Port No. 1 (Berth No. 4 and No. 5)	151,000 tonnes
Port No. 2 (Pontoon Berth No. 5b, 5c)	36,000 tonnes
Offshore Unloading (Lightering)	7,000 tonnes
At the River Banks	111,000 tonnes
Other Unknown Processing	10,000 tonnes
Total	315,000 tonnes

As seen from the above, there is a great efforts being exerted to handle cargo in excess of the existing port capacity. It would be impossible to handle more cargo at the present facilities. In addition to this, as will be described in the demand forecast in the following chapter, incoming cargo is expected to increase further, because Phnom Penh Port will become the center of goods distribution. Therefore, the rehabilitation and of expansion the Phnom Penh Port will become important, thus the role of this project will become very significant.

Sihanoukville Port was constructed in 1960 as the outer port for the Port of Phnom Penh. The port facilities and cargo handling equipment have not been properly maintained. The National Road Route No. 4, which connects the port with Phnom Penh is generally in good condition except some bridges destroyed. Their replacement are all temporary bridges. The volume of traffic handled at the Sihanoukville Port is inactive in comparison with the Port of Phnom Penh. However, it will play an important role with the increase in the future cargo traffic in Cambodia, taking into account of the deep seaport and the large stacking yard.

2.2.2 Inland Water Transport and the Port Facilities

A description of the local ports within Cambodia of Kompong Cham, Kratie, Kompong Chnang, Prey Veng (above are all river ports), and Kampot, Koh Kong (above are all sea ports) are described in Table 2-3. The port of Siem Reap which is at the north end of Tonle Sap Lake can be used only when the water level in the lake rises for the boats that traverse the lake waters. These ports are under the jurisdiction of the local governments. In addition to the above ports, there are ferry piers at Neak Leung (Mekong River) on Route National Road 1, Prek Kdam (Tonle Sap River) on National Road Route 6, and Stung Treng (Mekong River) on National Road Route 7.

Table 2-3 Description of Local Ports

Class of Port	Division of Port	Name of Port	Location	Description of Facilities	Condition of Waterways	Remarks
Local Ports	River Port	Kompong Cham	Right bank of Mekong 105 km upstream from Phnom Penh	Pier: Pontoon (10 m lg.) x 1 Ea Ferry ramp. River used in dry season. Wood pier 50 m lg. on left bank of Mekong river washed away by 1991 flood. Godown: 500 m²/600 tonne.	Waterway Width; More than 100 m Depth: 3.3 - 3.9 m	Requires dredging of river bed at Sudow Area approx. 61 km downstream. Private pier upstream using river bank. Secondary port for Phnom Penh.
		Kratie	Left bank of Mekong 221 km upstream from Phnom Penh.	Pier: Pontoon (35 m lg.) x 1 Ea Godown: 1,000 m²/5,000 tonne	Waterway Width; 100 m. Depth: 3.3 - 3.9 m Traffic possible year round.	Dredging required 40 km downstream at Fuomtsumai. Activities coordinated with Kompon Cham.
		Kompong Chhnang	100 km upstream from Phnom Penh on Tonle Sap River.	Pier: River bank used. No pier.	Waterway Width: 150 m Depth: 2.8 m Traffic possible year round.	Used mainly for fishing port for fishermen on Tonle Sap River.
		Prey Veng	Left bank of Mekong 76 km upstream from Phnom Penh.	Pier: River bank used. No pier.	Waterway Width: 120 - 180 m. Depth: 3.6 - 3.8 m	Neak Luong Ferry Stop is adjacent. Dredging required Churi Amir area.
	Sea Port	Kompot	On river bank on Gulf of Thailand on Rt. 3, 148 km from Phnom Penh. 100 km east of Sihanoukville.	Pier: River banks used. Wood berths provided for lighters on coast. After receiving cargo lighter barges proceed to Kompong Som via river route.	Depth: Sea Side: 11 m River Front: 4.6 m	Activities coordinated with Sihanoukville. There is scheduled small boats plying regular to Sihanoukville.
		Koh Kong	On Gulf of Thailand. 100 km northwest of Sihanoukville.	Pier: Unkown. There are some 19 boats plying regularly between Shianoukville and Kompot.		Activities coordinated with Sihanoukville.

The Ferry Terminals of Neak Leung and Prek Kdam were visited for a field investigation during this investigation.

Data on the volume of inland cargo transportation is difficult to obtain, but data from the Inland Water Transport Co. under the MOCTP is given in Table 2-4. This data indicates that the cargo handled reached its peak at 107,000 tonnes (3,100,000 ton • km) in 1987 and has decreased. The reason for this is attributed to the privatization of the cargo transport business.

The Inland Water Transport Co. owns the fleet of vessels given in Table 2-5. The boats are rusted and barely kept in operation by repairing the main engine. The boats do not have classification of vessel, and for this reason cannot be covered by insurance.

Table 2-4. Inland Water Cargo Handled by Inland Water Transport Co. under MOCTP

Year	Cargo Handled (Tonne)	(Ton • km)
1980	50,927	11,400,000
1981	45,050	9,052,416
1982	46,132	5,694,750
1983	50,236	10,788,907
1985	47,098	10,981,914
1986	94,619	31,262,187
1987	107,431	31,417,902
1988	83,306	15,577,813
1989	98,628	26,292,085
1990	89,811	24,541,804
1991	52,621	11,160,183
1992	26,724	5,732,166

Note: The total for 1992 is June thru Sept.
Source: MOCTP. Inland Water Transport Co.

Table 2-5 Fleet of Vessel owned by Inland Water Transport Co.

	Name of ship	HP	Tonnage DWT	No of Engine	Built in	F/o consump. (ℓ /H)	Height (m)	Draft		L O A (m)	B (m)
								Full(m)	Light(m)		
A)	Cargo Boat	421	150T	1	Vietnam	42	16.60	1.50	0.50	34.90	7.00
1.	UNICEF 0032	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
2.	UNICEF 004	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
3.	UNICEF 009	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
4.	UNICEF 010	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
5.	UNICEF 011	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
6.	UNICEF 012	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
7.	—	490	350T	3	CAMBODIA	58	10.75	3.00	1.50	42.00	6.50
8.	—	250	130T	1	CHINA	29	16.60	2.23	—	37.14	6.20
B)	Tug Boat										
9.	R. B1	550	1,200T	2	U.S.A	59	9.50	2.50	2.00	15.25	4.88
10.	R. B2	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃
11.	R. 003	900	2,500T	2	JAPAN	101	13.50	3.30	2.80	28.50	7.70
12.	R. 004	250	600T	1	CHINA	29	9.50	2.50		20.50	5.00
13.	BASAK N°3	250	600T	1	CHINA	29	8.90	3.50		20.60	4.80
C)	Barge										
14.	UNICEF 026	—	120T	—	SINGAPORE	—	5.25	1.50	0.50	26.10	6.40
15.	UNICEF 036	—	〃	—	〃	—	〃	〃	〃	〃	〃
16.	BK 03	—	200T	—	THAILAND	—	2.10	2.30	〃	23.00	6.10
17.	BK 04	—	200T	—	〃	—	〃	〃	〃	〃	〃
18.	BK 05	—	200T	—	〃	—	〃	〃	〃	〃	〃
19.	BK 06	—	300T	—	THAILAND	—	5.50	2.35	0.30	27.00	7.45
20.	BK 07	—	300T	—	〃	—	5.85	5.10	〃	25.70	7.75
21.	BK 08	—	300T	—	〃	—	〃	〃	〃	〃	〃
22.	BK 09	—	300T	—	〃	—	〃	〃	〃	〃	〃
23.	BK 10	—	300T	—	〃	—	〃	〃	〃	〃	〃
24.	SL CHRHP	—	400T	—	U.S.A	—	4.45	1.50	—	38.00	8.80
25.	SL SAMAKI	—	250T	—	Vietnam	—	4.45	1.30		38.00	7.50
26.	SL BASAK N°1	—	250T	—	CAMBODIA	—	8.70	2.60	2.00	31.00	6.50
27.	SL BASAK N°2	—	200T	—	U.S.A	—	1.52	1.20		32.00	9.00
D)	Oil Tanker										
28.	MATPIM	720	1,120T	1	JAPAN	75	13.10	1.20	3.00	65.00	9.00
29.	MEKONG 3	135	100T	1	Vietnam	17	7.25		1.50	32.45	6.50
30.	MEKONG 4	135	100T	1	V.N	17	〃	—	〃	〃	〃
E)	Bunker(Oil Barge)										
31.	SL 1961	—	450T	—	ENGLAND	—	6.95	2.37	0.40	31.70	11.20
32.	SL MEKONG 1	—	300T	—	Vietnam	—	7.65	1.45	—	38.30	8.80
33.	SL MEKONG 2	—	300T	—	Vietnam	—	〃	〃	—	—	〃

Note) Tonnage of tug boat shows its tow capacity by tonnage of the objective ships.

Source: MOCTP. Inland Water Transport Co.

2.2.2 Road Systems

(1) The National Road Network

The National Road Network are Route 1 through 7 given in the following table. These roads radiate away from Phnom Penh as the center, and the other important roads are those of the branch off roads from the National Roads which are connecting with the various region. The total length of roads in 1989 was 14,800 km, of which 3,500 km was National Roads, and Provincial Roads was 3,100 km.

National Road Designation	Route	Length (km)	Remarks
Rt. 1	Phnom Penh - Swai Rien - Vietnam Border	167	Uses Neak Leung Ferry (Mekong)
Rt. 2	Phnom Penh - Takeo - Vietnam Border	120	
Rt. 3	Phnom Penh - Kampot - Veal Renh	202	
Rt. 4	Phnom Penh - Kompong Son (Renamed Sihanoukville in Oct. 1992)	226	
Rt. 5	Phnom Penh - Pursat - Battambang - Poipet - to Thai Border	407	
Rt. 6	Phnom Penh - Skoun - Kompong Thom - Siem Reap - Sisophum	386	Terminates at Rt. 5 Prek Kdam Ferry (Tonle Sap River)
Rt. 6A	Chroy Changwar - Chuncherik	44	Starts at Rt. 5. Ends at Rt. 6
Rt. 7	Skoun - Kompong Cham - Vietnam Border	179	Starts at Rt. 6 Ferry (Mekong)

(2) Route 4 (Phnom Phen ~ Sihanoukville)

This is the national road Route 4 that connects Phnom Penh with Sihanoukville and has a significance with this study. Route 4 is 7 m wide with a total length of approximately 320 km and is a bituminous paved road. There are some damaged sections without repair but the road is generally in a good condition. There are many road bridges (41), and some of them were destroyed during the war. Of the destroyed bridges, there are 5 bridges that are very bad, and only single line traffic is possible at these places. The loads of the trucks are limited from 10 to 15 tonnes for passing these bridges. There is a restriction placed on the travel of large containers traffic.

2.2.3 Rail Transportation

The rail system is operated by the State Railway of Cambodia (CFC). The old line of 384 km runs from Phnom Penh and proceeds northwest and passes through Battambang to Thailand and was completed in 1929. The new line from Phnom Penh runs southwest to Sihanoukville. The 46 km of old line from Sisophon to Poipet on the Thai border is not operational. The rail system consists of the old line of 338 km and the new line of 263 km. The total of 601 km is being used. There are 2,249 employees of the CFC. The rolling stock of the CFC which can be operated as reported by UNDP are as follows:

Steam Locomotives	8	(24)
Diesel Locomotives (1,200 HP)	10	(13)
Diesel Locomotives (450 HP)	1	(8)
Diesel Railcar	1	(8)
Passenger Coaches	10	(99)
New Passenger Coaches (Vietnam manufactured)	10	
Freight Car	365	(727)

Note: Figures in ( ) indicate the numbers in 1960.

The locomotives are of French or Checkoslovakia manufacture in 1960, and the spare parts are difficult to obtain. Due to the poor condition of the tracks, the average speed is restricted to 20 ~ 30 km/hr. Although there are plans to rehabilitate the rolling stock and rails, there has been no budget for this work.

On the new line there is one train operated between Phnom Penh and Sihanoukville. It takes two days to make a return trip by this train (It is the same situation between Phnom Penh and Sisophon). Since the passenger coaches are used to transport the refugees back from Thailand, the train are made of 25 freight cars. One half of these are put to passenger use. The train leaves Phnom Penh every other day at 6 o'clock in the morning and stops at all 17 station on the way, and requires 12 ~ 14 hours to reach Sihanoukville. The principal cargo handled is as follows:

New Line	Sihanoukville → Phnom Penh	- Construction materials, cement
		- Fertilizer
		- Machinery, mainly import items
	Phnom Penh → Sihanoukville	- Almost none
Old Line	(Sisophon to Thailand is performed by trucks)	
	Thai → Phnom Penh	- Cement
		- Foods (including rice)
	Phnom Penh → Thai	- Chinaware (Vietnam manufacture)
		- Straw mats
		- Tabacco
		- Soybeans
		- Red beans
		- Sesame seeds

Detailed description of the cargo and the volume of cargo carried on the new line is unknown, but the volume of cargo on the old line is larger than that on the new line.

The cargo and passengers handled (old and new lines) by the CFC are given in Table 2-6.

Table 2-6 Cargo & Passengers Handled by Cambodian Railways (CFC)

Year	Cargo (Ton/km)	Passengers (1,000)	Personal Luggage (1,000 km)	Cargo (1,000 Ton/km)	Passenger (1,000 personal/km)	Personal Luggage (1,000 km)
1959	336	1,212	6	80,208	74,616	288
1960	300	1,416	6	68,784	81,526	300
1961	264	1,308	5	61,368	77,508	264
1962	292	1,260	5	216,020	72,516	252
1963	282	1,314	5	69,300	78,108	285
1968	348	2,395	12	81,544	167,345	991
1969	954	2,376	6	74,172	180,531	1,425
1979	26	-	-	6,501	-	
1981	84	1,147	6	19,080	174,047	1,280
1982	103	405	4	20,265	44,136	515
1983	109	404	8	22,163	31,324	1,276
1984	128	631	7	27,758	55,185	735
1985	149	710	9	32,164	62,553	954
1986	136	964	21	24,405	71,801	1,932
1987	150	906	19	30,495	61,281	1,834
1988	189	1,088	15	42,704	97,082	1,452
1989	140	828	13	27,635	61,792	1,596
1990	116	464	16	24,058	33,501	2,767
1991	64	617	17	12,369	41,897	1,848
1992	94	1,013	16	22,156	91,525	2,006

Notes: 1. No figures available for 1964 ~ 1967, 1970 ~ 1978, although CFC was operating.
2. Only foreign Aid supplies ware handled in 1979,
3. The data for 1992 is for Jan. 1 to Nov. 17.

Source: CFC

2.2.4 Air Service

The international airport is Pouchentong Airport in Phnom Penh with a secondary international airport at Seam Reap. Domestic airports are at Battamgbang, Sihanoukville, Stung Treng, and Kratie.

2.3 Description of Related Projects

2.3.1 The 1st National 5 Year Restoration Plan

The 1st National 5 year Restoration Plan was implemented from 1986 to 1990. The main policies of this plan were as follows:

(1) Acceleration of Agricultural Production

The 4 main agriculture programs of foodstuffs, rubber, lumber and marine goods are as follows:

1) Rice production was increased from 1,800,000 tonnes in 1985 to 2,750,000 tonnes in 1989. An average increase rate of 9 % was realized. The accomplishment of foodstuffs was attained 7 % in excess of the targeted amounts.

2) The raw rubber plantation was achieved the targeted area of 52,000 ha, but the production of dry rubber was 90 % of the planned target of 45,000 tonnes.

3) Lumber production was increased sharply from 128,000 m^3 in 1986 to 305,000 m^3 in 1987. But due to the enactment of the regulation to protect the forest environment, the production was decreased to 250,000 m^3 in 1990.

4) Marine goods was increased from 69,000 tonnes in 1986 to 86,000 tonnes in 1988, which exceeded the target 80,000 tonnes. However, the catch of inland fisheries was decreased due to the pollution in the water quality.

(2) Industry Production and Electric Power

1) The industries production amount was almost doubled from 3,900 mil. Riel (US$490 mil.) in 1986 to 8,000 mil. Riel (US$1,000 mil.) in 1990.

Out of this, the State-run industrial production was increased from 2,100 mil. Riel (US$260 mil.) in 1986 to 2,600 mil. Riel (US$320 mil.) in 1988 with an average growth of 11.6 %. During this period the private industries production amount was increased from 1,800 mil. Riel (US$220 mil.) to 3,000 mil. Riel (US$380 mil.) with a growth rate of 27.5 %.

2) Power generation which was 146 mil. kwh in 1986 was increased to 220 mil. kwh in 1990 but was less than the target by 300 mil. kwh.

(3) Rehabilitation of Infrastructures of Basic Societies

The rehabilitation on infrastructures of basic societies such as irrigation and transportation are the main projects to implement as follows;

1) The total length of 2,200 km of National Roads of Rt. 1, 2, 3, 5, 19, and the main roads in Phnom Penh have been repaired.

2) The two main railway lines have been repaired, but still is not sufficient for smooth operation.

3) With the rehabilitation of the transportation infrastructure the volume of transportation increased from 850,000 tonnes in 1986 to 1,500,000 tonnes in 1990.

2.3.2 The 2nd National 5 Year Restoration Plan

As a continuation of the 1st National 5 Year Restoration Plan, in order to revive the economy and increase the social benefits, the 2nd National Five Year Restoration Plan (1991 ~ 1995) was initiated with the following 4 economic plans.

(1) Priority on the economic plans

1) Agriculture
2) Industry
3) Transportation
4) Tourism

(2) The Leading Indicator for Socio-Economic Development

The leading indicator for the main economic factor and the national budget fixed by the various economic areas are given an follows:

1) The Leading Indicators for the Economy

Note: Based on 1984 Prices 1US$ = 8 Riel.

Production Rate (US$)	1991	1995	Growth Rate (%)	Total 5 Year Amount
Actual National GNP (US$ mil.)	3,593	5,260	10	21,875
National Income (US$ mil.)	2,263	3,313	10	
Per Capita Income (US$)	254	333	7	
Total Invested Amount (US$ mil.)	647	1,052	(1991~93):18 (1993~95):20	4,149

2) National Investment by Economic Areas

Group	Gross Amount 5 Year Investment (US$ mil.)	Percentage Share (%)
Agriculture	415	30
Transport, Communication	346	25
Industry	138	10
Electric Power	207	15
Tourism	69	5
Others	207	15
Total	1,383	100

2.3.3 Assistance from Multilateral and Bilateral Financing Institutions

1) Asian Development Bank (ADB)

The Study Team noted that there is a plan to provide $4,900,000 for supply of cargo handling equipment at the two ports of Phnom Penh and Sihanoukville to be financed under the Sector Loan for Emergency Restoration. The costs of cargo handling equipment to be required at both ports are expected to exceed the budgeted amount. In order to adjust the scope of supply of the cargo handling equipment, a discussion was made between the Study Team and ADB in Manila on February 25, 1993. ADB expressed in the discussion that all the rehabilitation work including the cargo handling equipment would be preferable to be done by Japanese ODA.

2) The World Bank and the Government of Denmark

(1) While the following request has been submitted by the SNC, there has been no commitment yet by the expected donors.

	Cost (US$1,000)
a) Pontoon (40 x 10 m) and Access Ramp for Berth 5a at Port No. 2	360
b) Barge for Lightering	200
c) Repair Shop Building (for repair of cargo handling equipment and machinery), to include tools and equipment	620
(shop building and gantry crane---------- 340)	
(tools and equipment---------- 280)	
Total ----------	1,180

The loan from the Government of Denmark is for Item (c), however a clear commitment has not yet been obtained similar to the World Bank. For these reasons, this request has been made to the Japanese Government as an additional request of the rehabilitation of the workshop.

(2) Spare parts for cargo handling equipment being planned to be requested.

	Cost (US$1,000)
a) Spare parts for 7 forklifts (Japan manufacture)	96
b) Spare parts for 6 each 6.5 ton cranes (KATO manufactured)	180
c) Spare parts for 3 each 30 KVA Electric Generators	60
d) Spare parts for 3 trucks	60
e) Spare parts for 3 conveyor belts	50
Total ----------	446

(3) Cargo Handling Equipment and Boats being planned to be requested.

		Cost (US$1,000)
a) 25 ton Crane ----------	1 ea.	191
b) 7 ton Crane----------	2 ea.	190
c) 11 ton Crane ----------	2 ea.	228
d) Tug Boat, 259 HP----------	1 ea.	412
e) Speed Boat, 100 HP ----------	1 ea.	234

f)	Pilot Boat, 140 HP----------	1 ea.	45
g)	Mooring Line Boat----------	1 ea.	129
h)	Excavator----------	1 ea.	150
i)	Custom Duty for Above Items--------	Lump Sun	25
	Total ----------		$1,604
	Grand Total ----------		$3,230

3) The Mekong Secretariat

The following items were proposed to the Mekong Secretariat. Cost estimates have not been made.

a) Dredging (for the river basin between Chroy Changwar Bridge and Royal Palace for the domestic cargo).
b) The protection of the river banks.
c) Office bldg. for topographic survey equipment and sounding crew team.
d) Equipment to clean garbage and remove river bed sediments.
e) Patrol boat.
f) 2 chassis trucks for hauling heavy goods.
g) Grading and pavement at garage area.
h) Study for a new Phnom Penh Port.
i) River pilot training center.

2.4 Outline of the Request

The request from the SNC for the rehabilitation of the Port of Phnom Penh has been accepted by the Japanese Government, and JICA decided to perform the Preliminary Investigations. JICA dispatched a Preliminary Study Team from August 31 to September 12, 1992.

Based on the results of the Preliminary Study Team, JICA confirmed to perform a Basic Design Study for the Rehabilitation of the Port of Phnom Penh. The Basic Design Study was performed based on the recommendations of the Preliminary Study Team.

The scope of the Project is basically in accordance with the items confirmed by the preliminary study team. The contents of the request is as follows:

(1) extension of the fixed type quays;
(2) widening and rehabilitation of the existing quays;

(3) paving of stacking yard;
(4) provision of ancillary works; and
(5) procurement of cargo handling equipment.

The Project site is at Port No. 1, i.e. consists of Berths Nos. 4 and 5, which handles import/export goods.

CHAPTER 3 OUTLINE OF THE PROJECT AREA

CHAPTER 3. OUTLINE OF THE PROJECT AREA

3.1 The Location of the Project Area and the Social Conditions

The location of the project site and the port area under the jurisdiction of the Department of the Phnom Penh Port is as shown in Fig. 3-1.

Phnom Penh Port is 330 km upstream from Vung Tau in Vietnam at the mouth of the Mekong River. The length of the waterway on the Mekong River within Cambodia is approximately 100 km.

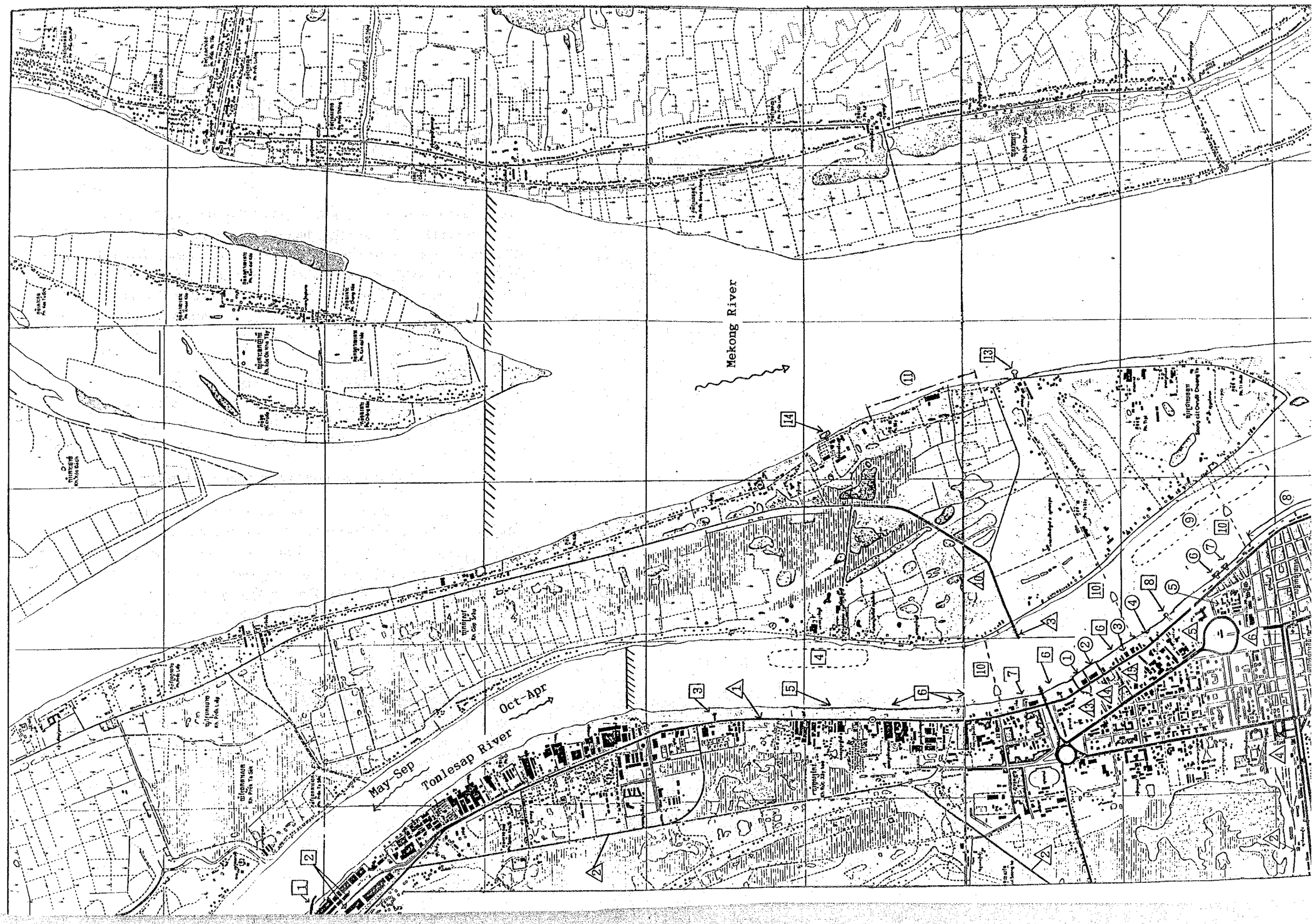
Phnom Penh Port is in the center of the capital city of Phnom Penh, and is located on the right bank of the Tonle Sap River. The operation of the Port of Phnom Penh is administered by the Department of the Phnom Penh Port. The area administered by the Department ranges from 2.5 km upstream from the Chroy Changwar Bridge along the Tonle Sap River to downstream 3 km from Quatre Bras along the Mekong River, and 6 km up along the Mekong River from Quatre Bras. The total waterfront length is 27 km. The cargo is handled mainly on the right bank of the Tonle Sap River 4.0 km upstream from the Royal Palace and a part of the Bassac River bank.

Foreign cargo is handled at Port No. 1 (Berths No. 4 and No. 5), Port No. 2 (Pontoon Berths 5b and 5c), and some cargo is unloaded from vessels anchored in the basin by lightering. Of the foreign cargo, petroleum products are unloaded at Km 4 and Km 13 (4 km and 13 km upstream from Phnom Penh Port on the right bank of the Tonle Sap River).

Domestic cargo is handled mainly in the area south of Port No. 2 to the Royal Palace and on the right bank of the Bassac River. There are other large areas of the river banks that are used for handling domestic cargo. Accurate information as to the volume of the goods and the number of berths involved are not available.

The area covered by the Project in this study is the foreign cargo Port No. 1 (Berths Nos. 4 and 5).

The facilities of the Port of Phnom Penh will be described in their order from the North to South. (refer to Fig. 2 and Fig. 3-1)


Mekong River
Tonlesap River
Oct-Apr
May-Sep
1
2
3
4
5
6
7
8
9
10
11
12
13
14

LEGEND

Major Facilities of Department of Port of Phnom Penh

Port area of Dept. of Port of Phnom Penh

① Berth No.4(Port NO.1/ international cargo)and Sheds
② Berth No.5(Port NO.1/ international cargo)and Sheds
③ WorkShop
④ Garage for cargo handling equipment
⑤ Dept. of Port of Phnom Penh
⑥ Berth No.5b (Port No.2/ international cargo)and Sheds
⑦ Berth No.5c (Port No.2/ international cargo)and sheds
⑧ River bank for domesticcargo andSheds
⑨ Anchorage
⑩ Quatre Bras, approach channel
⑪ Future site of New Phnom Penh Port

Other Waterfront Facilities

1 KH 6, Pier of Ministry of Commerce
2 KH 6, Storages of Ministry of Commerce
3 KH 4, Oil pier of Ministry of Commerce (at Ressey Keo)
4 Anchorage for oil tanker
5 River bank for mooring of Inland Water way Co. (Min.of Communications Transport and Posts)
6 River bank for discharging of cement, brick, gravel, soil and ete.
7 Oil unloadion pier for power plant(C-1, C-4)
8 Water intake for Bureau of Water Works of Phnom Penh City
9 Floating Hotel
10 Ferry
11 River bank for oil unloading (private) at Kbalthnal
12 Oil unloading pier for power plant(C-2)
13 Water intake
14 Naval pier

Other Facilities

△1 National Road 5

Port Area boundary

2 km eastside

Basaac River

LEGEND

Major Facilities of Department of Port of Phnom Penh

Port area of Dept. of Port of Phnom Penh

① Berth No,4(Port NO,1/ international cargo)and Sheds
② Berth No,5(Port NO,1/ international cargo)and Sheds
③ WorkShop
④ Garage for cargo handling equipment
⑤ Dept. of Port of Phnom Penh
⑥ Berth No,5b (Port No,2/ international cargo)and Sheds
⑦ Berth No,5c (Port No,2/ international cargo)and sheds
⑧ River bank for domesticcargo andSheds
⑨ Anchorage
⑩ Quatre Bras,approach channel
⑪ Future site of New Phnom Penh Port

Other Waterfront Facilities

[1] KH 6, Pier of Ministry of Commerce
[2] KH 6, Storages of Ministry of Commerce
[3] KH 4, Oil pier of Ministry of Commerce (at Ressey Keo)
[4] Anchorage for oil tanker
[5] River bank for mooring of Inland Water way Co. (Min.of Communications Transport and Posts)
[6] River bank for discharging of cement, brick, gravel, soil and ete.
[7] Oil unloadion pier for power plant(C-1, C-4)
[8] Water intake for Bureau of Water Works of Phnom Penh City
[9] Floating Hotel
[10] Ferry
[11] River bank for oil unloading (private) at Kbalthnal
[12] Oil unloading pier for power plant(C-2)
[13] Water intake
[14] Naval pier

Other Facilities

⚠1 National Road 5
⚠2 Cambodian National RailWay(CFC)
⚠3 Chroy Changwar Bridge
⚠4 Central station(CFC)
⚠5 Head quarter of UNTAC
⚠6 Ministry of Communications Transport and Posts
⚠7 Central Market
⚠8 Royal Palace
⚠9 Hotel Cambodiana
⚠10 National Road 6A
⚠11 National Road 1
⚠12 Bassac Bridge
⚠13 80th Street
⚠14 82nd Street
⚠15 84th Street

Port Area boundary
2 km eastside

Basaac River

Scale=1:20,000

Fig.3-1 General Plan of the Port of Phnom Penh and related Port Facilities

- Km 13

This area is 13 km upstream from the Port of Phnom Penh at Prekphneou, and was formerly used by the Shell Oil Co. The facility is presently managed by the Army and leased out to private enterprise. There are petroleum product unloading facilities here, and there are fuel oil storage tanks on land.

- Km 6

This area is 6 km upstream from Phnom Penh Port. There are concrete access bridges (110 m long and 7 m wide), with a pier (45 m long, 11 m wide) which is in a very damaged condition. There are 19 sheds (storage capacity 5,000 tonnes), and a railway spur is provided within the yard. This facility is under the jurisdiction of the Ministry of Trade and Commerce. Rice and other agricultural products are stored here.

- Km 4

This area is located on the right bank of the Tonle Sap River 4 km upstream from Phnom Penh Port at Ressey Keo, to unload petroleum products. There are oil storage tanks on shore. The facility is under the jurisdiction of the Ministry of Industry who handles fuel oil, diesel oil and gasoline.

- Unloading Facilities for Fuel Oil for the Power Generating Plant

The unloading pier for fuel oil and diesel oil for the generating plant (C1, C4) of the Phnom Penh Electric Power Public Corporation is located 0.5 km upstream from the Port of Phnom Penh on the right bank of the Tonle Sap River. The generating plant is located approximately 500 m to the west of the fuel pier, and they have their own storage tanks within the complex. The cooling water for the power plant is also obtained from this facility.

- Port No. 1

This is the area of the Project. The area is on the right bank of the Tonle Sap River, and consists of Berths No. 4 and No. 5, the access bridges, sheds, and other related facilities. Port No. 1 is used exclusively to handle the foreign goods. Berth No. 4 is 83.7 m long. Berth No. 5 is 100.2 m long with the width of 11.2 m to 12.3 m. The depth in front of the berth is -1.0 ~ -2.2 m at the present, and MOCTP have plans to dredge this area to -5.0 m by the April of 1993.

- Water Intake Tower for the Phnom Penh City Water Plant

The Phnom Penh City Office has a water intake tower for the Phum Prek Water Treatment Plant at 0.5 km downstream from the Phnom Penh Port No. 1 near the right bank. There are two water intake pipes of 750 mm diameter.

- Port No. 2

Berth No. 5b and 5c are mooring berths located on the right bank of 1.3 km downstream from Port No. 1 and is called Phnom Penh Port No. 2. Foreign cargo is also handled at this port similar to Port No. 1. This pier is of the floating type and consists of two steel pontoon (45 m long, 10 m wide) and each pontoon is connected to the land with steel bridges. There is a belt conveyor provided on the access bridge for transporting the bag freight. Since the bridge is very narrow, it is not possible for trucks to use the bridges. When the water level is low, the bridges slope so steep that even small vehicles cannot use the bridge. As the bridges are so short the pontoons are close to the river bank and it becomes easy for silt and sand to collect in this location and the pontoons hit bottom and careen forward and make it difficult to handle the cargo. The river bank from here to the front of the Royal Palace is protected with a concrete bank protection.

- Domestic Cargo Unloading Stand

Numerous vessels berth on the river bank for a distance of 0.7 km downstream from Port No. 2. They discharge their cargo of agricultural products, salt, lumber, charcoal, and general dry goods. This area is a beehive of activity. There are many ferry boats that cross the river from this area.

In addition to the above activities, there is brick, cement, sand, lumber and many other merchandise being unloaded along the river bank of the Tonle Sap River, and there are passengers, bicycles being transported by the ferry boats plying back and forth.

3.2 The Natural Conditions

3.2.1 The Weather and the Topography

Phnom Penh has a tropical climate with two distinct seasons, wet and dry. The dry season lasts from November through April. The rainy monsoon season lasts from May through October. The annual average temperature is 27.5°C. The annual rainfall record for the last 10 years is from 1,100 mm to 1,550 mm. The heaviest precipitation is concentrated in the rainy season.

The project site is 330 km upstream from the mouth of the Mekong River, and the elevation is +12 m in the central valley of Cambodia, in the midst of Cambodia's agricultural center.

The humidity from February to March averages 44 %, and the maximum humidity of 99.8% has been recorded in October. The wind records indicate a maximum speed observed 8 m/sec. from November to June in the period 1981 ~ 84, and was in the southeasterly direction. The maximum wind was 16 ~ 20 m/sec. between July to October and was in the west to northeasterly direction. The average temperature and rainfall for the Phnom Penh are as follows:

Average Temperature and Rainfall in Phnom Penh

Months	1	2	3	4	5	6	7	8	9	10	11	12
Avg. Temp. (°C)	26.1	27.5	28.9	29.4	28.8	28.1	27.6	27.7	27.3	27.2	26.7	25.4
Avg. Rainfall (mm)	9	8	28	73	146	129	129	147	231	250	134	36

3.2.2 The Flow of Water in the Tonle Sap River

The Tonle Sap River which flows in front of the Phnom Penh Port, connects the Tonle Sap Lake to the confluence with the Mekong River (Quatre Bras) for a length of approximately 100 km in the north-south direction and the width ranges from 500 m to 1,000 m. At the Port of Phnom Penh the width of the river is approximately 500 m, and the elevation of the river bed in the center is approximately -8 m, and -5 m in front of Port No. 1. The highest water level in the last 10 years was +9.81 m, and the lowest water level was +0.78 m. The flow in the river reverses with the change of the water volume in the Mekong River. From October to May the water flows downstream in the direction of the Mekong River, and in the

rainy season when the water level in the Mekong River rises the water in the river flow upstream in the direction of the Tonle Sap Lake. The average flow of water in the Mekong River is as follows:

Maximum Flow Volume	34,000 m^3/s
Minimum Flow Volume	1,700 m^3/s
Total Yearly Flow Volume	333.5 billion m^3
Maximum Velocity of Flow	1.85 m/s
Minimum Velocity of Flow	0.15 m/s

The flows of the Tonle Sap River was observed in front of the Phnom Penh Port on December 22, 1992 using a floater. According to the floater, the direction of the flow was parallel to the river banks at a large arc at a velocity of 0.8 m/sec., and the velocity was 1.2 ~ 1.3 m/sec. at a distance of 130 m away from the berth, and was farther towards the center of the river. (refer to Fig. 5-1 of Appendix 5)

The water level of the Tonle Sap River in gauged at the Berth of Phnom Penh Port, and the record of the water levels for the period 1983 to the present time in 1992 is given in Fig. 5-2 of Appendix 5. The maximum and minimum levels are as shown below.

Water Level Observations

Year	Maximum Water Level (m)	Minimum Water Level (m)
1988	+7.42	+0.63
1989	+7.92	+0.52
1990	+9.00	+0.52
1991	+9.70	+0.62
1992	+7.60	+0.78

The water velocities in front of Phnom Penh Port No. 1 on the Tonle Sap River is given in Fig. 5-3 of Appendix 5. According to the above data, the maximum velocity in front of Port No. 1 is 2.3 m/sec. (Approx. 4.5 Knot). The movement of the vessels to the Phnom Penh Port is affected by the water levels at the mouth of the Mekong River and the river velocity in front of berth. The restricted draft in the Mekong River is given in Fig. 5-4 of Appendix 5.

3.2.3 Soils Conditions

Soil borings were conducted at Phnom Penh Port No. 1, and the soils conditions were confirmed. The two samples BH-1 and BH-2 were taken to check the soils condition for the foundations of the berth structure, and two more samples BH-3 and BH-4 were taken on a line extended at the toe of the berth to investigate the soils behind the berths and the bank protection structure. In selecting the boring location, consideration was given to the investigation made by the Mekong Committee in 1991. The boring hole locations are given in Fig. 5-5, of Appendix 5. BH-1 to BH-4, and the soils log are given in Fig. 5-6 of Appendix 5. The soils are sand stone at a level of -18 m, over which there are 3 layers of soil each with a different degree of hardness. The first layer is from the surface level to -8.75 m, with a blowcount of N = 0 (N means N value), containing large amounts of water, and soft soils. The second layer was to -14 m with a N value of around 30 consisting of a hard clayey silt. Between the first and second layers, there was a 20 cm layer of gravel with 2-3 cm diameter gravel. The third layer had a blowcount of more than N = 50, and consisted of hard clay.

Bore Hole BH-3 and BH-4 were taken on a line normal to the river bank on the land reclaimed behind Berth No. 6, and the soil conditions for BH-1 ~ BH-2 are also shown in Fig. 5-7 of Appendix 5. Bore Hole BH-3 and BH-4 indicate that the soils below -8.75 m are similar to the soils at the toe of the river bank and are of a hard characteristic. Above the depth of -8.75 m the soils are of a different nature from that taken at the toe of the bank at the pier where the blow count is N = 0, and is very soft. There seems to be the two district layers of the upper strata with N = 1 ~ 3, and a lower strata with N = 3 ~ 10.

The results of soil investigation conducted by the Mekong Secretariat in 1991 and by the Department in 1980 are summarized in Figs. 5-8 and 5-9 of Appendix 5 respectively. Taking the aforementioned soil data into consideration, the design criteria of soil is summarized in Fig. 5-10 of Appendix 10.

3.2.4 Topographical and Hydrographical Survey

In order to get a better idea of the port facilities at Phnom Penh Port No. 1 and entrance at Quatre Bras, topographical and hydrographical survey were taken. The results are given in Fig. 5-11 to 5-14 of Appendix 5.

Datum for Survey

The Bench Mark (BM) used for the topographical survey and the sounding of the river was taken from the BM on the UNESCO Bldg. in the city of Phnom Penh established at El. + 11.5038. This is based on the M.S.L. of ± 0 at Hatien on the Gulf of Thailand. In the port area, there are 3 BMs which have been extended from the above BM i.e.: existing BM-C (El. + 10.506), and the new bench mark BM-A (El. + 10.140) established this Study Team for this project BM-B (El. + 10.090). (See Fig. 5-11 to 5-12 of Appendix 5)

The Inland Waterways Dept. of MOCTP also makes use of the bench mark and is performing their surveys and sounding to establish the navigation datum.

The water level records of the Tonle Sap River given in Fig. 5-2 of Appendix 5 from the level gauge underneath the Berth No. 5 in Port No. 1. In checking the levels, it was found that the "0" point on the gauge is 7.0 cm higher than the reading taken from the bench mark. It is not clear how this difference came about. By adding 7.0 cm to the recorded data in Fig. 5-2 of Appendix 5 will give the correct water levels.

3.3 The Social Environment

(1) Potable Water Service

The port area is presently supplied with potable water from the Phum Prek Water Treatment Plant of the Phnom Penh City Water Department. The plant is capable of treating 100,000 m^3/day, but due to deteriorated condition of the plant facilities, and the pipe line in the distribution network, it is reported that the actual amount supplied in only 65,000 m^3/day. The main trunk line in the roads outside of the port area are 200 mm in diameter.

(2) Electricity Service

Electricity is supplied by the Phnom Penh Power Corporation to the port area. There are 4 light towers erected at the berth area, but light tower and the distribution wiring are damaged and are not presently used. There are street lights within the port area but they have been damaged and cannot be used. There is a 15 KV underground power cable network provided by the power company from which power can be taken. General electric power rated at 220 V can be obtained from the substation near the port area. The city of

Phnom Penh is currently supplied with power from 4 generating plants. For a demand of approximately 45 MW, the generating capacity is about 45 MW. As the stable supply is said to be about 23 MW, the power situation within the city is very unreliable. Therefore, when providing new electrical facilities to the port area, it will be required to connect the system to the commercial power and also provide a stand-by generating plant as well.

(3) The Roadway Systems in the Hinterlands

Immediately behind the Phnom Penh Port there is the national road Route 5. As the port facility is in the center of the city, the vehicles exiting from the port area will have to cross with the general vehicular traffic. The roads are only 9 m wide (not including pedestrian sidewalks), and the main gate from the Phnom Penh Port is always congested, with traffic being held up by the trucks and cranes from the port. In order to get a feel for the actual vehicular traffic congestion, a traffic survey was conducted.

A traffic survey was conducted of the general vehicles on Rt. 5, and the vehicles from the port area for the direction, type of vehicle (passenger car, trucks, bicycle/motorcycles) for 3 consecutive days beginning December 15, 1992 (07:00 to 18:00 hours) at the Main Gate of Phnom Penh Port.

The survey furnished the following results:

Traffic Volume on Rt. 5, Number of Vehicles/Hour
(Average Volume per hour for 3 days)

Location	Route 5	Route 5	From Port Area	
Direction	North to South	South to North	Exit	Enter
Bicycle/Motorcycle	1,107	943	-	-
Passenger Car	119	112	-	-
Cargo Truck	28	33	9	8

The Survey showed that the bicycle/motorcycle had the largest count. The traffic on Rt. 5 is very heavy, and is an obstruction to the trucks and cargo handling equipment entering and leaving the Phnom Penh Port area. In order to solve this problem, a drastic change of the traffic system in Phnom Penh is required after the Chroy Changwar Bridge construction is completed.

3.4 Description of the Port of Phnom Penh and Related Ports

3.4.1 Description of the Port of Phnom Penh

(1) Description of Phnom Penh Port No. 1

1) The Facilities of Port No. 1 (See Fig. 3-2)

Phnom Penh Port No. 1 port yard is 50 m wide, approximately 400 m long, with an area of 2 ha. The port yard and the Road Rt. 5 is divided by a fence which encircles the yard. There are 3 gates but only the South Gate G1 (Front Gate) is open. The other 2 gates are emergency gates and are opened when there is traffic congestion at the front gate. Although there were wood factories and wood residences constructed in the adjacent yards on the south of the port yard, they were demolished by March 1993 except for a few residences along the river bank. The existing facilities in the project site of Port No. 1 are as follows:

Mooring Piers:

Berth No. 4, (Reinforced Concrete)	83.7 m lg., 12.1 ~ 12.3 m wd.
Berth No. 5, (Reinforced Concrete)	110.2 m lg., 11.2 ~ 12.1 m wd.
No. 1 Access Bridge	35.0 m lg., 5.3 m wd.
No. 2 Access Bridge	34.9 m lg., 5.3 m wd.
No. 3 Access Bridge	34.6 m lg., 4.6 m wd.

Open Storage Yard:

The open lot in the north side of the yard 100 m x 40 m (area between Shed No. 10 and No. 11) is presently being graded by the Department of the Phnom Penh Port preparatory to paving with macadam pavement. Behind Berth No. 4, there is a space approximately 80 m x 40 m open storage yard furnished with asphalt paving. It is used to store empty containers.

Port Yard Road System:

The yard roads are on the river side of the Shed, and are paved. But due to the width of 8 m it is not wide enough and is causing traffic problems in the moving of the cargo. Some damages on the asphalt pavement were observed.

Yard Lighting System:

There are 4 light towers on the pier and 8 light towers and they are all broken and there is no night work being performed.

Water Supply System:

The water supply piping is buried along Rt. 5 (200 mm diameter), with branch piping (50 mm diameter) extended into the port yard. There are no supply pipes onto the piers and berths. Water is delivered to the boats using water tank trucks.

Truck Weigh Scale:

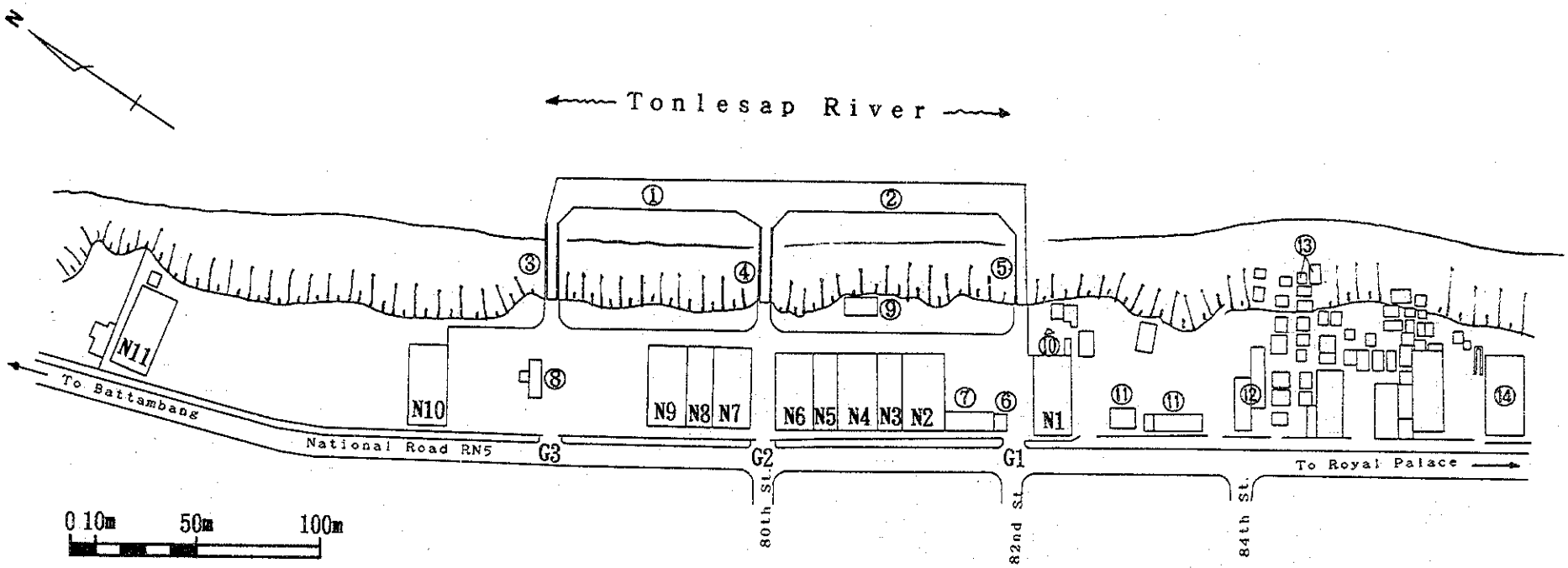
Alongside the north side gate (G3) there is a Soviet made weigh scale installed in 1981. It is not accurate and cannot be calibrated and is abandoned. No repairs have been made.

Shed:

There are 11 Sheds within the port yard. The shed occupancy rate is only 20 % and very little use is made. Some of the roofs are in a very bad state of disrepair.

Toilets:

There is a toilet attached to the Shed on the river side on one entrance the Main Gate (G1). Between access bridge No. 2 and No. 3 on the river side, there is a stevedores rest house and office building.



LEGEND

1 Berth No.4	9 Rest House
2 Berth No.5	10 Public Toilet
3 Access Bridge No.1	11 Offices (Partially demolished)
4 Access Bridge No.2	12 Wood Working Factory (Demolished)
5 Access Bridge No.3	13 Residences
6 Guard House	14 Workshop
7 Customs Office	N1 to N11 Sheds
8 Truck Scale	G1 to G3 Gates

Fig.3-2 Plan of Existing Facilities of Phnom Penh Port No.1

2) Navigation Route and Dredging

The navigation route from the mouth of the Mekong River to Phnom Penh Port has a large fluctuation in the water level throughout the year. Dredging is needed to keep the channels navigable for the ocean going vessels.

Navigation on the Mekong River waters within Cambodia are under the jurisdiction of the Inland Waterways Authority of MOCTP which is responsible for the navigable waterways from 160 km upstream of Phnom Penh and 100 km downstream to the border of Vietnam, including hydrographic survey, maintenance, dredging and maintaining of navigation aids. There are 7 sunken vessels in the 100 km waterways from Phnom Penh to the border, of which 3 are obstacles for the passage of vessels. There is a large amount of sedimentation at Quatre Bras, 2 km downstream from Phnom Penh, at the confluence of the Mekong and Tonle Sap Rivers. There is an access channel, 60 m in width and 850 m in length, where annual maintenance dredging is needed. There are no navigational beacons to identify the navigation channel at Quatre Bras. Vessels use the land marks such as roofs, tall buildings and the spire of the Royal Palace as navigation targets.

The navigation routes are kept open by the following two suction dredgers. The maintenance dredging was started in February 1993 and expected to be completed by April 1993.

	Main Engine	Auxiliary Engine
Dredge Boat 1	840 HP	150 HP
Dredge Boat 2	1,200 HP	400 HP

Maintenance dredging is performed in front of Berths No. 4 and No. 5, in front of the pontoon of Berths No. 5b and No. 5c, the access channel at Quatre Bras and approximately 7 km downstream at Chrouy Ampil, for a total of four locations. The depth of dredging is elevation -5.0 m at the channels and in front of the berths. The dredging period is mainly from December to January every year when the water level is low and the number of vessels are few.

The area dredged are as follows:

Location	Length (m)	Width (m)	Depth (Elev. m)
Access Channel	850	60	-5.0
Berths No. 4, 5	345		-5.0
Berths No. 5b, 5c	190		-5.0

The maintenance dredging performance in the port area has been as follows:

Maintenance Dredging Performed at Phnom Penh Port

Unit : Dredged Volume (1,000 m^3)
Construction Cost : 1,000 Riel

Year	Access Channel		Port No. 1 (Berth No. 4, No. 5)		Port No. 2 (Berth No. 5b, No. 5c)	
	Dredged Volume	Cost	Dredged Volume	Cost	Dredged Volume	Cost
1982	-	-	Unknown	N/A	-	-
1986	-	-	Not Determined	N/A	40	-
1987	54	838	-	-	-	-
1988	80	1,620	-	-	-	-
1989	83	N/A	-	-	-	-
1990	61	N/A	36	1,910	-	-
1991	29	5,000	18	3,330	-	-
1992, 1	136	63,000	-	-	35	15,000
1993, 2	87	87,000	-	-	-	-
1993, 4 Scheduled	-	-	67	67,000	55	55,000

Note: Dredging Unit Cost Dec. in 1992 is 1,000 Riel/m^3

3) Pier Structures

Field investigations were carried out for existing pier structures, i.e., Berths Nos. 4 and 5, and Access Bridges Nos. 1, 2 and 3. The structures are all in an advanced stage of deterioration. Numerous cracks are observed on the deck slabs, beams, and columns of those structures.

The years of construction and repairs of Berths Nos. 4 and 5 are shown in the table below. The cross sections of Berths Nos. 4 and 5 are given in Fig. 6-2, 6-6 and 6-7 of Appendix 6.

	Pier		Access Bridge		
	Berth No. 4	Berth No. 5	A/B No. 1	A/B No. 2	A/B No. 3
Constructed	1952	1960	1952	1952	1960
Repaired (latest)	1987	1987	1991	1984	1987

Note: The numbering of Access Bridge is, from up to downstream, A/B Nos. 1, 2 and 3.

Berth No. 4 is 12.3 m wide, and is divided into 3 blocks of 17.5 m, 17.0 m and 49.3 m with the overall length of 83.8 m. The deck is 20 cm thick. Their is a concrete curb at the edge of the deck. The foundation of the columms were supported by the 35 cm x 35 cm Dia., 11 m long precasted concrete piles. The number of foundation piles were mostly two except the first and seventh column foundation from upper stream at the river side which has 3 concrete piles and the fifth column which has 4 concrete piles. Berth No. 4 was repaired in 1987 at which time the beams and diagonal beams (30 cm x 30 cm) were repaired and strengthened.

Berth No. 5 has a width of 11.2 ~ 12.1 m with a total overall length of 100.5 m and is also divided into 3 blocks of 34.2 m, 32.0 m and 34.3 m. The deck is 20 cm thick. There is no concrete curb at the landside edge of the deck. At the time of construction, there were 35 cm x 60 cm columns running parallel to the face line of berth at 6.5 m spacing, and spaced 8.2 m in the cross section of berth. There are horizontal intermediate beams 4 m below the deck, 20 cm wide and 40 cm high running parallel to the face line of berth and 25 cm wide, 50 cm high beams are running at right angles, connecting to the columns. Column foundation is made of concrete footing with 2.4 m x 3.0 m and the thickness of 1.5 m. The column foundations are supported by three 35 cm x 35 cm Dia., 11 m long precast concrete piles. Berth No. 5 was repaired in 1983. The repair was made due to damages caused by a vessel which rammed and shifted the berth. Steel piles (one foundation pile fabricated by welding 2 I-beams of 20 m length to make a cross section of 400 mm x 360 mm with a steel plate of 10 mm, to which 2 each vertical and batter piles were added at each location) were added, the pile caps were strengthened, columns (600 mm x 600 mm cross section) were added on both the river and land sides, and fender foundations (300 mm x 2,400 m cross section) were added.

Access Bridges A/B No. 1, A/B No. 2, A/B No. 3, have a width of 5.3 m, 5.35 m, 4.6 m including the pedestrian walkways with a deck 20 cm thick. The concrete deck has potholes and the reinforcing steel exposed and cracked in many places. The columns have a cross section of 30 cm x 25 cm and the horizontal intermediate beams have a cross section of 30 cm x 30 cm. Access Bridge A/B No. 1 and A/B No. 2 have pedestrian walkways on both sides but A/B No. 3 has a walkway on the upstream side only. New columns have been added to A/B No. 1 and A/B No. 2. The old column and beams of the intermediate beam of the access bridges are delaminated and have their reinforcing steel exposed in many places.

The columns and beams of A/B No. 3 have many cracks and the reinforcing steel is exposed on the surface, and repairs have been made to column by increasing their cross section, and some places have been reinforced with angle irons.

(2) Investigation of Piers to Check Their Degree of Deterioration

1) Existing Condition of the Piers

The pier structures are all at a very advanced stage of deterioration, and the results of investigation are reported as follows. (Refer to Figures in Appendix 6)

Berth No. 4

The mortar covering the coarse aggregate of the concrete structures of the columns and intermediate beams under water at high water level were missing and gone.

The column have cracks throughout, and there are some tops of column on the river side and connections of intermediate beams that have cracked through their entire section.

The columns and intermediate top and bottom beams have the concrete cover missing and the reinforcing steel is exposed in many places.

The bottom surface of the pier deck have many cracks, and the concrete has broken off and the reinforcing steel is exposed in many places. The top surface of deck also has the reinforcing steel bar exposed in many places with many cracks.

Only the upper portion of the foundation piles were observed, but the concrete cover mortar were missing and gone. Some reinforcing steel bars are exposed at the top of concrete pile. The foundation concrete footings were covered with concrete many of which are cracked and exposed reinforcing steel bars. Concrete beams which are connecting concrete footings with each other also have many cracks and reinforcing steel bars exposed. There is also some beams which are severely damaged and exposing reinforcing steel bars.

This Berth No. 4 was constructed in 1952 and is 40 years old, and it has deteriorated to an advanced stage.

Berth No. 5

Berth No. 5 is in better condition than Berth No. 4, but the mortar cover on the columns and beams under high water level are missing. The columns are badly cracked, and there are many breaking portions at tops of columns on the river side and connections of intermediate beams. The concrete cover is missing and the reinforcing steel is exposed on the columns, intermediate beams top and bottom beams.

The bottom surface of the deck is cracked, the concrete missing, and the reinforcing steel is exposed. The top surface of deck have reinforcing steel exposed, and there are many cracks all over.

Precast concrete piles were covered with concrete footing at the top portion and protected with surrounding concrete tube. At the eighth foundation from the upstream at the river side, the concrete tube was slipped down and foundation piles can be observed. This foundation was located at the least shifting place at the time of berth damage when the ship rammed. Three precast concrete piles can be seen. The concrete cover mortar were missing, but cracks at the connection with pile and foundation could not be observed. The column is placed on this pile foundation footing.

This Berth was constructed in 1960 and is 32 years old, and seems to be badly deteriorated. It was reinforced in 1983 with additional steel piles, the tops of columns strengthened, and the columns were increased.

2) A Check of the Stress in the Pier Structure Members

The present piers are used to unload the cargo from vessels, and without storing on the decks, the cargo is loaded directly onto the trucks and transported outside of the port area. The loads on the decks are the trucks or the unloading cranes in case of this method of cargo handling. The typical cross section of the pier structures is as shown in Figures in Appendix 6. The spacing of the column in the direction parallel to the face line of berth is 6.0 m for Berth No. 4, and 6.5 m for Berth No. 5. The gross truck load in accordance with the Japan Road Standards are 20 ton (T-20) and 14 ton (T-14). The stress on the deck slab, beams and column for these condition on the pier structure has been calculated and given in Table 6-2 in Appendix 6.

As shown in the table, Berth No. 4 was checked by a truck with a gross weight of 14 ton, and the stress in the members could exceed the allowable stress. The repairs of the berth should take into consideration the slabs, beams, columns and the foundation piles as a whole. As the concrete is cracked and the reinforcing steel is exposed, this work will be very complicated to perform. In addition, by utilizing the existing structure to make the repairs using construction equipment on the piers will requires strengthening of the foundations, columns, and beams beforehand.

If a truck with a gross weight of 20 ton is mounted onto Berth No. 5, the structural members will exceed the allowable limit. By adding one pile in the center of the slab, and adding a new slab to strengthen the slab, still some structural members will exceed the allowable limits.

All the access bridges have a deck with a thickness of 20 cm, and even with the present restriction, a truck with a gross weight of 20 ton would overstress the members as the concrete is cracked and the reinforcing steel is exposed.

(3) Cargo Handling Equipment

The Cargo Handling Equipment currently used at the Phnom Penh Port are as follows:

Truck Cranes	9 Ea.
Fork Lifts	6 Ea.
Trucks	16 Ea.

The above trucks are also used at Port No. 2. In addition to the above there are two sets of belt conveyors that are used only at Port No. 2, and there are many abandoned unserviceable belt conveyors in the Service Garage. An investigation of the equipment has revealed that the equipment is in very poor condition. This can be attributed to the deteriorated condition of the equipment, the poor repair and service shops, and the shortage of spare parts. The capability of the repairmen are no problem as they are well qualified. The medium-sized truck crane (hoisting capacity 15 ~ 25 tonnes), and the small cranes (hoisting capacity 6.5 tonnes) are all very old. The forklifts and trucks could be repaired if the spare parts could be obtained. The present condition of the equipment are as follows: (Report of Investigation is given in Appendix 7)

1) The Present Condition the Cargo Handling Equipment

a) Truck Mounted Cranes:

	Hoisting Capacity (ton)		Country of Manufacture	Year Manufactured	Present Condition
(1)	25.0		USSR	1985	Equipment is in a bad condition but could be repaired if spare parts can be obtained.
(2)	25.0		USSR	1987	Not used.
(3)	16.0		USSR	1984	In bad condition. Should be replaced.
(4)	16.0		China	1979	In bad condition. Should be replaced.
(5)	6.5	KATO	Japan	1980	In bad condition. Could be repaired with spare parts.
(6)	6.5	KATO	Japan	1980	In bad condition. Could be repaired with spare parts.
(7)	6.5	KATO	Japan	1980	In bad condition. Could be repaired with spare parts.
(8)	6.5	KATO	Japan	1980	In bad condition. Could be repaired with spare parts.
(9)	6.5	KATO	Japan	1980	In bad condition. Could be repaired with spare parts.

b) Forklifts:

	Max. Load (ton)	Manufacturer	Year Manufactured	Present Condition
(1)	4.0	Komatsu	1980	In bad condition, but can be repaired if spare parts obtained
(2)	4.0	Komatsu	1980	In bad condition, but can be repaired if spare parts obtained
(3)	4.0	Komatsu	1980	In bad condition, but can be repaired if spare parts obtained
(4)	4.0	Toyota	1980	In bad condition, but can be repaired if spare parts obtained
(5)	4.0	Toyota	1980	In bad condition, but can be repaired if spare parts obtained
(6)	4.0	Toyota	1980	In bad condition, but can be repaired if spare parts obtained

c) Trucks (Load Capacity 8 ~ 12 tonnes):

	Make (Country Manf'a)		Present Conditions
(1)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(2)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(3)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(4)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(5)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(6)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(7)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(8)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(9)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(10)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(11)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(12)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(13)	KAMAZ	(USSR)	In bad condition, but can be repaired if spare parts can be obtained
(14)	MZA-PLATE	FORANE	In bad condition, but can be repair if spare parts can be obtained
(15)	FUSO-FN	(Japan)	In bad condition. Should be replaced.
(16)	FUSO-FN	(Japan)	In bad condition. Should be replaced.

2) Spare Parts

a) Truck Cranes

There are no more spare parts for the cargo handling equipment of ex-USSR and Chinese manufactures and it will be very hard to get the spare parts in the future. There are spare parts for the present truck crane of Japanese manufacture of KATO, but the available quantities is about 10 % of the required stock for the normal operation. The parts are still manufactured and are available to be imported.

b. Forklift

There are spare parts for the present forklift of Japanese manufacture of KOMATSU and TOYOTA, but the available quantities is about 10 % of the required stock for the normal operation. The parts are still manufactured and are available to be imported.

The storage room is within the repair shop and has adequate space. The quantities of the spare parts are very few and it is very hard to keep the equipment to be maintained in operational condition. When importing new equipment, it is recommended to import the type of equipment presently used so that they could be repaired.

3) Repair Shop for Cargo Handling Equipment

The Department of Phnom Penh Port owns a repair shop with 2,000 m^2 approximately 200 m south of Port No. 1 which has a machine shop (with lathes, drilling machines, etc.) but the machineries and the shop building are deteriorated and are beyond their useful age. For this reason a request for a replacement shop, overhead traveling crane and shop machines has been submitted to the World Bank and the Government of Denmark to which there has been no response, and the necessary improvements cannot be made for this work.

4) Service Garage for Cargo Handling Equipment

The present service garage of 40 m x 100 m for the cargo handling equipment is located in an area 200 m away from the above repair shop. However, neither the garage or the yard is paved and there is no garage

with a roof. The Department of Phnom Penh Port is presently reconstructing a service garage with a 76.5 m x 8 m (partially 6 m) garage building locates at 200 m southward from repair shop along the Tonle Sap River.

(4) Foreign Cargo Operation at the Port of Phnom Penh

1) The Statistical Data and Problem

The statistical data obtained of the port operation during the investigation are as follows:

(a) The Volume of Cargo Handled at Phnom Penh Port (1985 ~ 1992) ---------- Table 8-1 of Appendix 8

(b) The Number of Vessels Entered at Phnom Penh Port Classified by Country (1985 ~ 1992) ---------- Table 8-2 of Appendix 8

This data has been compiled by the Planning Section of the Department for 8 years from 1985, but the information recorded has not been classified properly and recorded manually (not computer processed), with the result that the detailed information of the item can not be extracted. Especially, the breakdown of the general cargo, which is 50 % of the entire cargo handled, cannot be obtained from the data. Also, the cargo handled at the foreign cargo pier (Port No. 1, Port No. 2, and the cargo lightered by barges) has not been properly classified, and there is no way to determine the cargo handling capability for each Port.

As trucks cannot enter to the pontoons at Port No. 2, it has been used to handle domestic cargo from the small vessels, but due to the increase of the foreign goods, it has been converted to handle foreign goods since September 15, 1991.

The foreign goods that requires special attention are, ① the goods imported from Vietnam by barges, cement, rice, fertilizer, etc. A part of this cargo is recorded in the data described above, but a greater part of this cargo is landed at the river banks over a wide area and no clear data are

obtainable: ② the other point is the ungrazed brick for building houses imported by barges from Vietnam which is not recorded:
These items are assumed to be imported in large quantities.

2) The Raw Data Collected and the Analysis

In order to determine the problem of the statistics, and to grasp the real condition of the good handled by the various ports, the raw data during 1992, and the observation during the 2 weeks of the site investigation are described.

Description of Data	Source of Data	Period
1) Statement of Facts	Dept. of Phnom Penh Port	Jan. 1, '92 - Dec. 19, '92 (328 vessels)
2) Manifest	Shipping Companies	Latter half of 1992 (145 vessels)
3) Terminal Performance Report	Study Team/ Dept. of Phnom Penh Port	Dec. 7, '92 - Dec. 20, '92 (14 vessels)

The analysis of this data is as described in subparagraphs 3) and 4) which follows.

3) The Record of Vessel Entering Phnom Penh Port

(a) The total number of vessels entered into Phnom Penh Port 328 Vessels
(Foreign Trade: Jan. 10, 92 ~ Dec. 19, '92)

(b) Total gross tonnage of above vessels (GRT): 225,226 tonnes

(c) Average tonnage per vessel (GRT): 687 tonnes/vessels

(d) Dimension of Large Vessel Entered Phnom Penh Port and Description of Cargo

Name of Vessel	M/V Socofil Trade (Largest)	M/V Angkor Wath 01
Nationality	Panama	Cambodia
Type of Vessel	General Cargo	General Cargo
DWT	6,266 Tonnes	3,230 Tonnes
GRT	4,860 Tonnes	2,574 Tonnes
NRT	2,196 Tonnes	1,314 Tonnes
LOA	111.6 m	91.8 m
B	18.0 m	14.0 m
Full draft	5.8 m	5.5 m
Draft when entering	4.0 m	4.2 m
Period stayed	Aug. 26, 92 ~ Sep. 3, 92	5 times during '92
Time loading/Unloading	Aug. 26, 92 ~ Aug. 31, 92	
Cargo volume	908 Tonnes	Each Time 500 ~ 700 Tonnes
Entered Port	Port No. 1	Port No. 1

Note: According to the pilot of the Department of Phnom Penh Port the largest vessels that can navigate the Mekong River is not only restricted by the ship's draft of 4.2 ~ 5.2 m, but is also limited by the maximum length of 110 m due to the configuration of the river. The M/V Socofil Trade is the largest vessel meeting this limitation.

(e) The Number of Vessels Entered by Port:
(Foreign trade: Jan. 10, '92 ~ Dec. 19, '92: breakdown of 328 vessels)

	Port No. 1	Port No. 2	Barge Handling (Lightering)	Total
Total Vessels Unloading (Import)	277 (277)	81 (81)	1 (1)	359 (359)
Total Vessels Loading (Export)	62 (47)	25 (17)	21 (16)	108 (8)
Total Vessels	281	96	22	399

Notes:

1. The numbers in the tables show vessels number handling cargo at 2 or more port locations, therefore the total number of vessels entering are in excess of the number of vessels entering Phnom Penh Port.
2. The number in brackets indicate the cargo information obtained from the "Statement of Facts", "Manifest".

(f) The Number of Vessels Entered by Nationality:
(Foreign trade: Jan. 10, '92 ~ Dec. 19, '92: breakdown of 328 vessels)

Unit: vessel

Panama	223	Cambodia	4
Honduras	28	Singapore	3
Vietnam	22	Denmark	6
Thailand	22	Germany	1
Malta	12	Panama	2
Indonesia	4	Kingston	1
		Total	328

(g) Number of Vessels by Embarkation Port:
(Foreign trade: "Manifest", breakdown of 145 vessels last period in 1992)

Singapore	116 vessels
Thailand	13 vessels
Indonesia	5 vessels
Hong Kong	8 vessels
Vietnam	2 vessels
China	1 vessels
Total	145 vessels

(h) The Occupancy of the Berths, and Demurrage Times

The record of the 328 vessels that entered the Port of Phnom Penh during the period Jan. 10 through Dec. 19, 1992 are summarized for their average time in port, average delayed times, and the average times of berthing as follows;

a) The average time required from the time of entry into the port to the time mooring at berth (average demurrage time) : 78 hours

b) The average time moored at the berth to the time of departure (average berth occupancy time) : 114 hours

c) The average time after departure from the berths to the time required to leave the anchorage : 40 hours

Total Average Time in Port, total a) + b) + c) : 232 hours

The average number of vessels that are occupying the berths simultaneously at Port No. 1 and No. 2 are 4.5 vessels.

4) The Volume of Cargo Handled at the Port of Phnom Penh:

From the raw data in paragraph 2), the following information was obtained for the period Jan. 10, '92 ~ Dec. 19, '92 (328 vessels):

Note: The figures shown hereunder are converted to be one year volume by using the proportion between aforementioned sampling period (Jan. 10, to Dec. 9, 1992: 345 days) and one year of 1992 (366 days).

(a) Export (for investigated vessels only)

Name of Port	Lumber (tonne)	Rubber (tonne)	Farm Products (tonne)	Textiles (tonne)	Total (tonne)	No. Vessels Called	Avg. Volume per vessel (tonne/vessels)
Port No. 1	3,535	10,481	1,524	4	15,544	50	311
Port No. 2	120	2,774	3,994	0	6,888	18	383
Lightering	0	3,811	1,609	0	5,420	17	319
Total	3,655	17,066	7,127	4	27,852	85	328

(b) Imports (1992)

Name of Port	General Cargo (tonne)	Rice (tonne)	Cement (tonne)	Fertilizer (tonne)	Sugar (tonne)	Cigarette (tonne)
Port No. 1	108,772	13,790	3,514	2,865	1,061	0
Port No. 2	17,624	3,008	2,593	530	0	1,810
Lightering	0	0	460	0	0	0
Total	126,396	16,798	6,567	3,395	1,061	1,810

Reinf. Steel (tonne)	Total (tonne)	No. Vessels Called (Vessels)	Avg. Volume per Vessel (tonne/vessel)
541	130,543	294	444
0	25,565	86	297
0	460	1	460
541	156,568	381	411

(c) Foreign Trade (Export + Import) Volumes

(Tonnes)

Name of Port	Export	Import	Total
Port No. 1	15,544	130,543	146,087
Port No. 2	6,888	25,565	32,453
Lightering	5,420	460	5,880
Total	27,852	156,568	184,420

Of the exports, as description par. 3) (e) in the No. of Vessels Entered, a part of the data is missing. If this information is adjusted proportionally by the number of vessels, the foreign trade volume for 1992 would be as follows:

(1992)

Name of Port	Export	Import	Total	
Port No. 1	20,505	130,543	151,048	(78 %)
Port No. 2	10,129	25,565	35,694	(18 %)
Lightering	7,114	460	7,574	(4 %)
Total	37,748 (19 %)	156,568 (81 %)	194,316	(100 %)

The exported cargo could be adjusted as follows. (imports would be the same as (b))

Export (1992)

Name of Port	Lumber	Rubber	Farm Products	Textiles	Totals
Port No. 1	4,663	13,826	2,010	6	20,505
Port No. 2	176	4,079	5,874	0	10,129
Lightering	0	5,002	2,112	0	7,114
Total	4,839	22,907	9,996	6	37,748

Based on the above results, the volume of cargo handled per linear meter of the berth could be assumed as follows:

Port No. 1: 151,048 t ÷ 183 m = 825 t/m/yr
Port No. 2: 35,694 t ÷ 90 m = 397 t/m/yr

In the above data, there is some difference for the figures for rice, cement and fertilizer with the data in Table 8-1 of Appendix 8 by the

Planning Sect. of the Department, and this can be attributed to the cargo unloaded on the river banks. Also, the data for the ungrazed brick from Vietnam is not recorded.

(5) Utilization of the Port of Phnom Penh

1) The Types of Cargo Handled:

a) Port No. 1 (Berth No. 4, No. 5):
Of the foreign cargo, general cargo, the large sized cargo, construction equipment, and containers are handled.

b) Port No. 2 (Pontoon Berth No. 5b, 5c)
Farm products (those that can be handled by belt-conveyor such as bagged rice, bean products, etc.), and automobiles that are capable of being self propelled on the ramps.

c) The River Banks

- Foreign imports such as cement, rice, fertilizer stuffed in bags by barge from Vietnam.
- All domestic items

d) Oil products are handled at Km-4 and Km-13 as described hereinbefore.

2) Port Activities:

The cargo handling, efficiency, barge turn around, delay of vessels were investigated and recorded (2 weeks study), and an analysis of 14 vessels moored at Port No. 1 has been prepared. The mooring of the vessels are as shown in Table 8-3, and Fig. 8-1 of Appendix 8 which shows the berths to be occupied for 100 % and more. Fig. 8-1 of Appendix 8 shows the vessels being shifted around in small degrees, and the reason for this is that the bow or stern is beyond the pier end and it is necessary to align the ship's hatch to line up with the pier. The loads, unloaded cargo, time for loading/unloading, loading efficiency of the berths are given in Table 8-4 of Appendix 8.

The observed records and the data have revealed the following features:

a) The general cargo and imports are from Singapore, Thailand, etc., except for the 2 barges of rice from Vietnam with aid supplies, and the imports from Singapore consist of more than 50 % of general cargo.

b) The vessels that carried the imported goods are almost empty on their return trip except for some farm products, lumber, and a few export items.

c) The 15 vessels listed in Table 8-4 of Appendix 8, with the exception of 4 vessels of Universal, Nhat Tao, Lighter DM157, DM074, the remaining 11 ply the Singapore, Bangkok, Hong Kong, Phnom Penh route on a regular schedule (Refer to Table 8-5 of Appendix 8, The Scheduled Vessels at Phnom Penh Port).
The Universal is a second hand Japanese vessel, and was on its trip to Vietnam to be sold and when it called at Hong Kong, it was loaded with cargo destined for Phnom Penh.

d) The cargo is made up of small lots except for the rice carried by lighters and sugar carried by Naga Rose (501 tonnes).

e) There were only 28 units of 20-foot containers which came into Phnom Penh Port during the investigation period, and there were 33 units of 20-foot containers which were taken out empty.

f) The incoming vessels are expected to be on stand-by status to moor, and during the investigation period there were 4-5 vessels waiting to moor and unload. Waiting time to unload seems to be long as 3 to 4 days. The average waiting time for 13 vessels were 87.5 hours per vessel.

g) There is also delays in departing, and the delays amounted to an average of 38.4 hr/vessel. The reasons given were:

- departure delayed due to late finish of unloading in the afternoon
- delay in the pilot to board the vessel at Phnom Penh
- waiting to have pilot scheduled at the Vietnam border
- mechanical troubles
- waiting for cargo to be collected at Singapore and other ports
- and other reasons.

h) The volume of cargo handled per gang on the 14 vessels investigation are as follows:

- the volume of cargo handled per gang is 11.3 t/hr/gang, and the volume per shift gang is 90.7 t/shift/gang (for the 14 vessels, the average cargo unloaded is 444 tonnes, the total 6,219.6 tonnes, and the total times of 548.5 hr was used in the calculation)

- the largest volume by the shift gang was for the rice imported from Vietnam of 175.3 tonnes (the No. 10 Lighter was 175.3 tonnes, No. 13 Lighter was 129.0 tonnes/shift/gang). The reasons that such a large volume was unloaded are stands in front of the trucks which made working level same height with trucks' loading deck, and simple handling works by many labourers.

- the largest volume of general cargo handled was 109 tonne/shift/gang (No. 8 Hosho Maru), and the least volume was 35 tonne/shift/gang (No. 11 M/V Sheraton II). This was due to the failure to arrange the dispatch of trucks properly by the middleman.

Notes:

1. The volume handled by the shift gang is based on a 8 hr/shift, and there is break time which should be considered and so a efficiency factor of 0.7 ~ 0.8 should be applied.
2. If a factor of an average of 90.7 ton and an efficiency factor of 0.75 is applied, and the annual volume is recalculated for Port No. 1 the volume will become 143,000 tonnes, and agrees well with the foreign trade volumes of 151,048 tonnes given in paragraph 3.4.1 (4), 4) (c).

   Annual Volume Handled = (average number of gangs) x (volume of shift/gang) x (efficiency) x (number of days worked)
   = 7 x 90.7 x 0.75 x 300
   = 143,000 tonnes.

i) The problem in the unloading work are as follows:

- those related with the structure of the piers.

  - The weight of containers is limited to 10 ton/each in the wet season and 8 ton/each in the dry season at Berth No. 5 which is sturdier than Berth No. 4.

  - Lowering of the weight of carrying efficiency of Ac. ss Bridge No. 3 on the downstream side which is comparatively stronger of the three.

  - To avoid strong impacts to the berths when mooring, and the time lost at times of change of shift.

- loss of transporting efficiency of the piers and access bridges due to the lack of width.

- due to the small size of the open storage yard, there is loss in the efficiency of the cargo handling equipment. This problem is related with the weight restriction of the berths.

- delays in the consignee of the cargo to show up with his trucks. (Note 1)

- mechanical breakdown of cranes making it impossible to receive cargo.

- breakage of crates and delay in claiming cargo. (Note 2)

- in picking up raw rubber, delays in accepting cargo due to in-sufficient number of forklifts to enter ship's hold.

- loss in efficiency due to lack of pier width and congestion on piers.

- due to non-palletizing of cargo, delay in loading cargo directly on trucks.

Notes:

1) Delay in Trucks

The problems of lack of number of truck was investigated which cause delay in accepting cargo, in addition to the lack of cargo handling equipment, and the time required to clear customs. The tracing of imported cargo was investigated as follows;

- Vessel Investigated: No. 12 Naga Rose
- Type of Cargo: Sanitary wares (bath-tubs, etc.) Wood Packing Case/Weight Approx. 100 kg each. B/L No. B/P005
- Type truck: 20 ft semi-trailer
- Truck Load: 14 crates (approx. 1.4 tons)
- Consignee: Karat Sanitary Ware Co., Ltd. (opposite Hotel Cambodiana, distance from Port gate: 3.1 km)
- Port Authority Crane Used: 6.5 ton truck crane
- By Consignee: Only one 1.0 ton forklift
- Time Study: Dec. 19, 1992

02:56	(0h0m)	Start loading (from ship to truck)
03:21	(0h25')	Finish loading (14 crates) leave pier. Wait for customs clearance papers at Port Gate
03:41	(0h45')	Papers finished. Leave Gate.
03:51	(0h55')	Arrive consignee warehouse. Start unloading with forklift.
04:19		2nd truck arrives warehouse. Wait in line for forklift)
04:42	(1h46')	Finish unloading
04:44	(1h48')	Leave consignee warehouse.
04:58	(2h02')	Return port.

- Problems:

The time cycle of loading at port (25 minutes) and the unloading (51 minutes) by consignee does not agree. This is due to shortage of forklifts at consignee warehouse, and lack of space in warehouse and difficulty to maneuver forklift. The trucks had to wait 23 minutes at consignee

warehouse. There was a 20 min. loss in receiving customs clearance papers. It was not able to be observed this time but the same consignee took receipt of ceramic titles (weight of crate 300 ~ 400 kg) and this required 2 to 3 times more time to take receipt of his cargo.

Notes:

2) Defective Crating

During the investigation period it was noticed that canned cooking oil containers spilled out onto the deck, and cassette tape recorders dropped out of the handling net due to defective crating. The goods in defective crating were transported to Singapore in containers where they were taken out of the containers, and transshipped to Phnom Penh in the defective crates.

j) A major portion of the cargo are loaded directly onto trucks at the pier, and these hauled to the warehouse outside of the port yard. The goods stored in the bonded warehouse at the port were several automobiles, electrical items such as taperecorders, and some textiles that were still being processed through customs. The export items being noted in the shed in the port was some timber cut up into boards and some agricultural product.
The occupancy rate of shed was only about 20 %.

k) The stevedores only worked one shift, and there was no night work. Sundays and legal holiday are not worked.

7:00 ~ 11:30	4.5 hours
14:00 ~ 17:30	3.5 hours
Total Hours Worked	8.0 hours

3) Containerization

a) The containers handled in 1992 was approximately 1,280 TEU, which is estimated to be approximately 12,800 tonnes in weight. The containers that were handled are as shown in Table 8-6 of Appendix 8, transported by 12 vessels for a count of 681 containers (20' size, total weight 6,880 tonnes) to which a few more were added (calculated at 2 pieces per day) to arrive at the figures.

b) In the data on vessels, there were many vessels without the ships manifest and it was difficult to discern the containers, and the short cargo handling times were assumed to be containers. The weight per container was assumed to be 10 tonnes.

c) In the export mode, the containers are almost all sent back empty, and only in rare cases they contain some agricultural produces.

d) As shown in Table 8-6 of Appendix 8 the vessel which has the highest efficiency with container handling is the No. 93 M/V ARKTIS PRINCESS which can handle 81 tonnes per hour, and for a 8 hour shift this equates to 648 t/shift/vessel. The average for the 12 vessels is 29 tonne/hr., and 233 t/shift/vessel.

e) The efficiency with containers exceeds the case of maximum efficiency of general cargo: 109 t/shift/gang. (Compared with 2 gangs per vessel.)

f) The total imported general cargo in 1992 was 269,000 tonnes at Phnom Penh Port, and the containerized cargo volume was 12,800 tonnes or 4.8 % of containerization factor.

Notes:

1. The total number of containers of the vessels that carried a few containers was 28 containers in 2 weeks, and this has been calculated as 2 container/day.
2. The information concerning containers in Table 8-6 of Appendix 8 was extracted from the Ports Activities Record for 1992.

(6) Issues of the Port of Phnom Penh

There are following issues that have been observed at the Phnom Penh Port, so it is not capable of performing its role and is not functioning properly.

1. The berths are not capable of handling the sudden increase of the cargo received recently, and need to be lengthened.

2. Due to the deterioration of the berth structures, the cargo handling efficiency has decreased.

3. The original berth structures were not designed to accept the weight of the containers and the cargo handling equipment at present, and it is necessary to restrict the size and weight of the cargo being received.

4. As the berths and access bridges are not wide enough, and the overall port yard is small, trucks, forklifts and other cargo handling equipment cannot operate efficiently and are lowering their capability.

5. The cargo handling equipment of Chinese and Russian manufacture having frequent mechanical breakdowns, and the lack of spare parts are aggravating this situation.

6. As the electrical supply is not reliable, and the yard lighting system is inadequate, there is no night work being performed when extended work times are required.

7. The above factors are working against each other, and three-fifth of the foreign cargo is handled at the berths of Port No. 1 and the remaining cargo is received on the river banks and also by lightering on to barges in the river. There is no extra capacity to accept any more incoming cargo.

8. The vessels are being delayed in having their cargo unloaded and are required to wait at the basins for several days to one week.

9. There are no navigational aids on the Mekong River for the 100 km from the border with Vietnam to Phnom Penh, and no night navigation is being performed.

10. There are no water supply facilities at the berths.

The Phnom Penh Port is an important distribution centre for the capital city, and the facility is indispensable for the reconstruction and development of Cambodia. In several years time as the economy recovers in Cambodia and aid supplies are expected to bring, in cargo volume will be several times more than at present. With this in mind, the above issues must be resolved and smooth handling could be enhanced, thereby contributing to the socio-economic benefit of Cambodia and stabilize the livelihood of the public at large.

3.4.2 Description of the Port of Sihanoukville (old Kompong Som Port)

Sihanoukville Port is located in Kampot Province on the Kompong Som Bay, and was built by the French in 1960. It is 220 km to the southwest of the capital city. It was originally planned to unload cargo at Sihanoukville Port and to transport the cargo by road (Rt. 4 : distance is 226 km) and the railway (new line: distance is 263 km) to the capital city.

The railway is a single line, and as there is no maintenance and repair of the tracks, the average speed is 30 km/hr., and together with the problem of security, the railway is not fulfilling its mission.

The railway was once used to transport 5,000 tonnes of staple food stuffs in 1992, but almost all cargo is transported by the road since 1989.

(1) The Present Facilities of the Port of Sihanoukville (See Fig. 3-3 and 3-4)

1) The Old Port

There is one wharf built with French Aid in 1960 using a foundation built with a pneumatic caisson and precast concrete beam superstructure (290 m x 29 m, 8.5 m draft), and a small boat mooring. Due to the little cover provided the concrete has become delaminated and the prestressed strands of the PC beam is exposed and rusted with the salt water environment, and repairs are necessary.

2) New Port

The new wharf was completed in 1969, and consists of an extension 350 m long of gravity type concrete blocks. The draft was -10 m when completed which is now -7.5 ~ -6.5 m due to siltation.

The port was planned to be provided with reclaimed land for storage area purpose and the area has a armour stone breakwater running north-south (500 m and 1,800 m partially completed). There is a fishing port in the northeast side of the new port, and there are 5 wood piers on wood piles, ship repair facilities, a shrimp freezing plant (CAMFEXIM), and other related facilities. There are many wood fishing boats (from several tones to 80 tonnes) operating at the port.

3) Port Entrance (see Fig. 3-3)

The bay on the west side of the old port is shallow, and the route for large vessels is the sea channel between Kaoh Poah Island and Sihanoukville, with a draft of -8.4 m. The bay bottom is rock and dredging for large vessels more than 10,000 ton is not easy.

4) Shed

There are 5 sheds at the Sihanoukville Port as follows:

Godown Number	Dimension	Items Stored
No. 1	120 m x 50 m	Fertilizer, Cement
No. 2	120 m x 50 m	Fertilizer, Cement
No. 3	120 m x 50 m	Rice, General Cargo
No. 4	120 m x 50 m	General Cargo
No. 5	120 m x 50 m	*

Notes:
* Shed No. 5 was leased to CAMSIN (Oil Exploring Co.) in June 1992 for 15 years, including pier of 125 m, and area behind the shed of 25,000 m^3

The roofs of the shed leak badly and need repairs except for shed No. 3.

60 % of the cargo unloaded at Sihanoukville Port is stored in shed, and 40 % is transported directly to Phnom Penh by land. The period of storage in the shed is 20 ~ 25 days, and 15 ~ 20 days in open storage.

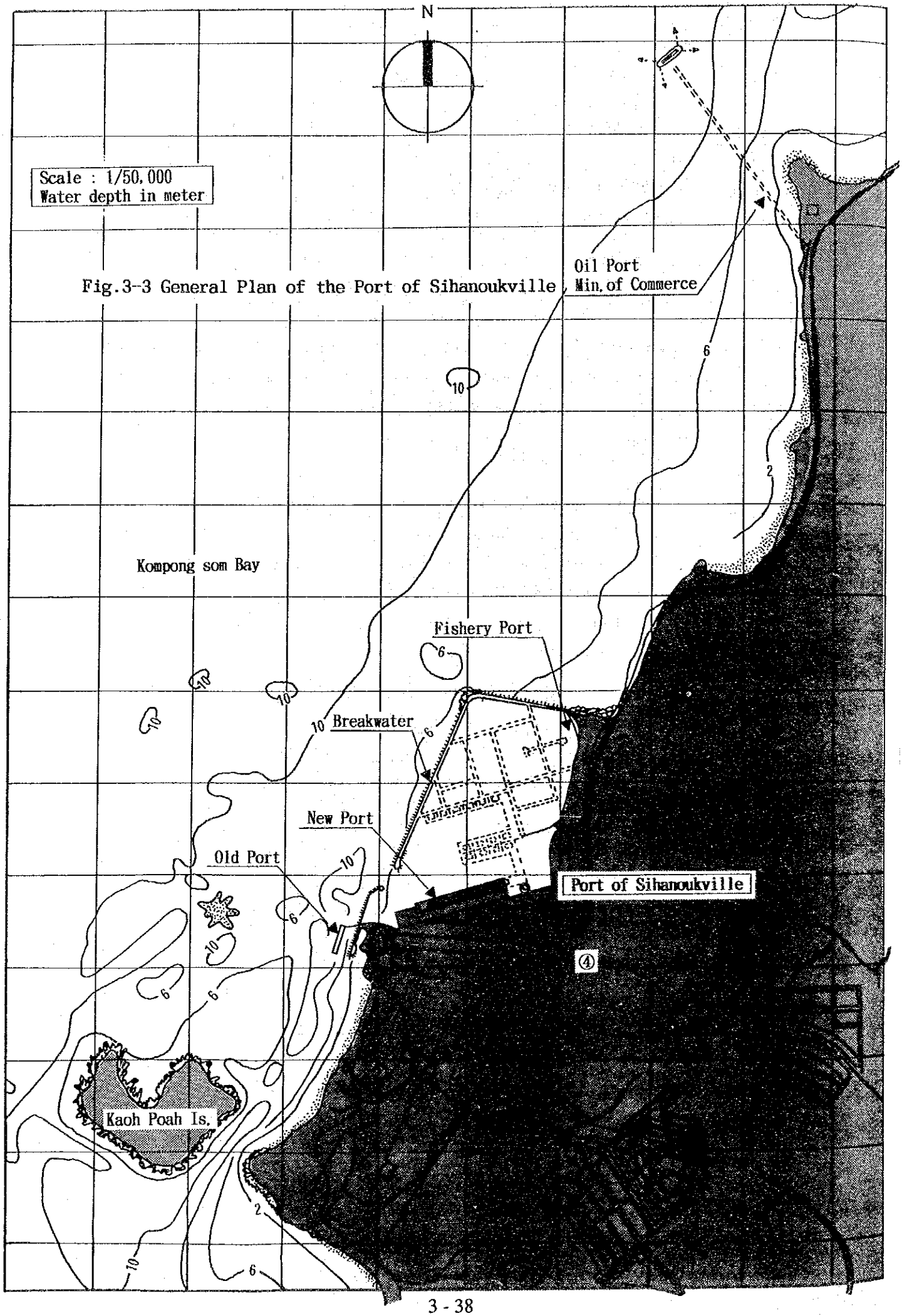


Fig.3-3 General Plan of the Port of Sihanoukville

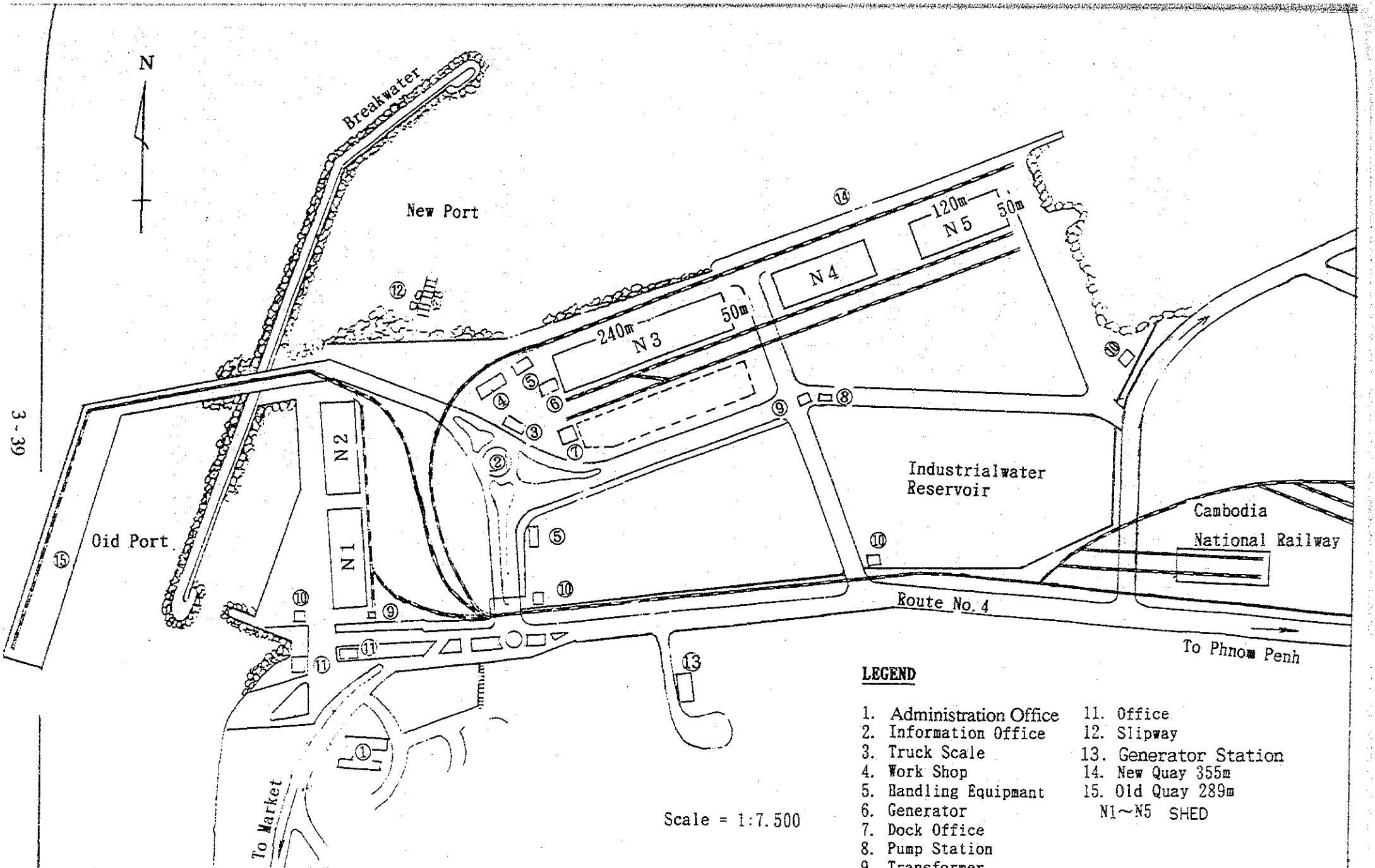


Fig.3-4 Plan of Existing Facilities of the Port of Sihanoukville

5) Cargo Handling Equipment

The cargo handling equipment at Sihanoukville is given in Table 9-1 of Appendix 9. The large cranes were all manufactured in old USSR, and are in need of repairs. There are many other equipment which seem to require repair work.

6) Tugboats

The tugboats and pilot boats owned at the Sihanoukville Port are kept in good condition.

-	Tugboat	600 HP	Made in China
-	Tugboat	1,600 HP	Made in Japan
-	Pilot Boat		Old USSR

7) Facilities required at the Sihanoukville Port

The repairs, facilities and equipment required by the Sihanoukville Port are given in their order of necessity.

(a) Cargo handling equipment

Forklift, 25 tonnes, to use at pier	1 Ea.
Forklift, 25 tonnes, to use in container yard	1 Ea.
Crane, 50 tonnes, to use with containers	1 Ea.

(b) Repair of shed
(c) Rehabilitate electric supply system
(d) Computerize the statistics collection and recording system
(e) Repair of old pier
(f) Repair of breakwaters
(g) Procurement of tugboat, 700 HP 1 Ea.

8) Oil Port (see Fig. 3-3)

The Oil Port is located approximately 9 km north northwest of Sihanoukville, and is equipped with the following facilities:

(a) Pier for 1,500 ton tanker boat (46 m lg. 4.5 m draft)
(b) Mooring facilities for 12,000 ton tankers (Cluster type, 11 m draft), together with submarine pipelines.

(c) Tank farm for storage of 60,000 m^3 of oil and oil refinery.

The mooring and oil refining facilities were operational until 1971, but the facilities were destroyed during the war, and have not been repaired and left abandoned.

(2) The Vessels Calling and the Volume of Cargo at the Port of Sihanoukville

The number of vessels calling at Sihanoukville, their nationality, the volume of foreign cargo, the details of the cargo and volume, the number of container handled are given in Table 9-2 to 9-6 of Appendix 9. The bay at Sihanoukville Port is deep, and ocean going vessels can enter the port directly, with the result that there are more vessels that enter the port compared to Phnom Penh Port. The volume of cargo has greatly decreased as the vessels from the old USSR have dropped in recent years. The type of imported cargo is similar to Phnom Penh Port and consists of general cargo and cement. Significant export is logs.

(3) Usage of the Port of Sihanoukville

With the decrease in the volume of cargo, the mooring facilities and shed are not being used and there are no vessels in waiting. The average number of days of vessels at their port area:

General Cargo Vessels	4 ~ 5 day/call
Container Vessels	24 hr/call

The container vessels take on an average 170 ~ 180 TEU containers in a week, and the contents are general cargo. On the export mode, the containers are generally empty, and in rare cases they are filled with rubber or lumber. Along National Road Route 4 from Sihanoukville to Phnom Penh, there are some bridges destroyed and have only a temporary bridge and there is a weight restriction on the container to 15 ton/container. In practice they carry 23 ton/container, and container traffic to Phnom Penh seems to present no problems.

The amount of containerization in 12 % as shown in the Detailed Volume of Cargo (Table 9-6 of Appendix 9).

The hours of stevedoring at Sihanoukville Port is only 1 shift due to the low volume of cargo, but depending on the volume, it can be increased to 2 shifts.

7:00 ~ 11:30 (1st Shift)
14:00 ~ 17:30 (2nd Shift)
19:00 ~ 23:00 (1st Shift)

(4) The Port Administration at the Port of Sihanoukville

The organization table is given in Fig. 9-1 of Appendix 9.
There is a similarity of the Sihanoukville Port with that of the Phnom Penh Port. The training schedule for the staff of the Sihanoukville staff is given in Table 9-7, the profit and loss statement is given in Table 9-8 of Appendix 9. The financial status is operating with a profit, similar to that of the Phnom Penh Port.

CHAPTER 4 OUTLINE OF THE PROJECT

CHAPTER 4. OUTLINE OF THE PROJECT

4.1 Objectives

The main objective of the Project is to contribute to the restoration of Cambodia through the rehabilitation and expansion of the port facilities, and improvement in port operations at Port of Phnom Penh.

4.2 Study and Examination of the Request

4.2.1 Justification of the Project and Check of Its Necessity

The two main ports in Cambodia are Phnom Penh and Sihanoukville. To check the justification and the necessity of this project, it is necessary to understand their functions, the type of cargo they handle, and distribute the volumes properly.

In the following paragraphs, the functions of the two ports and the demand forecast of Phnom Penh Port will be analyzed.

From these studies, the requested rehabilitation and extension of the berths and improvement of the land facilities and cargo handling equipment will all make the handling of cargo more smooth while reducing delays and damage to the cargo, and it has become evident that it will meet with the future cargo demand and is justified.

(1) The Share of Functions of the Ports of Phnom Penh and Sihanoukville:

The port of dispatch for the vessels entering both ports is mainly from Singapore, so the following two cases are proposed and compared as the representative examples.

Singapore = (Transport by Ship) = (Mekong River)
= Phnom Penh Port = Phnom Penh.

Singapore = (Transport by Ship) = Sihanoukville Port
= (Land Transportation) = Phnom Penh.

1) The Time Required to Travel the Mekong River and the Costs:

The first example of ascending the Mekong River is analyzed.

In the case that the vessel enters Phnom Penh Port from Singapore was considered for the steps that would have to be taken to enter the port, the time required, and costs involved.

(a) Singapore → Vung Tau (Vietnam) : 608 miles
÷ 16 knots = 38 hrs.
(approx. 1.5 dy)

(b) 24 hours prior to ships arrival, the shipping agency (Singapore) wires VOSA (Vietnam Ocean Shipping Agency) to inform arrival of the vessel.

(c) Re- confirm arrival of the vessel 3 hours prior to arrival of vessel at Vung Tau to VOSA by wire.

(d) Vessel anchors at Vung Tau. Performs customs clearance, entrance inspection, quarantine inspection, and await dispatch of pilot.:
Usually 6 hrs. to 1 day. (approx. 1.0 dy)

(e) Vung Tau → Cambodian Border : 124 miles
÷ 5 knot = 24 hrs.
(approx. 1.0 dy)

(f) Ship's Agent (Singapore) informs Dep. of Phnom Penh Port 72 hours prior to vessel arrival at Vung Tau by wire, and request for pilot to be arranged.

(g) Prior to departure from Vung Tau, ship's captain informs KAMSAB (Cambodian Shipping Co.) and reconfirms through Vietnam agent by wire.

(h) Cambodian pilot boards vessel at Cambodian border.
Wait for pilot to board. (approx. 0.5 dy)

(i) Cambodian Border → Phnom Penh : 55 miles
÷ 5 knot = 11 hrs.
(approx. 0.5 dy)

(j) Wait to dock at Phnom Penh. (approx. 1.0 dy)
Total Time, Singapore ~ Phnom Penh (5.5 dy)

Cost Per Ton (DWT)

- Marine cost: US$0.05/ton/mile x 608 miles = US$30.40/ton

- Tonnage Due: $\frac{1\ 000\ (GT)}{1\ 500\ (DWT)}$ x 0.13 x 2 = US$0.17/ton
- Channel Due: $\frac{1\ 000\ (GT)}{1\ 500\ (DWT)}$ x 0.31 x 2 = US$0.41/ton
- Clearance Fee: US$100 ÷ 1,500 = US$0.07/ton
- Pilotage Due: $\frac{1\ 000\ (GT)}{1\ 500\ (DWT)}$ x 0.003 x 179 = US$0.36/ton
- Berthage Due: $\frac{1\ 000\ (GT)}{1\ 500\ (DWT)}$ x 0.23 = US$0.15/ton
- Agency Fee: US$400 ÷ 1,500 = US$0.27/ton

Transportation Costs via Mekong River, Singapore ~ Phnom Penh: see Table 4-1.

2) Cost to Transfer Cargo Sihanoukville ~ Phnom Penh

Transportation cost via Shihanoukville, Singapore ~ Phnom Penh : See Table 4-1. Land Transportation by Truck US$0.084/t/km x 240 km = US$20.2/t.

3) Comparison of Cargo Volume at Both Ports

The comparison of volume of cargo by commodity in 1992 at Sihanoukville and Phnom Penh is as follows.

units : 1,000 ton

	Phnom Penh Port	Sihanoukville Port
Export		
Rubber	27.0	-
Lumber	0.9	72.5
Farm Produce	10.6	-
Others	7.7	0.4
Total	46.2	72.9
Import		
Rise	22.6	8.0
Fertilizer	9.1	7.3
Cement	85.3	59.1
Fuel Oil	-	6.8
Machine	-	20.3
General Cargo	151.6	61.6
Total	268.6	163.1
Grand Total	314.8	236.0

Note: The amount of cargo handled per year is based on 10 months at the Port of Phnom Penh and 9 months at the Port of Sihanoukville.

With the sudden decrease of cargo from the ex USSR, the activities at Sihanoukville Port seemed to be low, but this is expected to increase eventually. The special futures of exports at Sihanoukville is the export of logs, and this is expected to increase. General cargo is the main of the cargo at both ports, and Phnom Penh seems to have a larger amount. This trend should continue as long as there is no change in the land mode of transportation from Sihanoukville Port. The cheapest and safest mode will prevail for a large and continued system of transport of goods.

4) Comparison of Costs

The transport costs per ton of imported cargo, starting at Singapore and Phnom Penh as the destination for ① water transport on the Mekong River; ② Truck transport via Sihanoukville; ③ Railway transport via Sihanoukville; and the comparison of 3 modes is given in Table 4-1.

A study indicates that transportation cost of goods by railway from Sihanoukville Port is cheaper over truck transportation on the same routes. It must be remembered that the transport by the railway does not consider the additional costs for damage and pilferage of the cargo due to the double-handling. Until these problem of transportation by rail can be solved, the importers will continue to use trucks.

Table 4-1 Comparison of Transportation Costs (Singapore to Phnom Penh)

Description	Via Mekong River	Via Sihanoukville (US$/ton)	
	(US$/ton)	Truck	Railway
Sea Transportation	30.4	30.25	30.25
Passage Fee, Berth Fee, etc.	1.66	0.39	0.39
Agency Fee	0.27	0.27	0.27
River Transportation (1)	8.95	-	-
Port Charge (2) (Dys)	(6 days)	(3 days)	(3 days)
	10.00	5.00	5.00
Cargo Handling Fee	-	-	7.00
Land Transport Costs	-	20.20	10.00
Total	US$51.28/t	US$56.11/t	US$52.91/t

1. Vessel size 1,500 DWT (1,000 G.T.)
2. $2,500/day

5) Share of Function

Due to the deep harbour, large port yard space, large shed storage spaces, etc., the Sihanoukville Port facilities should be used for trans-shipment (via Singapore, Bangkok) regardless of the original source of the goods. It should be utilized to export and import of large lots of cargo and utilize the merits of the port.

The Phnom Penh Port should be utilized for the large amounts of consumer goods to the large centers where they will be required, and the port should be used for the distribution center of clean cargo such as general cargo.

With the implementation of Project the basic problem inherent with each port should be resolved and a high degree of port activities should be able to be performed.

With the containerization of cargo, and improvements are made for a safe and efficient port activities, with lowering of transportation costs, the port should be able to provide economic reconstruction from the user to the consumer.

(2) The Demand Forecast

1) The Procedures used to make the Analysis

Based on the data of the Mekong Secretariat ("The Economic Appraisal Study on the Rehabilitation and Extension of the Port of Phnom Penh in February 1992"), the following data are also considered.

(1) The 1st National 5 Year Reconstruction Plan : 1986 ~ 1990
The 2nd National 5 Year Reconstruction Plan : 1991 ~ 1991

(2) The Statistics Data prepared by the Ministry of Planning (Social and Economic Indices).

(3) The Statistics Data prepared by the Department of the Phnom Penh Port.

(4) The Statistics Data prepared by the Port of Sihanoukville.

(5) Data Cargo Manifest from the Shipping Companies.

(6) The Port Cargo Activities Report (Dec. 7, 1992 ~ Dec. 20, 1992)

The study was centered on Berths No. 4 and No. 5 (Port No. 1) which is the objective of this report for the foreign goods.

2) The Principal Socio-Economic Indices

The various indicators for the socio-economic indices for Cambodia are given in Tables 10-1 to 10-5 of Appendix 10-1.

The data may differ somewhat depending on the source they were quoted from.

3) Description of the Forecast by the Mekong Secretariat

The demand forecast study by the Mekong Secretariat forecasts the principle export items in 1995, 2000, 2010, as they would affect the whole country, together with a forecast of the share portion of Phnom Penh, Sihanoukville and other routes, and estimated the volumes for Phnom Penh and Sinavoukeville Ports. This is shown in Table 10-6 of Appendix 10-2. The figures in the [ ] was not shown in this report, but in order to simplify comparison with the actual figures for 1990 and 1991, the figures obtained proportionally was shown as complementary.

4) An Analysis of the Breakdown Volumes Forecast

Based on the aforementioned procedures and data, an analysis of the breakdown volumes forecast was made on individual items of rice, rubber lumber and others for export and on food, fertilizers, oil, construction materials, and machinery and manufactured items for import as shown in Appendix 10-3.

5) Comparison of the Demand Forecast

When the actual cargoes handled in 1992 at Phnom Penh and Sihanoukville ports are compared with the demand forecast of the Mekong Secretariat which is shown in Table 10-6 of Appendix 10-2, the results are shown in Table 10-27 of Appendix 10-4. The items given in the statistics at Phnom Penh and Sihanoukville ports have been combined with those of the Mekong Secretariat.

6) Conclusion

From the above studies of the consolidated data the following conclusion was devised of the demand forecast.

a) The figures of the Mekong Secretariat for the exports at Phnom Penh and Sihanouville Port are in close agreement with the actual figures.

- In view of the fact that the present and future port facilities at Phnom Penh are not suited for the export of logs, the ratio of share for 1995 has been set at 20:80 between Phnom Penh and Sihanoukville Ports.

- The export of red beans of farm produce has been adopted from the 5-Year Plan.

- The export of maize has been adopted for 1/3 of the 5 Year Plan.

b) The imports have shown a large increase with the recent improvements in the social and economic conditions in Cambodia as can be seen in the comparative tables. Especially the increase in "Machinery and Manufactured Items" during 1990 ~ 1992 has been several times over the previous years, and in 1992 the figures exceeded the figure by the Mekong Secretariat for the year 2010. The "Machinery and Manufactured Items" at Phnom Penh Port in 1992 was 56 % of the imports, and 46 % of the foreign trade. The Department of the Phnom Penh Port are treating this item as general cargo in their statistics. In order to supplement this investigation, the Study Team conducted an investigation of the Import/Export Cargo Items between Dec. 7 to Dec. 20, 1992 during their short stay. The results are given in Table 10-28 of Appendix 10-5.

The cargo investigated was the incoming cargo at the port of the 14 vessels during this period. Of the 14 vessels, the 2 barges No. 10 (Lighter) "DM 157" and No. 13 (Lighter), "DM674" brought in bagged rice as a single commodity (each approx. 860 t), but the other 12 vessels brought in small lots of general cargoes. Almost all of them were small lots of about 10 tonnes, but there were some lots of 100 tonnes (beer, soft drinks, used clothes, cigarettes, medicine, galvanized sheet metal). In order to check the

items even further, the ships manifest of 140 vessels that arrived in late 1992, and the Statement of facts prepared by the Department of Phnom Penh Port was checked. With the exception of large volume of lot of cement, cigarettes, reinforcing steel, and rice which were imported few times, general cargo in small lots made up most of the cargo. From the names of the consignee, although which is not a good method of checking, it was found that amount of cargo for the United Nations and other Relief Agencies was not so big and shared less than 10 % of the volume of cargo, which did not include rice imported as a single commodity mentioned above.

From this investigation, the general cargo handled at the Port of Phnom Penh, based on the actual quantity of 151,600 ton/yr., the rate of increase for the 5 years to 1995 was forecasted at 3.5 %, to 2000 at 3 %, and to 2010 at 2.5 %.

In conclusion, the forecast of the cargo handled by the Department of the Phnom Penh Port (at Ports No. 1 and 2 Lightening and others) is expected to be as follows:

(1,000 ton)

Item	1992 (Actual*)	1995	2000	2010
Export				
Rice	-	135	185	65
Rubber	27.0	39	42	59
Lumber	0.9	18	30	50
Marine Goods	-	1	2	2
Farm Produce	10.6	58	81	119
Others	7.7	-	-	-
Total	46.2	251	340	295
Imports				
Rice	22.6	-	-	-
Flour	-	8	10	13
Fertilizer	9.1	45	63	0
Cement	85.3	115	147	132
General Cargo	151.6	168	195	250
Total	268.6	336	415	395
Grand Total	314.8	587	755	690

Notes : (1) Does not include petroleum and bauxite.
(2) *Source: Statistic Data (Planning Section, Dept. of the Phnom Penh Port)