

To their figures, the amount of petroleum products is added, and the cargo handled at the port is shown in Fig. 4-1.

In the above forecast, it is expected that some of the cement which will exceed the handling capacity of Ports No. 1 and 2 will be continued to be brought in by barges, and unloaded at the river banks even in the future. It is assumed that the cargo handled at Port No. 2, and the cargo lightered on the barges, as described in paragraph 3.4.1 (4) 4) will be the same as in 1992. The cargo handled at Port No. 1 is expected to be as follows:

(1,000 tonnes)			
Year	1995	2000	2010
Export	234	323	278
Import	291	243	288
Total	525	566	566

For comparison, the forecast quantities of the Mekong Secretariat is given in the following:

(1,000 tonnes)			
Year	1995	2000	2010
Export	255	339	276
Import	203	295	259
Total	458	634	535

Note : The cargo volumes of the Mekong Secretariat do not include petroleum products, lumber and bauxite.

**Fig.4-1 Cargo Handled
at the Port of Phnom Penh and Port of Sihanoukville**

Year	Port of Phnom Penh	Port of Sihanoukville	Total	Year	Port of Phnom Penh	Port of Sihanoukville	Total
1960	842,000		842,000	1981	94,000	190,727	284,727
1961	741,000	95,575	836,575	1982	57,000	129,828	186,828
1962	898,000	166,339	1,064,339	1983	49,000	97,324	146,324
1963	962,500	369,559	1,332,059	1984	87,403	118,427	205,830
1964	707,800	514,834	1,222,634	1985	119,471	116,186	235,657
1965	595,400	942,228	1,537,628	1986	234,000	129,480	363,480
1966	517,100	548,525	1,065,625	1987	240,000	161,397	401,397
1967	535,200	543,537	1,078,737	1988	259,000	207,253	466,253
1968	453,100	747,838	1,200,938	1989	271,000	263,950	534,950
1969	227,700	954,210	1,181,910	1990	369,000	283,727	652,727
1970		734,926	734,926	1991	429,000	132,550	561,550
1979	61,000	72,576	133,576	1995	737,000	492,000	1,229,000
1980	165,000	291,521	456,521	2000	775,000	916,000	1,691,000
				2010	1,050,000	1,060,000	2,110,000

Notes:

1. Source:

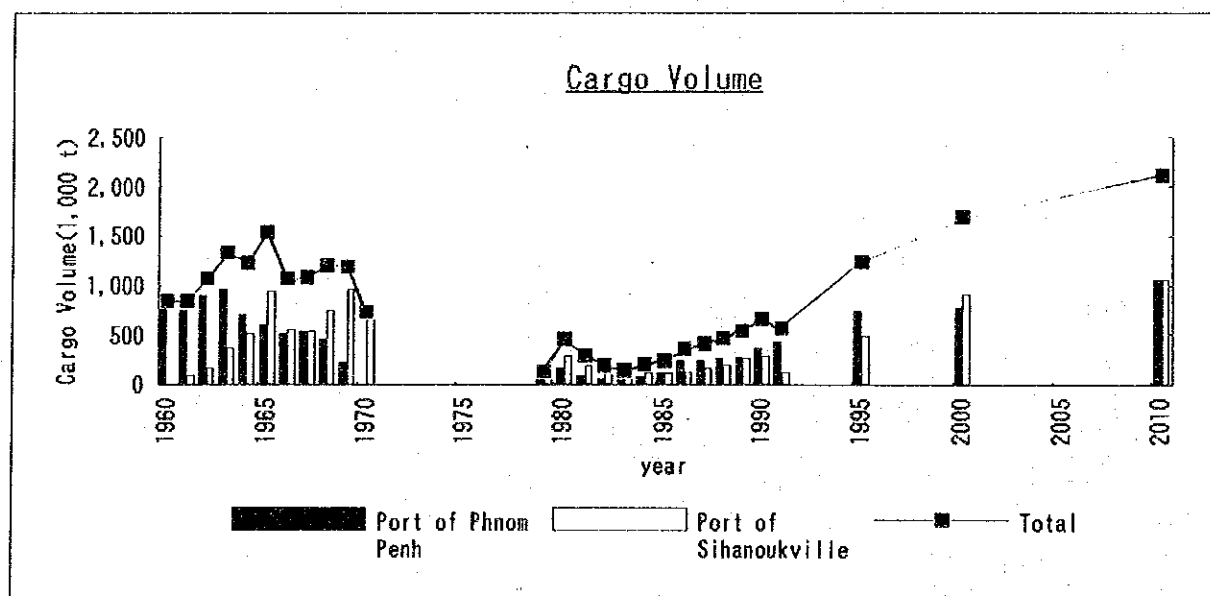
Sihanoukville 1961 - 1991: Sihanoukville Port(includes petroleums).

Pnom Penh 1960 - 1985: MOCTP, Planning Dept.(includes petroleums).

Pnom Penh 1986 - 1991: Department of Phnom Penh Port(includes petroleums).

2. Forecast for 1995-2010 (includes petroleum, mineral ores).

3. Data for 1970-1978 is not available due to the civil war.



(3) The Role played by the Port of Phnom Penh

The socio-economic activities are expected to expand as the political situation in Cambodia stabilizes. With the rapid restoration of the economic activities, the stable distribution in the flow of goods is one of the most important national objectives. The routes that foreign goods are brought in are varied and many such as the land routes of National Roads Rt. 1, 3, 4, 5, the old railway line (Phnom Penh ~ Poipet), the new railway line (Phnom Penh ~ Sihanoukville), the water route on the Mekong River. The transport by roads can be used only if the roads are in good condition and secure, and the receiving of cargo can be guaranteed.

The most efficient route to bring in the imports is through the Sihanoukville Port via Rt. 4, and this method must rely on the large volumes that the ocean going vessels can bring in, but has the problem of economics in transport overland. The condition of the new railway line is not in the best condition and it cannot be considered a reliable means of transportation. In view of these conditions, the water route through the Mekong River can be considered as the best gateway to bring goods into the capital city, and without a doubt it will play an important role for the time being. The Port of Phnom Penh serves almost as a door-to-door means in the unloading of cargo. Less damage to cargo, the few claims for pilferage, ease of delivery and the comparative low cost make the port very attractive to the small and medium size import handlers.

As described earlier, the present facilities of the Port of Phnom Penh are used to its maximum extent, and the various improvement plans proposed will have a very significant meaning.

(4) The Future of the Port of Phnom Penh

After the Project is implemented, and the repairs and expansion work is finished, the role of Port No. 1 is to handle general cargo, machinery, industries goods and clean cargo. On the one hand, bulk cargo such as petroleum products, mineral ores, cement, and grain will be handled at Port No. 2, piers managed by other ministry, and the river banks. It will be important to establish Port No. 2 as a permanent pier to keep on handling these items. It is expected that after the facilities at Port No. 1 will be expanded, a new port will be developed. Prior to expanding some of the improvements, the following should be considered:

- 1) Increase the cargo handling capacity by work on legal holidays, and night.
(2 ~ 3 shifts system should be employed)
- 2) Increase the containerization of the cargo to permit larger volumes to be handled and reduce the damage and loss of the cargo.
- 3) By the above methods reduce the time of transport and also reduce the transportation costs.

By putting the above methods into use, the port facilities can be utilized to their maximum after the repairs and expansion work is completed.

(5) Plan for the New Port of Phnom Penh

A Feasibility Study was prepared for the Phnom Penh New Port based on a request from Cambodia in 1965. The plan for the Phnom Penh New Port consists of expansion of the port yard and improvement of services, reducing of the amount of maintenance dredging, and the contribution to the Phnom Penh City Plan.

In this study, the increase of the foreign cargo volumes to Cambodia in the year 2010, it is expected to be as indicated in the following table:

The Forecast of Cargo at Sihanoukville/Phnom Penh Ports
and the Cargo Volume

Port Name	Actual Volume		Forecast (Note 5)			Cargo volume after rehabilitation
	1960	1992	1995	2000	2010	
1. Sihanoukville Port	954 (1969) (Note 1)	236 (Note 2)	492	916	1,060	
2. Phnom Penh Port	962 (1963) (Note 3)	315 (Note 4)	587	755	690	(Note 6) 566
Port No. 1		151	525	566	566	
Port No. 2 and lightering		43	43	43	43	
Others including river banks		121	19	146	81	
Total	-	551	1,079	1,671	1,750	

- Note
1. Breakdown between domestic and foreign cargo unknown (includes petroleum)
 2. Foreign cargo only, included petroleum
 3. Breakdown between domestic and foreign cargo unknown (includes petroleum)
 4. Foreign cargo only, does not include petroleum.
 5. Refer to Chapter 4.2.1 (2)
Sihanoukville Port : Foreign cargo only, includes petroleum
Phnom Penh Port : Foreign cargo only, does not include petroleum
 6. 566,000 tonnes is the amount of cargo that can be handled after rehabilitation

Due to the results of the investigation, and considering the problems in the future, the New Port will have the following position.

- (1) Cargo volume of 566,000 tonnes at Port No. 1, Phnom Penh Port will be the volume that could be handled in 2000 when subtracting the 146,000 tonnes of cement unloaded on the river banks from the total forecasted volume of 760,000 tonnes.
- (2) The volume of cargo handled at Sihanoukville Port in 1992 had decreased to 240,000 tonnes, the port handled million tonnes in the 1960s, and by making repairs to the port, it could manage to handle the volumes expected in the year 2010.
- (3) It will be necessary to consider the degree of the increased forecast due to the restoration of the economical activities of Cambodia. Further study should be made taking into consideration the developments that are being implemented under the 2nd National Reconstruction Plan.

4.2.2 Examination of Executing and Operational Plan

The Department of the Phnom Penh Port has a staff of 637. The section are organized vertically, and the Cargo Handling Equipment has the following section as an example:

Cargo handling section -----	Dispatch/Operation of Equipment
Equipment section-----	Storage of Equipment (Garage)
Technical section -----	Maintenance & Repair
Accounting section-----	Spare Parts

The cargo handling section leases the equipment from the equipment section. When repairs are required, the cargo handling section or the equipment section request to the Technical Section, while spare parts are received from the accounting section. It will be necessary to reorganize the organization for a functional effectively so that a centralized operation can be made.

The data and statistics of the port operation is performed by the following sections:

Warehouse section -----	Manifest
Cargo handling section -----	Recording of Cargo
Navigation services section -----	Statement of Facts

The data and records are collected by the navigation services section, and submitted to the commercial section. At the present time, the forms and methods of record keeping has not been established, and the computer system has not yet been established and improvements must be started from this area.

The revenue of the the Department of the Phnom Penh Port has increased as shown in the following table, and the Department is operating without support from the State, and is capable of supporting itself.

The financial status of the Department of Phnom Penh Port have been generally in the black as shown below.

(Unit: 000 Riel)

Year	Income	Exense
1984	5,710	6,965
1985	8,628	7,509
1986	10,783	8,128
1987	15,650	9,137
1988	17,880	20,617
1989	31,090	28,766
1990	258,923	124,557
1991	1,014,523	302,120
1992	3,152,180	704,639

Source : 1. The Department of the Phnom Penh Port
2. Fiscal year is Jan. ~ Dec.

4.2.3 The Components of the Plan and an Examination of the Components

In order to clarify the type, scope and the relationship of the components of the Project, the volume of the cargo after the project implementation is studied and compared with the results of the demand forecast made in para. 4.2.1. At the same this the present port facilities were compared against the cargo volumes and type of crating (especially containers), to determine what type of storage facilities, the facilities that the consignee and shipper would need to handle the cargo, and equipment was examined to meet the new needs.

(1) Port Cargo Handling Capacity at the Port of Phnom Penh

1) The Efficiency of the Cargo Handling

It is felt that the efficiency of the port facilities could be improved by widening of the berths, improving the fenders, increasing the cargo handling equipment, and introducing lighting fixtures, could be increased to 100 t/shift/gang from the present of average cargo handling capacity of 68 t/shift/gang.

The present average cargo handling capacity is calculated as follows.

$$\frac{90.7 \text{ t/shift/gang}}{\text{(Refer para. 3.4.1 (5)2)h)}} \times \frac{0.75}{\text{(efficiency)}} = 68 \text{ t/shift/gang}$$

2) Berth Occupancy

As described in Chapter 3, the berths of Port No. 1 are occupied by vessels with their bow or stern extending beyond the lengths of the berths, and this shows that the berths are occupied beyond 100 % of their capacity.

In order to correct this condition, the occupancy of the berths have been established at 90 %.

3) The Average Number of Gangs

By extending the berths by 117 m, for a total length of the berths at Port No. 1 to 300 m, the standard berth size of the vessels and their numbers will be established as follows:

$$1,000 \text{ DWT (58 m)} \times 3 \text{ vessels} + 1,500 \text{ DWT (67 m)} \times 2 \text{ vessels} = 308 \text{ m}$$

The number of gangs required will be as follows:

$$2 \text{ gangs} \times 3 \text{ vessels} + 3 \text{ gangs} \times 2 \text{ vessels} = 12 \text{ gangs}$$

4) Containerization

The containerization of Port No. 1 has been assumed by deleting the amount of lumber and cement, and establishing 10 % for 1995, and 20 % for the year 2000.

The containers to be handled are forecast as follows:

Unit: 1,000 ton

Year	1995	2000	2010
Containerized cargo	41	54	47
Others, general cargo, etc.	484	512	519
Total	525	566	566

The containerization assumes 300 t/shift/gang, and allows the times required to load the empty containers on the return journey.

5) Cargo Loading/Unloading Hours

The cargo handling hours of 1 shift are 8 hours per day operation. There is no night cargo handling work being performed due to the lack of dock lighting fixtures and the non reliable power supply.

Once the Project is implemented and the light fixtures installed and power supply (with generators) is in place, hours of cargo handling operation could be extended. However, it cannot be assumed that a 2 shift operation would not be commenced immediately knowing the situation of the port operations. Therefore, the following hours of operation are proposed during and after the Project:

7:00 ~ 11:30	4.5 hrs	} 1 shift
14:00 ~ 17:30	3.5 hrs	
18:00 ~ 22:00	4.0 hrs	0.5 shift
Total	12.0 hrs	1.5 shift

The efficiency of night operation is assumed to be 75 % that of the day operation.

6) Annual Number of Days of Work

It is assumed that approximately one-half of the Sundays and legal holidays would be worked, and the total number of days would be 330 days per year.

7) Study of the Cargo Handling Capacity

The unit cargo handling capacity was calculated as follows:

Unit cargo handling capacity:

(Gang cargo handling efficiency) x (Berth occupancy) x (Average gangs) x
(No. of shift x efficiency) x (No. of days worked for year) / (Length of
Berths)

Unit handling capacity for general cargo:

$$\frac{(100 \text{ t/shift/gang}) \times (0.90) \times (12 \text{ Gangs}) \times (1.0 \times 1.0 + 0.50 \times 0.75) \times (330 \text{ Dys})}{(300 \text{ m})}$$

$$= 1,634 \text{ t/m}$$

Unit handling capacity for container cargo:

$$\frac{(300 \text{ t/shift/gang}) \times (0.90) \times (12 \text{ Gangs}) \times (1.0 \times 1.0 + 0.50 \times 0.75) \times (330 \text{ Dys})}{(300 \text{ m})}$$

$$= 4,901 \text{ t/m}$$

The capacity of Port No. 1 (length 300 m) to handle cargo can be calculated as follows:

Port Cargo Handling Capacity

$$= \frac{(\text{Total berth length})}{\frac{(\text{Containerization ratio})}{(\text{Container cargo efficiency})} + \frac{(\text{General cargo ratio})}{(\text{General cargo efficiency})}}$$

Port cargo handling capacity in 1995 will be

$$\frac{(300 \text{ m})}{\frac{(0.10)}{(4.901 \text{ t/m})} + \frac{(0.90)}{(1.634 \text{ t/m})}} = 525,000 \text{ t/yr}$$

The cargo handling capacity for 2000 ~ 2010 will be

$$\frac{(300 \text{ m})}{\frac{(0.20)}{(4.901 \text{ t/m})} + \frac{(0.80)}{(1.634 \text{ t/m})}} = 566,000 \text{ t/yr}$$

The above has been consolidated in the following table.

Berth length	Year	Port cargo handling capacity (1,000 t/yr)	Cargo handled per unit berth length	
			Per 1.5 shift	Per shift
300 m	1995	525	(t/m/yr) 1,750	(t/m/yr) 1,273
	2000 and after	566	1,886	1,371

For comparison the demand forecast for para. 4.2.1 is given as follows:

**Demand Forecast of Cargo Handled
at the Port of Phnom Penh**

Unit: 1,000 ton

Year	Port No.1	Port No.2	Lightering	Others including river bank	Total
1995	525	36	7	19	587
2000	566	36	7	146	755
2010	566	36	7	81	690

This indicates that the port will be capable of handling the cargo of 1995 which includes cement, and the cargo in 2000 which does not includes cement, petroleum, mineral ores, with a pier length of 300 m.

(2) The Cargo Handling Modes at the Port of Phnom Penh

As described in para. 3.4.1 (5) 2), Port Activities, the cargo unloaded from the vessels at Port No. 1 are loaded directly on to trucks at the berth and taken to the consignee's warehouse outside the port yard since space is limited and the sheds do not have adequate space. The efficiency of the port activities depend upon that how those discharged cargos from the ships can quickly be taken back from the berth line toward the hinterland.

Along this purpose and to improve the lacking number of trucks and low handling efficiency at consignees' warehouse, an effective cargo stock system should be considered by utilizing the existing sheds and new yards.

The proposed new cargo flow system is shown in Fig. 4-2.

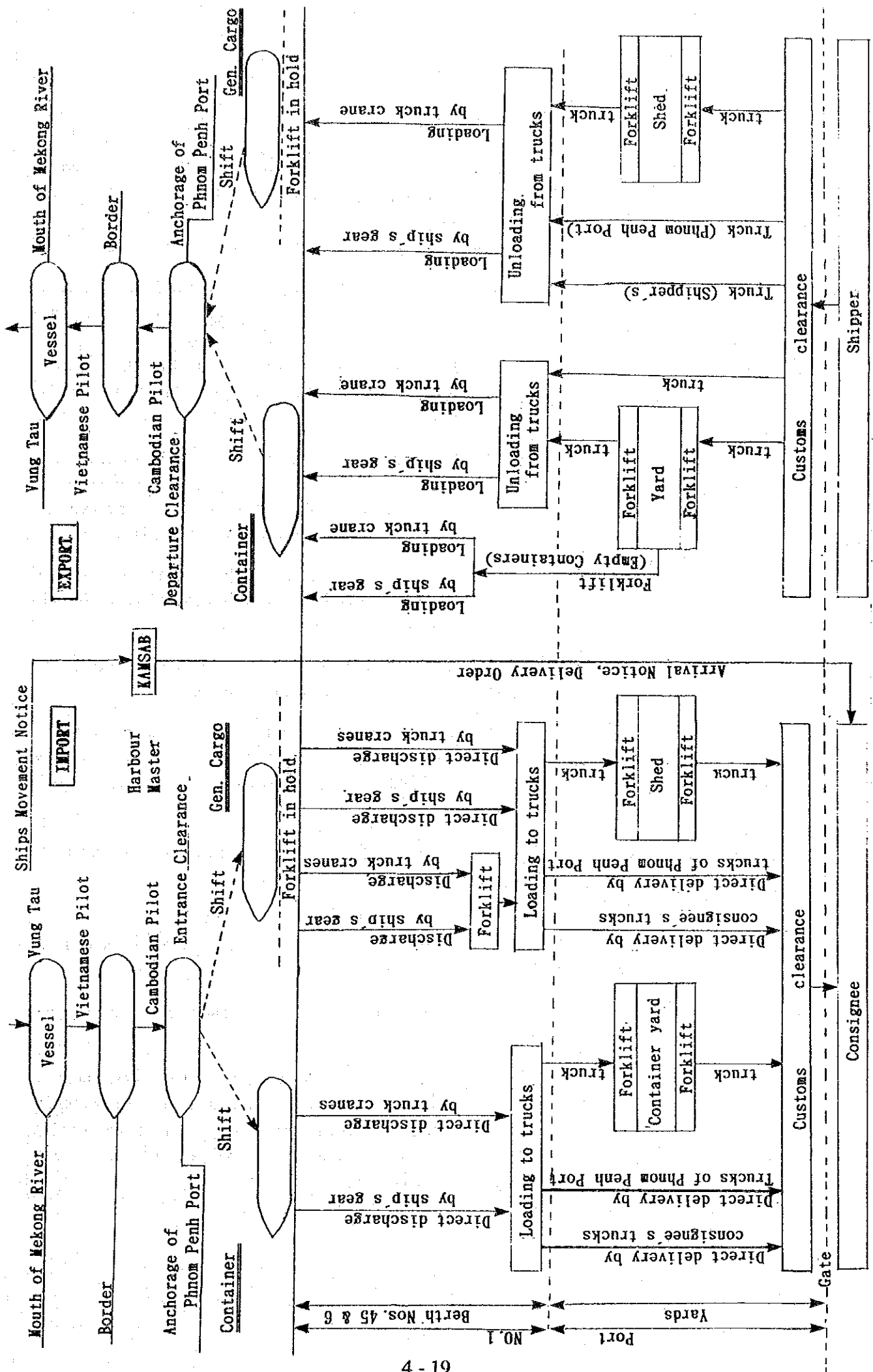


Fig. 4-2 Cargo Flow Diagram at Phnom Penh Port No. 1

(3) Components of Facilities and Equipment

The existing Phnom Penh Port details were added to Item (1) and (2) above, and the components and contents of the Project are summarized in Table 4-2.

Table 4-2 Components of the Project and their contents

Components	Principal Material and contents	Content Checked
Berth	Berth 300 m lg., Rubber fender, Mooring bitts, Access bridges	<ol style="list-style-type: none"> 1) Lengthening of the berth to 300 m for Port No. 1 in 2000 is as described in Para. 4.2.1 and 4.2.3 for the demand forecast. 2) Rubber fenders and mooring bitts will be provided for safe and quick mooring of the vessels. Also, mooring cleats will be provided underneath the berth to make it easy for small vessels to moor when the water level is low. 3) Independent mooring bitts will be provided at the upstream and downstream sides of the berths on the bank of river for the mooring of the vessels. 4) Three Access Bridges will be provided for the better flow of cargo and the location of the land facilities. 5) As described in Para. 3.4.1 it has been disclosed that Berths No. 4 and No. 5 are beyond economical repair. The berths will be used as is since it will not be economical to remove or repair them.
Yard on land	Removal of shed N1. Paving of yard and roads, Provision of drainage ditches, other related misc. work.	<ol style="list-style-type: none"> 1) Construct container yard for the containers of the present container vessels. 2) Remove shed: N1 to make space for yards. (shed: N10 will be demolished by Dept. of Phnom Penh Port) 3) Construct a yard for empty containers and return containers from Phnom Penh. 4) Core boring results indicate existing pavement has combined thickness of 7 cm for surface course, 23 cm for base course and capable for sustains heavy loads and will be used as it is. However, the damaged asphalt pavement area will be repaired.

Revetment	Revetment Bank Protection, Earth Fill	1) In order to maintain open Storage Yard, earth fill will be provided over the natural river bank with the surface protected with concrete.
River Bank Protection	Bank protection, Earth fill	1) In order to maintain open storage yard, earth fill will be provided over the natural river bank with the surface protected with concrete.
Cargo Handling Equipment	Truck crane (hvy. dty.) Truck crane (mid. & lt. dty.) Forklift (large) Forklift (mid. to sml.) Trailer track Spare parts	<p>1) The type and number of cargo handling equipment is based on the investigation of the Study Team, the requests of the Dept., and a check of the existing equipment, and determined after checking their needs and the costs involved.</p> <p>2) It will be important to move the unloaded cargo away from the water line as quickly and smoothly as possible and out of the port yard, to raise the efficiency of the equipment. As the ship's crane cannot be used when the water level is low, a heavy-duty crane will be used, and this crane can also be used to unload construction equipment.</p> <p>3) Trailer trucks will be used to move the discharged containers.</p> <p>4) Heavy-duty forklifts will be used to move the container within the container yard.</p> <p>The trailer trucks will be used for delivery of containers outside the port yard, and to deliver general cargo. It was discussed with the Department to use their trucks and private trucks on a continuing basis.</p> <p>5) The medium and small trucks, truck cranes and forklifts will be used to handle the general cargo other than the container cargo.</p> <p>6) The necessary numbers and size of cargo handling equipment will be treated in para. 4.3.4 which follows.</p> <p>7) Some spare parts will be supplied for the existing cargo handling equipment.</p>

Navigation Aids	Marker buoys Leading lights	<ol style="list-style-type: none"> 1) There are no navigation aids on the 100 km within Cambodia on the Mekong River. 2) There is no navigation performed at night on the Mekong River, due to sunken vessels and the configuration of River routes. 3) In order to solve the above deficiencies, a request for a budget has been submitted by the Department of Phnom Penh Port. 4) Once the navigational aids have been installed, the voyage days can be shortened.
Water Supply Facilities	Water supply pipe Water supply pit on berth	There are no water pipes on the berths to supply water to the vessels. Water supply pipes and water supply pits will be provided on the Berths.
Lighting Facilities	Light and light poles, electrical distribution wiring, panel boards, generator and generator house.	<ol style="list-style-type: none"> 1) Light fixtures will be provided to permit night work on the Berths. 2) Commercial power will be used for the illumination with emergency generation for power failures.
Workshop	Workshop	The existing workshop and machine shop are deteriorated and cannot be used any more. A request was submitted by the Department of Phnom Penh Port to include this item in the Study Team work scope. It was determined to include this work for the smooth operation of the cargo handling equipment, and the maintenance and operation of the equipment.
Weigh scale	Truck scale	The present Truck Scale which is inaccurate and cannot perform its function will be demolished. Based on a request from the Department, it was decided to include new truck scale as it establishes the basis for charging of standard fees.

4.2.4 Basic Policy for Cooperative Implementation of the Project

Since the effect, the practicality and the construction capability of Cambodia has been confirmed, this project has been found to qualify as a Grant Aid Project, and it has now been recognized to be recommended for Grant Aid from the Government of Japan. The project was further investigated for Grant Aid and it was provided with a Basic Design. There were some changes required to the request made as described hereinbefore.

4.3 Outline of the Project

4.3.1 The Executing Agency and the Operational Plan

The executing agency for this project will be the Department of Phnom Penh Port, of the Ministry of Communications, Transports and Posts and Telecommunications (MOCTP).

The organization of the Department of Phnom Penh Port is given in Fig. 4-3 and number of staff of the Department is shown in Table 4-3.

The following training program is requested by the Department of the Phnom Penh Port.

No.	Training Item	Number	Period	Location
1.	Port Administration Management	2	2 Months	Japan
2.	Financial Management of Ports	2	3 Months	Japan
3.	Improvement and Expansion of Port Infrastructure	2	3 Months	Japan
4.	Maintenance of Port Equipment	2	3 Months	Japan
5.	Freight Cargo Technique	12	3 Months	Japan
6.	Computerization of Port Operations	4	4 Months	Japan
7.	Improvement of Planning Section and Transactions with Customers	10	3~6 Months	Thailand
8.	Economic Section	2	3~6 Months	Thailand
9.	Port Management	2	3~6 Months	India
10.	Pilotage Techniques	18	18 Months	Phnom Penh
Total		56 People		

After this plan has been put into effect, as described in 4.2.3, with the increase of the volume of cargo, the work load will increase, but it is felt that the work can be performed adequately with the same level of staff.

4.3.2 Plan of Operation

(1) The Volume of Cargo Handled by the Port

The object of the Project which is Port No. 1 is the port where the foreign cargo is handled, and the volume processed at the port is expected to be as follows:

(Unit: 1,000 ton)

Item	1992 (Actual*)	1995	2000	2010
Export				
Rice	0	135	185	65
Rubber	14	30	33	50
Lumber	4	18	30	50
Marine Products	0	1	2	2
Farm Products	2	50	73	111
Others	0	-	-	-
Total	20	234	323	278
Imports				
Rice	14	-	-	-
Flour	-	5	7	10
Fertilizer	3	44	60	0
Cement	3	93	0	47
General Cargo	110	149	176	231
Total	130	291	243	288
Grand Total	150	525	566	566

Note: *Source, "Statement of Facts" Dept. of Phnom Penh Port

Table 4-3 Number of Staff of the Department of Phnom Penh Port

1. Accounting Department -----	21
2. Commercial Department-----	13
3. Staff Department - Administration-----	22
- Guards -----	34
- Students-----	15
4. Navigation Services Department -----	26
5. Cargo Handling Department-----	241
6. Warehouse Department-----	83
7. Inland Navigation Department-----	43
8. Technical Department - Mechanical Service - Technical Group-----	10
- Mechanical Group-----	34
- Construction Group -----	19
9. Equipment Department-----	76
<hr/>	
Total	637

Remarks: At Cargo Handling Dept., 202 persons are dockers.
At Inland Navigation Dept., 35 persons are dockers.

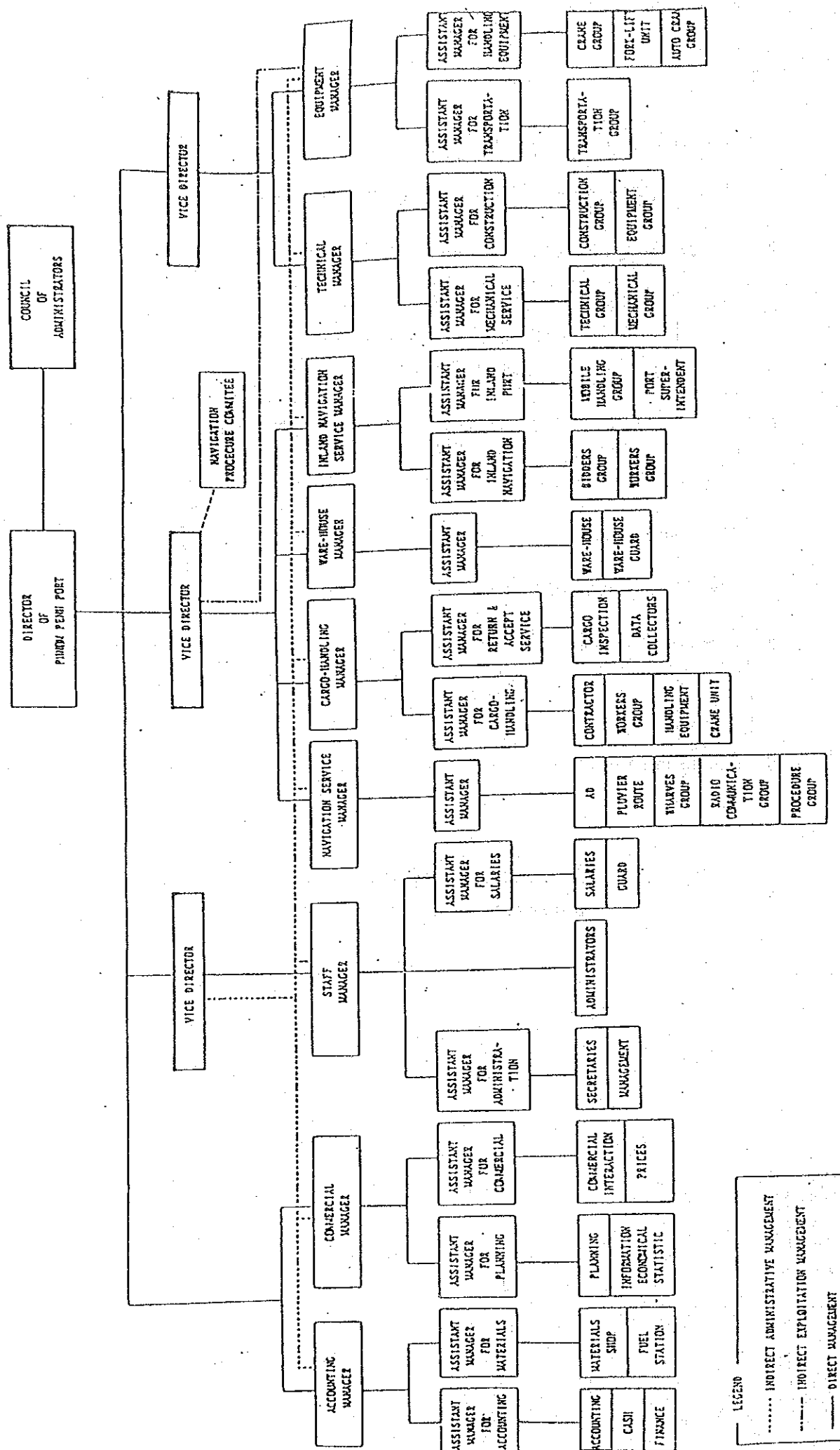


Fig. 4-3 Organization of the Department of Phnom Penh Port

(2) The Volume of Containers Handled

Containerization (Forecast)

1995: Cargo not including cement and Lumber	10 %
2000: Cargo not including cement and Lumber	20 %
2010: Cargo not including cement and Lumber	20 %

A breakdown of the container cargo is as follows:

Unit: 1,000 ton			
Year	1995	2000	2010
Container cargo	41	54	47
Other cargo (includes some cement)	484	512	519
Total	525	566	566

(3) The Number of Shifts for the Cargo Operation

It is expected that the 1.5 shift system instead of present 1 shift will be adopted.

Day shift	7:00 ~ 11:30	4.5 hrs
	14:00 ~ 17:30	3.5 hrs
	Total	8.0 hrs
Night shift	18:00 ~ 22:00	4.0 hrs
	Total	12.0 hrs

(4) Total number of working days: 330 day/yr.

(5) Berth occupancy: 90 %

(6) The port cargo handling capacity:

Year		1995	2000	2010
Port cargo handling capacity (1,000 ton/yr)		525	566	566
Cargo handled per unit length of berth	per 1.5 shift (t/m/yr)	1,750	1,886	1,886
	per shift (t/m/shift/yr)	1,273	1,371	1,371

4.3.3 Location of the Project Area and Present Condition

The project site is on the right bank of the Tonle Sap River, and is the Port No. 1. There were several private residences and wood working shops in the area, but those were demolished by March 1993 except for 3 private residences and further demolition of the remaining residences are now being arranged by the Department of the Phnom Penh Port. The trunk utilities lines for water and electricity is available adjacent to the site. Port No. 1 is very active with foreign trade cargo, and there are always several vessels anchored in the basin awaiting to berth.

4.3.4 Description of the Facilities and Equipment

(1) The Berth Layout (See Fig. 4-4)

In the investigation of the volume of cargo (refer to para. 4.2.3 (1)), lengthening the total length of Port No. 1 to 300 m (total of 3 berths for the cargo volume in 1995), is proposed.

Alignment of new berths

The new berth is to be constructed in front of the existing berth about 12 m forward, or at the same line of the existing berth after demolition and reconstruction of the existing berths as mentioned in the Application. And at the preliminary study stage it was explained that the new berth would be constructed about 8 to 12 meter forward from the existing berth including the rehabilitation of the existing berths.

The study team also explained in the meeting with the Department of the Port of Phnom Penh that the new berth will be constructed in front of the existing berth, including the rehabilitation of the existing structure.

For the determination of the new alignment of the new berth, the following plans are compared,

- 1) the new berth of 12 m width will be constructed in front of the existing structure, including the rehabilitation of the existing berths, and
- 2) the new berth of 20 m width will be constructed in front of the existing structures without rehabilitation work on the existing berths.

The plan to keep the same alignment requires more construction cost and time due to the difficulties for strengthening of the existing berths to resist the ship impact and widening the existing berths on the land side.

Due to the new berth forward from the existing berth, the amount of maintenance dredging will be reduced. And in case of the construction of the new structures in front of the existing ones, the existing berths and access bridges can be used for passing and parking of the light cars. The separation of the port traffic and people make the safe operation of the berth. The fabrication of site office is also available on the existing berths.

It is considered that the 20 m widening toward the riverside would not affect the scenery and disturb the navigation of vessels.

The abovementioned 12 m width is required for the construction of the structure against the ships' impact, then the total width will be 24 m including the area of rehabilitation of the existing berth. The 20 m width of the new berth is determined from the method of cargo handling system.

Berth layout plan

The layout of the berth for the 3 berths were planned at the Port No. 1 for the following Plan A and B.

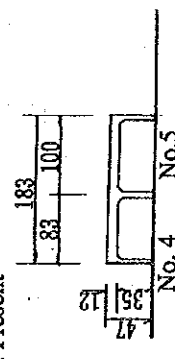
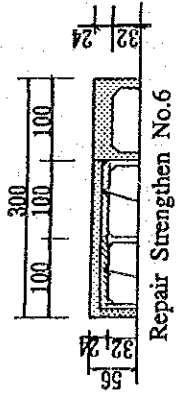
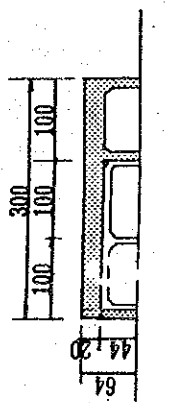
Plan A assumes the repair and widening of Berth No. 4, strengthening and widening of Berth No. 5, and new construction of Berth No. 6. The pier width is planned for a 24 m width.

Plan B proposes not to touch the existing berths since their stability and strength is low, but to construct a new 300 m long berth in front of the existing berths. The widths of the berths would be 20 m wide including the new Berth No. 6.

This new berth plan, the configuration of the berths, and construction period is compared in Fig. 4-4.

As shown in the evaluation in the Table, Plan B which is to construct a 20 m wide in front of Berth No. 4 and No. 5, and to construct a new Berth No. 6 downstream from Berth No. 5 is proposed.

Fig. 4 - 4 Comparison of Berth Plan of Phnom Penh Port No. 1

New Berth Plan	Outline of Structure				Comparison of Cost for Civil Work only. (Cost for Plan B is set as 1.)	Construction Period (Months)	Description	Evaluation (Ranking)
	Berth No.	Length (m)	Width (m)	Total Length (m)	Berth Area (m ²)			
<p>1. Present</p> 	No. 4	83	12	183	2,200		<ul style="list-style-type: none"> Berth No. 4 is 40 years old, and Berth No. 5 is 32 years old, and are deteriorated and require repairs. The existing facilities will no be able to handle the increase in the future cargo, and it will be necessary to extend the berth. 	2
	No. 5	100	12					
<p>2. Plan A</p>  <p>Repair Strengthen No.6</p>	No. 4 (repair & widening)	100	24				<ul style="list-style-type: none"> It is not certain that Berth Nos. 4/5 can be rehabilitated with any degree of certainty, and if the berths will have to be removed, the construction period will be very long. After completion of Berth No.6, the rehabilitation and strengthening of Berths 4/5 will be commenced. During the construction phase, there will be only 1.5 berth that can be placed in services. 	2
	No. 5 (strengthen & widening)	100	24	300	7,200	1.02		
<p>3. Plan B</p> 	No. 4	100	20				<ul style="list-style-type: none"> After completion of Berth No. 6, and half of No. 5, another half of No. 5 and No. 4 will be constructed. Existing Berths. No. 4/5 will not be rehabilitated. They will be used while placing certain restrictions on their use. The new berth structure will be separated from the existing structures. During the construction there will be only 1.5 berth that can be placed in service. 	1
	No. 5	100	20	300	6,000	1.00		
	No. 6	100	20			22		

The structures would be of the following dimensions:

Structure	Length (m)	Width (m)	Top Finish Elevation (m)
Berth No. 4	100.0	20.0	El. + 10.6
Berth No. 5	100.0	20.0	El. + 10.6
Berth No. 6	100.0	20.0	El. + 10.6
Access Bridge No. 1	44.0	12.0	
Access Bridge No. 3	44.0	12.0	
Access Bridge No. 4	44.0	12.0	

Study of the Berth Width

The present cargo operation makes use of the full width of the existing berth, and obstructs the passage of trucks. The new berth allows enough width for truck cranes to operate and for the efficient loading and unloading and a working space on the river side of 12 m. To this a two lane road 8 m wide has been provided for a total width of 20 m.

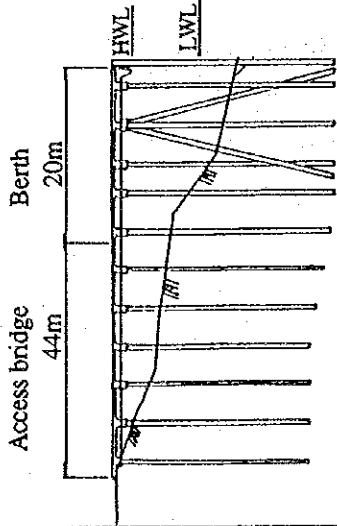
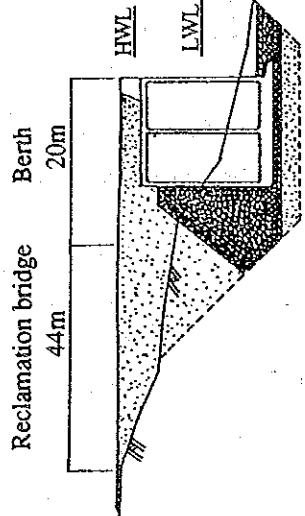
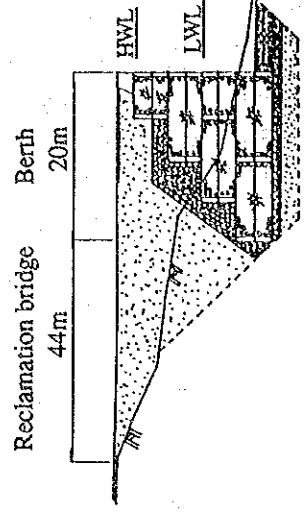
Study of the Access Bridge Width

A width of 12 m has been considered which will allow a parking space along the Access Bridge, and a two-lane passageway for truck of 8 m.

The Structure of the Berths

The present berth construction is a rigid concrete frame erected on a pile footing. This type of construction is based on concentrating the work of establishing the pile tip at a low elevation in the season when the water level is low. This project will be predicated on performing this work in the shortest time possible. This would require the use of steel pipe pile, caissons or cellular concrete constructions. As mentioned in Fig. 4-5, comparison of structural type of berth, this project proposes the use of steel pipe piles with batter and vertical piles.

Fig.4-5 Comparison of Structural Type of Berth

Type	Steel pipe pile type berth	Caisson type berth	Cellular concrete type berth
Typical cross section			
Description	<ul style="list-style-type: none"> • Construction can be proceeded quickly. • Construction will not be affected much by the changing of water level. • Less influence to the existing berth structure. • Less disturbance to the flow of the river. • Least construction cost among other types. 	<ul style="list-style-type: none"> • It is easy to fill the area behind the berths. • The foundation must be excavated up to -10m. But it is not sure that the existing berth structure is stable against the excavation. • It is very difficult to fabricate and launch caissons without proper facilities. • It disturbs the flow of the river due to the projection of the mass type structure from the bank. • Longer construction period than the pile type structure. • Construction can be easily affected by the change of water level and flow of river. 	<ul style="list-style-type: none"> • It is easy to fill the area behind the berth. • The foundation must be excavated up to -10m. But it is not sure that the existing berth structure is stable against the excavation. • Construction is easier that the caisson type. • It disturbs the flow of the river due to the projection of the mass type structure from the bank. • Longer construction period than the pile type structure. • Construction can be easily affected by the change of water level and flow of river. • Suitable material is required for filling blocks.
Cost ratio	1.0	2.8	2.3

(2) Cargo Handling Equipment

At Port No. 1 for foreign cargo, a new Berth No. 6 will be constructed for a total of 3 berths making a total length of 300 m berths, where general cargo will continue to be handled. There will be a combined total of 5 vessels of various sizes moored at the newly constructed berths. If the 5 vessels were to be unloaded simultaneously and the conventional method of stevedores system were applied, there could be 12 gangs put to work.

For the efficient use of the berths, the number of cranes used by the 12 gangs could be assumed as follows:

5 gangs would use the small size crane on the berth (hoisting capacity 7 ~ 20 tonnes)

3 gangs would use medium size cranes on the berth (hoisting capacity 25 tonnes)

4 gangs would use the ship's hoisting gear.

The cargo handling equipment on the land side will not be considered, as it is assumed that the trucks would carry the bulk of the cargo directly out of the port area and some of existing equipment may be used after repair.

1) The Number of Trucks and Forklifts Required

The number of cranes required by the 12 gangs to operate on the berths, would be:

Small Size Cranes : 5 each

Medium Size Cranes : 3 each

In consideration of the future increase in heavy weight cargo and containers, the following large size cranes could be required:

Large Size Cranes (Hoisting Capacity 40 ton): 1 each

Large Size Cranes (Hoisting Capacity 70 ton): 1 each

The number of forklifts required would be as follows:

Maximum lifting capacity 3.5 ton, for use
in vessel or dock side (High mast type): 5 each

Maximum lifting capacity 6.0 ton, for use on dock 5 each

Maximum lifting capacity 25.0 ton, for container hoisting 2 each

The maximum lifting capacity 25.0 ton forklift will be able to hoist the loaded containers, and also the empty containers. The maximum lifting 6.0 ton forklift will be capable of stacking second tier of empty containers.

The Department of Phnom Penh Port has purchased one 25 ton crane, and two 4 ton forklifts in 1992, so a corresponding number of equipment will be deducted. These equipment were unloaded at Sihanoukville Port and the import procedures were cleared when the Study Team was performing their investigation.

The number of equipment required will be:

Truck Cranes

<u>Hoisting Capacity</u>	<u>Quantity</u>
7 ton	5 Ea
25 ton	2 Ea
40 ton	1 Ea
70 ton	1 Ea

Forklifts

<u>Maximum lifting capacity</u>	<u>Quantity</u>
3.5 ton	5 Ea
6.0 ton	3 Ea
25.0 ton	3 Ea

2) The Number of Trucks Required

The number of trucks presently owned by the Department of Phnom Penh Port is 16 trucks and there is a need for more trucks. It is felt that they should have 4 more trucks for a total of 20 trucks. The 16 trucks could be kept running with spare parts. When there are 5 vessels docked at the berths simultaneously, there is a need for 30 trucks, and there is a need for 10 more trucks. This then means that there is a need for 14 more trucks

over their present fleet of trucks. In this number there is a need for 6 trailer trucks that can transport the 25 ton containers.

The number of trucks required are:

	<u>Carrying Capacity</u>	<u>Quantity</u>
Trucks	8 ~ 10 ton	8 Ea
Trailer Trucks	25 ton	6 Ea

3) The Request from the Department of Phnom Penh Port for Equipment

The request from the Department for equipment which became clear during the discussions are as follows:

a) Trucks Cranes:

<u>Hoisting Capacity</u>	<u>Quantity</u>
7 ton	9 Ea
16 ton	3 Ea
25 ton	2 Ea
40 ton	1 Ea
70 ton	1 Ea

b) Forklifts:

<u>Maximum lifting capacity</u>	<u>Quantity</u>
2.5 ton	6 Ea
4.0 ton	2 Ea (Magnetic Type)
4.0 ton	3 Ea
7.0 ton	1 Ea
20.0 ton	1 Ea
25.0 ton	2 Ea

c) Trailer Trucks:

<u>Load Weight</u>	<u>Quantity</u>
25 ton	6 Ea

4) Determination of Equipment quantities

The number of cargo handling equipment was determined reflecting the quantities requested by the Department of Port of Phnom Penh.

a) Truck Cranes:

It was determined to replace the 25 ton and 16 ton capacity of ex-USSR and Chinese manufacture with new ones, so two 25 ton cranes are proposed to procure. Five 6.5 ton cranes of Japanese manufacture (KATO) are considered to be usable for operation for another five years in case spare parts would be provided properly. Considering these circumstances for 7 ton truck cranes would be included under the Project. Further, one of each 40 ton and 70 ton truck crane will be included under the Project.

b) Forklifts:

Spare parts for forklift have been included in the Project, and so these forklifts have been considered as usable. It is expected that the general cargo to be received in the future will be palletized and so the existing forklift trucks will be used in the shed to increase the efficiency of operations there.

The Department has requested for the small and medium forklifts for palletized cargo and high-stacked cargo such as six 2.5 ton, five 4 ton, and one 7 ton forklifts in the vessel holds, and so this has now been prepared for five 3.5 ton high-mast forklifts, and three 6 ton forklifts. The 6 ton forklift trucks will be capable of handling empty containers. Since the containers will be unloaded directly on to the trailer trucks by crane at the dockside and be handled mainly by heavy duty forklift at the container yard, the heavy 25 ton duty forklift was limited to one.

c) Trailer Trucks:

It was contemplated to recommend eight 8 ~ 10 ton cargo trucks but the Department has advised that these types of trucks are available in the open market, so this class of trucks has not been considered. In place of this type of truck, six 25 ton trailer trucks have been included.

The results of the above study has been consolidated in paragraph 5.3.2 giving the capacity and quantities of the cargo handling equipment.

5) Spare Parts

The spare parts for the existing cargo handling equipment is as follows:

a) Truck Cranes

It is very hard to get spare parts for the truck cranes for ex-USSR and Chinese manufactures and spare parts for these equipment will not be included in the Project. Spare parts for 6.5 ton Truck cranes of Japanese manufactures of KATO are still manufactured and it is planned to be supplied so that the existing equipment will be operational condition. The spare parts will be examined and evaluated among the list which was proposed by the Department of the port of Phnom Penh.

b) Forklift

The spare parts for forklifts of Japanese manufacture of KOMATSU and TOYOTA are still manufactured and are available to be imported so that the equipment could be maintained in operational condition. The spare parts of TOYOTA's forklift will be included in the Project. The spare parts will be examined and evaluated among the list which was proposed by the Department of the port of Phnom Penh.

(3) Rehabilitation of Other Facilities

1) Installation of Navigation Lights

In order to navigate the narrow and bends of the Mekong River, and to identify the sunken vessels and permit navigation at night, navigation aids will be installed as shows in Dwg. 12 of Appendix 11. The buoys in the drawing installed in the river will be able to be identified by the ship's radar and no light fixtures have been installed. The last leg of the route to Phnom Penh at Quatre Bras will be provided with a Leading Light.

2) Workshop Equipment

In order to maintain the cargo handling equipment in good working order, the equipment in the Workshop will be rehabilitated. The equipment in the workshop will be provided as follows:

- Lathe
- Drilling machine
- Cutting-off machine
- Welding machine with generator
- Gas welding machine
- Air compressor
- Hydraulic garage jack
- Pipe bender
- Hydraulic press
- Pipe cutter
- Generator
- Oil cleaner
- Machine shop tools
- Tool case

4.3.5 Protection of the Environment

As described in the following, it is not expected that there will be any environmental problems during construction and in the post-construction phase.

1) Environmental Protection During Construction

The environmental problems that must be considered during construction are as follows:

Care must be exercised to not degrade the quality of water downstream from Port No. 1 as the water intake tower of the city water department is located in this area.

The quality standard of the raw water in the Tonle Sap River, and the quality of the treated water standards have been obtained from the Water Dept. and given in Table 4-4.

The flow of the water in the river are almost parallel to the banks of the river as disclosed in the investigation of river water flows (refer to para. 3.2, Natural Condition). The intake water tower is 500 m downstream on the same side as Port No. 1, and approximately 30 m into the river, and any degrading of the water quality will affect the quality of the water.

Some of the causes that could degrade of the water quality are as follows:

- a) degrading by dredging
- b) degrading by concrete work
- c) earth work (on land) which could degrade the water
- d) degradation by pile driving operation by the work boats.

The methods that could be taken to prevent degradation are as follows:

- a) Dredging is scheduled by MOCTP to dredge the river in the area around Quatre Bras at Port No. 1 and No. 2 early in 1993, and so this will not be a problem.
- b) The concrete work contemplated will be of short duration, and the concrete work may be of precast concrete type and will not be a problem.
- c) Earth work in the river could cause problems, but earth works are expected to be in the dry season when the water levels are low, and the earth fill works will be performed behind structures and it is not expected that this earth operation will cause problems.

- d) Oil pollution by the work boats will differ with the type of the work boat, but protective means could be made with the use of oil fences.

Noise and Vibration by Pile Drivers:

There are many private houses behind the port yard and the access road (National Road Rt. 5). They are mainly one or two storied with a few four storied houses. The houses are set back about 120 m from the water line, and the noise from pile drivers will be dampened by the shed and trees between the port and the houses. Some of the taller houses may be bothered by the pile driving but is expected to be very little. The pile driving operation are not critical in the overall schedule, and can be performed during daylight hours. The noise of pile driver operation is within allowable limits when compared with the noise of traffic on Rt. 5 and port operations.

The vibration from the pile drivers will be noticed only when the tip of piles reach the bearing strata. None of the residences are supported on piles and so the clay strata will act as a shock absorbing strata.

2) Environmental Affects after the Construction

The mooring facilities of the Project will be supported on pile foundations, and compared with other gravity type foundations they will not cause problems of scouring or settlement. Also there will not be any problems caused to the marine life in the river.

After completion of the port facilities, it is expected that the volume of cargo in the year 2000 will be four times that of 1992, and the level of traffic congestion, noise and air pollution would increase. This problem could be resolved by rearranging the traffic system in the port yard. The traffic congestion could be resolved by introducing by-pass roads and paving of 80th, 82nd and 84th Streets.

Table 4-4 Water Quality of the Tonle Sap River

Item	Raw Water	Treated Water (Water Dept.)
pH	7.2 - 6.8	7.2 - 6.7
MTU	15 - 450	1 - 16
t °C	27°C - 32°C	27 °C - 32 °C
Colour	13 - 35	5 - 17
Cond.	78 - 400	80 - 158
NO ₂	0.001 - 2.1	0.001 - 0.12
NO ₃	0 - 2.5	0.1 - 1.5
SO ₄	0 - 6.0	0.4 - 26
Ca, Mg	0.6 - 1.5	2.7 - 1.0
HCO ₃	0.6 - 1.3	0.5 - 1.0
Cl	0.5 - 14	5.5 - 15
NH ₄	0.1 - 1.48	0.5 - 1.0
Fe	0.03 - 0.006	-
Cu	0.02 - 0.12	-
Mn	0.07 - 0.55	-

Source: Phnom Penh Water Dept. Phum Prek Plant, Jul. 8, 1992.

4.3.6 Operation and Maintenance Plan

1) The Maintenance and Operations Organization

The maintenance and operations of facilities of the Port of Phnom Penh will be performed by the Department of Phnom Penh Port of the MOCTP.

The dredging operations at the mooring facilities and berths river channel survey, maintenance and operation of navigation aids are under the jurisdiction of the Inland Waterways Division of the MOCTP. The Department and the Inland Waterway Division is composed of 637 and 82 employees respectively. The port administration activities performed up to the present time, the maintenance of the cargo handling equipment, the dredging of the river channels, proof that the Department has an ability and capability to administrate, operate and maintain the port facility after the Project completion.

2) The Costs for Maintenance and Operation

The expenses for maintaining the Port of Phnom Penh including river channels are generally the following categories.

(a) Personnel costs

Senior staff personnel:

$$60,000 \text{ Riel/month} \times 35 \text{ persons} \times 12 \text{ months} = 33,600,000 \text{ Riel}$$

General staff personnel:

$$30,000 \text{ Riel/month} \times 202 \text{ pers.} \times 12 \text{ months} = 72,720,000 \text{ Riel}$$

Working and miscellaneous personnel:

$$16,000 \text{ Riel/month} \times 400 \text{ pers.} \times 12 \text{ months} = 76,800,000 \text{ Riel}$$

(b) Allowances and bonuses

$$\text{Assume same amount as personnel cost} = 183,120,000 \text{ Riel}$$

(c) Maintenance dredging to keep waterways open

$$200,000 \text{ m}^3/\text{yr} \times 1,000 \text{ Riel/m}^3 = 200,000,000 \text{ Riel}$$

(d) Costs to operate cargo handling equipment, tugboats, and repair shops

Fuel:

$$1,050 \text{ liter/dy} \times 330 \text{ day} \times 500 \text{ Riel/liter} = 173,250,000 \text{ Riel}$$

Spare parts and expendables: (assumption)

$$= 123,000,000 \text{ Riel}$$

(e) Electric costs

Fuel for generators:

$$20,000 \text{ Riel/dy} \times 330 \text{ days} = 6,600,000 \text{ Riel}$$

(f) Maintenance of port facilities (assumption)

$$= \underline{350,000,000 \text{ Riel}}$$

$$\text{Total Maintenance Cost} = 1,291,000,000 \text{ Riel}$$

Note: US\$1.00 = 2,000 Riel

3) Port Revenues

The revenues from port charges for 1995 are expected to be as follows:

(a) Tonnage dues

$$\begin{aligned} & \text{US\$0.13/GRT} \times 2 \times 800 \text{ GRT}^{1)} \times 800 \text{ ships}^{2)} \\ & \times 2,000 \text{ Riel/US\$} \end{aligned} = 332,800,000 \text{ Riel}$$

(b) Berthage dues

$$\begin{aligned} & \text{US\$0.23/GRT} \times 800 \text{ GRT} \times 800 \text{ ships} \\ & \times 2,000 \text{ Riel/US\$} \end{aligned} = 294,400,000 \text{ Riel}$$

(c) Channel dues

$$\begin{aligned} & \text{US\$0.31/GRT} \times 2 \times 800 \text{ GRT} \times 800 \text{ ships} \\ & \times 2,000 \text{ Riel/US\$} \end{aligned} = 793,600,000 \text{ Riel}$$

(d) Pilotage dues

$$\begin{aligned} & \text{US\$0.003/GRT} \times 2 \times 800 \text{ GRT} \times 800 \text{ ships} \\ & \times 55 \text{ mile} \times 2,000 \text{ Riel/US\$} \end{aligned} = 422,400,000 \text{ Riel}$$

(e) Tug assistance charges

$$\begin{aligned} & \text{US\$83/hr} \times 1 \text{ Hr} \times 2 \times 800 \text{ ships} \\ & \times 2,000 \text{ Riel/US\$} \end{aligned} = 256,600,000 \text{ Riel}$$

(f) Mooring and unmooring dues

$$\begin{aligned} & \text{US\$16.50/times} \times 2 \text{ times} \times 800 \text{ ships} \\ & \times 2,000 \text{ Riel/US\$} \end{aligned} = 52,800,000 \text{ Riel}$$

(g) Stevedoring charges by ships gear

$$\begin{aligned} & \text{US\$1.58/t} \times 525,000 \text{ ton} \times 4/12 \text{ Gang} \\ & \times 2,000 \text{ Riel/US\$} \end{aligned} = 553,000,000 \text{ Riel}$$

(h) Hire of cargo handling facilities (port side equipment)

US\$35/hr x 5 hr x 8 each x 330 day	
x 2,000 Riel/US\$	= 924,000,000 Riel
Total Port Revenues	3,629,000,000 Riel

Notes: 1) Average GRT
2) Average number of ship call

From the above, the profit at the Port of Phnom Penh yearly can realize 2,410 million Riel. This profit should be readjusted every 6 ~ 9 years to renew the port equipment for which it is used.

The revenues are mainly from the port facilities usage and pilotage, as shown above, but the payment is made as follows:

For domestic related expenses is in domestic currency (Riel), and for foreign cargo related items for export are paid in domestic currency, and related items for import are paid in foreign currency (Dollars).

The revenues are deposited in the National Treasury, and the necessary budgets are paid through MOCTP, after the request is submitted to the Ministry of Finance.

The purchase of spare parts and machineries are processed through KAMPEXIM Co., Ministry of Commerce, but in the near future the procedures will be changed to purchase directly through MOCTP.

CHAPTER 5 BASIC DESIGN

CHAPTER 5. BASIC DESIGN

5.1 Design Policy

The basic design of facilities for the Rehabilitation of the Port of Phnom Penh will be performed in accordance with the contents described in Chapter 4 of this report.

The basic design policy will be as follows:

- (1) The overall scope will be suitable for the entire project.
- (2) The natural conditions of the construction site shall be taken into consideration.
- (3) The structure, material and construction methods shall be suitable for the construction site.
- (4) The Phnom Penh Port No. 1 is currently in use, so the design and construction methods used shall take into consideration the on-going activities.

The berth will be divided into two phases for its length of 300 m for the construction, the down-stream half of 150 m will be completed first, after which the upstream half of 150 m will be started. It is felt that this will least impair the port activities.

5.2 Study and Examination of Design Criteria

Based on the results of the site investigations, the design criteria to be used will be established as follows:

(1) Water Level:

H.W.L.	(High Water Level)	+9.81 m
L.W.L.	(Low Water Level)	+0.78 m

(2) Velocity of the Water Flow:

The velocity of the flow downstream:	4.5 knot
The velocity of the flow upstream:	3.0 knot
Waves will not be considered as the project site is on the river bank.	

(3) Climate:

Maximum wind velocities:	20 m/sec.
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(4) Earthquake Forces:

Horizontal earthquake forces: $k_h = 0.05$

Vertical earthquake forces: $k_v = 0.00$

(5) Soil Conditions:

Refer to Chapter 3, paragraph 3.2.3, Soils Conditions.

(6) Conditions of Use:

The berths will be designed to the following conditions:

1) The subject vessels (freighters):

Weight Tonnage (DWT):	6,000	2,000
Draft (m):	5.2	5.2
Approaching Speed (cm/sec):	15	15

2) Traction Force of Vessel (t): 35

3) Uniform Load: 2.0 t/m^2

4) Automobiles: 20 ton (TL-20)

5) Fork Lift: Lifting Capacity: 25 ton (at yard and access bridges)

6) Truck Crane: Hoisting Capacity: 70 ton (at berth only)

(7) Construction Materials:

Weight of materials per unit volume:

Reinforcing steel	2.45 t/m^3 (in air), 1.45 t/m^3
Structural steel	7.85 t/m^3
Earth fill materials	1.8 t/m^3

(8) Safety Factors:

Pile, allowable pulling force 3.0 (Normal), 2.5 (Abnormal)

(9) Allowable stresses:

Structural steel pile (SKK 400) $1,400 \text{ kg/cm}^2$ (Bending stress)

Deformed reinforcing steel (SD30)	1,800 kg/cm ² (bending stress)
Reinforced concrete	240 kg/cm ² (design compression)
	90 kg/cm ² (allowable compression stress)

(10) Standard Criteria:

- 1) Technical Standards for Port and Harbour Facilities in Japan. Guidelines of the Japan Ports and Harbour Association.
- 2) Architectural Standards (Japan Architects Assoc.).

5.3 Basic Plan

5.3.1 Layout Plan

Port facilities should be planned for cargo to smooth operation for the storage, transport and ease of carry in and take out, and for the vessels to enter and exit the port facilities safely and rapidly. The layout is as shown in Fig. 5-1.

- Berths

In front of the existing Berths No. 4 and No. 5, and parallel to the new Berths No. 5 and No. 4, on the downstream side of the new Berth No. 5, the extended Berth No. 6 is arranged so that the facilities behind the existing berths can be utilized to their fullest.

The new Berths No. 4, No. 5 and No. 6 have been designed to a size, structure that will enable the cargo operations and hauling out and in, but the existing Berths No. 4 and No. 5 will be left in their condition since it will require time and costs to remove or repair them.

- Access Bridges

Three new access bridges have been considered to connect the berths and the open yard in behind. The new Access Bridges No. 1 and No. 3 will be constructed respectively on the upstream and downstream sides (outside) of the existing Access Bridges No. 1 and No. 3, and together with Access Bridge No. 4 at the downstream side of Berth No. 6, while the existing Access Bridge No. 2 will be left in its same position.

Also, in order to make efficient use of the extended length of 300 m of the berths, at both the upstream and downstream sides of berth one each mooring bitts will be newly provided for additional mooring of the bow or stern of the vessels.

- Roadways

There is one road on the river side of the sheds within the port yard. The river banks will be rehabilitated, and additional space will be provided within the port yard, so the road will be widened by paving another 5 m on the river side of the road, and a cargo processing space has been provided for the sheds. Road widths will be now 10 m wide. The damaged portion of the existing pavement will be repaired.

- River Bank Protection (Revetment)

The present river bank is of earth in its original condition and eroded by the rain water and drain water which is flowing from the land facilities. In order to protect the banks of the river and place reclaim land for the port yard, it is proposed to construct bank protection facilities and place fill behind the revetment with earth fill.

- Container Yard

The open space behind Berth No. 6 will be used for stacking containers. The space will be paved with concrete surfacing.

- Empty Container Yard

The open space on the upstream side behind Port No. 1 is presently being paved by the Department of Phnom Penh Port with macadam, and it is proposed to pave this area with concrete and use this space for stacking empty containers.

- Lighting Fixtures

In order to allow night work the berths and the port yard will be provided with a lighting system.

- Water Supply System

There will be two water supply outlets installed at each berth to allow water to be supplied to the moored vessels.

5.3.2 Cargo handling Equipment

As described in the Cargo Handling Equipment section, the following equipment will be supplied. (with 2 year stock of spare parts)

1) Truck Cranes

<u>Hoisting Capacity</u>	<u>Quantity</u>
7 ton	3 Each
25 ton	2 Each
40 ton	1 Each
70 ton	1 Each

- Fork Lifts

<u>Maximum lifting Capacity</u>	<u>Quantity</u>
3.5 ton	5 Each
6 ton	3 Each
25 ton	1 Each

- Trailer Truck

<u>Load Weight</u>	<u>Quantity</u>
25 ton	6 Sets

- Spare Parts for existing cargo handling equipment

For five 6.5 ton truck cranes (KATO)

For three 4.0 ton fork lifts (TOYOTA)

For three 4.0 ton fork lifts (KOMATSU)

5.3.3 Facilities Plan

(1) Navigation Aids

- 1) Marker Buoy (Without Light) : 14 Sets
- 2) Leading Light (lights at Quatre Bras) : 1 Set

(2) Workshop : 1 Set

(3) Truck Weigh Scale, 30 ton maximum capacity : 1 Set

5.3.4 Basic Design Drawings

The Basic Design Plan for the Rehabilitation of the Port of Phnom Penh is shown in Appendix 11.

5.4 The Implementation Plan

5.4.1 Implementation Methods

The affairs of the construction industry within Phnom Penh city are very active reflecting the reconstruction effort going by the neighboring countries of Thailand, Singapore, Vietnam with the private foreign monies available, and the construction of hotels, restaurants and other building construction can be seen throughout the city.

In the field of civil engineering projects, there are foreign aid projects provided by Japan Australia and other countries, and the Chroy Changwar bridge project is just commenced.

The local contractors are active, and there is the Public Corporation of the Bridge and Road Corporation, and several Joint Ventures formed with the Vietnams, Thai, Chinese, Singapore foreign firms, and it is expected that there will be many more joint ventures to be formed.

Locally available construction supplies are aggregates and lumber, and almost all other construction materials must be imported. Construction equipment that can be leased locally are dump trucks, backhoes, truck cranes, bulldozers, and motor graders. In view of the many public projects that are expected to be released when this project is announced, that these construction equipment will not be available. Work boats for ports and harbour work, the Inland Waterways Department of MOTCP owns flat barge, suction dredgers of 800 HP and 1,200 HP class, and

work boats can be hired through the Inland Waterways Corporation if available but heavy-duty pile driver barges will have to be chartered from Singapore or other foreign sources. (Note: There will be no dredging work required in this project.)

The local labourers available according to information obtained from a local contractor are engineers, technicians, and office workers, and in view of the many projects that can be expected in the near future, it may be necessary to hire the labourers from outside Cambodia.

5.4.2 Construction Conditions

Since the construction will be performed while using the existing port facilities, construction operations must be performed while taking care not obstruct the current cargo handling operations. For this purpose the 300 m extension of berths will be performed in two 150 m phases. After the first phase at the downstream side is completed and turned over to the client, the upstream phase will be commenced, thereby the port facilities will be allowed to maintain its function to the fullest.

The foundation work will use steel pipe piles and the berth construction work will be able to be performed regardless of the water levels. However, the works should take into consideration the water levels when performing the following construction operations:

- ① the fenders will be installed in the lower extremities of the pier in order to allow vessels to moor at low water levels;
- ② there will be mooring cleats installed 4 m below the deck for small vessels to deck, and there will be a connecting aisle provided for mooring of vessels; and
- ③ the revetment will have to be constructed when the water level is low, together with the earth fill operations behind the protective structures.

The construction equipment, construction supplies and construction workers used will be get from local source as much as possible.

5.4.3 Construction and Supervisory Plan

(1) Construction Administration

The contract for the consulting engineering services will be concluded by the Executing Agency of MOTCP, the Department of Phnom Penh Port, under the

procedures established for Grant Aids projects of the Japanese Government, and the approval of the Japanese Government Agencies will be obtained in the implementation of the contract.

(2) The Share of Responsibilities

1) The construction responsibilities of the Japanese Government:

- Berths
- Access Bridges
- Roads and pavement thereof
- Revetment and back fill
- Construction of the container yard and pavement
- Lighting facilities
- Water supply facilities

The following supplies will be provided for the rehabilitation of the Cargo Handling Equipment:\

- Truck cranes, 7 each (including a 2 year stock of Spare Parts)
- Forklifts, 9 each (including a 2 year stock of Spare Parts)
- Trailer trucks, 6 each (including a 2 year stock of Spare Parts)
- Other facilities
 - Supply of spare parts for existing handling equipment
 - Navigation aids
 - Workshop
 - Truck weigh scale
 - Toilet
 - Electric generator

2) The construction to be undertaken by the SNC:

There will be no problems concerning the construction since the new construction of berths, revetment, and paving of roads and yards are all within the land properties of the Department of Phnom Penh Port. However, there are some residences in the space behind Berth No. 6 which must be removed by the Department until the time the project is started. The Inland Waterways Co. has plans to dredge the river bed in front of Port No. 1 to elevation -5.0 m by April 1993. The dredging work is a part of the maintenance dredging performed by the Inland Waterways Co., and so this work will not be a part of this project, and will be performed by the SNC.

(3) Construction Plan

This rehabilitation work will be performed in 2 phases so that the function of the Department of Phnom Penh Port to process the cargo handling operations will not be hampered. The construction period will be 22 months.

Phase 1 includes Berth No. 6 and half of Berth No. 5, Access Bridges No. 3 and No. 4. Phase 2 includes the remaining portion of Berth No. 5 and Berth No. 4, and Access Bridge No. 1. For cargo handling equipment, most of equipment will be handed over at the time of completion of Phase 1 in order to improve the port cargo handling capacity. Installation of navigation aid and workshop will be included in Phase 2.

Construction plans of main activities are as follows:

1) Temporary Works Plan

Temporary Works Yard

The Project site has limited space, and there is very little space that could be spared for use as a temporary work yard. The activities of the existing port cannot be obstructed and care must be exercised in the siting of the temporary work facilities. The space are for the concrete plant, storage space for aggregates, space to store and fabricate reinforcing steel, a yard for fabricating concrete forms, materials storage yard, job site office, contractor's equipment yard, warehouse, for a total of approximately 8,500 m². If space cannot be made available within the port yard, space will have to be found outside the port yard.

Surveying

Surveying will be required at every phase of the field work, prior to start out of the works, during and after the work. The survey will be made by using existing bench marks.

Water and Power

Water required for construction will be obtained from the Phnom Penh City Water Department. There is no extra commercial power available from the City Power Company, so generators will be used.

2) Pile Driving Operations

There will be approximately 580 steel pipe piles (609.6 mm Ø, 26 m long) driven for the construction of the berths. There are no barge-mounted pile drivers available so there will have to be one towed in from outside, such as from Singapore. Since there will be batter piles and vertical piles, it will be necessary to work out a pile driving plan beforehand. The pile tops will be cutoff at the required elevations, and the pile tops will have to be connected to make the piles rigid against the water flows and the fluctuating water levels. The pile driver should have a leader of approximately 40 m length. Other work boats will be the anchor boats and flat deck work barges.

3) Berth Super-structures

There will be brackets welded to the driven piles together with braces. Using these brackets and braces, concrete forms will be prepared. The equipment required for the super-structures will be a 35 ton crawler crane mounted on a work barge (300 ton class), flat deck barge, welding machines, anchor boats, etc.

Concrete Work

Ready-mix concrete is not available in Phnom Penh so a concrete plant will be installed at the project site. The necessary facilities are to supply the aggregates, water and cement. The concrete will be charged into the agitator trucks to transport to the job site where it will be placed directly or by concrete pumps. The placed concrete will be vibrated in place. The placed concrete will be moist cured by water. The plant capacity will have a capacity of 25 ~ 30 m³ per hour, and other equipment will be shovel loaders, electric generator, and concrete pumps.

Other Related Works

The other related facilities in the berth work are the mooring bollards, and other items embedded into concrete which will have to be placed into the concrete.

4) Revetment Work

Precast concrete sheet piles will be driven at the toe of the revetment, and concrete capping will be placed at the head of the sheet piles. The revetment could be overtopped by the high water levels, so the work should be planned to be performed in the dry condition.

5.4.4 Procurement of Construction Materials and Equipment

(1) Construction Materials, Imported Equipment

1) Locally Procured Supplies

Locally available materials are aggregates, sand, lumber, brick, oxygen and acetylene. There is no problem as to their quantities.

The local materials that are expected to be used are and their quantities are as follows:

Earth Fill	12,000 m ³
Aggregates	12,100 m ³
Sand	3,130 m ³

Other materials that will be required are: fuel oils, lubricants, lumber, etc.

2) Imported Materials Procured Locally.

Portland cement, reinforcing steel (small diameter sizes), welding rods, tools imported from North Korea and China. Cement and reinforcing are available locally, but their quality and quantities cannot be guaranteed, and the reinforcing comes bent. For these reasons, portland cement will be imported from Thailand or the nearby countries, and the reinforcing steel will be imported from Japan or the third Countries.

3) The Main Materials and Equipment to be Imported from Japan

The following supplies cannot be procured locally, and the quality and quantity including the delivery of these materials are important in the implementation of the project. For these reasons they will be imported from Japan, including procurement in the third Countries.

Description	Criteria	Unit of Measurement	Quantity	Remarks
Steel Pipe Pile	609.6Ø ,27 m lg	Each	589	Not available locally. Must meet criteria and delivery date.
Reinforcing Steel	SD 295A	Ton	810	Must meet criteria and comparison of cost.
Fender	Front frame type	Ea.	24	Must meet criteria, and comparison of cost.
Bollard	35 t (bitt), 50 t (bollard)	Ea.	27	Not available locally.
Navigational Aids	Marker Buoys, Leading Light	Ea.	16	Not available locally.
Tools, Spare Parts		LS		Required for maintenance of machinery.
Testing, Surveying		LS		Not available locally.
Cargo Handling equ.		LS		Not available locally.
Machinaries at Work Shop Machine Shop Eqpt. Generator		LS		Not available locally.

(2) Construction Equipment

- 1) There is a limit on the types and quantity of construction equipment that can be procured locally, and due to the funds available, the spare parts are limited and the equipment are not well maintained, and lease of the equipment on a long term arrangement and reliable usage cannot be made. For this reason, the lease of equipment from local sources will be limited to short term arrangement and the equipment obtained will be of general use.

<u>Description of Equipment</u>	<u>Criteria</u>
Bulldozer	11 t
Shovel Loader	1.6 m ³
Power Shovel	2.2 m ³
Dump Truck	11 t
Road Roller	10 t
Motor Grader	3 m
Truck	6 t
Welding Machine	400 A
Portable Generator	50 ~ 75 KVA
Air Compressor	5 m ³

- 2) For the above reasons, the construction required for critical operations that must be reliable and safe, have been decided to use equipments which are imported from foreign countries. The equipment to be used for critical operations are the pile driver equipment, heavy duty cranes, backhoes, rock crushers, work barges, and they will almost be brought in from Singapore.

(3) Mobilization Plan

Domestic material, fuel oil, and laborers will be procured locally in Cambodia. Portland cement will be imported from neighbouring countries.

The construction equipment will be imported on barges by towing from other country, such as Singapore.

Materials and supplies from Japan will be imported directly to Phnom Penh via Sihanoukville Port by ocean liners but since ocean liner service is not yet established, the cargo would have to be transshipped through Singapore.

5.4.5 Implementation Schedule

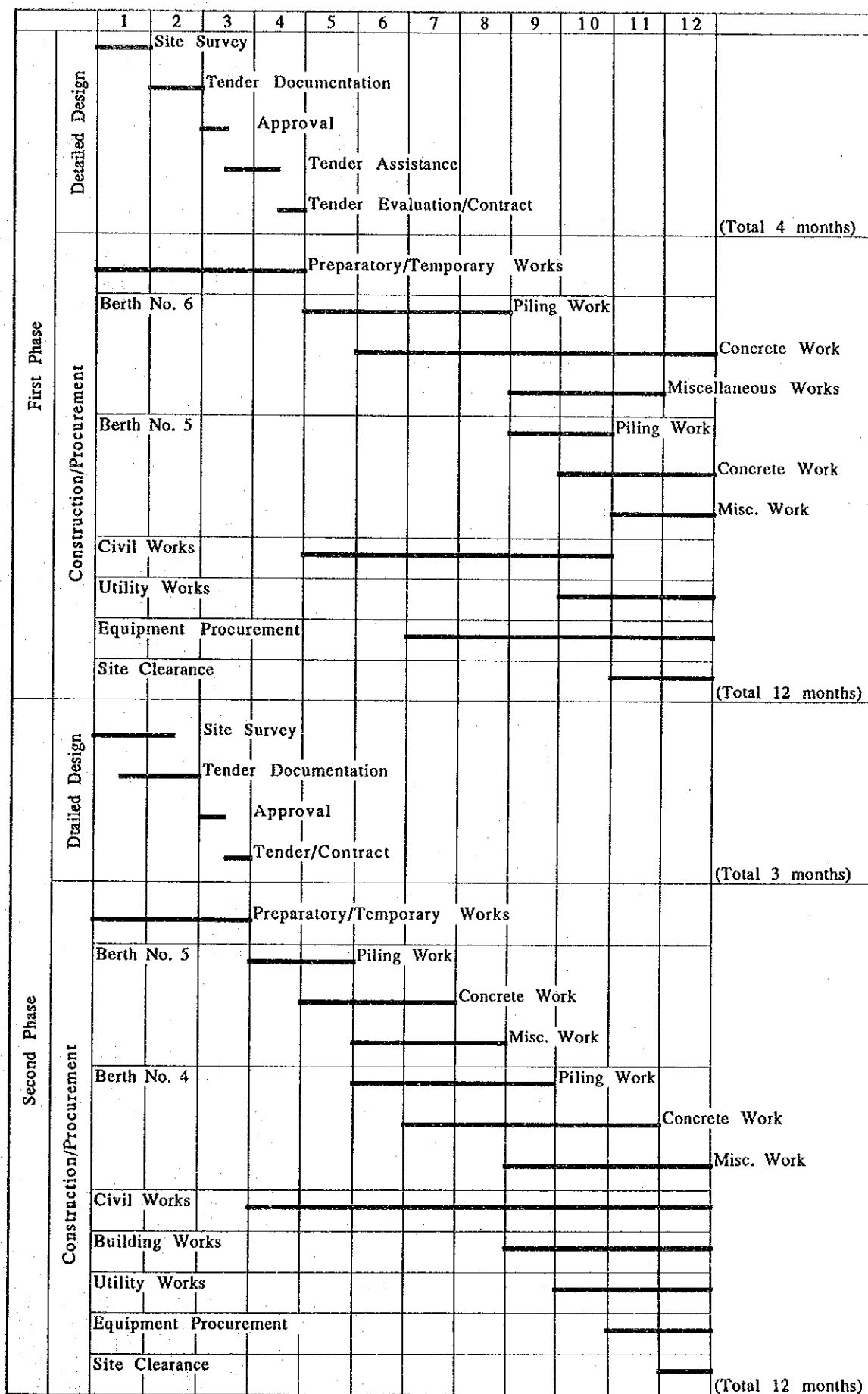
The implementation of the Project will be divided into 2 phases and performed as shown in Table 5-1.

5.4.6 Construction to be borne by the SNC

The constructions to be borne by the SNC is expected to be as follows:

The construction costs to be borne by the SNC side for the Project will be the removal of the residences and the shed (N10), dredging of port basin and navigation channel at Quatre Bras, and the construction of the fencing. The cost is estimated to be US\$90,000, that is, US\$2,000 for the removal, US\$85,000 for dredging and US\$3,000 for fencing. It is reported that the SNC has secured the monies required for this work.

Table 5-1 Implementation Schedule



CHAPTER 6 PROJECT EVALUATION AND CONCLUSION

CHAPTER 6. PROJECT EVALUATION AND CONCLUSION

The Port of Phnom Penh is not only the gateway and the capital city of Cambodia, but it has the territories extending to the borders of Thailand, Laos and Vietnam. The Port of Phnom Penh has many problems, and if they are not rehabilitated in time, they could affect the reconstruction of the Country, and it is felt that a greater part of these problems of the port could be resolved by the implementation of this project as shown in Table 6-1.

The project is expected to realize the correction of the problem related with the port, and contribute to the rebuilding of the nation and improve the well-being of its population. Due to the present capabilities of the SNC in terms of personnel and the finances, it is some difficult to realize and administrate this Project and it is considered that the Project as a Grant Aid is justified in its scope and contents.

Table 6-1 The Effects of the Project and the Improvements

Existing conditions and the problems	The Measures proposed by the Project	The effects of the Project, degree of improvement
<ul style="list-style-type: none"> The existing facilities of Phnom Penh Port No. 1 are deteriorated and cargo operations cannot be performed in a safe and efficient manner. The total length of berths (183 m) is not enough. The cargo handling equipment is superannuated and not enough, their efficiency is bad, and the max. capacity of 150,000 ton/yr has been reached. In its present condition, the port will not be capable of meeting the cargo forecasted in the future (approx. 530,000 ton in 1995), and will interfere with the reconstruction programs required in the post-war period. There is a constant line of waiting ships at Phnom Penh Port, and the total number of ships kept in waiting was a total of 1,228 days in 1992. The loss caused by the demurrage is estimated to be US\$2.5 mil. As there is very little containerization, the cargo handling efficiency is low, and high rate of damage to the cargo. The port yard space is limited, and storage within the port cannot be performed, which is lowering the efficiency. There are no navigation aids provided in the Mekong River, and no night traffic can be performed which is lowering the efficiency of the vessels. The repair shop and machine shop for the cargo handling equipment are deteriorated, and the repair and servicing of the equipment cannot be performed properly. There are no light fixtures available and no night cargo handling is being performed, lowering the port efficiency. 	<ul style="list-style-type: none"> Construct Berths No. 4, 5, 6 (total 300 m) and the Access Bridges. Furnish cargo handling equipment: <ul style="list-style-type: none"> Cranes 7 each Forklifts 9 each Trailer trucks 6 each Supply of spare parts for existing cargo handling equipment. Pavement of road surfaces and container yard, approx. 10,000 m² and repair. Navigation Aids to be provided: <ul style="list-style-type: none"> Marker buoys 14 each Leading lights 1 set Lighting fixtures and generator will be newly installed. Construct work shop and provide necessary machinery. Other port facilities to be constructed: <ul style="list-style-type: none"> - Water supply system - Truck weigh scale - Power generator - Toilet 	<p><u>Direct Effects</u></p> <ul style="list-style-type: none"> Improvement, expansion, and increase in the number of cargo handling equipment will increase the efficiency and the volume of cargo handled, and decrease damage and loss of the cargo. The installation of lighting fixtures will allow the present work day of 8 hr/day to be extended to 12 hr/day. The number of vessels waiting to dock should be reduced except at peak seasons. The cargo handling capacity will increase from 825 t/m/yr to 1,886 t/m/yr. The yearly cargo handling capacity is expected to increase from 150,000 t/yr to 570,000 t/yr. The improvement of the cargo handling, shortening of the overall time, lessening of demurrage, shortening of travel time on the Mekong River will reduce the cost of transportation Damage and loss of cargo will be reduced and reflect in cost of the goods. <p><u>Indirect Effects</u></p> <ul style="list-style-type: none"> The overall distribution of goods will improve not only in the Capital City of Phnom Penh but throughout Cambodia. The improvements will activate the economy and social activities. Employment opportunities will be increased, leading to increased income, and improve the living conditions of the masses.

APPENDICES

Appendix-1: Member List of Study Team

(1) For the Basic Design Study on the Project

Name	Title	Position
Mr. Tatsuhiko IKEDA	Team Leader	Director, International Affairs Office Ports and Harbours Bureau Ministry of Transport
Mr. Takeshi NAKAZAKI	Port Operation & Management Planner	Chief International Affairs Section International Affairs Office Ports and Harbours Bureau Ministry of Transport
Mr. Shigeki KOBAYASHI	Grant Aid Cooperation Planner	Grant Aid Division Economic Cooperation Bureau Ministry of Foreign Affairs
Mr. Nobuo KAWAMURA	Port Facility Planer	Pacific Consultants International
Mr. Eiji KAWABATA	Port Facility Designer	Pacific Consultants International
Mr. Masaaki GOSHIMA	Port Planner	Pacific Consultants International
Mr. Mitsuhiro HASEGAWA	Natural Conditions Surveyor	Pacific Consultants International
Mr. Yasuo SHIMOYAMA	Cargo Handling Equipment Planner	Pacific Consultants International
Mr. Katsuhiko TAKAHASHI	Execution Planner	Pacific Consultants International
Mr. Tadao MARUYAMA	Interpreter	Pacific Consultants International

(2) For the explanation of the Draft Report

Mr. Tatsuhiko IKEDA	Team Leader	Director, International Affairs Office Ports and Harbours Bureau Ministry of Transport
Mr. Masashi KOUNO	Grant Aid Cooperation Planner	Deputy Director Grant Aid Division Economic Cooperation Bureau Ministry of Foreign Affairs
Mr. Nobuo KAWAMURA	Port Facility Planner	Pacific Consultants International
Mr. Eiji KAWABATA	Port Facility Designer	Pacific Consultants International
Mr. Yasuo SHIMOYAMA	Cargo Handling Equipment Planner	Pacific Consultants International
Mr. Tadao MARUYAMA	Interpreter	Pacific Consultants International

Appendix-2: Schedule of Study Team

(1) For the Basic Design Study Team

Date in 1992		Itinerary	Activities
Nov. 22	(Sun.)	/BKK	Mobilization
Nov. 23	(Mon.)	BKK/PNH	Courtesy call to Japanese Embassy and MOCTP
Nov. 24	(Tue.)	PNH	Courtesy call to UNTAC, Discussion with Port of Phnom Penh (PPP)
Nov. 25	(Wed.)	PNH	Site Inspection, data collection
Nov. 26	(Thu.)	PNH	Field Survey, data collection, Signing of Minutes of Meeting
Nov. 27	(Fri.)	PNH/BKK	Government officials left for BKK to discuss with Mekong Committee
		PNH	Field Survey, data collection
Nov. 28	(Sat.)	BKK/TYO	Government officials left for Tokyo
		PNH	Data collection
Nov. 29	(Sun.)	PNH	Field survey
Nov. 30	(Mon.)	PNH	Field inspection of Shihanoukville
Dec. 1	(Tue.)	PNH	Field inspection of Shihanoukville
Dec. 2	(Wed.)	PNH	Data collection and analysis. One consultants staff left for Tokyo. One Staff mobilized to PNH.
Dec. 3	(Thu.)	PNH	Data collection and discussion with Cambodian National Railway and Inland Water Transports Co.
Dec. 4	(Fri.)	PNH	Analysis for construction method and structure
Dec. 5	(Sat.)	PNH	Data collection on Road and Bridge Dept. of MTCB and PPP. One consultants staff left for Tokyo
Dec. 6	(Sun.)	PNH	Preparation for site survey
Dec. 7	(Mon.)	PNH	Analysis on scale of facilities of PPP
Dec. 8	(Tue.)	PNH	Analysis of structures and data collection
Dec. 9	(Wed.)	PNH	Commencement of soil investigation, site survey of structures
Dec. 10	(Thu.)	PNH	Site survey of structures, soil investigation
Dec. 11	(Fri.)	PNH	Survey of base line and bench mark, data collection
Dec. 12	(Sat.)	PNH	Discussion with Ministry of Planning, site inspection for new Phnom Penh Port area.
Dec. 13	(Sun.)	PNH	Data analysis
Dec. 14	(Mon.)	PNH	Completion of soil investigation. Field inspection at KM6. Discussion with Ministry of Trade Commerce.
Dec. 15	(Tue.)	PNH	Discussion with PPP
Dec. 16	(Wed.)	PNH	Site inspection of facilities and utilities at PPP
Dec. 17	(Thu.)	PNH	Structural analysis of existing facilities. Interview with ships captain
Dec. 18	(Fri.)	PNH	Discussion with PPP. Topo and hydro survey at site

Date in 1992		Itinerary	Activities
Dec. 19	(Sat.)	PNH	Data collection and analysis. Topo survey
Dec. 20	(Sun.)	PNH	Four consultants staffs left for BKK Data collection and topo survey
Dec. 21	(Mon.)	PNH	Hydro survey
Dec. 22	(Tue.)	PNH	River flow tracing survey
Dec. 23	(Wed.)	PNH	Hydro survey
Dec. 24	(Thu.)	PNH	Data collection, analysis of topo/hydro survey
Dec. 25	(Fri.)	PNH	Preparation of drawing for topo/hydro survey
Dec. 26	(Sat.)	PNH	Preparation of drawing for topo survey
Dec. 27	(Sun.)	PNH	Data analysis and collection
Dec. 28	(Mon.)	PNH	Data collection and analysis, topo/hydro drawing
Dec. 29	(Tue.)	PNH/BKK	Last consultant staff left for BKK
Dec. 30	(Wed.)	BKK/	Demobilization from BKK to TYO

(2) For the Explanation of the Draft Report

Date in 1993		Itinerary	Activities
Feb. 24	(Wed.)	NRT/MNL	Mobilization
Feb. 25	(Thu.)	MNL	Discussion with ADB
Feb. 26	(Fri.)	MNL	Analysis of data
Feb. 27	(Sat.)	MNL/BKK NRT/BKK	Mobilization
Feb. 28	(Sun.)	BKK/PNH	Mobilization
Mar. 1	(Mon.)	PNH	Courtesy call to Japanese Embassy and MOCTP Explanation on the Draft Report
Mar. 2	(Tue.)	PNH	Explanation and discussion with Port of Phnom Penh (PPP) on the Draft Report
Mar. 3	(Wed.)	PNH	Discussion with PPP on the Draft Report
Mar. 4	(Thu.)	PNH	Explanation with Minister of Ministry of Foreign Affairs Two members of the Team left for BKK
Mar. 5	(Fri.)	PNH	Technical Discussion with PPP
Mar. 6	(Sat.)	PNH	Meeting with MOCTP
Mar. 7	(Sun.)	PNH	Site inspection of facilities at PPP
Mar. 8	(Mon.)	PNH	Meeting with PPP and UNTAC
Mar. 9	(Tue.)	PNH	Site inspection of Navigation Channel
Mar. 10	(Wed.)	PNH	Meeting with PPP Site Inspection of facilities at PPP
Mar. 11	(Thu.)	PNH	Courtesy call to Japanese Embassy and PPP
Mar. 12	(Fri.)	PNH/BKK	Demobilization to BKK
Mar. 13	(Sat.)	BKK/NRT	Demobilization to TYO

Appendix - 3 : Member List of Concerned Party

- (1) Japanese Embassy in Cambodia

Mr. Yukio Imagawa	Ambassador
Mr. Katsuhiro Sinohara	Counsellor
Ms. Noriko Abe	First Secretary
Mr. Touru Imamura	First Secretary
Mr. Shuuhei Imamura	JICA

- (2) Ministry of Communications, Transports, Posts and Telecommunications

Mr. So Khun	Minister
Mr. Tram IV Tek	Vice Minister
Mr. Meas Samith	Director of International Relation Office
Mr. Nahean Sras	Director of Planning Department
Mr. Kuy Pam	Sub Chief of Cabinet
Mr. Tep Nobora	Statistic Office
Mr. Trauch Chan Kosal	Vice Director of Road and Bridge
Mr. Sin Sisaket	Staff of Planning Department
Mr. Meas Chheng	Staff of Planning Department
Mr. Yit Bunna	Civ. Engineer, Director of Technical Dept.

- (3) Ministry of Foreign Affairs

Mr. Hor Namhong	Minister
Mr. Sek Setha	Vice Minister
Ms. You Ay	Director of Economic and Cultural Cooperation Dept.
Mr. Hem Heng	Deputy Director of Economic and Cultural Cooperation Dep

- (4) Ministry of Planning

Mr. Toshiyuki Kasai	Advisor Expert
Mr. Chhieve Nam	Deputy Director of Economic and Cultural Cooperation Dep
Mr. Phan Ho	Deputy Director of Commerce and Finance Dept.

- (5) Department of Phnom Penh Port

Mr. Mom Sibon	Director
Mr. Miech Yan	Vice Director
Mr. Ko Seng Heang	Vice Director
Mr. Lim Kim Sean	Chief of Technical office
Mr. Pen Shark Pheap	Manager of Dock office
Mr. Chieap Thol	Chief of Stevedoring
Mr. Khat Syani	Chief of Planning
Mr. Chor Pra	Harbour Master
Mr. Mok Orn	Assistant Harbour Master

- (6) UNTAC

Mr. Luis A. Canelli Zavala	Commander
Mr. Julio Ambrosoni	Lieutenant Commander
Mr. Enos Alcala	Port Authority, Military Office
Mr. Felix Sanagun	Port Authority, Military Office
Mr. Tony Fitt	Port Authority, Military Office
Mr. Emmanuel Passion	Port Authority, Military Office
Mr. Paul Flude	Port Authority, Military Office

- (7) Department of Sihanoukville (Port of Sihanoukville)

Mr. Lou Kim Chhum	Director of the Port of Sihanouk Ville
Mr. Pen Shita	Vice Director
Mr. Sem Ky Thay	Chief of financial
Mr. Norng Soyeth	Chief of planning
Mr. Nhinh Vuth	Chief of personnel and administration

- (8) Inland Water Ways

Mr. Khiev An	Director
Mr. Sem Sam	Vice Director
Mr. Koan Cheon	Chief of Technic

- (9) Road Transport Co.
Mr. Ouk Tat Vice Director
- (1 0) Cambodia National Railway (Chemin De Fer Du Cambodge, C F C)
Mr. Meas Neak Asst. Director of Exploitation Service
Mr. Chhoem Meanouvy chief of Exploitation Service
Mr. Va Souec Former Station Master of Phnom Penh Station
- (1 1) Inland Waterway Transport Co.
Mr. Bun Nguon Director
Mr. Sin Chhay Ship Engineer
- (1 2) KM 6, Centre de Ravitaillement
Mr. Math So Pheap President du Centre de Ravitaillement
- (1 3) CAMFEXIM (Cambodia Fishery Export & Import Co. Ltd.)
Mr. Chea Eav Meng General Director

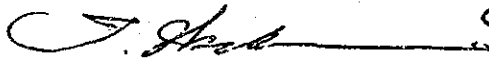
MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT FOR
REHABILITATION OF THE PORT OF PHNOM PENH
IN CAMBODIA

In response to the request from Cambodia, the Government of Japan decided to conduct a Basic Design Study of the Project for Rehabilitation of the Port of Phnom Penh (the Project), and entrusted the study to the Japan International Cooperation Agency (JICA).

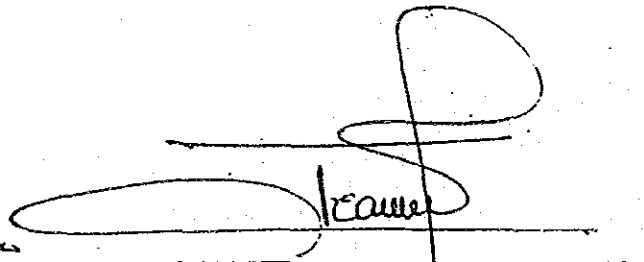
JICA dispatched to Cambodia a Basic Design Study Team (the Team) headed by Mr. Tatsuhiko Ikeda, Director, International Affairs Office, Bureau of Ports and Harbours, the Ministry of Transport, from November 23 to December 26, 1992. The Team held discussions with the officials concerned of Cambodia and carried out field surveys at the study area.

While discussions and field surveys are ongoing, both parties have confirmed the main items on the Project described in the attached sheets. The Team will proceed to further study and prepare the Basic Design Study Report.

Phnom Penh, November 26, 1992



Mr. Tatsuhiko Ikeda
Team Leader
Basic Design Study Team
on the Project for
Rehabilitation of the Port
of Phnom Penh



Mr. Tram Iv Tek
Vice Minister
Ministry of Communications,
Transports and Posts and
Telecommunications

1. OBJECTIVE

The objective of the Project is to restore cargo handling capacity at the Port of Phnom Penh by rehabilitating the existing port facilities.

2. PROJECT SITE

The site of the Project is shown in ANNEX-I.

3. EXECUTING ORGANIZATION

Department of Phnom Penh Port, Ministry of Communications, Transports and Posts and Telecommunications is responsible for the administration and execution of the Project.

4. CONTENTS REQUESTED BY CAMBODIA

After discussions with the Basic Design Study Team, the Cambodian side requested that the following components be included in the Project:

- a. extension of the fixed type quays;
- b. widening and rehabilitation of the existing quays;
- c. paving of stacking yard;
- d. provision of ancillary works; and
- e. procurement of cargo handling equipment.

The final components of the Project will be determined after conducting further studies.

5. THE JAPAN'S GRANT AID SYSTEM

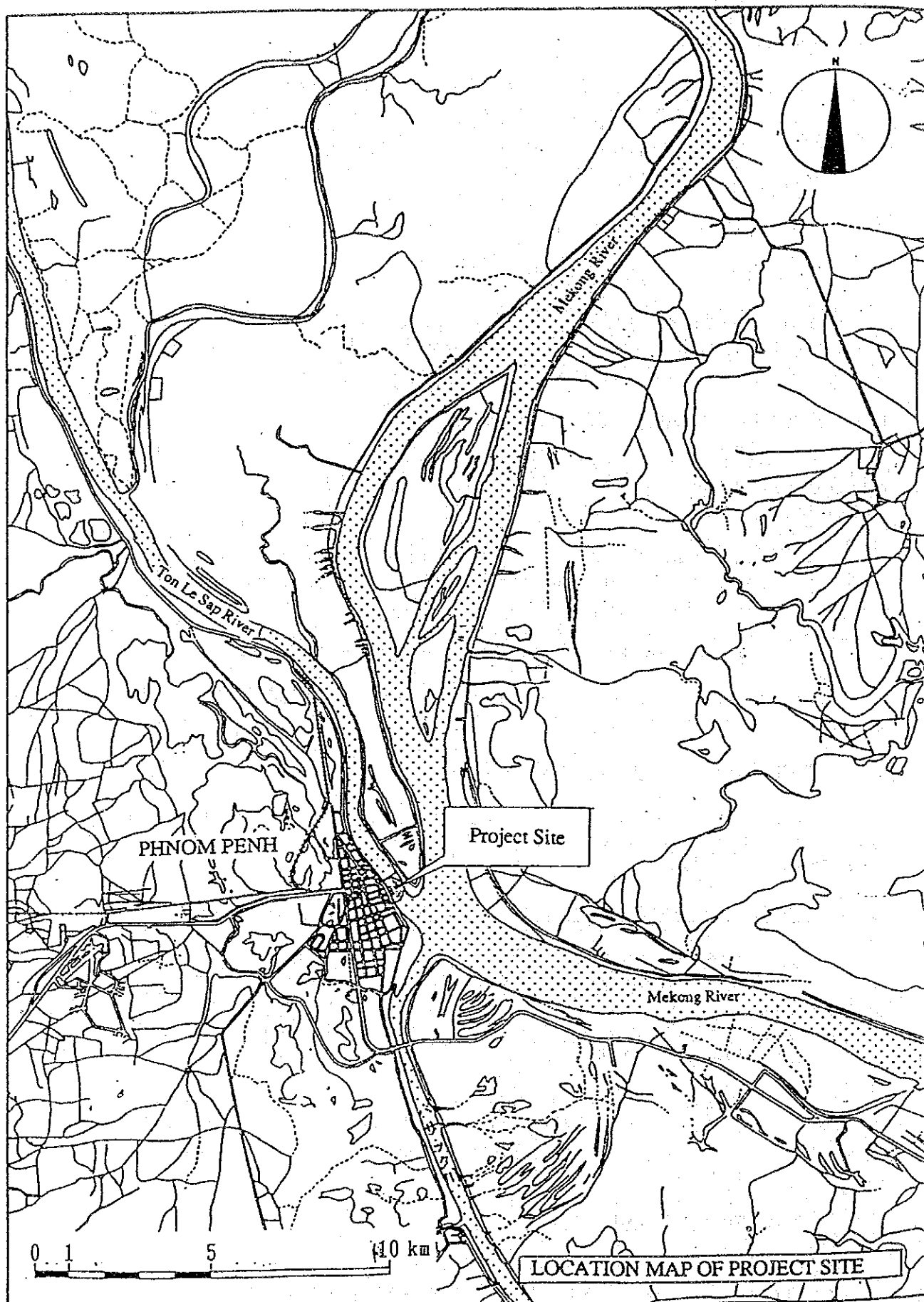
The Cambodia side has understood the procedures and the system of the Japan's grant aid programs which was explained by the Team.

6. PROVISIONS OF NECESSARY BUDGET AND PERSONNEL

- a. The Cambodia side will take necessary measures, described in ANNEX-II, for the smooth implementation of the Project, in condition that the Grant Aid Assistance by the Government of Japan is extended to the Project; and
- b. The Cambodian side has agreed to secure the budget for fulfilling the undertakings to be covered by the Cambodian side, prior to the commencement of the Project.

7. SCHEDULE OF THE STUDY

The Study Team will complete the Draft Final Report in accordance the confirmed items by the beginning of March 1993.



NECESSARY MEASURES TO BE TAKEN BY CAMBODIA

1. exempt the members of the Study Team from income taxes and other fiscal charges payable under the legislation of Cambodia in respect of any emoluments or allowances remitted to them from overseas;
2. ensure the safety of the Study members when and as it is required in the course of the Study;
3. ensure prompt processing of required internal formalities to secure the implementation of the Project;
4. secure and provide necessary space for construction of the Project facilities, in particular the land necessary for the extension of quays and their back-up area including removal and demolition of the existing non-port related facilities;
5. secure and provide necessary space for construction yards (for temporary office, labor camp, stock yard and motor pool, etc.), batching plant and other necessary temporary yards;
6. provide electric lines, water supply and telephone lines to the Project site;
7. control port operations including berth assignments and land side operations during the construction, to minimize delays of construction of Project facilities;
8. exempt taxes and levies and take necessary measures for customs clearance of the materials and equipment to be brought for the Project at the port of disembarkation;
9. accord Japanese nationals, whose services may be required in connection with the supply of products and services under the verified Project contracts, such facilities as may be necessary for their entry into Cambodia and stay therein for the performance of their work;
10. maintain and use properly and effectively the facilities constructed and repaired, and equipment purchased under the grant; and
11. bear all the necessary expenses other than those to be borne by the grant.

APPENDIX 5 NATURAL CONDITIONS

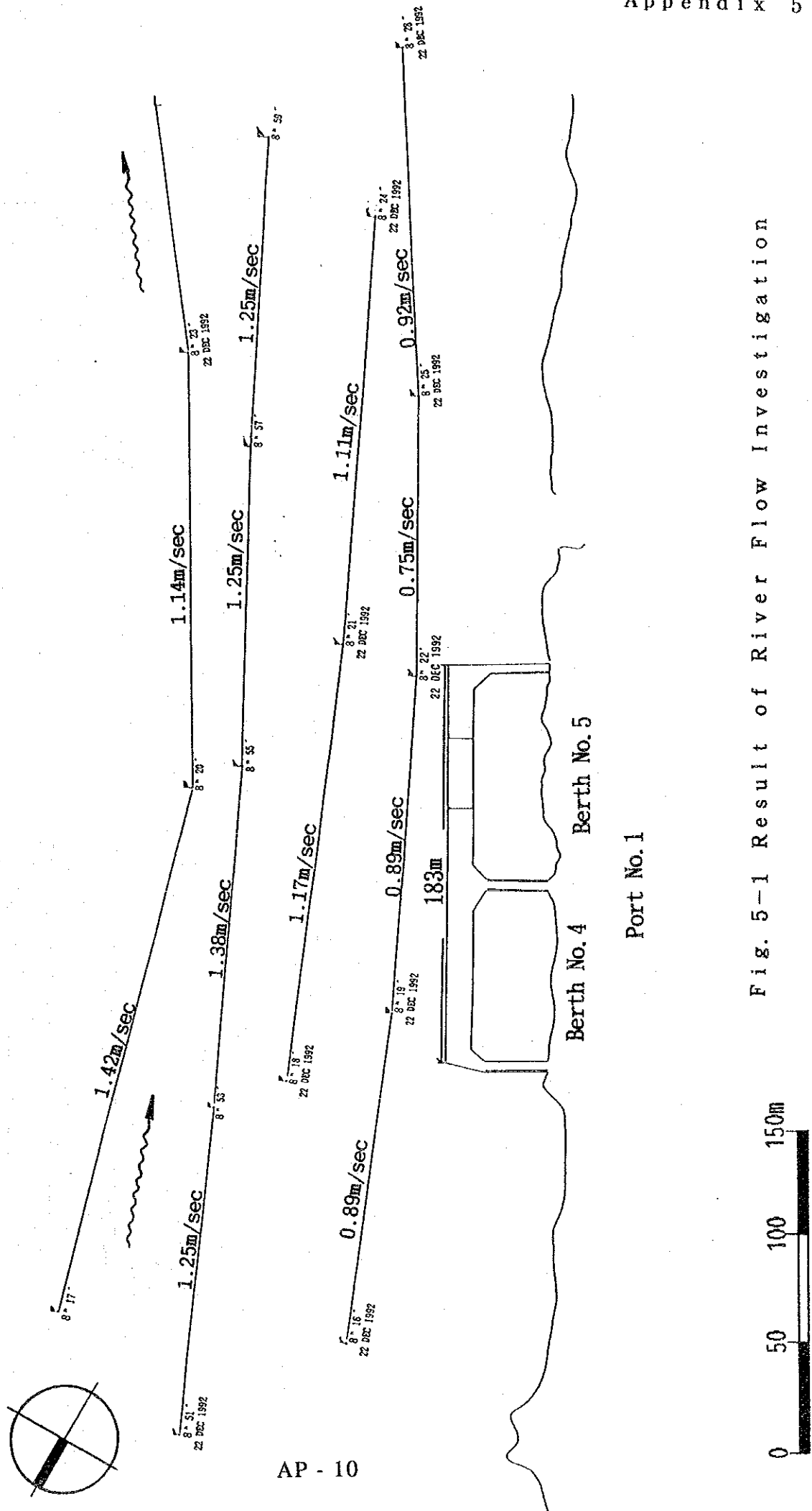
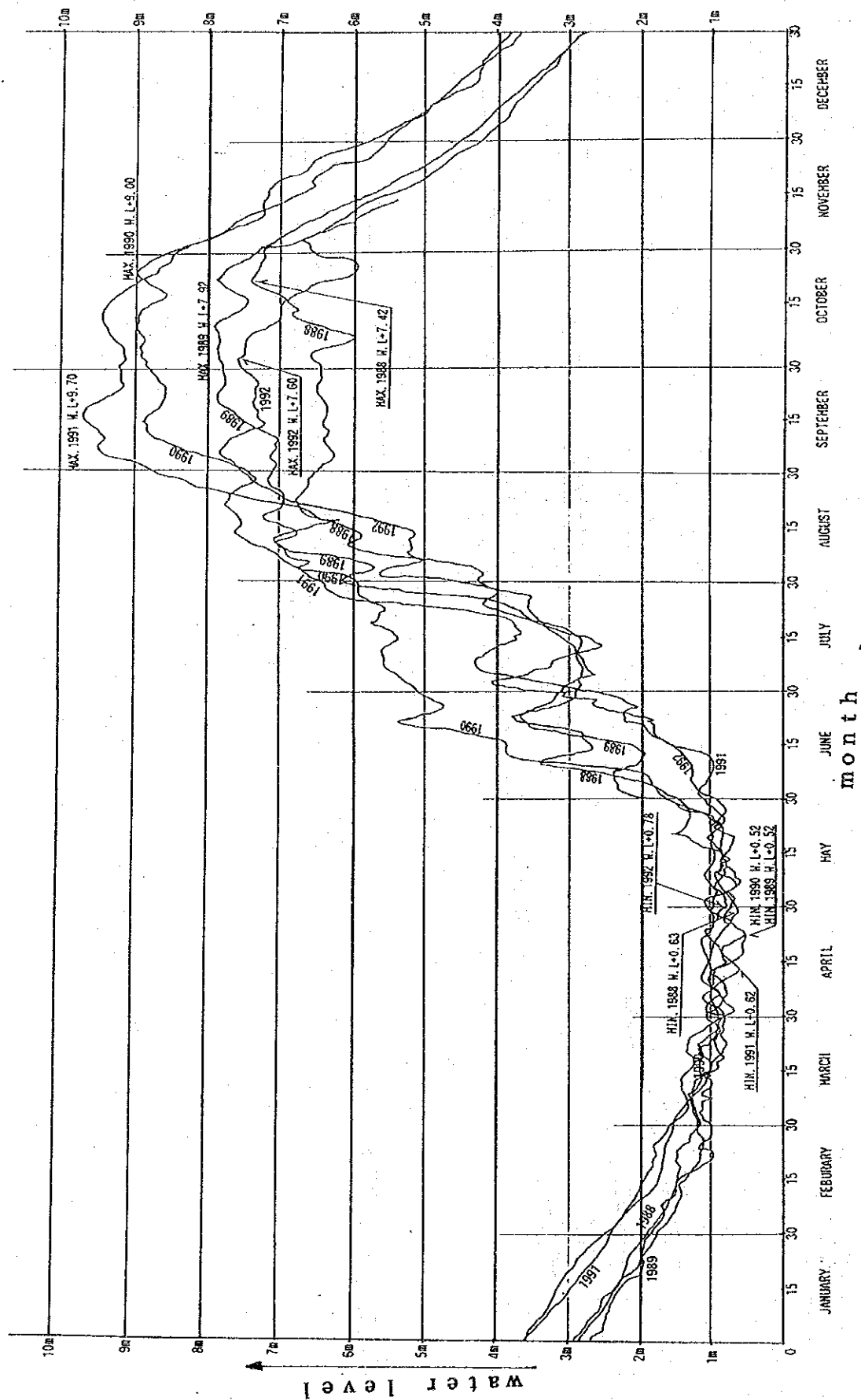


Fig. 5-1 Result of River Flow Investigation



Source: Water level record of Phnom Penh Port

Fig. 5-2 Water Level at Phnom Penh Port No. 1

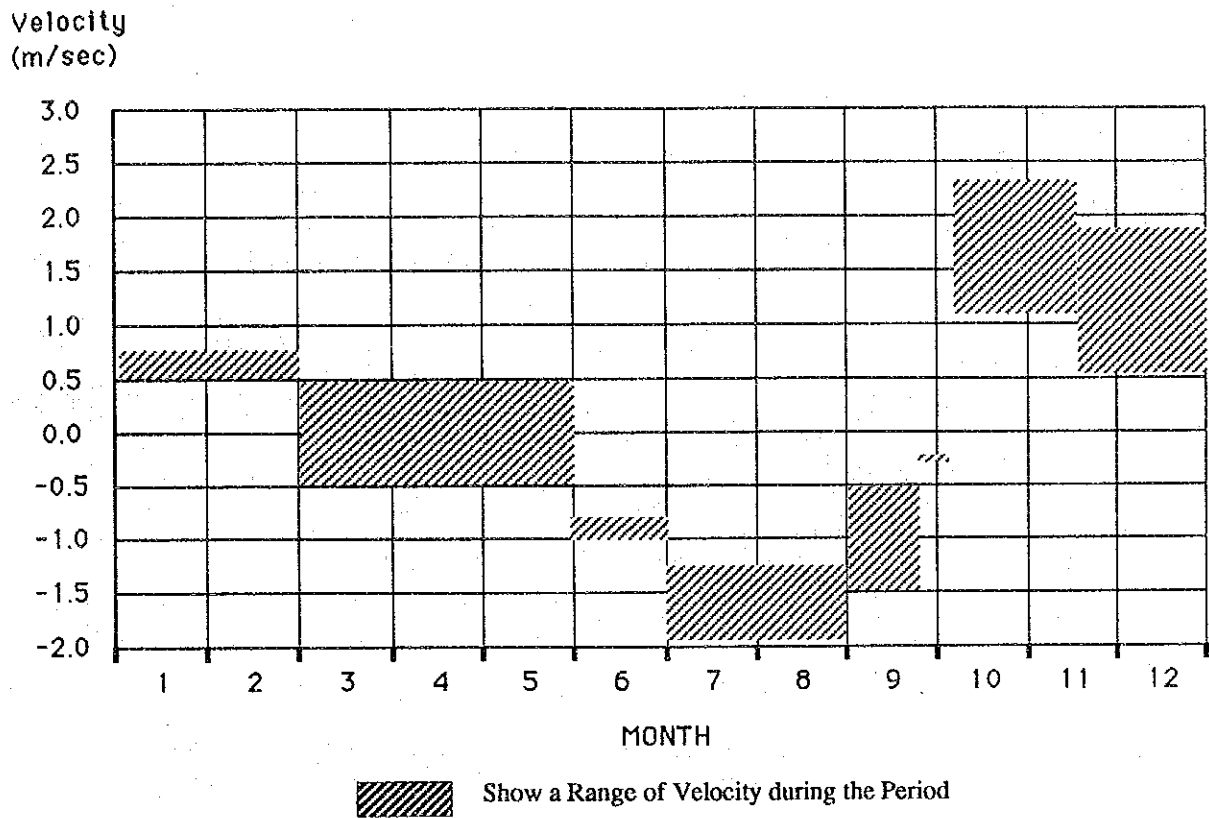


Fig.5 - 3 Velocity of Flow at Phnom Penh Port No. 1
Source: The Department of Phnom Penh Port

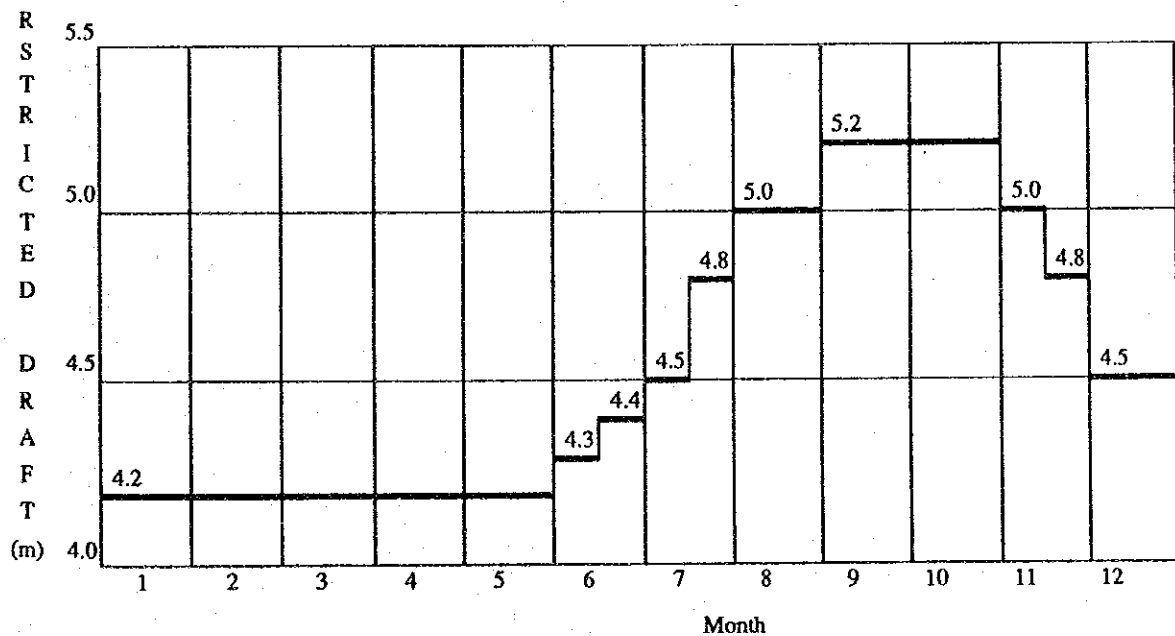
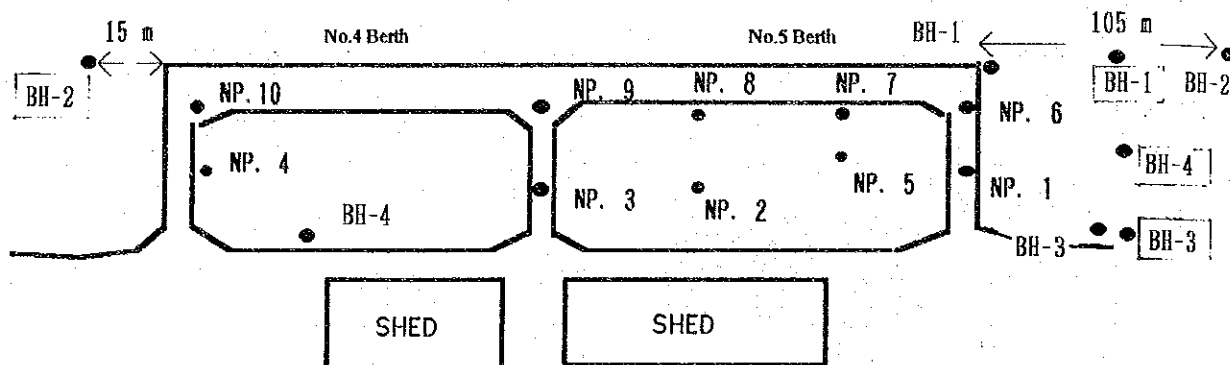


Fig. 5 - 4 Restricted Draft at the Mouth of Mekong River
Source: The Department of Phnom-Penh Port

Fig.5-5 Location of Boring



Note :

NP-1 ~ NP-10 : show investigations carried by the Department of Phnom Penh Port in Dec. 1980.

BH-1 ~ BH-4 : show investigations carried by Mekong Secretariat in Oct. 1991.

[BH-1] ~ [BH-4] : show investigation carried by JICA Study Team in Dec. 1992.

Fig.5-6 Soil Profile

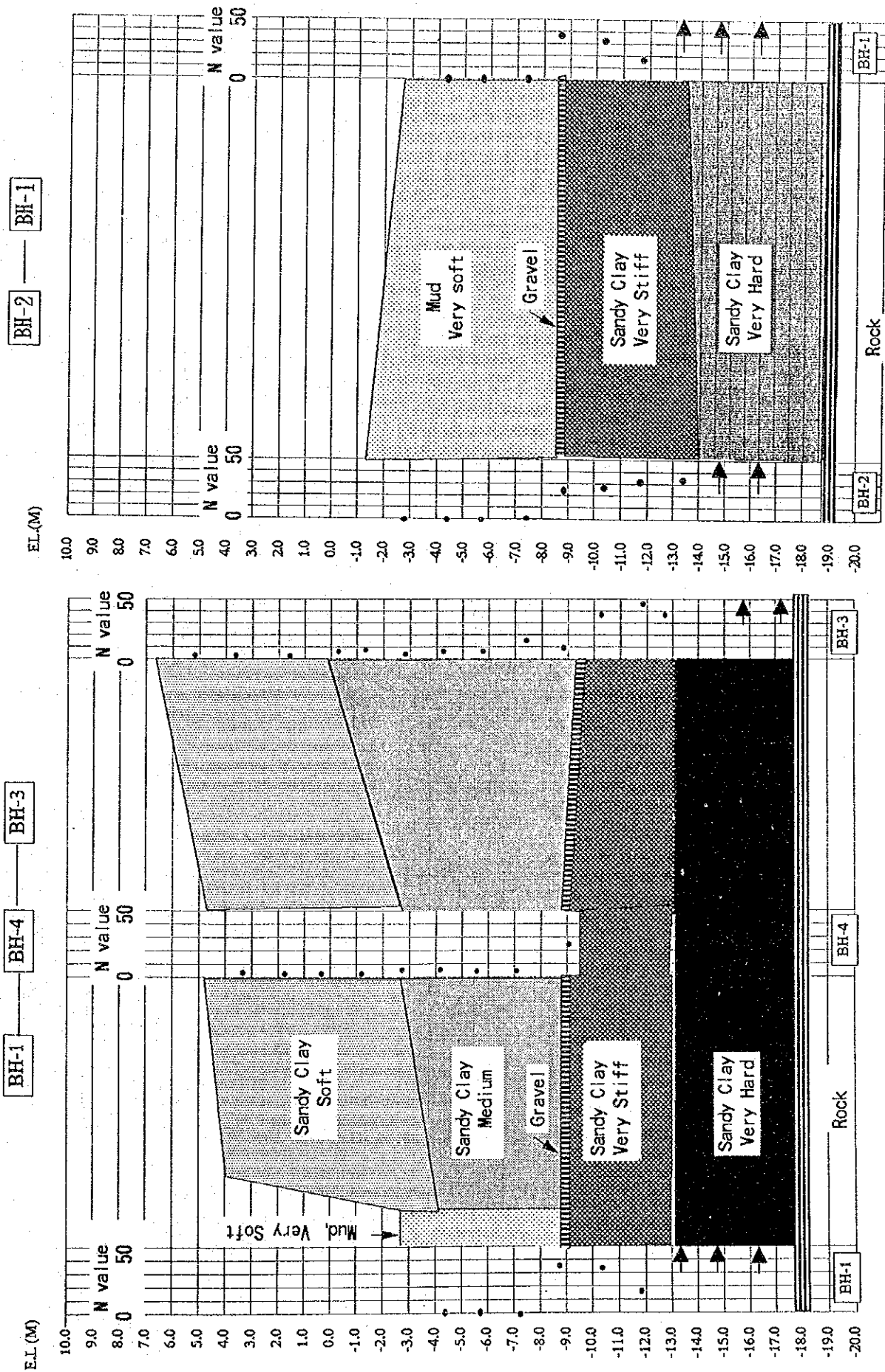
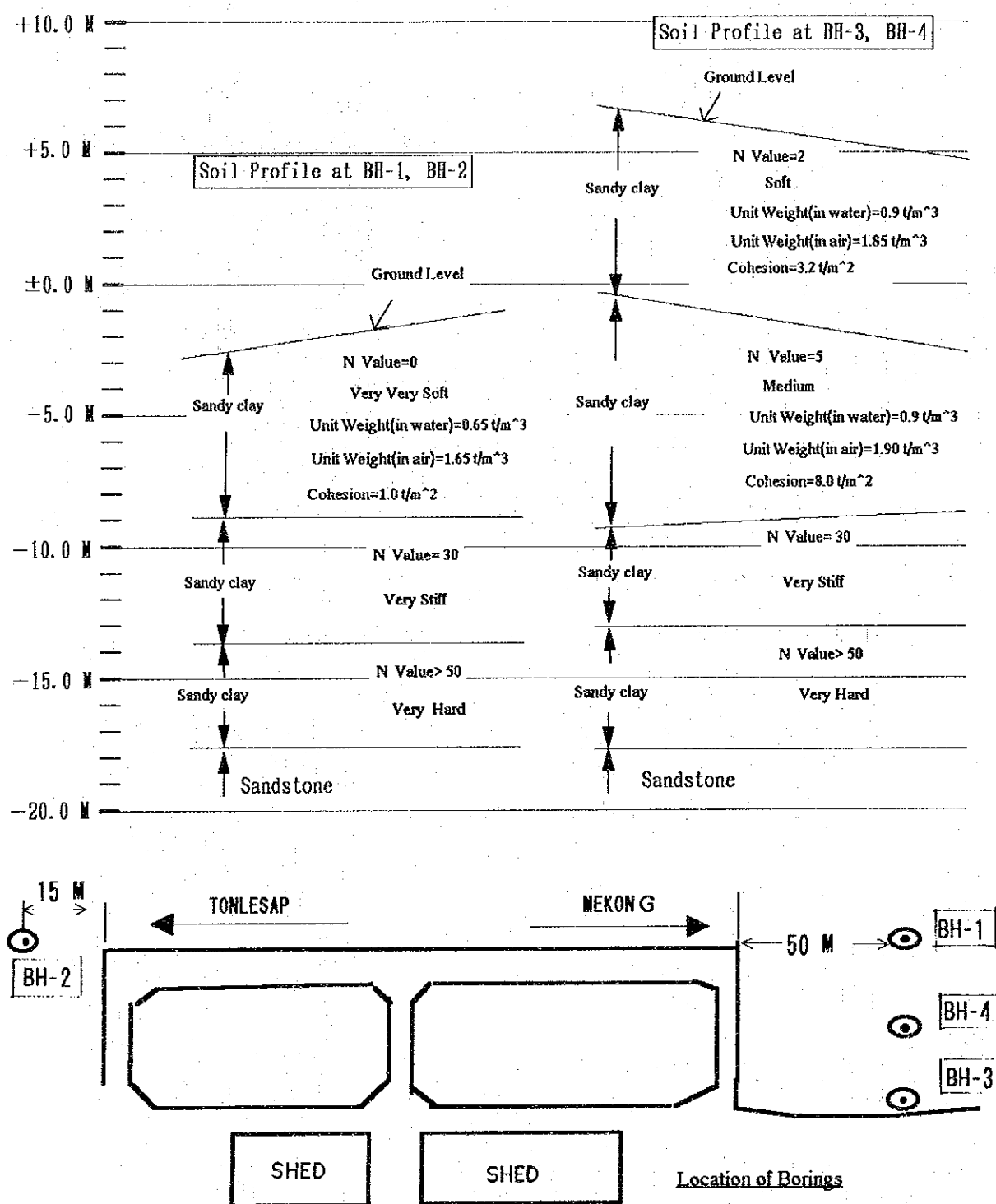
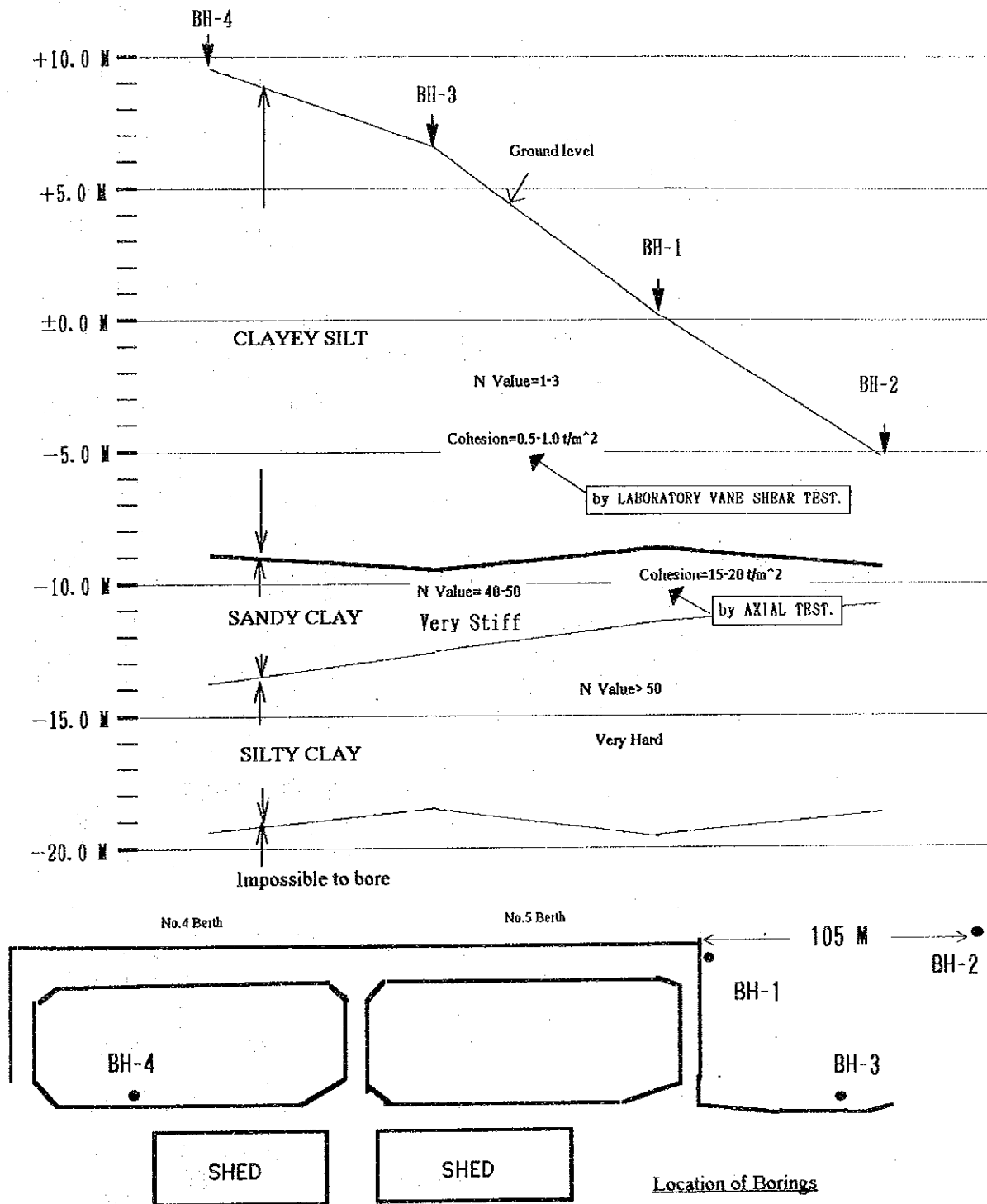


Fig.5-7 Summary of Soil Investigation(1)



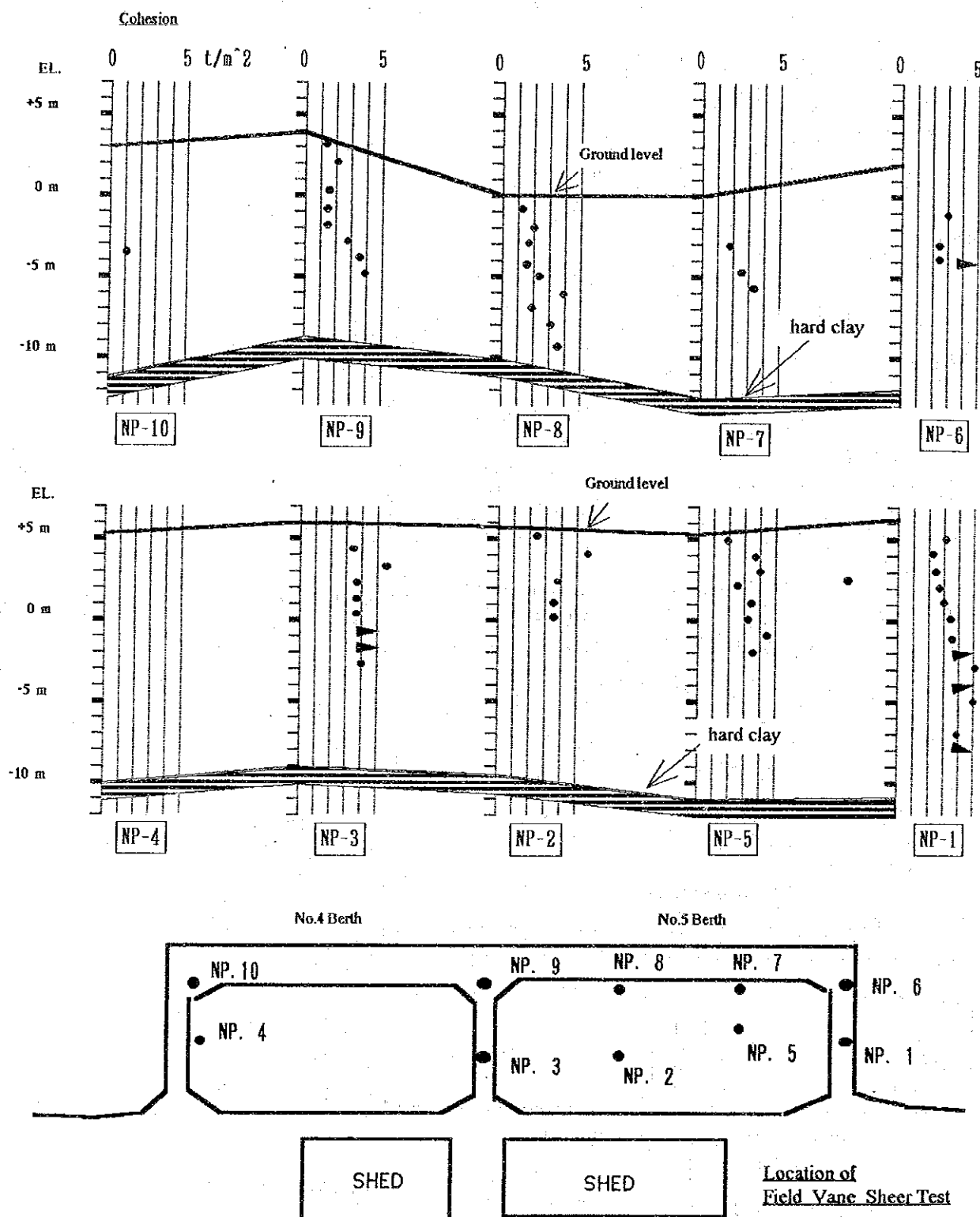
- Note:
1. Based on soil investigation carried by JICA Basic Design Study Team in December, 1992.
 2. This summary includes the result of SPT, classification of soil, etc.

Fig.5-8 Summary of Soil Investigation(2)



Note; Based on soil investigation carried by Mekong Secretariat
in October 1991.

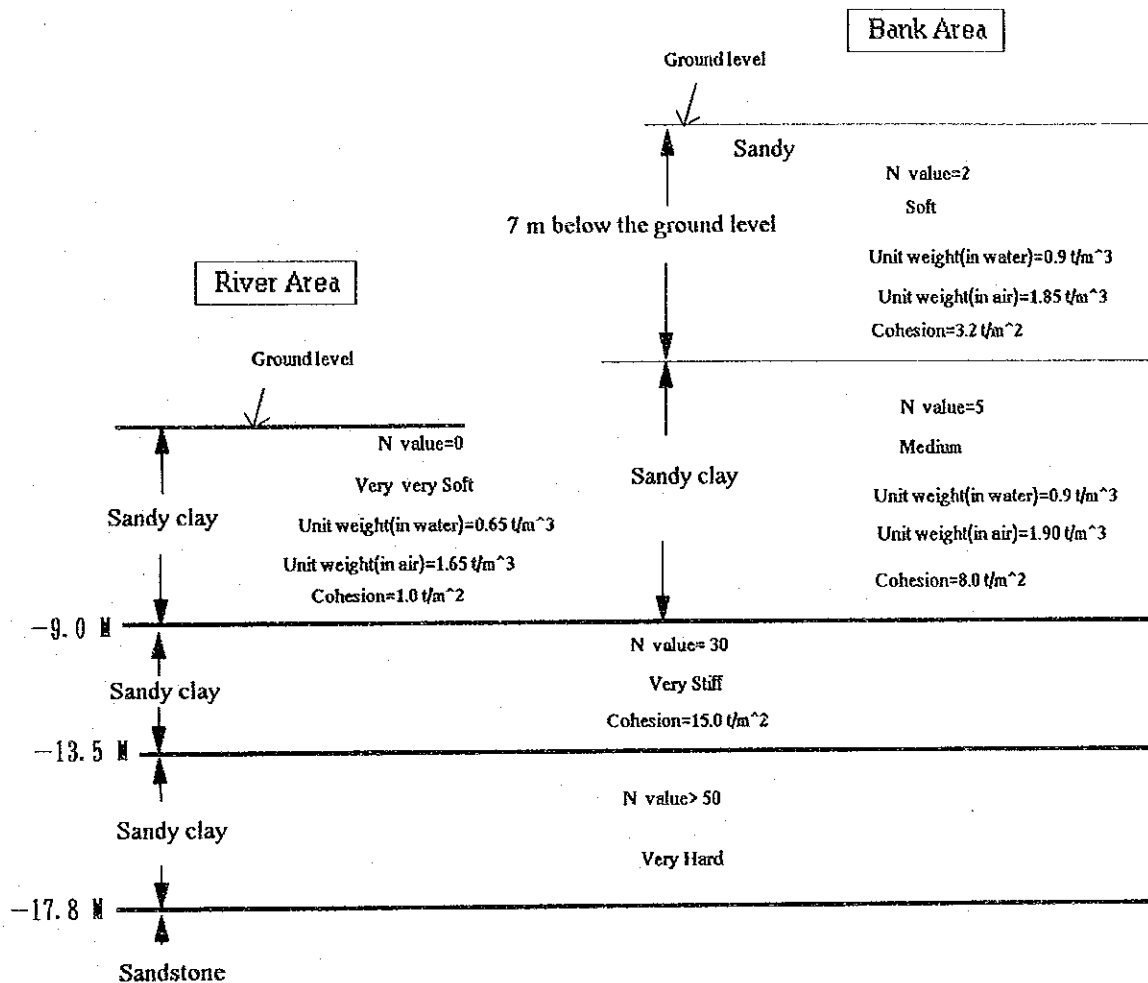
Fig.5-9 Summary of Soil Investigation(3)



Note:

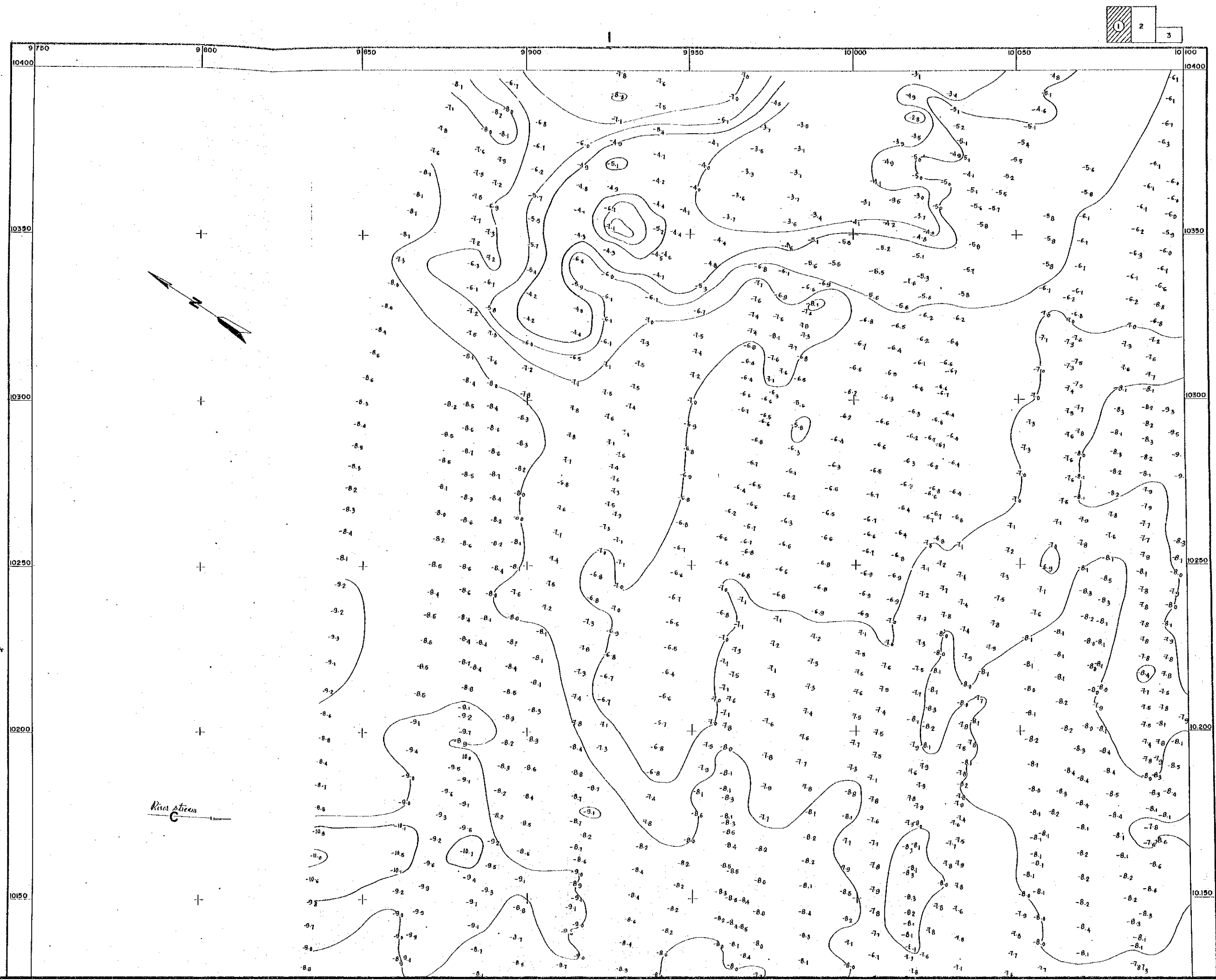
1. Based on soil investigation carried by the Department of Phnom Penh Port in December 1980.
2. \blacktriangleright shows that cohesion is more than 5

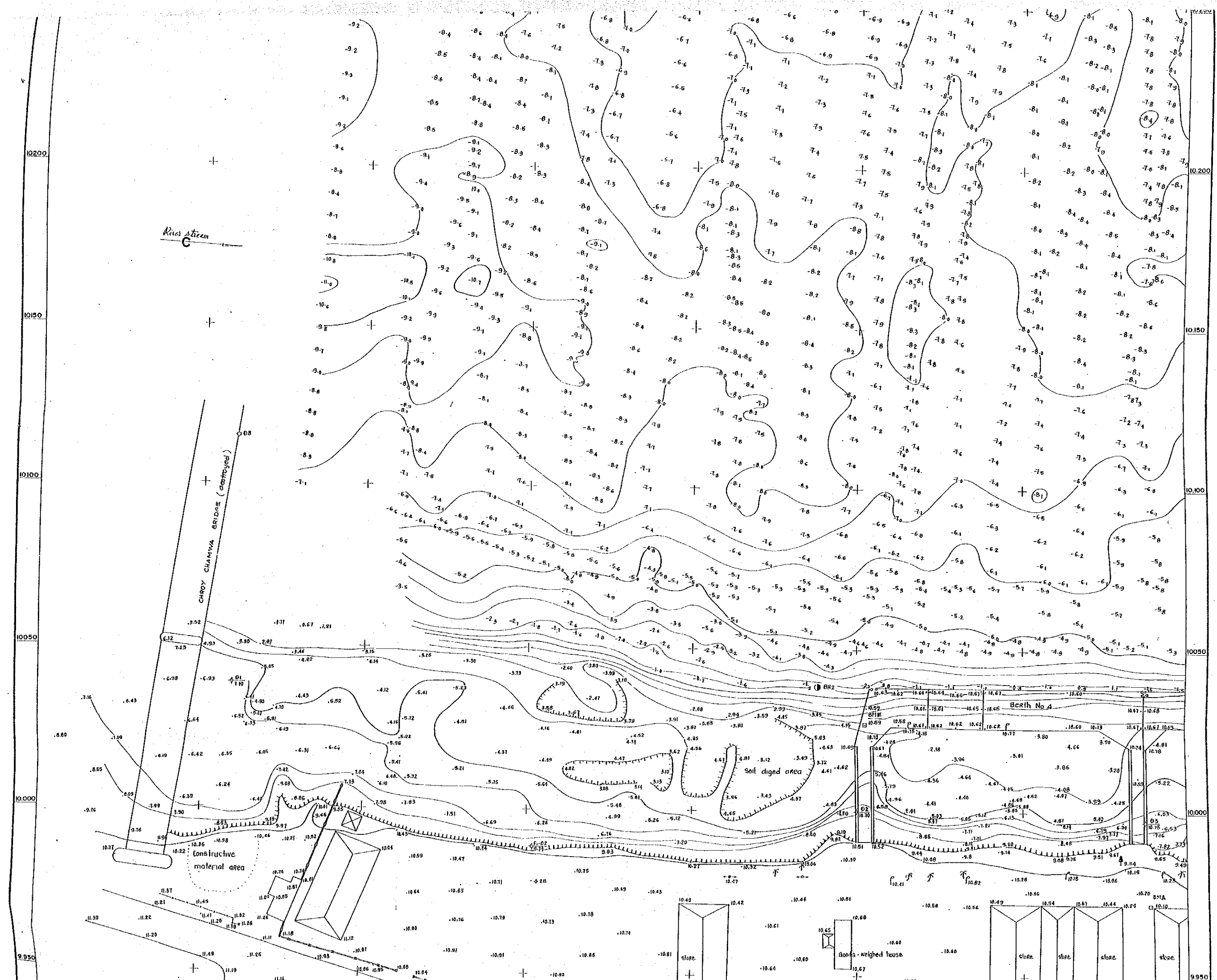
Fig.5-10 Design Criteria of Soil

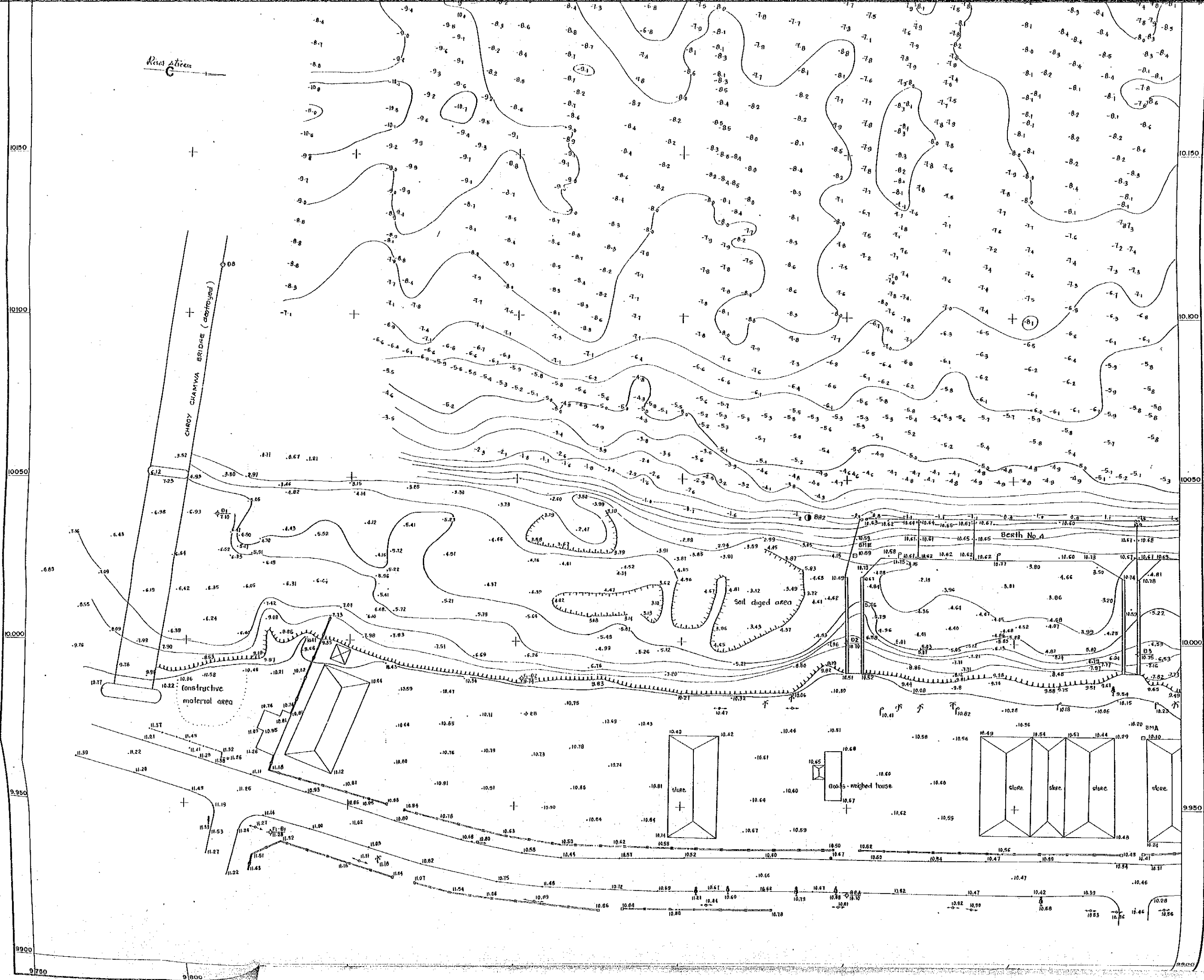


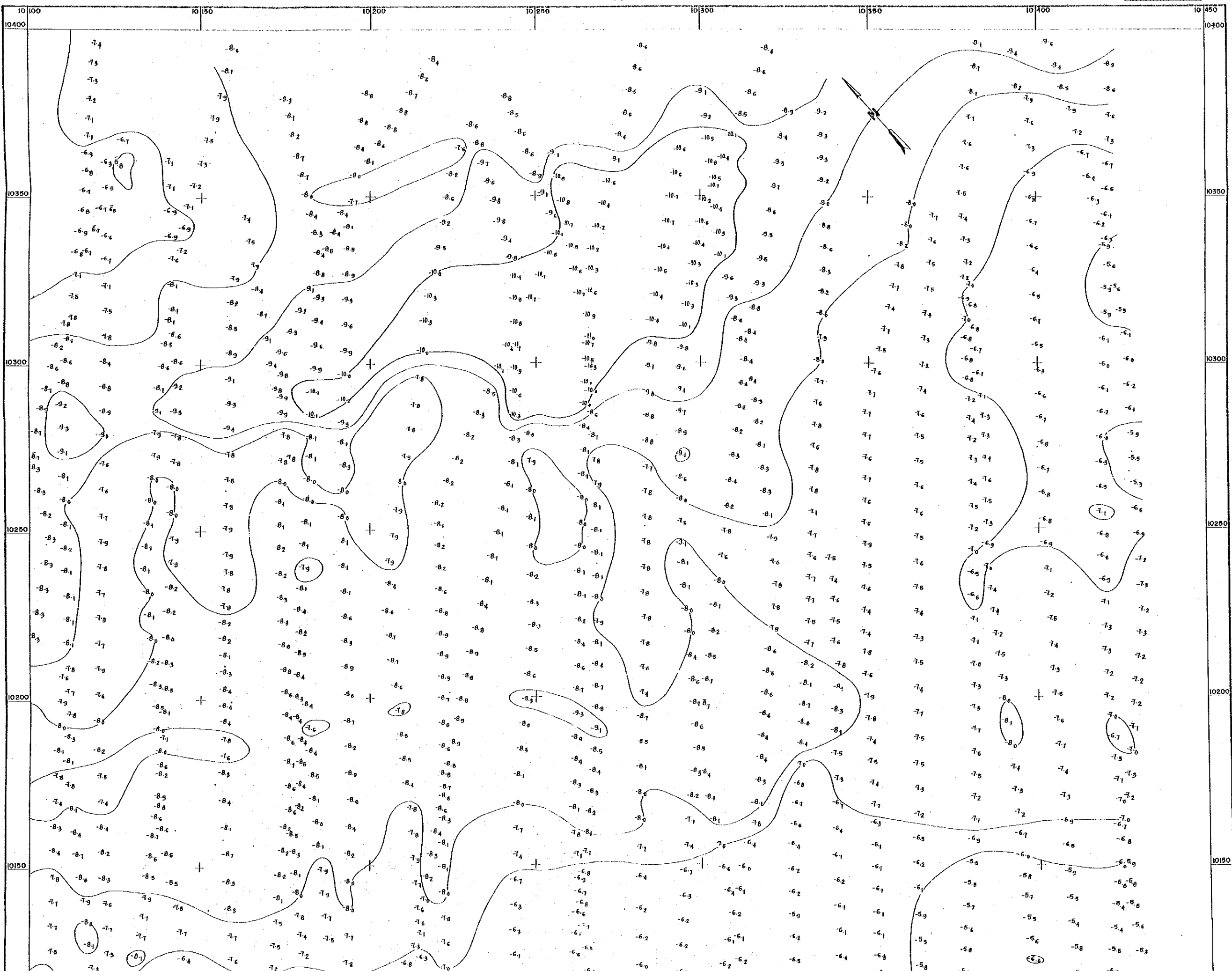
Note:

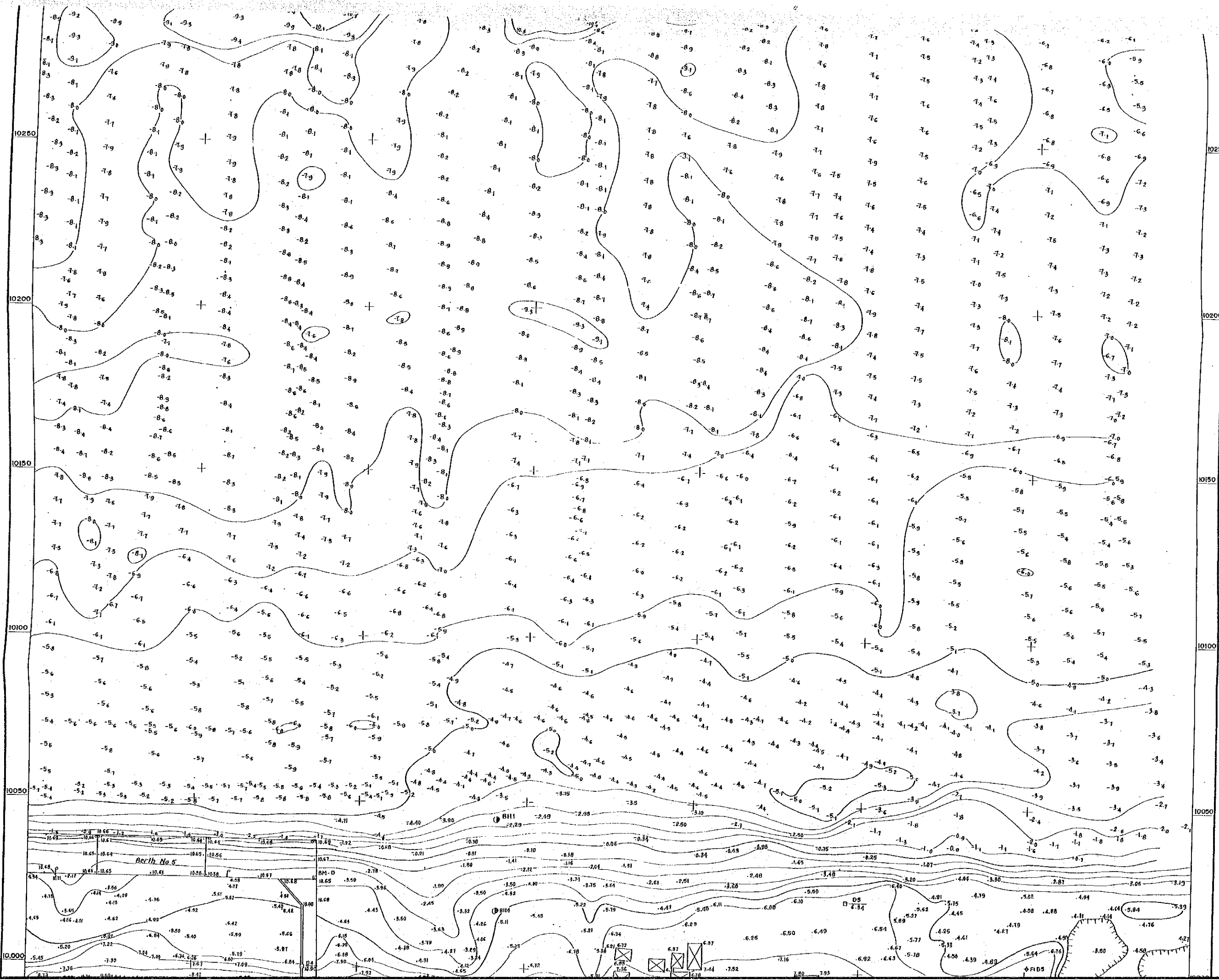
1. Design criteria of soil is determined by the result of soil investigation as shown in Fig.5-7 to 5-9 of Appendix 5.

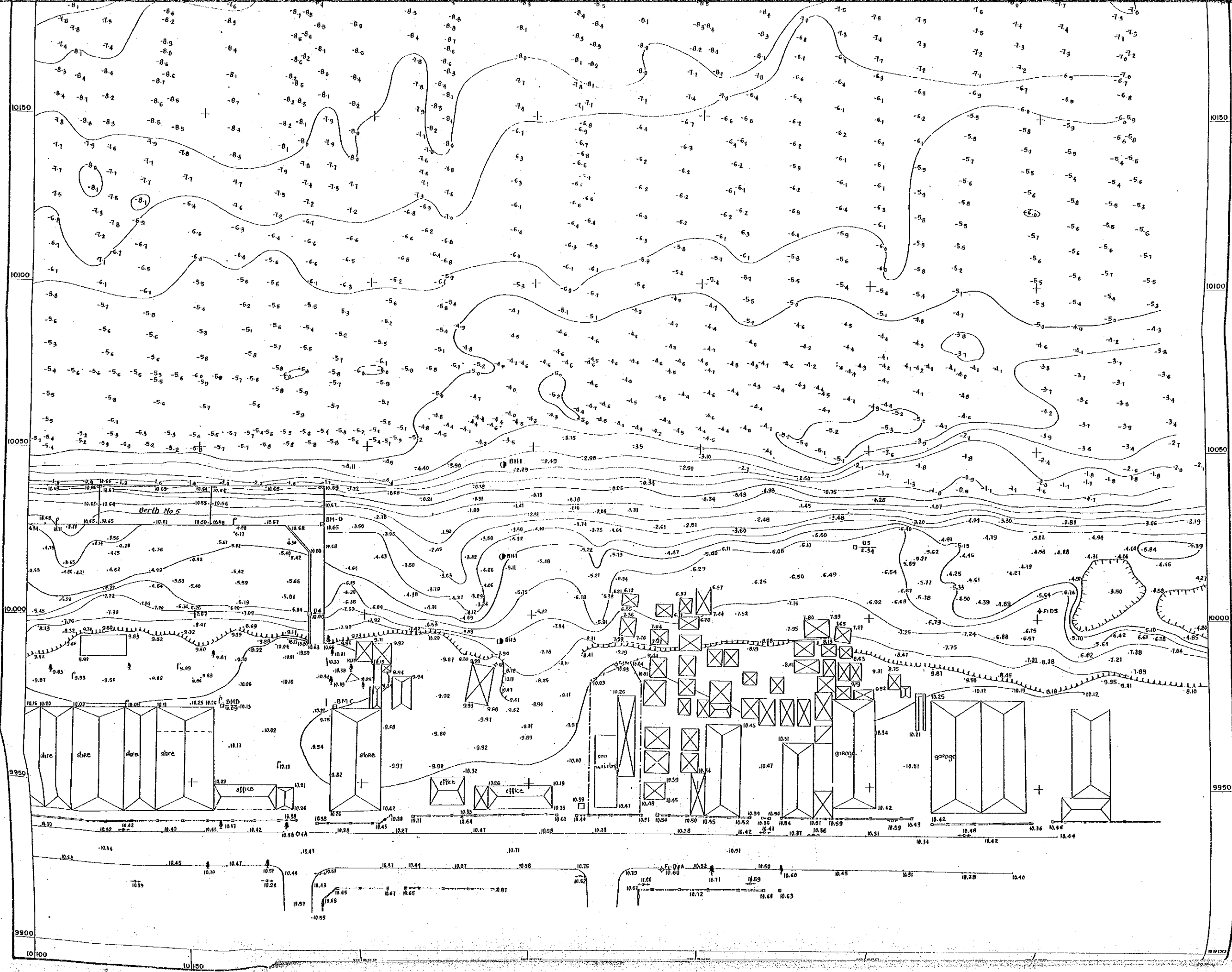


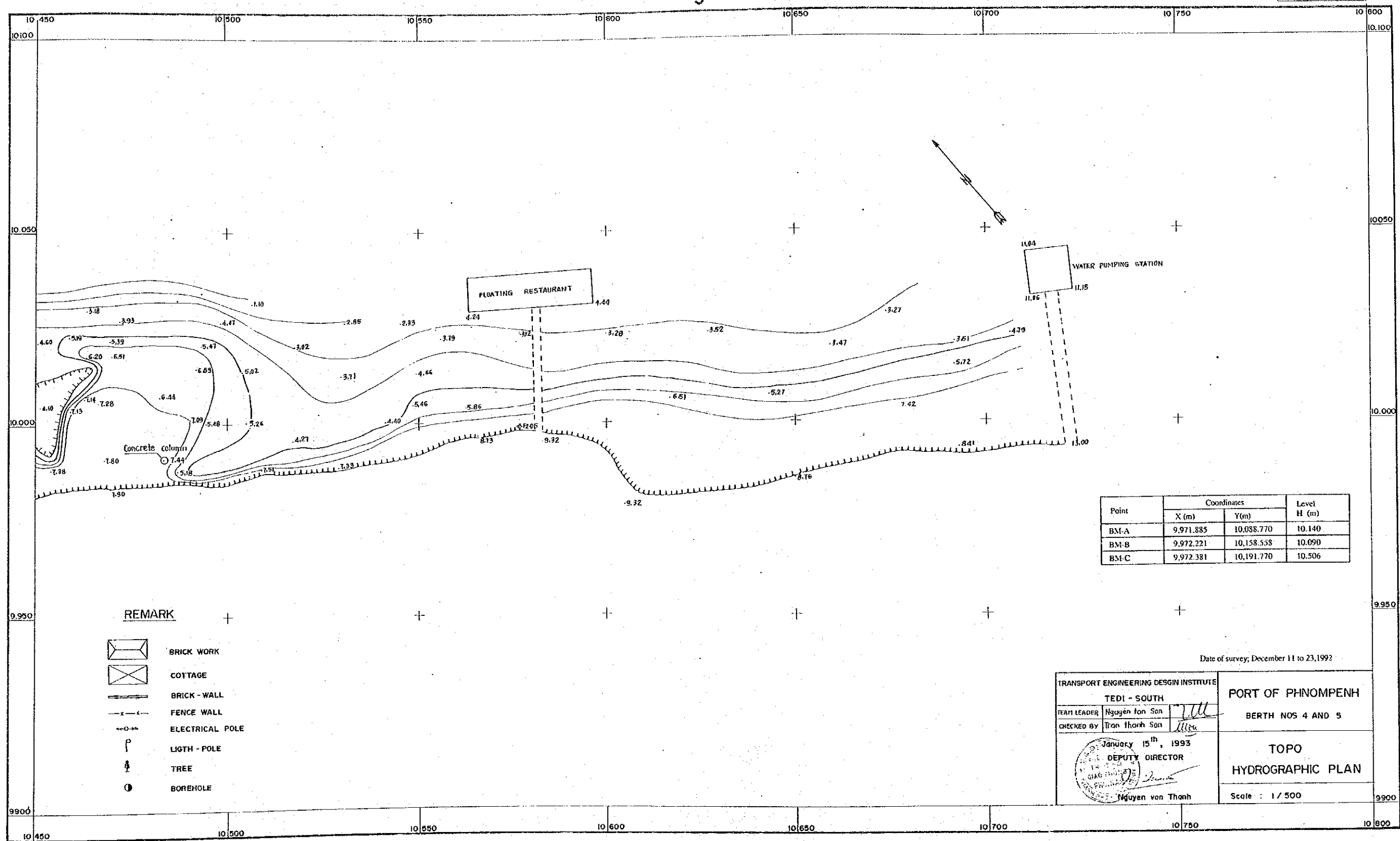












Point	Coordinates		Level H (m)
	X (m)	Y(m)	
BM-A	9,971.885	10,088.770	10.140
BM-B	9,972.221	10,158.553	10.090
BM-C	9,972.381	10,191.770	10.506

REMARK

- BRICK WORK
- COTTAGE
- BRICK - WALL
- FENCE WALL
- ELECTRICAL POLE
- LIGHT - POLE
- TREE
- BOREHOLE

Date of survey, December 11 to 23, 1992

TRANSPORT ENGINEERING DESIGN INSTITUTE	
TEDI - SOUTH	
TEAM LEADER	Nguyễn Văn Sơn
CHECKED BY	Trần Thanh Sơn
January 15 th , 1993	
DEPUTY DIRECTOR	
Nguyễn Văn Thanh	

PORT OF PHNOMPENH
BERTH NOS 4 AND 5
TOPO HYDROGRAPHIC PLAN
Scale : 1 / 500

