shed
Transit Shed
Workshop
Open Shed
Hardstanding
Trausit Shed
Hardstanding
Open Storage
Ware-house
Ware-house
Storage Shed
Administrative Office
Labour Canteen

800ft and the least depth alongside of 17'16" and is connected by four access ways with the transit sheds and other facilities in the rear. (See Fig. 5)

(b) Land Facilities

At the rear of the berth stand transit sheds, warehouses, open storages, dangerous goods sheds, an office building, and other buildings. They are:

Transit shed:	For imports	(100ft x 300ft)	2 bldg.
"	For exports	(100ft x 120ft)	2 "
Storage shed		16,000ft^2	1 "
Dangerous goods shed		1,000ft^2	2 "
Warehouse		10,000ft^2	2 "
Open storage		85,000ft^2	
Hardstanding		55,000ft^2	
Workshop			1 bldg.
Equipment shed			1 "
Office building			1 "
Fire station			1 "
Guard room			1 "
First aid station			1 "
Pump house			1 "
Labour shelter			1 "

In addition to the above, there are an Administrative Office and a Labour Canteen across the road.

(c) Cargo Handling Equipment

For loading and unloading cargo, the following machines and vehicles are kept:

Forklift truck	(3,500 - 6,000lbs)	15
Port tractor		16
Trailer	(1 - 15 tons)	110
Mobile crane	(5 - 15 tons)	2
Electric belt stacker		2
Stevedore pallet		2,000
Mooring boat	(40HP)	1

All of them are owned by K.P.A. No lighter is used at all.

(d) Limitations on Use of Present Facilities

From Tanah Puteh to Biawak, the river runs largely meandering and is 600ft to 1,300ft wide and -7ft to -40ft deep. Although deep enough around the berth at Tanah Puteh, the river has some shallow places on its way to Tanah Puteh. The width and the depth of the river are restrictive to vessels coming into the port, the largest capable of entering the port being 430ft in length and of 17ft draft. A vessel of 5,365G.T. (425ft long) and another of 6,390G.T. (416ft) made port at Tanah Puteh in 1965.

4-2-4 Anchorages

Pending provides an anchorage for the vessels which have to wait for a berth at Tanah Puteh. Near Pending Pt., the River Kuap is about 1,200ft wide and -20ft to -40ft deep and can berth a vessel of up to 400ft long and 18ft draft.

At Sejingkat, about 9 miles upstream from the estuary, vessels come to anchor to be loaded with timber. Timbers, mostly from the 1st and the 2nd Divisions, are carried on rafts down the River Lupar, Sadong, or Samarahan into the sea and then carried up the River Sarawak as far as Sejingkat to be taken aboard a vessel. This is the usual way of transporting timbers except when the northeastern monsoon prevails and makes sea voyage difficult. In 1965, about 50,000 tons of timbers were taken aboard by 56 vessels. At Sejingkat the river is 2,200ft wide and -30ft to -50ft deep, and can berth vessels of 550ft long and 25ft draft. The largest vessel that took up an anchorage here in 1965 was 9,333G.T. (512ft long).

4-2-5 Navigation Passage

Between Pending and the estuary, the river has several curves and at a little downstream from Sejingkat Anchorage, there lies Beting Tanju of -14 to -18ft deep. Near the estuary the river is -20 to -27ft deep, but the passage over the Inner Bar is -15ft deep and over the Outer Bar -16ft deep. The river itself is relatively deep, but due to shallow passage over the two Bars, 25ft draft is considered to be the maximum draft allowable.

For safe passage of vessels, there are leading lights at two points along the direction of the navigation passage. Between the estuary and the port, there are some beacons, such as leading lights and mileposts, to ensure vessels safe entry.

4-3 Management and Operation of the Port

4-3-1 Operation of Facilities at Tanah Puteh

K.P.A. conducts all business connected with the port, except that concerns the Customs Office, at Tanah Puteh. Mooring of vessels, handling of goods carrying of goods into and out of transit sheds and open storage, tallying, sorting, delivery, storage, measuring and weighing of goods, water supply for vessels, ---all business connected with the port is conducted directly by K.P.A. However, of the land facilities stated under 4-2-3 (b) above, two warehouses are leased to private companies.

For the management and operation of port facilities, K.P.A. has staff of about 280 officers and some 320 workers.

4-3-2 Receipts and Disbursements of the Kuching Port Authority

The receipts and disbursements of K.P.A. for the years from 1963 to 1966 are given in Table 4-1.

Table 4-1 Receipts & Disbursements of K.P.A.

Unit: M$

Year	Receipts (A)	Disbursement (B)	Balance (C)	C/A	Total Goods ton
1963	2,813,952	2,355,155	458,797	16 %	245,770
1964	3,390,215	2,692,116	698,099	20.5	290,340
1965	4,359,648	2,978,330	1,381,318	31.4	351,791
1966	4,632,062	3,213,658	1,418,404	30.4	378,124

As shown in the table above, net proceeds of 16 to 30 per cent were realized, which have been set aside as reserves for employees' retirement allowances, replacement of fixed assets, and the like.

Major items of receipts were the vessel account (about 54 %) and receipts from sorting, storage and delivery (about 39 %). Major items of disbursements were stevedorage (about 40 %), officers' salaries and allowances (28 %) and the depreciation account (15%).

Expenses per ton of goods are M$8.5 - 9.6 as shown in the above table.

4-4 Use Made of the Port

4-4-1 The Position of Port Kuching

Kuching Port is the foremost commercial port of Sarawak and has the whole of the 1st and the 2nd Divisions under its influence. The two Divisions combined account for only 16 per cent of the whole land of Sarawak in area, but have a share of about 50 per cent both of the population and the agricultural production, constituting the central position of Sarawak.

This regional condition of Kuching and Sarawak's dependent-on-external-trade type of industrial structure have contributed toward the position of Kuching port as an external trade port which handles some 50 per cent of agricultural products except timber and some 60 per cent of imports except oil and as the center of the river and coastal traffic. As such Kuching Port has provided the foundation to keep up Sarawak's economic activities and people's living.

4-4-2 Incoming Vessels

Of the vessels which entered Kuching Port, the number and the tonnage of the vessels making use of Tanah Puteh Wharf are given in Table 4-2. As for the use made of the wharf for internal trade in the city, no data is available.

Table 4-2 Vessels Which Entered Kuching Port (Only Those Using Tanah Puteh Wharf)

Year	Number of Vessels	Gross Tonnage	G.T/Number
1961	187	222,925	1,192
1962	292	435,231	1,490
1963	459	627,721	1,367
1964	514	677,975	1,319
1965	565	714,560	1,264
1966	624	848,056	1,360

Note: Tanah Puteh Wharf started working in June, 1961.

Some considerations will be given here to Tanah Puteh Wharf, which handles external trade in miscellaneous good---the subject of this investigation. The vessels making use of Tanah Puteh Wharf sharply increased to 2.1 times in number and to 1.9 times in tonnage between 1962 and 1966.

Per-vessel tonnage of the vessels which entered the port averaged 1,490G/T in 1962 and 1,360C/T in 1966, showing no big change. Of 669 vessels which used the wharf during the one-year period from March, 1966, to February, 1967, the number of vessels classified by gross tonnage was as follows:

Less than 1,000G/T	62%
1,000 - 2,000G/T	20
2,000 - 3,000	7
3,000 - 4,000	2
4,000 - 5,000	7
More than 5,000G/T	2

As seen from the above, vessels less than 5,000G/T accounted for 98 per cent. Vessels of over 5,000G/T numbered 12, the largest of which was 6,390G/T.

The distribtuion of numbers of vessels according to the number of days of stay in port during the month of February, 1967, was like this: 5 vessels--1 day; 4 vessels--7 days; 3 vessels--12 days; 2 vessels--7 days; and 1 vessel--1 day. Since this wharf takes three berths as the standard, it is apparent how frequently it is made use of.

4-4-3 Goods Handled at the Port

The volume of goods handled at Kuching Port has shown a very rapid increase, reflecting growth in development investment, increase in population and improvement of the standards of living in the area under its influence and the effect of the dispute on the Indonesian frontier. Tables 4-3, 4-4, and 4-5 show changes in the volume of goods handled at Kuching Port and in the volume of goods handled at Tanah Puteh and Biawak Wharves.

Table 4-3 Changes in the Volume of Goods Handled at Tanah Puteh Wharf

Unit: Ton

Year	1962	1963	1964	1965	1966
Imports	171,054	197,681	238,987	297,714	304,432
Exports	50,543	48,089	51,353	52,479	73,702
Total	221,597	245,770	290,340	350,193	378,134
Military Goods	0	13,000	18,150	45,000	65,000
Civilian Goods	221,597	232,770	272,190	305,193	313,134

Table 4-4 Changes in the Volume of External Trade Goods

Unit: 1,000 tons

Year	Exports	Imports	Total	
1957	48	99	147	Customs Office's data; excluding timber at Sejingkat and military goods and including oil at Biawak
1958	40	92	132	
1959	50	141	191	
1960	44	167	211	
1961	47	192	239	
1962	75	197	272	
1963	51	210	261	
1964	44	255	299	
1965	45	303	348	
1966	35	302	337	

Table 4-5 Biawak Oil Wharf (Bulk oil only)

Year	Volume Handled
1964	33,578 tons
1965	68,254 "
1966	68,603 "

The volume of goods handled at Tanah Puteh Wharf grew at an annual rate of 15 per cent, or 9 per cent excluding military goods, over the period from 1962 to 1966. This growth was realized as the result of the increase in imports which was brought about by those factors referred to above. Exports of agricultural products continued stagnant, however.

The quantities by items of goods handled at Tanah Puteh Wharf were given in Table 4-6.

The number of passengers handled at Tanah Puteh Wharf was 10,211 persons in 1966. The regular passenger service between Singapore, Kuching and Sabah makes use of Pending Point anchorage, because the depth alongside is not large enough in the frontage of Tanah Puteh Wharf.

Table 4-6

SUMMARY OF COMMODITIES
HANDLED AT TANAH PUTEH WHARF
1966

Imports		Exports	
Constructional Materials (not steel)	10,937 tons	Damar	303 tons
Cement	32,709 "	Ilipe Nuts	3,419 "
Fertilizers	19,042 "	Jelutong	97 "
Flour	4,874 "	Pepper	5,802 "
Lubricants	2,005 "	Rubber	11,996 "
Miscellaneous Consumer Goods	136,200 "	Sago Flour	5,009 "
Iron & Steel	6,530 "	Scrap Iron	420 "
Machinery	2,722 "	Sawn Timber	2,457 "
Sugar	12,693 "	Vegetable Oil (in drums)	3,097 j "
Rice	25,609 "	Miscellaneous	8,850 "
Salt	2,670 "	Transhipment	556 "
Military Equipment	33,000 "	Military Equipment	32,000 "
Motor Vehicles	2,722 Nos		
Earth Moving Equipment	202 "		
Livestock Buffaloes	804 "		
Rigs	5,217 "		
Bulk Diesel Fuel	9,637 tons		

JTG/SA

4-4-4 Loading & Unloading of Vessels and the Flow of Goods

The per-vessel volume of goods unloaded at Tanah Puteh Wharf, which ranged between 500 and 700 tons for the past several years, was about 600 tons in 1966.

The per-vessel volume of goods unloaded in February, 1967, was 625 tons on the average, the largest being 2,195 tons and the smallest 20 tons. Hours of vessels being on the berth averaged 42 hours on the average, the longest being 97 hours and the shortest 35 hours.

For loading and unloading of a vessel, the vessel's mast crane is used. There are a 15-ton and a 5-ton mobile crane, but no wharf crane. The apron is only 40ft wide and access ways are little too narrow, somewhat hampering smooth operation of goods handling.

No lighter is in use. All goods are transported by land. Carriage between the apron and the shed in the rear is done by means of tractors and trailers. Fork lifts are used for handling goods inside the sheds. Transit sheds are of two kinds: for exports and for imports. Customs examination of miscellaneous goods is made in the shed, but bagged or sacked goods of a great quantity, such as cement, rice, wheat flour, fertilizer, and maize, are specially allowed to be transported direct to warehouses in the city. The quantity of such goods is 20 per cent of total imported goods. All goods for export except timber have to pass through the export transit shed.

Normally goods remain in the shed for about four days, free of charge, up to seven days after their arrival there.

There are three K.P.A. owned warehouses at Tanah Puteh. Two of them are leased to private enterprise.

General goods are kept in custody at warehouses in Kuching City. Tanah Puteh Wharf is about 3 miles away from the center of Kuching and is connected with the city by a paved highway of quardruple roadways. In and around Kuching roads are generally in good order. Transport within the area is conducted by motor cars and boats. The handling of goods is under direct management of K.P.A. A gang normally consists of 8 men in the ship's hold, 2 winchment and 1 signalman on the ship's upper deck, 4 men on the wharf, two tractor drivers, 8 men and 1 forklift truck driver in the transit shed. There is one foreman to a gang in the shed but on board the ship the foreman may be in charge of more than one gang. The gang-hour quantity of goods handled was 15.5 tons in 1966, which was 1.6 times that in 1962. The man-day quantity of goods handled in the same year was 3.2 tons, which was 1.8 times that in 1962.

The annual quantity of miscellaneous goods handled per 1m of the length of the wharf was 1,430 tons and the quantity of the same per 1ft of the length of the wharf per day was 1.31 tons, which was more than the optimum capacity.

Tanah Puteh wharf is currently managed and operated smoothly and satisfactorily. With mechanization and other rationalization of the handling of goods well advanced, further improvement of efficiency in any great measure can hardly be expected.

4-4-5 Vessels Waiting for Berth

Due to recent increases in the volume of goods handled at the port, the existing facilities are proving short of meeting them, pushing up the ratio of use of berths remarkably---the ratio in 1966 was as high as 96.9 per cent. An increasing number of vessels, consequently, have been finding it difficult to gain a ready access to the wharf, compelled to wait idly at Pending Point for their turn to come. In 1966 such vessels numbered as many as 198, or 30 per cent of total number of vessels making port. Their hours waiting berth totalled 9,950 hours, which averaged 50 hours per vessel, the longest being 108 hours.

Such long hours waiting berths not only means a loss to vessels and shipping companies but causes ocean freightage to rise, leading eventually to higher prices of commodities or cancellation of export contracts, and throwing impediments in the way of regional economic development.

Changes in the volume of goods handled at the port, the ratio of use of berths, and hours waiting berths are given in Table 4-7.

Table 4-7 TRAFFIC STATISTICS OF TANAH PUTEH WHARF

	CARGO HANDLED	BERTH OCCUPANCY FACTOR	NO. OF VESSELS WAITING FOR BERTH	TOTAL HOURS LOST WAITING FOR BERTH	THE MAX. HOURS LOST WAITING VESSEL
1962	221 597 ton	60 %	34	674 hrs	30 hrs
1963	245 770	68	53	1 512	72
1964	290 340	79	103	3127	96
1965	350 193	87 7	205	10.930	131
1966	378 134	96 6	198	9 950	168

4-5 Natural Conditions

4-5-1 Topography in and around Kuching

The River Sarawak runs meandering near the city of Kuching. This is especially the case with its main stream, so much so that a mere 1.2-mile space between Tanah Puteh and Pending Point is lengthened to as many as 5 miles by waterway. (See Figs. 3 & 4)

Except for the highlands and areas of housing in the city of Kuching, this region is mostly of swampy low land, thickly wooded with nipa palms and mangroves. The lands on both sides of the river between Tanah Puteh and the estuary are of typical swampy low land and submerged at high tide in many places. In Sarawak it is rainy from December to February, and it often rains heavily, causing a flood. The swampy low land referred to above is built up of soil deposits resulting from floods, and is submerged when a flood takes place. In this area, most human habitation occurs along the river, and vessels are the sole means of traffic of the inhabitants.

The River Sarawak flows into the sea near the Cape of Po. The sea around here is shallow for some distance from the shore. Near the esturay are Inner Bar and Outer Bar. Over Inner Bar the sea is -15ft deep and over Outer Bar -16ft. They spread wide across the navigation passage. The draft is, therefore, a limiting factor to vessels coming in. Large vessels have to pass over them at high tide.

4-5-2 Weather Conditions

The north-eastern monsoon prevails in Sarawak from mid-October to early March, when clouds hang low and it rains much, often heavily, causing a flood. From May to September, the soft south-western monsoon prevails but in the afternoon there is a thunderstorm accompanied by a gust.

(a) Wind

According to the observations made over a 12-years' period from February, 1954, to January, 1966, the monthly maximum wind velocity was as shown in Table 4-8, the maximum throughout the period being 70m.p.h. (31.3 m/s).

Table 4-8 Maximum Wind Velocity

Direction		Speed	Direction		Speed
Jan.	W	36 m.p.h.	Jul.	S 60° W	43 m.p.h.
Feb.	N 50° W	54	Aug.	S 50° W	48
Mar.	N 80° W	37	Sep.	S 30° W	70
Apr.	N 30° W S 70° W	) 37)	Oct.	S 80° W	44
May	W	46	Nov.	W	57
Jun.	S 80° W	52	Dec.	S 80° W	42

The number of days when a gust of over 15m/s blew during the decade from 1956 to 1965 is given in Table 4-9. According to a record, a gust over 10m/s blew on 785 days (about 20 per cent) during the decade, and over 15m/s on 99 days (about 3 per cent). The direction of the gust is generally S-NW and it blows mostly from May to November.

Table 4-9

No. of days with gusts exceeding 15 $^m/_s$ 1956-1965

	N	NE	E	SE	S	SW	W	NW	TOTAL
Jan.	1	–	–	–	–	–	1	–	2
Feb.	–	–	–	–	–	–	1	1	2
Mar.	–	–	–	–	–	–	1	–	1
Apr.	–	–	–	–	–	–	4	1	5
May.	–	2	–	–	2	3	6	1	14
Jun	–	–	–	1	2	2	8	1	14
Jul.	–	–	–	–	–	6	4	2	12
Aug.	–	1	–	–	2	1	3	2	9
Sep.	1	–	–	1	4	6	3	3	18
Oct.	–	–	–	–	2	3	5	1	11
Nov.	–	–	–	–	2	–	8	–	10
Dec.	–	–	–	–	–	–	1	–	1
TOTAL	2	3	–	2	14	21	45	12	99

Table 4—10 RAINFALL IN INCHES

YEAR	RAINFALL	YEAR	RAINFALL
1.953	166.13	1.958	146.48
54	152.90	59	139.77
55	184.13	60	152.49
56	138.98	61	163.79
57	151.99	62	177.74

TABLE 4—11 RAINFALL (MONTHLY AVERAGE) IN INCHES

MONTH	RAINFALL	MONTH	RAINFALL
Jan.	27.62	Jul	9 01
Feb	17.33	Aug.	7.70
Mar.	11.80	Sep.	11.29
Apr	12.95	Oct.	11.20
May.	10.98	Nov.	12.96
Jun.	7.22	Dec.	17.39
		Total	157.44

Table 4-12

P.W.D. 194

PUBLIC WORKS DEPARTMENT.

DAILY RAINFALL — ANNUAL ABSTRACT SHEET

WATER YEAR 1962 TO 1963.

Station KUCHING (AIRPORT) (PWD.1-1) Latitude ... Height Above M.S.L. ... Ft. River System ...

Division FIRST ... Longitude ... Observer OPERATIONS. OFFICER. Catchment Area ... Sq. Miles

Month	July	August	September	October	November	December	January	February	March	April	May	June	Last Annual Figures
Taken Over ... Years: Mean													
Std. Dev.													
C. of V.													
1	0.22	–	1.82	0.87	0.42	0.21	0.25	0.27	8.14	–	–	–	
2	–	0.05	4.84	–	0.06	0.15	4.16	0.17	1.58	–	0.57	–	
3	2.20	0.09	1.01	0.83	0.02	0.89	0.31	0.06	0.78	–	0.05	–	
4	–	–	–	0.23	0.38	–	0.03	0.93	0.55	0.07	–	–	
5	0.31	–	–	0.91	0.98	0.52	0.37	0.39	2.13	0.09	–	0.06	
6	–	1.05	–	0.18	0.08	0.09	1.15	0.64	–	–	–	–	
7	0.04	–	–	0.02	0.01	0.04	1.18	0.69	0.34	–	0.28	–	
8	–	–	0.13	–	0.42	0.69	2.53	7.05	0.73	–	0.93	1.23	
9	0.06	0.71	2.12	0.08	0.01	0.08	4.94	0.17	1.56	0.06	0.33	–	
10	–	1.01	–	0.18	1.79	0.03	1.98	1.35	2.40	0.78	2.19	–	
11	–	0.41	–	1.12	0.33	0.07	3.40	0.12	0.07	1.35	0.43	2.20	
12	–	0.01	0.84	1.20	0.07	0.05	0.07	0.03	0.04	0.19	0.05	0.03	
13	–	0.15	–	–	0.18	–	0.67	2.59	0.09	0.09	0.34	0.34	
14	0.52	0.54	–	–	1.32	–	3.94	0.11	0.12	0.91	–	1.93	
15	0.31	0.70	2.33	0.06	–	–	0.99	0.20	2.10	–	0.54	–	
16	2.25	–	0.42	0.85	0.05	2.79	0.06	1.11	0.94	–	0.01	–	
17	0.21	0.85	–	–	0.45	0.01	–	1.18	2.53	0.32	3.06	–	
18	–	–	0.32	–	–	0.03	0.49	0.25	0.05	–	–	–	
19	0.06	–	0.31	–	–	–	0.97	1.15	–	–	3.71	1.87	
20	–	1.68	0.42	0.02	–	0.40	1.06	0.12	0.43	0.10	–	0.07	
21	0.57	0.23	–	0.03	0.08	0.20	0.38	1.31	–	–	–	–	
22	–	–	2.49	–	–	0.55	0.30	3.60	–	–	0.05	–	
23	0.02	–	0.02	0.15	2.79	4.30	0.79	0.40	–	0.01	–	0.95	
24	–	–	–	–	–	2.02	0.54	3.12	–	–	–	0.03	
25	–	0.17	0.78	–	0.05	1.09	2.21	1.67	0.13	–	0.01	1.97	
26	–	0.93	0.47	0.02	–	0.03	4.86	1.53	0.02	–	0.09	–	
27	–	0.14	–	–	1.33	0.14	10.96	4.24	0.48	–	–	0.64	
28	–	0.20	–	1.04	–	–	3.65	0.72	0.26	–	–	1.42	
29	–	–	–	0.05	0.77	0.58	0.29		0.04	–	–	0.03	
30	–	0.25	–	0.50	0.80	–	1.06		0.05	–	0.14	–	
31	0.01	–		0.20		0.77	0.39		–		1.31		Revised Annual Figures
Total	6.78	9.17	12.92	7.54	12.21	15.72	45.88	34.06	22.96	3.87	14.09		197.85
No. of Days ≥ 0.01 in	13	19	15	20	22	24	30	28	24	11	18		237
ε (Y-M)²													
Taken Over 10-11 Years: Acc Totals													
Acc. ε (Y-M)²	4.97	2.16	2.66	13.63	0.56	3.10	275.56	231.65	101.20	66.06	7.95	28.30	1312.61
Mean	9.01	7.70	11.29	11.15	12.96	17.48	29.38	18.54	12.80	12.12	11.21	7.72	161.62
Std. Dev.	0.70	0.47	0.52	1.69	0.23	6.52	5.01	4.58	2.03	2.49	0.85	1.52	10.92
C. of V.	7.83	5.97	4.61	9.77	1.77	2.97	17.11	24.31	22.67	20.[illegible]	7.54	19.69	6.76
Maximum Within: 1 Hr. / 12 Hr.	1.54 / 2.20	1.30 / 1.32	2.00 / 2.33	0.84 / 1.18	2.82 / 2.79	2.14 / 4.10	2.28 / 7.88	4.48 / 7.02	1.56 / 5.14	0.88 / 1.04	2.84 / 3.50	1.88 / 2.20	From Recording Gauge
Date / Date	3rd / 16th	20th / 26th	15th / 15th	28th / 12th	23rd / 23rd	23rd / 23rd	27th / 27th	8th / 8th	15th / 1st	14th / 11th	19th / 19th	11th / 11th	
3 Hr. / 18 Hr.	1.88 / 2.25	1.32 / 1.68	2.20 / 2.33	0.96 / 1.18	2.76 / 2.79	2.70 / 4.30	3.84 / 8.96	5.64 / 7.03	3.32 / 5.14	0.88 / 1.05	3.20 / 3.71	2.08 / 2.20	
Date / Date	3rd / 16th	26th / 26th	15th / 15th	28th / 12th	23rd / 23rd	23rd / 23rd	27th / 27th	8th / 9th	1st / 1st	14th / 14th	19th / 19th	11th / 11th	
6 Hr. / 24 Hr.	2.16 / 2.25	1.32 / 1.18	2.28 / 2.33	1.02 / 1.20	2.79 / 2.79	2.88 / 4.30	5.62 / 10.96	6.76 / 7.05	4.40 / 5.14	1.04 / 1.25	3.40 / 3.71	2.08 / 2.20	
Date / Date	3rd / 16th	26th / 26th	15th / 15th	28th / 12th	23rd / 23rd	23rd / 23rd	27th / 27th	1st / 1st	1st / 1st	11th / 11th	19th / 19th	11th / 11th	

NOTE: The Daily Rainfalls (in inches) entered here have occurred between ... a.m. on the day shown and the same time the next day. Weekly Rainfalls are shown as side entries and are taken from Sunday to Saturday. Maximum within one recorded day marked*

Table 4-12

(b) Rain

The records of rainfall observed by Kuching Airport for the decade from 1953 to 1962 are given in Table 4-10 and 11:

As shown in the table, the annual rainfalls were 139 to 184 inches and the months from December to February were rainier than any other months. The maximum rainfall during the decade was 42.41 inches which occurred in January, 1955, and the minimum was 1.08 inches which occurred in July, 1958. In January and February, 1963, there were record-breaking rainfalls, causing a flood in many places. Rainfall at Kuching Airport was 45.88 inches in January and 34.06 in February, the rainfall at maximum in a day was 10.96 inches which took place on January 27, 1963. (See Table 4-12)

4-5-3 Tides

"The Tide Table, 1967" published by the Malaysian Government contains a Table of Estimated Tide Levels on the River Sarawak. This table is an outcome of the calculation made on the basis of the observation values obtained on Lakei Island (at North Latitude 1°45' and East Longitude 110°30'). According to the Marine Department, zero is taken 1' lower than the normal datum plane. The maximum and the minimum values obtained of the High and the Low Water Levels, respectively, of each month from the Tide Table, 1967, are given in Table 4-13 as follows:

Table 4-13 Tidal Level at Pulau Lakei (1967)

Unit: feet

Month	H.W.L.		L.W.L.		Month	H.W.L.		L.W.L.	
	Max.	Min.	Max.	Min.		Max.	Min.	Max.	Min.
Jan.	17.7	12.3	9.7	0.9	Jul.	16.3	11.9	8.6	1.3
Feb.	17.7	12.6	10.1	1.0	Aug.	16.7	12.1	10.0	1.1
Mar.	17.8	12.1	10.2	1.8	Sep.	17.1	12.2	10.3	1.6
Apr.	17.8	11.7	10.0	0.8	Oct.	18.0	12.2	10.5	1.8
May	17.4	11.6	9.3	0.4	Nov.	18.4	12.3	10.0	1.1
Jun.	16.7	11.7	8.3	0.7	Dec.	18.2	12.5	9.0	0.7
Annual Maximum						18.4			0.4

As seen from Table 4-13, the High Water Level and the Low Water Level show values of 18.4' to 11.6' and 10.5' to 0.4', respectively. The Highest High Water Level and the Lowest Low Water Level are, throughout the year, 18.4' in November and 0.4' in May, respectively. The mean values of H.W. and L.W. for all days of the year were computed, that is, M.H.W. = 14.8' and M.L.W. = 5.6'. Kuching area is thus marked with a very large tidal range. Even at Pending and Kuching well upstream on the Sarawak, the river is subject in a large measure to tidal influence. To sum up the above.

H.H.W.L. = +18.4'
M.H.W. = +14.8'
M.L.W. = + 5.6'
L.L.W.L. = + 0.4'

So far about the tide conditions of the open sea around Island Lakei. The British Chart No. 1823 gives a description of the tides at Kuching and Sungei Biawak. Table 4-14 shows it.

Table 4-14 Tidal Level of Sungei Biawak and Kuching

			Sungei Biawak	Kuching
Average Heights	High Water	Mean Higher	16.1'	14.7'
		Mean Lower	15.0'	14.4'
	Low Water	Mean Higher	6.8'	6.8'
		Mean Lower	3.3'	3.8'
Heights at Springs near the Solstics	High Water	Mean Higher	18.4'	16.2'
	Low Water	Mean Lower	-0.2'	1.0'

The Datum in Table 4-14 is lower at Sungei Biawak by 10.96' than the Land and Survey Datum and by 20.86' than B.M. at the N.W. corner of the deck level of Biawak oil jetty. At Kuching the Datum is lower by 9.50' than the Lands and Survey Datum. The relations of the Lands and Survey Datum to the Datum of the tidal level at various places are given in Table 4-15. Of these, relations to the water guage at the pier of the Customs Office at Pending are the outcome of the survey of our investigation team and the others are obtained from the chart and the data of the Lands and Survey Department. By the way, +20.00' as recorded on the water guage fixed to the pier of the Customs Office at Pending corresponds to 20.42' of Biawak.

Table 4-15 Relations of Various Datum

		Difference from Lands & Survey Datum
Datum of Tidal Level	Kuching	9.50'
	Point of Water Level Observation on River Sarawak	10.19'
	Biawak	10.96'
Zero at the Pier of Pending Customs		11.38'

With no available data of tidal and water level observation, no accurate value of the tidal level at Pending is obtainable, but it is presumed that it is approximately the same as the value of Biawak. Consequently, on the supposition that the Datum at the Pending construction site is the same as that at Biawak, it is held that it is lower by 10.96' than the Lands and Survey Datum.

In this plan of ours, it is so decided that the heights above sea level and water depth are all to be indicated on this supposed Datum.

4-5-4 Sarawak River

(a) The velocity of the Current

The Sarawak is a tide-sensitive river and its current velocity changes according to tides. Near Kuching, its current runs slow at flood tide and run swiftly at ebb tide. It is said that at spring tide, the velocity is 4 to 5 knots and even at neap tide it is 1 to 3 knots. On the River Kuap, it is said, the velocity is 2.5

to 4.0 knots at ebb tide and 1.5 to 2.0 knots at flood tide. But without any data available, no accurate value is obtainable.

In the course of the present investigation, observation was made, in the interval of boring operations, of the velocity of the current and it was found that the maximum velocity at spring tide (at ebb tide) was 3.6 knots.

(b) Water Level

At Kuching, which lies at about 20 miles upstream from the estuary, the level of the river largely changes with the tide from the sea.

The results of the water-level observation, which is made by the Drainage and Irrigation Department, have revealed various peculiarities. The data contain observation values of H.W. and L.W. on all days of the years 1963 and 1964, giving even comparison with the predicted values of the tide. (See Fig. 6 & 7)

Fig - 6

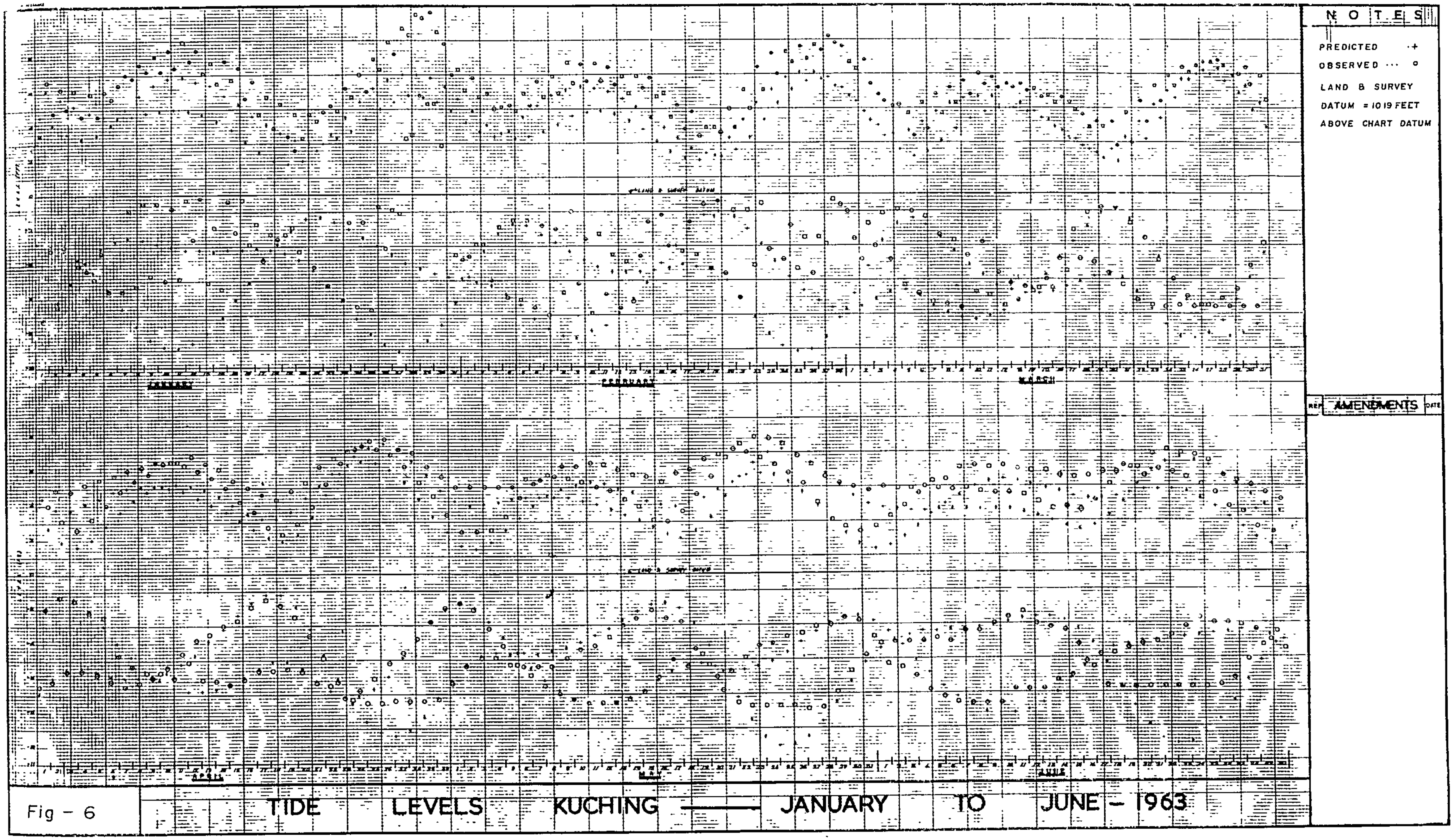


Fig - 6 TIDE LEVELS KUCHING —— JANUARY TO JUNE - 1963

Fig-7

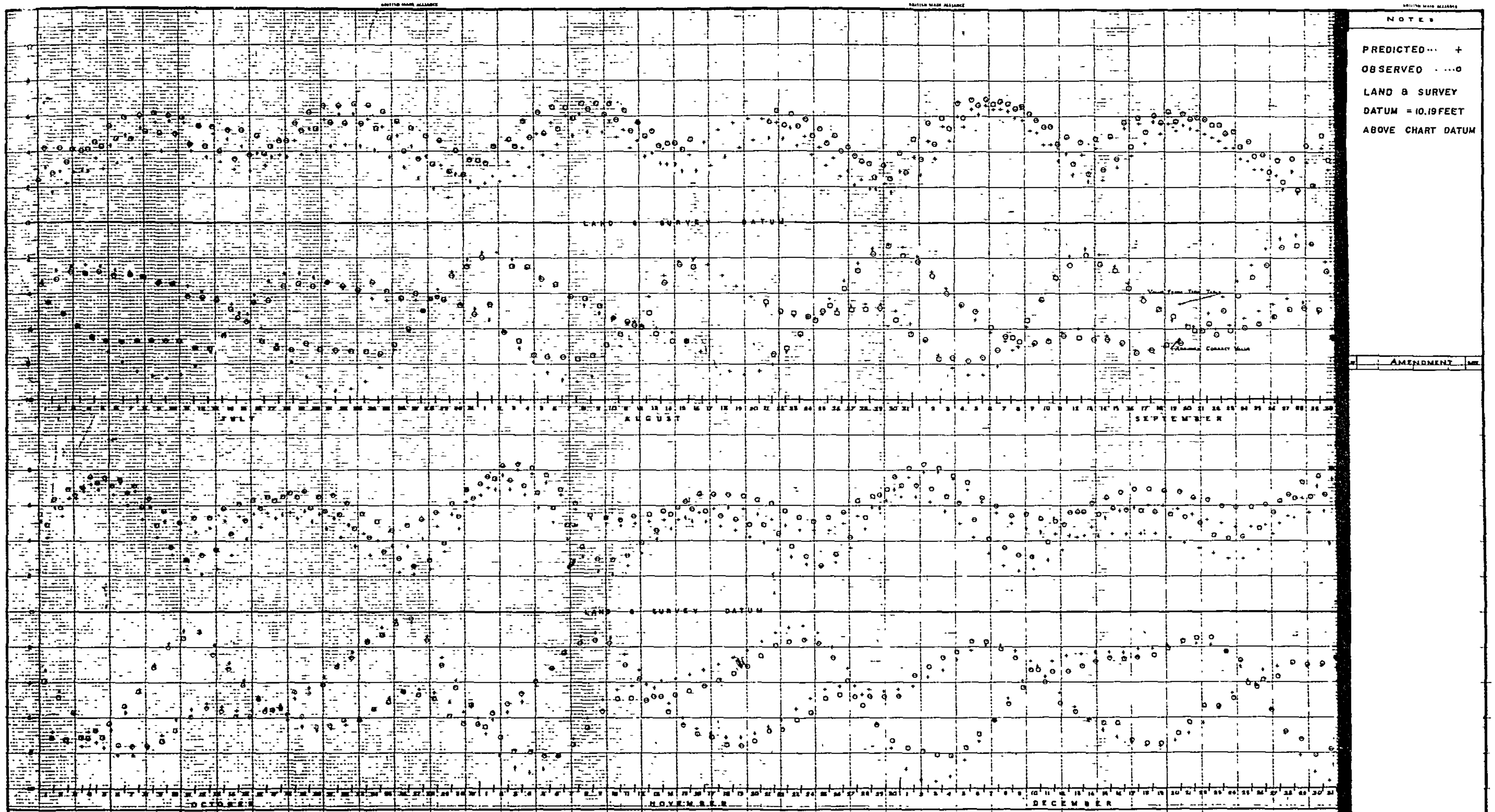


Fig - 7 TIDE LEVELS KUCHING — JULY TO DECEMBER 1963

(i) H. H. W. L. and L. L. W. L.

H. H. W. L. during the tv o years, which occurred on January 9, 1963, when the river was flooded, was +20. 80ft (as against 17. 2ft predicted for the day following the day of spring tide) and L. L. W. L., which occurred on Jan 1st, 1964, was +1. 9ft (as against the predicted +0. 5ft).

(ii) Values of observation actually made of the river generally come out higher than predicted values. At high tide, in particular, the former are almost always higher, but at low tide, they are often lower (within 1ft limits.) Occurrence rate of such difference between the actual and predicted values is given in Table 4-16.

Table 4-16 Rate of Occurrence (In percentage)

Diff. (feet) / Class	Over 4	3 - 4	2 - 3	1 - 2	0 - 1	0 - -1	-1 - -2	Total
H. W.	0. 4	1. 3	12. 5	48. 5	32. 6	4. 0	0. 7	100
L. W.	2. 3	1. 2	3. 4	7. 8	36. 2	47. 0	2. 1	100
Average	1. 3	1. 2	8. 0	28. 3	34. 4	25. 4	1. 4	100

(iii) The difference between actual and predicted values in time of a flood is larger at low tide than at high tide. For instance, on January 9, 1963, the difference at high tide was 3. 8ft while it was 13. 8ft at low tide. Again on February 28 the difference at high tide was 2. 5ft against 6. 3ft at low tide. This is attributable to the great influence of a large flux of the river itself resulting from a flood.

(iv) It is usual almost every month that 4 or 5 days before and after spring tide, the difference between actual and predicted values is large except in time of a flood, averaging 1. 7ft. This fact shows that while the sea level gets low at spring tide, the river level does not fall correspondingly.

(v) H. H. W. L. and L. L. W. L. for each month of the two years are given in Table 4-17.

Table 4-17 H. H. W. L. & L. L. W. L. (In feet)

	H. H. W. L.		L. L. W. L.	
	1963	1964	1963	1964
Jan.	+20. 8	+18. 3	+2. 9	+1. 9
Feb.	+19. 4	+19. 0	+3. 2	+2. 5
Mar.	+18. 0	+18. 1	+3. 6	+2. 0
Apr.	+18. 0	+18. 1	+2. 7	+2. 5
May	+17. 9	+18. 2	+2. 3	+2. 6
Jun.	+17. 3	+17. 8	+2. 6	+2. 4
Jul.	+16. 9	+17. 4	+2. 8	+2. 1
Aug.	+16. 9	+17. 1	+2. 5	+2. 3
Sep.	+17. 1	+17. 4	+2. 4	+2. 3
Oct.	+17. 8	+20. 0	+2. 6	+2. 4
Nov.	+18. 5	+18. 6	+2. 1	+2. 2
Dec.	+18. 7	+19. 7	+2. 1	+2. 6

4-6 Topography and Depth of Water of the Proposed Site

4-6-1 Outline of the Proposed Site

The proposed site occupies the whole of the place around Pending Point where the River Kuap joins the River Sarawak. The land lying between the two rivers forms a triangle. Near the site, the Kuap is about 400 yards wide, while the Sarawak is about 270 yards wide upstream of Pending Point and widens to some 550 yards downstream of the confluence.

A little upstream from the Customs Office, there is a shoal in the Kuap. When the river runs swift, a whirlpool is caused around it and the river is shallow around, but a little downward it is deep enough to afford a good anchorage for vessels. In the shore in front of the Customs Office, there is an outcrop of shale and a little downward on the left, the bank was eroded and some trees lay fallen.

Between Biawak and Pending Point, the river is shallow closer to the left bank, measuring -10 to -15ft in depth and deep closer to the right bank, where it is -20ft to -27ft deep. The bank was washed out here and there by swift current at ebb tide.

The triangular tract of land is generally low-lying ground except around the Customs Office and is thickly wooded with nipa palms and mangroves. It is submerged at high tide of spring tide.

4-6-2 Topographical Survey

In order to plan and design reinforcement of Kuching Port, topographical and soil survey were carried out of the Pending area. The topographical survey contained the surveying of the shore line on each bank and the traverse survey of the proposed site of the landing pier.

(a) Datum

The datum for measuring the heights above sea level was made to conform to the Datum of the Chart, that is, Chart Datum = Lands & Survey Datum— 10.96 , as stated under 4-5-3. Levelling operations were carried out from B.M. (which was on the box culvert on the River Pending) which the Lands & Survey Department established at the point some 400 yards west of the Customs pier. The measuring of heights was conducted by transferring the products on to the water guage provisionally built on the site.

(b) Shore Line Surveying

Survey was carried out over the distance of 1km (1,000yd.) along each bank of the River Kuap. To that end, triangulation survey was conducted between the right and left banks. Based on this survey, a base line was established on each bank and from these base lines, the shore line survey was done. At both ends (No. 5 & No. 17) of the shore line on the left bank, a square timber was driven in for later use.

(c) Crosssectional Survey of the Proposed Site for a Landing Pier

Crosssectional survey was carried out at 30 yards' intervals on the ground on the left bank side of the proposed site for construction of a pier. The area around being a swampy low land thickly wooded with nipa palms and mangroves, it was difficult to go deep into the forest and the survey had to be limited to about 20 yards in width from the shore line.

4-6-3 Sounding

(a) Method of Sounding

Up to 50 yards into the River Kuap from the left-bank shore line, sounding was carried out by casting the lead at a regular interval. All the rest of the sounding was almost taken by using a self-recording echo-sounder (NEC type 1500). The sounder was installed in a motor boat, which was made to steam along on the measuring lines set at 30 yards intervals. Due to the current, it was difficult for the boat to go on straight and therefore, a flag was hoisted on the bank as a landmark. To confirm the position of the boat, a transit was installed on the bank. By looking through the transit, contact was kept with the boat for its guidance. Operations were carried out at slack time, and stopped when the river was running swift.

(b) The Area for Surveying

Soundings were taken at intervals of about 30 yards over the length of the river with the Customs pier set for the upper end and a point 420 yards down from Pending Point for the lower end. The results of the soundings and of the shore line surveying are shown in Fig. 8.

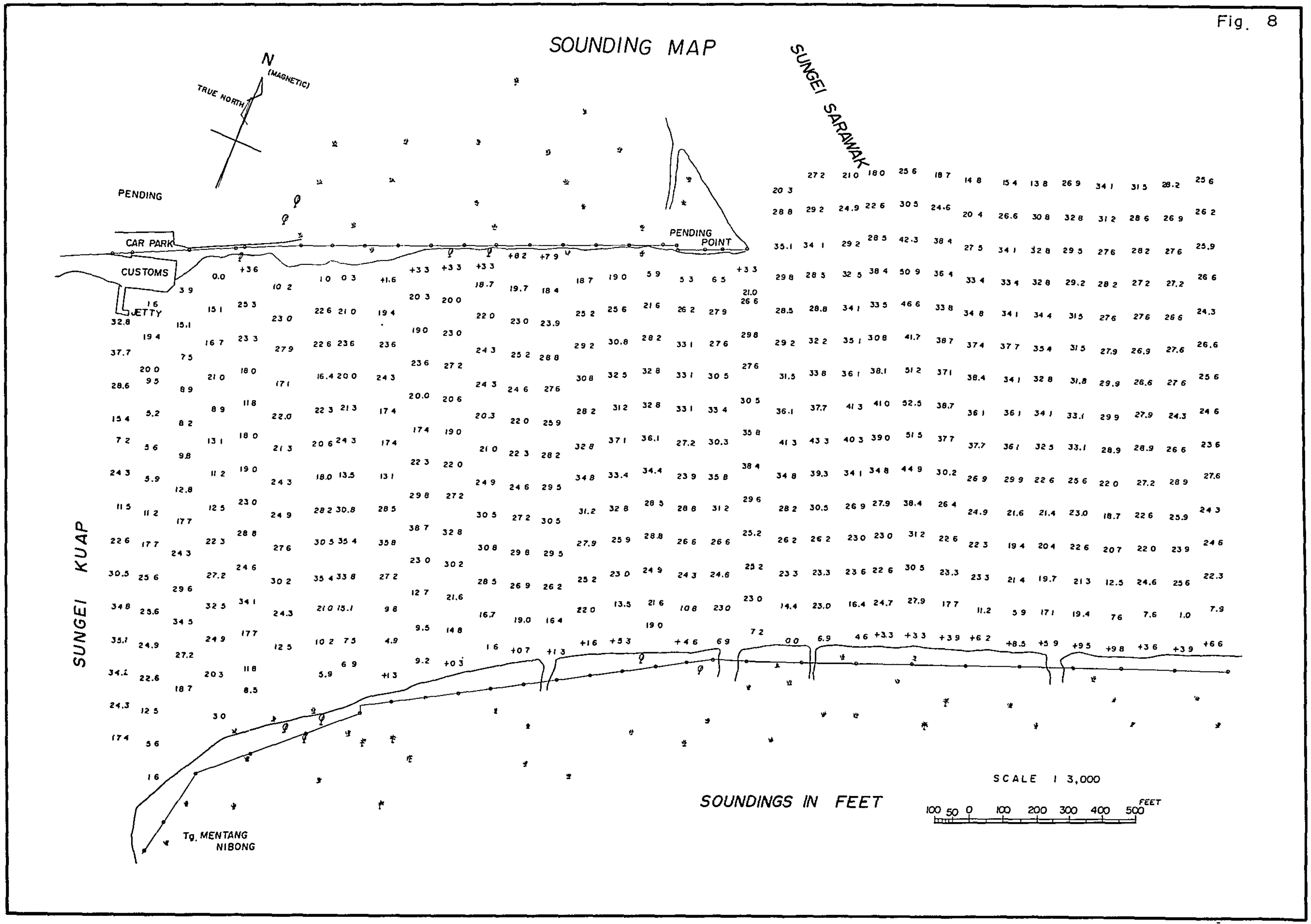

SOUNDING MAP
N (MAGNETIC)
TRUE NORTH
SUNGEI SARAWAK
PENDING
CAR PARK
CUSTOMS
JETTY
PENDING POINT
SUNGEI KUAP
Tg. MENTANG NIBONG
SOUNDINGS IN FEET
SCALE 1 3,000
100 50 0 100 200 300 400 500 FEET

Fig. 8

4-7 Soil of the Proposed Site

4-7-1 Soil Survey

(a) Method of Surveying

Boring operations were conducted mainly by the rotary system by using core tubes. Sampling was taken by means of fixed piston samplers at the rate one at an interval of 1 to 1.5m in the case of cohesive soil. In the case of sandy soil, because of its complicated formation, standard penetration tests or cone penetration tests were conducted once at an interval of lm. With a shale layer, which constituted the base foundation and is softened on the surface through heavy weathering, the standard penetration test was applied. When shale too hard to use this method of testing was reached, core tubes were used to obtained as many cores as possible. In this case measurement was taken of the speed of excavation for use as a yardstick to judge the hardness by. Detailed description will be given under 4-7-2.

Most of the boring operations ended with the confirmation of the shale layer and at two points both in the pier area and in the land area, the base layer was excavated up to 5 to 15m deep to examine the nature of rocks. The depth of each hole excavated is given in Table 4-18.

For the scaffolding for boring operations on the water were used pontoons (6m x 6m) made of steel like the one shown in the attached photograph. The performance and the standards of the boring machines, pumps and sampling tubes are given below:

(1) Boring Machine :

Type:	Toho Chika-Koki K. K.	A-2
Excavation capacity		200 m
Rotation		150 r.p.m.
Spindle stroke		300 m/m

(2) Pump :

Type:	Toho Chika-Koki K. K.	P-2
Volume discharged		30^{l}/min
Discharge pressure		$20kg/cm^2$

(3) Sampling Tubes :

Diameter	= 75m/m
Thickness	t = 1.5 m/m
Length	l = 1000 m/m

Table 4-18-1

LIST OF DRILL HOLES

Unit in meter (ft)

No. OF HOLE	ELEVATION OF GROUND	DEPTH OF HOLE	ELEVATION OF BOTTOM	ELEVATION OF SOFT ROCK	REMARKS
1	-6.5 (-21.3)	3.4(11.2)	-9.9 (-32.5)	-7.5 (-24.6)	
2	-4.5 (-14.8)	3 6(11.8)	-8.1 (-26.6)	-6.7 (-22.0)	
3	-4.6 (-15.1)	6.4(21.0)	-11 0 (-36 1)	-10.8 (-35.4)	
4	-4.1 (-13.5)	3.4(11.2)	-7.5 (-24.6)	-7.0 (-23.0)	
5	-5.8 (-19.0)	5.8(19.0)	-11.6 (-38.1)	-9.0 (-29.5)	
6	-5.6 (-18.4)	5.0(16.4)	-10.6 (-34.8)	-9.8 (-32.2)	
7	-5.6 (-18.4)	8.9(29.2)	-14.5 (-47.6)	-10 4 (-34.1)	
8	-6.4 (-21.0)	1.7(5.6)	-8.1 (-26.6)	-7.7 (-25.3)	
9	-6.8 (-22.3)	4 2 (13.8)	-11.0 (-36 1)	[-9 5 (-31 2)]	Stiff clay
10	-6.4 (-21.0)	4.2 (13.8)	-10 6 (-34.8)	-9.7 (-31.8)	
11	-7 9 (-25 9)	1.4 (4.6)	-9.3 (-30.5)	-7 9 (-25.9)	
12	-6.4 (-21.0)	3.1 (10.2)	-9.5 (-31 2)	[-8.6 (-28.2)]	Stiff clay
13	-7.2 (-23.6)	2.5 (8.2)	-9.7 (-31.8)	-8.4 (27.6)	
14	-8.8 (-28.9)	2 8 (9.2)	-11.6 (-38.1)	-11.3 (-37.1)	
15	-7.8 (-25.6)	2.5 (8.2)	-10.3 (-33.8)	-8.0 (-26.3)	
16	-6.0 (-19.7)	2.8 (9.2)	-8 8 (-28.9)	-7.0 (-23.0)	
17	-6.9 (-22.6)	4.7 (15.4)	-11 6 (-38.1)	-7.3 (-24 0)	
18	+5.3 (+17.4)	26.1 (85.6)	-20.8 (-68.2)	-7.0 (-23.0)	
19	+5.2 (+17.1)	28 5 (93.5)	-23.3 (-76.4)	-8.0 (-26 3)	
20	-11.3 (-37.1)	0.8 (2.6)	-12.1 (-39.7)	-11.7 (-38.4)	
21	-3.0 (-9.8)	2.0 (6.6)	-5.0 (-16.4)	-3.0 (-9.8)	
22	-5.2 (-17.1)	3.5 (11.5)	-8.7 (-28.5)	-5.2 (-17.1)	

Table 4-18-2

No. OF HOLE	ELEVATION OF GROUND	DEPTH OF HOLE	ELEVATION OF BOTTOM	ELEVATION OF SOFT ROCK	REMARKS
23	-7.0 (-23.0)	1.9 (6.2)	-8.9 (-29.2)	-7.0 (-23.0)	
24	-5.4 (-17.7)	2.7 (8.9)	-8.1 (-26.6)	-7.5 (-24.6)	
25	-5.2 (-17.1)	1.5 (4.9)	-6.7 (-22.0)	-5.2 (-17.1)	
26	-6.2 (-20.3)	2.6 (8.5)	-8.8 (-28.9)	-7.7 (-25.3)	
27	-7.9 (-25.9)	1.4 (4.6)	-9.3 (-30.5)	[-7.9 (-26.0)]	Stiff clay
28	+0.4 (+1.3)	7.4 (24.3)	-7.0 (-23.0)		
29	-3.9 (-12.8)	6.6 (21.7)	-10.5 (-34.5)	-7.9 (-25.9)	
30	-3.1 (-10.2)	6.8 (22.3)	-9.9 (-32.5)	-9.6 (-31.5)	
31	-0.2 (-0.7)	8.6 (28.2)	-8.8 (-28.9)	[-8.3 (-27.2)]	Stiff clay
32	-3.0 (-9.8)	7.5 (24.6)	-10.5 (-34.5)	[-10.4 (-34.1)]	
33	-3.2 (-10.5)	4.8 (15.8)	-8.0 (-26.3)	-7.4 (-24.3)	
34	-3.4 (-11.2)	2.7 (8.9)	-6.1 (-20.0)	-5.7 (-18.7)	
35	-1.4 (-4.6)	6.0 (19.7)	-7.4 (-24.3)	-7.2 (-23.6)	
36	-2.9 (-9.5)	4.1 (13.4)	-7.0 (-23.0)	-6.7 (-22.0)	
37	-6.6 (-21.7)	6.8 (22.3)	-13.4 (-44.0)	-13.0 (-42.7)	
38	-6.2 (-20.3)	8.0 (26.3)	-14.2 (-46.6)	-12.9 (-42.3)	
39	-4.9 (-16.1)	5.7 (18.7)	-10.6 (-34.8)	[-10.2 (-33.5)]	Stiff clay
40	-6.0 (-19.7)	4.3 (14.1)	-10.3 (-33.8)	-9.5 (-31.2)	
41	-5.8 (-19.0)	1.4 (4.6)	-7.2 (-23.6)	-6.2 (-20.3)	
42	-5.7 (-18.7)	1.8 (5.9)	-7.5 (-24.6)	-7.3 (-24.0)	
43	-6.0 (-19.7)	2.8 (9.2)	-8.8 (-28.9)	-8.6 (-28.2)	

Length of the edge	l'= 10 m/m
Thickness of the edge	t'= 0.1 m/m
Inside clearance ratio	Ic= 0.7 %
Material	Brass

(b) Boring Points

As shown in Fig. 9, boring points were distributed like this: 26 in the pier area (2 of which in the land area), 5 in the bank reventment area, 4 in the oil berth area, and 8 in the dredging area, totalling 43 points.

At first, 17 points were chosen for the pier area (2 of which in the land area) and 10 for the dredging area, totalling 27. But as the base layer was found to be shallower than expected, 11 points were added for the sake of accuracy, because the thickness and the sloping of the base layer were the key points in the designing and execution of work. Although boring operations at 5 points, Nos. 11 to 15, in front of the normal line of the pier had been intended for grasping the sloping of the base layer, which ran in the rectangular direction against the normal line, they proved to be for the dredging area.

In view of the interim result of the boring operations on the spot, 9 points were increased. 5 points were for the conservation of the ground behind the pier on the right bank of the Sarawak, because that part, as it was found, had been heavily eroded. The other 4 points were for the construction of a new oil berth. As to the area for dredging, since it was found that about half of the predetermined area on the downstream side was deeper than the planned depth of -8.5m, the boring points were redistributed, increasing to 6 points in the upper half and decreasing to 2 in the lower half, totalling 8 points, or 2 points less than at first planned.

In making survey to determine the boring points, first, according to the points on the plan for the project, boring points were determined by measuring from the temporary base line and after the completion of the boring operations, the base line was established by means of traverses and the measurement of accurate positions of the points was taken.

4-7-2 Results of the Survey

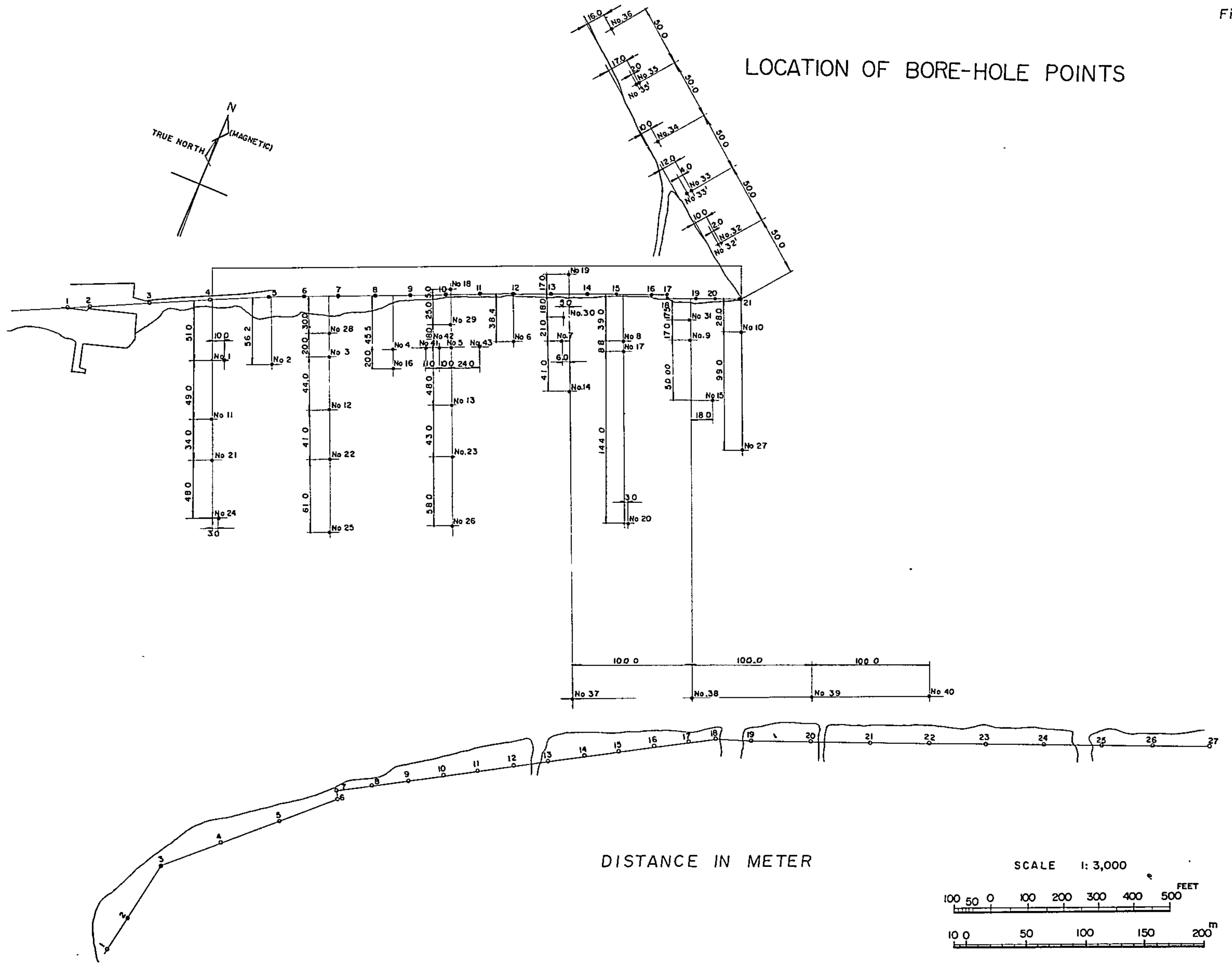
The results of the survey will be described under four heads, namely,(a) the pier (b) the bank revetment, (c) the oil berth, and (d) the dredging area.

(a) The landing pier area

In the pier area, boring operations were carried out at 26 points as shown in Fig. 9, namely, No.1 to No.17 and No.41 to No.43 near the normal

Fig. - 9

LOCATION OF BORE-HOLE POINTS



line of the pier and Nos. 28 to 31 in the rear of the normal line of the pier and Nos. 18 & 19 in the land area in the rear of the pier. Of these, at four points, Nos. 5, 7, 8 & 19, boring was pushed on about 5 to 14 meters farther after reaching the base layer in order to ascertain the nature and hardness of rocks. At other points, boring was ended when the base layer was confirmed as stated before.

As to the soil near the normal line, the base layer of the river-bed was -4.5 to -6.0m deep as shown by the soil profile in Fig. 10 and its supersurface was an accumulation of very soft clay silt of 1 to 1.5m thick with a layer of loose fine sand or coarse sand with gravel underneath to the depth of 2 to 4 m, with a weathered layer of shale underlying. This layer of shale, through excavation by water jet, presented an irregular and very uneven surface and its upper surface of about 3m thick was softened through weathering, which was especially severe with the 50 cm-thick uppermost surface. This layer of shale was inclined at 70 to 80°, almost standing vertical. The incline, when examined from post data, was found generally to be in the north-western direction and inclined at 50 to 80° in the south-western direction.

The land area consisted, as shown on the Soil Log in Fig. 11 (a) & (b), of soft clay of swampy alluvium from the ground surface (+5.2m) down to the depth of -4 to -5m, with a 2 to 4m-thick loose layer of sand and gravel underneath, which was underlain by a base layer of shale. This shale layer was generally even so far as the boring operations were concerned, with the depth of about -7 to -8m.

The properties of the clay in the land area will be dwelt upon in detail under 4-7-3 (a) & (b).

(b) The Bank Revetment Area (On the right bank of the Sarawak)

In carrying out boring operations for bank revetment, pontoons were arranged from No. 32 to No. 36 at intervals of 50m, as shown in Fig. 9, along the planned line of the bank revetment and as close to the land as possible.

In this area, like around the normal line of the pier as shown by the soil profile in Fig. 12, the shale layer was -5.7 to -10m deep and was severly deformed and complicated through excavation of water jet. The upper part of the layer was covered with sand of medium grades (N values:3 to 12) to the thickness of 2m at the thinnest part and 8m at the thickest. Over it lay and accumulation of soft silty clay.

Details of the physical and dynamic properties of this upper clay soil differed little from the results obtained of the boring operations in the pier

SOIL PROFILE

GENERAL CARGO WHARF

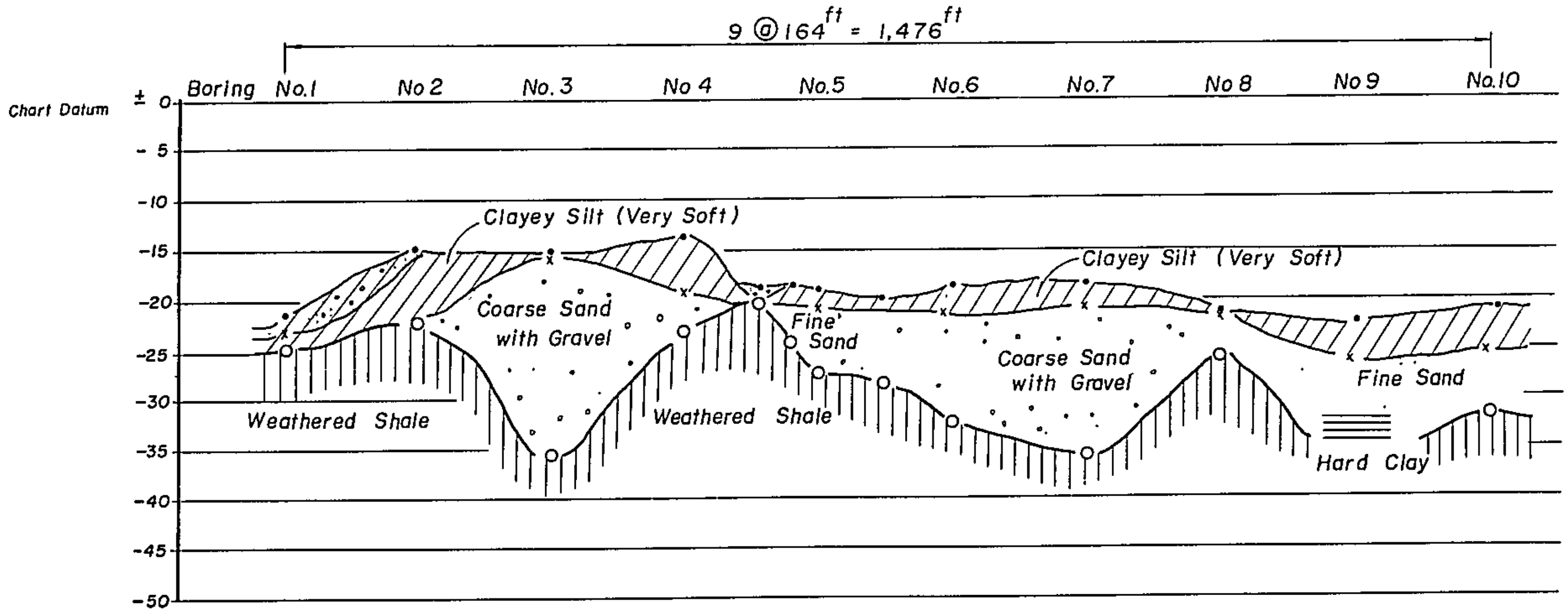


Fig – 10

Fig. — 11 (a)

Soil profile

Kuching No.18

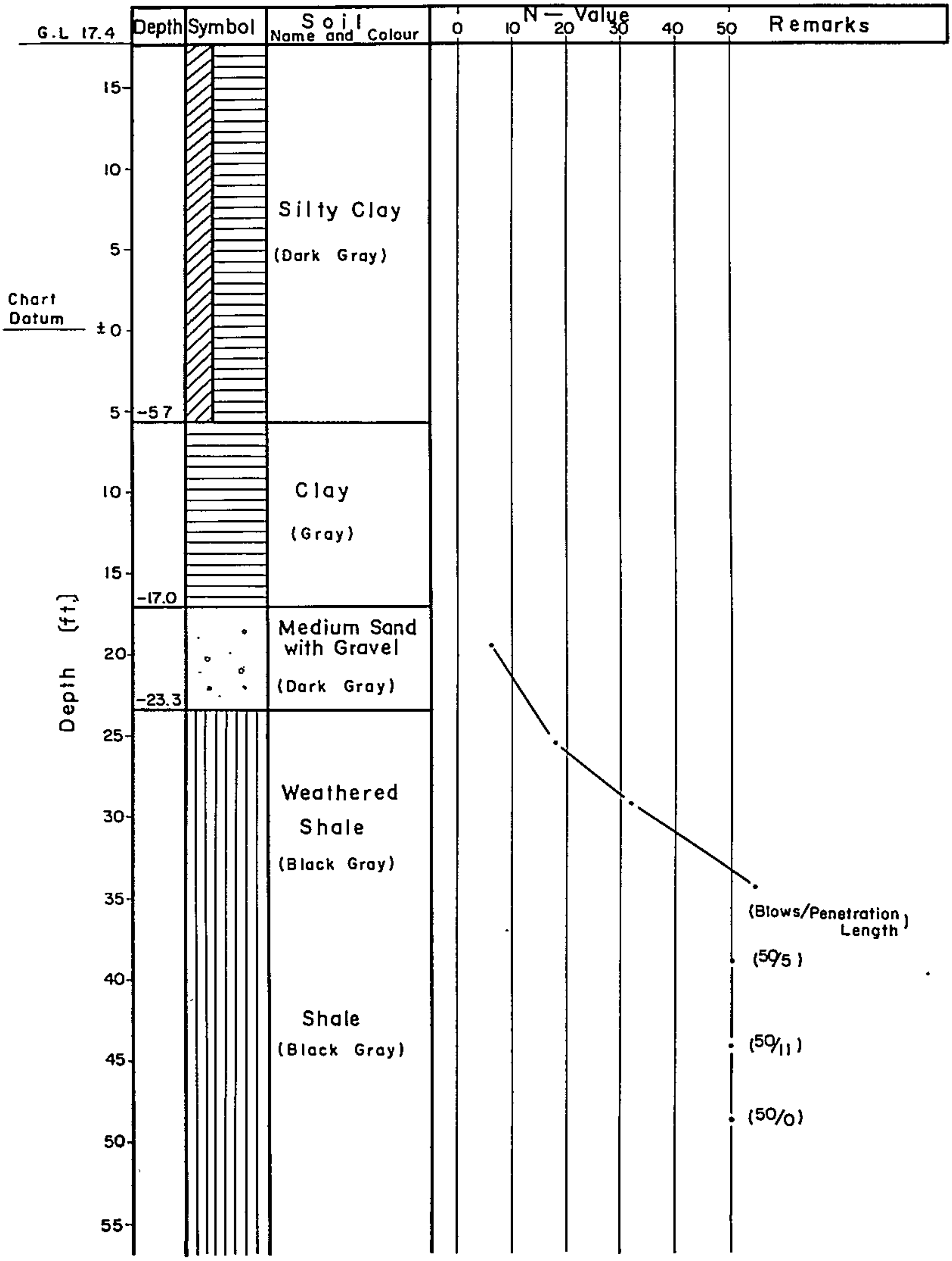
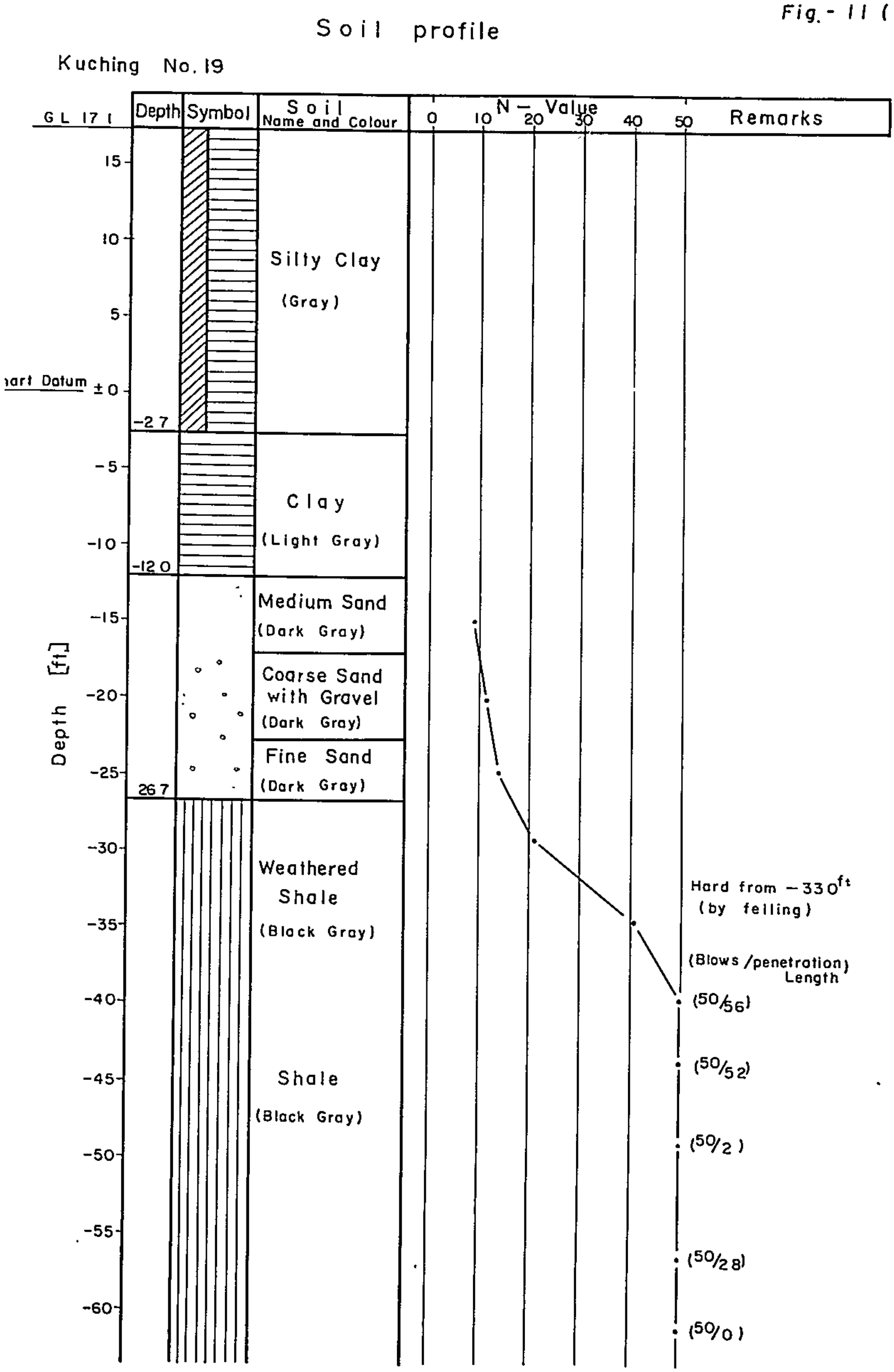
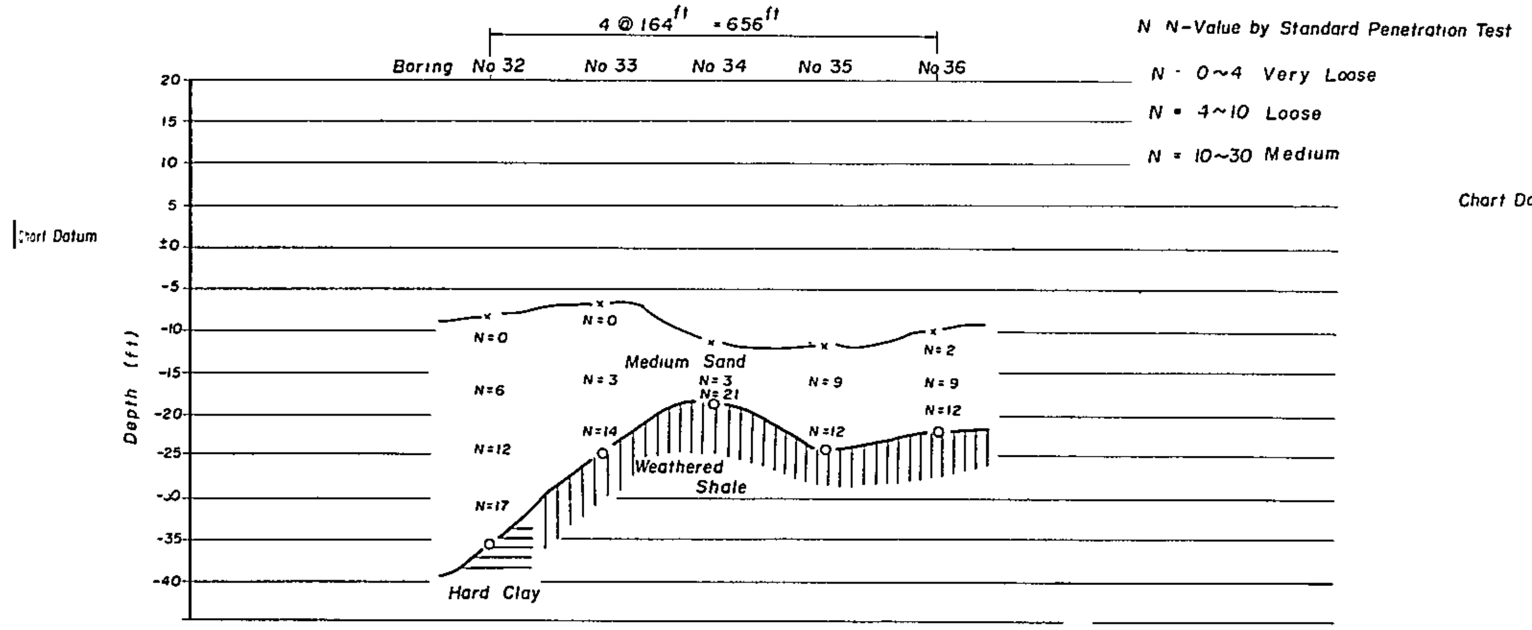


Fig.- II (b)

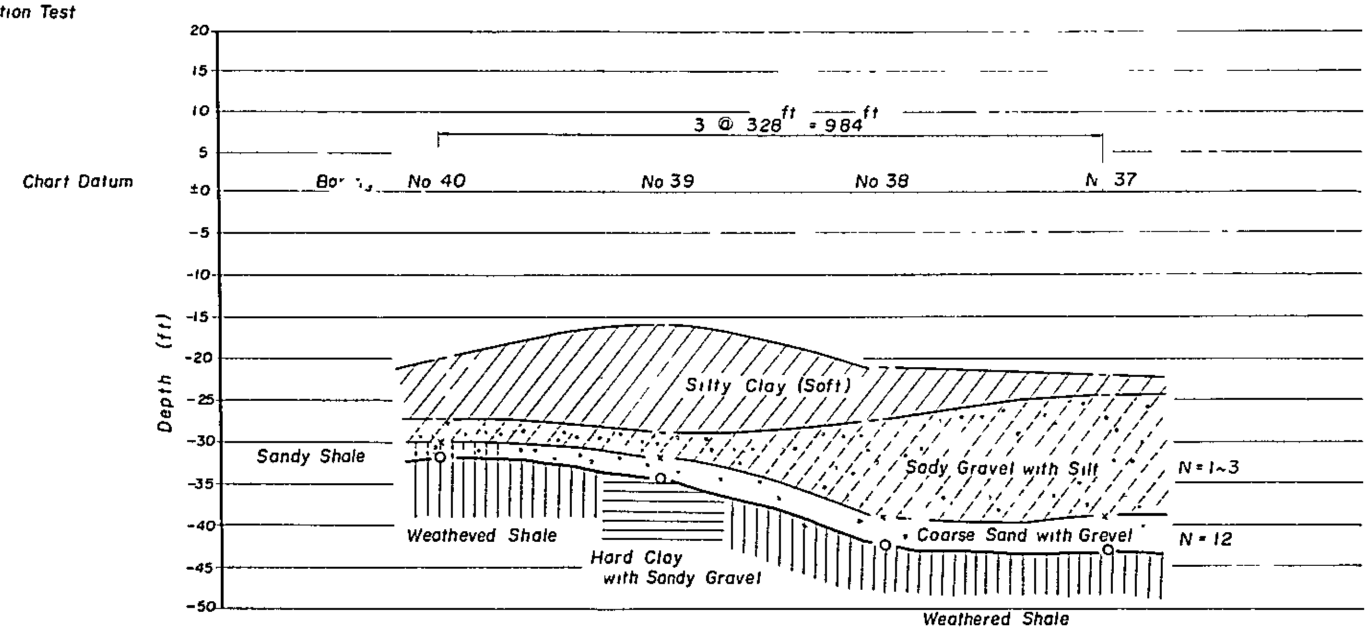

Soil profile
Kuching No. 19
GL 17.1
Depth
Symbol
Soil Name and Colour
N - Value
0 10 20 30 40 50
Remarks
15
10
5
Chart Datum ±0
-2.7
-5
-10
-12.0
-15
-20
-25
-26.7
-30
-35
-40
-45
-50
-55
-60
Depth [ft]
Silty Clay
(Gray)
Clay
(Light Gray)
Medium Sand
(Dark Gray)
Coarse Sand with Gravel
(Dark Gray)
Fine Sand
(Dark Gray)
Weathered Shale
(Black Gray)
Shale
(Black Gray)
Hard from -33.0 ft
(by felling)
(Blows / penetration Length)
(50/5.6)
(50/5.2)
(50/2)
(50/2.8)
(50/0)

SOIL PROFILE

RIGHT BANK OF SUNGEI SARAWAK



OIL BERTH



and the land areas. Reference to those results is desired.

(c) The Oil Berth Area

As shown in Fig. 9 showing the boring points, four points were chosen about 30m off the shore at intervals of 100m along the shore..

The result of the boring operations in this area is shown by the soil profile in Fig. 12. That is, the base layer, as compared with that in the pier area and the bank revetment area on the opposite bank, was on the whole a little deeper with a depth of -10 to -13m. The upper alluvial layer was of soft silty clay to the depth of -8m (the base layer of the river bed was about -5 to -7m deep), underlain by a layer of very loose sand and gravel (N value: 1 to 4) containing silt somewhat different from that found in the opposite bank area. Between this layer and the shale base layer lay a coarse sand and gravel layer of about 1m in thickness (N value: about 6 to 12).

The unconfined compression strength (qu) of silty clay of the supersurface was about 0.15 to 0.30 kg/cm^2.

(d) The Dredging Area

In the dredging area, boring operations were carried out at 8 points as stated before, of which 6 (Nos. 21 to 26),as shown in Fig. 9, were concentrated in the shallow depths on the upstream side.

In this area, there were outcroppings in the shale layer on the river bed. Standard penetration tests were, therefore, conducted outright on the riverbed, and farther down, the hardness of shale was measured by measuring the excavation speed by means of core tubes. The results are given in Table 4-19.

In the course of the boring through the shale layer during boring operations on land in the pier area,, relations of excavation speed to N value (whether or not there were any relations between them) were examined. The results are given in Table 4-20 for reference sake.

Rough properties of the surface-weathered shale layers over the whole area under survey were considered in the light of N values, the speed of excavation of core tubes, and how cores were collected. It was found as the result that the shale layer, when in a state of stratification, was fully capable of functioning as a supporting layer, but that due to the steep, almost vertical, incline of the layer, as stated before, the shale was so fragile and easy to break that core could hardly be collected. It is therefore considered that if a suitable dredging machine is used, dredging will not be difficult for the hardness of the shale.

Drilling Rates of shale layer

Bore Hole No	Depth (m)	Drilling Rate (Measure value) (cm/sec)	Drilling Rate (cm/min)	Boring Rod Length (m) Weight (kg)	Core Tnbe Diameter(m/m) Length (m)	Spindle Speed (r p m)
21	02 ~ 04	20/20	60	9 37 7	75 1.5	180~ 200
	04 ~ 06	20/10	120	〃 〃	〃 〃	〃
	06 ~ 08	20/20	60	〃 〃	〃 〃	〃
	08 ~ 10	20/40	30	〃 〃	〃 〃	〃
	10 ~ 12	20/40	30	〃 〃	〃 〃	〃
	1.2 ~ 14	20/25	48	〃 〃	〃 〃	〃
	1.4 ~ 16	20/45	27	〃 〃	〃 〃	〃
	16 ~ 18	20/120	10	〃 〃	〃 〃	
25	06 ~ 08	20/20	60	12 50 3	75 15	180
	10 ~ 12	3 /60	3	〃 〃	〃 〃	〃
26	24 ~ 26	20/30	40	12 50 3	75 15	180~ 200
27	1.2 ~ 14	20/10	120	13.5 56.6	65 15	180
11	10 ~ 12	20/20	60	16 5 69 1	75 15	180~ 200
17	2.0 ~ 2.2	20/20	60	12 50 3	65 1.5	180
	4.0 ~ 4.2	20/40	30	16.5 69 1	〃 〃	〃
	4.7 ~ 4.9	20/95	13	〃 〃	〃 〃	〃

But the lower part of the layer which was free from weathering effect could prove hard to dredge.

The contour line of the shale layer in the area under this survey is given in Fig. 13.

Table 4–20 (a) Relation between Drilling Rates and penetration Resistance, N of Shale layer.

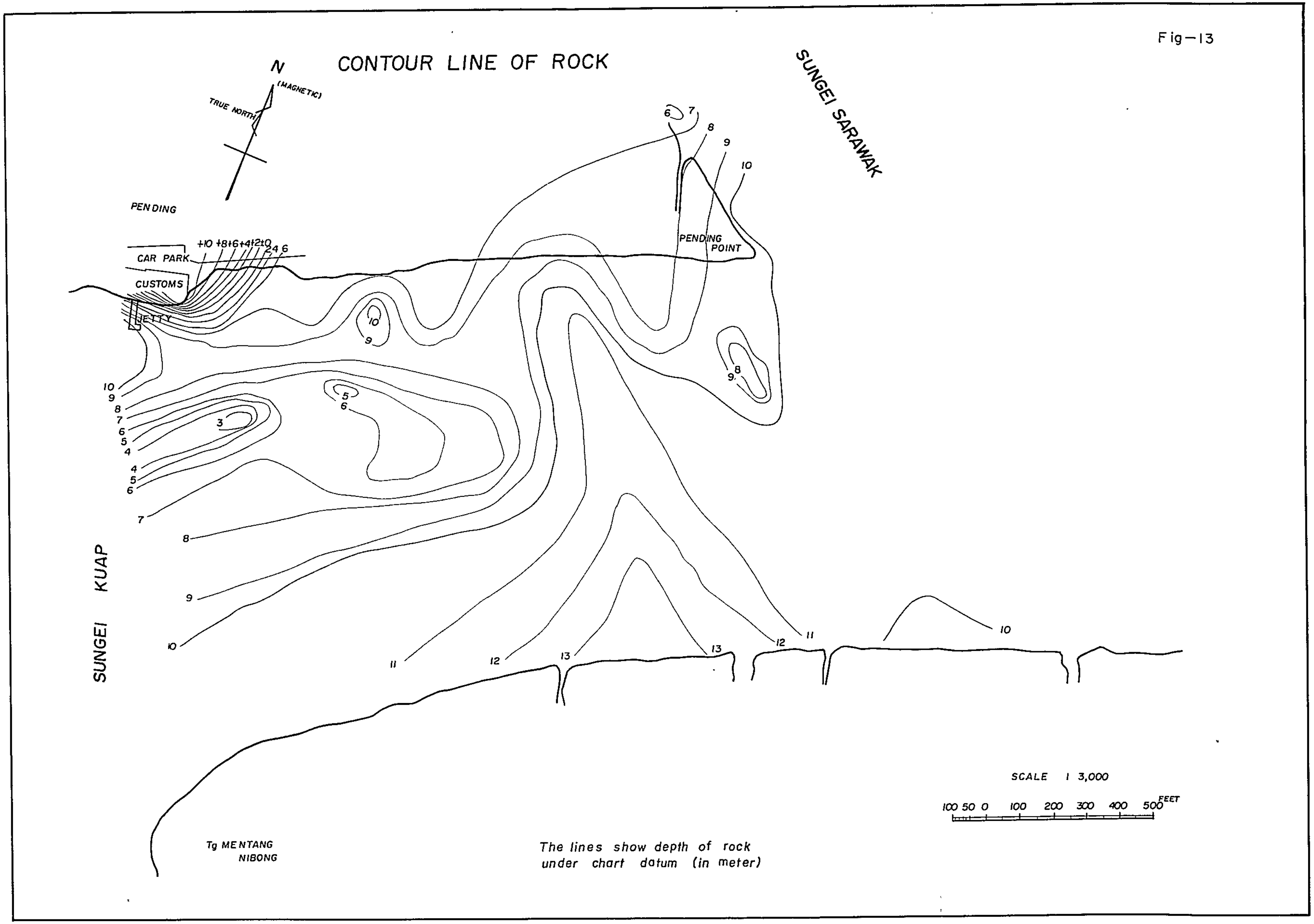
Bore Hole No 18

Depth (m)	Driling Rate (Measuve Value) (cm/sec)	Driling Rate (cm/min)	Boring Rod Length (m) Weight (kg)	Core Tube Diameter (m/m) Length (m)	Spindle speed (r p m)	N Value (Depth (m))
13 60 ~ 13 70	10/15	40	13 5 56 6	75 1 5	180 ~ 200	32 (13 8 ~ 14 1)
15 05 ~ 15 25	20/30	40	16 5 69 1	65 1 7	180 ~ 200	55 (15 25 ~ 15 55)
16 75 ~ 16 78	3/60	3	16 5 69 1	65 1 7	180 ~ 200	5/50 (16 80 ~ 16 85)
18 10 ~ 18 30	20/100	12	19 5 81 7	65 1 7	180 ~ 200	11/50 (18 35 ~ 18 46)
19 60 ~ 19 66	6/60	6	19 5 81 7	65 1 7	180 ~ 200	0/50 (19 80 ~)

Table 4—20 (b) Relation between Drilling Rates and Penetration Resistance, N of Shale layer

Bore Hole No 19

Depth (m)	Driling Rate (Measure Value) (cm/sec)	Driling Rate (cm/min)	Boring Rod Length (m) Weight (kg)	Core Tube Diameter (m/m) Length (m)	Spindle speed (r p m)	N Value (Depth (m))
14 50 ~ 14 70	20/30	40	18 0 75 4	65 1 7	180 ~ 200	41 (15 20 ~ 15 50)
17 90 ~ 18 10	20/40	30	21 0 88 0	65 1 7	180 ~ 200	13/50 (18 10 ~ 18 23)
20 00 ~ 20 20	24/60	24	21 0 88 0	65 1 7	180 ~ 200	5/50 (19 80 ~ 19 85)
20 80 ~	1/60	1	24 0 100 6	65 1 7	180 ~ 200	



Fig—13
CONTOUR LINE OF ROCK
N
(MAGNETIC)
TRUE NORTH
SUNGEI SARAWAK
PENDING
CAR PARK
CUSTOMS
JETTY
PENDING POINT
SUNGEI KUAP
Tg MENTANG NIBONG
SCALE 1 3,000
100 50 0 100 200 300 400 500 FEET
The lines show depth of rock under chart datum (in meter)

Table 4-21

List of Soil Tests.

Sample No.	Tests in Kuching			Tests in Japan					
	γ_u	γ_t	W	Gs	Ma	W_L	Wp	Con	Dir
No. 2 — 1	●	●	●	●	●	●	●	●	●
No 4 — 1	●	●	●						
No. 6 — 1									
No. 10 — 1	●	●	●	●	●	●	●		
No 18 — 1	●	●	●	●	●	●	●	●	
2	●	●	●	●	●	●	●		●
3	●	●	●	●	●	●	●	●	
4	●	●	●	●	●	●	●		●
5	●	●	●	●	●	●	●		
6	●	●	●	●	●	●	●	●	
No. 19 — 1	●	●	●						
2	●	●	●	●	●	●	●	●	
3	●	●	●	●	●	●	●		●
4	●	●	●	●	●	●	●		●
5	●	●	●	●	●	●	●	●	
No 28 — 1	●	●	●	●	●	●	●		
No. 32 — 1	●	●	●	●	●	●	●		
2	●	●	●						
3		●	●	●	●	●	●		
No. 33 — 1	●	●	●	●	●	●	●	●	
2	●	●	●	●	●	●	●		●
No. 35 — 1	●	●	●	●	●	●	●	●	●
2	●	●	●						
No. 37 — 1	●	●	●						
No 38 — 1	●	●	●						
2	●	●	●						
No 39 — 1	●	●	●	●	●	●	●		
2	●	●	●	●	●	●	●		
No. 40 — 1	●	●	●	●	●	●	●		
2	●	●	●	●	●	●	●		

Table 4-22(a)

CHART FOR RESULTS OF SOIL TEST

JOB TITLE ______________________

BORE HOLE No. ______________________ ELEVATION ______________ m

SAMPLE		RESULT FOR PHYSICAL TEST																										
		NATURAL CONDITION					SPECIFIC GRAVITY of SOIL	GRAIN SIZE ANALYSIS									CONSISTENCY								UNCONFINED COMPRESS. TEST			
								GRAIN COARSE (%)																	UNCONFINED COMPRESSIVE STRENGTH (kg/cm²)			
NO	DEPTH (m)	WATER CONTENT (%)	UNIT WEIGHT (t/m³)	VOID RATIO	DEGREE of SATURATION (%)	COEFFICIENT of PERMEABILITY (cm/sec)		GRAVEL	SAND	SILT	CLAY	MAX DIA (%)	60% DIA (%)	10% DIA (%)	UNIFORMITY COEFFICIENT	CLASSIFICATION of SOIL	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SHRINKAGE LIMIT (%)	PLASTICITY INDEX	LIQUID INDEX	RELATIVE CONSISTENCY	GROUP INDEX	ACTIVITY				SENCITIVITY
2 - 1	0 85 ~ 1 60	71 31	1 580	1 931	99 9		2 698		—	12 80	87 20					Clay	95 8	27 8		68 0	14 2	+ 0 36						
		71 30	1 577	1 925	99 6																							
4 - 1	0 00 ~ 0 65	81 47	1 547																									
10 - 1	0 45 ~ 1 25	117 73	1 409	3 202	100 0		2 720		7 59	31 91	60 50					Clay	87 8	28 7		59 1	1 15	- 0 51						
18 - 1	0 90 ~ 1 65	52 77	1 686	1 433	99 7		2 653		0 98	34 80	64 20					Clay	76 8	26 9		49 9	16 1	+ 0 48						
		55 60	1 670	1 472	100 2																							
18 - 2	3 10 ~ 3 85	67 91	1 582	1 832	99 0		2 670		2 96	19 10	78 00					Clay	91 2	30 1		61 1	16 0	+ 0 77						
18 - 3	4 55 ~ 5 40	66 99	1 593	1 826	98 9		2 696		1 30	24 40	74 30					Clay	87 5	32 6		54 9	9 4	+ 0 38						
		69 76	1 598	1 854	100 6																							
18 - 4	6 10 ~ 6 90	72 45	1 562	1 995	98 5		2 712			32 20	67 80					Clay	93 4	31 3		62 1	16 4	+ 0 34						
18 - 5	7 50 ~ 8 35	68 55	1 587	1 888	98 8		2 720			32 20	67 80					Clay	92 6	31 6		61 0	11 3	+ 0 39						
18 - 6	8 80 ~ 9 65	61 33	1 648	1 639	100 3		2 695		1 40	23 10	75 50					Clay	85 0	29 3		55 7	12 7	+ 0 43						
		59 86	1 649	1 613	100 0																							
19 - 1	0 90 ~ 1 70	74 35	1 545													Clay												
19 - 2	3 00 ~ 3 85	73 71	1 579	1 888	100 6		2 720		1 14	20 86	78 00					Clay	88 8	28 6		60 2	29 0	+ 0 25						
		69 54	1 597	1 992	100 1																							

Table 4-22 (b)

CHART FOR RESULTS OF SOIL TEST

JOB TITLE

BORE HOLE No.

ELEVATION m

SAMPLE NO	SAMPLE DEPTH (m)	NATURAL CONDITION: WATER CONTENT (%)	UNIT WEIGHT (g/cm³)	VOID RATIO	DEGREE of SATURATION (%)	COEFFICIENT of PERMEABILITY (cm/sec)	SPECIFIC GRAVITY of SOIL	GRAIN SIZE ANALYSIS: GRAIN COARSE (%) GRAVEL	SAND	SILT	CLAY	MAX DIA (%)	60% DIA (%)	10% DIA (%)	UNIFORMITY COEFFICIENT	CLASSIFICATION of SOIL	CONSISTENCY: LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SHRINKAGE LIMIT (%)	PLASTICITY INDEX	LIQUID INDEX	RELATIVE CONSISTENCY	GROUP INDEX	ACTIVITY	UNCONFINED COMPRESS TEST: UNCONFINED COMPRESSIVE STRENGTH (kg/cm²)	SENSITIVITY
19-3	4 60 ~ 5 30	67 40	1 590	1 832	99 0		2 690			56 00	44.00					Silty Clay	89.8	28 4		61 4	11.4	+ 0 37				
19-4	6 00 ~ 6 90	65 89	1 591	1 836	97 6		2.720			42.00	58 00					Clay	87 0	29.4		57.6	16 6	+ 0 37				
19-5	7 50 ~ 8 30	64 60	1 626	1 739	100.5		2.705		3.84	18 16	78 00					Clay	88 9	28 8		60 1	18 0	+ 0 40				
		71 34	1 594	1 908	101 1																					
28-1	0.00 ~ 0 80	76 50	1 555	2 090	100 0		2 732			28 50	71 50					Clay	85 6	29 1		56 5	16 3	+ 0 16				
28-1	0.00 ~ 0 40						2 674	2 91	87 93	9 16						Sand										
32-1	+0 50 ~ -0 10	59 71	1 638	1 658	98 0		2 732		1 98	38 02	60 00					Clay	84 3	28 5		55 8	16 8	+ 0.44				
32-3	-3 40 ~ -3 90	57 83	1.674	1 551	100 9		2 705		5 51	46 49	48 00					Clay	62 2	19 4		42 8	10 2	+ 0 10				
33-1	-0 25 ~ -1 10	57 23	1 687	1 509	102 1		2 692		3 29	50 71	46 00					Clay	76 0	24 5		51 5	12 4	+ 0 34				
		50 78	1 709	1 375	99 4																					
33-2	-1 30 ~ -2.05	54 30	1 687	1 482	99 4		2 712		1 92	39 08	59 00					Clay	76 6	27 1		49 5	13 5	+ 0 45				
35-1	-0 90 ~ -1 70	44 84	1 774	1 208	100 4		2 705		9 45	40.55	50.00					Clay	67 8	23 8		44 0	9 7	+ 0 52				
		46 13	1 754	1 200	99.5																					
35-2	-2 90 ~ -3 50	58 55	1 680																							

Table 4 −22 (c)

JOB TITLE

BORE HOLE No.

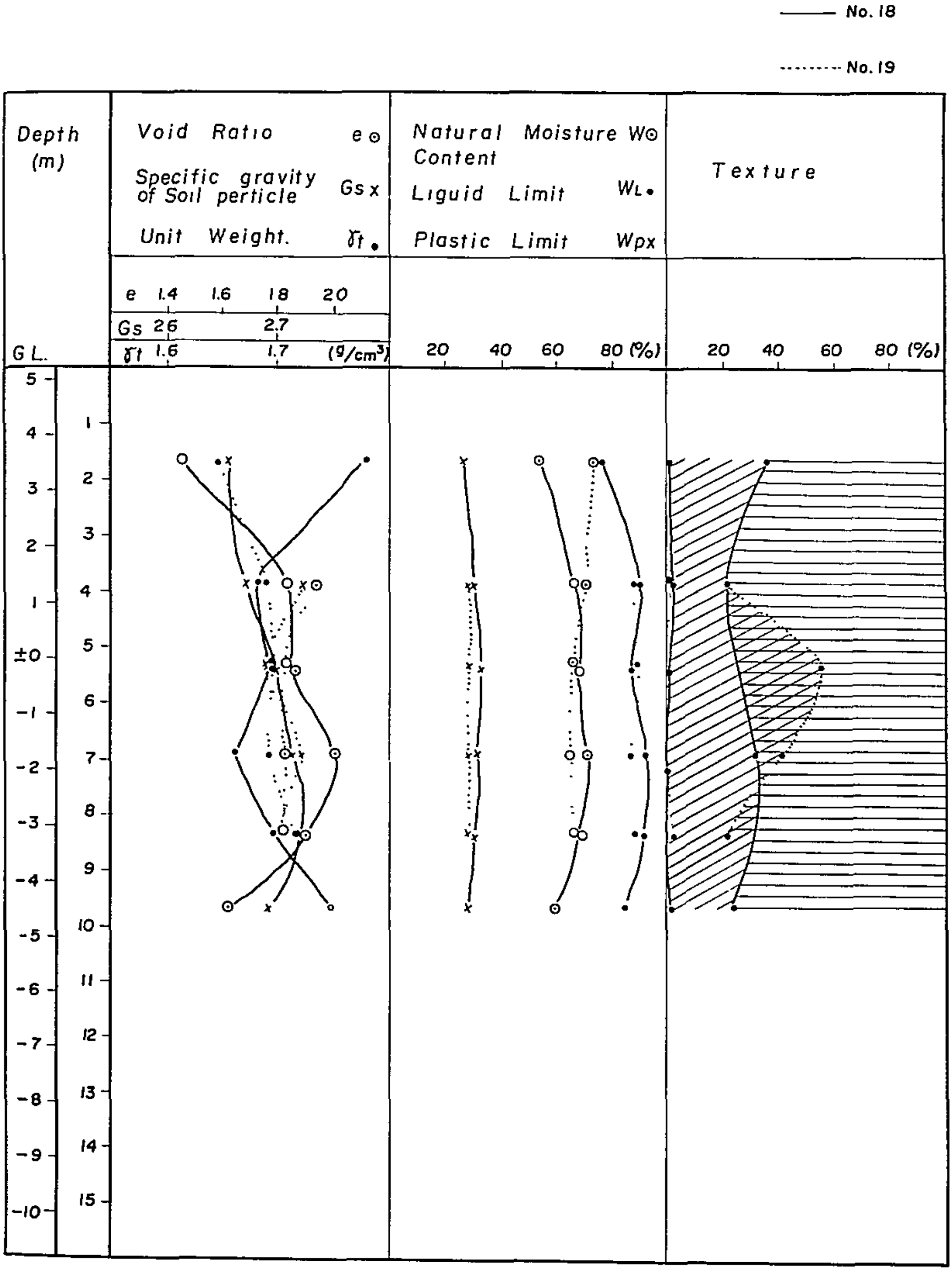
ELEVATION m

CHART FOR RESULTS OF SOIL TEST

SAMPLE		RESULT FOR PHYSICAL TEST																							UNCONFINED COMPRESS TEST		
		NATURAL CONDITION						GRAIN SIZE ANALYSIS									CONSISTENCY										
NO	DEPTH (m)	WATER CONTENT (%)	UNIT WEIGHT (g/m³)	VOID RATIO	DEGREE of SATURATION (%)	COEFFICIENT of PERMEABILITY (cm/sec)	SPECIFIC GRAVITY of SOIL	GRAIN COARSE (%) GRAVEL	SAND	SILT	CLAY	MAX DIA (%)	60% DIA (%)	10% DIA (%)	UNIFORMITY COEFFICIENT	CLASSIFICATION of SOIL	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SHRINKAGE LIMIT (%)	PLASTICITY INDEX	LIQUID INDEX	RELATIVE CONSISTENCY	GROUP INDEX	ACTIVITY	UNCONFINED COMPRESSIVE STRENGTH (kg/cm²)		SENSITIVITY
38 − 1	0 30 ~ 1 05	76 00	1 59																								
38 − 2	1 45 ~ 1 90	62 80	1 64																								
39 − 1	0 25 ~ 1 05	69 94	1 581	1 824	102 8		2 681		4 34	34 66	61 00					Clay	94 5	28 7		65 8	1 61	+0 37					
39 − 2	1 25 ~ 2 00	61 61	1 631	1 647	99 9		2 670		2 24	38 76	59 00					Clay	89 0	30 8		58 2	24.0	+0.47					
40 − 1	0 55 ~ 1 35	66 50	1 590	1 776	100 1		2 670		1 25	37 75	61 00					Clay	82 5	29 0		53 5	14 4	+0 30					
40 − 2	1 40 ~ 2 30	72 96	1 525	2 029	96 1		2 671		4 90	31 10	64 00					Clay	89 7	29 2		60.5	14 0	+0 28					

Fig. — 14

Soil properties



4-7-3 Soil Tests

(a) General Statement

The soil testing was twofold: that conducted on the spot outright and that conducted at the soil test laboratory back in Japan.

Testing on the spot comprised unconfined compression tests and measurement of unit weight and moisture content. It was so arranged that samples should be treated in the course of the day on which they were collected so that the values obtained would give the hardness and properties of the soil they came from as closely as possible.

In the tests conducted in Japan, physical testing (specific gravity of soil particle, liquid limit, plastic limit, mechanical analyses, etc.) was made with almost all samples collected (mainly undisturbed samples). Of sandy soil samples collected by the standard penetration test, chiefly grain size distribution alone was examined.

As for dynamic testing, consolidation tests and single shear tests (consolidated undrained tests --- CU tests) were made, chiefly with emphasis on No. 18 and No. 19 in the land area.

Items of testing with each boring hole are listed in Table 4-21. Marks used in the table are as follows:

qu	for	Unconfined Compression Test
	"	Unit Weight Test
W	"	Natural Moisture Content Test
Gs	"	Specific Gravity of Soil Particle Test
Ma	"	Mechanical Analysis
Wl	"	Liquid Limit Test
Wp	"	Plastic Limit Test
Con	"	Consolidation Test
Dir	"	Single Shear Test

(b) Results of Soil Tests

In all sections designed for boring in the water area, upper surfaces of clayey soil were so thin that only one or two samples were collected. It was impossible, therefore, to grasp the general propensity. Description here will accordingly be limited chiefly to Nos. 18 & 19 in the land area.

(1) Physical Properties

Physical properties are given in Table 4-22 and Fig. 14. As shown in the table and the Fig. clay contents were 44.0 to 87.2 per cent, --- such soil is classified as clay according to the triangular coordinates of the Mississippi River Commission Act. Gs was within the general range, with 2.65 to 2.73; W was 51 to 82 per cent; error of closure (e), 1.4 to 2.0; and γ, 1.54 to 1.72g/cm^3. Wl was 67.8 to 95.8 per cent; Wp, 23.8 to 32.6 per cent. Therefore, according to the plastic index of A, Casegrande, the soil is classified as High Plasticity Organic Clay.

Seen in the light of these results, the nature of soil of the supersurface of the land area, which constitutes the hinterland of the pier, can be said to be comparatively stable, considering its being swampy alluvial soil.

Other sections than Nos. 18 & 19 on the land area showed similar values in general, and therefore, it is concluded that the land over the whole area under this survey was approximately of the same nature of soil.

(2) Dynamic Properties

(i) Unconfined Compression Tests

Qu distribution by depths is given in Fig. 15 (a) & (b). As shown in the Fig. relations of increase in qu to depth were,

at No. 18:	qu = 0.065Z kg/cm^2	Z in meter
at No. 19:	qu = 0.07 Z "	"

thus revealing the existence of approximate congruence between the two.

Compressive strain which corresponds to qu is in general 3 to 5 per cent.

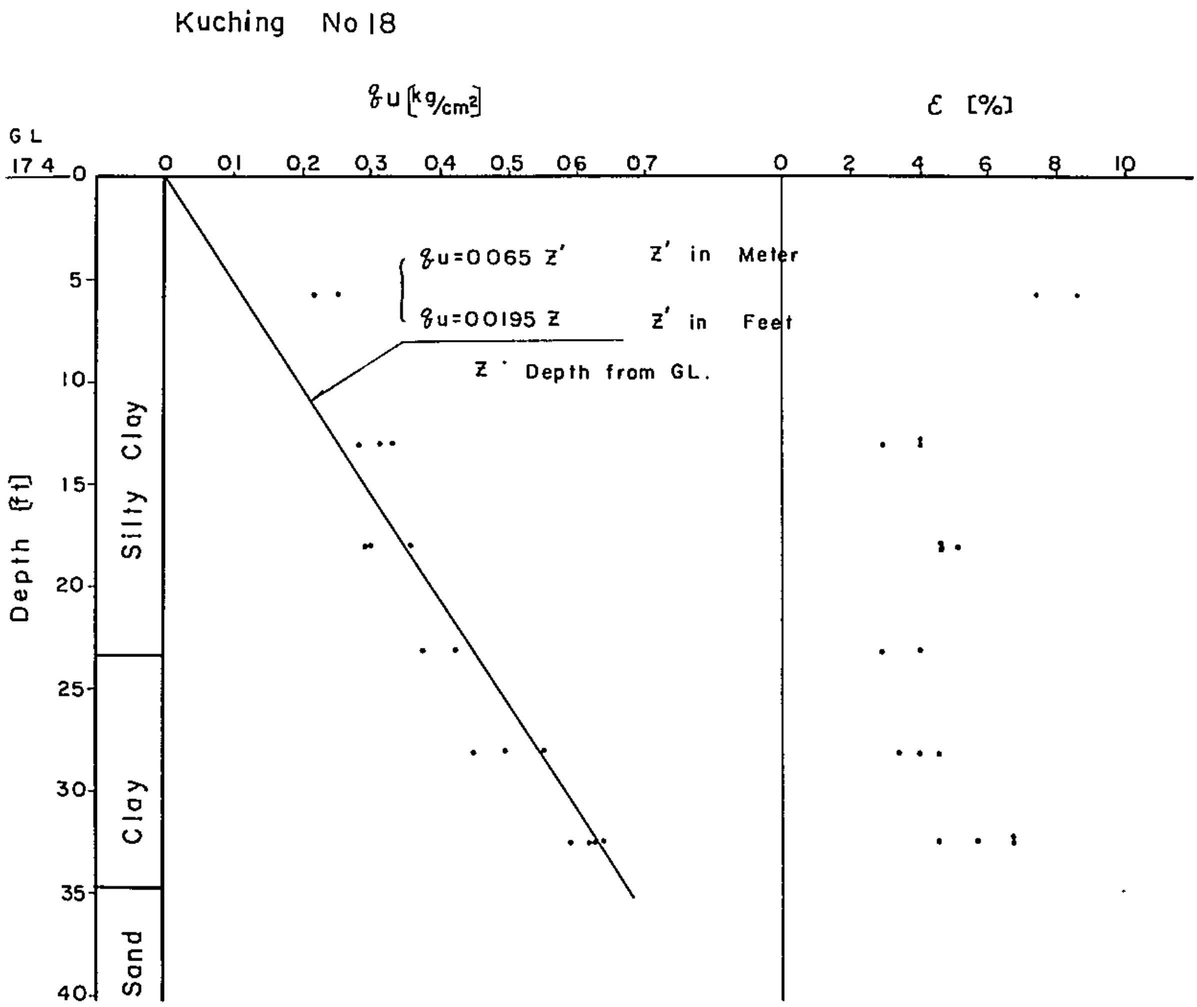
A slight difference was withnessed in the value of qu depending upon the results of both, and this was considered to be accounted for by the following facts:

(a) Where the supersurface was small in thickness, disturbances which occurred in time of sampling under the influence of live roots of nipa palms and other trees were responsible, and

(b) The supersurface contained a mixture of many cor-

Fig. -15 (a)

qu — Depth Relation



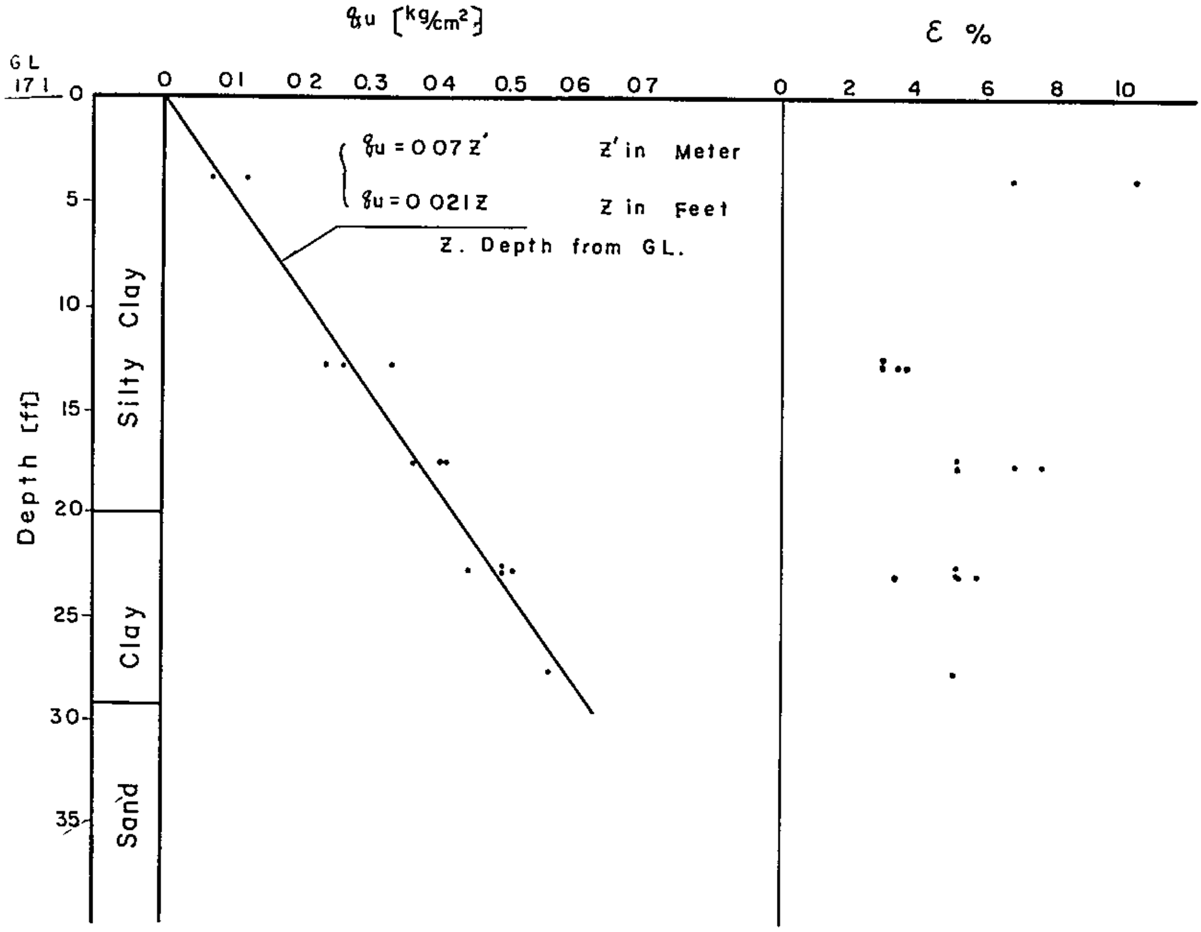
qu : Unconfined Compression Strength

ε : Strain

Fig. - 15 (b)

q_u — Depth Relation

Kuching No.19



q_u : Unconfined Compression Strength

ε . Strain

Fig—16

Relation between Coefficient of Consolidation (Cv) and Depth (m)

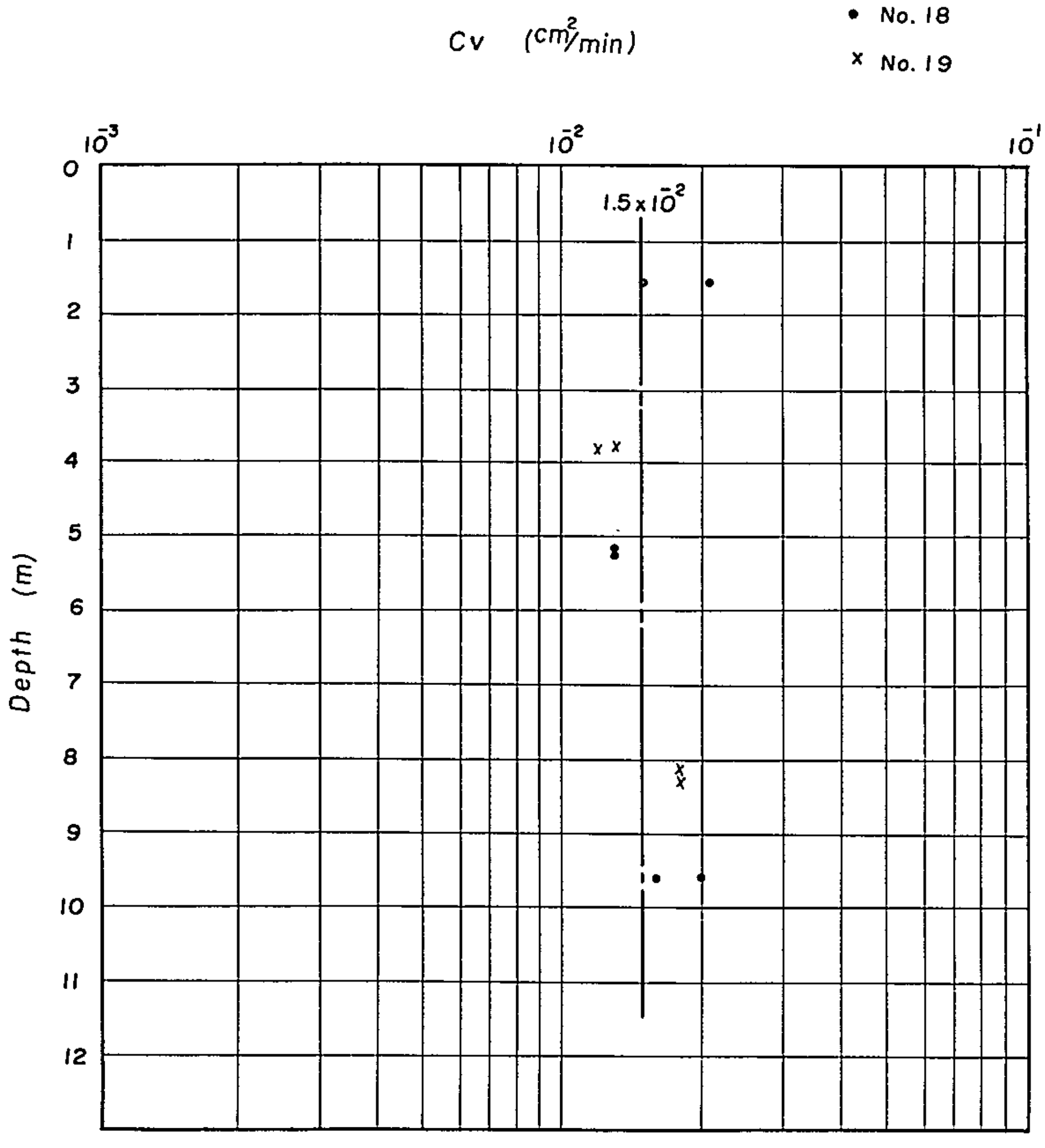


Fig. - 17

Relation between Consolidation pressuve (P)
Coefficient of Volume Compressibility (mv)

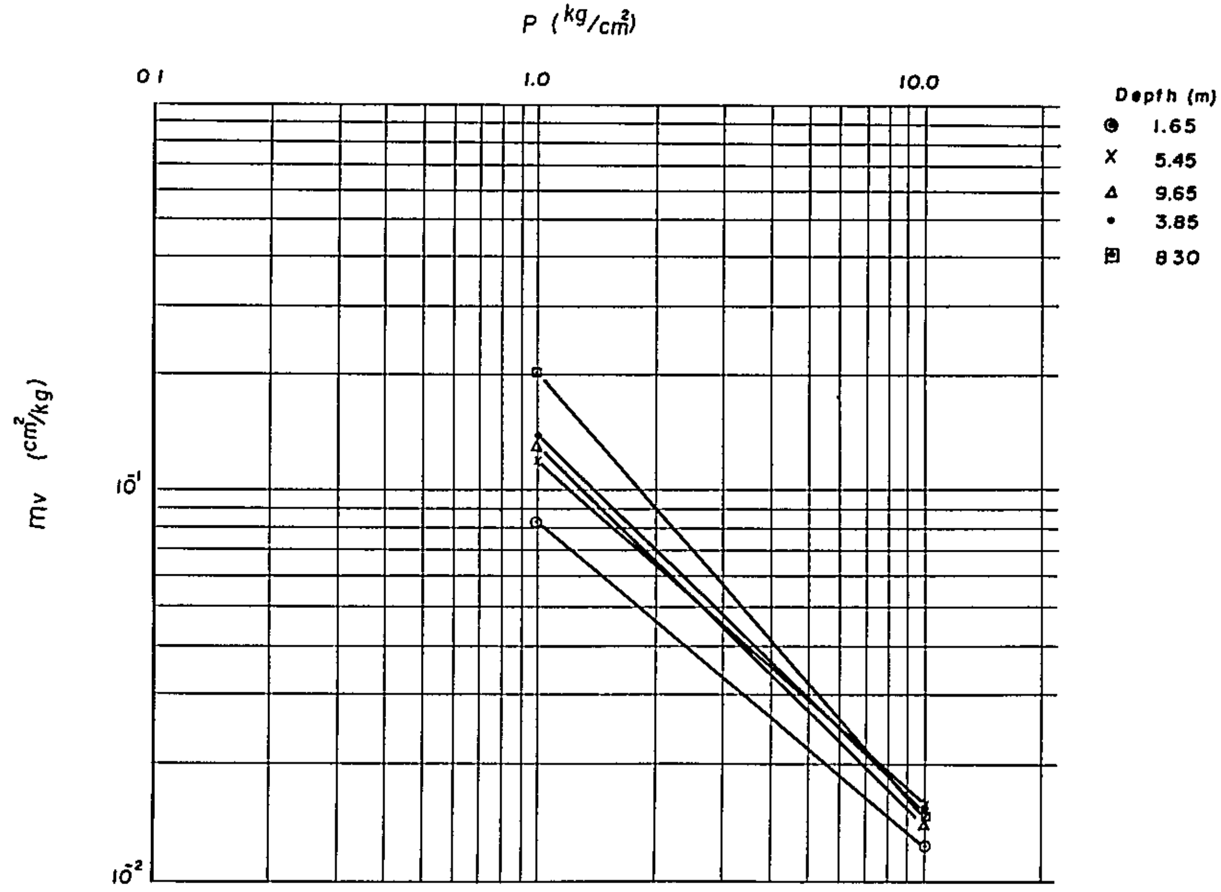
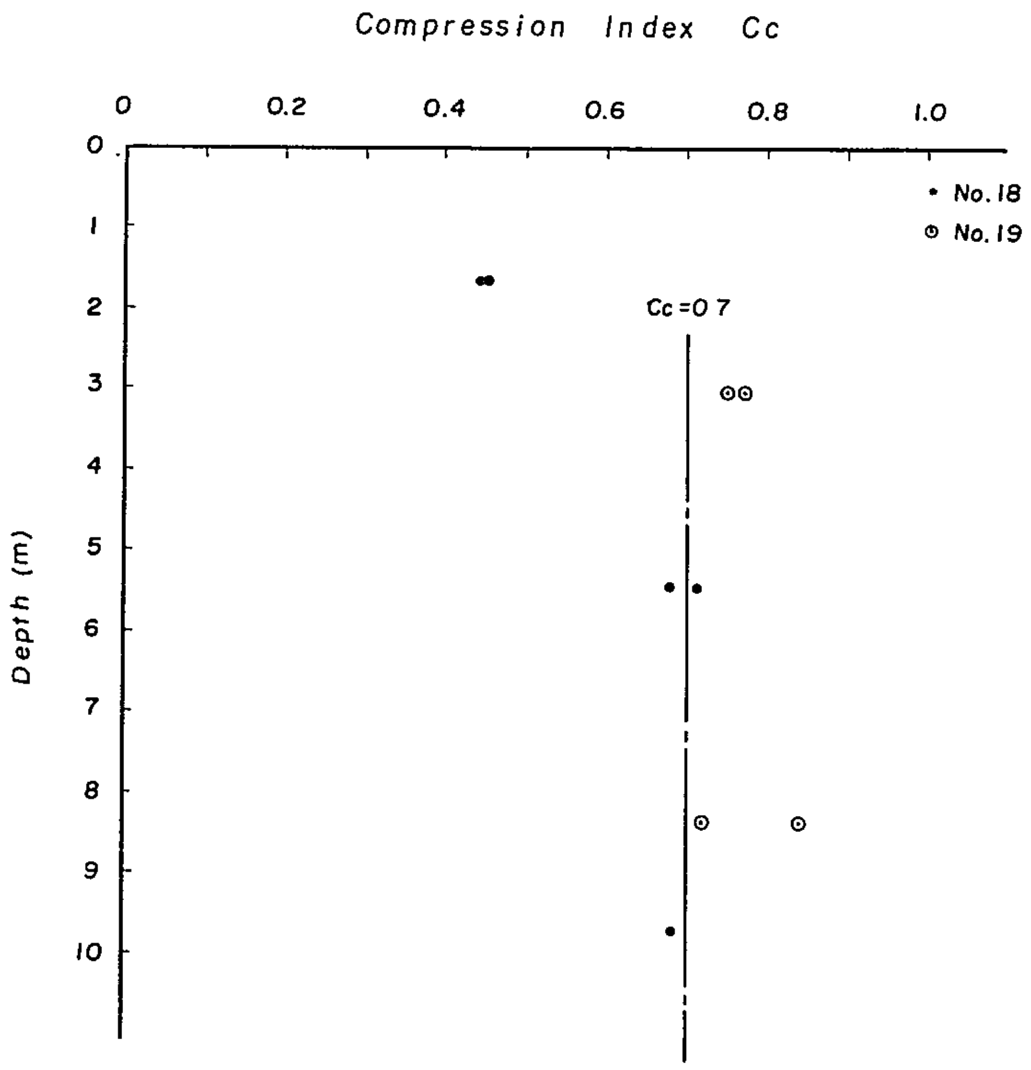
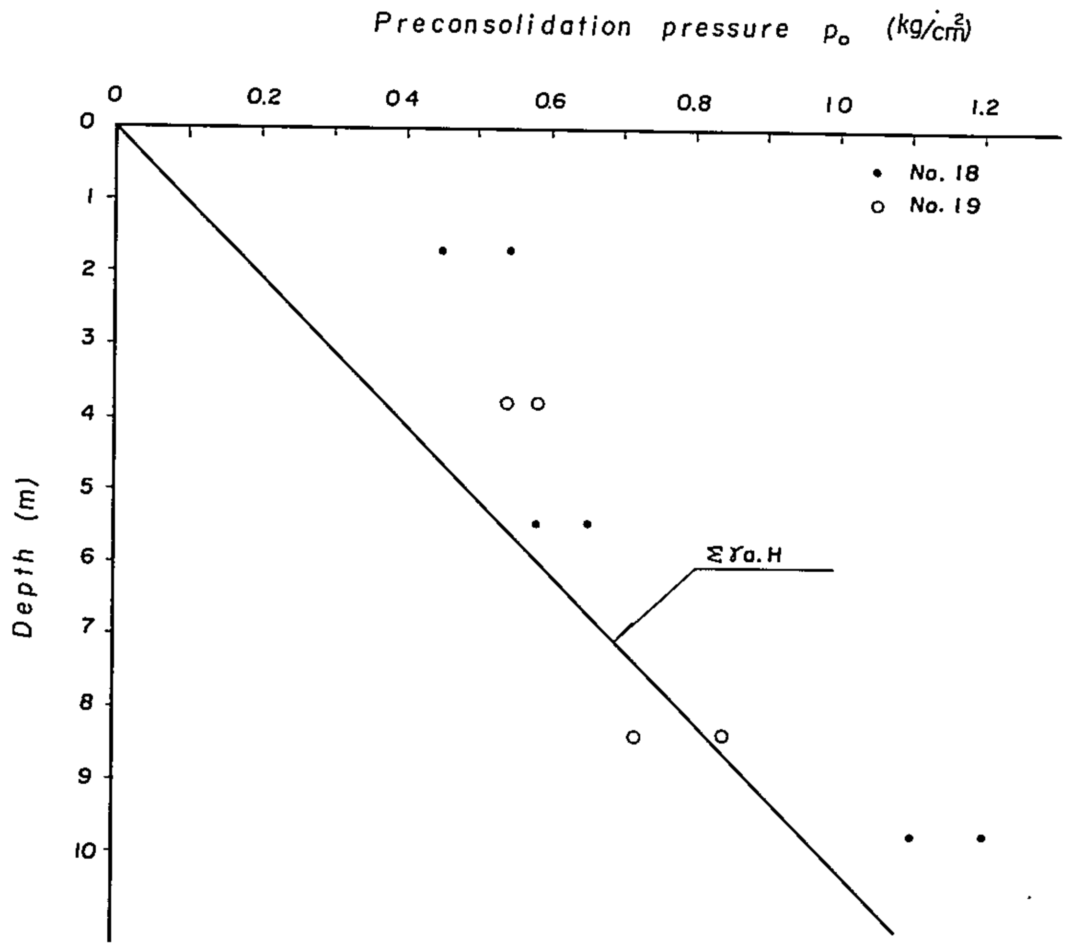


Fig — 18

Relation between Compression Index (Cc) and Depth (m).



Relation between preconsolidation pressuru (p_o), overburden Load and Depth (m).



rosives in the form of layer and the difference in the quantity and in the manner they got mixed in had influence upon the strength.

(ii) Results of the Compression Tests

The coefficient of consolidation (Cv), coefficient of volume change (Mv), the compression index (Cc), and the preconsolidation load (Po) are given in Table 4-23. The distribution of Cv by depth is shown in Fig. 16. As to Mv. the values of Mv taken under the consolidation load of 1.0 and 10.0 kg/cm^2 were plotted and shown in Fig. 17. The distribution of Cc by depth is shown in Fig. 18. Relations of Po to depth are shown in Fig. 19 together with overburden load ($\Sigma \gamma$d. H).

Table 4—23 Consolidation Coefficients.

Sample No	Depth (m)	Cv (cm^2/min)	mv (cm^2/kg)		Cc	Po (kg/cm^2)
			P = 1 0	P = 10 0		
18 - 1 - 1	1.65	1 5 x 10^{-2}	8 0 x 10^{-2}	1 3 x 10^{-2}	0 45	0.45
2		2 1 x 10^{-2}	8 5 x 10^{-2}	1 2 x 10^{-2}	0 44	0 54
18 - 3 - 1	5 40	1.3 x 10^{-2}	1.2 x 10^{-1}	1 6 x 10^{-2}	0 68	0 58
2		1 3 x 10^{-2}	1 2 x 10^{-1}	1.5 x 10^{-2}	0.71	0 65
18 - 6 - 1	9 65	2.0 x 10^{-2}	1 1 x 10^{-1}	1 5 x 10^{-2}	0 68	1.20
2		1 6 x 10^{-2}	1.5 x 10^{-1}	1 4 x 10^{-2}	0 70	1.10
19 - 2 - 1	3.85	1 2 x 10^{-2}	1 3 x 10^{-1}	1.6 x 10^{-2}	0.77	0.54
2		1 3 x 10^{-2}	1 5 x 10^{-1}	1 5 x 10^{-2}	0.75	0.58
19 - 5 - 1	8 30	1 8 x 10^{-2}			0.72	1 08
2		1 8 x 10^{-2}	2 0 x 10^{-1}	1.5 x 10^{-2}	0.84	1 05

As seen in Fig. 16, Cv showed approximately constant values to depth, that is, Cv = 1.5 x 10^{-2}.

Because the designed consolidation load was unknown, it was impossible to determine the value of Mv. Therefore, only values of dots were given as in Fig. 17.

Cc showed approximately constant values to depth, that is,

Cc = 0.7

Po, as compared with overburden load, showed a larger value in the supersurface, but there being no extreme difference, it was thought to be normally consolidated clay.

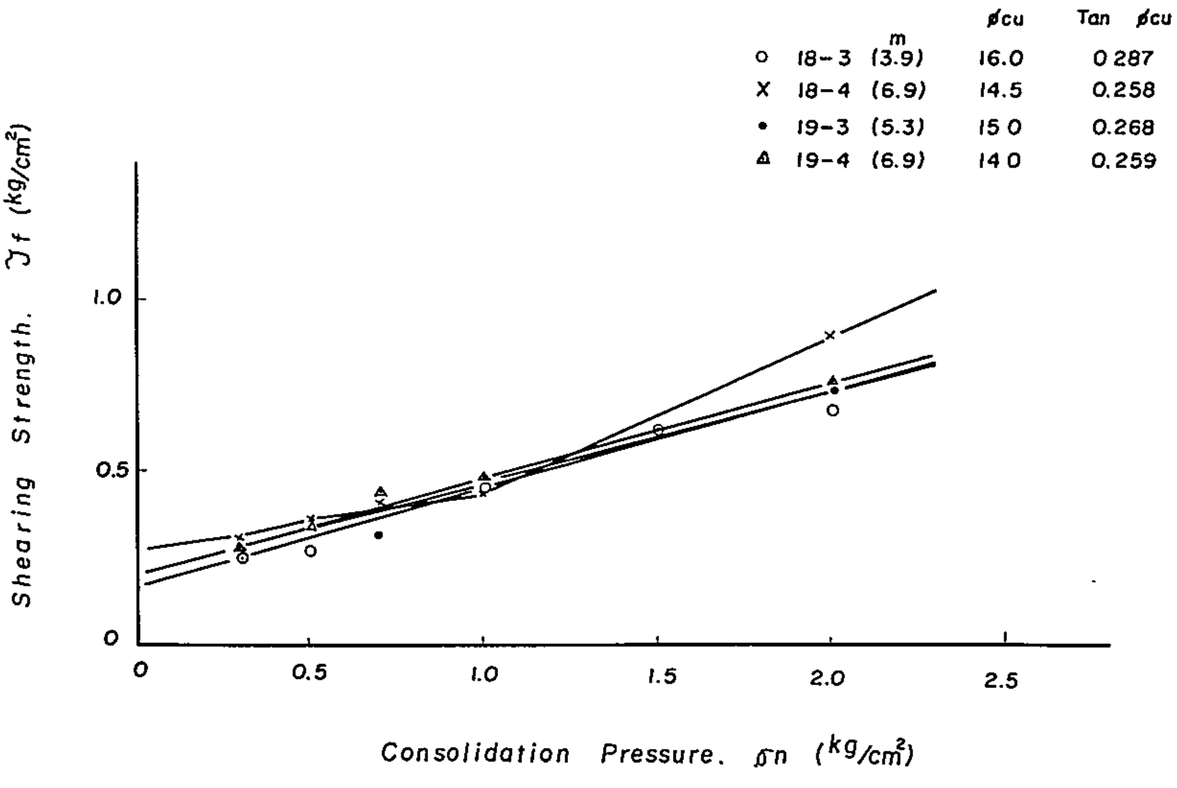
(iii) Single Shear Tests

In order to obtain the values necessary for presuming the ratio of increase in strength to increase in consolidation load (c/p), tests were conducted under the condition of consolidated undrain. The result is given in Fig. 20.

According to the figure, the value was: $\phi cu = 14.5$ to $16°$. From this the ratio of increase will be worked out like this:

$$\triangle C / \triangle P = 0.26 \text{ to } 0.29.$$

Fig—20 Results of Single shear Tests



CHAPTER V PLANNING FOR CONSTRUCTION OF A NEW PORT

CHAPTER V PLANNING FOR CONSTRUCTION OF A NEW PORT

-1 Need for a New Port

Tanah Puteh Wharf, which is currently made use of for external trade, is being managed and operated in a most efficient manner by the hands of the Kuching Port Authority.

The volume of goods handled at the wharf has grown so rapidly in recent years that it has now outgrown the capacity of the wharf to handle them smoothly. Generally speaking, the handling capacity of a wharf has a certain limit in terms of ocean transport economy. An inquiry into the utility factor of berths, the number of vessels compelled to wait for a berth, and hours waiting berth at Tanah Puteh Wharf in recent years has revealed, it must be concluded, that the wharf has been operating beyond its capacity.

It is foreseen on the other hand that, with the growth of population, progress in industrial development, and improvement of the living standards in the regions under the influence of Kuching Port, the volume of external trade goods will go on increasing year after year.

The depth alongside in front of the wharf at Tanah Puteh is no more than 17' 6", compelling large vessels of a larger draft to make use of Pending Point anchorage. With growth in scale of external trade, it is expected there will be more and more of such large vessels coming in and a growing demand, as well, for such large vessels.

In order to cope with this increasing volume of goods and the growth in size of vessels, and expedite thereby the regional industrial development, expansion of external trade, stabilization of the people's life and improvement of the living standards, it is a pressing need to establish a new wharf for general goods.

As for the oil wharf, although the existing facilities at Biawak Wharf have enough room in capacity, there is a strong demand for establishment of a new oil wharf capable of accommodating larger tankers than G-3 type ones currently in service. The oil wharf is, accordingly, to be treated separately from the general goods wharf in this report of ours. (See attached Supplemenary Information No. 2)

5-2 Forecast on Goods to be Handled at the Port

Goods for civil consumption handled at Tanah Puteh Wharf showed an annual average increase of 9 per cent over the period from 1962 to 1966. External trade goods handled at Kuching Port, except military goods and timber and including oil, showed an annual average increase of 10 per cent over the period from 1956 to 1966.

These rapid increases in the volume of goods have resulted from increase of imports of construction materials, such as cement and steel materials, and industrial manufactures, such as vehicles, electrical machinery and oil, export trade remaining stagnant , however. The increase in imports, in turn, have been accounted for by changes taking place in the economic structure and consumption structure in the hinterland. It is conceivable, therefore, that while increase in the volume will continue, there will be a decline in the rate of increase.

In estimating volumes of goods, 1977, ten years from now, and 1980, ten years after the completion of a new wharf, have been taken for target years.

First, the method of time series analysis was adopted. For the decade from 1957 to 1966, increases in the volume of external trade goods showed a linear propensity. A line of this propensity was computed by the method of least squares and was extended to the target years. The value of the ratio of the volume of goods of the target years to that of 1966 was then computed. By using this ratio as multiplier, the volume of general cargos of K.P.A. was worked out.

Second was to assume an annual average rate of increase. With respect to exports, the volume of exports of staple agricultural products, such as rubber, pepper and sago flour, showed a rate of increase of 5 to 7 per cent, as given in the 1st Malaysian Plan, and so it was assumed that K.P.A.'s export goods would also increase at the same rate of 7 per cent annually.

As for imports, imports of construction materials and motor cars, which have shown a sharp increases thus far, are expected to level off, and so it was assumed they would grow at an annual rate of 5.4 per cent --- the same rate as given in the 1st Malaysian Plan for the growth of the national gross product for the period from 1965 to 1980.

The volume of general cargos works out 550,000 tons for 1977 according to the first method and 570,000 tons according to the second method. Hence their mean number, 560,000 tons, was taken for the estimated volume for 1977. In like manner, the volume for 1980 was estimated to be 650,000 tons, that is, the mean number of 620,000 and 670,000 tons as calculated by the 1st and 2nd method, respectively.

5-3 Scale of the Plan

The volume of goods handled, the number of vessels waiting for a berth and hours waiting berth in the past --- with all these factors taken into consideration, the optimum annual volume of goods to be handled at Tanah Puteh Wharf is set at about 300,000 tons at the maximum.

With the optimum value of the utility factor of berth put at 75 per cent and the s .e of standard vessels, the volume of goods loaded and unloaded and the speed with w ıch goods are handled assumed generally to remain the same as at present, then the o tımum capacity of Tanah Puteh Wharf is calculated at about 300,000 tons.

In the case of the new wharf, a measure of improvement in efficiency is to be ex- p ·cted through introduction of new machines and improvement in the arrangement of an a,)ron and transit sheds.

Seen thus, the new wharf, which is to have a length of 800ft and a handling capacity of 350,000 tons, and Tanah Puteh Wharf, combined, will be capable of handling the volume of goods estimated for 1980.

With the length of 800ft, the wharf will be capable of accommodating 3 of the vessels of 220ft in length, the commonest size now in service, 2 of the vessels of 300 ft in length or one each of 500ft-long and 190ft-long vessels. Most efficient use will then be made of the wharf.

The above study has led to the conclusion that the new wharf should have a length of 800ft.

On the assumption that the largest draft of vessels making use of the wharf is 25 ft, the depth of the front area of the wharf has been determined at 27ft below the Chart Datum. This determination has been made by taking into account the existence of shallows at the mouth of the Sarawak, the depth of the river, tide, the nature of soil at the proposed site of the wharf, the size of the vessels making use of the wharf and their draft. Particulars are given in Supplementary Information I.

5-4 Location of the New Wharf

The new wharf is to be located on the left bank of the Kuap at Pending Point. This decision has been reached as the result of the following scrutiny.

(1) Depth of the River

The river is deep and not much curved from the estuary up to Pending, but is shallow and much curved from Pending upstream. If the wharf is to be designed for vessels of 25ft draft, then the wharf should be built on the downstream of or near the Pending. If it is to be built on the Upstream of Pending, with its connection with the city area and the existing facilities taken into account, then the water channel will need dredging, which will involve large dredging costs and maintenance expenses.

Pending Point is situated at the junction of the Sarawak and the Kuap. The Kuap is 1,200ft wide near the proposed site and about 1,600ft at the junction, affording ample room for turning a vessel. As to the depth, there are some shallow places which will have to be dredged.

(2) Relations with Kuching City and the Existing Facilities

Pending is about 4 miles from the central part of Kuching City and only 1.2 miles from Tanah Puteh. They are linked together by the paved Pending highway with two or more roadways, which will, as it is now, serve the purpose for the present. If the wharf is to be built on the downstream of Pending, its connection with Kuching by land will only be possible across the Sarawak or the Kuap. This will involve a large amount of money in the building of a bridge and creation of land for wharf use on the swampy ground.

(3) Land for Wharf Use

Pending and its neighbouring area is a swampy land thickly wooded with nipa palms and mangroves, with a sufficient area for use as wharf and port areas. In addition, as the land is state-owned, it is easy to acquire the necessary area of land for that purpose.

(4) Future Expansion of the Wharf

Generally speaking, it is desirable for the benefit of its users and from the standpoint of its management and operation that when a wharf is to be built in a new place, the place should have enough space for possible expansion of the wharf in the future.

On the left bank of the Kuap at Pending, it is possible to reserve enough space on the upstream of Pending Point for expansion of the wharf by 1,200ft.

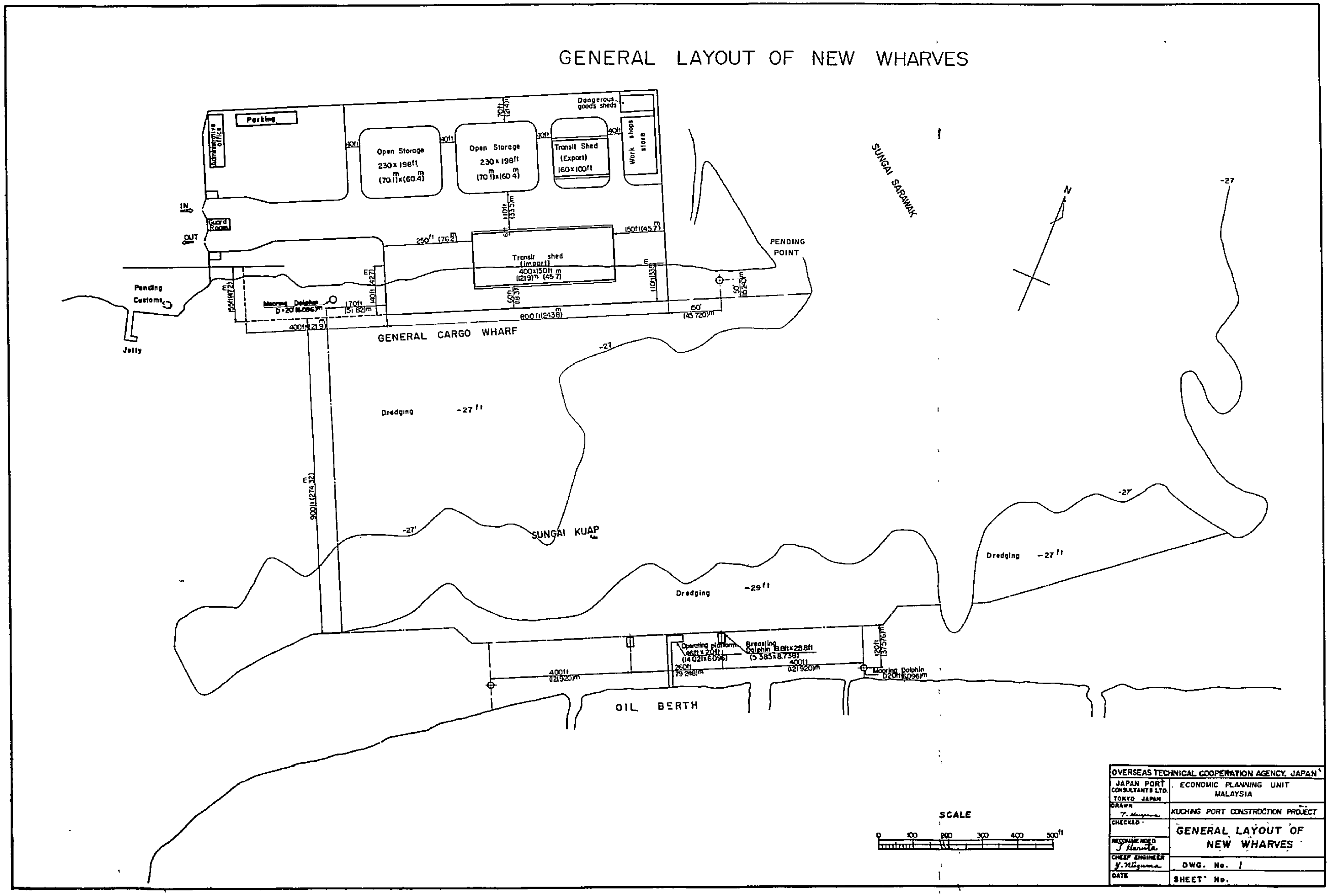
Scrutiny into all these conditions has led to the conclusion that there is no other alternative than to choose Pending for the site of the new wharf.

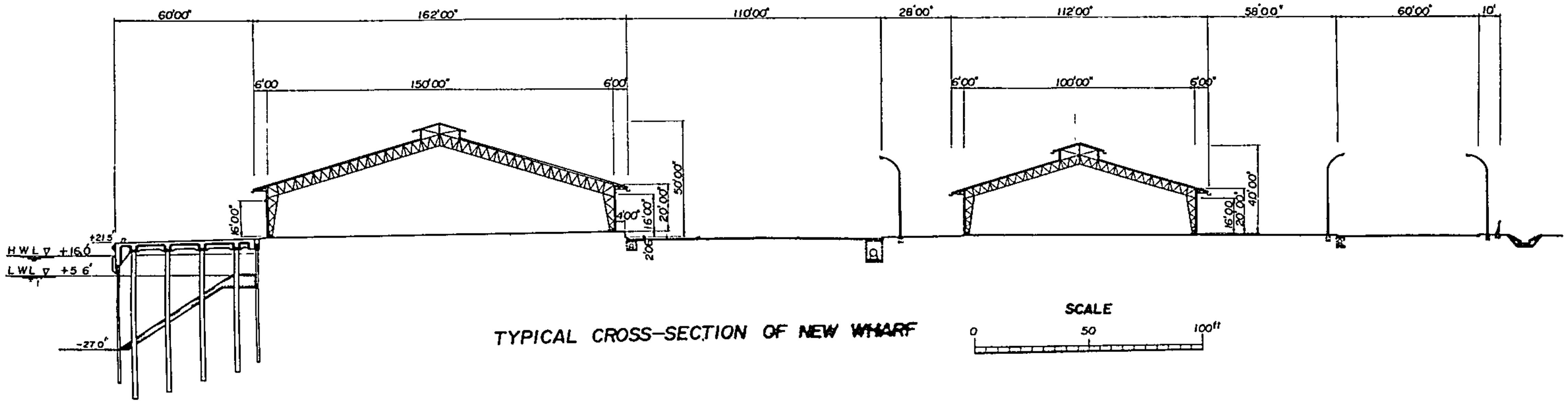
5-5 Plan for Facilities

(a) Mooring Wharf

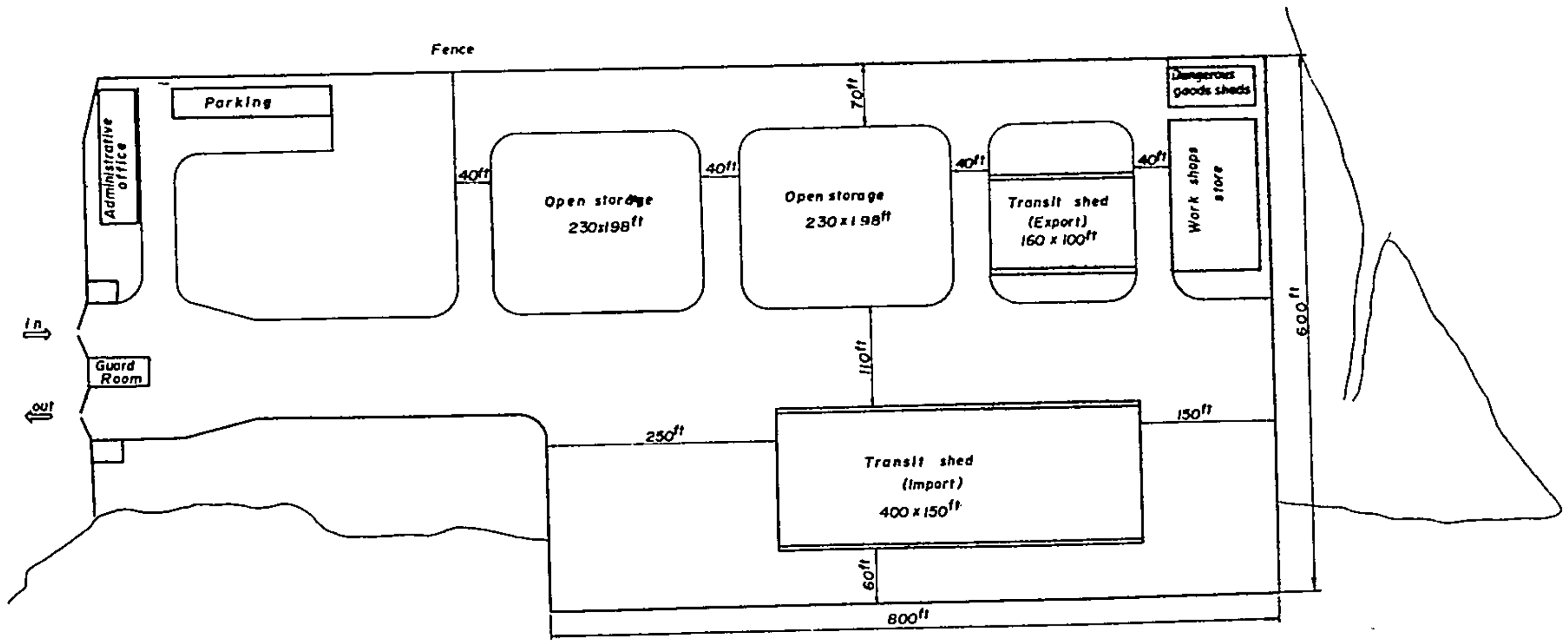
Length of Berth and its Place

The length of berth is to be 800ft. Its front normal line is to be set some 100ft


GENERAL LAYOUT OF NEW WHARVES
Parking
Administrative office
Open Storage
230 x 198ft
(70.1)m x (60.4)m
Open Storage
230 x 198ft
(70.1)m x (60.4)m
Transit Shed
(Export)
160 x 100ft
Dangerous goods sheds
Work shops store
IN
OUT
Guard Room
Transit shed
(Import)
400 x 150ft
(121.9)m (45.7)m
Pending Customs
Jetty
Mooring Dolphin
GENERAL CARGO WHARF
PENDING POINT
SUNGAI SARAWAK
N
Dredging -27ft
SUNGAI KUAP
Dredging -29ft
Dredging -27ft
-27'
Operating platform
Breasting Dolphin
Mooring Dolphin
OIL BERTH
SCALE
0 100 200 300 400 500ft
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN
JAPAN PORT CONSULTANTS LTD. TOKYO JAPAN
ECONOMIC PLANNING UNIT MALAYSIA
DRAWN
CHECKED
RECOMMENDED
CHEEF ENGINEER
DATE
KUCHING PORT CONSTROCTION PROJECT
GENERAL LAYOUT OF NEW WHARVES
DWG. No. 1
SHEET No.



TYPICAL CROSS-SECTION OF NEW WHARF



LAYOUT OF GENERAL CARGO WHARF

SCALE

0 50 100 150 200 ft

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DRAWN T. Hasegawa	KUCHING PORT CONSTRUCTION PROJECT
CHECKED	LAYOUT OF GENERAL CARGO WHARF AND TYPICAL CROSS-SECTION
RECOMMENDED I. Harita	
CHIEF ENGINEER Y. Nojuma	DWG No 2
DATE Sep. 10 1967	SHEET No

toward the mid-stream from the shore line to avoid rocky places, and the downstream end of the wharf is to be at some 300ft upstream from the tip of Pending Point in order to secure the area for wharf use. (See DWG. No. 1 & 2)

Depth in the Front Area of the Wharf

Putting the largest draft of vessels at 25ft and allowing some room thereto, the depth of water in the front area is to be 27ft below Chart Datum.

Width of the Apron

On the assumption that a vessel's mast crane and forklift are to be used in loading and unloading, the apron is to have a width of 60ft. Even in cases of possible container transport in the future, this will be wide enough for use of a trailer-forklift in loading and unloading a vessel.

(b) Transit Shed

Judged from the use made of Tanah Puteh Wharf in the past and in accordance with the view of K.P.A., one transit shed for exports of 16,000 square feet and another for imports of 60,000 square feet are to be built.

(c) Open Storage

In the light of past performance at Tanah Puteh Wharf, the open storage should have an area of 85,000 square feet.

(d) Warehouses

The warehouses at Tanah Puteh Wharf and in the city are to be made use of for the time being, and construction of new ones is not reckoned in the first stage of the plan. In the future, they will have to be built in the rear of the wharf.

(e) Wharf Area

According to the present plan, prospects are that expansion of facilities will be required after 1980. To meet the requirement, an area of land and water of 1,200ft in front length and 600ft in depth is to be secured to provided for a 400ft-expansion on the upstream of the new wharf.

(f) Tugboats

It is expected of the new wharf to provide moorage for vessels larger in size as well as in number than before. A little upstream of the wharf lies Pending Rock and the river bottom is rocky, making it hard for the anchor to hold fast and firm. To meet this situation, two tugboats are to be provided.

(g) Anchorage

The anchorage in front of the wharf is to be dredged to the depth of -27ft. The area to be dredged is: an area with a width of 900ft from the pier line which extends from the point 170ft farther upstream from the end of the 1,200ft long pier to about 1,200ft downstream from the Pending Pt.

(h) Cargo Handling Equipment

Mobile cranes, truck cranes, forklifts, trailers, and pallets are to be purchased.

(i) Others

A warehouse for dangerous goods, a workshop, a fire station and a gate are to be established.

CHAPTER VI PRELIMINARY DESIGN FOR PORT FACILITIES

CHAPTER VI PRELIMINARY DESIGN FOR PORT FACILITIES

6 1 The Scope of the Preliminary Design

The scope of the preliminary design contained in this report covers, in principle, the wharf for general cargoes at Pending and its ancillary structures and incidental work, and does not include the facilities located outside the port area. As regards the oil berth, as stated in Chapter V, design has been made for mooring facilities and cargo-handling equipment alone for reference sake, and work on rough estimates has been reckoned separately. Accordingly, pipelines have been excluded from our present purpose. The work for establishing connection with the trunk lines of roads, water service and electricity outside the port area have also been excluded from our present purpose.

In this report, which is a feasibility report, the preliminary design has been limited to necessary minimum calculations, and being not a working design, does not contain detailed design. Drawings, likewise, contain only a general view, standard sectional views and typical details, but detailed views are omitted.

6-2 Matters Noted in Designing

Matters noted in working out a preliminary desing are as follows:

(a) According to past records, the greatest wind velocity was 70m.p.h., which is considerably large for tropical regions. Wind pressures which buildings like transit sheds and moored vessels suffer and Impact which are felt by vessels at the time of getting moored, should be noted.

(b) The current of the river, although no accurate data are available, is estimated to run at the speed of 4kt, or 5kt in some places, at the maximum at spring tide. A little below Pending Customs, the left bank is eroded by waters, and therefore, the pier should be so constructed as to be free, as far as possible, from such erosive effect.

(c) The river is subject to tidal effects of the open sea and has a large range of level. In time of a flood caused by heavy rain, the land is submerged from time to time. All these need be taken into full account.

(d) Such structure should be avoided as will necessitate retracing through the influence of a swift current in the course of progress of work.

(e) The soil survey has revealed that the soil differs in nature from place to place, with rock-beds and sand and clay deposits lying mixed. In the designing of structures, such complicated and peculiar nature of soil should be taken into full account.

(f) Shortage of labour especially of akilled labour, force makes it desirable to adopt such structure as will allow employment of machinery. But such structure as will require a high degree of executive technique or involve use of many work vessles should be avoided.

(g) Berth shortage at Kuching Port is so serious that construction of new facilities is now a pressing need. Structure that will require a prolonged construction period should be avoided.

6-3 Conditions for Design

(a) Designed depth : -27ft (Below Chart Datum)

(b) Tidal level :

H.H.W.L.	+21.0ft
H.W.L.	+16.0ft
L.W.L.	+ 5.6ft
L.L.W.L.	+ 1.5ft

(c) Earthquake :

Kv = Kh = O

(d) Waves : Not taken into account.

(e) Current velocity : 4kt at the maximum.

(f) Wind velocity : SW - NW 35.0m/sec.

(g) Surcharge :

Uniform load	$2.0t/m^2$
Motor car load	TL - 20
Crane load :	10-ton capacity wheel-crane or truck-crane.

(h) Speed at which vessels are moored :

15,000 D.W.T. Draft 7.6m	V = 0.15m/sec.
3,000 D.W.T. Draft 5.6m	V = 0.20m/sec.
1,000 D.W.T. Draft 4.2m	V = 0.20m/sec.

6-4 Preliminary Design

6-4-1 Mooring Wharf

(a) Comparative Designing

Comparative designing has been made in three types, namely, gravity type, sheet-pile type and shore-bridge type.

The gravity type is to remove sand deposits from the soft surface and construct the quaywall proper of prepact concrete on the shale layer. The merits of this type lie in the absence of difficult points in the excution of work and in freedom from any hindrance in installing a crane of large capacity in case it is required in the future. But it has drawbacks in that it is the most expensive type of the three and reduces the sectional area of the river.

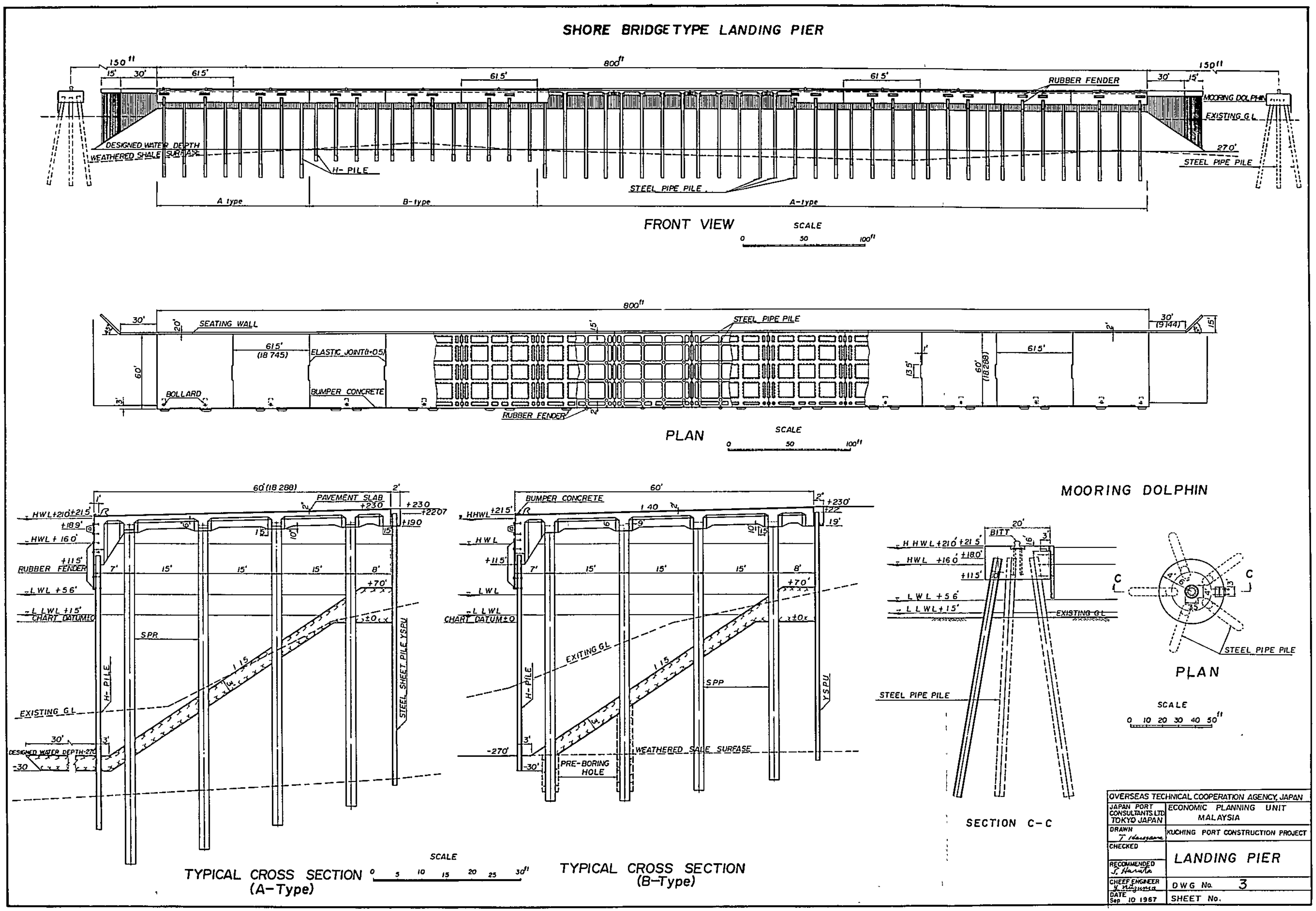
The sheet-pile type is to drive steel sheet-piles into the shale layer and to reclaim their rear side. This type has similar merits to those of the gravity type, and in terms of costs, it makes no big difference as compared with the shore-bridge type. But there is a fear of having to retrace the work done and besides, the sectional area of the river is reduced.

The shore-bridge type has these advantageous points as follows: there are very few difficult points in the execution of work, reduction in the sectional area of the river is small and costs are the smallest of the three. Despite the fact that by this type, it is difficult to remodel the structure when it is required to install a large handling machine in the future (and little of such possibility exists, though), this last type has been adopted.

(b) Structure

The designed depth is to be put at -27ft, the length at 800ft and the top end of the pier front at +21.5'. In the rectangular direction to the pier are driven in 4 steel pipe piles at intervals of 15ft, and in the parallel direction to the pier, they are driven in at intervals of 16.5ft. At the front edge of the pier, H-type steel sheet piles are driven in to protect steel pipe piles and for the furnishing of fenders. At the back of the pier are driven in steel sheet piles in succession as sheeting. All piles and sheet piles are to be driven into the rock-bed. These piles and sheet piles are linked together with beams and slabs of reinforced concrete provided, which are to form an apron of 60 ft in width. Under the concrete slab is an inclined plane sloping at 1:15 and covered with stone. The river bed in front of the pier is placed stones to the width of 30ft for protection of the river against erosion by water current.

On the upper part of the face of the pier are placed rubber fenders as a shock absorber in time of a vessel being moored. Bollards are to be provided at intervals of 61.5ft for vessels to be moored to. (See DWG. No. 3)


SHORE BRIDGE TYPE LANDING PIER
800 ft
150 ft
615'
RUBBER FENDER
MOORING DOLPHIN
EXISTING G.L.
DESIGNED WATER DEPTH
WEATHERED SHALE SURFASE
H- PILE
STEEL PIPE PILE
A type
B-type
A-type
FRONT VIEW
SCALE
0 50 100 ft
SEATING WALL
ELASTIC JOINT
BUMPER CONCRETE
BOLLARD
PLAN
PAVEMENT SLAB
HWL +21.0
HWL +16.0
RUBBER FENDER
L.WL +5.6'
L LWL +1.5'
CHART DATUM ±0
SPR
EXISTING G.L
STEEL SHEET PILE YSPU
TYPICAL CROSS SECTION (A-Type)
SCALE
0 5 10 15 20 25 30 ft
PRE-BORING HOLE
WEATHERED SALE SURFASE
SPP
TYPICAL CROSS SECTION (B-Type)
BITT
SECTION C-C
PLAN
SCALE
0 10 20 30 40 50 ft
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN
JAPAN PORT CONSULTANTS LTD TOKYO JAPAN
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DRAWN
KUCHING PORT CONSTRUCTION PROJECT
CHECKED
RECOMMENDED
LANDING PIER
CHEEF ENGINEER
DWG No. 3
DATE Sep 10 1967
SHEET No.

The surface of the apron is to slope at 1:40 for better drainage.

Where the rock-bed is too hard to drive in a pile, a hole slightly larger in diameter than a pile is dug, in which the pile is to be put and concreted firmly.

At a point some 150ft from each end of the pier, and close to the bank, the mooring dolphins are to be provided. They are to be constructed of 5 steel-pipe piles driven in at an angle of 10° and concreted on the top, on which a bit is placed.

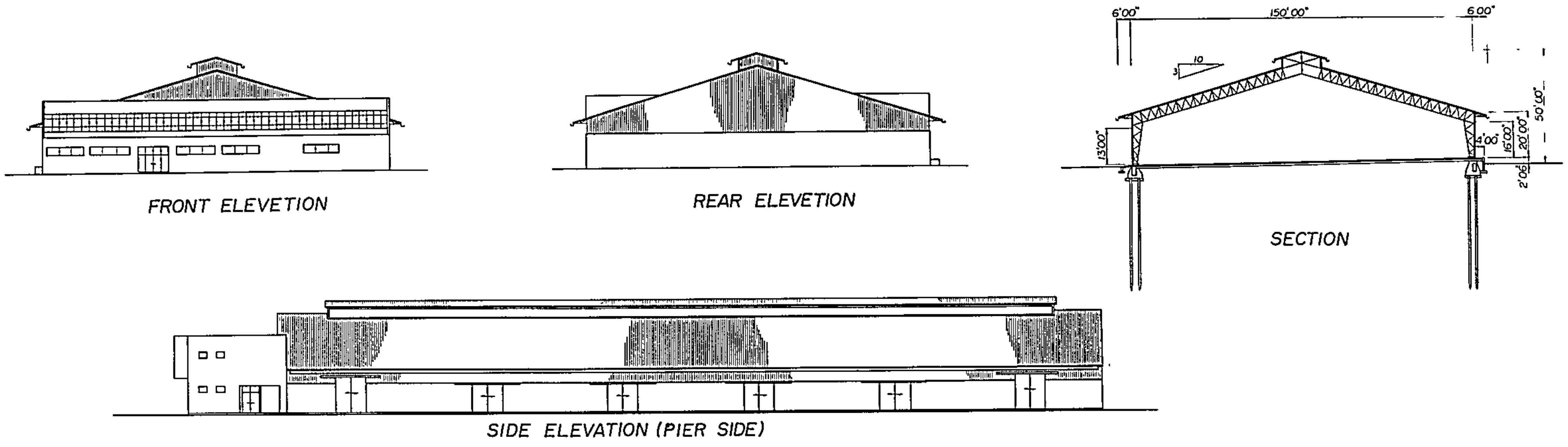
Steel-pipe piles and sheet piles are protected against corrosion by cathodic protection.

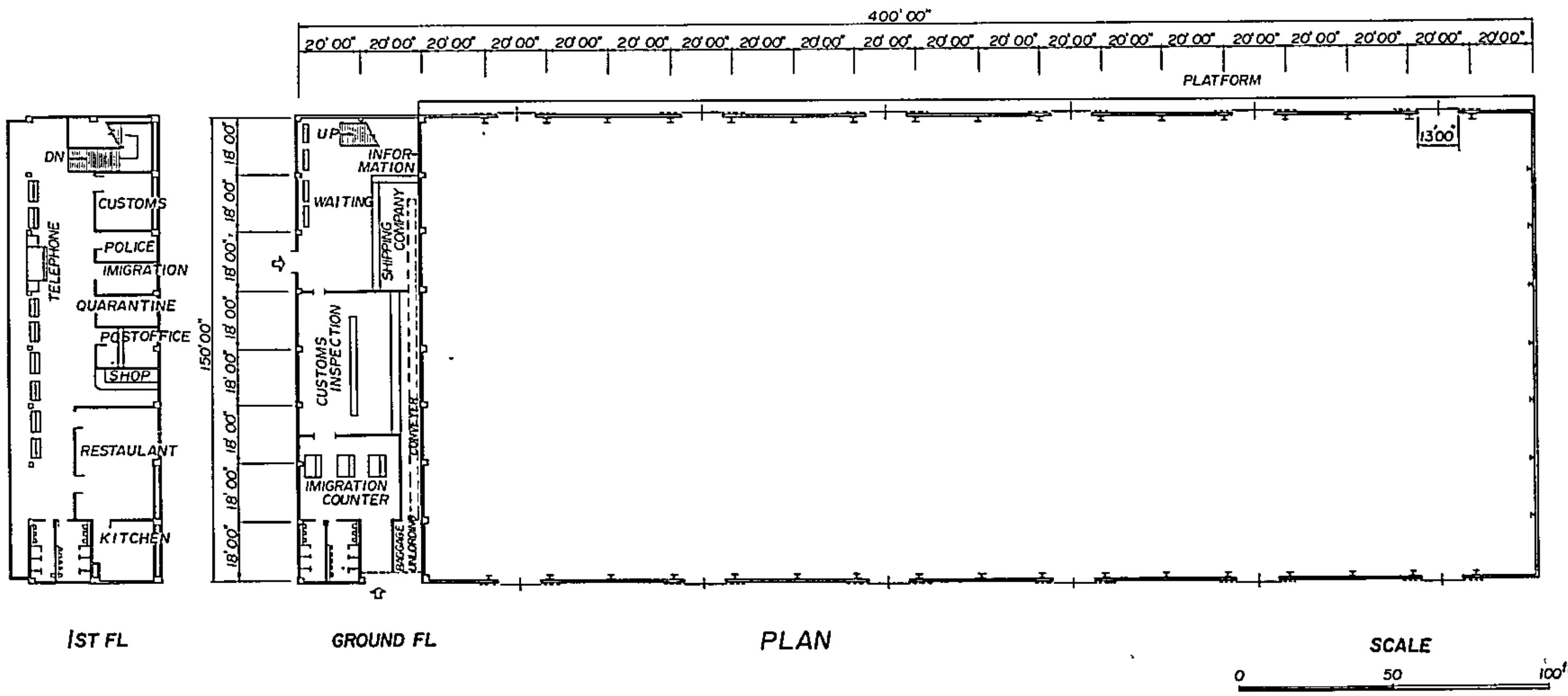
6-4-2 Transit Sheds

Transit Sheds for export and import are both of steel skeleton structure which has no intermediate supports. For steel skeleton truss has been chosen a diamond truss which is sutable for a structure of a large span. It is characteristic of this truss that its component is a solid skelton of triangular meshwork and therefore, it is a rational structure without any tie or bracing, that it needs no staging, that it is constructed economically, and in addition, it has a geometrical beauty.

The transit shed for imports is to have a span of 150ft and a length of 400 ft (of which 40ft is for passengers' use). There are to be 6 gateways both in the side facing the quaywall and in the reverse side, one on each end being 13ft wide and 16ft high and the rest 13ft both in width and height.

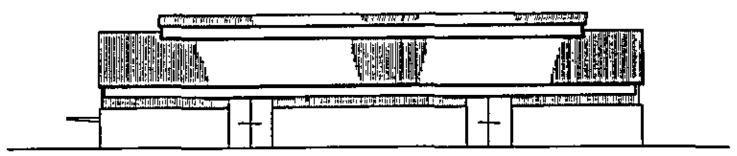
The passengers' quarters are two-storied with a total floor area of 13,000 square feet. On the ground floor, a certain space is reserved for Customs quarantine, immigration service and inspection of personal effects, and on the 1st floor, governmental office rooms, a post office, restaurants, telephones and money exchange are to be arranged. (See DWG. No. 4)



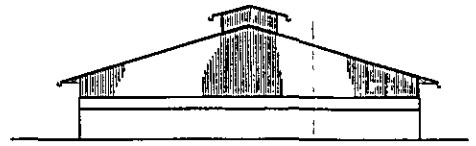


IMPORT TRANSIT SHED	
GENERAL	
FRAME	DIAMOND DIAGONAL STEEL TRUSS
ROOFING	RESIN COATED CORRUGATED GALVANISED IRON SHEET ON ASF LT FELT & CEMENTED EXCELSIOR BOARD
WALL UPPER	CORRUGATED ASBESTOS CEMENT SHEET
LOWER	REINFORCED CONCRETE MORTAL FINISH
FLOOR	REINFORCED CONCRETE
FOUNDATION	PRETENSIONED SPUN CONCRETE PILES
RAIN GUTEER	MADE OF GALVANISED IRON SHEET
PAINTING	ONE SHOP COAT OF RED OXIDE CHROMITE PRIMER & TWO SITE COAT OF OILPAINT
PASSENGERS QUARTERS	TWO STORIES REINFORCED CONCRETE CONSTRUCTION

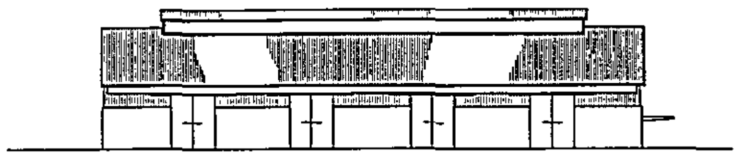
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN	
JAPAN PORT CONSULTANTS LTD TOKYO JAPAN	ECONOMIC PLANNING UNIT MALAYSIA
DRAWN T. Ideogawa	KUCHING PORT CONSTRUCTION PROJECT
CHECKED	IMPORT TRANSIT SHED
RECOMMENDED J. Harada	
CHEEF ENGINEER Y. Niizuma	DWG No 4
DATE Sep 10 1967	SHEET No.



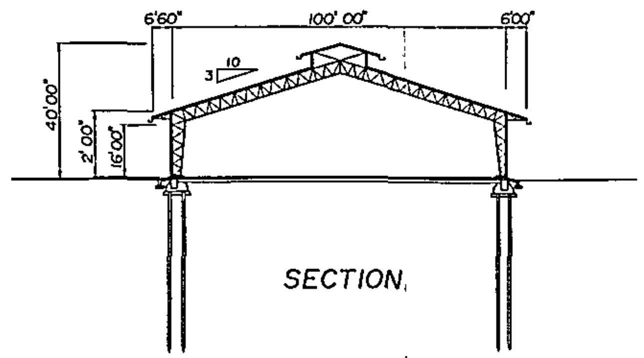
SIDE ELEVATION (REAR)



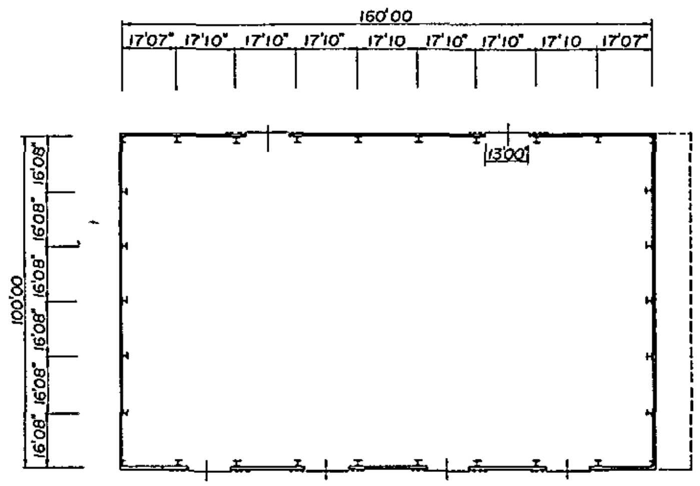
END ELEVATION



SIDE ELEVATION (PIER SIDE)



SECTION



PLAN

SCALE

0 50 100ft

EXPORT TRANSIT SHED	
GENERAL	
FRAME	"DIAMOND DIAGONAL STEEL TRUSS
ROOFING	RESIN COATED CORRUGATED GALVANIZED IRON SHEET ON ASPHALT FELT & CEMENTED EXCELSIOR BOARD INSULATION
WALL, UPPER.	CORRUGATED ASDESTCS CEMENT SHEET
LOWER	REINFORCED CONCRETE MORTAL FINISH
FLOOR	REINFORCED CONCRETE
FOUNDATION	PRETENTIONED SPUN CONCRETE PILES
RAIN GUTTER	MADE OF GALVANIZED IRON SHEET
PAINTING	ONE SHOP COAT OF RED OXIDE CHROMITE PRIMER & TWO SITE COAT OF OIL PAINT

OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN	
JAPAN PORT CONSULTANTS LTD TOKYO JAPAN	ECONOMIC PLANNING UNIT MALAYSIA
DRAWN T. Hasegawa	KUCHING PORT CONSTRUCTION PROJECT
CHECKED	EXPORT TRANSIT SHED
RECOMMENDED T. Harita	
CHIEF ENGINEER	D.WG No 5
DATE Sep 10 1967	SHEET No.

The transit shed for exports is to have a span of 100ft and a length of 160 ft. There are to be 4 gateways in the side facing the pier and 2 in the reverse side, all being 13ft wide and 16ft high. (See DWG. No. 5)

Both import and export transit sheds are to have eaves of 20ft high and are to be roofed with steel plates. The walls are lined with corrugated slate— the upper part is coated with asbestos and the lower part is built in reinforced concrete and touched up with mortar. (See DWG. No. 4 & 5)

The floor is to be concreted. For the foundation of the walls, prestressed concrete piles are to be used.

About 30ft-thick layer of clay lies in the upper surface of the land for the designed site. As to the site for the sheds, the ground will be improved by the paper drain method, as will be stated later on, and it is possible thereby to prevent future settlement of the ground. Therefore, there is no need for foundation piling except for the walls.

6-4-3 Administrative Office

The administrative office is to be a 2-storied building built in light-weight steel skelton. 35ft wide and 140ft long, the building has an entrance and a stairway in the middle. Both the ground and the 1st floors have corridors in the front part of the building, office rooms being arranged in the rear part.

For the foundation, prestressed concrete piles are to be used.

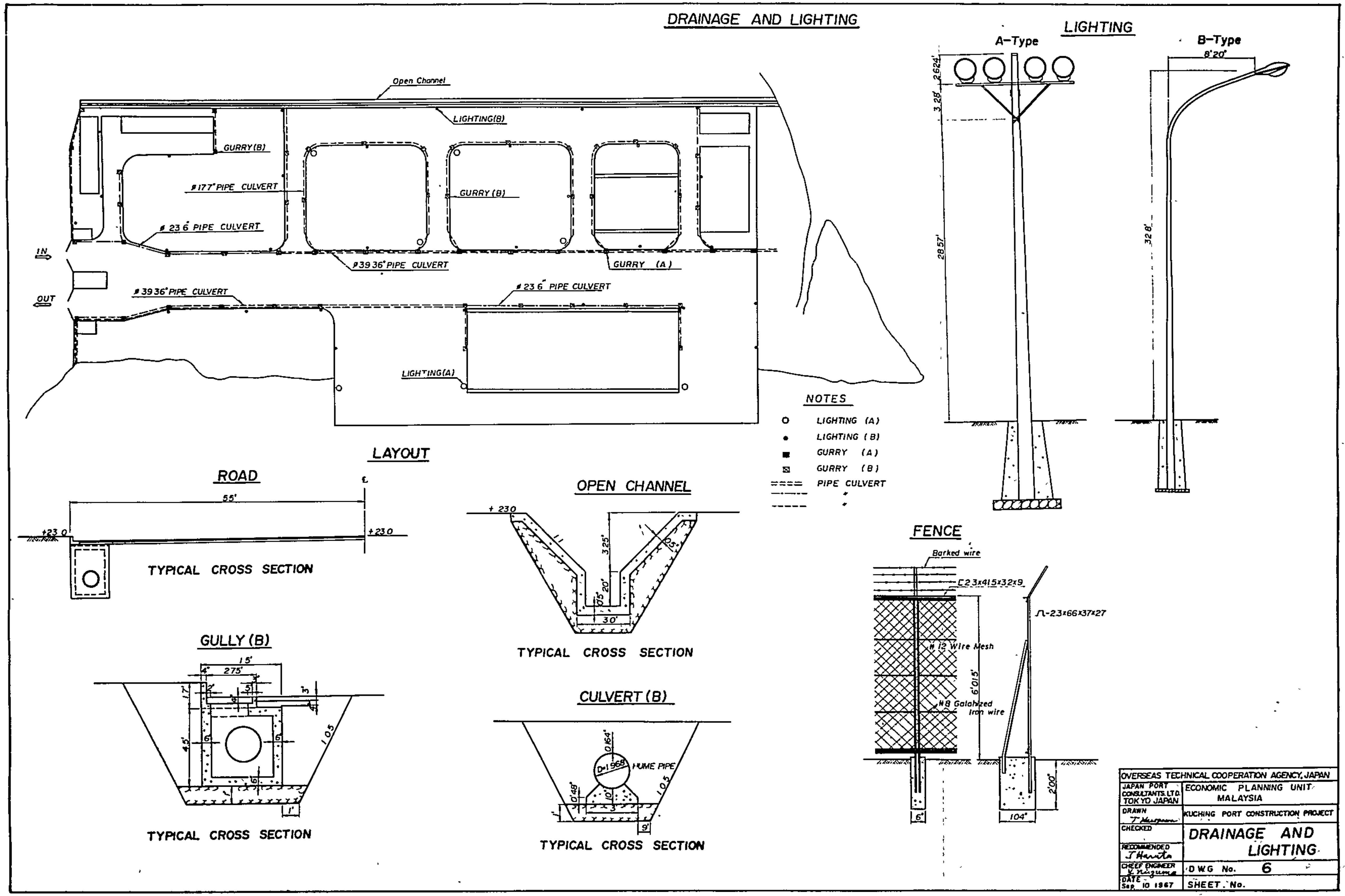
6-4-4 Roads

A total surface area of about 317,000ft^2 of the roads within the premises and an open space beside the transit shed for imports are to be paved with asphalt. The road running at the back of the import transit shed is to have a width of 110ft and one between the shed and the open storage, a width of 40ft.

The roads are to be paved 18 in thick.

Surface pavement	3in. thick
Road bed	4in. "
Lower bed	11in. "
Total	18in. thick

The surface is to be a little higher in the middle, with a cross-grade of 1.5 per cent. The roads are to have drains --- culverts in some places and conduits in others. The drains are to be so designed as to meet a heavy rain which may amount to 30mm in ten minutes.


DRAINAGE AND LIGHTING
Open Channel
LIGHTING(B)
GURRY(B)
ø177" PIPE CULVERT
ø 23 6" PIPE CULVERT
GURRY (B)
ø39 36" PIPE CULVERT
GURRY (A)
IN
OUT
ø 39 36" PIPE CULVERT
ø 23 6" PIPE CULVERT
LIGHTING(A)
LAYOUT
NOTES
LIGHTING (A)
LIGHTING (B)
GURRY (A)
GURRY (B)
PIPE CULVERT
LIGHTING
A-Type
B-Type
ROAD
55'
TYPICAL CROSS SECTION
OPEN CHANNEL
TYPICAL CROSS SECTION
GULLY (B)
TYPICAL CROSS SECTION
CULVERT (B)
HUME PIPE
TYPICAL CROSS SECTION
FENCE
Barked wire
#12 Wire Mesh
#8 Galvanized Iron wire
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN
JAPAN PORT CONSULTANTS, LTD. TOKYO JAPAN
ECONOMIC PLANNING UNIT MALAYSIA
DRAWN
CHECKED
KUCHING PORT CONSTRUCTION PROJECT
RECOMMENDED
DRAINAGE AND LIGHTING
CHEEF ENGINEER
DWG No. 6
DATE Sep. 10 1967
SHEET No.

6-4-5 Dredging

The shallow parts in front of the pier are to be dredged to the depth of -27ft. The quantity of soil to be dredged is 210,000 yd^3, of which 60,000 yd^3 is shale.

For the dredging of sand and clay, a suction dredger is used and for the dredging of shale, a rock cutter and a dredger will have to be used.

6-4-6 Reclamation

The land of about 620,000ft^2 at the back of the pier designed for the port area is to be reclaimed up to the level of +23ft. The quantity of earth required is about 5,110,000ft^3.

According to the calculation of consolidated settlement of sample soils of the supersurface which was done by using the data of this team's boring tests of soil nature, it is estimated that settlement between 2.5ft and 3.3ft will take place. About 7.5 years' time will be required for 80 per cent of the estimated settlement to finish. If settlement goes on at this rate, after the completion of the work, it will cause disturbance in the use of the transit sheds and other buildings. Improvement is to be made by the paper drain method, therefore, on the ground designed for the sites of the import and export transit sheds, the warehouses for dangerous goods and the workshop.

6-4-7 Tugboats

Since arrivals of vessels of the maximum 15,000 DWT are expected at the port in the future, 2 variable-pitch propelled tugboats of 800ps should be kept to help a vessel in getting moored or unmoored.

6-5 Plan for Execution of Work

6-5-1 Vessels and Equipment for Use in Execution

(a) Those Common to All Kinds of Work

Concrete plant :	Motor
Truck :	Trailer
Dump car	Bulldozer
Mobile crane	Truck crane
Excavator	Midzet belt-conveyer
Cutter	Welder
Generator	Winch

(b) For Work on Pier and Dredging Work

- Dredger
- Floating crane
- Tugboat
- Hopper barge
- Pontoon
- Floating pipe driver

(c) Building Work

- Pile driver

(d) Road and Reclamation Work

- Boad-roller
- Asphalt Plant
- Equipment for Paper Drain Method

6-5-2 Conditions for Execution of Work

(a) Labour

On account of a small population, there is a shortage of labour in general, especially of skilled workers. In carrying out the work, most of the skilled workers, it is thought, will have to be sought for outside Sarawak.

Wages are roughly estimated as follows :

General workers	M$	5 - 6/d
Carpenters	"	8 - 15
Electricians	"	7 - 11
Drivers	M$	180/m

(b) Materials

All construction materials except timber, earthen pipes, gravel, sand and stones will have to be imported. Although natural gravel is not obtaineable in the neighbourhood, P.W.D. has a quarry under its direct management about 7 miles south of Kuching. A quarry owned by Kuang Ching Chahg Co., Ltd. in Mt. Stapok some 5 miles south-west of Kuching is exclusively for private demands. Both quarries produce crushed stone.

Prices of materials for work are as follows :

Gravel M$ 9 /yd^3; Sand M$ 5 - 6 /yd^3; Stone M$ 8 - 9 /yd^3;

Cement M$ 78 /t;

Gasoline 1.58 cent/gallon.

Processed timber M$ 140 - 160 /50ft^3;

(c) Electric Power

The Sarawak Electricity Supply Corporation is responsible for generation and distribution of power. There are 20 power stations in the country, of which one in Kuching is the largest in generating capacity. Their generating capacity, power output, etc. are as follows. (as of 1965).

	Generating Capacity (KW)	Max. Demand (KW)	Units Generated (KWH)
Total for Sarawak	18,324	11,239	48,670,016
Kuching	7,925	6,350	30,865,116

The power transmission line is of 50C and 11,000V, which is reduced to 415V through the transformer.

The average unit price is as follows (as of 1965) :

Household use	31.5 cents/KWH
Commercial use	15.0 "
Industrial use	10.5 "

Situated about 0.5 mile south-west of Tanah Puteh and not far from Pending, Kuching Power Station is most suitably located for expansion of power supply, facilities consequent upon the construction of the new port.

(d) Water Service

Water supply is the responsibility of Kuching Water Board. It has two water sources. One is Matang Source, which takes in water from Sungei China in the western part of the city and the other is Batu Kitang Source which takes in water from the Sarawak River in the south-western part of the city.

In 1965, about 1,263,000,000 gallons of water was consumed, averaging about 3,500,000 gallons a day, the maximum daily consumption being 4,000,000 gallons. The water supply facilities are steadily being improved and there is nothing to fear about increasing demand in Pending.

Rates are as follows :

Commercial Rate		Domestic Rate	
Up to 5,000 gal/m	11$	Up to 2,000 gal/m	2.5$
6,000	13	3,000	3.75
7,000	15	4,000	5.00
8,000	17	5,000	6.25
9,000	19	6,000	7.50
10,000	21	7,000	8.75

6-5-3 Points at Issue in the Execution of Work

Generally speaking, port construction work requires special executive technique. It is to be noted, however, that for the following reasons, there are some factors peculiar to this project which are liable to prolong the construction period as compared with port construction work in other lands.

(1) The river is subject to the tidal influence in the open sea and has a large range of level of water and a considerably large velocity.

(2) It takes a long period of time to go through the work of dredging rock-beds in the river bottom.

(3) The ground is soft and weak due to the existence of a layer of clay deposits, leading to uneven settlement due to consolidation. It is, therefore, advisable to commence work of road pavement and drainage as late as possible.

(4) Because of the limited number of machines and vessels for use in the execution of work and the major materials having to be imported, much time is required for preparations.

(5) Shortage of skilled workers makes it unavoidable to train unskilled workers, and it will be long before they are skillful enough.

The land for the port area is covered with nipa palms and mangroves, which the contractor will have to get rid of promptly after he will have been awarded the contract in order to set to work raising the ground level. To do so will not only facilitate the execution of work but will enable him to have space to build a yard for his materials and his workshop, and more than that, will help accelerate the progress of settlement due to consolidation.

6-6 Plan of Schedule

The construction period is, as shown in Table 6-1, a three years' period from commencement of work on design. A working design will have to be prepared and a tender for the work will have to be produced, to begin with. This will take 6.5 months.

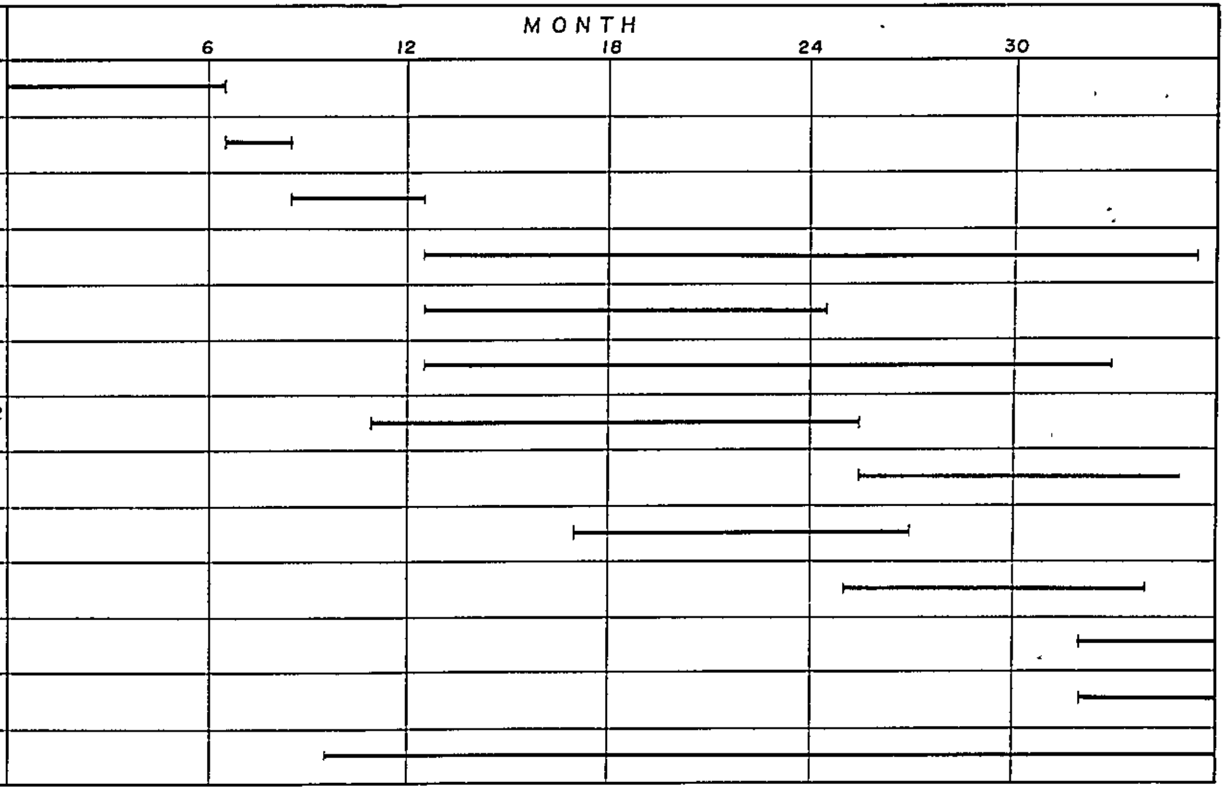
To accelerate progress of work, it is necessary to make careful preparations and map out a minute working plan and have a thorough knowledge of peculiar conditions of work on the spot.

Generally speaking, port construction work is done under water and many machines and vessels peculiar to this work have to be used and special technique is required. Most important of all factors that will have direct influence upon the progress and the workmanship of the work is to select an authentic contractor who is widely and well experienced in port construction work and possess high technical skill.

Table 6 - 1

CONSTRUCTION SCHEDULE

DIVISION OF WORKS		NUMBER
DESIGN		
TENDER		
PREPARATION	MARINE TRANSPOTATION	
	TEMPORARY WORKS	
LANDING PIER		800 ft
DREDGING		7622.100 ft³
RECLAMATION		620.000 ft²
ROAD		317000 ft²
TRANSIT SHEDS		2
OTHER BUILDINGS		
CARGO HANDING EQUIPMENTS		
TUG BOATS		2
OTHERS		



CHAPTER Ⅶ APPROXIMATE ESTIMATE OF CONSTRUCTION COSTS

CHAPTER VII APPROXIMATE ESTIMATE OF CONSTRUCTION COSTS

7-1 Basic Conditions

The chief conditions which have been taken into consideration in working out an approximate estimate of construction costs are as follows;

(1) The consultant who will enter into contract with the owner, K.P.A., is to be responsible for the working design for, and supervision over, the work of this project.

(2) The execution of work is to be undertaken by a contractor from abroad either by employing a domestic contractor as subcontractor or on the basis of joint venture with a domestic contractor.

(3) Work which requires high technical skill and many years' experience is to be performed by a foreign contractor who will bring technical engineers and skilled workmen to work under him, and a domestic contractor will perform other general works.

(4) In this plan, estimation has been done on the premise that a contractor from abroad is to be a Japanese.

(5) Estimation of construction costs has been done on the basis of the prices of commodities as of April, 1967. In case any extraordinary change takes place in the prices of commodities, these costs are to be subjected to reviewal.

(6) These construction costs do not include the following expenses:

(i) The owner's management and office expenses.

(ii) Any increases in the construction costs due to extraordinary natural calamities or change in the social situation.

(iii) Import duties on the import of materials and equipment to be transported.

(7) The estimated amounts of money, both foreign and domestic currencies, are given in Malaysian dollar. The division between the foreign and domestic currencies are in the main as follows :

Labour expenses :	Foreign currency	.....	Technical engineers & silled workmen.
	Domestic "	.....	Assistants to skilled workmen ; unskilled workmen.
Materials :	Foreign "	.....	Steel, cement, wire, & electric cable, asphalt & etc.

	Domestic currency ...		Stone, concrete aggregate, gasoline, oil & fat, timber, electric power, earthen tubes, etc.
Vessels & Machinery:	Foreign	"	Depreciation & maintenance
	Domestic	"	Rents & maintenance
Transport expenes :	Foreign	"	Between Japan & Kuching
	Domestic	"	Between Kuching & Singapore
Taxes :	Domestic	"	Clearance fees on materials, Registration fees, & income tax.

(8) 10 per cent of the net construction costs have been reckoned as an contingency fund.

(9) Interests on foreign and domestic loans have been computed at 4.5 per cent and 6.0 per cent, respectively, based on ECAFE's calculation standard.

(10) Engineering expenses have been reckoned at 5 per cent of the net construction costs based on ECAFE's calculation standard.

7-2 Summary of Construction Costs

(a) General Cargo Wharf

Total costs of construction of the general cargo wharf amount to M$ 18,308,000, of which M$ 12,586,000 are in foreign currency and M$ 5,722,000 in domestic currency. Their breakdown is given in Table 7-1 and Table 7-2.

(b) Total costs of construction of the oil wharf amount to M$ 1,700,000, of which M$ 1,418,000 is in foreign currency and M$ 282,000 in domestic currency. Their breakdown is given in Table 7-3.

Table 7-1 Summary of Estimated Cost of Kuching Port Development Scheme

(in M$)

	Total Cost	Foreign Currency	Domestic Currency
1. General Cargo Wharf	18,308,000	12,586,000	5,722,000
2. Oil Wharf	1,700,000	1,418,000	282,000
Total	20,008,000	14,004,000	6,004,000

Table 7-2 Estimated Cost of General Cargo Wharf

(in M$)

Items	Total Cost	Foreign Currency	Domestic Currency
1. Landing Pier	4,355,400	3,131,300	1,224,100
2. Dredging	2,695,700	2,378,000	317,700
3. Reclamation	1,081,900	159,300	922,600
4. Roads	932,800	87,600	845,200
5. Transit Sheds	2,052,700	1,235,700	817,000
6. Other Buildings	961,200	597,200	364,000
7. Cargo Handling Equipments	827,500	801,500	26,000
8. Tug Boats	1,585,000	1,583,000	2,000
9. Others	508,800	390,400	118,400
10. Contingencies	1,499,000	1,036,000	463,000
Total	16,500,000	11,400,000	5,100,000
11. Engineering	825,000	570,000	255,000
12. Interest during Construction	983,000	616,000	367,000
Grand Total	18,308,000	12,586,000	5,722,000

Table 7-3 Estimated Cost of Oil Wharf (in M$)

Items	Total Cost	Foreign Currency	Domestic Currency
1. Dolphins and Platform	700,400	530,700	169,700
2. Dredging	244,500	197,500	47,000
3. Machins	377,000	375,000	2,000
4. Others	99,000	83,800	15,200
5. Contingency	142,100	118,700	23,400
Total	1,563,000	1,305,700	257,300
6. Engineering	78,000	65,300	12,700
7. Interest during Construction	59,000	47,000	12,000
Grand Total	1,700,000	1,418,000	282,000

CHAPTER Ⅷ ECONOMIC BENEFITS

CHAPTER VIII ECONOMIC BENEFITS

8-1 Economic Benefits in General

Economic benefits which are expected to result from a completed construction project are classified in two: direct and indirect. Direct benefits come in the form of reduction of transport charges and stevedorage, the wiping off of losses which have been caused through shipping and freight congestion, and port revenue such as port dues and fees. Indirect befefits are those consequent upon industrial development, a higher level of industrial structure and improvement of the income level resulting from development investments.

In the case of Sarawak, the economic structure of which is characterized by its dependence upon external trade and which has no other alternative transport facilities than sea transportation, ports are the mainstay of its economic activities. If Sarawak is to seek its economic development, construction of the necessary minimum port facilities should be the matter which defies consideration of benefits of investment. Failure to improve port facilities, for instance, would result in increased hours waiting berth, in a rise in sea transport charges, and in an advance in price of foodstuff and other daily necessities of life and of production goods such as fertilizer and machinery, leading to higher production costs and declining efficiency of economy. Prices and transport charges of export goods would then rise; shipping congestion would upset shipment schedules, which would occasion frequent cancellation of export contracts and give rise to claims, followed by stagnation of export trade. The result would be a frustration of the development of export industry and the industries associated with export trade and in the case of Sarawak, the development of the whole local economy.

In order to give larger opportunities for employment to the increasing population of Sarawak, to improve the level of income of the inhabitants, and thus to fill up the regional gap between Sarawak and Malaya, which are the aim of the Development project, the construction of a new wharf now projected is the necessary minimum to meet the purpose and should promptly be carried out.

8-2 Amortization plan of Loans

8-2-1 Borrowed Money

Of the sum of M$ 17,325,000 borrowed for the general cargo wharf, M$ 11,970,000 in foreign currency, at the rate of 4.5 per cent per annum, is to be amortized over a period of 20 years (including 5 years' deferment) in equal installments including interest, and M$5,355,000 in domestic currency, at the rate of 6 per cent per annum is to be amortized within 30 years (including 5 years' deferment).

8-2-2 Revenue and expenditure Predicted

Amortization of the borrowed money and the interest thereon is to be met by net profits of K.P.A. K.P.A.'s revenue and expenditure has been predicted based on the volume of cargoes to be handled at the wharf and K.P.A.'s past actual revenues and expenditures.

(a) K.P.A.'s Revenue Predicted

a-1 Volume of cargoes Handled and Tonnage of Vessels

The volume of cargoes handled at Kuching Port is assumed to reach 560,000 tons in 1977 and 650,000 tons in 1980, on the assumption, however, that the volume of cargoes to be handled each year is to see a 5 to 6 per cent increase. Thus the volume of cargoes to be handled each year have been computed as shown in Table 8-1.

Next, the gross tonnage of vessels coming in has been computed by using the ratio of the gross tonnage of vessels to the volume of goods. The gross tonnage of vessels to the volume of cargoes (C.T.) which made use of Tanah Puteh Wharf in the past years showed a value of 1.97 to 2.54.

In the future, due to growth in size of vessels and improvement in the ratio of the volume of cargoes handled to the vessels' loading capacity, it is considered that G.T./C.T. will show a gradual decrease from 2.4 to 1.9, on the assumption of which G.T. (gross tonnage of vessels) has been computed.

Table 8-1 Volume of Cargoes Handled and the Gross Tonnage of Vessels in the Future

Year	Volume of cargoes	Ratio	Gross Tonnage of Vessels
1968	352,000^{t}	2.4	844,800^{t}
69	374,000	2.4	897,600
70	397,000	2.35	933,000
71	420,000	2.3	966,000
72	441,000	2.25	992,300
73	463,000	2.2	1,019,000
74	486,000	2.15	1,044,900
75	510,000	2.1	1,071,000
76	535,000	2.05	1,096,800
77	560,000	2.0	1,120,000
78	587,000	1.95	1,144,700
79	618,000	1.9	1,174,200
80	650,000	1.9	1,235,000

a-2 Port Dues and Berthing Fees

Until the completion of the new wharf, there will continue to be shipping congestion, keeping vessels waiting for berth, but after its completion, there will be no such congestion and as the result, incomings from port dues and berthing fees per ton of vessels will decrease. Such incomings per ton in the past years were 81 cents in 1962, 72 cents in 1963, and 80 cents in 1964. Based on these results in the past years, such incomings have been assumed to be 80 cents during the construction period and 65 cents after the completion of the new wharf.

a-3 Stevedorage

Until the completion of the new wharf, overtime and other charges will often be imposed for night and holiday work, enhancing per ton stevedorage. After the completion, however, those charges will decrease, causing the stevedorage to fall. Stevedorage per ton has been assumed to be M$5.7 during the construction period and M$5.0 after the completion.

a-4 Receipts, Sorting and Delivery

Incomings from these charges per ton of goods were M$4.4 to 5.15 in the past years. In the light of these figures, those incomings have been computed at M$5.2 during the construction period and M$4.5 after the completion.

(b) K.P.A.'s Expenditure Predicted

b-1 Labourers' Wages

From 1964 to 1966, labourers' wages per ton of cargoes handled were M$3.70 on the average. Until the completion of the new wharf, imposition of extra stevedorage will often be the case, but after the completion, it will be less, it is expected. During the construction period, therefore, wages per ton of cargoes have been calculated at M$3.75 and after that at M$3.60.

b-2 Staff Salaries

From 1964 to 1966, staff salaries per ton of cargoes handled were M$2.5. Until the completion of the new wharf, overtime allowances will amount to a lot, but after the completion they will decrease. But, thereafter there will be a gradual increase due to promotion.

b-3 Repairs and Maintenance

Repairs and maintenances per ton of cargoes have been assumed to M$0.2 to 0.25.

b-4 Miscellaneous Expenses

Water and electric light rates, office supplies, oil, telephone charges, traveling allowance and the like come under this head. Past records show that they were about M$1.1 per ton of goods. Unit the completion of the new wharf, therefore, they have been assumed to be M$ 1.1 per ton of goods, and M$1.2 for 3 years after that, and M$1.1 there after.

b-5 Depreciation

Annual depreciation for the period from 1964 to 1966 was about M$ 1.2 per ton of goods. This figure has been used in assuming the future depreciation.

By way of precaution, replacement costs of each type of facilities have been calculated from its life.

The life of each type of facilities has been taken as follows :

Buildings and structures	60 years
cargo handling equipment	15 "
Tugboats	30 "
Electrical equipments	30 "

Between the prime cost and the annual savings (depreciation) for replacement, there exist the following relation:

$$D = \frac{i}{(1 + i)^n - 1} P$$

P: Prime cost

D: Annual savings (Depreciation)

i : Annual interest

n: Life

Amount of annual savings (cost of depreciation) necessary for replacement of pier, cargo handling equipment, tugboats, electrical equipments, and buildings totals M$103,937 a year, as shown in Table 8-2. The cost of depreciation of M$1.2 per ton of goods will be sufficient.

(c) Revenue and Expenditure Predicted

The predicted revenue and expenditure of K.P.A. are given in Table 8-3. Revenue is expected to show a gradual increase from M$4,512,000 for 1968 to M$6,978,000 for 1980. As for expenditure, as shown in Table 8-4, it is assumed to increase from M$3,097,000 for 1968 to M$5,792,000 for 1980.

Net profits are, therefore, expected to be in the region of M$1,029,000 to M$1,556,000, as shown in Table 8-3.

8-2-3 Amortization Plan

(a) Amount to be Amortized

Of the borrowed money, the loan in foreign currency, at the rate of 4.5 per cent per annum, is to be left unredeemed for 5 years and after that to be amortized in equal installments, including interest, over the period of 15 years. On this assumption the annual amount to be repaid is calculated as follows :

Annual Cost of Depreciation

	PRIME COST	%	ANNUAL COST
	$ M		$ M
1) Replacement of Cargo Handling Equipments at 15 yrs.			
Foreign Currency	801,500	0.05187	41,574
Domestic Currency	26.000	0.04296	1,117
2) Replacement of Tug-Boats and Electrical Equipments etc. at 30 yrs			
Foreign Currency	1,973.400	0.01639	32,344
Domestic Currency	120.400	0.01265	1 523
3) Replacement of Buildings and Quaywalls at 60 yrs			
Foreign Currency	4,964.200	0.004606	22.865
Domestic Currency	2,405.100	0.001877	4.514
TOTAL			103.937

Symbols used are : = Coefficient

A = Borrowed money; i = Annual rate of interest

B = Sum to be amortized; n = Term of repayment

X = Annual amount to be repaid; n_o = Period of deferment

$$X = \frac{i\,(1+i)^n}{(1+i)^n - 1} \times B$$

$$B = A\,(1+i)^{n_o} \times f$$

Now, $i = 0.045,\ n = 15,\ n_o = 5,$

$$X = \frac{0.045 \times 1.045^{15}}{1.045^{15} - 1} \times B$$

$$= \frac{0.0870876}{0.935280} \times B = 0.093114B$$

There will be earnings from Tanah Puteh Wharf and the new wharf at Pending during the period of 5 years' deferment. Suppose that out of the earnings, an amount C is to be repaid in the year when amortization begins,

$$X = 0.093114\,(B - C)$$

A	11,970,000$M	B = 13,744,000$M
Interest during Construction	616,000 "	
Interest up to commencement of amortization	1,158,000 "	

Assuming C = 5,200,000

$$X = 0.093114 \times (13,744,000 - 5,200,000) = 795,566$$

Hence the annual amount repaid is put at M$800,000 for the loan in foreign currency.

Amortization of the loan in domestic currency is to be met by a greater part of the remainder of the net proceeds after deducting M$800,000.

(b) Amortization Plan

As seen in Table 8-5, the loan in foreign currency is to be fully amortized in 20 years by repaying M$800,000 each year. As for the loan in domestic currency, its amortization is to be completed by 1990.

8-3 Cost-Benefit Ratio

The cost-benefit ratio varies with years. The year 1977, that is, the 10th year of the term of repayment of 20 years, has been chosen for its calculation.

(a) Reduction in the Cost of Vessels' Waiting Berth

As shown in Tables 4-2 and 4-7, in 1966, 198 vessels, or about 20 per cent of 624 vessels that made port in that year, were compelled to wait for berth, their waiting hours totaling 9, 950 hours. After the completion of the new wharf, this situation will cease to exist, producting no small effect in favour of shippers and owners.

The waiting hours, except those due to rainfalls, in 1965 and 1966 were as follows :

Year	Total waiting hours	Waiting hours due to rain	Balance
1965	10, 930 hrs.	1, 675 hrs.	9, 255 hrs.
1966	9, 950	1, 967	7, 983
		Average:	8, 619 hrs.
		In days:	359 ds.

Assuming that the total number of waiting days is 1. 3 times of the net waiting days, or 359 days, the total number of days will be 466 days.

Per-day per-vessel cost of waiting of the vessels which came to anchor at the port will average M$2, 500. Therefore, reduction in the vessels' cost will be

M$2, 500 x 466 = M$1, 165, 000

(b) Earnings from Port Operation

Port dues & berthing fees, etc.	M$ 728, 000
Stevedorage	2, 800, 000
R.S. & D.	2, 520, 000
Gross Revenue:	M$ 6, 048,.000$M

(c) Operating Cost

Labourers' wages	M$ 2, 016, 000
Staff salaries	1, 478, 000
Repairs & maintenance	123, 000
Depreciation	672, 000
Others	616, 000
Total Operating Cost	M$4, 905, 000

(d) Cost-Benefit Ratio

Thus the cost-benefit ratio in 1977 works out 1. 47.

ESTIMATED REVENUE

GENERAL CARGO WHARF

YEAR	ESTIMATED GROSS TONNAGE OF VESSELS	AVERAGE RATE PER GROSS TONNAGE	PORT DUES BERTHING FEES ETC	ESTIMATED TONNAGE OF DRY CORGO	AVERAGE RATE PER TON OF DRY CORGO		STEVEDORAGE	R S & D	GROSS REVENUE	TOTAL OPERATING COST	NET REVENUE
					STEVEDORAGE	R S & D					
1968	844 800 t	80 CTS	676 000 $	352 000 $	57 $	52 $	2 006 000 $	1 830 000 $	4 512 000 $	3 097 000 $	1 415 000 $
69	897.600	〃	718 000	374 000	〃	〃	2 132.000	1 944.000	4 794 000	3 303 000	1 491.000
70	933.000	〃	746 000	397 000	〃	〃	2.263 000	2 064 000	5 073 000	3 517 000	1 556.000
71	966.000	72	696 000	420 000	54	49	2 268 000	2 058 000	5 022 000	3 649.000	1 573.000
72	992.300	65	645 000	441 000	50	45	2 205 000	1 985 000	4 835 000	3 806 000	1 029.000
73	1 019 000	〃	662 000	463.000	〃	〃	2 315 000	2 084 000	5 061.000	3 974.000	1 087.000
74	1.044 900	〃	679 000	486 000	〃	〃	2 430 000	2 187 000	5.296 000	4 190.000	1.106.000
75	1 071 000	〃	696 000	510 000	〃	〃	2 550 000	2 295 000	5 541.000	4.427 000	1.114.000
76	1.096 800	〃	713 000	535.000	〃	〃	2 675.000	2 408 000	5 796 000	4 666 000	1.130 000
77	1 120.000	〃	728 000	560.000	〃	〃	2 800 000	2 520 000	6 048 000	4 905 000	1 143 000
78	1.144 700	〃	744 000	587 000	〃	〃	2 935 000	2 642 000	6 321 000	5.183.000	1.138 000
79	1 174.200	〃	763 000	618 000	〃	〃	3 090 000	2 781 000	6 634 000	5 483 000	1.151.000
80	1 235 000	〃	803.000	650 000	〃	〃	3 250 000	2 925 000	6 978 000	5 792 000	1 186 000
81	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
82	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
83	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
84	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
85	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
86	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
87	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
88	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
89	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
90	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
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ESTIMATED EXPENDITURE

Table 8-4

GENERAL CARGO WHARF

YEAR	ESTIMATED TONNAGE OF DRY CARGO	AVERAGE RATE PER TON OF DRY CARGO					LABOURERS WAGES	STAFF SALARIES	REPAIRS AND MAINTENANCE	DEPRECIATION	OTHERS	TOTAL OPERATING COST
		LABOURERS WAGES	STAFF SALARIES	REPAIRS AND MAINTENANCE	DEPRECIATION	OTHERS						
1968	352 000t	3 75$	2 50$	0 25$	1 2 $	1 1 $	1 320 000$	880 000$	88 000$	422 000$	387 000$	3 097 000 $
69	374 000	"	2 53	"	"	"	1 403 000	946 000	94 000	449 000	411 000	3.303.000
70	397 000	"	2 56	"	"	"	1 489 000	1 016.000	99 000	476 000	437 000	3 517 000
71	420 000	3 67	2 40	0 22	"	1 2	1 541 000	1 008 000	92 000	504 000	504 000	3 649 000
72	441 000	3 60	2 43	0 20	"	"	1 588 000	1 072 000	88 000	529 000	529 000	3 806 000
73	463 000	"	2 48	"	"	1 1	1 667 000	1 148 000	93 000	556 000	510 000	3 974.000
74	486 000	"	2 52	"	"	"	1 750 000	1 225.000	97 000	583 000	535 000	4 190 000
75	510 000	"	2 56	0 22	"	"	1 836 000	1 306 000	112 000	612 000	561.000	4 427 000
76	535 000	"	2.60	"	"	"	1 926 000	1 391 000	118 000	642 000	589.000	4 666 000
77	560 000	"	2 64	"	"	"	2 016 000	1 478 000	123 000	672 000	616 000	4 905 000
78	587 000	"	2 68	0 25	"	"	2 113 000	1 573 000	147 000	704 000	646 000	5 183 000
79	618 000	"	2 72	"	"	"	2 225 000	1 681 000	155 000	742 000	680 000	5 483 000
80	650 000	"	2 76	"	"	"	2 340 000	1 794 000	163 000	780.000	715 000	5 792 000
81	"	"	"	"	"	"	"	"	"	"	"	"
82	"	"	"	"	"	"	"	"	"	"	"	"
83	"	"	"	"	"	"	"	"	"	"	"	"
84	"	"	"	"	"	"	"	"	"	"	"	"
85	"	"	"	"	"	"	"	"	"	"	"	"
86	"	"	"	"	"	"	"	"	"	"	"	"
87	"	"	"	"	"	"	"	"	"	"	"	"
88	"	"	"	"	"	"	"	"	"	"	"	"
89	"	"	"	"	"	"	"	"	"	"	"	"
90	"	"	"	"	"	"	"	"	"	"	"	"
91												

Table 8 – 5

PLAN FOR REPAYMENT OF BORROWED MONEY

GENERAL CARGO WHARF

YEAR	ESTIMATED NETT REVENUE	FOREIGN CURRENCY AMOUNT INVESTED	FOREIGN CURRENCY AMOUNT REPAID INTEREST 4.5 %	FOREIGN CURRENCY AMOUNT REPAID PRINCIPAL	FOREIGN CURRENCY AMOUNT REPAID TOTAL	FOREIGN CURRENCY BALANCE	DOMESTIC CURRENCY AMOUNT INVESTED	DOMESTIC CURRENCY AMOUNT REPAID INTEREST 0 6%	DOMESTIC CURRENCY AMOUNT REPAID PRINCIPAL	DOMESTIC CURRENCY AMOUNT REPAID TOTAL	DOMESTIC CURRENCY BALANCE
	$	$	$	$	$	$	$	$	$	$	$
1,968	1.415 000	11.970 000					5 355 000				
69	1.491.000										
70	1.556.000					12 586 000					5 722 000
71	1.373.000					13 152 000					6 065 000
72	1 073 000			5 200 000	5 200 000	8 544 000			1 500 000	1 500 000	4 930 000
73	1.113 000		384 000	416 000	800 000	8 128 000		296 000	4 000	300 000	4 926 000
74	1.155.000		366 000	434 000	〃	7.694 000		296 000	24.000	320 000	4 902 000
75	1.165.000		346.000	454 000	〃	7 240 000		294 000	36 000	330 000	4.866.000
76	1.184 000		326.000	474.000	〃	6 766.000		292 000	58 000	350 000	4 808.000
77	1.199.000		304 000	496 000	〃	6 270.000		288 000	72.000	360 000	4 736 000
78	1.197 000		282 000	518.000	〃	5 752 000		284 000	76 000	360 000	4 660.000
79	1.213 000		259.000	541.000	〃	5.211 000		280 000	100.000	380 000	4.560.000
80	1.251.000		234 000	566 000	〃	4 645.000		274 000	146 000	420 000	4 514.000
81	〃		209 000	591 000	〃	4 054.000		271 000	149 000	〃	4 365 000
82	〃		182.000	618.000	〃	3 436.000		262 000	158.000	〃	4 207.000
83	〃		155 000	645 000	〃	2 791.000		252 000	168 000	〃	4.039.000
84	〃		126 000	674.000	〃	2 117 000		242 000	178 000	〃	3 861 000
85	〃		95 000	705 000	〃	1.412 000		232 000	188 000	〃	3673 000
86	〃		64 000	736 000		672 000		220 000	200000	〃	3 473 000
87	〃		30.000	676 000	706.000	0		209.000	305 000	514.000	3.168.000
88	〃							178 000	1 042 000	1.220 000	2.126 000
89	〃							128 000	1 092 000	1.220.000	1 034 000
90	〃							62 000	1.034 000	1096 000	0
91											

SUPPLEMENTARY INFORMATION I.

SUPPLEMENTARY INFORMATION I.

On Reasons Why Vessels' Draft Should Be Limited to 25ft and the Depth of Water at Anchorage Be Made -27ft.

I. Reasons Why Vessels' Draft Should be Limited to 25ft.

1. Probing into Limiting Factors Due to Natural Conditions

(i) Conditions of the Navigation Passage

The river has several curves between Pending and the river mounth and is shallow along the inside of the curves and deep along the outside. Vessels navigate along the deep outsides of the curves. All along the navigation passage, the river is generally deep, measuring from -25 to -45ft., and at Sejingkat it is especially deep, with the depth of 40ft to 60ft and provides good anchorage. But at the points of 1.4ml, 3.5ml, 5ml, and 7ml below Pending, it is no more than -17ft to -22ft deep even along the navigation passage. 1.0 mile east of Sejingkat is a wide, shallow place called Beting Tanju.

From Tg. Batu downstream to Inner Bar, the river is generally shallow with the depth of -19ft to -27ft, but over Inner Bar the passage is -15ft deep and over Outer Bar, it is -16ft deep.

Thus the river has a nearly satisfactory depth for navingation, but around the river mouth and outwards, the navigation passage is shallow and especially so over the two bars, proving to be a limiting factor to incoming vessels.

(ii) Tides

The sea around here has a large tidal range at spring tide. According to the "Tide Table, 1967" published by the Malaysian Government, the tidal situation at Lakei Island is as follows :

Highest High	Water	Level	+18.4ft
Mean High	"	"	+14.8ft
Mean Low	"	"	+ 5.6ft
Lowest Low	"	"	+ 0.4ft

It is concluded, therefore, that at high tides even vessels of considerably large draft will be able to navigate over the bars in the sea and shallow parts in the river.

(iii) Soil Conditions

The findings of the soil survey of Pending conducted this time by this Survey Team reveal that where a pier is proposed to be constructed, a layer of shale lies comparatively shallow. In order to construct a deep pier there, this rock-bed will have to be removed. But to remove the rock-bed involves larger costs and a longer period of time to construct a pier.

(iv) The Team's Views on the Above

(a) Although the navigation passage is shallow over the bars near the estuary, it will be possible even for vessels of larger draft to enter the port, provided they wait for high tides. It is undesirable, however, for vessels to do so because it means a big economic loss to them. An ideal navigation passage should be one which provided for vessels of all sizes free and safe navigation at any time, but it will cost a great deal for dredging. For the present, attempts are to be made to find out navigable limitations based on things as they are.

High tide comes round twice a day. Of higher high water levels given in the Tide Table, the smallest value is +12.6ft, which takes place on August 1st, the next smallest being +12.8ft on February 19th. This means that a vessel can have for about a halfday waiting a depth of water of 27.6ft (15ft + 12.6ft) over Inner Bar at a certain time of day on all days of the year.

Vessels' clearance-of-depth requirement is 2 to 3 feet (3ft when the sea runs high). Taking this into account, vessels of 25ft draft will surely be able to clear the bar if only they wait for high tide.

(b) For vessels over 25ft draft, the bar will be navigable on a day of spring tide or at high tide on a day of medium tide, only they will have to wait possibly for days before the right time comes round.

A vessel of 28ft draft, for instance, will have only 196 days a year on which she can sail over the bars, and that after ten days' waiting at the most. A vessel of 30ft draft will have only 25 such days. This means increased economic loss to vessels and accordingly a poor traveling efficiency. Moreover it will give rise to many problems in terms of soil conditions to construct a pier with a large depth of water, as it will require a larger construction cost and a longer period of time.

(c) In order to provide free navigation for vessels of over 25ft draft, it is not inconceivable to carry out the dredging of Inner and Outer Bars, but it is subject to following drawbacks :

(i) During the period from November to February, the north-eastern monsoon prevails and the sea is rough, causing movements of sand which will make the passage the shallower. To keep the passage deep enough, therefore, maintenance dredging will have to be regularly carried out every year.

(ii) If dredging is to be carried out all along the navigation passage to the depth of -18ft in order to make it navigable for vessels of 28ft draft, the work will cost a huge amount of money as follows :

The quantity of sand to be dredged	800,000yd^3
Dredging cost	2,800,000M$

For this reason, the bars are not to be dredged under this plan, provided that in the future, when more vessels come in and a larger volume of goods are handled than the target figures, a plan for dredging is to be made.

2. On the Size of Vessels Utilizing the Wharf

The range of gross tonnage of the vessels utilizing the Tanah Puteh Wharf during the period from 1966 to 1967 is as follows :

Vessels	under	1,000G/T		62%
"	over	1,000G/T	and Under 2,000G/T	20
"	over	2,000G/T	and Under 3,000G/T	7
"	over	3,000G/T	and Under 4,000G/T	2
"	over	4,000G/T	and Under 5,000G/T	7
"	over	5,000G/T		2

As seen from the above, vessels of not more than 5,000 G/T showed an overwhelmingly large percentage of 98 per cent. Vessels of 5,000 G/T class, when loaded to capacity, will draw some 25ft. of water.

Of large vessels of over 5,000 G/T, which accounted for only 2 per cent, the largest had a gross tonnage of 6,390 tons. The full draft of a vessel of this size is generally 26ft to 27ft. But judged by the present scale of economy of the hinterland of Kuching Port, per-vessel quantity of cargo, and the characteristics of liners, it is inconceivable that any vessel should ever make port at a full draft.

Thus insofar as the vessels not utilizing the port are concerned, the planned draft can safely be set at 25ft.

Next, it is foreseeable that development of the hinterland will lead to increased demand for transportation which will in turn invite larger vessels to the port. Per-vessel quantity of goods handled is at present 625 tons on the average, the largest ever seen being 2,200 tons. Vessels loading and unloading over 1,000 tons of cargo accounted for only 25 per cent of the total number of vessels arriving. Even though there is a large increase in the volume of goods handled in the future, and accordingly, in the per-vessel volume of goods handled, it is considered that there will be hardly any need for vessels larger than the present large ones.

In the possible event of any large ocean-going vessels coming to enter the port, it is to be noted that vessels now serving on the European-Asian line have a gross tonnage of 10,000 tons and a full draft of about 30ft. But then it is characteristic of liners, it is to be noted, that they seldom make port at full draft. Apart from container vessels, liners have shown no sign of growing a lot in size. So long as the new wharf is to be constructed with general cargo in view, it is concluded that the draft limits of the vessels utilizing Kuching Port can safely be set at 25ft.

3. Conclusion

When viewed from two angles, namely draft limitations due to natural conditions such as the depth of water, the tide situation and soil conditions, and the type of incoming vessels, it is concluded that limits to draft will be adequately set at 25ft.

II. Reasons Why the Depth of Water of Anchorage be Made -27ft.

1. Clearance of depth

When a vessel is navigating or comes to anchor, there should be a certain space between the bottom of the vessel and that of the water for safe maneuvering of the vessel. What should that space, that is, clearance of depth, be is to be determined with various factors taken into consideration.

A planned Depth of Water = Vessel's Draft + Clearance of Depth

These are the factors :

The size of vessels, soil nature, waves, flow of the water, and the speed of vessels.

The size of vessels :

The larger the size of a vessel, the large the clearance of depth should be.

Soil :

Where the bottom of water is rocky along the navigation passage or in the anchorage, the clearance of depth should be larger correspondingly.

Waves :

Where waves are caused, the clearance of depth should be determined depending on the size of the waves.

Flow of the water :

Where flow of the water or the tidal current is swift the clearance of depth should be large.

Speed of vessels :

When a vessel is sailing, its hull dips due to change in the resistance of water or in wave-producing action, and until a certain speed is reached, the dip goes on increasing in proportion to the speed of the vessel. Where the sea or the water channel is shallow, therefore, the vessel's navigating speed should count in the determination of the clearance of depth.

At Pending anchorage, waves and the speed of vessels are negligible, and therefore, the size of vessels, soil and the flow of the river should be taken into account in the determination of the clearance of depth. At Pending, the river is comparatively swift, flowing at 3 to 4 knots at time of spring tide, and the bottom is rocky. It is desirable, therefore, the clearance of depth should be as large as possible. Ideally it should be 3 to 5ft for a vessel of 25ft draft.

2. The Nature of Soil

As stated under 4-7, it has been found by the soil survey of this time that shale layers lie shallow underneath the river bottom, with outcroppings occurring in some places, while the depth is so small on the upstream side of the front area of the pier that dredging is necessary to permit a vessel of 25ft draft to enter the port. As it is very costly and takes much time to dredge rocks, however, it is desirable that the clearance of depth should be as small as it is permissible.

3. The Level of the River

As stated under 4-5-3 and 4-5-4, the level of the Sarawak River is subject to the influence of tides of the sea and besides, the difference between H.W. and L.W. is great, while as the Datum of the chart is adopted for the datum, there is enough of the clearance of depth except at low tide of spring tide. The duration of low tide does not amount to much throughout the year, and it is desired that the clearance of depth be made as small as possible.

4. Optimum Minimum Depth

For the reasons given above, the optimum clearance of depth for vessels of 25ft draft should reasonably be 3ft, it was judged. Hence 28ft for the optimum minimum depth alongside of the new wharf.

5. Planned Depth

As stated under 4-5-4, according to the observation made at Kuching in 1963 and 1964 of the level of the Sarawak River, the lowest level was +1.9ft. That is to say that the river is always above the datum by more than 1.9ft. In view of the . that the proposed site is several miles away from the point of the observation and the period of the observation was limited, the lowest level of the river at Pending was assumed to be +1.0ft.

For this reason, it has been concluded that the planned depth of the anchorage in the front area of the new wharf should be -27ft.

SUPPLEMENTARY INFORMATION II.

SUPPLEMENTARY INFORMATION II.

PLAN FOR AN OIL WHARF

1. Present Condition of the Oil Wharf and Points at Issue

As stated in 4-2-2, there is in Biawak a berth for exclusive use of oil cargo. On account of structures and the width and the depth of the river, however, vessels making use of its are subject to the maximum limit of 450ft in length and 21ft in draft. This berth is now made use of by the Shell and Esso oil companies. Shell is thinking of putting in service larger tankers than the G-3 type of 5,739 gross tons, which is currently used by the company.

On the other hand, as stated in 5-1, although it is claimed that there have been increases in the volume of oil cargo, the truth is that in 1966 only 68,603 tons were handled, leaving much surplus in the handling capacity of the berth.

This situation is different from that of the general cargo wharf at Tanah Puteh, which is being utilized well beyond its capacity and is faced, on top of it, with a trend of rapid increase in the volume of general cargo handled. This makes a big difference in urgency between the two wharves, for general cargo and for oil cargo. For this reason, it has been decided that in this report the general cargo and oil cargo berths are treated separately, the former being taken up as the main subject and the latter left to be treated in the Supplementary Information. This way of treatment will make this report helpful in either case to carry out both projects at the same time or differing in time.

2. Designed Location

To meet the demand for the use of larger tankers, there are two alternatives, namely, to improve the facilities at Biawak or to establish new ones at another place. The former has the following drawbacks.

(a) Between Biawak and Pending Pt., shallow places in the river would have to be largely dredged.

(b) The river is narrow and forms a curve, and this part of the river is most frequently used by vessels going upstream to Kuching and Tanah Puteh, making it dangerous for large vessels to turn around about here.

For these reasons, it is necessary to establish new facilities at a place where the river is deep and wide enough in order to cope with the demand for larger tankers' entry into the port.

In the light of relations with the general cargo wharf, the depth and the width of the river and soil nature, it is concluded the most suitable place is the right bank of the Kuap, opposite to the new wharf.

Large oil tankers are to use this new wharf while small ones are to use Biawak Wharf as before.

3. Draft Limit for Large Tankers

As there are two shallow places, Inner Bar and Outer Bar, as stated in the attached Supplementary Information I, the draft limit of general cargo vessels is, it is judged, to be put at 25ft.

In the case of tankers, as they differ from general cargo vessels in various respects, their draft limit differs accordingly.

In the case of tankers, as compared with general cargo vessels,

(a) the number of tankers is far smaller,

(b) they enter loaded fully or nearly fully, and leave the port unloaded nearly wholly, and

(c) since daily consumption of oil in the hinterland is almost constant, it is easy for tankers to make a schedule of their visits to the port.

For these reasons, assuming that half of 365 days in a year on which they are allowed to enter the port will be enough to answer their purposes and taking into consideration the existence of some shallow places between the river mouth and Pending, the draft limit for tankers is put at 27ft.

4. Designed Depth Alongside of the Tanker Berth

Putting tankers' draft limit at 27ft, the designed depth alongside of the tanker berth is to be -29ft for the same reason as given in the attached Supplementary Information I.

It being taken for granted that large tankers are to pass over the bars off the river mouth and the shallow places in the river at high tide, this plan has left it out of consideration to dredge shallow places, except that pocket dredging is to be carried out regionally to the depth of -29ft in front of the tanker berth.

5. Size of Tankers

When tankers enter in at Pending loaded fully with oil cargo, the size of such tankers is not allowed to exceed 12,000 D.W.T. If a tanker, which is loaded to full at a port of shipment, discharges part of the load at a port on its way to Pending, then such a tanker can be larger than 12,000 D.W.T. and enter at Pending. Tankers of 17,000 D.W.T. and of 20,000 D.W.T. need to lessen their load so as to make their drafts smaller to 90 and 87 per cent, respectively.

6. Plan for Facilities of Oil Berth

To provide against possible breaking of the bank which may result from pocket dredging carried out in front of the oil berth, dolphins are to be placed at 150ft frontward from the shore.

Facilities are to consists of two breasting dolphins, an operating platform, access ways, two mooring dolphins, cargohandling equipment and anchorage.

Tankers are moored to a breasting dolphin, which is to protect the shock which a vessel may cause in her act of getting moored and to protect the platform from being affected by the shock.

The platform provides space for oil handling operation and is equipped with cargohandling equipment and instruments. Access ways are to connect breasting dolphins with the platform and the platform with land. This latter access way is to be so constructed as to enable a pipeline to be fixed to it.

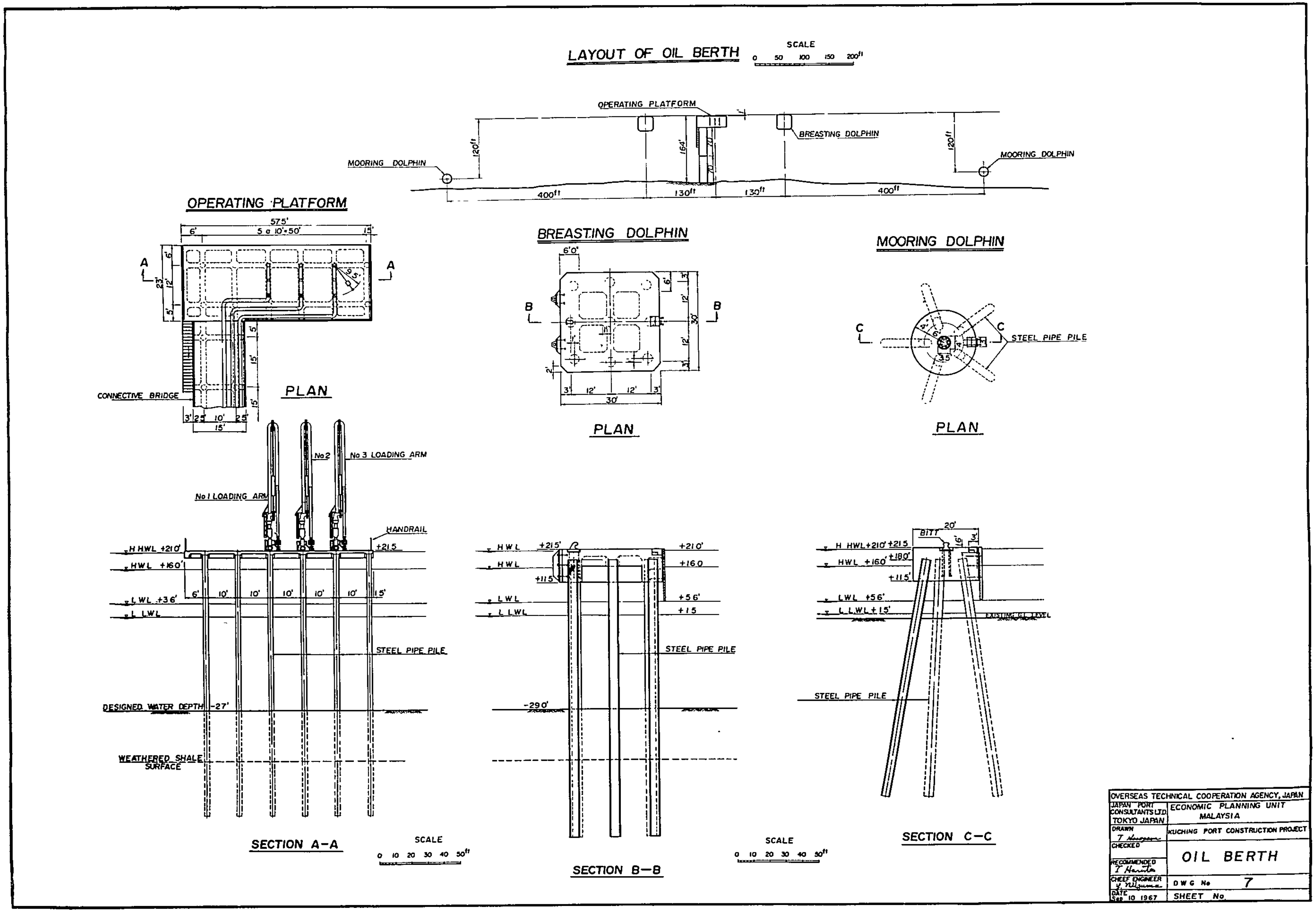
Two mooring dolphins are to be so constructed on a shallow place near the bank as to keep a distance of about 250ft from vessels. On their top rests a bit.

Anchorage is to be dredged over a distance of 1,150ft, longer than vessels' length, by some 70,000 yd^3 so that large tankers can safely be moored or unmoored. For a turning basin is to be chosen a deep place near the confluence of the Kuap and the Sarawak.

7. Structure of the Oil Berth

The breasting dolphins are to be piled with nine steel pipe piles, to be driven into a shale layer, at intervals of 12ft and the upper part of the piles are linked together with reinforced concrete.

The operating platform is likewise to be piled with 2 steel pipe piles in two rows driven into a shale layer and the upper part of the piles are linked together with reinforced concrete beams and slabs. On this platform are installed 3 unloading arms for handling oil cargo. (See DWG. No. 7)


LAYOUT OF OIL BERTH
SCALE
0 50 100 150 200ft
OPERATING PLATFORM
BREASTING DOLPHIN
MOORING DOLPHIN
120ft
164'
400ft
130ft
130ft
400ft
OPERATING PLATFORM
57.5'
5 @ 10'=50'
CONNECTIVE BRIDGE
PLAN
BREASTING DOLPHIN
30'
PLAN
MOORING DOLPHIN
STEEL PIPE PILE
PLAN
No 1 LOADING ARM
No 2
No 3 LOADING ARM
HANDRAIL
H HWL +21.0'
HWL +16.0'
LWL +3.6'
L LWL
STEEL PIPE PILE
DESIGNED WATER DEPTH -27'
WEATHERED SHALE SURFACE
SECTION A–A
SCALE
0 10 20 30 40 50ft
+21.5'
+21.0'
+16.0
+11.5
+5.6'
+1.5
STEEL PIPE PILE
-29.0'
SECTION B–B
SCALE
0 10 20 30 40 50ft
BITT
H HWL +21.0' +21.5
HWL +16.0' +18.0'
LWL +5.6'
L LWL +1.5'
EXISTING G.L. LEVEL
STEEL PIPE PILE
SECTION C–C
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN
JAPAN PORT CONSULTANTS LTD TOKYO JAPAN
ECONOMIC PLANNING UNIT MALAYSIA
DRAWN
CHECKED
RECOMMENDED
CHIEF ENGINEER
DATE Sep 10 1967
KUCHING PORT CONSTRUCTION PROJECT
OIL BERTH
DWG No 7
SHEET No.

Access ways are of the similar structure.

The mooring dolphins are to be piled with 5 steel pipe piles driven into a shale layer at an angle of 10° and their tops are linked together with reinforced concrete, on which rests a bit.

8. Construction Costs

As shown in Tables 7-1 and 7-3, construction costs amount to M$ 1,700,000, in including interest for the period of construction, of which M$ 1,418,000 are in foreign currency and M$ 282,000 in domestic currency.

9. Time in Which Work to be Completed

Time required for completion of the work varies according to whether or not it is undertaken simultaneously with that of the general cargo wharf. It is considered to take 1.5 to 2 years from investigation and designing.

10. Amortization Plan

As in the case of the general cargo wharf, the borrowed money amounting to M$ 1,641,000 is to be amortized out of K.P.A.'s earnings.

(a) Oil Cargo Stevedorage

Bulk oil stevedorage has been calculated based on K.P.A.'s data.

(b) Predicted Revenue

Calculation of revenue has been made by putting port dues, berthing fees etc. combined at 25 cents per gross ton of vessel and oil stevedorage per ton of oil at M$ 1. (Table 01)

(c) Predicted Expenditure

Unlike general cargo, oil cargo is handled by means of machine and requires less labour and less hours in handling. Labourwages, staff salaries, repair and maintenance costs, depreciation and other expenses per ton of oil have been calculated at 1/70, 1/14, 1/10, 1/10, and 1/10, respectively, of those in the case of the general cargo wharf. (Table 02)

(d) Revenue and Expenditure

Net proceeds from the oil wharf will, as seen in Table 01, show a gradual increase from M$ 73,000 for 1971 to M$ 261,000 for 1987, it is estimated.

(e) Amortization Plan

As in the case of the general cargo wharf, of the borrowed money of M$ 1, 371, 000 in foreign currency, at an interest rate of 4. 5 per cent per annum, is to be amortized in 15 years after 5 years' deferment, and M$ 270, 000 in domestic currency, at an interest rate of 6 per cent per annum, is to be amortized in 30 years after 5 years' deferment. By this plan, the whole amount of borrowed money will be completely amortized by 1988, as shown in Table 0. 3.

Table 01

ESTIMATED REVENUE

OIL WHARF

YEAR	ESTIMATED GROSS TONNAGE OF VESSELS	AVERAGE RATE PER GROSS TONNAGE	PORT DUES BERTHING FEES ETC	ESTIMATED TONNAGE OF BULK OIL	AVERAGE RATE PER TON	REVENUE	GROSS REVENUE	TOTAL OPERATING COST	NET REVENUE
1968	t	cts	$	t	$	$	$	$	$
69									
70									
71	90 000	25	23 000	100 000	1 0	100 000	123 000	50 000	73 000
72	99 000		25 000	110 000	〃	110 000	135 000	55 000	80 000
73	108 000	〃	27 000	120 000	〃	120 000	147 000	60 000	87 000
74	117 000	〃	29 000	130 000	〃	130 000	159 000	65 000	94 000
75	126 000	〃	32,000	140 000	〃	140 000	172 000	70 000	102 000
76	135,000	〃	34 000	150 000	〃	150 000	184 000	75 000	109 000
77	144 000	〃	36 000	160 000	〃	160 000	196.000	80 000	116 000
78	162 000	〃	41 000	180 000	〃	180 000	221 000	90 000	131 000
79	180 000	〃	45 000	200 000	〃	200 000	245 000	100 000	145 000
80	198 000	〃	49 000	220 000	〃	220 000	269 000	110 000	159.000
81	216 000	〃	54,000	240.000	〃	240 000	294 000	120 000	174 000
82	234 000	〃	59 000	260 000	〃	260 000	319.000	130 000	189 000
83	252 000	〃	63 000	280.000	〃	280 000	343 000	140 000	203 000
84	270 000	〃	67.000	300 000	〃	300 000	367 000	150 000	217 000
85	288 000	〃	72 000	320 000	〃	320 000	392 000	160.000	232 000
86	306.000	〃	76 000	340 000	〃	340 000	416 000	170.000	246.000
87	324 000	〃	81,000	360.000	〃	360 000	441.000	180.000	261 000
88	342 000	〃	85 000	380 000	〃	380 000	465 000	190.000	275 000

Table 02

ESTIMATED EXPENDITURE

OIL WHARF

	ESTIMATED TONNAGE OF OIL	AVERAGE RATE PER TON OF BULK OIL: LABOURERS' WAGES	STAFF SALARIES	REPAIRS AND MAINTENANCE	DEPRECIETION	OTHERS	LABOURERS' WAGES	STAFF SALARIES	REPAIRS AND MAINTENANCE	DEPRECIETION	OTHERS	TOTAL OPERATING COST
1968	ton	CTS	CTS	CTS	CTS	CTS	$	$	$	$	$	$
69												
70												
71	100 000	5	20	2	12	11	5 000	20 000	2 000	12 000	11 000	50.000
72	110 000	"	"	"	"	"	5 500	22 000	2 200	13 200	12 100	55.000
73	120 000	"	"	"	"	"	6 000	24 000	2 400	14 400	13 200	60 000
74	130 000	"	"	"	"	"	6 500	26 000	2 600	15 600	14 300	65.000
75	140 000	"	"	"	"	"	7 000	28 000	2 800	16 800	15 400	70.000
76	150 000	"	"	"	"	"	7 500	30 000	3 000	18 000	16 500	75 000
77	160 000	"	"	"	"	"	8 000	32 000	3 200	19 200	17 600	80 000
78	180 000	"	"	"	"	"	9 000	36 000	3 600	21 600	19 800	90 000
79	200.000	"	"	"	"	"	10 000	40 000	4 000	24 000	22.000	100 000
80	220 000	"	"	"	"	"	11 000	44 000	4 400	26 400	24 200	110 000
81	240 000	"	"	"	"	"	12 000	48 000	4 800	28 800	26 400	120 000
82	260.000	"	"	"	"	"	13 000	52 000	5 200	31 200	28 600	130 000
83	280 000	"	"	"	"	"	14 000	56 000	5 600	33 600	30 800	140 000
84	300 000	"	"	"	"	"	15 000	60 000	6 000	36 000	33 000	150 000
85	320.000	"	"	"	"	"	16 000	64 000	6 400	38 400	35 200	160 000
86	340 000	"	"	"	"	"	17 000	68 000	6 800	40 800	37 400	170 000
87	360 000	"	"	"	"	"	18 000	72 000	7 200	43 200	39.600	180 000
88	380.000	"	"	"	"	"	19 000	76.000	7.600	45 600	41 800	190 000

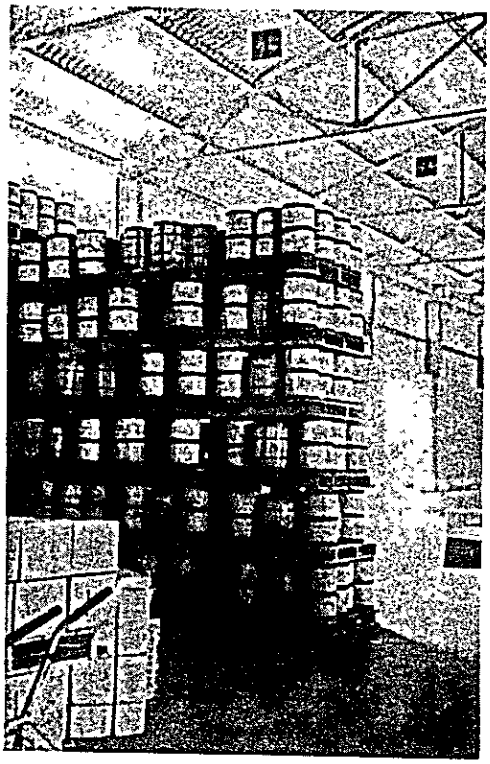
Table 03

PLAN FOR REPAYMENT OF BORROWED MONEY

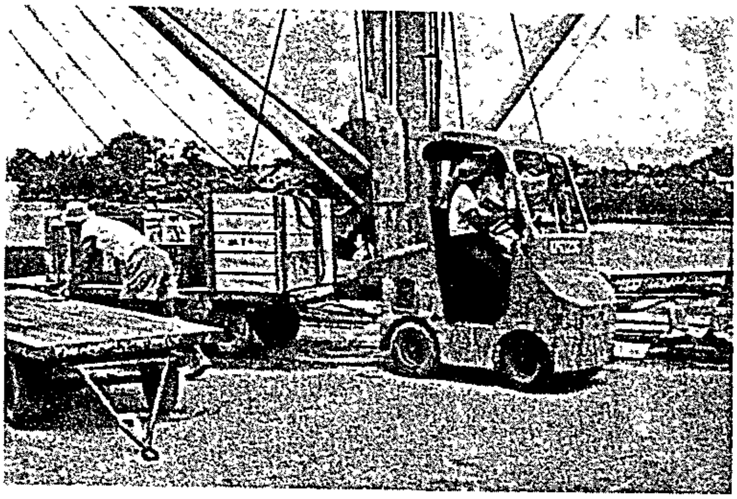
OIL WHARF

YEAR	ESTIMATED NET REVENUE	FOREIGN CURRENCY					DOMESTIC CURRENCY				
		AMOUNT INVESTED	AMOUNT REPAID			BALANCE	AMOUNT INVESTED	AMOUNT REPAID			BALANCE
			INTEREST 4.5 %	PRINCIPAL	TOTAL			INTEREST 6%	PRINCIPAL	TOTAL	
1968	$	$	$	$	$	$	$	$	$	$	$
69		1 371.000					270 000				
70						1 418 000					282. 000
71	73.000					1 482 000					299. 000
72	80 000			123.000	123 000	1.426 000			30.000	30.000	287 000
73	87 000		64 000	11 .000	75.000	1 415 000		17 000	- 5.000	12 000	292. 000
74	94.000		64.000	16 000	80.000	1 399.000		18 000	- 4.000	14.000	296 000
75	102.000		63.000	22.000	85.000	1 377.000		17.000	0.000	17.000	296 000
76	109 000		62.000	28.000	90 000	1 349 000		17.000	2 000	19 000	294.000
77	116.000		61 000	34.000	95 000	1 315 000		17.000	4.000	21.000	290 000
78	131.000		59.000	49 000	108 000	1 266.000		17 000	6.000	23.000	284 000
79	145.000		57 000	63 000	120.000	1. 203.000		17.000	8 000	25 000	276 000
80	159 000		54.000	78.000	132 000	1 125 000		16.000	11 000	27 000	265 000
81	174 000		51.000	96 000	147 000	1 029 000		16 000	11 000	27 000	254 000
82	189 000		46 000	124 000	170.000.	905.000		15.000	4.000	19 000	250. 000
83	203.000		41.000	139 000	180 000	766.000		15.000	8 000	23 000	242.000
84	217.000		34.000	161 000	195.000	605.000		15 000	7 000	22.000	235 000
85	232 000		27.000	178 000	205 000	427 000		14 000	8 000	22 000	227 000
86	246 000		19.000	201 000	220 000	226 000		14.000	12.000	26 000	215 000
87	261 000		10.000	226.000	236 000	0		13.000	12 000	25 000	203 000
88	275 000							12 000	203.000	215.000	0.

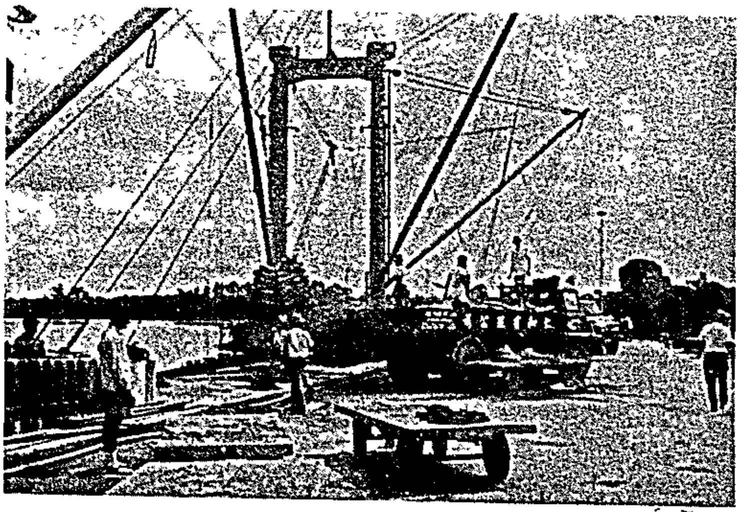
OPEN STORAGE TANAH PUTEH WHARF



INSIDE OF THE TRANSIT SHED

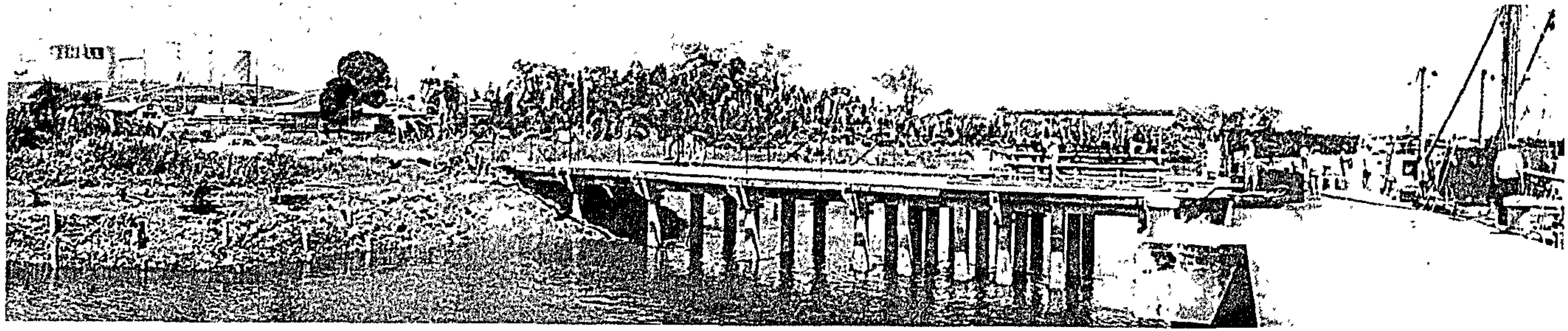


CARGO - HANDLING

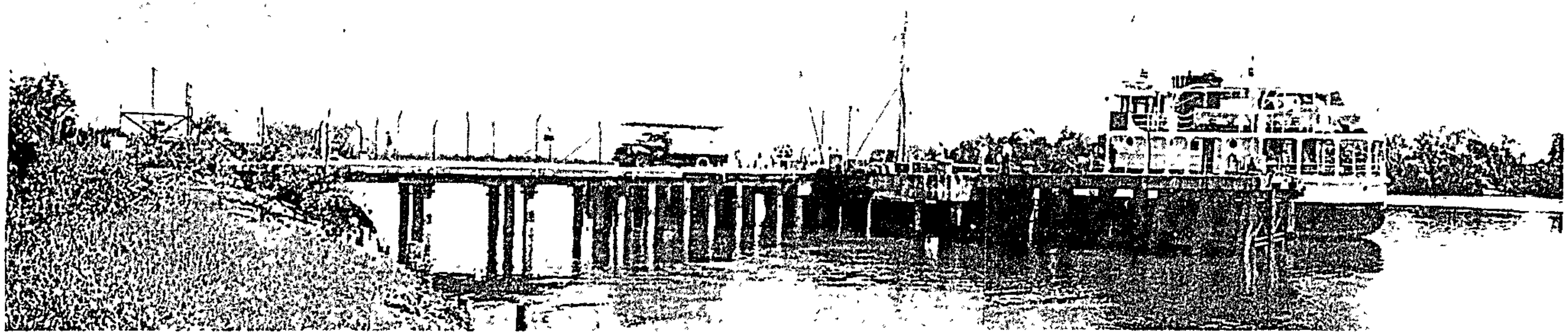


CARGO - HANDLING

BIAWAK OIL WHARF

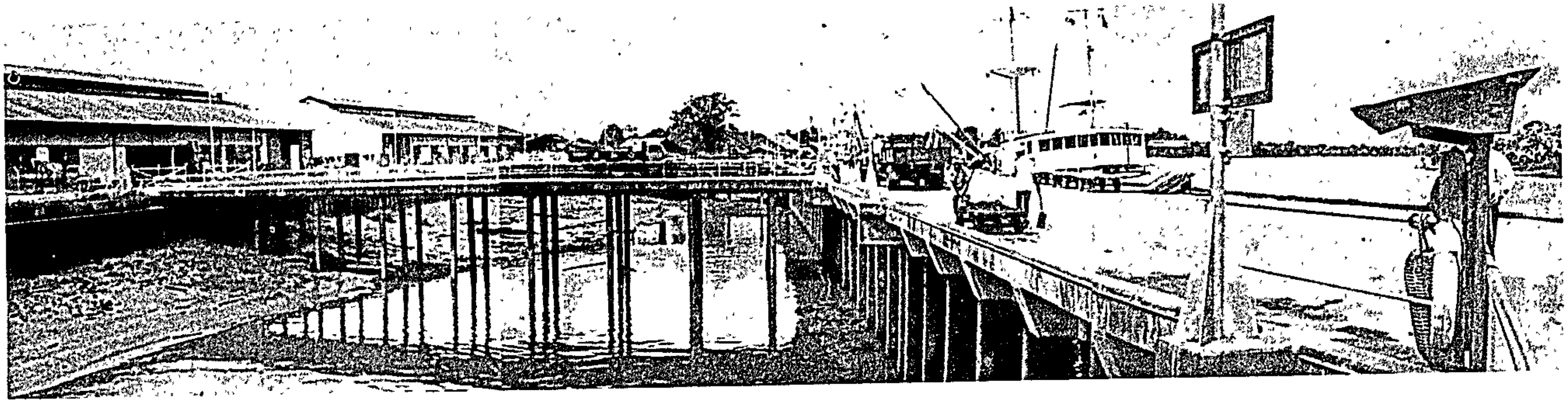


PIER AND TANKS

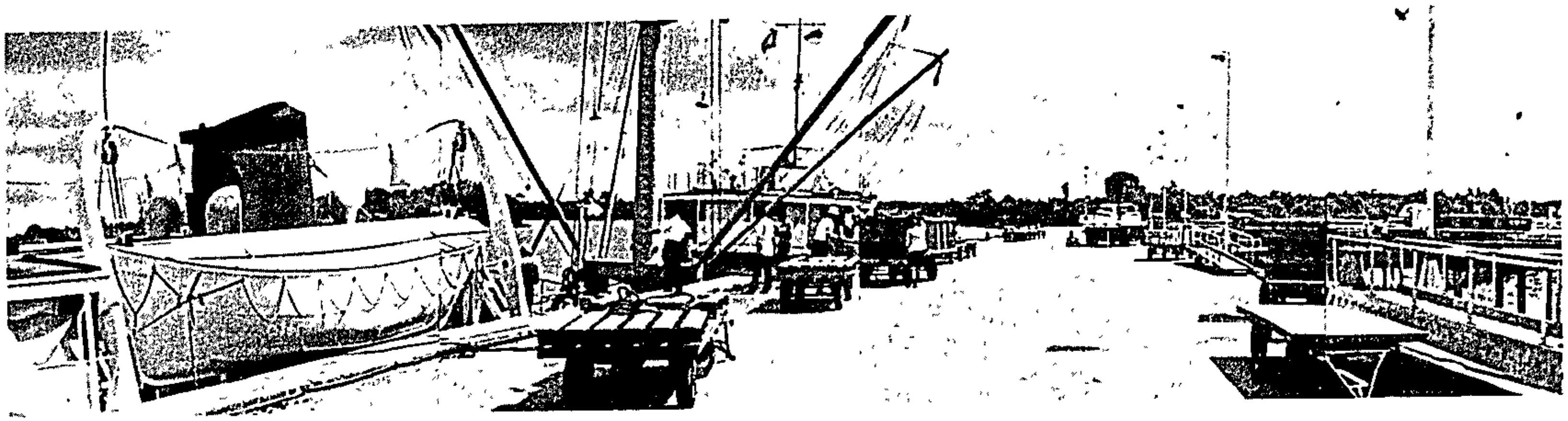


PIER

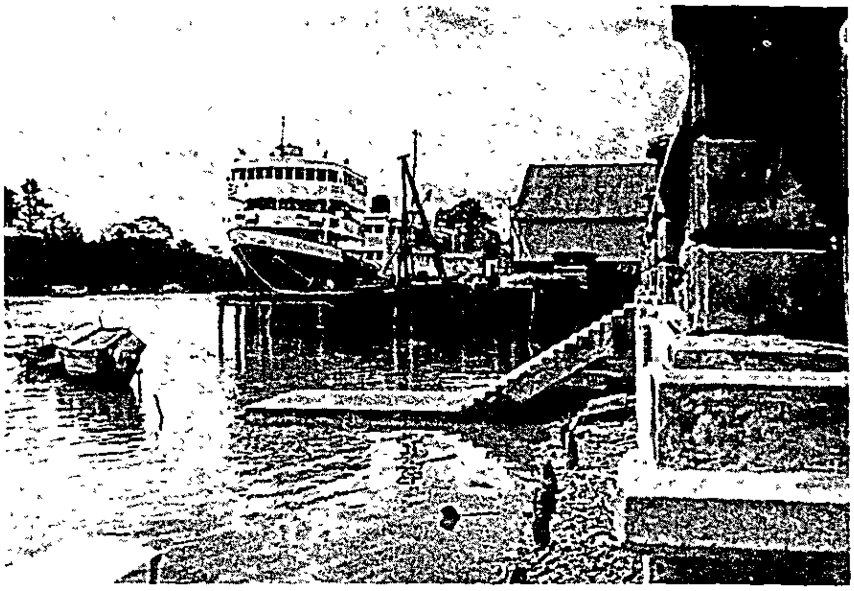
TANAH PUTEH WHARF



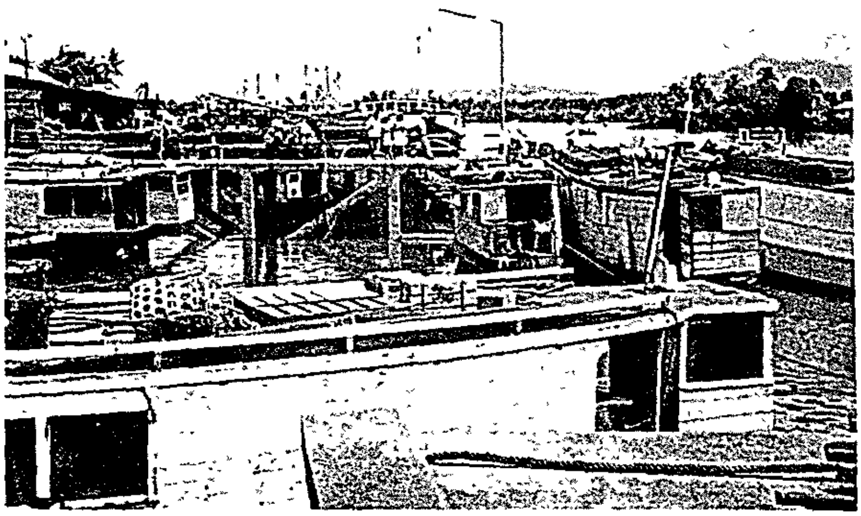
TRANSIT SHED & PIER



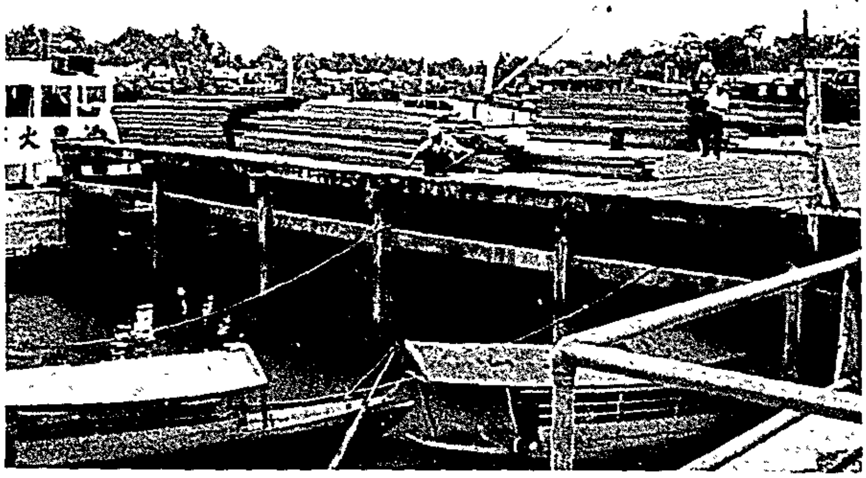
PIER



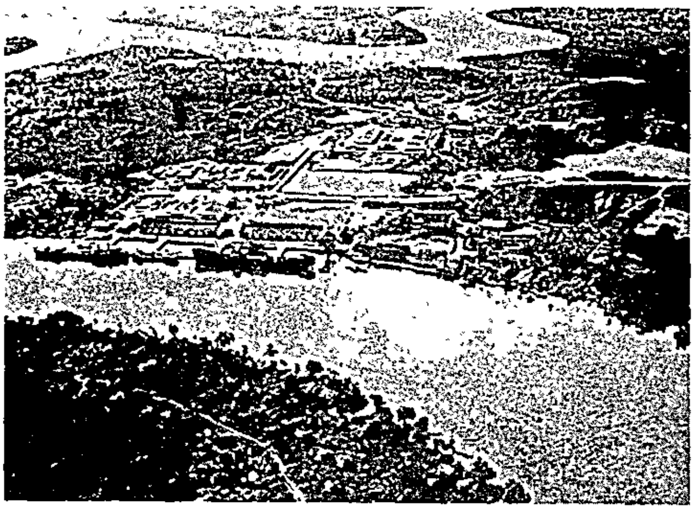
SARAWAK STEAM SHIP CO. WHARF



PIER FOR COASTAL VESSELS



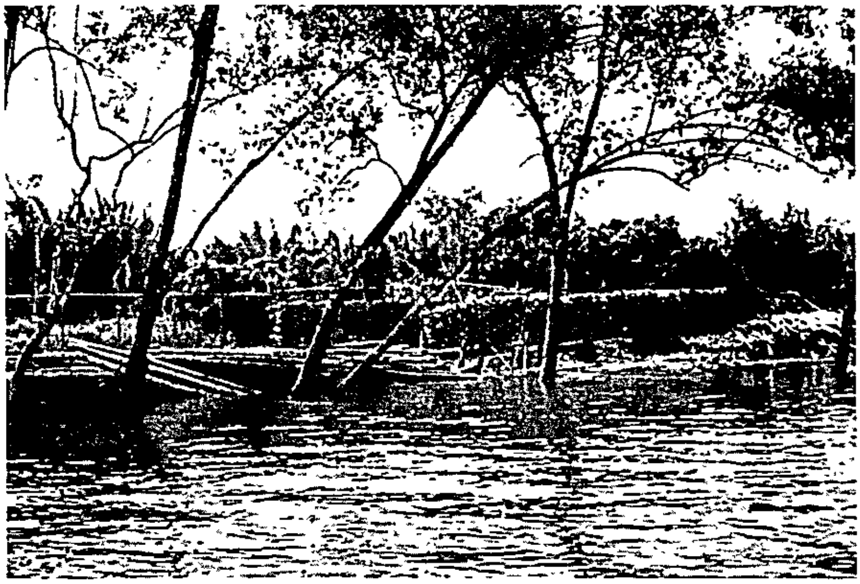
PIER FOR COASTAL VESSELS



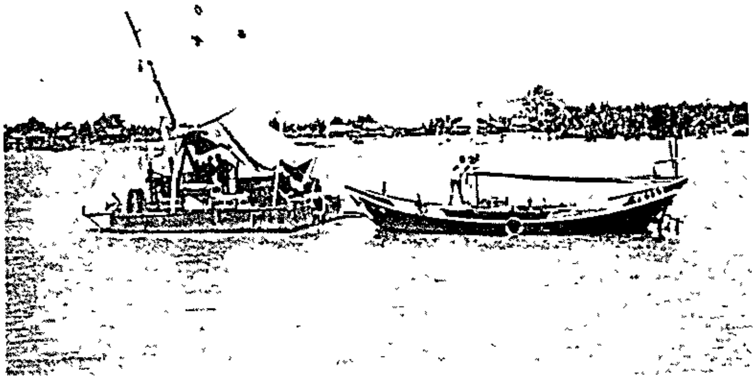
AERIAL VIEW ; TANAH PUTEH & PENDING POING

SITE OF NEW WHARF

PENDING POINT



DOWN STREAM OF PENDING CUSTOMS : EROSION



BORNING IN THE RIVER

PORING ON THE LAND