2.3 Future Socio-Economic Framework

This section describes the outline of some socio-economic indicators related to the basic parameters of transport demand projection. The basic socio-economic framework of Sinai as a whole is taken from the NPDS. The distribution of population, worker, and other factors by zone is then adjusted.

2.3.1 Future Framework of the Sinai Development

The NPDS and the Third Five-Year Development Plan provide the parameters of the future development framework such as population, worker and Regional Gross Domestic Product. However, the development framework of Sinai in the Third Five Year Plan is lower than that of the NPDS. and thus both frameworks are not compatible. Hence, it is anticipated that the Forth Five Year Plan will be prepared taking into account the NPDS development framework.

(1) NRTS

"The Study on the Transportation System and the National Road Transport Master Plan (hereinafter called NRTS)" has been prepared by JICA in 1992-1993. In the NRTS, future socio-economic framework and traffic demand were projected for 1997, 2002 and 2012. Sinai Peninsula are given low potential and small size socio-economic framework in NRTS study. However, some results of the NRTS are useful for the adjustment of the future socio-economic framework in the present study. The socio-economic framework of Egypt and Sinai Governorate as mentioned in the NRTS are shown in Table 2.3.1.

Table 2.3.1 Future Framework

(unit : Thousand persons, Mill. L.E.)

Area	Item	1997	2002	2012	Growth Rate
Egypt	Population	64,070	71,293	86,909	2.0%
	Worker	16,350	20,090	30,330	4.2%
	GDP	160,814	220,323	413,575	6.5%
Sinai	Population	265	293	355	2.0%
	Worker	-	-	122	-
	GRDP	594	807	1,649	7.0%

Source : NRTS
Note : Growth rate : average annual growth rate during 1997 to 2012

(2) National Strategy of Spatial Distribution

The Twenty Five-Years Long-Term Development Plan of Egypt is currently prepared. This long-term development plan is one of the outputs of the "Regional/Infrastructure Planning" project which is implemented with technical assistance from the UNDP. The long-term plan is prepared, with the aim to provide a guideline for the successive national five-year development plans and the regional development plans. According to the long-term plan, the 2017 target population is projected for National, Development Region and Governorate levels, and the total population of Sinai Peninsula is more or less the same as the number estimated in the NPDS.

This study adopted official figures of the national and governorate population projection in the Regional/Infrastructure Planning. Total population of Egypt will reach 69 million by 2002, 75 million by 2007 and 86 million by 2017. The population growth rate decline every five year with reflection of the Egyptian population control policy. The Future Population of Egypt and Sinai is shown in Table 2.3.2.

Table 2.3.2 Future Population

(unit : Thousand)

Area	1997	2002	2007	2012	2017
Egypt	62,068	69,106	74,978	80,673	86,009
(Annual Growth Rate)		2.2%	1.6%	1.5%	1.3%
Sinai	-	-	-	-	3,147

Source : MOP

(3) NPDS

This national project has already started from the third year of the Third Five Year Plan. The NPDS concentrates on a number of goals and foundations which are interwoven on the sectoral and local level. The project aims at achieving comprehensive development of Sinai over the period from 1994 to 2017.

The project aims at creating about 800 thousand job opportunities, leading to the settlement of 2,900 thousand inhabitants, increasing the total population of Sinai to 3,200 thousand inhabitants by 2017. This total framework, sectoral development plan and local development plan are adopted as the basic data of the future socio-economic framework.

2.3.2 Main Parameters for the Projection of Future Framework

(1) Socio-Economic Indicators

Socio-economic framework is base data for traffic demand projection. A series of discussion with related agencies, the following three indicators are taken as the socio-economic indicator in this Study. Population, Worker and GRDP will be estimated according to the traffic zones. Table 2.3.3 shows basic figures and ratio of the socio-economic indicator.

Table 2.3.3 Base Conditions of Socio-Economic Framework

Item	Area	1995	2002	2007	2017	Unit
Population	Whole Country	58,978	69,107	74,978	86,009	in thousand
	Siani	293	1,380	1,990	3,210	in thousand
Population Growth	Whole Country	-	2.3	1.6	1.4	% p.a.
	Siani	-	24.8	7.6	4.9	% p.a.
Population Share	Sinai	0.5	2.0	2.7	3.7	% p.a.
Worker Ratio	Sinai	26.6	27.0	27.5	28.5	% p.a.
GDP Growth	Whole Country	-	7.0	7.0	7.0(6.5)	% p.a.

Soure : MOP

Note : GDP growth rate after 2010 is 6.5% per annum

(2) Target Year

The target year of the future socio-economic framework is decided according to the following concept:

- 2017 as the target year

  This is decided to coincide with the target year of the NPDS.

- 2007

  New land reclamation development is one of the main features of the Sinai Development Plan. This implies that the initiation of the project has a great importance to accomplish the Sinai development on schedule. The construction of El Salaam Canal project which is currently under implementation is recognized as a pivotal project for the Sinai development and this project is expected to be completed by 1997. Taking this factor into account, it seems that the first 10 years will be a key period for the success of the NPDS. Accordingly the year 2007 is selected as an intermediate year.

- 2002

  The year 2002 is also considered as a short term intermediate year as it is the final year of the Fourth Five Year Plan.

(3) Development Cases

The Sinai development plan as a long term and large scaled development plan will be continually implemented up to 2017 in the various sectors and in the whole of Sinai area. Considering the current Sinai development plan and the possibilities of the sectoral development plan, and through the discussions and exchanged views with agencies concerned, the following three development cases are taken into consideration and the alternatives on socio-economic framework is set for traffic demand projection.

- Case 1 : Future population is 3.2 million by 2017
- Case 2 : Future population is 2.1 million by 2017
- Revised Case 3 : Future population is 1.5 million by 2017

Total population and sector composition by development case are shown in Table 2.3.4 and Fig. 2.3.1.

Table 2.3.4 Future Population by Development Case

Development Case	Population (2017)	Achievment Degree	Sector Composition (%)				
			Agriculture	Industry	Tourism	Others	Total
Case 1	3,209,700	100	25.6	31.1	10.5	32.8	100.0
Case 2	2,060,100	64	26.8	29.7	11.5	32.0	100.0
R. Case 3	1,521,700	47	36.3	11.5	15.5	32.4	100.0

Source : Study team

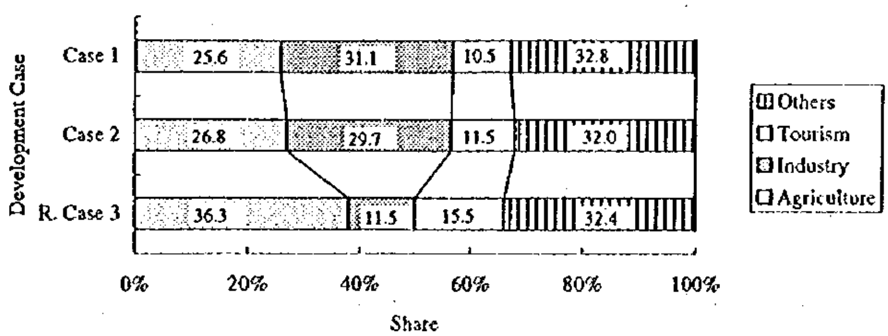


Fig. 2.3.1 Sector Composition by 2017

(4) Zone System

Zoning system is determined in order to project traffic demand crossing the Suez Canal. The zoning system consists of thirty traffic zones, including five external zones. The traffic zone aggregates semi Governorate and/or Markaz. Sinai Peninsula is divided into nine traffic zones, three in North Sinai Governorate, three in South Sinai Governorate and three to the Suez Canal Governorates. The traffic zones are tabulated in Table 2.3.5 and shown in Fig. 4.4.2.

Table 2.3.5 Traffic Zone System

Traffic Zone		Governorate or Markaz Name
Code	Name	
1	SINAI 1	El Arish, Bir el Abd, Rafah, El Sheikh Zuwiyad
2	SINAI 2	Bir el Hasana
3	SINAI 3	Nekhel
4	SINAI 4	Ras Sudr, Abu Zenima, Ras Abu Rudies
5	SINAI 5	Taba/Nuweiba, Dahab
6	SINAI 6	El Tur, St. Catherine, Sharm El Sheikh
7	EPTS	East Port Said
8	EISM	East Ismailiya
9	ESUZ	East Suez
10	WPTS	West Port Said
11	WISM	West Ismailiya
12	WSUZ	West Suez
13	DAM	Damietta, West Daqahliya
14	DKE	East Daqahliya
15	SKN	North Sharqiya
16	QAL	Qalyub, South Sharqiya
17	CAI	Cairo, Giza
18	KAF	Kafr el Sheikh, North Beheira
19	MIF	Minufiya, Gharbiya, South Beheira
20	ALX	Alexandria
21	FAY	Faiyum, Beni Suef, El Minya
22	WDS	Western Desert
23	RED	Red Sea
24	ASY	Asyut, Sohag, Qena, Aswan
25	NEW	New Valley
26	RAF	for Gaza
27	ORG	for Israel
28	TAB	for Jordan
29	MAT	for Lybia
30	BER	for Sudan

(5) Basic Approach

Basic approaches of the process of the future socio-economic framework are shown in Fig. 2.3.2 to Fig. 2.3.4.

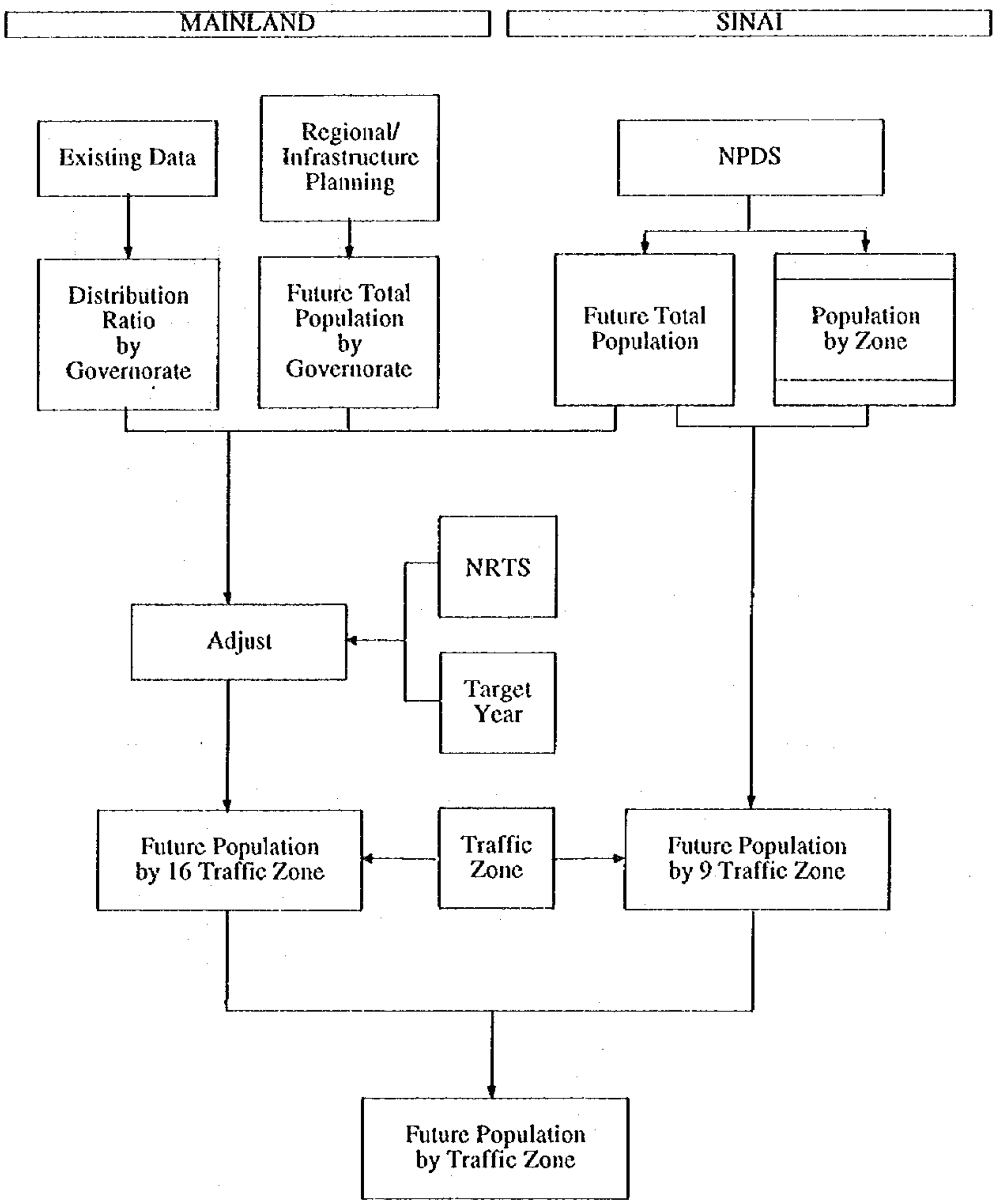


Fig. 2.3.2 Outline of Estimating the Future Population

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

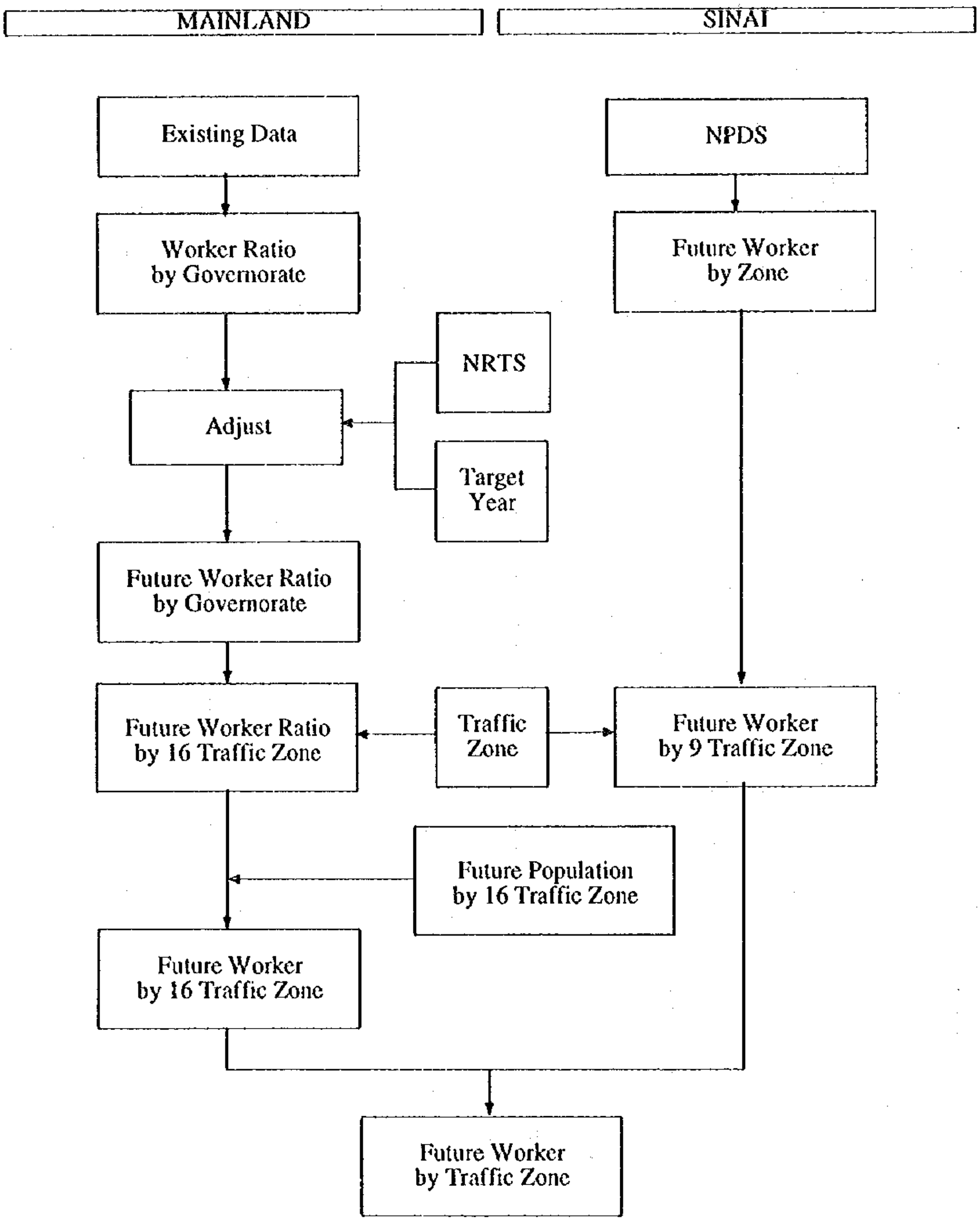


Fig. 2.3.3 Outline of Estimating the Future Worker

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

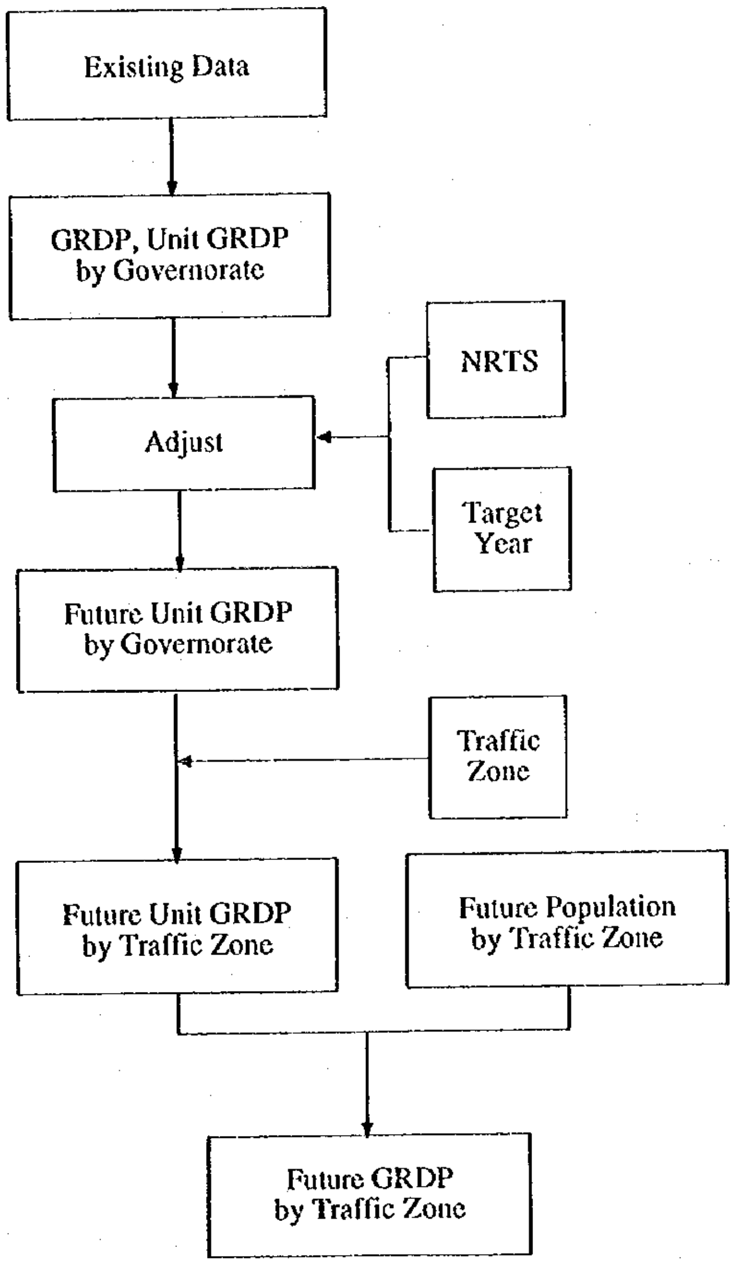


Fig. 2.3.4 Outline of Estimating the Future GRDP

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

2.3.3 Future Framework

Future socio-economic frameworks are calculated based on the above mentioned basic approach for each development case, by zone and by target year. The results of calculation are as follows :

(1) Population

Table 2.3.6 shows future population by 2017 and its distribution. Fig. 2.3.5 shows the population of Sinai and mainland of case 1 by 2017. Also Fig. 2.3.6 shows the future population by Sinai zone, by development case and by target year.

The total population of Sinai by 2017 will be 3,210 thousand in Case 1, 2,060 thousand in Case 2, and 1,522 thousand in Revised Case 3. The population share of Sinai by 2017, will reach 3.7% of the total population of Egypt in Case 1. The average growth rate is 11.5% per annum in Case 1, 9.3% per annum in Case 2, and 7.8% per annum in Revised Case 3.

As for the population distribution in Case 1, due to the large scale development in agriculture sector and industrial sector, a large number of inhabitants will settle in SINAI 1 zone (Northern Coastal area) and EISM zone (East Ismailiya). The number of population in these two zones will reach 1,069 thousand and 905 thousand, respectively by year 2017.

Table 2.3.6 Future Population by 2017

Traffic Zone		Population			(unit : person)	Distribution (%)		
Code	Name	1995	Case 1	Case 2	R. Case 3	Case 1	Case 2	R.Case 3
1	SINAI 1	204,900	1,068,700	811,700	613,100	33.3	39.4	40.3
2	SINAI 2	17,500	58,900	37,800	30,500	1.8	1.8	2.0
3	SINAI 3	6,200	54,600	37,000	30,800	1.7	1.8	2.0
4	SINAI 4	19,200	337,100	196,000	130,200	10.5	9.5	8.6
5	SINAI 5	5,600	258,400	176,000	170,700	8.1	8.5	11.2
6	SINAI 6	15,700	279,500	201,600	166,200	8.7	9.8	10.9
7	EPTS	0	195,000	158,100	108,100	6.1	7.7	7.1
8	EISM	23,500	904,700	392,700	236,700	28.2	19.1	15.6
9	ESUZ	0	52,800	49,200	35,400	1.6	2.4	2.3
Sinai Total		292,600	3,209,700	2,060,100	1,521,700	100.0	100.0	100.0
Mainland Total		58,685,000	82,799,000	83,948,600	84,487,000			
TOTAL		58,977,600	86,008,700	86,008,700	86,008,700			

Note : Study Team adjustment based on NPDS data, NSS data and NRTS data
R. Case 3 : Revised Case 3

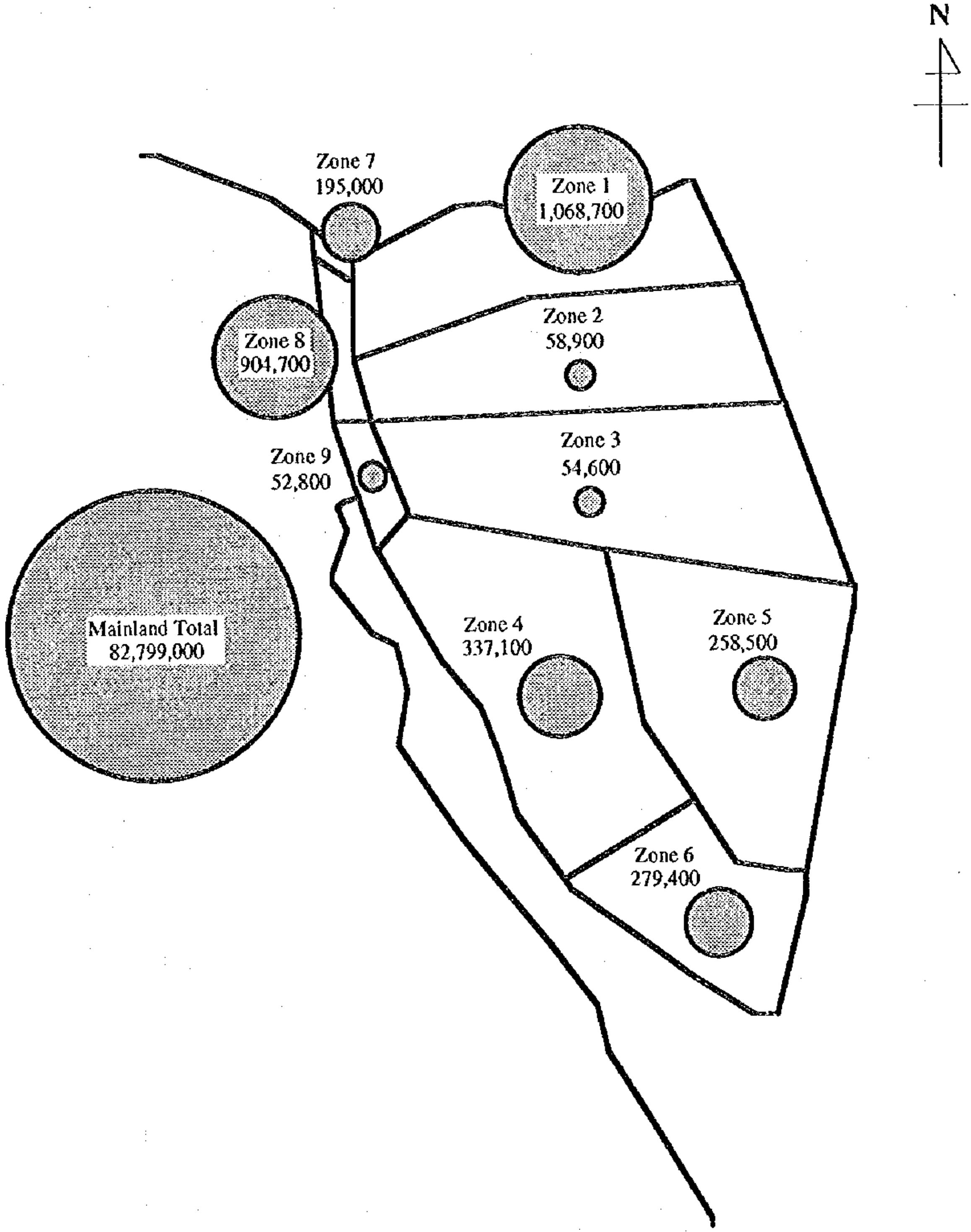


Fig. 2.3.5 The Distribution of Future Population by 2017 (Case 1)

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

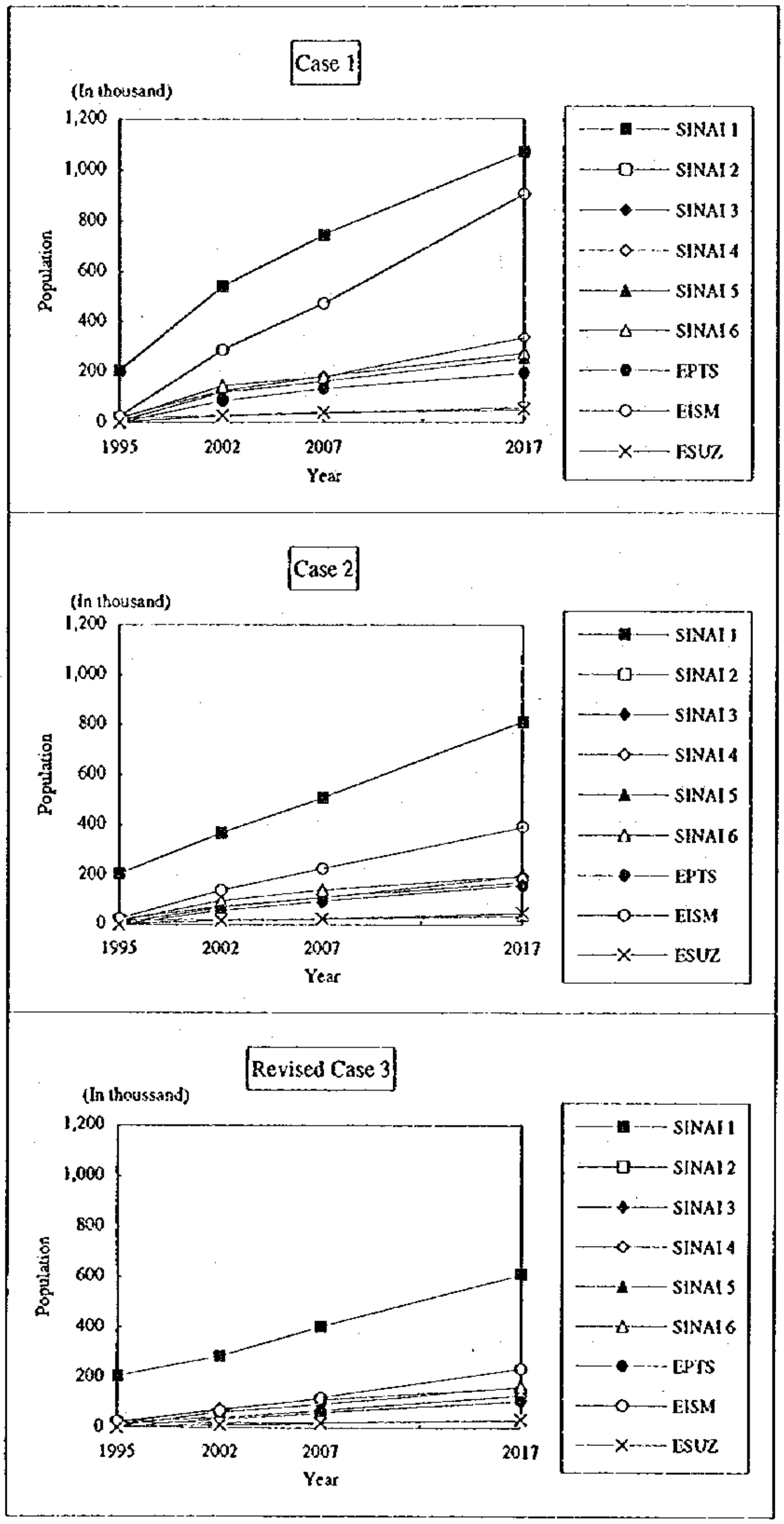


Fig. 2.3.6 Future Population by Zone and by Year

(2) Worker

Table 2.3.7 shows future workers by 2017 and its distribution. Fig. 2.3.7 shows the future workers in Sinai zone by development case and by target year.

The total workers of Sinai by 2017 will be 915 thousand in Case 1, 587 thousand in Case 2, and 434 thousand in Revised Case 3. The average growth rate is 11.9% per annum in Case 1, 9.6% per annum in Case 2, and 8.1% per annum in Revised Case 3.

As for the worker distribution in Case 1, due to the implementation of the large scale development in agriculture sector of 400 thousand Feddan land reclamation by El Salaam Canal project and 250 thousand Feddan land reclamation at East of the Canal, and industrial sector as Technology Valley project and other industrial complex projects, many of the job opportunities will be created in the zone SINAI 1 and the zone EISM. The number of workers in these two zones will reach 293 thousand and 243 thousand, respectively.

In Case 2 and Revised Case 3, the number of workers and its share of in the zone EISM will decrease because of the delay and/or scale down of key projects.

Table 2.3.7 Future Workers by 2017

Traffic Zone		Workers			(unit : person)	Distribution (%)		
Code	Name	1995	Case 1	Case 2	R. Case 3	Case 1	Case 2	R.Case 3
1	SINAI 1	51,600	293,100	220,400	165,000	32.0	37.5	38.0
2	SINAI 2	4,400	16,400	10,300	8,300	1.8	1.8	1.9
3	SINAI 3	1,600	15,000	9,900	8,100	1.6	1.7	1.9
4	SINAI 4	6,500	102,200	59,100	40,300	11.2	10.1	9.3
5	SINAI 5	2,000	89,100	60,200	59,000	9.7	10.3	13.6
6	SINAI 6	5,800	89,300	65,200	55,200	9.8	11.1	12.7
7	EPTS	0	53,300	42,600	28,300	5.8	7.3	6.5
8	EISM	5,900	242,500	106,500	60,500	26.5	18.1	13.9
9	ESUZ	0	13,900	12,900	9,000	1.5	2.2	2.1
Sinai Total		77,800	914,800	587,100	433,700	100.0	100.0	100.0
Mainland Total		14,670,500	28,566,000	28,893,700	29,047,100			
TOTAL		14,748,300	29,480,800	29,480,800	29,480,800			

Note : Study Team adjustment based on NPDS data, NSS data and NRTS data
R. Case 3 : Revised Case 3

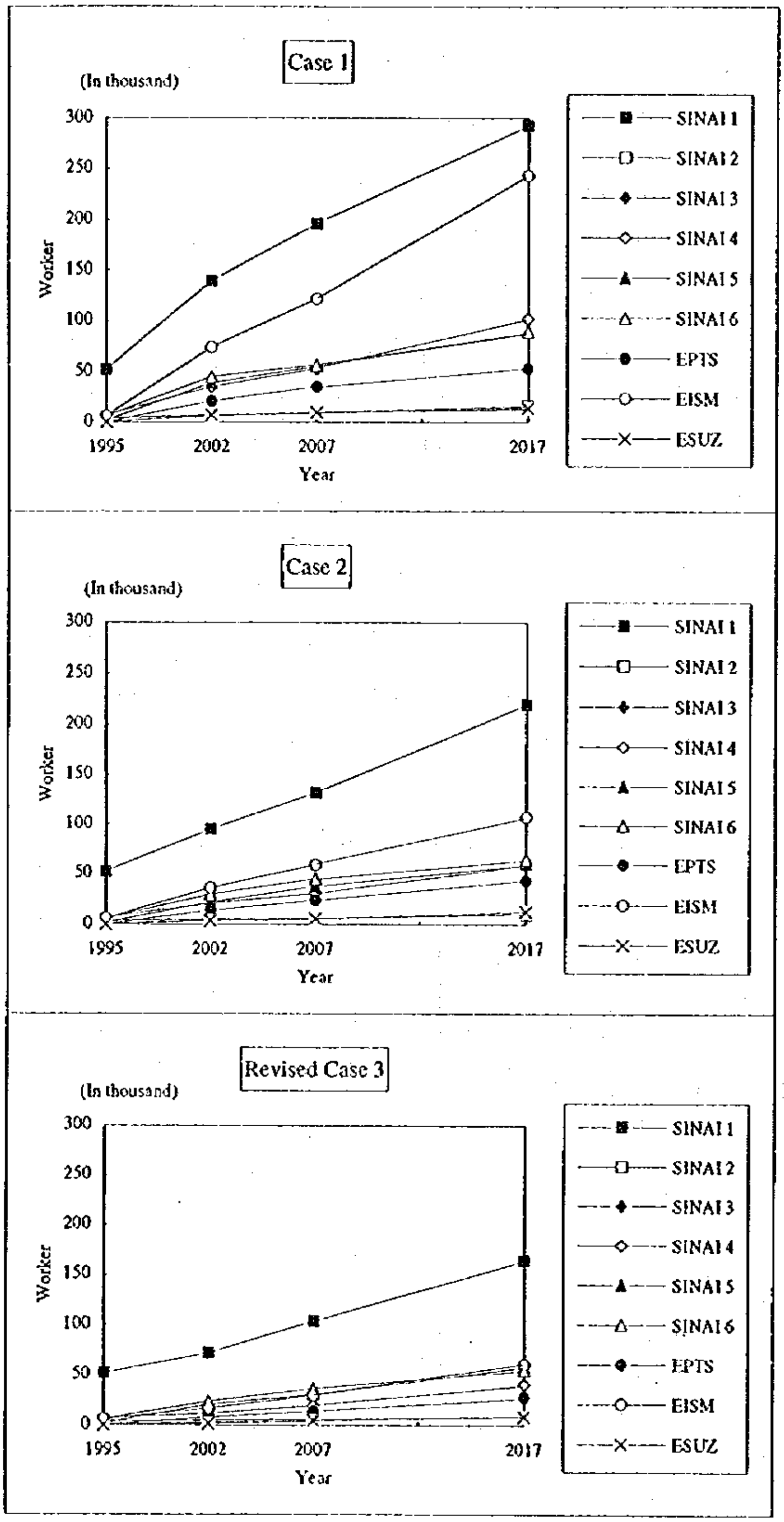


Fig. 2.3.7 Future Workers by Zone and by Year

(3) Gross Regional Domestic Product (GRDP)

Table 2.3.8 shows future GRDP by 2017 and its distribution. Fig. 2.3.8 also shows the future GRDP in Sinai zone by development case and by target year.

The GRDP of Sinai by 2017 will be L.E. 14,300 million (1991/92 fixed prices) in Case 1, L.E. 9,180 million in Case 2, and L.E. 6,780 million in Revised Case 3. The average growth rate is 15.0% per annum in Case 1, 12.8% per annum in Case 2, and 11.2% per annum in Revised Case 3.

The annual growth rate of GRDP is higher than the growth rates of population and worker, because of the high economic growth rate of 7.0% per annum during 1995 to 2010 that are adopted by government.

As for the GRDP distribution in Case 1, GRDP of SINAI 1 and EISM are L.E. 4,760 million and L.E. 4,030 million, respectively. The share of SINAI 1 and EISM occupies 61.5% of total of Sinai. The GRDP of SINAI 4, and SINAI 5 and SINAI 6 in South Sinai Governorate where the implementation of tourism development, mining and industrial developments are expected, are in the order of L.E. 1,100 to 1,500 million.

Table 2.3.8 Future GRDP by 2017

Traffic Zone		GRDP			(unit : million L.E.)	Distribution (%)		
Code	Name	1995	Case 1	Case 2	R. Case 3	Case 1	Case 2	R.Case 3
1	SINAI 1	435	4,763	3,617	2,732	33.3	39.4	40.3
2	SINAI 2	37	262	168	136	1.8	1.8	2.0
3	SINAI 3	13	243	165	137	1.7	1.8	2.0
4	SINAI 4	55	1,502	874	580	10.5	9.5	8.6
5	SINAI 5	16	1,152	784	761	8.1	8.5	11.2
6	SINAI 6	49	1,245	898	740	8.7	9.8	10.9
7	EPTS	0	869	704	482	6.1	7.7	7.1
8	EISM	50	4,033	1,751	1,055	28.2	19.1	15.6
9	ESUZ	0	235	219	158	1.6	2.4	2.3
Sinai Total		655	14,304	9,180	6,781	100.0	100.0	100.0
Mainland Total		139,709	591,084	596,208	598,607			
TOTAL		140,364	605,388	605,388	605,388			

Note : Study Team adjustment based on NPDS data, NSS data and NRTS data
R. Case 3 : Revised Case 3

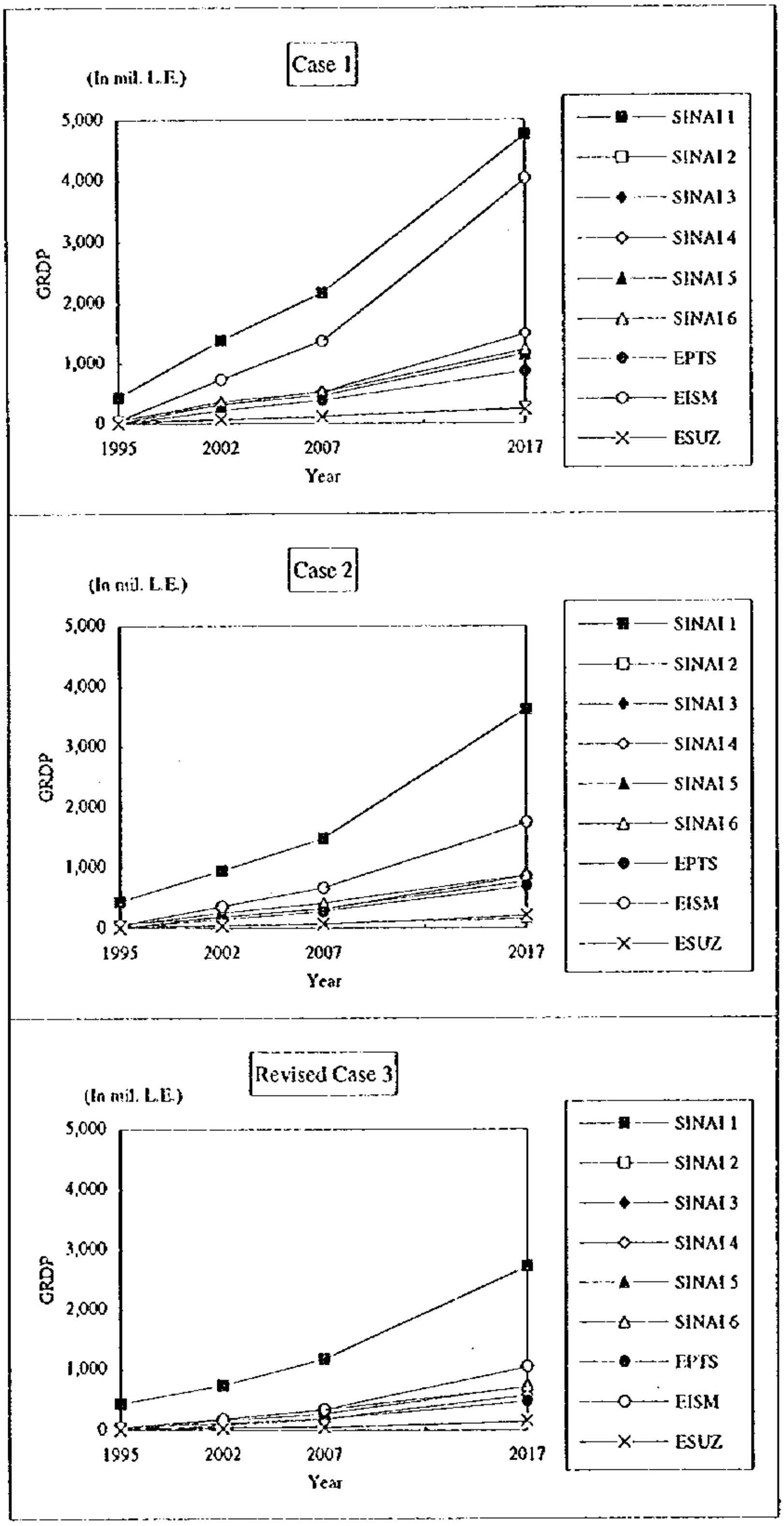


Fig. 2.3.8 Future GRDP by Zone and by Year

CHAPTER 3

SUEZ CANAL DEVELOPMENT PLAN

CHAPTER 3 SUEZ CANAL DEVELOPMENT PLAN

3.1 World Economy and International Trade

3.1.1 Introduction

The purpose of this chapter is to make a forecast of transit cargo through the Suez Canal with target years of 2017 and 2030. The year of 2017 is the target year of the Sinai development plan and the year of 2030 is considered as the end of project for the economic analysis. The target year including the depreciation period of bridge, about 50 years more, has been ignored because of difficulties of making a long-term forecast.

Generally speaking, the international economic climate has undergone major changes in recent years. For example, with the changes in the former USSR countries, the South East Asian countries, the Middle East countries and the OECD countries, international trade has became more complex. Therefore, a long term forecast of economic prospects until the year 2030 will be difficult and any such forecast should be regarded as very approximate only.

This chapter consists of two sections excluding the Introduction. They are:

- Section 3.1.2 World Economy and International Trade
- Section 3.1.3 Seaborne Cargo Forecast for The Suez Canal Traffic

Section 3.1.2 reviews some of the economic prospects of exporting/importing areas east and west of the Suez Canal, and sets up a frame work of the relevant area economy for this purpose by studying the data of the world economy undertaken by international organizations.

Section 3.1.3's main purpose is to make a forecast-analysis using groups of ten commodities of cargo passing through the Canal including oil, oil products, and dry cargoes. In particular, for each Suez Canal traffic commodity, approximate growth rates for each exporting/importing area must be established to serve as inputs for the demand forecast.

3.1.2 World Economy and International Trade

(1) Current Situation of World Economy

In 1994, world real GDP increased by 3.7 per cent over 1993. The GDP of industrial countries grew by 3.0 per cent, while developing countries experienced an increase of 6.3 per cent over the previous year. Growth was particularly strong in Asia at an average of 8.6 per cent, including China. Conversely, the former USSR suffered a corresponding decline. (-9.4 per cent)

In the developing countries in the Middle East and Europe, GDP growth rate has dropped from 3.7 per cent in 1993 to 0.7 per cent in 1994. Looking back to the last 25 years, we notice that low growth rate continued during the period of 1975, 1982 and 1991. But in recent years, the GDP growth rate has steadily increased. The GDP growth rate is shown in Table 3.1.1.

Table 3.1.1 Annual Per Cent Change of GDP

Region	1987	1988	1989	1990	1991	1992	1993	1994	*1995	*1996
World	4.0	4.6	3.4	2.4	1.3	2.0	2.5	3.7	3.8	4.2
Industrial Countries	3.2	4.4	3.3	2.4	0.8	1.5	1.2	3.0	3.0	2.7
United States	3.1	3.9	2.5	1.2	-0.6	2.3	3.1	4.1	3.2	1.9
European Union	2.9	4.2	3.5	3.0	1.1	1.0	-0.4	2.8	3.2	3.1
Japan	4.1	6.2	4.7	4.8	4.3	1.1	-0.2	0.6	1.8	3.5
Others	3.4	3.9	3.1	1.0	-1.1	0.6	1.4	3.9	3.8	3.0
Developing Countries	5.7	5.2	3.9	3.9	4.9	5.9	6.1	6.3	5.6	6.1
Africa	1.6	3.6	3.4	2.0	1.9	0.8	0.7	2.7	3.7	5.3
Asia	8.1	9.1	6.0	5.6	6.4	8.2	8.7	8.6	7.6	7.3
Middle East and Europe	5.0	-0.8	0.5	4.8	3.1	5.5	3.7	0.7	2.9	4.7
Countries in transition	2.6	4.0	2.0	-3.9	-11.6	-15.3	-9.2	-9.4	-3.8	3.5
Output per capita										
Industrial countries	2.6	3.7	2.5	1.6	-	0.8	0.6	2.4	2.4	2.0
European Union	2.7	3.9	3.1	2.3	0.6	0.7	-0.5	2.5	2.8	2.7
Developing countries	3.4	4.7	0.6	2.2	3.1	3.6	4.3	4.3	3.6	4.1
Asia	6.2	10.5	1.8	4.0	4.7	6.5	7.1	7.0	5.9	5.7
Middle East and Europe	1.2	-3.6	-1.2	3.3	1.9	-0.3	1.7	-2.1	0.4	1.0
Countries in trnsition	1.9	3.4	1.5	-4.5	-11.8	-15.6	-9.4	-9.5	-4.0	3.3

Source; World Economic Outlook, IMF, 1995

*; Estimated by IMF

(2) International Trade

In 1994, the volume of world trade grew by 9.4 per cent over the previous year. In industrial countries, the volume of exports grew by 8.6 per cent (8.3 per cent, non fuel), the volume of imports grew by 10.5 per cent (10.6 per cent, non-fuel). The growth rate of export volume of developing countries is 10.4 per cent, growth rate of import volume is 8.7 per cent. World trade growth, particularly in Asia (including China), is relatively stable. However, in the developing countries, the Middle East and Europe, the growth rate of import volume is -6.6 per cent, while compared to an export volume of 4.4 per cent. The trade growth is shown in Table 3.1.2.

Table 3.1.2 Annual Per Cent Change of Trade Volume

Region	1987	1988	1989	1990	1991	1992	1993	1994	*1995	*1996
Export volume										
Industrial Countries	4.1	8.3	7.2	5.4	2.8	4.2	1.5	8.6	8.0	4.8
United States	1.0	19.3	11.8	7.3	7.6	7.4	4.6	11.4	10.4	4.6
European Union	4.0	6.5	7.6	4.7	1.4	3.3	-0.1	10.0	7.7	6.2
Others	5.8	6.4	5.8	5.5	3.5	4.9	3.0	8.6	7.6	6.5
Developing Countries	15.3	11.4	7.8	6.2	7.1	9.6	9.0	10.4	9.1	10.7
Import volume										
Industrial Countries	6.0	8.3	7.6	4.7	2.1	4.3	1.5	10.5	7.8	5.0
United States	4.2	4.0	4.4	2.4	0.7	10.4	11.7	15.0	6.4	2.4
European Union	7.9	8.3	8.5	6.0	3.8	3.0	-4.3	8.5	6.7	6.2
Others	7.0	7.1	9.1	4.3	1.7	2.9	-0.8	7.8	8.3	6.6
Developing Countries	9.4	11.8	7.1	8.1	10.5	12.6	10.4	8.7	8.6	11.2
Middle East & Europe										
Export volume	7.1	10.1	9.8	1.8	-4.1	8.3	4.4	4.3	2.6	13.6
Import volume	1.4	0.8	1.9	6.4	0.4	8.9	4.2	-6.6	5.7	13.8
Terms of trade	9.3	-11.8	5.1	12.0	-10.5	-3.0	-2.9	-2.4	1.2	-0.1
Asia										
Export volume	23.9	17.2	9.5	7.8	12.8	12.3	11.0	13.4	11.1	11.3
Import volume	17.2	20.1	10.9	9.4	13.8	13.3	13.8	13.1	11.8	12.9
Non-oil trade										
Industrial countries										
Export volume	5.5	7.9	7.8	5.3	2.5	4.3	1.6	8.3	8.0	4.8
Import volume	8.8	7.9	8.2	4.8	2.3	4.7	1.4	10.6	8.2	5.1

Source;World Economic Outlook, 1995

*:Estimated by IMF.

(3) Regional Economies and Trades

Hereafter, in principle, the study is made in accordance with SCA's regional classification as shown in Table 3.1.3.

Table 3.1.3 Regional Classification

Trading Region	Abbreviation	Country
North & West Europe	EUR	Holland,France,Belgium,UK,Denmark,Germany
Baltic Sea	BALT	Sweden,Norway,Finland,Russia,Poland,Latvia
North Mediterranean	N-MED	Italy, Spain, Greece, Turkey, France, Croatia
East & S.E Mediterranean	E-MED	Israel, Cyprus, Malta, Syria, Lebanon
West & S.W.Mediterranian	W-MED	Algeria, Libya, Tunisia, Morocco
Black Sea	BLAK	Romania, Bulgaria, Ukrania
America	AME	USA, Canada, Venezuela, Brazil, Ecuador
Red Sea	RED	Yemen, Jordan, ARE, Saudi Arabia, Sudan, Ethiopia, Israel, Digibouti
East Africa & Aden	E-AFR	Aden, Kenya, Mozambique, Madagascar, Somalia
India & Pakistan	IND	India, Pakistan, Burma, SriLanka
Persian Gulf	GULF	Iran, Iraq. Kuwait, UAE, Oman, Saudi Arabia, Qatar, Bahrain
South East Asia	SE-ASI	Indonesia, Thailand, Malysia, Singapore, Vietnam, Cambodia
Far East Asia	FE-ASI	Japan, Chaina, Taiwan, South Korea, NorthKorea, Philippines Hong Kong, Newguinea
Australia	AUS	Australia, Newzealand

Source; SCA

Among economic regions with particular dependence on the Suez Canal, Red Sea and Persian Gulf, India and Asia are regarded as regions importing southbound cargoes, while Europe and Mediterranean are regarded as regions importing northbound cargoes. Traffic cargo volume for each region is shown in Table 3.1.4.

Table 3.1.4 Traffic Cargo Volume by Region

Including oil					Excluding oil				
Region	Loaded	Unloaded	Total	Share	Region	Loaded	Unloaded	Total	Share
EUR	23,010	49,951	72,960	0.199	EUR	18,172	18,301	36,473	0.170
BALT	3,688	1,427	5,116	0.014	BALT	3,458	1,025	4,483	0.021
N-MED	6,906	29,927	36,833	0.101	N-MED	6,040	10,003	16,043	0.075
E-MED	7,568	6,989	14,557	0.040	E-MED	6,718	6,567	13,285	0.062
W-MED	7,332	8,860	16,192	0.044	W-MED	5,082	4,661	9,743	0.045
BLAK	16,458	5,510	21,968	0.060	BLAK	13,625	4,191	17,816	0.083
AME	7,808	7,392	15,200	0.042	AME	7,074	1,661	8,734	0.041
RED	17,844	13,925	31,769	0.087	RED	4,034	13,257	17,291	0.080
E-AFR	2,522	1,640	4,162	0.011	E-AFR	2,420	749	3,168	0.015
IND	6,937	13,952	20,889	0.057	IND	5,675	10,220	15,895	0.074
GULf	49,804	7,276	57,081	0.156	GULf	3,230	5,050	8,280	0.039
SE-ASI	12,529	11,639	24,168	0.066	SE-ASI	11,635	9,512	21,147	0.098
FE-ASI	10,953	24,675	35,627	0.097	FE-ASI	10,514	23,018	33,532	0.156
AUS	8,884	458	9,342	0.026	AUS	8,733	275	9,008	0.042
Total	182,242	183,623	365,864	1.00	Total	106,409	108,490	214,899	1.00

Note;Excluding the goods that are not classified by region, such as Container cargoes.

;average of past 5 years, unit 1000 tons

3.1.3 Seaborne Cargo Forecast for the Suez Canal

(1) World Seaborne Trade and Goods Traffic in The Canal

1) General

In 1994, the growth of goods traffic on the Canal was -2.3 per cent compared with 1993. The annual growth rate during the last few years was relatively low, compared with the growth in world trade. Accordingly, the share of the goods traffic on the Canal, of the world trade, is around 7 per cent. In the southbound direction (Southbound vessels transit the West branch at the doubled area.), the major types of cargo are cereals, fertilizers and metals, while in the northbound (East branch), the major types of cargo are oil & oil products, ore & metals and coke & coal. In both directions, major types of cargo are containers and cars.

Table 3.1.5 Goods Traffic in the Canal

unit:1,000ton

Year	NORTH BOUND		SOUTH BOUND		TOTAL	
	Volume	Growth Rate	Volume	Growth Rate	Volume	Growth Rate
1980	86,547	9.9%	89,729	9.5%	176,276	9.7%
1985	151,901	75.5%	105,695	17.8%	257,596	46.1%
1986	165,048	8.7%	97,404	-7.8%	262,452	1.9%
1987	152,591	-7.5%	103,984	6.8%	256,575	-2.2%
1988	140,401	-8.0%	119,093	14.5%	259,494	1.1%
1989	150,348	7.1%	115,471	-3.0%	265,819	2.4%
1990	155,045	3.1%	116,836	1.2%	271,881	2.3%
1991	153,220	-1.2%	119,322	2.1%	272,542	0.2%
1992	152,522	-0.5%	122,505	2.7%	275,027	0.9%
1993	149,027	-2.3%	147,887	20.7%	296,914	8.0%
1994	142,872	-4.1%	147,083	-0.5%	289,955	-2.3%
Average*	150,537	-1.0%	130,727	5.2%	281,264	1.8%

* : Average of the past five years. Upper is tonnage and lower is annual growth rate.

Table 3.1.6 World Trade Tonnage and Goods Traffic in the Canal

unit: Million ton

Year	Total	Tanker		Drycargo		of which:main bulk*		Suez	
	(a)	Cargo(b)	Rate(b/a)	Total(c)	Rate(c/a)	(d)	Rate(d/a)	Total(e)	Rate(e/a)
1970	2,605	1,440	55.3%	1,165	44.7%	448	17.2%	-	-
1975	3,072	1,644	53.5%	1,428	46.5%	635	20.7%	-	-
1980	3,704	1,871	50.5%	1,833	49.5%	796	21.5%	176	4.8%
1985	3,382	1,459	43.1%	1,923	56.9%	857	25.3%	258	7.6%
1986	3,459	1,514	43.8%	1,945	56.2%	834	24.1%	262	7.6%
1987	3,505	1,506	43.0%	1,999	57.0%	875	25.0%	257	7.3%
1988	3,692	1,587	43.0%	2,105	57.0%	940	25.5%	259	7.0%
1989	3,891	1,692	43.5%	2,199	56.5%	965	24.8%	266	6.8%
1990	4,008	1,755	43.8%	2,253	56.2%	968	24.2%	272	6.8%
1991	4,120	1,790	43.4%	2,330	56.6%	1,005	24.4%	273	6.6%
1992	4,220	1,860	44.1%	2,360	55.9%	990	23.5%	275	6.5%
1993 *b	4,312	1,945	45.1%	2,367	54.9%	985	22.8%	297	6.9%
1994								290	

Sources: Review of Maritime Transport, UNCTAD,1993

* : Iron ore, grain, coal, bauxite/alumina and phosphate

*b: UNCTAD preliminary estimates

To estimate the goods traffic on the Canal, the following method will be prepared. Taking the special characteristics of relevant trading regions into account, goods traffic will be analyzed by commodity. Using the actual origin and destination tables for each region, the cargo volume is estimated with annual increase percentage rate for each commodity. Also, the average cargo tonnage in the last five years is used as the base value. The following goods are considered;

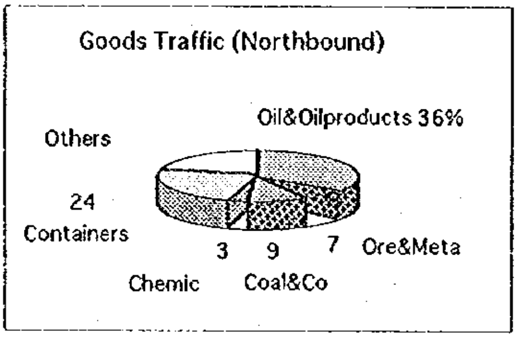
Crude oil, oil products, coal, ores, cereals, fertilizers, fabricated metals, foods stuffs, machinery (cars), containers, cement, vegetable oil, starch, wood and others.

Table 3.1.7 Transit Goods by Commodity (1994)

1,000ton

Northbound		Southbound	
Goods	Tonnage	Goods	Tonnage
Petroleum&Products	50,120	Petroleum&Products	9,288
Ores&Metals	9,931	Cereals	11,213
Coal&coke	13,221	Fertilizer	13,769
Chemicals&products	4,866	Fabricted Metals	32,094
Container	34,796	Container	46,826
Others	29,938	Others	33,893
Total	142,872	Total	147,083

Source; SCA



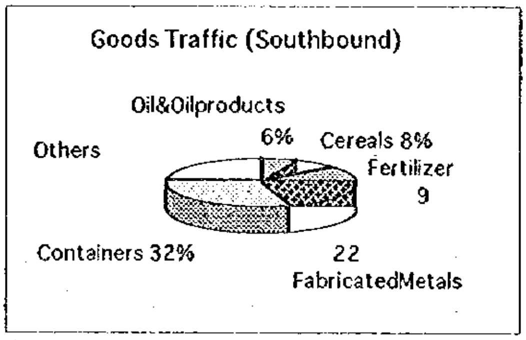


Fig. 3.1.1 The Share of Major Goods (1994)

(1) Crude Oil and Oil Products

The traffic volume of crude oil and oil products transited through the Canal is only equal to 4.4 per cent of world oil transported. Oil and oil products are transported from the Middle East to Europe, Mediterranean and America. Also oil products are transported in the opposite direction, from Europe to the Middle East and Asia.

Table 3.1.8 Oil Cargo Volume Through the Canal

unit:1000ton

Year	World Sea Borne Crude (a)	Suez Canal Transit Tonnage			
		Total (b)	North B.	South B.	Rate (b)/(a)
1986	1,029,400	104,971	92,180	12,791	10.2%
1987	1,059,900	88,040	75,794	12,246	8.3%
1988	1,071,800	72,930	57,080	15,850	6.8%
1989	1,183,300	72,286	58,377	13,909	6.1%
1990	1,248,500	79,640	65,796	13,844	6.4%
1991	1,249,700	84,877	70,535	14,342	6.8%
1992	1,314,000	83,270	71,283	11,987	6.3%
1993	1,332,400	76,042	60,502	15,540	5.7%
1994	1,379,700	59,408	50,120	9,288	4.3%

Source; SCA

The oil consuming countries will be adopting conservation policies. At the same time, oil producing countries are controlling their production and will not agree to increasing outputs. Under these circumstances projected crude oil production by the Middle East countries will only show a slight increase in the future. These trends will lead to the reduction of oil and oil products transiting through the Canal.

1) Oil Seaborne Cargo Volume

The flow of seaborne trade of oil which may transit the Canal is classified into the following two routes as shown in Fig. 3.1.2.

a. Middle East / North Western Europe + Mediterranean Europe

b. Middle East / North America

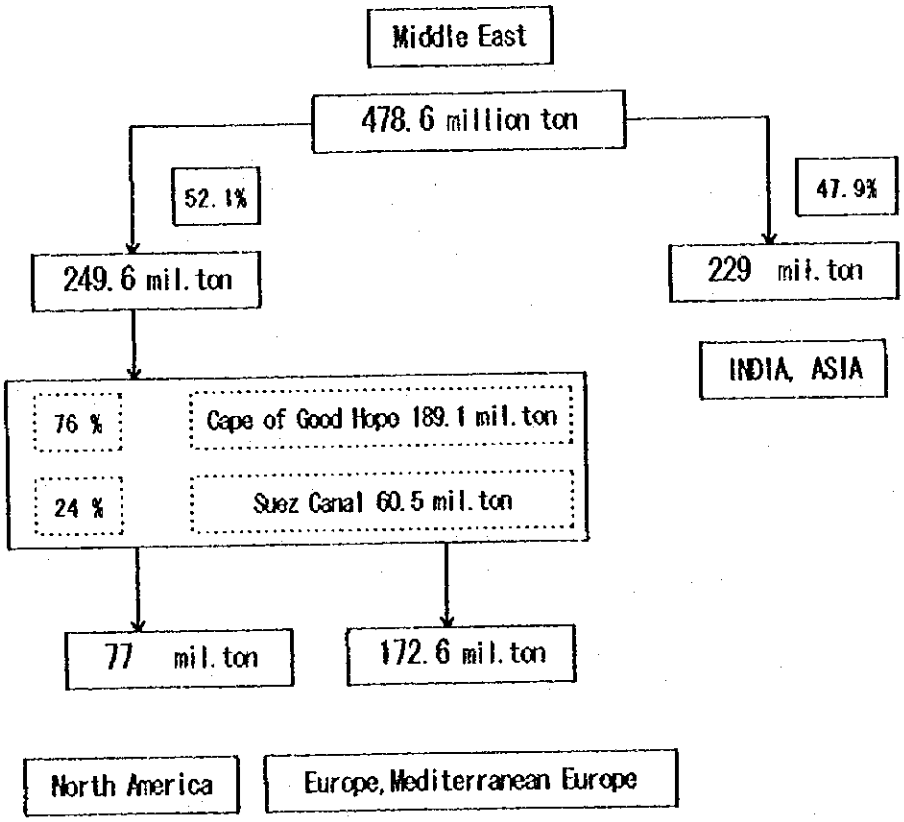


Fig. 3.1.2 The Flow of Seaborne Trade of Oil (1993)

The anticipated future annual increases are 0.859 per cent in Middle East / Europe and 0.985 per cent in Middle East / America based on the average annual growth rate from 1986 assuming the energy conservation policy continues in the advanced industrial nations.

Table 3.1.9 Forecast Oil Seaborne Cargo Tonnage in Future

Region	1992	1993	1994	1995	2002	2007	2017	2030
MiddleEast/Europe	174	172	173	175	186	194	211	236
MiddleEast/America	76	78	79	80	85	89	99	112
Total	250	250	252	255	271	283	310	348

2) Route Choice

Shipping cost and freight markets have a strong effect on the route allocation of tankers. The volume of oil cargo flow, by route, is considered to be inversely related to the basic cost. Also, the proportions on the routes will not change significantly in the future. The effect of the costs is shown in the estimation of the share of cargo flow. The freight rate per tonnage and share of cargo flow are shown in Table 3.1.10. The share will be used as Freight Market Effect Index.

Table 3.1.10 Sample of the Freight

Route	1993	Share
MiddleEast/Europe (Suez Canal)	$11.55	0.607
MiddleEast/Europe (Cape of Good Hope)	$17.84	0.393

Note ; by World Scale

3) Canal Capability of Ship Size

The size of tankers that can pass through the Canal has an influence on the Canal dimensions. The share of the oil cargo volume is considered to be related to the tanker size that transit the Canal. Table 3.1.11 shows the tanker size, accumulated tonnage share (average tonnage x bottoms) and the capability factor at the target year based, on the canal development plans. (See Table 3.2.3)

Table 3.1.11 Tanker Size and Canal Capability

Tanker Size (DWT)	Share	Year	Capability factor
up to 150,000	0.421	2002	0.4542
up to 200,000	0.570	2007	0.5492
up to 250,000	0.654	2017	0.8031
up to 300,000	0.900	'20/'30	0.9000

4) Pipeline

The resumption of pipeline transportation from Kuwait and Saudi Arabia to the Mediterranean as a result of the Peace Process in the Middle East will lead to a reduction of the Canal cargo traffic. Also in Egypt, the pipeline transportation from the Red Sea to the Mediterranean will be encouraged in the future. The total of these pipeline capacities is considered to be about 7.2 million barrels per day. This amounts to 335 million tons per year. In the estimation, transportation volumes will increase continuously until 2030. Table 3.1.12 shows the pipeline share of the seaborne oil cargo volume by target year. The pipeline factor is given as "1-(pipeline share)".

Table 3.1.12 Pipeline Share

Year	2002	2005	2007	2017	2030
Share	0.00	0.01	0.20	0.27	0.40

5) Northbound Oil Cargo

The above mentioned, oil seaborne cargo that passes through the Canal can be estimated as follows.

Oil Cargo passing throuth the Canal	=	Expected Oil Seaborne Cargo	x	Freight Market Factor	x	Canal Capability Factor	x	Pipeline Transportation Factor

In each target year, the factor and anticipated oil cargo that will pass through the Canal are shown in Table 3.1.13.

Table 3.1.13 Northbound Oil Cargo Volume Through the Canal

Item	2002	2007	2017	2030
Expected seaborne cargo volume (million tons)	271.0	283.4	309.9	348.2
Freight market factor	0.607	0.607	0.607	0.607
Canal capability factor	0.454	0.549	0.803	0.900
Pipeline transportation factor	1.00	0.80	0.73	0.60
Northbound oil cargo tonnage (million tons)	74.7	75.6	110.2	114.1

6) Southbound average traffic volume of oil products has reached 13 million tons in the last five years. In view of the improvement in the output of the oil refinery in the Gulf countries, the self-sufficiency ratio in these regions will increase in the long term. So, the cargo volume of oil products will be affected by the economy of the exporting regions. Considering the GDP per capita growth rate in industrial countries, the growth rate of the traffic volume through the Canal is estimated at 1.8 per cent per year.

7) Future tonnage of oil and oil products by direction is shown as follows.

Table 3.1.14 Oil and Oil Products

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	60,502	50,120	74,710	75,578	110,227	114,125
Southbound	15,540	9,288	14,995	16,393	19,595	24,710
Total	76,042	59,408	89,705	91,972	129,822	138,835

(2) Non Oil Cargoes

The non oil cargo volume of the Suez canal from 1990 to 1994 increased by an average of 4.8 per cent annually and the world seaborne trade volume of dry cargo in 1989-1993 period increased by an average of 1.9 per cent. The high growth of the Suez Canal traffic compared with the world growth is attributable to the following factors.

a. The seaborne trade between Asia and Europe increased dramatically.

b. The increase of container cargo between Europe and Asia in 1993.

c. The economic growth level was high in the Middle East countries from 1992 to 1993.

The future goods traffic through the Canal will increase, because the high share of general cargo (including container cargoes) may increase and this category of goods is essential for the development of the countries in the Middle East, Asia and Eastern Europe.

1) Fabricated Metals

Southbound quantity of fabricated metals reached 32.094 million tons in 1994. Origin includes the Black sea, East Mediterranean and North and West Europe with four million tons. Exporting quantity from Russia should steady increase. South East and Far East Asia are major destinations, in particular China is the first ranked. With regard to SCA classification of fabricated metals, most of these are steel products such as iron and steel, pig iron, plates and sheets, etc.

(unit; 1000 tons)

Region	loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	5,137	5,087	5,973	12,460	7,755	7,282	671	442	383	577	541	523
BALT	701	859	1,580	4,460	2,764	2,073	59	134	105	110	96	101
N-MED	1,239	1,045	786	3,576	1,672	1,664	151	115	38	58	210	114
E-MED	1,993	2,216	4,359	6,311	6,039	4,184	80	0	0	0	82	32
W-MED	422	774	432	1,550	1,463	928	35	0	0	0	126	32
BLAK	1,897	2,392	3,401	10,143	11,819	5,930	276	87	83	134	105	137
AME	1,560	723	713	905	582	897	0	33	0	0	6	8
RED	68	0	0	25	124	43	663	956	1,484	2,303	2,094	1,500
E-AFR	0	0	0	0	82	16	80	78	1	128	96	77
IND	374	185	110	174	232	215	2,496	1,353	2,234	1,660	2,496	2,048
GULf	39	117	53	164	237	122	2,035	1,741	1,783	1,127	1,023	1,542
SE-ASI	39	66	51	163	375	139	2,218	2,273	3,101	9,418	10,718	5,546
FE-ASI	600	71	138	137	43	198	5,395	6,693	8,629	24,743	15,630	12,218
AUS	72	133	51	134	97	97	252	17	12	29	37	69
Others.n	167	265	361	230	0	205	87	26	155	148	24	88
Others.s	194	15	0	3	0	42	4	0	0	0	0	1
Total.n	1,359	837	764	1,027	1,190	1,035	1,359	837	764	1,027	1,190	1,035
Total.s	13,143	13,111	17,244	39,408	32,094	23,000	13,143	13,111	17,244	39,408	32,094	23,000

Southbound traffic is shown shaded.

It is perceived that this increasing trend will continue as a result of development in South West Asia and Far East Asia. In view of the improvement of the self-sufficiency ratio in these Asian countries, the self-sufficiency ratio in these regions will increase in the long term. Considering the GDP per capita growth rate in Europe and Asian countries, the growth rate of the traffic through the Canal is estimated at 5.86 per cent per year until 2000, with 1.5 per cent for long term. Northbound traffic is estimated at 1.5%. Future traffic of fabricated metals by direction is shown below.

Table 3.1.15 Fabricated Metals

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	1,027	1,190	1,166	1,257	1,458	1,770
Southbound	39,408	32,094	33,347	35,924	41,691	50,594

2) Fertilizers

The quantity of fertilizers shipped through the Canal reached 14.72 million tons in 1994. Main ports of origin are in Europe and Black Sea. Main destination ports are in India, S.E. Asia and F.E.Asia. These regions import phosphates mostly from Morocco, import urea from Romania and import ammonia from European countries. In the northbound direction, fertilizers are exported from Jordan to Turkey and European countries.

(unit;1000 tons)

Region	loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	3,328	2,859	3,231	1,922	2,799	2,828	240	491	321	435	560	409
BALT	1,107	471	280	210	551	524	131	124	119	24	0	80
N-MED	877	903	981	702	421	777	569	260	270	336	530	393
E-MED	462	551	704	478	358	511	476	427	445	395	0	349
W-MED	1,365	1,400	1,634	1,640	1,339	1,476	53	7	43	5	120	46
BLAK	5,061	5,864	8,296	5,170	6,513	6,181	367	228	236	60	84	195
AME	1,036	2,028	1,682	1,131	868	1,349	24	15	37	67	60	41
RED	1,555	1,371	1,280	1,135	1,119	1,292	580	846	726	702	287	628
E-AFR	27	19	0	45	50	28	213	163	187	274	213	210
IND	71	8	0	43	0	24	3,715	4,423	5,220	3,785	3,379	4,104
GULf	108	52	64	45	120	78	801	436	733	631	702	661
SE-ASI	10	29	10	0	0	10	2,418	1,512	1,901	2,084	2,830	2,149
FE-ASI	55	61	117	21	0	51	6,666	7,749	8,911	4,521	6,323	6,834
AUS	34	12	0	62	110	44	309	110	157	36	35	129
Other.n	0	0	0	0	58	12	0	0	0	29	103	26
Other.s	1,480	1,163	1,027	786	920	1,075	14	0	0	6	0	4
Total.n	1,860	1,552	1,471	1,351	1,457	1,538	1,860	1,552	1,471	1,351	1,457	1,538
Total.s	14,716	15,239	17,835	12,039	13,769	14,720	14,716	15,239	17,835	12,039	13,769	14,720

Southbound traffic is shown shaded.

Future fertilizer traffic is considered to increase nearly in proportion to the production and consumption of phosphate. The demand for fertilizers is expected to increase, because of the increase of population and the increase of the agricultural production. Every nation in these regions is making efforts in their agricultural policy to increase production of food and reduce imports, and for this reason the demand for fertilizers is expected to increase in the future. On the other hand, every nation is making efforts to reduce the imports of fertilizers by increasing use of nitrogenous fertilizers. The quantity transit through the Canal is estimated by taking account of the increase in phosphate consumption and corresponding decrease of other fertilizers. Considering the population growth rate in Vietnam, India and Thai land, the growth rate of the southbound traffic through the Canal is estimated at 1.35 per cent per year until 2000 and, at 0.93 per cent for long term. Northbound traffic volume is small and it is believed that it will maintain the current level in future. Future traffic of fertilizers in each direction is shown below.

Table 3.1.16 Fertilizers

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	1,351	1,457	1,698	1,779	1,952	2,203
Southbound	12,039	13,769	16,252	17,024	18,681	21,078

3) Cereals

The quantity of cereals passing through the Canal reached 12.791 million tons in 1994. For the southbound traffic, the main exporting regions are Europe and America. The major importing region is Red Sea which imports wheat and barley. For northbound goods, the main items are rice, maize and wheat flour, but in small quantities. These items are mainly transported from South West Asia to Europe, and are shown below :

(unit; 1,000 tons)

	loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	4,255	5,390	4,781	1,443	4,197	4,013	605	565	320	510	1,040	608
BALT	227	147	46	42	117	116	80	0	93	122	0	59
N-MED	709	2,715	1,692	1,220	1,140	1,495	215	72	172	345	194	200
E-MED	47	1,014	1,530	260	736	717	146	147	443	557	0	259
W-MED	645	627	635	258	1,337	700	73	39	231	168	293	161
BLAK	122	200	129	18	50	104	232	572	386	343	0	307
AME	3,854	2,794	3,136	3,627	3,636	3,409	10	0	61	24	0	19
RED	316	0	449	848	0	323	5,621	7,648	7,944	4,523	8,484	6,844
E-AFR	145	74	0	0	26	49	176	56	136	46	185	120
IND	445	346	233	362	290	335	1,077	1,028	1,145	1,230	809	1,058
GULf	10	116	9	0	146	56	452	458	477	680	967	607
SE-ASI	168	251	377	262	529	317	258	438	233	74	230	247
FE-ASI	55	67	486	507	310	285	2,295	3,247	2,014	292	538	1,677
AUS	235	185	152	127	0	140	0	54	0	23	0	15
Other.n	0	445	0	0	277	144	13	89	0	37	51	38
Other.s	20	42	0	0	0	12	0	0	0	0	0	0
Total.n	1,374	1,484	1,706	2,106	1,578	1,650	1,374	1,484	1,706	2,106	1,578	1,650
Total.s	9,879	12,929	11,949	6,868	11,213	10,568	9,879	12,929	11,949	6,868	11,213	10,568

Southbound traffic is shown shaded.

In the future, the demand for trade will increase in the Middle East and East Africa because of their increasing populations, although efforts are being made to increase their own production output. The routes relating to the southbound traffic are from America and Europe to these regions. For South America and Australia, shipments to the Middle East and East Africa do not use the Canal. Also from the Pacific coast of Canada and USA, shipments of grain to Asia and India do not use the Canal. When considering the routes from exporting regions and the population growth rate in Saudi Arabia and East African countries, the growth rate of the southbound goods traffic through the Canal is estimated at 2.9 per cent per year until 2000, and 2.5 per cent for the long term. Northbound goods traffic is estimated at 0.34 per cent per year until 2000, and 0.15 per cent for long term taking account of the growth rate of the population of European countries. Future traffic of cereals by direction is shown below.

Table 3.1.17 Cereals

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	2,106	1,578	1,689	1,701	1,727	1,761
Southbound	6,868	11,213	13,180	14,912	19,089	26,314

4) Coal and Coke

The world seaborne cargo traffic of coal in 1993 was 313.4 million tons(1) and the major producers were Russia, China, USA and Australia. Consuming regions, mostly as raw material for steel production were European countries. The Suez Canal's share of world seaborne coal traffic is presently a limited per cent. The Canal traffic of coal and coke for each region sharing the loaded and unloaded categories is as follows.

(unit; 1,000 tons)

Region	loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	62	19	52	56	0	38	3,616	3,384	2,506	3,158	3,799	3,293
BALT	177	56	57	215	0	101	116	231	126	37	323	167
N-MED	1	0	2	32	0	7	2,194	2,704	1,554	2,763	2,850	2,413
E-MED	0	0	0	3	0	1	2,346	3,224	3,231	3,535	2,968	3,061
W-MED	0	0	0	0	0	0	1,837	551	306	470	633	759
BLAK	144	0	4	0	0	30	1,854	1,446	2,151	642	360	1,291
AME	268	579	232	244	0	265	55	2	74	113	2,265	502
RED	33	83	103	159	957	267	43	143	80	30	0	59
E-AFR	2,365	1,239	964	676	2,376	1,524	1	0	0	0	0	0
IND	33	64	32	219	64	82	303	56	65	208	0	126
GULf	24	0	20	0	855	180	137	133	195	156	0	124
SE-ASI	354	572	863	2,237	3,988	1,603	0	0	5	34	0	8
FE-ASI	2,065	5,314	4,906	2,650	1,480	3,283	149	322	2	122	0	119
AUS	7,144	4,270	3,060	4,777	3,501	4,550	0	0	0	0	0	0
Other.n	0	0	0	0	0	0	0	0	0	0	23	5
Other.s	0	0	0	0	77	15	19	0	0	0	77	19
Total.n	12,018	11,542	9,948	10,718	13,221	11,489	12,018	11,542	9,948	10,718	13,221	11,489
Total.s	652	654	347	550	77	456	652	654	347	550	77	456

Southbound traffic is shown shaded.

With regard to future trends, iron and steel industries are stepping up their strategy to reduce oil consumption. There is moreover an inevitable trend towards the expanded use of coal because coal has a higher potential for production increase. Australian coal is good quality and cheap. The coal producers, China and Australia encourage the increase of exports to consuming regions such as Europe. The coal traffic using the Canal is considered to have potential for increase. When considering the trade route and the GDP per capita growth rate of Europe, the Canal traffic is estimated to have an annual growth rate of 1.2% northbound. For southbound, cargo volume is small, so the Canal traffic will maintain the current level. Future traffic of coal and coke for each direction is calculated as follows.

(1); Excluding the goods traffic unit which is less than 5 million tons

Table 3.1.18 Coal and Coke

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	10,718	13,221	12,640	13,417	15,116	17,652
Southbound	550	77	502	532	600	701

5) Metals and Ores

In the Suez Canal Yearly Report, iron ore, bauxite, zinc, copper, etc. are included in the same section under Metals and Ores, in which, the share of iron ore traffic is more than 50 per cent.

The total volume of the world seaborne trade of iron ore is 301.8 million tons. of which, the quantity of iron ore shipped through the Canal is less than three per cent. Northbound goods traffic of metals and ores reached 9.931 million tons in 1994. Exporting regions include India and Australia with six million tons total. Of the importing regions, Europe and North Mediterranean are the main area and Italy is the first ranked, as shown in the following table.

(unit; 1,000 tons)

Region	Loeded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	508	787	608	1,007	318	646	2,871	2,028	2,769	1,969	1,902	2,308
BALT	20	0	16	53	1,109	240	788	148	41	103	327	281
N-MED	38	39	4	53	133	53	3,924	3,115	3,229	4,187	2,845	3,460
E-MED	44	88	133	276	0	108	297	758	488	917	980	688
W-MED	54	0	12	51	0	23	383	455	247	293	338	343
BLAK	6	72	140	288	0	101	1,971	1,279	651	1,019	2,049	1,394
AME	12	0	0	93	134	48	69	149	42	151	1,490	380
RED	92	175	109	89	406	174	92	16	43	122	0	55
E-AFR	101	126	21	53	1,157	292	0	0	0	42	0	8
IND	4,577	3,148	2,463	2,696	2,478	3,072	45	26	22	29	73	39
GULf	87	102	151	107	225	134	207	449	190	591	700	427
SE-ASI	189	90	150	802	1,635	573	90	340	334	380	584	346
FE-ASI	425	1,157	1,953	1,008	673	1,043	250	152	324	668	267	332
AUS	4,832	3,148	2,620	3,894	3,357	3,570	0	3	0	0	0	1
Other.n	0	0	0	0	0	0	0	14	0	10	0	5
Other.s	2	0	0	11	14	5	0	0	0	0	84	17
Total.n	10,303	7,946	7,467	8,649	9,931	8,859	10,303	7,946	7,467	8,649	9,931	8,859
Total.s	684	986	913	1,832	1,708	1,225	684	986	913	1,832	1,708	1,225

Southbound traffic is shown shaded.

Meanwhile, two shipping routes are considered as using the northbound transit of the Canal. One is from Asia to Europe and the Mediterranean, the other is from Australia to Europe and the Mediterranean. However, the production of pig iron and crude steel in Western Europe has remained at the same level in recent years and no significant increase is expected in the future. Also, for the steel producing countries, for example Asian countries and Middle East countries, there is a tendency to seek resources in nearby areas. However, for the Asian countries, the supply source may be the mines of the former USSR. Therefore, this report assumes the growth rate for the northbound goods traffic at 1.1 per cent and for the southbound goods traffic at 5.9 per cent until 2000, and at 1.8 per cent for the long term. Future traffic of metals and ores for each direction is calculated as follows.

Table 3.1.19 Metals and Ores

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	8,649	9,931	9,669	10,213	11,394	13,135
Southbound	1,832	1,708	1,790	1,957	2,339	2,950

6) Chemical Products

Chemical products are important cargoes in both directions. Northbound traffic of chemical products reached 4.866 million tons and southbound 6.362 million tons in 1994. Exporting regions are the Persian Gulf and the Red Sea for northbound traffic. Europe and West Mediterranean are exporting regions for southbound traffic. Importing regions are West Mediterranean and Europe for northbound, while India, Persian Gulf and South East Asia are for southbound traffic. Export traffic from Europe increased in 1994 and imports increased in the Persian Gulf and South East Asia. This increasing trend is continuing, as shown in the following table ;

(unit; 1,000 tons)

Region	loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	746	776	836	998	2,922	1,256	673	350	456	824	2,122	885
BALT	232	72	34	11	0	70	0	41	0	52	0	19
N-MED	986	910	829	902	222	770	472	341	575	824	316	506
E-MED	126	106	188	205	0	125	450	520	795	1,067	280	622
W-MED	1,212	1,511	1,791	1,724	2,144	1,676	1,913	767	1,049	1,191	1,357	1,255
BLAK	161	63	243	367	327	232	191	29	40	48	0	62
AME	242	184	263	278	129	219	172	415	405	581	608	436
RED	654	425	1,033	1,455	1,500	1,013	571	451	746	747	96	522
E-AFR	129	64	84	31	0	62	81	87	48	68	0	57
IND	84	43	111	75	0	63	2,157	2,219	2,542	2,024	2,635	2,315
GULf	2,586	1,831	2,015	2,858	2,392	2,336	283	498	451	422	1,110	553
SE-ASI	425	150	148	323	674	344	518	323	398	883	1,406	706
FE-ASI	9	113	107	82	47	72	928	1,025	1,082	820	414	854
AUS	0	0	16	1	0	3	35	123	0	28	0	37
Other.n	0	0	31	0	253	57	16	163	225	238	183	165
Other.s	873	1,104	1,083	507	618	837	5	0	0	0	701	141
Total.n	3,887	2,626	3,545	4,825	4,866	3,950	3,887	2,626	3,545	4,825	4,866	3,950
Total.s	4,578	4,726	5,267	4,992	6,362	5,185	4,578	4,726	5,267	4,992	6,362	5,185

Southbound traffic is shown shaded.

It is perceived that this trend will continue as a result of increasing consumption in the Developing countries. Considering the growth rate of the world seaborne cargo traffic of chemical products and the GDP growth rate of the world, the growth rate of the traffic through the Canal is estimated at 3.05 per cent per year until 2000, and at 1.8 per cent per year for long term in both directions. Future traffic of chemical products for each direction is shown as follows.

Table 3.1.20 Chemical Products

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	4,825	4,866	4,902	5,359	6,406	8,078
Southbound	4,992	6,362	6,435	7,035	8,409	10,604

7) Machinery and Parts

In the Suez Canal Yearly Report, this item includes cars, industrial and agricultural machinery and their spare parts, of which, cars represented nearly 100% in 1994. Cars represent the main northbound commodity. They are loaded from Japan, Asian countries and Saudi Arabia to Europe. In southbound traffic, cars are loaded from European countries to Middle East and Asian countries, as shown in the following table;

(unit; 1,000 tons)

Region	Loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	447	372	423	605	966	563	1,575	1,074	838	704	1,002	1,039
BALT	54	58	16	14	0	28	85	173	169	144	0	114
N-MED	199	143	134	210	0	137	194	477	619	471	264	405
E-MED	20	15	71	68	38	42	94	235	393	620	156	300
W-MED	105	92	66	46	0	62	148	369	348	243	212	264
BLAK	45	21	60	100	92	64	10	96	8	14	0	26
AME	96	236	223	223	66	169	0	72	6	13	0	18
RED	15	95	43	166	102	84	466	580	559	692	94	478
E-AFR	4	0	1	13	0	4	11	7	2	6	0	5
IND	17	16	17	41	85	35	23	22	20	63	0	26
GULf	2	37	5	8	306	72	77	102	87	61	458	157
SE-ASI	19	33	34	201	289	115	41	47	48	91	242	94
FE-ASI	2,061	2,315	2,297	1,762	804	1,848	323	174	277	353	144	254
AUS	0	0	0	22	0	4	20	5	0	0	0	5
Other.n	4	0	0	0	117	24	16	0	16	4	69	21
Other.s	0	0	0	0	46	9	5	0	0	0	270	55
Total.n	2,122	2,496	2,397	2,213	1,703	2,186	2,122	2,496	2,397	2,213	1,703	2,186
Total.s	966	937	993	1,266	1,208	1,074	966	937	993	1,266	1,208	1,074

Southbound traffic is shown shaded.

The recent car trade has often been affected by political situations. International trade is so politicized that the field of commercial goods, which is governed solely by the so-called demand-supply relationship, has become narrower. In the case of northbound car traffic, the car production factories are moving to Europe, resulting in a decrease of traffic using the Canal. Therefore, it is considered that the future trade of cars will not increase significantly. Based on the GDP growth rate of the European and Asian countries, the Canal traffic volume has been estimated to have an annual growth rate of 1.1 per cent until 2000, and 0.93 per cent for the long term northbound. The annual growth ratio southbound has been assumed at 1.1 per cent until 2000, and 1.55 per cent for the long term. Future traffic of machinery and parts for each direction is shown as follows.

Table 3.1.21 Machines and Parts

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	2,213	1,703	2,378	2,491	2,734	3,085
Southbound	1,266	1,208	1,150	1,159	1,177	1,201

8) Food Stuffs

This category includes sugar, spices, fruit, fish, coffee, etc.. The data of northbound traffic in 1994 is not available. Spices, sugar, fruits and fish are exported from Asia and Australia to Europe and Mediterranean in northbound direction. However, sugar is the main southbound cargo. It is exported from European countries to Asia, as shown in the following table ;

(unit; 1,000 tons)

Region	Loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	1,529	738	659	671	2,272	1,174	544	876	658	734		703
BALT	199	49	15	675	0	188	40	24	8	29		25
N-MED	359	271	235	374	51	258	490	693	495	490		542
E-MED	134	97	36	212	0	96	308	246	53	99		177
W-MED	186	195	143	152	39	143	213	191	273	482		290
BLAK	161	71	53	10	0	59	708	208	525	259		425
AME	755	204	298	510	157	387	15	13	52	27		27
RED	129	195	92	69		121	1,463	868	840	1,749	978	1,180
E-AFR	466	164	149	101		220	73	6	7	8	0	19
IND	317	468	223	199		302	603	107	46	71	449	255
GULf	11	3	19	82		29	462	364	419	506	1,120	574
SE-ASI	531	195	207	1,028		490	191	13	17	46	162	86
FE-ASI	419	1,159	1,264	543		846	619	329	143	263	344	340
AUS	476	67	126	113		196	16	0	0	0	0	3
Other.n	4	0	0	0		1	35	0	16	15		17
Other.s	94	62	33	39	779	201	0	0	0	0	245	49
Total.n	2,353	2,251	2,080	2,135	1,516	2,067	2,353	2,251	2,080	2,135	1,516	2,067
Total.s	3,427	1,687	1,472	2,643	3,298	2,505	3,427	1,687	1,472	2,643	3,298	2,505

Southbound traffic is shown shaded.

Considering the annual growth rate of the population and GDP per capita of European countries, the growth rate of the northbound goods traffic has been estimated at 0.34 per cent until 2000, and 0.16 per cent for long term. For southbound, the traffic volume has been estimated to have an annual growth rate of 1.35 per cent. Future traffic volume of food stuffs for each direction is shown as follows.

Table 3.1.22 Food Stuffs

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	2,135	1,516	2,116	2,133	2,166	2,210
Southbound	2,643	3,298	2,789	2,983	3,411	4,060

9) Containers

This category, along with oil, occupies an important position among of the traffic in the Canal, with large quantities in both directions. Also, a steady increase can be expected in the future. Information is sparse due to lack of data on container transport within the region. Data on transport in both directions, northbound and southbound is available for the past five years. It began to be recorded in statistics under " Container" in 1994. Before 1993, it has featured as "Others" in category "Other kinds of goods". Because of the difficulty of re-arranging the existing records, it has been recorded with the other statistics. In the following table, "Others" includes container cargo traffic.

Table 3.1.23 Others and Containers

unit:1,000ton

Year	Northbound traffic			Southbound traffic			Total		
	Container	Others	Ot.-Con.	Container	Others	Ot.-Con.	Container	Others	Ratio
1986		24,872			42,300			67,172	
1987		26,931			43,039			69,970	
1988		28,486			46,368			74,854	
1989		31,914			47,942			79,856	
1990	21,368	35,518	14,150	30,325	50,406	20,081	51,693	85,924	60%
1991	22,618	34,682	12,064	32,928	50,491	17,563	55,546	85,173	65%
1992	26,382	36,132	9,750	36,514	50,010	13,496	62,896	86,142	73%
1993	29,961	39,653	9,692	42,729	56,550	13,821	72,690	96,203	76%
1994	34,796	43,538	8,742	46,826	61,499	14,673	81,400	105,037	77%

The Canal cargo traffic is estimated with "Others" first as an annual growth rate of 2.38% taking account of the world GDP growth rate. After that, the container cargo volume has been estimated by using the containerized ratio of 0.85 in 2007 and 0.95 in 2030. The containerized ratio increases steadily between 2007 and 2030.

Table 3.1.24 Container Cargo Volume in both Directions

unit; million tons

Item	2002	2007	2017	2030
Others	127.0	142.6	180.4	245.0
Containers	104.0	121.2	159.7	232.7
Ratio	0.82	0.85	0.885	0.95

The amount of cargo in each direction has been estimated based on past records. Future container traffic in each direction is estimated as follows.

Table 3.1.25 Containers

unit; 1,000 tons

Year	1993	1994	2002	2007	2017	2030
Northbound	29,961	34,796	43,109	50,244	66,185	96,458
Southbound	42,729	46,826	60,893	70,971	93,489	136,250

Future cargo movements of the others excluding containers is calculated as follows.

Table 3.1.26 Others (excluding containers)

unit;1,000 tons

Year	1993	1994	2002	2007	2017	2030
Northbound	9,692	8,742	9,443	8,867	8,600	5,077
Southbound	13,821	14,673	13,338	12,524	12,148	7,171

The remaining cargo statistics for the other goods is estimated in the following paragraph.

10) Other Goods

This category includes starch, cement, wood, oil seeds, vegetable oil, molasses and lubricating oil. In SCA's classification, these seven goods are recorded separately and are estimated independently of the category "Other kinds of goods". Taking account of the index of socio economic data in the world, the traffic cargo statistics for these seven goods has been estimated as follows.

(unit; 1,000 tons)

Region	loaded						unloaded					
	1990	1991	1992	1993	1994	AVER	1990	1991	1992	1993	1994	AVER
EUR	176	289	489	657	254	373	9,413	8,326	7,956	7,476	9,500	8,534
BALT	172	110	4	308	0	119	223	79	137	206	254	180
N-MED	823	556	802	1,442	772	879	2,502	2,425	2,182	1,722	1,022	1,971
E-MED	690	650	728	811	1,793	934	1,383	1,026	1,203	1,366	423	1,080
W-MED	50	22	77	162	56	73	1,512	1,591	1,479	2,005	964	1,510
BLAK	777	463	1,008	1,066	1,308	924	1,271	227	149	67	66	356
AME	699	248	391	319	0	331	271	300	261	209	110	230
RED	609	1,060	758	900	252	716	917	946	1,690	3,392	3,010	1,991
E-AFR	317	102	222	157	329	225	333	140	320	246	225	253
IND	1,652	1,341	1,615	1,482	1,640	1,546	512	324	130	200	78	249
GULf	215	99	95	139	567	223	288	186	468	398	686	405
SE-ASI	11,204	6,933	6,590	8,065	7,424	8,043	509	412	553	335	53	332
FE-ASI	2,129	4,430	4,103	2,267	1,516	2,889	757	318	343	382	148	390
AUS	449	40	1	80	70	128	71	0	0	2	0	15
Other.n	0	1	44	0	637	136	0	32	61	39	96	46
Other.s	114	107	31	51	1,248	310	114	119	26	61	1,231	310
Total.n	16,575	14,006	13,428	13,090	12,435	13,907	16,575	14,006	13,428	13,090	12,435	13,907
Total.s	3,501	2,445	3,530	4,816	5,431	3,945	3,501	2,445	3,530	4,816	5,431	3,945

Southbound traffic is shown shaded.

Transit volume of starch, cement, wood, oil seeds, vegetable oil, molasses and lubricating oil

The origin and destination tables for each region of the starch, cement and wood etc. are attached to Appendix 3.1.1. In northbound goods, every year about five to seven million tons of starch are loaded from Thailand, Indonesia, Taiwan, China and others in Asia, to Holland and other European countries. Southbound cement, once the major cargo during the 1980's, decreased to one million tons, then recovered to four million tons currently. It is exported from the Black Sea countries of Turkey, Romania, Greece, Russia, Bulgaria to countries in the Middle East. The future demand by the Middle East is expected to increase and steady increase in supply by producing countries is also expected, therefore some increase is anticipated.

The future northbound traffic of starch is estimated at the annual growth rate of 1.12 percent. For the southbound, the maximum tonnage in recent years has been taken as the traffic for the target year. The southbound traffic of cement has been estimated at an annual growth rate of 3.6 per cent until 2000, and 1.8 per cent for the long term. For the northbound, the average tonnage in the past five years has been taken as the traffic for the target year. For the estimation of wood traffic, the annual growth rate of the northbound cargo has been assumed at 1.12 per cent, for the southbound it has been estimated at 3.56 per cent until 2000, and 1.8 per cent for the long term. Results of the future traffic for each direction are shown as follows.

Table 3.1.27 Starch

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	5,169	4,504	5,685	6,011	6,719	7,766
Southbound	24	0	24	24	24	24

Table 3.1.28 Cement

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	0	7	68	68	68	68
Southbound	3,838	4,200	3,911	4,276	5,111	6,445

Table 3.1.29 Wood

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	1,389	908	1,756	1,857	2,076	2,399
Southbound	481	624	594	650	777	979

The tonnage of vegetable oil, molasses and lubricating oil have been estimated at an annual growth rate of 1.12 per cent for the northbound cargo, taking account of the GDP growth rate of European countries. For the southbound, they have been estimated at an annual growth rate of 1.8 per cent. Future estimated cargo tonnage of these is shown in Table 3.1.30 and the future traffic of Oil-seeds is shown in Table 3.1.31.

Table 3.1.30 Vegetable Oil, Molasses and Lubricating Oil

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	4,791	5,501	5,776	6,107	6,826	7,889
Southbound	473	607	566	618	739	932

Table 3.1.31 Oil Seeds

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	1,741	1,515	1,949	2,061	2,303	2,662
Southbound	0	0	0	0	0	0

The remaining cargo tonnage of the Other Goods has been estimated as follows.

Table 3.1.32 Other Goods

unit;1,000 tons

Year	1993	1994	2002	2007	2017	2030
Northbound	2,758	1,317	2,439	2,527	2,713	2,976
Southbound	1,383	1,136	1,332	1,380	1,482	1,625

(3) Conclusion

Based on the preceding tables, the total traffic through the Canal has been estimated as follows.

Table 3.1.33 Oil and Oil Products

(unit;1,000 tons)

Year	1993	1994	2002	2007	2017	2030
Northbound	60,502	50,120	74,710	75,578	110,227	114,125
Southbound	15,540	9,288	14,995	16,393	19,595	24,710
Total	76,042	59,408	89,705	91,972	129,822	138,835

Table 3.1.34 Non-oil Cargoes

unit;1,000tons

Year	1993	1994	2002	2007	2017	2030
Northbound	88,525	92,752	106,484	116,090	138,443	175,187
Southbound	132,347	137,795	156,103	171,971	209,167	270,929
Total	220,872	230,547	262,587	288,061	347,610	446,116

The goods traffic through the Canal has decreased in recent years compared to world seaborne trade trends. It is possible that, as a result of the Peace Process in the Middle East, some Canal traffic may be replaced by other transportation systems, like oil pipelines and land transport for goods in Middle East countries. Also the relocation of the production bases in the advanced industrial countries (America, Europe, Japan etc.) is following an increasing trend. This could be a principal cause of traffic reduction through the Canal. However, the improvement project (deepening and widening) may result in an increase in the cargo tonnage. Based on these predictions, the oil and oil products share will remain constant in future. The most probable increase in the Canal goods traffic if any, is anticipated as being due to population increase and economic growth, and is likely to be in such cargoes as containers, fabricated metals, ores and fertilizers.

The change of cargo makeup and future cargo traffic are shown in Fig. 3.1.3 , 3.1.4 and Table 3.1.35.

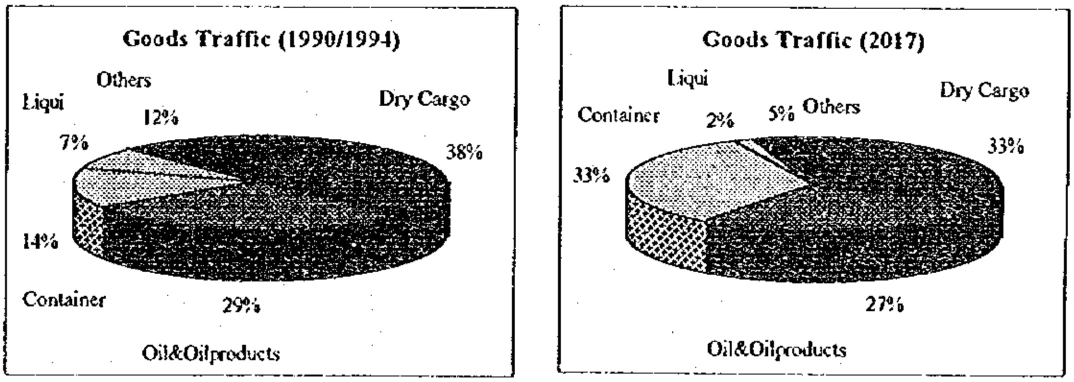


Fig. 3.1.3 Cargo Makeup

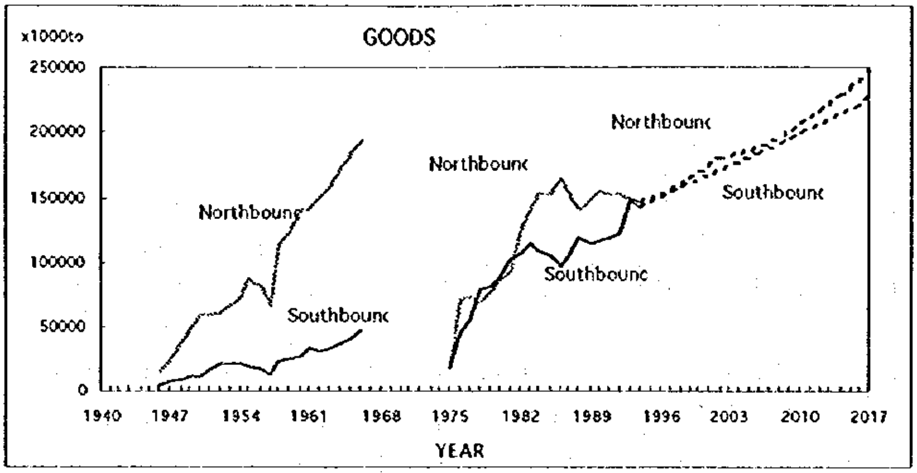


Fig. 3.1.4 Future Cargo Traffic

Table 3.1.35 Future Goods Traffic

Unit; 1,000tons

Goods / Year	1990	1991	1992	1993	1994	2002	2007	2017	2030
Oil & Oilproducts	65,796	70,535	71,283	60,502	50,120	74,710	75,578	110,227	114,125
Fabricated metals	1,359	837	764	1,027	1,190	1,166	1,257	1,458	1,770
Fertilizers	1,860	1,552	1,471	1,351	1,457	1,698	1,779	1,952	2,203
Cereals	1,374	1,484	1,706	2,106	1,578	1,689	1,701	1,727	1,761
Coal & Coke	12,018	11,542	9,948	10,718	13,221	12,640	13,417	15,116	17,652
Metal & Ores	10,303	7,946	7,467	8,649	9,931	9,669	10,213	11,394	13,135
Chemical products	3,887	2,626	3,545	4,825	4,866	4,902	5,359	6,406	8,078
Machine & Parts	2,122	2,496	2,397	2,213	1,703	2,378	2,491	2,734	3,085
Food Stuffs	2,353	2,251	2,080	2,135	1,516	2,116	2,133	2,166	2,210
Container	21,368	22,618	26,382	29,961	34,796	43,109	50,244	66,185	96,458
Starch	6,386	5,126	4,817	5,169	4,504	5,685	6,011	6,719	7,766
Cement	116	1	44	0	7	68	68	68	68
Wood	2,201	1,756	1,779	1,389	908	1,756	1,857	2,076	2,399
Vegitable Oil etc.	5,958	4,895	5,272	4,791	5,501	5,776	6,107	6,826	7,889
Oil Seeds	1,914	2,228	1,516	1,741	1,515	1,949	2,061	2,303	2,662
Others	16,030	15,327	12,051	12,450	10,059	11,881	11,393	11,313	8,052
N.bound Total	155,045	153,220	152,522	149,027	142,872	181,194	191,668	248,670	289,312
Oil & Oilproducts	13,844	14,342	11,987	15,540	9,288	14,995	16,393	19,595	24,710
Fabricated metals	13,143	13,111	17,244	39,408	32,094	33,347	35,924	41,691	50,594
Fertilizers	14,716	15,239	17,835	12,039	13,769	16,252	17,024	18,681	21,078
Cereals	9,879	12,929	11,949	6,868	11,213	13,180	14,912	19,089	26,314
Coal & Coke	652	654	347	550	77	502	532	600	701
Metal & Ores	684	986	913	1,832	1,708	1,790	1,957	2,339	2,950
Chemical products	4,578	4,726	5,267	4,992	6,362	6,435	7,035	8,409	10,604
Machine & Parts	966	937	993	1,266	1,208	1,150	1,159	1,177	1,201
Food Stuffs	3,427	1,687	1,472	2,643	3,298	2,789	2,983	3,411	4,060
Container	30,325	32,928	36,514	42,729	46,826	60,893	70,971	93,489	136,250
Starch	0	0	0	24	0	24	24	24	24
Cement	2,828	1,726	2,670	3,838	4,200	3,911	4,276	5,111	6,445
Wood	276	238	366	481	624	594	650	777	979
Vegitable Oil etc.	397	481	494	473	607	566	618	739	932
Oil Seeds	0	0	0	0	0	0	0	0	0
Others	21,121	19,338	14,454	15,204	15,809	14,670	13,905	13,630	8,796
S.bound Total	116,836	119,322	122,505	147,887	147,083	171,098	188,364	228,762	295,639

3.2 Canal Traffic

In this section, the computation of the numbers of each type of ship, through the Canal, has been estimated from the forecast results of the Suez Canal cargoes for each category under Section 3.1. This also takes account of the distribution of cargo carried by the vessels and the load factor in each type of ship, and has allowed for the increase in containerization and ship sizes.

3.2.1 Transits

In 1994, 16,370 ships made full transits through the Canal in both southbound and northbound directions. The number of transits has decreased from the peak of 22,545 ships in 1982. In recent years, the number of transits reached 18,326, but it has since dropped to a level of 17,000-18,000 ships per annum. The actual data and the forecast of The Study are shown in Fig. 3.2.1. In 1994, the average daily transit was 44.8 ships and the maximum was 69 ships.

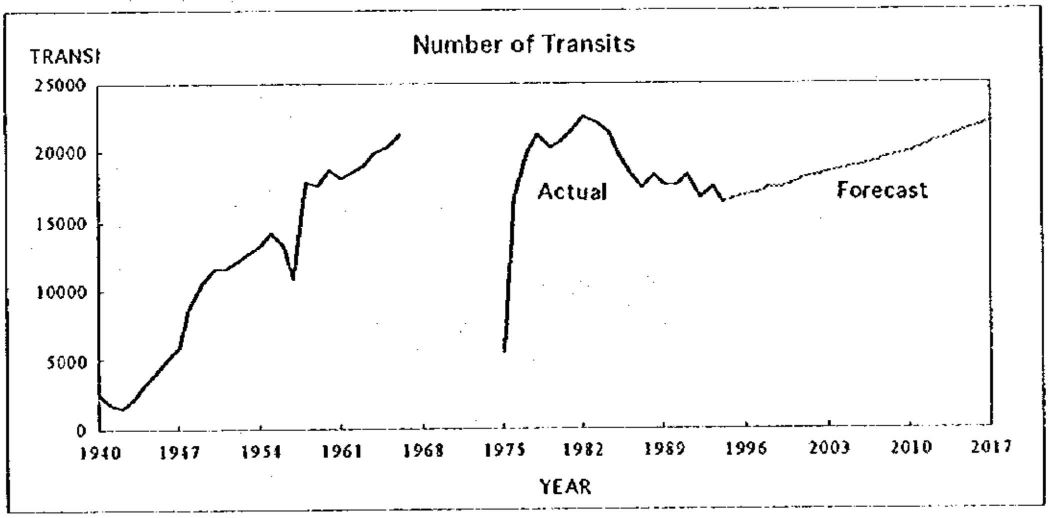


Fig. 3.2.1 Number of Transits by Year

The reduction in the number of transits resulted mainly from the increase of vessel sizes, although the total goods traffic volume didn't alter significantly. The increasing trend of vessel size can be seen from the change of the ship's tonnage as shown in Fig. 3.2.2.

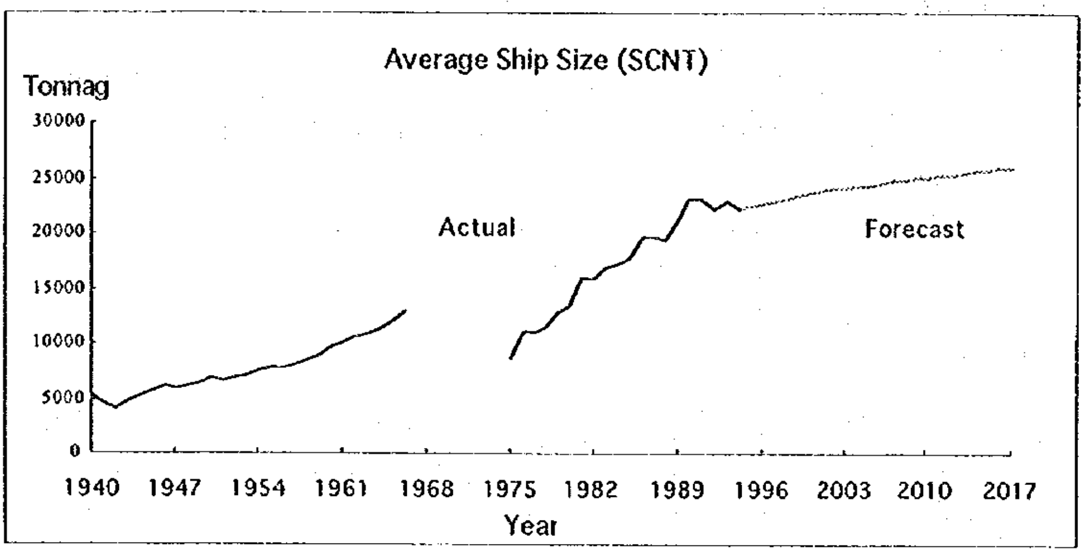


Fig. 3.2.2 Change of Ship Size

The ship records of the SCA include about 50 types. The share of the major ship type is shown in Fig. 3.2.3.

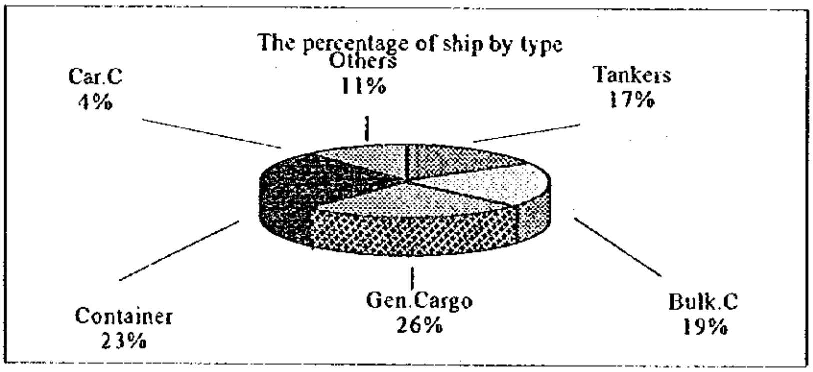


Fig. 3.2.3 The Distribution of Major Ship Types (1994)

3.2.2 Suez Canal Traffic Forecast

In this section, forecasting of the number of transits has been done on the basis of the seaborne cargo tonnage referred to in Section 3.1. The traffic flow forecast is shown in Fig. 3.2.4. The forecasting will use the following assumptions;

a. The number of transits has been determined based on the assumption that the size of future cargo ships will not be restricted by the canal capacity. However, the transits of oil tankers had been projected assuming this restriction.

b. Categorization of commodities and of vessel types for forecasting the future traffic has been based on the descriptions in Table 3.2.1.

c. The vessel sizes for each ship type have been based on the past transit data provided by SCA. (See Appendix 3.2.1. (12))

d. The increase in ship size has been based on the trend over the past five years, and a total average increase of about 14 per cent has been assumed up to the year 2017.

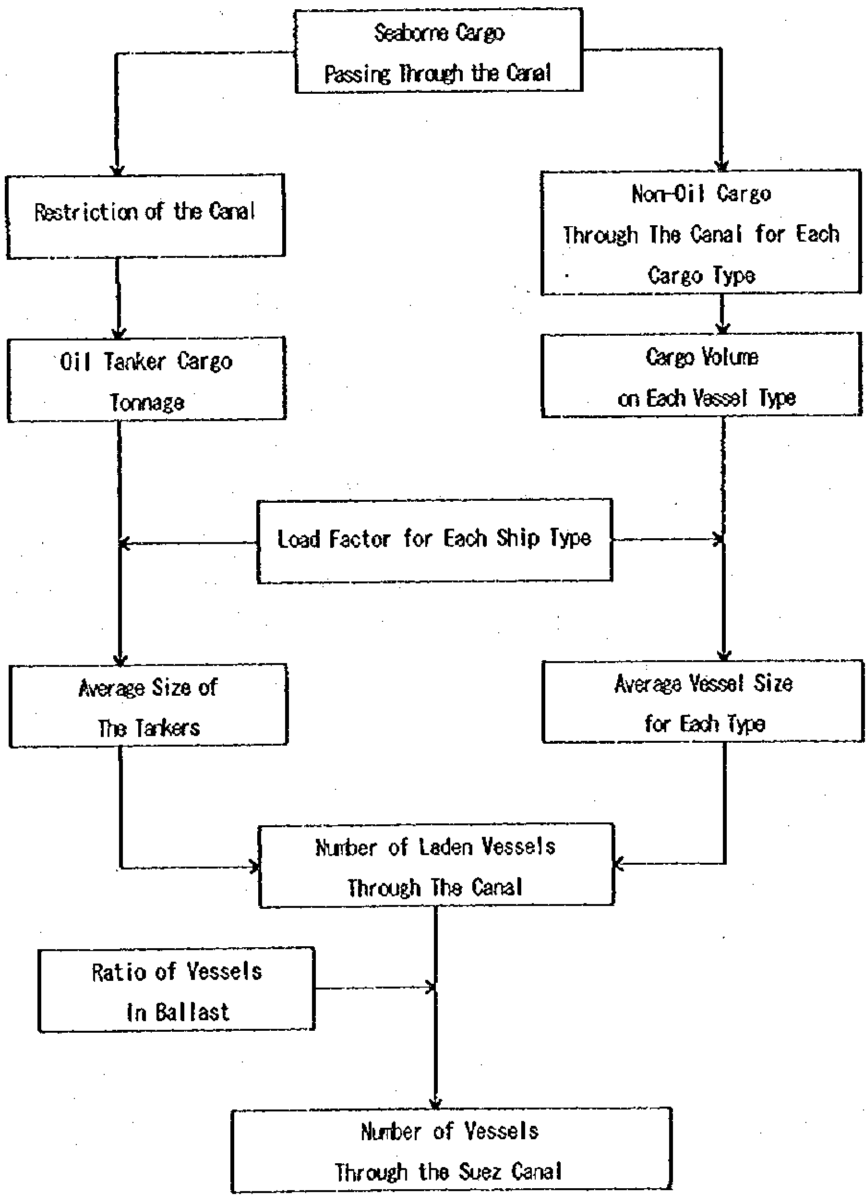


Fig. 3.2.4 Canal Traffic Forecast

Table 3.2.1 Category of Vessels and Commodity

Category	Vessels	Commodity
Tanker	Oil Tanker	Oil and oil products
Bulk Carrier	Bulk Cargo Carrier, Combined Carrier	Cereals, Fertilizers, Fabricated Metals, Ore & Metals, Coal & Coke, Chemical Products, Cement, Starch, Others
Cargo Carrier	General Cargo Carrier	Cereals, Fertilizers, Fabricated Metals, Ore & Metals, Coal & Coke, Chemical Products, Machines & Parts, Food Stuffs, Cement, Starch, Others
Containers	Container Carrier	Containers
Car Carrier	Car Carrier	Machine & Parts
Others	Lash, Ro/Ro, Others	Chemical Products, Food Stuffs, Others
Passenger	Passenger Ships	None
War Ship	War Ships	None

(1) Tanker Traffic Forecast

1) World Fleet and Actual Passage

Tankers are the main ship type in the world seaborne trade, and a breakdown of the world tanker fleet in 1978 and 1991 is shown in Table 3.2.2. The distribution of tanker sizes in 1978 and 1991 is similar, as shown in Fig. 3.2.5. (Source; JICA Report, 1980) The actual number of tankers transiting the Canal are shown in Table 3.2.3. It can be seen from Table 3.2.2 and 3.2.3 that there is a proportional increase in the transit of tankers in per cent of 300,000 DWT compared to the world fleet from 1978 to 1991. Due to the current canal depth, tankers over 200,000 DWT normally transit through the Canal in ballast. In fact, fully laden tankers up to 180,000 DWT can transit through the Canal.

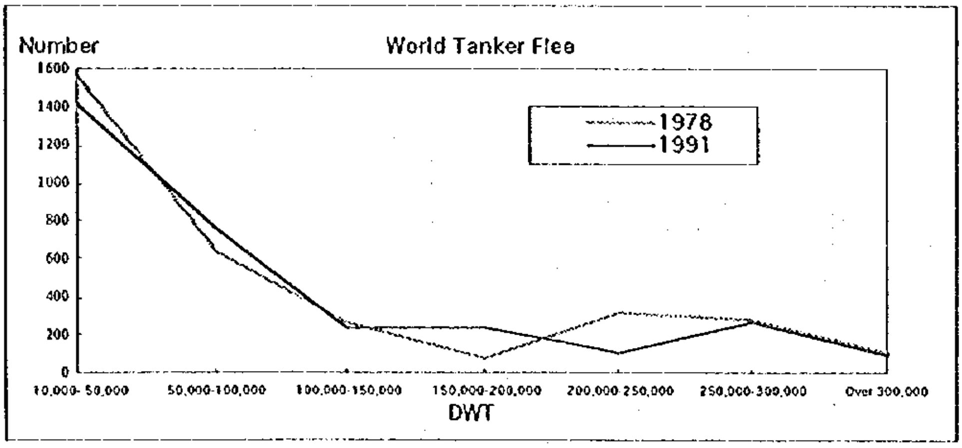


Fig. 3.2.5 World Tanker Fleet

Table 3.2.2 World Tanker Fleet

Year 1978		Year 1991	
Size (DWT)	No.	Size (DWT)	No.
10,000-20,000	447	0-500	724
20,000-25,000	303	500-1000	611
25,000-30,000	245	1000-2000	1,187
30,000-35,000	259	2000-3000	586
35,000-40,000	159	3000-5000	637
40,000-45,000	68	5000-10,000	593
45,000-50,000	78	10,000-20,000	395
50,000-60,000	147	20,000-30,000	418
60,000-70,000	120	30,000-50,000	612
70,000-80,000	136	50,000-100,000	775
80,000-100,000	241	100,000-200,000	502
100,000-150,000	269	200,000-220,000	15
150,000-200,000	83	220,000-240,000	96
200,000-250,000	313	240,000-260,000	91
250,000-300,000	276	260,000-280,000	125
		280,000-300,000	46
300,000-350,000	51	300,000-320,000	27
		320,000-340,000	13
350,000-400,000	30	340,000-360,000	12
		360,000-380,000	6
		380,000-400,000	4
400,000& Over	30	400,000-420,000	12
		420,000-440,000	3
		440,000-460,000	4
		460,000-480,000	0
		480,000-500,000	2
		500,000-	4
Total	3,255	Total	7,500

Table 3.2.3 Number of Tanker Transits

Size Group	Number of Transits, SCA (1994)			1978	1991
	Total	In Ballast	Laden		
10,000- 50,000	1,691	334	1,357	1,559	1,425
50,000-100,000	345	135	210	447	775
100,000-150,000	246	110	136	269	251
150,000-200,000	199	95	104	83	251
200,000-250,000	17	13	4	313	111
250,000-300,000	138	137	1	276	262
Over 300,000	94	93	1	111	87

Note; SCA data includes the number of tankers up to 10000 DWT tankers.
The data of 1978,1991 from Table 3.2.2.

It is possible that the future size of world tankers may not increase significantly, because the shippers want to reduce the berthing time, and hence the benefits of size increase may be lost. Nearly all of the world tankers will be able to transit through the Canal after widening and deepening has been completed to permit the transit of fully laden 300,000 DWT tankers. The average ship tonnage in the past five years and increase rate are shown in Table 3.2.4.

Table 3.2.4 Average Tonnage and Increase Rate

	Average DWT	Increase Rate
Northbound	58,988	0.27%
Southbound	27,794	1.35%

excluding the ships in ballast

The load factor of tankers has been calculated using the ratio between the tanker DWT and the actual load carried. From SCA records, the ratio of tankers in ballast compared to the total in transit is 0.201 for northbound, and 0.551 for southbound based on the past average value.

Table 3.2.5 Load Factor of Tankers

Year	2002	2007	2017	2030
Northbound	0.867	0.874	0.888	0.906
Southbound	0.622	0.640	0.680	0.740

Using the above information, the future number of tankers estimated is shown in Table 3.2.6. Details are attached to Appendix 3.2.1

Table 3.2.6 Number of Tankers

	1993	1994	2002	2007	2017	2030
North bound	1,485	1,315	1,717	1,700	2,376	2,327
South bound	1,708	1,415	1,736	1,725	1,698	1,651
Total	3,193	2,730	3,453	3,425	4,074	3,978

(2) Non-Tanker Traffic Forecast

This section describes the basic system of forecasting non-tanker traffic. The commodity tonnage in metric tons transiting has been estimated in section 3.1. The forecasting process uses the following factors in the calculations.

a. Select the ship type and share for each commodity.

b. Convert the total transiting cargo tonnage into the ship type share for each commodity.

c. Calculate the ship cargo volume using the load factor for each ship type.

d. Calculate the average ship size from past trend.

e. Calculate the ratio of the ships in ballast of total number for each ship type.

f. Estimate the number of non-tankers by studying the average displacement tonnage.

1) Share of Vessel Category for Each Commodity

Table 3.2.7 shows the share of cargo for each category of vessel ascertained from the current data. This information will be used to convert the cargo volume from commodity to vessel category.

Table 3.2.7 Share of Ships for Each Commodity

Northbound	Bulk Carrier	Gene. C. C.	Containers	Car Carrier	Others	Total
Cereals	36.7%	63.3%	0.0%	0.0%	0.0%	100.0%
Fertilizers	96.1%	3.9%	0.0%	0.0%	0.0%	100.0%
Fab.,M	84.0%	16.0%	0.0%	0.0%	0.0%	100.0%
Ore&M	90.6%	9.4%	0.0%	0.0%	0.0%	100.0%
Coal	90.0%	10.0%	0.0%	0.0%	0.0%	100.0%
Chemicals	66.4%	25.3%	0.0%	0.0%	8.3%	100.0%
Machinery	0.0%	0.2%	0.0%	99.8%	0.0%	100.0%
Foods	0.0%	32.2%	0.0%	0.0%	67.8%	100.0%
Cement	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Starch	66.6%	33.4%	0.0%	0.0%	0.0%	100.0%
Container	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
Others	45.1%	9.7%	27.8%	0.0%	17.4%	100.0%
Total	41.2%	9.1%	42.9%	1.8%	4.9%	100.0%

Gene.C.C.;General Cargo Carrier, Fab.M;Fablicated Metals, Ore&M;Ore and Metals

Southbound	Bulk Carrier	Gene. C. C.	Containers	Car Carrier	Others	Total
Cereals	87.3%	12.7%	0.0%	0.0%	0.0%	100.0%
Fertilizers	97.4%	2.6%	0.0%	0.0%	0.0%	100.0%
Fab.,M	90.7%	9.3%	0.0%	0.0%	0.0%	100.0%
Ore&M	89.6%	10.4%	0.0%	0.0%	0.0%	100.0%
Coal	90.9%	9.1%	0.0%	0.0%	0.0%	100.0%
Chemicals	78.6%	15.7%	0.0%	0.0%	5.7%	100.0%
Machinery	0.0%	11.3%	0.0%	88.7%	0.0%	100.0%
Foods	0.0%	60.6%	39.4%	0.0%	0.0%	100.0%
Cement	71.4%	28.6%	0.0%	0.0%	0.0%	100.0%
Starch	66.7%	33.3%	0.0%	0.0%	0.0%	100.0%
Container	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
Others	25.4%	28.5%	5.9%	0.0%	40.3%	100.0%
Total	48.1%	10.3%	35.7%	0.8%	5.2%	100.0%

Gene.C.C.;General Cargo Carrier, Fab.M;Fablicated Metals, Ore&M;Ore and Metals

2) Load factor

Table 3.2.8 shows the load factor for each ship category.

Table 3.2.8 Load Factor for Each Ship Category

(ton/SCNT)

	Bulk.C*	Gene.C	Container	Car.C	Others**	Total
Load F.North	1.50	0.81	0.73	0.12	0.61	0.76
Load F.South	1.69	0.93	0.92	0.10	0.89	1.09
Load F. Total	1.62	0.88	0.82	0.11	0.76	0.93

*: Including Combined Carriers.

**:Including "Lash ships", "Ro-Ro ships" and "Other type ships"

3) Results of Traffic Forecast

In 2017, the number of tankers will be 4074 and the number of non-tankers will be 18,115. The total number of the vessels will be 22,189 as shown in Table 3.2.9 and 3.2.10. Details are given in Appendix 3.2.1 of "Details of Traffic Forecast".

Table 3.2.9 Number of Non-tankers

Number

	1993	1994	2002	2007	2017	2030
Northbound	6,475	6,339	7,035	7,465	8,457	9,888
Southbound	7,649	7,301	7,875	8,390	9,658	11,356
Total	14,124	13,640	14,910	15,855	18,115	21,244

Table 3.2.10 Total Number of Ships

Number

	1993	1994	2002	2007	2017	2030
Northbound	7,960	7,654	8,752	9,165	10,833	12,215
Southbound	9,357	8,716	9,611	10,115	11,356	13,007
Total	17,317	16,370	18,363	19,280	22,189	25,222

Table 3.2.11 Annual Number of Ships

Number

	1993	1994	2002	2007	2017	2030
Northbound	**7,960**	**7,654**	**8,752**	**9,165**	**10,833**	**12,215**
Tanker	1,485	1,315	1,717	1,700	2,376	2,327
Bulk Carrier	1,455	1,369	1,226	1,255	1,330	1,400
Contaner Carrier	1,817	1,864	2,307	2,544	3,037	3,879
Cargo Carrier	1,956	1,962	1,964	2,116	2,484	2,999
Car Carrier	415	343	470	483	511	552
Others	722	678	942	938	959	910
Passenger	34	36	34	37	44	56
War Ships	76	87	92	92	92	92
Southbound	**9,357**	**8,716**	**9,611**	**10,115**	**11,356**	**13,007**
Tanker	1,708	1,415	1,736	1,725	1,698	1,651
Bulk Carrier	2,098	2,008	2,149	2,245	2,467	2,775
Contaner Carrier	1,839	1,849	2,371	2,656	3,240	4,270
Cargo Carrier	2,379	2,230	2,151	2,320	2,789	3,350
Car Carrier	337	262	297	290	277	261
Others	863	814	770	740	739	543
Passenger	32	36	32	34	41	52
War Ships	101	102	105	105	105	105
Total	**17,317**	**16,370**	**18,363**	**19,280**	**22,189**	**25,222**

Table 3.2.12 Daily Number of Ships

Number

	1993	1994	2002	2007	2017	2030
Northbound	**21.8**	**21.0**	**24.0**	**25.1**	**29.7**	**33.5**
Tanker	4.07	3.60	4.70	4.66	6.51	6.38
Bulk Carrier	3.99	3.75	3.36	3.44	3.64	3.84
Contaner Carrier	4.98	5.11	6.32	6.97	8.32	10.63
Cargo Carrier	5.36	5.38	5.38	5.80	6.81	8.22
Car Carrier	1.14	0.94	1.29	1.32	1.40	1.51
Others	1.98	1.86	2.58	2.57	2.63	2.49
Passenger	0.09	0.10	0.09	0.10	0.12	0.15
War Ships	0.21	0.24	0.25	0.25	0.25	0.25
Southbound	**25.6**	**23.9**	**26.3**	**27.7**	**31.1**	**35.6**
Tanker	4.68	3.88	4.76	4.73	4.65	4.52
Bulk Carrier	5.75	5.50	5.89	6.15	6.76	7.60
Contaner Carrier	5.04	5.07	6.50	7.28	8.88	11.70
Cargo Carrier	6.52	6.11	5.89	6.36	7.64	9.18
Car Carrier	0.92	0.72	0.81	0.79	0.76	0.72
Others	2.36	2.23	2.11	2.03	2.02	1.49
Passenger	0.09	0.10	0.09	0.09	0.11	0.14
War Ships	0.28	0.28	0.29	0.29	0.29	0.29
Total	**47.4**	**44.8**	**50.3**	**52.8**	**60.8**	**69.1**

3.2.3 Mast height (Air Draught)

If a bridge is planned to cross over the Canal, it will be necessary to collect the data of ship mast heights to determine the necessary clearance of the bridge. After determining the bridge clearance, it will be necessary to estimate the number of ships unable to pass under the bridge.

(1) Data of Mast Height

This section describes the outline of the mast height data.

a. The ship mast height is a maximum when the ship is in light condition, but the mast height data in this condition is not known because normally the ships navigate themselves on the Canal in ballast condition. (See Fig. 3.2.6)

b. Ship transiting data is recorded by SCA, but this data does not include the mast height.

c. Information on ships under the Japanese flag is available. (Japan Shipping Register 1991)

d. Information on ships under foreign flags is also available. (Lloyd's Register of Shipping 1991). Lloyd's Register does not include the mast height for ships in ballast but includes it in fully laden condition. Therefore, the mast height of foreign ships has been determined using the data from ships under the Japanese flag as reference, for the purpose of this analysis

e. The actual mast height varies between ships of the same size and category. It is however possible to get this information upon request.

f. The predicted dimension of ships yet to be built should only be estimated by statistical methods.

g. It is therefore expected that the values predicted will have a wide range.

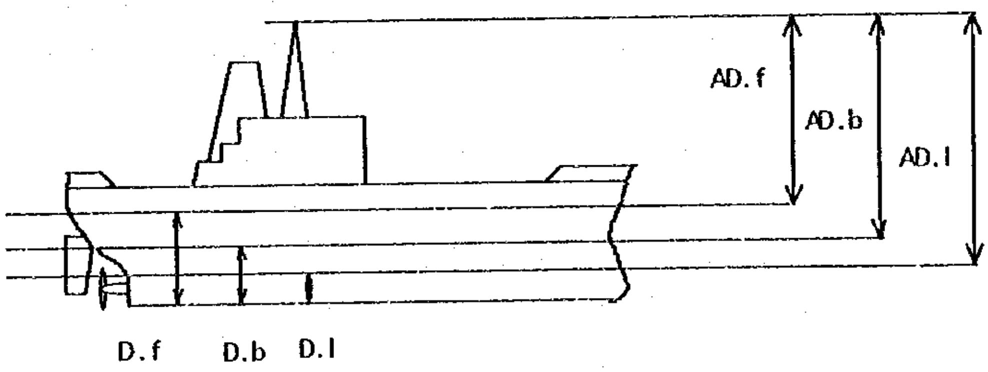
h. A clearance of 2 m should be allowed for the mast height to take account of ship pitching motion.

(2) Current Situation

Ignoring the ship category, the number of ships unable to pass through the Canal with a clearance of 65 m and 70 m from the ship data have been determined. This shows that there are 16 ships with a mast height above 63 m in ballast, including 9 ships under the Japanese flag with a mast height above 68 m. (See Appendix 3.2.2)

The Lloyd's Register of Shipping only indicates the mast height in fully laden condition for ships under the foreign flags. Using statistical analysis, the mast height of the ships in ballast has been estimated. This shows that there are 25 ships with a mast height above 50 m in fully laden condition, including 13 ships with a mast height above 55 m. (See Appendix 3.2.2)

Other than the ships mentioned above, there are two ships and five rigs that have previously transited through the Canal, but will not be able to transit with a clearance of 70 m. For this analysis, the ship dimensions are shown in Fig. 3.2.6.



Note: D.f: Draught in full load condition, D.b; Draught in ballast, D.l; Draught in light load condition
AD.f; Mast height (Air draught) in full load condition, AD.b; Mast height (Air draught) in ballast,
AD.l; Mast height (Air draught) in light load condition

Fig. 3.2.6 Draught and Mast Height (Air Draught)

The actual, water line is not parallel to the keel of the ship as shown in Fig. 3.2.6. The stern draught is deeper than the bow draught. In this report, all draughts and mast heights are measured at mid ship.

(3) Statistical Analysis by Ship Category

For the statistical analysis, the category of ships includes tankers, container carriers, bulk carriers, gas carriers and car carriers. Using the current ship sizes and mast heights, general cargo carriers have been excluded from the analysis because the mast height is low. From the data for big car carriers and big passenger ships, statistical analysis has not been done and the mast height data only selected, because of the problems of interpretation resulting from the large differences in the data.

1) Tankers

The mast height is greater than 65 m for tankers in excess of 400,000 DWT transiting the west branch (southbound) in ballast. In the past (1988/1994), the number of tankers in excess of 400,000 DWT which transited through the Canal was 27 ships. It is considered that nearly all the tankers of this class, in the world, transited the Canal. The maximum number of transits was 37 ships in 1989, and the largest tanker was 560,000 DWT.

From those ships which transited the Canal, and whose mast height data is available, two ships the "Hellas Fos (554,974 DWT)" and "Kapetan Giorgis (456,390 DWT)", will be unable to transit the Canal with a bridge height of 70 m clearance. Their sister ships the "Hellas Point Kapital (381,913 DWT)" and "Jaher Viking (564,650 DWT)" may also be unable to transit the Canal, although their mast height is not known.

Table 3.2.13 Number of Transits of Tankers

Number

Year	Total	Over 200,000		No. of vessels			No. of transits		
	No. of Transits	No. of Transits	of which ratio	Over 300,000	Over 400,000	Over 500,000	Over 300,000	Over 400,000	Over 500,000
1985	-	188		-	-	-	-	-	-
1986	3,659	261	7.1%	-	-	-	-	-	-
1987	3,402	249	7.3%	-	-	-	-	-	-
1988	3,429	323	9.4%	42	7	2	105	11	4
1989	3,424	400	11.7%	40	15	3	80	30	7
1990	3,682	518	14.1%	50	14	3	104	33	5
1991	3,549	503	14.2%	44	13	1	99	25	2
1992	3,153	236	7.5%	22	3	0	33	4	0
1993	3,193	381	11.9%	44	11	1	78	32	1
1994	2,730	249	9.1%	32	11	3	62	28	4

Note: Vassel weight unit : DWT
Source : SCA

Normally, it is possible to adjust the ship draught by adjusting ballast, but the maximum dimensions of vessels are given by the Rules of Navigation (SCA). As such, the maximum ballast draught is 31 ft.(9.45 m) for bow draught and 35 ft.(10.67 m) for stern draught with a beam of 210 ft.(64 m). Two such tankers transited through the Canal with 10 m draught in ballast. Ships with a beam over 245 ft. (73 m) may be allowed to transit the Canal with special permission.

Nisseimaru (484,276 DWT, under the Japanese flag), has a mast height of 71 m, but she has not been allocated to the route passing through the Canal.

Allowing for changes in the world tanker fleet, it is not considered likely that the maximum vessel size will increase.

From the statistical analysis for tankers, the mast height of 360,000 DWT class tankers is about 63.0 m, and that of 500,000 DWT class tankers is about 67.6 m. From the world tanker fleet, there are 35 ships in excess of 360,000 DWT, including 4 tankers greater than 500,000 DWT. (See Table 3.2.2 and Table 3.2.12)

From the aforementioned, about four tankers can be considered as being unable to pass through with a bridge clearance of 70 m. From past records, they may pass through the Canal 12 times per year. (See Appendix 3.2.3)

Table 3.2.14 Mast Height of Tankers

unit:m

DWT	Japanese Flag			Foreign Flag	
	MastHeight	Draught.F	Draught.B	MastHeight	Draught.F
500	14.9	3.1	1.82	15.0	3.0
10,000	28.3	7.7	3.40	28.8	7.5
20,000	32.9	9.5	3.93	33.5	9.2
30,000	35.9	10.7	4.28	36.6	10.4
50,000	40.0	12.5	4.76	40.9	12.2
100,000	46.5	15.4	5.49	47.6	15.1
150,000	50.7	17.4	5.98	52.0	17.1
200,000	53.9	19.0	6.35	55.4	18.6
250,000	56.6	20.4	6.65	58.1	20.0
300,000	58.8	21.5	6.90	60.5	21.1
350,000	60.8	22.5	7.13	62.6	22.1
400,000	62.6	23.5	7.33	64.4	23.0
450,000	64.2	24.3	7.51	66.1	23.9
500,000	65.7	25.1	7.68	67.6	24.7
555,000	67.2	25.9	7.85	69.2	25.5
600,000	68.3	26.5	7.97	70.4	26.1

Note; Draught F : Draugh in full load condition
Draught B : Draught in ballst

2) Container Carriers

From SCA transit records, the maximum size vessel is the Leverkusen Express (88,424 DWT). By statistical analysis, container carriers up to 100,000 DWT, will be able to transit through the Canal in future, with a bridge height clearance of 70 m.

Furthermore, among container carriers under the Japanese flag, The North Sea(35,229 DWT) has a mast height of 69.05 m with 9.07 m draught in ballast, so she could not transit the Canal with a bridge clearance of 70 m. (See Appendix 3.2.3) From the data records, she has not transited the Canal to date.

3) Bulk Carriers

From SCA transit records, the maximum size vessel is the Tradefortitude (245,288 DWT). By statistical analysis, the 70 m clearance is sufficient to permit transit of all current bulk carriers. In future, the vessel size may increase, and transit of some of the new bulk carriers may not be possible.

Among ships under the Japanese flag, the Wakayamamaru (133,357 DWT) and Aobayamamaru (138,655 DWT) have mast heights above 70 m. (See Appendix 3.2.3) They have not transited the Canal to date.

4) Car Carriers

From SCA transit records, the maximum size of this type is 600,00 DWT. According to statistical analysis, it should be possible to transit through the Canal with 70 m bridge clearance, even if the car carrier size increases in the future. Among ships under the Japanese flag, London Highway, Century Leader III, Mercury Ace, Neptune Ace and Aurora Ace have mast heights above 68 m, so they will not be able to transit the Canal with 70 m clearance. London Highway, Mercury Ace and Neptune Ace have transited the Canal and they will have to change the route after bridge construction.

Table 3.2.15 Car Carriers of Mast Height Above 65 m

Name	DWT	Draught.B	M. Height	GT	Flag	Build	Tranit Date (1994)
LONDON HIGHWAY	14,683	5.24	76.01	22,324	Japan	12/1986	18/4,8/7
CENTURY LEADER III	14,155	5.06	72.62	22,240	Japan	03/1986	
MERCURY ACE	16,603	6.55	69.22	26,501	Japan	09/1985	15/2,14/4,17/5,12/11
NEPTUNE ACE	16,560	6.55	69.22	26,501	Japan	06/1985	19/3,28/8,24/11
AURORA ACE	17,090	4.70	68.84	-	Japan	06/1984	
CENTURY LEADER I	11,961	5.17	65.88	20,439	Japan	03/1984	

Note; Draught. B : Draught in ballast.
M. Height : Mast height

5) Rigs and Others

From the data of Lloyd's Register, 398 rigs are active in the Middle East area and they may wish to pass through the Canal. This number may vary depending up on the loading condition. None of the 381 rigs will be able to transit the Canal with the 70 m clearance. From transit record of SCA, there have been seven transits by six rigs in five years. These rigs will not be able to transit the Canal after bridge construction.

Table 3.2.16 Transit Record of Drilling Rigs (past 5 years)

NAME	DATE	Height(m)*	Draught(m)
Key Gibraltal	24/10/90	115.5	7.8
Key Manhattan	17/09/91	116.7	4.8
Santa Fe 136	26/12/92	117.9	5.7
Ben loyal	22/12/93	96.6	7.2
West Delta	05/05/94	106.0	8.5
Santa Fe 136	11/12/94	117.9	5.7
Key Victoria	31/12/94	103.8	7.3

*;Height is measured from bottom to top

George Washington (Aircraft Carrier, USA) is 73 m(244 ft.) tall, 76 m(257 ft.) wide and 330 m(1,094 ft.) long. Assuming that the draught is about 10 m and the mast height is about 63 m, she would be able to transit the Canal.

Gas carriers may be able to transit the Canal in future even though the vessel size will increase. (See Appendix 3.2.3)

(4) Conclusions

a. From SCA transit records and the shipping register, there are vessels that will not be able to transit the Canal with a 70 m bridge height clearance, but their number is small. (See Appendix 3.2.3)

b. By statistical analysis, the mast height of 500,000 DWT tankers is approximately 67.6 m in ballast, the mast height of 300,000 DWT bulk carriers is about 67.5 m and the mast height of 150,000 DWT gas carriers is about 67.3 m. These are the maximum sizes of vessels which can transit the Canal with a 70 m bridge clearance. (See Appendix 3.2.3)

c. There is however the possibility of building tankers or bulk carriers with mast heights above 68 m in the future. (See Appendix 3.2.1 (4) and (5))

d. The mast height of 100,000 DWT container carriers appears to be about 64.2 m, and therefore this category of ship will be able to transit the Canal in future. (See Appendix 3.2.1 (6) and 3.2.3 (2))

e. After the construction of the bridge, about seven vessels (excluding oil rigs) will be unable to pass through the Canal and will have to change the route. Their maximum annual transiting frequency could be three for each vessel. Their name are Hellas Fos, Kapetan Giorgis, Hellas Point Kapital, Jaher Viking, London Highway, Mercury Ace and Neptune Ace. (See Appendix 3.2.3 (1), Table 3.2.15)

f. With a 65 m height clearance, between 15 and 35 vessels will be unable to transit the Canal and will have to change their route. This information is shown in Table 3.2.2, 3.2.13 and Appendix 3.2.3 (1).

g. About two oil rigs annually will be unable to pass through the Canal after the construction of the bridge. (See Table 3.2.16)

h. It is considered that the 70 m clearance requirements should be reasonable for the width of navigable channel marked by the pairs of light buoys.

3.3 Development Plan

3.3.1 Present Situation of the Canal

(1) Canal Topography

The Suez Canal is a waterway connecting the Mediterranean and Red Sea. The Canal has a total length of 162.5 km between Port Said in the north and Port Suez in the south, and three lakes are situated along the Canal: Timsah Lake is at Km.76.578 - 81.878, the Great Bitter Lake is at Km.97.700 - 115, and the Little Bitter Lake at Km.115 - 134 as shown in Fig. 3.3.1.

Table 3.3.1 (1) - (2) and Fig. 3.3.2 (1) - (4) show the condition of the present Canal (56 feet draft). The main channel, including the by-pass of the eastern branches, has a minimum dredged water depth of 20.5 m, and the western branches (38 feet draft) a minimum dredged water depth of 15.0/15.5 m. The Canal side slopes are graded at 1/4 in the northern part, as far as Km.61.00 and 1/3 in the southern part. (Note: Nowadays Port Said west branch and Ballah west branch have a depth of 16.0 m, and allow vessels of 42 feet draft to pass through).

The Canal is provided with five by-passes as follows (refer to Fig. 3.3.3 (1) - (5)):

1) Port Said By-Pass

The by-pass starts at Km.17.00 and extends north to join the existing Port Said roadstead at Hm. (Hundred meter) 94.90 and continues until Hm.195.

2) Ballah Loop

Between Km.51 and Km.61 the Canal is twinned on the East side by a branch. This length of the Canal between the North and South ends where the 2 branches meet is called "Ballah Loop".

In the East Branch the kilometer marks are suffixed by the letter "E", and this branch has a total length of 8.444 km.

	West Branch	East Branch
Kilometer marking of North end	51.477	51.499 E
Kilometer marking of South end	60.333	59.943 E

3) Timsah By-Pass

Between Km.76.578 and Km.81.878 E.

Length : 5.300 km

4) Deversoir By-Pass

This branch begins at Km.95.000 and joins the main East channel in the Great Bitter Lake at Km.104.160.

Length : 9.160 km

5) Kabrit By-Pass

This begins at Km.114.957 and ends at Km.122.100. The by-pass is separated from the west branch by a submerged island which is at a depth of between 2 and 6 meters.

Length : 7.143 km

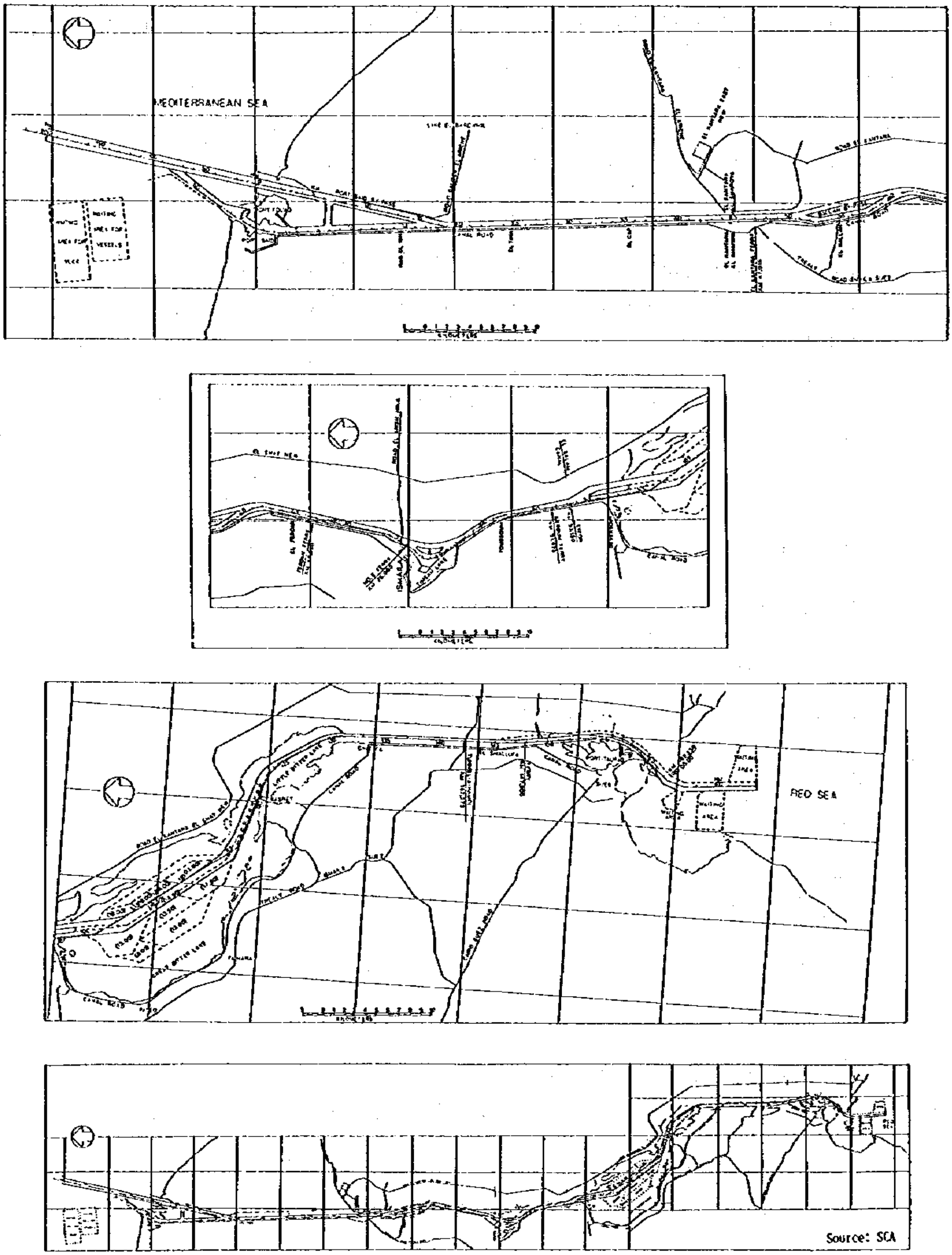


Fig. 3.3.1 Existing Layout of the Canal

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

Table 3.3.1(1) Present Condition of Width and Depth of the Canal

Point (Hm,Km)	Location (Hm,Km) from	Location (Hm,Km) to	Depth (m)	Width at Bottom(m)	Slope Grade	
	Port Said by-pass East Branch					
Hm 195.00	195.00	195.00	21.0	754	>1:15	
Hm 80.00	80.00	80.00	21.0	400	>1:15	
Km 0.000	Main Canal					
1.000	1.000	1.000	21.0	130	1:4	
	1.348	2.400	20.5	174	1:4	
	2.400	3.400	20.5	182-134	1:4	Junction
	3.400	15.190	20.5	134	1:4	
	15.190	15.540	20.5	Variable	1:4	Junction
17.000	17.000	19.000	20.5	Variable	1:4	Entrance of by-pass
	19.000	30.430	20.5	149	1:4	Straight
	30.430	32.350	20.5	149-226	1:4	
	32.350	32.950	20.5	226	1:4	Siding Km.32
	32.950	35.110	20.5	226-134	1:4	
	35.110	49.512	20.5	134	1:4	Straight
50.000	49.512	51.477	20.5	Variable	1:4	Curve
	51.449	51.785	20.5	134	1:4	Curve Km51E
	51.785	59.943	20.5	134	1:4	Straight
60.000	60.308	60.333	18.5-20.:	Variable	1:4	Curve Km61
	60.333	63.419	20.5	Variable	1:3	Curve Km61
	63.419	64.514	20.5	179-153	1:3	Apprach curve
70.000	64.514	71.164	20.5	153	1:3	Straight Line
	71.164	71.964	20.5	153-173	1:3	Apprach curve
	71.964	75.311	20.5	173	1:3	"S" Curves
	75.311	76.033	20.5	173	1:3	Straight Line
	76.033	76.519	20.5	173	1:3	Straight Line
	76.519	78.300	20.5	173	1:3	Curve Timsah

Point (Hm,Km)	Location (Hm,Km) from	Location (Hm,Km) to	Depth (m)	Width at Bottom(m)	Slope Grade	
	Port Said by-pass West Branch					
Hm 80.00	80.00	80.00	16.5	520	1:5	
Hm 25.00	25.00	25.00	16.5	230	1:5	
Km 0.000	Port Said West Branch					
1.000	0.000	1.450	15.5	Port	1:4	Basin
	1.450	3.650	15.5	Port	1:4	Basin
	3.729	4.890	15.5	Variable	1:4	Junction
	4.890	6.000	15.5	Variable	1:4	Junction
	6.000	16.500	15.5	189	1:4	Straight
	16.500	16.663	15.5-19.0	189-161	1:4	Straight
	16.663	17.000	15.5-19.0	Variable	1:4	Junction
	West Branch Ballah Loop					
50.000	51.477	51.800	18.5	110	1:4	S/L(siding Km51.5)
	51.800	52.054	15.5	134	1:4	Straight
	52.054	53.298	15.5	Variable	1:4	Curve Km53
	53.298	54.098	15.5	148.6-134	1:4	Apprach curve
	54.098	56.397	15.5	134	1:4	Straight Line
	56.397	56.871	15.5	Variable	1:4	Appr.curve Km57
	56.871	58.797	15.5	Variable	1:4	Curve Km57
	58.797	59.269	15.5	145.8-134	1:4	Apprach curve
	59.269	59.900	15.5	134	1:4	Straight Line
60.000	59.900	60.308	18.5	110	1:4	S/L(siding Km60.0)
70.000						
	West Branch Timsah Lake					
	76.033	77.371	15.5	93-164	1:3	Curve
	77.371	77.672	15.5	164-217	1:3	Junction
	77.672	77.912	15.5	217-250	1:3	Junction
	77.912	79.800	15.5	250	1:3	Curve Timsah Lake
80.000	79.800	81.000	19.0	112	1:3	S/L(siding Km80.0)

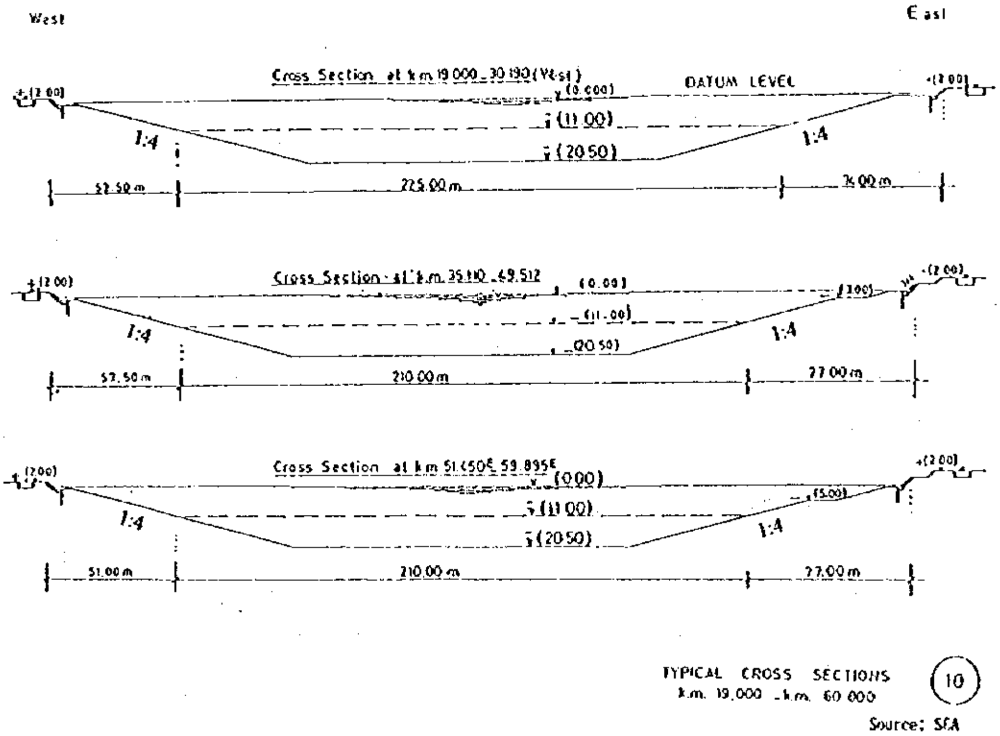
Source: SCA' Rules of Navigation

Table 3.3.1(2) Present Condition of Width and Depth of the Canal

Point (Hm.Km)	Location (Hm.Km) from	to	Depth (m)	Width at Bottom(m)	Slope Grade	
80.000	78.900	80.949	20.5	Variable	1:3	Encoche Km80
	80.949	81.692	20.5	173	1:3	Curve Timsah
	81.000	82.000	20.5	Variable	1:3	Junction
	82.000	85.027	20.5	173	1:3	Straight Line
	85.027	87.414	20.5	173	1:3	Curve Km85
	87.414	88.814	20.5	173-138	1:3	Approach curve
90.000	88.814	92.950	20.5	138	1:3	Straight Line
	92.950	93.050	20.5	138-183	1:3	Junction
	93.050	93.446	20.5	183	1:3	Syphons Zone
	93.446	95.000	20.5	Variable	1:3	Junction
	95.000	95.250	20.5	Variable	1:3	Junction to E/B
	95.250	96.000	20.5	196-133	1:3	Junction to E/B
100.000	96.000	100.666	20.5	133	1:3	Straight Line
	100.666	102.600	20.0	136	1:3	Straight Line
	Bitter Lake East Channel					
	102.600	105.030	19.5	Variable	1:3	Curve
	105.030	112.860E	19.5	355	1:3	S/L(Main Channel)
	112.860E	114.200	19.5	Variable	1:3	Junction
	114.200	114.957	20.0	Variable	1:3	Junction
	Kabrit Loop East Branch					
	114.957	115.320E	20.5	241-143	1:3	Junction
120.000	115.320E	121.937E	20.5	143	1:3	Straight Line
	121.937E	122.100E	20.5	153	1:3	Begining Km122 curve
	122.100	125.507	20.5	Variable	1:3	Curve Km122
	125.507	129.499	20.5	153	1:3	Straight Line
130.000	129.499	131.975	20.5	153	1:3	Curve Km130
	131.975	133.175	20.5	153-123	1:3	Approach curve
	133.175	144.714	20.5	123	1:3	Straight Line
	144.714	147.146	20.5	195-123	1:3	Encoche Km146
	147.146	149.500	20.5	123	1:3	Straight Line
	149.500	153.524	25.0	121	1:3	Straight Line
	153.524	154.724	25.0	121-151	1:3	Approach curve
	154.724	155.724	25.0	151	1:3	Curve Km154
	155.724	156.274	25.0	151	1:3	Straight Line
	156.274	159.998	25.0	151	1:3	Curve Km157
160.000	159.998	161.050	25.0	151	1:3	Straight Line
	161.050	162.250	25.0	151-312	1:3	Southern appr. Canal
	South Entrance					
Hm 1.00	1.00	80.80	23.0	268	1:3	

Point (Hm.Km)	Location (Hm.Km) from	to	Depth (m)	Width Bottom(m)	Slope Grade	
90.000						
	Deversoir Wast Branch					
	95.000	95.500	18.00	164-153	1:3	Junc.,(siding Km95.0)
100.000	95.500	100.200	15.00	171	1:3	Straight Line
	100.200	101.050	14.50	174-408	1:3	Junction
	Bitter Lake West Channel				1:3	
	101.050	103.759	14.50	408	1:3	Straight Line
	103.759	103.957W			1:3	
		104.160E	14.50	408-229	1:3	Junction
	104.160	114.200	14.50	229	1:3	West Channel
	Kabrit Loop West Branch				1:3	
	114.200	115.603	15.00	394-146	1:3	Junction
120.000	115.603	122.100	15.00	146	1:3	Straight Line

Source: SCA' Rules of Navigation



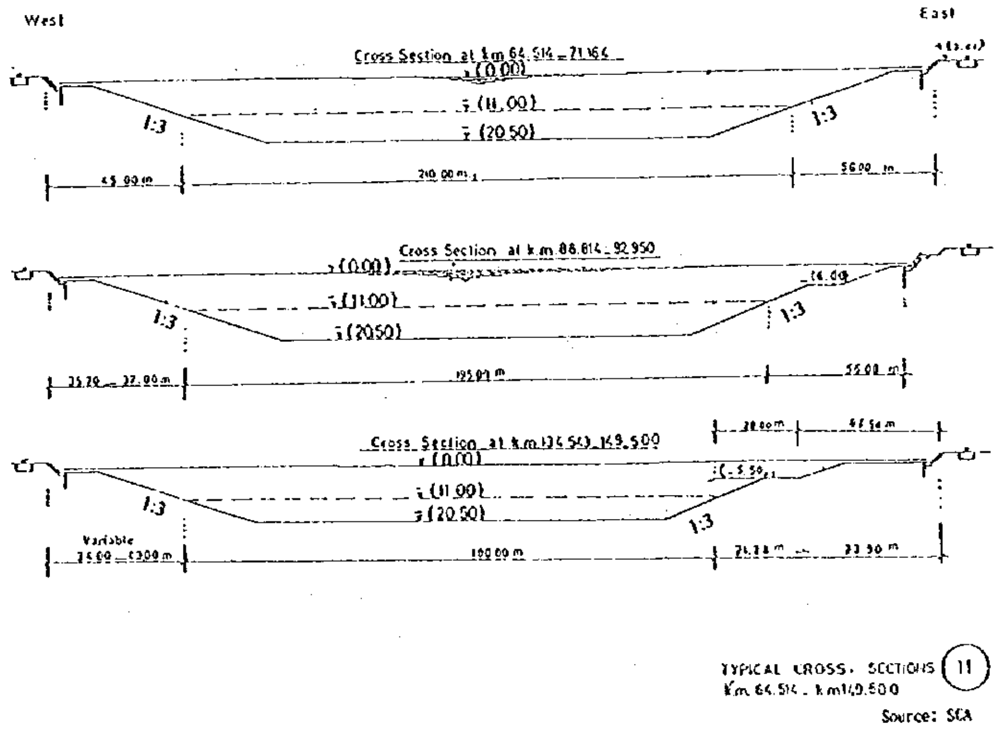
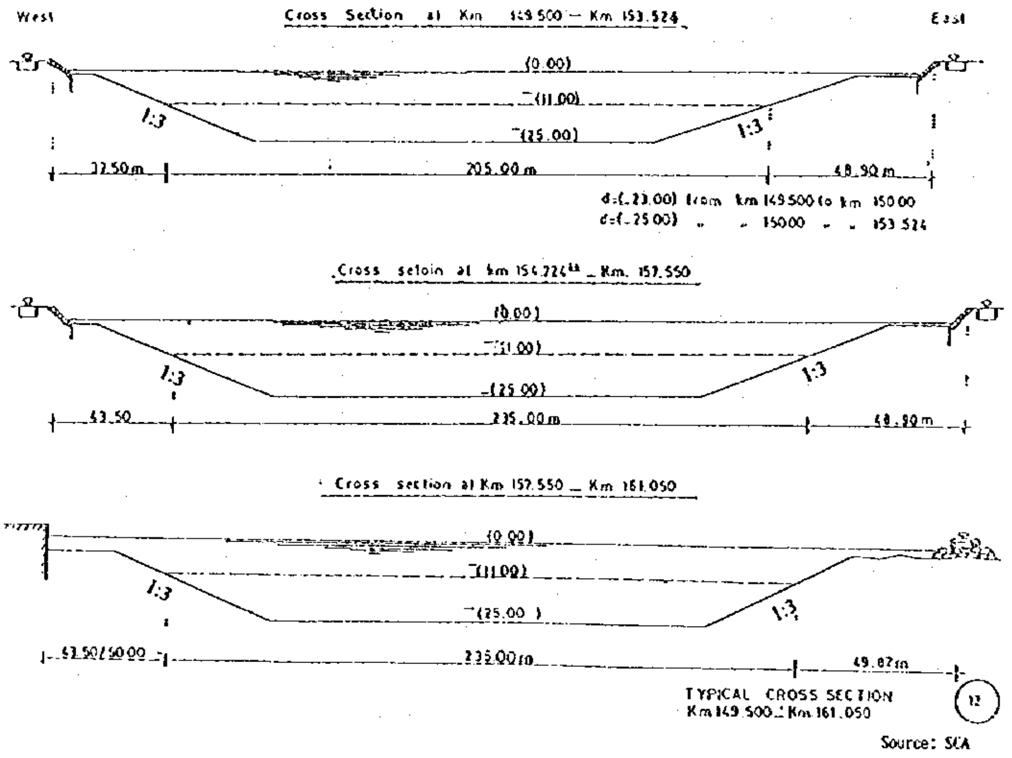


Fig. 3.3.2 (1) Cross Sections (Km.19.000 - Km.60.000)

Fig. 3.3.2 (2) Cross Sections (Km.64.514 - Km.149.500)

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL



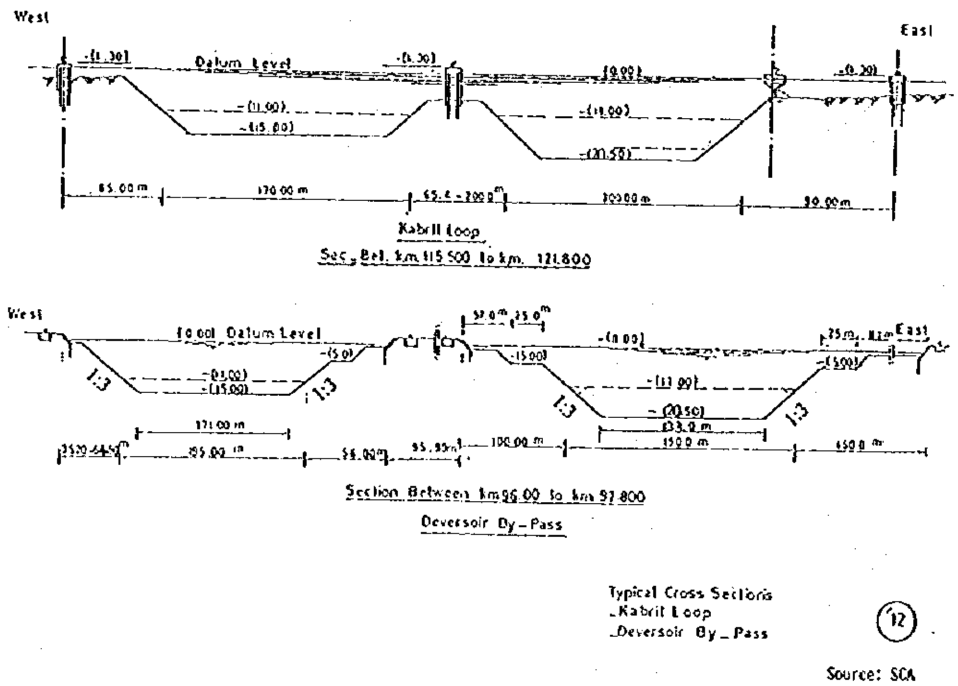
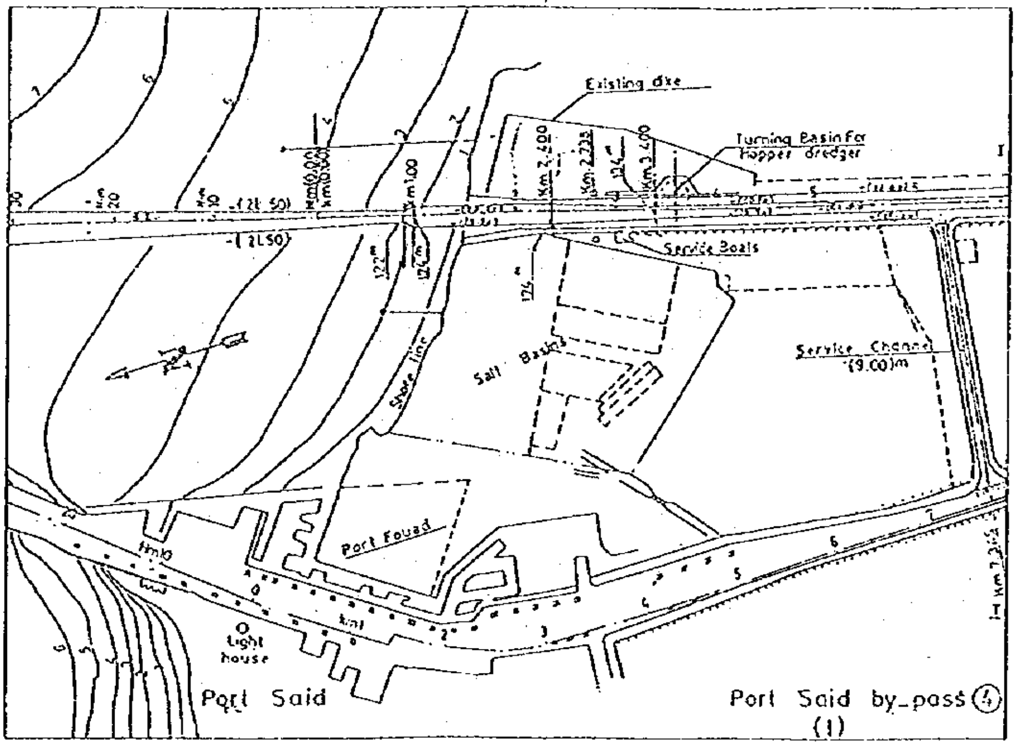
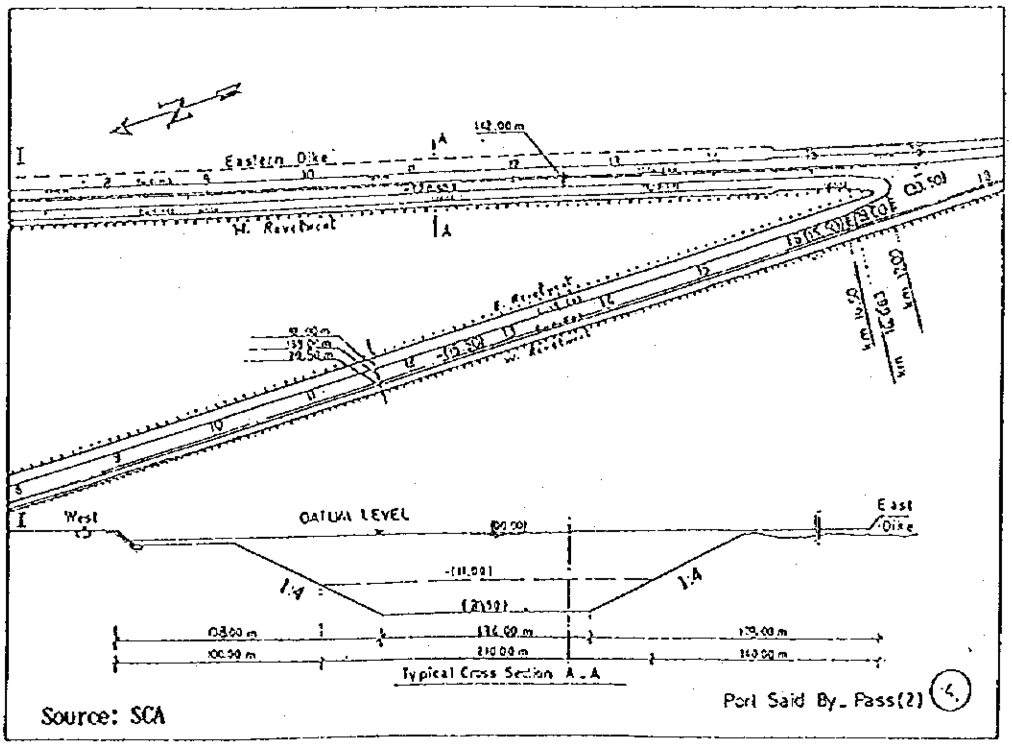


Fig. 3.3.2 (3) Cross Sections (Km.149.500 - Km.161.050)

Fig. 3.3.2 (4) Cross Sections (Kabrit Loop, Deversoir By-Pass)

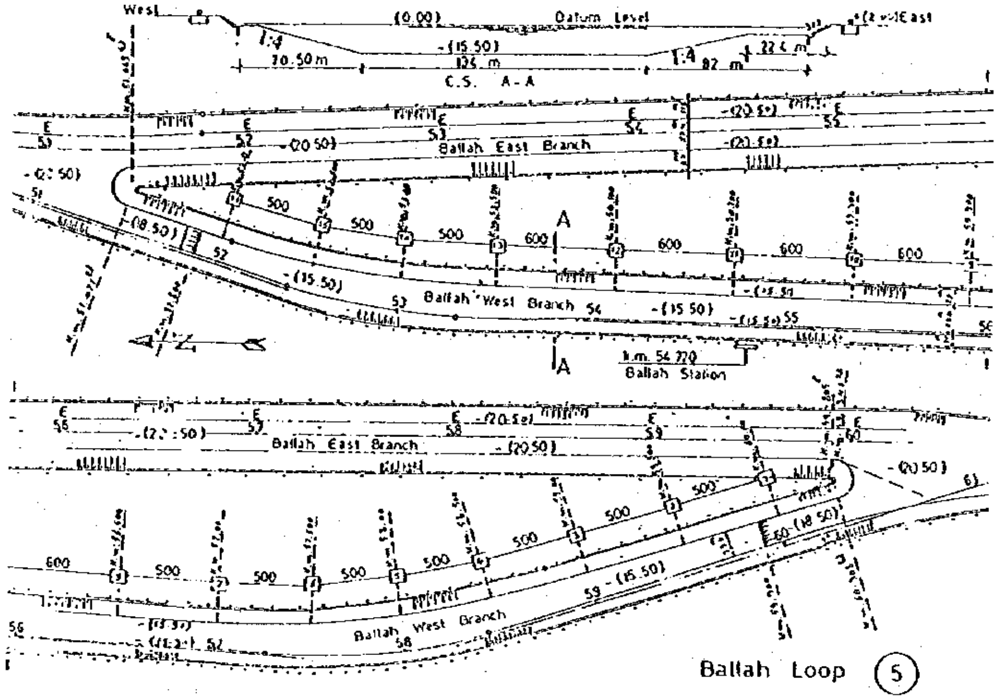




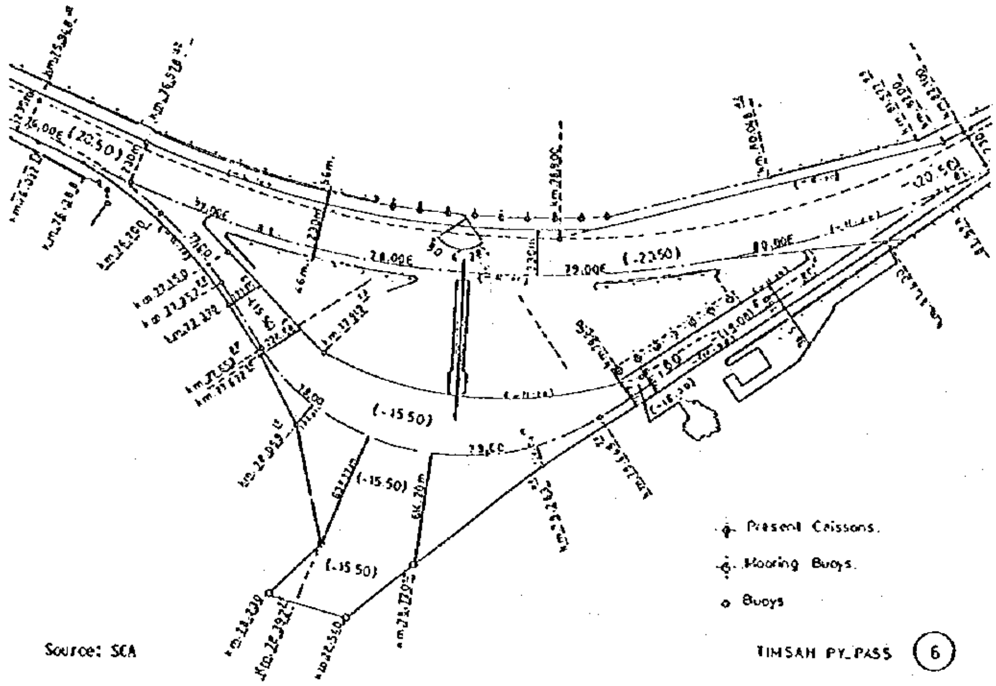
Source: SCA

Fig. 3.3.3 (1) Present Details of Port Said By-Pass

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL



Source: SCA

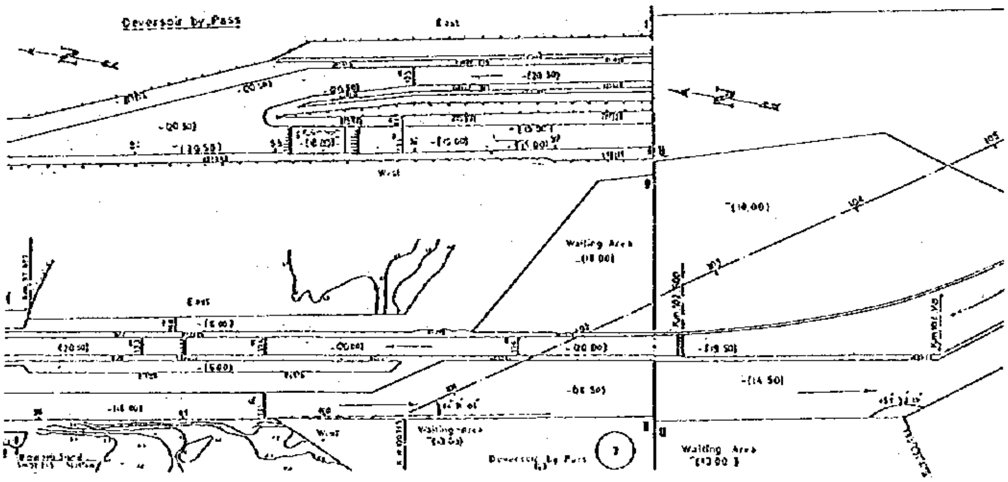


Source: SCA

Fig. 3.3.3 (2) Present Layout of Ballah Loop

Fig. 3.3.3 (3) Present Layout of Timasah By-Pass

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL



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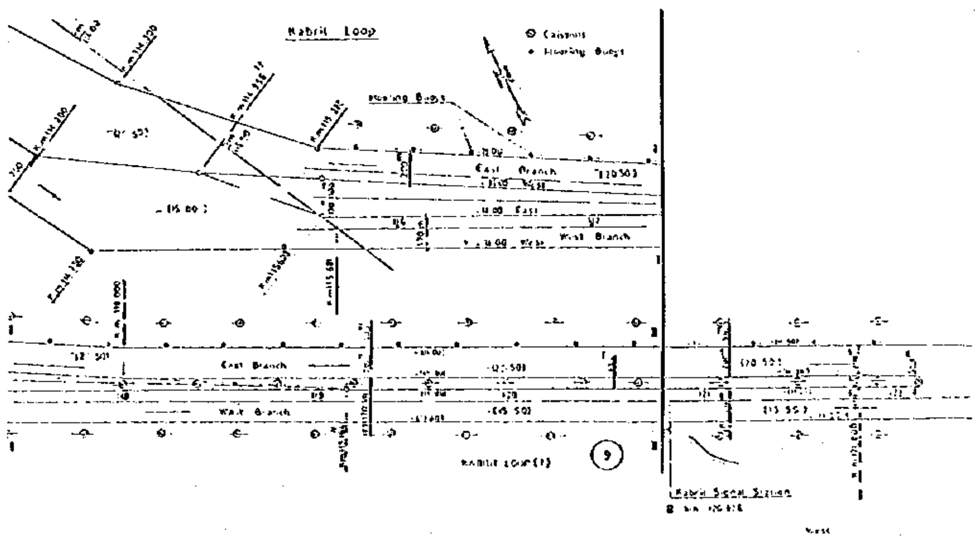


Source: SCA

Fig. 3.3.3 (4) Present Layout of Deversoir By-Pass

Fig. 3.3.3 (5) Present Layout of Kabrit By-Pass

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

6) Bends

The location of the beginning and end of each bend is shown in Table 3.3.2.

Table 3.3.2 Location of Each Bend in the Canal

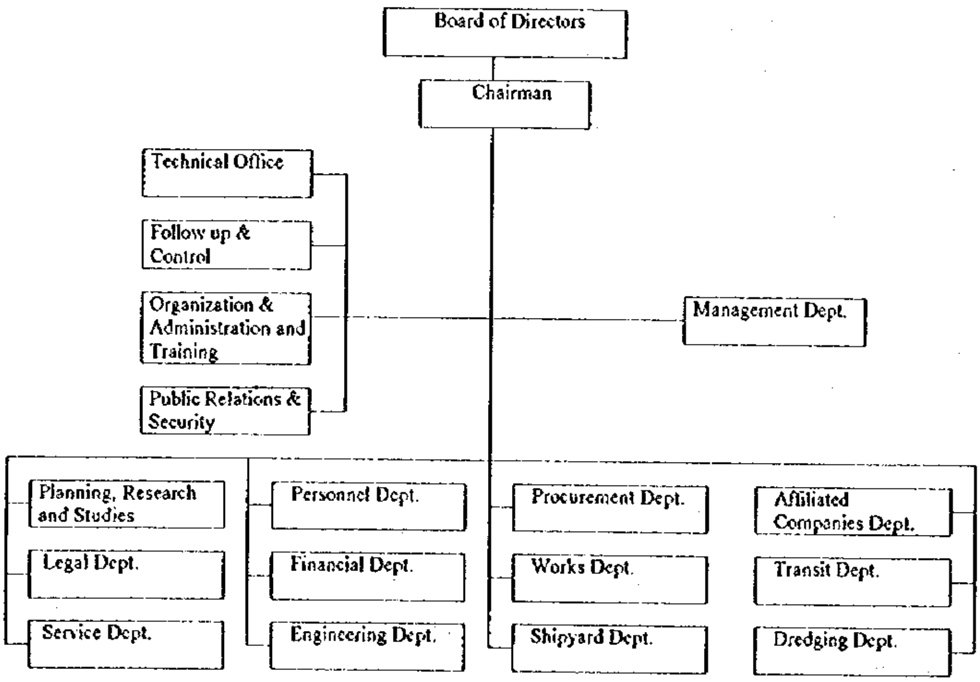
Canal Bends	Kilometer indication at start	Kilometer indication at end
Km. 51	Km. 49.510	Km. 51.480 W
		Km. 51.790 E
Km. 53	Km. 52.050	Km. 53.520
Km. 57	Km. 56.870	Km. 58.800
Km. 61	Km. 60.310 W	
	Km. 59.940 E	Km. 63.300
"S" Curves	Km. 71.960	Km. 75.300
Timsah Curve	Km. 76.520	Km. 81.700 E
Km. 85	Km. 85.030	Km. 87.400
Km. 103	Km. 102.600	Km. 105.030
Km. 122	Km. 121.940 E	
	Km. 122.500 W	Km. 125.510
Km. 130	Km. 129.500	Km. 131.980
Km. 146	Km. 145.500	Km. 146.330
Km. 154	Km. 154.700	Km. 155.720
Km. 157	Km. 156.280	Km. 160.000

Source: Suez Canal Rules of Navigation

(2) Canal Traffic

1) Organization

The Canal is managed and operated by the following organization of the SCA based on the Rules of Navigation.



Source: SCA

Fig. 3.3.4 Organization of the SCA

2) Convoy System

A system convoys operates on a 24-hours cycle basis, with one northbound convoy and two southbound convoys per day.

Those vessels needing to transit the Canal have to give at least 4-days notice before the scheduled day of transit, and are also required to advise ETA, drafts and whether or not there are dangerous goods on board etc. within 48 hours prior to their arrival. However, vessels arriving without previous notification may join the convoy if there is capacity remaining. If there is not they may join the next convoy. They must also obtain anchorage instructions from the Harbor Master using the VHF radiotelephone link when they reach a point of 15 miles before the fairway buoy in Port Said, or 5 miles before No. 1 Buoy of the Suez traffic separation zone.

a. Northbound Convoys

At present, ships with a maximum draft of 56 feet (17.1 m) and 158 feet (48.2m) beam are permitted to transit northbound through the Canal. The northbound convoy has an unrestricted run from Port of Suez to Port Said, unless it has to stop in the Bitter Lakes as a result of the southbound convoy or for emergency.

The convoy starts from 06:00 at Km.160 and consist of two groups of vessels; Groups A and B. Group A is for navy ships, 4th Generation container ships, 3rd Generation container ships over 40,000 SCGT (Suez Canal Gross Tonnage), lash over 35,000 SCGT, LPG and LNG and loaded chemical carriers, and loaded VLCC's, conventional loaded tanker and heavy bulk carriers. Group B is for cargo and other vessels anchored in Suez anchorage.

b. Southbound Convoys

The southbound convoy is available for vessels with a maximum draft of 42 feet (12.8 m). Applications for the southbound convoys stop at 19:00 every day to permit assembly and organizing of the convoy.

As above, the southbound vessels are also divided into two convoys; the first convoy (N1) and the second convoy (N2).

The first convoy starts from 00:00 to 05:00 and consists of 3 groups of vessels; Groups A, B and C. Group A is for vessels anchored in Port Said Harbor, Group B is for vessels anchored in the northern anchorage area consisting of 4th Generation container ships, 3rd Generation container ships, VLCC's in ballast over 42 feet (12.8

m) draught, LPG, LNG vessels in ballast or loaded and lash over 35,000 SCGT. Group C is for vessels anchored in the southern anchorage. The first convoy awaits the passage of northbound vessels at the western anchorage in the Bitter Lakes, having passed through the east branch of Ballah by-pass, the east channel of Lake Timsah and the Deversoir west channel. When the convoy restarts from the anchorage in the Bitter Lakes, it is reorganized and the first vessel of the convoy adjusts it's speed to pass the last northbound vessel abeam of Kabrit station.

The second convoy starts from 06:30 to 09:00, and the formation and extent of this convoy are subject to traffic demand and time available. This convoy awaits the passage of the northbound vessels whilst moored at the Ballah west branch.

3) Transit Speed

The Suez Canal Rules of Navigation state that the transit speeds are as follows:

Station	Tanker Group	Other Vessels
Port Suez - Geneifa, head current	11 km/hr	13 km/hr
Port Suez - Geneifa, stern current	14 km/hr	15 km/hr
Geneifa - Kabrit	14 km/hr	15 km/hr
Kabrit - Deversoir	15 km/hr	16 km/hr
Deversoir - Port Said	14 km/hr	15 km/hr

4) Time Intervals between Vessels

There are no specific regulations on the headway between ships in the Rules of Navigation. However, the SCA requires that the following intervals be observed.

Type of Vessel	Time Intervals in Minutes
Normal Cargo ship	6 - 10
Container over 40,000 DWT	10 - 15
LPG and VLCC	20 - 25
Tanker and Bulk loaded	20 - 25

(3) Canal Navigation Safety

1) Navigation Aids

The Navigation channel is marked by pairs of light buoys as follows:

- On the east side: Green buoys showing "Green Light".
- On the west side: Red buoys showing "Red Light".

- In the straight sections, the distance between each pair is 1.5 km in the north section and 1.0 km in the south section.

- In the curves, the distance will be less than 1.0 km.

All buoys in the Canal and its approaches are fitted with radar reflectors, whilst only buoys in the Canal emit a constant light.

The buoys in the Canal and approaches are located and identified by the SCA as follows:

Position	Type of Buoy	No.
Port Said approaches	Approach buoy	2
Port Said sea channels (East)	Sea channel buoy	30
Port Said sea channels (West)	Sea channel buoy	14
Port of Suez approaches	Approach buoy	7
Port of Suez separation zone	Approach buoy	2
Port of Suez sea channels	Sea channel buoy	15
Port Said west branch	Canal buoy	10
Port Said east branch	Canal buoy	10
Main Canal	Canal buoy	28
Ballah west branch	Canal buoy	8
Ballah west branch	Conical	1
Ballah east branch	Canal buoy	8
Main Canal	Canal buoy	18
Main Canal	Conical	7
Timsah Lake	Canal buoy	13
Timsah east branch	Canal buoy	6
Main Canal	Canal buoy	15
Main Canal	Conical	2
Deversoir west branch	Canal buoy	9
Deversoir east branch	Canal buoy	10
Great Bitter Lake	Canal buoy	29
Kabrit west branch	Canal buoy	9
Kabrit east branch	Canal buoy	9
Main Canal	Canal buoy	26
Main Canal	Conical	9

2) Traffic Control

The traffic is controlled in accordance with the SCA's Rules of Navigation, which controls the organization of convoys and monitoring of ship movement, to ensure efficient operation of the Canal and safety of navigation. To achieve this, it has a central navigation control office and a radio station at Ismailiya, with a harbor control office at both Port Said and Suez, plus 11 signal stations along the west bank of the Canal. These facilities maintain close contact with the SCA pilots.

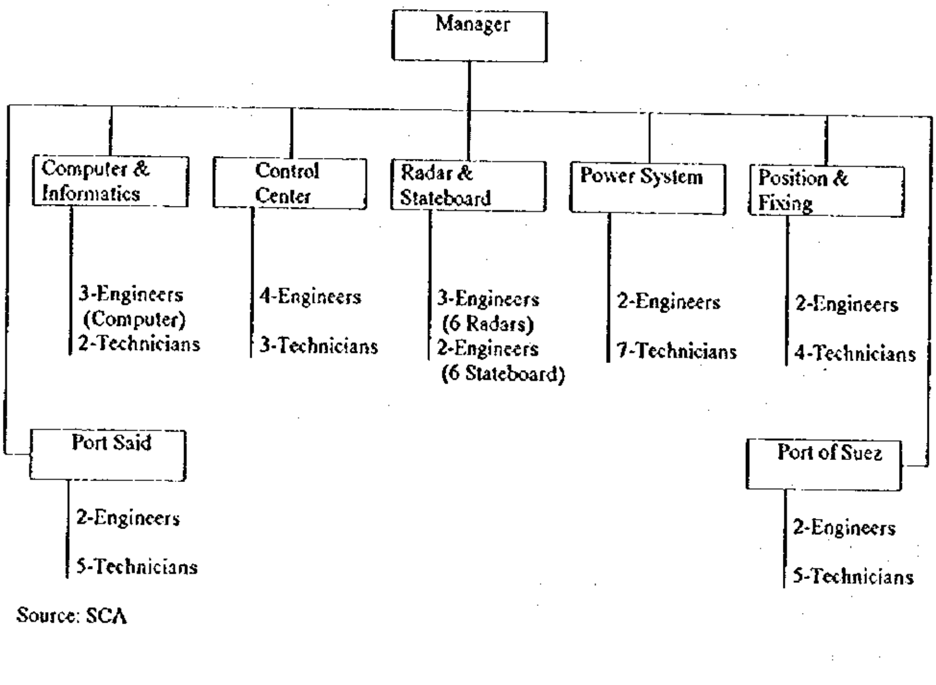
The SCA has just completed the installation of a new Suez Canal Vessel Traffic Management System (SCVTMS), which is a centralized integrated control and management system of vessels transiting the Canal, and an extremely effective and efficient system for ensuring the safe and efficient management of the Canal.

The main new VTM system is summarized as follows:

a. Suez Canal Vessel Traffic Management System (SCVTMS)

The former VTM system was installed in 1980, but the system has not been utilized for some time. The SCVTMS, a new upgraded VTM system, incorporates the tracking by radar systems, the Loran-C system, management database system etc., and also has the ability to display a vessel's position, speed, course etc.

The SCVTMS is operated as shown in the following organization chart. This system has three operation centers, the main one at Ismailiya, with two operational sub-centers at the northern and southern ends of the Canal in Port Said and Port of Suez respectively, which are controlled by the information received from the six radar sites.

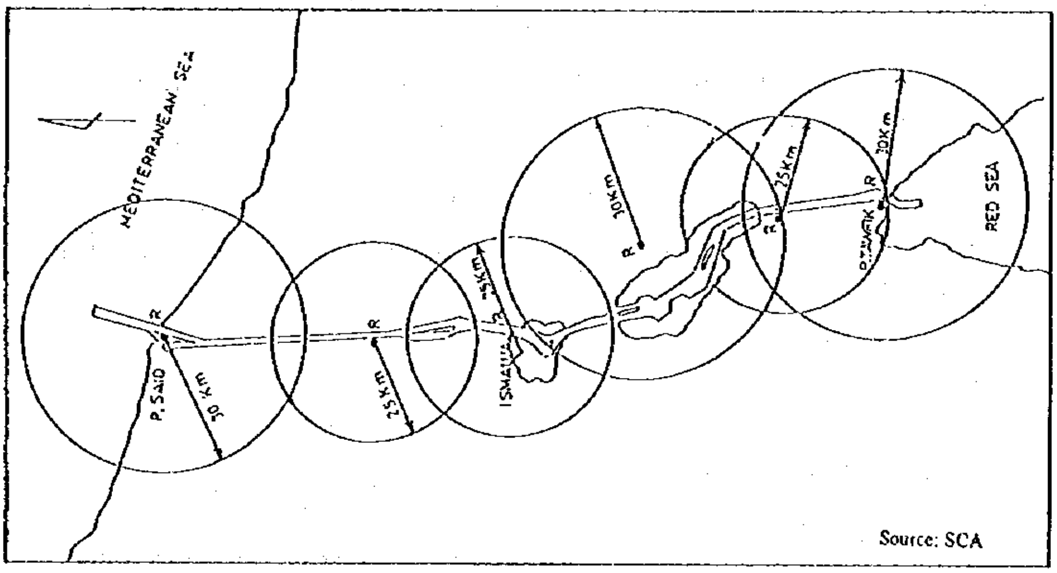


Source: SCA

Fig. 3.3.5 Organization of SCVTMS

b. Tracking by Radar

Tracking radars are provided at six locations, Port Said, Qantara, Ismailiya, Great Bitter Lake, Geneifa and Port of Suez as shown in Fig. 3.3.6. The Port Said, Great Bitter Lake and Port of Suez radars each cover an area of 30 km whilst the remainder have a range of 25 km.



Source: SCA

Fig. 3.3.6 Area of Radar Coverage

The tracking information of the vessels from the Port Said and Suez radars is transmitted to their own operation centers and the Main Operation Center in Ismailiya. This information is then transmitted back to Port Said and Port of Suez, while the information from the other four radar stations is transmitted directly to the Main Operation Center in Ismailiya. This information will be integrated with all other information before it is transmitted to the display system and presented on the display screen.

As a vessel passes along the Canal in convoy, it will leave one radar area and enter another radar area, and this process is repeated until it completes its passage.

c. Loran-C System

The information from this system is interfaced with the VTM. When a radar site is out of service, the radar data for a vessel within the area covered by that site is missing, but the tracking can be maintained using this Loran-C interface system. However, the SCA has plans to change this system to the Global Positioning System (GPS) in 1996.

d. Management Database (Informatics) System

This database system relays to each vessel identifier, the position, speed, course, etc. of the vessel, and also transmits information to the display of stateboard at the signal stations by means of Personal Computers. Based on this information, various hard-copy print-out's can be requested and obtained from the printers and plotters at the operation centers, in the form of lists, charts and reports.

The displays of stateboards are updated from Ismailiya through a workstation based on the information on the interface.

Each signal station is marked on the graphical display monitors. The database periodically updates the signal station PCs with the convoy position, vessel name, call sign, speed and location during transit of the Canal.

3) Regulations

At stated above, traffic in the Canal is governed by the SCA Rules of Navigation. The Rules of Navigation comprise the following parts;

- Part I: Navigation, covers general transit rules, features of the Canal, approaches, pilotage, entering port and preparation for transit, convoy transit system, maximum size of ship, towing, escorting, emergency procedures and prohibited items.

- Part II: Canal and Lakes (Characteristics); include the characteristics of the approaches, Canal and Lakes; with details of the buoys.

- Part III: Communication, Signals; covers communication, liaison and signals.

- Part IV: Tonnage and Dues; covers computation of tonnage, transit, towing and payment of Canal dues.

- Part V: Dangerous Cargoes; covers regulatory requirements for vessels carrying dangerous cargoes.

4) Pilots and Extra Pilots

For vessels of 300 SCGT or more, the use of both harbor pilots and Canal pilots is mandatory.

Harbor pilots embark at both port anchorage, and transfer to Canal pilots is made at the entrance of the Canal.

For the passage between Port Said and Port of Suez, the Canal pilots provide the service, with a change-over effected to both the northbound and southbound convoys at Ismailiya. Additional pilots (Extra Pilot) must be engaged in the following circumstances.

- Vessels of 80,000 SCGT or more
- 3rd and 4th generation containers (over 40,000 SCGT), lashes of 35,000 SCGT and over
- Vessels with restricted visibility
- Vessels of low speed
- Vessels not fitted with resting quarters for pilots
- When the master of the vessel or the SCA specifically considers that extra pilots are necessary

Any harbor pilot candidate must be a holder of the Masters Certificate (Foreign going vessels), and must pass several examinations and training courses until achieving "full service" list status for harbor pilots after entry into the SCA.

To pilot ships in excess of 25,000 tons, the harbor pilot will be sent on a training course in Canal pilotage, and must also pass again several examinations and training courses up to Chief pilot level. There are a total of 239 Canal pilots who are divided into five categories, dependent upon their qualifications.

5) Tugs and Escort Tugs

Tugs must be provided for vessels during the Canal transit in the following circumstances:

- When the SCA considers that tug service is necessary
- Disabled vessels
- Vessels with restricted visibility
- Drilling vessels
- Vessels with only one anchor

An escort of a tug or tugs for VLCCs, LPG and vessels of the same category will be provided in the following circumstances.

- Loaded vessels of less than 130,000 DWT, with a draft of more than 47 feet (14.33m) : 1 tug
- Loaded vessels from 130,000 to 170,000 DWT: 1 tug
- Loaded vessels over 170,000 DWT: 2 tugs
- Vessels in ballast with beam between 218 feet (66.5m) and 233 feet (71.0m) : 1 tug
- Vessels in ballast with beam over 233 feet (71.0m) : 2 tugs

The SCA owns the following salvage tugs, escort tugs and harbor tugs in Port Said, Ismailiya and Port of Suez as indicated Table 3.3.3.

Table 3.3.3 Salvage, Escort, Harbor Tugs

Kind	Port Said			Ismailiya			Port of Suez		
	Engine (HP)	Force (ton)	No.	Engine (HP)	Force (ton)	No.	Engine (HP)	Force (ton)	No.
Salvage Tug	4,500	50	1	16,000	160	1	16,000	160	1
				3,200	60	1	6,400	60	1
Sub-total			1			2			2
Escort Tug	3,700	40	2	5,000	50	1	3,700	40	3
	3,400	36	1	3,700	40	5	3,200	42	2
	3,200	42	2	3,400	36	1			
	3,200	30	1	3,200	43	2			
				1,740	-	1			
				1,600	16	2			
				1,556	-	2			
				1,080	-	1			
Sub-total			6			15			5
Harbor Tug	3,200	16	2				1,740	-	1
	2,600	30	2				1,600	16	1
							1,980	10	1
Sub-total			4						3

Source: SCA

(4) Current Canal Transit

1) Number of Transit Vessels

A record is kept at the Main office of the Central Operation Center in Ismailiya of the information received from each signal station on the overall control and management of all vessels transiting the Canal. Table 3.3.4 shows the number of transit vessels on the busiest days for each month during 1994.

Table 3.3.4 Number of Transit Vessels on the Busiest Days in 1994

Month	Number of Vessels			Most Congested Day						
	North bound	South bound	Total	Date	Southbound			Northbound		Total
					N1	N2	N3	TN	OR	
Jan.	728	695	1,423	28-01	14	5	9		32	60
Feb.	671	613	1,284	22-02	29	8			30	67
Mar.	754	687	1,441	27-03	27			17	15	59
Apr.	752	685	1,437	13-04	23	15		5	17	60
May	793	654	1,447	15-05	28	4		25	6	63
Jun.	748	575	1,323	29-06	24	7		23	6	60
Jul.	731	583	1,314	03-07	24	4		13	15	56
Aug.	733	618	1,351	18-08	20	11		8	18	57
Sep.	684	658	1,342	20-09	18	8		7	36	69
Oct.	697	643	1,340	18-10	26	6		4	23	59
Nov.	728	618	1,346	18-11	23	7		8	18	56
Dec.	697	629	1,326	29-12	18	6		13	16	53

Note: N: Northbound Convoy Group, TN: Tanker Group of Northbound Convoy,
OR: Other Group of Northbound Convoy

Source: SCA

As mentioned above, the particular day of September 20, 1994 represented the day of the heaviest traffic density. The traffic diagram is tabulated as shown in Fig. 3.3.7.

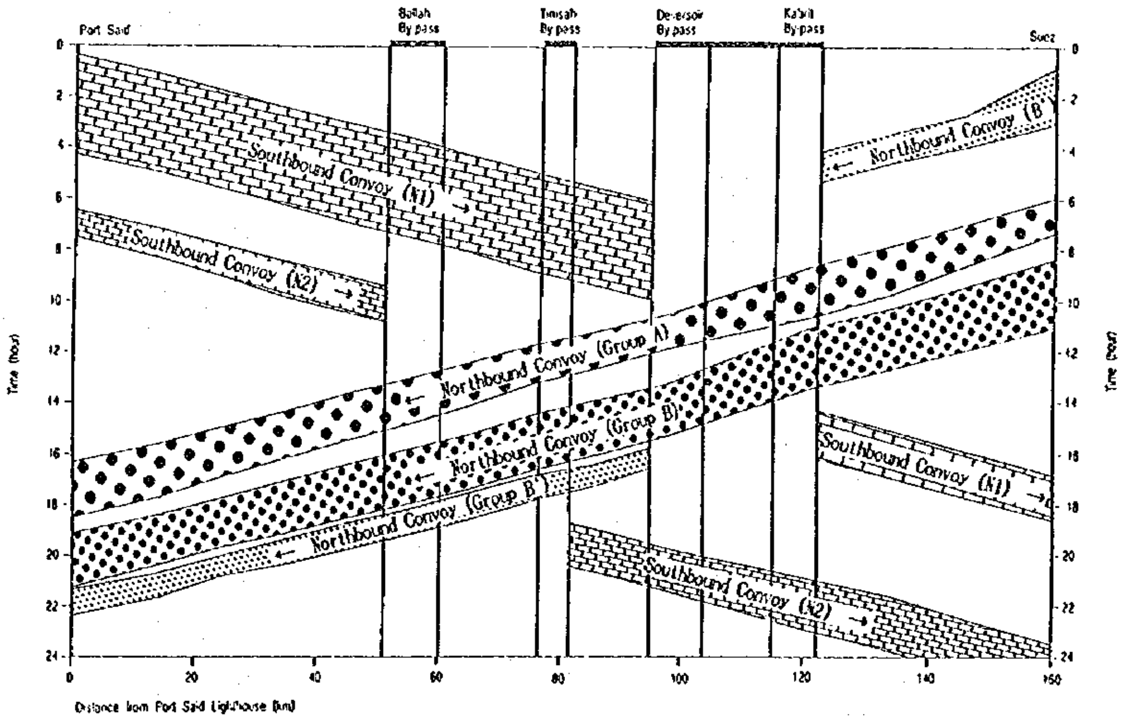


Fig. 3.3.7 Traffic Flow Diagram on September 20, 1994

2) Transit Conditions

Table 3.3.5 shows the Average Transit Time, Speed, Anchored or Tied up, and Waiting Time of the northbound and southbound convoys obtained from transit record for the busiest day, September 20, 1994.

According to this table, both northbound and southbound convoys were each divided into three groups. However, the northbound convoys of G-A and G-B are the same category of convoy.

The mean transit times of northbound vessels was 10 hr 44 min., 10 hr 15 min. and 19 hr 23 min. respectively, and southbound vessels was 15 hr 21 min., 17 hr and 17 hr respectively.

The maximum transit speeds of northbound vessels was 15.32 km/hr, 16.25 km/hr and 17.88 km/hr and southbound vessels 15.83 km/hr, 16.82 km/hr and 16.25 km/hr respectively, slightly exceeding the speeds prescribed in the Rules of Navigation.

For the mean anchored or tied up time, G-B' northbound convoy waited 9 hr 41 min. at the Kabrit By-Pass, and each southbound convoy waited at the Deversoir By-Pass, Timsah By-Pass and Ballah By-Pass for 6 hr 17 min., 7 hr 18 min. and 6 hr 51 min. respectively.

Table 3.3.5 Average Transit Time and Speed, Anchored or Tied up, and Waiting Time

Item	Northbound			Southbound		
	G-A	G-B	G-B'	N1	N2	N2'
Transit Time						
Max. (hr/min)	11.05	10.37	19.27	16.29	17.01	18.29
Min (hr/min)	10.17	9.54	19.15	14.17	16.58	17.25
Mean (hr/min)	10.44	10.15	19.23	15.21	17.00	17.00
Transit Speed						
Max. (hr/min)	15.32	16.25	17.88	15.83	16.82	16.25
Min (hr/min)	12.49	12.11	–	–	–	–
Mean (hr/min)	14.76	15.45	8.16	10.36	9.31	8.82
Anchored or Tied up Time						
Max. (hr/min)	–	–	10.52	7.26	7.24	7.00
Min (hr/min)	–	–	9.26	3.44	7.10	6.42
Mean (hr/min)	–	–	9.41	6.17	7.18	6.51
Wating Time for Transit						
Max. (hr/min)	21.26	27.05	41.27	24.00	10.45	14.35
Min (hr/min)	5.21	11.00	40.05	7.04	5.00	5.00
Mean (hr/min)	10.15	21.17	41.02	15.3	7.29	9.45

Note: G-: Northbound convoy group
N : Southbound convoy group
Source : SCA

The maximum waiting time of vessels at Port Said and Port of Suez, shows G-B' as 41 hr 27 min., which was the longest waiting time for any of these convoys. However, this was a fishery vessel group which had to wait for special reasons. Groups G-B, N1, G-A, N2' and N2 followed G-B' in descending time orders of 27 hr 5 min., 24 hr, 21 hr 26 min., 14 hr 35 min. and 10 hr 45 min. respectively.

Table 3.3.6 shows the Average Time Intervals between Vessels, which were obtained form the same records as those above, for vessels entering/exiting the Canal at the signal stations of Port Said and Port of Suez.

Table 3.3.6 Average Time Interval between Vessels

Time in minutes	Northbound						Southbound					
	G-A		G-B		G-B'		N1		N2		N2'	
	PT	PS	PT	PS	PT	PS	PS	PT	PS	PT	PS	PT
Max. (min)	24	45	10	15	5	5	35	16	10	121	15	79
Min (min)	9	5	5	5	5	5	10	5	10	7	10	35
Mean (min)	13	18	10	6	5	5	14	8	10	10	13	77

Note: PT : at Suez Port

PS : at Port Said

Source : SCA

This shows that these intervals can be shortened or extended during the transit of vessels through the Canal. These results show that the minimum time between vessels in the majority of cases is normally five to ten minutes, and the average time with exception of N2' is about 10 minutes.

3) Accident Records

The only accidents in the period from 1991 to 1994 were grounding accidents. However, none of these accidents appears to have been serious as according to SCA records, they have never resulted in the closing of the Canal.

The total number of groundings has shown a marked decrease from 174 in 1982, to 18 in 1994. This decrease is mainly due to the widening and the deepening of the Canal, but also to the improvement of the navigation aids and mooring operations.

Tables 3.3.7 to 3.3.9 provide information on the Grounding Accidents in the Canal from 1991 to 1994.

The causes of grounding are roughly classified into five groups; engine trouble, steering gear trouble, steering wheel failure, bad weather, and others. Of the 90 cases of grounding, the most numerous were the 30 caused from steering gear trouble, the 15 from engine trouble and 13 from bad weather (refer to Table 3.3.7).

Table 3.3.7 Number of Groundings for Each Cause

Direction	1991			1992			1993				1994				Total
	N/B	S/B	Total	N/B	S/B	Total	N/B	S/B	Others	Total	N/B	S/B	Others	Total	
Engine Trouble	4	3	7	4	7	11	2	1	1	4	5			5	27
Steering Gear Trouble	4	3	7	2	1	3	7	4		11	5	3	1	9	30
Steering Wheel Failure				1		1	2	1		3	1	2		3	7
Bad Weather				2	4	6	3	4		7					13
Others	3	1	4	2	2	4	3	1		4	1			1	13
Total	11	7	18	11	14	25	17	11	1	29	12	5	1	18	90

Source: SCA

The vessels that grounded are divided into five types; general cargo vessels (30), container vessels (18), dry bulk carriers (17), oil tankers (7) and others (15). The predominant vessel size is concentrated in the 10,000 - 19,000 SCGT range which accounts for 30 % of the total number, followed by 5,000 - 9,900 SCGT (17 %), 1,000 - 4,900 SCGT (14 %), 20,000 - 29,000 SCGT (14 %) and 30,000 - 39,000 SCGT (12 %). Only one vessel exceeds 60,000 SCGT (refer to Table 3.3.8).

Table 3.3.8 Number of Groundings for Each Vessel Type and Size

SCGT	General Cargo			Container			Dry Bulk			Tanker			Others				Total	
	N/B	S/B	Total	N/B	S/B	Total	N/B	S/B	Total	N/B	S/B	Total	N/B	S/B	Others	Total		%
- 1000														1		1	1	1.1
1,000 - 4,900	6	4	10										2	1		3	13	14.4
5,000 - 9,900	4	7	11	1		1		1	1		1	1	1			1	15	16.7
10,000 - 19,000	5	5	10	4	2	6	4	1	5	2	2	4	1		1	2	27	30.0
20,000 - 29,000				2	1	3	5	3	8	1		1	1			1	13	14.4
30,000 - 39 000	2		2	4	1	5	1	2	3				1	1		2	12	13.3
40,000 - 49,000				1		1							3			3	4	4.4
50,000 - 59,000				1	1	2					1	1		1		1	4	4.4
90,000 - 91,000														1		1	1	1.1
Total	17	16	33	13	5	18	10	7	17	3	4	7	9	5	1	15	90	100

Source: SCA

Table 3.3.9 shows the location of grounding accidents for each direction of transit in the past four years. Accidents are heavily concentrated in the areas of By-passes, lakes and curves and occurred most frequently at the Bitter Lake, where the number of groundings northbound and southbound was 38 and 26.

Table 3.3.9 Number of Groundings per Location

Position (Area)	Distance (a) (km)	Direction				Ratio
		N-Bound	S-Bound	Others	Total (b)	(b)/(a) x 2
By-pass, Lake and Curves						
Port Said By-pass	19.000	3	1	1	5	0.13
Ballah By-pass	15.002	6	1		7	0.23
Timsah Lake	10.836	4	5		9	0.42
Bitter Lake	41.050	23	11	1	35	0.43
Others	10.268	2	8		10	0.49
Sub-Total	96.156	38	26	2	66	0.34
Straight Area	63.844	13	11		24	0.19
Total	160.000	51	37	2	90	0.28

Source: SCA

According to the above information, the most distinct feature of the causes of grounding is that they are attributable to human factors, such as unskilled ship maneuvering techniques, port machinery maintenance and erroneous engine operation, poor lookout, etc.

In spite of the many groundings, no collision with the ferry, ferry terminal or dredger, by transit vessel has ever occurred. That there have been no collisions is mainly due to the mandatory pilotage system in force.

3.3.2 Canal Development Plan

The number of vessels expected to transit the Canal each day is forecast as 61 (60.8) in 2017 and 70 (69.1) in 2030.

The design size of vessels for the Canal section is 300,000 DWT tankers for the northbound (east) channel and is 80,000 DWT container vessels and 500,000 DWT tankers in ballast for the southbound (west) channel.

The cross section of the Canal is studied according to the design size of vessel.

However, at present, SCA is carrying out an expansion plan for deepening and widening the Canal according to SCA's development plan, with a target year of 2012 as shown in Figs. 3.3.8 and 3.3.9, and is summarized as follows:

(1) Current Expansion Plan of SCA

1) 56 Feet Plan

This plan was completed in September, 1994 in which the Canal was deepened from -19.5 to -20.5 m, and widened from 160 m to 180/225 m at the level of -11.0 m in the whole main channel length of 162 km.

2) 58 Feet Plan

This plan was started after completion of the 56 feet plan and is expected to be completed by March 1996, in which the Canal will be depended from -20.5 m to -21.5 m.

3) 62 and 66 Feet Plans

These plans will be carried out after completion of the 58 feet plan.

4) 72 Feet Plan

SCA is considering the 72 feet plan as the final form of the Canal expansion, in which the Canal will be deepened to -27.0 m and accommodate 300,000 DWT tankers fully laden and all tankers in ballast in the world.

5) Other Plans

SCA has another plan for extending the existing Deversoir By-Pass, starting from Km.95.000 northwards which comprises several stages, but is independent of the future expansion plan mentioned above. The reason for this is that in spite of the rapid increase in the number of container vessels, the average transit time for the N1 southbound convoy is about 15 hours, which is about 5 hours longer than the northbound convoy.

Therefore, SCA believes that the extension of the Deversoir By-Pass is the most important project to reduce the transit hours for efficient shipping and to improve navigational safety. This project is planned to be completed in the year 2012 (refer to Fig. 3.3.10).

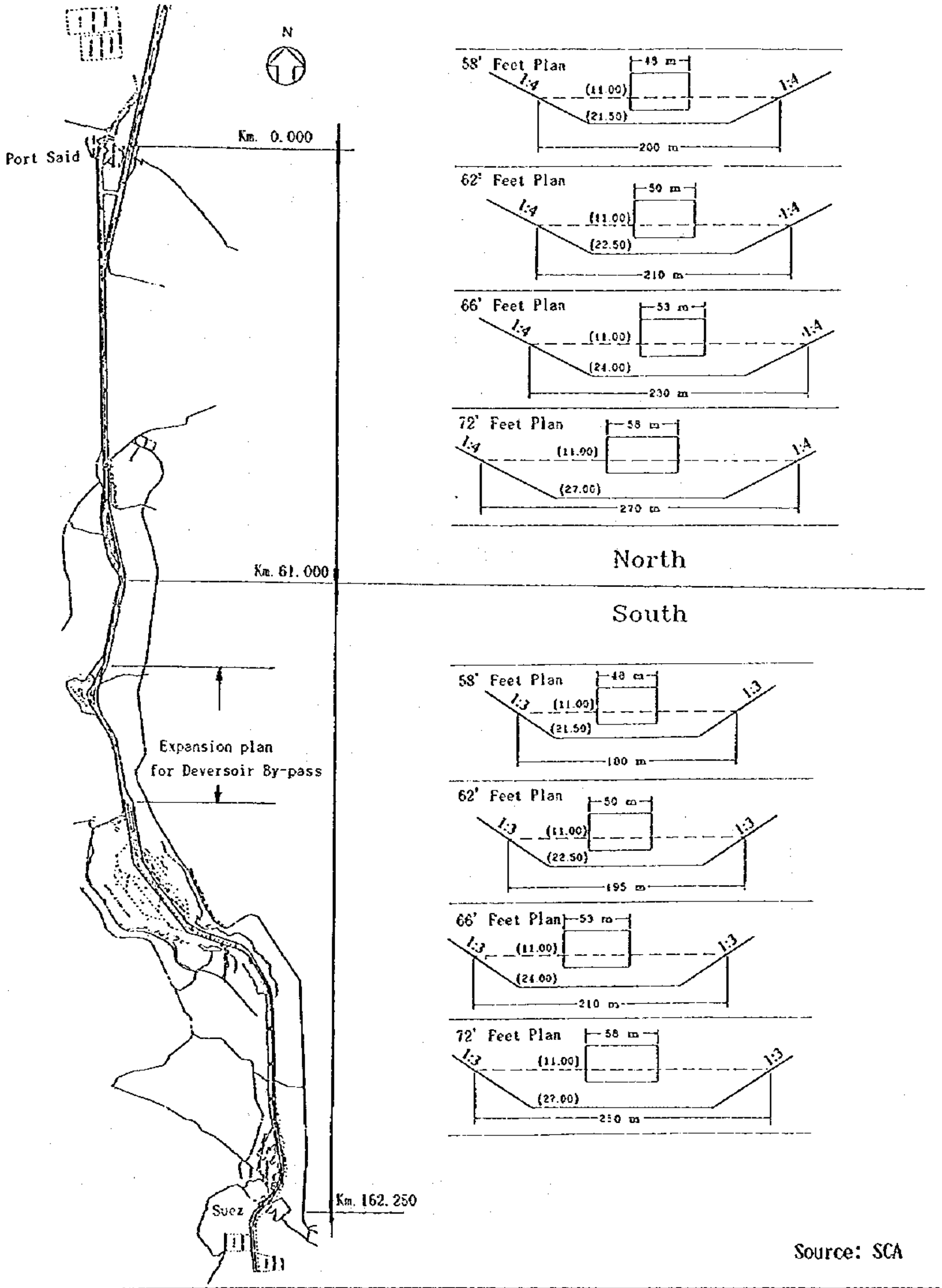
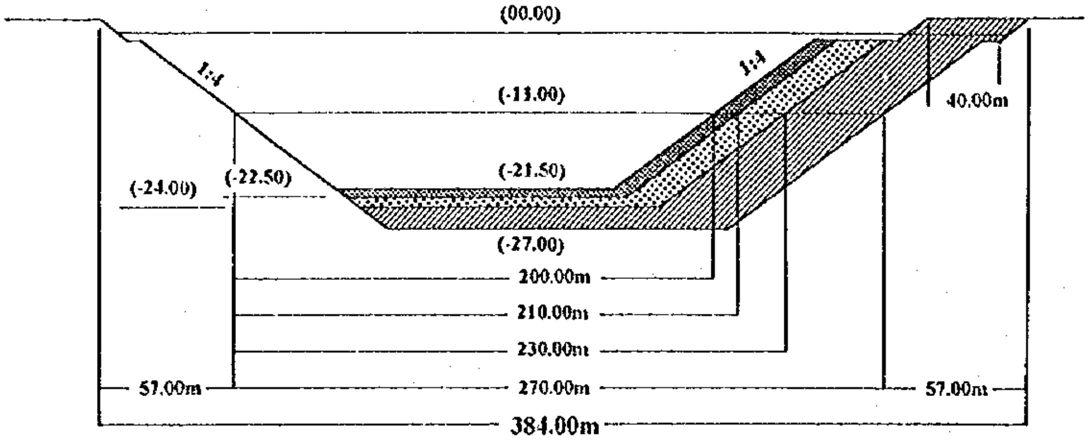


Fig. 3.3.8 Expansion Plan of the Suez Canal Target Year: 2012

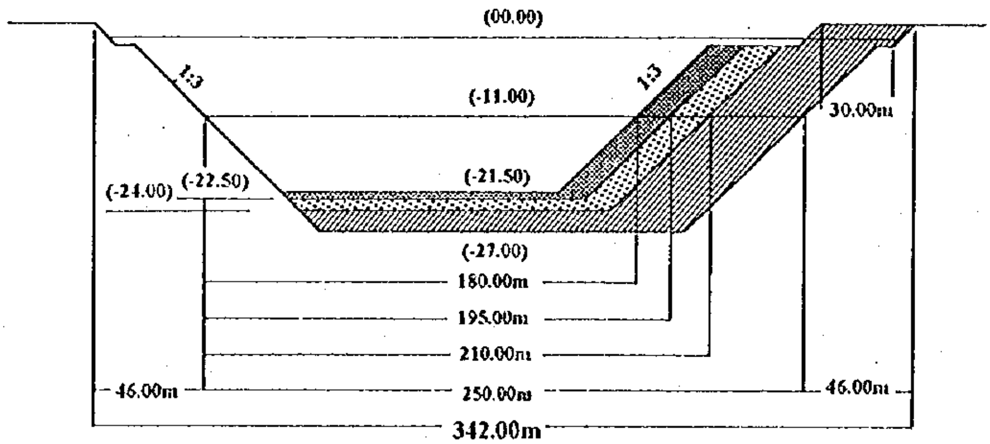
THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL



(Horizontal Clearance Without Any Structures)

58 feet stage (21.50m)
62 feet stage (22.50m)
66 feet stage (24.00m)
72 feet stage (27.00m)

Suez Canal Devlopment Projects
Cross Section North to Km 61.00



(Horizontal Clearance Without Any Structures)

58 feet stage (21.50m)
62 feet stage (22.50m)
66 feet stage (24.00m)
72 feet stage (27.00m)

Suez Canal Devlopment Projects
Cross Section South to Km 61.00

Source: SCA

Fig. 3.3.9 Cross Section of the Suez Canal Expansion Plan

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

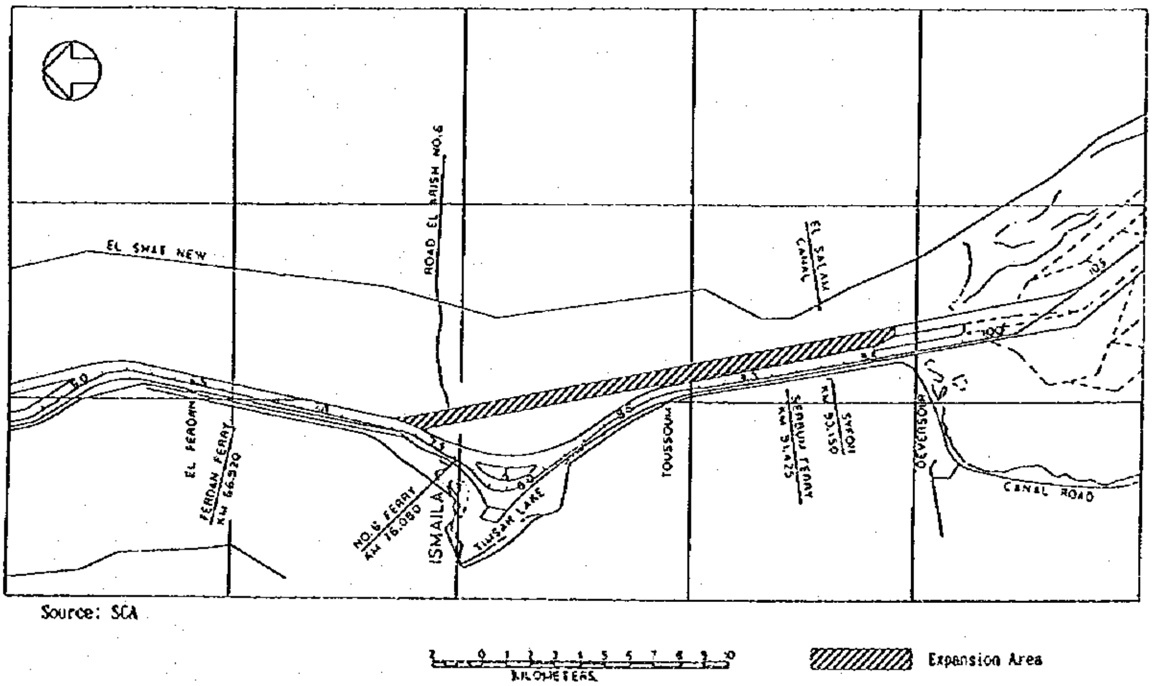


Fig. 3.3.10 Extension Plan for Deversoir By-Pass

(2) Transit Capacity

To determine the current transit capacity of the Canal, a theoretical transit capacity has been calculated to ascertain the number of transit vessels possible in a given period using a "standard vessel". The transit capacity is obtained from the following equation which assumes that the navigation time for both northbound and southbound transit is equal.

$$N = (C - (1/Vn + 1/Vs) \times L) / T$$

Where, N : transit capacity (total number of vessels for both directions)
C : transit cycle (24 hours)
Vn : average speed of northbound vessels (13 km/hr)
Vs : average speed of southbound vessels (14 km/hr)
L : longest single-lane section
T : average time interval between vessels

Ten minutes is adopted as the average time interval between vessels based on the actual records mentioned above.

As a result, the Canal has a current transit capacity of 84 standard vessels per day. Fig. 3.3.11 shows the current traffic flow of the Canal based on the above calculation, however, the transit system is based on the following principles;

- One northbound convoy transit the Canal without halting.

- For the southbound convoys, N1 convoy will wait at Great Bitter Lake and N2 convoy at the Ballah By-Pass.

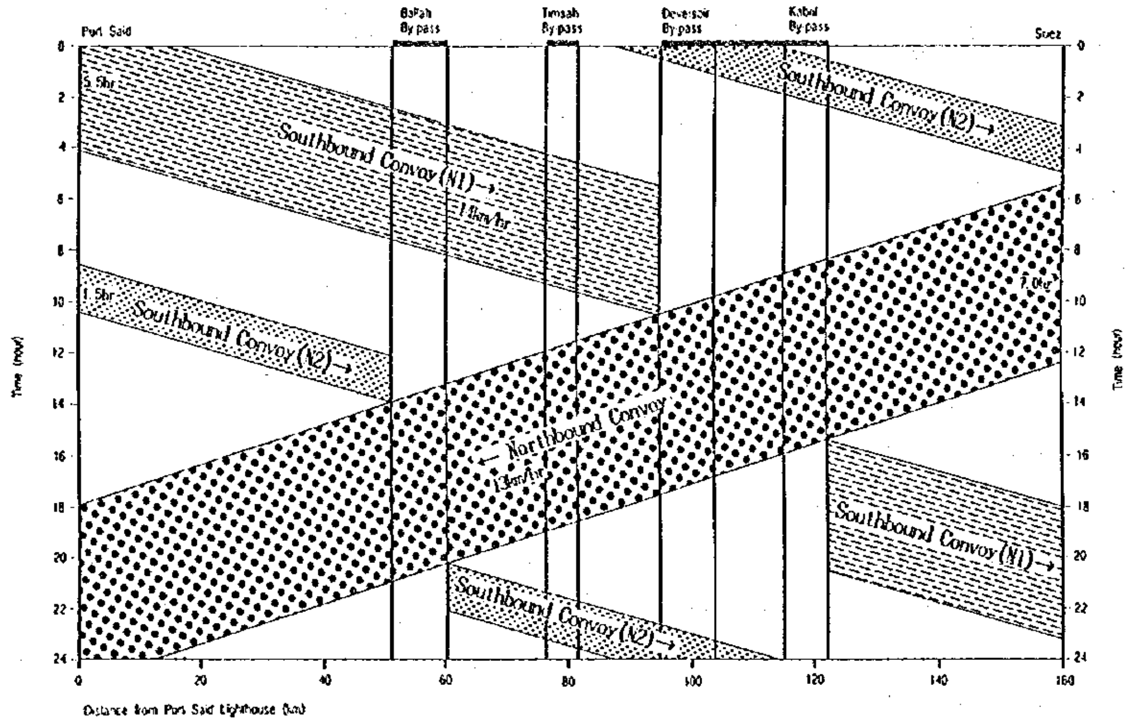


Fig. 3.3.11 Traffic Flow Diagram

As stated at the start of Section 3.3.2, the average number of transit vessels on the Canal per day is forecast to be 70 in 2030. Therefore, the existing Canal has enough capacity for these transit vessels and appears to have sufficient size to cope with large-size southbound vessels.

Fig. 3.3.12 shows the traffic flow diagram after completion of the extension of the Deversoir By-Pass. This indicates a reduction in transit time of the southbound convoy, but it will be necessary to carry out a further detailed study to ascertain the financial and economic effects.

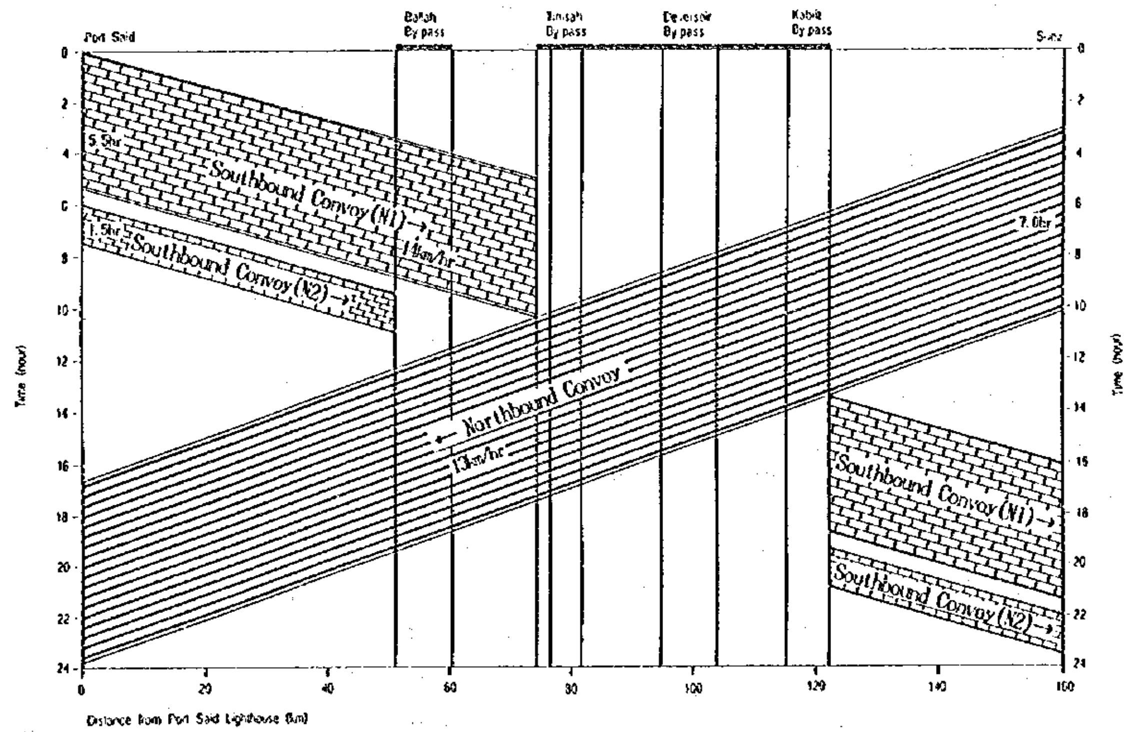


Fig. 3.3.12 Traffic Diagram after Extension of the Deversoir By-Pass

(3) Canal Section

1) Design of Canal Section

The design of the Canal has been made using past experience and also by the results of detailed model studies. The required Canal depth (dredging depth) is the sum of the Loaded Draft, Squat, Trim, and Allowance, with a loss of depth due to siltation. The lane width of the Canal has been determined based on extensive past experience and the results of experimental studies. The main section of the Canal has been designed in the following manner.

a. Full Load Draft

The full load draft should be taken for the largest vessel which is anticipated to transit the Canal (an approximate values can be obtained from the information of existing vessel date).

b. Squat and Trim

A vessel settles during navigation, and the average hull sinkage is called "Squat". The difference in draft between the stem and the bow is called "Trim". Both of these are given by the following equations:

Squat $= (1.43 \times Vs/\sqrt{gh} - 0.11) \times Lpp/100$
Trim $= (0.57 \times Vs/\sqrt{gh} - 0.03) \times Lpp/100$

here, h : Canal depth
Lpp : Length perpendicular
Vs : Vessel speed (km/hr)
g : Gravity value

c. Allowance

The allowance is usually taken as 5 % of the vessel's draft.

Allowance = 0.05 x Fully laden draft

d. Depth Loss due to Siltation

It has been assumed that maintenance dredging is carried out when the siltation layer reaches between 50 to 90 cm. The maximum thickness has been assumed to be twice the average, to give 1.0 - 1.8 m. To allow for local variations, therefore, a value of 1.0 - 1.8 m has been taken for siltation.

e. Lane Width

The width of the navigation lane has been determined by considering the navigational accuracy of the vessel, the topography along the Canal, the bank slope, etc. In this Study, the following values have been used in accordance with the values presently employed.

	Lane Ratio	
Laden Tanker :	2.8 (Slope 1/4 section),	3.0 (Slope 1/3 section)
Ballast Tanker :		3.0 (Slope 1/3 section)

f. Cross Section Area

The Canal section may be designed by taking a bank slope of 1/4 (Km.0 -61) for the northern area and 1/3 (Km.61 - 162) for the southern area and using the values of the Canal depth and lane width. However, it is necessary to take into account an "Area Ratio" which is a factor in the resistance of a navigation vessel and the siltation rate in the channel. According to the present values used, the following have been employed in this study.

	Area Ratio	Vessel Speed
Laden Tanker :	4.8	13 km/hr
Ballast Tanker :	4.8	14 km/hr

In accordance with the design method of the Canal section mentioned above, both channels can be designed as follows:

2) East Channel

The design draft is to be 22.0 m for fully laden 300,000 DWT tankers. The main section of the east channel will be designed as described below.

a. Depth

Depth = (draft) + (squat and trim) + (allowance) + (siltation)

D = 22.0 + 1.2 + 1.1 + 1.8 ≒ 27.0 m

b. Cross Section

The 300,000 DWT tankers fully laden has a breath of 58 m, therefore, the design breadth shall be at 58 m. The cross section will be designed as defined in (f) above with a target Area Ratio of 4.8 and a Lane Ratio of 2.8 (slope 1:4 section) and 3.0 (slope 1:3 section) respectively. The calculations are as follows:

Midships area	: 22 m x 58 m = 1,276 m2 (300,000 DWT fully laden)	
Channel area needed	: 1,276 x 4.8 = 6,125 m2	
Channel width at -24.0 m	: 2.8 x 58 m = 162.4 m	
Channel width at -11.0 m	: 266.4 m	≒ 270 m (slope 1:4 section)
Channel width at -0.0 m	:	= 358 m (slope 1:4 section)
Channel width at -27.0 m	:	= 142 m (slope 1:4 section)
Channel area	: 6,750 m2 > 4.8	
Channel width at -24.0 m	: 3.0 x 58 m = 174 m	
Channel width at -11.0 m	: 252 m	≒ 250 m (slope 1:3 section)
Channel width at -0.0 m	:	= 316 m (slope 1:3 section)
Channel width at -27.0 m	:	= 154 m (slope 1:3 section)
Channel area	: 6,345 m2 > 4.8	

Note: Channel width at -0.0 m does not include the berm width at both side of revetment slope.

Thus a width of 270 m in the section with a slope of 1/4 and 250 m in the section with a slope of 1/3 is required for the east channel at a depth of -11.0 m.

3) West Channel

The design draft is to be 13.7 m for container vessels of 80,000 DWT and the design breadth is to be 79 m for 500,000 DWT tankers in ballast.

The east channel is planned to be used for the southbound vessels such as VLCC's in ballast and 3rd and 4th generation containers, etc. as far as the Deversoir By-Pass.

Therefore, the cross section of the west channel will be designed to the south as far as Km.95.

The main cross section will be designed as described below.

a. Depth

Depth	=	(draft)	+	(squat and trim)	+	(allowance)	+	(siltation)		
D	=	13.7	+	1.1	+	0.7	+	1.0	=	16.5 m

b. Section

The 500,000 DWT tanker in ballast has a breadth of 79 m and a draft of 12 m, therefore, the design breadth shall be at 79 m. The channel section with an Area Ratio of 4.8 and a Lane Ratio 3.0 is used.

Midships area	:	12 m x 79 m = 948 m2 (500,000 DWT in ballast)	
Channel area needed	:	948 x 4.8 = 4,550 m2	
Channel width at -13.5 m	:	3.0 x 79 m = 237 m	
Channel width at -11.0 m	:	252 m	≒ 250 m (slope 1:3 section)
Channel width at -0.0 m	:		= 316 m (slope 1:3 section)
Channel width at -16.5 m	:		= 217 m (slope 1:3 section)
Channel area	:	4,397 m2 < 4.8	

Note: Channel width at -0.0 m does not include the berm width at both sides of revetment slope.

As mentioned above, channel area is insufficient, however, vessels may be allowed to transit the Canal under the special request in accordance with the Rules of Navigation. Therefore, the width of the west channel at a depth of -11.0 m is 250 m.

Details of the main sections are as follows:

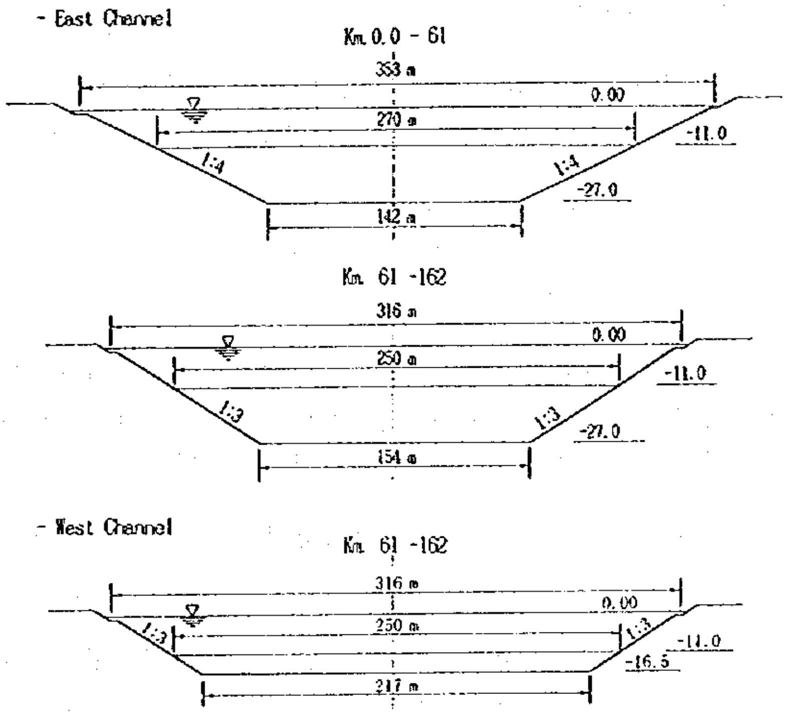


Fig. 3.3.13 Standard Cross Sections of the Suez Canal

(4) Navigation Safety

As mentioned above, Part V (covering vessels carrying dangerous goods) of the Rules of Navigation state that the responsibility for any accident involving transiting vessels is imposed on the transit vessels and that SCA shall be held responsible for ensuring safety of the Canal.

However, for any accident which impedes vessel traffic through the Canal, SCA will dispatch its personnel to remedy the situation. Its jurisdictional area is a follows: up to Km.51 from the end of both branches under Port Said, from Km.51 to Km.105 belong to Ismailiya, from Km.105 to between Ras El Adabiya and Ras Misaita belong to Suez.

In accordance with the study objectives, standards of navigation safety concerning the navigation aids, communication system, accident prevention and others are proposed as follows:

1) Standards of Navigation Safety

To ensure that vessels can navigate safety within the Canal, traffic control is carried out in accordance with the SCA's Rules of Navigation. There are three requirements to ensure safe passage of vessels through the Canal as follows:

- Shape of the Canal must be suitable,
- Proper support facilities such as navigational aids and mooring facilities must be provided, and
- Proper support system such s communications system must be provided.

a. Strengthening Navigation Aids

For vessels approaching the crossing point of a bridge area, correctly positioned navigation aids greatly contribute to the prevention of accidents. Therefore, it is necessary to improve the navigation aids at these areas as follows:

- The channel buoys in the crossing point of a bridge area are to be changed to the fixed light buoys.
- Maintenance system is to be strengthened on buoy provided in the area mentioned above with due observance of routine checks on the lighting condition.
- Maintenance must also include positional checks.
- Authorized charts incorporating the latest information of crossing point of a bridge are to be offered to users of the Canal.

b. Strengthening Canal Traffic Communication System

For transit vessels, the lack of information ad poor communications at time of transit not only cause difficulties in the preparation of transit operation but also bring about undue fear and irritation with resultant deterioration of the safety in transit of the Canal. Therefore, Canal traffic communication system should be strengthened.

Periodic broadcasts and emergency broadcasts using VHF or SSB should be introduced for the following matters.

- Organization of convoys and other operational information such as the time of commencement of transit.
- Estimated time of passage of large-sized vessels, carrier of dangerous good and special cargoes.
- Construction of a bridge.
- Accidents.

- Sea and weather conditions.

- Irregularities of aids to navigation.

- Other items of information considered necessary for the transit of vessels.

In addition to the above, controlled information is provided for each vessel from the SCVTMS, therefore, the SCVTMS becomes the most important function for the efficient control and management of the Canal and transiting vessels including the Canal traffic communication system. However, an image of a vessel on display monitor of the SCVTMS may disappear when it passes behind a bridge. In this case, it is required the image should be pursued and represented on display monitor by changing the process for the information of a vessel or setting an additional new radar.

c. Preventive Measures

To prevent accidents such as head-to stern collisions and grounding, the transiting speed prescribed in the Rules of Navigation should be observed.

During the construction of a bridge, of course, the works engaged in this construction should never interfere with the navigation of transit vessels.

Measures to prevent accidents between construction site and transit vessels are as follows:

- Four hours prior to expected time of passage of the transit vessels, the transit dept. of SCA communicates this information to the construction site by wireless.

- In case of the passing of transit vessels, in principle the construction materials concerned shall not remain in the fairway of the Canal.

- If there is some trouble during construction works, the manager of the construction must inform the transit dept. by wireless at once.

Furthermore, it is necessary to periodically hold meetings with the persons concerned, i.e. pilot, construction managers and members of the transit dept. to confirm SCA's safety countermeasures.

d. Others

- With the completion of the bridge, the mast height of transit vessels Will be limited. Therefore, it will be necessary to add this limitation to the Rules of

Navigation and obtain the vessel's data including the mast height when vessels book in.

- Data on the movements of transiting vessels, e.g., time of arrival in waiting area, anchoring position, time of heaving anchor, time of passing major points, time of embarkation/disembarkation of pilots, times of typing up in bypasses, time of casting off/having up anchor in lake, etc. should be recorded for statistical analysis.

CHAPTER 4

TRAFFIC DEMAND PROJECTION

CHAPTER 4 TRAFFIC DEMAND PROJECTION

4.1 Present Conditions

4.1.1 Road Network

(1) Road Function and Classification

Jurisdiction over inter-city roads in Egypt effectively corresponds to that of the actual road classification. The relationship is shown below.

Table 4.1.1 Classification and Function of Inter-City Roads

Jurisdiction	Classification	Function
GARBLT	Highways Divided & Standard Two lanes	Interconnection between Capitals of governorates and Main Cities
Local Government	Local Road including unpaved	Interconnection between other cities and villages within a governorate

Source: General Authority of Roads and Bridges

The General Authority for Roads and Bridges is in charge of managing highways and main roads, which are classified as divided roads and other national trunk roads designed for high speed traffic. Local governments are responsible for local roads.

(2) Configuration of The Major Arterial Road Network

The configuration of the major arterial roads, which consist of divided roads and main roads is shown in Fig. 4.1.1. The divided roads serve as major national trunk roads and have been developed in general to connect Cairo with the other major cities. The main roads leading to Sinai, namely Cairo to Ismailiya, Cairo to Suez and Ismailiya to Suez, are connected by divided roads which link to key roads via ferry crossings to serve Sinai.

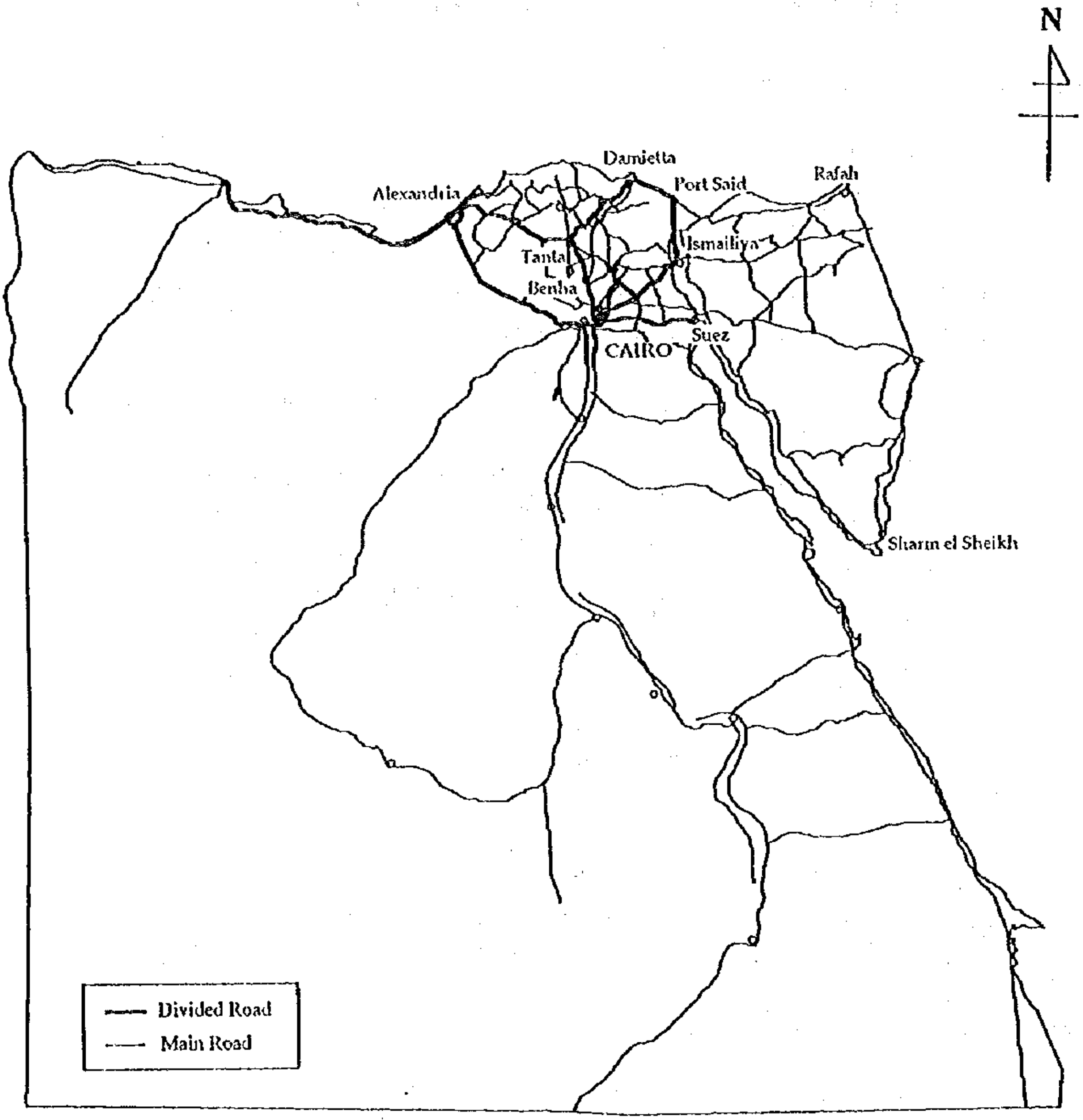


Fig. 4.1.1 Arterial Road Network

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

4.1.2 Road Traffic

(1) Current Road Traffic Volume

The current traffic volumes are shown in Fig. 4.1.2. These indicate a higher traffic volume in the Nile Delta region when compared to Sinai. The traffic data collected by a survey conducted by GARBLT indicates that the traffic volume in the vicinity of the Suez Canal is not very high at present, amounting to around 500-6,000 vehicles / day in 1995 (Garb's data). It is to be noted that the traffic volume of the divided road between Cairo and Ismailiya reaches around 13,000 vehicles / day. The traffic flow and network configuration also shows that Ismailiya acts as a pivot in the region adjacent to the Suez Canal.

(2) Flow Pattern

An OD survey was carried out as part of the National Road Transport Study (NRTS) conducted by JICA in 1992. Fig. 4.1.3 shows the passenger distribution pattern by private car, taxi, inter-city bus and railway. These indicate higher activity in the Nile Delta regions and less traffic in Sinai peninsula at present.

(3) Traffic Crossing the Eastern National Border

As a result of the undergoing Peace Process between Israel and the Arab countries, traffic crossing the border between Egypt and Israel has increased considerably. Traffic crossing at eastern border is shown in Table 4.1.2.

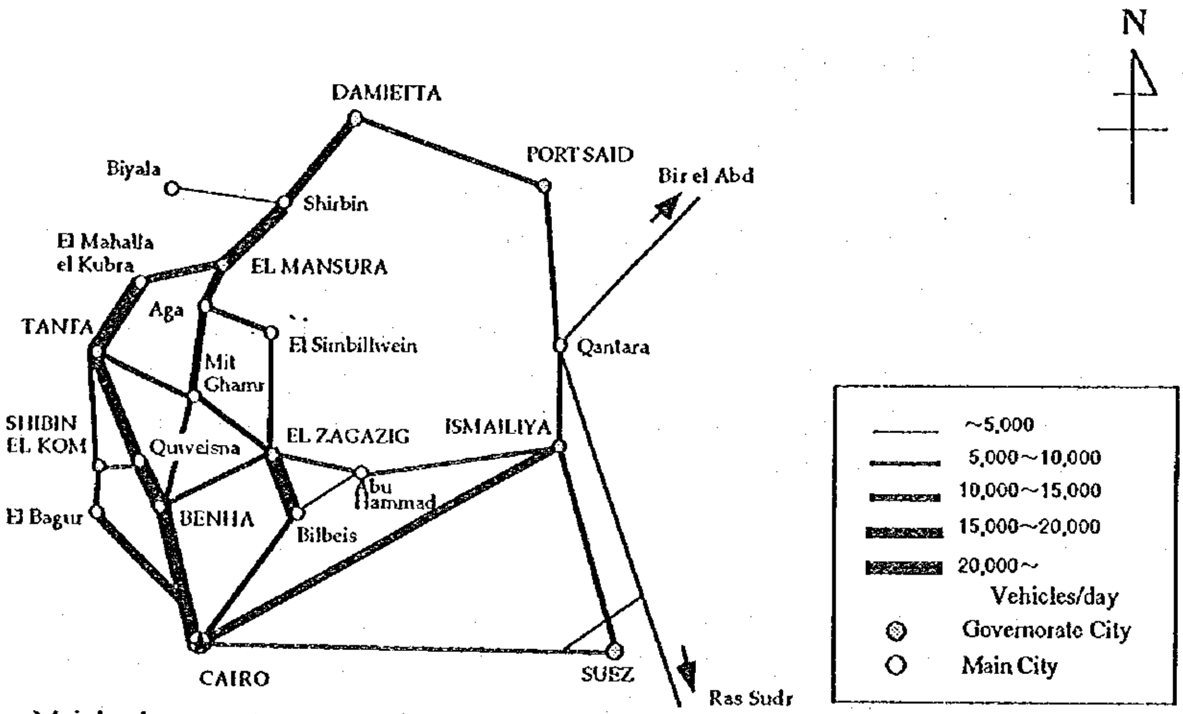
Table 4.1.2 Traffic Crossing at Eastern Border

Station	1994		1995	
	Person	Vehicles	Person	Vehicles
Rafah	419,618	4,166	148239*1	553*1
El Auja*2	.-	1,326	.-	1,086
Taba*3			158,872	4,487

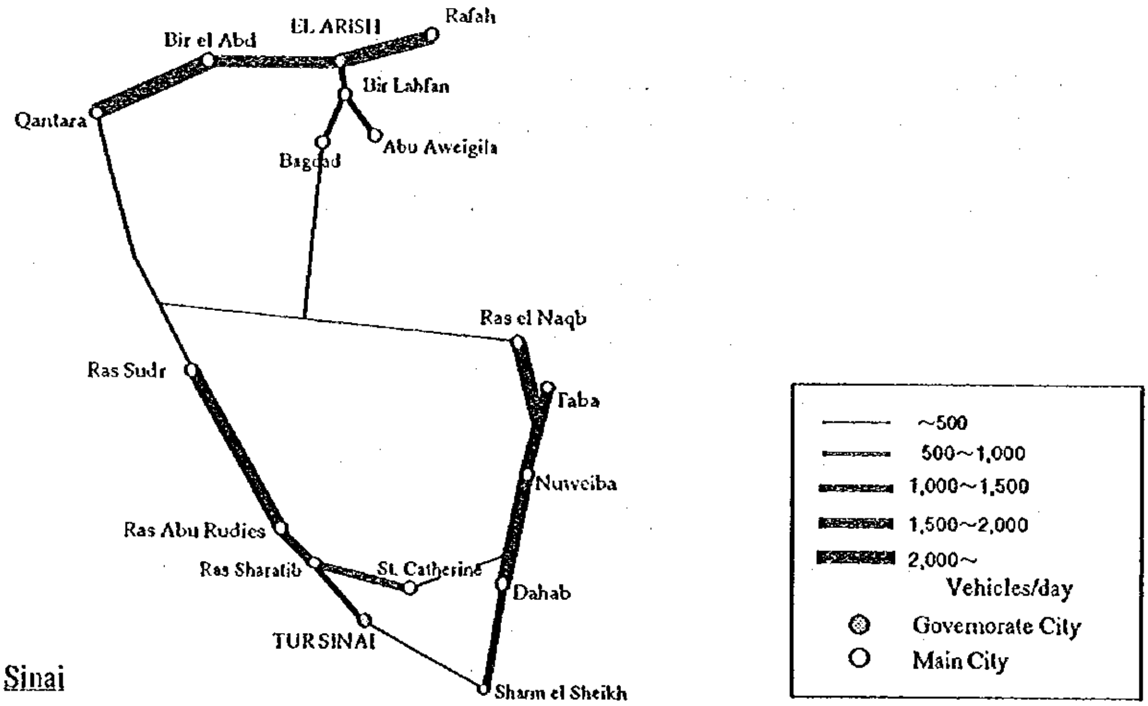
*1 June and July in 1995

*2 heavy Truck Only *3 July and August in 1995

Note: Departure and arrival Source: Custom/Tourism



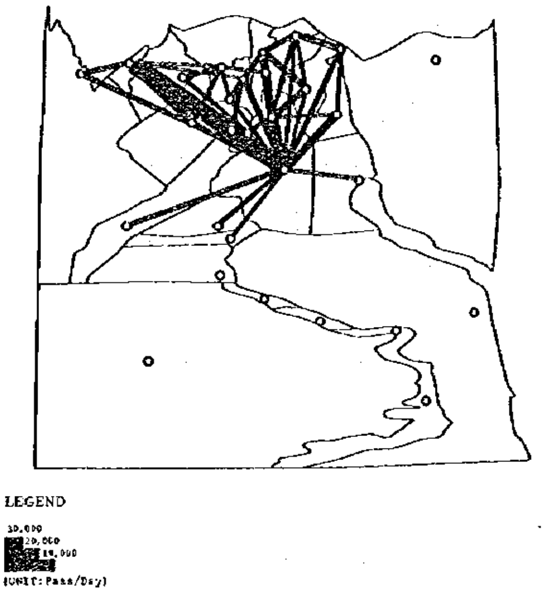
Mainland



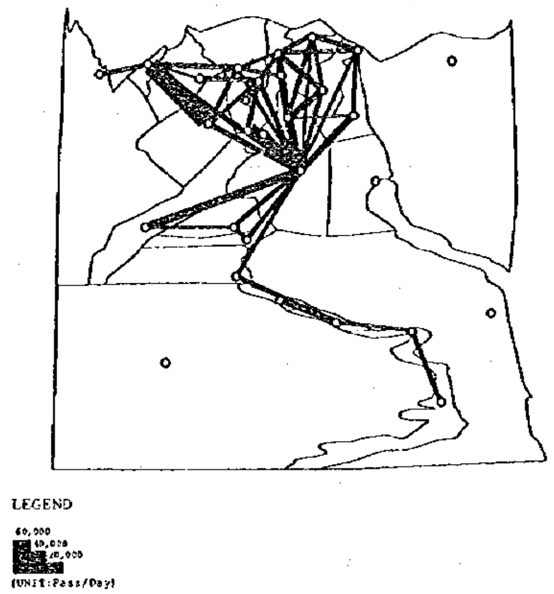
Sinai

Fig. 4.1.2 Traffic Volume in Mainland in 1995

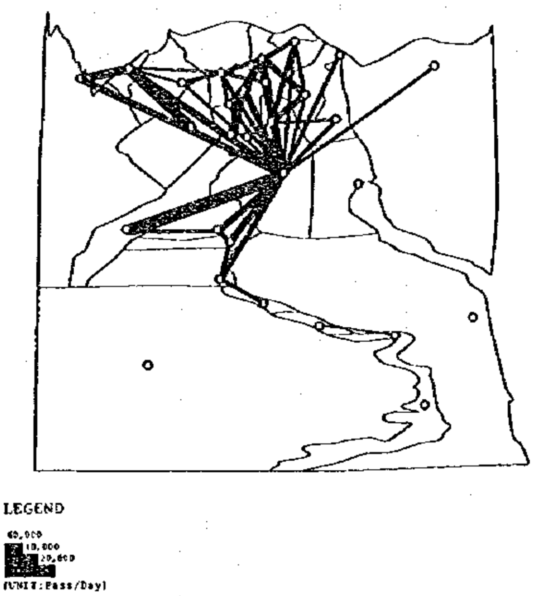
THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL



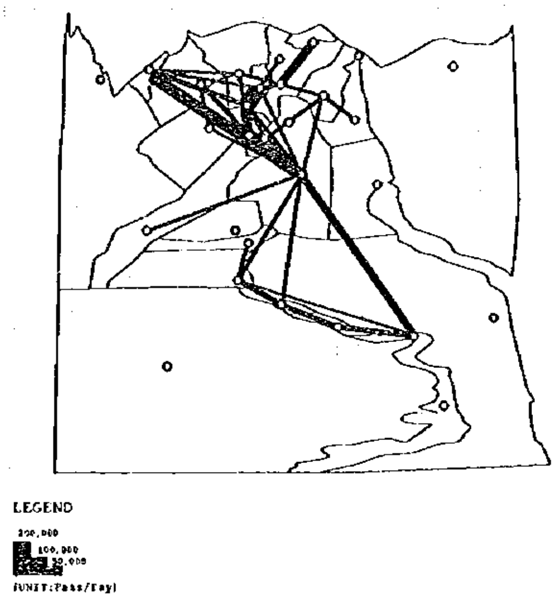
1992 Private Car Passenger



1992 Inter City Taxi Passenger



1992 Inter City Bus Passenger



1992 Rail Passenger

Fig. 4.1.3 Passenger Traffic Flow

THE FEASIBILITY STUDY ON A BRIDGE OVER NORTHERN PART OF THE SUEZ CANAL

4.1.3 Traffic Volume Crossing the Canal

(1) Outline of the Survey

The following traffic survey was conducted at the beginning of December 1995 to obtain the current Canal crossing traffic data. The detailed results of the traffic survey are summarized in the Appendix and only the major and significant ones are described below.

- Traffic Count survey

This survey was carried out to obtain the screen traffic volume crossing the Suez Canal axis and to enlarge the OD sample survey.

- Roadside OD interview survey

This survey was carried out to obtain the origin and destination of vehicles crossing the Canal.

- Travel time survey

This survey was carried out to obtain the waiting time and crossing time of the vehicles using the Canal crossings both during and outside the convoy operating times.

The location, survey time, and kinds of survey are tabulated in Table 4.1.3.

Table 4.1.3 Traffic Survey Time by Location

Station	Survey Type	Traffic Count	O-D	Travel Time		Capacity of passenger ferry	
				Convoy	Non convoy	Convoy	Non convoy
Qantara	Workday	8:00 to 22:00	8:00 to 22:00	16:00 to 18:00	11:00 to 13:00	16:00 to 18:00	11:00 to 13:00
	Friday	8:00 to 22:00	8:00 to 22:00	16:00 to 18:00	9:30 to11:30	16:00 to 18:00	9:30 to11:30
Ferdan	Workday	8:00 to 24:00	8:00 to 24:00	15:00 to 17:00	10:00 to 12:00	-	-
	Friday	6:00 to 24:00	6:00 to 24:00	15:00 to 17:00	9:30 to 11:30	-	-
No.6	Workaday	8:00 to 22:00	8:00 to 22:00	15:00 to 17:00	10:00 to 12:00	-	-
	Friday	8:00 to 22:00	8:00 to 22:00	14:30 to 16:30	9:00 to 11:00	-	-
Srabuiom	Workaday	8:00 to 22:00	8:00 to 22:00	11:00 to 13:00	16:00 to 18:00	-	-
	Friday	8:00 to 22:00	8:00 to 22:00	13:00 to 15:00	16:00 to 18:00	-	-
A H.Tunnel	Workaday	5:00 to 5:00	5:00 to 5:00	-	-	-	-
	Friday	4:00 to 4:00	4:00 to 4:00	-	-	-	-
Shatt	Workaday	5:00 to 17:00	5:00 to 17:00	8:40 to 10:40	11:30 to 13:30	-	-
	Friday	5:00 to 17:00	5:00 to 17:00	8:30 to 10:30	11:45 to 13:45	-	-

Note : The detailed explanation is in the Appendix
Source : Traffic survey by JICA Team

(2) Traffic Count

1) Crossing Vehicles

The results of the traffic count is shown in Table 4.1.4. The total traffic volume crossing the Canal reached 6,372 vehicles on a working day and 5,111 on a Friday both of which have been converted to annual average day traffic volume (AADT). Qantara has the largest traffic volume followed by A. H. Tunnel.

Table 4.1.4 Traffic Volume

AADT Unit: Vehicles/day

Station \ Volume	Workday			Friday		
	East to West	West to East	Total	East to West	West to East	Total
Qantara	1275	1238	2513	982	952	1934
Ferdan	373	355	728	227	213	440
No. 6	249	223	472	238	265	503
Srabulom	386	320	706	325	285	610
A.H.Tunnel	778	913	1691	729	712	1441
Shalt	105	157	262	96	87	183
Total	3166	3206	6372	2597	2514	5111

* Including others
Source : Traffic survey

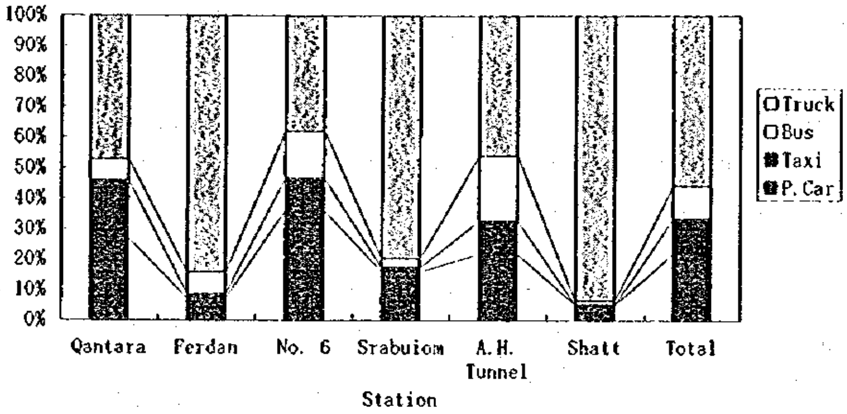
2) Truck Ratio

Fig. 4.1.4 shows the percentages by type of each survey station. A much higher proportion of trucks is indicated, particularly at Ferdan and Shatt due to their characteristics.

However the proportion of heavy vehicles to total traffic on the Canal section on a workday is much lower and the survey shows 23.1 % which comprises large buses and heavy trucks (see Table4.1.6 in Appendix).

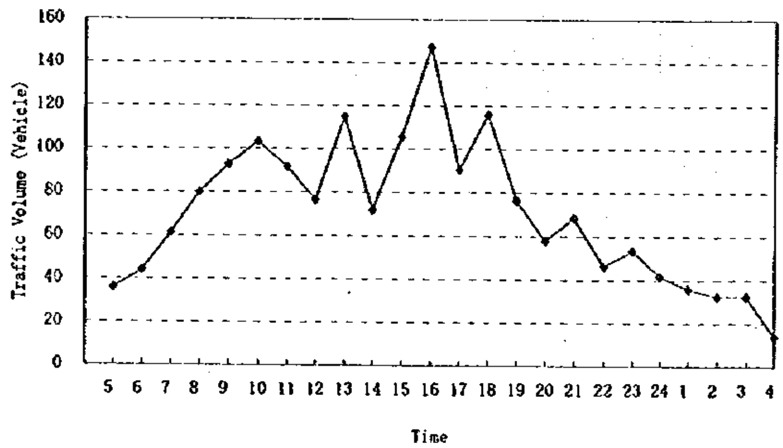
3) Hourly Fluctuation

Fig. 4.1.5 shows the hourly fluctuation at A. H. Tunnel. The time band from 15:00 to 16:00 indicates the peak hour in a day with 8.7 % of all the vehicles.



Source : Traffic survey by JICA Team

Fig. 4.1.4 Composition by Type



Source : Traffic survey by JICA Team

Fig. 4.1.5 Hourly Fluctuation

4) Passenger Traffic

Table 4.1.5 shows the number of passengers crossing the Canal. Qantara and A.H. Tunnel has a large number on passenger traffic.

Table 4.1.5 Passenger Crossing

Stations		Passenger
Qantara	1	7,130
	2	4,041
	S. Total	11,171
Ferdan		1,251
No. 6		2,089
Srabuiom		1,366
A.H. Tunnel		9,534
Shatt		89
Total		25,500

Note: 1; ferry for vehicles
2; ferry for passengers

(2) OD Distribution

a. OD Pattern

OD distribution pattern at two major survey stations, Qantara and A. H. Tunnel, is shown in Fig. 4.1.6. A large traffic flows from north Sinai to the mainland at Qantara and from south Sinai to Cairo and surround regions at A. H. Tunnel.

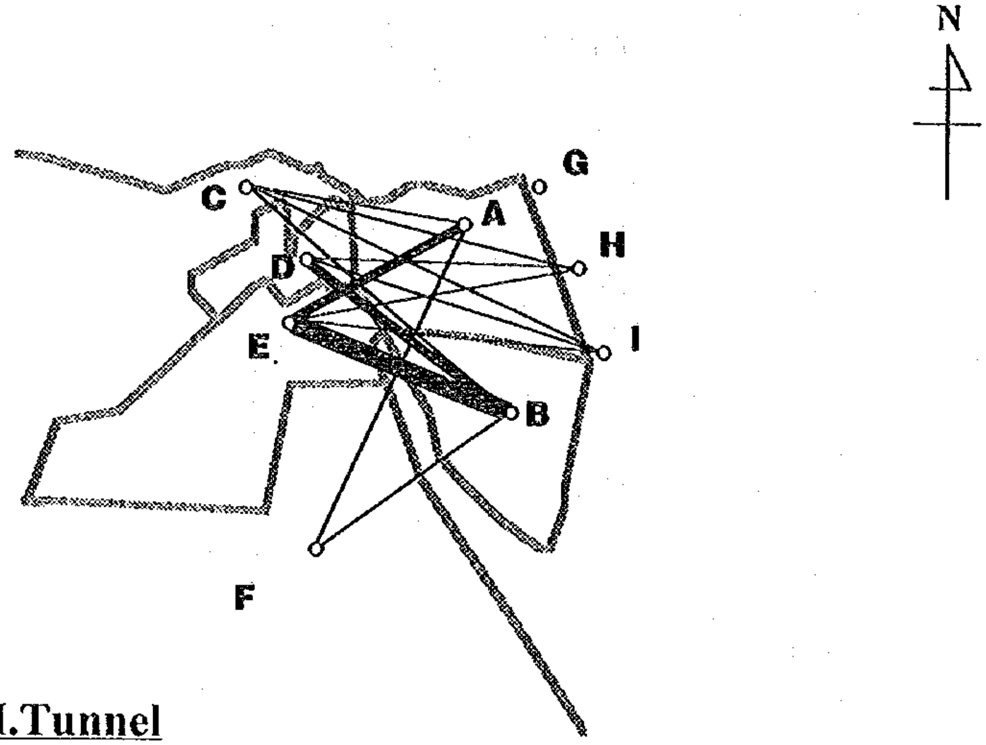
b. Community Movement

The community movement across the Canal indicated in Table 4.1.6 which shows the volume and ratio of traffic between opposite side of zone numbers 7, 8, and 9, and zone numbers 10, 11 and 12. This show that Ismailiya and Srabuiom have a larger ratio of community movement across the Canal.

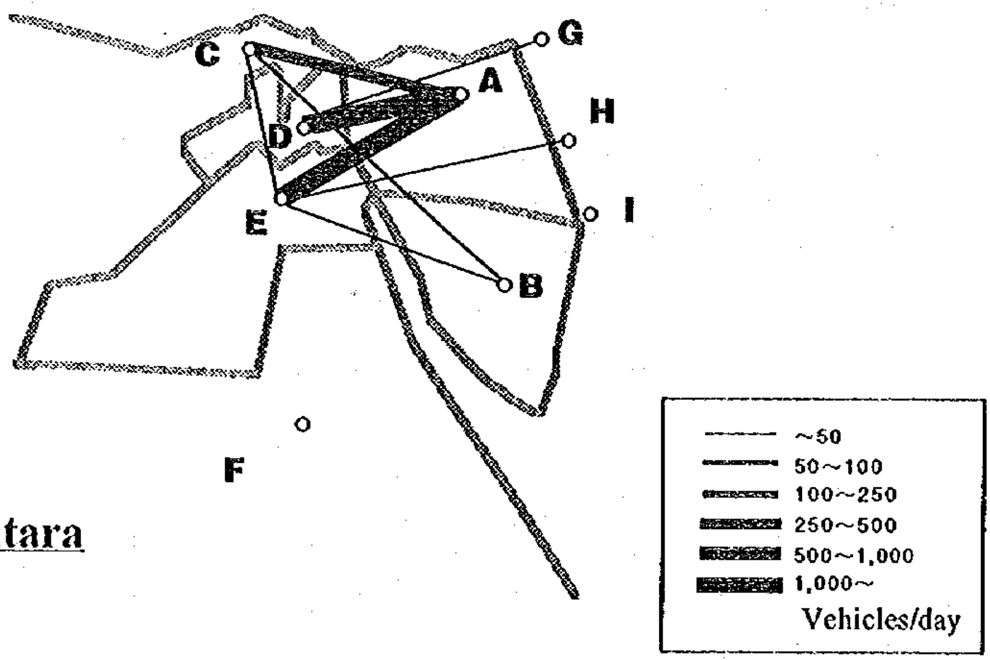
Table 4.1.6 Community Movement

Station	Volume 1 (Vehicles)	Total (Vehicles)	Ratio	Remarks
Qantara	518	2513	0.206	zone 8-11
Ferdan	71	728	0.098	zone 8-11
No. 6	229	473	0.484	zone 8-11
Srabuiom	339	706	0.480	zone 8-11
A.H. Tunnel	65	1691	0.038	Zone 9-12
Shatt	28	261	0.107	Zone 9-12

Source: Traffic survey



A.H.Tunnel



Qantara

Note : Concerning aggregated zones A to H, refer to Table 4.4.2 Zone Code

Fig. 4.1.6 OD Pattern in 1995

c. Cargo Flow

Table 4.1.7 shows the items transported and approximate quantities crossing the Canal. Construction materials are predominant.

Table 4.1.7 Commodity Across the Canal

(Tons/day)

Ranking	Kind of Commodity	Volume
1	Construction Materials	4,893
2	Cement	2,625
3	Food products	1,485
4	Petroleum products	1,348
5	Metal & Metal products	1,198
6	Natural gas	818
7	Fruit & Vegetables	500
8	Fertilizer	332
9	Manufacturing products	287
10	Chemical products	266

Source: Traffic Survey

d. Crossing Time

Table 4.1.8. shows the crossing time for vehicles at each survey station both during and outside the convoy operating time. The results of the crossing time survey show the similar tendency at each survey station and, that is, that the crossing time of the vehicles during the convoy operating time is longer than when no convoys are operating. In addition the longest crossing time from east to west was recorded at Ferdan showing 132 minutes (2.2 hours) on average. This means that the average waiting time can reach 125 minutes (2 hours). This is because the ferry ship at Ferdan can only accommodate two or three large trucks or trailer type vehicles at a time.

The ferry at Ferdan serves mainly trucks and it operates between 6:00 until 24:00 hours or 18 hours per day. It was observed that a large number of trucks were unable to cross the Canal after midnight. Table 4.1.9 shows the number of trucks waiting overnight for the opening of the ferry service in the morning, at Ferdan.

Table 4.1.8 Crossing Time

(Unit: minutes)

Station	Direction	Condition	Average Vehicle Waiting Time	Average Ferry Crossing Time	Average Vehicle Crossing Time
Qantara	W to E	Non Convoy	11	6	17
		Convoy	15	7	22
	E to W	Non Convoy	8	6	14
		Convoy	57	7	64
Ferdan	W to E	Non Convoy	15	5	20
		Convoy	16	5	21
	E to W	Non Convoy	10	4	14
		Convoy	125	7	132
No. 6	W to E	Non Convoy	19	8	27
		Convoy	9	7	16
	E to W	Non Convoy	16	6	22
		Convoy	50	13	63
Srabuiom	W to E	Non Convoy	9	7	16
		Convoy	15	6	21
	E to W	Non Convoy	19	6	25
		Convoy	25	6	31
Shatt	W to E	Non Convoy	16	6	22
		Convoy	12	6	18
	E to W	Non Convoy	12	6	18
		Convoy	20	6	26

Source : Traffic survey

Table 4.1.9 Trucks Waiting Overnight

Unit: Vehicles

Direction	Trucks
To west	21
To East	30
Total	51

Note: By observation at Ferdan