NO.

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

SUMMARY REPORT

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)

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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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EXECUTIVE SUMMARY

INTRODUCTION

1. In response to a request made by the Government of the Arab Republic of Egypt, the Government of Japan has decided to conduct a study on the Effective Management System of the Suez Canal in the Arab Republic of Egypt.

2. The Study objectives are as follows; (i) to prepare a traffic forecasting model of the Canal, (ii) to prepare a tariff setting system in order to maximize the net revenue from the Canal, (iii) to examine previous development plans and management system of the Canal based on the above, (iv) to make any necessary comments and/or recommendations to realize a more efficient management system of the Canal, (v) to transfer relevant technology to Egyptian counterpart personnel in the course of the Study

OUTLINE OF THE RESULTS

FORECAST

3. In this study, the major output is the forecast of Suez transit. As requested by SCA, not only are the results of the forecast presented, but also the operational forecast model that can be easily handled by personal computer has been prepared by the study team within the scope given by JICA.

4. It is, however, difficult to formulate a world trade forecast model which is useful for forecasting the number of vessels and cargo transiting the Suez Canal with a computer of small capacity. Hence, the study team forecast the future world trade firstly using a large scale computer model operated by WEFA (one of the members of Study consortium), and then after adjusting the forecast results to match the current actual data of transit, the study team constructed the forecast model for Suez potential cargo which is operational with a personal computer.

5. In forecasting the future transit, various factors which will affect the mode and route choices of the sea-borne trade cargo in the future such as the progress of containerization, land-bridges, pipelines, world fleet mix, ocean

freight and even the possibility of alternative routes such as the Panama Canal and the Arctic Ocean route are investigated.

6. In estimating the O-D cargo, the world trade zone from/to which the cargo will potentially use the Suez Canal is classified into 12 zones. Total potential tonnage of trade by all transport modes in the year 2020 is estimated as 1,243 million tons (an increase of 88% between 1998 and the year 2020).

7. Suez potential cargo refers to sea-borne trade that will potentially use the Suez Canal. It is a portion of total potential trade. Future Suez Potential cargo is estimated as 1,047million tons.

8. Based on the estimated Suez potential cargo, Suez transit (cargo and vessel) is estimated through the route choice model which is essentially a transport cost comparison between the Suez route and the Cape route.

9. In the comparison of the costs, Suez Canal toll is assumed to be the same as present, and future fleet mix for each type of vessel is estimated based on the present fleet mix and the trends.

10. It is assumed that 300,000DWT full loaded tankers can transit through the Canal in 2020 given the current deepening plan.

11. As a result, total transit cargo is forecast as 851,178 thousand tons in 2020 which is about 2.78 times the cargo transit in 1999, and total number of vessels is 28,657 (78.5 vessels per day on average).

12. After forecast of transits, future revenue is also forecast based on the current tariff. Estimated revenue is 3,339.4 million SDR in 2020 which is 2.52 times the revenue of 1,323.6 million SDR in 1999.

13. An additional case, where the Canal deepening work is delayed is also analyzed. This scenario results in a decrease in the number of laden tanker transit (-124 vessels) and a decrease in revenue (-31.4million SDR).

14. The condition of the maritime transport market is another variable that is studied. If the market condition is such that charter rate will cover only 50% of the capital cost, then number of transit will become 27,239 vessels in 2020 and revenue will become 3,270.8 million SDR. If the market condition is such that charter rate will not cover even the capital cost, then number of transit will become 24,696 vessels (about 86% of normal condition) and revenue will become 2,959.1 million SDR.

15. Another condition is the fleet-mix. If Container Ships and Vehicle

Carriers will become larger at a faster pace, the number of transit will be 26,843 vessels in 2020 (73.5 vessels par day on average). The revenue will be 3,318.7 million SDR.

MANAGEMENT AND OPERATION POLICY

16. Basic policy on management and operation of the Canal is not clearly defined in the existing documents. After evaluating the effects of the past Canal closure and the Canal's role in the world, regional and national economy, the basic policy should be:

- to consider the balance of power in the global politics.
- to play a role as a safety net for the world maritime transport.
- to achieve co-prosperity for both users and SCA.
- to secure transparency and fairness in management and operation.

TOLL STRUCTURE AND RATES

17. Based on the basic policy above, current toll structure and rates are evaluated in comparison with the structure applied at the Panama Canal and the St Lawrence Seaway.

18. Current structure of Suez Canal toll is considered to be the best in terms of maximizing the toll revenue, although some modifications are necessary. In particular, rates should be based on a standard saved distance of around 4,700 miles (or in between 3,300 miles and 4,700 miles). In addition to this point, it is recommended to introduce a fixed rebate rate system regarding saved distance by main O-D pairs.

19. Another major modification involves revising the toll structure for Container Ships to be able to reflect the earning capacity of the ship, mainly for setting SCNT. The Study Team believes that the currently applied weather deck surcharge based on the number of tiers on deck should be replaced with a discount system based on TEUs once the EDI system is introduced.

20. In the short term, the Study Team recommends a slight increase in the current rates for most of the vessel types, and to monitor the effects carefully for the future revision.

21. And it is also recommended that SCA review and assess the results itself, since complete data on transiting vessels have not been provided to the Study Team by SCA from the managerial reason of SCA.

22. Currency unit to which the toll is to be pegged is also evaluated from various viewpoints such as foreign currency earning capacity for the national accounting, and users' convenience and ease in assessing changes in behavior of users.

MARKETING SYSTEM

23. Marketing policy and marketing managing system are studied. Considering the behavior and characteristics of the shipping market, new marketing management system is proposed for each of the sub-systems of marketing plan and budgeting, marketing information system and marketing organization.

24. Some ideas on improving marketing activities are proposed. They are:

- to create an inter-net homepage.
- to listen to customers' opinions and reflect them in the management.
- to hold regular seminars on the Canal services at maritime centers.
- to strengthen the functions of marketing, etc.

SOME IDEAS ON IMPROVING MANAGEMENT AND OPERATION

25. Some ideas on the improvement of management and operation in the fields of Canal transit service, business diversification, financial management and the modification of some parts in the rules of navigation are proposed based on the analysis of the current operational procedures.

26. After evaluating available transit capacity, the Study Team recommends some changes in the interval of transiting vessels and starting time of the convoys.

27. For the diversification of business, some ideas are proposed such as maritime construction, consulting works and leasing of equipment. However, more precise assessment based on analyses on productivity and financial viability of each activity is recommended, mainly because of lack of

necessary data in the study team because of the managerial reason of SCA.

28. The same can also be said in the case of the financial management. Major points to be assessed are proposed in this connection.

PROJECT EVALUATION

29. Re-evaluation of the projects is conducted based on the newly forecast data on transits. As the forecast volume of transits is much less than the forecast in the past, it would be premature to evaluate the Second Phase Expansion Plan proposed in the past JICA study at this moment; only the Deversoir By-pass Extension Plan is considered to be financially viable. Based on the forecast transits, the plan should be implemented from around 2010.

30. On the other hand, in case that much larger Container Ships would be used in the future, this project seems to be risky. Accordingly, it is recommended to conduct again the demand forecast and project evaluation before average daily transit reaches around 55 vessels.

1. This summary report contains a synthesis of objectives, assumptions, methodology and results of the entire study. The out line in chapters is the same as the main report which will be submitted as part of the final report.

2. Annexes to the main report are submitted separately.

- I: Back Ground Situation of the Arab Republic of Egypt
- II: Present Situation of the Suez Canal
- III: World Trade and International Shipping
- IV: Factor Analysis on Suez Canal Transit
- V: Toll policy and Issues
- VI: Transit Forecast Model

I. INTRODUCTION

3. In response to a request made by the Government of the Arab Republic of Egypt, the Government of Japan has decided to conduct a study on the Effective Management System of the Suez Canal in the Arab Republic of Egypt.

4. The Study objectives are as follows; (i) to prepare a traffic forecasting model of the Canal, (ii) to prepare a tariff setting system in order to maximize the net revenue from the Canal, (iii) to examine previous development plans and management system of the Canal based on the above, (iv) to make any necessary comments and/or recommendations to realize a more efficient management system of the Canal, (v) to transfer relevant technology to Egyptian counterpart personnel in the course of the Study.

5. In order to achieve the objectives mentioned above, the Japan International Cooperation Agency (JICA) consigned the Study to a joint venture which consists of the Overseas Coastal Area Development Institute of Japan (OCDI) and Mitsubishi Research Institute, Inc. (MRI).

6. Actual Study work commenced in August 2000 with the arrival of the Study team in Egypt. Since then, the Study was carried out both in Egypt and in Japan including six months of field works in Egypt.

7. In the course of the Study, the Inception Report, the Progress Report I, the Interim Report, the Progress Report II and the Draft Final Report were submitted to A.R.E.. In addition to formal presentations, informal sessions of working groups involving SCA officials and various ad-hoc discussions took place. Comments were given by the SCA Steering Committee. This Final Report incorporates the results of all these surveys and discussions.

8. This report consists of eight volumes: the Summary Report which presents a summary of the study results (Vol. I), the Main Report which presents the general framework, conclusion for all volumes and recommendations (Vol. II), and the rest of the volumes are compiled as the Annexes to the Main Report which present the background situation of the A.R.E. (ANNEX I), present situation of the Suez Canal (ANNEX II), world trade and international shipping (ANNEX III), factor analysis on Suez Canal transit (ANNEX IV), toll policy and issues (ANNEX V), transit forecast model (ANNEX VI).

9. List of counterpart members and related personnel is as follows:

SCA(Planning, Research and Studies Dept.)	Title
(Eng. Aly Abdel-Aziz Ibrahim)	Ex-Director
Dr. Abdel-Tawab Haggag	Director
Eng. Essam El-Din Mohammed Khattb	Vice Director
Eng. Ahmed El-Manakhly	Manager, E.U.
Mr. Mahmoud A. Rizk	Manager, E.U.
Mr. El-Sayed Marei	Manager, E.U.
Mr.Yehia Rushdy	Economic Researcher, E.U.
Mr. Fatehy M. Abdel-Bary	E.R., E.U.
Mr. El-Sayed A. Fetouh El-Sharkawy	E.R., E.U.
Mr. Refaat Saad Mostafa	E.R.,E.U.
Mr. Hossam H. Abdel-Karim.	E.R.,E.U
Mr. Ahmed Abdel Fatah	E.R.,E.U.
Mr. Emad Hamdi Fawaz	E.R.,E.U.
Mr. Hatem Abdel Gawad	E.R.,E.U.
Mr. Wahid Kamel Adly	E.R.,E.U
Study Team	**Institution**
Mr. Hidehiko Kuroda Team	Leader (OCDI)
Mr. Seiji Sato	Sub Team Leader (OCDI)
Mr. Yoshihisa Tateno	(OCDI)
Mr. Masayuki Fujiki	(OCDI)
Capt. Nobuaki Kojima	(OCDI)
Mr. Yoshinobu Shakuto	(OCDI)
Dr. Nobuharu Miyatake	(MRI)
Mr. Yoshiteru Sunago	(MRI)
Dr. Hiroshi Mori	(MRI)
Mr. Paul Bingham	(MRI)
Mr. Mizuki Konno	(MRI)
Mr. Fumiaki Isono	(MRI)

II. MAJOR FINDINGS OF THE STUDY

A. OUTLINE OF THE RESULTS

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B. COMPOSITION OF THE REPORTS

38. Final Report of this study consists of (1) SUMMARY REPORT, (2) MAIN REPORT, and (3) Annexes to this main report.

39. Annexes provide details of data and information as well as theoretical explanations on the techniques applied in the study. They are as follows:

ANNEX I : BACKGROUND SITUATION OF ARAB REPUBLIC OF EGYPT
ANNEX II : PRESENT SITUATION OF THE SUEZ CANAL
ANNEX III: WORLD TRADE AND INTERNATIONAL SHIPPING
ANNEX IV: FACTOR ANALYSIS ON SUEZ CANAL TRANSIT
ANNEX V: TOLL POLICY AND ISSUES
ANNEX VI: TRANSIT FORECAST MODEL

40. For those who are interested only in the outline of methodologies and results, Main Report provides sufficient information. For those who are interested in the detailed techniques which the study team used, and in following up and applying them by themselves, detailed models and manuals together with the applied data and theoretical derivations are explained in the Annexes.

III. WORLD TRADE AND SUEZ TRANSIT

A. OUTLOOK ON WORLD ECONOMY AND TRADE

TRENDS OF ECONOMY

41. The short-term outlook for world economic growth is still positive, with broad agreement by many of the international institutions, including the OECD, the IMF and the World Bank. Longer run economic growth returns to the trend of nearly four percent growth in output per year.

TRENDS OF MAJOR COMMODITIES

42. The trade in key commodity groups significant to the Suez Canal is briefly discussed next.

- Crude Oil: Overall crude oil trade demand will follow economic growth, but with a long-term trend towards slightly less OPEC crude oil consumption.
- Oil Products: As Europe, North America and South America will have significant refining capacity to serve their own markets, overseas import demand for product will not increase significantly over the forecast period.
- LNG/LPG: The shift of Western Europe towards consumption of gas via pipeline from Eastern Europe and Russia will continue to dampen demand for European and Mediterranean LNG/LPG imports.
- Chemicals: As chemicals are inputs to a large number of other manufacturing industries, demand will continue to increase along with increases in the manufactured products share of goods consumption.
- Grains: International trade is growing slowly with the expansion in population and world agriculture trades.
- Fabricated Metal: The trade growth is projected to continue with Eastern Europe and Asia continuing to be large exports regions.
- Coal and Coke: The bulk of the trade demand growth is coming from the Asia-Pacific region. Steam and metallurgical coal production in Europe continues to decline so imports increasingly must make up the

supply.

- Ores: Steel made by electric arc furnaces has replaced steel made with older technologies. The new production method is projected to continue to increase over the forecast period, which will have a large affect on ore trade.
- Fertilizers: Continued long-term economic growth around the world, stronger Asian economies and improved economic performance in Europe are positive factors.
- Automobiles: The long-term outlook for trade in vehicles is for steady volumes, with more and more of the vehicles moving on shorter trade routes such as North America-Latin America and Eastern Europe-Western Europe..
- General Cargo: The long-term forecast for general cargo trade is for a continuation of the shift by shippers away from general cargo, shipping by container vessels instead.

B. OUTLOOK ON INTERNATIONAL SEABORN TRADE

CONTAINERIZATION

43. Strength of demand for imported higher value goods moving in containers is forecast to continue as recovery from the Asian economic crisis of two years ago proceeds. With the prospect of additional increases in container trade, the industry has responded with new orders for significant numbers of new container vessels.

LAND-BRIDGE

(i) Euro-Asia Land Bridge

44. Land bridge has an advantage over sea-borne trade in that it is faster, but has a disadvantage in that it has less capacity and costs much more consequently.
Moreover there are severe condition areas for surface transportation on the middle of the continent.
Furthermore some borders are unable to be crossed because of the confrontations among countries, or if possible to cross, only with complicated procedures.

45. The Land bridges should be paid attention to, but they will not be strong competitors of the Canal in the future.

(ii) Egyptian Inland Route

46. The containers from the Red Sea to Europe have to be transferred twice at a port of the Red Sea and a port of the Mediterranean. These transfers are the weak point of this route.

47. The Egyptian Inland Route will be limited to domestic transportation not and will be used as a bypass route similar to the US land bridge

PIPELINES

(i) Crude Oil pipeline

48. Pipeline is one of the strongest competitive transportation modes

of the Suez Canal.

49. The pipelines having a major impact on the transit of the Canal are as follows:

- SUMED: SUMED has a complementary role to the Suez Canal. SUMED's main users are Saudi Arabia, Iran, and Iraq. Tariff of SUMED is flexible and automatically indexed on monthly changes in spot rate of VLCCs.
- Iraq – Turkey Line: The Iraq – Turkey pipeline receives crude oil from oil fields near Kirkuk and Baghdad and transmit it to the Port of Ceyhan. Though Iraq is trying increase the capacity, it is said that repairs will take time to complete.

(ii) Gas pipeline

50. The most serious competitors exist in Egypt. The facilities are still in the planning, and it is not clear when they will be open. But once these facilities are open, the Suez Canal will be less attractive as a route of LNG.

C. SUEZ CANAL TRANSIT & FACTORS AFFECTING CANAL TRANSIT

INTERNATIONAL MARITIME TRANSPORTATION ACCOUNTING

(i) Ocean Freight

51. Container: FCL cargo is shipped on a Service Contract Cargo in which ocean freight rates are agreed upon bilaterally between a shipper and a shipping line. On the other hand, most of the rates applied to LCL cargo reflect the tariff level because LCL cargo shippers are in a weaker negotiating position. As a result, the consolidation business is more profitable than FCL cargo forwarding.

52. Tanker: the ocean freight is decided according to the following formula in accordance with the commercial negotiation system which is standard throughout the world.

F = WSF x WSR x C

Where F is Gross Freight, WSF is World Scale Flat, WSR is World Scale Rate, and C is cargo quantity in MT (Metric Ton).

53. Car Carrier: Generally, ocean freight of a car carrier is charged for the space of one unit (passenger car). Car carrier market is rather closed and freight rate level is not always available.

54. Bulk Carrier: The ocean freight is decided according to the kind of cargo, size of ship, service route (including numbers of loading/discharging ports) and market level.

(ii) Disbursements (shipping cost)

55. Shipping costs are traditionally called “disbursements” in the shipping industry. They are basically comprised of the following items regardless of the type of ship; namely “Managing cost” ("Indirect cost" such as depreciation and interest and "Direct cost" such as manning cost) and “Operation cost” (bunker charge, dues at ports/canals).

(iii) Earnings vs Disbursements

56. The most popular method of voyage accounting of the current Japanese shipping lines is called “ N/P, C/B and H/B system ”. Internationally, slight differences in voyage accounting methods are found in Britain, North

Europe, and America.

57. Net Proceed (N/P)

Total earnings minus cargo expenses including container expenses is called "cargo profit/loss" or N/P in shipping terminology. N/P can also be used as "vessel operation profit/loss" which total earnings minus total operation cost of a particular vessel's voyage covering port charges, bunker charge and operation NOE.

58. Charter Base (C/B)

Unit Value of "vessel operation profit/loss" is called C/B.

59. Hire Base (H/B)

Vessel cost, regardless of whether it is owned or long-term chartered, covering capital cost, crew manning cost, insurance, M&R is called H/B.

60. Per box freight earnings (container)

Traditionally, each freight conference or agreement used to have an independent tariff containing item-wise rates. However as containerization develops, cargo item-wise tariffs have started to disappear and are being replaced by a small number of box rates.

61. Per box P/L (container)

In traditional shipping business accounting, vessel-wise P/L was the most important factor. In container business, however, a container is treated as a small ship and in every day business earnings/disbursement together with P/L of a container are critical.

VESSEL FLEET

(i) Tanker (excluding LPG/LNG tanker) in the world

62. Larger vessels such as ULCC have been decreasing and this trend will continue in the future. The reason of this decrease is to avoid risks of accidents.

Table 1 Fleet-mix of Tankers

DWT / Year	10-24,999	25-49,999	50-74,999	75-99,999	100-124,999	125-149,999	150-199,999	200-249,999	250-299,999	300,000+	Total
1980	4.4%	9.5%	6.1%	8.8%	4.2%	5.6%	3.4%	1.3%	28.7%	28.0%	100%
1985	5.1%	11.9%	6.5%	10.2%	4.8%	6.3%	3.8%	1.1%	24.0%	26.2%	100%
1990	5.6%	13.5%	6.7%	12.3%	5.5%	6.7%	4.1%	1.0%	21.8%	23.0%	100%
1995	4.9%	12.9%	6.0%	13.3%	5.9%	7.1%	4.4%	1.0%	22.3%	22.2%	100%
2000	5.0%	13.8%	6.2%	14.7%	6.2%	6.9%	4.2%	1.0%	21.7%	20.3%	100%
2020	5.1%	14.6%	5.2%	20.8%	9.7%	11.7%	7.2%	1.5%	24.2%	0.0%	100%

Source) 1980-2000: Clarkson Tanker Register
2020 : JICA Study Team estimation

(ii) LPG/LNG Tanker in the world

63. The world LPG/LNG tanker fleet-mix distribution has been stable for recent 20 years, and it will remain in the next 20 years.

(iii) Bulk Carrier in the world

64. The ratio of over-150,000DWT has been increasing and this trend will continue in the future. The bulk carrier pursues economies of scale. The vessels of large size are used in a long-haul voyage of major bulk commodity.

Table 2 Fleet-mix of Bulk Carriers

DWT / Year	10-24,999	25-49,999	50-74,999	75-99,999	100-124,999	125-149,999	150-199,999	200-249,999	250,000+	Total
1980	23.3%	49.3%	14.8%	2.4%	1.8%	7.9%	0.6%	0.0%	0%	100%
1985	17.1%	45.9%	19.2%	2.9%	2.2%	9.8%	2.8%	0.1%	0%	100%
1990	13.3%	43.0%	20.0%	2.7%	2.3%	10.1%	8.4%	0.2%	0%	100%
1995	11.3%	40.0%	21.6%	2.8%	2.7%	12.0%	9.4%	0.2%	0%	100%
2000	9.1%	36.0%	24.4%	2.7%	2.3%	10.2%	14.8%	0.3%	0%	100%
2020	2.0%	25.3%	32.3%	3.8%	2.1%	9.5%	24.5%	0.5%	0.0%	100%

Source) 1980-2000: Clarkson Bulk Carrier Register
2020 : JICA Study Team estimation

(iv) Containership in the world

65. The ratio of Post Panamax has been increasing rapidly and this trend will continue in the future. These large containerships are used in Asia-Europe route, and directly influence the transits through the Suez Canal.

Table 3 Fleet-mix of Containerships

DWT / Year	10-24,999	25-49,999	50-74,999	75-99,999	100-124,999	125,000+	Total
1980	48.9%	49.9%	1.1%	0.0%	0.0%	0.0%	100%
1985	41.9%	55.7%	2.4%	0.0%	0.0%	0.0%	100%
1990	33.2%	59.0%	7.6%	0.2%	0.1%	0.0%	100%
1995	30.2%	57.9%	11.3%	0.4%	0.2%	0.0%	100%
2000	24.7%	51.7%	21.0%	1.9%	0.8%	0.0%	100%
2020	16.4%	40.4%	36.2%	5.0%	2.0%	0.0%	100%

Source) 1980-2000 : Clarkson Liner Register
2020 : JICA Study Team estimation

(v) General Carrier in the world

66. The world general carrier fleet is entirely less than 25,000 DWT in recent 20 years, and it will remain in the next 20years.

(vi) Car Carrier in the world

67. The world car carrier fleet is predominantly composed of vessels less than 25,000 DWT. Still, there have been some carriers that are larger than 25,000 DWT.

(vii) Fleet-mix in the Suez Canal

68. Average vessel size through the Suez Canal becomes constantly larger from 1980 to 1999. The size increase was especially prominent for Containership, Bulk Carrier, and Car Carrier.

PORT DEVELOPMENT

(i) El Sokhna Port Development

69. The new port, together with one container terminal and two bulk terminals, is Egypt's most advanced port and will contribute to the economic development of the Gulf of Suez and Egypt as a whole.

(ii) Port Said East Port

70. East Port Said will have a possibility of influence on the Suez Canal subject to a careful charging policy to encourage the feeder activities of the prospective user lines.

POSSIBILITY OF ALTERNATIVE ROUTES

(i) Panama Canal

71. Manufacturing and assembly operations in Far East Asia have, shifted toward Southeast Asia. From these locations, some containers shipped to the U.S. East Coast are now moving via the Suez Canal, thereby bypassing both the Panama Canal and the U.S. land bridge.

72. The current capacity of the Panama Canal is approximately 15,000 transits, including those made by non-commercial ocean-going vessels. This equates to approximately 42-45 maximum sustainable canal transits per day.

73. The Panama Canal Authority has taken significant steps in recent years to provide increased transit capacity. This program it taking several years and is costing approximately $US 1 billion to complete. They intend to complete all of these steps by the end of 2002. The result of this major capital program will be an increase in the throughput capacity of the Panama Canal to a maximum sustainable level of about 48-50 transits per day.

(ii) The Arctic Ocean at present

74. INSROP (International Northern Sea Route Program) was started in 1993. Data obtained from the research were analyzed and integrated into a navigation simulation for specific routes.

75. However, even in the future, the Arctic Ocean route will be in limited use. It will be hard to overcome the freezing in winter season and the severe circumstances throughout the year.

IV. TRANSIT FORECAST MODEL

A. STRUCTURE OF FORECAST MODEL

FRAMEWORK OF THE MODEL

76. Target year of the forecast is 2020.

OUTPUT OF THE MODEL

77. 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).

78. 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.

Table 4 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

BASIC CONCEPT

79. Figure 1 is the flowchart of forecasting procedure. Boxes marked as P1 to P5 in this figure represent steps in the forecast. Boxes marked as F1 to F7 are relevant factors.

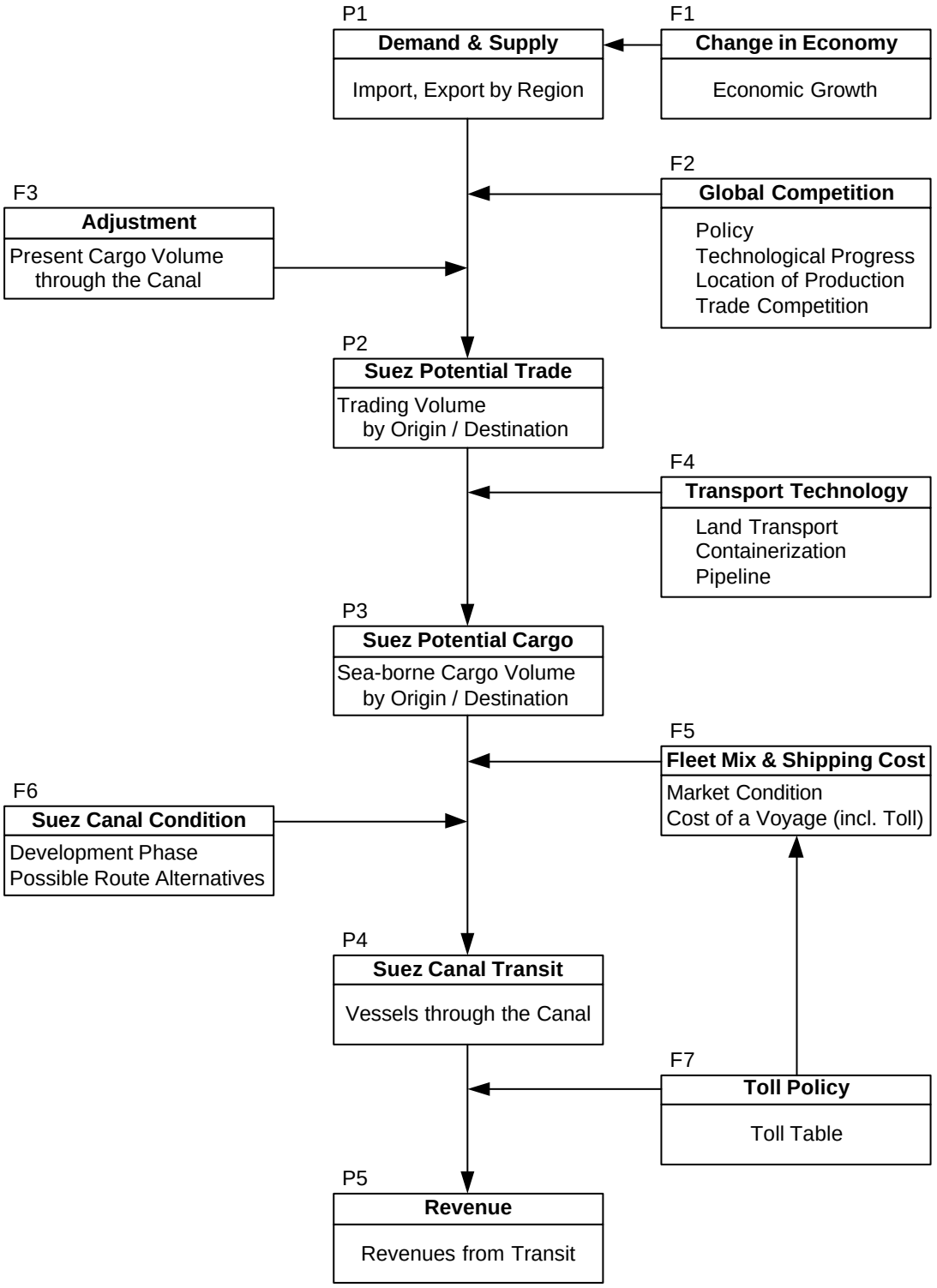


Figure 1 Flowchart for the Forecast

CONSTRAINTS OF FORECAST MODEL

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

81. In spite of our best efforts, the forecast, of course, will contain errors due to the nature of modeling.

B. FORECAST OF SUEZ POTENTIAL TRADE

SUEZ POTENTIAL ROUTE AND SUEZ POTENTIAL TRADE

82. 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.

83. 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 transportation technology makes a big progress in future.

84. 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 5 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

METHOD OF FORECAST

85. For the estimation of the Suez Potential Trade, a two-phase, multi-step forecasting approach was used. The first phase was the forecast with a large-scale macro econometric model. This model was developed based on world statistics. The second phase was the revision of the output of the first phase with using the actual Canal Transit.

FACTORS AND PROCESS

86. 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.

87. 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.

88. 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. 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.

RESULT OF FORECAST

89. 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 trade, “Others” (including General Cargo) is forecast to grow at a fast pace.

C. FORECAST OF SUEZ POTENTIAL CARGO

SUEZ POTENTIAL CARGO

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

91. 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.

PROCEDURE OF FORECAST

92. Figure 2 shows the procedure to forecast Suez Potential Cargo.

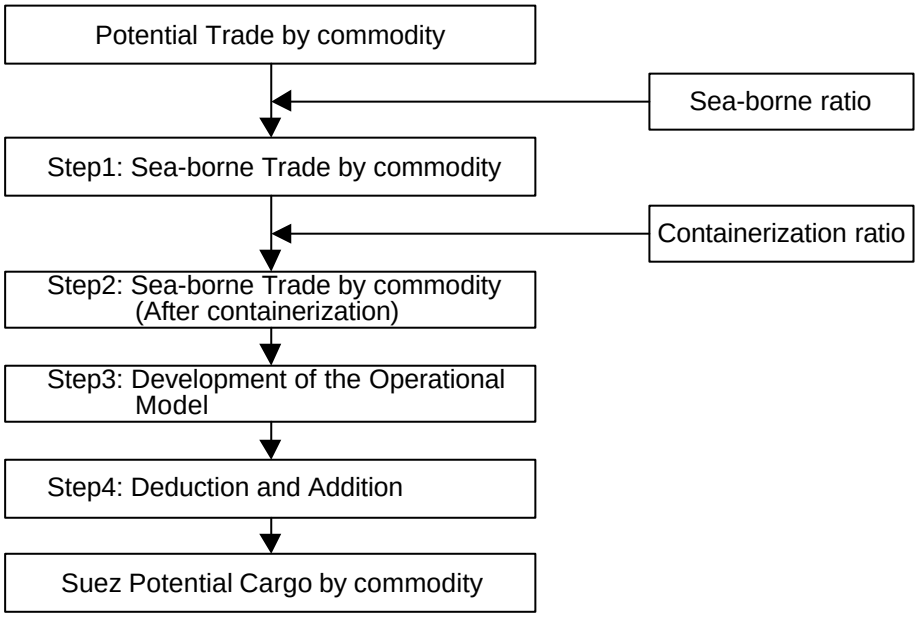


Figure 2 Flowchart of Forecasting Suez Potential Cargo

FACTORS

(i) Pipelines

93. It was presumed in forecasting that 120 mil tons use the SUMED line and 30mil tons use the Iraq-Turkey line in the future. The uses of other lines are not included in the forecast.

(ii) Possible routes

94. If the Panama Canal is considered, a route between East Coast and E. Asia is not a Suez potential route but a Panama potential route. At present, most of sea-borne container routes are crossing through the Panama Canal in spite of the fact that the Panama Canal has physical constraints. However, routes from Asia to East Coast across the Atlantic are becoming popular, and in the future these routes may grow.

FORECAST MODEL OF SUEZ POTENTIAL CARGO

(i) Purpose of the operational forecast model

95. The trade forecast model used in previous section was a large-scale model that had many variables such as prices, population, growth rate for each country. These variables produce thousands of equations. However, the handling of the large-scale model is very difficult. Continuous data collection and model correction are necessary to maintain the model.

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

(ii) Structure of the model

97. Figure 3 is the flowchart of the forecasting model.

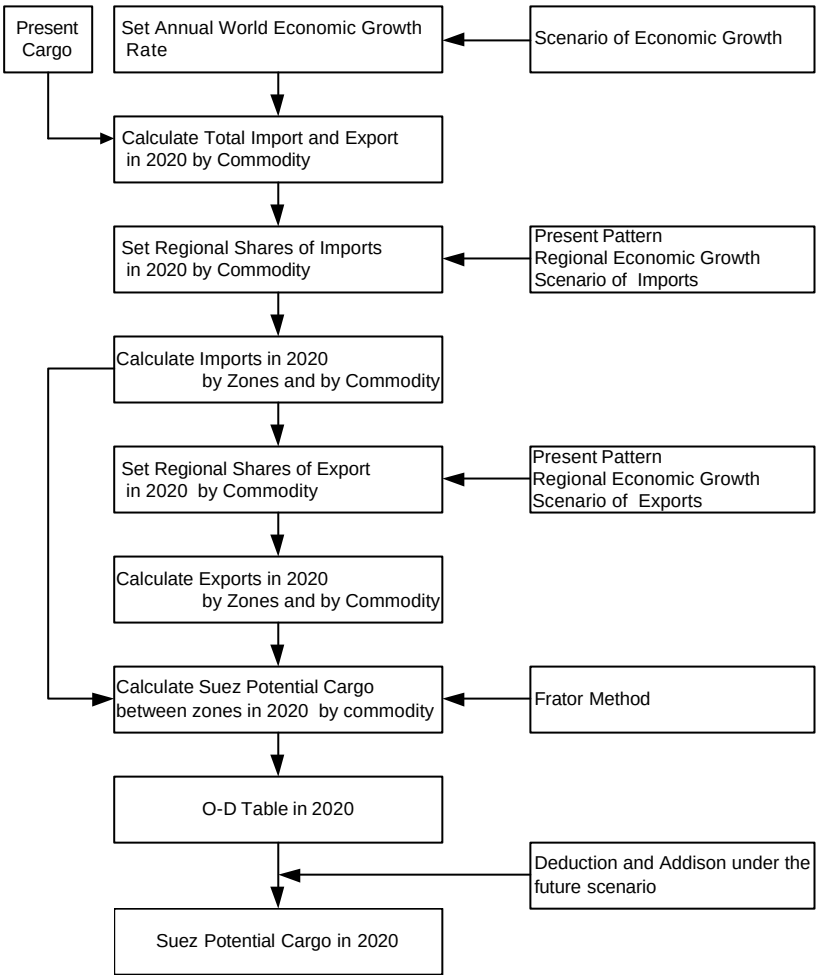
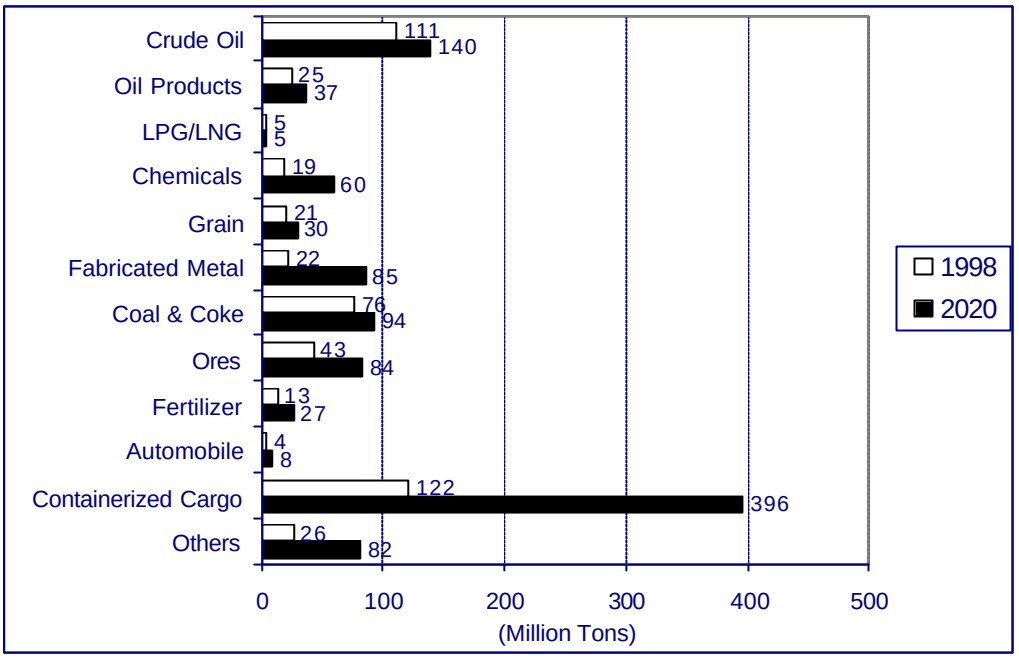


Figure 3 Flowchart of Suez Potential Cargo Forecasting

RESULT OF FORECAST

98. Figure 4 shows the future potential cargo. Containerized Cargo will rapidly increase in the next 20 years.



Source) Estimated by JICA Study Team

Figure 4 Suez Potential Cargo

D. FORECAST OF THE SUEZ TRANSITS

FACTORS OF ROUTE CHOICE

99. 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 depression market or shipping cost in healthy market. It means that the market is an important factor in route choice.

100. However it is almost impossible to forecast the future fleet market. Therefore the forecasting model in this study concentrates route choice in healthy market. The operators choose a route whose shipping cost is the minimum.

101. 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 and this individual study is not suitable to this macroscopic forecast model. Consequently, present pattern and trend is presumed in the forecast.

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.

PROCEDURE OF TRANSIT FORECASTING

102. 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 14 has two flows.

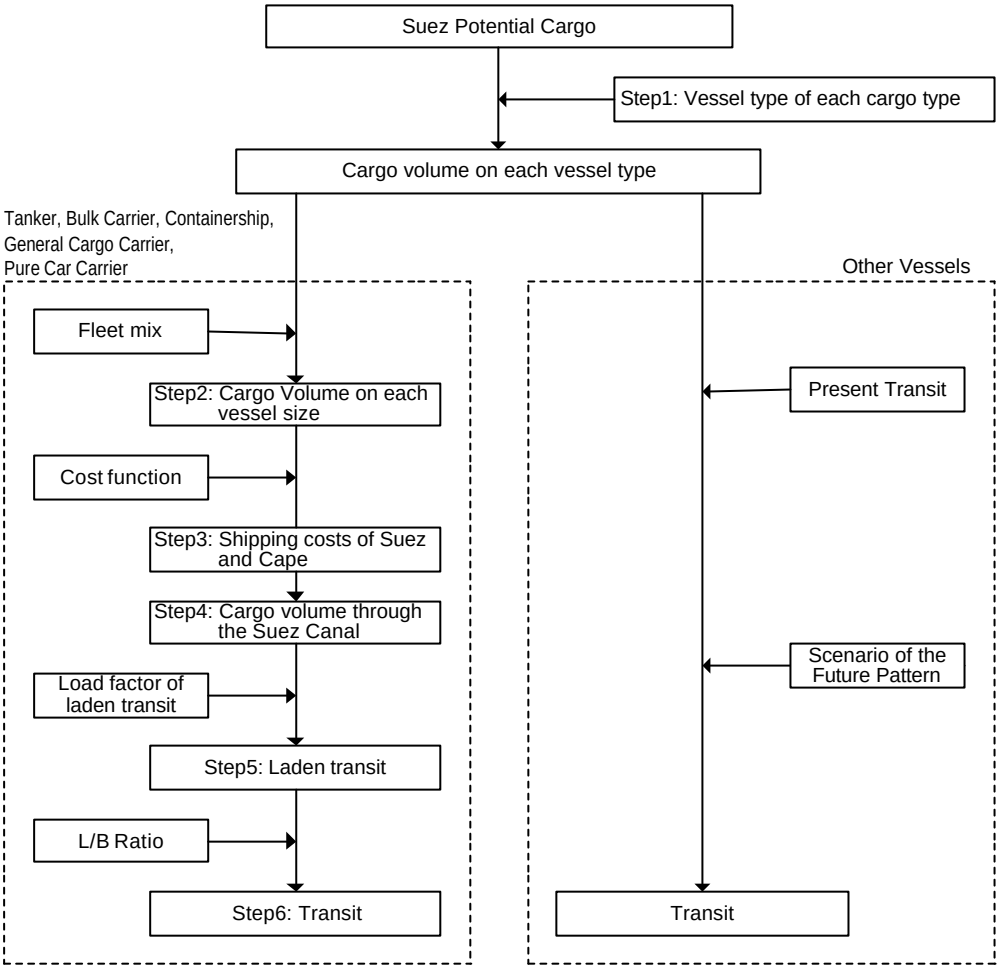


Figure 5 Procedure of forecasting the Suez Transits

SHIPPING COST ESTIMATION

103. Even if there are two voyages whose vessel types, commodity types, and volumes of loaded cargo 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.

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

105. Pure Car Carrier has a similar additional voyage cost. That is the inventory cost of automobiles.

106. A shipping cost function is calculated:

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

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

A,B : coefficient(constant)

D : distance of one trip (from an origin to a destination)

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

Table 6 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 7 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	-	-	-	-	-

107. The values in above tables were calculated under the present Toll Table of SCA.

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

Cape.

If B x DC + A > B x DS + A + Esc, then Suez is selected.

If B x DC + A < B x DS + A + Esc, then Cape is selected.

This condition is equivalent to the following expression.

If B x (DC – DS) > Esc, then Suez is selected. Otherwise, Cape is selected.

The difference of distance DD that is calculated from the equation B x DD = Esc is the break-even distance.

If DC – DS > DD, then Suez is selected. If DC – DS < DD, then Cape is selected.

DISTANCE OF TRIPS

109. Distance of a trip from one zone to another zone is assumed to be the distance between representative ports of both zones. The distance is measured along a voyage route both in the Suez route and the Cape route.

PRESUMPTIONS

(i) Alternative routes of the Suez Canal Route

110. The Panama route can be competitive to the Suez route but trades that may use the Panama Canal are limited because of the physical restrictions of the Panama Canal.

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

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

(ii) A vessel type matrix

113. A vessel type matrix is used to set the type of vessel on which each unit cargo (one ton of cargo) is carried.

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.

114. 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.
d) LASH and Combined Carrier will be negligible.
e) Passenger Ships and War Ships don't carry cargo.

(iii) Fleet-mix

115. 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.

116. The calculation of the future fleet-mix had 3 steps.

Step1: Calculate the present fleet-mix from database
Step2: Calculate the growth rate of the fleet-mix by vessel size
Step3: Multiply the present fleet-mix to the ratio of the future share and the present share.

117. The potential fleet-mix except Crude Oil Tanker will be almost equal to the fleet mix through the Canal. The data source was SCA database. The present potential fleet-mix of Crude Oil Tanker was derived from other data source. (Database from JAMRI)

118. The future world fleet-mix was forecast from the trend of new buildings of vessels.

119. The voyage distance was considered because vessel sizes were not equal in different routes. All routes were divided into 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

120. After reviewing the present fleet-mix for each range, the scenario in Table 8 was applied.

Table 8 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 long & middle range and short ranges.
LPG/LNG Tanker	Present fleet-mix will continue.
Other 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.
Car Carrier	All ranges have the same fleet-mix. The trend of the world fleet-mix is applied to all ranges.

(iv) The Canal constraints

121. 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.

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

RESULT OF FORECAST

(i) Cargo on Vessel

123. The cargo will be 851,178thousand ton in 2020, about 2.78 times the cargo volume in 1999.

Table 9 Cargo Ton in 2020

(1000ton)

Vessel Type	(1)Forecast in 2020 S-bound	N-bound	Total	Comp. Ratio	(2)Actual in 1999 Total	Comp. Ratio	Growth (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

(ii) Transit

124. Total number of transits is expected to be 28,657 (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.

Table 10 Transit in 2020

(Number)

Vessel Type	(1)Forecast in 2020 V-Number	Comp. Ratio	(2)Actual in 1999 V-Number	Comp. Ratio	Growth (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

E. REVENUE

PROCEDURE OF FORECAST

125. The result of the forecast of Transit was transformed to SCNT. Then SCNT was multiplied to toll.

RESULT OF FORECAST

126. The trend of growth of SCNT is similar to that of Transit. Containership, Tanker and Bulk Carriers will contribute much increase of SCNT.

Table 11 Suez Canal Net Ton (2020)

(1000SCNT)

Vessel Type	(1)Forecast in 2020 SCNT	Comp. Ratio	(2)Actual in 1999 SCNT	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

127. 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%.

Table 12 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

F. SUMMARY AND ADDITIONAL SCENARIOS

BASELINE SCENARIO

(i) Presumptions

128. Table 13 is the presumptions used for forecasting.

Table 13 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)
	LNG Tanker	50%(between E. Africa and W.E. Med)
	Surcharge	: 35% for every trip
	Containership	
	War Ship	: 9.7% for every trip
	Other Charges	: 25% for every trip
		: 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	

(ii) Results

129. 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 14 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

ADDITIONAL CASE AND SCENARIO

(i) Additional Case: Delay of the Canal Work

130. 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 15 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.

131. 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.

(ii) Additional Scenario: Low Market

132. In baseline scenario, the shipping market 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 16 Additional Scenario for the Market Conditions

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

133. 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 17 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

134. In the baseline scenario, the future world fleet-mix was set based on the scenario that the recent delivery would be the future fleet-mix. Another additional scenario was considered based on the idea that the much larger Containerships and Car Carriers would be used in the future.

Table 18 Additional scenario for 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%

135. Table 19 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 19 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

V. MANAGEMENT AND OPERATION SYSTEM

A. CURRENT SITUATION OF THE MANAGEMENT AND OPERATION OF THE SUEZ CANAL

SUEZ CANAL OUTLOOK

(i) Physical Feature of the Canal

136. The Canal connects the Mediterranean Sea with the Red Sea over a distance of 162km and it is the world longest channel without locks.

137. The depth of the main channel, including the eastern branches of the by-pass sections, will be 22.5m (permissible ship draught is 62ft) in 2001. The length of doubled parts is 78km.

(ii) Economic Feature of the Canal

138. The Canal plays an important role both in the world economy and in the Egyptian economy.

139. About 6% of world seaborne cargo is now transiting the Canal, while 3-4% is transiting the Panama Canal. As to the short cut effect, Suez Canal route is 29% of distance via the Cape route between the port of Munbay and port of Ismir and 71% of distance between Singapore and Rotterdam.

140. Revenue of SCA in 1998/99 is estimated to about US$ 2 billion of which toll revenue accounts for US$ 1.77 billion. In the national budget account, the contribution is allocated to tax revenue which the SCA pays in the form of industrial and commercial tax and to fees in the form of royalty and to profit transfer in terms of surplus. Suez Canal revenue accounts for 9% of the total foreign currency earnings, almost twice of the petroleum export in 1998/99.

MANAGEMENT SYSTEM OF THE SUEZ CANAL

141. The Suez Canal is managed and operated by the Suez Canal Authority according to the SCA Act.

142. SCA is managed by a Board of Directors consisting of a chairman

and directors. The organization of SCA consists of the following 13 departments and there are about 14,500 employees and workers within the SCA.

- Management Dept.
- Financial Dept.
- Services Dept.
- Affiliated Companies Dept.
- Engineering Dept.
- Shipyards Dept.
- Planning, Research and Studies Dept.
- Legal Dept.
- Personnel Dept.
- Procurement Dept.
- Transit Dept.
- Dredging Dept.
- Works Dept.

143. Main functions of SCA relating to the Canal are the transit control in the Canal and the maintenance and improvement of the Canal and ports. SCA is also engaged in a wide range of business activities extending over the Canal zone. Further, SCA has nine affiliated companies.

OPERATION SYSTEM OF THE SUEZ CANAL

144. Total number and total SCNT of vessels transiting the Canal in 1999 are 13,490 vessels (daily average: 37 vessels) and 385 million tons respectively.

145. Passage through the Canal is operated on a convoy system: the Northbound and the Southbound (N1 and N2) convoys.

146. Vessels of the Northbound convoy leave Suez between 0600 and 1130. The Northbound convoy usually proceeds without stopping.

147. Vessels of the Southbound convoy (N1) leave Port Said between 0000 and 0500. The vessels must wait for the last vessel of the Northbound to pass at El Kabrit.

148. A second convoy (N2) of the Southbound is sometimes formed if the density of traffic justifies it. Vessels of this convoy leave Port Said between 0630 and 0900. The vessels must make fast in El Ballah West Branch until the last vessel of the Northbound convoy enters El Ballah East Branch.

149. Arrival times are set at certain hours before each starting time. Vessels must have anchored in the anchorage and be declared ready for transit before the arrival times.

150. The Suez Canal Vessel Traffic Management System (SCVTM) provides the continuous monitoring of vessels.

151. Pilotage is compulsory for all vessels in principle. Detailed rules are

specified in the Rules of Navigation.

TOLL STRUCTURE AND RATES

152. Suez Canal tolls are expressed in SDR (Special Drawing Rights) per SCNT (Suez Canal Net Tonnage) by vessel type and size.

Table 20 Rates of Tolls to be Applied as from 1st January 2000

(SDR/SCNT)

	Vessel Type	SC Net Tonnage											
		First 5000		Next 5000		Next 10000		Next 20000		Next 30000		Rest	
		L	B	L	B	L	B	L	B	L	B	L	B
1	✳Tankers of Crude Oil Only, etc.	6.49	5.52	3.62	3.08	3.25	2.77	1.40	1.19	1.40	1.19	1.21	1.03
2	✳Tankers of Petroleum Products, etc.	6.75	5.52	3.77	3.08	3.43	2.77	1.93	1.19	1.93	1.19	1.93	1.03
3	✳Dry Bulk Carriers, etc.	7.21	6.13	4.14	3.52	2.97	2.53	1.05	0.90	1.00	0.85	1.00	0.85
4	✳Other Bulk Liquid Carriers ✳LNG Carriers ✳Chemical Carriers, etc.	7.50	6.38	4.14	3.56	3.81	3.24	2.68	2.28	2.68	2.28	2.68	2.28
5	✳LPG Carriers	6.75	5.75	3.77	3.21	3.43	2.92	2.42	2.06	2.42	2.06	2.42	2.06
6	✳Containerships ✳Vehicle Carriers	7.21	6.13	4.10	3.49	3.37	2.87	2.42	2.06	2.42	2.06	1.83	1.56
7	✳Special Floating Units	7.21	-	4.14	-	3.77	-	2.63	-	2.63	-	2.63	-
8	✳Other Vessels	7.21	6.13	4.14	3.52	3.77	3.21	2.63	2.24	2.63	2.24	2.63	2.24

Source) SCA Circular

153. Additional tolls are levied on slow vessels. A surcharge of tolls is to be applied for Navy vessels and for Container Ships or LASH carrying containers or lashes over weather deck.

154. Some reductions of toll are offered to certain kinds of vessels in the form of the Long Haul Rebate, the reduction for VLCC in ballast coming from America to Arabian Gulf, for Segregated Ballast Tankers, for VLCC using SUMED integration and for LNG Carriers, rebate for vessels with special O-D and cargoes, volume incentives for Tanker of Crude Oil and for LNG Carriers and so on.

155. Other dues and charges are levied for towage, berthing, pilotage, tugboats, trial transit. Basic Pilotage dues are not payable by vessels transiting the Canal.

B. BASIC POLICY ON MANAGEMENT AND OPERATION OF THE SUEZ CANAL

156. The basic policy on management and operation of the Canal should be based on the wider aspects of its role, namely, from the viewpoints of its impact on the global economy and the national economy, as well as the socio-economy of the region which depends much on the Canal.

157. Hence the basic policy on management and operation of the Canal should be:

- 1) to consider the balance of power in the global politics

  The impact of the Canal on the global economy is so immense that it can change both the maritime transport structure and the world trade structure. A drastic structural change in maritime transport and world trade can severely damage regions which greatly depend on the Canal. This in turn could jeopardize the political stability of the region.

- 2) to play a role as a safety net for the world maritime transport

  The security of maritime transport, not only the physical safety of the transit but also the security of free trade is important.

- 3) to achieve co-prosperity of both users and SCA

  This policy involves the assessment on the profitability not only of the SCA and the maritime transport sector but also of the shippers/ consignees, since the benefit of the Canal is shared by them.

- 4) to secure transparency and fairness in management and operation

  This policy is important to promote competitive and free world trade. In the maritime transport sector, equilibrium condition among prices and quantities is achieved through the transactions among SCA, shipping lines, shippers/consignees. Hence it is ideal that the toll plays the role of moderator between them.

C. TARIFF SYSTEM

TARIFF SETTING PRINCIPLES, STRUCTURE AND THEIR RATIONALE

158. The general approach consists of four aspects: 1) to review toll policy theory and concepts, 2) to evaluate the theoretical dimensions and performance of the current Suez Canal toll policy, structure and rates, 3) to comparatively analyze the cases of other canals, and 4) to specify and analyze alternative Suez Canal toll structures and rates and to develop the optimal structure and rates.

(i) Macroscopic Influence of Toll

159. The influences of the high toll level on the users and trades can be macroscopically grasped through the past bitter experience during the closure of the Suez Canal as follows:

- Diversion to alternative routes (Cape of G.H. and Panama Canal)
- Diversion to alternative modes (air, road and railway)
- Increase of voyage distance and shipping cost
- Increase of commodity price in CIF (damage to world economy)
- Change in trade (damage to countries nearby the Canal)
- Change in fleet mix (damage to smaller vessel, increase of VLCC)
- Increase of pipeline capacity
- Decrease of port activities nearby the Canal

160. Theoretical derivation of the effects of higher toll shows the following results:

- If the toll is raised and freight rate (exclusive toll) is unchanged, maximum distance of trade becomes shorter. Namely, a shipper will change its trade partner to nearer countries, or lose its market.
- For the shipper that trades in higher valued commodities and has a lower level of shut down price, higher toll can be tolerable.
- Time sensitive cargo will change its transportation mode to more speedy mode or change its trade partner when the toll goes above tolerable level.

161. Higher toll will cause the decrease in transit demand by changing their route or mode and may decrease SCA revenue according to the circumstances.

162. Therefore, optimal toll should be carefully considered to balance the revenue maximizing motivations of SCA and the traders reflecting trends in world trade patterns.

163. In addition, toll maximizing net profit is more important than maximizing toll revenue. Therefore, expenditure by SCA for management and operation of the Canal including project investment is another important factors in determining the optimal toll system.

(ii) Basic Characteristics of Maritime Shipping Market

164. The toll level affects on the vessel's route choice, namely, via Suez or via other alternative routes. The vessel's route choice is based on the comparison of the profits via Suez and via other routes. The profit perceived by a shipping line or shipper/consignee differs with the type of vessel and shipping contract.

165. Industrial carriers were extensively introduced in the 1960s so that industrial capitals greatly depending upon the seaborne trade avoid negative impacts caused by changes in the shipping market. Industrial carriers generally have the following peculiarities:

- The vessels are owned and operated by industrial capitals or by shipping lines under long-term contracts which are agreed at nearly full cost recovery level.
- The vessels are fully operated all year round, namely, there is no waiting time or no time to spare.
- The vessels are not affected by fluctuations in shipping market nor in transport demand.

166. Liner services such as container transportation generally have the following peculiarities:

- Liner operators make a public notice regarding "Sailing Schedule" and "Itemized Freight Rate" to shippers/consignees.
- Liner operators maintain service routes and it difficult for them to suspend their regular services.

- The Liner Market does not have an automatic space-adjusting function as in the Tramp Market, in other words, It is a non-elastic market.
- Annual number of round voyages by a fleet of vessels is fixed and the vessels are fully operated all year round because of regular service.
- Liner cargo is time sensitive, market sensitive and interest sensitive.
- Inventory cost can be perceived by shippers/consignees since cargo values are significantly higher than those of Tankers or Dry Bulk Carriers.
- Quality of service such as safety, speed and frequency is as important as freight rate.

167. Common tramp carriers generally have the following peculiarities:

- The vessels are affected by fluctuations in the tramp market and in transport demand.
- There is no dominant player in the tramp market and free competition is observed. Tramp market has an automatic adjusting function regarding freight level and ships' space.
- Tramp cargo is cheap in value but transported in large volumes. The first priority for this type of cargo is a low freight rate, and transport speed or care during transport are not such important factors.
- Freight difference between possible routes can generally be neglected since the cargo value is rather low.

168. Common/industrial carriers parity by vessel type is as follows:

- Container ships - 100% common carriers
- Vehicle carriers, LNG/LPG - 100% semi-industrial carriers
- Tankers - 70% - 80% industrial carriers
- Bulk carriers - 60% industrial carriers

(iii) Relations between vessel profitability and costs at Suez

169. Shipping lines are considered to make their route choice after

comparing the profit/loss figures that would result from using each of the possible routes.

170. Maximum bearable cost at the Suez Canal can generally be expressed as follows:

(Maximum bearable cost at the Suez Canal)
= (Freight difference) + (Savings in shipping cost)

Note) shipping cost at sea = managing cost + fuel cost

- Common tramp carrier: The freight difference can be neglected. Maximum bearable cost at the Canal is equal to savings in shipping cost. However, savings in managing cost are not perceived or not fully perceived depending upon the shipping market condition (when the vessel is not fully operated for example).
- Liner carrier: Maximum bearable cost at the Canal is equal to the sum of the freight difference and savings in shipping cost. The freight difference can generally be regarded as the savings in inventory cost.
- Industrial carrier: The least cost route is generally chosen. Then maximum bearable cost at Suez Canal is just equal to the savings in shipping cost.

171. Hence, the toll level will affect directly the route choice of the carriers. Therefore it is important to decide the toll level considering the shipping cost and the shipping market condition.

(iv) Toll Setting Principles

a) Alternative toll setting principles

172. From the economic aspect of the Suez Canal, we can identify three categories of beneficiary ― regional, national and global. Pricing principle will vary according to the objective beneficiary.

- First alternative: applying *the marginal cost pricing* to the toll based on the idea of *global infrastructure.* As a result, SCA will obtain zero profit in the long run but the world economy will possibly enjoy maximum trade through lowest transiting cost.
- Second alternative: applying the *price discrimination* based on

the idea of *regional infrastructure*. Namely, applying marginal cost pricing to those vessels for the region while applying maximum revenue toll to those vessels outside the region.

- Third alternative: applying the pricing that maximizes national benefit of Egypt based on the idea of *national infrastructure.* Namely, applying completely discriminating price to each group of vessels that have different O-Ds, size, type and with different loaded cargoes.

b) Toll structure of other canals

173. In case of the Panama Canal, tolls are required to be set at rates calculated to produce revenues to cover all costs of maintaining and operating the canal and to provide capital for plant replacement, expansion and improvements. Tolls are assessed on the vessel earning capacity (Panama Canal net tonnages), and toll structure does not vary by ship type or size but by laden/ballast. It encourages use by small ships.

174. In case of the St. Lawrence Seaway, the toll policy and rate schedule are determined by the amount needed to cover operation and maintenance costs and maximize traffic. The toll rate structure comprises a primary component based on cargo carried and a secondary component based on vessel earning capacity (gross registered tonnages). The primary component differentiates among cargo types but not among cargo tonnage intervals. The rate charged per metric ton remains constant. Secondary toll component does not differentiate among vessel types or sizes.

c) Toll policy & principles—criteria on toll structure

175. A toll policy represents a set of principles underlying the objectives to be achieved by a given toll structure. These objectives are:

- 1) revenue
- 2) equity or fairness
- 3) promotion of traffic growth
- 4) efficiency or capacity utilization of the canal
- 5) administrative simplicity.

176. The Suez Canal toll structure contains various aspects of price discrimination such as laden versus ballast, type of ships, type of cargo with

combined carriers and the Long Haul arrangement where the toll is linked directly to the value of service to the user.

177. In line with the basic objectives of the toll structure, the Suez Canal toll structure contains all the objectives but administrative simplicity. Hence it can be said that current structure of the Suez toll is the most favorable structure, although there is room for some modification of rates reflecting the recent change in the maritime transport structure and for improving the administrative simplicity.

(iv) Structure of toll and rates

178. It is recommended to apply a fixed rate tariff system.

179. Standard toll level is recommended to be set based on the saved shipping cost as follows;

$$Ts = S \times Rs = (B \times Ds - Esc) \times Rs \qquad (1)$$

where,
- Ts: standard toll level (US$/SCNT)
- S: saved cost by using the Canal (US$/SCNT)
- Rs: ratio of supplier's receipt
- B: shipping cost at sea per mile (US$/SCNT/mile)
- Ds: saved distance (mile)
- Esc: excess cost at the Canal (US$/SCNT) (time loss cost + other charges)

180. As to the ratio Rs, it is necessary to be perceived by the users so that they can choose the route via Suez based on the apparent advantage of using the Canal. It is recommended to set the value of Rs at 80%.

181. Fixed rate tariff system is recommended to be set by the type and size of vessel and regardless of O-D, and the rate is recommended to be set as fixed accumulated price/SCNT for each size class as is currently set by SCA.

182. In the calculation of the fixed rate regardless of O-D, "standard saved distance" must be set. Under this method, the toll calculated with the set rate will favor the vessels with O-D pair having longer saved distance than the standard distance and less favor the vessels with O-D pair having less saved distance than the standard distance.

183. Hence, it will have the effect to guard the trade among the region with long trip without Suez Canal. In other words, it is favorable from the view point of the regional economic policy.

184. On the other hand, it will have an effect to divert the trade with less saved distance than the standard saved distance to the route via Cape. In order to avoid the diversion of these vessels, it is recommended to apply rebate system to these vessels such as the Long Haul Rebate which is currently applied by SCA.

185. The following alternative tariff structures, though easier to calculate the toll than the current structure of fixed accumulated price/SCNT, cause greater deviation from the actual saved cost curve and hence would result in either less revenue or fewer users.

- Alternative-1: a fixed unit price for each size class
- Alternative-2: a fixed price for each size class

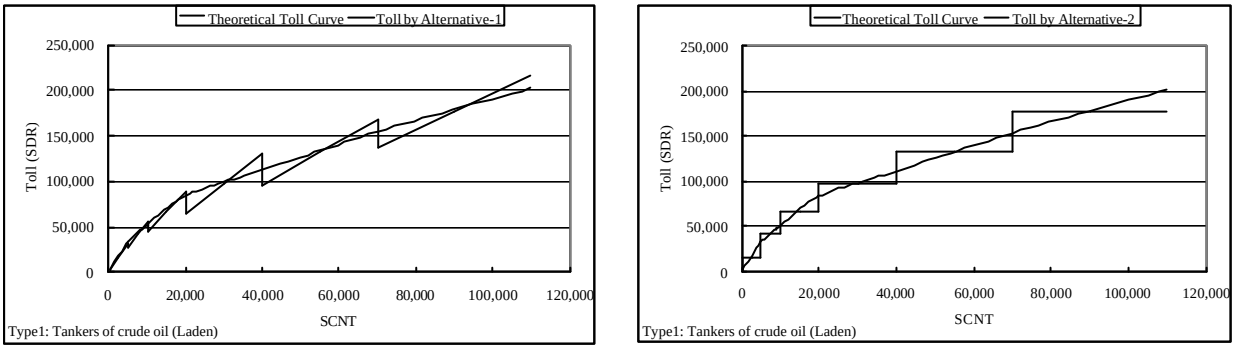


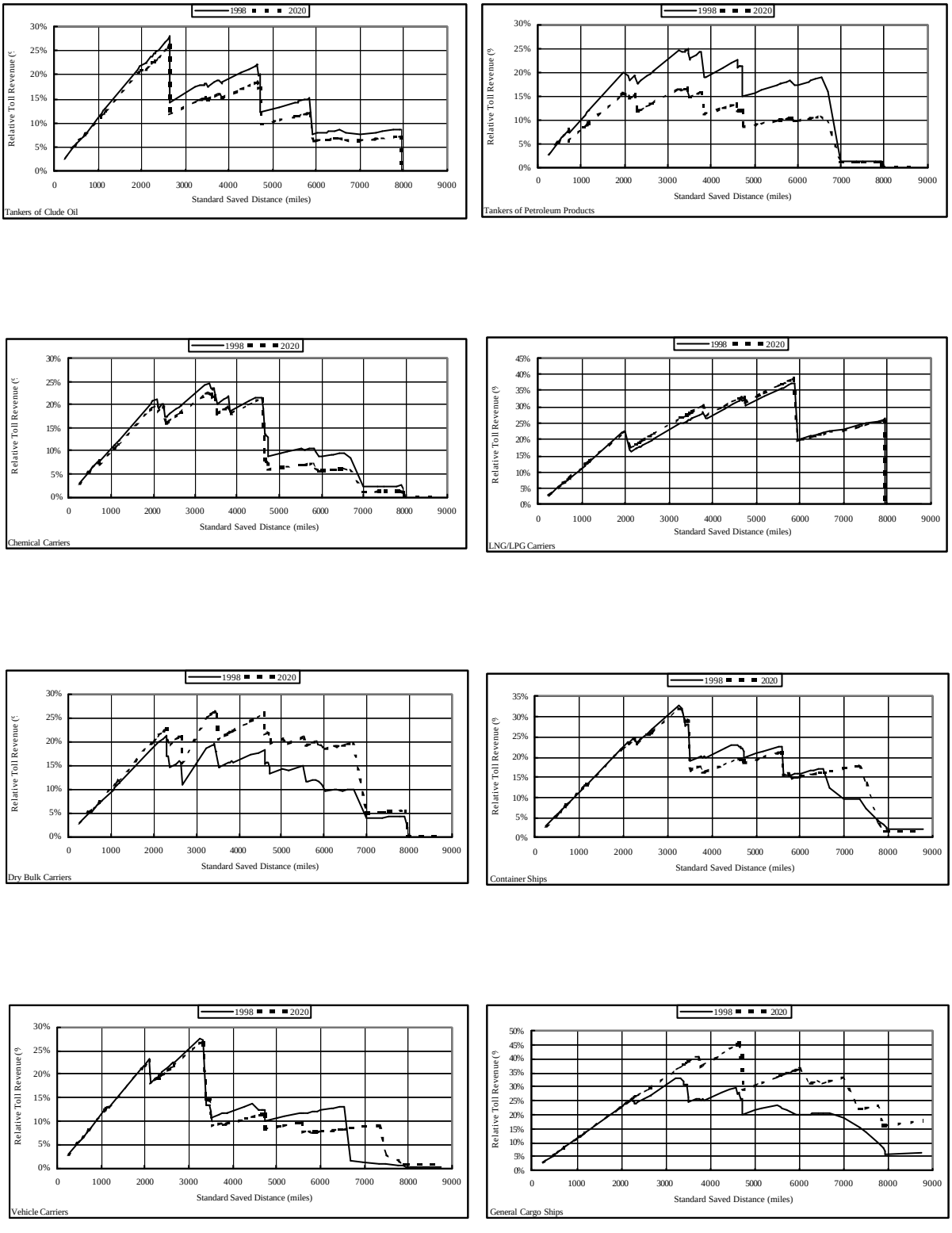
Figure 6 Alternative Tariff Structure

186. As a conclusion, current toll and rate structure using fixed unit price tariff by vessel size ranks and type is the best way to match the toll setting principles.

OPTIMAL TOLL LEVEL

187. Without applying rebate/discount system, optimal toll level within the proposed tariff structure is decided based on the standard saved distance. Relation between standard toll level and total toll revenue is shown in figure 7. These figures generally depict mountainous shapes since total toll revenue is a product of toll revel and transit cargoes which are inversely correlative to toll level.

188. Hence, expected toll revenue varies with the standard toll level, namely with standard saved distance. In considering all kinds of cargoes as a whole, optimal toll level corresponds to the standard saved distance of around 3,300 miles for the potential cargo.



Source) The Study Team

Figure 7 Relative Toll Revenue

189. For Suez potential cargo carried by each vessel type, optimal toll level saved distance and percentage of cargo that would potentially divert to the Cape route is shown in the following table.

Table 21 Optimal Toll Level Saved Distance

Vessel Type	OTL (miles)	PCD (%)	SOL (miles)	PCD (%)
Tankers of Crude Oil	2,654	7.4	4,657	58.4
Tankers of Petroleum Products	3,462	36.9	3,783	43.3
LNG and LPG Carriers	5,863	44.2	4,733	40.5
Chemical Carriers	3,321	34.7	4,597	58.8
Other Tankers	3,321	13.7	4,451	48.0
Bulk Carriers	2,302	18.8	3,432	50.3
Combined Carriers	3,321	26.6	3,787	46.2
General Cargo Ships	3,321	12.3	3,432	20.8
Container Ships	3,245	11.5	3,462	29.0
LASH	3,245	6.4	4,597	46.4
RoRo	3.245	10.0	4,597	49.7
Vehicle Carriers	3,245	25.8	2,101	3.0
Others	3,321	13.6	4,597	47.4
Total	3,321	38.9	4,597	59.8

Notes) OTL: optimal toll level saved distance

SOL: secondary optimal toll level saved distance

PCD: percentage of amount of cargo potentially to divert to the Cape route

Source) The Study Team

190. Percentage share in the Table 21 means percentage share of cargo carried by each vessel type which will be offered long haul rebate. Hence, it is desirable to set the standard saved distance to decrease this percentage, since large share means increase of administrative complication by individual treatment of the toll charge.

191. These optimal levels will basically vary with the change of the amount of potential cargo of each O-D. They have, however, a tendency to show the peak toll revenue at the same saved distance point.

192. Long saved distance trips are mainly those of O-D countries nearby the Canal which were severely damaged by the past closure of the Canal. Hence, it is desirable to offer these countries a cheaper toll to protect the trade of these countries. This can be achieved by setting the standard saved distance at about 4,700 miles.

193. Therefore, it is recommended to set the standard saved distance (corresponding toll level) in between 3,300 miles and 4,700 miles with applying rebate/discount system.

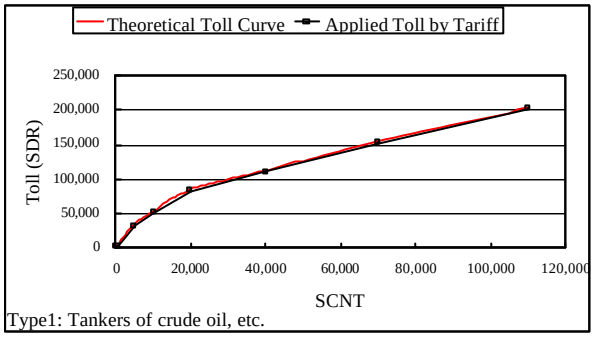
OPTIMAL CLASSIFICATION OF TARIFF

(i) Classification of vessel size

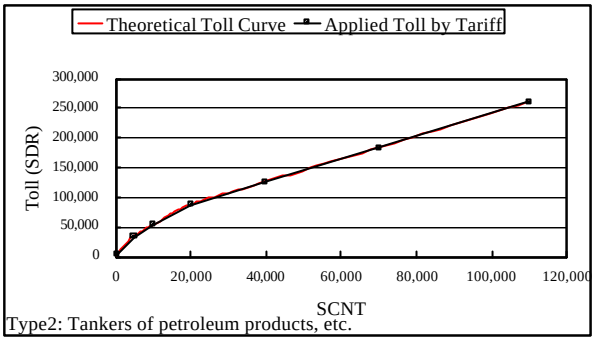
194. Figure 8 shows the theoretically calculated toll curve. The curve tends to become gentle as the vessel size gets larger. It is desirable to have a large number of classes for the smaller-sized vessels in order to minimize the deviation between theoretical toll and applied toll as is applied in the current tariff table.

195. From Figure 8, it is not possible to identify any typical deviation between the theoretical toll and applied toll. Accordingly, size classification of the current tariff can be said reasonable.

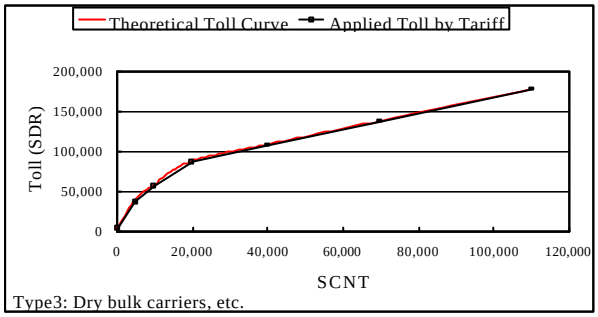
196. For vessels larger than 70,000 SCNT, current tariff table applies the same rate. It may be possible to identify a deviation between theoretical toll and applied toll. Hence it is recommended to add two more size classes: next 40,000 SCNT and next 50,000 SCNT.



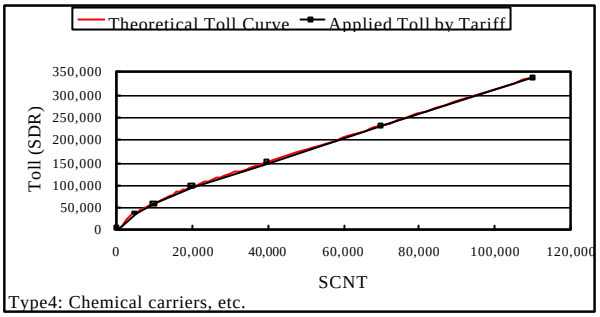
Type1: Tankers of crude oil, etc.



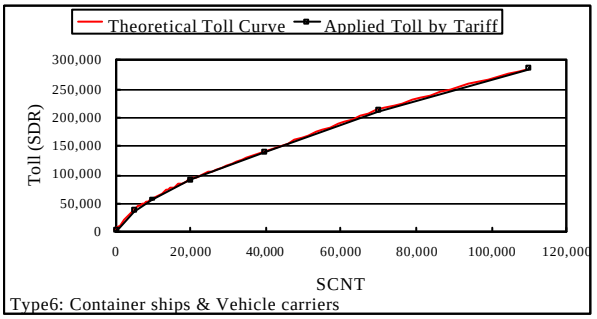
Type2: Tankers of petroleum products, etc.



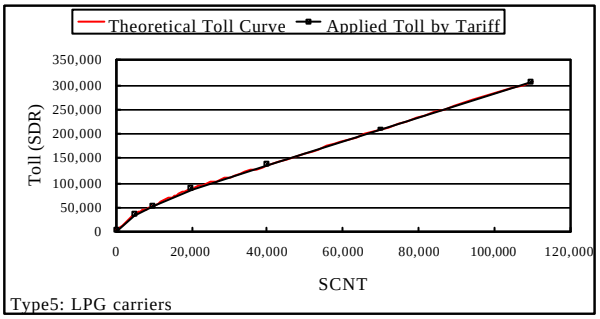
Type3: Dry bulk carriers, etc.



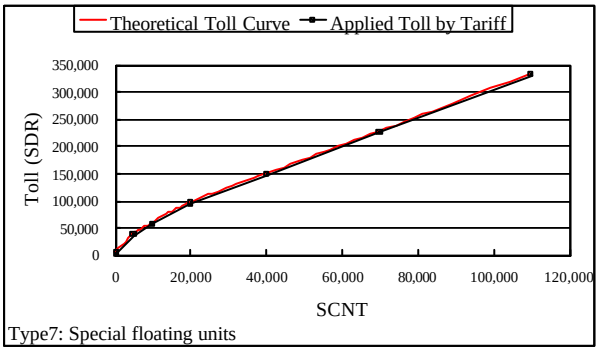
Type4: Chemical carriers, etc.



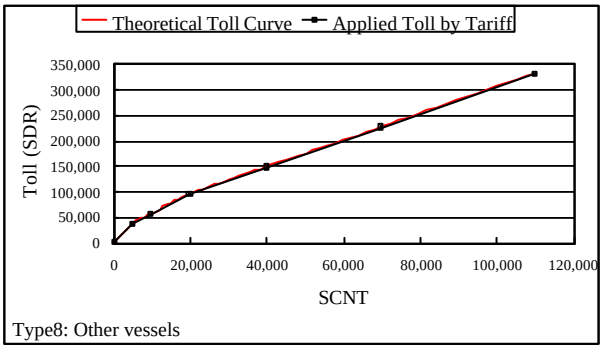
Type6: Container ships & Vehicle carriers



Type5: LPG carriers



Type7: Special floating units



Type8: Other vessels

Source) The Study Team

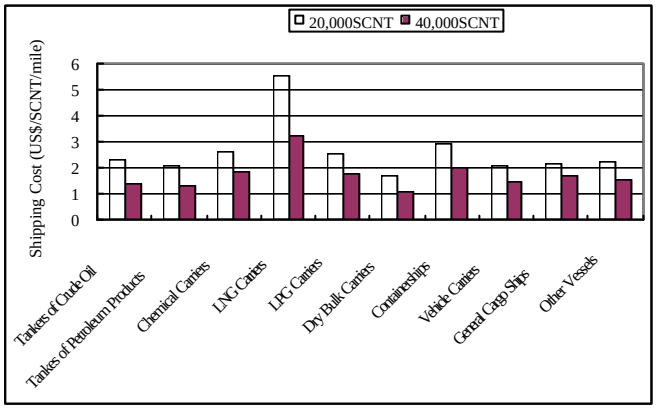
Figure 8 Applied Toll and Theoretical Toll

(ii) Classification of vessel type

197. It is reasonable to set different toll for different vessel types of which shipping costs are different as is applied in the current tariff.

198. Figure 9 shows shipping cost by vessel type. There is an apparent difference between Chemical Carriers and LNG Carriers, and between Container Ships and Vehicle Carriers. On the other hand, there is no significant difference between Tankers of Crude Oil and Tankers of Petroleum Products, and between Chemical Carriers and LPG Carriers.

199. Hence, it is recommended to classify Chemical Carriers and LNG Carriers and Container Ships and Vehicle Carriers into different categories. And for the shake of simplicity, it is effective not to classify Chemical Carriers and LPG Carriers as well as Tankers of Crude Oil and Tankers of Petroleum Products.



Source) The Study Team

Figure 9 Shipping Cost by Vessel Type

(iii) Classification of laden and ballast

200. Vessel's speed in the ballast condition is said to become 10-20% higher than that in fully laden condition and the shipping cost can be saved to 90-80% because of the increased turn-around number. Therefore, currently applied classification of tariff for laden and ballast can be said appropriate.

201. In the case where a vessel has no plan of next voyage or free time till the next voyage, only the fuel cost is perceived as savings by shipping lines. Therefore, it is recommended to set the rate based on only savings in the fuel cost in the above case in applying Long Haul Rebate for ballast ships.

FLEXIBLE CHARGING SYSTEM

202. To cope with fluctuations in the shipping market and to complement the tariff table which is based on the standard saved distance, current Long Haul Rebate system based on individual savings of each trip should be kept. Long Haul Rebate system is an excellent tool in order to prevent vessels from diverting to other routes.

203. However, some shipping lines operating Dry Bulk Carriers are using the route via the Cape, even though they are well aware of the Long Haul Rebate system. This seems to happen for the following reason:

- A shipping line calculates the shipping cost of one voyage or one term to propose a freight rate to a shipper/consignee.
- In the calculation, the shipping line sets the rebate rate lower than the actual level, because they do not want to undertake a risk.
- As a result, calculated shipping cost via the Cape becomes lower than that via the Canal.
- After the freight rate and route are fixed by contract, the shipping line cannot change the route without the consent of the consignee because this would possibly generate additional inventory cost for the consignee.

204. It could be possible to prevent the vessels from diverting to other routes if shipping lines or shippers/consignees could know in advance the fixed figure of the rebate rates.

205. Hence, it is recommended to introduce a fixed rebate rate system regarding saved distance. It should be noted, however, that such a fixed rebate rate system should not apply for Container Ships and Tankers of Crude Oil. Proposed applying method is as follows:

Fixing rebate rates by main O-D pairs

SCA fixes and announces rebate rates by main O-D pairs like current reduction for VLCC in ballast coming from America to Arabian Gulf. SCA can revise the rebate rates every six months to reflect changes in fuel price. Users can apply current Long Haul Rebate instead of the fixed rebate system to reflect changes in the shipping market.

CALCULATION OF NEW TOLL AND FIXED REBATE RATE

206. Based on the proposed toll structure, new toll and fixed rebate rates are calculated. These calculations are based on the following premises and need to be assessed based on the past data of vessels transiting the Canal.

(premises of toll calculation)

- In the calculation based on the equation-1, Rs (ratio of supplier's receipt) is taken as 0.8.
- Indirect managing cost is based on the contract price of newly built vessels and capital cost and depreciation cost (for 15 years with fixed rate) are counted.
- Fuel price is set as 100US$/ton and speed and fuel consumption rate of the vessel are based on the world vessels' data.
- For Container Ships, the inventory cost and the container box capital cost are considered.
- For the Vehicle Carriers, the inventory cost is considered.
- Standard saved distance is taken as 4,700 miles.
- Excess cost for managing and fuel cost is based on the about 1day time loss.
- Excess cost of other charges is the sum of port dues, agency fees etc. and tug charge.
- Shipping cost for 5,000SCNT and 10,000SCNT is calculated by linearly extending those for 20,000SCNT and 40,000SCNT.
- Toll is calculated based on the exchange rate of 1.30US$/SDR.

207. The ratios of calculated tolls based on above mentioned premises to current tolls are shown in Table 22. It can be said that current tolls are basically same level as the calculated tolls. It should be noted, however, that these premises (exchange rate US$/SDR in particular) directly affect the results in this table and following recommendations.

Table 22 Ratio of Calculated Toll to Current Toll

	Vessel Size (SCNT)							
Vessel Type	5,000	10,000	20,000	40,000	70,000	110,000	160,000	220,000
＊Tankers of Crude Oil	1.06	1.39	1.47	1.33	1.22	1.13	1.11	1.10
＊Tankes of Petroleum Products	0.90	1.20	1.28	1.12	1.01	0.89		
＊Chemical Carriers	1.00	1.33	1.45	1.30	1.20	1.10		
＊LNG Carriers	3.47	4.54	4.72	3.46	2.64	2.08		
＊LPG Carriers	1.06	1.41	1.54	1.35	1.27	1.21		
＊Dry Bulk Carriers	0.69	0.91	1.05	1.06	1.08	1.04		
＊Containerships	1.09	1.39	1.54	1.36	1.17	1.04		
＊Vehicle Carriers	0.79	1.04	1.18	1.11	1.05			
＊General Cargo Ships	0.81	1.07	1.21	1.26	1.28	1.24		
＊Other Vessels	0.90	1.18	1.27	1.11	1.00	0.90		

Note) Current tolls for Container Ships are applied the weather deck surcharge of 9.7%
Source) The Study Team

208. Hence it is recommended to raise the rates by 3% for the classes where the ratio of calculated toll to current toll is more than 1.10 (except LNG Carriers) as the first step and to monitor the reaction to this increase. The

threshold criterion of 10% is set considering validity of used premises in toll calculation.

209. On the other hand, for the classes where the ratio of calculated toll to current toll is less than 0.90, it is recommended to leave the rate as it is since there is no firm evidence that reducing the toll would increase toll revenues. Additional comments and recommendations by vessel type are as follows:

(i) Tankers of Crude Oil

210. For common carriers, current rates calculated based on the World Scale can basically be said appropriate. However, following points can be observed.

- In case of high World Scale Rate: Vessels bound for Europe are enjoying more than 20% surplus compared with the Cape route, while vessels bound for America are enjoying less than 10% surplus.
- In case of low World Scale Rate: Advantage of using the Canal decreases. For the vessels bound for America, the Cape route becomes more advantageous than the Suez route.

211. Hence, it is possible to raise the toll for vessels bound for Europe while a greater discount is needed to the vessels bound for America. In case of low World Scale Rate, further discount is necessary.

212. Basic toll rates, however, should be set based on the shipping cost savings since the industrial carriers represent 70% of Tankers of Crude Oil.

213. The ratio of calculated toll to standard saved distance is 49% for the vessels bound for Mexican Gulf (saved distance 2,600 miles) and 35% for those bound for Caribbean Zone (saved distance 2,000 miles). Accordingly, discount rates for Mexican Gulf and for Caribbean Zone are recommended to be raised to 51% and 65%, and this discount should be applied to all vessels, not limiting to VLCC in ballast.

(ii) LNG Carriers

214. LNG Carriers receive a 35% discount as a means to bolster the competitive power of Arabian LNG against Algerian LNG in the European market.

215. FOB price of LNG in Qatar tends to be higher than CIF price of LNG in Spain and this is caused by the relatively lower price of Algerian LNG. Hence,

it can be said that even with free transit of the Canal, increase of LNG export from Gulf area cannot be expected.

216. Current level of toll is the result of the negotiation between SCA and related countries and there is no room for discussion.

(iii) Dry Bulk Carriers

217. Dry Bulk Carriers are the major vessel type using the Long Haul Rebate and major O-Ds of which saved distance are less than 4,700 miles are Oceania - NW. Europe (saved distance = 2,300 miles), SE. Asia - NW. Europe (saved distance = 3,500 miles) and E. Africa(south) - the Mediterranean (saved distance = 2,300 miles).

218. Long Haul Rebate for those vessels of major O-Ds are recommended to be set as follows:

- Oceania-NW Europe 59%
- SE Asia-NW Europe 30%
- E. Africa-Mediterranean Sea 59%

(iv) Container Ships

219. It is recommended to count savings in container box capital cost and in inventory cost of cargoes.

220. It should be noted that there are some direct services between Singapore and NW. Europe of which saved distance is 3,500 miles and careful attention should be paid to such services, though the Long Haul Rebate is not applied for Container Ships.

221. Currently applied weather deck surcharge, which is levied based on number of tiers, sometimes forces shipping lines to perform unnecessary container handling for reducing the number of tiers. In addition, shipping lines are given the impression that they are excessively charged since the weather deck surcharge is applied to almost transits of Container Ships.

222. Although current weather deck surcharge is not ideal, it should be left as it is since there is no better alternative. However, a discount based on number of carried TEUs on condition that the basic tolls be raised will be better than the current system after EDI (electronic data interchange) system, which will prevent false declarations by shipping lines, is introduced.

(viii) Vehicle Carriers

223. It is recommended to count savings in inventory cost of cargoes since the vehicles carried are high priced goods.

224. Saved distance which brings the maximum toll revenue is 3,300 miles corresponding to Far East - the Mediterranean and shows typical peak point. Hence, it seems to be rational to apply a fixed rebate rate of 34% for this O-D.

225. Currently, vessels are said to use the Canal even with smaller rebates than their claimed rates. Therefore, there is a possibility that the toll revenue would be decreased if the fixed rebate rate is applied. However, current behavior of vessels can be considered a temporary phenomenon caused by the constraints of available capacity of ship space.

CHARGING CURRENCY

226. From the view point of the foreign currency earning function of the Canal, it is also an important issue to which currency unit the toll should be pegged. Currently it is pegged to SDR and paid in US$ applying the exchange rate of US$/SDR.

227. The issue of charging currency can be discussed from the view point of a risk hedge against changes in the US$/SDR exchange rate. There are 3 interested parties: 1) users who pay tolls, 2) SCA who sets tolls, 3) Egyptian national treasury (including SCA) who gets toll revenue.

228. For users who pay tolls, US$ pegged toll is preferable since almost all transactions of international maritime transport are now conducted in US$.

229. For SCA who sets tolls, US$ pegged toll is preferable since toll setting is now originally made in US$.

230. For Egyptian national treasury (including SCA) who gets toll revenue, it depends upon the purpose of use: 1) payments for purchasing goods, 2) repayments of the foreign debt.

231. If the main purpose is payments for purchasing goods, it makes no difference to which currency the toll is pegged as far as it is required to pay in respective currency after exchange of $ currency SCA owns since purchasing power of the currency solely depends on the exchange rates of SDR at the time of purchase and of setting tolls.

232. If the main purpose is repayment of the foreign debt, the currency

which is more favorable from the view point of repay ability of national debt depends upon the % share of the debt in US$.

233. In order to judge which currency is more repayable, we can introduce an index to evaluate the sensitivity of revenue and total debt of the nation evaluated in US$ to the fluctuation of SDR value against US$. If the sensitivity of the toll revenue ($value change of toll revenue by the change of SDR value in US$ compared with the value before SDR value change) is more/less than that of total national debt ($ value change of total national debt by the change of SDR value in US$ compared with the value before SDR value change), it can be said that repay ability of the toll revenue is more sensitive. In other words, it is more risky. Then the optimal solution depends on the % share of the debt in US$. To find the break point which is more risky, evaluation table is shown in Table 23.

Table 23 Comparison of Elasticity

Sd	0		0.2		0.4		0.445		0.5		0.6		0.8		1	
r	Es	Ed	Es	Ed	Es	Ed	Es	Ed	Es	Ed	Es	Ed	Es	Ed	Es	Ed
0.5	**0.789**	**0.526**	**0.872**	**0.581**	**0.974**	**0.649**	1.000	**0.667**	1.034	**0.689**	1.103	**0.735**	1.271	**0.847**	1.500	1.000
0.4	**0.814**	**0.581**	**0.888**	**0.634**	**0.977**	**0.698**	1.000	**0.714**	1.029	**0.735**	1.087	**0.776**	1.224	**0.874**	1.400	1.000
0.3	**0.844**	**0.649**	**0.908**	**0.698**	**0.982**	**0.755**	1.000	**0.769**	1.023	**0.787**	1.069	**0.822**	1.173	**0.902**	1.300	1.000
0.2	**0.882**	**0.735**	**0.931**	**0.776**	**0.987**	**0.822**	1.000	**0.833**	1.017	**0.847**	1.049	**0.874**	1.119	**0.933**	1.200	1.000
0.1	**0.932**	**0.847**	**0.961**	**0.874**	**0.993**	**0.902**	1.000	**0.909**	1.009	**0.917**	1.026	**0.933**	1.062	**0.965**	1.100	1.000
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
-0.1	1.098	1.220	1.052	1.168	1.009	1.121	1.000	1.111	**0.989**	1.099	**0.970**	1.078	**0.934**	1.037	**0.900**	1.000
-0.2	1.251	1.563	1.124	1.405	1.021	1.276	1.000	1.250	**0.976**	1.220	**0.935**	1.168	**0.862**	1.078	**0.800**	1.000
-0.3	1.524	2.176	1.233	1.762	1.036	1.480	1.000	1.429	**0.959**	1.370	**0.893**	1.276	**0.785**	1.121	**0.700**	1.000
-0.4	2.148	3.581	1.417	2.362	1.057	1.762	1.000	1.667	**0.938**	1.563	**0.843**	1.405	**0.701**	1.168	**0.600**	1.000
-0.5	5.045	10.091	1.790	3.581	1.088	2.176	1.000	2.000	**0.910**	1.820	**0.782**	1.563	**0.610**	1.220	**0.500**	1.000

Es=(1+r)/(1+(1-Sd)*(1+0.5821/P)*r)
Ed=1/(1+(1-Sd)*(1+0.5821/P)*r)
E=△TR/TR／△D/D

234. This table shows that non-shadowed zone is less risky and darker shadowed zone is more risky to the value change of SDR. As a whole, we can say that in the case where the share of USD currency debt in $ value amount of total debt is more than 80%, USD-pegged toll is more favorable than SDR-pegged toll against the fluctuation of USD value to SDR.

235. Hence it is recommended that this issue be deeply discussed within the Egyptian Government.

D. MARKETING SYSTEM

MARKETING POLICY

236. It is effective to declare literally and advertise the basic policy on the management of the Suez Canal. Basic policy of the management of the Suez Canal should be 1) to take the balance of power in the global politics, 2) to play a role as a safety net for the world maritime transport, 3) to achieve co-prosperity of both the users and SCA and 4) to secure transparency and fairness in management and operation.

237. In order to retain customers, it becomes more and more important to secure transparency and fairness in management and operation of the Canal. Frequent contact and discussion with the customers based on reliable relationship would bring SCA accurate information on customers' needs.

MARKET MANAGEMENT SYSTEM

238. The concrete process for the establishment of better business from the marketing view roughly constitutes of five steps:

- 1) analysis of marketing environment and identification of market opportunity/threat
- 2) market segmentation and selection of target market
- 3) positioning
- 4) strategy formulation of marketing mix
- 5) marketing management

239. Shipping lines are direct users of the Canal but shippers and consignees are behind them as influential indirect users. In the case of container ships, the principal counterparts are shipping lines. On the other hand, shippers are more influential than shipping lines for tankers, etc.

240. Ships can be divided into two categories, i.e. common carriers and industrial carriers. Common carriers/industrial carriers parity by ships' types is as follows:

- Container ships - 100% common carriers
- Vehicle carriers, LNG/LPG - 100% semi-industrial carriers

- Tankers - 70% - 80% industrial carriers
- Bulk carriers - 60% industrial carriers

241. It is recommendable to approach such major associations of shipping lines and shippers/consignees as:

- International Chamber of Shipping (ICS)
- European Shippers' Council
- European Community Ship-owners' Association (ECSA)
- Asian Ship-owners' Forum
- Baltic and International Maritime Councils (BIMCO)
- International Association of Dry Cargo Ship-owners (INTERCARGO)
- International Association of Independent Tanker Owners (INTERTANKO)

242. Marketing management system consists of three sub-systems — marketing plan and budgeting, marketing information system, and marketing organization. It is necessary to build up the Plan-Do-See-Feedback system within the organization.

SOME IDEAS ON IMPROVING MARKETING ACTIVITIES

- To create an internet homepage.
- To listen to customers' opinions and to reflect them in the management.
- To have seminars regularly on the Canal services, etc. for shipping lines and for shippers/consignees at major maritime centers.
- To establish regional offices abroad.
- To dispatch middle or young staff as trainees to foreign shipping industries and relevant organizations.
- To establish the SCA Chairman's Award.
- To strengthen the functions of marketing and information.
- To use data-base more effectively.

E. SOME IDEAS ON IMPROVEMENT OF MANAGEMEN AND OPERATION

CANAL TRANSIT SERVICE

243. The Suez Canal has made effort to improve its transit service. Safe navigation and reduced transit time have been attained through deepening and widening of the Canal with the improvement of the transit system.

(i) Operating speed

244. Current operating speed can be said reasonable.

(iI) Interval between vessels

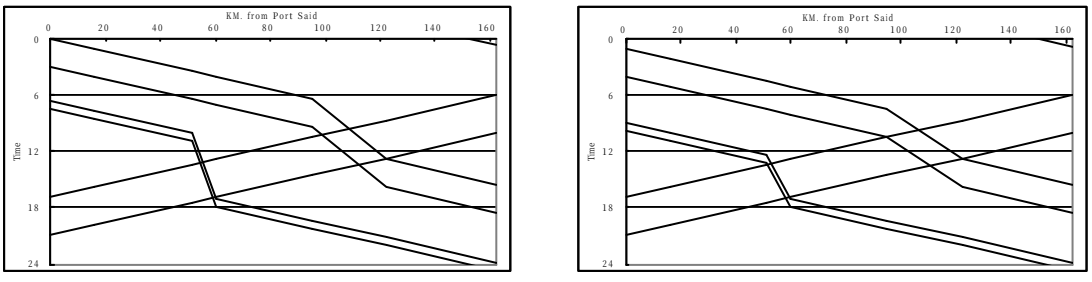
245. The concept of vessels' interval seems to have a room to be reconsidered given the high-maneuverability of container vessels as well as PCC, general cargo, passenger and naval ships.

246. Attention should be focused on the loss of course control and its resultant running aground or collision with bank. Escorting tugs are generally very suited to prevent this kind of accident and thus more training in this area should be conducted.

247. Time adjustment for entering the Canal would have to be carefully conducted so as not to exceed the standard intervals. As a result, the time adjustment would effectuate to shorten the total length of a convoy.

(iii) Starting time of the convoy

248. Revision of the starting time of convoys is proposed to reduce the waiting time (see Figure 10). In addition, it is indispensable to revise the present arrival time limit off Port Said anchorage according to the revised starting time.



(Current Starting Time) (Proposed Starting Time)

Figure 10 Diagram image at 52 standard ships/day

(iv) Transit procedure

249. By the introduction of EDI system which has been widely adopted at major ports in recent years, the transit procedures could be simplified and communication gaps between SCA and users would be minimized.

DIVERSIFICATION OF THE BUSINESS

250. In order to create new income sources for SCA, some potential field of business diversification are suggested in Table 24.

251. In order to realize the advancement of the engineering or construction business of SCA, it is necessary to establish a core department.

Table 24 Prospect on Business Diversification

Field of Business	Area of Markets	Component of Organizations
Maritime Construction Works	- Dredging - Reclamation - Construction of Breakwater - Construction of Quay-wall - Construction of Slip-way - Pavement - Setting of Offshore Structures	Dredging Dept. Works Dept. Engineering Dept. The Canal Harbor & Great Projects Co. The Canal Naval Construction Co
Consulting Work of Research Center	- Field Surveys (Tide, Current, etc.) - Environmental Survey - Soil Boring and Tests - Water and Material Tests - Echo Sounding (Sounding Chart) - Siltation and Sedimentation Studies - Hydraulic Model Tests - Hydraulic Studies - Environmental Impact Assessment - Design of Maritime facilities - Supervising	Engineering Research Center Engineering Dept.
Leasing Equipment	- Floating Docks - Floating Cranes - Tugs - Deck Barges - Mobil Cranes - Other Construction Equipment	Transit Dept. Shipyards Dept. Works Dept. The Port Said Engineering Works Co. The Canal Naval Construction Co. Timsah Shipbuilding Co.
Diversification of shipbuilding Activities	- Pipe Processing Works - Bridge Materials Works - Steel Works of Offshore Structures - Steel Caisson Production - Precast Concrete Production	Shipyards Dept. The Port Said Engineering Works Co. The Canal Naval Construction Co. Timsah Shipbuilding Co.

PROJECT EVALUATION

252. The Deversoir By-Pass Extension Plan straightly extends the existing Deversoir By-Pass, from northern end of the existing by-pass (Km.95.000) up to north of the Timsah Lake (Km.72.000). The objectives of the plan are as follows.

- to shorten the total transit time including waiting time
- to increase the transit capacity
- to improve navigational safety by straightening the curve section at around the Timsah Lake

253. Total cost and the period of construction works of the Deversoir By-Pass Extension Plan are estimated by SCA at about US$ 500 million and five years respectively.

254. Future traffic through the Canal is estimated at 78 ships/day in 2020 which is equivalent to 86 standard ships/day. The concept of standard ship, of which the time interval is set at 10 minutes, is introduced in order to compare the transit demand and the transit capacity of the Canal.

255. The effective capacity of the present Canal is estimated at about 78 standard ships per day when the effect of slow speed vessel and the Poisson's distribution of vessel arrival are considered.

256. The effective capacity of the Canal with the Deversoir By-Pass Extension Plan is estimated at about 87 standard ships per day.

257. Initial investment will be done from year 2010 to year 2014 for the high quality service without waiting.

258. The result of the FIRR calculation is 25% (up to 2030), which exceeds commercial interest rate of around 12% in Egypt in case that construction works start in 2010. Accordingly, the Deversoir By-Pass Extension Plan is thought to be financially viable.

259. On the other hand, in case that much larger Containerships would be used in the future, this project seems to be risky. Accordingly, it is recommended to conduct again the demand forecast and project evaluation just before average daily transit reaches around 55 vessels.

FINANCIAL MANAGEMENT

260. Main objectives of financial management are as follows:

- To evaluate the efficiency of each activity or segment
- To make financial plans for the future
- To estimate the degree of contribution of new activities to financial soundness
- To persuade financial institutions or investors to furnish funds or loan

261. Accounting is preferable to be conducted in accordance with the International Accounting Standard. In addition, segment-wise profit and loss statement produced by considering interdepartmental costs and profits is useful to evaluate the efficiency of each activity or segment.

262. The Study Team has not been provided with the financial statements of the SCA. The SCA, however, must bear in mind that credibility of the SCA's announcements on financial issues including toll revision and the requests on the financial loans solely depend on the accuracy of the financial statements and the reliability on the SCA's skills on the financial management.

263. Currently, almost all independent organizations which manage international economic activities issue annual financial reports. With these financial reports, the maritime shipping market can assess the economic condition and reflect the rational behavior.

264. Hence it is very important for the users of the Canal to be able to assess the stability of the conditions on which the route choice is judged by them.

265. Financial evaluation should based on a well acquainted method using various financial indexes:

- Rate of Return on Net Fixed Asset > 7%
- Debt Service Coverage Ratio > 1.75 (at least 1.0)
- Operating Ratio < 70 - 75%
- Working Ratio < 50- 60%

266. SCA is recommended to conduct these evaluations by itself, since the Study Team could not obtain necessary data for these analysis because of the managerial reason of the SCA.

MODIFICATION OF THE RULES OF NAVIGATION

267. On the definition of the container ships: The words "4th Generation Containerships and 3d Generation Containerships" described in the present rules of navigation should be replaced by "container ships not smaller than the third generation ships ". Pertinent articles are Art.8 B (2) b) i, Art.11 B (1) a), Art.11C (1) a), Art.49 A (1) a) i, Art.49 B (1) b), Art.49 B (3), Art.49 C (2), Art.50 A (1), and Art.50 B (1).

268. With the recent completion of the SCA's development plan, 58ft (62ft in 2001) draught vessels have been able to transit the canal. The BEAM AND DRAUGHT TABLE II in the Art.52 (2) should be amended.

269. Considering the currently applied flexible speed, transit speed is better to be regulated in a qualitative manner rather than stipulating the quantitative figures, provided that additional tolls for slow speed ships could be based on the present standard speeds stipulated in the article 54.

Vessels shall at all times proceed at a safe speed so that they can take proper and effective action to avoid collision and be stopped within a distance appropriate to prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

1) *the state of visibility;*
2) *the distance from the preceding vessel;*
3) *the maneuverability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;*
4) *the state of wind, tidal current, and the proximity of navigational hazards;*
5) *the draught in relation to the available depth of water;*
6) *and the characteristic, efficiency, and limitation of the operating radar.*

270. Other minor modifications to meet the current operation are as shown in Table 25.

Table 25 Other Minor Modifications

Article	Present content	Supplement/Replacement/Deletion
12 (1)	name of vessel	(add) previous name if any and SCID
	draught	(add) and beam
	deadweight	(add) and SCA net tonnage
13 (1)	name of vessel	(add) previous name if any and SCID
	deadweight	(add) and SCA net tonnage
20 (2)	One mooring boat or	(delete)
49 C (4)	,excluding Tankers over 90,000 Tons SCGT	(delete)
49 C (5) d)	Vessels carrying Radioactive substance Group I	(replace) Vessels carrying un-containerized radioactive substance Group I
57 (5) b	Vessels over 1,000 SCGT	(replace) Vessels over 1,500 SCGT