NO.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SUEZ CANAL AUTHORITY (SCA)

ANNEX VI TRANSIT FORECAST MODEL

FINAL

THE STUDY ON THE EFFECTIVE MANAGEMENT SYSTEM OF THE SUEZ CANAL IN THE ARAB REPUBLIC OF EGYPT

AUGUST 2001

THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN (OCDI)
MITSUBISHI RESEARCH INSTITUTE, INC. (MRI)

The following foreign exchange rates are applied in this study:

US$1.00=LE(Egyptian Pound)3.50=JP¥109.00

US$1.30= SDR1.00

as of August, 2000

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PREFACE

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct a study on the Effective Management System of the Suez Canal in the Arab Republic of Egypt and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched a study team to Egypt three times between August 2000 and June 2001, which was headed by Mr. Hidehiko Kuroda and was composed of members from the Overseas Coastal Area Development Institute of Japan (OCDI) and Mitsubishi Research Institute, Inc. (MRI).

The team held discussions with the officials concerned of the Government of the Arab Republic of Egypt and Suez Canal Authority (SCA) and conducted field surveys at the study area. Upon returning to Japan, the study team conducted further studies and prepared this final report.

I hope that this report will contribute to this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of SCA and other authorities concerned for their close cooperation extended to the study team.

August 2001

Kunihiko Saito
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

August 2001

Mr. Kunihiko Saito
President
Japan International Cooperation Agency

Dear Mr. Saito:

It is my great pleasure to submit herewith the Final Report of the Study on the Effective Management System of the Suez Canal in the Arab Republic of Egypt.

The study team of the Overseas Coastal Area Development Institute of Japan (OCDI) and Mitsubishi Research Institute, Inc. (MRI) conducted surveys in Egypt over the period between August 2000 and June 2001 as per the contract with the Japan International Cooperation Agency.

The study team compiled this report, which proposes the Effective Management System of the Suez Canal including the transit forecast model and the tariff setting system, through close consultations with officials of the Suez Canal Authority (SCA).

On behalf of the study team, I would like to express my heartfelt appreciation to SCA and other authorities concerned of the Government of the Arab Republic of Egypt for their diligent cooperation and assistance and for the heartfelt hospitality, which they extended to the study team.

I am also greatly indebted to your Agency, the Ministry of Foreign Affairs, the Ministry of Land, Infrastructure and Transport and the Embassy of Japan in Egypt for valuable suggestions and assistance through this study.

Yours faithfully,

Hidehiko Kuroda
Team Leader
The Study on the Effective Management System
of the Suez Canal in the Arab Republic of Egypt

ABBREVIATION LIST

APA	Alexandria Port Authority
BAF	Banker Adjusting Factor
BIMCO	Baltic and International Maritime Council
BOT	Build, Operate and Transfer
C/B	Charter Base
CBE	Central Bank of Egypt
CEU	Car Equivalent Unit
CFS	Container Freight Station
CHS	Container Handling Surcharge
CIF	Cost, Insurance and Freight
CRF	Capital Recovery Factor
CY	Container Yard
DEM/DES	Demurrage/Dispatch
DO	Diesel Oil
DPA	Damietta Port Authority
DST	Double Stack Train
DWT	Dead Weight Tonnage
ECSA	European Community Ship-owners' Association
EDI	Electronic Data Interchange
EMDB	Egyptian Maritime Data Bank
ENR	Egyptian National Railway
ETA	Estimated Time of Arrival
FAK	Freight All Kinds
FCL	Full Container Load Cargo
FIRR	Financial Internal Rate of Return
FO	Fuel Oil
FOB	Free on Board
GDP	Gross Domestic Product
GARE	Government of Arab Republic of Egypt
GOJ	Government of Japan
GT	Gross Tonnage
H/B	Hire Base
ICS	International Chamber of Shipping
INSROP	International Northern Sea Route Program
INTERCARGO	International Association of Dry Cargo Ship-owners
INTERTANKO	International Association of Independent Tanker Owners
JAMRI	Japan Maritime Research Institute
JICA	Japan International Cooperation Agency
JP¥	Japanese Yen
LB	Land Bridge
LCL	Less than Container Load Cargo
LE	Egyptian Pound
LNG	Liquefied Natural Gas

LOA	Length Overall
LOOP	Louisiana Offshore Oil Port
LPG	Liquefied Petroleum Gas
LUP	Laying-Up Point
MOMT	Ministry of Maritime Transport
MRI	Mitsubishi Research Institute, Inc.
MSL	Maersk-Sealand
MT	Metric Ton
N/P	Net Proceeds
NPV	Net Present Value
NWA	New World Alliance
OCDI	Overseas Coastal Area Development Institute of Japan
O-D	Origin and Destination
OSRA	Ocean Shipping Reform Act
PAE	Petroleum Authority of Egypt
PCC	Pure Car Carrier
P/L	Profit/Loss
PSPA	Port Said Port Authority
QGC	Quay-side Gantry Crane
RGT	Rubber-Tired Gantry
S/C	Service Contract
SCA	Suez Canal Authority
SCCT	Suez Canal Container Terminal
SCGT	Suez Canal Gross Tonnage
SCNT	Suez Canal Net Tonnage
SCVTMS	The Suez Canal Vessel Traffic Management System
SDR	Special Drawing Right
SSA	Stevedoring Services of America
SUMED	Arab Petroleum Pipelines Co.
S/W	Scope of Work
TEU	Twenty-foot Equivalent Unit
ULCC	Ultra Large Crude Carrier
US$	US Dollar
VLCC	Very Large Crude Carrier
WSF	World Scale Flat
WSR	World Scale Rate

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Chapter 1 Structure of the Forecast Model

1.1 Purpose of the forecast model

The forecast model is made to assist the decision-making of the Suez Canal Authority.

The future volume through the Suez Canal is quite important for the following reasons:

1. To determine the future revenue of SCA
2. To make a strategic toll system for the Suez Canal
3. To determine the necessity of the enlargement of the Suez Canal

The main output of the forecast model is the number of vessels that will pass thorough the Canal in the future. The revenue can be calculated after the number of vessels is forecast.
A strategic toll system can be considered after type and size of vessels are analyzed. The toll should give reasonable benefits both to SCA and to ship operators.
The future number of vessels is directly related to the necessity of the enlargement of the Canal. If the number exceeds the capacity of the Canal, the Canal will have to be enlarged.

1.2 Framework of the model

1.2.1 Target year of the forecast

Target year of the forecast is 2020.
This forecast model is a so-called long-term forecast model.

Basically the forecast is the work of the analyses of trends and scenarios. The basic structure of the demand is followed after the past and the present trends, but it may change in the long run. Therefore, the factors that possibly may change in 20 years were analyzed. This procedure is totally different from a simple regression model that is often used in a short-term forecast model.

1.2.2 Output of the model

The output of the forecast model is the number of vessels that will pass through the Suez Canal (referred to as "Transit" hereafter in this study).

Transit should be classified by vessel type, vessel size, load status (laden / in-ballast), and direction (northbound / southbound) according to the purpose of the model. The characteristics of Transit are directly related to the strategy of the management of the Suez Canal.

The cargo volume and the commodity types are important but are less important than Transit. The reason is that the cargo volume and the commodity types have no direct relations to the operation of the canal. Therefore, the best efforts were paid to forecasting Transit. But the cargo volume and the commodity types are also the output of the model and have reasonable reliability.

The classification used in the forecast model is listed in Table 1.2.1.

Table 1.2.1 Classification of Transit

Category	Class
Vessel type	Crude Oil Tanker Other Tanker Bulk Carrier Containership General Cargo Carrier Car Carrier Other vessel *1
Vessel size	0 — 25,000DWT 25,000 — 50,000DWT 50,000 — 75,000DWT 75,000 — 100,000DWT 100,000 — 125,000DWT 125,000 — 150,000DWT 150,000 — 200,000DWT 200,000 — 250,000DWT 250,000 — 300,000DWT 300,000＋ DWT
Load status	Laden In-ballast
Direction	Northbound Southbound
Commodity type	Crude Oil Oil Products LPG/LNG Chemicals Grain Fabricated Metal Coal & Coke Ores Fertilizer Automobile Containerized Cargo Others

Note) *1: Other vessel type is separated in detail in later process

1.3 Structure of the forecast model

1.3.1 Basic concept

The procedure of forecasting should have the following characteristics.

. Reasonable
The result of forecasting has to be explanatory. Relations between variables and parameters should be clear. Procedure of forecast is followed after theoretical background. And the model should include factors that will influence Transit.

. Operational
Socio-economic conditions around the Suez Canal are not constant. It is preferred that the model is able to reflect future changes of socio economic conditions on Transit. For this purpose, parameters in the model are set to be simple and easy to operate.

. Easy to modify
According to changes in management strategy such as the enlargement of the canal or a toll system, it is preferred that the structure of the model is simple and the components of the model can be modified easily.

To achieve these requirements, an "Intensive Structure Model" was developed. The structure and the parameters were determined after the detailed analysis of cargo demand and vessel movements.
If the present trends of Transit remain in the future, the future Transit can be simply forecast by time-series-forecasting model. Therefore, a simple time-series-forecasting model was also developed. This model is called a "Basic Structure Model". The purpose of the Basic Structure Model is to check the stability of the Intensive Structure Model.

This report mainly describes the methodology and the result of the Intensive Structure Model. The Basic Structure Model is described in Appendix E of this ANNEX.

Figure 1.3.1 is the flowchart of forecasting procedure of the Intensive Structure Model. Boxes marked as P1 to P5 in this figure represent steps in the forecast. Boxes marked as F1 to F7 are relevant factors.

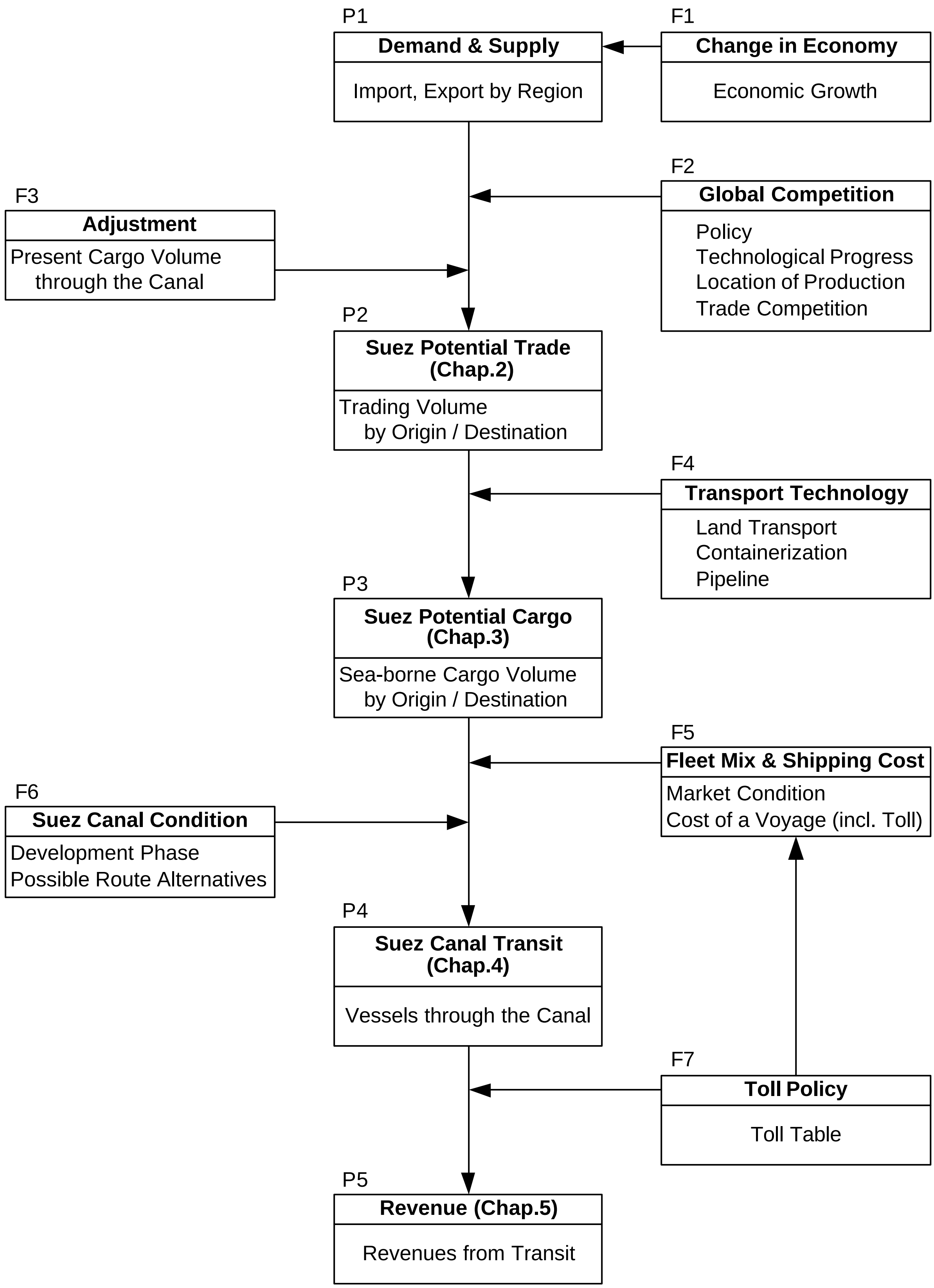


Figure 1.3.1 Flowchart for the Forecast

In P1 the future cargo demand and supply to/from regions are set. Various factors such as production capacity and consumption will affect imports and exports. In this model the GDP was selected as a representative variable of factors.

Future trade is set in P2. Trade is the result of the balancing of production and consumption in and between regions. There are many factors that affect the trade structure. The market is extending globally in accordance with developments in information technology and transport technology. These advanced technologies may change industrial structures or consumers' behaviors. Tough trade competition between regions is introduced after the activities of economic sectors. This competition will also affect the productivity and prices of goods. Political behavior, such as the formation of the EU, will ease the barriers to trading and extend the power of trading. It is not easy to establish this complex trade structure in numerical equations. Therefore, the output of a large-scale world trade forecast model was used in this model. The output of the model was modified to fit the forecast of the Suez Canal Transits.
The output of this process is called "Suez Potential Trade" in this study report. At first, Suez Potential Trade was estimated based on the world statistics. And then this estimation was adjusted to the actual cargo volume through the Canal.

In P3 Sea-borne trade is forecasted. Sea-born trade is picked up from the world trade. Transport technology will change the balance between maritime transport and other modes. Containerization is considered in this process. The volume of containerized cargo is estimated.
The output of this process is called "Suez Potential Cargo" in this study report. Suez Potential Cargo is the cargo that will use the Canal when there are no restrictions on maximum size and no toll on vessels.

The estimation of Canal Transit, P4, is the final output of the demand forecast model. Maritime factors related to the shipping business, and the physical restrictions and toll of the Canal are the relevant factors.

P5 is an additional function of the forecast model. The revenue from the Canal is calculated from the toll table and Transit.

The forecast models used in this study are summarized in Table 1.3.1.

Table 1.3.1 Forecast Model described in this Study

Model	Sub-model	Type of the model	Purpose of the model	Development of the model	Chapter
Intensive Structure Model	A large-scale trade forecast model	Macro-economic model	To forecast Suez Potential Trade	An existing large-scale econometric model was used, and output was modified to fit this study.	Chapter 2
	Operational cargo forecast model	Elasticity model	To forecast Suez Potential Cargo	The output of above model was used to estimate parameters of Elasticity model.	Chapter 3
	Route-choice model	Shipping Cost model	To forecast Transit from Suez Potential Cargo	The behavior of ship operators was simulated.	Chapter 5
Basic Structure Model		Time-series trend model	To forecast Transit easily from past trends of Transit	Simple equations and parameters were estimated.	Appendix E

1.3.2 Constraints of forecast model

In general, each model has its own purpose. In this study, the forecast model was developed mainly for the purposes of Transit forecast in long-term. The model structure and parameter were established to fit this purpose as a priority.

This model was constructed for long-term forecasting. It is not suitable in short-term forecasting or making short-term toll policy. Transit and cargo volume fluctuates in the short-term. This fluctuation occurs owe to short-term fluctuations of economy and fleet market. Individual shippers' strategy or development of individual ports will affect transits and cargo movement in the short-term, too. The forecast model doesn't support these kind of short-term factors.

It should be recognized that forecasting constraints come from the structure of this forecast model. This model follows a 4-step estimation approach that is widely used in transportation demand forecasting. The structure is reasonable and easy to understand, but a drawback of this model is the difficulty in forecasting induced demand.
If the toll of the Canal becomes quite expensive, a destination country of the cargo may stop importing. Factories in an origin country of cargo may move to another country and the trade across the Canal may decrease. However, the model in this study doesn't consider such a scenario. This presumption may sound improper, but actually the toll will not be set at a high level, and the change of toll within a reasonable range will be absorbed in world trade in the long run.
It will be necessary to construct a dynamic model or general equilibrium model in order to forecast the induced demand. This kind of model is not necessary operational due to the present modeling technology.
According to above consideration, the model structure is selected as described in this study report.

The model developed in this study is a trend model in the sense that the parameters for forecasting are determined from the past and the present demand structure, although it is not a simple time-series trend model. The parameter should be revised and it may even necessary to revise the model structure if drastic changes in the economy or trade occur.

In spite of our best efforts, the forecast, of course, will contain errors due to the nature of modeling. There are two (2) causes for these errors.

The 1st reason is due to the simplification of the model. Commodities, for example are classified into only 12 categories though the actual cargo consists of a lot more commodity types. Another example is zoning. Regions are grouped into zones. Some trades between two zones use ports in the other zone. This kind of trade results in a mismatch in the forecast and the actual transit.

The 2nd reason is that the factors considered in the forecast process are simplified. Actual Transit is the result of behaviors of shipping operators. There are a lot of trends and factors that may influence Transit. But some of them are very difficult to express numerically, and some are very difficult to give future values. Accordingly, parameters used in the model are limited.

Chapter 2　Forecast of Suez Potential Trade

2.1 Suez Potential Route and Suez Potential Trade

2.1.1 Definition

Many commodities are moving across the Suez Canal. Suez Potential Routes are defined as the possible routes from the origins or the destinations of these commodities.

Suez Potential Trades are trades along Suez Potential Routes. The trade from East Asia to Oceania, for example, does not clearly pass through the Suez Canal. The trades of this kind are not Suez Potential Trade.

Suez Potential Trade includes trades by land-transport and air-transport. These trades do not use the Suez Canal at present, but may pass through the Canal if innovations in transportation technology occur in future.

In this study, the final output of Suez Potential Trade is expressed in tons, not monetary terms because cargo movement rather than trade is the more important factor here.

Table 2.1.1 shows zones in this study. The countries classified in each zone are listed in Appendix A.

Table 2.1.1　Zoning for the study

Direction	Zone
North of the Canal	01.CS.America
	02.N.Amrica
	03.NW.Europe
	04.W.Med
	05.N.Africa
	06.E.Med
South of the Canal	07.E.Africa
	08.A.Gulf
	09.S.Asia
	10.SE.Asia
	11.E.Asia
	12.Oceania*

*) Oceania is divided into 4 zones for dry bulk cargo in the later chapters

Suez Potential Trade is a portion of the world trades. Figure 2.1.1 shows Suez Potential Route. These routes are determined by comparing the voyage distance via the Canal to the distance via the Cape. The distance via the Panama Canal was also considered to define Suez Potential Route.

A representative port was selected in each zone to determine the distances between zones. The distances between representative ports were defined as the distances between zones. Because the representative ports are dependent on the commodity type, Suez Potential Route is defined depending on the commodity type.

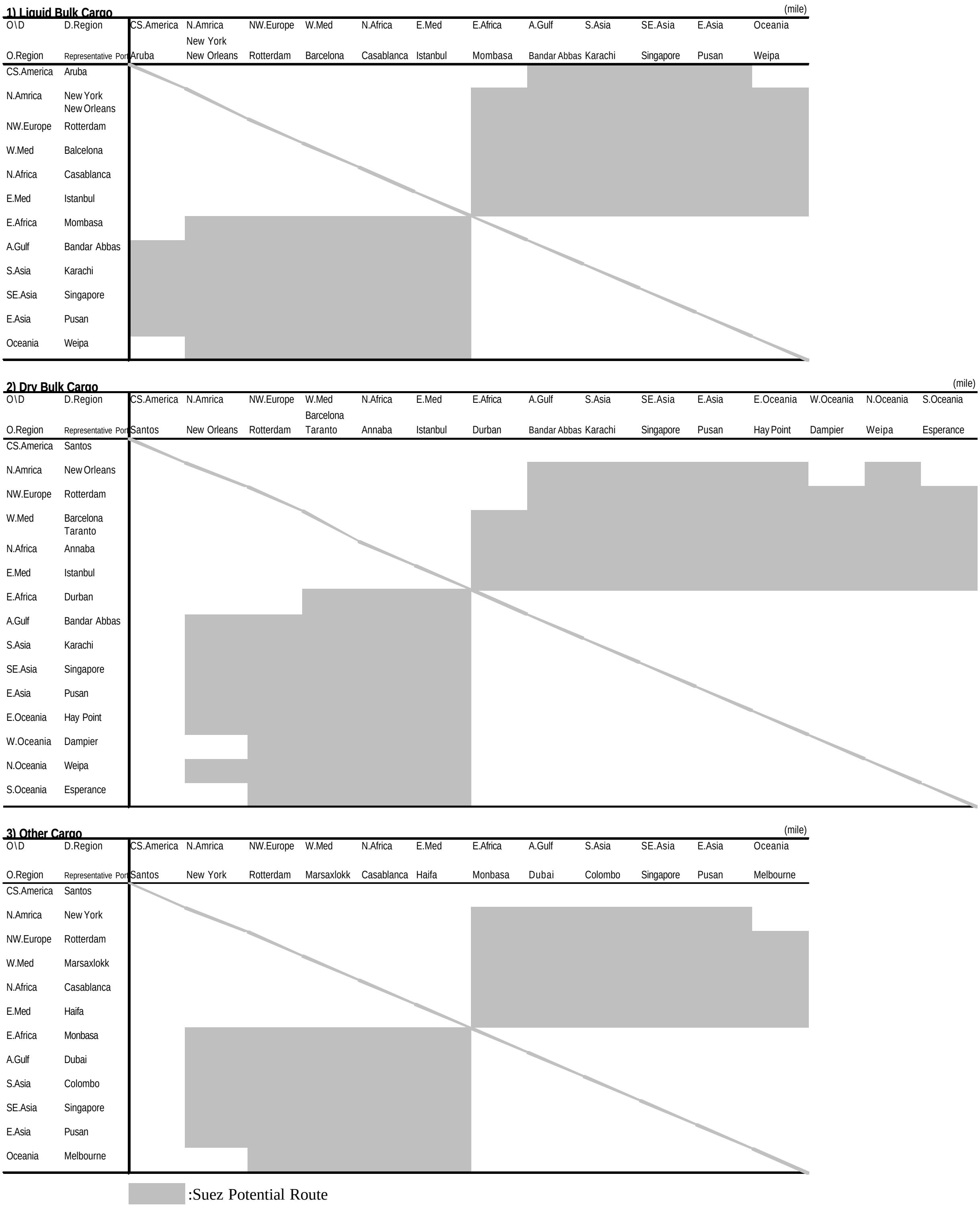


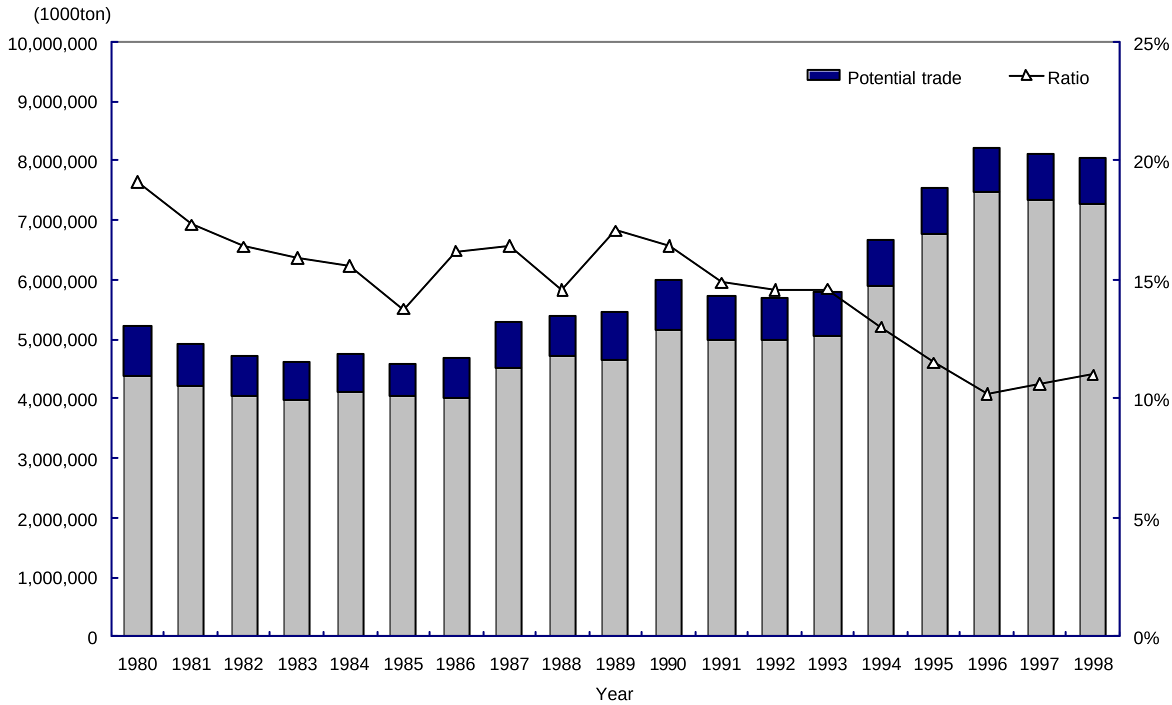
Figure 2.1.1 Suez Potential Route

2.1.2 The world trade and Suez Potential Trade

The historical data of the world trade and trade along Suez Potential Route are shown in Figure 2.1.2 and Table 2.1.2.

Suez Potential Trade is increasing but the ratio to the world trade is decreasing.

It should be noted that the trades in the Figure 2.1.2 and Table 2.1.2 were obtained from the statistics. As explained later, there is inconsistency of the actual cargo volume with the statistics. The values in Figure 2.1.2 and Table 2.1.2 are not necessarily equal to the values of the Suez Potential Trade described in the later section.



Source) WEFA, Inc (JICA Study Team), summarized from UN Trade Statistics

Figure 2.1.2 The World Trade and Potential Trade

Table 2.1.2 The World Trade and Potential Trade

(1000 ton)

Year	World trade	Potential trade	Ratio
1980	4,377,966	836,906	19.1%
1981	4,207,832	728,333	17.3%
1982	4,061,089	665,501	16.4%
1983	3,990,497	635,172	15.9%
1984	4,100,091	638,890	15.6%
1985	4,039,303	555,676	13.8%
1986	4,025,596	652,305	16.2%
1987	4,528,769	743,808	16.4%
1988	4,717,082	687,226	14.6%
1989	4,650,721	793,163	17.1%
1990	5,155,332	845,760	16.4%
1991	4,980,261	740,342	14.9%
1992	4,977,336	724,949	14.6%
1993	5,069,496	740,402	14.6%
1994	5,907,924	768,235	13.0%
1995	6,777,188	779,747	11.5%
1996	7,460,321	760,163	10.2%
1997	7,333,572	779,911	10.6%
1998	7,262,645	799,045	11.0%

Source) WEFA, Inc (JICA Study Team), summarized from UN Trade Statistics

Table 2.1.3 The World Trade and Potential Trade by Commodity

CRUDE OIL (1000 ton)

Year	World trade	Potential trade	Ratio
1980	1,186,266	419,565	35.4%
1981	919,948	292,596	31.8%
1982	834,868	220,182	26.4%
1983	823,845	190,315	23.1%
1984	854,066	163,327	19.1%
1985	731,538	107,832	14.7%
1986	761,561	198,621	26.1%
1987	917,699	286,998	31.3%
1988	766,738	182,585	23.8%
1989	904,282	269,970	29.9%
1990	1,132,519	355,383	31.4%
1991	1,098,565	273,514	24.9%
1992	1,046,228	238,656	22.8%
1993	1,039,017	199,995	19.2%
1994	1,597,473	279,486	17.5%
1995	1,632,888	251,065	15.4%
1996	1,755,465	237,652	13.5%
1997	1,736,110	258,034	14.9%
1998	1,738,194	294,649	17.0%

OIL PRODUCTS (1000 ton)

Year	World trade	Potential trade	Ratio
1980	342,718	16,815	4.9%
1981	343,451	17,554	5.1%
1982	358,041	23,862	6.7%
1983	358,259	25,786	7.2%
1984	387,616	26,623	6.9%
1985	412,801	34,054	8.2%
1986	460,159	44,224	9.6%
1987	456,934	44,834	9.8%
1988	495,276	39,987	8.1%
1989	482,532	50,889	10.5%
1990	446,073	52,702	11.8%
1991	553,342	50,173	9.1%
1992	402,865	42,304	10.5%
1993	513,859	62,023	12.1%
1994	564,502	48,056	8.5%
1995	514,128	40,201	7.8%
1996	620,260	40,694	6.6%
1997	563,070	39,827	7.1%
1998	593,332	35,771	6.0%

LPG/LNG (1000 ton)

Year	World trade	Potential trade	Ratio
1980	146,486	18,307	12.5%
1981	145,001	11,722	8.1%
1982	129,613	11,331	8.7%
1983	132,069	19,642	14.9%
1984	121,904	14,945	12.3%
1985	125,989	14,159	11.2%
1986	138,829	12,893	9.3%
1987	136,517	17,092	12.5%
1988	154,459	20,317	13.2%
1989	142,903	19,873	13.9%
1990	165,777	18,118	10.9%
1991	190,025	6,575	3.5%
1992	176,841	3,956	2.2%
1993	187,613	6,148	3.3%
1994	269,569	6,138	2.3%
1995	272,998	5,655	2.1%
1996	439,266	6,198	1.4%
1997	446,113	5,486	1.2%
1998	445,626	6,044	1.4%

CHEMICALS (1000 ton)

Year	World trade	Potential trade	Ratio
1980	146,348	13,486	9.2%
1981	135,215	12,960	9.6%
1982	140,777	16,300	11.6%
1983	144,359	14,793	10.2%
1984	151,209	15,273	10.1%
1985	161,773	15,259	9.4%
1986	193,009	19,344	10.0%
1987	174,910	27,919	16.0%
1988	172,406	28,191	16.4%
1989	168,931	23,875	14.1%
1990	145,518	19,915	13.7%
1991	147,917	19,772	13.4%
1992	156,294	19,977	12.8%
1993	177,888	43,793	24.6%
1994	176,671	26,183	14.8%
1995	184,300	27,412	14.9%
1996	192,536	26,508	13.8%
1997	207,569	26,867	12.9%
1998	214,455	25,633	12.0%

GRAIN (1000 ton)

Year	World trade	Potential trade	Ratio
1980	315,362	83,195	26.4%
1981	351,532	90,194	25.7%
1982	337,421	86,443	25.6%
1983	304,908	80,576	26.4%
1984	324,360	85,786	26.4%
1985	294,023	62,596	21.3%
1986	265,417	54,902	20.7%
1987	245,219	55,046	22.4%
1988	271,587	72,094	26.5%
1989	306,860	86,457	28.2%
1990	266,879	63,786	23.9%
1991	287,017	59,117	20.6%
1992	283,546	63,556	22.4%
1993	284,421	71,295	25.1%
1994	252,506	53,906	21.3%
1995	259,998	80,389	30.9%
1996	257,576	68,369	26.5%
1997	258,505	59,827	23.1%
1998	277,652	57,367	20.7%

FABRICATED METAL (1000 ton)

Year	World trade	Potential trade	Ratio
1980	246,836	45,100	18.3%
1981	271,380	53,940	19.9%
1982	261,677	54,002	20.6%
1983	233,609	39,635	17.0%
1984	251,641	50,916	20.2%
1985	260,939	49,228	18.9%
1986	186,528	28,894	15.5%
1987	183,204	25,713	14.0%
1988	220,134	28,886	13.1%
1989	230,120	29,887	13.0%
1990	234,776	27,034	11.5%
1991	227,322	25,428	11.2%
1992	224,982	27,620	12.3%
1993	226,144	41,269	18.2%
1994	255,448	44,579	17.5%
1995	253,850	36,232	14.3%
1996	261,694	42,663	16.3%
1997	279,750	37,675	13.5%
1998	284,461	37,286	13.1%

Source) WEFA, Inc (JICA Study Team), summarized from UN Trade Statistics

Table 2.1.3 The World Trade and Potential Trade by Commodity(continued)

COAL&COKE

(1000 ton)

Year	World trade	Potential trade	Ratio
1980	317,498	50,335	15.9%
1981	332,130	57,868	17.4%
1982	305,558	55,711	18.2%
1983	290,676	47,614	16.4%
1984	295,906	48,385	16.4%
1985	343,650	47,939	14.0%
1986	336,829	50,522	15.0%
1987	302,993	50,573	16.7%
1988	338,657	53,682	15.9%
1989	360,722	49,671	13.8%
1990	414,206	52,851	12.8%
1991	428,497	57,977	13.5%
1992	435,771	61,803	14.2%
1993	460,452	54,246	11.8%
1994	444,415	58,519	13.2%
1995	412,459	44,562	10.8%
1996	454,997	40,807	9.0%
1997	487,612	47,166	9.7%
1998	592,617	64,186	10.8%

ORES

(1000 ton)

Year	World trade	Potential trade	Ratio
1980	304,359	31,013	10.2%
1981	324,259	34,511	10.6%
1982	326,431	39,983	12.2%
1983	285,536	43,334	15.2%
1984	307,813	40,934	13.3%
1985	321,063	43,317	13.5%
1986	351,203	52,707	15.0%
1987	693,448	45,712	6.6%
1988	483,403	61,606	12.7%
1989	428,075	39,617	9.3%
1990	733,104	38,801	5.3%
1991	421,686	42,186	10.0%
1992	465,701	46,583	10.0%
1993	484,371	40,025	8.3%
1994	514,016	36,153	7.0%
1995	1,304,499	66,318	5.1%
1996	1,456,324	58,959	4.0%
1997	1,206,557	59,449	4.9%
1998	1,014,938	36,726	3.6%

FERTILIZER

(1000 ton)

Year	World trade	Potential trade	Ratio
1980	121,228	13,555	11.2%
1981	110,027	11,636	10.6%
1982	94,617	9,821	10.4%
1983	94,777	9,710	10.2%
1984	126,182	15,065	11.9%
1985	125,998	14,509	11.5%
1986	118,450	10,793	9.1%
1987	114,876	11,657	10.1%
1988	178,030	18,389	10.3%
1989	142,890	20,138	14.1%
1990	137,668	20,892	15.2%
1991	139,125	24,067	17.3%
1992	131,145	25,216	19.2%
1993	108,233	18,869	17.4%
1994	127,042	24,860	19.6%
1995	137,368	30,888	22.5%
1996	142,896	29,287	20.5%
1997	144,689	29,063	20.1%
1998	145,330	26,672	18.4%

AUTOMOBILE

(1000 ton)

Year	World trade	Potential trade	Ratio
1980	31,368	11,835	37.7%
1981	31,046	11,453	36.9%
1982	31,121	12,001	38.6%
1983	29,948	12,083	40.3%
1984	32,591	13,714	42.1%
1985	34,684	15,611	45.0%
1986	28,235	12,134	43.0%
1987	26,088	9,983	38.3%
1988	27,010	9,012	33.4%
1989	28,759	9,419	32.8%
1990	30,026	9,775	32.6%
1991	28,659	8,842	30.9%
1992	28,676	8,006	27.9%
1993	27,014	6,564	24.3%
1994	27,743	5,790	20.9%
1995	28,315	5,582	19.7%
1996	31,358	5,784	18.4%
1997	36,159	6,710	18.6%
1998	38,127	6,879	18.0%

OTHER CARGO

(1000 ton)

Year	World trade	Potential trade	Ratio
1980	1,219,496	133,700	11.0%
1981	1,243,843	133,900	10.8%
1982	1,240,964	135,865	10.9%
1983	1,292,511	151,685	11.7%
1984	1,246,803	163,920	13.1%
1985	1,226,844	151,172	12.3%
1986	1,185,377	167,272	14.1%
1987	1,276,882	168,282	13.2%
1988	1,609,385	172,479	10.7%
1989	1,454,648	193,367	13.3%
1990	1,448,786	186,503	12.9%
1991	1,458,106	172,691	11.8%
1992	1,625,287	187,272	11.5%
1993	1,560,483	196,175	12.6%
1994	1,678,539	184,566	11.0%
1995	1,776,385	191,442	10.8%
1996	1,847,950	203,243	11.0%
1997	1,967,439	209,806	10.7%
1998	1,917,913	207,831	10.8%

Source) WEFA, Inc (JICA Study Team), summarized from UN Trade Statistics

2.2 Method of forecast

For the estimation of the Suez Potential Trade, a two-phase, multi-step forecasting approach was used.

The first phase was the forecast based on world statistics. First, the entire world trade by commodity and trade route was forecast. The world trade forecast in the study covers trade in all goods (sea-borne, land and air cargo) for the entire world as the foundation for the Suez Canal trade analysis. Then, Suez Canal specific potential trade by commodity and trade route in tons was calculated.

The second phase was the revision of the output of the first phase. After trade was forecast from world statistics, the sea-borne trade was calculated. The result of the forecast of sea-borne trade has some inconsistency with the actual transit. Therefore, the trade in the first phase was adjusted to the actual movement.

In this section, the factors and presumption of forecasting are described.

2.2.1 Factors and process

The models used to forecast international trade took into account a number separate economics factors to best reflect the impacts of future economic activity on trade demand. In the trade models for this project, a bottom-up approach was implemented for the forecasts that were then made subject to a set of imposed controls. This bottom-up approach assumes that the demand for each commodity represents a universe of individual economic decisions by companies and consumers. In this approach, differential price and production factors were taken into account as a result of a scaling process where the market shares were determined by the relative competitiveness of each exporting country for each commodity category.

For this study, the trade models cover the entire trade of the world including the intra-Less-Developed-Country trade between countries and regions. Thus there was a comprehensive amount of country detail incorporated where the total for all trading partners adds up to total world trade without double counting (by definition exports of all countries/regions to the world are exactly equal to imports of all countries/regions from the world).

In the model system, each commodity model of world trade model stands alone, defining the interrelationship between exporters and importers trading in a single commodity category. The main factor affecting future patterns of trade is the observed past pattern of traded goods in the world. The pooled cross-sectional economic model uses as a foundation the past patterns of trade as reported by official government agencies. The historical trade statistics have detail by commodity and trade partner country, covering trade by 160 countries worldwide.

Import demand equations in the model are estimated based on macroeconomic data, industry data, price data, exchange rate, and exporter performance measures – relative wages and relative rates of productivity growth. The models also take into account market size and wealth per person in each trading country. These last two factors are important because shifts in future trade may be related to market size since larger markets tend to demand more of some products. Larger markets also tend to be more competitive as foreign sellers find it less expensive to penetrate larger markets (the market potential is greater and thus the cost of entry per probable unit of sales is less). The wealth effect on trade is usually positive since wealthier markets attract more foreign suppliers. The model also captures the influence of technology investments and globalization of production.

Export supply factors included in the models of potential trade include the relative rate of expansion or contraction of production within each exporting region. The world trade models embody structural relationships for production in the exporting region, capturing shifts from differential productivity and wages across countries.

Trade-specific commodity prices are included as factors through a hybrid methodology of world commodity price statistics, currency exchange rates, and general export price indices for exporting countries and regions. The measures used in models are specific to OECD and selected emerging market countries. Import demand price forecasts are based on forecasts derived from separate inter-industry sector models and reflect the macroeconomic developments and factors specific to related industries and commodities.

To insure that the trade forecasts reflect reality and are statistically robust, an expert system of decision rules was used with the models to constrain the resulting trade flows. Limits are automatically imposed on the potential demand for trade to smooth out the peaks and troughs experienced in the forecast interval.

The models of world trade produce output first measured as the potential future value of trade, because that is basis on which consumers make their import purchasing decisions. For the analysis for this transportation study, however, the tonnage of trade shipped is required. Therefore, the tonnage of trade moving by sea, by land (railroad, truck or pipeline) or by air was estimated using a database of ton per value factors and transport mode share information. The value to ton conversion factors are derived from recent historical trade statistics that report both the value and volume of trade, by transportation mode, by trading country pairs and commodity. This data permitted the translation to be done at the detailed level of trade, using the different transportation characteristics of individual commodity groups shipped on different trade routes. The resulting sea-borne, air-borne, and overland trade tonnage forecasts reflect individual patterns of commodity and trading country transportation.

From the tonnage forecast data, the Suez Canal route potential trade was then calculated. The Suez Canal Routes and Commodity categories were mapped to the world trade forecast dimensions using detailed historical trade statistics. The Suez Potential Zones have been defined using groupings of individual countries. The Suez Canal commodity categories have been defined using underlying historic patterns of trade, collected and reported using the four-digit Standard International Trade Classification of commodities.

The detailed methods are attached in Appendix B of this ANNEX.

2.2.2 Factors and presumptions for forecast

There are several factors and presumptions that should be considered as potentially influencing the Suez Potential Trade. These may lead to situations and conditions different from those expected in the baseline forecast that would necessarily lead to different levels of potential trade in the world and through the Suez Canal.

The first presumption is the future economic growth. Table 2.2.1 shows the future regional economic growth rates used for forecasting.

Table 2.2.1 Economic Growth in future (-2020)

Zone		%/Year
01	CS. America	3.79
02	N. America	2.77
03	NW. Europe	2.39
04	W. Mediterranean	4.25
05	E. Mediterranean	2.47
06	CIS/E. Europe	4.34
07	E. Africa	4.84
08	A. Gulf	4.00
09	S. Asia	6.86
10	SE. Asia	5.57
11	Mid Asia	6.84
12	E. Asia	2.58
13	Oceania	3.60

The factors of the future change of trade pattern are the World Trade Organization (WTO) and regional world trading blocks. The member nations of the WTO agree to standard practices of trade policy with regards to other countries in exchange for favorable trading partner treatment by other country members of the organization. Many countries are eager to complete the application process and be accepted because they correctly see inclusion in the group as a way to achieve higher levels of exports and foreign sales. Successful negotiations for significant expansion of the WTO will lead to increased levels of overall world trade, as countries further specialize production to those areas where they have the greatest comparative advantage and can buy and sell more commodities internationally.

Another factor is one where instead of global trade improvement through the WTO, international trade fractures through adoption of more regional world trading blocks and bilateral trade agreements. Examples of regional trading country blocks include the European Union, Mercosur in Latin America, and NAFTA in North America. The common characteristics of trading country blocks are a decrease in tariffs and an increase in trade between the countries in the trade block or agreement. Trading blocks can also result in a reduction in trade between the countries inside the block and those countries outside the trade block. This may act to reduce the level of total world trade, as purely competitive world exporting countries may be excluded from existing markets where they were previously able to trade.

Wars, religious conflicts, regional rivalries, as well as nationalism could possibly further reduce the potential for trade growth by diverting resources and attention away from purely economic decisions that lead to growth in international trade. Conflicts such as those in the Balkans in recent years have destroyed much of the infrastructure and the economic potential that had existed ten years ago that could have led to higher trade, if not for the conflicts. Such scenarios as these events are difficult to predict, let alone measure their impact on trade. However, it can be concluded that scenarios such as these are always bad for overall global volumes of trade. There are circumstances where individual trades see increases due to disruptions in source supplies or trade routes to other regions in conflict, but these are unpredictable.

Natural disasters such as earthquakes, volcanoes, and major storms also can shift patterns of trade for significant periods of time, though traditional industry and infrastructure is usually rebuilt in the long-term in countries suffering from these disasters. From a trade impact perspective, natural disasters have a permanent impact of a loss of potential trade during the period of the disaster and the recovery from it.

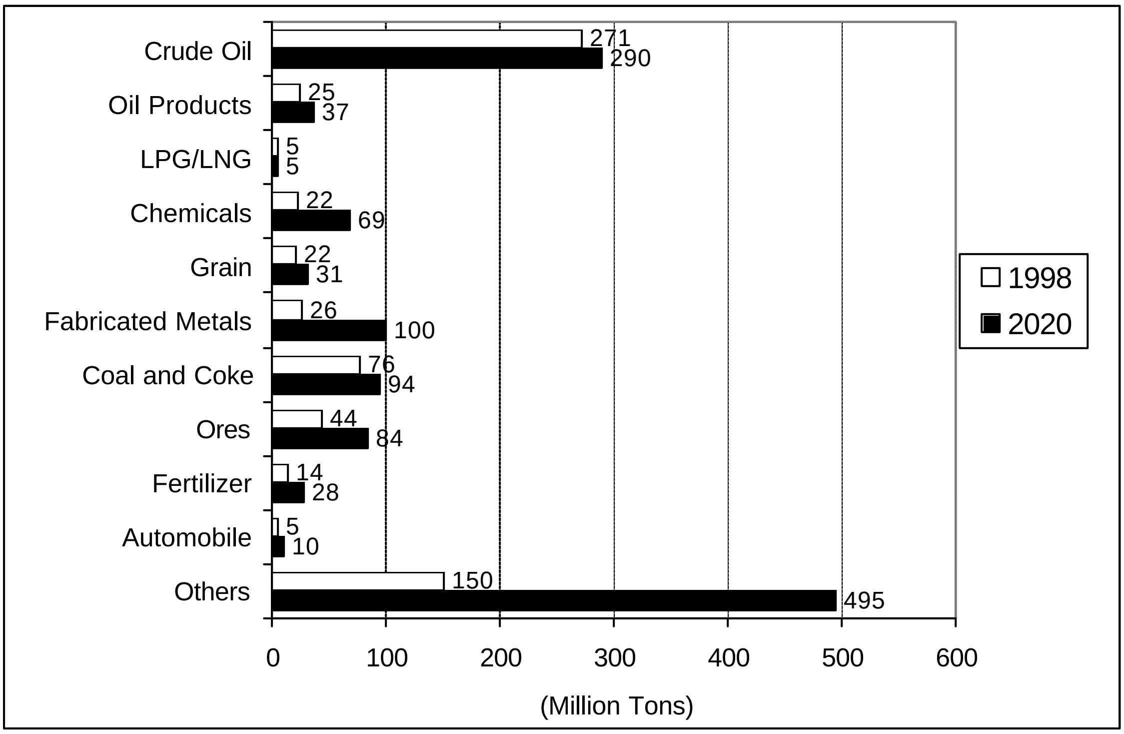
There is also a potential factor where global environmental concerns reduce the potential for trade by constraining the growth of industrial development and activity. This could take many forms, including those that would be necessary to fully implement the carbon emissions restrictions negotiated globally as part of the Kyoto accords. A strict environmental scenario would see a direct reduction in global energy commodity demand due to restrictions on energy consuming equipment. Such a scenario would also see an indirect negative impact on trade by reducing underlying economic growth that provides the demand for all international trade. This relationship was analyzed and attached in Appendix of ANNEX III.

2.3 Result of forecast

The potential trade along the Suez Potential Route was forecast by a large-scale model that is explained in Appendix B of this ANNEX.
This forecast was based on the world statistics. But the value of this model was smaller than the actual cargo that passes through the Canal. Therefore, the output of the large-scale model was revised to fit the actual movement. The followings are the result of the revised potential trade.

2.3.1 Total Trade

The total potential tonnage of trade will increase over 88 percent between 1998 and the year 2020, rising from 660 million tons to over 1,243 million tons. Among the potential commodity, "Others" (including General Cargo) is forecast to grow at a fast pace.



Source) JICA Study Team

Figure 2.3.1 Suez Potential Trade Tonnage Forecast by Commodity

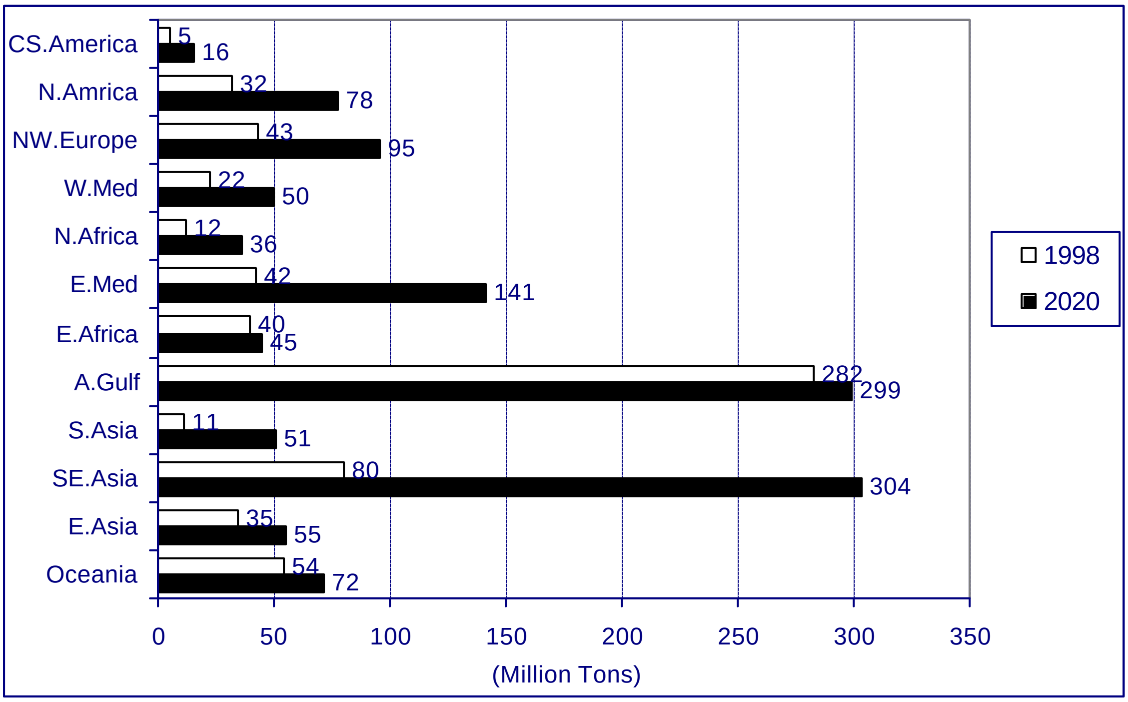
Crude oil potential for Suez Canal routes will see almost the same due to shifts in supply regions for crude in North America from South America and domestic production as well as continued imports of Eastern European crude by Western Europe and the Mediterranean.

Shifts of Western European and North and Eastern Mediterranean energy supply towards the east will also affect LNG/LPG trades as new imports to those regions will come from Eastern Europe and Russia instead of the Suez Canal route. European government energy policy will continue to be reductions in energy intensity of their economies with taxes and incentives being used to promote more efficiency in consumption of energy.

Fabricated metals will increase due to Asian exports to Europe and the Mediterranean through Suez. East Europe will also export to Asia.

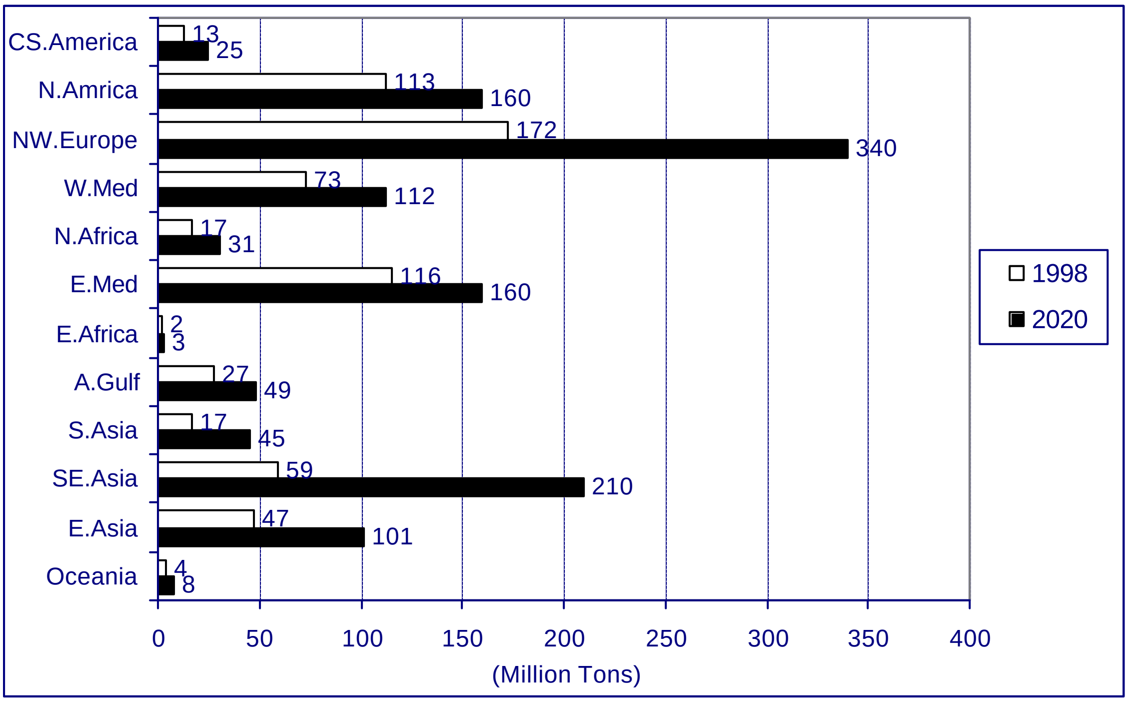
The Southeast Asian economies will continue to develop export industries that will take competitive share away from other traditional country producers, including domestic producers within Europe and the Mediterranean.

From a geographic perspective, the world trade region that is the largest source of Suez Potential Trade tonnage today is the Arabian Gulf region. By 2020, however, SE.Asia will be the largest origin of Suez Potential Trade, with Arabian Gulf falling to second.



Source) JICA Study Team

Figure 2.3.2 Suez Potential Trade Tonnage Forecast by Export Region



Source) JICA Study Team

Figure 2.3.3 Suez Potential Trade Tonnage Forecast by Import Region

The rough directional balance of tonnage observed transiting the canal in 1998 between northbound and southbound cargoes will be still be in possible in 2020, though the composition of the northbound and southbound commodity tonnage will remain quite different. The potential for substantial increases in Suez Canal tonnage exists from the underlying future demand for trade. Whether or not this potential traffic will be attracted to Canal transits will be analyzed in subsequent sections of this report.

2.3.2 O-D tables of Suez Potential Trade

Suez Potential Trades in ton by Origin-Destination and by commodity are listed from Table 2.3.1 to Table 2.3.12.

Table 2.3.1 Potential Trade in Ton (Total)

Year: 2020 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	235	162	4,204	10,981	-	15,582
	2	N.Amrica							267	8,088	8,118	46,356	14,918	-	77,747
	3	NW.Europe							241	16,390	7,742	51,044	15,548	4,319	95,283
	4	W.Med							1,027	5,874	2,772	6,198	33,387	635	49,893
	5	N.Africa							18	2,087	15,670	5,961	11,158	1,354	36,248
	6	E.Med							1,715	16,018	10,384	95,991	15,251	1,997	141,355
South the Canal	7	E.Africa	-	303	1,012	22,870	169	20,863							45,217
	8	A.Gulf	11,264	86,271	104,426	27,997	8,873	60,515							299,345
	9	S.Asia	35	8,229	22,968	4,993	1,490	13,246							50,962
	10	SE.Asia	12,748	56,844	140,725	39,872	15,906	37,690							303,785
	11	E.Asia	749	8,087	23,298	5,135	3,604	14,394							55,268
	12	Oceania	-	-	47,122	11,300	517	12,903							71,842
TOTAL			24,796	159,735	339,552	112,168	30,558	159,611	3,268	48,691	44,847	209,753	101,243	8,306	1,242,527

Year: 1998 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	74	20	1,444	3,895	-	5,433
	2	N.Amrica							126	4,498	4,348	17,053	6,277	-	32,302
	3	NW.Europe							211	10,613	3,886	17,749	8,340	2,145	42,945
	4	W.Med							787	3,708	1,184	1,954	14,135	264	22,033
	5	N.Africa							13	1,180	3,107	1,636	5,036	785	11,757
	6	E.Med							823	7,350	4,396	19,425	9,244	1,228	42,466
South the Canal	7	E.Africa	-	37	266	19,574	71	20,047							39,994
	8	A.Gulf	9,808	91,688	85,729	27,331	10,944	56,907							282,408
	9	S.Asia	16	1,573	4,599	1,294	409	3,406							11,297
	10	SE.Asia	2,343	13,909	33,552	12,696	3,035	14,528							80,063
	11	E.Asia	647	5,336	13,834	3,021	2,065	9,949							34,851
	12	Oceania	-	-	34,080	8,978	525	10,785							54,369
TOTAL			12,813	112,544	172,060	72,894	17,050	115,623	1,960	27,424	16,942	59,259	46,928	4,423	659,918

Table 2.3.2 Potential Trade in Ton (Crude Oil)

Year: 2020 (1000ton)

origin \ destination		North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	1,342	7,899	-	9,241
	2 N.Amrica							-	-	-	1	23	-	25
	3 NW.Europe							-	-	-	1,011	615	-	1,626
	4 W.Med							-	-	-	-	-	-	-
	5 N.Africa							-	-	-	220	-	-	220
	6 E.Med							-	-	0	644	1,108	-	1,752
South the Canal	7 E.Africa	-	-	-	-	-	-							-
	8 A.Gulf	7,396	78,664	99,212	24,667	6,925	55,961							272,826
	9 S.Asia	-	-	-	-	-	-							-
	10 SE.Asia	1,053	2,222	955	-	-	-							4,230
	11 E.Asia	-	-	-	-	-	-							-
	12 Oceania	-	-	52	-	-	-							52
TOTAL		8,450	80,887	100,218	24,667	6,925	55,961	-	-	0	3,219	9,645	-	289,971

Year: 1998 (1000ton)

origin \ destination		North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	595	3,241	-	3,836
	2 N.Amrica							-	-	-	2	49	-	51
	3 NW.Europe							-	-	-	1,931	1,440	-	3,371
	4 W.Med							-	-	-	-	-	-	-
	5 N.Africa							-	-	-	138	-	-	138
	6 E.Med							-	-	0	976	1,152	-	2,128
South the Canal	7 E.Africa	-	-	-	-	-	-							-
	8 A.Gulf	6,099	86,136	80,660	24,645	9,615	53,140							260,295
	9 S.Asia	-	-	-	-	-	-							-
	10 SE.Asia	306	445	176	-	-	-							927
	11 E.Asia	-	-	-	-	-	-							-
	12 Oceania	-	-	42	-	-	-							42
TOTAL		6,405	86,581	80,878	24,645	9,615	53,140	-	-	0	3,643	5,882	-	270,788

Table 2.3.3 Potential Trade in Ton (Oil Products)

Year: 2020 (1000ton)

origin \ destination			North the Canal						South the Canal						
			1	2	3	4	5	6	7	8	9	10	11	12	
			CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	TOTAL
North the Canal	1	CS.America							-	66	0	658	505	-	1,230
	2	N.Amrica							0	330	663	779	724	-	2,496
	3	NW.Europe							22	99	13	307	59	11	511
	4	W.Med							22	43	50	47	17	0	179
	5	N.Africa							-	10	4	61	492	0	567
	6	E.Med							25	66	32	1,554	275	0	1,953
South the Canal	7	E.Africa	-	-	23	-	-	-							23
	8	A.Gulf	2,582	4,144	2,587	322	10	379							10,025
	9	S.Asia	-	1	49	33	-	10							93
	10	SE.Asia	10,713	4,930	655	1,177	-	2,280							19,755
	11	E.Asia	207	106	27	7	-	151							498
	12	Oceania	-	-	1	-	0	0							1
TOTAL			13,501	9,180	3,343	1,539	10	2,822	69	614	763	3,407	2,072	12	37,332

Year: 1998 (1000ton)

origin \ destination			North the Canal						South the Canal						
			1	2	3	4	5	6	7	8	9	10	11	12	
			CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	TOTAL
North the Canal	1	CS.America							-	54	0	592	192	-	839
	2	N.Amrica							0	330	414	693	879	-	2,317
	3	NW.Europe							38	157	18	525	87	19	844
	4	W.Med							33	48	61	33	17	0	193
	5	N.Africa							-	9	3	22	486	0	520
	6	E.Med							32	23	16	1,295	620	0	1,987
South the Canal	7	E.Africa	-	-	29	-	-	-							29
	8	A.Gulf	2,209	3,423	3,320	388	9	357							9,706
	9	S.Asia	0	0	38	26	-	7							71
	10	SE.Asia	1,766	1,341	291	795	-	3,610							7,803
	11	E.Asia	252	116	63	20	-	249							701
	12	Oceania	-	-	2	-	0	0							2
TOTAL			4,227	4,881	3,743	1,229	9	4,223	104	622	513	3,160	2,281	20	25,011

Table 2.3.4 Potential Trade in Ton (LPG/LNG)

Year: 2020 (1000ton)

origin \ destination		North the Canal						South the Canal						
		1	2	3	4	5	6	7	8	9	10	11	12	
		CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	-	-	-	-
	2 N.Amrica							-	3	0	11	57	-	71
	3 NW.Europe							-	1	1	1	0	0	3
	4 W.Med							0	2	0	2	1	-	5
	5 N.Africa							-	-	-	11	48	-	59
	6 E.Med							3	0	2	0	0	0	5
South the Canal	7 E.Africa	-	-	-	-	-	-							-
	8 A.Gulf	1,266	430	143	1,421	52	1,407							4,718
	9 S.Asia	-	-	-	-	-	0							0
	10 SE.Asia	31	21	0	0	0	30							82
	11 E.Asia	0	2	0	0	-	-							2
	12 Oceania	-	-	0	4	4	7							15
TOTAL		1,297	453	143	1,425	56	1,444	3	7	3	24	107	0	4,961

Year: 1998 (1000ton)

origin \ destination		North the Canal						South the Canal						
		1	2	3	4	5	6	7	8	9	10	11	12	
		CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	-	-	-	-
	2 N.Amrica							-	5	0	11	82	-	98
	3 NW.Europe							-	2	1	1	0	0	5
	4 W.Med							0	4	0	2	1	-	8
	5 N.Africa							-	-	-	11	43	-	54
	6 E.Med							4	0	3	0	0	0	7
South the Canal	7 E.Africa	-	-	-	-	-	-							-
	8 A.Gulf	1,456	252	156	1,285	46	1,408							4,604
	9 S.Asia	-	-	-	-	-	0							0
	10 SE.Asia	28	10	0	0	0	15							53
	11 E.Asia	0	3	0	0	-	1							4
	12 Oceania	-	-	1	11	11	18							41
TOTAL		1,484	265	158	1,296	57	1,442	4	11	5	25	127	1	4,874

Table 2.3.5 Potential Trade in Ton (Chemicals)

Year: 2020 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	169	161	2,204	2,577	-	5,111
	2	N.Amrica							5	194	788	8,947	4,312	-	14,245
	3	NW.Europe							49	385	433	2,673	1,802	350	5,692
	4	W.Med							8	375	1,217	2,628	20	20	4,267
	5	N.Africa							7	394	14,458	1,542	497	42	16,940
	6	E.Med							21	243	228	2,373	392	72	3,329
South the Canal	7	E.Africa	-	-	22	20	-	0							41
	8	A.Gulf	20	1,226	707	356	324	593							3,227
	9	S.Asia	35	110	337	137	9	150							779
	10	SE.Asia	950	2,716	5,988	1,356	191	1,882							13,083
	11	E.Asia	542	637	400	428	-	132							2,140
	12	Oceania	-	-	153	-	8	76							237
TOTAL			1,548	4,690	7,607	2,298	531	2,833	90	1,760	17,286	20,366	9,599	484	69,091

Year: 1998 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	20	20	257	461	-	758
	2	N.Amrica							3	128	410	2,501	1,668	-	4,710
	3	NW.Europe							40	271	263	1,067	932	213	2,787
	4	W.Med							5	217	334	847	5	8	1,416
	5	N.Africa							4	174	2,627	383	121	16	3,325
	6	E.Med							12	106	147	383	233	65	947
South the Canal	7	E.Africa	-	-	3	3	-	0							6
	8	A.Gulf	44	920	490	209	171	563							2,397
	9	S.Asia	16	37	109	44	3	64							273
	10	SE.Asia	243	826	1,620	244	33	629							3,594
	11	E.Asia	395	648	430	401	-	146							2,019
	12	Oceania	-	-	87	-	3	63							153
TOTAL			697	2,431	2,739	901	210	1,464	65	915	3,802	5,438	3,421	301	22,385

Table 2.3.6 Potential Trade in Ton (Grain)

Year: 2020 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							-	2,618	2,324	12,899	-	-	17,841
	3	NW.Europe							-	1,495	334	829	168	0	2,827
	4	W.Med							31	724	148	281	53	-	1,238
	5	N.Africa							-	2	-	-	-	-	2
	6	E.Med							62	1,942	304	201	1,195	0	3,704
South the Canal	7	E.Africa	-	-	-	-	9	86							94
	8	A.Gulf	-	0	-	0	0	3							3
	9	S.Asia	-	113	975	98	240	420							1,845
	10	SE.Asia	-	52	1,749	113	277	690							2,881
	11	E.Asia	-	-	0	-	0	-							0
	12	Oceania	-	-	158	24	97	213							491
TOTAL			-	165	2,883	235	622	1,411	94	6,782	3,110	14,210	1,415	0	30,927

Year: 1998 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							-	1,724	1,892	7,856	-	-	11,471
	3	NW.Europe							-	1,613	521	705	441	1	3,280
	4	W.Med							66	692	230	244	138	-	1,371
	5	N.Africa							-	1	-	-	-	-	1
	6	E.Med							79	823	264	156	2,296	2	3,619
South the Canal	7	E.Africa	-	-	-	-	3	45							48
	8	A.Gulf	-	0	-	0	0	4							4
	9	S.Asia	-	50	266	20	49	208							593
	10	SE.Asia	-	35	427	30	74	221							787
	11	E.Asia	-	-	0	-	0	-							0
	12	Oceania	-	-	150	33	133	266							582
TOTAL			-	85	843	83	260	744	145	4,852	2,907	8,961	2,875	3	21,756

Table 2.3.7 Potential Trade in Ton (Fabricated Metal)

Year: 2020 (1000ton)

origin \ destination		North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	-	-	-	-
	2 N.Amrica							-	115	205	438	-	-	757
	3 NW.Europe							-	1,784	1,268	4,484	611	368	8,515
	4 W.Med							-	377	319	587	47	24	1,353
	5 N.Africa							1	19	12	77	2	-	110
	6 E.Med							292	5,324	3,687	57,001	1,502	113	67,919
South the Canal	7 E.Africa	-	-	-	-	-	4							4
	8 A.Gulf	-	13	81	49	29	266							438
	9 S.Asia	-	1,883	1,124	390	75	982							4,454
	10 SE.Asia	-	3,472	3,399	916	217	2,914							10,917
	11 E.Asia	-	-	2,505	512	180	1,481							4,679
	12 Oceania	-	-	426	34	2	168							629
TOTAL		-	5,367	7,535	1,901	503	5,815	293	7,618	5,491	62,586	2,161	506	99,776

Year: 1998 (1000ton)

origin \ destination		North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	-	-	-	-
	2 N.Amrica							-	61	68	100	-	-	229
	3 NW.Europe							-	1,046	598	1,384	250	187	3,464
	4 W.Med							-	187	129	131	17	8	471
	5 N.Africa							0	8	3	16	0	-	28
	6 E.Med							187	2,133	1,261	8,726	477	27	12,810
South the Canal	7 E.Africa	-	-	-	-	-	9							9
	8 A.Gulf	-	10	73	40	22	236							382
	9 S.Asia	-	477	335	97	18	430							1,358
	10 SE.Asia	-	1,054	1,010	323	77	1,412							3,876
	11 E.Asia	-	-	1,601	169	55	942							2,767
	12 Oceania	-	-	377	23	1	106							506
TOTAL		-	1,542	3,397	651	172	3,135	187	3,435	2,059	10,356	743	222	25,900

Table 2.3.8 Potential Trade in Ton (Coal & Coke)

Year: 2020 (1000ton)

origin \ destination			North the Canal						South the Canal						
			1	2	3	4	5	6	7	8	9	10	11	12	
			CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							-	26	2	1,027	-	-	1,055
	3	NW.Europe							-	45	2	18	25	16	106
	4	W.Med							-	-	-	-	-	-	-
	5	N.Africa							-	-	-	-	-	-	-
	6	E.Med							-	0	-	5	50	-	55
South the Canal	7	E.Africa	-	-	-	16,386	-	14,384							30,770
	8	A.Gulf	-	-	-	-	-	-							-
	9	S.Asia	-	0	11	6	-	3							20
	10	SE.Asia	-	3,564	15,887	14,003	825	5,075							39,355
	11	E.Asia	-	-	150	29	-	-							179
	12	Oceania	-	-	11,772	3,488	259	6,587							22,106
TOTAL			-	3,564	27,820	33,913	1,084	26,049	-	71	4	1,050	75	16	93,646

Year: 1998 (1000ton)

origin \ destination			North the Canal						South the Canal						
			1	2	3	4	5	6	7	8	9	10	11	12	
			CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							-	32	3	907	-	-	941
	3	NW.Europe							-	45	2	21	36	13	117
	4	W.Med							-	-	-	-	-	-	-
	5	N.Africa							-	-	-	-	-	-	-
	6	E.Med							-	0	-	1	18	-	20
South the Canal	7	E.Africa	-	-	-	16,386	-	14,384							30,770
	8	A.Gulf	-	-	-	-	-	-							-
	9	S.Asia	-	0	6	3	-	2							11
	10	SE.Asia	-	2,109	9,256	7,113	407	2,538							21,423
	11	E.Asia	-	-	144	28	-	-							172
	12	Oceania	-	-	13,180	3,932	296	5,611							23,020
TOTAL			-	2,109	22,586	27,462	703	22,535	-	77	5	929	54	13	76,474

Table 2.3.9 Potential Trade in Ton (Ores)

Year: 2020 (1000ton)

origin \ destination		North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	-	-	-	-
	2 N.Amrica							-	1	3	62	-	-	67
	3 NW.Europe							-	1,510	17	1,445	13	2	2,986
	4 W.Med							-	1	20	20	28	3	72
	5 N.Africa							-	0	-	20	-	3	23
	6 E.Med							-	14	11	3,176	352	16	3,568
South the Canal	7 E.Africa	-	-	-	2,443	-	5,349							7,792
	8 A.Gulf	-	0	189	8	-	392							589
	9 S.Asia	-	209	7,487	2,202	0	6,195							16,093
	10 SE.Asia	-	1,511	3,052	5,995	339	942							11,839
	11 E.Asia	-	-	2	0	-	0							2
	12 Oceania	-	-	28,863	7,252	2	4,754							40,871
TOTAL		-	1,721	39,594	17,899	341	17,633	-	1,526	51	4,725	393	22	83,904

Year: 1998 (1000ton)

origin \ destination		North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1 CS.America							-	-	-	-	-	-	-
	2 N.Amrica							-	1	2	41	-	-	44
	3 NW.Europe							-	1,310	7	751	10	1	2,081
	4 W.Med							-	1	12	10	17	2	43
	5 N.Africa							-	0	-	10	-	2	13
	6 E.Med							-	7	5	328	157	5	503
South the Canal	7 E.Africa	-	-	-	2,443	-	5,349							7,792
	8 A.Gulf	-	0	122	5	-	214							341
	9 S.Asia	-	55	1,323	389	0	1,323							3,090
	10 SE.Asia	-	256	576	1,543	90	249							2,714
	11 E.Asia	-	-	3	0	-	0							3
	12 Oceania	-	-	18,244	4,728	2	3,963							26,936
TOTAL		-	311	20,269	9,108	91	11,097	-	1,319	27	1,141	184	11	43,559

Table 2.3.10 Potential Trade in Ton (Fertilizer)

Year: 2020 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							-	38	1,925	1,724	-	-	3,687
	3	NW.Europe							-	154	699	1,561	206	242	2,862
	4	W.Med							9	80	62	253	67	-	471
	5	N.Africa							-	421	627	1,722	503	1,215	4,488
	6	E.Med							75	131	2,774	11,077	832	458	15,347
South the Canal	7	E.Africa	-	-	-	0	-	-							0
	8	A.Gulf	-	664	7	0	-	49							720
	9	S.Asia	-	0	13	19	1	14							48
	10	SE.Asia	-	12	11	-	13	14							50
	11	E.Asia	-	-	4	0	0	1							5
	12	Oceania	-	-	2	-	-	0							2
TOTAL			-	676	37	20	14	78	84	824	6,088	16,337	1,607	1,915	27,681

Year: 1998 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							-	11	1,032	1,038	-	-	2,080
	3	NW.Europe							-	113	265	1,082	177	240	1,877
	4	W.Med							10	44	30	95	49	-	227
	5	N.Africa							-	204	296	598	364	726	2,187
	6	E.Med							50	64	1,579	3,566	861	511	6,630
South the Canal	7	E.Africa	-	-	-	0	-	-							0
	8	A.Gulf	-	602	5	0	-	50							657
	9	S.Asia	-	0	10	15	1	4							29
	10	SE.Asia	-	4	3	-	3	3							13
	11	E.Asia	-	-	3	0	0	2							5
	12	Oceania	-	-	2	-	-	0							2
TOTAL			-	606	23	15	4	60	60	435	3,202	6,377	1,451	1,476	13,708

Table 2.3.11 Potential Trade in Ton (Automobile)

Year: 2020 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							3	404	20	166	124	-	717
	3	NW.Europe							22	636	24	918	929	353	2,882
	4	W.Med							2	74	20	53	75	61	283
	5	N.Africa							1	4	-	1	0	-	7
	6	E.Med							6	60	63	107	46	9	291
South the Canal	7	E.Africa	-	-	1	-	-	0							1
	8	A.Gulf	-	0	3	3	1	17							25
	9	S.Asia	-	0	66	15	14	45							140
	10	SE.Asia	-	2	169	12	11	60							254
	11	E.Asia	-	1,734	2,432	249	151	710							5,277
	12	Oceania	-	-	4	0	0	0							5
TOTAL			-	1,737	2,675	279	177	832	34	1,178	126	1,244	1,174	423	9,880

Year: 1998 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							3	158	4	28	48	-	241
	3	NW.Europe							22	259	8	165	357	167	978
	4	W.Med							2	20	7	7	24	17	77
	5	N.Africa							2	1	-	0	0	-	3
	6	E.Med							7	16	12	11	20	4	70
South the Canal	7	E.Africa	-	-	0	-	-	0							0
	8	A.Gulf	-	0	1	0	0	3							5
	9	S.Asia	-	0	10	3	2	8							23
	10	SE.Asia	-	0	66	4	3	31							104
	11	E.Asia	-	907	1,725	176	107	843							3,759
	12	Oceania	-	-	1	0	0	0							2
TOTAL			-	907	1,803	183	113	886	36	454	30	211	449	188	5,261

Table 2.3.12 Potential Trade in Ton (Others)

Year: 2020 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							259	4,358	2,189	20,302	9,679	-	36,787
	3	NW.Europe							147	10,282	4,951	37,796	11,121	2,976	67,273
	4	W.Med							956	4,198	936	2,328	33,080	527	42,024
	5	N.Africa							9	1,235	568	2,307	9,617	95	13,832
	6	E.Med							1,230	8,238	3,282	19,853	9,499	1,329	43,431
South the Canal	7	E.Africa	-	303	966	4,021	160	1,040							6,491
	8	A.Gulf	-	1,129	1,495	1,170	1,531	1,448							6,774
	9	S.Asia	-	5,913	12,907	2,092	1,151	5,427							27,490
	10	SE.Asia	-	38,342	108,860	16,299	14,033	23,805							201,339
	11	E.Asia	-	5,608	17,777	3,910	3,272	11,918							42,485
	12	Oceania	-	-	5,691	499	146	1,097							7,434
TOTAL			-	51,295	147,696	27,992	20,294	44,734	2,601	28,312	11,926	82,586	72,996	4,927	495,359

Year: 1998 (1000ton)

origin \ destination			North the Canal 1 CS.America	2 N.Amrica	3 NW.Europe	4 W.Med	5 N.Africa	6 E.Med	South the Canal 7 E.Africa	8 A.Gulf	9 S.Asia	10 SE.Asia	11 E.Asia	12 Oceania	TOTAL
North the Canal	1	CS.America							-	-	-	-	-	-	-
	2	N.Amrica							119	2,049	525	3,876	3,551	-	10,120
	3	NW.Europe							111	5,798	2,202	10,116	4,611	1,304	24,141
	4	W.Med							671	2,495	380	585	13,867	229	18,228
	5	N.Africa							6	783	178	458	4,021	41	5,488
	6	E.Med							452	4,179	1,107	3,982	3,409	615	13,744
South the Canal	7	E.Africa	-	37	233	741	68	260							1,340
	8	A.Gulf	-	345	900	758	1,081	932							4,016
	9	S.Asia	-	954	2,502	697	336	1,360							5,850
	10	SE.Asia	-	7,828	20,128	2,644	2,348	5,820							38,768
	11	E.Asia	-	3,661	9,863	2,227	1,903	7,766							25,421
	12	Oceania	-	-	1,995	252	80	758							3,085
TOTAL			-	12,826	35,621	7,320	5,816	16,897	1,360	15,304	4,392	19,017	29,460	2,188	150,201

Chapter 3 Forecast of Suez Potential Cargo

3.1 Suez Potential Cargo

3.1.1 Definition

Suez Potential Cargo is the sea-borne trade portion of Suez Potential Trade. Some of Suez Potential Trade use land transportation such as trains. Some use airplanes. Crude oil uses pipelines. These cargos are not Suez Potential Cargo.

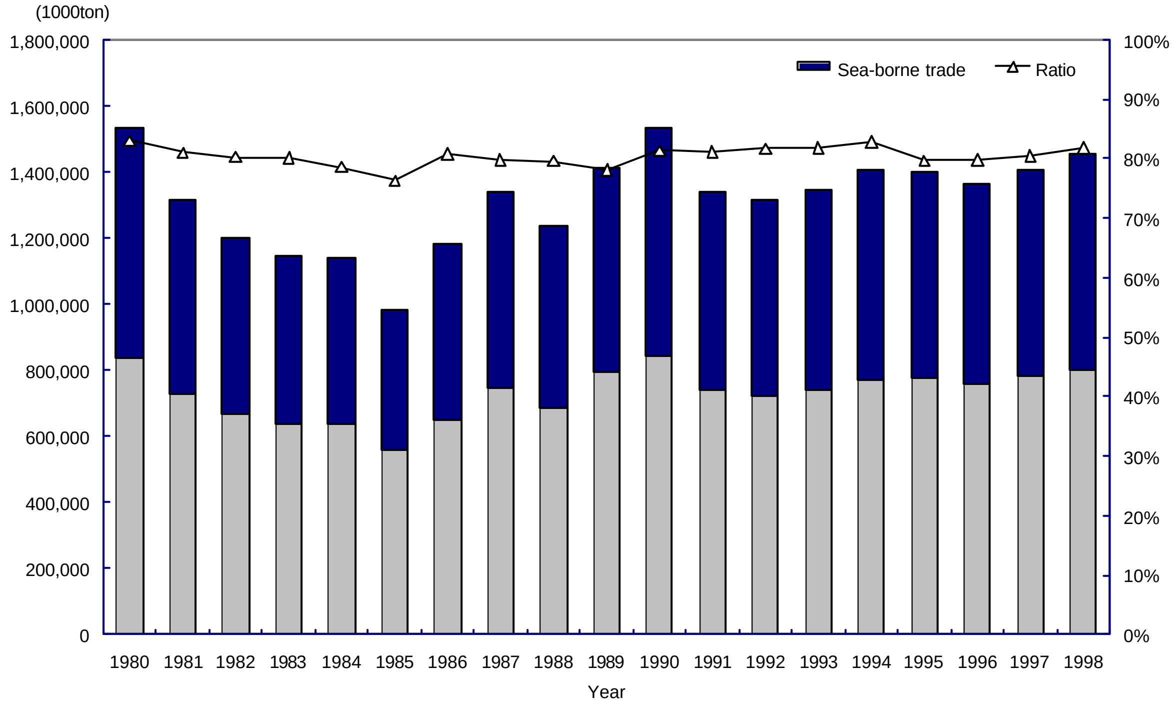
Some of the potential trade includes the cargo that will not use the Suez Canal even if that trade is sea-borne trade. One reason is the statistics. The zone for forecast is country –basis because the world trade is measured for each country in statistics. In this study, sea-borne trade to/from US West coast is deducted from US total trade. US total trade to/from Suez Potential Zone is included in Suez Potential Trade, but trade between US West coast and Suez Potential Trade is not included in Suez Potential Cargo.

In this stage of forecasting, the volume of containerized cargo is estimated. Containerized cargo is not a commodity type but a cargo type. But containerized cargo is treated as a commodity type in this report.

As the result, Suez Potential Cargo (ton) by O-D pair and commodity type is obtained in this process.

3.1.2 Potential Trade and sea-borne trade

Table 3.1.1 is the historical data of total potential trade and sea-borne trade. This sea-borne trade includes crude oil trade via SUMED pipeline. Table 3.1.1 shows the ratio of sea-borne trade sometimes fluctuated, but now looks stable.



Source) Estimated by JICA Study Team

Figure 3.1.1 Total Potential Trade and Sea-borne Trade

Table 3.1.1 Total Potential Trade and Sea-borne Trade

(1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	836,906	694,833	83.0%
1981	728,333	590,062	81.0%
1982	665,501	534,085	80.3%
1983	635,172	509,065	80.1%
1984	638,890	502,234	78.6%
1985	555,676	423,991	76.3%
1986	652,305	527,494	80.9%
1987	743,808	593,143	79.7%
1988	687,226	547,320	79.6%
1989	793,163	620,519	78.2%
1990	845,760	688,260	81.4%
1991	740,342	600,300	81.1%
1992	724,949	592,121	81.7%
1993	740,402	605,122	81.7%
1994	768,235	637,034	82.9%
1995	779,747	621,285	79.7%
1996	760,163	606,418	79.8%
1997	779,911	627,972	80.5%
1998	799,045	653,793	81.8%

Source) Estimated by JICA Study Team

Table 3.1.2 is the ratio of sea-borne trade against the potential trade by commodity. The ratios are stable for each commodity.

Table 3.1.2 Potential Trade and Sea-borne Trade by Commodity

CRUDE OIL (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	419,565	396,683	94.5%
1981	292,596	277,002	94.7%
1982	220,182	206,134	93.6%
1983	190,315	174,178	91.5%
1984	163,327	147,670	90.4%
1985	107,832	91,172	84.5%
1986	198,621	175,838	88.5%
1987	286,998	251,420	87.6%
1988	182,585	156,464	85.7%
1989	269,970	231,456	85.7%
1990	355,383	317,007	89.2%
1991	273,514	249,664	91.3%
1992	238,656	220,886	92.6%
1993	199,995	184,028	92.0%
1994	279,486	259,592	92.9%
1995	251,065	234,223	93.3%
1996	237,652	220,332	92.7%
1997	258,034	237,389	92.0%
1998	294,649	270,788	91.9%

OIL PRODUCTS (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	16,815	12,324	73.3%
1981	17,554	11,831	67.4%
1982	23,862	16,880	70.7%
1983	25,786	16,918	65.6%
1984	26,623	17,403	65.4%
1985	34,054	21,768	63.9%
1986	44,224	31,083	70.3%
1987	44,834	30,577	68.2%
1988	39,987	27,230	68.1%
1989	50,889	32,782	64.4%
1990	52,702	38,329	72.7%
1991	50,173	35,451	70.7%
1992	42,304	27,055	64.0%
1993	62,023	45,794	73.8%
1994	48,056	32,190	67.0%
1995	40,201	27,143	67.5%
1996	40,694	28,390	69.8%
1997	39,827	29,381	73.8%
1998	35,771	24,989	69.9%

LPG/LNG (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	18,307	16,042	87.6%
1981	11,722	8,841	75.4%
1982	11,331	9,525	84.1%
1983	19,642	17,243	87.8%
1984	14,945	13,431	89.9%
1985	14,159	12,768	90.2%
1986	12,893	11,606	90.0%
1987	17,092	15,997	93.6%
1988	20,317	18,948	93.3%
1989	19,873	18,616	93.7%
1990	18,118	16,594	91.6%
1991	6,575	4,150	63.1%
1992	3,956	2,984	75.4%
1993	6,148	5,190	84.4%
1994	6,138	4,990	81.3%
1995	5,655	4,471	79.1%
1996	6,198	5,042	81.4%
1997	5,486	4,450	81.1%
1998	6,044	4,868	80.5%

CHEMICALS (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	13,486	9,753	72.3%
1981	12,960	9,503	73.3%
1982	16,300	12,544	77.0%
1983	14,793	11,519	77.9%
1984	15,273	11,690	76.5%
1985	15,259	12,015	78.7%
1986	19,344	14,265	73.7%
1987	27,919	19,612	70.2%
1988	28,191	23,150	82.1%
1989	23,875	17,955	75.2%
1990	19,915	14,713	73.9%
1991	19,772	15,017	75.9%
1992	19,977	15,151	75.8%
1993	43,793	27,970	63.9%
1994	26,183	20,571	78.6%
1995	27,412	20,820	76.0%
1996	26,508	20,518	77.4%
1997	26,867	20,634	76.8%
1998	25,633	19,459	75.9%

GRAIN (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	83,195	55,284	66.5%
1981	90,194	61,218	67.9%
1982	86,443	61,284	70.9%
1983	80,576	55,336	68.7%
1984	85,786	61,095	71.2%
1985	62,596	44,232	70.7%
1986	54,902	39,590	72.1%
1987	55,046	38,138	69.3%
1988	72,094	50,663	70.3%
1989	86,457	61,748	71.4%
1990	63,786	43,701	68.5%
1991	59,117	42,344	71.6%
1992	63,556	43,762	68.9%
1993	71,295	53,625	75.2%
1994	53,906	37,697	69.9%
1995	80,389	55,042	68.5%
1996	68,369	46,317	67.7%
1997	59,827	40,510	67.7%
1998	57,367	40,127	69.9%

FABRICATED METAL (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	45,100	30,735	68.1%
1981	53,940	36,181	67.1%
1982	54,002	38,600	71.5%
1983	39,635	28,693	72.4%
1984	50,916	34,568	67.9%
1985	49,228	35,140	71.4%
1986	28,894	21,972	76.0%
1987	25,713	19,489	75.8%
1988	28,886	22,821	79.0%
1989	29,887	23,748	79.5%
1990	27,034	21,464	79.4%
1991	25,428	20,589	81.0%
1992	27,620	23,553	85.3%
1993	41,269	38,290	92.8%
1994	44,579	41,099	92.2%
1995	36,232	32,291	89.1%
1996	42,663	39,692	93.0%
1997	37,675	34,516	91.6%
1998	37,286	30,725	82.4%

Source) Estimated by JICA Study Team

Table 3.1.2 Potential Trade and Sea-borne Trade by Commodity (continued)

COAL&COKE (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	50,335	33,570	66.7%
1981	57,868	38,956	67.3%
1982	55,711	37,957	68.1%
1983	47,614	35,655	74.9%
1984	48,385	37,917	78.4%
1985	47,939	37,970	79.2%
1986	50,522	41,879	82.9%
1987	50,573	42,241	83.5%
1988	53,682	44,111	82.2%
1989	49,671	40,223	81.0%
1990	52,851	43,444	82.2%
1991	57,977	48,993	84.5%
1992	61,803	53,040	85.8%
1993	54,246	46,388	85.5%
1994	58,519	51,360	87.8%
1995	44,562	44,033	98.8%
1996	40,807	40,030	98.1%
1997	47,166	46,330	98.2%
1998	64,186	58,282	90.8%

ORES (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	31,013	30,606	98.7%
1981	34,511	34,084	98.8%
1982	39,983	39,666	99.2%
1983	43,334	43,145	99.6%
1984	40,934	40,747	99.5%
1985	43,317	43,069	99.4%
1986	52,707	52,377	99.4%
1987	45,712	45,412	99.3%
1988	61,606	61,060	99.1%
1989	39,617	38,857	98.1%
1990	38,801	38,094	98.2%
1991	42,186	41,064	97.3%
1992	46,583	44,500	95.5%
1993	40,025	38,257	95.6%
1994	36,153	35,262	97.5%
1995	66,318	43,406	65.5%
1996	58,959	38,248	64.9%
1997	59,449	41,782	70.3%
1998	36,726	35,949	97.9%

FERTILIZER (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	13,555	9,143	67.5%
1981	11,636	8,195	70.4%
1982	9,821	6,328	64.4%
1983	9,710	6,393	65.8%
1984	15,065	9,506	63.1%
1985	14,509	9,229	63.6%
1986	10,793	7,155	66.3%
1987	11,657	7,129	61.2%
1988	18,389	12,513	68.0%
1989	20,138	13,419	66.6%
1990	20,892	14,343	68.7%
1991	24,067	15,374	63.9%
1992	25,216	18,067	71.7%
1993	18,869	14,477	76.7%
1994	24,860	17,581	70.7%
1995	30,888	23,439	75.9%
1996	29,287	22,886	78.1%
1997	29,063	21,727	74.8%
1998	26,672	17,598	66.0%

AUTOMOBILE (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	11,835	6,876	58.1%
1981	11,453	6,789	59.3%
1982	12,001	6,955	58.0%
1983	12,083	6,893	57.0%
1984	13,714	7,469	54.5%
1985	15,611	8,196	52.5%
1986	12,134	6,553	54.0%
1987	9,983	5,674	56.8%
1988	9,012	5,515	61.2%
1989	9,419	5,848	62.1%
1990	9,775	6,137	62.8%
1991	8,842	5,792	65.5%
1992	8,006	5,429	67.8%
1993	6,564	4,436	67.6%
1994	5,790	3,766	65.1%
1995	5,582	3,857	69.1%
1996	5,784	4,196	72.5%
1997	6,710	4,884	72.8%
1998	6,879	5,045	73.3%

OTHER CARGO (1000 ton)

Year	Potential trade	Sea-borne trade	Ratio
1980	133,700	93,817	70.2%
1981	133,900	97,461	72.8%
1982	135,865	98,212	72.3%
1983	151,685	113,093	74.6%
1984	163,920	120,739	73.7%
1985	151,172	108,431	71.7%
1986	167,272	125,175	74.8%
1987	168,282	117,454	69.8%
1988	172,479	124,844	72.4%
1989	193,367	135,867	70.3%
1990	186,503	134,434	72.1%
1991	172,691	121,861	70.6%
1992	187,272	137,694	73.5%
1993	196,175	146,667	74.8%
1994	184,566	132,927	72.0%
1995	191,442	132,560	69.2%
1996	203,243	140,766	69.3%
1997	209,806	146,369	69.8%
1998	207,831	145,963	70.2%

Source) Estimated by JICA Study Team

3.2 Method of forecast

3.2.1 Factors and process

The sea-borne forecast model has two purposes. One is the subtraction of Suez Potential Cargo from Suez Potential Trade. Another is the estimation of the volume of containerized cargo.

The modal choice is, in general, based on the availability of modes, transport cost, and levels of services. Sea-borne trade is the result after shippers consider these factors. In this study, the sea-borne ratio is used to estimate the future sea-borne-trade. The sea-borne ratio is a parameter that means the result of these considerations. In other saying, the sea-borne ration is an aggregated parameter of many factors.

Containerization is expressed as a containerization ratio. This ratio depends on the type of commodity and the O-D pair the cargo is transported to/from.

The basic processes of forecasting Suez Potential Cargo are in Figure 3.2.1. The input of this procedure is the Suez Potential Trade that was calculates in Chapter2.

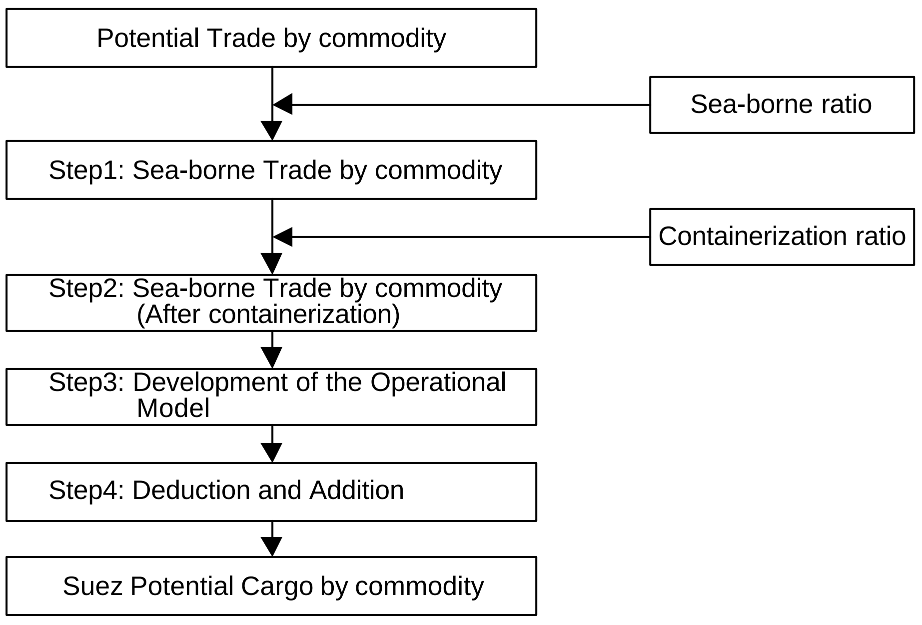


Figure 3.2.1 Flowchart of Forecasting Suez Potential Cargo

Step1 of the procedure is the calculation of sea-borne trade. It is calculated by the multiplication of the Potential Trade and sea-borne ratio by commodity and O-D pair.

Step2 is containerization. The volume of containerized cargo is the sum of all containerized cargo of each commodity type. The sea-borne tonnage portion of world trade includes containerized cargo. In order to forecast the future potential containerized tonnage for the Suez Canal on a comparable basis, commodity group disaggregated sea-borne tonnage into containerized and non-containerized tonnage. Therefore, sea-borne containerized potential trade tonnage for Suez Canal was measured for each commodity category, for each trade route. The remainder of Suez Canal sea-borne trade tonnage is termed the non-containerized tons. Finally, the containerized tons were aggregated with non-containerized tons to yield total sea-borne Suez Canal tons.

Step3 is the development of the forecasting model. The first step of forecasting Transit was the forecast of Suez Potential Trade, which involved two problems.

The first one was the difficulty of the operation of the model. Suez Potential Trade was forecast from a large-scale model. This model is too complex to use for easy forecasting. The second problem was the inconsistency of the actual Suez Transits. A large-scale model was developed based on world statistics. But the estimation of the present cargo volume under the large-scale model was not equal to the actual Suez cargo volume.

Therefore, a model called “the Operational Forecasting Model” was developed to forecast Suez Potential Cargo.

Step4 is the deduction and the addition of some cargo volume from/to the output of the forecast model. These cargoes are pipeline crude and containerized cargo.

The example is the containerized cargo between US East coast and East Asia. Most of this cargo doesn’t use the Suez Canal because few container routes are established. This cargo is, in a sense, potential cargo of the Suez Canal because the Panama Canal has a physical constraint. This cargo was considered here as an input of the next process, a route choice model.

Crude oil by pipelines was excluded in this step. Crude oil by pipeline was treated as sea-born trade at first because major transportation mode was ship. However, this cargo was not sea-borne trade for the Suez Canal.

3.2.2 Scenario and parameter settings

(1) Sea-borne ratio

As seen in Figure 3.1.1, the sea-borne ratio is stable for recent years. There will be no drastic change in transportation mode in the next 20 years. Therefore the trends of sea-borne ratio for recent years are used for forecasting sea-borne trade.

(2) Containerization

Containerization is still a boom in the world sea-borne trade. Containerization of the cargo through the Suez Canal has already reached high level, but this trend will continue.
Table 3.2.1 is the historical data on the containerization ratio of Suez Potential Cargo. As seen in this Table, there is still trend in containerization of "Others" that include General Cargo.

The containerization in major containership routes, Asia-Europe/Mediterranean and Asia-N.America. is progressing. Deep-water container ports are being developed and will be more developed in the future.
Even in other regions where containerization is at a low level will make a big progress in containerization.

Containerization is not limited to general cargo. Any type of commodity can be containerized. Tank containers for liquid cargo and open-top containers for bulk cargo have been developed and are now used. But the use of these types of containers is limited now, especially limited to short distance voyages. The containerization of this type will not be expected to grow rapidly for the cargo through the Suez Canal in next 20 years.

The process and parameters were set based on the above scenarios. The process has two steps.
Step1 is to estimate containerized cargo from the trends of containerization through the Canal. Each commodity has its containerization ratio, and this ratio is multiplied to the volume of each commodity.
Step2 is additional containerization. "Others" including General Cargo will be containerized with high ratio. Most of General Cargo will be containerized between Europe/Mediterranean/N.America and SE.Asia/E.Asia. Therefore, containerization ratio of "Others" on General Cargo Carrier along this lane is set high. This step was performed after the cargo was allocated to each type of vessel in Chpter4. But the result of forecast is listed in this chapter.
The cargo volumes after Step1 and Step 2 are the same, except "Others" and Containerized Cargo.

Table 3.2.1 Containerization Ratio

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Crude Oil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oil Products	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
LPG/LNG	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Chemicals	16.1%	14.2%	13.9%	13.8%	14.2%	15.1%	20.6%	27.1%	17.5%	16.6%	17.1%	14.9%	15.4%	33.3%	16.2%	17.0%	17.2%	17.4%	18.7%
Grain	0.7%	0.8%	0.9%	0.8%	0.9%	0.9%	1.0%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	1.2%	0.9%	0.9%	0.9%	0.9%	1.0%
Fabricated Metal	10.2%	10.3%	10.7%	10.9%	10.6%	11.0%	11.5%	11.6%	11.9%	12.1%	12.2%	12.4%	12.8%	13.3%	13.4%	13.4%	13.7%	13.7%	13.3%
Coal & Coke	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Ores	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Fertilizer	4.2%	4.2%	4.8%	4.5%	4.4%	4.7%	5.3%	5.6%	6.7%	6.6%	6.4%	6.4%	6.4%	7.3%	6.8%	5.7%	6.1%	7.2%	6.6%
Automobile	15.7%	15.9%	16.0%	16.1%	16.2%	16.3%	16.5%	16.7%	17.0%	17.2%	17.3%	17.6%	17.8%	18.0%	18.0%	18.3%	18.5%	18.7%	18.9%
Others	59.4%	57.6%	59.7%	50.9%	54.1%	59.0%	49.7%	60.5%	58.1%	55.9%	56.6%	57.3%	56.5%	55.2%	58.1%	57.9%	60.3%	59.6%	62.0%
TOTAL	9.0%	10.7%	12.5%	12.6%	14.5%	17.0%	13.2%	13.6%	14.9%	13.6%	12.2%	12.9%	14.5%	16.2%	13.9%	14.0%	15.9%	15.7%	15.4%

Source) Estimated by JICA Study Team

(3) Pipelines

Competitive Crude Oil pipelines in operation are only SUMED line and Iraq-Turkey line. But pipelines are strong competitors to the Suez Canal. The possibility for the use of the pipelines will be determined by political decision.

Cost of pipeline transport is very competitive to Tanker. Therefore, it is expected that pipelines will be maximally used. This means that the volume of the crude oil equal to the capacity of the pipeline will be subtracted from the potential trade of the Suez Canal.

The future prospects for the operation of pipelines are unclear because it is a political matter. In this study it is presumed that pipelines other than SUMED and Iraq-Turkey pipeline will not be operated because these pipelines have been closed for many years. Iraq-Turkey line may increase its transmitting volume if the UN sanctions against Iraq ends. But the future of this line will be almost the same because no future plan has been developed to increase its transmitting volume.

In conclusion, it is presumed in forecasting that 120 mil tons will use the SUMED line and 30mil tons will use the Iraq-Turkey line in the future. The uses of other lines are not included in the forecast.

In the calculation program, the volume through the pipelines is just subtracted from the potential volume of crude oil. The volume subtracted is flexible to the changes in the future scenario.

(4) Possible routes

1) Container between Asia –East Coast of N.America

Container trades between East Coast and SE. & E. Asia are potential trades of the Suez Canal as long as the possible routes are limited to the Suez route and the Cape route. But if the Panama Canal is considered, the route between East Coast and E.Asia will be the potential route of the Panama Canal.
Most actual trades between East Coast and Asia use the land-bridges, and some are sea-borne trades. Most sea-borne container routes are crossing through the Panama Canal in spite of the fact that the Panama Canal has a physical constraint. Containership has to call on many ports during its voyage. It unloads and loads containers at each port. In general, enough local demand at each calling port is necessary for routing.
Singapore is in a profitable position for the Suez Canal, but container demand is located east of Singapore. Therefore the cargo between US East Coast and Singapore prefers to move across the Pacific and the Panama Canal at present.

However, routes from Asia to East Coast across the Atlantic are becoming popular, and in the future these routes may grow. It is still uncertain that this route becomes the major route
Therefore in this study, a half of the future container trades between East Coast and E./SE.

Asia were presumed to use the Suez Canal.

Table 3.2.2 Distance via Suez and via Panama for Containership

(miles)

Route			via Suez	via Panama
E.Asia (Pusan)	–	N.America (New York)	12,719	10,085
SE.Asia (Singapore)	–	N.America (New York)	10,216	11,368

2) Bulk Carrier via the Panama Canal

The distances between Asia and America/Europe are in Table 3.2.3. As seen in this table, the Panama Canal is favorable to a voyage between East Asia and America.
Bulk cargo is carried on large bulk carriers over Panamax size. Therefore, bulk cargo along this route was not treated as Panama Potential Cargo. Other cargos are, in general, carried on smaller vessels. They can pass through the Panama Canal.

Table 3.2.3 Distance via Suez and via Panama for Bulk Carrier

(miles)

Route			via Suez	via Panama
E.Asia (Pusan)	–	N.America (New Orleans)	14,000	9,516
E.Asia (Pusan)	–	CS.America (Santos)	13,807	12,546
E.Asia (Pusan)	–	NW. Europe (Rotterdam)	10,791	12,914
SE.Asia (Singapore)	–	N.America (New Orleans)	11,467	11,937
SE.Asia (Singapore)	–	CS.America (Santos)	11,304	11,967
SE.Asia (Singapore)	–	NW. Europe (Rotterdam)	8,288	15,335

3.3 Forecast Model of Suez Potential Cargo

3.3.1 Purpose of the operational forecast model

Trade is the result of imbalances between demands and supplies of commodities to/from regions. There are many factors that will determine supplies from a region. The availability of labor, machinery, resources, and technology are examples. Demand also has many factors such as the necessity of commodities that are used for production and consumption in a region. Price of commodity is an important factor of trade, but the actual price in the market is the result of the balance of trading.

The trade forecast model used in Chapter 2 has many variables such as prices, population, growth rate for each country. These variables produce thousands of equations. This large-scale model is preferred to forecast detail changes in the socio-economic condition of each country. However, the handling of the large-scale model is very difficult. Continuous data collection and model correction are necessary to maintain the model.

The operational forecast model was developed for easy operation. Users can estimate future demand by inputting values of a socio-economic parameter in the model when the socio-economic condition changes.

3.3.2 Structure of the model

This model consists of the following 4 steps.

1st step is the forecast of the total import of Suez Potential Cargo (=total export) .
2nd step is the forecast of the import of Suez Potential Cargo to each zone.
3rd step is the forecast of the export of Suez Potential Cargo from each zone.
4th step is the forecast of Suez Potential Cargo between zones.

The 1st step uses the elasticity of the growth of demand (import) against the economic growth rate. The 2nd step uses the present patterns of import to each zone and the economic growth of each zone. The 3rd step uses the present pattern of export from each zone. In both the 2nd and 3rd steps, scenarios of the future movement of cargo are considered and are reflected in the parameters. Frator Method, which is commonly used in transport demand forecasting, is employed in the 4th step.

Suez Potential Cargo is the possible sea-borne cargo of the Suez Canal. The pipeline Crude Oil and a portion of Containerized Cargo between Asia and N.America were excluded from Suez Potential Cargo.

However, in the operational forecast model, forecast the potential cargo includes these cargoes such as pipeline oil. However that these cargos should be subtracted after the total cargo volume is forecast.

Figure 3.3.1 is the flowchart of this model.

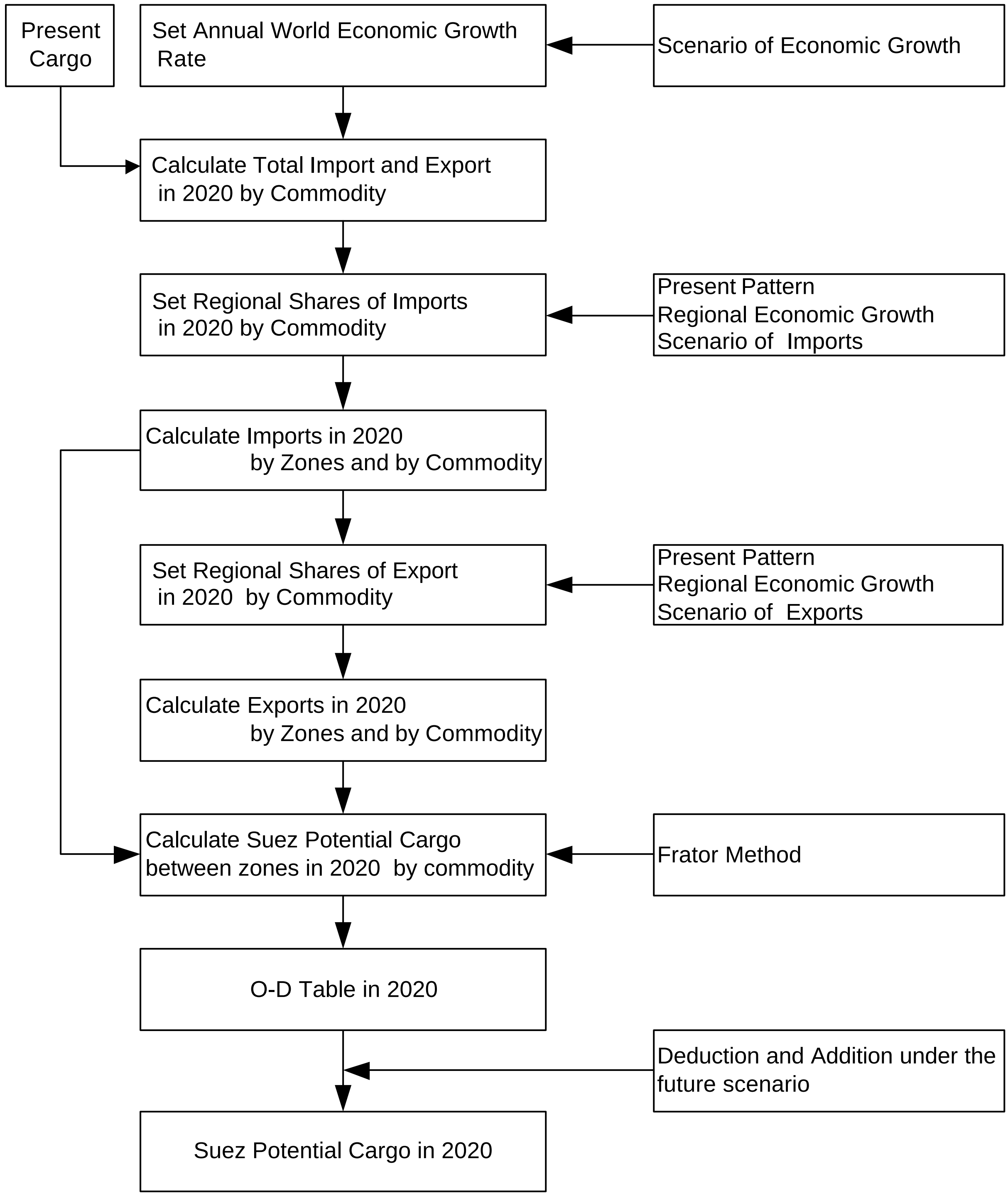


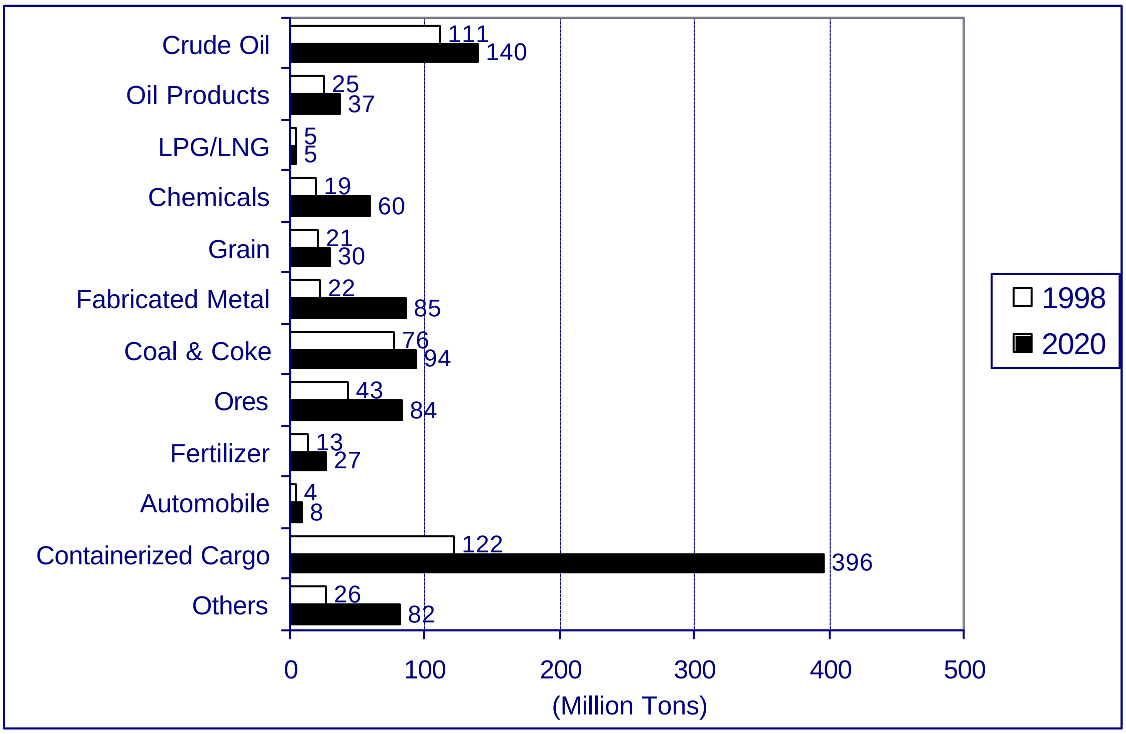
Figure 3.3.1 Flowchart of Suez Potential Cargo Forecasting

3.4 Result of forecast

3.4.1 Total Cargo

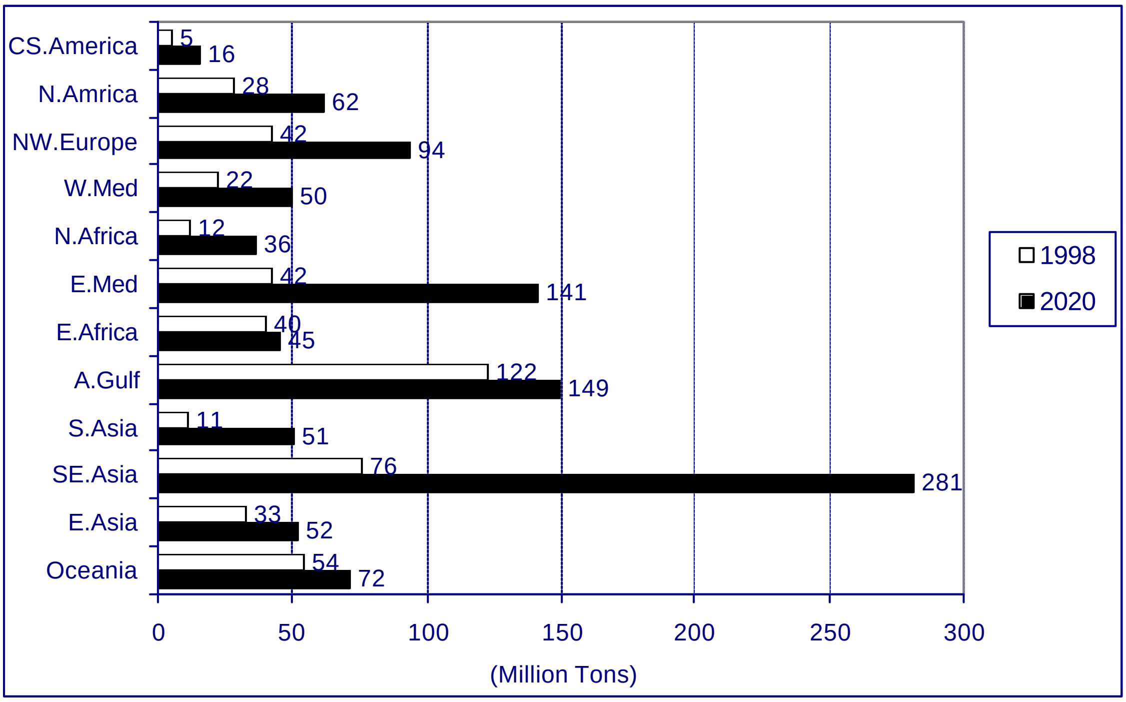
Figure 3.4.1 is the volume of Suez Potential Cargo in 2020 and 1998.
Containerized Cargo will rapidly increase in the next 20 years. The major source of increase will be the trade from SE.Asia.

Industrialization in SE.Asia will have a big impact on Suez Potential Cargo.
The volume of Crude Oil and LPG/LNG will stay at their present levels, and they will have much smaller shares in the total volume.



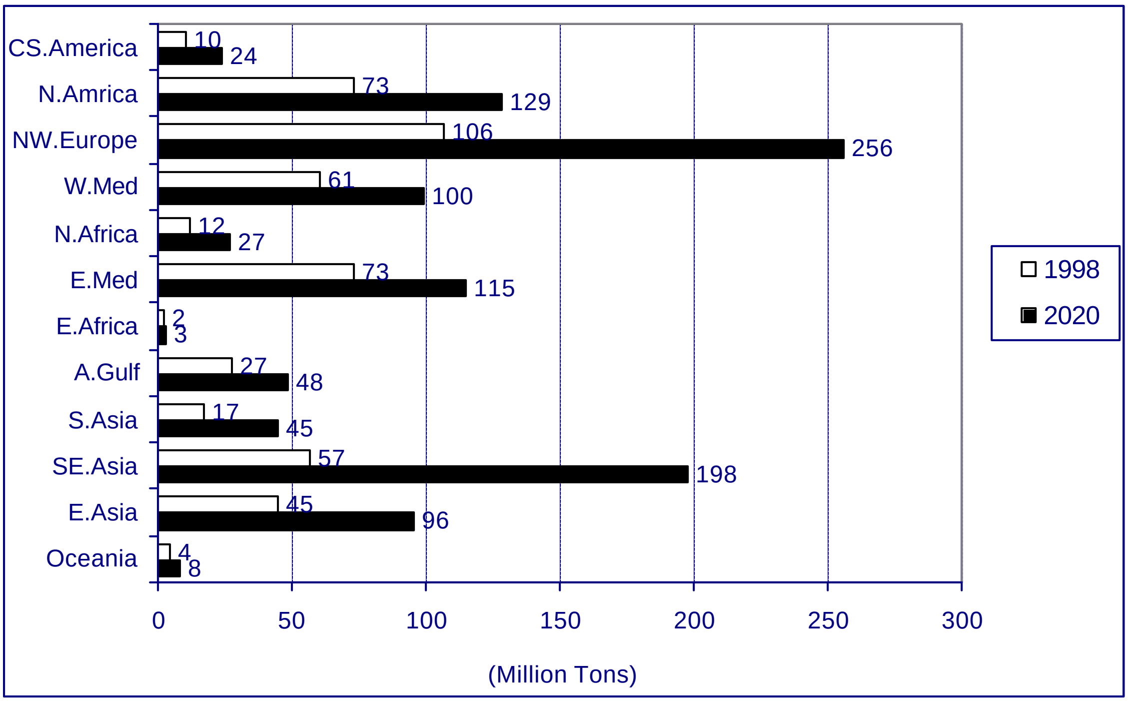
Source) Estimated by JICA Study Team

Figure 3.4.1 Suez Potential Cargo Forecast by Commodity



Source) Estimated by JICA Study Team

Figure 3.4.2 Suez Potential Cargo Forecast by Export Zone



Source) Estimated by JICA Study Team

Figure 3.4.3 Suez Potential Cargo Forecast by Import Zone

3.4.2 O-D tables of Suez Potential Trade

Suez Potential Cargo by Origin-Destination and by commodity is listed from Table 3.4.1 to Table 3.4.13

Table 3.4.1 Suez Potential Cargo (Total, 2020)

All Commodity (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America								235	162	4,202	10,980		15,579
N.America							264	8,029	8,084	35,261	10,014		61,652
NW.Europe							238	16,195	7,675	50,176	15,329	4,241	93,854
W.Med							1,023	5,849	2,759	6,181	33,244	632	49,688
N.Africa							18	2,071	15,635	5,930	11,046	1,353	36,053
E.Med							1,701	15,985	10,374	95,894	15,243	1,988	141,184
E.Africa		300	1,002	22,826	167	20,861							45,156
A.Gulf	10,398	77,051	25,037	15,662	5,391	15,744							149,284
S.Asia	35	8,150	22,736	4,982	1,475	13,236							50,615
SE.Asia	12,747	37,980	137,720	39,705	15,741	37,596							281,490
E.Asia	749	5,247	22,677	5,107	3,565	14,326							51,670
Oceania			46,939	11,297	515	12,899							71,650
Total	23,929	128,727	256,111	99,579	26,855	114,662	3,244	48,364	44,689	197,645	95,856	8,212	1,047,874
												Actual Suez Transit Cargo in 1999	306,571

Table 3.4.2 Suez Potential Cargo (Crude Oil, 2020)

Crude Oil (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America										1,342	7,899		9,241
N.America										1	23		25
NW.Europe										1,011	615		1,626
W.Med													
N.Africa										220			220
E.Med									0	644	1,108		1,752
E.Africa													
A.Gulf	6,531	69,464	19,842	12,333	3,463	11,192							122,825
S.Asia													
SE.Asia	1,053	2,222	955										4,230
E.Asia													
Oceania			52										52
Total	7,585	71,686	20,848	12,333	3,463	11,192			0	3,219	9,645		139,971
												Actual Suez Transit Cargo in 1999	9,599

Table 3.4.3 Suez Potential Cargo (Oil Products, 2020)

Oil Products (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America								66	0	658	505		1,230
N.America							0	329	662	777	723		2,491
NW.Europe							22	98	13	307	59	11	511
W.Med							22	43	50	47	17	0	179
N.Africa								10	4	61	491	0	566
E.Med							14	66	32	1,554	275	0	1,941
E.Africa			23										23
A.Gulf	2,581	4,135	2,587	322	10	379							10,015
S.Asia		1	49	33		10							93
SE.Asia	10,713	4,919	652	1,173		2,271							19,728
E.Asia	207	106	27	7		151							498
Oceania			1		0	0							1
Total	13,501	9,159	3,340	1,535	10	2,812	58	613	761	3,405	2,070	12	37,275
										Actual Suez Transit Cargo in 1999			10,005

Table 3.4.4 Suez Potential Cargo (LPG/LNG, 2020)

LNG/LPG (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America								3	0	10	57		71
NW.Europe								1	1	1	0	0	3
W.Med							0	2	0	2	1		5
N.Africa										10	47		57
E.Med							3	0	2	0	0	0	5
E.Africa													
A.Gulf	1,266	418	143	1,418	51	1,404							4,699
S.Asia						0							0
SE.Asia	31	20	0	0	0	30							81
E.Asia	0	2	0	0									2
Oceania			0	4	4	7							15
Total	1,297	441	143	1,422	54	1,441	3	7	3	23	105	0	4,939
										Actual Suez Transit Cargo in 1999			3,920

Table 3.4.5 Suez Potential Cargo (Chemical, 2020)

Chemicals (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America								169	161	2,203	2,576		5,108
N.America							4	153	623	7,071	4,303		12,154
NW.Europe							38	257	345	1,956	1,350	263	4,210
W.Med							6	326	1,093	2,315	16	17	3,774
N.Africa							7	312	14,430	1,219	393	41	16,402
E.Med							19	218	205	2,014	336	64	2,855
E.Africa			18	15		0							34
A.Gulf	20	969	568	236	256	320							2,368
S.Asia	35	87	273	113	7	123							639
SE.Asia	950	2,147	4,588	1,081	151	1,472							10,388
E.Asia	542	636	331	342		108							1,959
Oceania			113		8	41							162
Total	1,547	3,839	5,891	1,787	422	2,065	74	1,434	16,857	16,778	8,974	386	60,053
										Actual Suez Transit Cargo in 1999			17,496

Table 3.4.6 Suez Potential Cargo (Grain, 2020)

Grain (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America								2,567	2,279	12,650			17,496
NW.Europe								1,471	329	814	165	0	2,779
W.Med							31	713	145	276	52		1,216
N.Africa								2					2
E.Med							61	1,912	298	197	1,176	0	3,644
E.Africa					9	84							93
A.Gulf		0		0	0	3							3
S.Asia		111	957	96	235	413							1,812
SE.Asia		51	1,713	111	271	678							2,825
E.Asia			0		0								0
Oceania			154	23	97	209							483
Total		162	2,825	231	612	1,387	92	6,665	3,051	13,937	1,393	0	30,354
										Actual Suez Transit Cargo in 1999			22,253

Table 3.4.7 Suez Potential Cargo (Fabricated Metal, 2020)

Fabricated Metal (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America								98	174	373			644
NW.Europe								1,515	1,076	3,776	514	311	7,192
W.Med								322	272	500	40	21	1,154
N.Africa							1	16	10	65	2		94
E.Med							251	4,563	3,159	48,848	1,287	97	58,204
E.Africa						3							3
A.Gulf		11	70	42	25	228							375
S.Asia		1,602	958	334	64	841							3,800
SE.Asia		2,954	2,903	783	185	2,497							9,323
E.Asia			2,131	437	153	1,267							3,989
Oceania			363	29	2	144							537
Total		4,567	6,425	1,625	428	4,981	251	6,512	4,692	53,562	1,842	429	85,314
										Actual Suez Transit Cargo in 1999			23,108

Table 3.4.8 Suez Potential Cargo (Coal & Coke, 2020)

Coal & Coke (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America								26	2	1,027			1,055
NW.Europe								45	2	18	25	16	106
W.Med													
N.Africa													
E.Med								0		5	50		55
E.Africa				16,385		14,382							30,767
A.Gulf													
S.Asia		0	11	6		3							20
SE.Asia		3,564	15,886	14,003	825	5,075							39,353
E.Asia			150	29									179
Oceania			11,770	3,488	259	6,586							22,103
Total		3,564	27,817	33,911	1,084	26,046		71	4	1,049	75	16	93,637
										Actual Suez Transit Cargo in 1999			24,243

Table 3.4.9 Suez Potential Cargo (Ore, 2020)

Ore (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America								1	3	62			67
NW.Europe								1,505	17	1,441	13	2	2,977
W.Med								1	20	20	28	3	72
N.Africa								0		20		3	23
E.Med								14	11	3,167	350	16	3,557
E.Africa				2,435		5,331							7,766
A.Gulf		0	188	8		391							587
S.Asia		209	7,464	2,195	0	6,177							16,044
SE.Asia		1,506	3,043	5,977	338	939							11,803
E.Asia			2	0		0							2
Oceania			28,766	7,230	2	4,740							40,737
Total		1,715	39,463	17,844	340	17,578		1,521	51	4,710	392	22	83,636
										Actual Suez Transit Cargo in 1999			17,042

Table 3.4.10 Suez Potential Cargo (Fertilizer, 2020)

Fertilizers (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America								36	1,800	1,611			3,447
NW.Europe								149	678	1,514	199	235	2,775
W.Med							9	78	53	246	52		437
N.Africa								394	586	1,610	470	1,215	4,275
E.Med							73	127	2,682	10,752	807	442	14,882
E.Africa				0									0
A.Gulf		621	7	0		45							674
S.Asia		0	13	16	1	14							44
SE.Asia		11	11		12	14							47
E.Asia			4	0	0	1							5
Oceania			2			0							2
Total		632	36	17	13	74	81	784	5,800	15,732	1,528	1,891	26,588
										Actual Suez Transit Cargo in 1999			18,920

Table 3.4.11 Suez Potential Cargo (Automobile, 2020)

Automobile (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America							3	325	16	134	124		600
NW.Europe							18	511	19	737	746	284	2,314
W.Med							1	59	16	42	60	49	228
N.Africa							1	3		0	0		6
E.Med							5	48	51	86	37	7	234
E.Africa			1			0							1
A.Gulf		0	3	3	1	13							20
S.Asia		0	53	12	11	36							112
SE.Asia		2	136	10	9	48							204
E.Asia		1,731	1,954	200	122	571							4,579
Oceania			3	0	0	0							4
Total		1,734	2,150	224	143	669	28	947	102	999	967	340	8,302
												Actual Suez Transit Cargo in 1999	3,942

Table 3.4.12 Suez Potential Cargo (Containerized Cargo, 2020)

Containerized Cargo (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America							252	2,735	2,323	10,808	4,784		20,902
NW.Europe							91	6,196	3,670	35,829	9,606	3,075	58,466
W.Med							909	1,494	294	1,431	32,306	518	36,951
N.Africa							2	412	461	2,515	9,522	94	13,006
E.Med							1,035	5,830	2,656	26,968	8,767	1,341	46,597
E.Africa		300	329	3,673	86	832							5,220
A.Gulf		1,243	1,352	435	197	1,088							4,315
S.Asia		5,041	12,472	564	668	4,989							23,734
SE.Asia		18,391	87,176	6,553	7,244	21,261							140,625
E.Asia		2,772	17,510	3,658	2,833	12,113							38,886
Oceania			5,454	428		1,100							6,982
Total		27,745	124,293	15,312	11,028	41,383	2,288	16,667	9,404	77,551	64,985	5,027	395,684
												Actual Suez Transit Cargo in 1999	129,605

Table 3.4.13 Suez Potential Cargo (Others, 2020)

Others (1000ton,2020)

O \ D	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania	Total
CS.America													
N.America							6	1,755	203	737			2,700
NW.Europe							69	4,448	1,525	2,772	2,037	43	10,894
W.Med							45	2,811	816	1,302	672	24	5,670
N.Africa							7	922	144	208	123	0	1,404
E.Med							242	3,208	1,278	1,659	1,049	21	7,457
E.Africa			630	317	72	228							1,248
A.Gulf		191	277	865	1,390	679							3,402
S.Asia		1,099	487	1,613	489	629							4,317
SE.Asia		2,193	20,658	10,014	6,706	3,311							42,882
E.Asia			568	434	456	114							1,572
Oceania			261	95	145	72							573
Total		3,482	22,881	13,338	9,259	5,034	369	13,144	3,965	6,679	3,881	88	82,120
										Actual Suez Transit Cargo in 1999			26,439

Chapter 4 Forecast of the Suez Transits

4.1 Factors of route choice

As described in ANNEX IV, the allocation of vessels is determined so that the ship operator gets the maximum profit. The profit is the difference of freight and cost. Freight is determined by the demand and the supply of fleets. And cost the operator would care of is voyage cost in a depression market or shipping cost in a healthy market. It means that the market is an important factor in route choice. However it is almost impossible to forecast the future fleet market.

Therefore the forecasting model in this study concentrates on route choice in a healthy market. The operators choose a route whose shipping cost is the minimum.

Each ship operator has his shipping cost. Even one operator has a variety of shipping costs depending on the voyages. However in the forecast model, typical costs are calculated and are used for the route choice.

Even if the cost structures of operators are the same, the size of vessels should be considered. The shipping costs are not the same if cargo is carried in vessels of different sizes. In general, the larger vessel carries one unit of cargo (one ton of cargo) at a lower cost. In this respect, vessel size is one of the factors that affect the route choice.

In conclusion, the key factor in route choice is the shipping cost of cargo. Shipping cost is influenced by ship size, vessel contract price, cost of crews, toll, bunker oil prices, and many other elements as will be described in this chapter.

Other factors are the development of ports and the strategy of ship operators.
Deep water ports are necessary for calling of large vessels such as VLCC and over-Panamax containership. Port developments should be considered individually but this individual study is not suitable to this macroscopic forecast model. Consequently, present pattern and trend is presumed in the forecast. The trend includes that container terminals will be developed according to the increase of containerized cargo.
The strategy of ship operator becomes more important especially in containership routing. Alliances and calling ports strategy are the keys for ship operators to survive. Hub-operation will affect the shipping cost and containerization of regions. It is also difficult to include individual strategy in the model. This factor is included as the trend of maritime transportation.

4.2 Procedure of Transit forecasting

4.2.1 General Procedure

The input of route choice model is the Suez Potential Cargo by commodity that was forecast in Chapter 3.

The flow chart of the procedure is shown in Figure 4.2.1.

As seen in Figure 4.2.1, six steps are used to forecast Suez transits of the major vessel types (Tanker, Bulk Carrier, Containership, General Cargo Carrier, and Pure Car Carrier) while the present pattern and scenario setting is used for other vessel types. The numbers of other vessel types are relatively small, and the route choice model is not easy to build up. This is the reason that Figure 4.2.1 has two flows.

The Steps for the major vessel types were:

Step1: Estimate type of vessels on which cargo is carried.
A vessel type matrix was used for this purpose. (refer to Sec4.5.2)
Cargo volume on each vessel type was the output of this step.

Step2: Estimate sizes of vessels on which cargo is carried.
Fleet mix distribution was used for this purpose. (refer to Sec.4.5.3)
Cargo volume of each O-D was allocated to vessels of each size according to this fleet mix distribution.

Step3: Estimate shipping costs of all alternative routes
Shipping cost equation was established (refer to Sec.4.3.2) and cost of alternative routes was calculated by using this cost equation.

Step4: Sum up the cargo volumes that choose the Suez Canal
Each cargo was assumed to choose the route of minimum shipping cost. The volumes of cargo were summed up by commodity type, vessel type and vessel size.

Step5: Estimate number of laden vessels.
The number of laden vessels was calculated by dividing the cargo volume by the average volume on a vessel.

Step6: Estimate number of total vessels
The number of in-ballast vessels was calculated by using laden/in-ballast ratio. Then laden and in-ballast vessels were summed up.
The output of this procedure was the number of total vessels passing through the Canal by type, size, and laden/in-ballast. this is the output of the Demand Forecasting Model.

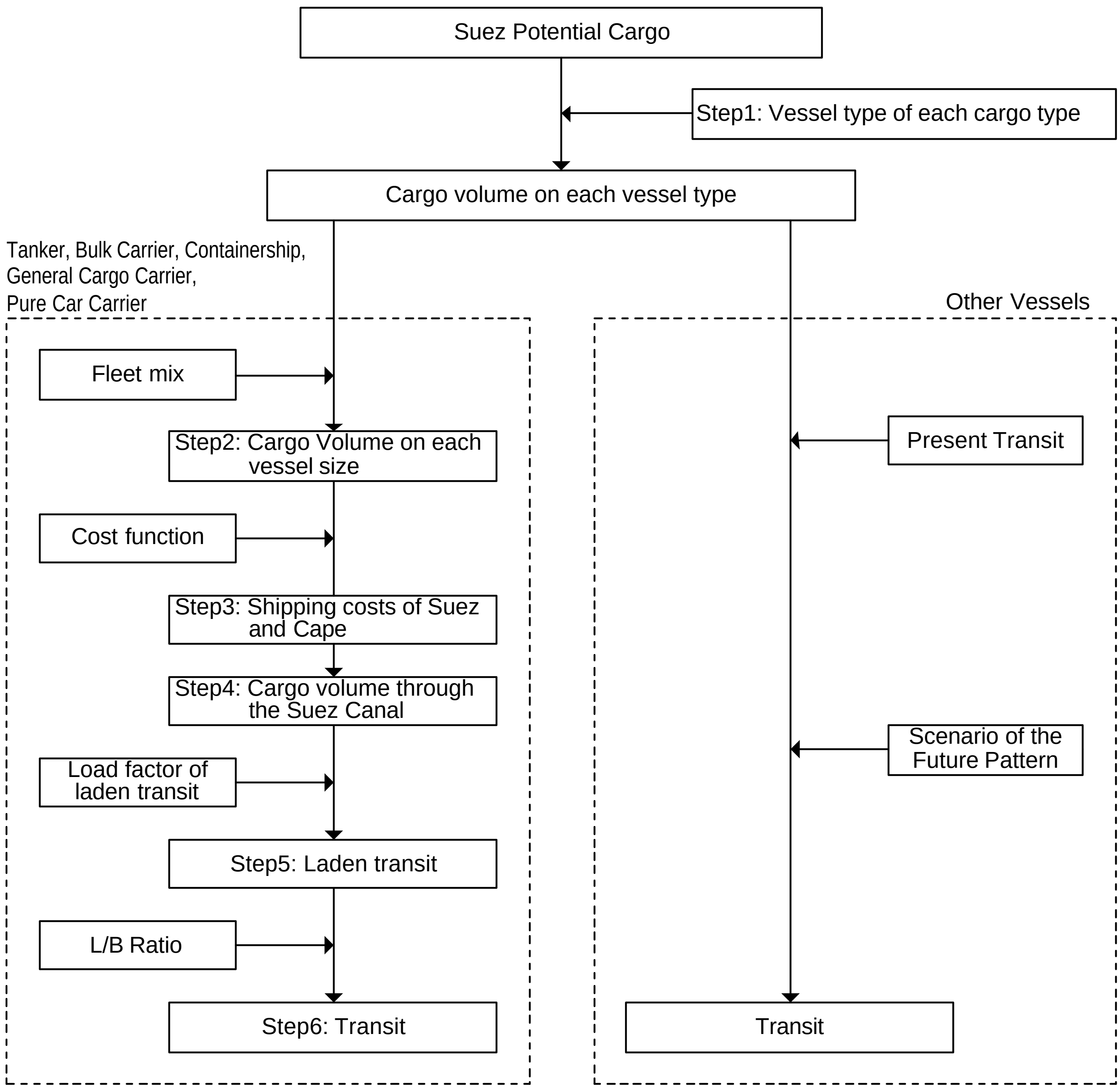


Figure 4.2.1 Procedure of forecasting the Suez Transits

4.2.2 Procedure for each vessel type

General procedure of forecasting is followed after the steps mentioned in Sec. 4.2.1.
The special process that was dependent on a vessel type is described below.

(1) Tanker

The route choice of Crude Oil Tanker is deferent from that of other tanker and other vessels in some points.
Crude Oil Tanker is restricted to pass through the Canal due to the size of the Canal. In the forecast, it was presumed that 300,000DWT or larger laden tankers could not use the Canal. Some VLCCs transport Crude Oil in half-laden condition. But the number of such transits is not large and was not included in the forecast.

Another difference was that the route is forecast based on a round voyage (two-directions). The alternative routes were S/S, C/S, and C/C. In-ballast Tankers were directly forecast in the route choice process.
The route choices of Other Tankers (Tanker other than Crude Oil Tanker) were forecast for laden vessels (one-direction). Laden/in-ballast ratio was used to estimate in-ballast vessels.

Crude Oil Tanker is so large that some ports cannot be used as calling ports. Therefore, the following restrictions are added to the route choice.
N.America East Coast was divided into two sub-zones. One was the East Coast and another was the Mexican Gulf. Ports on the East Coast don't have deep-water berths, and cannot accommodate tankers over about 150,000DWT. The Mexican Gulf can accommodate ULCCs. Therefore, the crude oil demand from the Arabian Gulf was divided into demand to each zone based on the present ratio of the Suez transit cargo. And then different fleet-mixes were applied.

(2) Bulk Carrier

The large volumes of bulk cargo on Bulk Carrier move from Oceania to Europe. Because Oceania stands in a sensitive location for the route choice, Oceania was divided into four regions (north/south/east/west). West Mediterranean was also divided into two.

(3) Containership

In general, containerized cargo is time-sensitive. Ship operators or shippers select the fastest and shortest route. In order to reflect this behavior in the forecast process, inventory cost saving of the cargo was considered. The cost for route choice was the sum of basic shipping cost and additional shipping costs.
There are two types of additional costs:

a. Inventory cost of containerized cargo
The average value of time sensitive containerized cargo was estimated, and then,

inventory cost per container was calculated. This value was multiplied by the number of expensive containers.

b. Capital cost of container box

Container box also has values. This value was multiplied by the number of containers on a Containership.

These costs were treated as parts of shipping cost in the forecast model.

In some routes, the shipping cost via the Canal is more expensive than that via the Cape. However, actual Containerships uses the Canal even in such routes. The reason is that a Containership calls many ports during her voyage. Cargo's O-D is not necessarily equal to vessel's O-D.
Therefore in the forecast model, Containerships use the Canal even if the shipping cost via the Canal is more expensive in a given Cargo's O-D.

(4) General Cargo Carrier

There is a lack of available data on the movement of General Cargo Carrier and General Cargo. Therefore, no modification was performed for General Cargo Carrier. The forecast was processed according to the basic procedure in the flowchart.

(5) Pure Car Carrier

A Pure Car Carrier (PCC) carries high-valued commodities. Therefore, commodity inventory cost should be included in the shipping cost. The value of automobile was estimated, and then inventory cost per cargo ton was calculated. This value was multiplied by the volume of automobile on a PCC. This cost was treated as a part of shipping cost in the forecast model.

The critical O-D for the choice of the Suez Canal is E.Asia -NW.Europe. At present no PCC on this route chooses the Cape route while the shipping cost via the Cape is highly competitive. Demand of PCCs is strong, and PCCs calls on many ports in the Mediterranean. Therefore most of the voyages between Asia-NW.Europe are not direct ones. Therefore, voyage distance between Asia and E.Med was used for the shipping between Asia and NW.Europe.

(6) Other Vessels

The sizes of Other Vessels are relatively small. This vessel type was directly forecast from the present pattern and the future scenario of each vessel type. Other Vessels were classified into Combined Carrier, LASH, Ro/Ro, Passenger Ship, War Ship, and Others.

4.3 Shipping cost estimation

4.3.1 Components of shipping cost

Shipping cost is structured as in Table 4.3.1

Table 4.3.1 Component of Shipping Cost

Managing Cost	Indirect Cost	Capital
	Direct Cost	Manning, Insurance, Administration, Others
Voyage Cost		Fuel, Port Charge, Toll, Other charges

Managing cost is the cost that is paid even if a vessel is not in voyage.

Indirect Managing Cost is sometimes called Capital Cost. This cost includes the cost of construction of vessels, fitting out expense, the interest of the capital for construction. A part of this cost is charged to a voyage according to days of the voyage.

Direct Managing Cost is the expense that the shipping company has to pay for operation even if a vessel does not voyage.

Voyage cost is the cost that is consumed in a voyage. Most of this cost is fuel cost. Others are port charge, toll and other charges such as cost for pilots.

4.3.2 Shipping cost function

Even if vessel types, commodity types, and volumes of loaded cargo of two voyages are the same, the actual shipping costs depend on each voyage. However, shipping cost should be simplified to use in the model. For this purpose, a shipping cost is modeled. A shipping cost model is expressed as a function of trip distance of a voyage.

$$C = A + B \times D$$

,where C : shipping cost (USD)
A, B : coefficient
D : distance of one trip (from an origin to a destination) (mile)

The following equations are used to derive the shipping cost function.

The days for a trip is calculated in Eq(1)

$$DV = Dsea + Dport + Dsuez$$
$$= (D / Sp) \times (1 / 24) + Dport + Dsuez \quad \text{..........(1)}$$

,where DV : days for one trip
Dsea : days in ocean
Dport : days at load and unload ports

Dsuez : additional days at Suez Canal (=0 if the Cape route is chosen)
Sp : voyage speed (miles/hr)

Managing cost per day is calculated in Eq(2).

CMD = (1+Fr) x P x Rd / 345 + a + b + c + d + e + f ....(2)

,where CMD : managing cost allocated for a day (USD/day)
P : Contract price (USD/ship)
Fr : Fitting out expense rate
Rd : Depreciation rate
345 : days of voyages of a vessel
a : Manning (cost for crews) (USD/day)
b : H & M(insurance for hull and machinery) (USD/day)
c : P&I (insurance for protection and indemnity)(USD/day)
d : R&M(cost for repair and maintenance) (USD/day)
e : S&L(cost for supplies and lubricating oils)(USD/day)
f :Administration (cost for company and land operation)(USD/day)

Then the managing cost for a trip is the multiplication of cost per day and days of a trip as Eq(3)

CM = CMD x DV ....(3)

,where CM : Managing cost for a trip(USD)

Voyage cost is the sum of voyage cost in ocean, voyage cost at ports, toll, and other chaeges.

CV = CBsea + CBport + Toll + OC
= FCS x Dsea x PB + FCP x Dport x PB +Toll + OC ....(4)

,where CV : Voyage cost for a trip(USD)
CBsea :Bunker oil cost in ocean (USD)
CBport :Bunker oil cost at ports (USD)
Toll :Toll of Suez Canal (=0 if the Cape route is chosen)(USD)
OC :Other charges for passing through the Canal(USD)
FCS :Fuel consumption rate in ocean (ton/day)
FCP :Fuel consumption rate at ports (ton/day)
PB :Bunker Oil Price(USD/ton)

Total cost for a trip is the sum of CM and CV, and is calculated by Eqs(1) to (4).

CT = CM + CV ....(5)

,where CT : total cost for a trip(USD)

There are special costs for Containership. One is the container box capital cost, and another is the commodity inventory cost.

The container box itself has a value and is a cost component for a ship operator. Commodity in a container box, of course, has a value and is transport time is a loss for a shipper. These cost are calculated by Eq(6).

CIV = CB + CI

= CBD x 0.8 x TEU x DV

+ CCD x 0.3 x (RDWT x LF) x DV ...……….(6)

,where CIV : Inventory cost for a trip (USD)

CB : Container box inventory cost (USD)

CI : Commodity inventory cost (USD)

CBD : Daily container box capital cost per TEU (USD/day-TEU)

TEU : Nominal capacity of a containership (TEU)

CCD : Daily commodity inventory cost per ton (USD/day-ton)

RDWT : vessel size (DWT)

LF : load factor

There are two numerical parameters in Eq(6).

“0.8” is the ratio of carried container box against a nominal capacity of a containership.

“0.3” is the ratio of high valued cargo volume against total cargo volume. It is presumed that 20% of northbound containerized cargo is expensive cargo, and 40% of southbound cargo is expensive one. 30% is used as the average ratio of expensive cargo.

Thus, Eq(5) is revised to Eq(7) for Containership.

CT = CM + CV + CIV...(7)

Pure Car Carrier has a similar additional voyage cost. That is the inventory cost of automobiles. The value of an automobile is quite high. The commodity inventory cost should be considered.

This cost is calculated by Eq(8).

CAV = CAD x RDWT x LF x DV. ....(8)

,where CAV : Inventory cost for a trip (USD)

CAD : Daily commodity inventory cost per ton (USD/day-ton)

Thus, Eq(5) is revised to Eq(9) for PCC.

CT = CM + CV + CAV ....(9)

Shipping cost of a unit of cargo is derived from this total cost and the volume on a vessel.

C = CT / (RDWT x LF) ....(10)

= B x D + A + Esc

, where C : shipping cost of cargo of a trip (USD/ton)

A : coefficient(constant)(USD/ton)

B : coefficient(constant)(USD/ton-mile)

Esc : additional cost of the Suez route (USD/ton)

Now, Eq(10) is a shipping cost function and is used to choose a vessel route.

Assume DS is the distance via Suez, and DC is the distance via Cape.

If $B \times DC + A > B \times DS + A + Esc$, then Suez is selected.

If $B \times DC + A < B \times DS + A + Esc$, then Cape is selected.

This condition is equivalent to the following expression.

If $B \times (DC - DS) > Esc$, then Suez is selected. Otherwise, Cape is selected.

The difference of distance DD that is calculated from the equation $B \times DD = Esc$ is the break-even distance. If $DC - DS > DD$, then Suez is selected. If $DC - DS < DD$, then Cape is selected.

The coefficients B and Esc are the key parameters to determine the voyage route. B and Esc are derived from Eqs(1) to (10).

For Vessels other than Containership and PCC

$$B = (CMD + FCS \times PB) / (SP \times 24 \times RDWT \times LF) \qquad (\$ / \text{ton-mile})$$

$$Esc = ((CMD + FCP \times PB) \times Dsuez + Toll + OC)) / (RDWT \times LF) \qquad (\$ / \text{ton})$$

For Containership

$$B = (CMD + FCS \times PB + CBD \times 0.8 \times TEU) / (SP \times 24 \times RDWT \times LF) + (CCD \times 0.3) / (SP \times 24) \qquad (\$/\text{ton-mile})$$

$$Esc = ((CMD + FCP \times PB + CBD \times 0.8 \times TEU) \times Dsuez + Toll + OC)) / (RDWT \times LF) + CCD \times 0.3 \times Dsuez \qquad (\$ / \text{ton})$$

For PCC

$$B = (CMD + FCS \times PB) / (SP \times 24 \times RDWT \times LF) + CAV / (SP \times 24) \qquad (\$/\text{ton-mile})$$

$$Esc = ((CMD + FCP \times PB) \times Dsuez + Toll + OC)) / (RDWT \times LF) + CAV \times Dsuez \qquad (\$ / \text{ton})$$

B is the coefficient for voyage distance. Esc is the additional cost that is added only when a vessel selects the Suez Canal. The values of these parameters are listed in Table 4.3.2, Table 4.3.3 and Table 4.3.4.

Two kinds of Escs are listed in the tables. EscL in Table 4.3.3 is the additional cost for laden vessels. EscB in Table 4.3.4 is the additional cost for in-ballast vessels. The former Esc is easy to understand, but the latter Esc needs explanation because Esc is the additional cost for unit cargo volume.

In-ballast vessels, of course, don’t carry any cargo. Therefore, “cost for unit cargo volume” seems meaningless. But even if a vessel is in-ballast, some cost should be burdened to the vessel. EscB is used as this cost. The route choices of in-ballast vessels were done only for Crude Oil Tanker. Additional Cost of a round voyage is (EscL+EscB) x (Cargo volume) for S/S or (EscL) x (Cargo volume) for S/C.

If EscB is expressed in unit of USD/SCNT, EscB looks reasonable. However, the route choice is based on shipping cost of cargo, not cost of a vessel. This is the reason that Esc and even EscB are expressed in USD/ton.

Table 4.3.2 Coefficient B of a Shipping Cost Function

Shipping Cost 'B' (dependent on the distance) (US$/ton-1000mile)

	V-Size(1000DWT)									
V-Type	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+
Crude Oil Tankers	3.774	1.448	0.928	0.722	0.611	0.561	0.534	0.444	0.415	0.408
Tankers (Products)	4.486	1.372	0.970	0.807	0.711	0.629	0.616	-	-	-
Tankers (LNG)	10.884	4.809	3.597	-	-	-	-	-	-	-
Tankers (LPG)	4.513	2.080	1.796	-	-	-	-	-	-	-
Tankers (Chemicals)	3.287	1.798	1.334	1.083	1.027	-	-	-	-	-
Tankers (Others)	5.404	1.758	1.176	0.895	-	-	-	-	-	-
Bulk Carriers	1.845	1.122	0.748	0.668	0.537	0.492	0.459	0.421	-	-
General Cargo Ships	3.558	2.073	1.842	-	-	-	-	-	-	-
Containerships	4.246	2.690	2.259	1.992	1.832	-	-	-	-	-

Table 4.3.3 Coefficient Esc of a Shipping Cost Function for a Laden Vessel

Shipping Cost 'EscL' (additional cost of the Suez route) (US$/ton)

	V-Size(1000DWT)									
V-Type	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+
Crude Oil Tankers	5.781	3.652	2.671	2.190	1.932	1.814	1.799	1.568	1.471	1.448
Tankers (Products)	7.436	4.256	3.284	2.888	2.651	2.523	2.488	-	-	-
Tankers (LNG)	15.060	10.135	8.978	-	-	-	-	-	-	-
Tankers (LPG)	9.096	6.095	5.426	-	-	-	-	-	-	-
Tankers (Chemicals)	6.525	4.819	3.932	3.391	3.270	-	-	-	-	-
Tankers (Others)	8.640	5.110	4.160	3.627	-	-	-	-	-	-
Bulk Carriers	5.302	4.012	2.735	2.437	1.937	1.837	1.701	1.592	-	-
General Cargo Ships	9.649	6.625	5.769	-	-	-	-	-	-	-
Containerships	9.393	7.436	6.869	6.838	6.736	-	-	-	-	-

Table 4.3.4 Coefficient Esc of a Shipping Cost Function for an In-ballast Vessel

Shipping Cost 'EscB' (additional cost of the Suez route) (US$/ton)

	V-Size(1000DWT)									
V-Type	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+
Crude Oil Tankers	5.004	3.145	2.298	1.884	1.662	1.561	1.496	1.281	1.243	1.225

The values in above tables were calculated under the present Toll Table of SCA.
Other charge (OC) includes the following cost items.

1) Tugboat

For vessels other than LNG/LPG Tanker

Laden :	over 70,000 SCNT and less than/equal to 90,000 SCNT	
	6,600 SDR/vessel	(1 boat)
	over 90,000 SCNT	
	13,200 SDR/vessel	(2 boats)
In-ballast:	over 130,000 SCNT	
	6,600 SDR/vessel	(1 boat)

For LNG/LPG Tanker

	over 25,000 SCNT	
	6,600 SDR/vessel	(1 boat)

2) Agent and others

Agent, Pilots, Electrician	4,500 USD/vessel
Fee for Port Authority	0.13 USD/SCNT

Other parameters used in cost estimation are listed in Appendix D.

4.4 Distances of trips

Distance of a trip from one zone to another zone is assumed to be the distance between representative ports between both zones. The distance is measured along a voyage route both in the Suez route and the Cape route.
Table 4.4.1, Table 4.4.2, and Table 4.4.3 are the distance tables for the route choice model.

The voyage distance of a return trip (north via Suez and south via Suez (S/S)) is twice the distance of "via Suez" in this table. The voyage distance of a round trip (north via Suez and south via the Cape (S/C)) is the sum of "via Suez" and "via Cape" in this table.

The representative ports of zones are very important factors for route choice model. In this study, three sets of representative ports are provided. Some additional work will be necessary for more detailed study. For example, the representative port of CS.America is Santos in Brazil because this port is a big exporting port of dry bulk cargo. If another port is selected, the Suez Route may become advantageous.
It is recommended in future work that ports should be studied based on the ability of port facilities and the handling volume of each commodity.

The representative ports are dependent on types of commodity. And special arrangements are necessary for Crude Oil Tanker and Bulk Carrier.

N.America of Crude Oil Tanker: the Maxican Gulf is the major area of crude oil, and the East Coast lacks deep-sea ports for large crude oil tankers. Therefore, North America is divided into two zones. New York and New Orleans were set as the ports of the East Coast and the Mexican Gulf for Crude Oil Tanker from A.Gulf, respectively.

Oceania of Bulk Carrier: Oceania is in sensitive location for dry bulk trade to/from Europe. Therefore, Oceania was divided in to four sub-zones for export by Bulk Carrier. Weipa, Hay Point, Esperance, Dampler are the representative ports of sub-zones.

West Mediterranean of Bulk Carrier: Similarly, West Mediterranean has two representative ports, Barcelona and Taranto.

Table 4.4.1 Distance Table via S.C. and via C.G.H. – Tanker

(mile)

O \ D	D.Region	CS.Ameri	N.Amrica	NW.Euroı	W.Med	N.Africa	E.Med	US Gulf	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	Oceania
O.Region	Representative Port	**Aruba**	**New York**	**Rotterdam**	**Barcelona**	**Casablanca**	**Istanbul**	**New Orleans**	**Mombasa**	**Bandar Abbas**	**Karachi**	**Singapore**	**Pusan**	**Weipa**
CS.America	**Aruba**	-	-	-	-	-	-	-	8,276	10,472	10,438	11,378	13,735	12,605
N.Amrica	**New York**	-	-	-	-	-	-	-	9,278	11,474	11,440	12,380	14,737	13,607
NW.Europe	**Rotterdam**	-	-	-	-	-	-	-	8,653	10,849	10,815	11,755	14,112	12,982
W.Med	**Balcelona**	-	-	-	-	-	-	-	8,097	10,293	10,259	11,199	13,556	12,426
N.Africa	**Casablanca**	-	**via SUEZ**		-	-	-	-	7,403	9,599	9,565	10,505	12,862	11,732
E.Med	**Istanbul**	-	-	-	-	-	-	-	9,382	11,578	11,544	12,484	14,841	13,711
US Gulf	**New Orleans**	-	-	-	-	-	-	-	-	11,979	-	-	-	-
E.Africa	**Mombasa**	8,641	8,108	6,263	4,577	5,089	3,775	-	-	-	-	-	-	-
A.Gulf	**Bandar Abbas**	8,494	7,691	6,116	4,430	4,942	3,628	9,325	-	-	-	**via CAPE**		-
S.Asia	**Karachi**	8,511	7,978	6,133	4,447	4,959	3,645	-	-	-	-	-	-	-
SE.Asia	**Singapore**	10,666	10,133	8,288	6,602	7,114	5,800	-	-	-	-	-	-	-
E.Asia	**Pusan**	13,169	12,636	10,791	9,105	9,617	8,303	-	-	-	-	-	-	-
Oceania	**Weipa**	13,058	12,525	10,680	8,994	9,506	8,192	-	-	-	-	-	-	-

Source) JICA Study Team from Fairplay's database

Table 4.4.2 Distance Table via S.C. and via C.G.H. – Bulk Carrier

(mile)

O \ D	D.Region	CS.America	N.Amrica	NW.Europe	W.Med	N.Africa	E.Med	W.Med2	E.Africa	A.Gulf	S.Asia	SE.Asia	E.Asia	E.Oceania	W.Oceania	N.Oceania	S.Oceania
O.Region	Representative Port	Santos	New Orleans	Rotterdam	Barcelona	Annaba	Istanbul	Taranto	Durban	Bandar Abbas	Karachi	Singapore	Pusan	Hay Point	Dampier	Weipa	Esperance
CS.America	Santos	-	-	-	-	-	-	-	4,157	8,062	8,028	8,968	11,325	10,846	8,542	10,195	8,340
N.Amrica	New Orleans	-	-	-	-	-	-	-	8,074	11,979	11,945	12,885	15,242	14,763	12,459	14,112	12,257
NW.Europe	Rotterdam	-	-	-	-	-	-	-	6,944	10,849	10,815	11,755	14,112	13,633	11,329	12,982	11,127
W.Med	Barcelona	-	-	-	-	-	-	-	6,388	10,293	10,259	11,199	13,556	13,077	10,773	12,426	10,571
N.Africa	Annaba	-	-	-	-	-	-	-	6,512	10,417	10,383	11,323	13,680	13,201	10,897	12,550	10,695
E.Med	Istanbul	-	via SUEZ		-	-	-	-	7,673	11,578	11,544	12,484	14,841	14,362	12,058	13,711	11,856
W.Med2	Taranto	-	-	-	-	-	-	-	7,106	11,011	10,977	11,917	14,274	13,795	11,491	13,144	11,289
E.Africa	Durban	11,846	11,039	7,830	6,144	5,836	5,342	5,496	-	-	-	-	-	-	-	-	-
A.Gulf	Bandar Abbas	9,132	9,325	6,116	4,430	4,122	3,628	3,782	-	-	-	via CAPE		-	-	-	-
S.Asia	Karachi	9,149	9,342	6,133	4,447	4,139	3,645	3,799	-	-	-	-	-	-	-	-	-
SE.Asia	Singapore	11,304	11,467	8,288	6,602	6,294	5,800	5,954	-	-	-	-	-	-	-	-	-
E.Asia	Pusan	13,807	14,000	10,791	9,105	8,797	8,303	8,457	-	-	-	-	-	-	-	-	-
E.Oceania	Hay Point	14,548	14,741	11,532	9,846	9,538	9,044	9,198	-	-	-	-	-	-	-	-	-
W.Oceania	Dampier	12,393	12,586	9,377	7,691	7,383	6,889	7,043	-	-	-	-	-	-	-	-	-
N.Oceania	Weipa	13,696	13,889	10,680	8,994	8,686	8,192	8,346	-	-	-	-	-	-	-	-	-
S.Oceania	Esperance	13,006	13,199	9,990	8,304	7,996	7,502	7,656	-	-	-	-	-	-	-	-	-

Source) JICA Study Team from Fairplay's database

Table 4.4.3 Distance Table via S.C. and via C.G.H. – Other Vessel

(mile)

O \ D O.Region	D.Region Representative Port	CS.Ameri Santos	N.Amrica New York	NW.Euro Rotterdam	W.Med Marsaxlokk	N.Africa Casablanca	E.Med Haifa	E.Africa Monbasa	A.Gulf Dubai	S.Asia Colombo	SE.Asia Singapore	E.Asia Pusan	Oceania Melbourne
CS.America	Santos	-	-	-	-	-	-	5,866	8,111	7,719	8,968	11,325	9,461
N.Amrica	New York	-	-	-	-	-	-	9,278	11,523	11,131	12,380	14,737	12,873
NW.Europe	Rotterdam	-	-	-	-	-	-	8,653	10,898	10,506	11,755	14,112	12,248
W.Med	Marsaxlokk	-	-	-	-	-	-	8,576	10,821	10,429	11,678	14,035	12,171
N.Africa	Casablanca	-	via SUEZ		-	-	-	7,403	9,648	9,256	10,505	12,862	10,998
E.Med	Haifa	-	-	-	-	-	-	9,582	11,827	11,435	12,684	15,041	13,177
E.Africa	Monbasa	9,279	8,108	6,263	3,923	5,089	3,158	-	-	-	-	-	-
A.Gulf	Dubai	9,181	8,010	6,165	3,825	4,991	3,060	-	-	-	via CAPE		-
S.Asia	Colombo	9,771	8,600	6,755	4,415	5,581	3,650	-	-	-	-	-	-
SE.Asia	Singapore	11,304	10,133	8,288	5,948	7,114	5,183	-	-	-	-	-	-
E.Asia	Pusan	13,807	12,636	10,791	8,451	9,617	7,686	-	-	-	-	-	-
Oceania	Melbourne	14,127	12,956	11,111	8,771	9,937	8,006	-	-	-	-	-	-

Source) JICA Study Team from Fairplay's database

4.5 Presumptions

4.5.1 Alternative routes of the Suez Canal Route

Theoretical alternative sea-borne routes to the Suez Canal Route are

1. The Cape of Good Hope
2. Panama Canal
3. Arctic Ocean

As discussed in the previous section, the Panama route can be competitive to the Suez route but it is quite uncertain. Trades that may use the Panama Canal are limited because of the physical restrictions of the Panama Canal and the trade structure of commodities.

The Arctic route will not be popular in 2020 even if the some commodities may use this route.

In conclusion, the Cape of Good Hope route is chosen as the alternative route for the Suez route in the route choice model.

4.5.2 A vessel type matrix

A vessel type matrix is used to set the type of vessel on which each unit cargo (one ton of cargo) is carried. Crude Oil is carried on Tankers. But containerized cargo is carried on General Cargo Carriers as well as Containerships. A Containership carries only containerized cargo if the vessel is a full-containership.

In order to set a vessel type matrix for forecasting, the actual vessel matrix of the Suez Canal is referred. The actual vessel matrix is derived from SCA Transit database in 1997-1999.

Table 4.5.1 Vessel Type Matrix at Present

Southbound

Vessel Type	Crude Oil	Oil Products	LNG/LPG	Chemicals	Grain	Fabricated Metal	Coal & Coke	Ore	Fertilizers	Automobile	Containers	Others
Tankers	82.6%	81.8%	100.0%	95.0%							0.7%	
Bulk Carriers		3.0%		2.0%	91.9%	91.9%	94.7%	86.8%	93.9%	2.2%	32.2%	
Combined Carriers	17.4%	15.0%		0.2%	3.5%	0.4%		7.3%	0.1%		0.9%	
General Cargo Ships		0.2%		0.5%	4.4%	7.5%	5.3%	5.8%	5.9%	2.5%	59.4%	0.9%
Containerships												98.4%
LASH Ships											1.2%	0.1%
Ro/Ro Ships					0.1%	0.1%				2.7%	1.8%	0.6%
Car Carriers										92.6%		
Passenger Ships												
War Ships												
Others				2.3%	0.1%	0.1%	0.1%	0.1%	0.1%		3.8%	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.1%	100.0%	100.0%	100.0%	100.0%	100.0%

Northbound

Vessel Type	Crude Oil	Oil Products	LNG/LPG	Chemicals	Grain	Fabricated Metal	Coal & Coke	Ore	Fertilizers	Automobile	Containers	Others
Tankers	99.3%	86.7%	100.0%	83.6%							0.4%	
Bulk Carriers		2.6%		14.4%	81.9%	85.9%	99.5%	95.0%	82.7%	0.2%	54.3%	
Combined Carriers	0.7%	10.4%		0.1%	1.1%		0.4%	1.6%				
General Cargo Ships		0.1%		0.7%	16.8%	14.0%	0.1%	3.4%	17.2%	0.3%	40.7%	0.9%
Containerships												98.6%
LASH Ships											1.6%	0.1%
Ro/Ro Ships				0.1%		0.1%				0.7%	1.0%	0.4%
Car Carriers										98.6%		
Passenger Ships												
War Ships												
Others		0.2%		1.1%	0.2%				0.1%	0.2%	2.0%	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source) JICA Study Team (from SCA transit database 1997-1999)

After reviewing the present matrix, the following scenario was introduced:

a. Basically, vessels will shift to the following four major vessel types.
 . Tanker
 . Bulk Carrier
 . Containership
 . Car Carrier

b. For minor routes, General Cargo Carrier will remain, but will shift to mainly Containership and Bulk Carrier for major routes.

c. Ro/Ro Ships will remain in the future. Transit and the cargo volume were set to be equal to the present ones.
 Therefore, Ro/Ro ship was not listed in these tables, but added later.

d. LASH and Combined Carrier will be negligible.

e. Passenger Ships and War Ships don’t carry cargo.

Then, Table 4.5.2 and Table 4.5.3 were used in the route choice model.
. Vessel Type Matrix (0) was applied to major routes.
. Vessel Type Matrix (1) was applied to minor routes.
The major routes and the minor routes are listed in Table 4.5.4.

Table 4.5.2 Vessel Type Matrix for forecasting (0)

Southbound (%,2020)

Vessel Type	Crude Oil	Oil Products	LNG/LPG	Chemicals	Grain	Fabricated Metal	Coal & Coke	Ore	Fertilizers	Automobile	Containers	Others
Tankers	100.0%	100.0%	100.0%	100.0%								
Bulk Carriers					100.0%	100.0%	100.0%	100.0%	100.0%			100.0%
Combined Carriers												
General Cargo Carriers												
Containerships											100.0%	
LASH Ships												
Ro/Ro Ships												
Car Carriers										100.0%		
Passenger Ships												
War Ships												
Others												
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Northbound (%,2020)

Vessel Type	Crude Oil	Oil Products	LNG/LPG	Chemicals	Grain	Fabricated Metal	Coal & Coke	Ore	Fertilizers	Automobile	Containers	Others
Tankers	100.0%	100.0%	100.0%	100.0%								
Bulk Carriers					100.0%	100.0%	100.0%	100.0%	100.0%			100.0%
Combined Carriers												
General Cargo Carriers												
Containerships											100.0%	
LASH Ships												
Ro/Ro Ships												
Car Carriers										100.0%		
Passenger Ships												
War Ships												
Others												
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.5.3 Vessel Type Matrix for forecasting (1)

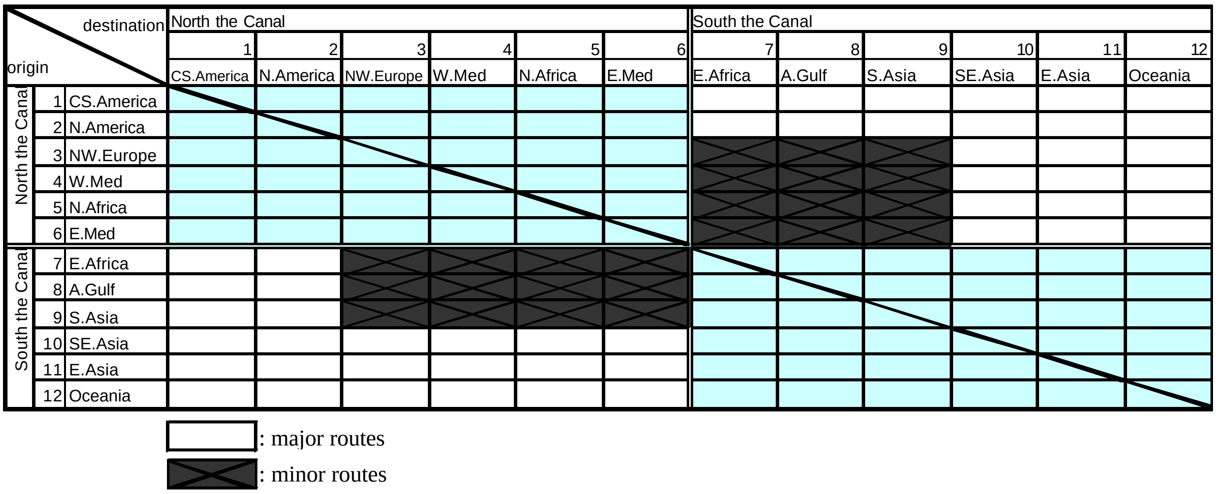
Southbound (%,2020)

Vessel Type	Crude Oil	Oil Products	LNG/LPG	Chemicals	Grain	Fabricated Metal	Coal & Coke	Ore	Fertilizers	Automobile	Containers	Others
Tankers	100.0%	100.0%	100.0%	100.0%								
Bulk Carriers					100.0%	100.0%	100.0%	100.0%	100.0%			40.6%
Combined Carriers												
General Cargo Carriers										2.5%		59.4%
Containerships											100.0%	
LASH Ships												
Ro/Ro Ships												
Car Carriers										97.5%		
Passenger Ships												
War Ships												
Others												
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Northbound (%,2020)

Vessel Type	Crude Oil	Oil Products	LNG/LPG	Chemicals	Grain	Fabricated Metal	Coal & Coke	Ore	Fertilizers	Automobile	Containers	Others
Tankers	100.0%	100.0%	100.0%	100.0%								
Bulk Carriers					100.0%	100.0%	100.0%	100.0%	100.0%			59.3%
Combined Carriers												
General Cargo Carriers										0.3%		40.7%
Containerships											100.0%	
LASH Ships												
Ro/Ro Ships												
Car Carriers										99.7%		
Passenger Ships												
War Ships												
Others												
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.5.4 Route Setting for Vessel Type Matrixes



4.5.3 Fleet-mix

Fleet-mix is the distribution of the capacity of vessels.

Two parameters were used to set the future fleet-mix of the Suez potential transits. They were the present potential fleet mix and the future world fleet-mix.

The potential fleet-mix except Crude Oil Tanker will be almost equal to the fleet mix through the Canal. Therefore, the present potential fleet mix was estimated from the actual Suez transits.
However the potential fleet-mix of Crude Oil Tanker is not clearly equal to the fleet mix through the Canal because laden VLCCs use the Cape route. Therefore, the present potential fleet-mix was derived from another data source. (Database from JAMRI)

The future world fleet-mix was set from the trend of new buildings of vessels. The setting of the future fleet mix is described in ANNEX IV.

After the present potential fleet-mix and the future world fleet-mix were set, the future potential fleet-mix was calculated.

Accordingly, the calculation of the future fleet-mix had 3 steps.

Step1: Calculate the present fleet-mix from database
For Crude Oil Tanker, JAMRI database that contains all voyages via Suez and via Cape was analyzed. The data year was 1999.
For other vessels, SCA data was analyzed. The averages fleet-mix from 1997 to 1999 were used.

Step2: Calculate the growth rate of the fleet-mix by vessel size
For Crude Oil Tanker, Product Tanker, Chemical Tanker, Bulk Carrier and Containership, the future fleet-mixes were estimated from Clerkson's data as described in ANNEX IV.
For Other vessels, the present fleet-mixes were used for the future fleet-mix.

Step3: Multiply the present fleet-mix by the ratio of the future share and the present share.
Then future fleet-mixes were obtained. These fleet-mixes were adjusted such that the sum of the percentages became 100%.

In this stage, the voyage distance was considered because vessel sizes were not equal in different routes. All routes were divided into three categories.

The distance is classified to three ranges.
Short range : shorter than 6116 miles (distance between A.Gulf and NW.Europe)
Middle range : shorter than 8228 miles (distance between SE.Asia and NW.Europe)
Long range : longer than 8228 miles

After reviewing the present fleet-mix for each range, the scenario in Table 4.5.5 was applied.

Table 4.5.5 Scenario of Fleet-mix of Suez Transit vessels in 2020

Vessel Type	Scenario
Crude Oil Tanker	Fleet-mixes will differ in each route.
Products Tanker	Long and middle ranges have the same fleet-mixes. The trend of the world fleet-mix is applied to each of long & middle range and short ranges.
LPG/LNG Tanker	Present fleet-mix will continue in all ranges.
Chemical Tanker	All ranges have the same fleet-mix. The trend of the world fleet-mix is applied to all ranges.
Bulk Carrier	Each range (short, middle, and long) has its own fleet-mix. The trend of the world fleet-mix is applied to middle range and long range. Present fleet-mix will continue in short range
Containership	Long and middle ranges have the same fleet-mixes. The trend of the world fleet-mix is applied to long & middle range. Present fleet-mix will continue in short range.
General Cargo Carrier	Present fleet-mix will continue in all ranges.
Car Carrier	All ranges have the same fleet-mix. The trend of the world fleet-mix is applied to all ranges.

Table 4.5.6 Present Fleet-Mix

(1000DWT)

V-Type	Note	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+	Total
Crude Oil Tankers	NW.Europe				1%	1%	0%	0%		69%	29%	100%
	S.Europe & N Africa		0%		8%	9%	19%	11%		53%		100%
	US Gulf			0%	1%	0%	1%	1%	1%	29%	67%	100%
	Others	0%	0%		1%		1%		3%	43%	52%	100%
	Other Origins		0%	4%	15%	8%	8%	2%		45%	18%	100%
Tankers (Products)	long&middle	3%	30%	16%	41%	7%	1%	2%				100%
	short	9%	43%	17%	24%	6%		1%				100%
Tankers (LNG)	all	1%	38%	61%								100%
Tankers (LPG)	all	32%	41%	25%			1%	1%				100%
Tankers (Chemicals)	all	40%	58%	1%	1%	0%						100%
Tankers (Others)	all	27%	44%	14%	16%							100%
Bulk Carriers	long	3%	38%	36%	2%	1%	5%	14%	0%			100%
	middle	6%	32%	31%	4%	3%	13%	12%				100%
	short	9%	62%	13%	2%	1%	4%	9%	0%			100%
General Cargo Ships	all	93%	7%	0%								100%
Containerships	long&middle	1%	26%	63%	9%	1%						100%
	short	5%	63%	27%	2%	3%						100%
Car Carriers	all	92%	8%	0%								100%

Source) JAMRI database in 1999(Crude Oil Tanker)

SCA database ave.'97-'99 (exc ept Crude Oil Tanker)

Table 4.5.7 Growth Ratio of Fleet-mix

(1000DWT)

V-Type	Note	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+	Total
Crude Oil Tankers	A.G / N.Amrica				1.41	1.56	1.70	1.71		1.12		1.00
	A.G / N. Europe & UK		1.06		1.41	1.56	1.70	1.71		1.12		1.00
	A.G / S. Europe $ N Africa			0.84	1.41	1.56	1.70	1.71	1.50	1.12		1.00
	A.G / US Gulf & Carrebian	1.02	1.06		1.41		1.70		1.50	1.12		1.00
	Others		1.06	0.84	1.41	1.56	1.70	1.71		1.12		1.00
Tankers (Products)	long&middle	1.02	1.06	0.84	1.41	1.56	1.70	1.71				1.00
	short	1.02	1.06	0.84	1.41	1.56		1.71				1.00
Tankers (LNG)	all	1.00	1.00	1.00								1.00
Tankers (LPG)	all	1.00	1.00	1.00			1.00	1.00				1.00
Tankers (Chemicals)	all	1.02	1.06	0.84	1.41	1.56						1.00
Tankers (Others)	all	1.02	1.06	0.84	1.41							1.00
Bulk Carriers	long	0.22	0.70	1.32	1.41	0.91	0.93	1.66	1.67			1.00
	middle	0.22	0.70	1.32	1.41	0.91	0.93	1.66				1.00
	short	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
General Cargo Ships	all	1.00	1.00	1.00								1.00
Containerships	long&middle	0.66	0.78	1.72	2.63	2.50						1.00
	short	1.00	1.00	1.00	1.00	1.00						1.00
Car Carriers	all	1.01	0.92	1.00								1.00

Source) Estimated by JICA study team

Table 4.5.8 Future Fleet-Mix

(1000DWT)

V-Type	Note	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+	Total
Crude Oil Tankers	NW.Europe				1%	1%	1%	1%		96%		100%
	S.Europe & N Africa		0%		8%	10%	24%	14%		44%		100%
	US Gulf			0%	3%	0%	3%	5%	5%	83%		100%
	Others	0%	1%		1%		3%		8%	87%		100%
	Other Origins		0%	3%	20%	12%	13%	4%		48%		100%
Tankers (Products)	long&middle	3%	26%	11%	48%	9%	1%	3%				100%
	short	8%	40%	12%	30%	8%		2%				100%
Tankers (LNG)	all	1%	38%	61%								100%
Tankers (LPG)	all	32%	41%	25%			1%	1%				100%
Tankers (Chemicals)	all	39%	59%	0%	2%	0%						100%
Tankers (Others)	all	25%	43%	11%	21%							100%
Bulk Carriers	long	1%	25%	45%	3%	1%	4%	21%	1%			100%
	middle	1%	21%	39%	5%	3%	11%	19%				100%
	short	9%	62%	13%	2%	1%	4%	9%	0%			100%
General Cargo Ships	all	93%	7%	0%								100%
Containerships	long&middle	0%	13%	69%	15%	2%						100%
	short	5%	63%	27%	2%	3%						100%
Car Carriers	all	93%	7%	0%								100%

Source) Estimated by JICA study team

The example of the calculation is as follows:

Crude Oil Tanker (NW. Europe)

1000DWT	Present Fleet-Mix (Table 4.5.6)		Growth Rate (Table 4.5.7)						Future Fleet-Mix (Table 4.5.8)
0-25	0.0%	×	1.02	=	0.0%	÷	0.803	=	0.0%
25-50	0.0%	×	1.06	=	0.0%	÷	0.803	=	0.0%
50-75	0.0%	×	0.84	=	0.0%	÷	0.803	=	0.0%
75-100	0.7%	×	1.41	=	1.0%	÷	0.803	=	1.2%
100-125	0.5%	×	1.56	=	0.8%	÷	0.803	=	1.0%
125-150	0.3%	×	1.70	=	0.5%	÷	0.803	=	0.6%
150-200	0.4%	×	1.71	=	0.7%	÷	0.803	=	0.9%
200-250	0.0%	×	1.50	=	0.0%	÷	0.803	=	0.0%
250-300	69.3%	×	1.12	=	77.3%	÷	0.803	=	96.3%
300+	28.8%	×	0.00	=	0.0%	÷	0.803	=	0.0%
Total	100.0%				80.3%				100.0%

As described above, the future-fleet-mix was mathematically calculated. This calculation was based on the scenario that the recent delivery would be the future world fleet-Mix. Another scenario was considered based on a more active vessel market where the fleet-mix would shift to larger sizes. This scenario can be adopted especially in Containership and Car Carrier. This scenario is described as an additional scenario in Chapter6.

4.5.4 The Canal constraints

Due to the physical restriction of the Canal, laden tankers of more than 200,000DWT are have difficulty using the Canal at present. For the setting of the conditions in 2020, it is presumed that full-loaded tankers under 300,000DWT can use the Canal. This setting is a tentative setting for this study and not authorized by the Study Team. The maximum vessel size will be dependent on the future work of SCA.

Other conditions, such as toll system, operation system, are presumed to be the same as the present condition.

4.6 Result of Forecast

4.6.1 Cargo on Vessel

Table 4.6.1 is the forecast of the cargo volume through the Canal in 2000.

The cargo will be 851,178thousand ton in 2020, about 2.78 times the cargo volume in 1999.
This growth will be mainly caused by the large increase of Containerships, Tanker and Bulk Carrier. The industrialization in Asia will largely contribute to this demand increase.
Tanker will carry 110,373thousand tons, 13% of total cargo volume, and 50,305thousand tons out of that volume will be Crude Oil.

Table 4.6.1 Cargo Ton in 2020

(1000ton)

	(1)Forecast in 2020				(2)Actual in 1999		Growth
Vessel Type	S-bound	N-bound	Total	Comp. Ratio	Total	Comp. Ratio	(1)/(2)
Tankers	36,715	73,659	110,373	13.0%	37,736	12.3%	2.92
Crude Oil Tankers	2,798	47,508	50,305	5.9%	9,505	3.1%	5.29
Other Tankers	33,917	26,151	60,068	7.1%	28,232	9.2%	2.13
Bulk Carriers	119,317	204,316	323,633	38.0%	114,506	37.3%	2.83
Combined Carriers	-	-	-	0.0%	1,865	0.6%	0.00
General Cargo Ships	9,031	3,035	12,066	1.4%	18,192	5.9%	0.66
Containerships	175,266	219,363	394,629	46.4%	126,958	41.4%	3.11
LASH Ships	-	-	-	0.0%	953	0.3%	0.00
Ro/Ro Ships	1,242	710	1,952	0.2%	1,528	0.5%	1.28
Car Carriers	3,314	4,907	8,221	1.0%	3,781	1.2%	2.17
Passenger Ships	0	0	1	0.0%	0	0.0%	9.79
War Ships	22	38	60	0.0%	95	0.0%	0.63
Others	122	122	243	0.0%	1,055	0.3%	0.23
Total	345,029	506,149	851,178	100.0%	306,670	100.0%	2.78

Source) (1)JICA study team, (2)SCA transit database 1999

4.6.2 Transit

Table 4.6.2 is the forecast of Transit in 2020

Total number of forecast is exported to be 28,657 transits (78.5 transits per day in average) in 2020. This demand is about 2.11 times the transits in 1999. Most of cargo vessel types will increase their transits.
The Containership will have the largest increment to 11,639 transits, 2.66 times the transits in 1999. The share of Tanker will be almost same. General Cargo Carrier will decrease.

Note that Ro/Ro Ship, Passenger Ship and War Ship are not forecasted. The numbers in 2020 in the table are the average transits from 1997 to 1999.

Table 4.6.2 Transit in 2020

(Number)

Vessel Type	(1)Forecast in 2020		(2)Actual in 1999		Growth
	V-Number	Comp. Ratio	V-Number	Comp. Ratio	(1)/(2)
Tankers	4,179	14.6%	1,991	14.6%	2.10
Crude Oil Tankers	725	2.5%	-	-	-
Other Tankers	3,455	12.1%	-	-	-
Bulk Carriers	8,037	28.0%	2,805	20.6%	2.87
Combined Carriers	-	0.0%	42	0.3%	-
General Cargo Ships	1,674	5.8%	2,157	15.8%	0.78
Containerships	11,639	40.6%	4,377	32.2%	2.66
LASH Ships	-	0.0%	41	0.3%	-
Ro/Ro Ships	259	0.9%	219	1.6%	1.18
Car Carriers	2,075	7.2%	929	6.8%	2.23
Passenger Ships	105	0.4%	120	0.9%	0.87
War Ships	215	0.7%	198	1.5%	1.08
Others	473	1.7%	734	5.4%	0.64
Total	28,657	100.0%	13,613	100.0%	2.11

Daily Transit	78.5	37.3

Source) (1)JICA study team, (2)SCA transit database 1999

Table 4.6.3 is the transits in 2020 by loading status and direction (northbound /southbound).

Most transits (26,608transits, 93% of the total transits) will be laden transits.
Directions of transits are almost balanced similar to transits in 1999.

Table 4.6.3 Transit in 2020 by L/B and Direction

(Number,2020)

Vessel Type	Laden			In Ballast			Total		
	S-bound	N-bound	Total	S-bound	N-bound	Total	S-bound	N-bound	Total
Tankers	1,818	1,568	3,386	608	185	793	2,426	1,753	4,179
Crude Oil Tankers	24	268	292	406	27	433	430	295	725
Other Tankers	1,795	1,299	3,094	202	159	360	1,996	1,458	3,455
Bulk Carriers	3,172	4,549	7,721	141	174	316	3,313	4,724	8,037
Combined Carriers	-	-	-	-	-	-	-	-	-
General Cargo Ships	1,156	390	1,546	23	105	129	1,179	495	1,674
Containerships	5,187	6,339	11,526	82	31	114	5,269	6,370	11,639
LASH Ships	-	-	-	-	-	-	-	-	-
Ro/Ro Ships	120	105	225	16	19	34	135	124	259
Car Carriers	713	1,056	1,768	300	7	307	1,013	1,063	2,075
Passenger Ships	1	1	2	48	55	103	49	56	105
War Ships	11	8	19	103	92	195	114	100	215
Others	207	207	414	29	29	59	236	236	473
Total	12,385	14,223	26,608	1,351	698	2,049	13,736	14,921	28,657

Source) JICA Study Team estimation

Table 4.6.4 is the transit in 2020 by vessel size.

Tanker, Bulk Carrier, Containership will be larger than the present sizes.
As for Tanker, transits by 250-300,000DWT class will increase more than the average increase of Tanker. This is caused by the presumption that the maximum size of laden Tanker is set 300,000DWT.

Table 4.6.4 Transit by Size in 2020

(Number,2020)

Vessel Type	V-Size(1000DWT)										
	0-25	25-50	50-75	75-100	100-125	125-150	150-200	200-250	250-300	300+	Total
Tankers	2,110	1,214	82	161	72	115	59	15	350	-	4,179
Crude Oil Tankers	4	7	8	107	63	115	58	15	350	-	725
Other Tankers	2,107	1,208	74	55	9	0	1	-	-	-	3,455
Bulk Carriers	886	4,578	1,906	137	27	116	378	9	-	-	8,037
Combined Carriers	-	-	-	-	-	-	-	-	-	-	-
General Cargo Ships	1,635	39	1	-	-	-	-	-	-	-	1,674
Containerships	492	3,990	5,495	752	910	-	-	-	-	-	11,639
LASH Ships	-	-	-	-	-	-	-	-	-	-	-
Ro/Ro Ships	150	109	-	-	-	-	-	-	-	-	259
Car Carriers	1,992	82	1	-	-	-	-	-	-	-	2,075
Passenger Ships	104	-	1	-	-	-	-	-	-	-	105
War Ships	213	2	-	-	-	-	-	-	-	-	215
Others	473	-	-	-	-	-	-	-	-	-	473
Total	8,056	10,014	7,485	1,050	1,010	231	437	24	350	-	28,657

Source) JICA Study Team estimation

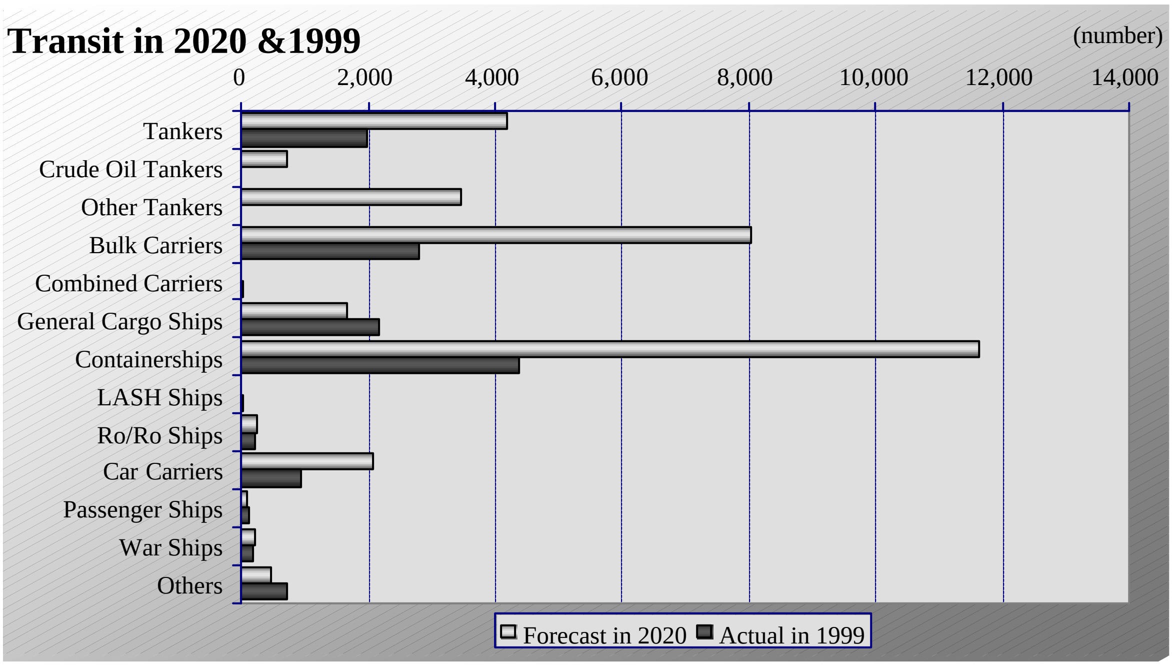


Figure 4.6.1 Transit in 2020 and 1999

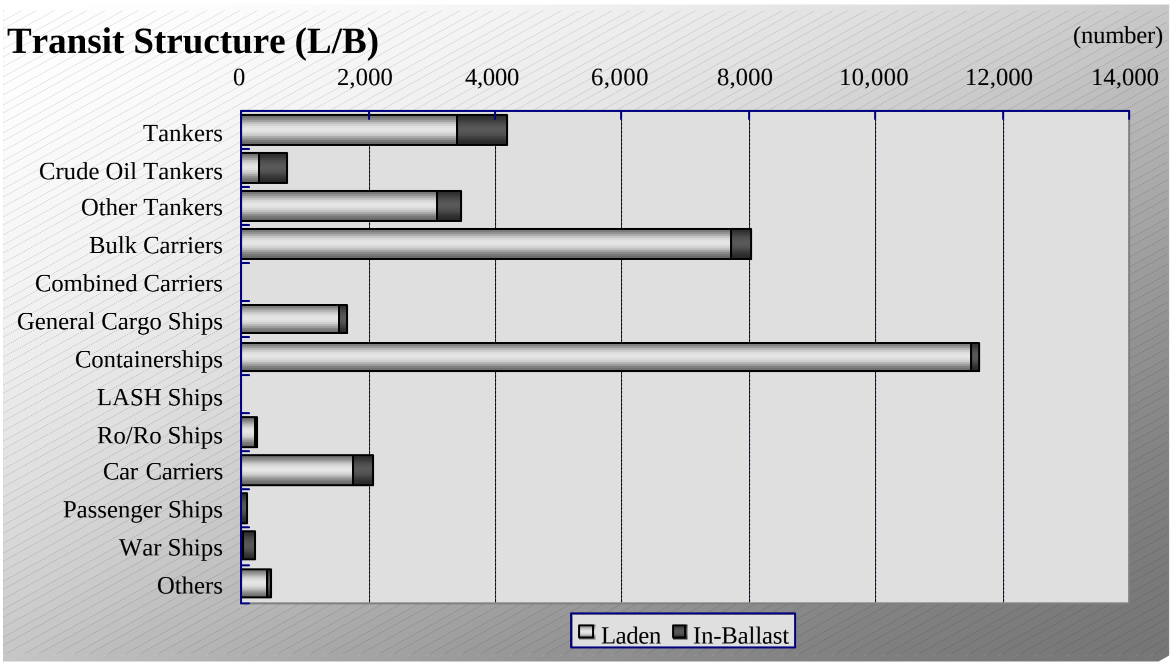


Figure 4.6.2 Transit Laden/in-Ballast in 2020

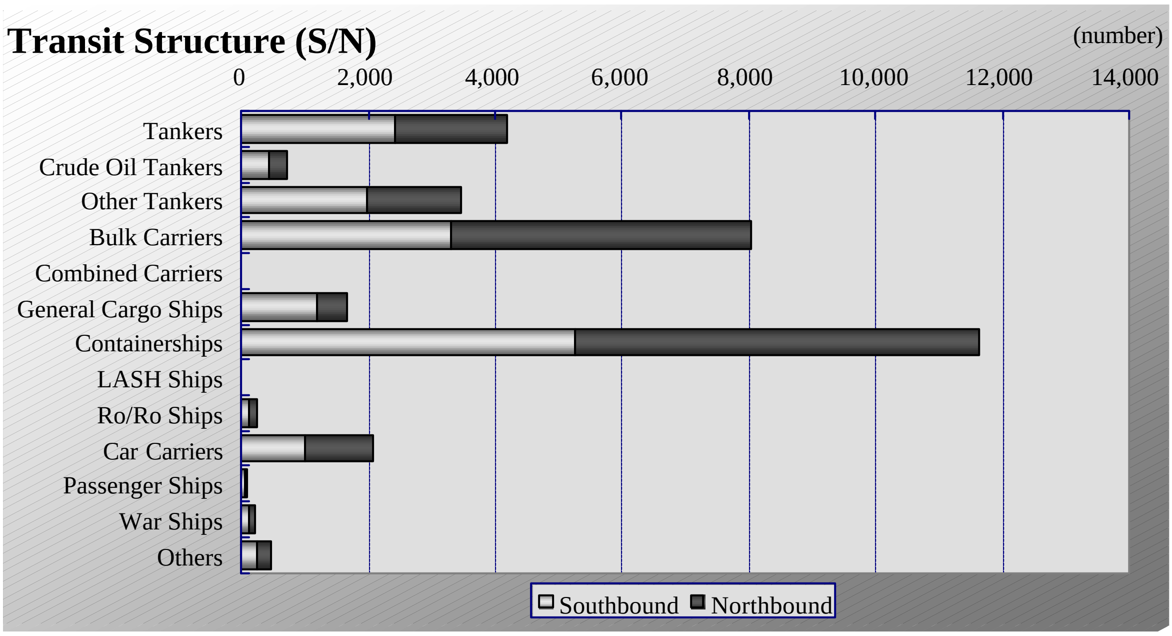


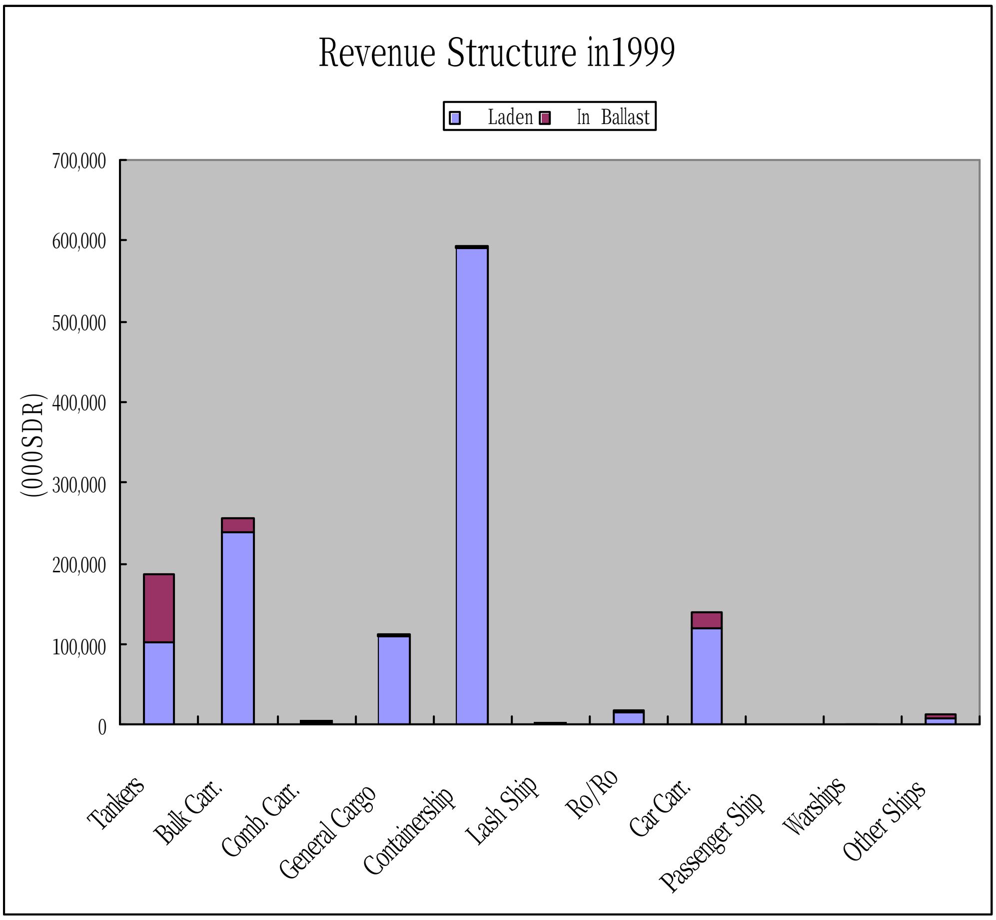
Figure 4.6.3 Transit Northbound/southbound in 2020

Chapter 5 Revenue

5.1 Present revenue structure

Revenue defined here is the income of SCA from Transit. SCA has other sources of revenue such as piloting, but this revenue is not included here.

The containership is the most important source of revenue for SCA at present.
The share of containership to total canal transit was 44% in SCNT in 1999. The revenue is estimated to be and about 590 million SDR. The next is Bulk Carrier followed by Tanker



Source) JICA Study Team estimated from SCA Transit Database

Figure 5.1.1 Revenue Structure (1999)

Table 5.1.1 Share of Containership

	Containership	Total	Share %
Cargo Ton	126,958,000 Ton	306,670,000 Ton	41%
Suez Net Ton	168,278,000 SNT	385,125,000 SNT	44%
Number of Vessel	4,377	13,613	32%
Revenue	590mill. SDR	1,324mill.SDR	45%

Source) JICA Study Team estimated from SCA Transit Database

5.2 Procedure of forecast

Forecast of revenue is quite simple. The result of the forecast of Transit in Chapter 4 was multiplied with Toll of the Suez Canal.

Transit was forecast by vessel size class of DWT in Chapter 4.
The representative SCNT of each vessel size class was determined by converting DWT to SCNT. Then, Toll was multiplied by SCNT.

5.3 Result of forecast

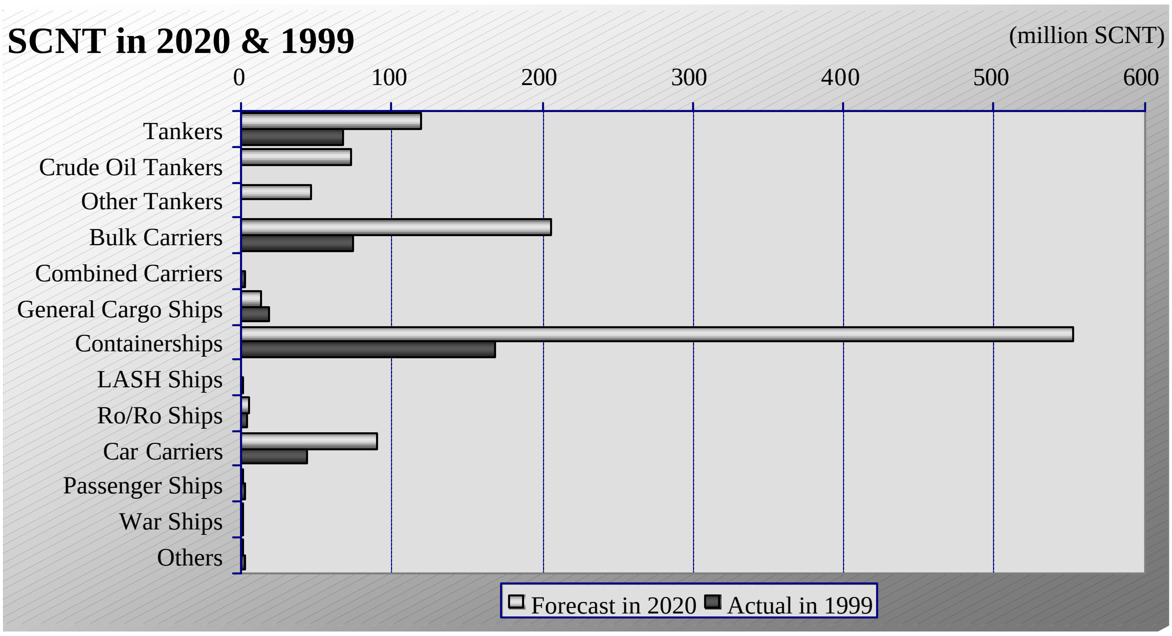
Table 5.3.1 is the future SCNT by vessel type. The trend of growth of SCNT is similar to that of Transit.
Containership, Tanker and Bulk Carrier will contribute to the great increase in SCNT.

Table 5.3.1 Suez Canal Net Ton (2020)

(1000SCNT)

Vessel Type	(1)Forecast in 2020 SCNT	(1)Forecast in 2020 Comp. Ratio	(2)Actual in 1999 SCNT	(2)Actual in 1999 Comp. Ratio	Growth (1)/(2)
Tankers	119,595	12.1%	67,862	17.6%	1.76
Crude Oil Tankers	73,076	7.4%	-	-	-
Other Tankers	46,519	4.7%	-	-	-
Bulk Carriers	206,084	20.8%	73,610	19.1%	2.80
Combined Carriers	-	0.0%	2,260	0.6%	-
General Cargo Ships	13,217	1.3%	18,880	4.9%	0.70
Containerships	552,734	55.7%	168,278	43.7%	3.28
LASH Ships	-	0.0%	1,159	0.3%	-
Ro/Ro Ships	5,144	0.5%	3,890	1.0%	1.32
Car Carriers	90,800	9.2%	43,262	11.2%	2.10
Passenger Ships	1,465	0.1%	1,797	0.5%	0.82
War Ships	1,434	0.1%	1,370	0.4%	1.05
Others	1,414	0.1%	2,758	0.7%	0.51
Total	991,888	100.0%	385,125	100.0%	2.58

Source) (1)JICA study team, (2)SCA transit database 1999



Source) JICA Study Team estimated from SCA Transit Database

Figure 5.3.1 SCNT in 2020 and 1999

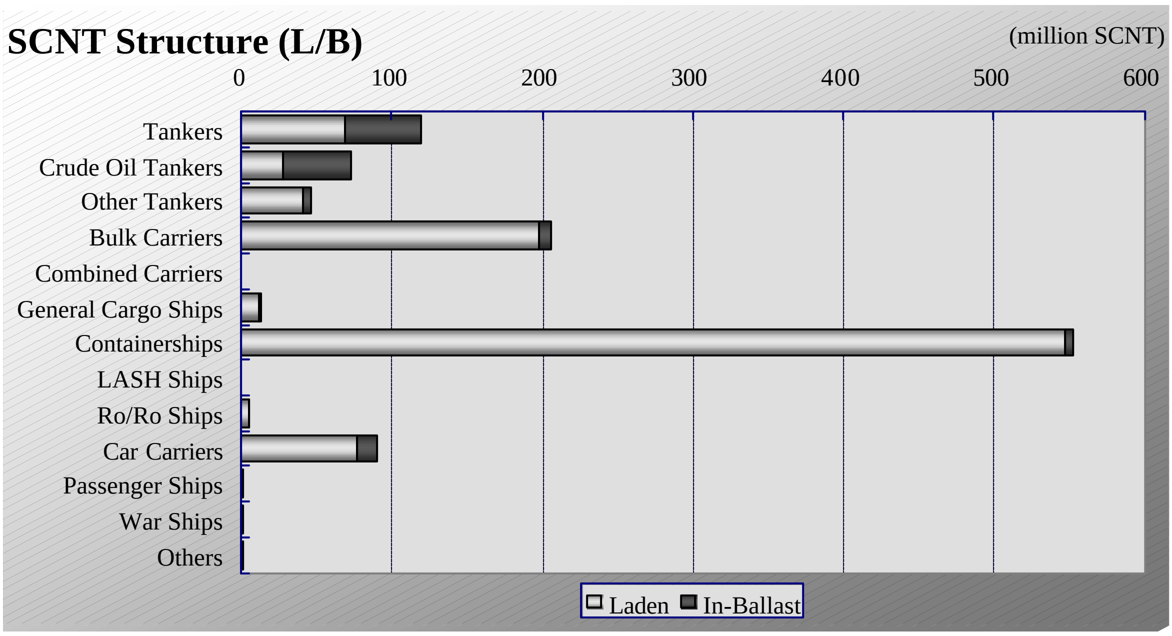
Table 5.3.2 is SCNT by direction and loading status.
Crude Oil Tanker should be paid attention to. SCNT of in-ballast Crude Tanker is near that of laden Tanker. Even if the maximum size of the Suez transits becomes 300,000DWT, some tankers will use C/S route. In-Ballast VLCCs will pass the Canal bound for the south. As result, Crude Oil Tanker will remain in the profitable position in SCNT while it will be only 2.5% in number of vessels.

Table 5.3.2 Suez Canal Net Ton by Direction and L/B (2020)

(1000SCNT,2020)

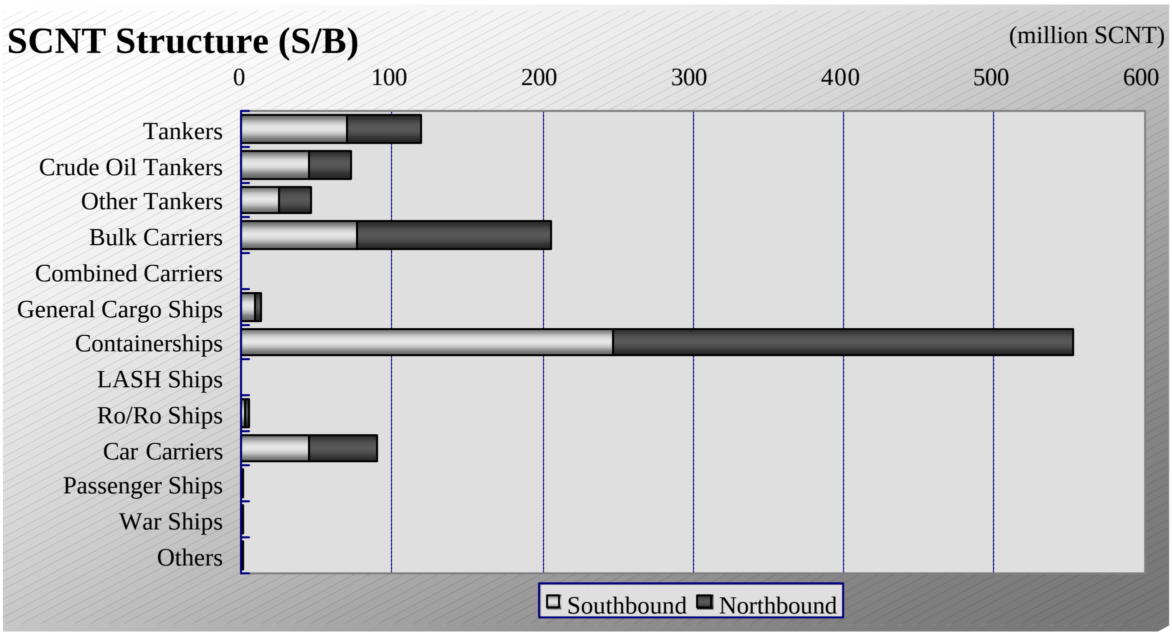
Vessel Type	Laden			In Ballast			Total		
	S-bound	N-bound	Total	S-bound	N-bound	Total	S-bound	N-bound	Total
Tankers	23,210	45,089	68,299	47,204	4,093	51,297	70,414	49,182	119,595
Crude Oil Tankers	1,547	26,271	27,818	43,269	1,990	45,259	44,816	28,260	73,076
Other Tankers	21,663	18,818	40,481	3,935	2,103	6,038	25,598	20,921	46,519
Bulk Carriers	73,068	125,119	198,187	3,879	4,019	7,897	76,946	129,138	206,084
Combined Carriers	-	-	-	-	-	-	-	-	-
General Cargo Ships	9,133	3,069	12,202	184	831	1,015	9,317	3,900	13,217
Containerships	242,398	304,918	547,316	3,964	1,454	5,418	246,362	306,372	552,734
LASH Ships	-	-	-	-	-	-	-	-	-
Ro/Ro Ships	2,515	2,320	4,834	138	171	309	2,653	2,491	5,144
Car Carriers	31,187	46,185	77,372	13,116	312	13,428	44,303	46,497	90,800
Passenger Ships	14	15	29	653	783	1,436	668	798	1,465
War Ships	111	115	226	646	562	1,208	757	677	1,434
Others	620	620	1,239	88	88	175	707	707	1,414
Total	382,255	527,449	909,703	69,872	12,313	82,185	452,127	539,761	991,888

Source) JICA Study Team estimation



Source) JICA Study Team estimation

Figure 5.3.2 SCNT Laden/In-ballast in 2020



Source) JICA Study Team estimation

Figure 5.3.3 SCNT Northbound/Southbound in 2020

Table 5.3.3 is the revenue from Transit in 2020.
The major source of the revenue will be Containership. Containership is the best revenue source for SCA at present, and the share of Containership will exceed 50%. The share of Car Carrier will be smaller because of less growth than Containership.

Table 5.3.4 shows the structure of revenue. It is almost the same as that of SCNT.

Table 5.3.3 Revenue (2020)

(million SDR)

Vessel Type	(1)Forecast in 2020 Revenue	Comp. Ratio	(2)Estimated in 1999 Revenue	Comp. Ratio	Growth (1)/(2)
Tankers	353.2	10.6%	175.4	13.3%	2.01
Crude Oil Tankers	127.8	3.8%	-	-	-
Other Tankers	225.4	6.7%	-	-	-
Bulk Carriers	564.1	16.9%	248.2	18.8%	2.27
Combined Carriers	-	0.0%	5.2	0.4%	-
General Cargo Ships	79.2	2.4%	110.3	8.3%	0.72
Containerships	1,979.0	59.3%	589.7	44.6%	3.36
LASH Ships	-	0.0%	4.6	0.3%	-
Ro/Ro Ships	37.2	1.1%	18.6	1.4%	2.00
Car Carriers	300.0	9.0%	140.2	10.6%	2.14
Passenger Ships	5.9	0.2%	7.2	0.5%	0.83
War Ships	3.9	0.1%	5.3	0.4%	0.73
Others	16.9	0.5%	18.9	1.4%	0.89
Total	3,339.4	100.0%	1,323.6	100.0%	2.52

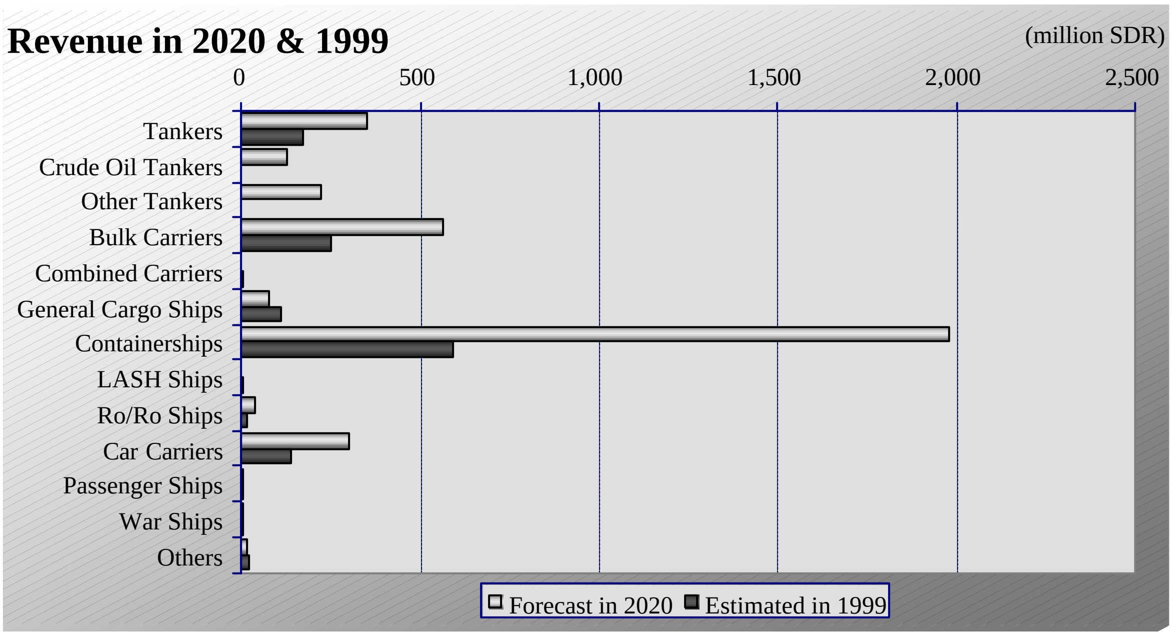
Source) JICA Study Team estimation

Table 5.3.4 Revenue by Direction and L/B (2020)

(million SDR, 2020)

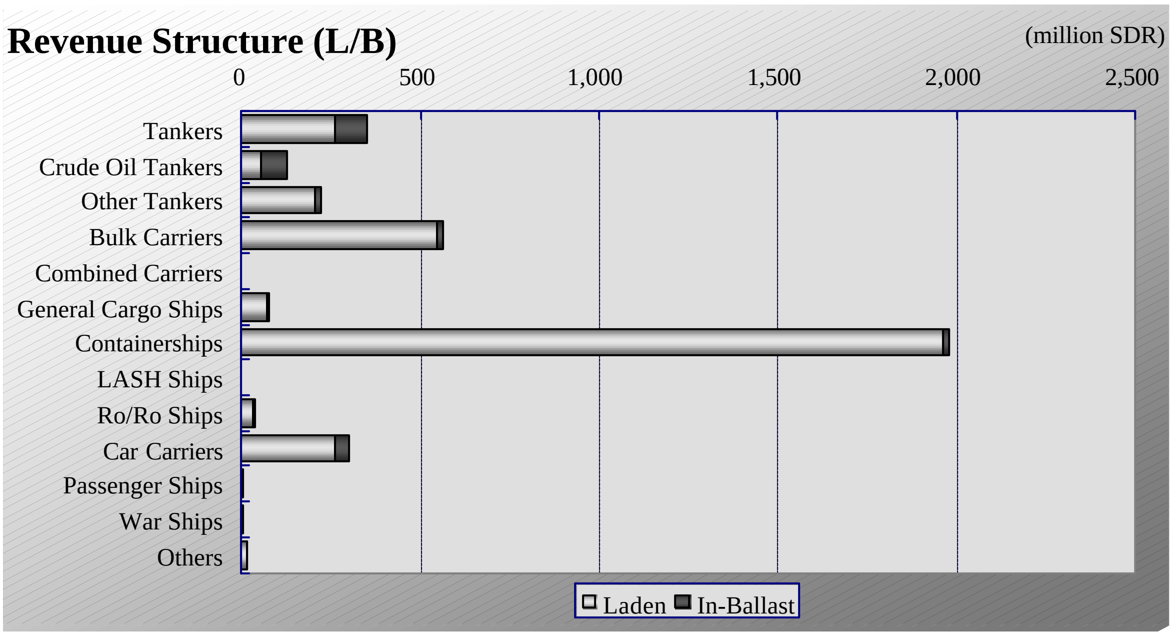
Vessel Type	Laden S-bound	Laden N-bound	Laden Total	In Ballast S-bound	In Ballast N-bound	In Ballast Total	Total S-bound	Total N-bound	Total Total
Tankers	119.3	140.7	260.0	81.7	11.5	93.2	201.0	152.2	353.2
Crude Oil Tankers	3.5	51.5	55.0	69.2	3.6	72.8	72.7	55.1	127.8
Other Tankers	115.8	89.1	204.9	12.5	7.9	20.4	128.3	97.0	225.4
Bulk Carriers	256.8	287.9	544.6	7.5	12.0	19.5	264.3	299.8	564.1
Combined Carriers	-	-	-	-	-	-	-	-	-
General Cargo Ships	55.3	18.6	73.9	0.9	4.3	5.2	56.3	22.9	79.2
Containerships	873.0	1,089.6	1,962.6	12.0	4.4	16.4	885.0	1,094.0	1,979.0
LASH Ships	-	-	-	-	-	-	-	-	-
Ro/Ro Ships	18.1	16.2	34.3	1.3	1.6	2.9	19.3	17.8	37.2
Car Carriers	105.4	156.0	261.4	37.6	0.9	38.5	143.0	156.9	300.0
Passenger Ships	0.1	0.0	0.1	2.7	3.1	5.8	2.8	3.1	5.9
War Ships	0.4	0.3	0.7	1.7	1.5	3.2	2.1	1.8	3.9
Others	7.5	7.5	15.1	0.9	0.9	1.8	8.5	8.5	16.9
Total	1,435.8	1,716.9	3,152.8	146.5	40.1	186.6	1,582.3	1,757.1	3,339.4

Source) JICA Study Team estimation



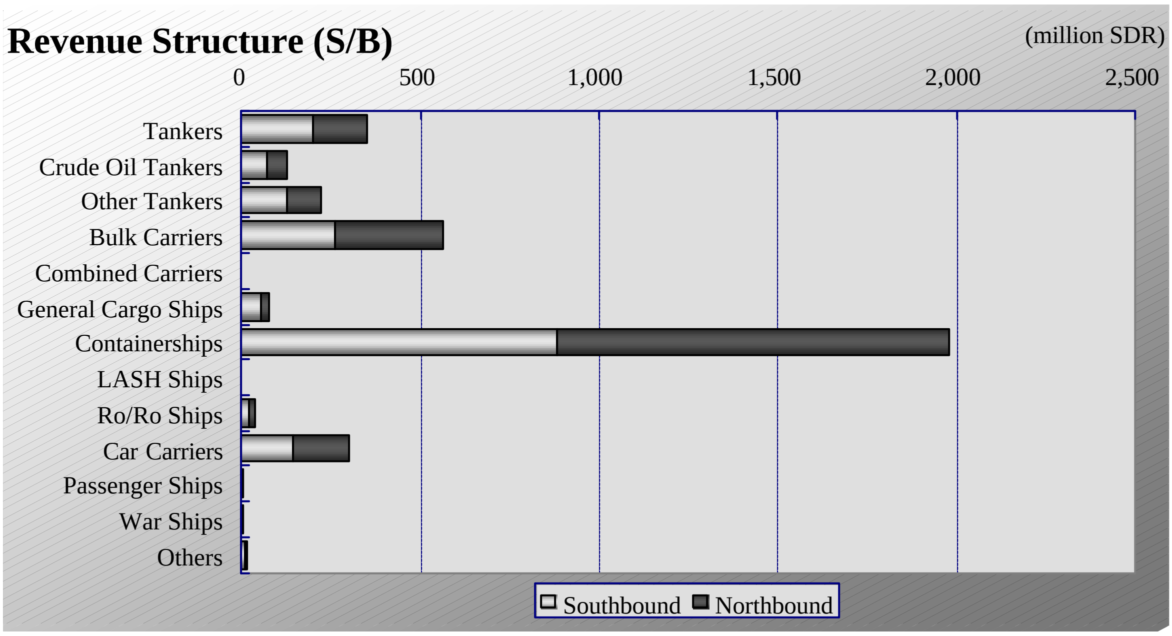
Source) JICA Study Team estimation

Figure 5.3.4 Revenue in 2020 and 1999



Source) JICA Study Team estimation

Figure 5.3.5 Revenue Laden/In-ballast in 2020



Source) JICA Study Team estimation

Figure 5.3.6 Revenue Northbound/Southbound in 2020

Chapter 6 Summary and Additional Scenarios

6.1 Baseline Scenario

6.1.1 Presumptions

Table 6.1.1 is the presumptions used for forecasting.

Table 6.1.1 Presumption of the Forecast

World Trade	GDP	:3.1%
Potential Cargo	Sea-borne ratio	: the present ratio (1998)
	Containerization ratio	
	Liquid Cargo	: the present ratio (1998)
	Bulk Cargo	: the present ratio (1998)
	Other Cargo	: Increase to 80-90%
	Deduction to Crude Oil Pipelines	
	SUMED	: 120 million ton/year
	Iraq-Turkey	: 30 million ton/year
Transit	Route Choice	: A route with the minimum shipping cost is selected
	Canal Size Constraint	: Full-laden Tanker of 300,000DWT
	Toll	: the present toll table
	Discount	
	Crude Oil Tanker	: 45%(in-ballastVLCC from Mexican Gulf) 55%(in-ballast VLCC from CS. America)
	Bulk Carrier	: 80%(between NW. Europe and Oceania) 50%(between NW. Europe and SE./E. Asia) 50%(between E. Africa and W.E. Med)
	LNG Tanker	: 35% for every trip
	Surcharge	
	Containership	: 9.7% for every trip
	War Ship	: 25% for every trip
	Other Charges	: Tugboats, Agents, Pilots and Others Fee to Port Authority
	Shipping Cost	: a cost model was developed
	Commodity Inventory Cost is added for Containership (Applied to 30% of containerized cargo)	
	Container Box Capital Cost is added for Containership (Applied to 80% of nominal capacity of a Containership)	
	Commodity Inventory Cost is added for Car Carrier	
	Market Condition	: healthy market
SCA Revenue	Revenue from Toll and Tugboat	

6.1.2 Results

Table 6.1.2 is the summary of the forecast results of the baseline case.

In 2020, the Suez Canal will get 28,657 vessels as a demand. If all demand passes through the Canal, 3,339mil SDR will be paid to SCA.

Table 6.1.2 Summary of Forecast (2020)

Vessel Type	Transit (Number)	SCNT (1000SCNT)	Revenue (million SDR)
Tankers	4,179	119,595	353
Crude Oil Tankers	725	73,076	128
Other Tankers	3,455	46,519	225
Bulk Carriers	8,037	206,084	564
Combined Carriers	-	-	-
General Cargo Ships	1,674	13,217	79
Containerships	11,639	552,734	1,979
LASH Ships	-	-	-
Ro/Ro Ships	259	5,144	37
Car Carriers	2,075	90,800	300
Passenger Ships	105	1,465	6
War Ships	215	1,434	4
Others	473	1,414	17
Total	28,657	991,888	3,339

Source) JICA Study Team estimation

Transit Structure (V-Type)

Total 28,657 transits

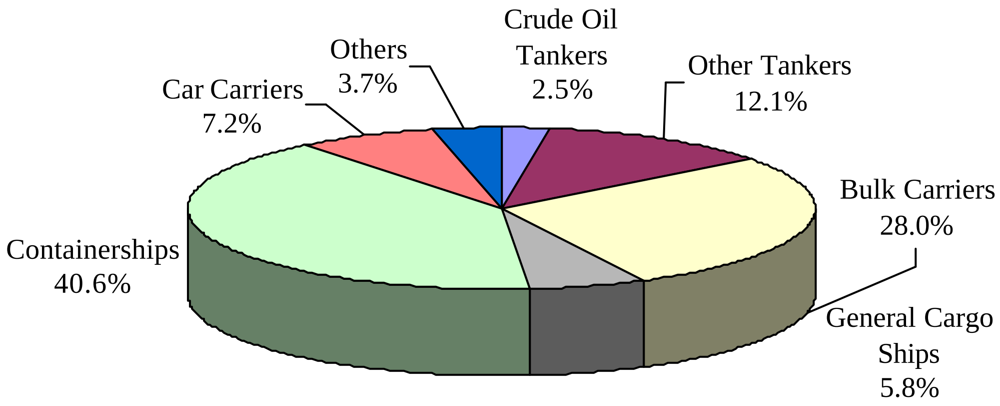


Figure 6.1.1 Transit in 2020

SCNT Structure (V-Type)

Total 991,888 thousand SCNT

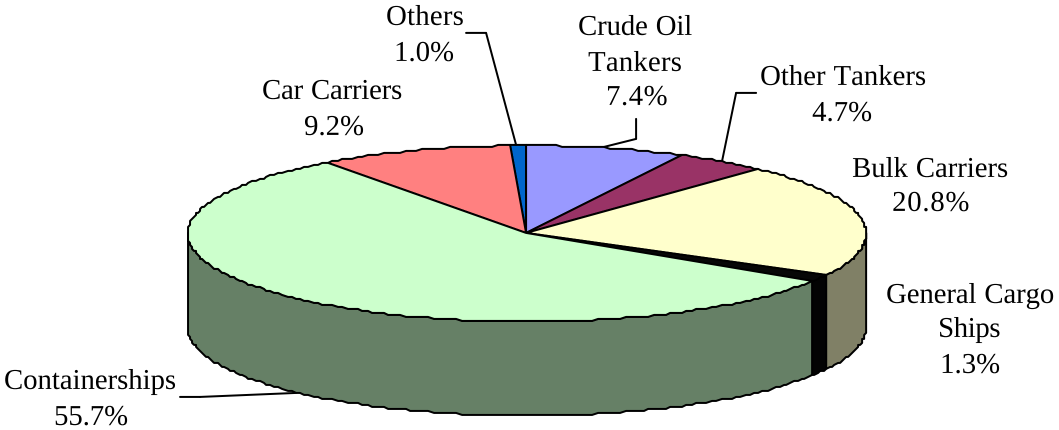


Figure 6.1.2 SCNT in 2020

Revenue Structure (V-Type)

Total 3,339 million SDR

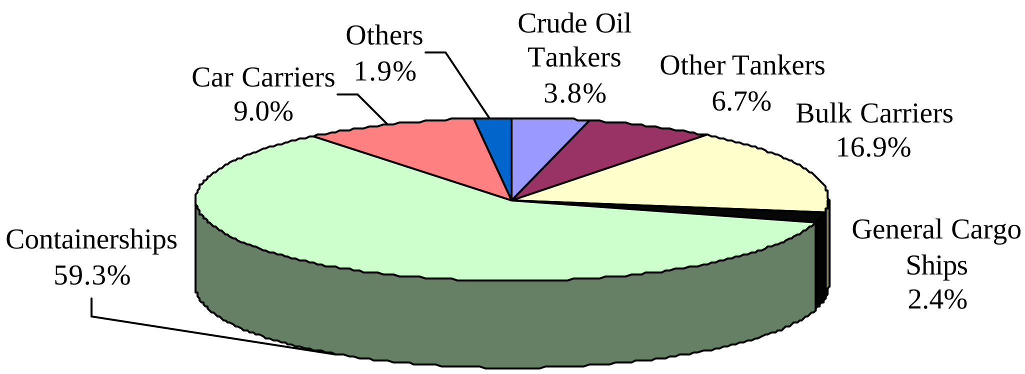


Figure 6.1.3 Revenue from Transit in 2020

6.2 Additional Case and Scenario

6.2.1 Additional Case: Delay of the Canal Work

This additional case is a negative condition of the Canal work. In baseline case, the maximum size of the canal transits was presumed to be 300,000DWT. But if the work of the Canal is delayed and the maximum size becomes 200,000DWT, the Canal will lose the chance to get Transit.

Table 6.2.1 Additional Case for the Canal Size

	Scenario
Case 0 (Baseline case)	300,000DWT or smaller laden vessels can use the Canal.
Case 1	200,000DWT or smaller laden vessel can use the Canal.

The result of Forecast is Table 6.2.2. The number of laden Tanker will be 168 for case 1, while it will be 292 for case0. The Canal will lose 124 laden tankers. These tankers will use the Canal in ballast, but SCA will lose 31.4 mil SDR, about 24.6% of revenue from Crude Oil Tanker.

Table 6.2.2 Result of Forecast of Crude Oil Tanker

	Presumption		Result				
	V-Size Range (1000DWT)	SC transit Possibility	Transit (Number) Laden	In-Ballast	Total	SCNT (1000SCNT)	Revenue (millionSDR)
(1) Case 0	0-200	O	168	192	360	21,365	45.8
	200-300	O	124	241	365	51,711	82.0
	300+	X		0	0	0	0
	Total		292	433	725	73,076	127.8
(2) Case 1	0-200	O	168	192	360	21,365	45.8
	200-300	X		241	241	34,066	50.6
	300+	X		0	0	0	0
	Total		168	433	601	55,431	96.4
Difference [=(2)-(1)]	0-200				0		
	200-300		-124		-124	-17,645	-31.4
	300+				0		
	Total		-124	0	-124	-17,645	-31.4
Ratio [=(2)-(1)/(1)]			-42.5%		-17.1%	-24.1%	-24.6%

6.2.2 Additional Scenario A: Low Market

In baseline scenario, the shipping market is presumed to be healthy. But the actual market will not be necessarily healthy. Because it is almost impossible to forecast the future market, the forecast under other market conditions were studied.

Table 6.2.3 Additional Scenario for the Market Conditions

	Scenario
Scenario 0 (Baseline Scenario)	Market is healthy. Charter rate will cover the full capital cost.
Scenario 1	Market is not healthy. Charter rate will cover only 50% of the capital cost.
Scenario 2	Market is not healthy. Charter rate will not cover the capital cost.

Table 6.2.4 is the result of forecast under each scenario.
If the market is not healthy and no capital cost is considered for the route choice, the transit will be 24,696 vessels per year. This value is 86% of Transit under a healthy market. The loss of revenue would be as much as 380.3 million SDR (= 3,339.4 - 2,959.1)

Table 6.2.4 Forecast under different market conditions
(case0: 300,000DWT Canal)

	Transit (Number)	SCNT (1000SCNT)	Revenue (millionSDR)
Scenario 0 (Healthy Market)	28,657 78.5/day	991,888	3,339.4
Scenario 1 (50% of the Capital cost)	27,239 74.6/day	943,629	3,207.8
Scenario 2 (0% of Capital cost)	24,696 67.7/day	840,042	2,959.1

If the Canal Work is delayed (200,000DWT Canal), the forecast under each scenario is given in Table 6.2.5

Table 6.2.5 Forecast under different market conditions
(case1: 200,000DWT Canal)

	Transit (Number)	SCNT (1000SCNT)	Revenue (millionSDR)
Scenario 0 (Healthy Market)	28,533 78.2/day	974,242	3,307.9
Scenario 1 (50% of Capital cost)	27,190 74.5/day	936,608	3,195.3
Scenario 2 (0% of Capital cost)	24,677 67.6/day	837,322	2,954.3

Table 6.2.6 Forecast under different market conditions by vessel type (case0: 300,000DWT Canal)

	Scenario 0						Scenario 1						Scenario 2					
	Transit		SCNT		Revenue		Transit		SCNT		Revenue		Transit		SCNT		Revenue	
Vessel Type	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio
Tankers	4,179	14.6%	119,595	12.1%	353.2	10.6%	3,246	11.9%	90,217	9.6%	268.4	8.4%	2,197	8.9%	43,509	5.2%	157.8	5.3%
Crude Oil Tankers	725	2.5%	73,076	7.4%	127.8	3.8%	560	2.1%	54,139	5.7%	94.7	3.0%	265	1.1%	19,190	2.3%	37.5	1.3%
Other Tankers	3,455	12.1%	46,519	4.7%	225.4	6.7%	2,686	9.9%	36,078	3.8%	173.7	5.4%	1,931	7.8%	24,319	2.9%	120.3	4.1%
Bulk Carriers	8,037	28.0%	206,084	20.8%	564.1	16.9%	7,596	27.9%	187,532	19.9%	519.4	16.2%	6,116	24.8%	130,962	15.6%	382.7	12.9%
Combined Carriers	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
General Cargo Ships	1,674	5.8%	13,217	1.3%	79.2	2.4%	1,631	6.0%	12,888	1.4%	77.2	2.4%	1,617	6.5%	12,579	1.5%	75.8	2.6%
Containerships	11,639	40.6%	552,734	55.7%	1,979.0	59.3%	11,639	42.7%	552,734	58.6%	1,979.0	61.7%	11,639	47.1%	552,734	65.8%	1,979.0	66.9%
LASH Ships	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
Ro/Ro Ships	259	0.9%	5,144	0.5%	37.2	1.1%	259	1.0%	5,144	0.5%	37.2	1.2%	259	1.0%	5,144	0.6%	37.2	1.3%
Car Carriers	2,075	7.2%	90,800	9.2%	300.0	9.0%	2,075	7.6%	90,800	9.6%	300.0	9.4%	2,075	8.4%	90,800	10.8%	300.0	10.1%
Passenger Ships	105	0.4%	1,465	0.1%	5.9	0.2%	105	0.4%	1,465	0.2%	5.9	0.2%	105	0.4%	1,465	0.2%	5.9	0.2%
War Ships	215	0.7%	1,434	0.1%	3.9	0.1%	215	0.8%	1,434	0.2%	3.9	0.1%	215	0.9%	1,434	0.2%	3.9	0.1%
Others	473	1.7%	1,414	0.1%	16.9	0.5%	473	1.7%	1,414	0.1%	16.9	0.5%	473	1.9%	1,414	0.2%	16.9	0.6%
Total	28,657	100.0%	991,888	100.0%	3,339.4	100.0%	27,239	100.0%	943,629	100.0%	3,207.8	100.0%	24,696	100.0%	840,042	100.0%	2,959.1	100.0%

Table 6.2.7 Forecast under different market conditions by vessel type (case1: 200,000DWT Canal)

	Scenario 0						Scenario 1						Scenario 2					
	Transit		SCNT		Revenue		Transit		SCNT		Revenue		Transit		SCNT		Revenue	
Vessel Type	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio
Tankers	4,056	14.2%	101,950	10.5%	321.8	9.7%	3,197	11.8%	83,196	8.9%	255.9	8.0%	2,178	8.8%	40,789	4.9%	152.9	5.2%
Crude Oil Tankers	601	2.1%	55,431	5.7%	96.4	2.9%	511	1.9%	47,118	5.0%	82.2	2.6%	246	1.0%	16,470	2.0%	32.7	1.1%
Other Tankers	3,455	12.1%	46,519	4.8%	225.4	6.8%	2,686	9.9%	36,078	3.9%	173.7	5.4%	1,931	7.8%	24,319	2.9%	120.3	4.1%
Bulk Carriers	8,037	28.2%	206,084	21.2%	564.1	17.1%	7,596	27.9%	187,532	20.0%	519.4	16.3%	6,116	24.8%	130,962	15.6%	382.7	13.0%
Combined Carriers	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
General Cargo Ships	1,674	5.9%	13,217	1.4%	79.2	2.4%	1,631	6.0%	12,888	1.4%	77.2	2.4%	1,617	6.6%	12,579	1.5%	75.8	2.6%
Containerships	11,639	40.8%	552,734	56.7%	1,979.0	59.8%	11,639	42.8%	552,734	59.0%	1,979.0	61.9%	11,639	47.2%	552,734	66.0%	1,979.0	67.0%
LASH Ships	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
Ro/Ro Ships	259	0.9%	5,144	0.5%	37.2	1.1%	259	1.0%	5,144	0.5%	37.2	1.2%	259	1.1%	5,144	0.6%	37.2	1.3%
Car Carriers	2,075	7.3%	90,800	9.3%	300.0	9.1%	2,075	7.6%	90,800	9.7%	300.0	9.4%	2,075	8.4%	90,800	10.8%	300.0	10.2%
Passenger Ships	105	0.4%	1,465	0.2%	5.9	0.2%	105	0.4%	1,465	0.2%	5.9	0.2%	105	0.4%	1,465	0.2%	5.9	0.2%
War Ships	215	0.8%	1,434	0.1%	3.9	0.1%	215	0.8%	1,434	0.2%	3.9	0.1%	215	0.9%	1,434	0.2%	3.9	0.1%
Others	473	1.7%	1,414	0.1%	16.9	0.5%	473	1.7%	1,414	0.2%	16.9	0.5%	473	1.9%	1,414	0.2%	16.9	0.6%
Total	28,533	100.0%	974,242	100.0%	3,307.9	100.0%	27,190	100.0%	936,608	100.0%	3,195.3	100.0%	24,677	100.0%	837,322	100.0%	2,954.3	100.0%

6.2.3 Additional Scenario B: Larger Containerships and Car Carrier

In the baseline scenario, the future fleet-mixes were calculated from the fleet-mix of the present Suez transits and the future world fleet-mix. The future world fleet-mix was set based on the scenario that the recent delivery would be the future fleet-mix.

Additional scenario is based on the idea that the much larger Containerships and Car Carriers will be used in the future. Table 6.2.8 shows the future (2020) fleet-mixes of both scenarios. For Containership, the fleet-mix in long & middle range will shift to larger sizes. Vessels in short range will remain in the present size because larger containerships will be used in longer routes.

Table 6.2.8 The Future Fleet-Mix

(1000DWT)

V-Type	Voyage distance range	Scenario	0-25	25-50	50-75	75-100	100-125	125-150	Total
Containership	Long & middle	Baseline		13%	69%	15%	2%		100%
		Additional		5%	25%	40%	25%	5%	100%
	Short	Baseline	5%	63%	27%	2%	3%		100%
		Additional	5%	63%	27%	2%	3%		100%
Car Carrier	All	Baseline	93%	7%					100%
		Additional	75%	25%					100%

Large Containerships (125-150,000DWT) will be operated in the additional scenario. It should be noted that a representative vessel size is set for each vessel size range. In the forecasting program the representative vessel size of 100-125,000DWT Containership was set 120,000 DWT in the baseline scenario. It was shifted to 112,500DWT in the additional scenario.

In the baseline scenario, the maximum size range was limited to 125,000DWT, but the representative size was set in a relatively large size to reflect the trend of building larger containers. However, in the additional scenario, the trend of larger vessels was reflected on the new size range (125-150,000DWT). Therefore the representative size was set at the middle of 100-125,000DWT.

Table 6.2.9 shows the result of the forecast of the additional scenario. Due to the larger Container ships and Car Carriers, total number of transits will be smaller. But total SCNT will be larger.

Revenue will be slightly less than that of the baseline scenario because SCA tariff table is favorable to larger vessels.

Table 6.2.9 Summary of Forecast (2020)

(Larger Containerships and Car Carriers)

Vessel Type	Transit (Number)	SCNT (1000SCNT)	Revenue (million SDR)
Tankers	4,179	119,595	353
Crude Oil Tankers	725	73,076	128
Other Tankers	3,455	46,519	225
Bulk Carriers	8,037	206,084	564
Combined Carriers	-	-	-
General Cargo Ships	1,674	13,217	79
Containerships	9,997	575,584	1,965
LASH Ships	-	-	-
Ro/Ro Ships	259	5,144	37
Car Carriers	1,905	90,800	293
Passenger Ships	105	1,465	6
War Ships	215	1,434	4
Others	473	1,414	17
Total	26,843	1,014,738	3,319

Daily Transit	73.5

Source) JICA Study Team estimation

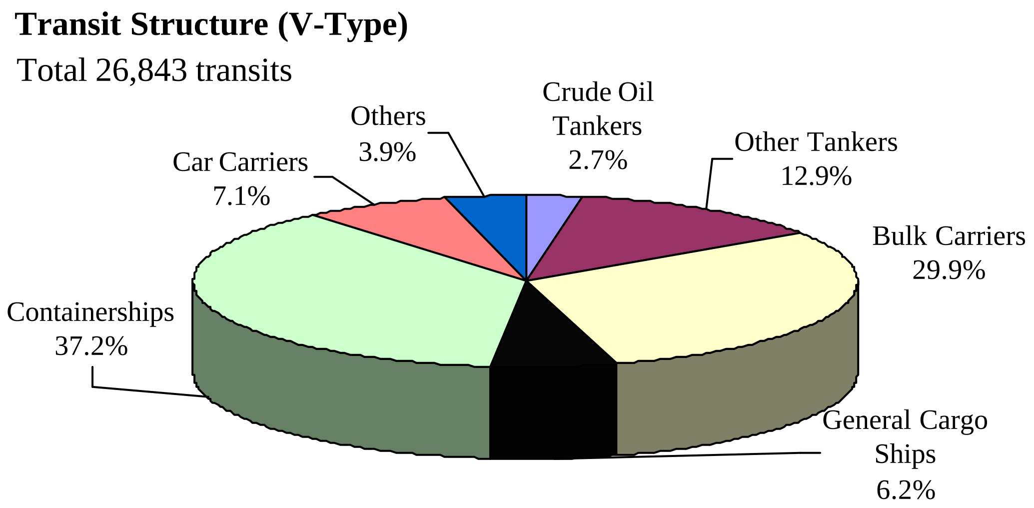


Figure 6.2.1 Transit in 2020 (Additional Scenario B)

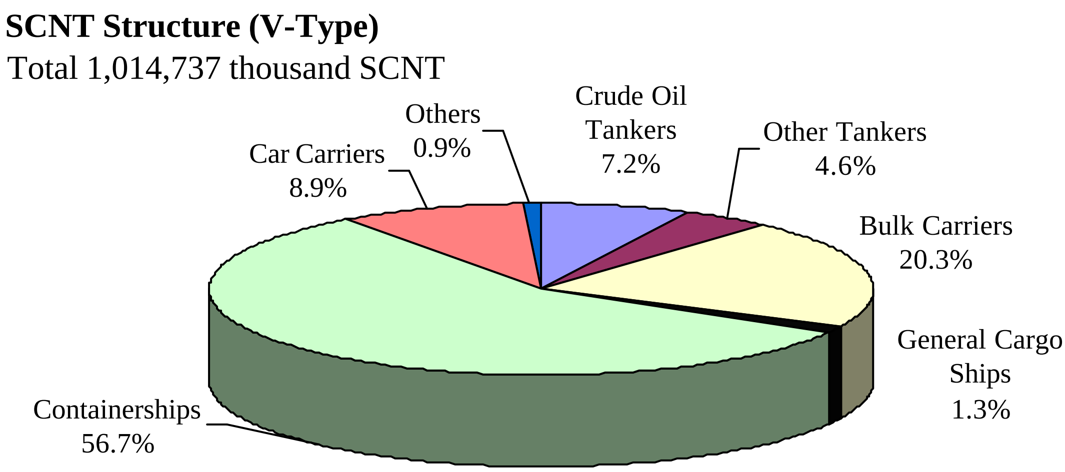


Figure 6.2.2 SCNT in 2020 (Additional Scenario B)

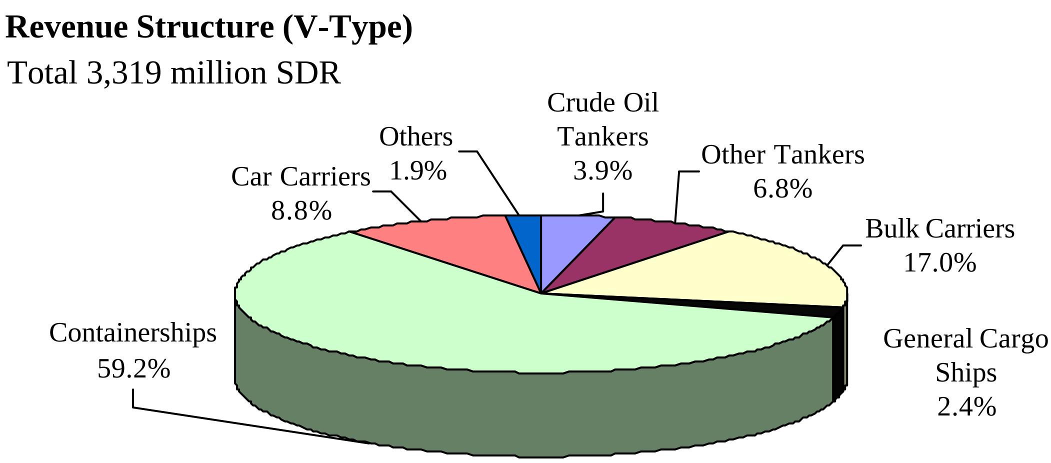


Figure 6.2.3 Revenue from Transit in 2020 (Additional Scenario B)

Table 6.2.10 shows the combination of two scenarios (low Market and Larger Containership / Car Carrier).

Table 6.2.10 Forecast under different market conditions and larger vessels
(Scenario A & B)
(case0: 300,000DWT Canal)

	Transit (Number)	SCNT (1000SCNT)	Revenue (millionSDR)
Scenario 0 (Healthy Market)	26,843 73.5/day	1,014,738	3,318.7
Scenario 1 (50% of the Capital cost)	25,426 69.7/day	966,479	3,187.1
Scenario 2 (0% of Capital cost)	22,883 62.7/day	862,891	2,938.5

Table 6.2.11 Forecast under different market conditions and larger vessels
(Scenario A & B)
(case1: 200,000DWT Canal)

	Transit (Number)	SCNT (1000SCNT)	Revenue (millionSDR)
Scenario 0 (Healthy Market)	26,720 73.2/day	997,092	3,287.3
Scenario 1 (50% of Capital cost)	25,377 69.5/day	959,458	3,174.6
Scenario 2 (0% of Capital cost)	22,864 62.6/day	860,172	2,933.6

Table 6.2.12 Forecast under different market conditions by vessel type (Scenario A & B)
(case0: 300,000DWT Canal)

	Scenario 0						Scenario 1						Scenario 2					
	Transit		SCNT		Revenue		Transit		SCNT		Revenue		Transit		SCNT		Revenue	
Vessel Type	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio
Tankers	4,179	15.6%	119,595	11.8%	353.2	10.6%	3,246	12.8%	90,217	9.3%	268.4	8.4%	2,197	9.6%	43,509	5.0%	157.8	5.4%
Crude Oil Tankers	725	2.7%	73,076	7.2%	127.8	3.9%	560	2.2%	54,139	5.6%	94.7	3.0%	265	1.2%	19,190	2.2%	37.5	1.3%
Other Tankers	3,455	12.9%	46,519	4.6%	225.4	6.8%	2,686	10.6%	36,078	3.7%	173.7	5.4%	1,931	8.4%	24,319	2.8%	120.3	4.1%
Bulk Carriers	8,037	29.9%	206,084	20.3%	564.1	17.0%	7,596	29.9%	187,532	19.4%	519.4	16.3%	6,116	26.7%	130,962	15.2%	382.7	13.0%
Combined Carriers	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
General Cargo Ships	1,674	6.2%	13,217	1.3%	79.2	2.4%	1,631	6.4%	12,888	1.3%	77.2	2.4%	1,617	7.1%	12,579	1.5%	75.8	2.6%
Containerships	9,997	37.2%	575,584	56.7%	1,964.9	59.2%	9,997	39.3%	575,584	59.6%	1,964.9	61.7%	9,997	43.7%	575,584	66.7%	1,964.9	66.9%
LASH Ships	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
Ro/Ro Ships	259	1.0%	5,144	0.5%	37.2	1.1%	259	1.0%	5,144	0.5%	37.2	1.2%	259	1.1%	5,144	0.6%	37.2	1.3%
Car Carriers	1,905	7.1%	90,800	8.9%	293.4	8.8%	1,905	7.5%	90,800	9.4%	293.4	9.2%	1,905	8.3%	90,800	10.5%	293.4	10.0%
Passenger Ships	105	0.4%	1,465	0.1%	5.9	0.2%	105	0.4%	1,465	0.2%	5.9	0.2%	105	0.5%	1,465	0.2%	5.9	0.2%
War Ships	215	0.8%	1,434	0.1%	3.9	0.1%	215	0.8%	1,434	0.1%	3.9	0.1%	215	0.9%	1,434	0.2%	3.9	0.1%
Others	473	1.8%	1,414	0.1%	16.9	0.5%	473	1.9%	1,414	0.1%	16.9	0.5%	473	2.1%	1,414	0.2%	16.9	0.6%
Total	26,843	100.0%	1,014,738	100.0%	3,318.7	100.0%	25,426	100.0%	966,479	100.0%	3,187.1	100.0%	22,883	100.0%	862,891	100.0%	2,938.5	100.0%

Table 6.2.13 Forecast under different market conditions by vessel type (Scenario A & B)
(case1: 200,000DWT Canal)

	Scenario 0						Scenario 1						Scenario 2					
	Transit		SCNT		Revenue		Transit		SCNT		Revenue		Transit		SCNT		Revenue	
Vessel Type	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio	V-Number	Comp. Ratio	SCNT	Comp. Ratio	Revenue	Comp. Ratio
Tankers	4,056	15.2%	101,950	10.2%	321.8	9.8%	3,197	12.6%	83,196	8.7%	255.9	8.1%	2,178	9.5%	40,789	4.7%	152.9	5.2%
Crude Oil Tankers	601	2.2%	55,431	5.6%	96.4	2.9%	511	2.0%	47,118	4.9%	82.2	2.6%	246	1.1%	16,470	1.9%	32.7	1.1%
Other Tankers	3,455	12.9%	46,519	4.7%	225.4	6.9%	2,686	10.6%	36,078	3.8%	173.7	5.5%	1,931	8.4%	24,319	2.8%	120.3	4.1%
Bulk Carriers	8,037	30.1%	206,084	20.7%	564.1	17.2%	7,596	29.9%	187,532	19.5%	519.4	16.4%	6,116	26.7%	130,962	15.2%	382.7	13.0%
Combined Carriers	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
General Cargo Ships	1,674	6.3%	13,217	1.3%	79.2	2.4%	1,631	6.4%	12,888	1.3%	77.2	2.4%	1,617	7.1%	12,579	1.5%	75.8	2.6%
Containerships	9,997	37.4%	575,584	57.7%	1,964.9	59.8%	9,997	39.4%	575,584	60.0%	1,964.9	61.9%	9,997	43.7%	575,584	66.9%	1,964.9	67.0%
LASH Ships	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
Ro/Ro Ships	259	1.0%	5,144	0.5%	37.2	1.1%	259	1.0%	5,144	0.5%	37.2	1.2%	259	1.1%	5,144	0.6%	37.2	1.3%
Car Carriers	1,905	7.1%	90,800	9.1%	293.4	8.9%	1,905	7.5%	90,800	9.5%	293.4	9.2%	1,905	8.3%	90,800	10.6%	293.4	10.0%
Passenger Ships	105	0.4%	1,465	0.1%	5.9	0.2%	105	0.4%	1,465	0.2%	5.9	0.2%	105	0.5%	1,465	0.2%	5.9	0.2%
War Ships	215	0.8%	1,434	0.1%	3.9	0.1%	215	0.8%	1,434	0.1%	3.9	0.1%	215	0.9%	1,434	0.2%	3.9	0.1%
Others	473	1.8%	1,414	0.1%	16.9	0.5%	473	1.9%	1,414	0.1%	16.9	0.5%	473	2.1%	1,414	0.2%	16.9	0.6%
Total	26,720	100.0%	997,092	100.0%	3,287.3	100.0%	25,377	100.0%	959,458	100.0%	3,174.6	100.0%	22,864	100.0%	860,172	100.0%	2,933.6	100.0%