

1. Introduction

1.1 Background of the Study

1.1.1 Background

Since the establishment of the Royal Government of Cambodia (GOC) in 1993, the government has been pursuing two basic principles: to establish the strategy and administration for the rehabilitation and the development of the country, and to promote private sector participation in the economic development of Cambodia.

In accordance with the above policy of the country, various investment projects have been brought to the country. The major sectors which invited foreign investment are: agriculture, industry, construction and tourism. In addition, foreign financial institutions have been extending the financial assistance program.

The cargo traffic at the ports has subsequently expanded at a very high rate over the past five years. Being the sole deep sea port of Cambodia, Sihanoukville Port has experienced rapid increase of the cargo volume and the rehabilitation and expansion of its cargo handling facilities are quite urgent to meet the country's economic growth.

Among other rehabilitation and expansion projects of the infrastructure, GOC requested the government of Japan (GOJ) for a study of the development of Sihanoukville Port.

In response to the request of the Royal Government of Cambodia (GOC) submitted in August 1995, the Government of Japan (GOJ) has decided to conduct a study of "the Master Planning and Feasibility Study of Sihanoukville Port in the Kingdom of Cambodia" which is, hereinafter, referred to as "the Study", within the general framework of the Technical Cooperation Scheme between the Kingdom of Cambodia, hereinafter referred to as "Cambodia" and Japan, in close cooperation and coordination with the authorities concerned of GOC.

Accordingly, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical cooperation programs of GOJ, sent a preparatory survey mission to Cambodia in December 1995 and conducted preliminary surveys of the Study.

As the results of the work of the preparatory survey mission, the "Scope of Work" of the said study project was finalized and agreed upon between the Ministry of Public Works and Transport (MPWT) and JICA on December 21, 1995 at Phnom Penh.

JICA sent a study Team for the said study project to Cambodia in April, 1996. The study team has been working at Sihanoukville City, project site, with the Counterpart Team formulated for the study. This report is intended to give an explanation of the Study Team's accomplishment over the period from April through October, 1996.

1.1.2 Scope of work

(1) Objectives of the Study

The objectives of the Study are:

- a. to formulate a Master Plan of Sihanoukville Port over the period up to the year 2015,
- b. to conduct a feasibility study for the short-term plan for Sihanoukville Port over the period up to the year 2005, within the framework of the Master Plan, and
- c. to propose urgent measures to be done prior to the implementation of the short term, if those measures turn out to be indispensable.

(2) Study area

The Study covers an area from the Old Jetty in the south up to the Oil Port in the north is covered by the Study. The study also examines the alternative navigation channel to the existing one. The potential water area for the alternative channel, therefore, is also included in the study area (see Fig. - 1-4).

1.2 Methodology of master planning

The work flow of the study is schematically exhibited in Fig. -1-1. The detailed explanation is given in the Inception Report which was submitted to Cambodian side on the commencement of the study.

This Interim Report is intended to report the accomplishment of the Study Team up to October, 1996, and covers the preparation of Master Plan of Sihanoukville Port with the target year 2015 (Item a of the objectives), and proposal of the urgent measures, which should be implemented as soon as possible (Item c).

1.3 Maps for reference

For the reference in the latter chapters, the following figures are attached herewith:

- Figure - 1-2; Location map of the country,
- Figure - 1-3; Bay of Compong Som,
- Figure - 1-4; Sihanoukville Port (1) s= 1/50,000,
- Figure - 1-5; Sihanoukville Port (2) s= 1/20,000,
- Figure - 1-6; Sihanoukville Port (3), and
- Figure - 1-7; Sihanoukville Port (Oil Port) s=1/5,000.

WORK IN CAMBODIA PHASE 1

WORK IN JAPAN PHASE 1

WORK IN CAMBODIA PHASE 2

WORK IN JAPAN PHASE 2

Present Situation
Field Surveys
Formulation of the Master Plan
Feasibility Study on the Short-Term Plan

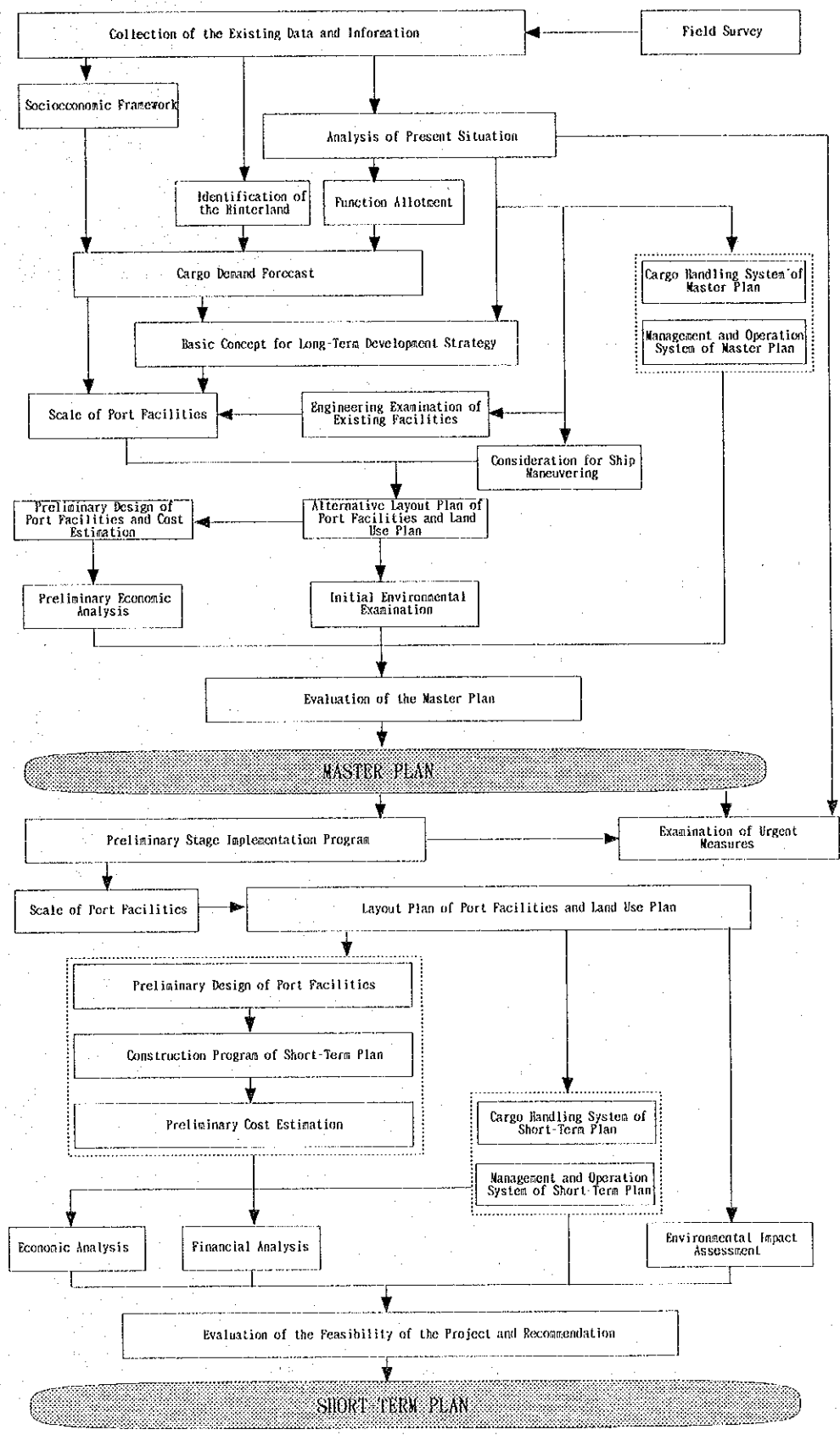


Fig. -1-1 Work flow

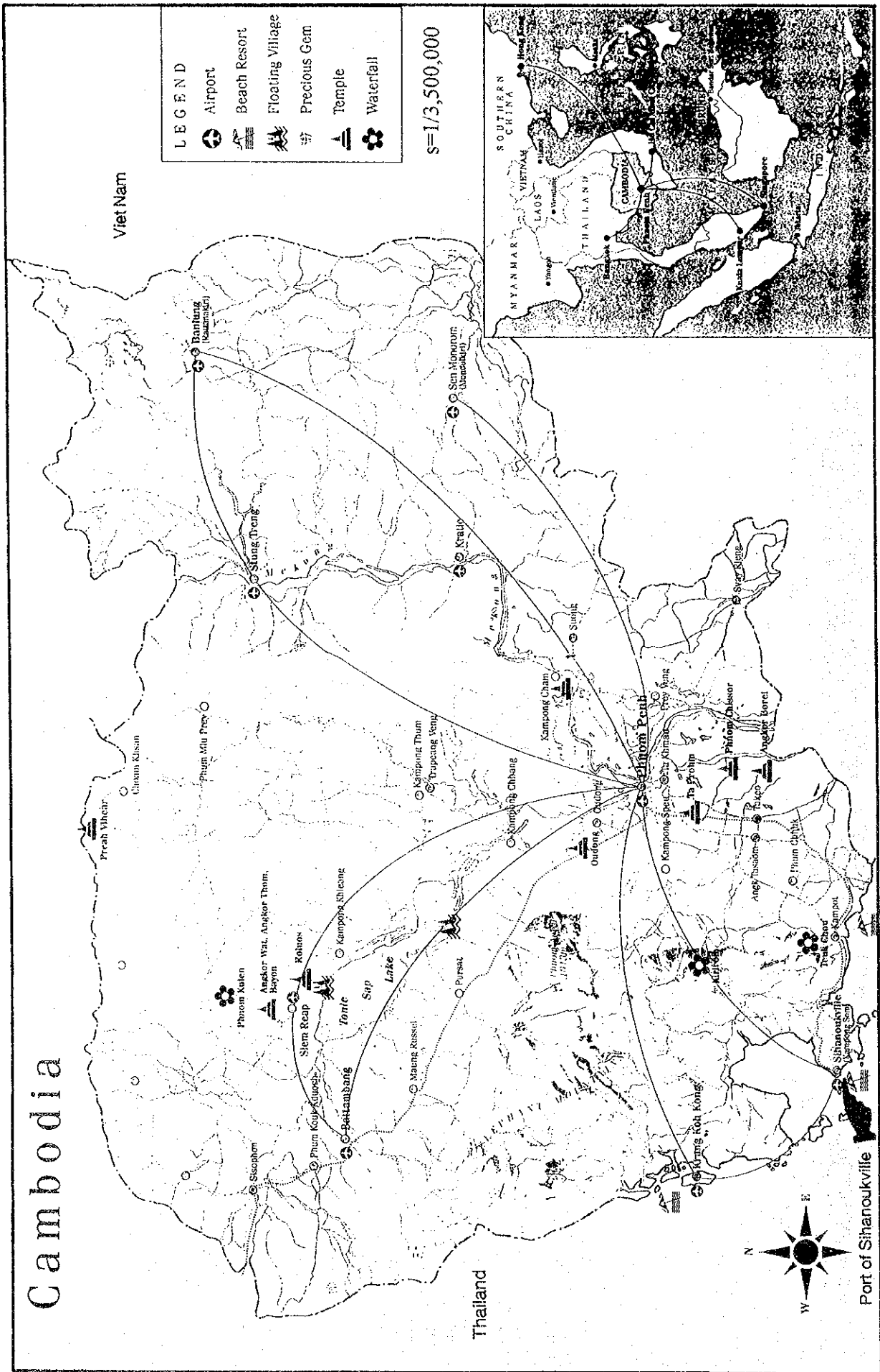


Fig. -1-2 Location map

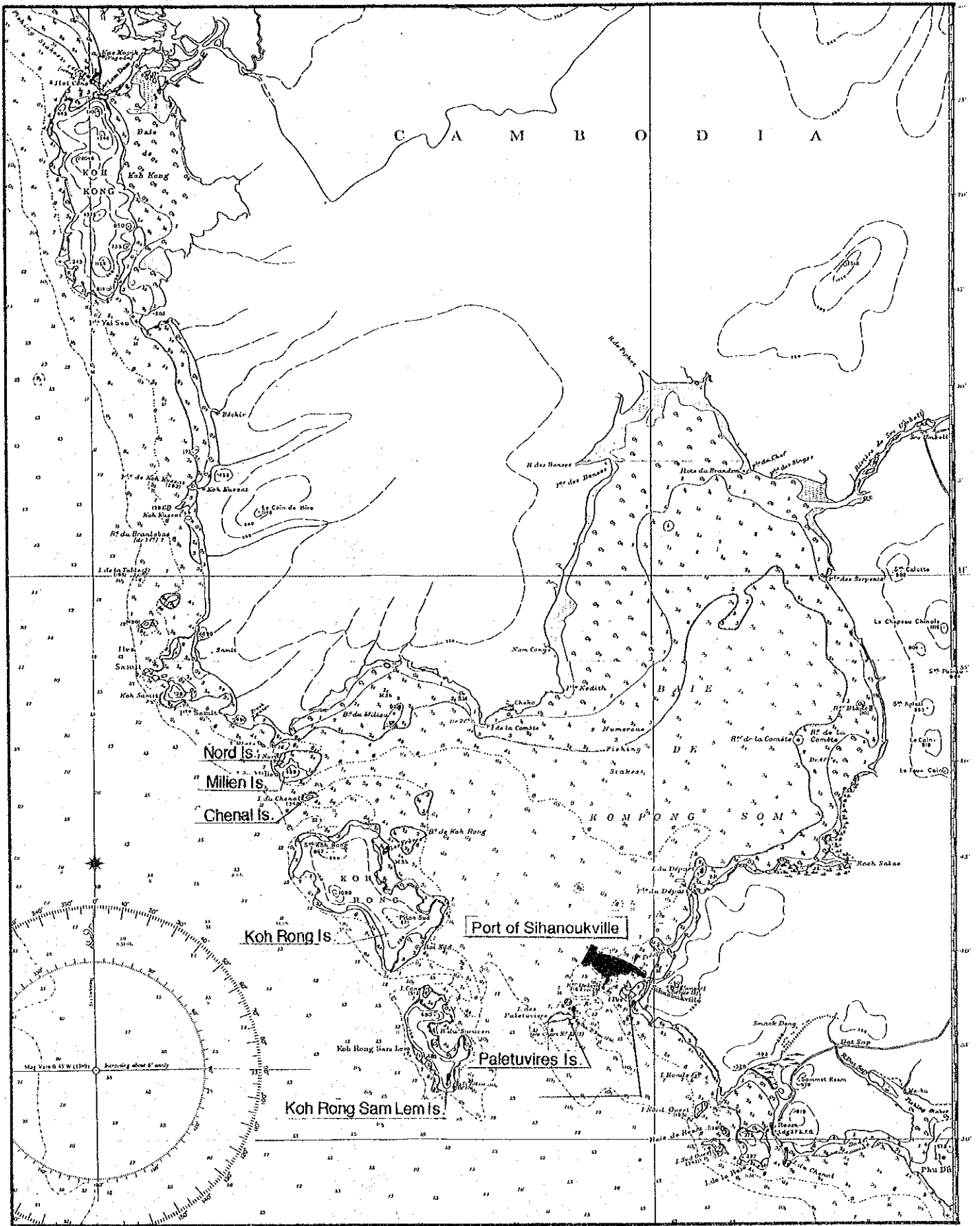
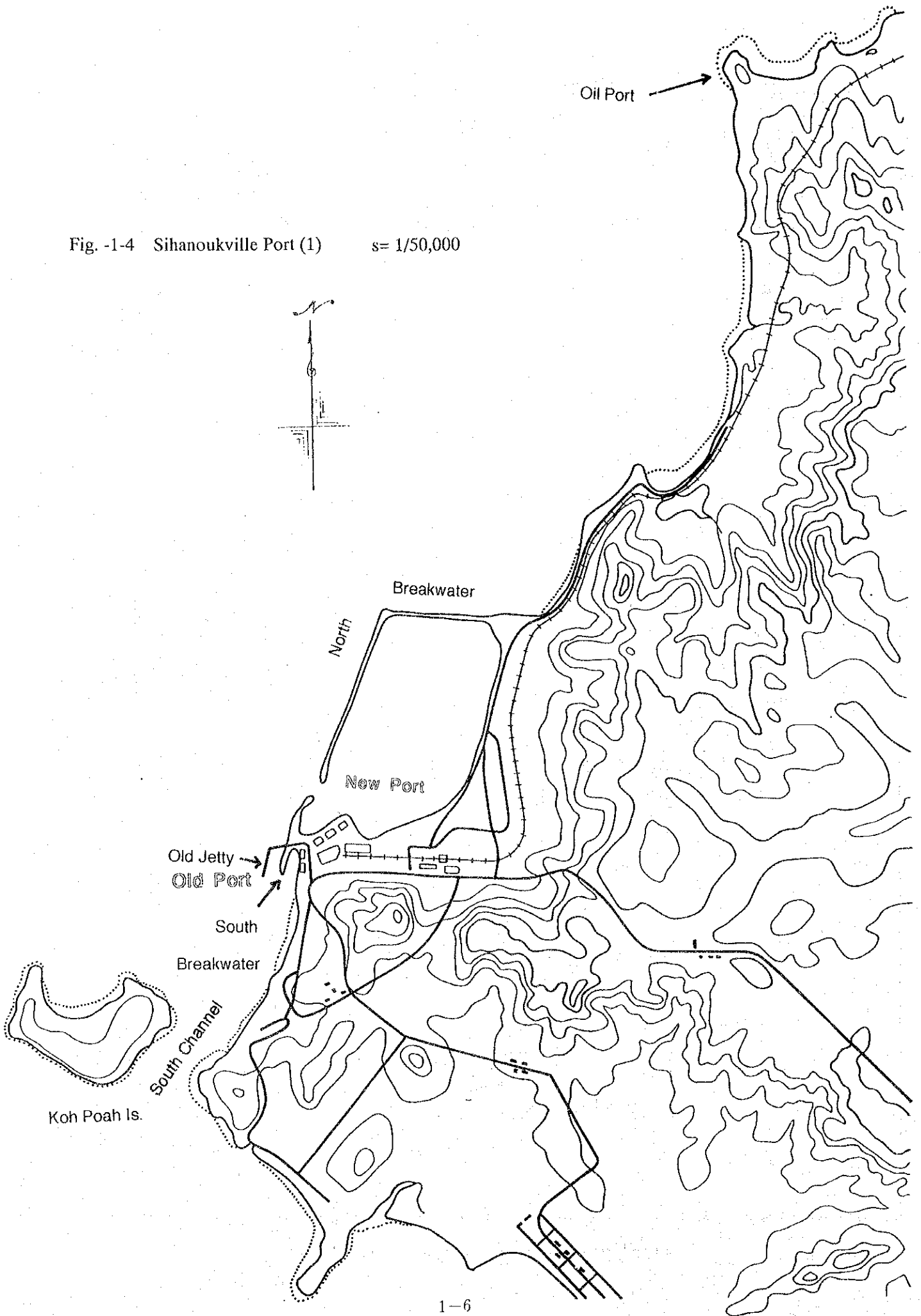
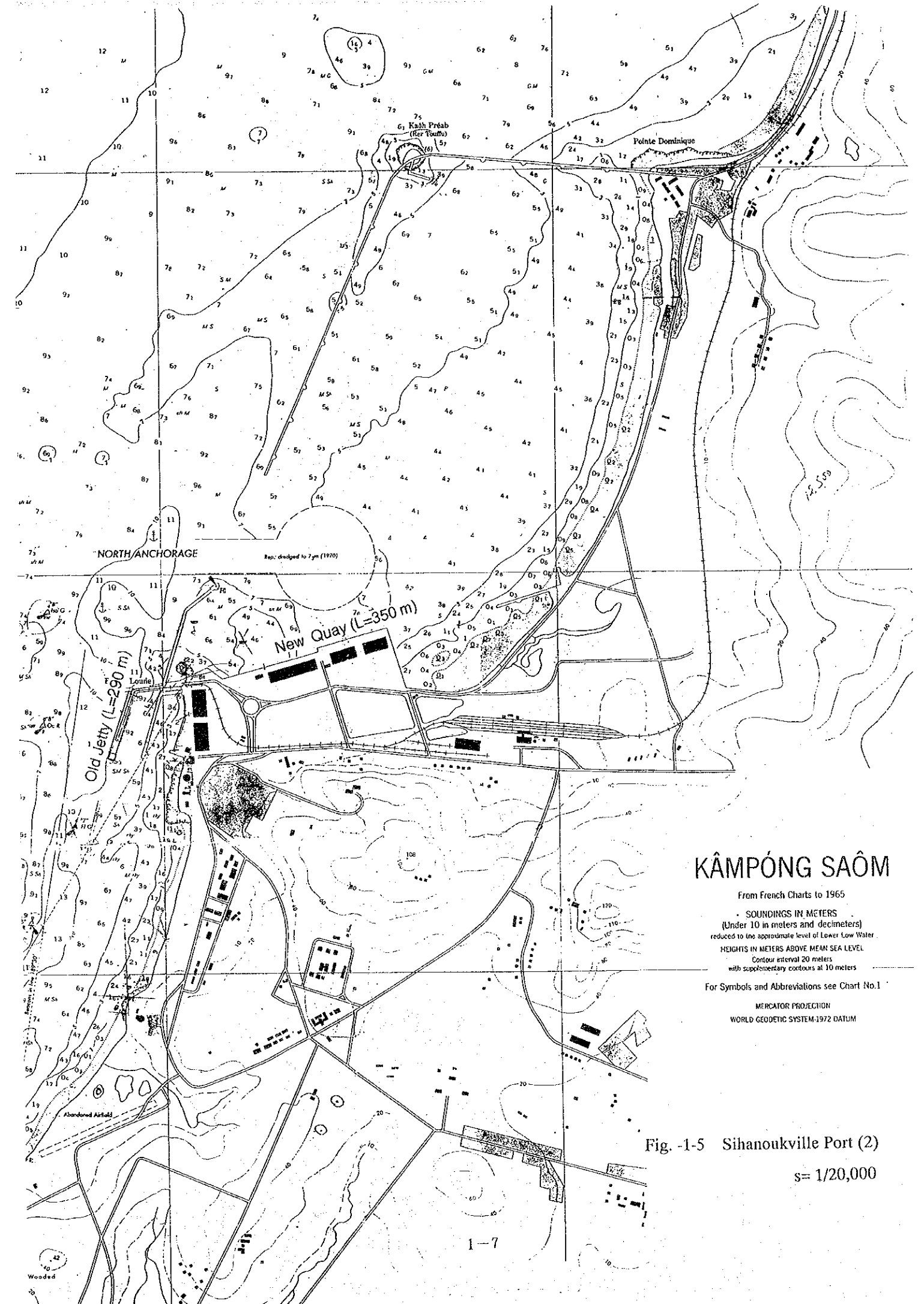


Fig. -1-3 Bay of Kompong Som s= 1/50,000

Fig. -1-4 Sihanoukville Port (1) s= 1/50,000





KÂMPÔNG SAÔM

From French Charts to 1965

SOUNDINGS IN METERS
(Under 10 in meters and decimeters)
reduced to the approximate level of Lower Low Water

HEIGHTS IN METERS ABOVE MEAN SEA LEVEL
Contour interval 20 meters
with supplementary contours at 10 meters

For Symbols and Abbreviations see Chart No.1

MERCATOR PROJECTION
WORLD GEODETIC SYSTEM-1972 DATUM

Fig. -1-5 Sihanoukville Port (2)

s= 1/20,000

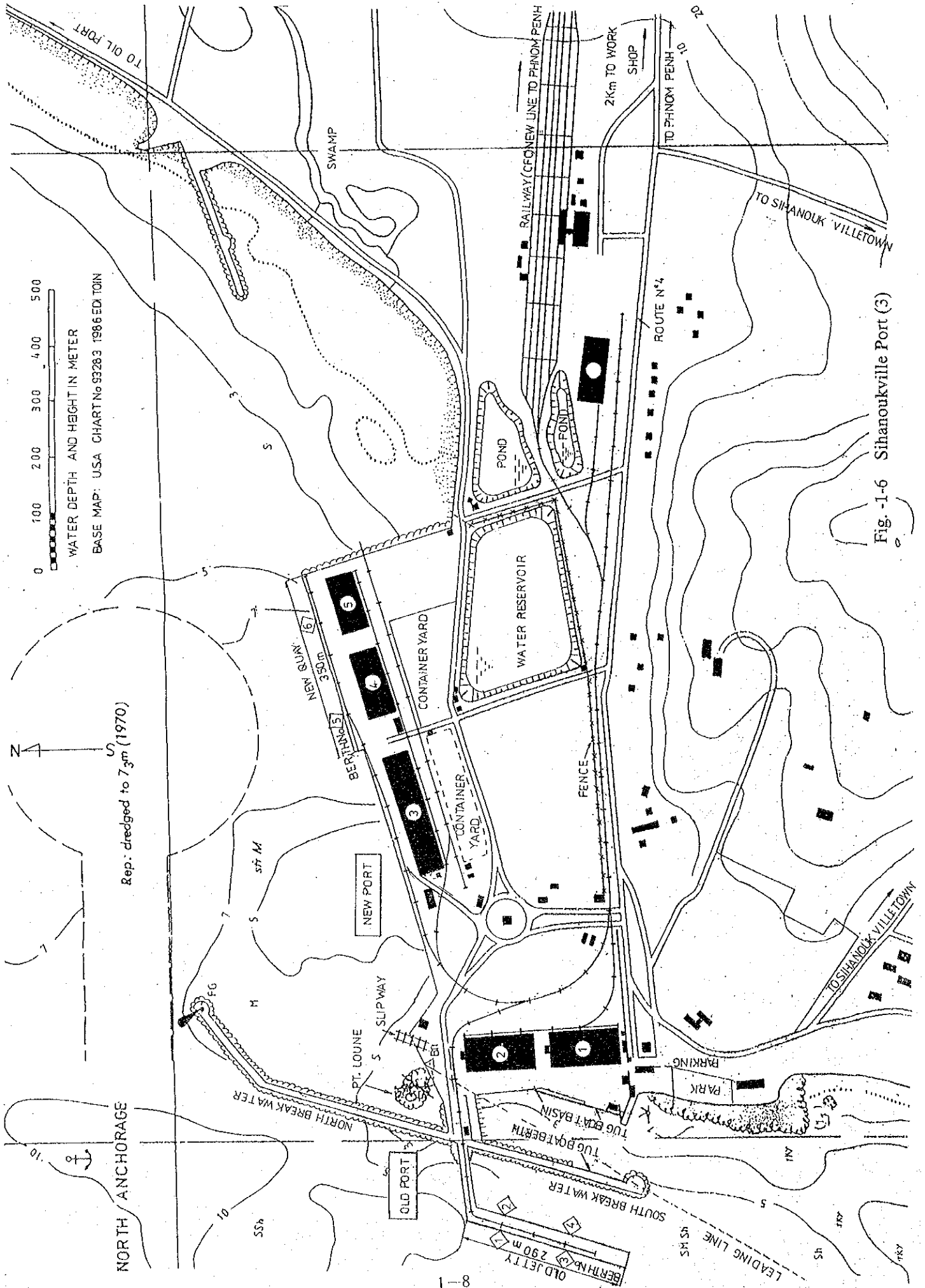


Fig. 1-6 Sihanoukville Port (S)

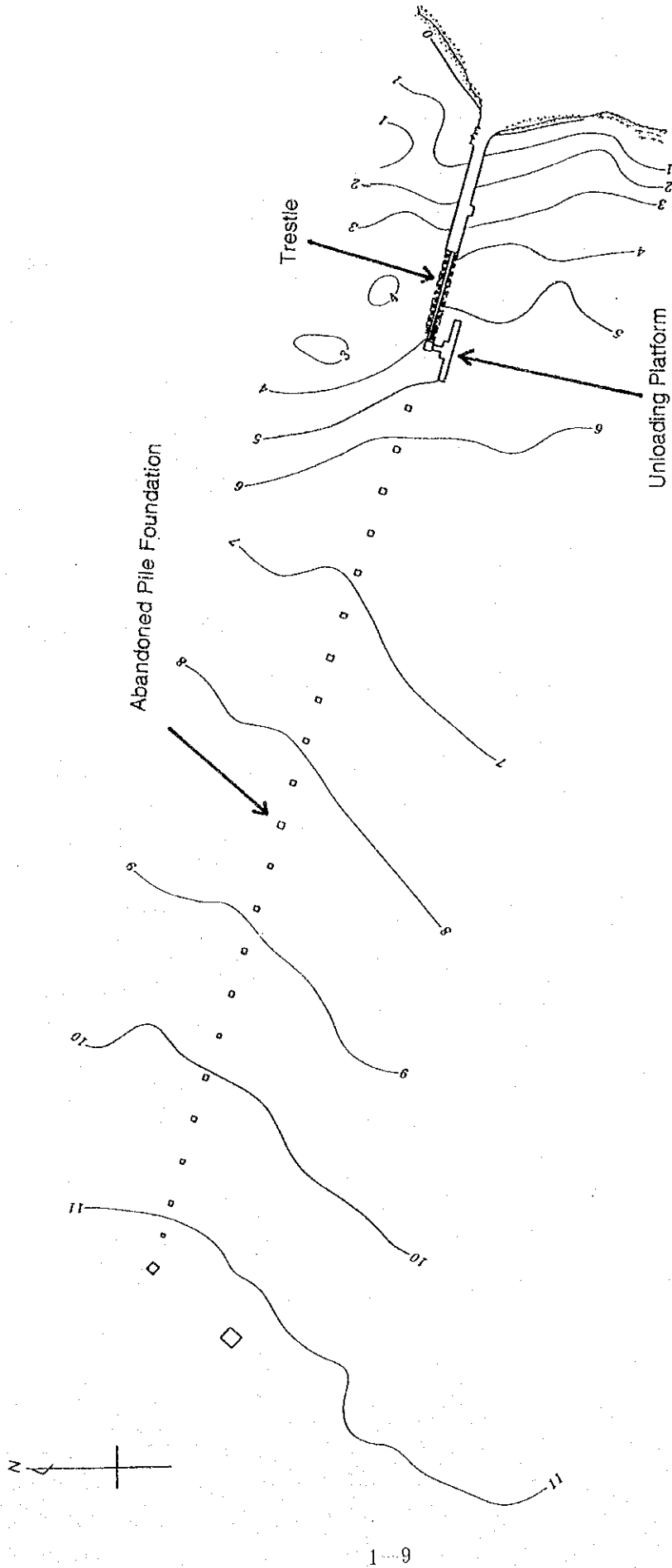


Fig. -1-7 Sihanoukville Port (Oil Port) s=1/5,000

2. Brief review of the existing situation

2.1 General aspects of the country

Cambodia used to be rich in agricultural products and forestry resources such as rice, natural rubber and logs. In 1960s, the country was enjoying growing economy in the production and trade of these products. However, through the period of invasion of Vietnam and the disturbance of civil war, the infrastructure of the country was almost completely ruined. The economic activities was stagnant over the decades from 1979 to 1990.

Restoration of the nation stated in 1993 by the newly established Royal Government of Cambodia (GOC) within a framework of parliamentary democracy after the election conducted under the United Nations Transitional Authority in Cambodia (UNTAC).

The new government is making great effort to rehabilitate the nation and to restructure its previous planned to market economy. New government published the five year economic development plan for the first time in 1996, which announces its policy and strategy in public.

After the economic boom during UNTAC period, the government is making great effort in the rehabilitation and restoration of urban and rural infrastructure and to invite investment by private sector both foreign and local based.

Being the sole deep sea port, Sihanoukville Port is expected to play a role as the gateway of Cambodian trade.

2.2 Natural conditions

2.2.1 Geography*

Cambodia has a land area of 181,035 km² in the southwestern part of the Indochina peninsula, about 20 % of which is mainly used for agriculture. It lies completely within the tropics with its southernmost points slightly more than 10 degrees above the Equator. International border are shared with Thailand and the Lao People's Democratic Republic on the west and on the north, and the Socialist Republic of Viet Nam on the east and the southeast. The country is bounded on the southwest by the Gulf of Thailand. The country has a coastline of 435 km.

The dominant feature of the Cambodian landscape are the large, almost centrally located, Tonle Sap (Great Lake) and the Bassac River systems and the Mekong River, which traverses the country from north to south surrounding the Central Plains which covered three quarters of the country's area are the more densely forested and sparsely populated highlands.

The Tonle Sap basin - Mekong lowlands region consists chiefly of plains with elevations generally of less than 100 meters. As the elevation increases, the terrain becomes more rolling and dissected. The Cardamom Mountains in the southwest rise to more than 1,500 meters and is oriented generally in a north-southeast direction. The Elephant Range, an extension of the Cardamom Mountains, runs toward the south and the southeast and rises to elevations of between 500 and 1,000 meters. These two ranges are bordered on the west by a narrow coastal plain facing the Gulf of Thailand that contains Kompong Som Bay.

The Mekong River, Cambodia's largest river, dominates the hydrology of the country. The river originates in mainland China, flows through Myanmar, Laos, Thailand before entering Cambodia. At Phnom Penh, with its alternative arms, the Basak River from the south, and the Tonle Sap River linking with the Tonle Sap from the northwest, it continue, further southeastward to its lower delta in Viet Nam and to the South China Sea.

The section of Mekong River passing through Cambodia lies within the tropical wet and dry zone. It has a pronounced dry season during the northern hemisphere winter, with about 80% of the annual rainfall occurring during the southwest monsoon in May-October. The Mekong River's average annual flow at Kratie of 441 km³ is estimated as 93% of the total Mekong run-off discharge at Kratie ranges from a minimum of 1,250 m³/s to a maximum 66,700 m³/s.

The role of the Tonle Sap as a buffer of the Mekong River system floods and the source of beneficial dry season flows warrants explanation. The Mekong River swells with water during the monsoon season reaching a flood discharge of 40,000 m³/s at Phnom Penh. By about mid-June, the flow of the Mekong and the Basak River fed by monsoon rains, increases to a point where its outlets through the delta cannot handle the enormous volume of water, flooding extensive adjacent

* CAMBODIA, The Reemergence of New Opportunities, Business and Investment Handbook, pp.1-5, 1996

flood plains for 4-7 months. At this point, instead of overflowing its banks, its flood water reverse the flow of the Tonle Sap River (about 120 km in length), which then has a maximum inflow rate of 1.8 m/s and enters the Great Lake, the largest natural lake in Southeast Asia, increasing the size of the lake from about 2,600 km² to 10,000 km², and exceptionally to 13,000 km² and raising the water level by an average 7m at the height of the flooding.

2.2.2 Natural conditions*

The entire land of Indochina peninsula including Cambodia, Lao, Viet Nam and the east Thailand had been formed by the middle period of Jurassic, and is called the Indosinia. The Indosinia as the land mass have come to the present state without any holding and large scale sea water intrusion except for the period of sedimentation of red colored thick rock layer by the large scale of marine transgression at the latter period of Mesozoic.

The climate in Cambodia is tropic monsoon, caused by annual alternating high pressure and low pressure over The Central Asian land mass. In Summer, the southwest monsoon is drawn landward from the Indian Ocean, and, during the winter, the northeast monsoon sends back dry air. The Southwest monsoon brings the rainy season from mid May to early October, and the northeast monsoon flow of drier and cooler air lasts from early November to March. The average annual rainfall is between 1,000 and 1,500 mm, with the heaviest in the southwest and southeast coastal areas (over 3,000 mm annually). Rainfall from April to September in Tonle Sap Basin Mekong lowlands area averages 1,300 to 1,900 mm annually, with the lowest rainfall found in the rain shadow region of the Elephant and Cardamom Mountains. Marked variability exists both by year and from one zone to another.

Temperatures are fairly uniform throughout the Central Basin area, with small variations from the average annual mean of about 25 °C. The maximum mean is about 28 °C, the minimum is about 22 °C. Maximum temperatures of higher than 32 °C, however, are common and, just before the start of the rainy season, maximum temperatures may rise to more than 38 °C. Minimum temperatures rarely fall below 10 °C. January is the coldest month, and April is the warmest. Typhoons (tropical cyclones), which often devastate coastal Viet Nam, rarely cause damage in Cambodia.

* CAMBODIA, The Reemergence of New Opportunities, Business and Investment Handbook, pp.6-7.

2.3 Socioeconomic situation

2.3.1 Laws and regulations related to the project

(1) Investment policy

In order to encourage both local and foreign investments in Cambodia, the "Law on the Investment of the Kingdom of Cambodia" provide legislative background for the incentives to the investors: some of these are exemptions of duties and taxes, land ownership, hiring foreign employees, and remittance abroad the wages and salaries, among others.

With the Law of Investment, 85 local and foreign or joint investment projects have been approved by the Council for the Development of Cambodia (CDC). The field of investment, numbers of companies, amount of capital investment are listed in Table - 2.3.1-1.

The outstanding investment project are:

- a. Cement plant (investor from Cambodia); US\$148 million,
- b. Pochentong(Phnom Penh) Airport (France/Malaysia); US\$117 million
- c. Dry Port(Singapore); US\$20 million
- d. Naga Island (in Sihanouk Ville) (Malaysia); US\$1,300 million

(2) Environment

The basic environmental protection laws are presently being prepared by the Ministry of Environment. Thus no reference standards, which the current study should comply with, is available at the present stage. With respect to Environmental Impact Assesment (EIA) and Initial Environment Evaluation (IEE), the basic rules and standards required for the preparation, procedure, allowable limits of pollutant, etc., are not available either.

It is thus recommended that, lack of Cambodian laws and regulation, the standards of environmental protection, practiced by JICA(Japan International Cooperation Agency), OECF(Overseas Economic Cooperation Fund), World Bank, United Nations, etc. shall be applied for the current study and the evaluation of the project.

With respect the determination of the target level of preservation of natural environment, due consideration shall be taken of the special conditions of socioeconomic and geographic features of Cambodia.

(3) Structural design and construction

In the absence of the regulations and standards in Cambodia, engineers and contractors use individual different reference data and standards which they are most accustomed through their professional couriers. The establishment of appropriate standards on the basis of the locality of Cambodia is urged.

Table - 2.3.1-1 Investment project approved by CDC

(Unit: Thousand US\$)

No	Field of activity	Country of investors	Number of Companies	Invested Capital
1	Garment	Australia, Cambodia, China, Hong Kong, Malaysia, Singapore U.S.A.	17	75,579
2	Construction Construction material	Australia, Cambodia, Canada, China, England, France, Malaysia, Singapore, U.Taiwan, U.S.A.	14	243,963
3	Agriculture	Cambodia, China, Hong Kong, Malaysia, Singapore, Taiwan	12	66,722
4	Food Industry, Brewery & Beverages	Cambodia, China, France, Hong Kong, Malaysia, Singapore, Thailand	9	76,636
5	Manufacturing & Chemicals	Cambodia, France, Malaysia, Singapore, Taiwan, Thailand, U.S.A.	11	16,440
6	Mining	Thailand	1	4,500
7	Shipbuilding & Motorcycle	Malaysia Singapore	2	3,000
8	Cigarettes	Australia, Cambodia, Hong Kong, Singapore	5	59,600
9	Telecommunications	Indonesia	1	8,000
10	Transportation	Cambodia, France, Malaysia, Singapore	3	147,000
11	Tourism	Cambodia, France, Malaysia, Singapore, Thailand, England	8	1,635,175
12	Energy	Malaysia, U.S.A.	2	44,000
Total			85	2,274,115

Source: Cambodia, Business & Investment Handbook (1996)

2.3.2 National economic situation

(1) Population

The population of Cambodia was surveyed in 1979, according to the Ministry of Planning, and after that population was estimated to grow at an annual rate of 2.8 % from 1980-1989 and 2.5 % after 1990. On the other hand, an official population census was carried out in 1962 and most recently by UNTAC in 1992.

According to the "Socio-Economic Survey of Cambodia 1993/94 (All Round)" (Ministry of Planning) which was based on UNTAC data, the population of Cambodia has increased and reached 9.87 million in 1994. The population share of male and female by age group in 1994 is shown in Fig. - 2.3.2-1. The percentage of the population under 14 years was very high, more than 40 % for both male and female, and the tendency was observed in all areas of Cambodia.

Table - 2.3.2-1 shows the general trend of the population, number of households and density in Cambodia. There were 274,000 urban households and 1,540,000 rural households in 1994. Judging from the population and number of households, average household size was 5.63 in urban areas and 5.33 in rural areas. The density in Cambodia was 55 person / Km² in 1994, with Phnom Penh having the highest population density at 3,045 person / Km² and Mondol Kiri the lowest 2 person / Km².

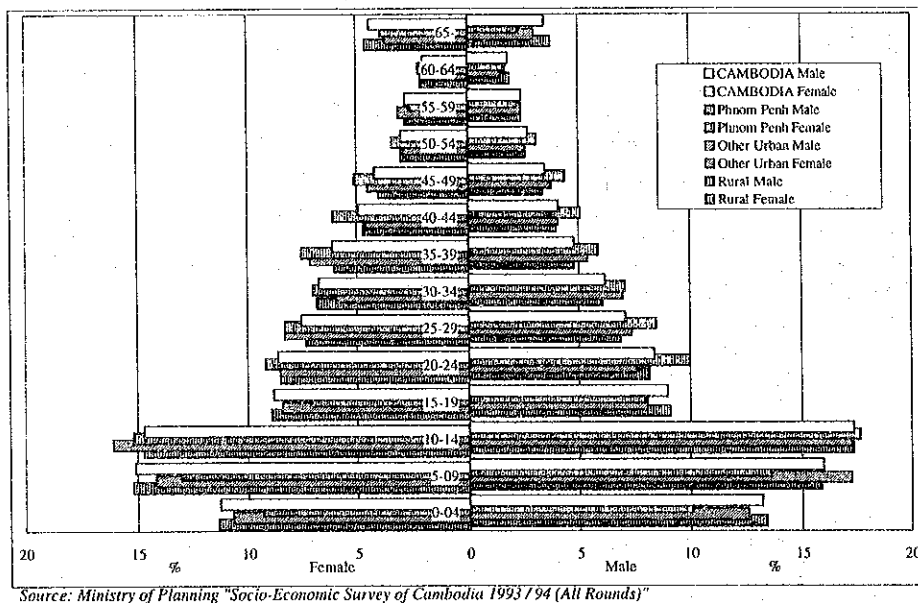


Fig. - 2.3.2-1 Population by age group

Table - 2.3.2-1 Trend of population in Cambodia

		(Unit: thousand)			
		1981	1992	1993	1994
Population		6,682 (6,679)	8,824	9,337 (9,653)	9,753 (9,856)
Density		38	50	52	55
Number of household	Urban				1,540
	Rural				274
	Total				1,814

Note: Land area in Cambodia is 178,035 km² (excluding Tonle Sap Lake 3,000 km²)

Figures in parenthesis at population are data of Ministry of Economy and Finance.

Source: Data of Ministry of Planning, Ministry of Economy and Finance "Monthly Bulletin of Statistics" and Ministry of Commerce "Cambodia Business & Investment Handbook 1996"

(2) National products

a. Gross domestic products

Gross Domestic Product (GDP) increased from 241 billion riels in 1989 to 325 billion riels in 1995 at 1989 constant prices, an increase of 1.35 times. Annual growth rate between 1989 and 1995 is 5.1 % as shown in Table - 2.3.2-2 and Fig. - 2.3.2-2. GDP growth rate suddenly increased from 1991 to 1992, exceeding 7 %. This was due to a construction boom in Phnom Penh before and during UNTAC's stay. On the other hand, GDP growth rate in 1990 was at a low level because of the withdrawal of the Communist bloc from Cambodia.

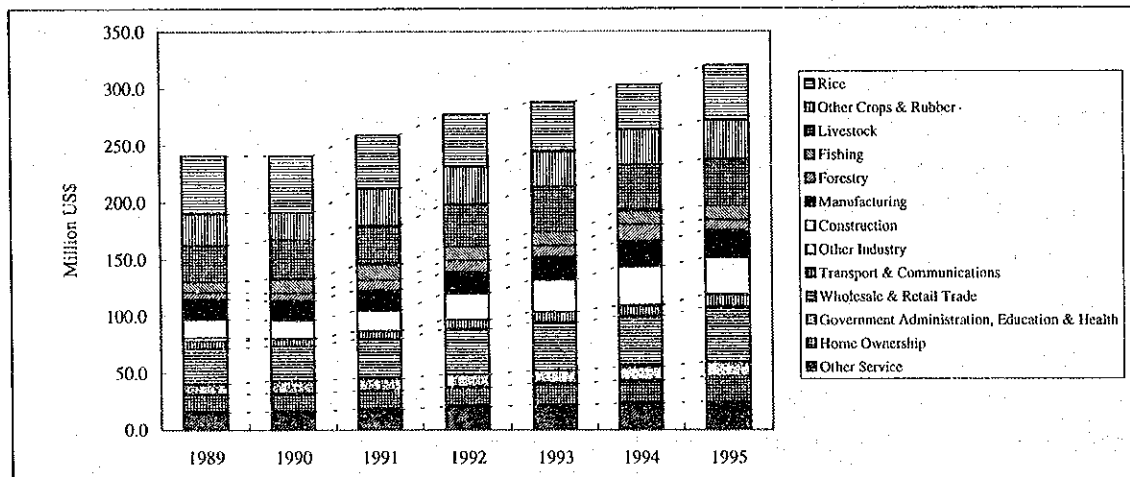
Regarding GDP in 1995 by sector, Agriculture sector, Industry sector and Service sector registered values of 144.7 billion Riels, 60.9 billion Riels and 119.2 billion Riels respectively at 1989 constant price. Compare these figures with 1989, Agriculture sector, Industry sector and Service sector increased by 1.15 times, 1.64 times and 1.53 times of 1989, respectively. According to the "Key Indicator of Developing Asian and Pacific Countries" (Asian Development Bank), share of GDP by sectors at current market prices is shown in Table - 2.3.2-3. Agriculture sector has the largest share during the period (1987 -1993). Agriculture, Trade and Other Service have large shares; average share during 1987 - 1993 was 52 %, 12 %, and 15 % respectively. The total share of these three sectors accounts for more than 70% of the whole GDP. The share of Government & Financial Service and Manufacturing decreased, from 14.5 % and 10.7 % in 1966 to 3.99 % and 4.88 % in 1993.

Table - 2.3.2-2 GDP by industrial origin at 1989 constant price

INDUSTRY	(Unit: Billion Riels)						
	1989	1990	1991	1992	1993	1994	1995
Agriculture	125.9	127.4	135.9	138.5	135.7	137.6	144.7
Crops & Rubber	78.2	74.0	79.3	79.0	74.6	70.3	82.5
Rice	51.1	49.6	47.6	46.7	44.1	39.2	48.2
Other Crops & Rubber	27.1	24.4	31.7	32.3	30.5	31.1	34.3
Livestock	32.3	34.1	34.5	36.9	39.2	40.4	41.1
Fishing	9.4	12.4	13.5	12.7	12.0	12.0	12.2
Forestry	6.0	6.9	8.6	9.9	9.9	14.9	8.9
Industry	37.1	36.3	39.5	45.7	52.6	60.1	60.9
Mining & Quarrying	2.5	2.8	3.0	3.2	3.4	3.6	4.0
Manufacturing	18.0	17.2	18.4	19.0	20.5	22.1	24.1
Electricity & Water	0.6	0.5	0.5	0.6	0.7	0.7	0.8
Construction	16.0	15.8	17.6	22.9	28.0	33.6	32.0
Service	77.9	80.0	86.8	96.4	103.3	109.1	119.2
Transport & Communications	6.5	6.4	7.0	8.1	8.9	9.3	10.7
Wholesale & Retail Trade	31.2	30.5	34.4	39.9	42.3	44.8	48.4
Hotels & Restaurants	0.4	0.7	1.0	1.3	1.4	1.5	1.8
Government Administration, Education & Health	9.3	11.0	11.0	11.0	11.5	11.8	12.9
Home Ownership	15.5	15.9	16.3	17.4	18.8	20.2	21.8
Other Service	15.0	15.5	17.1	18.8	20.4	21.5	23.0
TOTAL	240.9	243.7	262.2	280.6	291.6	306.8	324.8
Annual Growth Rate		1.2%	7.6%	7.0%	3.9%	5.2%	5.9%
Average Growth Rate During 1989-1995							5.1%

Note: 1994 and 1995 are Estimated.

Source : Ministry of Planning "First Socioeconomic Development Plan 1996-2000"
Ministry of Commerce "Cambodia Business & Investment Handbook"



Note: 1994 and 1995 are Estimated.

Source : Ministry of Planning "First Socioeconomic Development Plan 1996-2000"
Ministry of Commerce "Cambodia Business & Investment Handbook"

Fig. - 2.3.2-2 Share of GDP by industrial origin at 1989 constant price.

Table - 2.3.2-3 Share of GDP by industrial origin at market price

		1989	1990	1991	1992	1993	1994	1995 estimate
Exchange Rate	Riel / US\$	224	537	818	1,666	2,816	2,571	2,463
Population	Million	8.30	8.57	8.81	9.05	9.31	9.87	10.20
CPI	1989=1.00	1.00	2.46	5.10	8.94	18.57	19.98	22.17
GDP at Current Price	Million Riel	240,909	598,636	1,335,968	2,508,000	5,414,000	6,131,000	7,200,000
	Million US\$	1,075	1,115	1,633	1,505	1,923	2,385	2,923
	Growth Rate %	23.17	3.65	46.51	-7.83	27.71	24.03	22.59
Per capita	Riel	29,025	69,853	151,642	277,127	581,525	621,175	705,882
	US\$	130	130	185	166	207	242	287
GDP at Constant Price 1989	Million Riels	240,909	243,700	262,200	280,600	291,600	306,800	324,800
	Million US\$	1,075	1,088	1,171	1,253	1,302	1,370	1,450
	Growth Rate %	3.50	1.16	7.59	7.02	3.92	5.21	5.87
Per capita	Riel	29,025	28,436	29,762	31,006	31,321	31,084	31,843
	US\$	130	127	133	138	140	139	142
GDP Deflator	%	19.0	145.6	107.4	75.4	107.7	7.6	10.9

Source: Ministry of Economy and Finance "Monthly Bulletin of statistics"
ADB "Key Indicators of Developing Asian and Pacific Countries"

b. Other economic indicators

Table - 2.3.2-4 shows the summary of main economic indicators. Exchange rate with the US\$ was about 2,463 Riels in 1995, about 11 times that of 1989. In recent years the exchange rate has stabilized and the value of the Riel has risen.

Consumer Price Index (CPI) in 1995, assuming CPI in 1989 is equal to one, was about 22.17. Annual rise rate of CPI was more than 100% during 1989 to 1991, and has risen gradually since 1993

GDP per capita at 1989 constant price in 1995 was 31,843 Riels, an increase of some 10 % over 1989.

Table - 2.3.2-4 Socioeconomic indicators

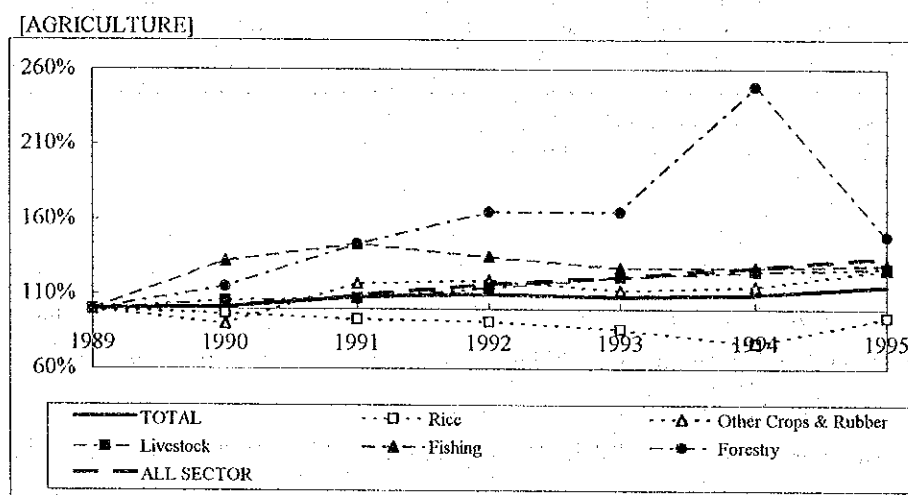
[SHARE of GDP by INDUSTRIAL ORIGIN]								
	1966	1987	1988	1989	1990	1991	1992	1993
Agriculture	39.10%	44.69%	62.40%	52.24%	55.64%	49.89%	47.78%	53.46%
Energy, Water	1.20%	0.51%	0.30%	0.25%	0.36%	0.52%	0.65%	0.55%
Manufacturing	10.70%	11.98%	8.11%	8.52%	5.76%	5.67%	5.40%	4.88%
Construction	5.40%	7.80%	5.34%	6.64%	5.03%	5.91%	7.11%	6.06%
Transportation	2.20%	3.17%	2.16%	2.70%	3.77%	3.23%	3.43%	3.20%
Trade	23.40%	13.50%	9.69%	12.18%	9.76%	13.00%	13.04%	11.22%
Government & Financial Service	14.50%	3.50%	2.93%	3.86%	4.73%	4.68%	4.32%	3.99%
Other Service	3.50%	14.84%	9.08%	13.60%	14.95%	17.11%	18.27%	16.65%
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: ADB "Key Indicators of Developing Asian and Pacific Countries"

c. Production of various sectors

1) Agriculture, Fishery and Forestry

The increase of GDP of Agriculture sector was very little and was less than that of whole sectors as shown in Fig. - 2.3.2-3. This figure express the increase of GDP at 1989 constant prices as 100 % in 1989. According to this figure, GDP of rice was decreased from 1990 to 1994; it increased in 1995, but did not reach the level of 1989. Forestry steadily increased from 1990 to 1994 but suddenly decreased in 1995.



Source: Cambodia Business & Investment Handbook, Ministry of Planning "First Socioeconomic Development Plan 1996-2000"

Fig. - 2.3.2-3 GDP trend of agriculture

i) Agriculture

The major agricultural product of Cambodia is rice, which is cultivated on 1,924,000 ha in 1994 - 1995 or 11 % of the total Cambodian territory as shown in Table - 2.3.2-5 and Fig. - 2.3.2-4. The main agriculture products other than rice are sugar corn and vegetable, with production volumes of 219,000 tons and 197,000 tons in 1995 respectively. Rubber, maize, vegetable, mung bean and soy bean have large cultivated area, 37 ha, 34 ha, 26 ha and 22ha respectively in 1994 - 1995.

Comparing the production in 1994 with 1966, rice production had almost recovered to the 1966 level (2,500,000 tons) from 1988 to 1990, but decreased after that. Cultivated area, however, has never exceeded 80 % of the 1966 level (2,508 ha). As to other agriculture products, the production of corn, mung bean, peanuts, sesame, sugar corn and so on in 1993 or 1994, was less than the level of 1966. Production of cassava, sweet potato and soy bean exceeded the 1960 level, but there were no agriculture products which displayed a clear tendency to increase in the last several years.

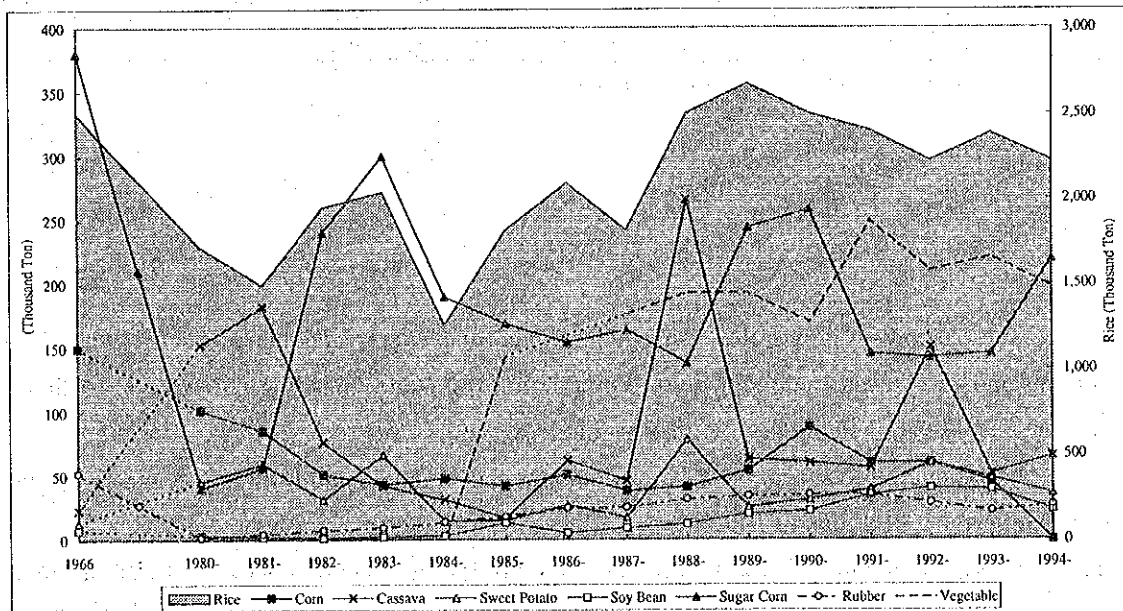
Production of rubber, peaked at about 52,000 tons in 1960 (data of 1966 not available). After falling off, it steadily increased during 1980 - 1991, reaching 35,000 tons, but decreased in 1992 and 1993, and registered 27,000 tons in 1994. Cultivated area steadily increased till 1991 and reached 61,000 ha in 1994 or 94 % of the level of the 1960s'.

Table - 2.3.2-5 Agriculture production

[AGRICULTURE PRODUCTION]													(Unit: Thousand Ton)			
	1966	1980-	1981-	1982-	1983-	1984-	1985-	1986-	1987-	1988-	1989-	1990-	1991-	1992-	1993-	1994-
Rice	2,500	1,717	1,490	1,949	2,039	1,260	1,812	2,093	1,815	2,500	2,672	2,500	2,400	2,221	2,383	2,223
Corn	150	101	85	51	43	48	42	51	38	41	54	88	60	60	45	
Cassava	23	152	182	76	42	31	17	62	46	266	63	60	56	150	51	65
Sweet Potato	13	45	59	31	66	14	15	27	17	78	25	31	39	60	48	36
Mung Bean	25	10	21	18	20	16	21	16	23	22	14	12	13	14	11	17
Peanuts	21	3	6	5	7	3	5	4	4	6	3	4	4	4	5	5
Soy Bean	7	3	2	1	2	3	13	5	9	12	20	22	35	40	39	23
Sesame	10	1	3	3	4	4	6	7	8	4	6	5	8	6	5	4
Sugar Corn	380	40	56	240	300	190	169	154	164	138	244	258	145	142	145	219
Jute	2	0	1	1	1	1	3	4	8	4	2	2	1	2	2	2
Cotton	3	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Tobacco	10	0	5	5	5	5	6	6	7	6	6	8	9	9	5	12
Black Pepper	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA
Rubber	52	1	4	7	9	13	18	24	25	31	34	35	35	28	22	27
Maize	NA	101	85	51	43	48	42	51	38	41	54	88	60	60	54	45
Vegetable	NA	NA	NA	NA	NA	NA	143	NA	NA	193	193	170	249	210	221	197

[CULTIVATE AREA]																
	1966	1980-	1981-	1982-	1983-	1984-	1985-	1986-	1987-	1988-	1989-	1990-	1991-	1992-	1993-	1994-
Rice	2508.20	1,441.00	1,493.00	1,674.00	1,740.00	1,418.00	1,462.00	1,535.00	1,378.00	1,879.00	1,932.00	1,890.00	1,910.00	1,844.00	1,857.56	1,924.00
Corn	117.00	101.00	85.00	61.00	49.00	43.00	46.00	43.00	40.00	50.00	49.00	45.00	50.00	48.00	42.91	NA
Cassava	2.10	19.00	25.00	12.00	11.00	5.00	8.00	12.00	10.00	27.00	10.00	11.00	11.00	16.00	9.80	10.00
Sweet Potato	1.40	9.00	11.00	8.00	6.00	5.00	5.00	6.00	5.00	8.00	7.00	8.00	9.00	10.00	8.15	10.00
Mung Bean	47.90	16.00	39.00	37.00	40.00	35.00	39.00	26.00	29.00	44.00	26.00	0.00	27.00	24.00	20.83	26.00
Peanuts	22.80	4.00	10.00	8.00	10.00	6.00	9.00	6.00	5.00	9.00	5.00	6.00	7.00	7.00	7.08	7.00
Soy Bean	8.10	5.00	3.00	3.00	5.00	5.00	10.00	7.00	11.00	12.00	13.00	15.00	14.00	16.00	NA	22.00
Sesame	14.60	3.00	6.00	8.00	10.00	9.00	11.00	14.00	16.00	11.00	12.00	10.00	16.00	13.00	10.20	9.00
Sugar Corn	5.00	2.00	2.00	8.00	9.00	7.00	8.00	7.00	7.00	7.00	7.00	-6.00	6.00	6.00	6.47	7.00
Jute	8.20	0.30	0.70	1.10	1.80	1.30	2.10	3.00	5.40	2.90	2.00	1.60	1.40	1.90	2.35	1.80
Cotton	3.90	0.20	0.20	0.30	0.30	0.50	0.80	1.50	0.80	0.70	0.20	0.90	0.20	0.20	NA	0.07
Tobacco	17.40	0.00	9.10	9.20	9.00	12.00	11.30	11.50	12.40	11.50	11.50	15.60	17.40	17.50	8.79	14.00
Black Pepper	0.70	0.00	0.01	0.01	0.02	0.05	0.07	0.11	0.07	0.22	0.28	0.26	0.24	0.27	NA	NA
Rubber	NA	50	80	118	145	195	263	358	400	415	468	511	516	509	610	NA
Maize	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	37.00
Vegetable	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	28.11	34.00

Source: Ministry of Agriculture Forestry and Fishery "Bulletin of Agricultural Statistics and Studies"



Source: Ministry of Agriculture Forestry and Fishery "Bulletin of Agricultural Statistics and Studies"

Fig. - 2.3.2-4 Trend of agriculture production

Table - 2.3.2-6 shows the average yield of rice (production / cultivate area) in 1966 and 1985 - 1994. Average yield was over 1.3 tons / ha during 1986 - 1990 and still less than 2.0 ton / ha all through the period.

Table - 2.3.2-6 Yield of rice

	1966	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Yield	1.00	1.24	1.36	1.32	1.33	1.38	1.32	1.26	1.20	1.28	1.16
Growth rate	-	-	10%	-3%	1%	4%	-4%	-5%	-4%	6%	-10%

Source: Ministry of Agriculture and Fishery "Bulletin of Agricultural Statistics and Studies"

ii) Livestock

Livestock accounts for 10.5 % of GDP in 1995. The number of livestock which are used for subsistence and draft, are as shown in Table - 2.3.2-7, used for subsistence and draught. All livestock has been increased steadily since 1980.

Table - 2.3.2-7 Livestock production

[LIVESTOCK PRODUCTION]	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Cows	772	917	1,143	1,271	1,436	1,560	1,705	1,852	1,891	2,095	2,181	2,257	2,468	2,542
Buffaloes	375	404	482	540	603	613	635	659	709	739	736	755	804	824
Pigs	131	223	723	824	1,009	1,203	1,161	1,251	1,500	1,737	1,515	1,550	2,043	2,123
Poultry	2,442	2,883	4,779	4,595	5,430	6,398	7,347	7,164	9,259	8,717	8,163	8,816	9,901	10,692
Draught Cattle	562	635	703	811	832	780	786	893	952	942	1,018	1,042	1,050	1,184
Draught Buffaloes Cattle	277	294	329	380	374	425	452	453	456	449	478	502	482	520

Source: Ministry of Agriculture Forestry and Fishery "Bulletin of Agricultural Statistics and Studies"

iii) Fishery

Table - 2.3.2-8 shows the fish catch. The fresh water and marine catch was about 65,000 tons and 21,000 tons, and aquaculture production was 7,600 tons in 1994. Total fresh fish production was 93.7 tons in 1994, 4.8 times as much as 1980.

The production of processed fish (dried, smoked, steamed and fermented) and fish sauce was 7,400 tons and 1,400 tons in 1992.

There were 596,000 people (25,500 families) engaged in fishing, 457,000 people (3,000 families) engaged in aquaculture and 457,000 people (3,000 families) engaged in fish production in 1994.

Table - 2.3.2-8 Fish catch

[FISH CATCH]	(Unit: Thousand Tons)														
	1980-	1981-	1982-	1983-	1984-	1985-	1986-	1987-	1988-	1989-	1990-	1991-	1992-	1993-	1994-
Fresh Fish	19.6	51.6	68.7	68.2	62.8	67.6	71.4	79.6	82.2	76.6	105.0	111.4	102.1	100.8	86.1
Fresh Water	18.4	50.8	65.7	58.7	55.1	56.4	64.2	62.2	61.2	50.5	65.1	74.7	68.9	67.9	65.0
Marine	1.2	0.8	3.0	9.4	7.7	11.2	7.2	17.4	21.0	26.1	39.9	36.7	33.2	32.9	21.1
Aquaculture	0.0	0.0	0.0	0.0	1.6	3.0	2.2	2.5	4.6	5.5	6.4	6.7	8.5	7.4	7.6
TOTAL	19.6	51.6	68.7	68.2	64.4	70.6	73.6	82.1	86.8	82.1	111.4	118.1	110.6	108.2	93.7

Source: Ministry of Agriculture Forestry and Fishery "Bulletin of Agricultural Statistics and Studies"
Ministry of Commerce "Cambodia Business & Investment Handbook 1996"

iv) Forestry

Table - 2.3.2-9 shows the forestry production. Main products consisted of round wood (309,000 m³), swan wood (16,000 m³) and fire wood (62,000 m³) in 1991. On the other hand, exported log woods and sawn wood were about 234,300 m³ and 25,500 m³ in 1991.

In 1992 exported logs (273,000 m³) exceeded the production of round wood (105,000 m³). It is suspected that the data of the guessed that the exported round wood had produced before the year, real production of round wood was more than the figure or defect of statistics.

The export of logs was banned in 1993. Officially, logs and sawn timber exports are controlled, and there was a clamp-down on illegal exports in 1994.

Table - 2.3.2-9 Forestry production

[FORESTRY PRODUCTION]	1980	1985	1988-	1989-	1990-	1991-	1992-	1993-
Round Logs (,000m ³)	0	97	283	225	257	309	105	76
Sawn Wood (,000m ³)	13	13	19	16	16	16	29	83
Fire Wood (,000m ³)	26	84	96	123	105	62	103	58
Charcoal (,000ton)	4	53	9	7	7	0	N.A	N.A

Source: Ministry of Agriculture Forestry and Fishery "Bulletin of Agricultural Statistics and Studies"
Ministry of Commerce "Cambodia Business & Investment Handbook 1996"

2) Industry and Service

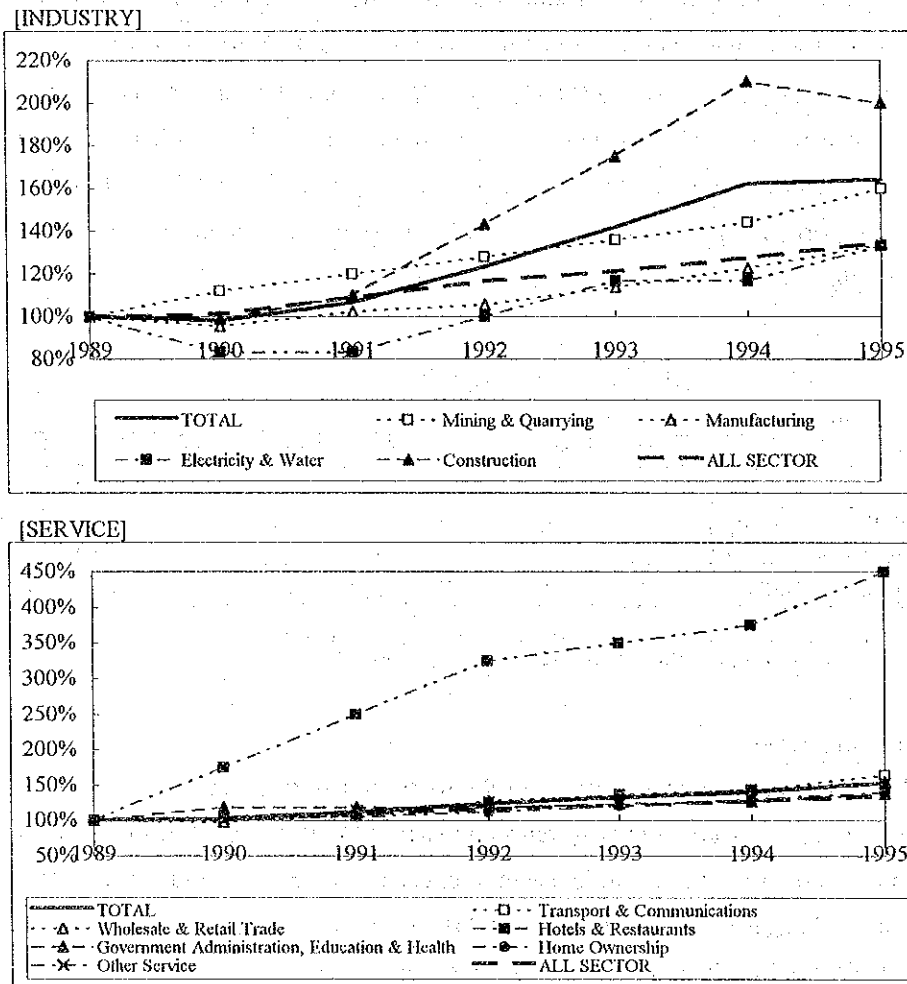
The GDP (1989 constant price) of Industry and Service sectors as 100 % in 1989 is shown in Fig. - 2.3.2-5. Annual growth rates and share of both sectors are shown in Table - 2.3.2-10. The annual growth rate of these sectors exceeds the growth rate of all sectors (5.1%). Hence, the share of these sectors to the whole GDP also increased in these six years; the Industrial sector from 15.4 % to 18.8 % and the Service sector from 32.3 % to 36.7 %.

The growth rate of the Industrial sector exceeds that of whole sectors' GDP among the period. Especially the GDP growth rate of construction (12.3%) was very high and the GDP in 1995 was double that of 1989. Mining & quarrying has steadily increased. GDP of electricity & water decreased 1990 and 1991, but increased after 1992. GDP of industries, mining & quarrying and manufacturing has steadily increased.

Service sector was twice the size of the Industrial sector, and 40 % of it relates to

wholesale & retail trade. The annual growth rate of Service sector's GDP by each sub-sector was about 5.6 % - 8.7 % during 1989 to 1995 except hotel & restaurants, and these growth rates exceeded the GDP of all sectors. The GDP of hotel & restaurants was suddenly increased through 1990 - 1995 and reached to about 4.5 times as much as the 1989 level in 1995 because of the UNTAC's stay and increase of foreign visitors.

Table - 2.3.2-11 shows the production of manufacturing by 1980 constant price. The table shows that the food industry had the largest share, followed by machine industry, chemical industry, textile industry.



Source: Cambodia Business & Investment Handbook, Ministry of Planning "First Socioeconomic Development Plan 1996-2000"

Fig. - 2.3.2-5 GDP trend of industry and service

Table - 2.3.2-10 Trend of GDP at industry sector and service sector

[GDP GROWTH RATE OF INDUSTRY AND SERVICE SECTOR]							
SECTOR	1990	1991	1992	1993	1994	1995	Average (1989-95)
Industry	-2.2%	8.8%	15.7%	15.1%	14.3%	1.3%	8.6%
Mining & Quarrying	12.0%	7.1%	6.7%	6.3%	5.9%	11.1%	8.1%
Manufacturing	-4.4%	7.0%	3.3%	7.9%	7.8%	9.0%	5.0%
Electricity & Water	-16.7%	0.0%	20.0%	16.7%	0.0%	14.3%	4.9%
Construction	-1.3%	11.4%	30.1%	22.3%	20.0%	-4.8%	12.2%
Service	2.7%	8.5%	11.1%	7.2%	5.6%	9.3%	7.3%
Transport & Communications	-1.5%	9.4%	15.7%	9.9%	4.5%	15.1%	8.7%
Wholesale & Retail Trade	-2.2%	12.8%	16.0%	6.0%	5.9%	8.0%	7.6%
Hotels & Restaurants	75.0%	42.9%	30.0%	7.7%	7.1%	20.0%	28.5%
Government Administration, Education & Health	18.3%	0.0%	0.0%	4.5%	2.6%	9.3%	5.6%
Home Ownership	2.6%	2.5%	6.7%	8.0%	7.4%	7.9%	5.8%
Other Service	3.3%	10.3%	9.9%	8.5%	5.4%	7.0%	7.4%
Industry and Service	1.2%	7.6%	7.0%	3.9%	5.2%	5.9%	5.1%

[GDP SHARE OF INDUSTRY AND SERVICE SECTOR]							
SECTOR	1989	1990	1991	1992	1993	1994	1995
Industry	15.4%	14.9%	15.1%	16.3%	18.0%	19.6%	18.8%
Mining & Quarrying	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Manufacturing	7.5%	7.1%	7.0%	6.8%	7.0%	7.2%	7.4%
Electricity & Water	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Construction	6.6%	6.5%	6.7%	8.2%	9.6%	11.0%	9.9%
Service	32.3%	32.8%	33.1%	34.4%	35.4%	35.6%	36.7%
Transport & Communications	2.7%	2.6%	2.7%	2.9%	3.1%	3.0%	3.3%
Wholesale & Retail Trade	13.0%	12.5%	13.1%	14.2%	14.5%	14.6%	14.9%
Hotels & Restaurants	0.2%	0.3%	0.4%	0.5%	0.5%	0.5%	0.6%
Government Administration, Education & Health	3.9%	4.5%	4.2%	3.9%	3.9%	3.8%	4.0%
Home Ownership	6.4%	6.5%	6.2%	6.2%	6.4%	6.6%	6.7%
Other Service	6.2%	6.4%	6.5%	6.7%	7.0%	7.0%	7.1%
TOTAL	47.7%	47.7%	48.2%	50.6%	53.5%	55.1%	55.4%

Note: 1994 and 1995 are Estimated.

Source: Ministry of Planning "First Socioeconomic Development Plan 1996-2000"
Ministry of Commerce "Cambodia Business & Investment Handbook"

Table - 2.3.2-11 Industrial production at 1980 constant price

[INDUSTRIAL PRODUCTION AT 1980 CONSTANT PRICE]												(Unit: Million Riels)	
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
Electricity	200	201	198	218	257	296	306	353	382	543	390	-	
Machinery	28	28	19	34	87	58	90	91	87	79	94	261	
Chemical Industry	33	21	8	39	91	57	82	77	92	112	94	62	
Construction Material	4	3	4	9	13	22	32	21	24	27	12	6	
Textile Industry	4	35	25	52	87	96	132	154	140	170	175	44	
Food	48	67	102	244	338	458	604	696	793	924	1,026	659	
Light Industry	5	3	6	7	17	22	57	41	66	63	56	22	
TOTAL	322	358	362	603	890	1,009	1,303	1,433	1,584	1,918	1,847	1,054	

[SHARE OF SUB-SECTOR TO INDUSTRIAL SECTOR]												
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Electricity	62%	56%	55%	36%	29%	29%	23%	25%	24%	28%	21%	-
Machinery	9%	8%	5%	6%	10%	6%	7%	6%	5%	4%	5%	25%
Chemical Industry	10%	6%	2%	6%	10%	6%	6%	5%	6%	6%	5%	6%
Construction Material	1%	1%	1%	1%	1%	2%	2%	1%	2%	1%	1%	1%
Textile Industry	1%	10%	7%	9%	10%	10%	10%	11%	9%	9%	9%	4%
Food	15%	19%	28%	40%	38%	45%	46%	49%	50%	48%	56%	63%
Light Industry	2%	1%	2%	1%	2%	2%	4%	3%	4%	3%	3%	2%

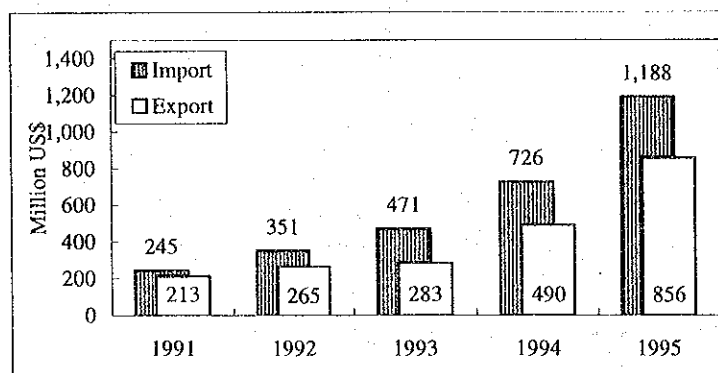
Source: Ministry of Industry, Mines and Energy

3) Trade

In Cambodia, the pattern of trade has changed considerably in the 1990s, following the dissolution of the Soviet Union and the Council for Mutual Economic Assistance (COMECON). Before 1990 most foreign trade was with former USSR; 90 % of imports were formerly from the USSR. But since then, the value of foreign trade with former COMECON has decreased and trade has shifted to countries such as Singapore, Indonesia, Thailand and so on.

Figure - 2.3.2-6 shows recent export and import value. Both export and import increased during 1991 - 1995, but import value was 1.4 times of export in 1995. An excess of import was 322.4 million US\$ in 1995, about ten times the value in 1990 (32.5 million US\$).

In value terms, the main export commodity is logs (13 % of export in 1995), sawn timber (8.5 % the same) and rubber (4.8 % the same) as shown in Table - 2.3.2-12. Main imports are gold (25 % of import in 1995), cigarettes (16.2 % the same), petroleum product (8.3 % the same), motorbike (3 % the same) and vehicle (1.9 % the same).



Source: Ministry of Planning "First Socioeconomic Development Plan, 1996-2000"

Fig. - 2.3.2-6 Trend of external trade

Table - 2.3.2-12 External trade in 1994 and 1995

(Unit: Million US\$)

	1994			1995		
	Official Data	Unrecorded Trade	Total	Official Data	Unrecorded Trade	Total
Export	429.2	60.5	489.8	733.9	121.6	855.5
Logs	100.0	42.3	142.3	51.6	60.0	111.6
Sawn Timber	63.0	18.3	81.3	15.3	57.6	72.9
Fish Products	2.4		2.4	1.9		1.9
Rubber	25.6		25.6	37.2	4.0	41.2
Agriculture Product	5.0		5.0	10.0		10.0
Others	5.5		5.5	30.9		30.9
Re-Export	227.7		227.7	586.9		586.9
Import	643.7	145.3	725.9	922.9	342.5	1,187.9
Cigarettes	140.5		140.5	192.8		192.8
Motorbikes	32.7		32.7	35.7		35.7
Beer	14.5		14.5	14.7		14.7
VCRs	22.6		22.6	14.9		14.9
TV set	21.3		21.3	17.5		17.5
Audio Cassettes	4.2		4.2	4.0		4.0
Gold	78.4		78.4	296.9		296.9
Vehicles	11.4		11.4	22.3		22.3
Construction Materials	25.1		25.1	19.3		19.3
Clothing	10.8		10.8	17.3		17.3
Cloth	35.3		35.3	12.6		12.6
Petroleum Product	61.7		61.7	99.7		99.7
Sugar	9.2		9.2	6.5		6.5
Cement	4.9		4.9	12.4		12.4
Steel	2.3		2.3	4.3		4.3
Others	168.8		168.8	152.1		152.1
Undercoverage Estimate		145.3	145.3		342.5	342.5
Freight & Insurance			-63.1			-77.5

Source: National Bank of Cambodia

Note: Official data are Custom data except Rubber. Data of rubber is by Rubber Department.

: Rubber is 5.2 million US\$ by the Custom data.

: Others in import changed after 94, Jul.

: "Undercoverage Estimate" include government import, foreign aid and donated.

2.3.3 National development plans

(1) The National Programme to rehabilitate and develop Cambodia (NPRDC)

The development policy of national economy are founded on “the National Programme to rehabilitate and develop Cambodia (NPRDC)”, which was published in February 1994. The essential concept of the programme is that the new government, on one hand to establish a real free market system by facilitating the private sector, and has devote itself for the national rehabilitation and development on the other.

On the basis of NPRDC, “the Socioeconomic Rehabilitation Plan (1994-1995)” and “the Implementing the National Programme of Rehabilitate and Develop Cambodia” were published in turn in 1994 and 1995, respectively, and the government has made grate effort to rehabilitate infrastructures with the assistance of foreign countries.

In order to realize the objectives of the policy, the government elaborated “the First Socioeconomic Development Plan 1996-2000(FSDP)” in February, 1996. The plan comprises three parts:

- I. Objectives and strategy,
- II. Review recent macro-economic progress and propose the public investment programme for 996-2000, and
- III. Development programmes for sectors.

Items emphasized in Part I is;

- 1) commercialization of agricultural products
- 2) establishment of an “enabling environment” for domestic and foreign investment,
- 3) promotion of labor-intensive, export-oriented, natural-resources-based industries,
- 4) Promotion of self-employment in both rural and urban areas through vocational training, and
- 5) development of tourism to generate jobs, incomes, tax revenue and foreign exchange in short term.

The key element of the scenario of the macro-economic development described in the Part II of the programme are:

- 1) The GDP growth rate is assumed to be 7.5 %,
- 2) Domestic exports are expected to rise nominally but to remain stable as a ratio to GDP, and will be supported by increase in tourism earnings,
- 3) Imports are also likely to increase as reconstruction proceeds, and the deficit on

- current account(excluding official transfer) is scheduled to rise nominally,
- 4) A negative trade imbalance is projected to be maintained at a level higher than that observed in 1995(10% of GDP)
 - 5) Negative service balance(4.2 % of GDP I 1995) is assumed to become lower and be eliminated by 2000, and
 - 6) Official transfer on current account(8.2% of GDP in 1995) are assumed to fall progressively to 3.7% in 2000.

In Part III, it is described that the plan assumes the public and the private investment over the period 1996-2000 to be US\$1.3 billion and US\$3.7 billion, respectively. The public and the private investment were amounted to US\$420 million and US\$1.4 billion during the period 1991-1995, respectively.

The projected public and private investment in 1996 and 2000 are as shown in Table - 2.3.3-1, and the planned sectoral allocation of the public investment over the five years is shown in Table - 2.3.3-2. As shown in the latter table, the transport sector is given the largest share in the Plan.

Table - 2.3.3-1 Projected public and private investment (1996-2000)

	(US\$ million)		
	1996	2000	Annual Growth 1996 - 2000 (%)
Private Investment	463.0	1,010.0	16.9
Domestically financed	378.0	650.0	11.5
Foreign finance	85.0	360.0	33.5
Public Investment	182.7	352.0	14.0
Domestically financed	27.7	80.0	23.6
Foreign financed	155.0	272.0	11.8
Total investment	645.7	1,362.0	16.1
Domestically financed	405.7	730.0	12.5
Foreign financed	240.0	632.0	21.5

Source: FSDPc

Table - 2.3.3-2 Sectoral allocation of the public investment (1996-2000)

Sector	Rural proportion	Urban proportion	Sector proportion	Total (US\$ million)
Agriculture	97	3	10	220
Manufacturing and Mining	25	75	4	88
Transport and Communications	85	15	23	506
Electricity	26	74	8	176
Water Supply and Sanitation	25	75	8	176
Education and Training	70	30	11	242
Health	75	25	10	220
Social Services	70	30	7	154
Religious and Cultural Affairs	60	40	3	66
Administration/Special Programmes	50	50	11	242
Unallocated	65	35	5	110
Total	65	35	100	2,200

Source: FSDP

(2) The Public Investment Programme

On the basis of the Governments Goals and objectives defined in NPRDC and the framework of the national investment plan provided in FSDP, the Public Investment Program (PIP) identifies the priority project and provide the operational programme of activities. The PIP is a three year rolling investment programme, which shall be updated annually. The PIP consists of two part: Part I is the summary and Part II is the description of the projects proposed by the ministries.

The PIP is intended not only to provide budget allocation for the projects proposed, but also to provide a project assessment process. The investment programme for 1996-1998 has been set at the level of US\$1,400 million. Of this amount, \$1,200m is allocated for high priority projects submitted by ministries and the rest \$200m is an allowance for special projects for public sector reforms. The allocation by sectors is as shown in Table - 2.3.3-3. The transport and communication sector are given a large proportion: the total amount and share of these two sectors are \$312 million and 26%, respectively.

Table - 2.3.3-3 Allocation by Sector (PIP 1996-1998)

(US\$ million)

Sector	Ministries	Allocation	Share
Agriculture and Rural Development	Agriculture, Forestry and fisheries Rural Development Cambodia Mine Action Center	168	14.0 %
Manufacturing and Mining	Commerce, Industry, Mines and Energy	24	2.0 %
Transport and Communication	Public Works and Transport Post and telecommunications Tourism, Cambodia Aviation Autho.	312	26.0 %
Electricity	Industry, Mines and Energy	108	9.0 %
Water	Education	96	8.0 %
Education	Health	144	12.0 %
Health	Health	240	20.0 %
Social, Community & Government Administration	Social Affairs, Labour and veteran Affairs Justice, Economy and Finance, Planning, Information, Environment Secretariats of the States	72	6.0 %
Culture and religion	Culture and Arts Cultures and Religious Affairs	36	3.0 %
Subtotal		1,200	100.0 %
Special projects		200	
Total		1,400	

Source: PIP, 1996 - 1998

2.4 Transportation sector

2.4.1 Transportation network in Cambodia

The routes of the highways, rails and inland waterways are exhibited in Fig. - 2.4.1-1.

(1) Highway network

The highway network of Cambodia consists of the radial national highways, i.e. No. 1 through 7, which interconnect Phnom Penh, the Capital and other major cities, and other secondary highways which are given the number No. 10 and larger. Over the decades of disturbances of war, these highways and bridges have been destroyed. Since 1993, restoration of the national and rural roads is given top priority in the national rehabilitation project. The constructions are being done all over the country, and by the end of 1996, restoration work and rehabilitation work will be completed over the length of 300 km and 550 km, respectively.

The restoration and rehabilitation National Road No. 4, which is the artillery road between Phnom Penh and Sihanoukville, has been almost completed over its entire length of 224 km. The remaining work is the construction of bridges, and these are also scheduled to complete within 1996. The road is fully paved and the allowable maximum Gross Vehicle Weight (GVW) is 25 tons, while other roads still remain at substandard level (15 tons or less).

With the national road No. 4, the land transportation of cargoes between the Capital and Sihanoukville Port by land is fully ensured, and it does not seem to require any additional expansion of this access road as a part of the long-term plan of Sihanoukville Port.

(2) Railways

The Royal Railway of Cambodia (CFRC) operates its 385 km long Northern line and 246 km long Southern Lines. The former links Phnom Penh with rich agricultural provinces in the northwestern regions of the country. However, without renewal since its completion in 1943, the condition of Northern Line is very poor.

Completed in 1969 to link Sihanoukville Port with Phnom Penh, the rails of Southern Line is still in good condition and the rehabilitation of the track bed is presently being implemented. In early 1996, the CFRC started container freight service between Sihanoukville Port and Phnom Penh. The Phnom Penh Station is being renovated for the convenience of container handling. The Southern Line is, thus, expected to provide an alternative route to the highway between Sihanoukville Port and the capital.

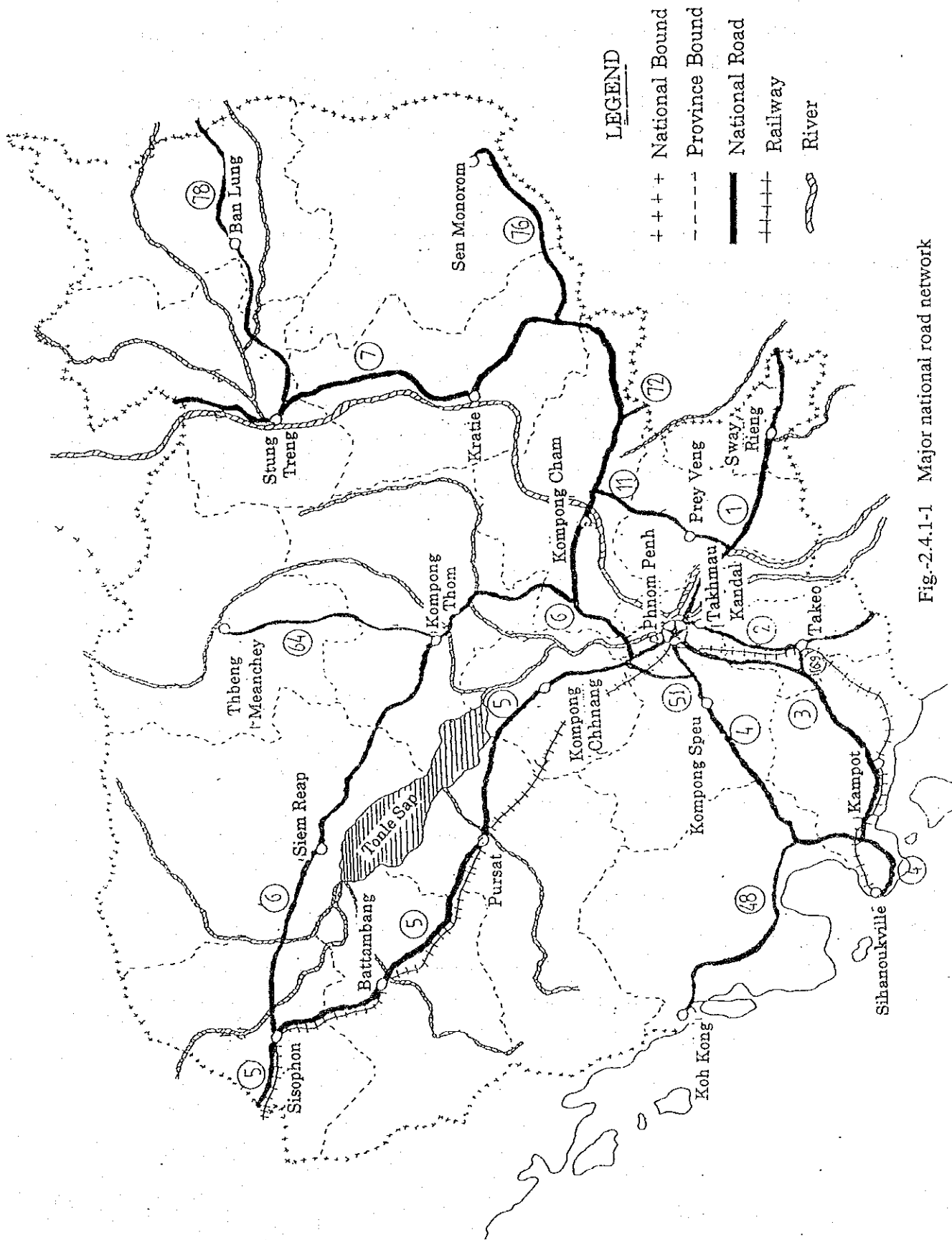


Fig.-2.4.1-1 Major national road network

(3) Inland waterways

Sihanoukville Port is separated from the network of the extensive inland waterways in the plain regions, while Phnom Penh is in the center of the network. Thus, it seems that the function of inland water transport is indirect: the cargo brought from Sihanoukville Port to Phnom Penh may be transshipped there to distribute the cargoes further into rural areas in plain region.

(4) Dry Port

The site of the proposed the Dry Port is located near Pochentong Airport(Phnom Penh Airport) where the highway No.4 and the railway crossed each other.

The Dry Port, which is expected to start operation in late 1997, comprises a container yard having 6 ha land area with a plan to expand additional 19 ha in the future, a warehouse and an administration building. When completed, the Dry Port is expected to handle 80% (or approximately 800 - 900 TEU per month) of container cargoes of Sihanoukville. The Dry Port will benefit both shipping lines and consignors by completing custom office there.

To start the business, containers will be brought to the Dry Port by trailers. Rail transportation may be cooperated when the capacity of the Southern Line of the CFRC is increased.

2.4.2 Port network

(1) Classification of ports in Cambodia

Ports in Cambodia are classified in to two categories: international port and domestic port. The latter is sometimes called regional port or municipal port. In addition to these international and domestic ports which are administrated by the Ministry of Public Works and Transport, there are fishing ports which are administrated either by the Ministry of Agriculture, Forestry and Fisheries or the Department of Fisheries of the Municipalities.

Table - 2.4.2-1 summarizes the international and domestic ports of Cambodia, classified by their locations.

The ports located on the Mekong formulate a radial network with the centre at Phnom Penh, and the three domestic ports on Gulf of Siam are interconnected each other, while Sihanoukville Port plays a role as the alternative gateway to Phnom Penh. There is no cargo movement between International Sihanoukville Port and other three domestic ports.

Table - 2.4.2-1 Classification of ports of Cambodia

Location	Name of port	Classification
Mekong	Phnom Penh	International (Domestic)
	Phnom Penh(Municipal)	Domestic
	Kompong Cham	Domestic
	Kratie	Domestic
	Stung Treng	Domestic
Tonle Sap	Kompong Chhnang	Domestic
	Chhrok Tru, Krakor, Siem Reap	Domestic
Gulf of Siam	Sihanoukville	International
	Sihanoukville(Municipal)	Domestic*
	Koh Kong	Domestic*
	Kampot	Domestic

Note: * demotes that the port handle international cargoes, too.

(2) International Ports

The ports of Phnom Penh and Sihanoukville are the two main ports for international trade. They are administrated by the government, the Ministry of Public Works and Transport. Phnom Penh Port is a river port in Mekong River, and located in the capital, has been the largest port. Sihanoukville Port is located in Gulf of Siam and the sole international deep sea port of the country. In addition to these two ports, Koh Kong Port, though it is a municipal port, is now an important transshipment point between international and regional trade. The total international cargo volume at Phnom Penh and Sihanoukville exceeded amounted to over 1.248 million tonnes (including oil which amounted to 459 million) in 1995: this amount is still lower than the recorded peak volume 1.5 million in 1965. Most of the cargoes are transshipped in Singapore.

Phnom Penh Port has been the largest port with large portion of general cargoes and nearly all oil import. In 1995, Sihanoukville Port handled 75% of general cargoes and almost all the container cargoes, which amounted to one thirds of the volume of general cargo. With some expansion plan of the oil terminal at Sihanoukville Port, the oil import volume is also expected to increase. Now, Sihanoukville Port is, thus, the largest port of the country.

Both the Phnom Penh and Sihanoukville Ports have separate berthing facilities for oil tankers, and the Ports are responsible for operation and maintenance of these berthing facility and the access channel and the docking operation including tug service. Oil companies are responsible for the oil unloading.

In Phnom Penh Port, domestic cargoes are handled at the river banks. There are two sites

for domestic cargo handling to the north of Phnom Penh international port. The southerly site is administrated by the Port of Phnom Penh and northerly part by the municipality.

In Sihanoukville Port, aside from the port facilities administrated by the Port of Sihanoukville, there is a municipal port administrated by the Department of Transportation under the Municipality. At the Sihanoukville municipal port, both international and domestic cargoes are handled, and there are regular passenger liner services from Sihanoukville to Koh Kong and Kampot.

2.4.3 Functions of Sihanoukville Port in the cargo traffic in the country

Sihanoukville Port is the alternative port to Phnom Penh Port. The hinterland of the both ports is completely overlapped, and the international seaborne cargoes to and from Cambodia pass through one or the other. The port statistics of recent years show that Phnom Penh Port is characterized to handle oil while Sihanoukville to handle containers, and wood products. Such characteristics of cargo movement shall be dully taken into considerations in the stage of the cargo forecast.

2.5 Present situation of Sihanoukville Port

2.5.1 Natural situations

(1) Collected information associated with the development Sihanoukville Port

An investigation of natural conditions around the area of Sihanoukville Port was carried out by the Russian survey team in 1988 * (hereinafter referred to as 'USSR report'). This report is composed of three volumes, either of them is the geodesic prospecting engineering including the bathymetric survey (Vol.1), the geological researching engineering (Vol.2) and the hydrologic prospecting engineering (Vol.3), respectively. The significant contents of these volumes are reviewed bellow.

Vol.1 contains the results of topographic survey around the old and New Port area, alongside the north breakwater and the Oil Port area with the scale of 1 to 500. A hydrographic survey using an echo-sounder was conducted in the vicinity of the basin in front of the New Port wharf and the south channel. The outcome was also shown by the bathymetric map with the scale of 1 to 5000.

Plenty of numbers of borings were conducted around the Old Port area, at the New Port basin, a work shop area which is formerly planned, alongside the north breakwater and the Oil Port area. Vol.2 contains the geological information such as the stratification of those area, the physical test results including the water contents, the plasticity index, the specific gravity, the grain size distribution, the shear strength and even the consolidation coefficient. However, any standard penetration test (SPT) which gives a most useful geotechnical information for the port designer, was not carried out somehow.

Vol.3 is composed of 'Characteristics of meteorology' and 'Characteristics of hydrology'. The former describes the temperature of air, humidity of air, rainfall and winds. According to USSR report** , all the data are referred to the reports shown below.

- Survey documents of Kompong Som meteorology station, during periods of 1956-1972 and 1982-1985.
- Documents concerning the exploration carried out by the surveyor, 1988
- Documents collected by the Kampuchea side during the past year.
- Technical standards in use in the people republic of Kampuchea and technical publication.

* Technical report on the prospecting of the filling material in the maritime throught of Kompong Som Port, Vol.1 to Vol.3, USSR v/o Technoexport People's Republic of Kampuchia, 128-10, 1988.

** USSR report, Vol.3.

Those data are collected by the meteorological station which was used to be stationed 1.5 km southeast from Sihanoukville Port and its level was around 15m above the mean sea level. The activity of meteorological observation was performed from 1957-1972, but the station was closed during 1973-1981 period. Then the survey started again from 1982.

The latter describes mainly fluctuation of sea level, velocity of sea current, wave height, seabed material, which are collected by the Russian survey team from January to December in 1988.

(2) Climate

The climate of Sihanoukville is particularly marked by the changing of wind direction depending on the season like as overall of Cambodia. In a year, there are two typical seasons, which are North East Monsoon season and South West Monsoon season. During the North East season, it is the dry season with light cloudy, few rainfall and the moderated air temperature. During the South West Monsoon, it is the rainy season with cloudy sky and rainfall mostly followed by a storm. During the transit periods, when the season change, the direction of wind, rains and storm are movable.

a. Temperature

Table - 2.5.1-1 and Table - 2.5.1-2 shows the monthly average of maximum and minimum temperature from 1985 to 1995 and from 1957 to 1971, respectively. According to these data, the average temperature of the air during 1957-1972 was 27.3 °C. The yearly average temperature is typical one for a tropical climate. The coolest month is January with a monthly average temperature of 26.2 °C and the hottest month is April with a monthly average temperature of 28.7 °C. These tendencies are the same as the ones of 1985-1995, other than the present rise of averaged minimum temperature compared with 1957-1971.

b. Wind

Table - 2.5.1-3 shows the monthly maximum wind speeds from the years of 1984 to 1995. It is realized that through the year, the strong wind occur mostly in a South-West Monsoon season with the direction of West, South-West, an exceptionally North-West. The records of strong winds during this periods is 20 m/s with the direction of South-West. Figure - 2.5.1-1 shows the wind rose of at Sihanoukville from 1983-87 and 1994-96. It shows that the south wind is outstanding.

Table - 2.5.1-4 shows the wind direction with maximum speed in each month through the year of 1960 to 1969 and it shows that the maximum wind speed is 27 m/s with the direction of West. The reason for the discrepancy in the high occurrence wind rose direction between both data is that the location of the station observed was different and, in particular, the level of anemometer was 10m to 15m above the sea level. Figure - 2.5.1-2 shows the wind rose trough

1963-1970 based on the data of Table - 2.5.1-5. During the dry season , the south wind is outstanding and rainy season, the south-west direction.

Table-2.5.1-1 (a) Monthly average of maximum temperature (°C)

Station; Sihanouk Ville (Latitude: 10 ° 38 ,Longitude: 103 ° 29')													
Month													
Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1985	29.2	29.4	29.5	30.9	30.9	29.6	29.5	29.4	29.4	29.5	30.5	29.7	29.8
1986	29.4	29.8	30.6	34.0	30.8	30.0	30.0	29.3	29.8	30.4	30.2	30.0	30.4
1987	29.9	30.2	30.8	29.9	30.2	30.8	29.4	29.6	29.9	28.3	30.2	29.6	29.9
1988	29.8	29.9	31.5	30.0	30.4	31.0	29.9	29.2	29.7	30.2	30.7	29.8	30.2
1989	30.0	30.5	32.0	31.7	32.6	30.7	30.2	29.0	29.2	29.8	30.0	29.0	30.4
1990	29.9	31.3	31.7	32.2	32.9	30.5	30.3	29.7	30.2	29.9	31.5	30.6	30.9
1991	29.7	31.7	31.9	32.3	32.6	30.6	29.9	28.8	29.4	30.0	30.2	30.0	30.6
1992	29.9	30.9	31.6	32.4	32.5	31.0	30.0	29.4	30.0	29.8	30.4	29.9	30.7
1993	29.5	30.2	31.3	32.1	32.0	30.9	29.8	29.3	31.1	30.2	30.8	30.6	30.7
1994	30.1	31.2	31.2	32.0	31.0	31.2	30.1	29.5	30.3	29.8	30.1	30.9	30.6
1995	31.0	31.5	31.6	32.8	32.5	31.4	30.6	29.3	29.9	29.9	30.6	30.8	31.0
Ave.	29.9	30.6	31.2	31.8	31.7	30.7	30.0	29.3	29.9	29.8	30.5	30.1	30.5

Table-2.5.1-1 (b) Monthly average of minimum temperature (°C)

Month													
Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1985	22.0	22.2	29.8	24.6	25.1	24.5	24.1	24.1	23.7	24.0	23.7	22.2	24.2
1986	22.5	23.0	24.0	25.0	24.8	24.5	24.5	23.1	23.0	23.0	23.2	22.6	23.6
1987	22.6	23.7	25.8	22.6	23.7	25.8	25.5	25.3	26.6	22.7	27.2	24.0	24.6
1988	21.9	22.5	25.3	25.5	26.3	24.4	24.3	24.3	25.4	23.5	24.0	23.9	24.3
1989	22.3	23.2	24.5	24.9	26.8	25.6	24.2	24.5	25.0	23.7	24.2	24.0	24.4
1990	22.0	22.7	25.5	26.0	26.7	25.9	24.1	23.9	24.9	23.0	23.9	23.6	24.4
1991	21.6	22.5	23.7	25.6	26.3	26.0	24.0	24.6	24.3	22.9	22.6	22.2	23.9
1992	21.5	22.0	22.9	24.2	25.8	25.3	24.2	24.0	24.6	23.0	22.9	22.4	23.6
1993	21.3	21.7	21.9	24.0	24.2	24.7	24.7	24.0	24.0	24.1	22.9	23.2	23.4
1994	22.6	23.4	24.8	25.0	25.3	24.9	24.6	24.2	24.1	23.6	22.7	22.1	23.9
1995	22.9	23.1	25.0	26.0	26.2	25.1	24.7	24.4	23.9	23.3	23.0	22.6	24.2
Ave.	22.1	22.7	24.8	24.9	25.6	25.2	24.4	24.2	24.5	23.3	23.7	23.0	24.0

Source; Ministry of Agriculture, Forestry and Fishery department of Hydraulic, Hydro-meteorology, Meteorological Office

Table-2.5.1-2 Average, max. and min. of temperature (1957-1971)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Ave.	26.2	26.9	27.9	28.7	28.4	27.8	27.2	27.1	27	26.9	27.1	26.6	27.3
Mx Av	29.8	30.5	31.7	31.9	31.3	30.2	29.6	29.3	29.3	29.9	30.3	30.2	30.3
Mn Av	23.3	23.8	24.8	25.2	25.5	25	24.6	24.7	24.6	24.5	24.3	23.7	24.5

Source;USSR report, 1988, vol.3, p.9

Table-2.5.1-3 Monthly maximum of wind (m/s) (1984-1995)

Years	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd	dir	spd
1984	N	8.0	E	8.0	S	8.0	S	6.0	NW	6.0	NW	12.0	W	12.0	NW	6.0	W	8.0	NW	10.0	W	7.0	N	6.0
1985	S	20.0	S	6.0	E	6.0	S	6.0	NW	7.0	W	8.0	W	18.0	NW	8.0	W	8.0	S	6.0	E	4.0	N	6.0
1986	N	8.0	S	6.0	N	8.0	SE	4.0	SE	8.0	W	4.0	W	8.0	W	6.0	W	8.0	NW	8.0	NW	8.0	N	8.0
1987	N	8.0	NW	8.0	S	8.0	S	8.0	S	4.0	W	8.0	NW	10.0	NW	8.0	W	7.0	S	9.0	N	8.0	NW	6.0
1988	S	8.0	SE	7.0	SE	7.0	S	6.0	NW	8.0	W	10.0	W	12.0	W	7.0	W	8.0	NW	9.0	NW	8.0	N	6.0
1989	N	7.0	SW	9.0	S	9.0	SW	12.0	SW	10.0	SW	12.0	SW	20.0	SW	20.0	SW	17.0	SW	10.0	SW	12.0	N	10.0
1990	NE	6.0	E	7.0	SE	10.0	SW	16.0	SW	20.0	SW	17.0	SW	14.0	W	18.0	SW	12.0	SW	10.0	SW	10.0	N	8.0
1991	N	10.0	SW	8.0	S	8.0	SW	10.0	SE	20.0	SW	12.0	SW	10.0	NW	14.0	W	12.0	SW	9.0	SW	9.0	N	8.0
1992	NE	10.0	S	9.0	S	8.0	SW	20.0	W	20.0	SW	16.0	W	10.0	SW	9.0	SW	18.0	NW	7.0	SW	7.0	N	8.0
1993	N	9.0	SE	7.0	E	10.0	SE	16.0	SW	18.0	W	12.0	W	14.0	NW	17.0	W	7.0	E	9.0	W	N	8.0	
1994	S	7.0	SE	6.0	SE	9.0	NW	16.0	NW	7.0	W	8.0	W	10.0	NW	9.0	W	8.0	NW	10.0	NW	8.0	NW	7.0
1995	SE	10.0	NE	9.0	SE	7.0	S	8.0	SE	7.0	W	16.0	SW	16.0	W	15.0	SW	9.0	NW	10.0	NW	6.0	NW	6.0

Source: Ministry of Agriculture, Forestry and Fishery department of Hydraulic, Hydro-metrology, Meteorological Office

Table-2.5.1-4 Wind direction with max. speed in each month (m/s,1960-1969)

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Mx.
Jan	18	20	16	12	8	10	14	12	10	8	8	8	8	8	10	12	20
Feb	14	16	12	14	12	12	12	14	8	12	14	12	8	8	8	10	16
Mar	8	12	10	8	10	12	12	16	16	12	12	10	12	10	8	8	16
Apr	16	12	8	8	10	10	14	12	16	10	12	10	16	8	16	8	16
May	8	8	10	8	16	12	14	18	19	19	19	12	18	17	14	16	19
Jun	19	19	19	8	21	8	8	8	17	13	23	25	22	8	16	8	25
Jul	14	8	8	8	8	8	8	8	23	9	23	11	21	12	21	8	23
Aug	8	8	8	11	8	8	8	8	23	14	22	13	27	18	21	17	27
Sep	8	8	8	8	11	8	8	8	17	13	21	21	21	19	21	16	21
Oct	14	8	12	8	17	8	16	8	19	18	20	19	24	9	8	8	24
Nov	16	8	17	8	17	8	16	8	8	7	16	8	16	8	8	8	17
Dec	20	20	20	8	17	8	17	8	8	8	8	8	8	8	12	8	20
Year	20	20	20	14	21	12	17	18	23	19	23	25	27	19	21	17	27

Source:USSR report, Vol.3, p.28

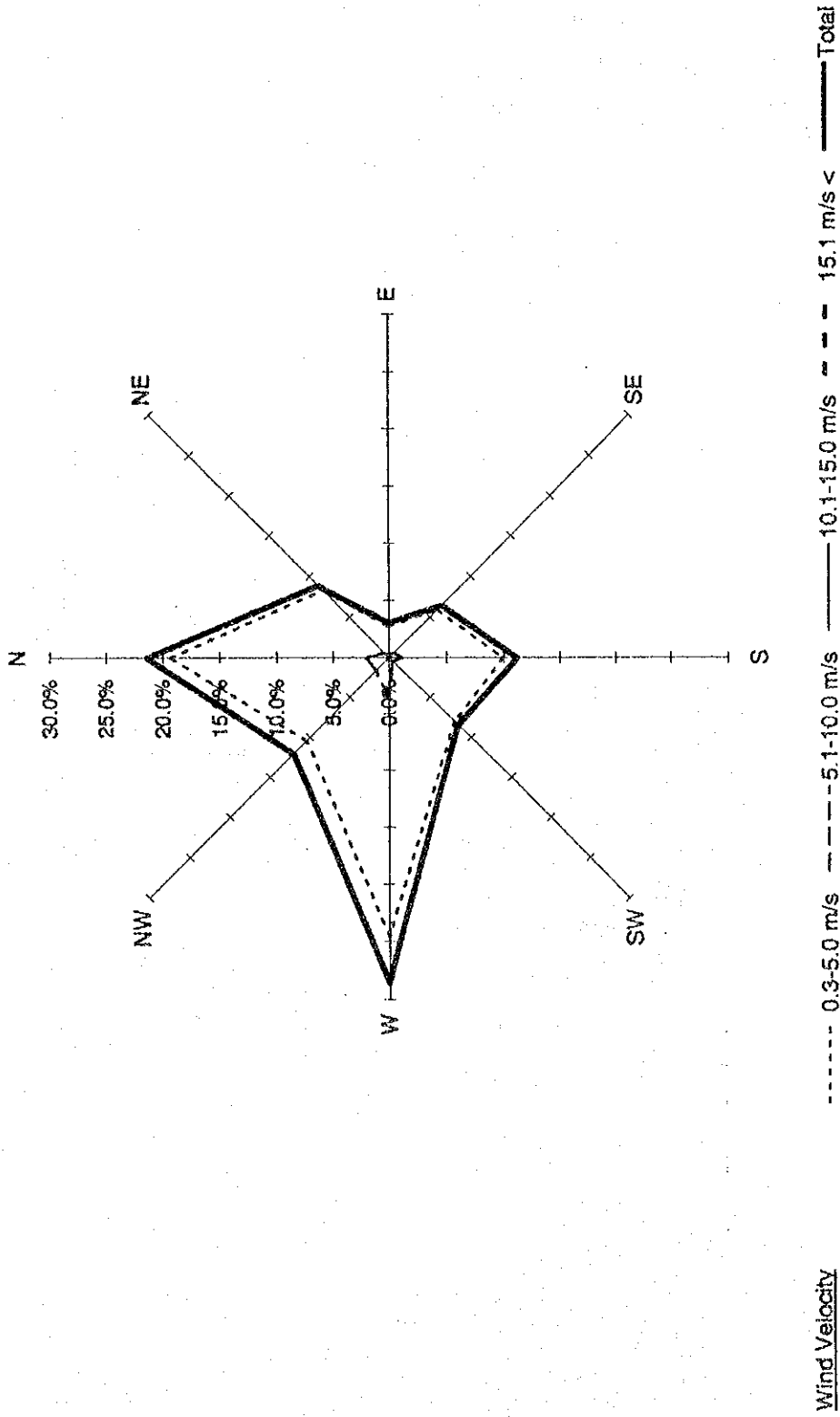


Fig-2.5.1-1 Wind rose at Sihanoukville (1983-87,1994-96)

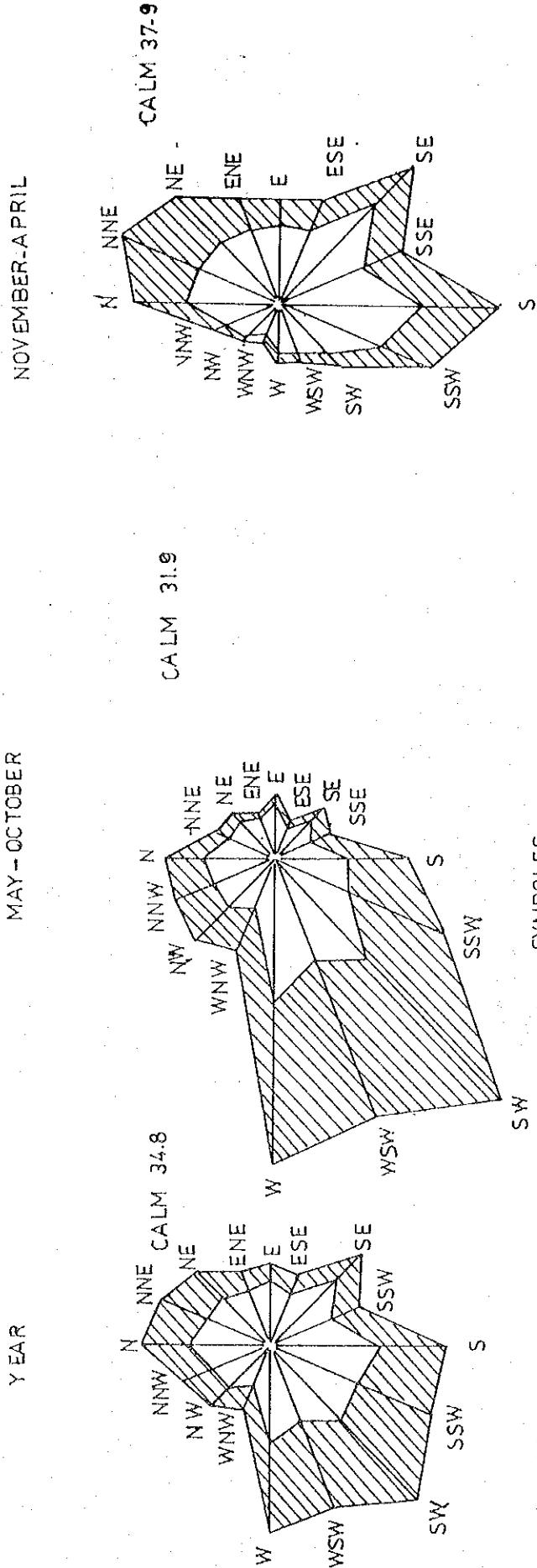


Fig-2.5.1-2 Wind rose at Sihanoukville (1963-70)

Table - 2.5.1-5 Frequency of wind-speed by direction (%) in 8 min. observation (1963-1970)

(from January to December)																	
W/Speed(m/s)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Occurrence(%)
0-1	2.71	2.22	2.19	1.93	2.11	1.77	3.10	2.07	3.65	3.17	3.42	2.63	3.18	1.38	1.89	2.05	34.8
1-3	1.46	1.63	1.20	0.58	0.56	1.18	1.11	2.25	2.58	2.58	3.42	2.90	2.81	0.92	0.86	0.94	39.47
4-8	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.03	0.08	0.20	0.15	0.12	0.02	0.02	0.03	24.99
9-13	4.18	3.85	3.40	2.51	2.68	2.36	4.29	3.19	5.93	5.83	7.05	5.69	6.12	2.32	2.77	3.02	0.71
14-20										0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03
Sum.	4.18	3.85	3.40	2.51	2.68	2.36	4.29	3.19	5.93	5.83	7.05	5.69	6.12	2.32	2.77	3.02	100.00
(Rainy season)																	
W/Speed(m/s)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Occurrence(%)
0-1	2.38	1.61	1.61	1.29	1.67	0.98	1.73	1.22	2.53	2.67	4.48	3.47	4.69	1.65	2.21	2.22	31.89
1-3	1.18	0.51	0.38	0.23	0.31	0.17	0.60	0.78	1.97	3.40	6.04	5.33	5.14	1.51	1.45	1.29	36.41
4-8	0.03	0.01			0.01	0.03	0.03	0.01	0.06	0.15	0.39	0.29	0.24	0.04	0.04	0.05	30.29
9-13	3.59	2.13	1.99	1.52	1.99	1.15	2.36	2.01	4.56	6.22	10.92	9.10	10.09	3.21	3.70	3.57	1.35
14-20										0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.06
Sum.	3.59	2.13	1.99	1.52	1.99	1.15	2.36	2.01	4.56	6.22	10.92	9.10	10.09	3.21	3.70	3.57	100.00
(Dry season)																	
W/Speed(m/s)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Occurrence(%)
0-1	3.06	2.85	2.80	2.61	2.58	2.61	4.54	2.97	4.82	3.70	2.31	1.75	1.59	1.09	1.55	1.85	37.87
1-3	1.76	2.82	2.05	0.94	0.81	1.03	1.78	1.47	2.54	1.72	0.65	0.35	0.35	0.31	0.24	0.58	42.68
4-8			0.03	0.01	0.01												19.40
9-13	4.82	5.67	4.88	3.56	3.40	3.64	6.32	4.44	7.36	5.42	2.96	2.10	1.94	1.40	1.79	2.43	0.05
14-20																	
Sum.	4.82	5.67	4.88	3.56	3.40	3.64	6.32	4.44	7.36	5.42	2.96	2.10	1.94	1.40	1.79	2.43	100.00

Source: USSR report vol.3, 1988, pp. 22-23.

c. Rainfall

Table - 2.5.1-6 shows the rainfall records from 1985 to 1995. The quantity of yearly rainfall through this periods is 3000 m/m to 4000 m/m. When the records from 1985 to 1989 is omitted because of lack data, it is found that the rainfalls mostly come during the rainy season from May to October, the quantity of rainfall of this term is over nearly 80 % of the total amount of the year . Table - 2.5.1.7 shows the similar data to Table - 2.5.1-6, but from 1956 to 1971. The quantity of yearly average rainfall during this term is 3616 mm. Table - 2.5.1-8 shows the average numbers of rainy days, which is 183 days. Table - 2.5.1-9 shows the intensity of rainfall through the year of 1960-1970.

Table - 2.5.1-6 Rainfall historical (Station; Sihanoukville)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
1985	Total	4.6	20.1	74.0	263.5	343.6	551.9	217.3	609.3	468.6	429.8	165.6	23.5	3171.8
	Max	4.6	12.4	17.8	72.5	-	118.0	56.5	103.3	89.3	77.2	82.3	22.0	118.0
	Nos./Rain	1	3	7	8	-	15	16	21	21	21	11	2	118.0
1986	Total	6.8	59.2	35.6	58.1	522.8	558.6	785.5	654.0	596.8	34.8	152.0	5.2	3469.4
	Max	6.8	30.7	35.6	12.3	137.5	74.3	311.8	-	-	-	-	-	-
	Nos./Rain	1	2	1	7	21	19	19	-	-	-	-	-	-
1987	Total	4.5	0.0	0.4	216.3	216.1	778.1	221.1	363.6	555.4	318.3	409.4	-	3083.2
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nos./Rain	-	-	-	-	-	-	-	-	-	-	-	-	-
1988	Total	14.2	70.5	23.7	127.6	454.2	600.4	799.1	338.7	555.9	447.7	122.6	0.0	3554.6
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nos./Rain	-	-	-	-	-	-	-	-	-	-	-	-	-
1989	Total	30.4	22.8	120.3	83.8	613.2	388.2	540.6	864.7	224.5	380.1	53.4	8.9	3330.9
	Max	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nos./Rain	-	-	-	-	-	-	-	-	-	-	-	-	-
1990	Total	35.2	21.1	109.6	81.9	209.5	683.5	309.3	626.7	590.7	261.8	111.9	2.0	3043.2
	Max	35.2	13.9	38.7	30.3	90.6	110.2	48.5	65.6	79.1	65.5	33.4	2.0	110.2
	Nos./Rain	1	3	10	9	13	24	25	26	24	24	8	1	168
1991	Total	37.2	23.5	2.6	223.1	224.1	505.4	1315.7	720.7	775.2	402.2	4.2	1.0	4234.9
	Max	32.5	20.0	1.6	62.2	44.6	90.0	180.0	73.0	106.2	60.2	3.0	1.0	180.0
	Nos./Rain	5	4	3	14	16	22	22	27	27	18	2	1	161
1992	Total	1.0	58.5	14.9	80.0	179.6	670.8	483.7	717.9	393.3	324.3	9.4	2.6	2936.0
	Max	1.0	34.4	9.0	28.0	71.0	95.4	55.2	104.0	162.0	64.0	7.2	2.6	162.0
	Nos./Rain	1	3	4	6	12	19	26	25	19	21	4	1	141
1993	Total	40.0	10.0	129.7	158.9	196.6	654.7	741.9	504.1	607.8	256.3	100.6	42.4	3443.0
	Max	18.5	10.0	62.5	71.6	44.5	132.3	174.0	86.9	105.6	37.4	50.2	27.6	174.0
	Nos./Rain	5	1	5	9	11	21	24	24	25	23	11	5	164
1994	Total	62.5	16.4	221.2	199.2	352.6	612.9	408.0	560.7	760.4	208.1	23.3	83.4	3508.7
	Max	43.1	9.6	59.0	66.2	69.8	85.5	41.7	63.4	126.2	41.0	10.0	35.2	126.2
	Nos./Rain	7	3	17	10	22	21	26	23	27	14	5	6	181
1995	Total	24.8	6.0	53.6	63.2	299.3	363.6	544.4	941.1	540.2	286.7	42.9	24.2	3190.0
	Max	18.4	6.0	30.0	15.8	105.4	59.0	87.0	110.2	68.5	45.1	17.1	14.0	110.2
	Nos./Rain	4	1	7	11	14	23	22	26	28	22	9	5	172

Source: Ministry of Agriculture, Forestry and Fishery department of Hydraulic, Hydro-meteorology, Meteorological Office

Table - 2.5.1-7 Average, maximum and minimum quantity of rainfall
at Sihanoukville (1956-1971) in m/m

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average	28.0	35.2	84.0	158.0	333.0	501.0	540.0	674.0	623.0	378.0	162.0	49.8	3616.0
Max.	160.0	98.2	389.0	307.0	644.0	1028.0	938.0	1094.0	1160.0	735.0	357.0	152.0	4566.0
Min.	0.0	0.0	0.0	18.4	7.9	34.7	71.5	262.0	280.0	36.1	20.3	0.7	1520.0

Source: USSR report, Vol.3, 1988, p. 12

Table - 2.5.1-8 Average, maximum and minimum day numbers
with rain (1957-1972, 1982-1985) in m/m

	Jan.	Feb.	Mar	Apr.	May	Jun	Jul.	Aug	Sep	Oct	Nov	Dec	Year
Av. Rain days	3	4	7	12	20	23	25	25	24	23	12	5	183
Max. day	7	8	17	21	28	27	28	30	30	27	21	15	
of day/ year	1969	1965	1959	1970	1964	1962	4yrs	1963	1957	1961	1963	1966	
	1984				1966	1969		1968					
						1982							
Min. day of					11	15	16	17	17	19	6	1	
of day/year	4 yrs	1983	1967	1983	1962	1985	1985	1985	1983	1960	1968	3 years	
										1968			

Source: USSR report, Vol.3, 1988, p.13

Table - 2.5.1-9 Intensity of rainfall (1960-1970)

	Quantity of rainfall in m/m				Intensity of rainfall in mm/min			
	15.0	30.0	45.0	60.0	15.0	30.0	45.0	60.0
1960	18.0	28.8	36.6	39.0	1.20	0.96	0.81	0.65
1961	25.2	30.0	36.0	49.7	1.68	1.00	0.80	0.83
1962	40.0	65.0	83.0	94.0	2.67	2.17	1.84	1.57
1963	28.0	49.0	59.0	64.0	1.87	1.63	1.31	1.07
1964	30.0	58.0	80.0	93.4	2.00	1.93	1.78	1.56
1965	30.0	49.0	57.0	67.0	2.00	1.63	1.27	1.12
1966	53.5	67.0	73.5	83.0	3.57	2.23	1.63	1.38
1967	40.0	60.0	85.0	111.0	2.67	2.00	1.89	1.85
1968	42.8	52.4	68.5	76.0	2.85	1.75	1.52	1.27
1969	35.0	50.0	54.5	63.9	2.33	1.67	1.21	1.06
1970	34.0	50.0	73.5	86.5	2.27	1.67	1.63	1.44

Source: USSR report, Vol.3, 1988, p. 15

(3) Topographic condition

a. General

A north-north-east part to south-south-west of Sihanoukville Port is facing the Kompong Som bay with a water depth of -5m to -10m. The distance from the other side of the bay is approximately 50 km in the north direction and 25 km in the north-west direction, respectively. The port area are enclosed by a low rolling hill, by which the north-east seasonal wind from the gulf of Thailand is broken. The Kaoh Rong island and Kaoh Rong Samloem are existing and those islands break the south-west wind in the monsoon season. Furthermore, the Kaoh Poah island exists at the distance of 1.5 km from the coastal line.

A hillside at the hinterland is covered with a sandy soil made of weathered sandstone, otherwise outcropped. This ground condition was formed by the orogenic movement at the latter of Cretaceous period and it appears around overall of Sihanoukville. There used to be three quarries of this material, which was utilized for the construction of Sihanoukville Port. A rain water around this area mostly run in the south-east area of Sihanoukville peninsula, through the small river and flows into the sea, where a lagoon or small size lake are formed. A natural beach is not remained at the New Port area.

The New Port is enclosed by the north breakwater from Pte.Loune to Pte.Domonique, where only the basin area for the New Port wharf was dredged down to -8m or -9m and the other area remains with no dredging work, hence -4m to -6m of its water depth. There is a trunk line road in the distance of about 500m to 600m away from the New Port wharf. The area between the wharf and this trunk road is utilized as the port facilities. The area behind the trunk road connects to the hill with the approximate height of 100m.

This trunk road has one track lane and runs from the New Port area to the Oil Port area alongside the coastal line. Two clusters of fishing village, which is described more in the chapter 2.6.8, exists around the base of the north breakwater and the groyne. Behind the coastal road, there is a small lake with a swampy area, whose scale depends on the season of either rainy or dry. The area behind this swamp is rather narrow, and so reach the foot of the slightly elevated hill at the distance of 150m to 300m from the coastal line. The area of Oil Port cape (Pte Depart) is rock shore.

b. Topographical survey*

The topographical survey using a total work station shown by Fig. - 2.5.1-3 was conducted through 24 May to 2 June covering a entire potential port development area shown by Fig. - 2.5.1-4.

* Report (Vol.1) on Natural Condition and Environmental Survey for the study on the Master Planning and Feasibility Study of Sihanoukville Port, 1996.

1) The bench mark

The bench mark at Lun Beacon was adopted and checked against two other benchmarks at RP-1 and Quai stations.

A series of benchmark was established temporarily in relation to the standard benchmark adopted from LUN BEACON (RL = 2.140 MSL)

2) Chart datum

When the present survey work started, a results of the harmonic analysis on the basis of the observed tidal data were not obtained. Therefore, the Chart Datum (CD) at Sihanoukville Port was adopted tentatively as 1.0m below the Mean Sea Level (MSL) based on Admiralty Tide Tables, Vol.3, 1996** , as follows.

Chart datum = 1.000m below MSL.

Remarks: Z_0 is normally determined by 5 years observation. Since the available data for the moment is only one month, Z_0 must be modified after sufficient data obtained, which is described more in (7).

All the survey data has been processed by the computer and reported by the separate volume, in which the outcomes are shown by Table - 2-5-1-10 and Table - 2.5.1-11.

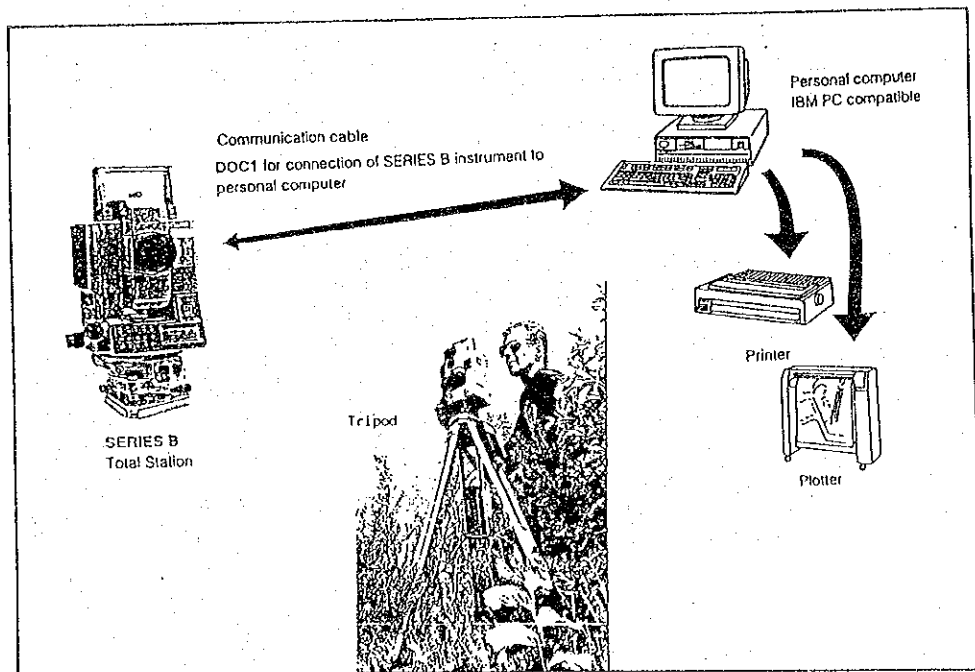


Fig. - 2.5.1-3 Equipment set-up of topographic survey

** Admiralty Tide Tables and Tidal Stream Tables, Vol. 3, 1966. (Published by the Hydrographer of the Navy)

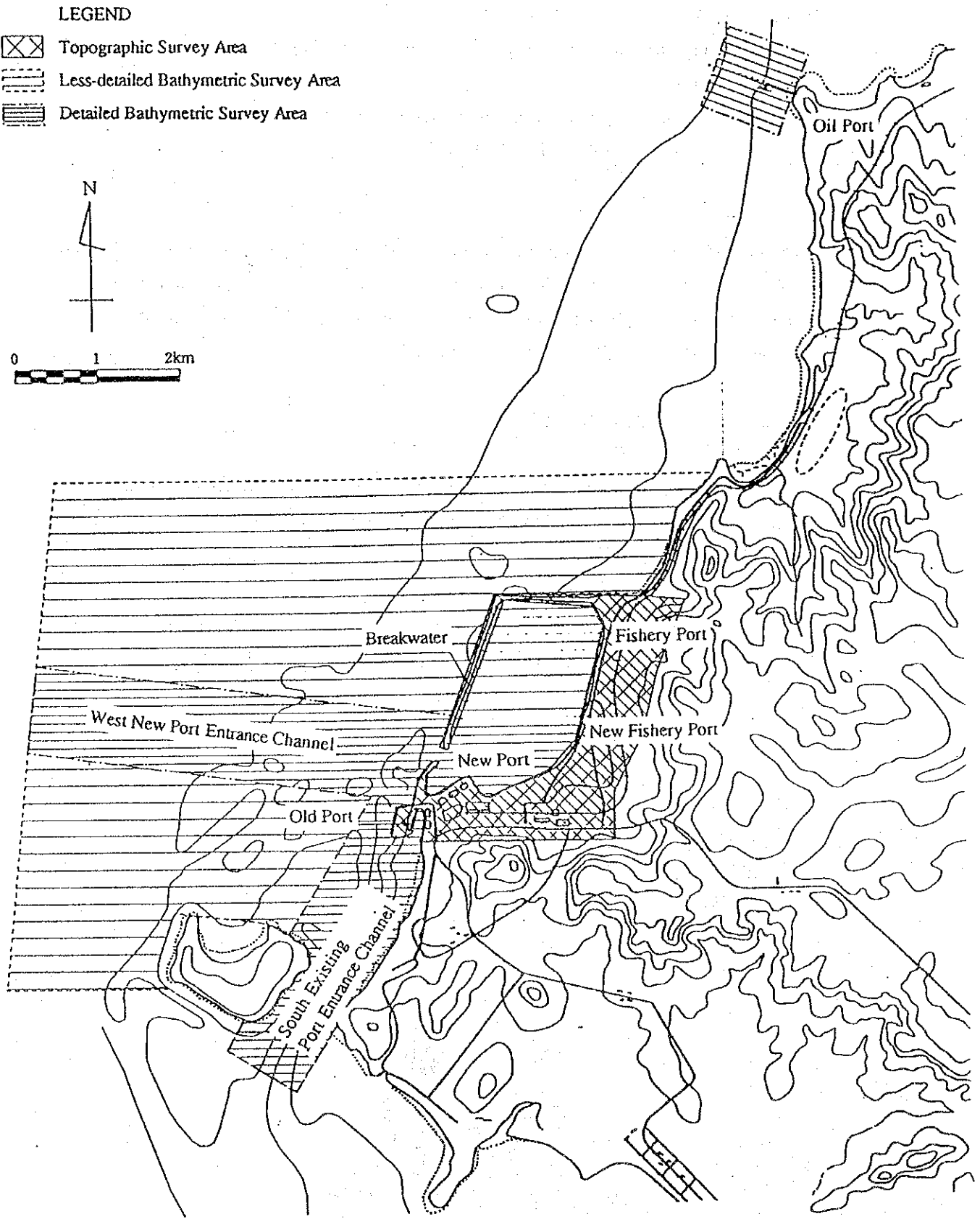


Fig.-2.5.1-4 Location map of topographic and bathymetric survey area

Table - 2.5.1-10 Summary of topographic survey results

Type of Survey Work	Location	No. of Map for Each Set	Marking (Drawing No.)	Scale
Topographic Survey	(a) Old Port	3 Nos	Top/15 of 17	1:1000
			Top/16 of 17	1:1000
			Top/17 of 17	1:1000
	(b) New Port	3 Nos	Top/12 of 17	1:1000
			Top/13 of 17	1:1000
			Top/14 of 17	1:1000
	(c) New Fishing Port	4 Nos	Top/8 of 17	1:1000
			Top/9 of 17	1:1000
			Top/10 of 17	1:1000
	(d) Fishing Village	4 Nos	Top/11 of 17	1:1000
			Top/4 of 17	1:1000
			Top/5 of 17	1:1000
	(e) North of Break water	3 Nos	Top/6 of 17	1:1000
			Top/7 of 17	1:1000
			Top/1 of 17	1:1000
			Top/2 of 17	1:1000
			Top/3 of 17	1:1000

Table - 2.5.1-11 Summary of level survey results

Type of Survey Work	Location	No. of Map for Each Set	Marking (Drawing No.)	Scale	No. of Section
Level Survey (Break water)	(a) Topo Plan	5 Nos	-BW/1 of 5	1:1000	
			-BW/1 of 5	1:1000	
			-BW/1 of 5	1:1000	
			-BW/1 of 5	1:1000	
			-BW/1 of 5	1:1000	
	(b) Cross-Section	5 Nos	-XS/1 of 5	1:200	-12
			-XS/1 of 5	1:200	-12
			-XS/1 of 5	1:200	-12
			-XS/1 of 5	1:200	-12
			-XS/1 of 5	1:200	-07
	(c) Longitudinal Section	2 Nos	-LS/1 of 2	Vertical = 1:200	-01
			-LS/2 of 2	Horizontal = 1:1000	-01

(4) Bathymetric survey

The bathymetric survey was conducted through 24 May to 2 June using the small boat equipped with the depth sounder (E-Sea Sound 103 shown by Fig. - 2.5.1-5) and the Trimble DGPS Model 4000 , so that the location of the boat can be exactly acknowledged by the satellites with the accuracy of 1m, in particular under fine weather. All the data were recorded and processed by the computer.

The area covered by the detailed and less-detailed surveying are shown by Fig. - 2.5.1-6 and Fig. - 2.5.1-7 respectively. The former area was surveyed with a interval of 50m and the latter 100m interval. The outcome of this survey are summarized by Table - 2.5.1-12.

Table - 2.5.1-12 Summary of bathymetric survey results

Type of Survey Work	Location	No. of Map for Each Set	Marking (Drawing No.)	Scale
Detailed Bathymetric Survey	(a) Oil Port	1 No.	- OP/1 of 1	1:2500
	(b) New Port(South haft)	3 Nos.	- NW/1 of 3	1:2500
			- NW/2 of 3	1:2500
			- NW/3 of 3	1:2500
	(c) West of Port	3 Nos.	-SWCH/1 of 3	1:2500
			-SWCH/2 of 3	1:2500
			-SWCH/3 of 3	1:2500
	(d) South of Port	4 Nos.	-SSCH/1 of 4	1:2500
			-SSCH/2 of 4	1:2500
			-SSCH/3 of 4	1:2500
		-SSCH/4 of 4	1:2500	
Less-Detailed Bathymetric Survey	(a) Western Area of Port	6 Nos.	OUT/1 of 9	1:5000
			OUT/2 of 9	1:5000
			OUT/3 of 9	1:5000
			OUT/4 of 9	1:5000
			OUT/5 of 9	1:5000
			OUT/6 of 9	1:5000
	(b) Southern-Western Area of Port	3 Nos.	OUT/7 of 9	1:5000
			OUT/8 of 9	1:5000
			OUT/9 of 9	1:5000

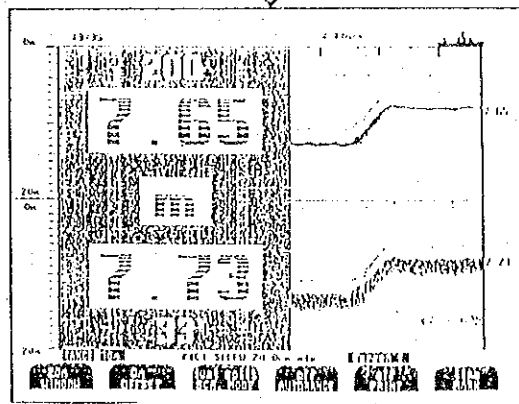
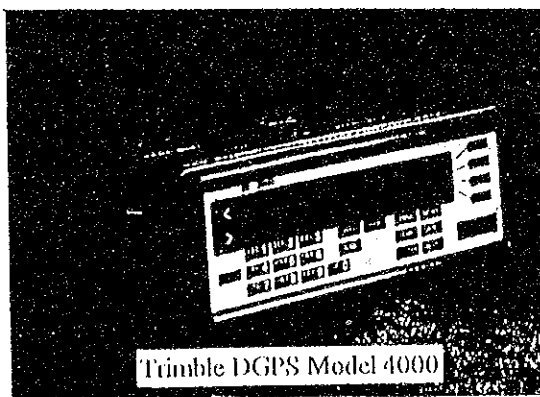
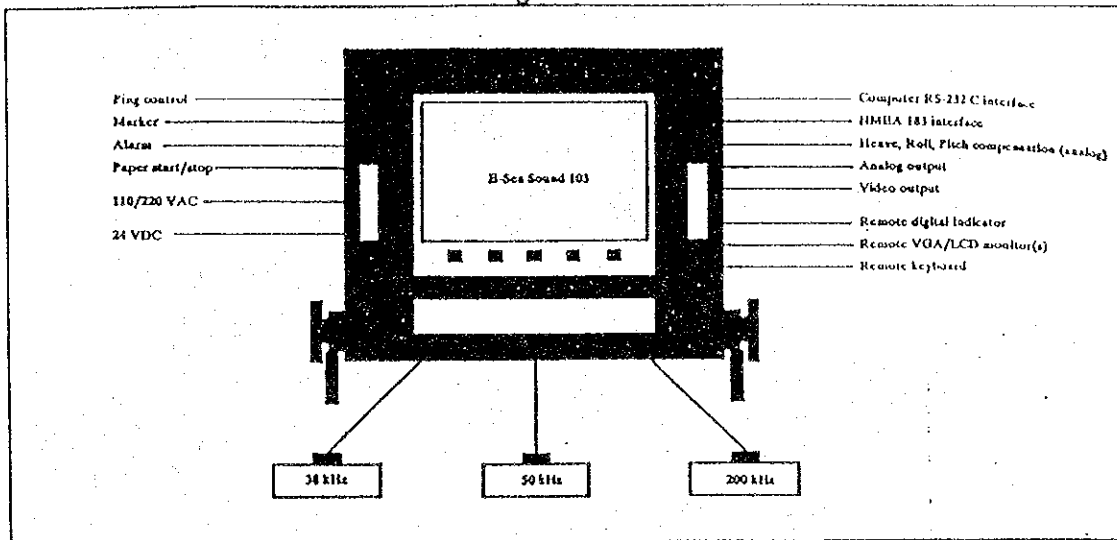
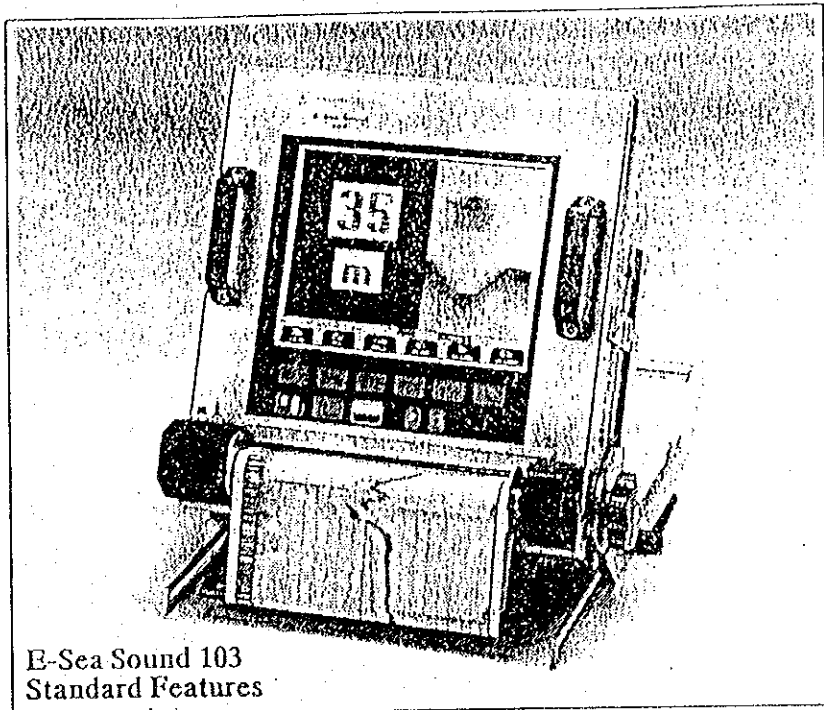


Fig. - 2.5.1-5 Equipment set-up of bathymetric survey

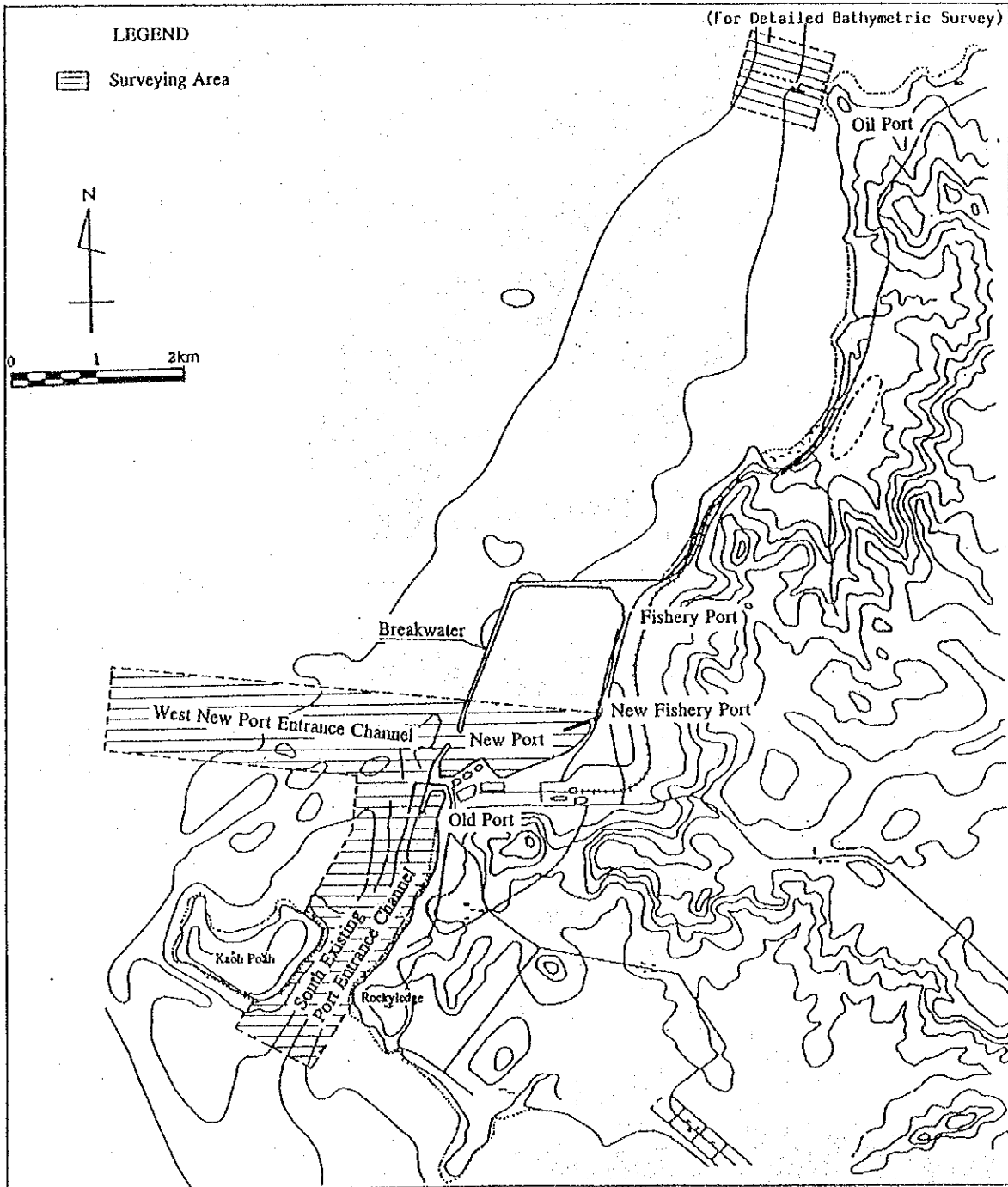


Fig. - 2.5.1-6 Location map of detailed bathymetric & seismic survey

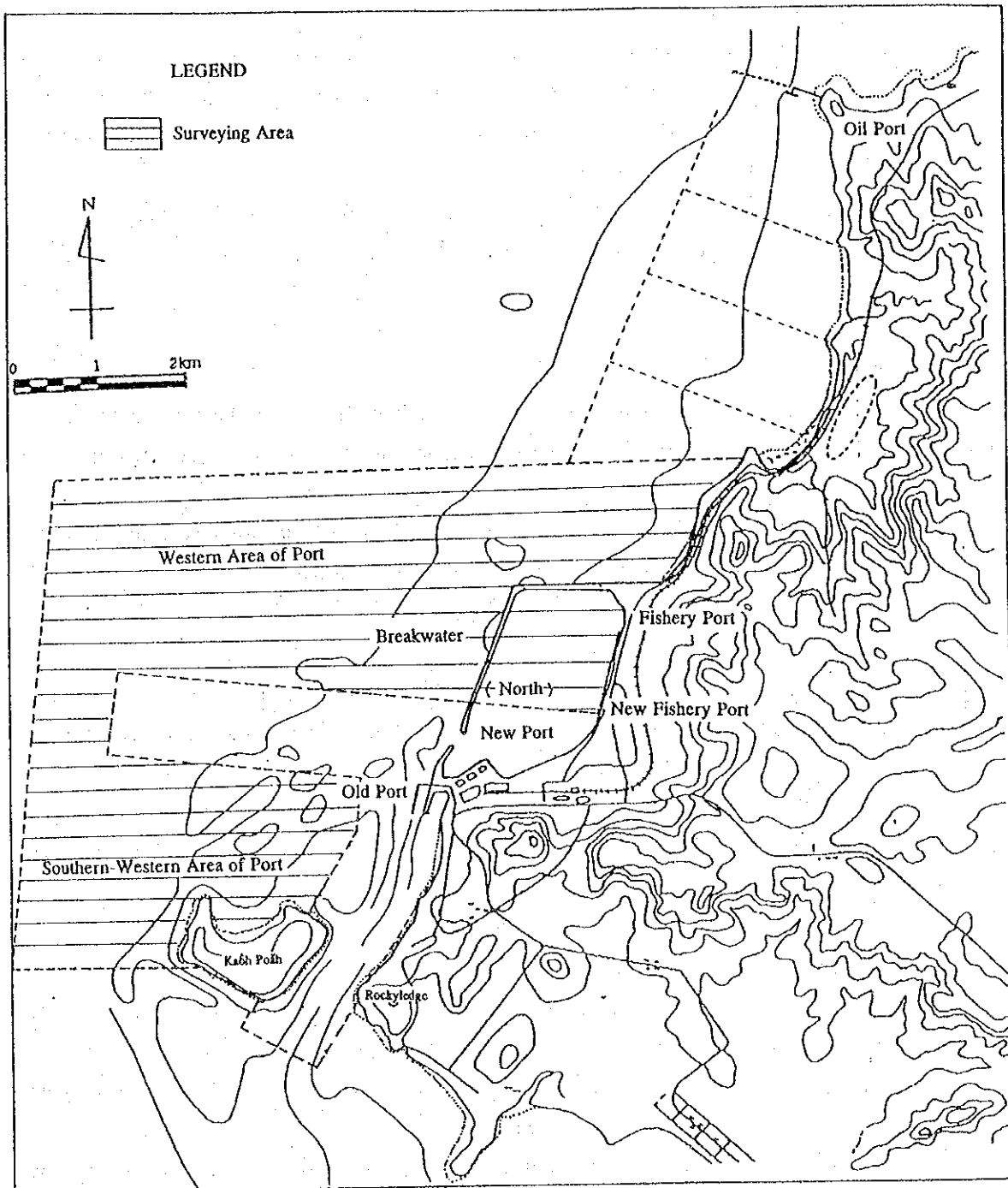


Fig. - 2.5.1-7 Location map of less-detailed bathymetric survey

(5) Sonic prospecting of rock layer

A top layer distribution of rock ground seems rather shallow and this may affect the construction cost for a future dredging work. Thus the sounding survey was carried out at the same area as the one of detail bathymetric survey shown by Fig. - 2.5.1-6. The equipment utilized for this survey are shown by Fig. - 2.5.1-8.

The summary of seismic survey results are shown by Table - 2.5.1-13, and the results, of survey, especially shallow geology, are described below (the precise data are reported by the separate volume).

a. New Port

The superficial sediment have thickness varying from 4m to 20m thick in most area apart from small area in the south western corner where the superficial sediments is recorded up to 25m thick.

In the south western corner where the sub-seabed reflects are obscured by seabed sediments which is medium to coarse sediments and could be disturbed.

b. West New Port Entrance Channel

The superficial sediments (Upper Alluvium) are clayey to silty sand. The sediments below the superficial (Lower Alluvium & Completely Weathered Rock) are more consolidated silty sand with silty sand and sand interbedded.

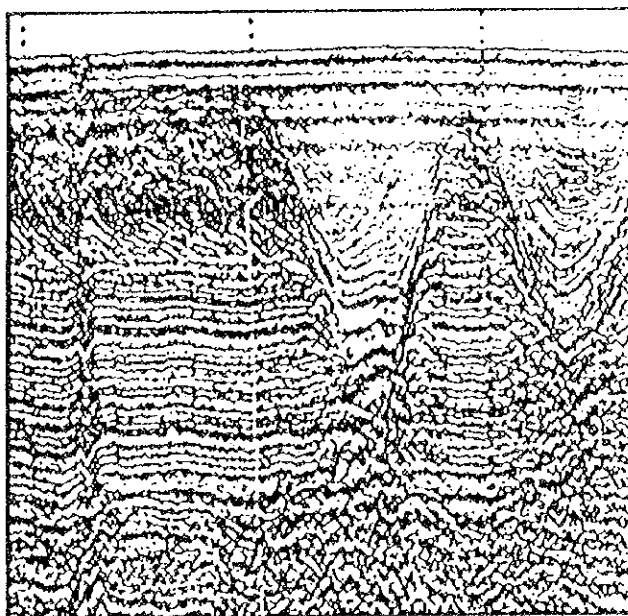
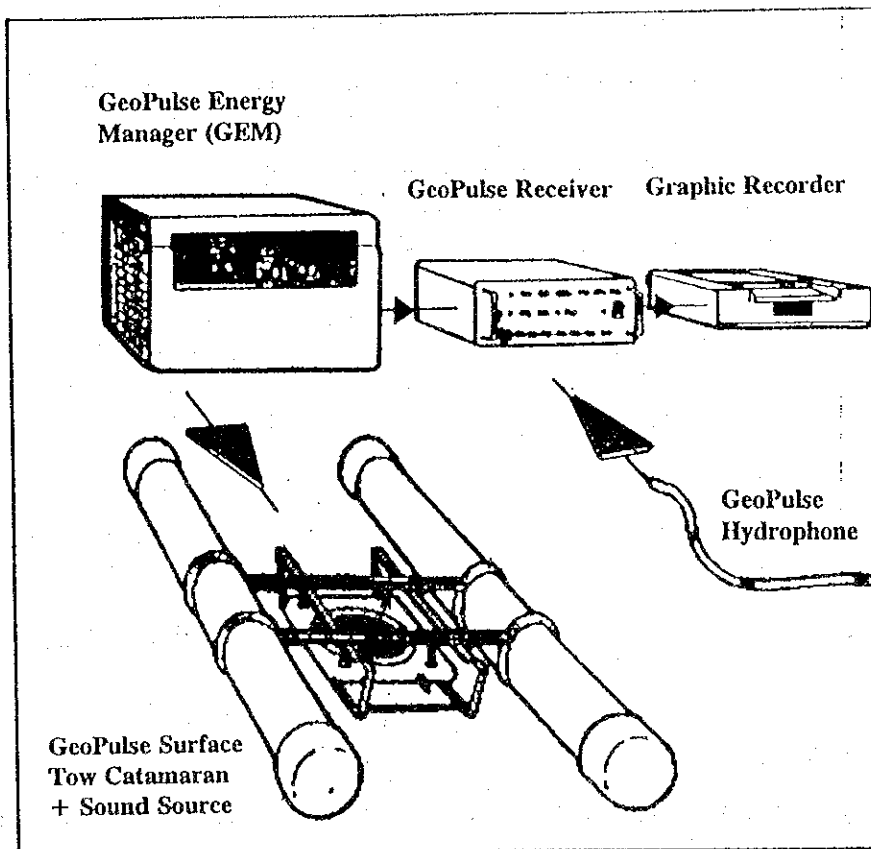
In the eastern quarter of the site, the seabed sediment is medium to coarse sand and fine silty sand on the rest of the area. Thick sequence of interbedded silty sand and sand is predominant sediment beneath the superficial layer.

c. South Existing Port Entrance Channel

There is a second area in the site where the sub-bottom reflectors are obscured by the seabed sediments. In this area, there is a strong seabed multiple identified on the record and some small area of irregular seabed. The seabed sediments in this area are possibly more consolidated sediment outcrops or boulder scattered on the seabed.

The remaining of the area in the south covered by a layer of superficial sediments have thickness varying from 4m to 20m thick. The maximum thickness is noted in the southern part of Drawing No SCH/3 OF 4 where the superficial sediment comprises thick sequence of complex sequence of cut and fill channels. While in the southern end of Chart No 4 refer to Drawing No SCII/ 4 OF 4, the superficial sediments are generally thinner between 4m and 15m.

Two areas within the channel are having different seabed sediments. The first area in the north are most medium to coarse sand and the second area in the middle of the south channel is more consolidated seabed sediments outcrop.



GeoPulse Record

Fig.-2.5.1-8 Equipment set-up of seismic survey