

No. 58

REPORT  
ON  
THE FEASIBILITY STUDY PHASE II ON  
THE COMPREHENSIVE STORAGE FACILITIES  
DEVELOPMENT PROJECT  
IN  
THE KINGDOM OF THAILAND

VOLUME II  
(APPENDIX)

June, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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APPENDIX A

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1. Summary of The Feasibility Study Phase I

1. Agriculture is the largest and most important sector of the Thai economy. Agricultural production has increased remarkably in the recent years at an annual average rate of five percent.

Export of agricultural products have always been the major source of the foreign exchange earnings and they have about 70 percent of the total export income in 1981.

With the steady progress of agricultural production, Thailand became the most advanced agricultural country in the Southeast Asia.

In 1960, total export of agricultural products from Bangkok port was about 2.6 million tons, out of which milled rice was 1.3 million tons. After 20 years, the export of these products reached about 12.5 million tons including 3 million tons of milled rice.

The income of Thai farmers, however, has been limited and their living standard is still low. In the Fifth Five-Year National Economic and Social Development Plan, special emphasis has been placed on the encouragement of farmers to develop their social and economic status.

2. Thailand's agricultural exports increased substantially in the past decade. However at the present they have to face the keen competition in the quality oriented international market. It is indeed difficult for Thailand to find new foreign buyers of Thai products as well as maintaining her traditional overseas market. It is, therefore, a matter of vital importance to improve the quality of Thai agricultural products for export and also to develop the related systems and facilities in order to facilitate the application of the appropriate technology.

3. In the domestic marketing of agricultural commodities, traders, in general, can take advantage over farmers since farmers have little knowledge about marketing, especially pricing mechanism. Thai farmers are not an exception in this case.

If the farm gate price of agricultural products could not satisfy the farmer's minimum requirement, it would be impossible to ask the farmers to improve the quality of their products. In addition to the proper incentive to be given to the farmers, it is also necessary to develop the post-harvest facilities, such as storage, transport, processing, handling and so forth.

4. According to the survey conducted by the Bank of Thailand in 1979, total capacity of storage of various commodities in Thailand was about 14.4 million tons. Most of these storage facilities are simple shelters to protect the commodities from rain or theft.

Many of the storages used for rice stock in the country are built mainly to store paddy so that they are not suitable to store milled rice safely under the severe climatic conditions in the tropics. Furthermore, insufficient knowledge on the storage technology caused much inconvenience and losses. Insect pests and rodents damages to the stored rice and other products are estimated to be enormous.

5. In Thailand, various equipment and facilities, including processing, storage and ship loading, for cassava products, maize and sugar for export have been improved rapidly in line with their remarkable increase of exports in the past two decades.

However, as far as the transport and loading facilities of rice are concerned, very little change has been made to improve the efficiency of the necessary works. Most of the ship loading facilities are remained unchanged as they were in 1960s when the rice exports were 1.5 million tons, while the rice exports have already reached 3.7 million tons in 1983.

6. The Public Warehouse Organization (PWO), being a state enterprise attached to the Ministry of Commerce, has been assigned by the Thai Government to alleviate the hardship of low-income people and is instructed to offer its relevant service to stabilize the prices of certain agricultural products through its procurement and distribution of these commodities.

Among several agricultural products with which the PWO has been dealing, rice is the most important item in view of its significant effect on the national economy.

In the past, the PWO performed its duty in compliance with the instructions given by the Government to stabilize the price of rice regardless of the unfavorable market conditions. As a consequence of this difficult operation, the marketing strategy of the PWO resulted in a considerable deficit of its account.

7. Some of the causes attributed to the unfavorable result of rice marketing operation of the PWO is reported that storage facilities of rice at the desired places are short in numbers and far below the acceptable standard.

In fact, the PWO was obliged to rent a great many privately owned warehouses to stock rice. Unfortunately, most of these warehouses were low-standard and not suitable to store milled rice for a long period of time.

Under these circumstances, losses and wastages of stored rice under the PWO's operation were far beyond normal expectations.

8. When the study team assigned by JICA visited Bangkok, H. E. Kosol Krairiksh, the Minister for Commerce, the Government of Thailand, personally told the team members that the Thai Government intended to allow the PWO to intervene in the market of agricultural products and the target of procurement by the PWO would be about 10 percent of the marketable surplus of the commodities under the program agreed by the Government.

9. In view of these significant points to improve the technical and economical functions of the PWO, it is considered that the Comprehensive Storage Facilities Development Project of the PWO would be undoubtedly of great help to improve it's functions to meet the national requirements.

The primary objectives of this project would be as follows:

- 1) to increase farmers' income and improve their living standard.
- 2) to secure and develop overseas markets through improvement of quality and efficiency of loading capacity at port.
- 3) to facilitate government programs such as paddy price support and rice price stabilization.
- 4) to reduce post-harvest losses and wastages.

10. Based on the findings of the Feasibility Study Phase-I, it is concluded that the project to improve the storage facilities of the PWO would be urgently necessary and it is recommended that further study should be taken as soon as possible to promote and to justify the project.

The basic concept to approach the project would be as follows:

- 1) Regional Warehouses

Under the project, new warehouses with total storage capacity of 180,000 tons would be constructed at the selected places. This estimation of storage capacity is made based on the following factors:

- i) The PWO will procure about 450,000 tons of milled rice annually.
- ii) The existing warehouses of the PWO were taken into account in terms of storage capacity, location and technical standard.

2) Central Shipping Complex

New shipping complex with a storage capacity of 35,000 tons will be required for smooth, efficient operation of receiving milled rice from regional warehouses, mixing, regrading, remilling and repacking. Advanced equipment for fumigation and loading of rice will be included as well.

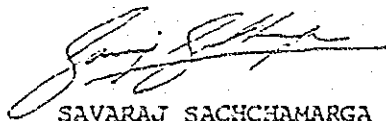
3) Storage Technology Development Facilities

Appropriate technology of storage of agricultural products, including field works regarding storage, handling, pest control and ship loading as well as managerial control such as stock control, is essential to achieve the PWO's objectives.

In this connection, it would be necessary to have the staff training course and the relevant facilities attached to the PWO.

This report on the Comprehensive Storage Facilities Development Project has been prepared based on the study carried out in the Feasibility Study Phase-I with generous guidance and cooperation extended by the PWO and other authorities concerned in Thailand. Since the Study Phase-I is confined to find out the facts related to the problems of storage and marketing of the PWO and to formulate the basic concept to approach the realistic way how to improve the PWO's function, it would be necessary to make a further study on the technical & economical evaluation possibly with adjustments and alternatives, so that the project could be fully justified to obtain external financing assistance and technical cooperation.

2. SCOPE OF WORK  
FOR  
THE FEASIBILITY STUDY PHASE II  
ON  
THE COMPREHENSIVE STORAGE FACILITIES DEVELOPMENT PROJECT  
IN  
THE KINGDOM OF THAILAND  
AGREED UPON BETWEEN  
PUBLIC WAREHOUSE ORGANIZATION  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY  
BANGKOK, AUGUST 30, 1984

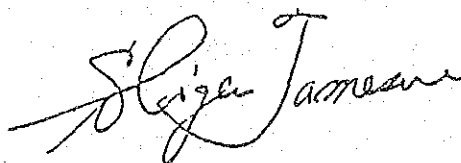


SAVARAJ SACHCHAMARGA

Managing Director

Public Warehouse Organization

Ministry of Commerce



SHIGERU TAMESUE

Leader of the Japanese

Preliminary Survey Team

Japan International Cooperation Agency

## I. INTRODUCTION

In response to the request of the Government of Thailand, The Government of Japan has decided to conduct the phase II of the Feasibility Study on the Comprehensive Storage Facilities Development Project (hereinafter referred to as "the Study"), within the general framework of technical cooperation between Japan and Thailand, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of Thailand signed on 5 November 1981.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the Technical cooperation programs of the Government of Japan, will undertake the Study in accordance with the relevant laws and regulations in force in Japan and in close cooperation with the authorities of Thailand. The present document sets forth the scope of work for the Study.

## II. OBJECTIVES OF THE STUDY

The objectives of the Study are to formulate a comprehensive storage facilities development plan along with the line of the direction and concept agreed upon between the parties concerned in the Feasibility Study Phase I and to verify the technical and economic feasibility of the project.

## III. OUTLINE OF THE STUDY

1. Components of the project
  - A) Regional warehouse
  - B) Central shipping complex
  - C) Storage technology development facilities

## 2. Scope of the Study

The Study is composed of field survey in Thailand and home office work in Japan as follows.

### (1) Field works

- 1) To carry out data collection and field survey on the following items
  - A) Storage Technology
  - B) Structure and attached facilities of existing warehouses
  - C) Marketing conditions
  - D) Transportation of rice and paddy
  - E) Economic activities of farmers, middlemen, exporters and other related groups
  - F) Topography
  - G) Soil nature
  - H) Environmental aspect
  - I) Price structure of materials and supply conditions
  - J) Others
- 2) To make suggestion on the most suitable locations and capacity of the warehouses

### (2) Home office work

- 1) To formulate the project
- 2) To estimate the costs and benefits of the project
- 3) To make economic and financial evaluation
- 4) To prepare implementation schedule of the project
- 5) To formulate operation and maintenance plan for the project



#### IV. WORK SCHEDULE

The Study work will be proceeded according to the tentative work schedule attached.

#### V. REPORTS

JICA will prepare and submit the following reports in English to the Government of Thailand.

(1) Plan of Operation

Thirty (30) copies at the commencement of the Study

(2) Progress Report

Thirty (30) copies at the end of the field survey

(3) Draft Final Report

Thirty (30) copies within one (1) month after the end of the home office work. The Government of Thailand is requested to provide its comments on the Draft Final Report within one (1) month after the submission of the Draft Final Report.

(4) Final Report

Fifty (50) copies within one (1) month after receiving comments on the Draft Final Report from the Government of Thailand.

#### VI. UNDERTAKING OF THE GOVERNMENT OF THAILAND

1. To facilitate smooth conduct of the Study, the Government of Thailand shall take necessary measures;

(1) To secure the safety of the Japanese study team,

(2) To permit the members of the Japanese study team to enter, leave and sojourn in the Kingdom of Thailand for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees,

- (3) To exempt the members of the Japanese study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into the Kingdom of Thailand for the conduct of the Study,
  - (4) To exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,
  - (5) To provide the necessary facilities to the Japanese study team for the remittance as well as utilization of funds introduced into the Kingdom of Thailand from Japan in connection with the implementation of the Study,
  - (6) To secure permission for entry into private properties or restricted area for the conduct of the Study,
  - (7) To secure permission to take all data and documents related to the Study including photographs out of the Kingdom of Thailand to Japan by the Japanese study team, and
  - (8) To provide medical services as needed. Its expense will be chargeable on the members of the Japanese Study team.
2. The Government of Thailand shall bear claims, if any arises, against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the members of the Japanese study team.
  3. Public Warehouse Organization (hereinafter referred to as "PWO"), shall act as counterpart agency to the Japanese study team and also as coordinating body to other relevant organizations for the smooth implementation of the Study.

4. PWO shall, at its own expense, provide the Japanese study team with the following, in cooperation with other agencies concerned, if necessary.

- (1) available data and information related to the Study
- (2) counterpart personnel
- (3) suitable office with necessary equipment and furniture

#### VII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures;

- (1) To dispatch, at its own expenses, the study team in accordance with the attached tentative work schedule, and
- (2) To pursue technology transfer to the Thai counterpart personnel in the course of the Study.

VIII. JICA and PWO will consult with each other in respect of any matter that is not agreed upon in this document and may arise from or in connection with the Study.

Tentative work schedule (Phase III)

Month	1.	2.	3.	4.	5.	6.	7.	8.
Item								
Field Survey								
Home Office Work								
Submission of Report								
	P.O.	P.R.			D.F.R.		F.R.	

Remarks:

- P.O. / Plan of Operation
- P.R. / Progress Report
- D.F.R. / Draft Final Report
- F.R. / Final Report

APPENDIX B

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4.	Supported Price of Paddy by Government (1965/66-1983/84)	4



1. Value of Agricultural Exports 1978-1982

Products	Unit: million bahts				
	1978	1979	1980	1981	1982
Rice	10,424.0	15,592.4	19,507.6	26,366.4	22,463.4
Rice products	260.0	283.1	310.0	465.2	564.5
Food crop	6,180.9	7,881.0	9,772.8	11,565.5	11,929.9
Cassava products	10,891.8	9,891.2	14,887.2	16,446.5	19,742.9
Raw sugar and products	4,491.3	5,426.9	3,356.7	10,310.9	13,793.7
Oil seeds	833.5	830.9	388.9	683.6	602.0
Vegetable oils	29.9	12.8	225.0	218.6	292.0
Fiber crop	3,037.9	3,686.8	3,783.2	3,217.8	3,953.2
Garden crop and fruits	175.8	210.8	204.8	313.8	505.5
Fruits and products	1,726.9	1,752.4	2,122.7	2,974.8	3,123.7
Spices	74.8	49.7	32.3	512.2	203.9
Miscellaneous crop	344.1	653.5	761.3	818.3	1,024.3
Other food products	140.2	224.2	243.2	415.8	620.5
Tobacco	1,161.2	1,243.4	1,371.6	1,741.0	2,563.1
Rubber	8,213.7	12,704.5	13,024.6	11,470.0	10,065.3
Live animals	291.8	249.4	165.1	96.5	107.4
Animal feed	1,021.1	1,387.8	1,618.2	1,874.3	1,599.5
Animal products	1,027.2	1,531.6	1,390.4	1,053.9	2,346.2
Milk products	110.1	144.3	160.8	149.5	205.5
Fertilizer and pesticides	2.3	3.6	14.2	9.9	21.7
Fishery products	4,325.8	6,388.1	6,185.4	7,635.3	9,996.7
Paper products	102.3	159.6	225.3	188.0	236.1
Forestry products	1,473.9	1,737.8	1,702.7	1,742.8	1,738.0
	56,340.4	72,046.4	81,453.3	100,270.3	107,699.3
Total value of agricultural products exports	56,340.5	72,045.8	81,454.0	100,270.6	107,699.0
Percentage	69.34	67.75	62.46	67.31	68.92
Total value of Exports	81,251.8	106,336.5	130,406.2	148,962.2	156,269.1
Percentage	100	100	100	100	100

Source: Agricultural Statistics of Thailand, Crop Year 1982/83.

2. Rice (Major and Second Rice): Planted Area,  
Production and Farm Value, Crop Year  
1973/74 - 1982/83

Crop Year beginning April	Planted area	Production	Yield Per rai	Farm Price	Farm Value
	1,000 rais	1,000 tons	kgs. per rai	bahts per ton	million bahts
1973/74	52,270	14,899	285	1,935.53	28,838.00
1974/75	49,889	13,386	268	2,104.01	28,164.29
1975/76	55,602	15,300	275	1,949.35	29,824.95
1976/77	53,595	15,068	281	1,849.15	27,862.38
1977/78	56,444	13,921	246	2,302.42	32,051.41
1978/79	62,667	17,470	280	2,183.96	38,153.68
1979/80	58,971	15,758	267	2,604.67	41,043.51
1980/81	60,110	17,368	289	3,082.30	53,533.75
1981/82	59,970	17,774	296	2,838.73	50,456.45
1982/83	60,134	16,879	281	2,809.63	47,422.30

Remarks: Rice, crop year 1973/74 is Major Rice crop year 1973/74  
and second Rice year 1974

Source: Agricultural Statistics of Thailand, Crop Year 1982/83.



3. Second Rice: Planted Area, Production and Farm Value,  
Year 1974-1983

Crop Year beginning April	Planted area	Production	Yield Per rai	Farm Price	Farm Value
	1,000 rais	1,000 tons	kgs. per rai	bahts per ton	million bahts
1974	2,038	1,014	497	1,667.41	1,690.00
1975	2,068	939	454	2,088.59	1,961.18
1976	2,358	1,208	512	1,966.96	2,376.34
1977	2,736	1,393	509	1,897.53	2,644.18
1978	2,979	1,586	532	2,143.71	3,399.53
1979	4,257	2,264	532	2,163.76	4,898.21
1980	2,103	1,111	528	2,543.84	2,826.66
1981	3,228	1,963	608	3,194.80	6,270.47
1982	3,578	2,017	564	2,859.28	5,765.97
1983	3,963	2,104	531	2,526.35	5,315.69

Source: Agricultural Statistics of Thailand, Crop Year 1982/83.

4. Supported Price of Paddy by Government  
(1965/66 - 1983/84)

	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	Baht/MT
Paddy which converted to the milled rice																				
White rice 100% A	1,100	1,100	1,200	1,300	1,300	1,300	1,125	-	-	2,800	2,650	2,250	2,400	2,700	3,400	3,800	4,050	3,600	3,600	3,600
" B	1,050	1,050	1,100	1,200	1,200	1,200	1,075	-	-	2,800	2,600	2,250	2,300	2,600	3,300	3,700	3,950	3,500	3,500	3,500
" C	1,000	1,000	1,050	1,150	1,150	1,150	1,025	-	-	2,800	2,500	2,250	2,200	2,500	3,200	3,600	3,850	3,400	3,400	3,400
												2,050								
White rice 5%	950	950	1,000	1,100	1,100	1,100	975	-	-	2,700	2,500	2,100	2,100	2,400	3,100	3,500	3,750	3,300	3,300	3,300
" 10%	900	900	950	1,050	1,050	1,050	925	-	-	2,600	2,400	2,060	2,000	2,300	3,000	3,400	3,650	3,200	3,200	3,200
" 15%	900	900	950	1,050	1,050	1,050	925	-	-	2,500	2,350	2,000	2,000	2,300	3,000	3,300	3,550	3,100	3,100	3,100
White rice 20-25%	850	850	900	1,000	1,000	1,000	875	-	-	2,400	2,300	1,900	1,900	2,200	2,900	3,200	3,450	3,000	3,000	3,000
Glutinous rice 10% long	900	900	950	1,050	1,050	850	-	-	-	2,300	2,300	1,670	1,800	2,100	2,800	3,200	3,300	2,900	2,900	2,900
" short	850	850	900	1,000	1,000	800	725	-	-	2,200	-	-	-	-	-	3,100	3,100	2,800	2,800	2,800
" 15% short	-	-	-	-	-	-	725	-	-	2,100	2,150	1,650	1,700	-	-	-	-	-	-	-
" 20-25%	-	-	-	-	-	-	675	-	-	-	-	-	-	-	-	-	-	-	-	-
Parboiled rice 20-25%	-	-	-	-	-	-	-	-	-	2,300	-	-	-	-	-	-	-	-	-	-

Source: Ministry of Agriculture & Cooperative, Bank of Thailand

APPENDIX C

<u>No.</u>		<u>Page</u>
1.	Rent of Warehouse	1
2.	Rice and General-Cargo Godown	2
3.	Rice and General Cargo Warehouses in Bangkok	3

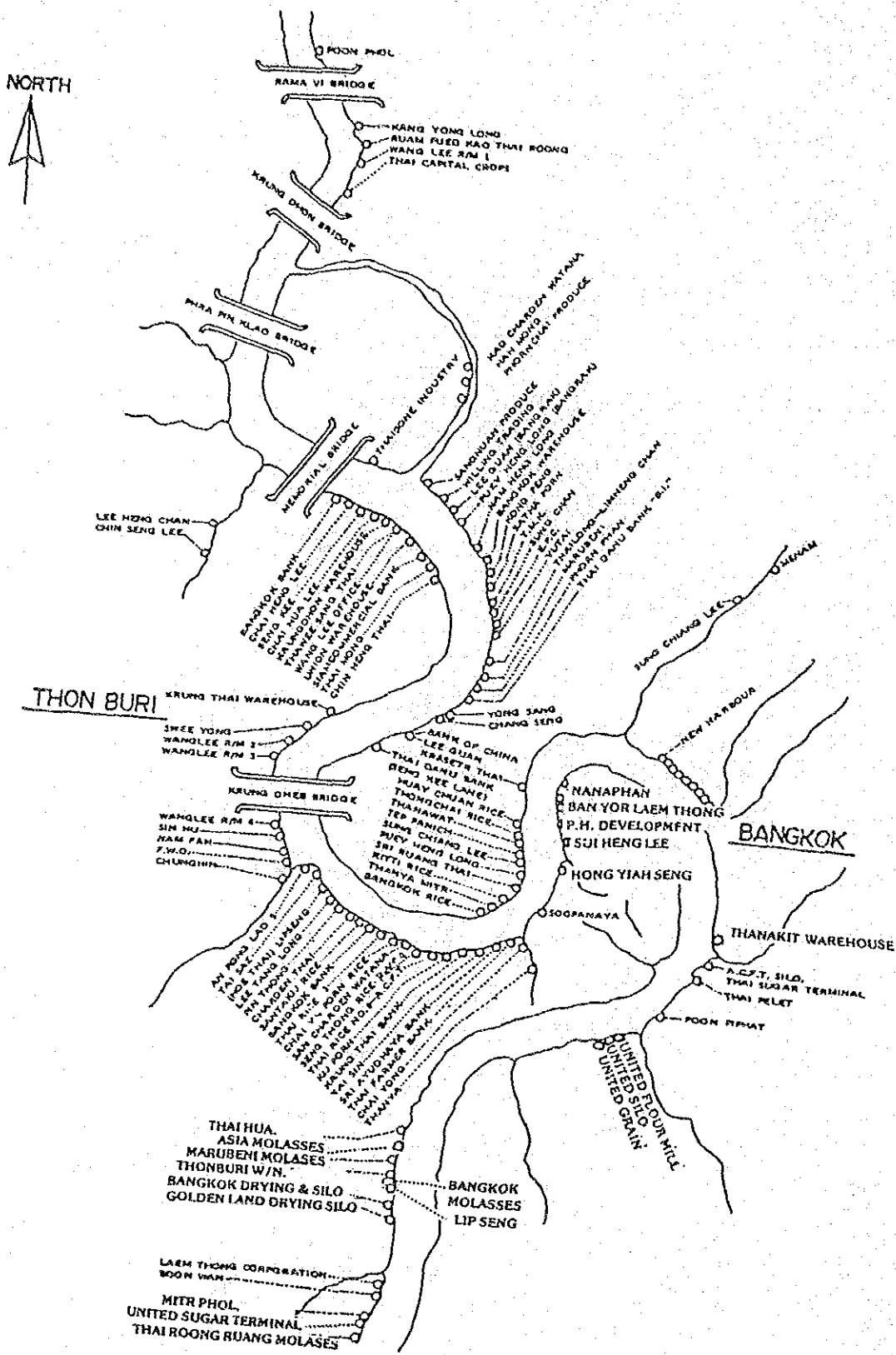


1. Rent of Warehouse

Unit of Warehouse Capacity : Metric tons

<u>Locations</u>	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>
Bangkok Area	271,633	415,215	416,119
Northern Region	161,270	142,532	84,109
Northeastern Region	352,157	775,226	145,765
Central Plains Region	330,158	797,003	236,237
Southern Region	25,470	11,500	-
Total	<u>1,140,688</u>	<u>2,240,476</u>	<u>882,230</u>

2. **RICE AND  
GENERAL-CARGO GODOWN**



3. RICE AND GENERAL CARGO WAREHOUSES IN BANGKOK

Name of G/D	Location	Capacity M/T	Owner	Shippers	Commodities
A.C.F.T. Warehouse	Rasburana	40,000	A.C.F.T.		Rice
An Fong Lao No. 5	Bukkalo	14,000	An Fong Lao	Kin Ponn	Rice
Bangkok Bank Warehouse	Klongsan (Near River)	5,000	Bangkok Bank	Thai Rice	Rice
Bangkok Bank Warehouse	Rasburana	57,000	Bangkok Bank	An Fong Lao	Rice
				Various Shippers	Various
				Associated Supplies	Various
				An Fong Lao	Rice
Bangkok Rice 3 G/D	16 Bangpooang, Satupradit	17,000	Bangkok Rice Co., Ltd.	Bangkok Rice Co., Ltd.	Rice
Chai Heng Lee	Ta Dindaeng	700	Chai Heng Lee	Chai Heng Lee	Steamed Bone Meal
Chai Hua Lee	Ta Dindaeng	300	Chai Hua Lee	Chai Hua Lee	Steamed Bone Meal
Charoen Thai Warehouse	Bangprakok	25,000	Charoen Thai	Charoen Thai Co., Ltd.	Rice
Chai Yong Warehouse	Prapadaeng	40,000	Chai Yong	Chai Yong, Chaiyaporn	Kapokseed, Tapioca
Chung King	Bukkalo	3,000	Chung King	Chung King	Jute
Chin Heng Thye	Kongzan	5,000	Chin Heng Thye	Chin Heng Thye	Rice
Charoen Watana	13/3 Trok Rong Nam Khang 1	2,500	Charoen-Watana Rice	Charoen Watana Rice Co.	Rice
Chaiwat Enterprise	55 Bangrak, New Rd.	500	Chaiwat Enterprise	Chaiwat	Beans
G/D No. 1	163 Bangrak, New Rd.	800	Chaiwat Enterprise	Kijisuwat	Beans
G/D No. 2	Wat.Prayakrol, Ban Mai	18,000	Chan Sang Ltd. Part.	Chan Sang Ltd. Part.	Fertilizer
Chan Sang	182/1 Bang-Ka-So, Nondaburi	4,000	Chia Meng Rice Mill	Chia Meng R/M Ltd. Part	Rice
Chia Meng	"	4,000	"	"	Rice
		8,000			
E.P.C.	161 Soi Mitrapadung, K-Thow	4,000	K-Thow Co., Ltd.	E.P.C.	Rice
Hoe Thal (Lip Seng)	Opposit Thanon Tok	17,000	Hoe Thal	Hoe Thal Co., Ltd.	Rice
Hoe Thal (Lip Seng)	Prapadaeng	60,000	Hoe Thal Co., Ltd.	Hoe Thal Co., Ltd.	Rice, Maize
Hong Yiah Seng & Pwo 3	Prapadaeng	100,000	Hong Yiah Seng	Hong Yiah Seng Co., Ltd.	Rice, Maize
				Nakorn Luang Export	Rice, Maize
Ha Mong	Trok Rong Nam Khaeng 1 New Rd.	250	Siri Thanys Export	Ha Mong	Rice
Huay Chuan Rice	624-630 Satupradit	40,000	Huay Chuan Rice Co.	Huay Chuan Rice Co., Ltd.	Rice, Maize
6 G/D	Ta Dindaeng	8,000	Krung Thon	Various	Various
Krung Thon Warehouse	Sam Ray	87,500	Krung Thai Bank	B.K.K. Trading Co., Ltd.	Rice, Maize
Krung Thai Bank	Rasburana	94,000	Krung Thai Bank	Hah Lee Produce	Maize
				P.H. Development	Tapioca
				Thal Phramual Enterprise	Various
				Kaset Asia	Tapioca
				Union South East Product	Maize
				Pak Nam Po Fire Co., Ltd.	Castorseed
				Porn Amnuay Sab	Cottonseed
				Vithayroj Import Export	Maize, Sorghum
				Kamol Kij Co., Ltd.	Rice, Maize
				Amorn Chai Co., Ltd.	Tapioca Pellets
Kamol Kij	71 Pak Kred Nhondecuri	6,000	Kamol Kij Co., Ltd.		
G/D A	"	3,000	"		
G/D B	"	8,000	"		
G/D F	"	11,000	"		
G/D G	"	19,000	"		
G/D K	"	3,000	"		
G/D H	"	6,000	"		
G/D I	"	19,000	"		
G/D P	"	25,000	"		
G/D Q	"	100,000	"		
	Total				

(to be continued)

Name of G/D	Location	Capacity M/T	Owner	Shippers	Commodities
Keng Sae Seng Kitti Rice	Trek Rong Nam Kheang 1 16 Satupradit Rd.	500 38,000	Keng Sae Seng Kitti Rice Ltd., Part.	Keng Sae Seng Kitti Rice Ltd., Part. Den Chal Rice Co., Ltd. Thong Rung Rung Produce Kong Pang Ltd., Part.	Beans Rice, Maize Maize, Beans sesameseed
Kong Pang	170 Sol Leekopus, New Rd.	6,000 4,000 10,000	Kong Pang Ltd. Part. "		Rice
Kesort Thai	Naei Wat Dan, Satupradit	2,000	Kasini Thai Rice Trading Co., Ltd.	Thai Damrong Patana Kasini Thai Rice Trdg. Co., Ltd. Chalyaporn Rice Co.	Rice
Leam Thong Corp. 10 G/D	Bangyok, Prapradang	76,500	Leam Thong Corp.	An Fong Len/TSC	Rice, Sugar Fertilizer
Leam Thong Corp. 13 G/D	Bangprakok, Prapradang	140,000	Leam Thong Corp.	Joe Seng Co., Ltd.	Maize, Beans
Lee Teng Long Warehouse	Bangprakok	24,000	Lee Teng Long	I.C.C.	Beans
Lee Guan	8-9 Sol Wet Prayakrat,	4,000	Lee Guan Enterprise Co., Ltd.	Pin Thong	Rice
Lim Heng Chan	25-26 Ban Mal, New Rd.	2,500	Lim Heng Chan Co.	Lee Guan Enterprises Co., Ltd. Lim Heng Chan Co., Ltd.	Sesameseed, Beans Sesameseed, Beans
Macubon	102/1 Sol Makus, Wat Prayakrat	6,000	Marubami Corp.	Marubami Corporation,	Sugar
Nam Fah Warehouse	Sukkalo	12,000	Nam Fah	Various	Various
Nam Heng Long	161 Rong Nam Kheang 1	4,000	Nam Heng Long Co.	Nam Heng Long Co., Ltd.	Beans
Nanpan Enterprise	Prapradang	70,000	Nanpan Enterprise	Nanpan Enterprise Co., Ltd.	Maize, Tapioca, Beans
P.H. Development Co. 8 G/D	Bangyok, Prapradang	129,000	P.H. Development	P.H. Development	Tapioca Pellets
P.W.O.	Bukkalo	51,210	Ministry of Commerce	Ministry of Commerce	Rice
	Rajburana	58,450	"	"	"
	Bangkrasoy	21,670	"	"	Kenaf
Phornchal Produce	109 Rong Nam Kheang 1	1,400	Phornchal Produce Co.	Phornchal Produce Co., Ltd.	Maize
Phorn Phan	25-26 Ban Mal, New Rd.	3,500	Phorn Phan Phanich	Phornphan Phenich Co., Ltd.	Sesameseed, Beans
Pusy Itang Long	77 Bangrak, New Rd.	36,000	Pusy Heng Long Co.,	Pusy Itang Long Co., Ltd.	Rice Beans, Maize
Pusy Heng Long	43/1 Te 38 Satupradit.	35,000	Pusy Heng Long Co., Ltd.	Pusy Heng Long Co., Ltd.	Maize, Rice
Ruam Pund Kao Thai Rung	3 Dhanan Rd., Duait	4,000	Ruam Pund Kao Thai Rung	Ruam Pund Export	Rice
Sri Ayudhaya Bank	Raburens	48,000	Sri Ayudhaya Bank	Various	Various
Sab Sathaporn	Prapradang	60,000	Sab Sathaporn	Sab Sathaporn	Tapioca, Maize
Soops Nawa	Prapradang	10,000	Soops Nawa	Nam Sae Lee P.C. Enterprise	Rice Tapioca
Seguen Produce	16 Trek Captainbus,	1,500	Seguen Producer	Siam Ka Kao Co., Ltd.	Rice
Sataphorn	161 Sol Mit Pradung	4,200	K. Thow Co., Ltd.	Seguen Produce Ltd., Part.	Maize Beans
Sri Rung Thai	16 Satupradit	4,500	Sri Rung Thai Co., Ltd.	Sataphorn	Beans, Sesameseed
Sung Ching Lee	73 Satupradit.	6,000	Tep Phanich Co., Ltd.	Sri Rung Thai Co., Ltd.	Rice Maize
Sung Chlang Lee 2 G/D	491 Chongmonsi,	5,000	Sung Chlang Lee Co., Ltd.	Sung Chlang Lee Co., Ltd.	Rice
Sung Chan	161 Sol Mitpradung	4,200	K. Thow Co., Ltd.	Sung Chan	Rice
Sung Kes	Te Dindang	500	Chook Chal Lee	Sung Chan Chook Chal Lee	Beans, Sesameseed Steamed Bone Meat
Santikij	Bangprakok	10,000	Santikij	Chai Lee	"
Swee Yong	Sam Ray	8,000	Sri Yong (2509) L.P.	Santikij	Rice
Sang Thong Rice	Raburens	102,000	Sang Thong Rice	Sri Yong (2509) Ltd., Part. San Cheroen Sang Thong Rice Chin Heng	Tapioca Rice Rice Rice Rice
Thai Rice 1	Raburens	15,000	Thai Rice Co., Ltd.	Chalyaporn Rice M.D.F. Kijpoom Co., Ltd. World Grain A.C.F.T. Thai Rice 1	Rice Rice Rice Rice Rice Rice Rice



Name of G/D	Location	Capacity M/T	Owner	Shipper	Commodities
Tai Sae	Bangpratek	15,000	Tai Sae Co., Ltd.	Tai Sae Co., Ltd.	Rice
Tai Sin	Bangpratek	8,000	Tai Sin Trading	L.H. Co., Ltd.	Tapioca
Thai Commercial Bank	Klong San	8,000	Thai Commercial Bank	Charoen Pokpand	Animal Feed
Thai Mong	Klong San	7,000	Thai Mong	Thai Mong	Rice
Tawee Sang Thai	Wang Lee Office	12,000	Wang Lee Co., Ltd.	Tawee Sang Thai Co.	Rice
Thai Hua	Prapadaeng	60,000	Thai Hua (2511) Co., Ltd.	Thai Hua Chalyaporn Rice	Rice, Maize
Thai Farmer Bank	Rosburana	28,000	Thai Farmer Bank	Various	Various
Tep Phanich	73 Satupradit	5,000	Tep Phanich Co., Ltd.	Tep Phanich Co., Ltd.	Rice, Maize
Thai Capital Crops	Trok Karn Rua, Bangkrabue.	3,000	Thai Capital Crops	Thai Capital Crops Co., Ltd.	Rice
Thanawat	Satupradit	12,000	Bank of Asia	Various	Sugar
Thai Danu Warehouse (B1) A1	2094 New Rd. San Mai	2,500	Thai Danu Bank	Sugar Industry	Beans, Rice, Sugar
A 2		2,500	"	Sugar Produce Trading	Sesameseed
A 3		2,200	"		
A 3B		1,400	"		
B 1		1,500	"		
B 2		1,500	"		
B 3		1,500	"		
B 4		1,500	"		
C		8,200	"		
Thai Danu Bank (Seng Kee) Big G/D		20,800	Thai Danu Bank		
small G/D		10,000	"		
		2,000	"		
		12,000	"		
Thai Long	25-26 Ban Mai, New Rd.	2,500	Lim Heng Chan Co.	Charoen Pokpand Co., Ltd.	Rice, Maize, Sorghum
Thanakit Warehouse Co. 6 G/D	Wat Mahawong		Thanakit Warehouse	Prema Co., Ltd.	Kapokseed, Beans
G/D No. 1 & 2		34,000	"	Share Co., Ltd.	
G/D No. 3		17,000	"	Lim Heng Chan Co., Ltd.	Beans, Sesameseed
G/D No. 4, 5 & 6		51,000	"	P.W.O. (PWO 7)	Rice
		102,000	"	E.P.C. Rice Trading Co.	Rice
			"	Soon Hua Seng Co.	
Thonburi Warehouse Co. 7 G/D	Prepradeng	35,000	Kwang Soon Lee Co.	Charoen Watana Rice Co.	Rice
3 Molasses tanks			"	P.W.O. (PWO 12)	Rice
Thong Chal Rice	73 Satupradit.	12,300	Thong Chal Rice Co.	Ashahi Co., Ltd.	Chemical
T. M. K.		8,000	"	Thong Chal Rice Co., Ltd.	Rice
Wang Lee 2	161 Sol Mittr Phadung.	1,200	K. Thow Co., Ltd.	Sahakij Overseas Com.	Seediac
Wang Lee 3	Sam Ray	10,000	Wang Lee Co., Ltd.	Toyomenka (Thailand) Ltd.	Rice
Wang Lee 4	Sam Ray	13,000	Wang Lee Co., Ltd.	Wang Lee Co., Ltd.	Rice
Union Warehouse	Sam Ray	13,000	Wang Lee Co., Ltd.	Wang Lee Co., Ltd.	Rice
United Silo & Services Co. 16 G/D	Klong San	47,000	Various	Various	Various
Yong Sang	161 Sol Mittr Phadung	245,000	United Silo & Services	Thal pellets Co. Others	Tapioca pellets,
Yu Tai	TMN Wat Proyakrai	14,000	Yong Sang Ltd., Part.	Yong Sang Ltd., Part.	General cargos
	161 Sol Mittr Phadung	4,000	K. Thow Co., Ltd.	Yu Tai Trading Ltd., Part.	Beans, Sesameseed
					Sesameseed, Beans



APPENDIX D

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1. System and Channel of Rice Purchase of PWO under the Government's Paddy Price

Stabilization Programme

Quantity : Million Bags  
Value : Million Bahts

Purchasing System	Purchasing Channel	1981		1982		1983	
		Quantity	Value	Quantity	Value	Quantity	Value
1. Bidding	- Rice Trader, Miller, Exporter and Farmer's Institution	9.80	5,729	10.8	5,906	1.1	603
	- Farmer's - Institution	-	-	-	-	2.9	1,661
	- AFOT & ARP.	0.91	569	1.6	1,096	1.5	896
	- Farmer's Institution	0.89	136	0.3	476	-	-
Total		11.6	6,734	13.3	7,478	5.5	3,160

Source : Business Planning and Policy Division, PWO.

2. Milled Rice Market Share of PWO

Unit : 1,000 metric tons

	1981	1982	1983	1984
Domestic Consumption	10,725	10,942	11,155	11,357
Surplus Export	4,665	5,822	5,077	5,077
Ending Stock	2,004	1,482	704	732
1. Total Supply in market	17,394	18,246	16,936	17,166
2. Total purchase by PWO	1,824	1,772	739	300
- PWO Business	665	446	184	300
- Under government policy	1,159	1,326	555	-
Market share (percentage)	10	9	4	1.7

Remark 1. Data from Table 5

2. Business Planning and Policy Div, PWO

3. Operation of PWC under the Government's Paddy Price Stabilization Programme

Quantity : Million Bags  
Value : Million Bahts

Items	1981		1982		1983	
	Quantity	Value	Quantity	Value	Quantity	Value
Carry Over Stock	-	-	7.7	-	7.4	-
Purchase	11.6	6,734	13.3	7,478	5.5	3,161
Domestic Sale	2.2	1,488	8.8	4,300	4.4	1,794
Export	1.7	1,104	4.8	2,879	5.3	2,571
Balance	7.7	-	7.4	-	3.2	-

Source : Business Planning and Policy Division, PWC.

4. Administrative of the PWO's Manpower

Administrative of PWO's Manpower (1978 - 83)

Unit : Person

Order	Administrative Rankings	1978	1979	1980	1981	1982	1983
1.	Top Executive	7	7	8	10	10	9
2.	Senior Executive	50	50	53	57	61	64
3.	Junior Executive	160	169	169	173	175	178
4.	PC. 3 and lower	259	300	587	675	692	574
Total		476	517	817	915	938	825

Note Top Executive : Managing Director, Deputy Managing Director, Assistant Managing Director and Head of Department

Senior Executive : Chief of Division, Assistant Division Chief and PC.6 or higher

Junior Executive : PC. 4 - Pc. 5



5. Public Warehouse Organization  
Details of Administrator in New Organization

Position	Sex	Year Employed	Present Position Since	Degree Received	Faculty	University	Major Subject
1. Managing Director	Male	1983	1984	Ph.D	Economic	Texas A&M(USA)	Economics
2. Deputy Managing Director	"	1962	"	B.A.	Account	Thammasart	Account
3. Assistant Managing Director	"	1957	"	B.A.	Account, Law	"	Account, Laws
4. Office of Managing Director Chief	"	1981	"	M.A.	Economic	The American (USA)	Computers
5. Research & Planning Division Chief	-	-	-	-	-	-	-
5.1 Plan & Project Section Chief	Male	1982	"	M.A.	Politic	NIDA	Politics
5.2 System Development Section Chief	Female	1982	"	B.A.	Politic	Chulalongkorn	Politics
5.3 Statistic & Evaluation Section Chief	"	1976	"	D.A.	Literature	Silpakorn	Literature
5.4 Market & Price Analysis Section Chief	"	1974	"	D.A.	Literature	Thammasart	English
6. Budget Division Chief	Male	1982	"	M.A.	Economic	NIDA	Economics
6.1 Budget Analysis & Arrangement Section Chief	Female	1971	"	B.A.	Account	Thammasart	Accounts
6.2 Budget Control Section Chief	"	1975	"	B.A.	Account	Thammasart	Accounts
7. Public Relations Section Chief	"	1979	"	B.A.	Business Admin.	Ban Kamheang	Finances
8. Computer Section Chief	"	1975	"	B.A.	Law	Chulalongkorn	Laws
9. Legal Advisor	Male	1982	"	M.A.	Statistic	NIDA	Operating Research
10. Legal Section Chief	"	-	-	-	-	-	-
	Female	1975	"	B.A.	Law	Thammasart	Laws

Public Warehouse Organization  
Details of Administrator in New Organization

Position	Sex	Year Employed	Present Position Since	Degree Received	Faculty	University	Major Subject
11. Internal Audit & Division Chief	Female	1975	1984	B.A.	Economic	Thammasart	Economics
11.1 Finance & Account Audit Section Chief	"	1975	"	B.A.	Business Admin	"	Money & Banking
11.2 Management Audit Section Chief	Male	1979	"	B.A.	Art	Chiang-Mai	Economics
12. Administration Department Chief	"	1971	"	Certificate	Business	Assumption School	-
13. Administrative Division Chief	Female	1971	"	B.A.	Law	Thammasart	Laws
13.1 Correspondence Section Chief	"	1975	"	D.A.	Law	"	Laws
13.2 Personnel Section Chief	Male	1975	"	B.A.	Law	"	Laws
13.3 Training & Development Section Chief	"	1982	"	B.A.	Politic	INDA	Politics
14. Finance Division Chief	Female	1971	"	B.A.	Business	Thammasart	Money & Banking
14.1 Cash Receive Section Chief	"	1975	"	B.A.	Business	"	Money & Banking
14.2 Cash Payment Section Chief	"	1955	"	Certificate	-	Saint Frank School	-
14.3 Finance Admin. & Document Inspection Section Chief	"	1977	"	B.A.	Business Admin	Kamkamheang	Accounts
15. Accounting Division Chief	"	1971	"	B.A.	Business	Thammasart	Accounts
15.1 Account Section Chief	"	1975	"	B.A.	"	"	"
15.2 Debt Follow-up Section Chief	"	1974	"	B.A.	Business Admin	College of Commerce	Accounts
15.3 Accounting System Chief	"	1975	"	B.A.	Business	Thammasart	Accounts

Public Warehouse Organization  
Details of Administrator in New Organization

Position	Sex	Year Employed	Present Position Since	Degree Received	Faculty	University	Major Subject
16. Supplies Division Chief	Male	1971	1984	B.A.	Business	Thammasart	Account
16.1 Procurement Section Chief	Female	1975	"	B.A.	Law	"	Laws
16.2 Control Section Chief	"	1975	"	B.A.	Law	"	Laws
16.3 Machine & Vehicle Section Chief	Male	1968	"	Certificate	-	Pattawan Machanic School	-
16.4 Office Repair & Maintenance Section Chief	"	1958	"	"	-	Bangkok Technic School	-
17. Trade Department Chief	"	1982	"	M.A.	Politic	U.S.A.	International
18. Purchasing Division Chief	Female	1955	"	Certificate	-	Sohksa Naree School	-
18.1 Agriculture Product Section Chief	"	1975	"	B.A.	Business	Thammasart	Money & Banking
18.2 Consumer Product Purchase Section Chief	"	1975	"	B.A.	Economic	College of Commerce	Money & Banking
19. Sale Division Chief	"	1971	"	B.A.	Economic	Thammasart	Economics
19.1 Sale Section 1 Chief	"	1973	"	B.A.	Business Admin.	College of Business	Personnel Admin.
19.2 Sale Section 2 Chief	"	1970	"	Certificate	-	Thonburi Commerce	Accounts
19.3 Sale Section 3 Chief	"	1964	"	"	-	Tream Udom Sorlde	-
19.4 Sale Section 4 Chief	"	1977	"	B.A.	Business	Thammasart	Money & Banking

Public Warehouse Organization

Details of Administrator in New Organization

Position	Sex	Year Employed	Present Position Since	Degree Received	Faculty	University	Major Subject
19.5 Sale Section 5 Chief	Female	1974	1984	B.A.	Art	Thammasart	Statistics
19.6 Sale Section 6 Chief	"	1975	"	Certificate	Business Admin.	College of Commerce Thonburi	-
19.7 Sale Section 7 Chief	"	1955	"	Certificate	-	Benjarasutit School	-
19.8 Sale Section 8 Chief	"	1974	"	B.A.	Economic	Thammasart	Money & Banking
19.9 Sale Section 9 Chief	"	1955	"	Certificate	-	Sattree Wat Raking School	-
19.10 Sale Section 10 Chief	"	1976	"	"	-	Tangkrongjit Commerce School	Account
19.11 Sale Section 11 Chief	"	1961	"	"	-	Santirajbomdung School	-
19.12 Sale Section 12 Chief	"	1980	"	B.A.	Science	Kasetsart	Economics
19.13 Sale Coordinate Section Chief	"	1977	"	B.A.	Law	Thammasart	Laws
20. Sale at Home Unit Chief	Male	1977	"	B.A.	Economic	"	Economics
21. Ambulatory Sale Unit Chief	"	1971	"	Certificate	-	Sirisart School	-
22. Department Store Unit Chief	"	1983	"	B.A.	Art	Thammasart	English
23. Foreign Trade Division Chief	Female	1975	"	B.A.	Business	"	Money & Banking
23.1 Administrative Section Chief	"	1975	"	B.A?	"	"	General Admin.
23.2 Marketing Section Chief	Male	1975	"	-	-	-	-
24. Warehouse Department Chief	-	-	-	-	-	-	-

Public Warehouse Organization  
Details of Administrator in New Organization

Position	Sex	Year Employed	Present Position Since	Degree Received	Faculty	University	Major Subject
25. Warehouse Management Division Chief	Male	1981	1984	M.A.	Politic	Brigham Young (USA)	General Admin
25.1 Public Warehouse Section Chief	"	1977	"	B.A.	-	Srinakari Virod	Education
25.2 Stock Control Section Chief	Female	1975	"	B.A.	Business	Thammasart	Account
26. Central Warehouse Division Chief	Male	1964	"	B.A.	Law	"	Laws
26.1 Administrative Section Chief	Female	1955	"	Certificate	-	Karnshang Satree Phanaborn Tai, School	-
26.2 Warehouse 1 Chief (Thonburi)	Male	1975	"	B.A.	Economic	Thammasart	Money & Banking
26.3 Warehouse 2 Chief (Rajbuarane)	"	1982	"	B.A.	Law	"	Laws
26.4 Warehouse 3 Chief (Nonthaburi)	"	1974	"	B.A.	Science	Kasetsart	Agriculture
27. Regional Warehouse Division Chief	"	1971	"	D.A.	Law	Thammasart	Laws
27.1 Administrative Section Chief	Female	1975	"	B.A.	Law	"	Laws
27.2 Banpai Warehouse Chief	Male	1971	"	Certificate	-	Bomrungvit School	-
27.3 Buayai Warehouse Chief	"	1957	"	"	-	Wat Mahatara School	-
27.4 Sawanklailok Warehouse	"	1971	"	B.A.	-	Takushoka (Tokyo)	International Trade



APPENDIX E

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1. Amount of Farmer's Surplus of Major and Second Rice Crop (1/7)

Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
Central	5,305	1,142	4,163	2,492	3,634	1,671
Lower North	2,991	790	2,201	668	1,458	1,533
Upper North	1,908	796	1,112	453	1,249	659
N. East	5,632	3,080	2,552	1,753	4,833	799
South	1,131	580	551	634	1,214	△83
Whole Kingdom	16,967	6,388	10,579	6,000	12,388	4,579

Note: 1. Estimated demand of rice growing households is amount of home consumption, seed, loss of postharvest, feed, sweet etc.

2. Use milling recovery 60% for North East and 65% for other regions.

(2/7)

Amount of Farmer's Surplus of Major and Second Rice Crop

(Unit 1,000 ton, paddy basis)

Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
<u>Central</u>						
Bangkok Metropolitan	167.2	30.0	137.2	1,133.0	1,163.0	995.8
Nonthaburi	146.7	20.8	125.9	83.9	104.7	42.0
Pathumthani	444.7	61.2	383.5	47.2	108.4	336.3
Ayurthya	423.4	98.2	325.2	110.2	208.4	215.0
Anthong	252.7	49.8	202.9	19.2	69.0	183.7
Saraburi	253.0	52.9	200.1	64.3	117.2	135.8
Lopburi	405.8	87.6	318.2	62.1	149.7	256.1
Singburi	282.8	47.6	235.2	8.4	56.0	226.8
Chainat	370.6	54.3	316.3	29.7	84.0	286.6
Sub Total	2,746.9	519.9	2,227.0	1,495.1	2,015.0	731.9
<u>East</u>						
Samut Prakan	105.2	19.3	85.9	112.7	132.0	Δ 26.8
Nakhon Nayok	180.9	43.0	137.9	4.2	47.2	133.7

(3/7)

Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
<b>(East)</b>						
Prachinburi	345.6	101.0	244.6	40.4	141.4	204.2
Chchoengsao	495.9	85.8	410.1	47.1	132.9	363.0
Cholburi	62.5	24.5	38.0	128.1	152.6	△ 90.1
Rayong	50.6	17.0	33.6	58.8	75.8	△ 25.2
Chanthaburi	46.6	15.5	31.1	51.6	67.1	△ 20.5
Trat	20.1	8.0	12.1	20.5	28.5	△ 8.4
Sub Total	1,307.4	315.7	991.7	426.6	742.3	565.1
<b>West</b>						
Kanchanaburi	86.6	34.9	51.7	81.3	116.2	△ 59.6
Ratburi	168.8	51.1	117.7	93.3	144.4	24.4
Phetburi	89.4	32.8	56.6	49.3	82.1	7.3
Prachaup Khirikhan	26.5	9.7	16.8	74.8	84.5	△ 58.0
Suphanburi	564.9	123.5	441.4	67.0	190.5	374.4
Nakhon Pathom	262.7	49.4	213.3	102.4	151.8	110.9
Samut Sakhon	49.9	10.4	39.5	52.0	62.4	△ 42.2
Samut Songkhram	1.5	0.4	1.1	43.7	44.1	△ 42.6
Sub Total	1,250.5	310.8	939.7	568.7	879.5	371.0
Total	5,304.8	1,146.4	4,158.4	2,490.4	3,636.8	1,668.0

(4/7)

Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
<u>Lower North</u>						
Nakhon Sawan	622.6	157.5	465.1	125.5	283.0	339.6
Phichit	539.4	114.5	424.9	40.2	154.7	384.7
Kamphaeng Phet	301.0	77.4	223.6	83.8	161.2	139.8
Phisanulok	470.3	116.4	353.9	87.7	204.1	266.2
Sukhothai	270.1	90.9	179.2	62.4	153.3	116.8
Uttaradit	191.4	62.5	128.9	60.9	123.4	68.0
Uthai Thani	168.8	45.0	123.8	29.0	74.0	94.8
Tak	52.9	27.7	25.2	51.2	78.9	△ 26.0
Phetchabun	273.6	97.8	175.8	136.0	233.8	39.8
Total	2,990.1	789.7	2,200.4	669.3	1,459.0	1,531.1
<u>Upper North</u>						
Chiang Rai	755.1	246.5	508.6	13.1	259.6	508.6
Chiang Mai	372.4	147.3	225.1	175.4	322.7	49.7
Payao	247.3	85.0	162.3	41.9	126.9	120.4
Nan	94.5	68.9	25.6	35.3	104.2	△ 9.7
Phrae	109.8	64.1	45.7	58.7	122.8	△ 5.8

(5/7)

Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
<u>Upper North</u>						
Lampang	190.1	123.6	66.5	57.7	181.3	8.8
Lamphun	103.0	52.0	51.0	45.2	97.2	5.8
Mae Hong Son	35.5	20.3	15.2	16.1	36.4	Δ 0.9
Total	1,907.7	793.9	1,113.8	458.8	1,252.7	655.0
<u>North East</u>						
Nakhon Rajsima	394.1	255.0	139.1	320.0	575.0	Δ 180.9
Burirum	543.0	227.7	315.3	112.2	339.9	203.1
Surint	556.7	226.9	329.8	83.8	310.7	246.0
Sri Saket	367.5	224.7	142.8	99.9	324.6	42.9
Ubol	483.7	292.0	191.7	176.1	468.1	15.6
Chayapun	290.2	224.4	65.8	32.9	257.3	32.9
Khon Kaen	453.0	233.2	219.8	173.3	406.5	46.5
Maharakam	258.9	160.0	98.9	69.4	229.4	29.5
Roi-et	399.1	241.5	157.6	76.8	318.3	80.8
Kalasint	287.3	148.2	139.1	78.4	226.6	60.7
Loei	129.0	68.3	60.7	66.6	134.9	Δ 5.9
Udon	552.2	266.4	285.8	168.0	434.4	117.8
Sakol Nakhon	272.2	155.7	256.5	77.3	233.0	39.2

(6/7)

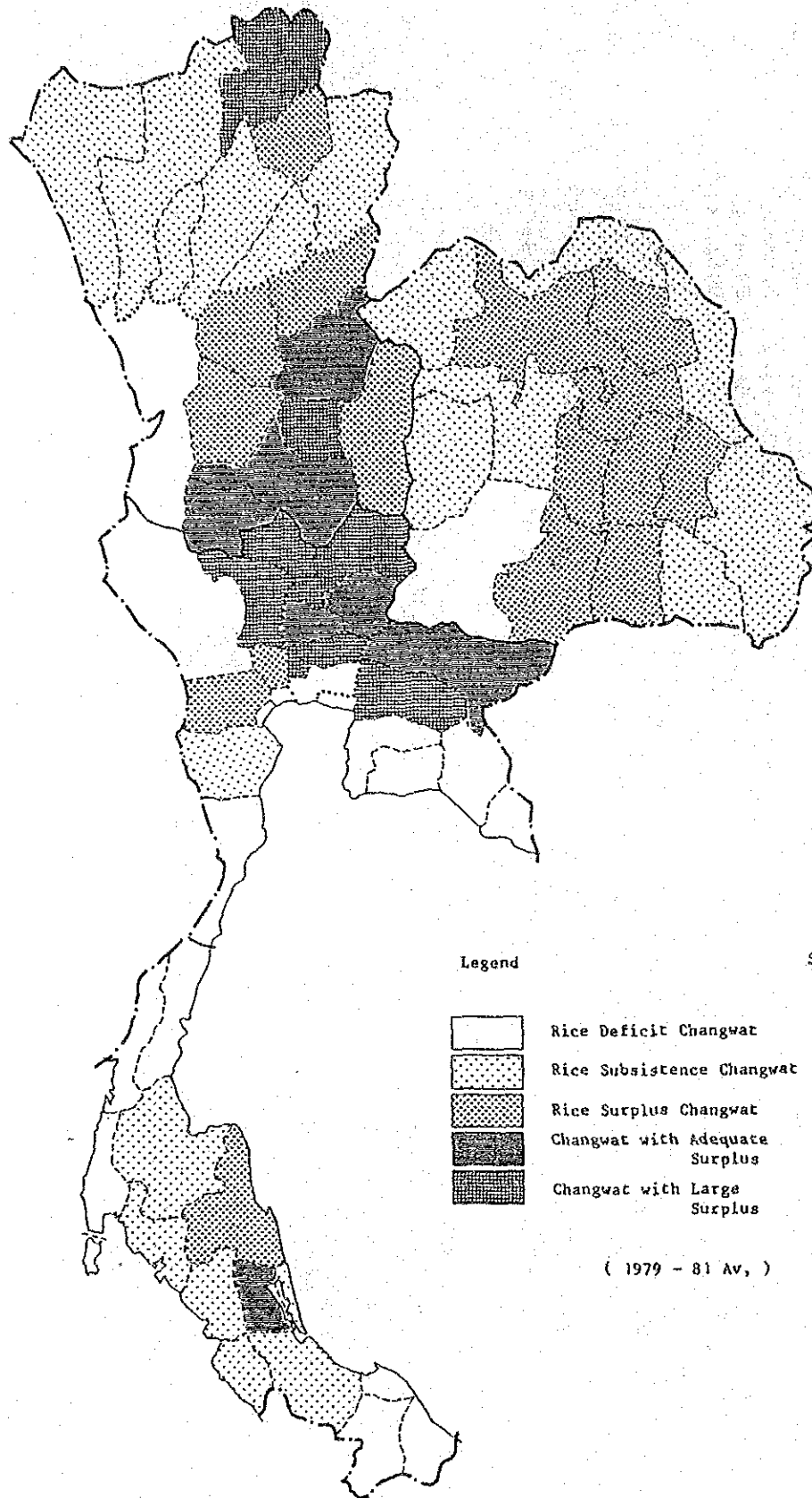
Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
<b>(North East)</b>						
Nong Khai	218.5	123.1	95.4	79.1	202.2	16.3
Nakhon Phanom	241.3	149.4	91.9	78.7	228.1	13.2
Yosothon	185.0	100.8	84.2	36.8	137.6	47.4
Total	5,631.8	3,079.3	2,552.5	1,753.6	4,832.9	798.8
<b>South</b>						
Chumpon	41.5	24.4	17.1	44.3	68.7	Δ 27.2
Surathani	121.5	48.7	72.8	74.7	123.4	Δ 1.9
Nakhon Sritamaraj	307.4	155.3	152.1	107.1	262.4	45.0
Phatalung	194.9	73.4	121.5	12.4	85.8	109.1
Songkla	151.9	79.8	72.1	96.9	176.7	Δ 24.8
Pathani	54.6	44.2	10.4	51.0	95.2	Δ 40.6
Yala	21.8	13.3	8.5	43.7	57.0	Δ 35.2
Narativas	47.6	34.6	13.0	57.3	91.9	Δ 44.3
Satool	37.3	19.2	18.1	15.1	34.3	3.0
Trang	83.4	42.7	40.7	46.1	88.8	Δ 5.4
Krabi	44.5	21.3	23.2	24.2	45.5	Δ 1.0
Phuket	3.3	2.5	0.8	25.3	27.8	Δ 24.5

(7/7)

Region	Paddy Production	Estimated Demand of Rice Growing Households	Sales of Paddy from Rice Growing Households	Estimated Demand of Non-Rice Growing Households	Total Demand	Surplus and Deficit
(South)						
Phanga	15.4	9.2	6.2	27.2	36.4	Δ 21.0
Ranong	4.5	2.7	1.8	14.7	17.4	Δ 12.9
Total	1,129.6	580.6	549.0	635.0	1,215.6	Δ 86.0

Note: Calculation is done with finite number of digits.

2. SURPLUS and DEFICIT of RICE by CHANGWAT



Legend



	Supply Demand Ratio
Rice Deficit Changwat	85 % >
Rice Subsistence Changwat	85-115 %
Rice Surplus Changwat	115-200 %
Changwat with Adequate Surplus	200-250 %
Changwat with Large Surplus	250 % <

( 1979 - 81 Av, )



3. Population Projections of Different Regions by Assumption of Low Fertility in 1990 and 2000

		Average annual growth rate		1990 (1,000)	Average annual growth rate	
		1980 (1,000)	1980 - 1990 (%)		1990 - 2000 (%)	2000 (1,000)
0.	Whole Kingdom	46,455	1.77	55,345	1.43	63,772
01.	Bangkok Metro- polis	5,152	2.87	6,840	2.32	8,600
02.	Whole Kingdom excl. Bangkok Metropolis	41,303	1.62	48,500	1.30	55,170
1.	Central	14,601	2.00	17,800	1.62	20,900
11.	Central excl. Bangkok Metro- polis	9,449	1.49	10,960	1.26	12,300
2.	North	9,667	1.45	11,160	1.17	12,500
21.	Lower North	5,108	1.45	5,900	1.17	6,630
22.	Upper North	4,559	1.43	5,250	1.16	5,890
3.	North East	16,433	1.77	19,580	1.43	22,570
4.	South	5,754	1.82	6,890	1.47	7,970
5.	Central and Lower North excl. Bangkok Metropolis	14,557	1.48	16,860	1.17	18,930



APPENDIX F

<u>No.</u>		<u>Page</u>
1.	A List of Possible Sites for Building a Warehouse	1
2.	Total Construction Cost of of Building	4



1. A List of Possible Sites for Building a Warehouse

Indicated in order of the survey data

Site survey No.	Survey Date	Region	Place	Owner	Location	Environment				Electricity	Telephone	Water Pains	Existing Structure	Obstacles, etc.	Rating
						Ventilation	Fire	Private Houses	Pollution from Pungent						
14	Oct. 29, 1984	Prachin buri	Wuang	State Railway of Thailand	Rear of station; extension possible; path faces Suwanna Born RD No. 310; the width of the front road is 10 m.	Good	Safe	Spotted	None	Available; extension of 100 m	Available	None; wells required	Existing; railway platform office; possible to demolish	Existing platform Trees 2500 3 2500 6 2500 1	1
15	Oct. 29, 1984	Prachin buri	Khok Mahok	State Railway of Thailand	Rear of station; extension possible; unpaved road with the width of 5 m runs at a distance of 1 km.	Good	Safe	Spotted	None	Available; extension of 30 m	None	Available; extension of 50 m	None	Trees 2600 6	3
13	Oct. 29, 1984	Prachin buri	Ban Drom Seang	Real Estate Division Treasury Dept.	Along No. 33 to Prachin buri; 44, 7 km	Good	Safe	None	None	Available; extension of 30 m	None	None; wells required	None	None Ricefields	2
10	Oct. 30, 1984	Nakhon Ratchasima	Zan Thosang	Dept. of Highways	20 km from Nakhon; Faces No. 24	Good	Safe	None	None	Available; extension of 30 m	None	None; wells required	None	Woody area Lumbered land	3
11	Oct. 30, 1984	Nakhon Ratchasima	Krok Krod	Real Estate Division Treasury Dept.	12 km from Nakhon; 150 m from No. 2	Good	Safe	None	None	Available; extension of 200 m	Possible	None; wells required	None	Woody Possible to adjust land by tractors	1
12	Oct. 30, 1984	Nakhon Ratchasima	Wuang	State Railway of Thailand	Rear of Nakhon station; 1.2 km extension possible; narrow road; 2.8 km from No. 104	Good	Safe	None	None	Available; extension of 50 m	Available	Available; extension of 100 m	None	Grassy private lane required	2
8*	Oct. 31, 1984	Surin	Wai Hwang	Ministry Education	No. 2 for protection of historical spots; edge of a road; near the town	Good	Safe	None	None	Available; extension of 30 m	Available	None; wells required	None	Traces of a moat depth unknown	2
9	Oct. 31, 1984	Surin	Wuang	State Railway of Thailand	500 m west of Surin station; narrow road to the west	Good	Many wooden houses	Many	None	Available; extension of 100 m	Available	None; wells required	None; with a bridge	Traces of earth removed for railway; pond of lotus	3
9*	Oct. 31, 1984	Surin	Wanchi	State Railway of Thailand	8.7 km from Surin; about 1 km of unpaved road from No. 2078; along the plaza in front of a station	Good	Safe	Spotted	None	Available; extension of 20 m	None available at a regional agricultural laboratory which is a distance of 3 km	None; wells required	None	Jet pond with the width of 3 m; 5 trees with a width of 1.0 m to 2.0 m each	1
6	Nov. 1, 1984	Ubon Ratchathani	Ban Non That	Treasury Dept.	30 km from Ubon; faces a road with a width of 6 m	Good	Safe	None	None	Available; extension of 30 m	Available; extension of 300 m	None; wells required	None	30 trees with a width of 1.2 m; a bush of bamboo with a width of 30 m; ricefield	3

Fire-survey No.	Survey Date	Region	Place	Owner	Location	Environment					Electricity	Telephone	Water Main	Existing Structure	Obstacles, etc.	Rating
						Ventilation	Fire	Private Houses	Pollution from Disposition	Electricity						
7	Nov. 1, 1984	Udon Ratchabhandi	Vachachantrap	State Railway of Thailand	Side of station; extension impossible	Good	Safe	None	None	Available; extension of 10 m	Available; extension of 50 m	Available; extension of 50 m	None	12 trees with a width of 1.2; a slope with no width	2	
1	Nov. 2, 1984	Udon Thani	Wuang	State Railway of Thailand	Rear of station; extension may be used after repair; longer part of the site faces a road with a width of 6 m	Good	Safe	Government offices	None	Available; extension of 10 m	Available; extension of 30 m	Available; extension of 50 m	Extensive steam engine; wooden plate warehouse; 1,452.5 m	Grooves for inspection inside the garage; removal of railways required	2	
1	Nov. 2, 1984	Udon Thani	Hong Rva	Dept. of Highways	7.5 km from Udon Thani station; corner of 100 m facing No. 22; a warehouse of 4,500 tons to the south; a tapioca factory to the east	Good	Safe	Spotted	None	Available; extension of 10 m	Available	None; wells required; water level of 20 m	None	None	1	
5	Nov. 3, 1984	Khon Keen	The Pre	State Railway of Thailand	12.8 km from Khon Keen rice mill in the neighborhood of Tapota station	Good	Safe	None	None	Available; extension of 30 m	Available; extension of 150 m	None; wells required	None	1 tree with a width of 700	1	
5	Nov. 3, 1984	Khon Keen	San Pui	PHO	47 km from Khon Keen	Good	Safe	None	None	Available	Available	Available	Many buildings currently in use	None	2 Distance only	
25	Nov. 5, 1984	Phitsanulok	Huayaw	Treasury Dept.	Unpaved road of 800 m from No. 1066; 3 km to the city	Good	Safe	None	None	Available; extension of 1 km	None	None; wells required	None	Ricefield	1	
24	Nov. 5, 1984	Phitsanulok	Tengmae	State Railway of Thailand	4 km from the city; rear of Tengmae station	Good	Safe	Spotted	None	Available; extension of 700 m	None	None; wells required; water level of 4.0 m	None	Marsh	2	
17	Nov. 6, 1984	Lam Pang	Soptuey	State Railway of Thailand	About 1 km from station; 2 km from Asian road	Good	Safe	Exist	None	Available; extension of 10 m	None	None; wells required	None	Foundation of a guard house; 3 trees with a width of 500	2	
18	Nov. 6, 1984	Lam Pang	Kohkha	PMO Rented land	12 km from Lam Pang crossing with Yakhka; along No. 2	Good	Safe	None	None	Available; extension of 30 m	Available; extension of 30 m	Available; extension of 150 m	None	None; marsh	1	
19	Nov. 7, 1984	Chieng Mai	Sao Hae Lao San Sai	Mt. Jansacaw	5 km of Chieng Mai; 2 km from No. 2; many rice mill factories	Good	Safe	None	None	Available; extension of 30 m	Available; extension of 100 m	None; wells required	None	None; ricefield	1	

Pre-survey No.	Survey Date	Region	Place	Owner	Location	Environment				Electricity	Telephones	Water Main	Existing Structure	Obstacles, etc.	Rating
						Ventilation	Fire	Private Houses	Pollution from Pungation						
22	Nov. 8, 1984	Chiang Mai	Uat Kat	State Railway of Thailand	Rear of Chiang Mai Station Hotel; adjacent to irrigation office; 1.5 km to highway	Good	Safe	None	None	Available; extension of 30 m	Available; extension of 100 m	None	None	2 to 30 trees with a width of 300; marsh	1
23	Nov. 8, 1984	Chiang Mai	Saraphi	State Railway of Thailand	10 km of Chiang Mai side of Saraphi station	Good	None	Spotted	None	Available; extension of 100 m	None; well required	None	None	6 trees with a width of 1,000	2
27	Nov. 9, 1984	Nakhon Sawan	Hong Pliang	State Railway of Thailand	1 km of Nakhon Sawan station; 5 km from No. 11 adjacent to a gas station	Good	None	None	None	Available; extension of 300 m	None; well required	None	None	Traces of ricefields	1
28	Nov. 9, 1984	Nakhon Sawan	Erethpra	Mr. Sangar Suseboon	14 km south of Nakhon Sawan on No. 11; 4 sites in 20 rais; 3 sites 2 km to the west in 100,000 rais.	Good	None	None	None	Available for A sites; None for B site	None; well required	None	None	Jungle	2
29	Nov. 13, 1984	Surat thani	Puang	State Railway of Thailand	About 500 m at the rear of station; close to Bangkok; between railway and a river	Good	None	None	None	Available; extension of 30 m	None; well required	None	None	11 trees with a width of 300	1
30	Nov. 20, 1984	Saphan Buri		Treasury Dept.	6.3 km from Saphan Buri; faces No. 321	Good	None	None	None	Available; extension of 30 m	None; well required	None	None	Ricefields; a poultry farm at a distance of 200 m to the west	2
31	Nov. 20, 1984	Saphan Buri		Treasury Dept.	700 m north west of Site 30	Good	None	Exist	Exist	Available	None; well required	None	None	Electric wire on the site; possible to remove	1
32	Nov. 21, 1984	Phichit		Treasury Dept.	4.1 km from Provincial office; 1.4 km from N15 line	Good	None	None	None	Available after two years	Available after two years	None	None	Inside a planned site; good environment	1
33	Nov. 21, 1984	Sara Buri		Bank	9 km from the city; 25.1 km from Saraburi	Good	None	None	None	Available	Wells available	Exists; as shown on the chart	None		2
34	Nov. 21, 1984	Sara Buri		Bank	1.7 km from bank; faces No. 1	Good	None	None	None	Available	None; wells required	None	None	Many trees	1
35	Nov. 21, 1984	Sara Buri		Bank	9.9 km from Sara Buri; rear of the maize warehouse	Good	None	None	None	Available; extension of 300 m	Available	None	None	Woody	3
36	Dec. 4, 1984	Chai nat		Public Works Dept.	Planned site of urban development	Good	None	None	None	Available; extension of 2 km	Available; extension of 2 km	None	None	Woody	

2. Total Construction Cost of Building

Location	Warehouse	W/U Equipment Work	Articles Accessory Building	Truck Scale	Office	Demolition	Cleaning Rice Grading Facilities	Rice Packing Facilities	R.P.E. Domestic Rice	Grain Processing Facilities	R.P.E. Export Rice	Civil Engineering	Total
Nonhaburi	30,284,800	4,550,000	867,000	430,332	-	12,813,000	-	1,781,000	-	-	17,304,000	24,005,200	92,035,332
Nakhon Sawan	32,494,824	6,987,300	5,550,650	215,116	1,200,000	-	1,008,000	1,781,000	-	675,000	-	6,506,000	56,417,890
Lampang	22,403,736	5,263,700	5,290,575	215,166	800,000	-	1,008,000	1,781,000	-	-	-	1,633,000	38,395,177
Nakhon Ratchasima	21,663,576	4,066,000	7,224,150	210,446	800,000	-	-	1,781,000	-	675,000	-	753,000	37,173,172
Surat Thani	5,415,804	2,739,200	964,800	210,446	400,000	30,000	-	1,781,000	-	-	-	469,000	12,010,250
Total	112,262,740	23,606,200	19,897,175	1,281,506	3,200,000	12,843,000	2,016,000	8,905,000	-	1,350,000	17,304,000	33,366,200	236,031,821
Suphan Buri	5,600,934	2,589,200	3,238,575	215,166	-	-	-	-	-	-	-	2,881,000	14,524,875
Chai Nat	5,415,804	2,739,200	2,813,550	210,446	-	-	-	-	-	-	-	485,000	11,664,000
Saraburi	5,415,804	2,739,200	2,364,000	210,446	-	-	-	-	-	-	-	999,000	11,728,450
Phitsanulok	5,600,934	2,739,200	2,176,750	215,116	-	-	-	-	-	-	-	2,240,000	12,972,000
Phichit	5,600,934	918,500	3,289,950	215,116	-	-	-	-	-	-	-	2,023,000	12,047,500
Chiang Mai	5,415,804	2,739,200	2,007,900	210,446	-	-	-	-	-	-	-	2,748,000	13,121,350
Chiang Rai	5,415,804	2,739,200	1,978,050	210,446	-	-	-	-	-	-	-	877,000	11,220,500
Udonthani	5,415,804	2,739,200	1,427,900	210,446	-	-	-	-	-	-	-	472,000	10,265,350
Surin	5,415,804	2,739,200	1,998,895	210,446	-	30,000	-	-	-	-	-	1,306,000	11,700,345
Ubon Ratcharhani	5,415,804	2,739,200	2,028,975	210,446	-	100,000	-	-	-	-	-	494,000	10,988,425
Total	54,713,430	25,421,300	23,324,545	2,118,520	-	130,000	-	-	-	-	-	14,525,000	120,232,795
Laem Chaban	105,996,800	15,925,000	250,000	430,332	1,600,000	-	-	-	-	-	-	20,696,000	154,748,132
Bukkalo	-	200,000	150,000	-	-	50,000	-	-	7,000,000	-	-	2,000,000	9,400,000







APPENDIX G

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1. Soil Test Data (1)

Fig-1 Nonthaburi

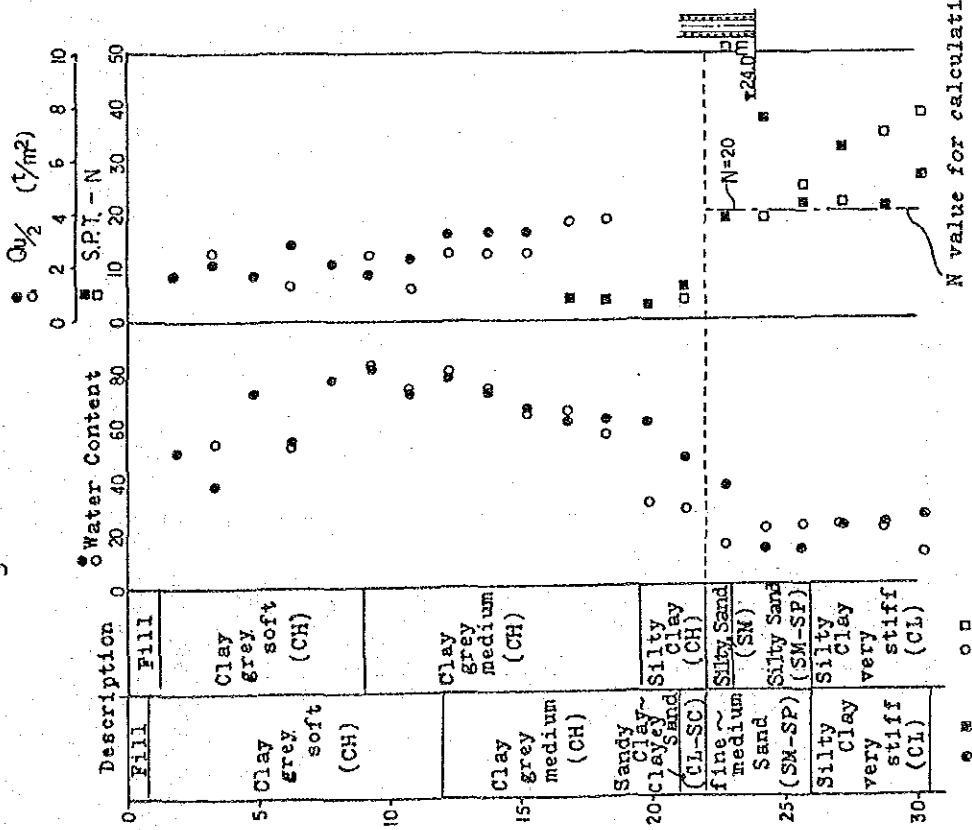


Fig-2 Ayutthaya

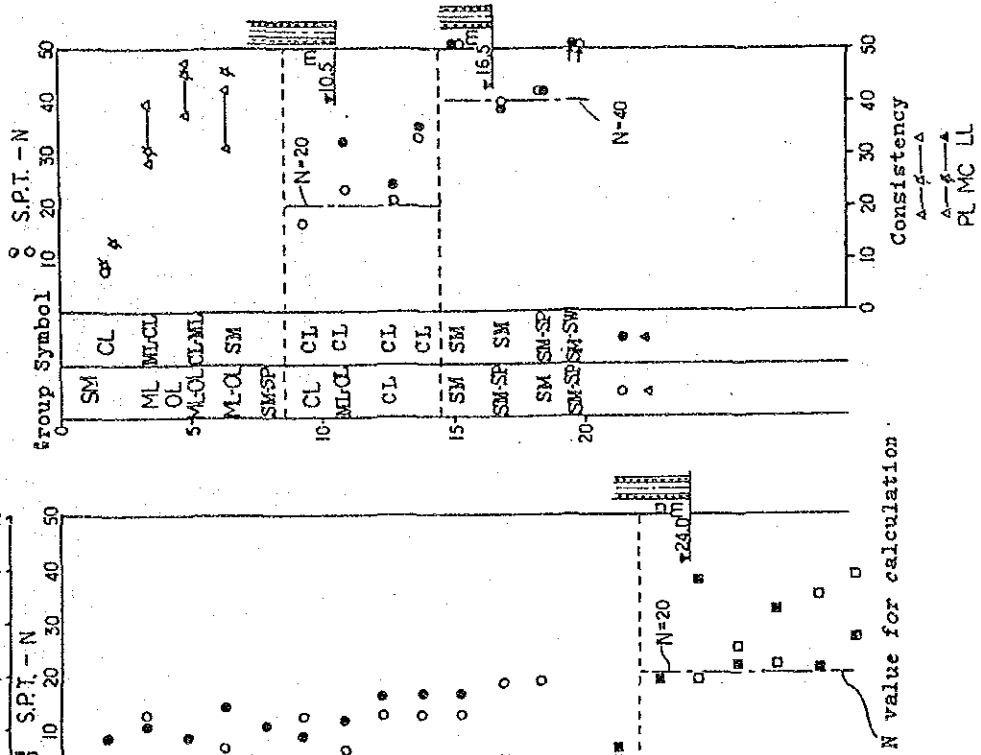
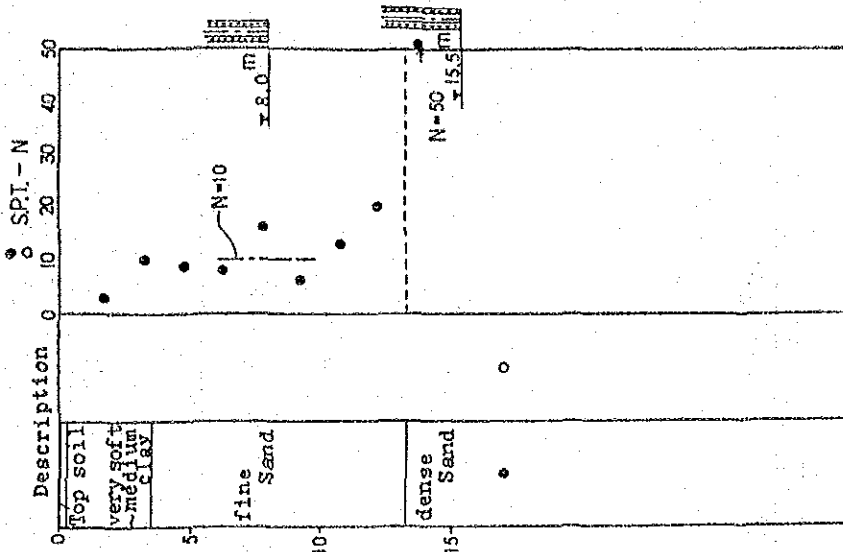


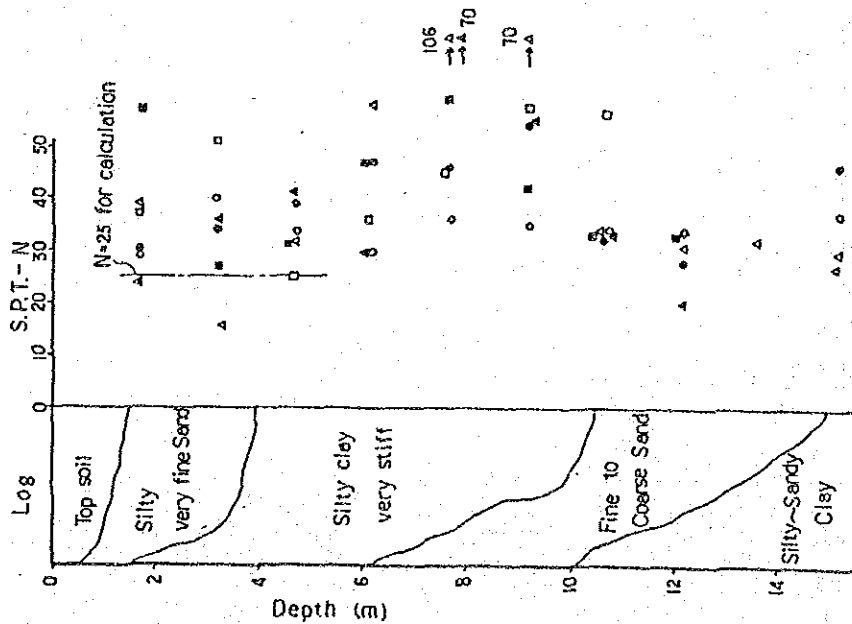
Fig-3 Phisnulok



N value for calculation

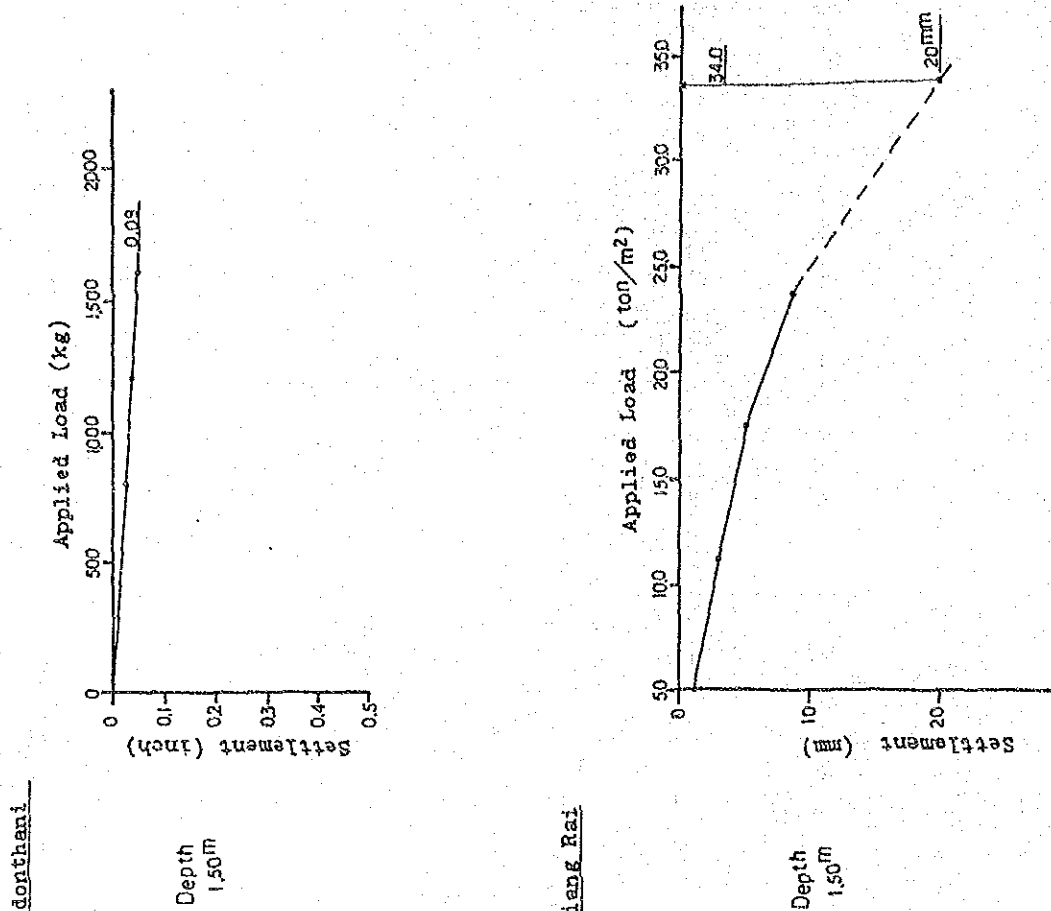
2. Soil Test Data (2)

Fig-4 Chiang Mai



- BH-1
- -2
- △ -3
- △ -4
- -5
- -6

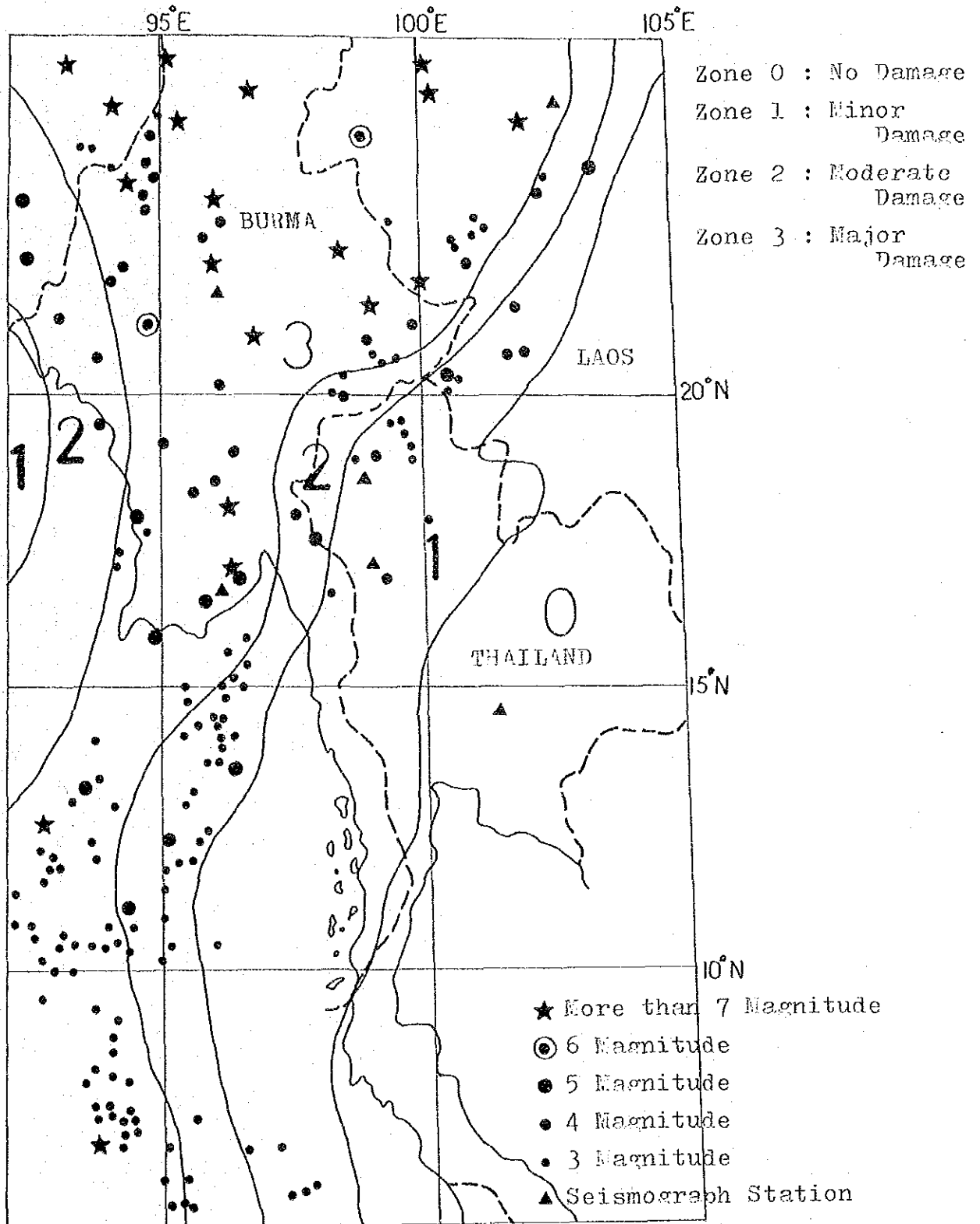
Fig-5 Plate Bearing Test



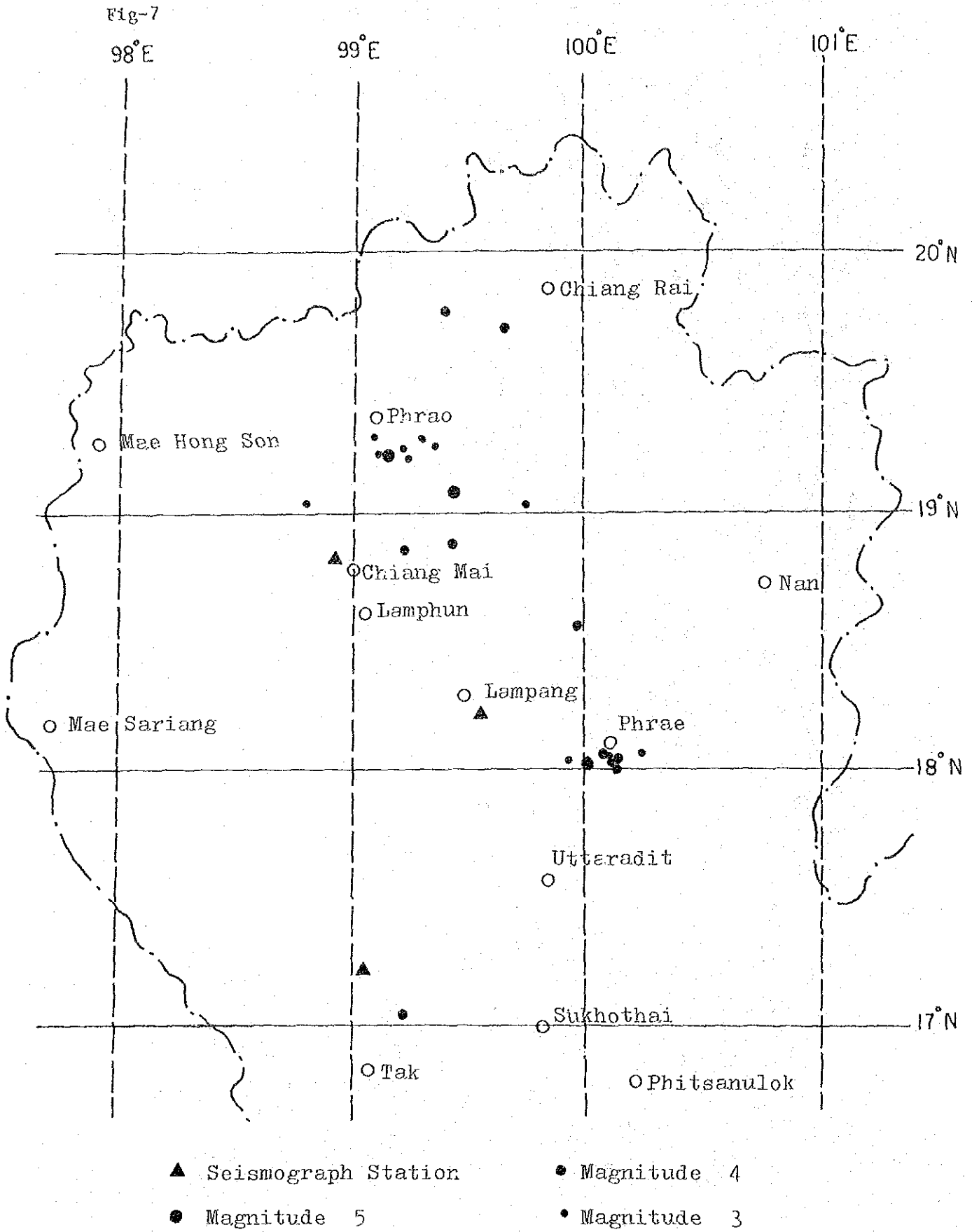
3. Seismic Probability Map For Thailand And Neighbouring Countries

Distribution Of Earthquake Epicenters : 1975 - 1981

Fig-6



#### 4. Distribution of Earthquake Epicenters of North Thailand





5. Survey Note of Civil Engineering

(1) UDON THANI NO.1

Geological Condition

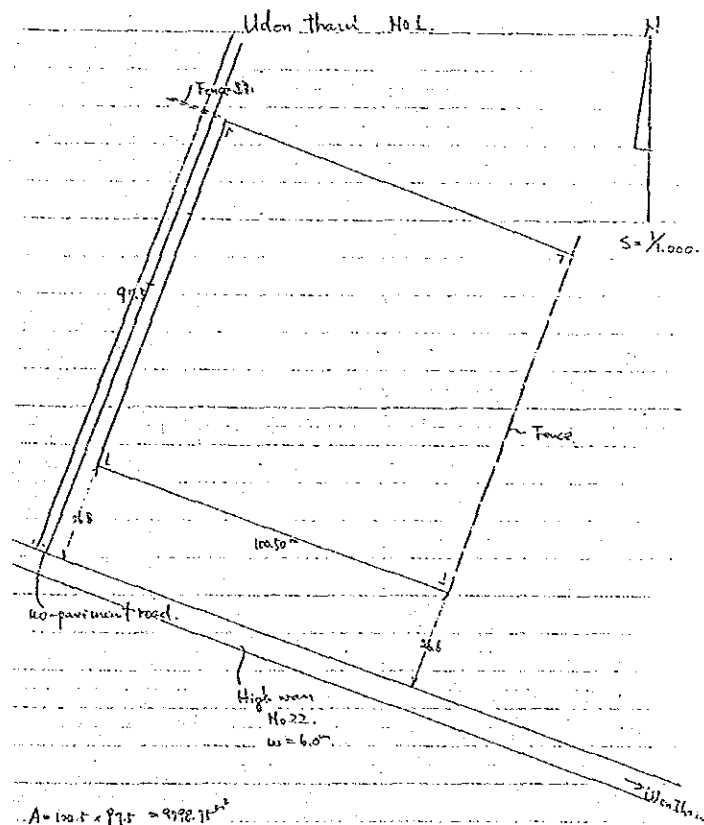
Flat plane,

Top soil is fine sand, the under layer is Laterite, well consolidated.

Water level is deep.

Civil Engineering Works

- |                |                          |
|----------------|--------------------------|
| a, Land area   | about 9800m <sup>2</sup> |
| b, Access road | L = 30m                  |
| c, Banking     | Leveling of ground       |
| d, Drainag     | L = 400m                 |
| e, Siding      | L = 0m                   |
| f, Foundation  | Individual footing       |



(2) UDON THANI NO.2

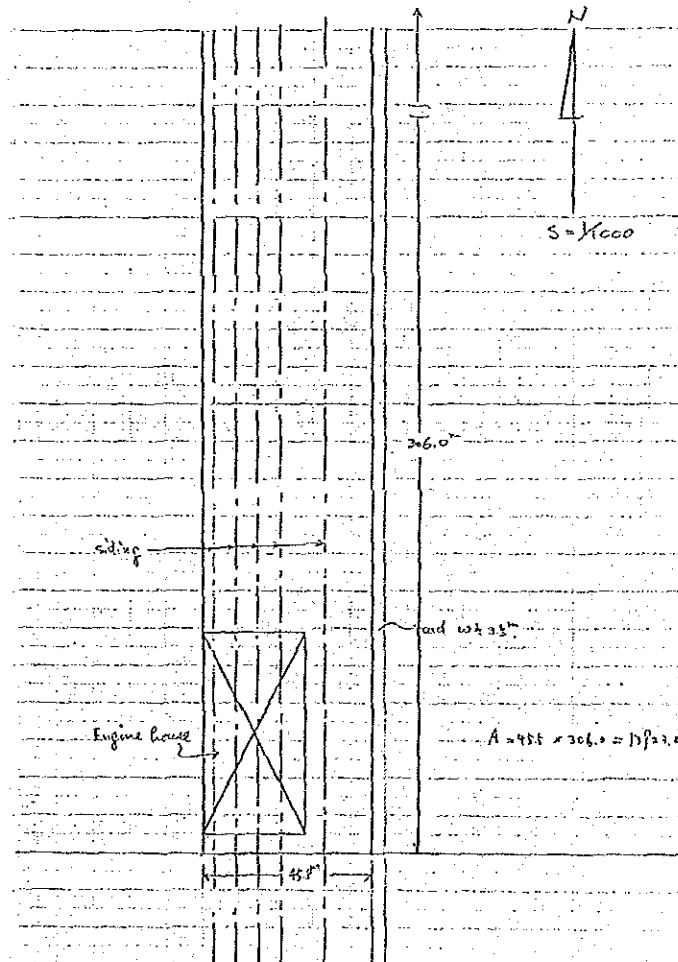
Geological Condition

Flat plane, on the existing siding of Udon Thani station.  
Top soil is Laterite. Water level is deep.

Civil Engineering

- a, Land area about 13900 m<sup>2</sup>
- b, Access road newly construction L= 10 m  
extended work L=780 m
- c, Banking
- d, Drainage L=400 m
- e, Siding Existing siding can be used after repair
- f, Foundation Individual footing

Udonthani No.2



(3) KHON KAEN NO.5

Geological Condition

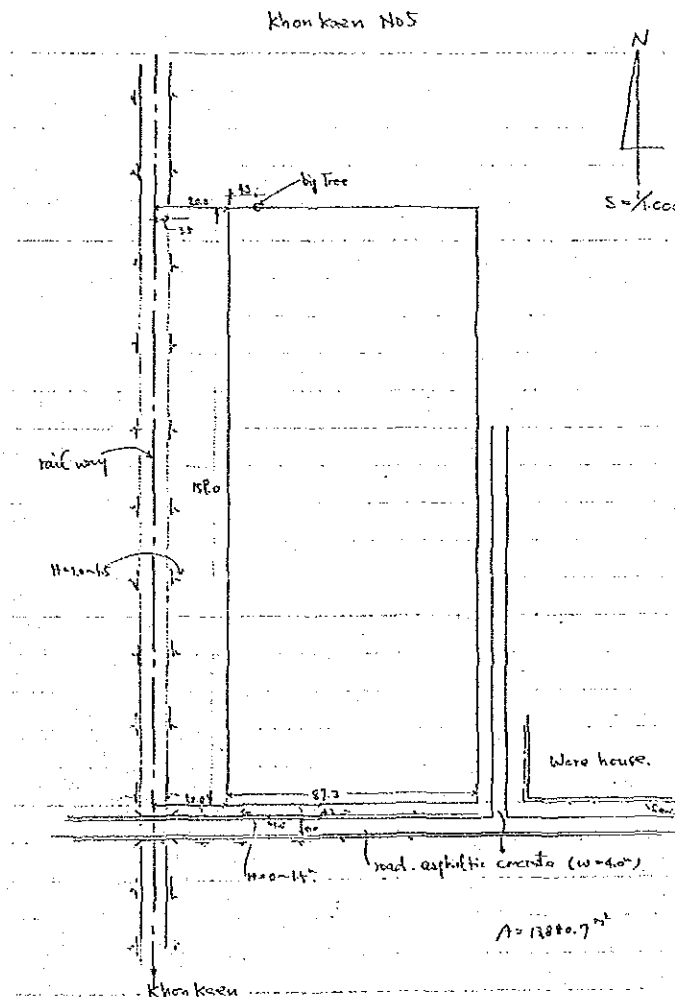
Flat plane,

Top soil is Silt and soft, the under layer is Silty Sand.

Water level is approximately 1.5 m below surface.

Civil Engineering Works

- |                |                                 |
|----------------|---------------------------------|
| a, Land area   | about 13900 m <sup>2</sup>      |
| b, Access road | L= 5 m                          |
| c, Banking     | H= 0.5 m                        |
| d, Drainage    | L=300 m                         |
| e, Siding      | L= 0 m                          |
| f, Foundation  | Continuos or individual footing |



(4) UBON RATCHATANI NO.6

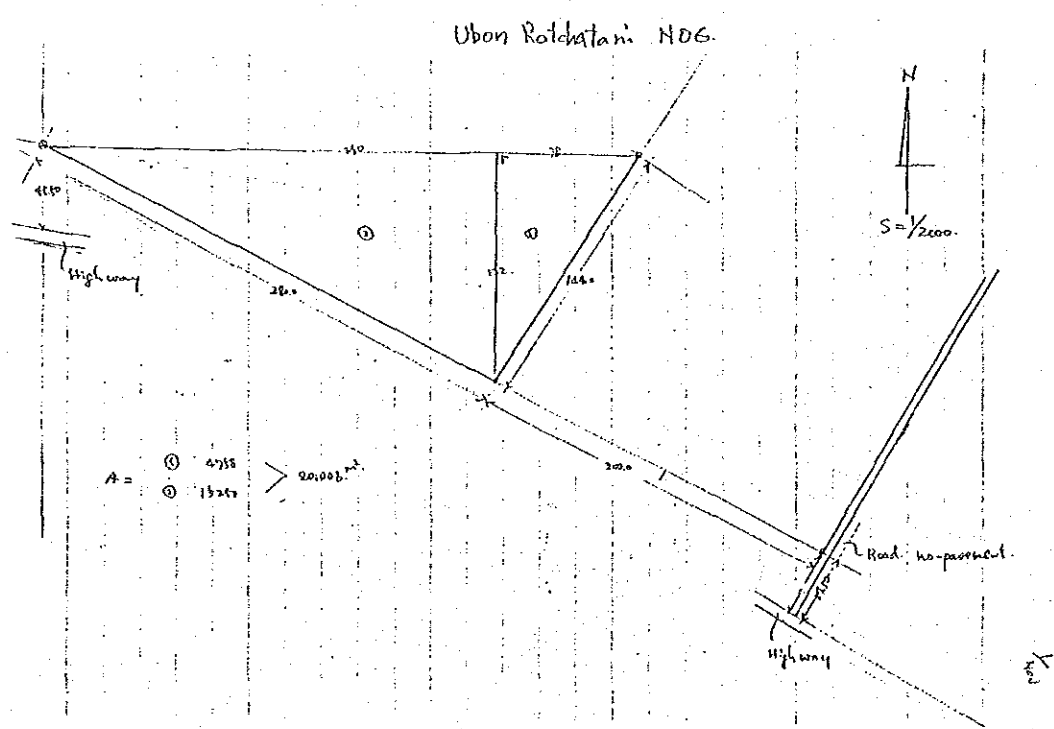
Geological Condition

On a gently sloped hill,  
Top soil is Silty Sand, under the layer is Laterite, well consolidated,  
Water level is deep.

Civil Engineering Works

- a, Land area                      about 20000 m<sup>2</sup>
- b, Access road                   L= 40 m
- c, Banking                        Leveling of ground about 5000 m<sup>2</sup>
- d, Drainage                       L=420 m
- e, Siding                          L= 0 m
- f, Foundation                    Continuous or individual footing

Remarks ; There are big trees, need pulling routes.



(5) UBON RATCHATANI NO.7

Geological Condition

A steep slop of a hill, relative height about 6 m.

Need a high wall.

Water level is deep.

Civil Engineering Works

- |                |   |
|----------------|---|
| a, Land area   | about 2500 m <sup>2</sup>                     |
| b, Access road |   |
| c, Banking     | Cutting and banking about 2500 m <sup>2</sup> |
| d, Drainage    | L=280 m                                       |
| e, Siding      | L= 0 m  |
| f, Foundation  | Continuous or individual footing              |

(6) SURIN NO.9

Geological Condition

Pond, water depth about 1.0 m.

Civil Engineering Works

- a, Land area
- b, Access road
- c, Banking
- d, Drainage
- e, Siding
- f, Foundation

Remarks ; This land is unsuitable for warehouse.

(7) SURIN NO.9'

Geological Condition

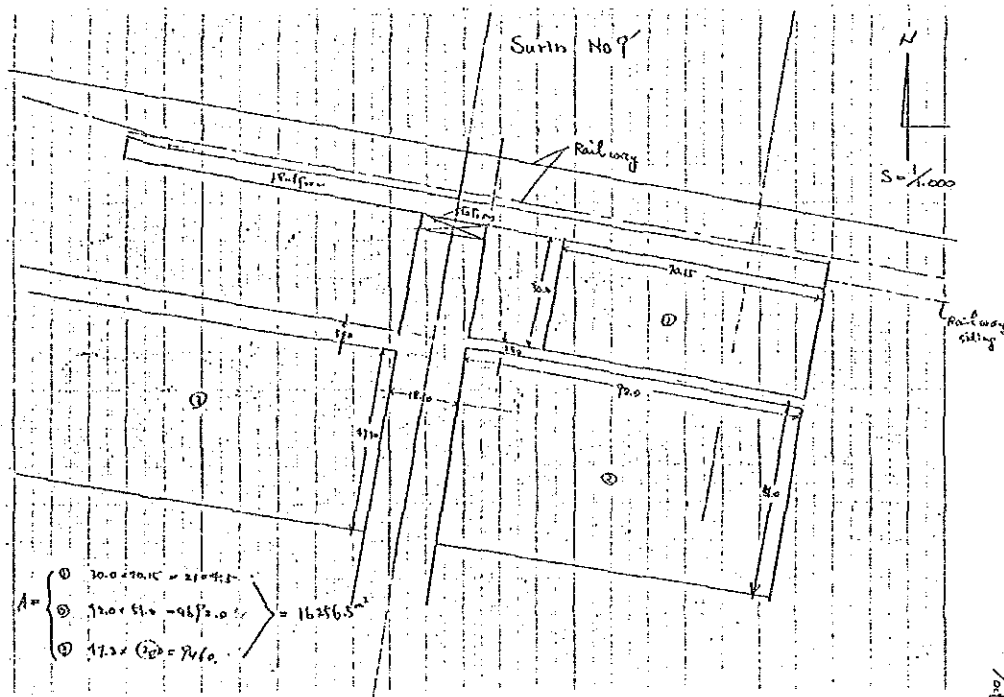
Flat plane,

Top soil is Sandy Silt, under the layer is Laterite.

Water level is approximately 2.0 m below surface.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | 16000 m <sup>2</sup>             |
| b, Access road | L=1000 m (extention W=3.5 m)     |
| c, Banking     | H=0                              |
| d, Drainage    | L= 350 m                         |
| e, Siding      | L= 150 m                         |
| f, Foundation  | Continuous or individual footing |



(8) SURIN NO.8

Geological Condition

Ruins of a castle wall and a ditch,  
The ditch is a water canal,  
The relative hight between ground surface and bottom of  
water is so high.

Civil Engineering Works

- a, Land area
- b, Access road
- c, Banking
- d, Drainage
- e, Siding
- f, Foundation

Remarks ; This land is unsuitable for warehouse.





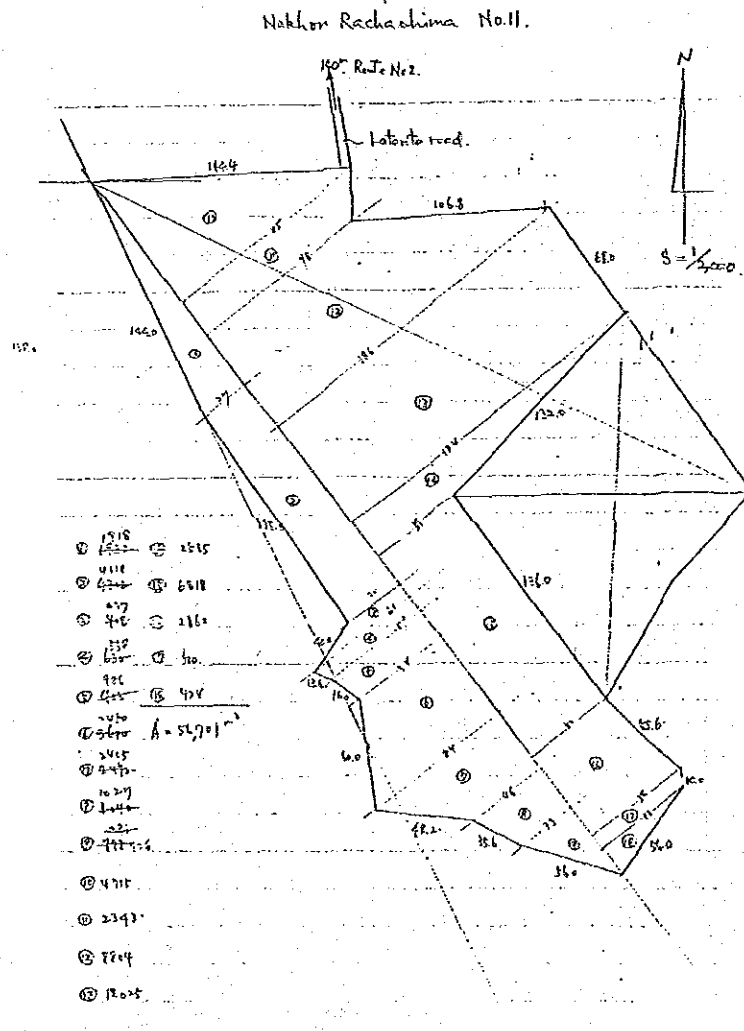
(10) NAKON RATCHASIMA NO.11

Geological Condition

On a gently hill,  
Top soil is Laterite with Gravel, compacted,  
Water level is deep.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | about 56700 m <sup>2</sup>       |
| b, Access road | L=140 m                          |
| c, Banking     | Leveling of ground               |
| d, Drainage    | L=350 m                          |
| e, Siding      | L= 0 m                           |
| f, Foundation  | Continuous or individual footing |



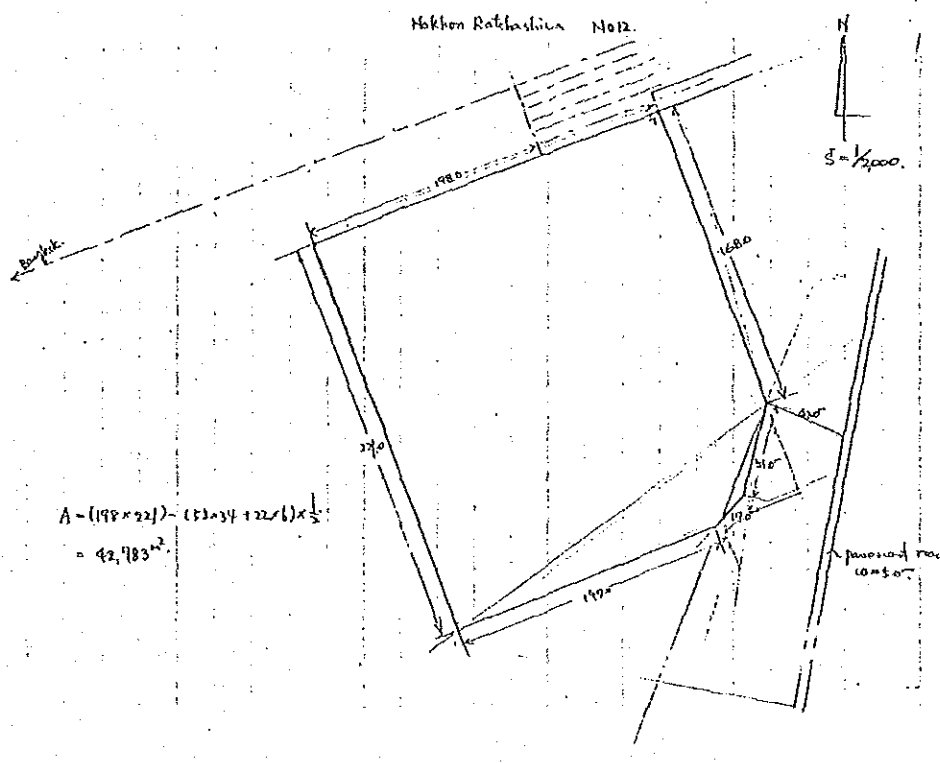
(11) NAKON RATCHASIMA NO.12

Geological Condition

Top soil is Silt to Sandy Silt,  
Water level is approximate 2.0 meters below surface.  
S.P.T-N approximate 8 to 15.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | 42800 m <sup>2</sup>             |
| b, Access road | L= 50 m                          |
| c, Banking     | H= 0.5 m                         |
| d, Drainage    | L=800 m                          |
| e, Siding      | L=100 m                          |
| f, Foundation  | Continuous or individual footing |



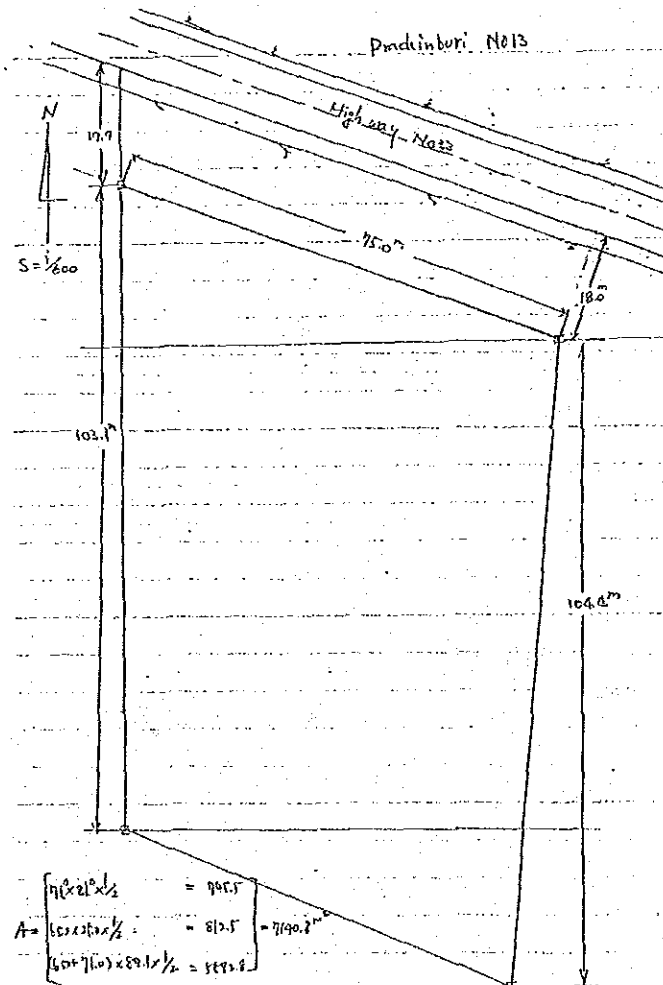
(12) PRACHINBURI NO.13

Geological Condition

On a natural level, top soil is Silty Sand,  
Water level is 2 - 3 meter depth below surface.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | 7140 m                           |
| b, Access road | L= 20 m                          |
| c, Banking     | Leveling of ground               |
| d, Drainage    | L=250 m                          |
| e, Siding      | L= 0 m                           |
| f, Foundation  | Continuous or individual footing |



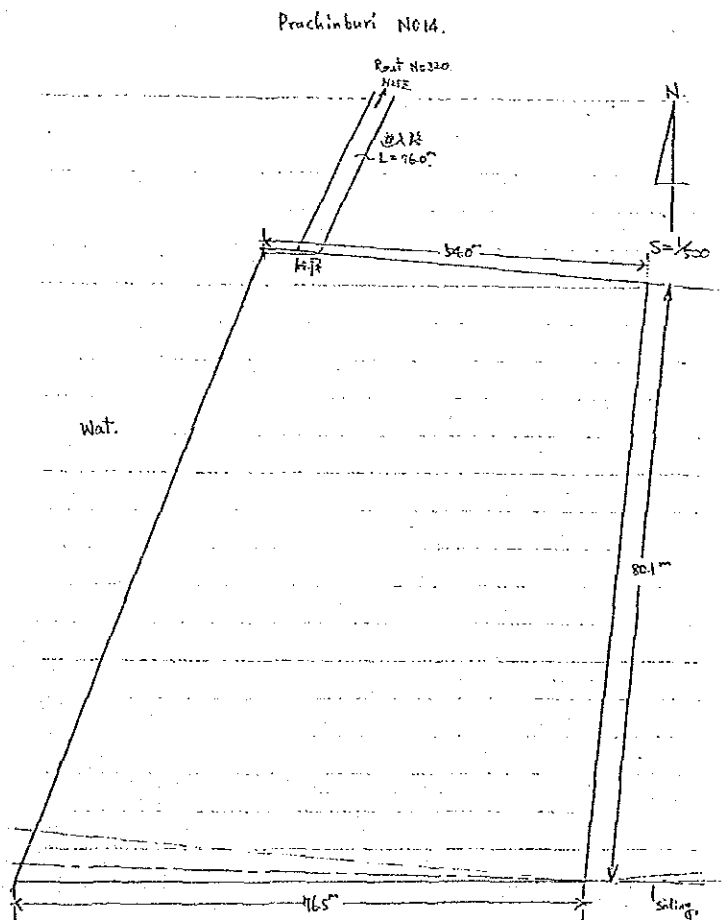
(13) PRACHINBURI NO.14

Geological Condition

Flood plane of the Bang Pakong River,  
Alluvial deposit deep,  
Water level is approximate 1.0 m below surface,  
flood mark is observed.

Civil Engineering Works

- |                |                           |
|----------------|---------------------------|
| a, Land area   | about 5290 m <sup>2</sup> |
| b, Access road | L= 30 m                   |
| c, Banking     | Leveling of ground        |
| d, Drainage    | L=200 m                   |
| e, Siding      | L= 0 m                    |
| f, Foundation  | Continuous footing        |



$$A = \left[ \begin{array}{l} (76.0 + 116.5) \times 80.1 \times \frac{1}{2} = 7124.7 \\ 76.5 \times 6.3 \times \frac{1}{2} = 114.5 \end{array} \right] = 5290.2 \text{ m}^2$$

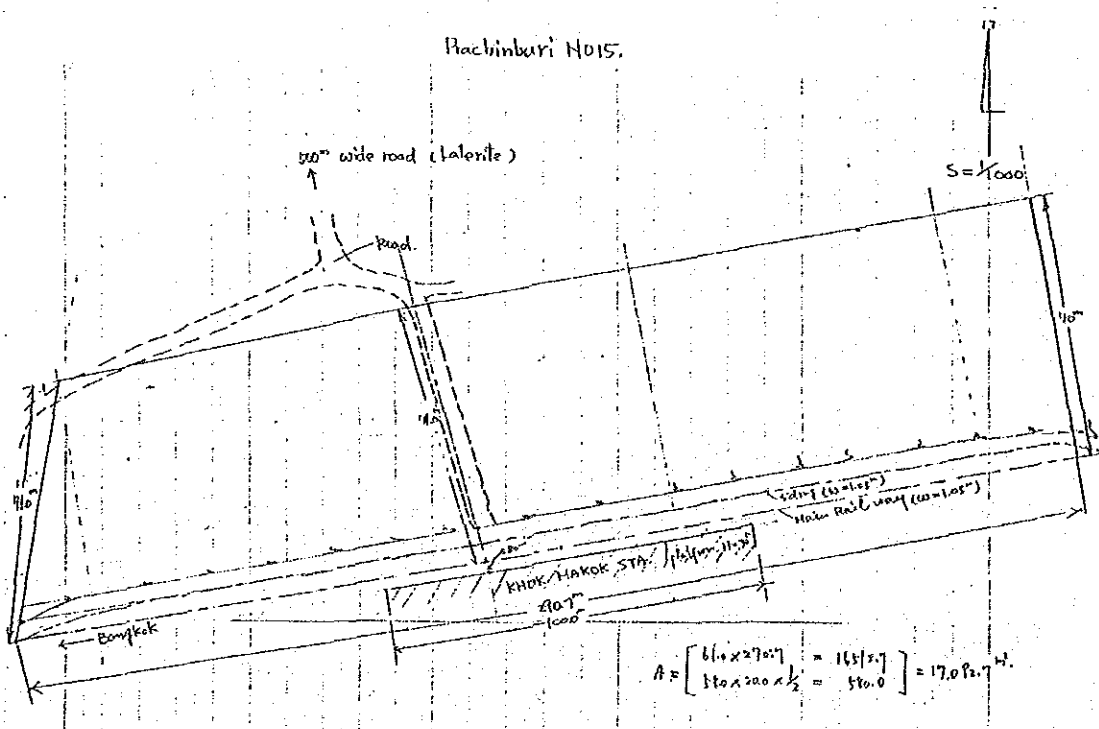
(14) PRACHINBURI NO.15

Geological Condition

Delta of the Bang Pakong River,  
Alluvial deposit deep,  
Water level is deep (approximate 4.0 meters)

Civil Engineering Works

- |                |                            |
|----------------|----------------------------|
| a, Land area   | about 17000 m <sup>2</sup> |
| b, Access road | L=500 m                    |
| c, Banking     | Leveling of ground         |
| d, Drainage    | L=200 m                    |
| e, Siding      | L= 0 m                     |
| f, Foundation  | Pile need                  |





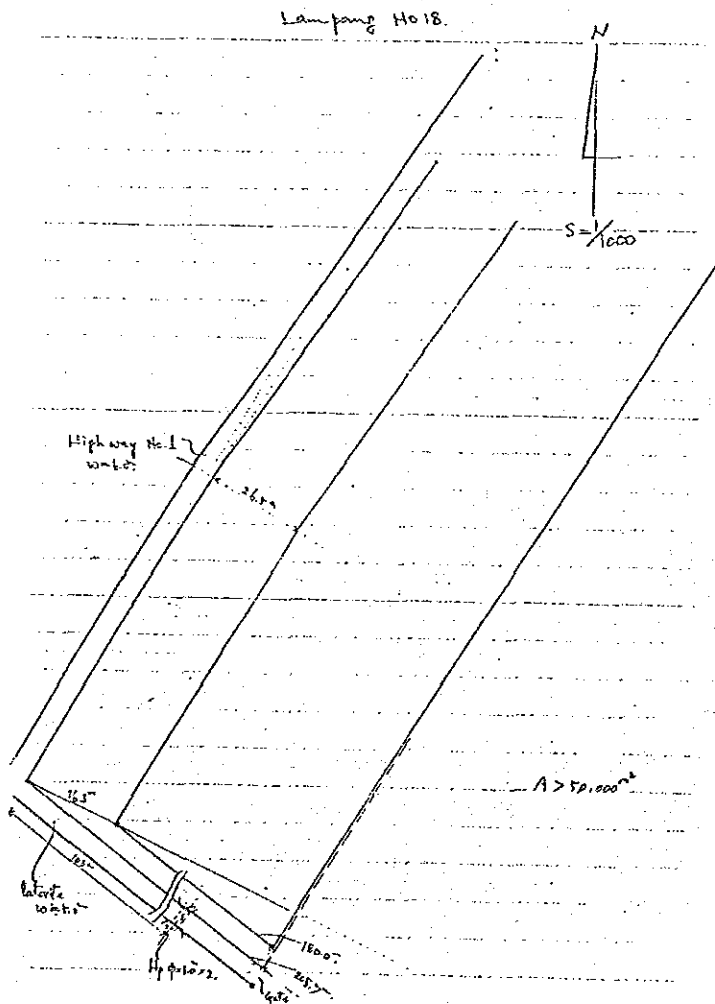
(16) LAMPANG NO.18

Geological Condition

Flood plane of the Wang River, alluvial deposits deep. Water level is shallow, in rainy season the land will be covered by water.

Civil Engineering Works

- |                |   |
|----------------|---|
| a, Land area   | about 30000 m <sup>2</sup>              |
| b, Access road | L= 30 m                                 |
| c, Banking     | H=0.5-1.0 m                             |
| d, Drainage    | L=600 m                                 |
| e, Siding      | L= 0 m                                  |
| f, Foundation  | pile need, length approximate 10 meters |





(17) CHIENG RAI NO.19

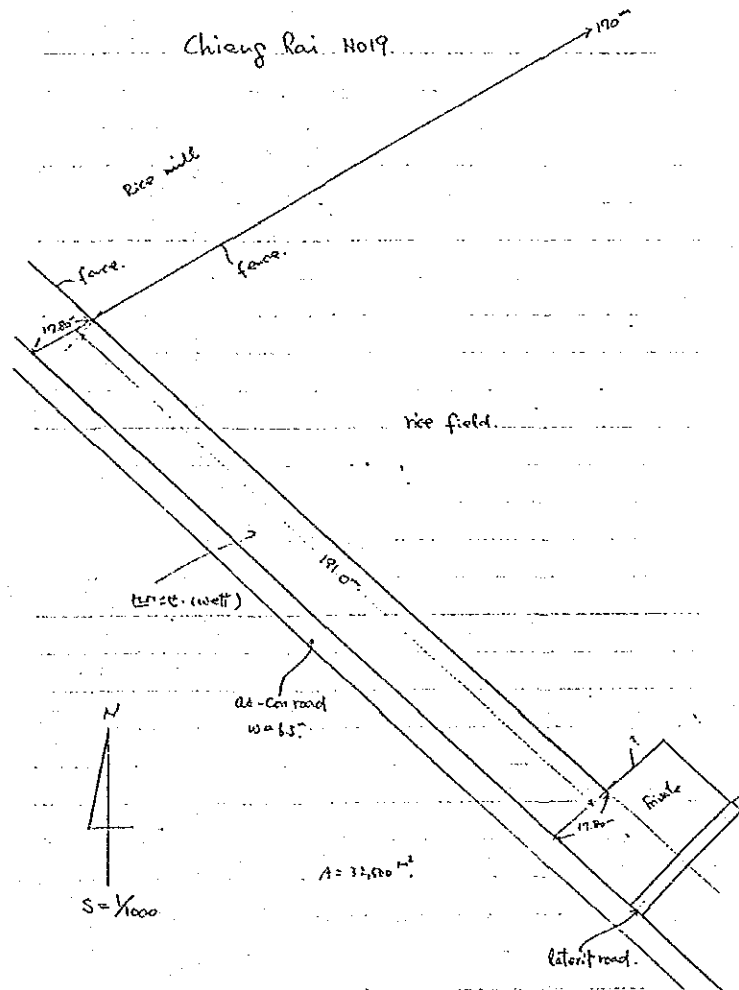
Geological Condition

Flat plane, now using for rice field.

Top soil is Silt, water level is 1.0 to 1.5 meters.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | about 32500 m <sup>2</sup>       |
| b, Access road | L= 20 m                          |
| c, Banking     | H= 1.0 m                         |
| d, Drainage    | L=535 m                          |
| e, Siding      | L= 0 m                           |
| f, Foundation  | Continuous or individual footing |



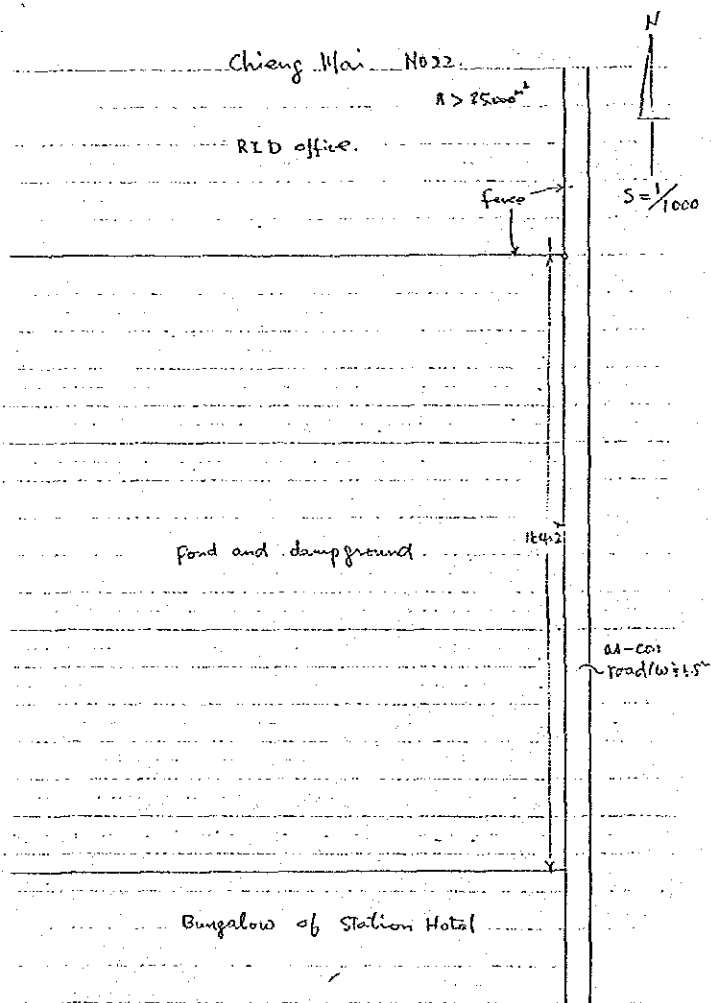
(18) CHIENG MAI NO.22

Geological Condition

Pond, water depth about 2 to 3 meters.  
Alluvial deposit is approximate 7 meters.

Civil Engineering Works

- a, Land area 30000 m<sup>2</sup>
- b, Access road L= 10 m
- c, Banking H= 3 - 4 m
- d, Drainage L=440 m
- e, Siding L= 0
- f, Foundation Pile need, length approximate 10 meters



(19) CHIENG MAI NO.23

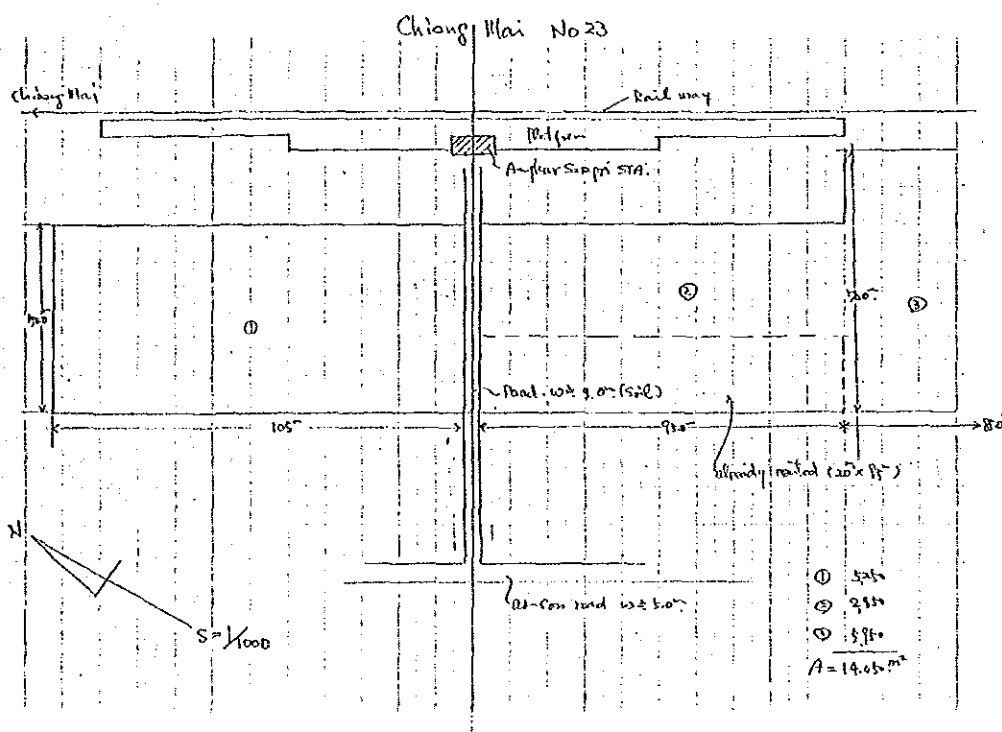
Geological Condition

Flat plane, top soil is Sandy Silt, under the layer is Laterite.

Water level is 1.0 to 1.5 meters depth.

Civil Engineering Works

- |                |   |
|----------------|---|
| a, Land area   | about 14000 m <sup>2</sup>                          |
| b, Access road | newly construction L=100 m<br>extended work L= 70 m |
| c, Banking     | H= 0.5 m  |
| d, Drainage    | L=400 m   |
| e, Siding      | L=150 m   |
| f, Foundation  | continuous or individual footing                    |



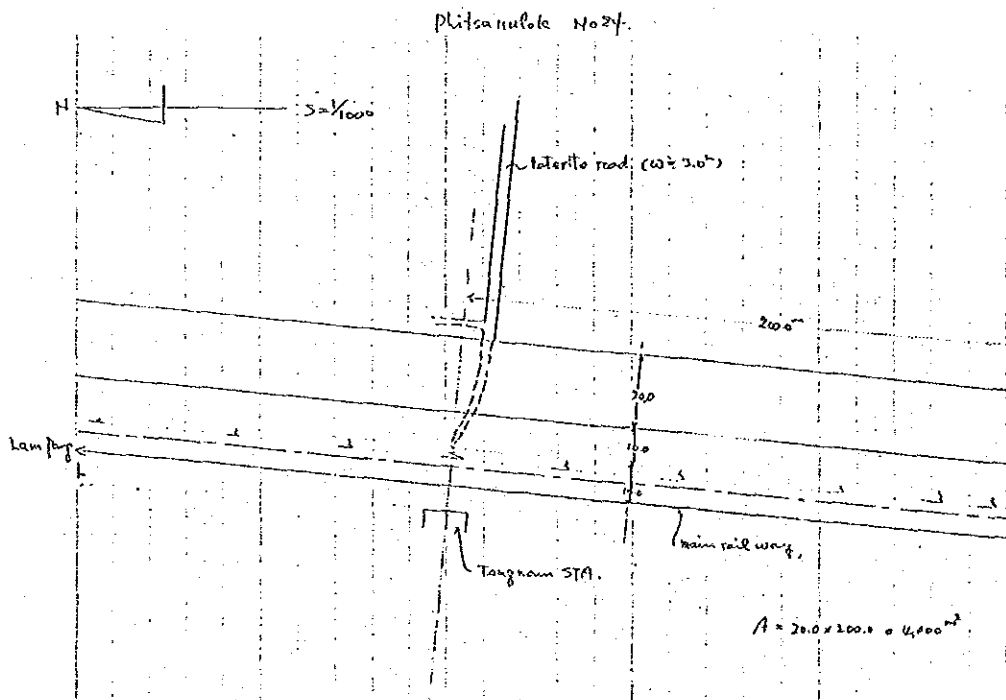
(20) PHISNULOK NO.24

Geological Condition

Wet land, in rainy season the land will be water way.  
 Top soil is soft in 2 to 3 meters depth.  
 Water level is 0.5-1.0 meter below surface.

Civil Engineering Works

- |                |   |
|----------------|---|
| a, Land area   | about 6000 m <sup>2</sup>               |
| b, Access road | L=200 m                                 |
| c, Banking     | H=2 to 3 m                              |
| d, Drainage    | L=500 m                                 |
| e, Siding      | L= 0 m                                  |
| f, Foundation  | Pile need, length approximate 13 meters |



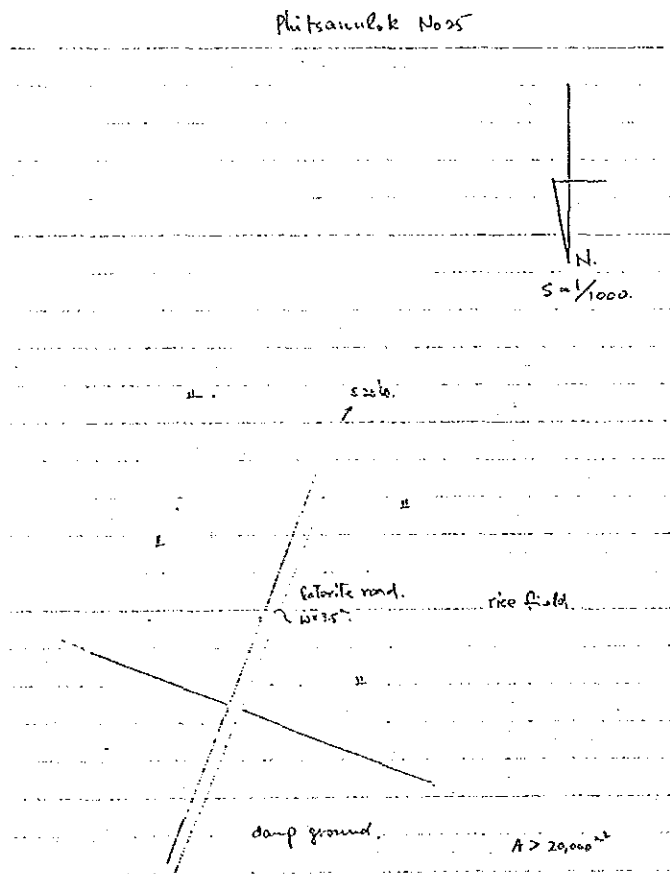
(21) PHSNULOK NO.25

Geological Condition

Flat and wet land, now using for rice field.  
Silt is approximate 10 meters below surface.

Civil Engineering Works

- a, Land area about 80000 m<sup>2</sup>
- b, Access road L=200 m
- c, Banking H=2 to 3 m
- d, Drainage L=400 m
- e, Siding L= 0 m
- f, Foundation Bearing layer is approximate 13.0 meters below surface



(22) NAKHON SAWAN NO.26 (A)

Geological Condition

Flood plane of the Mae Nam River, flood marks are observed on the land.

The land is unsuitable for warehouse.

(23) NAKHON SAWAN NO.26 (B)

Geological Condition

Flood plane of the Mae Nam River, flood marks are observed on the land.

Alluvial deposit deep. Pile length approximate 10 meters.

This land is unsuitable for warehouse.

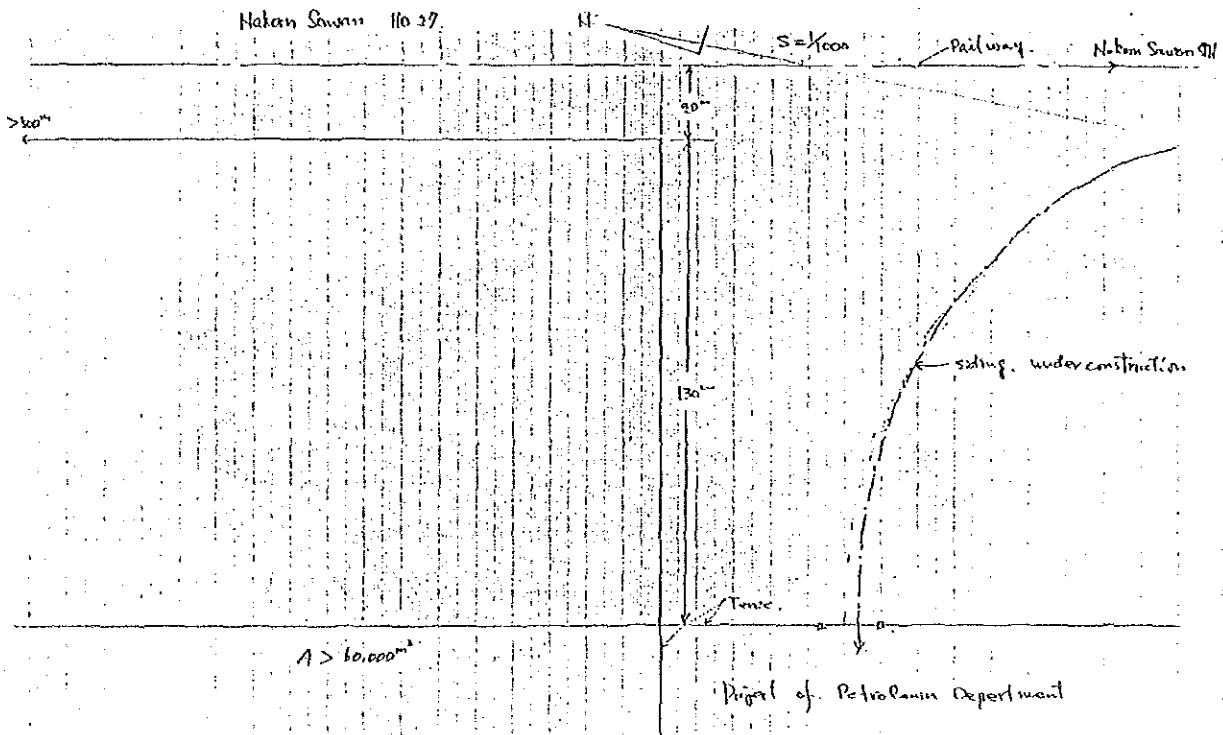
(24) NAKHON SAWAN NO.27

Geological Condition

Flat plane,  
Top soil is Silt, the under layer is Laterite.  
Water level is 1.5 to 2.0 meters.

Civil Engineering Works

- |                |   |
|----------------|---|
| a, Land area   | about 48000 m <sup>2</sup>                      |
| b, Access road | L=200 m   |
| c, Banking     | H= 0.3 m  |
| d, Drainage    | L=780 m   |
| e, Siding      | L=400 m   |
| f, Foundation  | Pile need, pile length approximate<br>10 meters |



(25) SUPHAN BURI NO.28

Geological Condition

Flat plane, alluvial deposit is distributed.  
Water level is about 0.5 to 1.0 meter.

Civil Engineering Works

- |                |   |
|----------------|---|
| a, Land area   | 5155 m <sup>2</sup>                             |
| b, Access road | L=400 meters extended                           |
| c, Banking     | H= 1.0 meter                                    |
| d, Drainage    | L=300 meters                                    |
| e, Siding      | L= 0 meter                                      |
| f, Foundation  | Pile need, pile length approximate<br>10 meters |



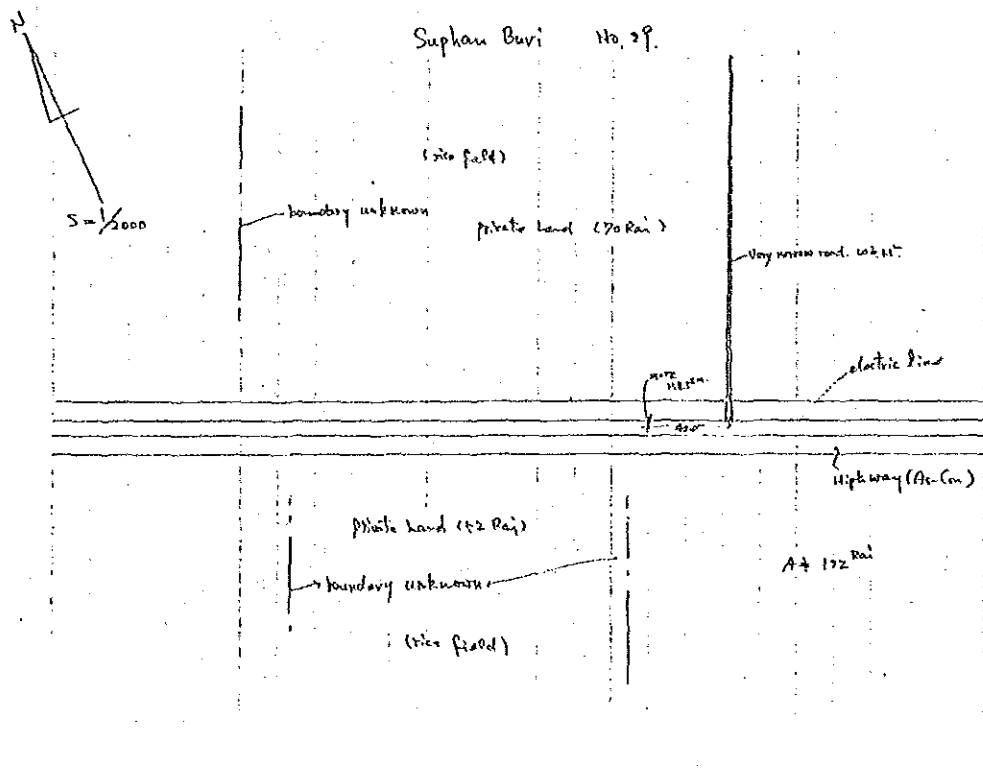
(26) SUPHAN BURI NO.29

Geological Condition

Flood plane, now using for rice field.  
Alluvial deposit is distributed.  
Water level is 0.5 to 1.0 meter.

Civil Engineering Works

- a, Land area 152 Rai
- b, Access road L= 20 m
- c, Banking H= 1.5 m
- d, Drainage L=300 m
- e, Siding L= 0 m
- f, Foundation Pile need, length approximate 10 meters



(27) PHICHIT NO.30'

Geological Condition

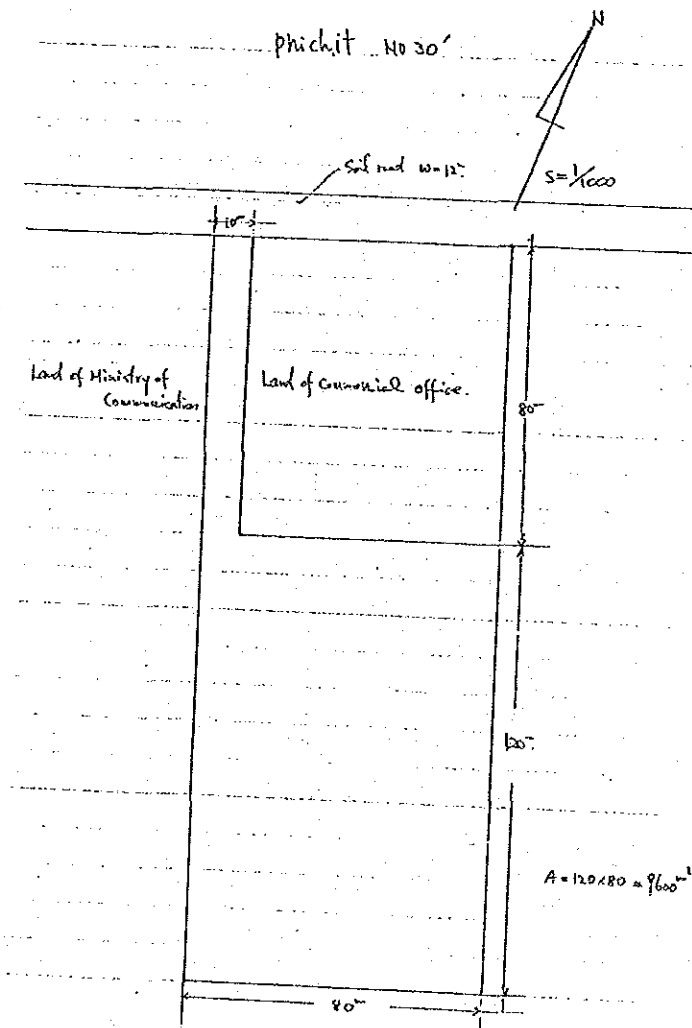
Flat plane, alluvial deposit is distributed.

Top soil is Silt.

Water level is approximate 1.0 meter.

Civil Engineering Works

- |                |  |
|----------------|--|
| a, Land area   | about 9600 m <sup>2</sup>                    |
| b, Access road | L= 80 m                                      |
| c, Banking     | H= 1.0 m                                     |
| d, Drainage    | L=400 m                                      |
| e, Siding      | L= 0 m                                       |
| f, Foundation  | Pile need, pile length approximate 10 meters |



(28) SARA BURI NO.31

Geological Condition

On a gently sloped hill, around the land is a farm.  
Water level is deep.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | about 15400 m <sup>2</sup>       |
| b, Access road | L= 0 m                           |
| c, Banking     | H= 0 m                           |
| d, Drainage    | L=200 m                          |
| e, Siding      | L= 0 m                           |
| f, Foundation  | Continuous or individual footing |

(29) SARA BURI NO.32

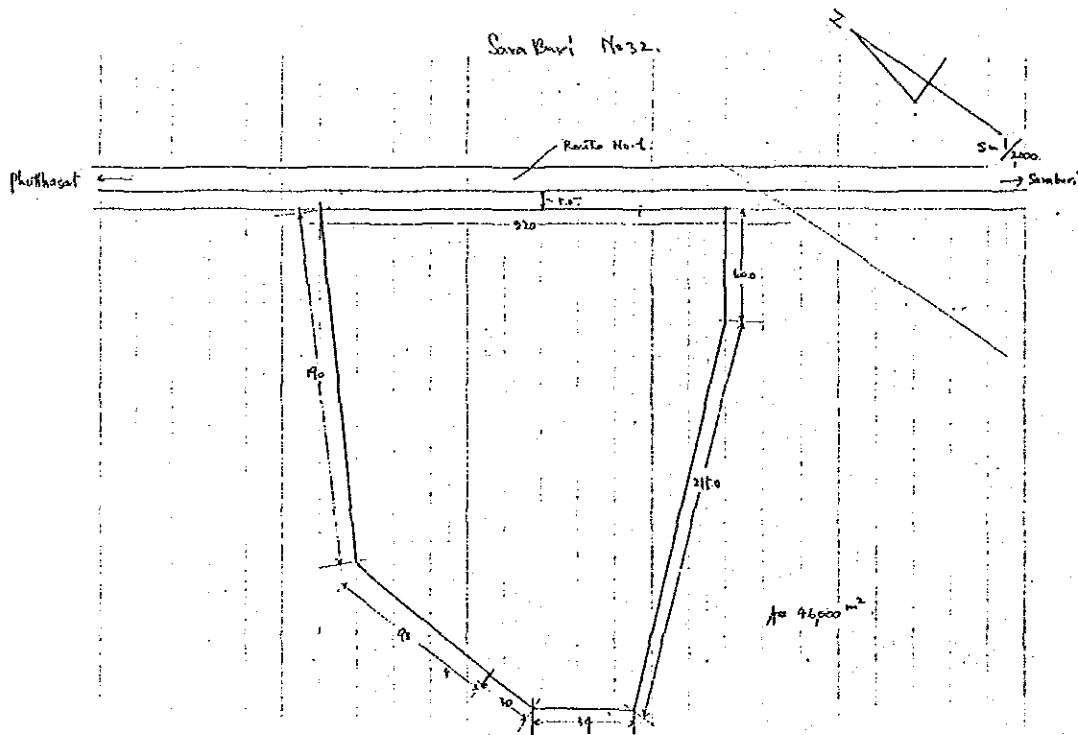
Geological Condition

On a gently sloped hill, wett land.

Water level is approximate 2 meters below surface.

Civil Engineering Works

- |                |                                  |
|----------------|----------------------------------|
| a, Land area   | about 46000 m <sup>2</sup>       |
| b, Access road | L= 10 m                          |
| c, Banking     | H= 1.0 m                         |
| d, Drainage    | L=300 m                          |
| e, Siding      | L= 0 m                           |
| f, Foundation  | Continuous or individual footing |



(30) CHAINAT NO.34

Geological Condition

Gently sloping hilly land.

Laterite is widely distributed.

Water level is about 3.0 to 4.0 meters below surface.

Civil Engineering Works

a, Land area	16000 m <sup>2</sup>
b, Access road	L= 0 m
c, Banking	H= 0 m
d, Drainage	L=300 m
e, Siding	L= 0 m
f, Foundation	Individual footing

(31) SURAT THANI

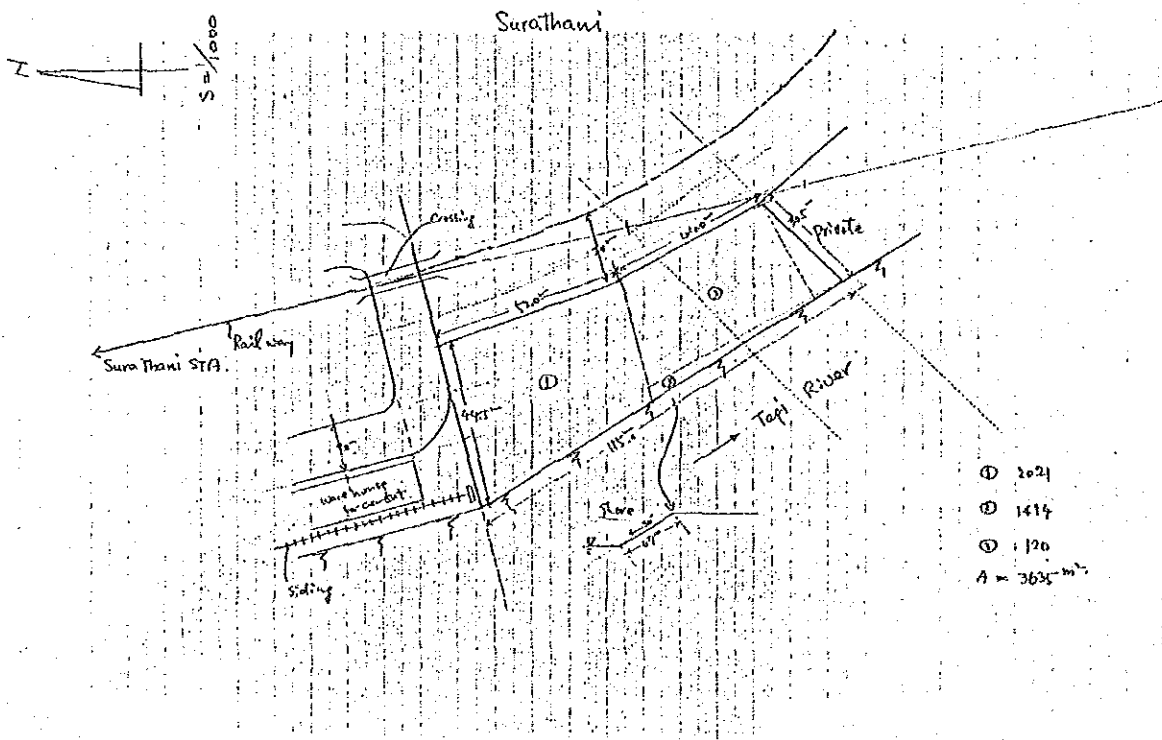
Geological Condition

Narrow land between big hill and the Tapi River.

Top soil is this, rock is situated in 2 to 3 meters below surface.

Civil Engineering Works

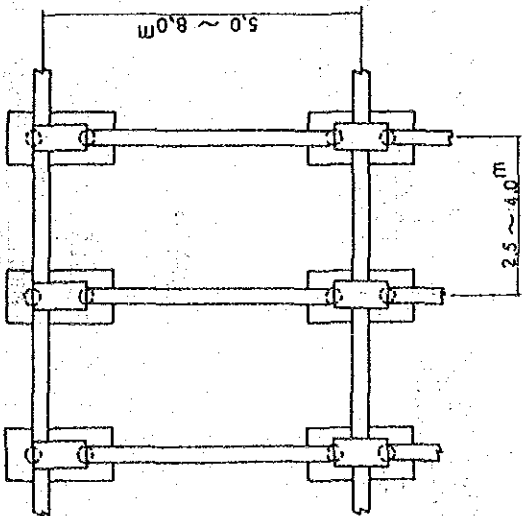
- |                |                     |
|----------------|---------------------|
| a, Land area   | 3500 m <sup>2</sup> |
| b, Access road | L= 5 m              |
| c, Banking     | no need             |
| d, Drainage    | L=300 m             |
| e, Siding      | L=200 m             |
| f, Foundation  | Individual footing  |



6. Standard Pile Foundation Plan and Footing Plan

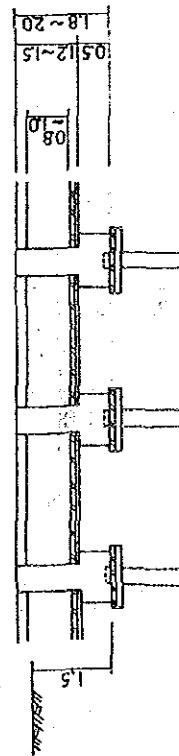
Fig-8 Standard Pile Foundation

Plan



Section

A~A'



B~B'

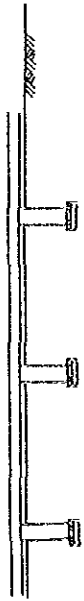
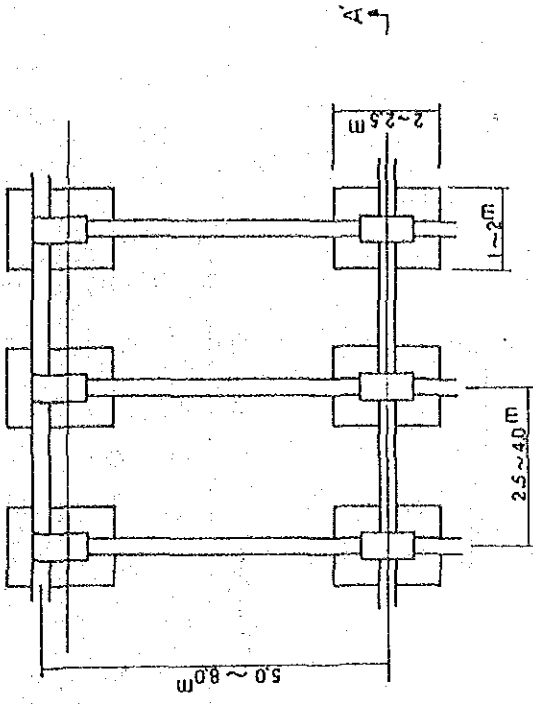


Fig-10 Standard Individual Footing

Plan



Section

A~A'

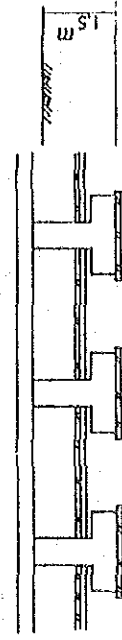
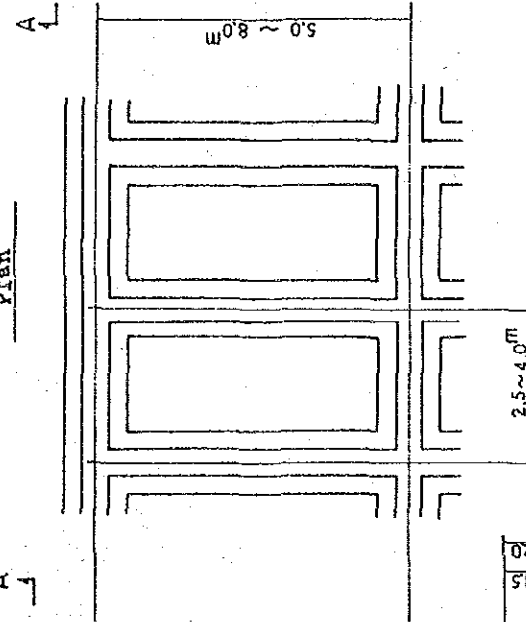


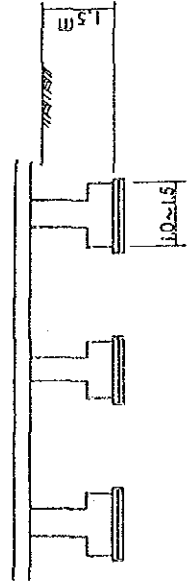
Fig-9 Standard Continuous Footing

Plan



Section

A~A'



7. Access Road

Fig-11 Civil Engineering Facilities

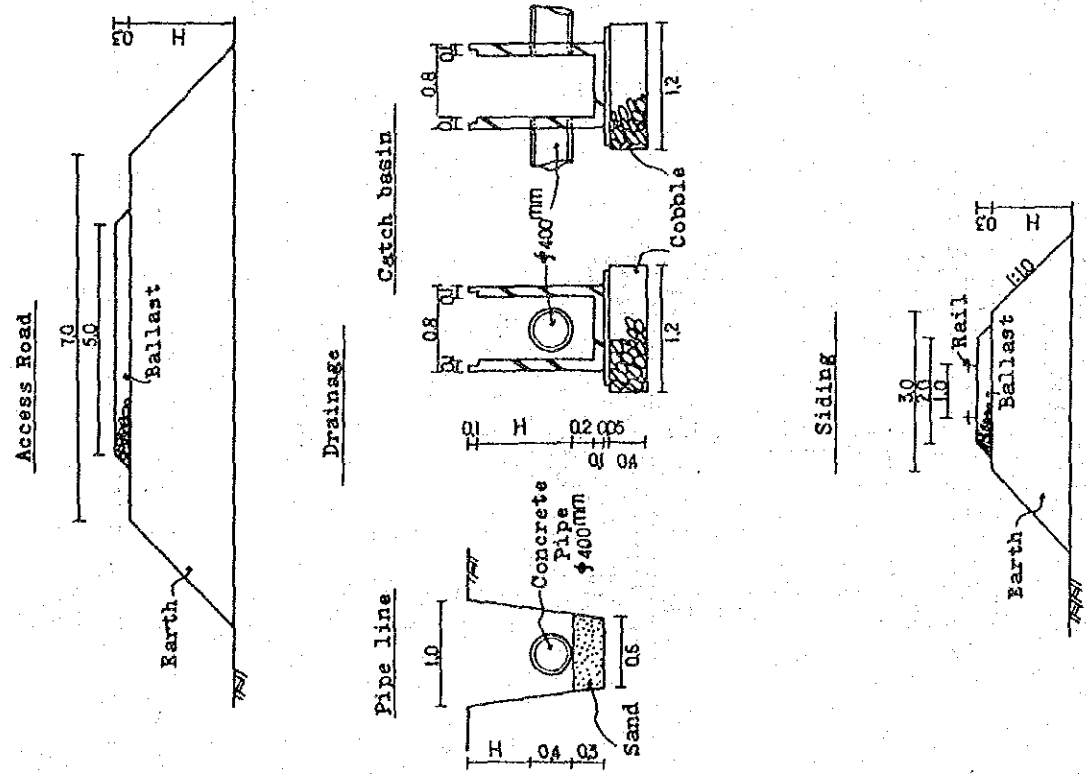
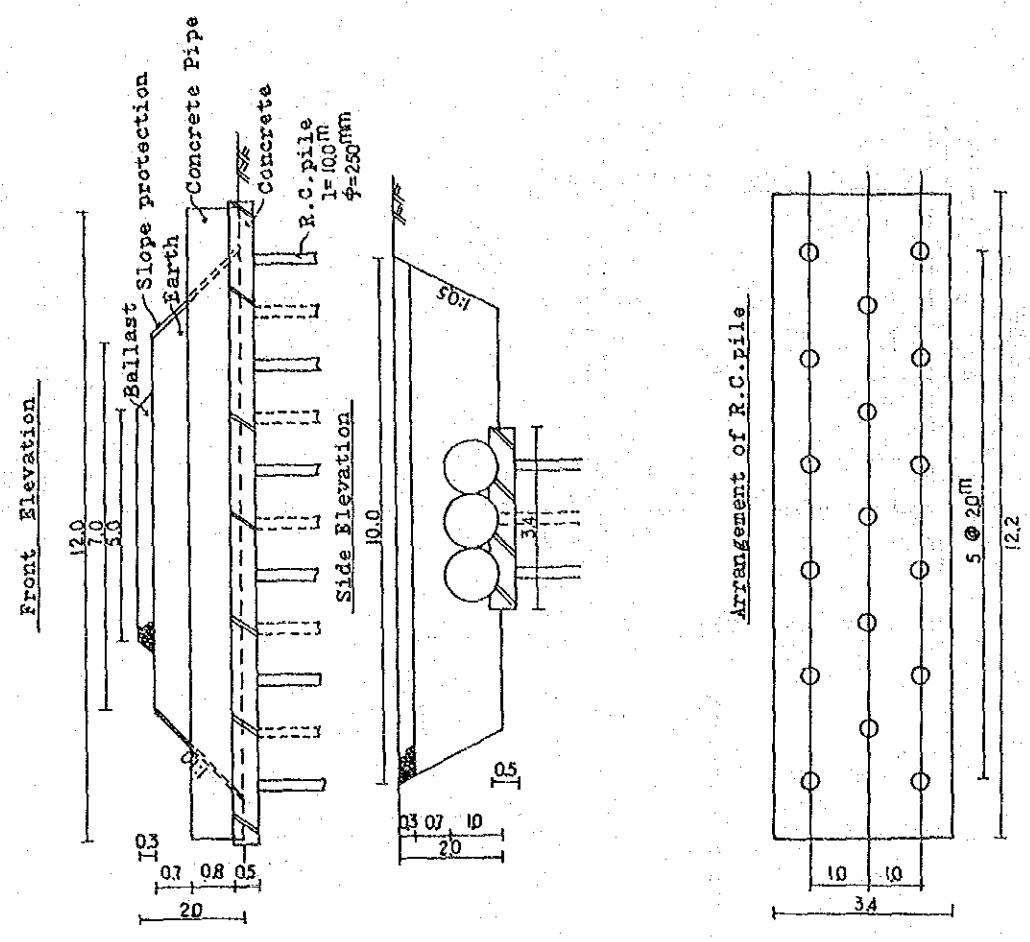


Fig-12 Access Road (Nonthaburi)





10

Fig-13 Slab

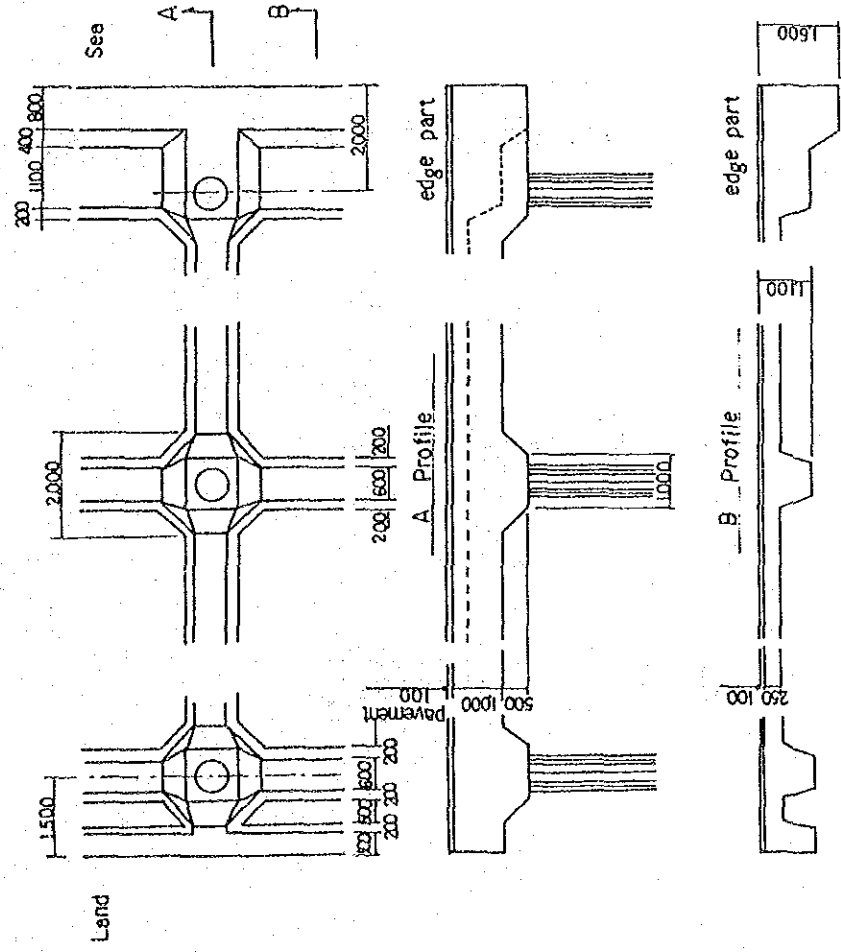
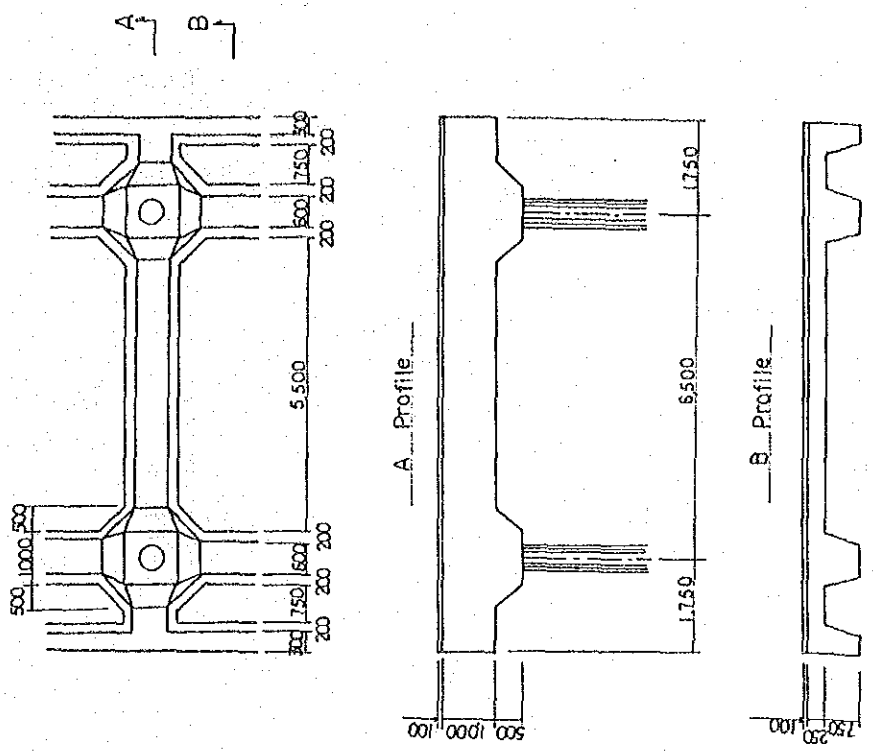
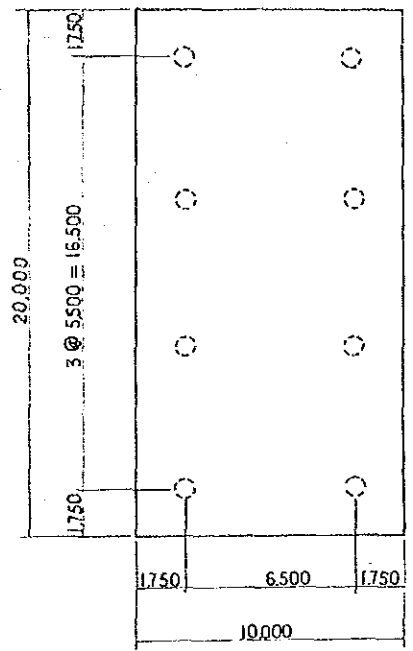
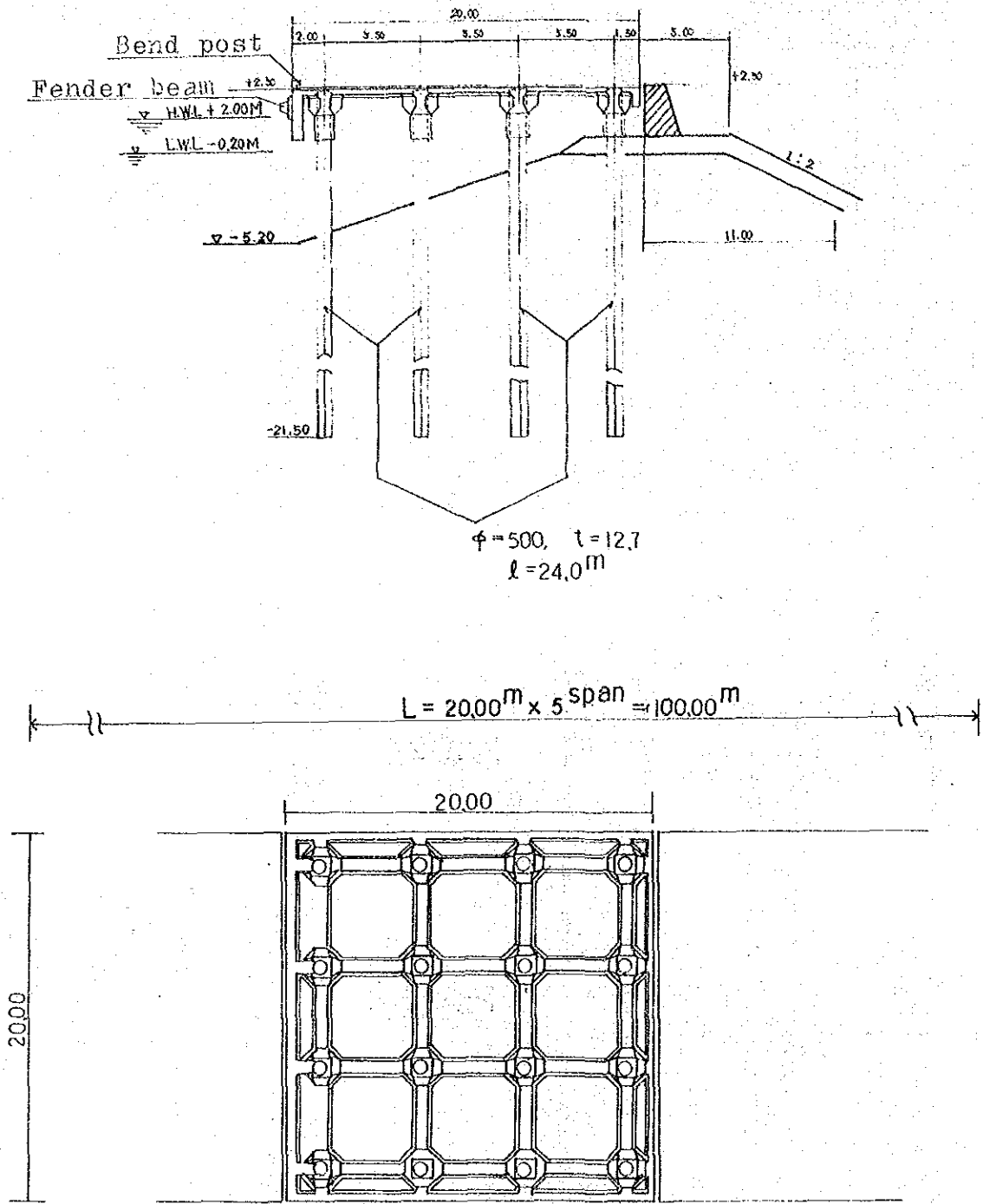


Fig-15 Pile Arrangement



### 9. Profile of Wharf

Fig-17 Profile of Wharf



10. Dimension of River Vessels

(1) River Vessels (Self Propelled Vessel)

Type	Classification	Range GRT.	Dimension(m)			1983 Projected	
			Length	Breadth	Depth	No.	GRT.
Self Pro- pelled Vessel	Cargo	0.1- 1.0	8.5	1.2	0.40-0.50	1,603	901
		1.1- 3.0	8.5- 9.7	1.2-2.0	0.50-0.60	1,457	2,418
		3.1- 6.0	9.7-12.4	2.0-2.5	0.60-0.70	322	1,811
		6.1- 10.0	12.4-18.0	2.5-3.0	0.70-0.80	147	1,182
		10.1- 20.0	18.0-19.0	3.0-3.5	0.80-1.50	123	1,514
		20.1- 30.0	19.0-20.0	3.5-4.0	1.50-1.80	28	681
		30.1- 40.0	20.0-22.0	4.0-4.5	1.80-1.90	6	219
		40.1- 60.0	22.0-24.0	4.5-5.3	1.90-2.10	9	495
		60.1- 80.0	24.0-24.7	5.3-6.0	2.10-2.30	6	427
		80.1-100.0	24.7-25.2	6.0-7.2	2.30-2.90	7	587
		100.1-200.0	25.2-32.2	7.2-8.4	2.90-3.70	10	1,442
		200.1-400.0	32.2-42.6	8.4-9.1	3.70-3.80	23	6,953
Total						3,741	18,630

(2) River Vessels (Non-Self Propelled Vessel)

Type	Classification	Range GRT.	Dimension(m)			1983 Projected	
			Length	Breadth	Depth	No.	GRT.
Wooden- Barge	Cargo	0.1- 1.0	8.5	1.2	0.40-0.50	1	1
		1.1- 3.0	8.5- 9.7	1.2-2.0	0.50-0.60	109	322
		3.1- 6.0	9.7-12.4	2.0-2.5	0.60-0.70	321	1,844
		6.1- 10.0	12.4-18.0	2.5-3.0	0.70-0.80	533	4,862
		10.1- 20.0	18.0-19.0	3.0-3.5	0.80-1.50	2,147	33,089
		20.1- 30.0	19.0-20.0	3.5-4.0	1.50-1.80	1,122	28,065
		30.1- 40.0	20.0-22.0	4.0-4.5	1.80-1.90	600	20,777
		40.1- 60.0	22.0-24.0	4.5-5.3	1.90-2.10	512	23,488
		60.1- 80.0	24.0-24.7	5.3-6.0	2.10-2.30	19	1,339
		80.1-100.0	24.7-25.2	6.0-7.2	2.30-2.90	26	2,381
		100.0-200.0	25.2-32.2	7.2-8.4	2.90-3.70	62	8,356
		200.1-400.0	32.2-42.6	8.4-9.1	3.70-3.80	6	1,205
Total						5,458	125,729

(3) River Vessels (Non-Self Propelled Vessel)

Type	Classification	Range GRT.	Dimension(m)			1983 Projected	
			Length	Breadth	Depth	No.	GRT.
Steel- Barge	Cargo	1.1- 3.0	8.5- 9.7	1.2-2.0	0.50-0.60	3	7
		3.1- 6.0	9.7-12.4	2.0-2.5	0.60-0.70	16	87
		6.1- 10.0	12.4-18.0	2.5-3.0	0.70-0.80	70	503
		10.1- 20.0	18.0-19.0	3.0-3.5	0.80-1.50	80	1,156
		20.1- 30.0	19.0-20.0	3.5-4.0	1.50-1.80	372	9,840
		30.1- 40.0	20.0-22.0	4.0-4.5	1.80-1.90	117	3,845
		40.1- 60.0	22.0-24.0	4.5-5.3	1.90-2.10	88	4,592
		60.1- 80.0	24.0-24.7	5.3-6.0	2.10-2.30	91	6,382
		80.1-100.0	24.7-25.2	6.0-7.2	2.30-2.90	230	21,505
		100.1-200.0	25.2-32.2	7.2-8.4	2.90-3.70	475	61,482
		200.1-400.0	32.2-42.6	8.4-9.1	3.70-3.80	62	17,241
400.1-600.0	42.6-47.8	9.1-12.2	3.80-3.90	-	-		
800.1-1000.0	60.8-81.5	13.0-14.0	5.30-5.45	2	1,646		
Total						1,606	128,286

(4) River Vessels (Non-Self Propelled Vessel)

Type	Classification	Range GRT.	Dimension(m)			1983 Projected	
			Length	Breadth	Depth	No.	GRT.
River- Lighter	Cargo	1.1- 3.0	8.5- 9.7	1.2-2.0	0.50-0.60	-	-
		3.1- 6.0	9.7-12.4	2.0-2.5	0.60-0.70	-	-
		6.1- 10.0	12.4-18.0	2.5-3.0	0.70-0.80	1	10
		10.1- 20.0	18.0-19.0	3.0-3.5	0.80-1.50	9	112
		20.1- 30.0	19.0-20.0	3.5-4.0	1.50-1.80	31	765
		30.1- 40.0	20.0-22.0	4.0-4.5	1.80-1.90	36	1,395
		40.1- 60.0	22.0-24.0	4.5-5.3	1.90-2.10	87	4,131
		60.1- 80.0	24.0-24.7	5.3-6.0	2.10-2.30	30	1,993
		80.1-100.0	24.7-25.2	6.0-7.2	2.30-2.90	45	4,085
		100.1-200.0	25.2-32.2	7.2-8.4	2.90-3.70	97	15,171
200.1-400.0	32.2-42.6	8.4-9.1	3.70-3.80	69	18,037		
400.1-600.0	42.6-47.8	9.1-12.2	3.80-3.90	1	400		
Total						406	46,099

Source: The Harbor Department, Thailand

## 11. Design of Wharf

### 1. Foundation pile

Demension of one block  $20^m \times 20^m$  / one block.

Load condition ( /one block)

vertical load. ① dead load  $2.0t/m^2 \times 20^m \times 20^m = 800\text{ton}$   
 ② live load  $1.0t/m^2 \times 20^m \times 20^m = 400\text{ton}$   
 ③ crave load = 50ton  
 total 1250ton.

horizontal load. ④ impulsive and tractive load 30ton

Space of piles 5.50 meters

Pile number/one block 16pieces

Vertical load work upon one pile

$1250\text{ton} / 16\text{pieces} = 78\text{ton}$

Ultimate Bearing Capacity  $R_u$  and Allowable Bearing Capacity  $R_a$  of vertical direction of pile.

$$R_u = 40\bar{N} \cdot A_p + \left( \frac{\bar{N}_s}{5} L_s + C_u L_c \right) \phi$$

$$R_a = R_u / F_s \quad F_s = 2.5$$

Piles are driven till EL-21.5 meters, and then,

$$\bar{N} = 20 \quad \bar{N}_s = 20 \quad L_s = 2.0^m$$

$$C_u = 2.0t/m^2, \quad L_c = 14.0 \text{ meters}$$

Calculation  $R_u$ ,  $R_a$  of each diameter,

$\phi 300$	$A_p = 0.0707$	$\phi = 0.942$	
	$R_u = 56.6 + 33.9 = 90.5$		$R_a = 36.2$
$\phi 400$	$A_p = 0.1257$	$\phi = 1.257$	
	$R_u = 100.6 + 45.3 = 145.9$		$R_a = 58.4$
$\phi 500$	$A_p = 0.196$	$\phi = 1.571$	
	$R_u = 156.8 + 56.6 = 213.4$		<u><math>R_a = 85.4 &gt; 78</math></u>
$\phi 600$	$A_p = 0.283$	$\phi = 1.571$	
	$R_u = 226.4 + 67.9 = 294.3$		$R_a = 117.7$

Therefore pile is S.P.P  $\phi = 500\text{mm}$ , available.

Demension of pile

S.P.P  $\phi = 500\text{mm}$ ,  $t = 12.7\text{mm}$ ,  $l = 24.0 \text{ meters}$ .

### Horizontal force

In case of above mentioned dimension pile allowable horizontal power is as following, calculation, Horizontal Coefficient of Soil Reaction  $K_n$  of Clay layer,

$$K_n = \alpha E_o D^{-3/4} = 0.89$$

where  $\alpha$  ; coefficient 0.2  
 $E_o$ ; Modulus of Elasticity  
 $E_o = 28N = 84kg/cm^2$   
 $N = 8q_v = 160kg/cm^2 \div 3$   
 $D$  ; pile diameter 50cm

### Stress Intensity in Bending of pile $\sigma$

$$\sigma = \frac{V}{A_p} \pm \frac{M_o}{Z}$$

Where  $V$  ; Vertical force  
 $A_p$ ; True sectional area of pile tip  $197.6cm^2$   
 $Z$  ; Modulus of Section  $239 \times 10cm^3$   
 $M_o$ ; Bending Moment

### Bending Moment of fixed pile in head

$$\therefore M_o = \pm Z(\sigma_a - \frac{V}{A_p})$$

Where  $V = 78ton$   
 $\sigma_a = 1400kg/cm^2$   
 $(\sigma_a$ ; Allowable Stress Intensity in Bending)  
 $M_o = \pm 239 \times 10 \times (1400 - \frac{78 \times 10^3}{197.6}) = 2,402,579kg/cm$

Bending Moment of head fixed and jutting pile is by changa's equation as followed,

$$M_o = \frac{H}{2\beta} \times (1 + \beta h)$$

Where  $H$  ; Horizontal force  
 $\beta$  ; Chavacteristic Value  
 $\beta = \sqrt[4]{\frac{K_n \cdot B}{E \cdot I}} = \sqrt[4]{\frac{0.89 \times 50}{21 \times 10^5 \times 606 \times 10^2}} = 4.32 \times 10^{-3}$   
 $B$  ; pile diameter 50cm  
 $h$  ; Length of jutting part 770cm

Therefore Allowable Horizontal Force of pile is as followed,

$$H = \frac{M_0 \cdot 2B}{(1 + \rho h)} = \frac{2,402,579 \times 2 \times 4.32 \times 10^{-3}}{(1 + 4.32 \times 10^{-3} \times 770)} = 4,798 \text{ kg} = 4.8 \text{ ton/piece}$$

Allowable Horizontal Force  $\Sigma H$  is as followed,

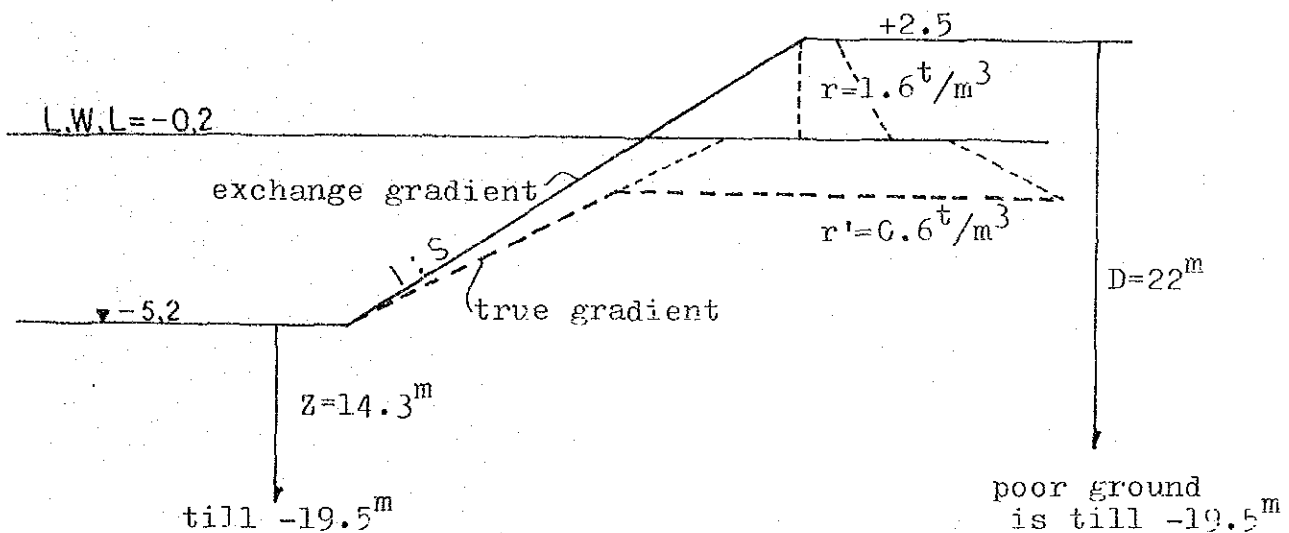
$$\Sigma H = 4.8 \text{ ton/piece} \times 16 \text{ piece} = 76.8 \text{ ton} > 30 \text{ ton}$$

This is, in case of  $\phi=500\text{mm}$  S.P.P. design condition is sufficient on Horizontal Force.

## 2. Stability of Retaining Wall

The profile of retaining wall is as followed,

Fig-16 Calculation of Stability Slope Gradient



P and P' in above figure are load on cobble banking and ground. Allowable Bearing Capacity  $q_a$  of clay layer is as followed,

$$q_a = N_c \frac{C_0}{F} + r_2 D$$

Where	$N_c$ ; Bearing Capacity Factor	5.3
	$C_0$ ; Cohesion	$2.0 \text{ t/m}^2$
	$F$ ;	2.5
	$r_2 D$ ; Depth weight	$1.5 \text{ t/m}^2$

$$\therefore q_a = 5.3 \times \frac{2.0}{2.5} \times 1.5 = 5.74 \text{ t/m}^2 > P' = 4.0 \text{ t/m}^2$$

This is, Allowable Bearing Capacity of Clay layer is sufficient against the load.

### 3. Stability of Slope

The stability slope gradient after dredging is obtained by Talor's figure,

$$F_s = \frac{C \cdot N_s}{\sum \gamma H}$$

Where	C ; Cohesion	2.0t/m <sup>2</sup>
	N <sub>s</sub> ; Stability Intensity	
	γ ; Density of soil	1.6t/m <sup>3</sup>
	γ' ; Density in water	0.6t/m <sup>3</sup>
	H ; Height of Slope	2.7m and 5.0m
	F <sub>s</sub> ; Safety Factor	
	n ; Coefficient of Depth	

$$\sum \gamma H = 1.6 \times 2.7^m + 0.6 \times 5.0^m = 7.32t/m^2$$

$$n = 22 / (22 - 14.3) = 2.86$$

In case of gradient 1 : 1.5

$$\beta \approx 34^\circ,$$

$$\therefore N_s = \frac{\gamma H}{c} = 5.6$$

$$F_s = \frac{2 \times 5.6}{7.32} = 1.53 > 1.3$$

Therefore true gradient is 1:2.0



12. Civil Engineering Cost of the sites

<u>Item No</u>	<u>Site</u>		<u>Total Cost</u> (฿'000)	<u>Foreign</u> <u>Currency</u> (฿'000)	<u>Local</u> <u>Currency</u> (฿'000)
C- 1	Suphan Buri	No.28	2,881	1,318	1,563
C- 2	Suphan Buri	No.29	4,950	1,600	3,350
C- 3	Sara Buri	No.31	577	328	249
C- 4	Sara Buri	No.32	999	239	710
C- 5	Chai Nat		485	273	212
C- 6	Lam Pang		1,633	401	1,232
C- 7	Chieng Mai	No.22	2,748	781	1,967
C- 8	Chieng Mai	No.23	921	413	508
C- 9	Chieng Rai		877	283	594
C-10	Nakhon Sawan		6,506	3,209	3,297
C-11	Phisnulok		2,240	736	1,504
C-12	Phichit		2,023	852	1,171
C-13	Nakhon Ratchasima	No.10	869	464	405
C-14	Nakhon Ratchasima	No.11	753	403	350
C-15	Nakhon Ratchasima	No.12	2,272	769	1,503
C-16	Surin		1,306	393	913
C-17	Ubon Ratchatani		494	259	235
C-18	Udon Thani	No. 1	472	254	218
C-19	Udon Thani	No. 2	1,081	307	774
C-20	Surat thani		469	250	219
C-21	River Port (Nonthaburi-1)		26,303	17,426	8,877
C-22	River Port (Nonthaburi-2)		50,429	32,320	18,109
C-23	Sea Port (Laem Chabang)		9,850	6,061	3,789

C-1 Suphan Buri No.28

Description	Scale	Quantity	Unit	Rate (฿)	Total Cost (฿)	F/C (฿)	L/C (฿)
<b>1. Access road</b>							
Earth	$400^m \times 3.5^m \times 1.0^m \times 1.2$	1,800.0	m <sup>3</sup>	70	126,000	—	126,000
Ballast	$400 \times 5.0 \times 0.3 \times 1.2$	720.0	"	200	144,000	—	144,000
Bulldozer	$2520^m^3 \div 500^m^3 \times 8^hr$	40.0	hr	329. <sup>4</sup>	13,176	9,036	4,140
Labor	$7^d \times 10^men$	70.0	day	80	5,600	—	5,600
Total					288,776	9,036	279,740
<b>2. Banking</b>							
Earth	$5,155^m^2 \times 1.0 \times 1.2$	6,200.0	m <sup>3</sup>	70	434,000	—	434,000
Bulldozer	$6,200 \div 500 \times 8$	99.0	hr	329. <sup>4</sup>	32,610	22,364	10,246
Labor	$10^d \times 5^men$	50.0	day	80	4,000	—	4,000
Total					470,610	22,364	448,246
<b>3. Drainage</b>							
Concrete pipe	$L = 197^m$	50.0	pcs	5,573	278,650	167,190	111,460
Cement		1,320.0	kg	1. <sup>7</sup>	2,244	1,346	898
Sand		42.2	m <sup>3</sup>	180	7,596	—	7,596
Ballast		3.1	"	200	620	—	620
Cobble		1.2	"	200	240	—	240
Steel bar		400.0	kg	9. <sup>6</sup>	3,840	2,688	1,152
Backhoe		128.0	hr	266. <sup>5</sup>	34,112	22,477	11,635
Labor		108.0	day	80	8,640	—	8,640
Total					335,942	193,701	142,241
<b>4. Foundation</b>							
P.C. pile	$L = 16.5^m, \phi = 300^mm$	410.0	pcs	3,564	1,461,240	876,744	584,496
Pile driving		410.0	"	693	284,130	207,415	76,715
Total					1,745,370	1,084,159	661,211
<b>5. Pre-engineering works</b>							
Survey	$5,155^m^2$	3.0	day	500	1,500	—	1,500
Soil test	$20^m \times 3$	60.0	m	650	39,000	9,328	29,672
Total					40,500	9,328	31,172
<b>TOTAL</b>					2,881,198	1,318,588	1,562,610

C-2 Suphan Buri No.29

Description	Scale	Quantity	Unit	Rate (฿)	Total Cost (฿)	F/C (฿)	L/C (฿)
<b>1. Access road</b>							
Earth	20.0 <sup>m</sup> x 7.0 <sup>m</sup> x 1.5 <sup>m</sup> x 1.2	252.0	m <sup>3</sup>	70	17,640	—	17,640
Ballast	20.0 x 5.0 x 0.3 x 1.2	36.0	"	200	7,200	—	7,200
Bulldozer		5.0	hr	329. <sup>4</sup>	1,647	1,130	517
Labor		5.0	day	80	400	—	400
Total					<u>26,887</u>	<u>1,130</u>	<u>25,757</u>
<b>2. Banking</b>							
Earth	18,000 <sup>m<sup>2</sup></sup> x 1.5 <sup>m</sup> x 1.2	32,400.0	m <sup>3</sup>	70	2,268,000	—	2,268,000
Bulldozer		518.0	hr	329. <sup>4</sup>	170,629	117,016	53,613
Labor		324.0	day	80	25,920	—	25,920
Total					<u>2,464,549</u>	<u>117,016</u>	<u>2,347,533</u>
<b>3. Drainage</b>							
Concrete pipe		100.0	pcs	5,573	557,300	334,380	222,920
Cement		2,640.0	kg	1. <sup>7</sup>	4,488	2,693	1,795
Sand		89.4	m <sup>3</sup>	180	15,972	—	15,972
Ballast		6.2	"	200	1,240	—	1,240
Cobble		2.4	"	200	480	—	480
Steel bar		880.0	kg	9. <sup>6</sup>	8,448	5,276	2,552
Backhoe		256.0	hr	266. <sup>5</sup>	68,224	44,754	23,270
Labor		216.0	day	80	17,280	—	17,280
Total					<u>672,652</u>	<u>327,923</u>	<u>284,729</u>
<b>4. Foundation</b>							
P.C. pile	L=16.5 <sup>m</sup> φ=300 <sup>mm</sup>	410.0	pcs	3,564	1,461,240	876,744	584,496
Pile driving		410.0	"	693	284,130	207,415	76,715
Total					<u>1,745,370</u>	<u>1,084,159</u>	<u>661,211</u>
<b>5. Pre-engineering works</b>							
Survey	18,000 <sup>m<sup>2</sup></sup>	3.0	day	500	1,500	—	1,500
Soil test		60.0	m	650	39,000	9,328	29,672
Total					<u>40,500</u>	<u>9,328</u>	<u>31,172</u>
<b>TOTAL</b>					<b>4,949,958</b>	<b>1,597,556</b>	<b>3,350,402</b>

C-3 Sara Buri No. 31

Description	Scale	Quantity	Unit	Rate (₪)	Total Cost (₪)	F/C (₪)	L/C (₪)
<b>1. Drainage</b>							
Concrete pipe	350m	88.0	pes	5,310	467,280	280,368	186,912
Cement		2,310.0	kg	1.62	3,742	2,245	1,497
Sand		73.9	m <sup>3</sup>	200	14,780	—	14,780
Ballast		5.4	"	160	864	—	864
Cobble		2.1	"	150	315	—	315
Steel bar		770.0	kg	9.1	7,007	4,204	2,803
Backhoe		224.0	hr	266.5	59,696	39,334	20,362
Labor		189.0	day	80	15,120	—	15,120
Total					568,804	326,151	242,653
<b>2. Foundation</b>							
P.C. pile			pes				
Pile driving			hr				
Total							
<b>3. Pre-engineering works</b>							
Survey	15,000m <sup>2</sup>	4.0	day	500	2,000	—	2,000
Soil test	10m×1	10.0	m	650	6,500	1,555	4,945
Total					8,500	1,555	6,945
<b>TOTAL</b>					<b>577,304</b>	<b>327,706</b>	<b>249,598</b>

C-4 Sara Buri No.32

Description	Scale	Quantity	Unit	Rate (₱)	Total Cost (₱)	F/C (₱)	L/C (₱)
<b>1. Access road</b>							
Earth	$5.0 \times 7.0 \times 2.0 \times 1.2$	840	m <sup>3</sup>	40	3,360		3,360
Ballast	$5.0 \times 5.0 \times 0.3 \times 1.2$	90	"	150	1,350		1,350
Bulldozer		80	hr	329 <sup>4</sup>	2,635	1,807	828
Labor		100	day	80	800		800
Total					8,145	1,807	6,338
<b>2. Banking</b>							
Earth	$9805 \times 1.0 \times 1.2$	11,766.0	m <sup>3</sup>	40	470,640		470,640
Bulldozer	260	188.0	hr	329 <sup>4</sup>	61,927	42,469	19,458
Labor		235.0	day	80	18,800		18,800
Total					551,367	42,469	508,898
<b>3. Drainage</b>							
Concrete pipe	260 <sup>m</sup>	65.0	pcs	5,310	345,150	207,090	138,060
Cement		1,650.0	kg	1 <sup>62</sup>	2,673	1,604	1,069
Sand		548	m <sup>3</sup>	200	10,960	—	10,960
Ballast		3.9	"	160	624	—	624
Cobble		1.7	"	150	255	—	255
Steel bar		550.0	kg	9 <sup>1</sup>	5,005	3,503	1,502
Backhoe		166.0	hr	266 <sup>5</sup>	44,239	29,150	15,089
Labor		207.0	day	80	16,560	—	16,560
Total					425,466	241,347	184,119
<b>4. Foundation</b>							
P.C. pile			pcs				
Pile driving			hr				
Total							
<b>5. Pre-engineering works</b>							
Survey	9805 <sup>m<sup>2</sup></sup>	30	day	500	15,000		15,000
Soil test	10 <sup>m</sup> x 2	20.0	m	650	13,000	3,109	9,891
Total					14,500	3,109	11,391
<b>TOTAL</b>					<b>999,478</b>	<b>288,732</b>	<b>710,746</b>

C-5 Chai Nat

Description	Scale	Quantity	Unit	Rate (฿)	Total Cost (฿)	F/C (฿)	L/C (฿)
1. Access road							
Ballast	5.0 <sup>m</sup> × 5.0 <sup>m</sup> × 0.3 × 1.2	9.0	m <sup>3</sup>	200	1,800	—	1,800
Bulldozer		8.0	hr	329. <sup>4</sup>	2,635	1,807	828
Labor		10.0	day	80	800	—	800
Total					5,235	1,807	3,428
2. Drainage							
Concrete pipe	290.0 <sup>m</sup>	73.0	pcs	5,310	387,630	232,578	155,052
Cement		1,980.0	kg	1. <sup>62</sup>	3,208	1,925	1,283
Sand		61.3	m <sup>3</sup>	200	12,260	—	12,260
Ballast		4.6	"	200	920	—	920
Cobble		1.8	"	200	360	—	360
Steel bar		610.0	kg	9. <sup>5</sup>	5,795	4,056	1,739
Backhoe		185.0	hr	266. <sup>5</sup>	49,302	32,486	16,816
Labor		233.0	day	80	18,640	—	18,640
Total					478,115	271,045	207,070
3. Foundation							
P.C. pile			pcs				
Pile driving			hr				
Total							
4. Pre-engineering works							
Survey	13,000 <sup>m<sup>2</sup></sup>	4.0	day	500	2,000	—	2,000
Soil test			m		—	—	—
Total					2,000	—	2,000
TOTAL					485,350	272,852	212,498

3-6 Lam Pang

Description	Scale	Quantity	Unit	Rate (฿)	Total Cost (฿)	F/C (฿)	L/C (฿)
<b>1. Access road</b>							
Earth	$300 \times 10 \times 2.0 \times 1.2$ m m m	504.0	m <sup>3</sup>	50	25,200	—	25,200
Ballast	$300 \times 50 \times 0.3 \times 1.2$	54.0	"	220	11,880	—	11,880
Bulldozer		9.0	hr	329. <sup>4</sup>	2,964	2,033	931
Labor		90.0	day	80	7,200	—	7,200
Total					47,244	2,033	45,211
<b>2. Banking</b>							
Earth	$14,530 \times 1.0 \times 1.2$ m <sup>2</sup> m	17,556.0	m <sup>3</sup>	50	877,800	—	877,800
Bulldozer		280.0	hr	329. <sup>4</sup>	92,232	63,252	28,980
Labor		292.0	day	80	23,360	—	23,360
Total					993,392	63,252	930,140
<b>3. Drainage</b>							
Concrete pipe	308 <sup>m</sup>	77.0	pcs	5,989	461,153	276,692	184,461
Cement		1,980.0	kg	1. <sup>7</sup>	3,366	2,020	1,346
Sand		64.9	m <sup>3</sup>	70	4,543	—	4,543
Ballast		4.6	"	220	1,012	—	1,012
Cobble		1.8	"	150	270	—	270
Steel bar		610.0	kg	9. <sup>6</sup>	5,856	4,099	1,757
Backhoe		196.0	hr	266. <sup>5</sup>	52,234	34,418	17,816
Labor		245.0	day	80	19,600	—	19,600
Total					548,034	317,229	230,805
<b>4. Foundation</b>							
P.C. pile			pcs				
Pile driving			hr				
Total							
<b>5. Pre-engineering works</b>							
Survey	15,000 <sup>m<sup>2</sup></sup>	4.0	day	500	2,000	—	2,000
Soil test	15 <sup>m</sup> x 4	60.0	m	700	42,000	18,655	23,345
Total					44,000	18,655	25,345
<b>TOTAL</b>					1,632,670	401,169	1,231,501