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COMMISSION FOR THE STUDY OF ALTERNATIVES TO THE PANAMA CANAL

THE STUDY OF ALTERNATIVES TO THE PANAMA CANAL (COMPONENT STUDY : ECONOMIC ANALYSIS AND IMPACT ON USERS)

FINAL REPORT

COMISION DE ESTUDIO
DE LAS ALTERNATIVAS
AL CANAL DE PANAMA
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Introduction

This is the Final Report for the study on Economic Analysis and Impact on Users (EAIU), which was executed in accordance with the Terms of Reference set forth by the Commission for the Study of Alternatives to the Panama Canal for this project on 4 September 1992.

The Feasibility Analysis/Final Report (FA/FR) Study of Alternatives to the Panama Canal produced a Detailed Plan of Study in September 1990, which included an overall work flow chart (Fig.1) identifying various study components. The work flow also identified and described a number of component studies, each with its own terms of references, to be carried out by other consultants. The component studies included the Economic Analysis and Impact on Users Study, identified in Fig.1 as work items B.6.1 and B.6.5.

The Final Report consists of six Chapters and five Annexes. In Chapter I, the concepts of benefits and costs of the project and fundamental factors for project appraisal are outlined, and project life, the Social Discount Rate to be applied and definition of alternative canals which are premises for the appraisal are presented. In Chapter II, estimation methodology and estimation of the direct benefits based on the transit projection data and shipping cost estimates provided by the component study "Commodity and Traffic Projections, Phase II Final Report" are presented in detail. In Chapter III, the costs are estimated in detail based on the engineering and cost data provided by the component study "Engineering and Cost Estimates, Phase II Final Report". Using the estimated direct benefits and costs, cost-benefit analysis on the alternative canals is made in Chapter IV. Indirect benefits and impact of the project, which are not taken into consideration in calculating the Cost-Benefit Ratio (an index for evaluating the investment efficiency of the project), are discussed/estimated in Chapter V. The various impact from the project, ranging from those on the regional economy to those on the social and natural environment, are selected from the viewpoint of "Economic Analysis of the Project". The impact analysis partly utilizes the results of the component study "Financing Scheme and Financial Analysis/Management Arrangements". In Chapter VI, the last chapter, an overall evaluation of the alternative canal project is carried out based on not only cost-benefit but also impact analysis.

Special topics such as the Social Discount Rate, a detailed explanation of the formulae for calculating benefits, and intermediate estimates of benefits are attached in the Annex. Lastly, the terminology appearing in the main report is defined in Annex, too.

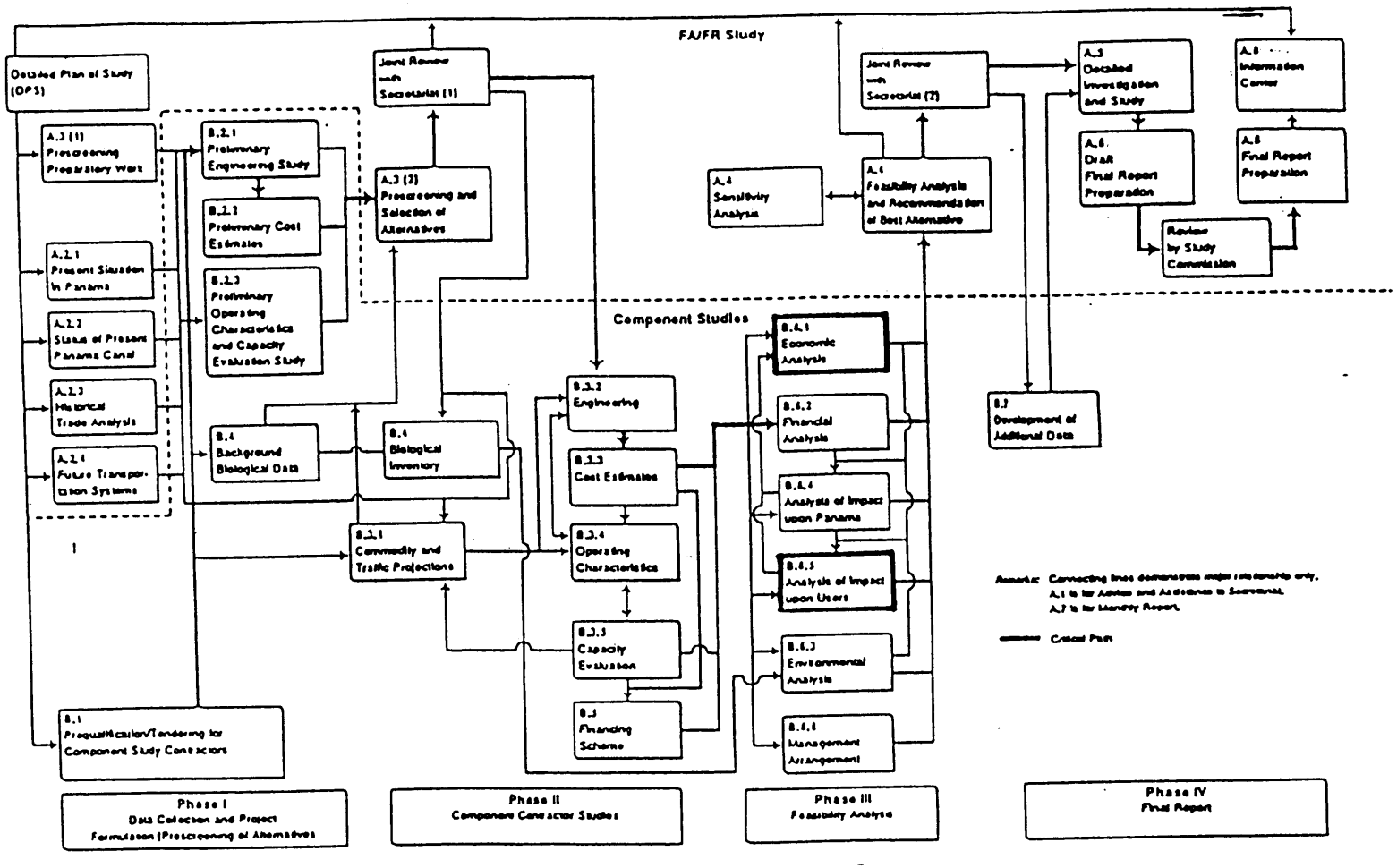


Fig.1 Overall Work Plan Flow

Summary

Summary

1. Appraisal of the Project

(1) Economic Appraisal

1) Premises of the appraisal

(a) Source for basic data

Traffic projection	:	Commodity and Traffic Projection, Phase II Final Report
Cost	:	Engineering and Cost Estimate, Phase II Final Report

(b) Project life and period of operation

Project life	: 2010 (base year) ~ 2120
Period of operation	: 2020 ~ 2120

(c) Social Discount Rate (SDR) in the year 2010 (see I.3)

a) SDR in the year 2010 : 5%/annum (recommended by the Study Team)

b) Assumptions behind the SDR estimate:

- The U.S.A. and Japan are to be the main beneficiaries of this project, based on Origins and Destinations (OD) of major sea cargos.
- The economic growth rates and market soundness of the two countries around the year 2010 are conjectured.

2) Economic appraisal of the project

(a) Items adopted to calculate the Cost-Benefit Ratio (CBR) and Internal Rate of Return (IRR) of the project

Benefits : Direct benefits from the project such as

- Route-shifting benefits by over-panamax vessels

- Size-shifting benefits
- Route-shifting benefits by under-panamax vessels

Costs :
- Project costs (Construction and Indirect costs)
- Operation, Maintenance and Management costs

These benefits and costs are measured on the With-Without Project principle.

(b) Economic efficiency of the Alternative Canal Project

Table 1-1 Economic Efficiency of Alternative Canals

(million US$)

Alternatives	C B R						Estimated IRR
	undiscounted	3%	4%	5%	6%	7%	
High-Rise- Lock 150.000DWT (Average)	151,928	22,965	14,427	9,710	6,912	5,141	6.0%
	24,977	10,133	8,634	7,618	6,879	6,308	
	6.08	2.27	1.67	1.27	1.00	0.81	
High-Rise- Lock 150.000DWT (Dry Year)	151,928	22,965	14,427	9,710	6,912	5,141	5.9%
	25,172	10,359	8,850	7,823	7,070	6,486	
	6.04	2.22	1.63	1.24	0.98	0.79	
High-Rise- Lock 200.000DWT (Average)	156,271	23,711	14,922	10,060	7,173	5,342	5.5%
	27,273	11,588	10,012	8,949	8,176	7,581	
	5.73	2.05	1.49	1.12	0.88	0.70	
High-Rise- Lock 200.000DWT (Dry Year)	156,271	23,711	14,922	10,060	7,173	5,342	5.5%
	27,312	11,705	10,132	9,065	8,288	7,686	
	5.72	2.03	1.47	1.11	0.87	0.70	
Sea Level Case(a) (Average)	163,656	24,540	15,422	10,393	7,411	5,522	4.0%
	35,237	17,098	15,285	14,075	13,210	12,557	
	4.64	1.44	1.01	0.74	0.56	0.44	
Sea Level Case(b) (Average)	163,656	24,540	15,422	10,393	7,411	5,522	4.1%
	31,326	16,608	15,155	14,186	13,493	12,970	
	5.22	1.48	1.02	0.73	0.55	0.43	
Sea Level Case(c) (Average)	163,656	24,540	15,422	10,393	7,411	5,522	3.9%
	36,639	17,932	16,059	14,808	13,913	13,236	
	4.47	1.37	0.96	0.70	0.53	0.42	

Upper : Total Present Benefits
Middle : Total Present Costs
Lower : Cost-Benefit Ratio

The High-Rise Lock Alternatives all have CBRs of over 1.0 (1.11~1.27) at a 5 percent Social Discount Rate. The CBR is lower in the case of Dry years than in that of Average years because the brunt of expenses comes earlier during Phase II of construction, although the differences are marginal. The difference in CBR between a 150,000 DWT canal and a 200,000 DWT canal is larger than that between an assumed sequence of Dry and Average years. CBRs for a 200,000 DWT canal approach 1.0, reflecting the fact that additional enlargement of maximum draft size does not add many benefits compared to the additional cost. This is because a 150,000 DWT canal would attract almost all route-shifting cargo carried by over-panamax vessels and a 200,000 DWT canal would attract very little more. Sea Level Alternatives show relatively low CBRs for the same reason. Their CBRs are 0.70~0.74, where present value of benefits remain considerably below that of present economic costs.

Very rough estimates of IRRs are also shown in Table 1-1. IRRs for a High-Rise Lock 150,000 DWT canal are 6.0 percent in the case of Average years and 5.9 percent in the case of Dry years. Both figures are 5.5 percent for a 200,000 DWT canal. In the case of a Sea Level Canal, the highest IRR is 4.1 percent. IRR for other Sea Level Canals are 4.0 percent and 3.9 percent.

Economic evaluation of alternatives depends to a great extent upon the level of Social Discount Rate. Judging from a CBR evaluated at a 5 percent of Social Discount Rate, both High-Rise Lock Alternatives are found to be economically feasible, while Sea Level Alternatives are not.

(2) Overall Appraisal of the Project

1) (Summary) Other benefits and impact of the project

Aside from the direct benefits adopted in the calculation of the CBR and IRR of this project, the following expected benefits and impact can be summarized:

Item	Description of other benefits and impact
Improvement of navigation safety	-The planned alternative canals would generally provide existing/potential users with more navigation safety than in the case of the existing canal. This is because their design standards of locks would be more in keeping with recent developments in ship construction and because alternatives have more allowance for vessels navigation.
Induced trade	-In the case of a 150,000 DWT canal, 68 million US dollars or 563 thousand tons of world trade would be induced in the year 2020, which is very small, compared with the GDPs of the beneficiary countries and the volume of transit cargo.
Saved cost-induced income	-In the case of a 150,000 DWT canal, 921 million US dollars of incremental income to the world economy is expected in the year 2020, which are very small, compared with the GDPs of the beneficiary countries.
Influence on shipping industry	-Only demand for about 20 larger ships of Full Container size is expected, which would bring in about 1,600 million US dollars at 1990 prices (less than 5% of current world annual ship construction).
Impact on adjacent countries	-Movement of labor excluding skilled labor from the adjacent countries would not be expected due to a relatively small number of new jobs created (68 thousand), almost all of which would be absorbed in Panama. -2 to 28 million US dollars of imports to Panama from the adjacent countries are expected. -The international trade of the adjacent countries would be heavily influenced by the canal price due to their high dependency on the Panama Canal.

Impact during construction	-In the case of a 150,000 DWT canal, and for 10 years from Phase I of construction: Expenditure in Panama : 845 mil.US dollars Induced industrial production in Panama : 1,518 mil. US dollars New jobs created : 68,000 jobs Panama national income induced from local expenditure : 1,685 mil. US dollars -Concentration of population in Panama City and Colon is expected. -There might be a widening difference in income distribution among the states and an increase in the social cost of keeping peace and order.
Impact of tolls	-In the case of a 150,000 DWT canal, Expenditure of Panama Canal Authority and Government : 904.3 mil. US dollars in the year 2040 Induced industrial production in Panama : 1,369 mil. US dollars in the year 2040
Socio-cultural Impact	-Necessity of preparing social infrastructures and public services for the increasing people in Metropolitan Region. -Decreased allocation of the government resource to general use.
Environmental Impact	-Water pollution due to lowered water table of the Sea Level Canal. -Hydrogical and geomorphical problems at the place for disposal of excavated earth and rock. -Inter-ocean migration of species.

2) Overall appraisal of the project

As stated in (1) above, the High-Rise Lock 150,000 DWT and 200,000 DWT alternatives were found to be economically feasible in the Cost-Benefit analysis on condition of a Social Discount Rate of 5 percent. Sea Level Canal Alternatives, on the other hand, are not economically feasible due to the relatively high construction costs compared with the expected benefits.

On the other hand, the other types of benefits and impact of the project summarized in (2) above are almost all favorable, but with relatively small impact on the aspects concerned. The impact is not so significant as to upset the economic infeasibility of the Sea Level Alternatives.

Consequently, it can be concluded that realization of the High-Rise Lock 150,000 DWT and 200,000 DWT alternatives would not encounter any serious problem when the investment efficiency is evaluated from the viewpoint of the world economy, while Sea Level Canal Alternatives need to be considered with great caution.

2. Transit Cargo Projection (Premise of the Appraisal)

(1) Transit Cargo Projection from the Year 1990 to 2060

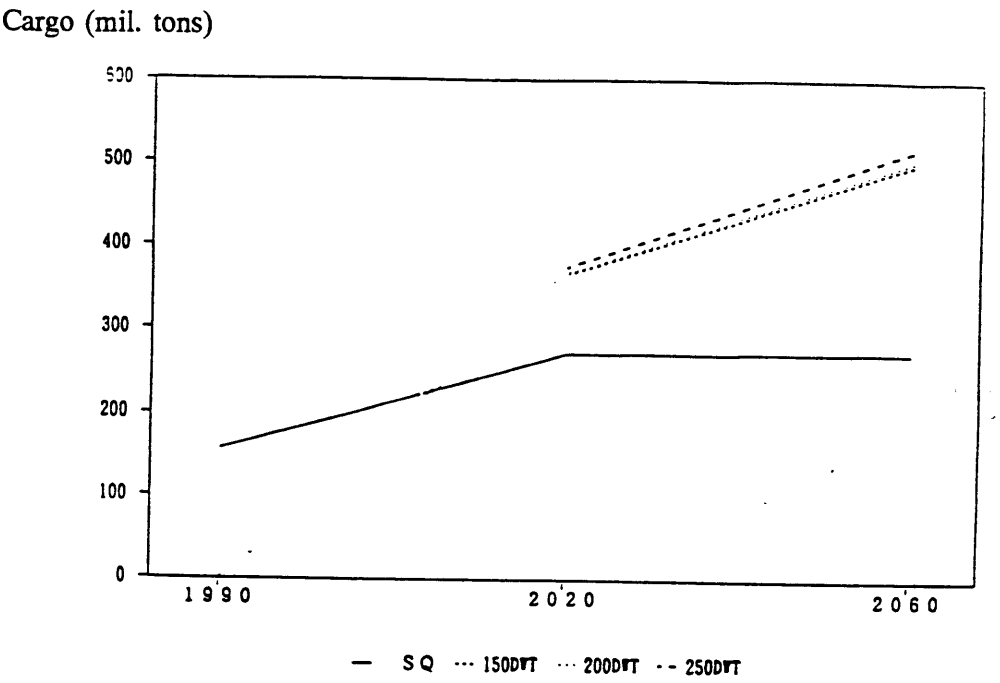


Fig. 2-1 Transit Cargo from 1990 to 2060

- Almost all incremental transit cargo generated by Alternative Canals (the difference in the transit cargo volume passing through the Alternative Canals and the SQ Canal) would be generated in the case of the 150,000 DWT Alternative Canal.

- This is because this Alternative is almost sufficient for realization of the three types of benefits in terms of volume.

- Transit cargo along the 150,000 DWT Alternative Canal is expected to increase at a rate of 0.8 percent per annum for the period of the year 2020–2060.

(2) Transit Cargo by Canal Alternatives, Ship Sizes and Ship Types from the Year 2020 to 2060

- In the year 2020, transit cargo carried by only three types of ship, Combined and Dry Bulk Carriers (CD), Full Containers (FC) and Oil Tankers (OT), would be affected by the Canal Alternatives, while that carried by the other seven types of ship would not be affected. Effects on the first three types would be realized through:

  (a) a shift of ships of these types to the alternative canals, and
  (b) an increase in the size of ships currently transiting the SQ canal

- From the year 2020 to 2060, the following factor would contribute to an increase in transit cargo, along with the above two factors:

  (c) expansion of capacity brought about by the alternative canals. In about the year 2020, the capacity of the SQ canal will be fully utilized. The alternative canals with larger capacities than that of the SQ canal would be able to accommodate excess ships of under-panamax size which would prefer to pass through the Panama Canal. Transit cargo carried by CD, FC and OT would increase through all three factors, while increases in that carried by the other seven types of ship would be realized through only the third factor.

Table 2-1 Transit Cargo by Canal Alternatives, Ship Sizes, and Ship Types (Year=2020)

(1,000 tons)

		0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	TOTAL
C D	S Q	0	47,355	65,692	14,519				127,566
	150	0	43,684	57,973	24,678	78,485			204,820
	200	0	43,735	57,973	24,626	62,938	17,868		207,140
	250	0	43,735	57,973	24,626	62,938	17,404	6,986	213,662
F C	S Q	6	16,151	26,260					42,417
	150	6	14,738	17,707	13,786				46,237
	200	6	14,738	17,707	13,786				46,237
	250	6	14,738	17,707	13,786				46,237
O T	S Q	392	6,755	13,537	1,299				21,983
	150	392	6,790	8,354	6,447	14,000			35,983
	200	392	6,790	8,354	6,447		14,000		35,983
	250	392	6,790	8,354	6,447			14,000	35,983
C B	S Q	0	16,389	9,164					25,553
	150	0	16,389	9,164					25,553
	200	0	16,389	9,164					25,553
	250	0	16,389	9,164					25,553
C T	S Q	1,580	18,927	3,776					24,283
	150	1,580	18,927	3,776					24,283
	200	1,580	18,927	3,776					24,283
	250	1,580	18,927	3,776					24,283
C G	S Q	838	7,858						8,696
	150	838	7,858						8,696
	200	838	7,858						8,696
	250	838	7,858						8,696
L P	S Q	177	1,970	449					2,596
	150	177	1,970	449					2,596
	200	177	1,970	449					2,596
	250	177	1,970	449					2,596
R E	S Q	4,072	7,237						11,309
	150	4,072	7,237						11,309
	200	4,072	7,237						11,309
	250	4,072	7,237						11,309
R R	S Q	213	1,482	802					2,497
	150	213	1,482	802					2,497
	200	213	1,482	802					2,497
	250	213	1,482	802					2,497
V C	S Q	90	2,414						2,504
	150	90	2,414						2,504
	200	90	2,414						2,504
	250	90	2,414						2,504
TOTAL	S Q	7,368	126,538	119,680	15,818	0	0	0	269,404
	150	7,368	121,489	98,225	44,911	92,485	0	0	364,478
	200	7,368	121,540	98,225	44,859	62,938	31,868	0	366,798
	250	7,368	121,540	98,225	44,859	62,938	17,404	20,986	373,320

Table 2-2 Transit Cargo by Canal Alternatives, Ship Sizes, and Ship Types (Year=2060)

(1,000 tons)

		0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	TOTAL
C D	S Q	0	26,070	56,387	32,732				115,189
	150	0	59,527	76,178	65,315	87,026			288,046
	200	0	59,527	76,178	65,315		91,105		292,125
	250	0	59,527	76,178	65,315		88,973	15,933	305,926
F C	S Q		15,381	31,439					46,820
	150		19,168	18,660	12,962	8,076			58,866
	200		19,168	18,660	12,962	8,076			58,866
	250		19,168	18,660	12,962	8,076			58,866
O T	S Q	244	2,719	2,325	728				6,016
	150	372	5,081	5,973	3,044	14,000			28,470
	200	372	5,081	5,973	3,044		14,000		28,470
	250	372	5,081	5,973	3,044			14,000	28,470
C B	S Q	0	23,019	11,635					34,654
	150	0	28,944	15,161					44,105
	200	0	28,944	15,161					44,105
	250	0	28,944	15,161					44,105
C T	S Q	1,455	24,079	7,381					32,915
	150	1,648	25,624	7,739					35,011
	200	1,648	25,624	7,739					35,011
	250	1,648	25,624	7,739					35,011
C G	S Q	1,326	12,183						13,509
	150	1,705	14,281						15,986
	200	1,705	14,281						15,986
	250	1,705	14,281						15,986
L P	S Q	150	656	265					1,071
	150	150	1,087	265					1,502
	200	150	1,087	265					1,502
	250	150	1,087	265					1,502
R E	S Q	2,385	13,721						16,106
	150	2,894	14,919						17,813
	200	2,894	14,919						17,813
	250	2,894	14,919						17,813
R R	S Q	407	1,666	925					2,998
	150	414	2,516	1,280					4,210
	200	414	2,516	1,280					4,210
	250	414	2,516	1,280					4,210
V C	S Q	104	2,816						2,920
	150	104	2,828						2,932
	200	104	2,828						2,932
	250	104	2,828						2,932
TOTAL	S Q	6,071	122,310	110,357	33,460	0	0	0	272,198
	150	7,287	173,975	125,256	81,321	109,102	0	0	496,941
	200	7,287	173,975	125,256	81,321	8,076	105,105	0	501,020
	250	7,287	173,975	125,256	81,321	8,076	88,973	29,933	514,821

Note : The cargo volumes in Table 2-1 and 2-2 were calculated by summing up the cargo volumes listed in CTP(II) Final Report (FR).

3. Direct Benefits of the Project

(1) Benefits Adopted in Calculating the Cost-Benefit Ratio (CBR) and Internal Rate of Return (IRR) of the Project

1) Types of direct benefits

The direct benefits of this project maybe recapitulated as follows :

Table 3-1 Direct Benefits in the EAIU Study

Route-shifting benefit by over-panamax vessels	Benefits for cargos on over-panamax vessels which can pass through a new canal due to the enlargement of the canal
Size-shifting benefit	Benefits for cargos now carried on smaller vessels in the SQ canal and shift to larger vessels after the operation of a new canal
Route-shifting benefit by under-panamax vessels	Benefits for cargos on under-panamax vessels which cannot use the SQ canal because of the capacity limitation and come to use a new canal after the operation of a new canal

2) Formulae for estimating direct benefits

Route-shifting benefit by over-panamax vessels

$$B_o = Q_o \times (C_a - C_p)$$

B_o : benefit for route-shifting cargos carried by over-panamax vessels ($)

Q_o : cargo volume carried by over-panamax vessels which shift routes to

C_a : unit transportation cost of the least expensive alternative route ($/ton)

C_p : unit transportation cost of the canal route ($/ton)

Size-shifting benefit

$$B_s = TC_b - TC_a$$

B_s : benefit for size-shifting cargos ($)

TC_a : total transportation cost for cargos utilizing the new canal which were SQ transit cargos before the new canal opened ($)

TC_b : total transportation cost for SQ transit cargos

Route-shifting benefit by under-panamax vessels

$$B_u = Q_u \times (C_a - C_p)$$

B_u : benefit for route-shifting cargos carried by under-panamax vessels ($)

Q_u : cargo volume carried by under-panamax vessels which shift routes to the new canal (tons)

C_a : unit transportation cost of the least expensive alternative route ($/ton)

C_p : unit transportation cost of the canal route ($/ton)

(2) Estimation of Direct Benefits

1) Summary of direct benefits in the year 2020 and 2060

Table 3–2 is a summary of benefits produced by new canals in 2020 and in 2060. As mentioned in previous sections, all of the benefits in 2020 and most of the benefits in 2060 will come from CD, FC and OT.

Size–shifting benefits enjoying economies of scale will be almost the same for all canal sizes both in the year 2020 and 2060.

Compared to benefits in the year 2020, benefits in 2060 will be larger, especially due to route–shifting by over–panamax vessels. The increase in transit demand will be reflected in this benefit.

Route–shifting benefits by under–panamax vessels will be independent of canal size as long as there are no constraints on passage through the canal.

Table 3–2 Summary of Benefits

(1,000 US$)

Benefits case/year	Route–shift by over–panamax	Size–shift	Route–shift by under–panamax	Total
150,000DWT 2020	217,094	255,711	0	472,805
2060	445,406	291,395	324,306	1,061,107
200,000DWT 2020	240,284	255,971	0	496,255
2060	471,264	292,547	324,306	1,088,117
250,000DWT 2020	259,590	255,971	0	515,561
2060	498,970	292,547	324,306	1,115,823

Source : Table II–4–1

2) Direct benefits by type of ship in the year 2020 and 2060

In the year 2020, all of the benefits, and in the year 2060, 97 percent of the benefits would be realized by CD (Combined and Dry Bulk Carriers), FC (Full Container Ships) and OT (Oil Tankers).

Table 3-3 Direct Benefits by Types and Type of Ship
- 150,000 DWT case -

(unit : 1,000 US$ at 1990 price)

		Route-shift by over-panamax	Size-shift	Route-shift by under-panamax	Total
CD	2020	195,275	34,927		230,202
	2060	412,499	20,898	260,128	693,525
FC	2020	16,919	215,933		232,852
	2060	23,053	270,497	3,622	297,172
OT	2020	4,900	4,851		9,751
	2060	9,854		26,203	36,057
CB	2020				
	2060			14,254	14,254
CT	2020				
	2060			3,566	3,566
CG	2020				
	2060			5,552	5,552
LP	2020				
	2060				
RE	2020				
	2060			10,565	10,565
RR	2020				
	2060			379	379
VC	2020				
	2060			37	37
Total	2020	217,094	255,711	0	472,805
	2060	445,406	291,395	324,306	1,061,107

Source : Table II-2-8, II-3-22

3) Direct benefit by Origin–Destination (OD) pair

Table 3–4 and 3–5 present benefits by OD pair for CD, which account for 49 percent of total benefits in the year 2020 and 65 percent in 2060. The five largest benefits by OD pair (in the case of 150,000 DWT canal) are as follows:

Five Largest Benefits for Combined and Dry Bulk Carriers (CD)

(unit : 1,000 US$, %)

(a) in the year 2020

Order	OD		Benefit	Share
1	US EC	– Asia	167,566	72.8
2	S.America EC	– Asia	18,005	7.8
3	Canada WC	– Europe	14,285	6.2
4	Canada EC	– Asia	3,769	1.6
5	Oceania	– US EC	3,534	1.5
	Others		23,044	10.0
	Total		230,203	100.0

(b) in the year 2060

Order	OD		Benefit	Share
1	US EC	– Asia	237,932	34.3
2	Asia	– US EC	86,616	12.5
3	US WC	– Europe	48,278	7.0
4	Canada WC	– Africa	45,360	6.5
5	US WC	– Africa	37,634	5.4
	Others		237,705	34.3
	Total		693,525	100.0

As shown in the above Table, the route between the U.S.A. and Asia remains a major beneficiary of this project in spite of a decrease in CD's share of total benefits from 72.8 percent in the year 2020 to 46.8 percent in 2060.

Table 3-4 Benefits in the Year 2020 (Ship Type : CD)

150,000 DWT
200,000 DWT
250,000 DWT

(US$)

Northbound

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	39,037	121,432	16,603	-	45,570	3,160,146
	0	39,024	121,432	16,586	-	45,570	3,160,146
	0	39,024	121,432	16,586	-	45,570	3,160,146
C America West Coast	7,235	103,860	-	146,612	-	20,451	286,668
	7,235	103,860	-	146,612	-	20,451	286,668
	7,235	103,860	-	146,612	-	20,451	286,668
Canada West Coast	1,402,573	21,075	-	14,285,163	572,792	1,103,319	235,410
	1,402,573	21,084	-	14,741,893	572,792	1,505,754	235,410
	1,402,573	21,084	-	14,741,893	572,792	1,505,754	235,410
Oceania	0	41,450	165,155	78,360	-	182,546	3,534,477
	0	41,450	165,155	78,360	-	182,546	3,534,505
	0	41,450	165,155	78,360	-	182,546	3,634,505
S America West Coast	54,086	21,609	1,548	3,333,000	0	29,895	266,417
	54,086	21,609	1,548	4,993,432	0	29,895	266,417
	54,086	21,609	1,548	4,993,432	0	29,895	266,417
U S West Coast Hawaii	2,512,696	9,516	113,520	3,447,311	-	69,670	15,484
	2,512,722	9,516	113,520	3,447,322	-	69,670	15,484
	2,512,722	9,516	113,520	3,447,322	-	69,670	15,484

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	96,688	541,469	76,204	32,025	40,663
	-	96,688	541,469	76,204	32,025	40,663
	-	96,688	541,469	76,204	32,025	40,663
C America East Coast	159,765	68,160	0	0	46,885	47,108
	159,765	68,160	0	0	46,885	47,108
	159,765	68,160	0	0	46,885	47,108
Canada East Coast	3,768,906	-	-	13,118	23,386	-
	5,162,883	-	-	13,118	23,386	-
	5,627,543	-	-	13,118	23,386	-
Europe	87,919	199,160	176,958	44,088	59,568	1,822,542
	87,919	199,160	176,958	44,088	59,568	1,822,542
	87,919	199,160	176,958	44,088	59,568	1,822,542
Middle East	-	-	-	-	0	-
	-	-	-	-	0	-
	-	-	-	-	0	-
S America East Coast	18,005,126	37,050	16,555	-	217,387	602,169
	30,541,625	37,050	16,555	-	217,387	602,169
	37,062,999	37,050	16,555	-	217,387	602,169
U S East Coast	167,565,969	561,618	8,961	237,789	219,155	57
	167,565,969	561,618	8,961	237,789	219,155	57
	167,565,969	561,618	8,961	237,789	219,155	57

Table 3-5 Benefits in the Year 2060 (Ship Type : CD)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	3,129,055	1,793,778	0	-	171,724	86,615,812
	0	3,129,055	1,793,778	0	-	171,724	86,615,812
	0	3,129,055	1,793,778	0	-	171,724	86,615,812
C America West Coast	1,889	0	-	4,607,327	-	267,837	99,497
	1,889	0	-	4,607,327	-	267,837	99,497
	1,889	0	-	4,607,327	-	267,837	99,497
Canada West Coast	45,359,858	16,197	-	13,894,981	338,908	3,046,891	190,987
	45,359,858	16,197	-	15,445,846	338,908	3,895,932	190,987
	45,359,858	16,197	-	15,445,846	338,908	3,895,932	190,987
Oceania	0	2,128,075	2,216,165	0	-	0	4,435,232
	0	2,128,075	2,216,165	0	-	0	4,435,232
	0	2,128,075	2,216,165	0	-	0	4,435,232
S America West Coast	2,368,378	1,388,589	91,223	9,166,808	0	0	19,736,096
	2,368,378	1,388,589	91,223	10,918,570	0	0	19,736,096
	2,368,378	1,388,589	91,223	10,918,570	0	0	19,736,096
U S West Coast Hawaii	37,633,734	1,817	26,385	48,277,580	-	436,418	3,614
	37,633,734	1,817	26,385	48,277,580	-	436,418	3,614
	37,633,734	1,817	26,385	48,277,580	-	436,418	3,614

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	192,108	28,516,531	0	62,662	1,273,776
	-	192,108	28,516,531	0	62,662	1,273,776
	-	192,108	28,516,531	0	62,662	1,273,776
C America East Coast	161,600	131,996	16,856	83,031	2,759,874	45,832
	161,600	131,996	16,856	83,031	2,759,874	45,832
	161,600	131,996	16,856	83,031	2,759,874	45,832
Canada East Coast	14,792,843	-	-	356,817	1,527,877	-
	20,860,155	-	-	356,817	1,527,877	-
	22,377,303	-	-	356,817	1,527,877	-
Europe	0	260,360	2,486,690	0	513,514	1,546,280
	0	260,360	2,486,690	0	513,514	1,546,280
	0	260,360	2,486,690	0	513,514	1,546,280
Middle East	-	-	-	-	312,843	-
	-	-	-	-	312,843	-
	-	-	-	-	312,843	-
S America East Coast	19,535,528	441,378	190,938	-	0	1,721,918
	27,805,219	441,378	190,938	-	0	1,721,918
	40,275,008	441,378	190,938	-	0	1,721,918
U S East Coast	237,932,009	1,758,366	0	2,803,684	16,056,818	45
	237,932,009	1,758,366	0	2,803,684	16,056,818	45
	237,932,009	1,758,366	0	2,803,684	16,056,818	45

(3) Yearly Benefits

1) Interpolation method between the years 2020 and 2060

Benefits during the years 2020 and 2060 are estimated by applying compound rate calculations based on estimated benefits in those years.

2) Benefits after the year 2060

Taking into consideration the long lifetime of the facilities constructed during Phase I and Phase II and the expected increase in the volume of cargo passing through the canal after the year 2060, benefits after 2060 are extrapolated based on the number of transit vessels after that year. The number is extrapolated up to the corresponding canal capacity by alternatives, adopting a rate of increase calculated based on the number of the transit vessels in the year 2020 and 2060. The number remains unchanged at the level at which the extrapolated number reaches the canal capacity.

4. Costs of the Project (Premise of the Appraisal)

(1) Costs of the Project

Economic appraisal of a project is carried out from the standpoint of the whole society and economy where the project is planned. As a result not only the tangible costs of the project but also the intangible costs incurred by the project but borne ultimately by the society or the economy have to be counted as costs. The latter costs are referred to collectively as the "External Diseconomy" of a project, and the mitigation costs, costs for keeping social order and damage to natural resources expected in the case of the Panama Canal Alternative project are classified as such.

Unfortunately, the latter costs of the project are not quantified. Accordingly, only the tangible costs of the project are adopted as the basis for calculating costs in the appraisal. These can be estimated by converting the costs expressed in market price, i.e. financial costs into economic costs.

(2) Conversion of Financial Costs to Economic Costs for the Project

1) Cost items to be converted

Based on the method of measuring project costs in the Final Report issued by the ECE Study Team, and from the viewpoint of logical consistency with the social discount rate, the figure for project costs is expressed in international border prices and is adopted as the numeraire for appraisal of this project. As a result, the values of the local portion of costs have to be converted into the same unit as that used for the numeraire.

The economic cost of the local portion, especially in the field of construction costs, cannot be directly estimated based on the data presented in the Final Report of ECE Study. This is because the cost estimation procedure adopted in the Report is different from that for estimating the economic cost. However, individual data and information for estimating the

economic cost are scattered about in the Report itself. By referring to this data and information, the following four local cost items were ultimately selected for consideration :

(a) Unskilled labor costs,
(b) Land costs,
(c) Compensation costs, and
(d) Electrical power costs.

2) Conversion formulae

(a) In Section III.1 of the Final Report, formulae for the conversion of the values of the above cost items are presented, taking into account characteristics of the cost items as well as primary factor input shadow prices and the Conversion Factors (CF) adopted for the conversions.

(b) Adopted shadow prices and conversion factors are as follows:

Shadow prices and CFs		Adopted to
Shadow wage rate of unskilled labor	: 0.6	Cost item (a)
Conversion factor for agriculture product	: 0.912	Cost item (a)
Standard conversion factor	: 0.894	Cost item (b) and (c)
Accounting ratio for electricity in Panama	: 2.747	Cost item (d)

The above shadow prices and CFs are cited from the document "Estimación de Precios de Cuenta para Panamá" MIPPE, BID, 1990.

(3) Economic Cost of the Project

1) Financial and economic project costs

The following Table summarizes the financial and economic project costs by construction phase:

Table 4-1 Financial and Economic Project Costs by Construction Phase

(unit : mil. US$ at 1990 price)

Cost Items		High Rise Lock Canal Alternatives					
		150,000 DWT			200,000 DWT		
		Phase I	Phase II	Total	Phase I	Phase II	Total
Construction Cost	Financial	6,278.4	1,215.2	7,493.6	7,290.3	1,166.1	8,456.3
	Economic	6,232.4	1,161.3	7,393.7	7,238.1	1,210.1	8,448.3
Indirect Cost	Financial	1,096.0	191.8	1,287.8	1,255.7	184.1	1,439.8
	Economic	1,184.6	182.9	1,367.5	1,343.1	190.6	1,533.7
Project Cost	Financial	7,374.4	1,407.0	8,781.4	8,546.0	1,350.1	9,896.1
	Economic	7,417.0	1,344.2	8,761.2	8,581.2	1,400.7	9,981.9

Cost Items		Sea Level Canal Alternatives 250,000 DWT								
		Case a			Case b			Case c		
		Phase I	Phase II	Total	Phase I	Phase II	Total	Phase I	Phase II	Total
Construction Cost	Financial	11,752.7	1,497.2	13,250.0	11,079.4	675.5	11,754.9	12,310.9	1,497.2	13,808.1
	Economic	11,662.2	1,484.6	13,146.8	11,013.2	1,210.1	12,223.3	12,214.9	1,484.6	13,699.5
Indirect Cost	Financial	1,766.6	219.8	1,986.4	1,667.6	99.2	1,766.7	1,848.4	219.8	2,068.2
	Economic	1,748.3	217.8	1,966.2	1,652.1	190.6	1,842.6	1,829.3	217.8	2,047.1
Project Cost	Financial	13,519.3	1,717.0	15,236.3	12,747.0	774.7	13,521.7	14,159.3	1,717.0	15,876.3
	Economic	13,410.5	1,702.4	15,113.0	12,665.3	1,400.7	14,066.0	14,044.2	1,702.4	15,746.6

Data source : Table III-1-1, III-1-2, III-2-5, III-2-6, III-2-7

The economic construction cost is lower than the financial cost by less than 1 percent of the latter due to the effect of the conversion factors, while in the case of the indirect economic cost of the High-Rise Lock Alternatives, the economic cost of land is newly counted, resulting sometimes in a higher economic than financial cost.

2) Financial and economic maintenance, operating and management costs

The economic cost is larger than the financial cost in the cases of all alternatives due to the high economic cost of electricity.

Table 4-2 Financial Operation, Maintenance and Management Costs

Items	Unit	High-Rise Lock Alternatives				Sea Level Canal Alternatives					
		150,000 DWT		200,000DWT		Case (a)		Case (b)		Case (c)	
		2020	2060	2020	2060	2020	2060	2020	2060	2020	2060
Electrical Power	mill US$	10.4	11.3	10.8	12.2	7.8	10.4	0.6	0.6	8.2	10.8
Man power and Other O & M Cost	mill US$	103.9	163.8	112.2	172.1	154.6	205.8	144.3	195.5	159.7	210.9
Total O & M Cost	mill US$	114.3	175.1	123	184.3	162.4	216.2	144.9	196.1	167.9	221.7

Source : ECE Study Final Report

Table 4-3 Economic Operation, Maintenance and Management Costs

Items	Unit	High-Rise Lock Alternatives				Sea Level Canal Alternatives					
		150,000 DWT		200,000DWT		Case (a)		Case (b)		Case (c)	
		2020	2060	2020	2060	2020	2060	2020	2060	2020	2060
Electrical Power	mill US$	29	31	30	34	21	28	2	2	23	30
Man power and Other O & M Cost	mill US$	98	154	106	162	145	193	136	184	150	198
Total O & M Cost	mill US$	127	185	136	196	166	221	138	186	173	228

Source : The Study Team's Estimate

(4) Yearly Economic Cost of the Project

1) Annual distribution of the economic project cost

Economic cost distributions were defined under the following premises:

a) Phase I of construction with the canal opening for traffic in the year 2020 is completed in the year 2019.

b) Phase II of construction for the High-Rise Lock Canal is scheduled according to CAS's instructions as shown.
Phase II of construction for the Sea Level Canal takes five years and is completed in the year 2059.

Precondition for Phase II of Construction for High-Rise Lock Canal

	Case(I) 150,000DWT	Case(II) 200,000DWT
Average Year	2057 Indio Dam 2057 Canal Crossing (No Pump Station)	2052 Trinidad Dam 2057 Canal Crossing 2058 Pump Station I (No Pump Station II)
Dry Year	2020 Indio & Ciri Dam 2034 Pump Station I 2052 Pump Station II 2057 Canal Crossing	2020 Indio & Trinidad Dam 2029 Pump Station I 2049 Pump Station II 2057 Canal Crossing

Note : Opening year of operation

2) Annual operation, maintenance and management costs

For the period of the year 2020 to 2060 annual costs are counted based on the activity level of the alternative canals, while after the year 2060 they are considered to be the same as the one in that year.

5. Other Benefits and Impact of the Project

5-1 Improvement of Navigation Safety

As shown in a report issued by the Panama Canal Commission (PCC) to the effect that only five major accidents have occurred since 1970, serious ship accidents seldom happen on the existing Panama Canal. Moreover, the planned alternative canals would generally provide existing/potential users with greater navigation safety due to design standards of locks that are more in keeping with recent development in ship construction, and due to more allowance for vessel navigation in the channel.

5-2 Impact during Construction

(1) Objective

Estimating the impact of local construction expenditures (Phase I only) on Panama's industry and labor market, and the multiplier effect of the additional income generated through the local expenditure of construction. Impact is measured in the form of incremental/induced industrial production and employment of local labor generated by expenditures, and increment of the Panama national income.

(2) Estimation Procedure

(a) Estimation of local expenditures due to construction (see Table V-1-1 ~ V-1-5), and

(b) Estimation of the impact of local expenditures on local industries and the local labor market (see Table V-1-6 ~ V-1-8).

(c) Adaption of the well-known formula for the multiplier effect.

(3) Estimated Impact

(a) In the case of the 150,000 DWT Alternative, 845 million US dollars in local expenditures at 1990 price over the ten years of Phase I of construction (11.5% of Phase I project cost) are expected out of the Phase I project costs. Local expenditure will induce 1,518 million US dollars of Panamanian industrial production (induced coefficient : 1.80), the annual average of which is equivalent to 3.1 percent of Panama's GNP (1990) (see Table 5-1).

(b) The additional income generated through the local expenditure due to the construction will induce 979 million US dollars of Panama national income (see Table 5-2).

(c) Induced production will create 68,000 new jobs in Panama over ten years, of which 38,000 are expected in the construction industry (see Table 5-1). Based on the existing regional job distribution, a large portion of the new jobs will be absorbed in Panama City and Colon. However, this may promote the concentration of population in these two cities.

(d) The situation stated in (b) above implies that the difference in income distribution among the states of Panama would become wider and the social cost of keeping peace and order in these two cities would increase, especially during the Phase I construction period.

Table 5-1 Repercussion Effect on the Local Economy of Panama during the Construction of 150,000 DWT Canal

Year	Local Expend. of Project ('000US$)	Agri.Exp.	Agr. Grain	Livestock	Other Agr.	Agro-ind.	Other Ind.	Construct.	Commerc.	Service	Finance	Total
Coefficient		0.0006	0.0003	0.0012	0.0029	0.0034	0.3087	1	0.1326	0.1689	0.1785	
1	9,400	6	3	11	27	32	2,902	9,400	1,246	1,588	1,678	16,893
2	9,400	6	3	11	27	32	2,902	9,400	1,246	1,588	1,678	16,893
3	32,619	20	10	39	95	111	10,069	32,619	4,325	5,509	5,822	58,620
4	136,979	82	41	164	397	466	42,285	136,979	18,163	23,136	24,451	246,165
5	106,289	64	32	128	308	361	32,811	106,289	14,094	17,952	18,973	191,012
6	126,695	76	38	152	367	431	39,111	126,695	16,800	21,399	22,615	227,684
7	120,078	72	36	144	348	408	37,068	120,078	15,922	20,281	21,434	215,792
8	152,494	91	46	183	442	518	47,075	152,494	20,221	25,756	27,220	274,047
9	100,304	60	30	120	291	341	30,964	100,304	13,300	16,941	17,904	180,256
10	50,258	30	15	60	146	171	15,515	50,258	6,664	8,489	8,971	90,319
11												
12												
13												
14												
15												
Total	844,516	507	253	1,013	2,449	2,871	260,702	844,516	111,983	142,639	150,746	1,517,680
Employment ('000)		0	0	0	0	0	11	38 *(50)	9	4	5	68

Note *: The number refers to the estimated number of laborers in the Engineering Study (ECE), inclusive foreign and local laborers.
Source: MRI and YEC Consortium. Repercussion coefficients are obtained from the MOCECA Input -output table.

Table 5-2 Impact Due to Construction

(mil. US$)

	Direct Impact		Indirect Impact
	Production	Income	(Multiplier Effects)
150,000DWT	1,518	706	979
200,000DWT	1,700	790	1,096
250,000DWT	1,953	908	1,259

Note 1 : 0.712 (Marginal propensity to consume) and 0.131 (Import ratio) are assumed, from Table V-2-2
Note 2 : Initial income of the direct impact is excluded from the indirect impact.

5-3 Induced Trade

(1) Objective

Estimating the induced world trade which would be brought about by a portion of the transportation cost savings which are expected from this project due to decrease in prices of traded goods.

(2) Estimation Procedure

As presented in Chapter V.2 in the form of formulae,

(a) Estimation of volume of induced world trade, and
(b) Estimation of value of induced trade based on (a) above.

(3) Estimated Induced Trade

In the case of the 150,000 DWT Alternative, induced world trade is estimated to be 68 million US dollars or 563 thousand metric tons in the year 2020. This is extremely small compared with the GDPs of the countries of origin and destination of transit cargo on the Panama Canal (total: 14,509 billion US dollars) and the expected volume of transit cargo.

The most significant increases in trade are expected in exports from the U.S East Coast (88% of total induced exports, in the case of the 150,000 DWT canal) and in imports to Asia (92% of total induced imports) (see Table 5-3).

Table 5-3 Induced Trade (Volume) Due to Transport Cost Savings from Canal Alternatives in the Year 2020

Regions	⊿Export('000 MT) 150DWT	200DWT	250DWT	⊿Import('000 MT) 150DWT	200DWT	250DWT
(Pacific)						
1. Asia	14	14	14	519	607	694
2. C. America WC	2	2	2	2	2	2
3. Canada WC	-8	8	2	3	3	3
4. Oceania	1	1	1	1	1	1
5. S. America WC	3	3	3	1	1	1
6. U. S. WC	19	19	19	7	7	7
(Atlantic)						
1. Africa	3	3	3	6	7	7
2. C. America EC	2	2	2	3	3	3
3. Canada EC	-2	9	8	1	1	1
4. Europe	7	7	7	3	20	14
5. Middle East	0	0	0	0	0	0
6. S. America EC	27	105	193	0	0	0
7. U. S. EC	495	495	495	17	17	17
TOTAL	563	668	749	563	668	749

Source: MRI and YEC Consortium.

Note : Minus figures imply reduced trade caused by higher tolls and other transportation costs for the alternative canal than for the SQ canal.

5-4 Impact of Tolls

(1) Objective

Estimating Panamanian industrial production induced by incremental maintenance and operation costs required for the new canal and incremental government expenditures expected based on the increase in government revenue from the Panama Canal Authority in the year 2040.

(2) Estimation Procedure

(a) Estimation of incremental maintenance and operation costs and government revenue (see Table V-3-1), as well as government expenditure in industrial sectors with the same composition ratio as that for total demand in Panama, and

(b) Estimation of induced industrial production using the inverse matrix of Panama's input coefficient matrix.

(3) Estimated Induced Industrial Production

In the case of the High-Rise Lock 150,000 DWT Alternative, incremental expenditure of 904.3 million US dollars is expected in the year 2040 from the Panama Canal Authority and Government, and additional industrial production of 1,369 million US dollars will be induced by this incremental expenditure.

5-5 Saved Cost-Induced Income

(1) Objective

Estimating the income induced from transportation cost savings through decreases in prices of traded goods.

(2) Estimation Procedure

As shown in Chapter V.4 in the form of formulae,

(a) Estimation of total income accrued from transportation cost savings,
(b) Allocation of total income to transit exporting and importing regions cargo, and
(c) Estimation of income by region through the multiplier effect.

(3) Estimated Saved Cost-Induced Income

Incremental income to the world economy from the new canal is estimated to be 921 million US dollars in the year 2020 in the case of 150,000 DWT Alternative. This is extremely small compared with the GDPs of the countries of origin and destination.

Table 5-4 Induced Income and Multiplier Effect Due to Transport Cost Savings from Canal Alternatives in the Year 2020

Regions	⊿Income('000 US$)			Multiplier Effect('000 us$)			% to GNP		
	150,000DWT	200,000DWT	250,000DWT	150,000DWT	200,000DWT	250,000DWT	150,000DWT	200,000DWT	250,000DWT
(Pacific)									
1. Asia	133,980	140,779	146,002	389,378	409,139	424,317	0.01%	0.01%	0.01%
2. C. America WC	1,152	1,152	1,152	1,502	1,502	1,502	0.00%	0.00%	0.00%
3. Canada WC	-1,016	2,113	996	-1,963	4,084	1,924	0.00%	0.00%	0.00%
4. Oceania	207	207	207	170	170	170	0.00%	0.00%	0.00%
5. S. America WC	758	789	789	764	795	795	0.00%	0.00%	0.00%
6. U. S. WC	13,140	13,140	13,140	45,259	45,259	45,259	0.00%	0.00%	0.00%
(Atlantic)									
1. Africa	3,357	3,387	3,387	2,314	2,334	2,334	0.00%	0.00%	0.00%
2. C. America EC	846	846	846	1,173	1,173	1,173	0.00%	0.00%	0.00%
3. Canada EC	-101	1,907	1,696	-195	3,686	3,278	0.00%	0.00%	0.00%
4. Europe	10,363	13,492	12,374	17,198	22,390	20,536	0.00%	0.00%	0.00%
5. Middle East	0	0	0	0	0	0	0.00%	0.00%	0.00%
6. S. America EC	5,014	19,389	35,690	6,279	24,280	44,693	0.00%	0.01%	0.01%
7. U. S. EC	133,155	133,155	133,155	458,646	458,646	458,646	0.01%	0.01%	0.01%
TOTAL	300,854	330,355	349,433	920,525	973,459	1,004,629			

Source: MRI and YEC Consortium.

Note : Minus figures imply reduced trade caused by higher tolls and other transportation costs for the alternative canal than for the SQ canal.

5-6 Impact on Adjacent Countries

(1) Movement of Labor

The employment increase due to Phase I of construction is estimated to be 68 thousands (in the case of a 150,000 DWT canal). This number will be absorbed in the local labor market in Panama, and there will be little need to import labor from abroad, except skilled labor required in construction.

(2) Movement of Commodity

Since major equipment for construction will be bought from the developed countries, probably from the U.S.A. and Japan, a significant amount of imports from the adjacent Central and South American countries is not expected. Only indirectly will industries in Panama stimulated by local expenditure on construction increase the amount of imports from the adjacent countries.

Based on Panama's dependency on import (26% estimated) and the structure of Panamanian imports from the adjacent countries, 2 to 28 million US dollars of imports from the adjacent Central and South American countries are expected (in the case of a 15,000 DWT canal).

(3) Impact on Adjacent Countries during Operation

Two interesting features of Panama Canal traffic can be observed:

- Countries with large economies such as the U.S.A., Canada and Japan are more important for the canal than those with small economies, and
- The canal is more important for adjacent countries with relatively small economies such as Chile, Peru, Ecuador and Mexico than those with large economies.

This implies that if these three countries were to stop using the canal for their trade (both export and import) the canal would lose more than 80 percent of its revenues and that the canal price most affects the trade of the smaller adjacent countries.

5-7 Influences Exerted by the Panama Canal Project on the Shipping Industry

(1) Objective

Estimating the demand for construction of larger ships and the value of contracts to the world's ship-building industry which would be generated through enlargement of canal ship size brought about by the project, and on the supposition of a more competitive shipping industry market.

(2) Estimation Procedure

(a) Identification of types of ships for which demand for larger vessels exists, to based on the transit cargo projections by type of ship presented by the WEFA, and analysis of the impact on the shipping industry of the introduction of such larger ships.

(b) Estimation of the number of larger ships for which new demand will arise and the value of contracts to the ship-building industry, based on analysis of and assumptions on the activities of the shipping and ship-building industries.

(3) Estimated Impact

Through estimation procedure (a) above, it is supposed that there will be demand for only Full Container with larger capacity, which would be generated through enlargement of canal ship size brought about by the project. There would be demand for about 20 Full Container Ships with a capacity of 4,000 TEU after completion of the new canal, amounting to approximately 1,600 million US dollars at 1990 prices. However, this amount is equivalent slightly less than 5 percent of current world annual ship construction.

6. Additional Study

As for cost-benefit comparison of alternative canals, the additional work was conducted. The report of this study was separately documented in "The Study of Alternatives to the Panama Canal, Component Study : Economic Analysis and Impact on Users (Additional Study)".

This chapter summarizes the result of the additional study.

The basic difference of the additional study from the original study (this report) comes from the following points:

1) The capacity of the status-quo(SQ) canal is 17,000 vessels while CTP Study Phase II assumed that it was about 18,000 vessels.
2) The canal shape is a single lane option:

   Culebra single cut for 150,000 DWT and 200,000 DWT canals.

   Atlantic approach single channel for 250,000 DWT canal.

   This option leads the smaller amount of economic cost and the smaller capacity of alternative canals.

The benefits of alternative cargos were re-calculated based on the new capacity. The economic costs were calculated based on construction costs from ECE Phase II additional study. The capacity of alternative canals were derived from Operating Characteristics and Capacity Evaluation Study Phase II.

The SQ canal capacity is smaller as much as about 1,000 vessels compared to that of the original study. Hence about 1,000 vessels cannot use the SQ canal. There are three ideas about which vessels have to use alternative routes.

These vessels are:

case 1) vessels whose cost saving by the canal routes are the smallest.

case 2) vessels whose cost saving by the canal routes are not negative and are the smallest.

case 3) vessels chosen randomly.

Table 6-1 shows the benefit of alternative routes based on those three ideas.

Table 6-1 Benefit of Alternative Canals

Canal Size	Year	Calculation case		
		1)	2)	3)
150,000 DWT	2020	458,118	458,416	535,987
	2060	1,196,314	1,243,945	1,418,687
200,000 DWT	2020	482,789	483,087	560,658
	2060	1,223,323	1,270,954	1,445,696
250,000 DWT	2020	502,095	502,393	579,963
	2060	1,251,030	1,298,661	1,473,403

Table 6-2 shows the cost-benefit ratios (CBRs) and rough estimations of the Internal Rate of Returns (IRR) for the alternative canals. Here, Average year option and Dry year option were considered for High-Rise Lock Canal, while only Average year case was considered for Sea Level Canal (case(a):Tidal Lock, case(b):Tidal Gate).

The benefits in Table 6-2 are based on case 3) idea which is mentioned above.

Table 6–2 Economic Efficiency of Alternative Canals

(million US$)

Alternatives	C B R								Estimated IRR
	undiscounted	3%	4%	5%	6%	7%	8%	9%	
High-Rise- Lock	220,865	30,971	18,982	12,507	8,751	6,422	4,889	3,830	
150.000DWT	23,035	8,450	7,026	6,082	5,410	4,902	4,500	4,170	8.5%
(Average)	9.59	3.67	2.70	2.06	1.62	1.31	1.09	0.92	
High-Rise- Lock	220,865	30,971	18,982	12,507	8,751	6,422	4,889	3,830	
150.000DWT	23,230	8,676	7,243	6,287	5,602	5,081	4,665	4,323	8.3%
(Dry Year)	9.51	3.57	2.62	1.99	1.56	1.26	1.05	0.89	
High-Rise- Lock	219,879	31,405	19,350	12,806	8,990	6,614	5,046	3,959	
200.000DWT	25,117	9,679	8,177	7,182	6,474	5,940	5,517	5,170	7.6%
(Average)	8.75	3.24	2.37	1.78	1.39	1.11	0.91	0.77	
High-Rise- Lock	219,879	31,405	19,350	12,806	8,990	6,614	5,046	3,959	
200.000DWT	25,153	9,795	8,295	7,297	6,585	6,044	5,615	5,260	7.5%
(Dry Year)	8.74	3.21	2.33	1.75	1.37	1.09	0.90	0.75	
Sea Level	127,527	25,082	16,703	11,713	8,564	6,476	5,030	3,993	
Case(d)	32,642	14,714	12,960	11,805	10,990	10,383	9,910	9,529	5.0%
(Average)	3.91	1.70	1.29	0.99	0.78	0.62	0.51	0.42	
Sea Level	227,304	32,201	19.833	13,129	9,224	6,791	5,185	4,071	
Case(e)	28,419	13,768	12.330	11,374	10,691	10,176	9,769	9,437	5.5%
(Average)	8.00	2.34	1.61	1.15	0.86	0.67	0.53	0.43	

Upper : Total Present Benefits
Middle : Total Present Costs
Lower : Cost-Benefit Ratio

Alternatives except Sea Level Case(a) have CBRs over 1.0 (1.15–2.06) at 5 percent of social discount rate. If 6 percent of social discount rate is adopted, CBRs of Sea Level Case(b) will also become under 1.0.

Estimated IRR in Table 6–2 shows that 150,000 DWT canal has IRRs over 8 percent and 200,000 DWT has IRRs around 7.5 percent, while Sea Level Canal has IRRs 5 to 5.5 percent.

I. Basic Benefit and Cost Concepts

I. Basic Benefit and Cost Concepts

I.1 Identification of Benefits and Costs

We define benefits/costs of a project in this study as the marginal increase/decrease in economic welfare as compared to without the project.

(1) Direct Benefits and Costs

Among the various items to be identified as benefits/costs, we define direct benefits/costs as economically tangible immediate benefits/costs.

1) Direct Benefits

In the case of alternative canal projects, benefits take the form of reductions in resource expenditures. Based on this definition, the following have been identified as direct benefits resulting from the execution of alternative canal projects. Transportation cost reductions can be realized in three ways:

(a) Route–shifting benefits by over–panamax vessels
(b) Route–shifting benefits by under–panamax vessels
(c) Size–shifting benefits

Panamax is defined as the maximum–size ship that can pass though the existing Panama Canal and is generally of 65,000 dwt capacity. Route–shifting benefits by over–panamax vessels comprise transportation cost reductions achievable by an alternative canal that would be shorter and cheaper than other waterway and land–bridge routes. Route–shifting benefits by under–panamax vessels are cost savings that would occur, as a result of an alternative canal being able to handle more shipping traffic, in the case of SQ–size vessels which could not use the canal if capacity is reached, but would use the canal if capacity is increased. Size–shifting benefits comprise reductions in transportation costs achievable by shippers being

able to use larger ships via an alternative canal route. Here, cost savings are due to economies of scale regarding ship size. The benefits occur within the combination of ships which pass through the SQ canal.

2) Costs

Direct costs of an alternative canal project arise in the following three ways:

(a) Construction costs
(b) Operation, maintenance and management costs
(c) Mitigation costs

Resources once invested in a canal construction project, or in operation, maintenance and management of the project, such as labor, materials and equipment, cannot be used for other purposes. Such expended resources are identified as costs in this study. There is also the possibility that construction work will damage the local environment. If any of this damage is to be mitigated, the resources for doing so marginally added by the project are also identified as costs. However, the costs are not available to this study.

(2) Other Benefits and Costs

There are other potential benefits/costs in addition to direct benefits/costs.

1) Social Benefits and Costs

Most social benefits and costs concern the region where canal construction will be executed and are as follows:

(a) Socio-culrutal impact
(b) Environmental costs

Large-scale construction requires large numbers of laborers who will need service industries to satisfy their living needs. Regional infrastructure will have to be prepared to this end, as

well as direct logistical support facilities for construction work. People coming from various regions to work could potentially affect public peace and order as well, and increases in security costs are also to be considered as a social cost.

Environmental damage due to the construction is also a social cost. The large scale geographic alteration for the projects potentially affects a natural ecology system or the supplying source of fresh water.

2) Intangible Benefits

One intangible benefit of an alternative canal would be an improvement in navigation safety, which would result in a decrease in ship accidents. However, this benefit, which is sometimes quantified as a decrease in expected economic losses due to accidents, is technically hard to estimate.

(3) Other Impact

Other impact constitute those effects of an alternative canal project not categorized as benefits/costs. We identified the following such effects for this project:

1) Increased Demand Effect

Construction and operation/management work increases the demand for the industrial production. The same impact is caused by expenditure from the toll revenue of the canal operator. This type of impact results in changes only in the pattern of resource utilization. However, this effect does not mean there will actually be any change in total resources used. Accordingly, it is not classified as a benefit.

2) Multiplier Effects

Once someone's income increases, it promotes expenditure and creates new demand

in the economy. This multiplier effect occurs in the following ways as regards the project:

(a) Further personal expenditure due to income from construction work;
(b) Further expenditures due to savings in transportation costs.

Effects under (b) would occur worldwide through canal users coming from various countries. Effects in (a), however, would occur in a more centralized area around Panama through sourcing of labor and materials for construction.

Increased production level and induced income due to multiplier effects are not considered as benefits since they are indirect in nature.

3) Induced Trade Flows

A lowering of transportation costs will potentially induce new trade flows in addition to route-shifting. This impact would produce an increase in income through the occurrence of induced trade flows. However, this too is only a change in the pattern of resource utilization and does not represent an increase in resources. This kind of price adjustment is called a monetary effect, and is not theoretically categorized as a benefit.

4) Increased/Decreased Demand in the Ship-Building Industry

Alternative canals accommodate over-panamax ships. Size-shifting action in response to new canals increases the demand for large ships, while route-shifting action decreases relatively the demand for ship tonnage due to the shorter voyage through the new canal. The total change in demand, whether positive or negative, has an influence on the ship-building industry. The impact is not classified as a benefit or cost since no change in resource is induced.

5) Influence of Toll Rate on Users

A toll rate is one of important determinants for users choosing the canal. It sometimes leads directly to the economic damage for captive users who do not have any other alternative route but the Panama Canal route. User's damages due to the toll is not classified as

economic costs since the damages are only a transfer of the resources to the canal operator by the payment of the toll.

(4) Evaluation Process

Identified benefits, costs and types of impact are summarized in Table I-1-1. The direct benefits/costs are considered in an economic comparison of the project, while other benefits and types of impact are considered in an overall evaluation process.

Table I-1-1 Benefits, Costs and Other Impact Taken into Consideration in the Overall Evaluation Process

Impact		
Benefits/ Costs		Other Impact
Direct	Others	
.Transportation cost savings .Construction costs .Operation/management costs	.Social .Intangible	.Increased demand effect .Multiplier Effect .Induced trade income effect .Increased demand for ship-building industry .Influence of toll

I.2 Project Life

Benefits, costs and impact occur at different times, and an alternative canal would provide benefits in the long run. This situation raises two issues. One is how to compare benefits/costs at different times, and the other is how long into the future benefits/costs should be considered in the evaluation of the project. For the former issue a technique of discounting future values into present values using a social discount rate is usually applied.

The second issue, however, is not subject to analysis by a standard technique. Generally, benefits disappear at the time the physical facilities cease to function (physical project life) or the facility loses its market position with the advent of new competitors (economic project life). In the case of alternative canals, there is no reason for denying that relative economies between transportation routes, on which WEFA's traffic projection is based, will hold and that they will keep their market after the year 2060. Regarding physical facilities, the experience of the present canal shows that they can continue to be operated for more than 80 years.

Therefore, for simplicity's sake a duration of 100 years is assumed for canal operation, and it is also assumed that WEFA's projected growth rate will continue until demand reaches the capacity of the new alternatives. Since 2020 is the hypothesized opening year of the operation, the last year of the project life is defined as 2120.

The base (first) year is the beginning year in which construction begins. The ECE Report assumes that the first and second phases of construction, which will take 10 years, will be executed to accommodate the projected number of ships for the year 2020. To decide the base year itself is an optimization issue, choosing a certain point in time before 2010. We set the base year at the latest possible date to meet traffic demand for 2020, taking account of the fact that growth in demand is larger than the adopted social discount rate.

In conclusion, therefore, the year 2010 is selected as the base year for the appraisal, and the 110 years from approximately 2010 to 2120 are adopted as the project life.

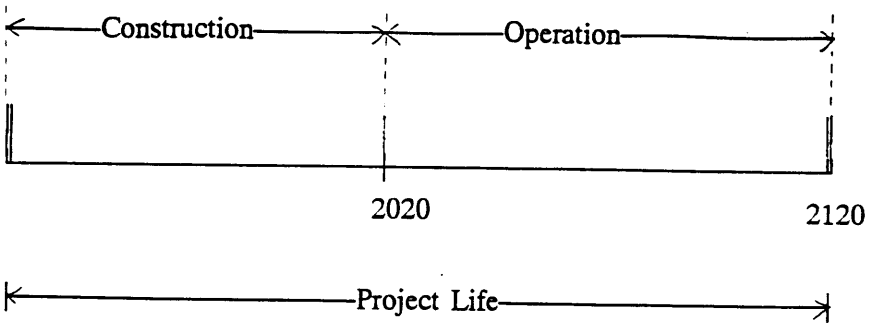


Fig.I-2-1 Project Life

I.3 Social Discount Rate

(1) Summary

The Social Discount Rate (SDR) is used to discount future direct benefits and costs of a project and provides a basis for evaluating indicators (e.g. Internal Rate of Return (IRR)) which represent the investment efficiency of the project (for details, see Chapter 1 of the attached Annex I).

SDR as discussed in published literature and papers is approached mainly from two sides: a purely theoretical approach and theoretical–practical approach. In the former approach, the SDR is defined by fully applying welfare economics and is intended to be calculated based on the Production Possibility Curve and Social Indifference Curve, while in the latter approach, the SDR is also theoretically developed by partially applying welfare economics, while methods of estimating the SDR based on actual economic data are discussed in sentences. Many papers have been published mainly by international financial organizations, including case studies in which the SDRs of developing countries are estimated in accordance with the suggested estimation methods.

However, one problem common to both the above–mentioned approaches is in the measurability of the SDR based on actual economic data in the economy concerned. In the case of the former approach, the derived SDR is immeasurable due to the non–existence of appropriate data, which can be obtained only on assumption of Complete Competitive Markets. In the case of the latter approach, there are the following two problems relating to;

- A large amount of related data and analysis thereon are required for estimating the SDR
- One–point estimation of the SDR is very difficult due to low accuracy of results estimated through a few sub–approaches based on actual economic data

Therefore, the literature recommends ultimately adopting a two–step approach or integration of different sub–approaches or proxies of the Opportunity Cost of Capital (OCC) (e.g. Market Interest Rate (real) and highest yield rate on long term National Bonds) (for details, see Chapter 2 of the attached Annex I).

For the purposes of this study it is necessary to forecast the SDRs of developed countries for the year 2010, the base year of this project appraisal, within the time limits allowed by study. Forecasts and estimates of the SDRs of the developed countries cannot be found in any of the above literature, excepting discussion of forecasting methodologies. Accordingly the second approach is not adopted in estimating and forecasting the SDR applied to this project appraisal.

Based on the theory of SDR to which welfare economics is fully applied, and taking into account the characteristics of actual markets (capital, factors of production, and finished products), the SDR of the economy concerned is considered, in this study, to be a function of economic growth rate and factor of risk premium in the economy. The SDR is expressed by the following proposed formula:

$$SDR = EG + RP$$

The first determining factor, "EG", is the average annual economic growth rate in the economy concerned in the years preceding and subsequent to the year for which the SDR is to be estimated. The second factor, "RP", is an independent variable that is determined mainly by the degree of market soundness in the economy concerned. The first factor can be relatively easily found in published statistics, while the second is based on a rough estimation and forecast of market development. A detailed discussion of the theoretical basis for adopting these two factors as explaining SDR variables is presented in Chapter 2 of Annex I, and the relationship between the degree of market soundness and the factor "RP" and estimation of "RP" in the SDRs recommended by international financial organizations and major donor countries are described in Chapter 3 of Annex I.

As the concept of SDR in itself implies, the SDR applied to this project has to represent that of the main beneficiaries and final cost bearers. The U.S.A. and Japan are selected as the main beneficiaries based on the Potential Commodity Projection provided by the WEFA Study Team. As for who finally bears the costs, i.e. the organization responsible for the project costs, this depends on the characteristics of the business entity of the project. However, there exists a general limitation in that the SDR for discounting project benefits should be the same as the one for evaluating costs, resulting automatically in a situation whereby whatever types of business entity are proposed, they cannot be considered in determining the characteristics of the SDR applied to this project, because it is determined from the viewpoint of its main beneficiaries. Detailed discussion on these issues is presented in Chapter 4 of Annex I.

By referring to the SDR for the yer 1990 estimated according to the above procedure (6–7 percent per annum, estimated) and assuming the macro economies and degree of market soundness of the two countries in around the year 2010, it is recommended that an SDR of 5 percent per annum is recommended for application to the economic appraisal of the alternative canal project.

(2) Estimating the SDR for the Year 2010 Recommended for Application to The Project

The SDR for the year 1990, on the basis of which the SDR for 2010 can be determined, can be worked out by calculating "RP" based on the supposed degree of market soundness in the U.S.A. and Japan, and adopting the average annual GDP/GNP (Gross Domestic/National Product) growth rate of the two countries (the "EG" factor) for the latter half of the 1980s.

SDR is generally better calculated as a weighted mean of the two sums for "RP" and "EG" for the two countries. The weights are calculated based on the sea cargo volume destined for the U.S.A. and Japan, respectively, which passed through the Panama Canal during 1990. However, an arithmetic mean of the two sums is calculated due to lack of precise data on the cargo volume between the two countries.

Fundamental data for estimating SDR for the year 1990 are shown in Table I–3–1. Taking into account the degree of market soundness in the two countries along with the GDP growth rate shown in the Table, the SDR for the year 1990 is estimated as follows:

$$\begin{aligned} \text{SDR for the year 1990} &= EG + RP \\ &= 3.8 + 3.0 \\ &= 6.8\% \ / \text{ annum} \end{aligned}$$

In the above equation, "RP" is set at 3 percent per annum, which is almost half that for the developing countries (for details, see Chapter 3 of Annex I).

The SDR estimated above is somewhat higher than the arithmetic mean of the rate of yield on national bonds and real interest rates on lending in the two countries, but a little lower than annual nominal rates. When evaluating the estimated SDR from the viewpoint of

the yield/lending interest rate, the monetary policies followed in the latter half of 1980s in the two countries, especially the U.S.A., have to be taken into consideration.

As discussed in Chapter 5 of Annex I, the economic growth rates of the U.S.A. and Japan in the latter half of the first decade of the 21st century are expected to be lower than in the latter half of 1980s and to converge, so to speak, in their potential, unless a technological revolution takes place. On the other hand, their degree of market soundness will surely be higher than in the year 1990. Consequently, the SDR for the year 2010 recommended for appraisal of this project can be estimated as follows:

SDR for the year 2010 = EG + RP
= 2.5 + 2.5
= 5.0% / annum

The SDR for the year 2010 is expected to be lower than that for 1990 by approximately 2 percentage points.

Table I-3-1 Fundamental Data for Estimating the 1990 SDR

	Growth rate of GDP (%/annum) *1	(1) Real yield/ interest lending rate (%/ annum)		(2) Rate of increase in consumer prices (%/annum) *1	(3) Nominal yield/ interest lending rate (%/ annum) *2	
		National bonds	Lending interest rate		National bonds	Lending interest rate
U.S.A	3.1	5.2	5.7	3.6	8.8	9.3
Japan	4.5	3.9	4.5	1.1	5.0	5.6

*1 : Average annual growth rate for the period of the year 1984~1989
*2 : Arithmetic mean for the period of the year 1985~1989
(1) = (3) - (2)
Source : Calculations based on International Financial Statistics, IMF

I.4 Alternative Canals

(1) Definition of Alternative Canals

Alternative canals as evaluated in this study are defined as follows. Below dwt (dèad weight tonnage) is used to indicate vessel size, while DWT is used for alternative cases.

1) High-Rise Lock Canal Alternatives

These alternatives call for the construction of a third set of larger new locks having one lane with an option for a second additional future lane. Under this alternative the navigational channel cross section would be two lanes throughout. The water level in Gatun Lake would be 85 or 90 feet. The following design ship sizes are to be considered:

. High-Rise Lock with a design ship size of 150,000 dwt (referred to below as 150,000 DWT CASE)
. High-Rise Lock with a design ship size of 200,000 dwt (referred to below as 200,000 DWT CASE)

2) Single-Lane Sea Level Canal Along Route 10

This alternative calls for the construction of a sea level canal 16 kilometers west of the existing canal, basically along the route suggested in the Anderson Report as Route 10. The canal would be one lane with double lane approaches. The design ship size would be 250,000 dwt. Cases to be studied are the following with different tidal gates or tidal locks near both entrances.

. Sea Level with a tidal lock only on the Pacific side (referred to below as the 250,000 DWT (Case(a)) CASE)
. Sea Level with tidal gates on both the Pacific and Atlantic sides (referred to the below as the 250,000 DWT (Case(b)) CASE)
. Sea Level with a combination of tidal lock and tidal gate on both sides (referred to below as the 250,000 DWT (Case(c)) CASE)

(2) Comparison of Condition With & Without the Project

The above alternatives are evaluated on the basis of a comparison of condition with and without the project. The Status Quo (SQ) canal means the existing Panama Canal implementation of the Gaillard Cut widening project at a nominal channel width of 630 feet. Activities or behaviors under the SQ canal form the base antenna (without the project), to be compared with those under alternative canals (with the project).

II. Benefits of Alternatives

II. Benefits of Alternatives

II.1 Concept of Direct Benefits

(1) General

Direct benefits in the EAIU Study originate from cargo shipping cost savings. Cargo vessels in principle use the most economic way of transportation. Cargo vessels will change routes and/or vessel size depending on individual cost savings. Transportation costs in this context consist of many cost elements including transit costs, inventory costs, handling costs, etc.

Transportation costs are determined by the route for each shipping. The difference of costs between the canal route and an alternative route becomes a cost saving if a vessel shifts to the canal. Over-panamax vessels have no chance to select the canal route unless a new canal is constructed. After the completion of a new canal, they will use it if the canal route is the least expensive. They can gain benefits by choosing the canal. This benefit is called the Route-Shifting Benefit for Over-panamax vessels in this report.

Another benefit comes from economies of scale. In general, the unit cost of transportation by a large vessel is more economical than that by a small one. If a new canal is operated, cargo on existing under-panamax vessels will have a new alternative in terms of vessel size. Some cargos will select larger vessels if they are available. The transportation cost of cargo will decrease compared to that carried by small vessels. Thus cargos can enjoy benefits. This benefit is called the Size-Shifting Benefit.

There will be another benefit related to the capacity of the status quo (SQ) canal. Transit demand is projected to grow larger. Heavy congestion is expected when the number of vessels wishing to use the canal reaches capacity. Under this circumstance, some vessels will use an alternative route because transportation costs will increase due to delays caused by congestion. If a new canal is operated, the congestion problem will not occur. Hence, a new canal will give carriers the benefit of congestion-free transportation. Only under-

panamax vessels can enjoy this benefit because over-panamax vessels cannot use the SQ canal. This benefit can be gained by shifting a route from an alternative route to the canal. This benefit is called the Route-Shifting Benefit by under-panamax vessels in this report.

Table II-1-1 provides a summary of direct benefits considered in the EAIU Study.

Table II-1-1 Direct Benefits in the EAIU Study

Route-shifting benefit by over-panamax vessels	Benefits for cargos on over-panamax vessels which can pass through a new canal due to the enlargement of the canal
Size-shifting benefit	Benefits for cargos now carried on smaller vessels in the SQ canal and shift to larger vessels after the operation of a new canal
Route-shifting benefit by under-panamax vessels	Benefits for cargos on under-panamax vessels which cannot use the SQ canal because of the capacity limitation and come to use a new canal after the operation of a new canal

(2) Route-Shifting Benefits by Over-panamax Vessels

Under all alternatives, over-panamax vessels will be able to pass through a new canal. If the canal route is the best choice in terms of transportation costs, it is assumed that vessels will select the canal route. This choice is decided by each vessel and is dependent on route and vessel size.

If a ton of cargo experiences a saving of "X" dollars by shifting to a new canal, the benefit to the cargo is "X" dollars. Total benefit is the sum of benefits which each cargo gains. Accordingly, the basic formula for the Route-Shifting Benefit by over-panamax vessels is expected by the following equation.

$$B_o = Q_o \times (C_a - C_p)$$

B_o : benefit for route-shifting cargos carried by over-panamax vessels ($)
Q_o : cargo volume carried by over-panamax vessels which shift routes to a new canal (tons)
C_a : unit transportation cost of the least expensive alternative route ($/ton)
C_p : unit transportation cost of the canal route ($/ton)

$(C_a - C_p)$ equals a unit-cost saving of a ton of shifted cargo. The benefit is calculated for each Origin and Destination (OD) pair. The equation is explained in detail in Annex II, 1 Route-shifting benefits by over-panamax vessels, page A-II-1.

(3) Size-Shifting Benefits

In general, a large-size vessel can enjoy economies of scale relative to smaller vessels carrying similar commodities. Therefore, when a new larger canal opens, some cargo will shift from small vessels to larger ones. Only SQ transit cargo can gain this benefit because cargo not utilizing the SQ canal is not affected by vessel size enlargement. Fig.II-1-1 illustrates cargo distribution by ship size. (A) shows the cargo distribution for the SQ canal, and (B) shows cargo distribution of SQ transit cargo after a new larger canal is opened. Area (a) is equal to area (b) because shifts in ship size occur within the volume of SQ transit cargo.

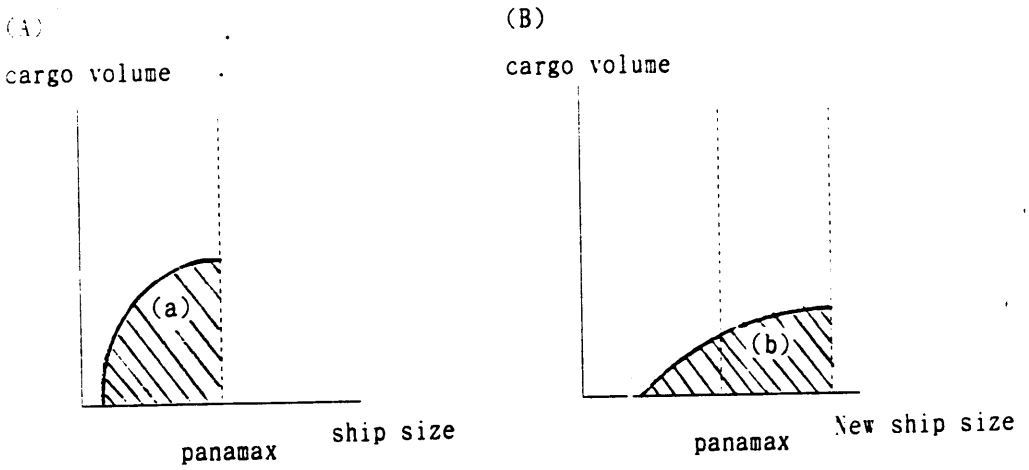


Fig.II-1-1 Cargo Distribution by Ship Size at the Panama Canal

The total transportation cost for cargo volume (a) in Fig.II-1-1(A) is larger than that for (b) in Fig.II-1-1(B). Otherwise, no shift can occur. The difference between these costs constitutes the benefit of size shifting. The basic formula for this benefit is expressed in the following equation :

$$B_s = TC_b - TC_a$$

B_s : benefit for size-shifting cargos ($)

TC_a : Total transportation cost for cargos utilizing the new canal which were SQ transit cargos before the new canal opened ($)

TC_b : Total transportation cost for SQ transit cargos

The benefit is calculated for each OD pair. The equation is described in detail in Annex II.

(4) Route-Shifting Benefits by Under-panamax Vessels

Transit cargo demand is increasing, and congestion becomes heavier as demand approaches the capacity of the SQ canal. Under this circumstance, some potential cargos use alternative routes because the waiting time for transit is longer and total transportation costs are more expensive. In general, transportation costs include the inventory cost of cargo and the cost of the vessel, which is a function of time period.

After a new canal opens, the capacity for transit cargo will increase and traffic will not be congested. Hence, some cargo will shift to the canal.

The CTP(II) study predicts that this shift would occur by the year 2060, but not in the year 2020. This benefit affects under-panamax vessels because only these vessels are affected by SQ canal capacity.

As for method of calculation, the concept is the same as that for route-shifting by over-panamax. Both benefits will be gained by vessels which shift from alternative route to the canal. The basic formula of this benefit is expressed by the following equation :

$$B_u = Q_u \times (C_a - C_p)$$

B_u : benefit for route-shifting cargos carried by under-panamax vessels ($)
Q_u : cargo volume carried by under-panamax vessels which shift routes to the new canal (tons)
C_a : unit transportation cost of the least expensive alternative route ($/ton)
C_p : unit transportation cost of the canal route ($/ton)

The benefit is calculated for each OD pair. The equation is described in detail in Annex II.

(5) CTP and Cost Saving

The CTP study provides transit cargo volumes for the SQ canal and alternative canals. Route-shifting cargos and size-shifting cargos are the source of benefits. These cargos are not projected separately in the CTP study. These shifts are reflected in the change of transit ship size distribution as scaled to cargo volume.

Future transits are forecasted for the year 2020 and 2060 by commodity, OD route, ship type, and ship size. Table II-1-2 and II-1-3 show a summary of forecasts for those categories. The findings relating to estimating benefit are summarized below.

(a) Total SQ cargo transits volume is forecasted to be 269,404 thousand tons in the year 2020 and 272,198 thousand tons in the year 2060. Such slight growth over these 40 years is due to the fact that transit volume will reach capacity soon after the year 2020.

(b) The 150,000 DWT alternative canal will attract 95,074 (= 364,478 - 269,404) thousand tons' more transit cargo than the SQ canal in the year 2020. The 200,000 DWT canal will also attract 97,394 (=366,798 - 269,404) thousand tons' more transit cargo than the SQ canal in the year 2020. The 250,000 DWT canal will affect 103,916 (373,320 - 269,404) thousand tons in new cargo volume. The 200,000 DWT and 250,000 DWT alternative canals will affect only slightly more new cargo volume than the 150,000 DWT canal.

(c) Vessels shift to alternative canals due to larger draft size or enlarged capacity with respect to the number of ships, if the new larger canals accommodate the vessels' design and favorable transportation economies are identified. In the year 2020, the shift will be due only to the larger draft size, and will be limited to three types of ships: Combined and Dry Bulk, Full Container, and Oil Tankers. Accordingly, cost savings will not occur in the case of other types of ship. In the year 2060, ship types other than the above three will shift also in size category under 65,000 dwt. A larger quantity of induced transits would take place in the case of the 150,000 DWT canal, and enlargement of the capacity of the alternative canals from 150,000 DWT to 200,000 DWT or 250,000 DWT would bring about a relatively small increase in transit volume compared with in the case of the 150,000 DWT canal.

(d) In the case of the 150,000 DWT canal, all route-shifting cargo tonnage in the year 2020 would be transported by CD (77,254 thousand tons, or 81.3%), FC (3,820 thousand tons, or 4.0%), and OT (14,000 thousand tons, or 14.7%). In the year 2060, all attracted cargo tonnage would be transported by CD (172,857 thousand tons, or 76.9%), FC (12,046 thousand tons, or 5.4%), OT (22,454 thousand tons, or 10.0%), CB (9,451 thousand tons, or 4.2%), CT (2,096 thousand tons, or 0.9%), CG (2,477 thousand tons, or 1.1%), LP (431 thousand tons, or 0.2%), RE (1,707 thousand tons, or 0.8%), RR (1,212 thousand tons, or 0.5%), and VC (12 thousand tons, or 0.0%). (see the list of abbreviation below)

In the cases of the 200,000 DWT and 250,000 DWT canals, the breakdown is almost the same as for the 150,000 DWT canal.

Abbreviations

CB : Container Breakbulk Ships
CD : Combined and Dry Bulk Carriers
CG : Conventional General Cargo Ships
CT : Chemical Tankers
FC : Full Container Ships
LP : Liquid Petroleum Gas Carriers
RE : Refrigerated Cargo Ships
RR : Roll-on Roll-off Ships
OT : Oil Tankers
VC : Vehicle Carriers

(e) The alternative canals lose some under-panamax vessels compared with the SQ canal in the year 2020. For example, cargo volume on 10,000–39,999 dwt vessels is 126,538 thousand tons for the SQ canal and 121,489 thousand tons for 150,000 DWT canal. This is explained by size-shift transit volume.

In the year 2060, this size-shift transition is not found in the summary data. However, there does not exist any reason to deny the size-shift transition. Route-shifting cargo volume due to enlarged capacity compensates for the loss of cargo by the size-shift transition in the under-panamax size. The size-shift transition appears clearer in the year 2020 than 2060 since no attracted cargo is transported by under-panamax size vessels.

The unit cost of transit cargo ($/ton) for the SQ canal is given in Volume II of CTP(II)FR (Cost Comparison of Using the Panama Canal and Alternative Routes). Ship size categories for unit cost are different from those for transit projections. In the EAIU Study, average unit costs were calculated to merge categories.

The unit costs of transit cargo carried by over–panamax vessels are listed in Volume I of CTP(II)FR. These costs are based on routes between cities/countries although the origins and the destinations are areas in EAIU Study. Hence, average unit costs were calculated to adjust for route category. The unit costs of each route were weighed with cargo volumes and averaged.

The EAIU Study assumed that unit costs are common for all canal sizes. For example, the unit cost for cargo from the U.S. West Coast to Africa by 40,000–64,999 dwt CD vessels is listed as 14$/ton for the SQ canal. This 14$/ton is applied to all canals which are able to handle 150,000 dwt, 200,000 dwt, and 250,000 dwt vessels.

Table II-1-2 Transit Cargo by Canal Alternatives, Ship Size, and Ship Type (Year=2020)

(1,000 tons)

		0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	TOTAL
C D	S Q	0	47,355	65,692	14,519				127,566
	150	0	43,684	57,973	24,678	78,485			204,820
	200	0	43,735	57,973	24,626	62,938	17,868		207,140
	250	0	43,735	57,973	24,626	62,938	17,404	6,986	213,662
F C	S Q	6	16,151	26,260					42,417
	150	6	14,738	17,707	13,786				46,237
	200	6	14,738	17,707	13,786				46,237
	250	6	14,738	17,707	13,786				46,237
O T	S Q	392	6,755	13,537	1,299				21,983
	150	392	6,790	8,354	6,447	14,000			35,983
	200	392	6,790	8,354	6,447		14,000		35,983
	250	392	6,790	8,354	6,447			14,000	35,983
C B	S Q	0	16,389	9,164					25,553
	150	0	16,389	9,164					25,553
	200	0	16,389	9,164					25,553
	250	0	16,389	9,164					25,553
C T	S Q	1,580	18,927	3,776					24,283
	150	1,580	18,927	3,776					24,283
	200	1,580	18,927	3,776					24,283
	250	1,580	18,927	3,776					24,283
C G	S Q	838	7,858						8,696
	150	838	7,858						8,696
	200	838	7,858						8,696
	250	838	7,858						8,696
L P	S Q	177	1,970	449					2,596
	150	177	1,970	449					2,596
	200	177	1,970	449					2,596
	250	177	1,970	449					2,596
R E	S Q	4,072	7,237						11,309
	150	4,072	7,237						11,309
	200	4,072	7,237						11,309
	250	4,072	7,237						11,309
R R	S Q	213	1,482	802					2,497
	150	213	1,482	802					2,497
	200	213	1,482	802					2,497
	250	213	1,482	802					2,497
V C	S Q	90	2,414						2,504
	150	90	2,414						2,504
	200	90	2,414						2,504
	250	90	2,414						2,504
TOTAL	S Q	7,368	126,538	119,680	15,818	0	0	0	269,404
	150	7,368	121,489	98,225	44,911	92,485	0	0	364,478
	200	7,368	121,540	98,225	44,859	62,938	31,868	0	366,798
	250	7,368	121,540	98,225	44,859	62,938	17,404	20,986	373,320

Table II-1-3 Transit Cargo by Canal Alternatives, Ship Size, and Ship Type (Year=2060)

(1,000 tons)

		0 ~ 9.999	10.000 ~ 39.999	40.000 ~ 64.999	65.000 ~ 99.999	100.000 ~ 149.999	150.000 ~ 199.999	200.000 ~ 250.000	TOTAL
C D	S Q	0	26.070	56.387	32.732				115.189
	150	0	59.527	76.178	65.315	87.026			288.046
	200	0	59.527	76.178	65.315		91.105		292.125
	250	0	59.527	76.178	65.315		88.973	15.933	305.926
F C	S Q		15.381	31.439					46.820
	150		19.168	18.660	12.962	8.076			58.866
	200		19.168	18.660	12.962	8.076			58.866
	250		19.168	18.660	12.962	8.076			58.866
O T	S Q	244	2.719	2.325	728				6.016
	150	372	5.081	5.973	3.044	14.000			28.470
	200	372	5.081	5.973	3.044		14.000		28.470
	250	372	5.081	5.973	3.044			14.000	28.470
C B	S Q	0	23.019	11.635					34.654
	150	0	28.944	15.161					44.105
	200	0	28.944	15.161					44.105
	250	0	28.944	15.161					44.105
C T	S Q	1.455	24.079	7.381					32.915
	150	1.648	25.624	7.739					35.011
	200	1.648	25.624	7.739					35.011
	250	1.648	25.624	7.739					35.011
C G	S Q	1.326	12.183						13.509
	150	1.705	14.281						15.986
	200	1.705	14.281						15.986
	250	1.705	14.281						15.986
L P	S Q	150	656	265					1.071
	150	150	1.087	265					1.502
	200	150	1.087	265					1.502
	250	150	1.087	265					1.502
R E	S Q	2.385	13.721						16.106
	150	2.894	14.919						17.813
	200	2.894	14.919						17.813
	250	2.894	14.919						17.813
R R	S Q	407	1.666	925					2.998
	150	414	2.516	1.280					4.210
	200	414	2.516	1.280					4.210
	250	414	2.516	1.280					4.210
V C	S Q	104	2.816						2.920
	150	104	2.828						2.932
	200	104	2.828						2.932
	250	104	2.828						2.932
TOTAL	S Q	6.071	122.310	110.357	33.460	0	0	0	272.198
	150	7.287	173.975	125.256	81.321	109.102	0	0	496.941
	200	7.287	173.975	125.256	81.321	8.076	105.105	0	501.020
	250	7.287	173.975	125.256	81.321	8.076	88.973	29.933	514.821

Note 1: The cargo volumes in Table II-1-2 and II-1-3 were calculated by summing up the cargo volumes listed in CTP(II) Final Report (FR).

II.2 Benefits in the Year 2020

(1) Transit Cargo

Table II-2-1 shows that 364,478 thousand tons of cargo will pass through a new canal in the year 2020 if its size is sufficient to handle 150,000 dwt vessels. If the size of the canal were 200,000 DWT or 250,000 DWT, the transit volumes would be 366,798 thousand tons or 373,720 thousand tons respectively. If the canal size remained unchanged, i.e. in case of the SQ, only 269,404 thousand tons could pass through. This increase in total cargo volume comprises the transit cargo carried by route-shifting vessels due to canal enlargement.

Another shift can be seen in the ship size distribution for canal cargo. Some cargos which use small vessels in the case of the SQ canal will change to larger carriers.

Table II-2-1 shows the result of the combination of these two types of cargos. It is necessary to identify the cargo volume of each type by route and ship type and size.

Table II-2-1 Total Cargo Volume in the Year 2020

(1,000tons)

Ship size / Canal size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	7,368	126,538	119,680	15,818	0	0	0	269,404
150,000DWT	7,368	121,489	98,225	44,911	92,485	0	0	364,478
200,000DWT	7,368	121,540	98,225	44,859	62,938	31,868	0	366,798
250,000DWT	7,368	121,540	98,225	44,859	62,938	17,404	20,986	373,320

(calculated from Table II-1-2)

The cargo increase for each ship type can be calculated from Table II-1-2. This shows that CD, FC and OT cargos will increase in a larger canal while other cargos will remain unchanged even if the canal size become larger. This means that no cost savings will be gained for any but CD, FC and OT cargos. The benefits of a new canal (150,000 DWT, 200,000 DWT or 250,000 DWT) will affect only CD, FC and OT cargos.

In the following sections, the benefits for each ship type are discussed.

(2) Benefits for Combined and Dry Bulk Carriers (CD)in the Year 2020

Table II-2-2 shows the differences in transit cargo volume for Combined and Dry Bulk Carriers by ship size and canal size. For example, there will be an increase of 77,254 thousand tons if a 150,000 DWT canal is constructed. This volume is the net increase in transit cargo, i.e. the amount of cargo that will shift from alternative routes to the canal.

Another beneficial effect will be economies of scale for cargo, in case of a 150,000 DWT canal, there will be a decrease of 3,671 thousand tons in volume of cargo carried by 10,000–39,999 dwt vessels and 7,719 thousand tons in that carried by 40,000–64,999 dwt vessels. There will be a total decrease of 11,390 thousand tons in cargo volume carried by under-panamax vessels. This decrease will be caused by shifting to over-panamax vessels. It is concluded that 11,390 thousand tons of cargo will benefit from a larger scale of operation.

Table II-2-2 Transit Cargo by Ship and Canal Size in the Year 2020 (ship type: CD)

(1,000tons)

Case \ Ship size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ		47,355	65,692	14,519				127,566
150		43,684	57,973	24,678	78,485			204,820
150-SQ		-3,671	-7,719	10,159	78,485			77,254
200		43,735	57,973	24,626	62,938	17,868		207,140
200-SQ		-3,620	-7,719	10,107	62,938	17,868		79,574
250		43,735	57,973	24,626	62,938	17,404	6,986	213,662
250-SQ		-3,620	-7,719	10,107	62,938	17,404	6,986	86,096

(calculated from Table II-1-2)

Fig.II-2-1 shows the results of analysis of the case of a 150,000 DWT canal. 116,176 thousand tons out of the SQ cargo (127,566 thousand tons) will not change ship size category nor route even after the canal is enlarged. These cargos will not produce benefits because there are no cost savings.

The volumes of cargo that will benefit are 11,390 thousand tons and 77,254 thousand tons. The former will shift from alternative routes to the canal route, the unit transportation costs of which will decrease due to the shorter sailing distance of the canal route. The latter will shift to larger vessels, the unit transportation costs for which will decrease through economies of scale resulting from use of the larger vessels which can be accommodated by a larger canal channel.

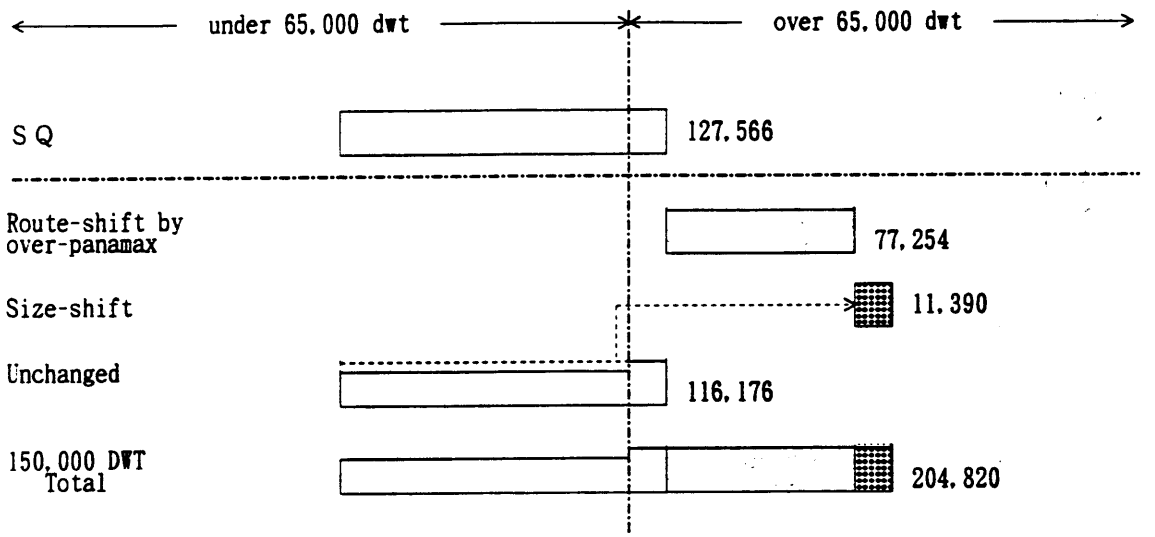


Fig.II-2-1 Cargo Shift between SQ and 150,000 DWT in the Year 2020
(ship type : CD)

(1,000ton)

Note : Over-panamax (over-65,000 dwt) vessels pass through even the SQ canal. However, this fact does not affect the calculation of benefits.

Fig.II-2-1 is derived from Table II-2-2. Cargo distribution by ship size needed to be analyzed in detail for each OD route. After analysis of cargo distribution, the cargo volume that will shift from alternative routes to the canal and from small vessels to larger vessels were identified for each OD. A detailed explanation is given in Annex II of this report.

After evaluation of cargo volumes by type of shift between the SQ canal and each new canal, the cost savings were calculated for each OD route. These savings are equal to the benefits of a new canal.

Table II-2-3 summarizes the benefits for CD vessels in the year 2020. Route-shifting is limited to over-panamax vessels because under-panamax vessels can use the canal. If a cargo uses SQ canal, it will also use a new canal. If a cargo does not use the SQ canal, it will not use a new canal even after the enlargement of the canal. Canal size will not affect the choice of routes for under-panamax vessels.

11,399 thousand tons will shift to larger ships in the case of 150,000 DWT canal and produce US$34,927,000. The size-shifting cargo volume in Table II-2-3 is 11,399 thousand tons, which is different from the 11,390 thousand tons in Fig.II-2-1. Fig.II-2-1 is calculated from Table II-2-2 which is the total of cargo volume, while Table II-2-3 is a summation of each size-shift cargo as analyzed by OD route. The cause of the difference is the size-shifting of cargos from large vessels to smaller ones. These cargos will not produce and benefit. Their volume is small. Size-shifting cargos will be 11,348 thousand tons in the case of 200,000 DWT canal, producing a greater benefit, US$35,187,000. The reason is that cargo will shift to larger ships in the case of a 200,000 DWT canal than in that of a 150,000 DWT canal. The cost savings, i.e. benefit, for a 200,000 DWT canal will be larger than those for a 150,000 DWT canal.

Table II-2-3 Benefits of the New Canals in the Year 2020 (ship type: CD)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	195,275 (000US$) (77,254 (000tons))	34,927 (11,399)	0 (0)	230,202 (88,653)
200,000DWT	211,465 (79,576)	35,187 (11,348)	0 (0)	246,652 (90,924)
250,000DWT	218,451 (86,098)	35,187 (11,348)	0 (0)	253,638 (97,446)

The benefits of each OD route are shown in Annex III.

(3) Benefits for Full Container Ships (FC) in the Year 2020

Table II-2-4 shows the differences in transit cargo volume carried by Full Container Ships by ship size and canal size. The amount of cargo that will shift from alternative routes to the canal is 3,820 thousand tons. This cargo will be carried by 65,000–99,999 dwt vessels.

There will be no cargo carried by ships in this size category in the SQ canal. Hence the cargos listed in this ship size category come from alternative routes or smaller vessels. The difference between the cargos in this category (13,786 thousand tons) and new cargos (3,830 thousand tons) is accounted for by shifted cargos from under-panamax vessels. The volume of such cargos is 9,966 thousand tons (= 13,786 – 3,820) and is equal to the sum of 1,413 thousand and 8,553 thousand, which are the differences in volume of 10,000–39,999 dwt and 40,000–64,999 dwt, respectively.

Table II-2-4 Transit Cargo by Ship and Canal Size in the Year 2020 (ship type: FC)

(1,000tons)

Case \ Ship size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	6	16,151	26,260	0				42,417
150	6	14,738	17,707	13,786				46,237
150-SQ	0	-1,413	-8,553	13,786				3,820
200	6	14,738	17,707	13,786				46,237
200-SQ	0	-1,413	-8,553	13,786				3,820
250	6	14,738	17,707	13,786				46,237
250-SQ	0	-1,413	-8,553	13,786				3,820

(calculated from Table II-1-2)

Cargo distribution was analyzed in detail for each OD. The unit cost savings for FC ship are relatively larger than for other ship types. For example, the unit cost for 32,700 dwt vessels is 289.67 US$/ton and that for 90,000 dwt vessels is 266.16 US$/ton for the Asia-U.S. East Coast route (source : page 5-45 of Vol. 1 of CTP(II)FR). Hence, if a ton of cargo shifts from a 32,700 dwt to a 90,000 dwt carrying vessel, the benefit for the cargo will be US$23.51.

The routes which produce benefits for FC cargo are only four OD pairs. However, because of large unit cost savings, the benefit for FC cargos is relatively large in proportion to tonnage and number of routes.

Table II-2-5 shows the total benefits for FC of each alternative canal. Because cargo distributions for 150,000 DWT, 200,000 DWT and 250,000 DWT canals are equal, they have the same benefits.

Table II-2-5 Benefits of the New Canals in the Year 2020 (ship type: FC)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	16,919 (000US$) (3,820 (000tons))	215,933 (10,054)	0 (0)	232,852 (13,874)
200,000DWT	16,919 (3,820)	215,933 (10,054)	0 (0)	232,852 (13,874)
250,000DWT	16,919 (3,820)	215,933 (10,054)	0 (0)	232,852 (13,874)

Note 1 : The unit cost on the canal route from Asia to the U.S. East Coast is more expensive than the least expensive alternative (see Page 5-45 of Vol. 1 of CTP(II)). However, according to the commodity projection, 1,400 thousand tons will shift from alternative routes. The reason for this shift will not be the cost savings. The benefit for route-shift cargo in this route was estimated as zero in the EAIU Study. Accordingly, only size-shift cargos are beneficiary cargos in this route.
This idea was also applied to the Asia-U.S. East Coast route, where 1,500 thousand tons will shift without cost savings.

Note 2 : The size-shift cargo volume in Table II-2-5 is different from that given on the previous page (9,666 thousand tons). The reason for the difference is size-shift cargo to smaller vessels (87 thousand tons in the U.S. East Coast to Europe).

(4) Benefits for Oil Tankers (OT) in the Year 2020

The increase in volume of oil via the new canals is 14,000 thousand tons as shown in Table II-2-6. This cargo will come from the East Coast of South America to Asia. If a new canal is not constructed, this cargo will have to use an alternative route. There is no other cargo with route-shifting, while some cargos will shift their vessels to larger vessels for economy-of-scale reasons.

There is an increase of 35 thousand tons in cargo for 10,000–39,999 dwt vessels for the new canals as compared to the SQ canal. This increase is interpreted as part of a shift from the 40,000–64,999 dwt category since the increase in the 10,000–39,999 dwt category (35) and 65,000–99,999 dwt category (5,148) equals the decrease in the 40,000–64,999 dwt category (5,183). The increased cargos in the 65,000–99,999 dwt category receive the size-shifting benefits. The increased cargo in the 10,000–39,999 dwt category, however, is ignored in calculating of benefits because this shift cannot be explained by cost savings. The amount of this shift is very small.

Table II-2-6 Transit Cargo by Ship and Canal Size in the Year 2020 (ship type: OT)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	392	6,755	13,537	1,299				21,983
150	392	6,790	8,354	6,447	14,000			35,983
150-SQ	0	35	-5,183	5,148	14,000			14,000
200	392	6,790	8,354	6,447		14,000		35,983
200-SQ	0	35	-5,183	5,148		14,000		14,000
250	392	6,790	8,354	6,447			14,000	35,983
250-SQ	0	35	-5,183	5,148			14,000	14,000

(calculated from Table II-1-2)

The amount of the increased cargos does not change by the alternative canals (14,000 thousand tons), and the same amount of cargos is transported by vessels with the largest category of sizes which the alternatives can accommodate. The transition of the vessel size by alternative canals implies that those cargos will shift to the Panama route and that vessel

size will be changed at the same time. The benefits due to the route-shift depends which size of vessel would be used to detour the SQ canal.

The CTP Study shows the ship size distribution of oil tankers in the past and future (see Table 3.20 and 3.2 in CTP Study Final Report, volume 1, pages 3-49 to 3-51). The ratio of larger vessels is higher. The 250,000 to 299,000 dwt range is the highest. It also shows that the transportation cost of the Panama route is more economical than the alternative route even if the vessel size is smaller (see Table 5.14 in CTP Study Final Report, volume 1, page 5-44).

The following assumption was made based on the CTP study regarding the ship size distribution of tankers and the cost comparison:

a) If alternative canals are not constructed, the 14,000 thousand tons of cargos will have to sail on an alternative route with 250,000-29,000 dwt vessels.
b) If alternative canals are constructed, these cargos will shift to the canal with down-sized but the largest vessels to be accommodated by the canals.

Hence the route-shifting benefits of alternative canals are not purely those of a shift in routes. They are reduced by the cost increase due to the down-sizing. Table II-2-7 summarizes the benefits for OT cargos.

Table II-2-7 Benefits of the New Canals in the Year 2020 (ship type: OT)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	4,900 (000US$) (14,000 (000tons))	4,851 (5,183)	0 (0)	9,751 (19,183)
200,000DWT	11,900 (14,000)	4,851 (5,183)	0 (0)	16,751 (19,183)
250,000DWT	24,220 (14,000)	4,851 (5,183)	0 (0)	29,071 (19,183)

Note 1 : The benefit of 14,000 thousand tons is classified as a route-shift benefit, although it includes the benefit by economy of scale.

Note 2 : Size-shift volume includes shifting cargos to smaller vessels.

(5) Summary of Benefits in the Year 2020

Table II-2-8 are summarizes the benefits in the Year 2020. Only CD, FC and OT will produce benefits.

The benefits by route-shifting account for about half of the total benefits and the rest comprises size-shifting in the case of a 150,000 DWT canal. However, the ratio of these two kinds of benefits are different for ship type. As for CD and OT, the route-shifting benefit accounts for more than 80 percent, while size-shifting is more than 90 percent in the case of FC vessels.

This trend is true for other canal sizes (200,000 DWT, 250,000 DWT). If a larger canal is constructed, the route-shifting benefit becomes more significant. As seen in the case of CD and OT.

Table II-2-8 Summary of Benefits in the Year 2020

(1,000 US $)

Type	Benefit / Alternatives	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total	(%)
CB	150.000DWT	0	0	0	0	0.0%
	200.000DWT	0	0	0	0	0.0%
	250.000DWT	0	0	0	0	0.0%
CD	150.000DWT	195.275	34.927	0	230.202	48.7%
	200.000DWT	211.465	35.187	0	246.652	49.7%
	250.000DWT	218.451	35.187	0	253.638	49.2%
CT	150.000DWT	0	0	0	0	0.0%
	200.000DWT	0	0	0	0	0.0%
	250.000DWT	0	0	0	0	0.0%
FC	150.000DWT	16.919	215.933	0	232.852	49.2%
	200,000DWT	16,919	215,933	0	232,852	46.9%
	250.000DWT	16.919	215.933	0	232.852	45.2%
CG	150.000DWT	0	0	0	0	0.0%
	200.000DWT	0	0	0	0	0.0%
	250.000DWT	0	0	0	0	0.0%
LP	150.000DWT	0	0	0	0	0.0%
	200,000DWT	0	0	0	0	0.0%
	250.000DWT	0	0	0	0	0.0%
RE	150.000DWT	0	0	0	0	0.0%
	200.000DWT	0	0	0	0	0.0%
	250,000DWT	0	0	0	0	0.0%
RR	150.000DWT	0	0	0	0	0.0%
	200,000DWT	0	0	0	0	0.0%
	250,000DWT	0	0	0	0	0.0%
OT	150,000DWT	4.900	4.851	0	9,751	2.1%
	200.000DWT	11.900	4.851	0	16.751	3.4%
	250,000DWT	24.220	4.851	0	29.071	5.6%
VC	150.000DWT	0	0	0	0	0.0%
	200,000DWT	0	0	0	0	0.0%
	250,000DWT	0	0	0	0	0.0%
Total	150.000DWT	217.094	255,711	0	472,805	100.0%
	200.000DWT	240.284	255.971	0	496,255	100.0%
	250.000DWT	259.590	255.971	0	515.561	100.0%

Fig.II-2-2(a)-(c) illustrate the total benefits by type of beneficiary cargo.

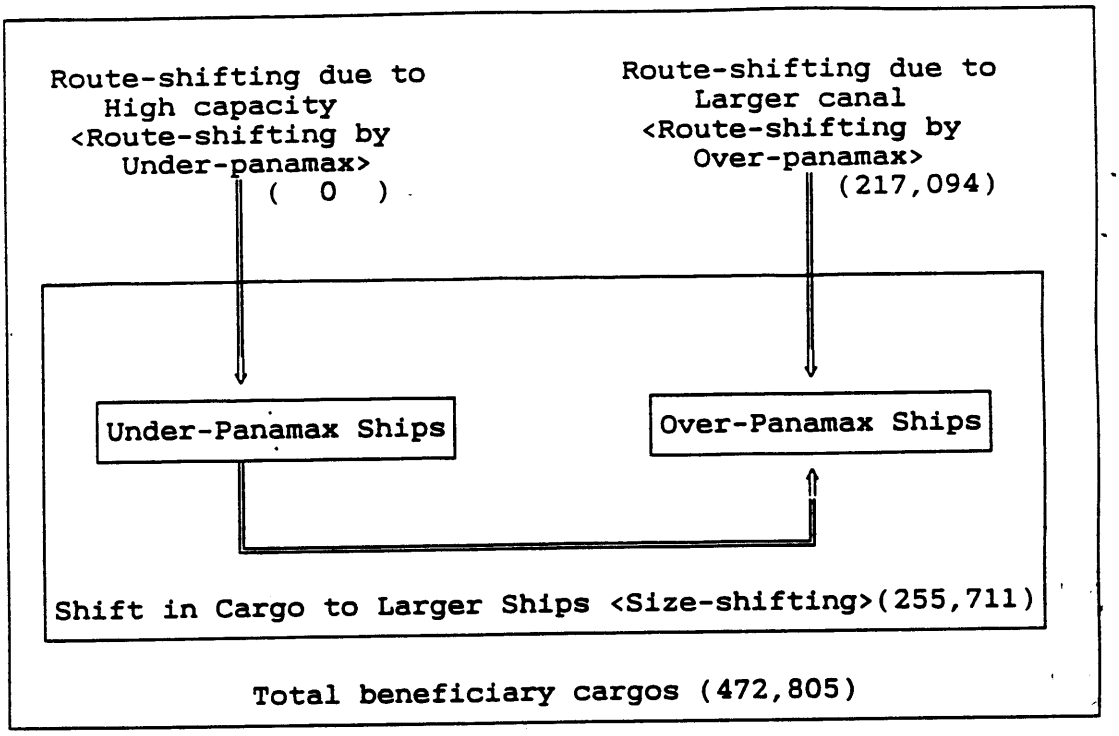


Fig.II-2-2(a) Benefits in the Year 2020 for a 150,000 DWT Canal (1,000 US$)

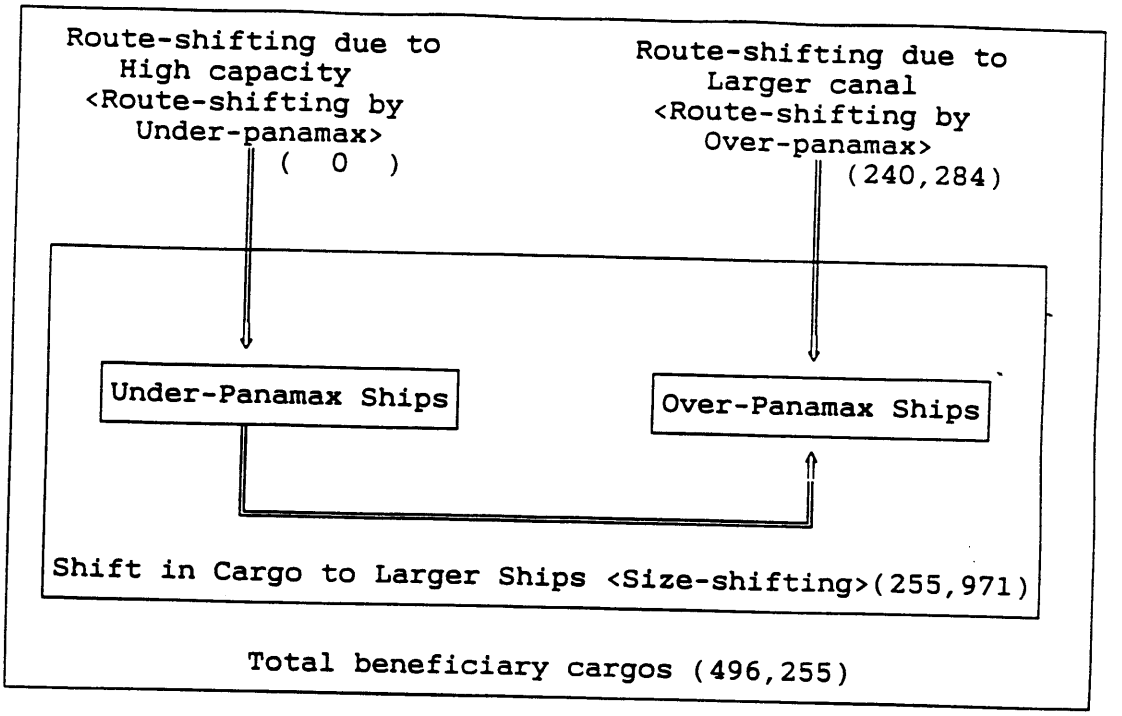


Fig.II-2-2(b) Benefits in the Year 2020 for a 200,000 DWT Canal (1,000 US$)

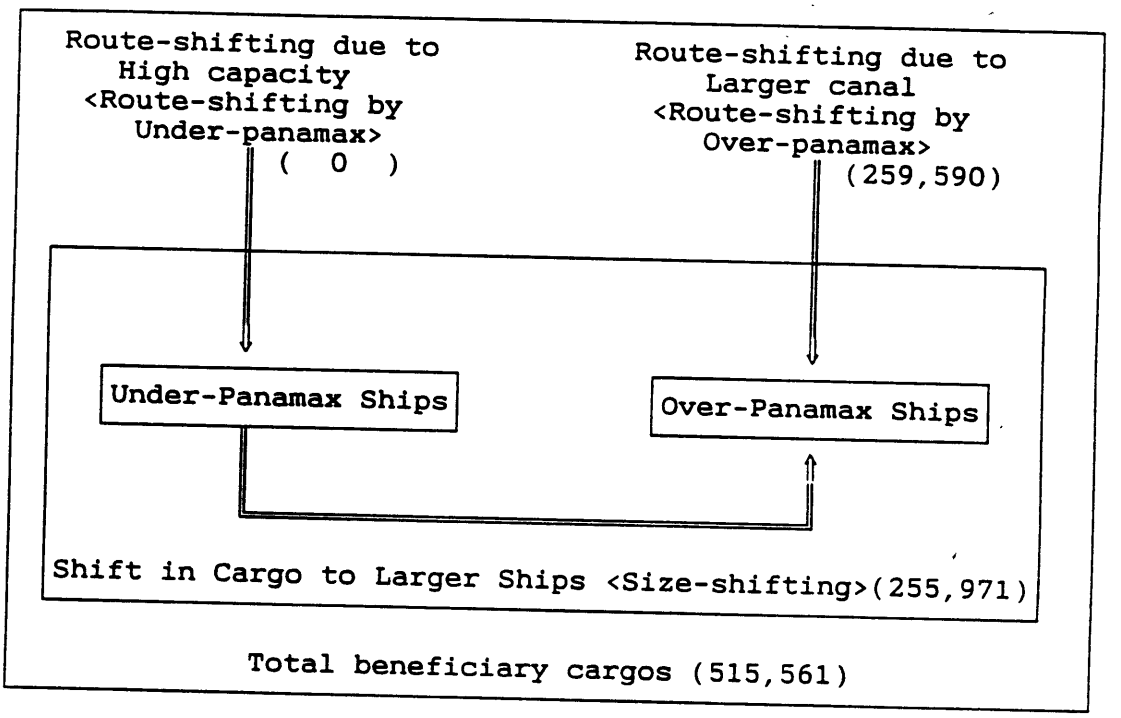


Fig.II-2-2(c) Benefits in the Year 2020 for a 250,000 DWT Canal (1,000 US$)

II.3 Benefits in the Year 2060

(1) Transit Cargo

Fig.II-3-1 shows the time series for transit cargo volume. The lines are connected between the year 1990 and 2020 and between the year 2020 and 2060. The horizontal line for the SQ canal between the year 2020 and 2060 implies that it will reach capacity soon after the year 2020. As mentioned in CTP(II)FR (page 5-48 of Vol. 1), the original CTP projections had the SQ canal exceeding capacity in the year 2060. CTP(II) considered the capacity and the output of CTP(II)FR is the constrained forecast for the SQ canal in the year 2060.

If the capacity of the SQ canal remains unchanged in the year 2060, some vessels will have to refrain from using the canal because of capacity constraints. Their size will be under-panamax. This shifting to alternative routes will occur in any year when the larger canal is in operation after the saturation of SQ.

If a larger canal is available, vessels will be able to pass through it without capacity constraints.

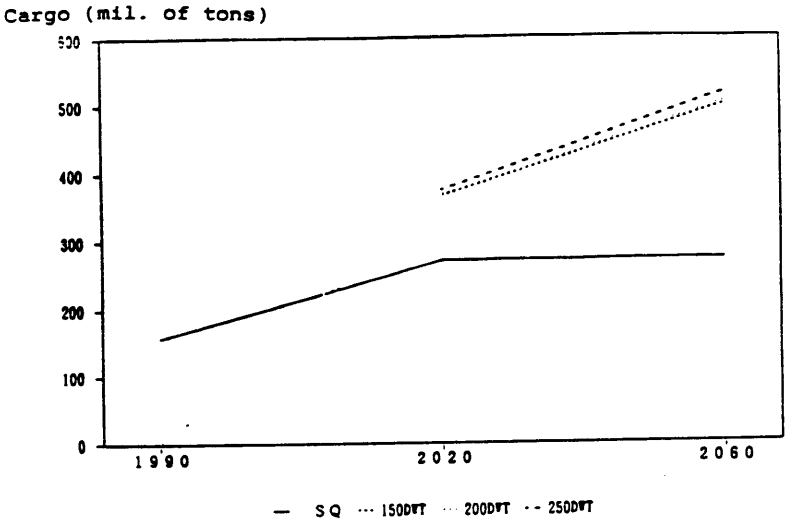


Fig.II-3-1 Transit Cargo from the Year 1990 to 2060
(derived from CTP(II) and Table II-1-2,II-1-3)

Table II-3-1 gives the total of transit cargo volumes in the year 2060 by ship size. This table shows the increase in cargo carried by under-panamax vessels. For example, there will be an increase of 51,655 (= 173,975 - 122,310) thousand tons in case carried by 10,000-39,000 dwt vessels if a new canal comes into operation. Similar increases will occur for all ship size categories. These increases will be caused by freedom from the constraint of canal congestion.

In addition to under-panamax vessels which will shift to a new canal, over-panamax vessels which cannot use the SQ canal will also use the new canal. Both types of vessel will shift from alternative routes to the canal, but they are distinguished from each other in this EAIU Study because the reason for the shifts are different.

Table II-3-1 Total Cargo Volume in the Year 2060

(1,000tons)

Ship size / Canal size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	6,071	122,310	110,357	33,460	0	0	0	272,198
150,000DWT	7,287	173,975	125,256	81,321	109,102	0	0	496,941
200,000DWT	7,287	173,975	125,256	81,321	8,076	105,105	0	501,020
250,000DWT	7,287	173,975	125,256	81,321	8,076	88,973	29,933	514,821

(calculated from Table II-1-3)

Along with route-shifting, size-shifting was considered. As found in the analysis of cargo distribution in the year 2020, there will be size-shifting due to economies of scale. The benefit was calculated by comparing cargo distribution between the SQ new canals.

Because benefits are calculated on the With/Without principle, the size-shifting benefit has to be included in the benefit in the year 2060 although the shifting will have been completed by the year 2060.

The cargo volumes which would produce size-shifting benefits were evaluated based on the volume of size-shifting in the year 2020. This evaluation was done by ship type and route. The basic idea of the evaluation is that cargos should be treated as size-shifting cargos in the year 2060 if the same cargos shift to larger carriers in the year 2020.

(2) Benefits for Combined and Dry Bulk Carriers (CD) in the Year 2060

Table II-3-2 shows the difference in transit cargo volume for CD vessels by ship and canal size. There will be an increase of 172,857 thousand tons if a 150,000 DWT canal is constructed. This is a net increase, i.e. the amount of cargo that will shift from alternative routes to the new canal. Some of this volume will be carried by under-panamax vessels which will shift routes due to higher canal capacity, while the rest will be accounted for by over-panamax vessels which will shift routes due to the larger canal size.

Table II-3-2 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type: CD)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ		26,070	56,387	32,732				115,189
150		59,527	76,178	65,315	87,026			288,046
150-SQ		33,457	19,791	32,583	87,026	0	0	172,857
200		59,527	76,178	65,315	0	91,105	0	292,125
200-SQ		33,457	19,791	32,583	0	91,105	0	176,936
250		26,070	56,387	32,732	0	0	0	115,189
250-SQ		33,457	19,791	32,583	0	88,973	15,933	190,737

(calculated from Table II-1-3)

Fig.II-2-1 showed the cargo shifting in the year 2020 for a 150,000 DWT canal. There were 11,390 thousand tons of size-shifting cargos (this value was calculated from Table II-2-2). The result of a detailed analysis size-shifting cargo was 11,399 thousand tons.

These cargos are also counted as size-shifting cargos in the year 2060. Detailed analysis of cargo distribution by route was necessary because some routes used in 2020 will not be used in the year 2060. After the analysis, the size-shifting volume in the year 2060 was calculated at as much as 10,609 thousand tons. The detailed methods are described in Annex II.

Fig.II-3-2 shows summarizes cargo shifting. Route-shifting cargo will be 172,857 thousand tons. 63,856 thousand tons out of that volume will be produced by under-panamax vessels and the rest, 109,001 thousand tons, will be carried by over-panamax vessels.

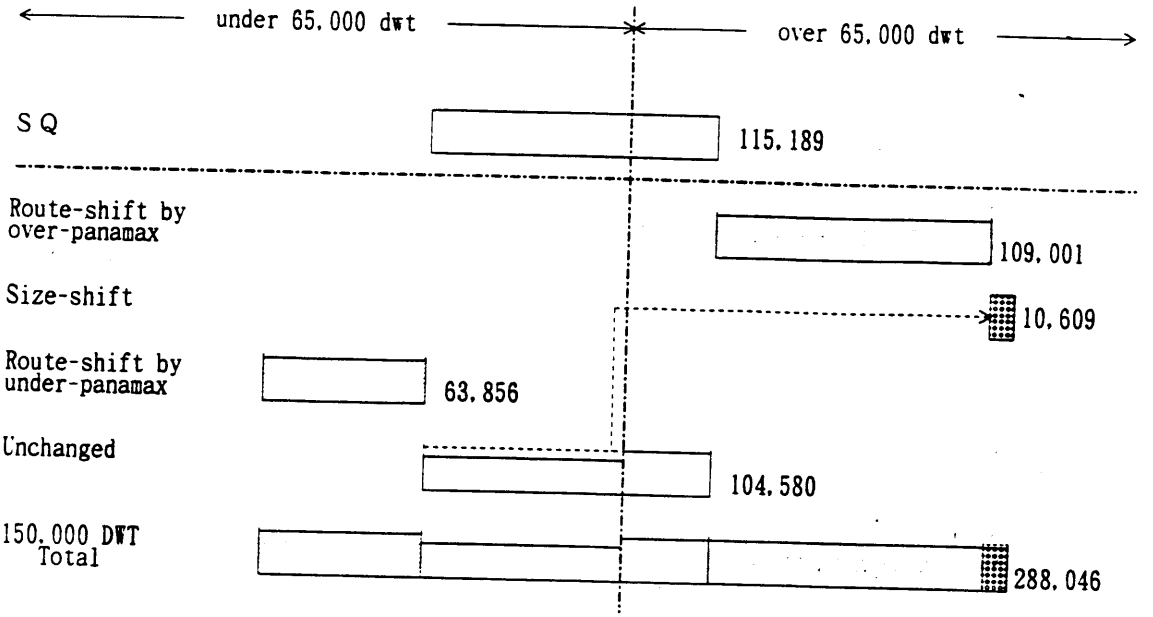


Fig.II-3-2 Cargo Shift between SQ and 150,000 DWT in the Year 2060 (ship type : CD)

(1,000 tons)

The benefits were calculated for each type of cargo by route for all canal sizes. The results by route and canal size are listed in Annex III. Table II-3-3 gives a summary of benefits.

Table II-3-3 Benefits of the New Canals in the Year 2060 (ship type: CD)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	412,499 (000US$) (109,001 (000tons))	20,898 (10,609)	260,128 (63,856)	693,525 (183,466)
200,000DWT	429,536 (113,080)	22,050 (10,609)	260,128 (63,856)	711,714 (187,545)
250,000DWT	443,523 (124,935)	22,050 (10,609)	260,128 (63,856)	725,701 (199,400)

More than half the benefits come from cargo on over-panamax vessels using the new canals. The contribution to total benefits of size shift cargo is only about 3 percent.

(3) Benefits for Full Container Ships (FC)in the Year 2060

Table II-3-4 shows the changes in transit cargo volume for Full Container ships. The changes in cargo volume are equal for all canal sizes. This means that the benefits produced by new canals are equal for all canal sizes. The net increase, 12,546 thousand tons, consists of shifted cargo from alternative route to the canal carried by under-panamax vessels and over-panamax vessels.

The difference in cargos carried by 40,000–64,999 dwt vessels is negative. The reason is that the amount of cargos shifting to larger ships from 40,000–64,999 dwt vessels is larger than the cargos shifted to the canal by vessels of this size.

Table II-3-4 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type: FC)

(1,000tons)

Case \ Ship size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	0	15,381	31,439	0	0			46,820
150	0	19,668	18,660	12,962	8,076			59,366
150-SQ	0	4,287	-12,779	12,962	8,076			12,546
200	0	19,668	18,660	12,962	8,076			59,366
200-SQ	0	4,287	-12,779	12,962	8,076			12,546
250	0	19,668	18,660	12,962	8,076			59,366
250-SQ	0	4,287	-12,779	12,962	8,076			12,546

(calculated from Table II-1-3)

Fig.II-3-3 gives a summary of cargo shifting in the case of a 150,000 DWT canal. Detailed analysis of cargo distribution by route was necessary to derive these values. The methods are described in Annex III.

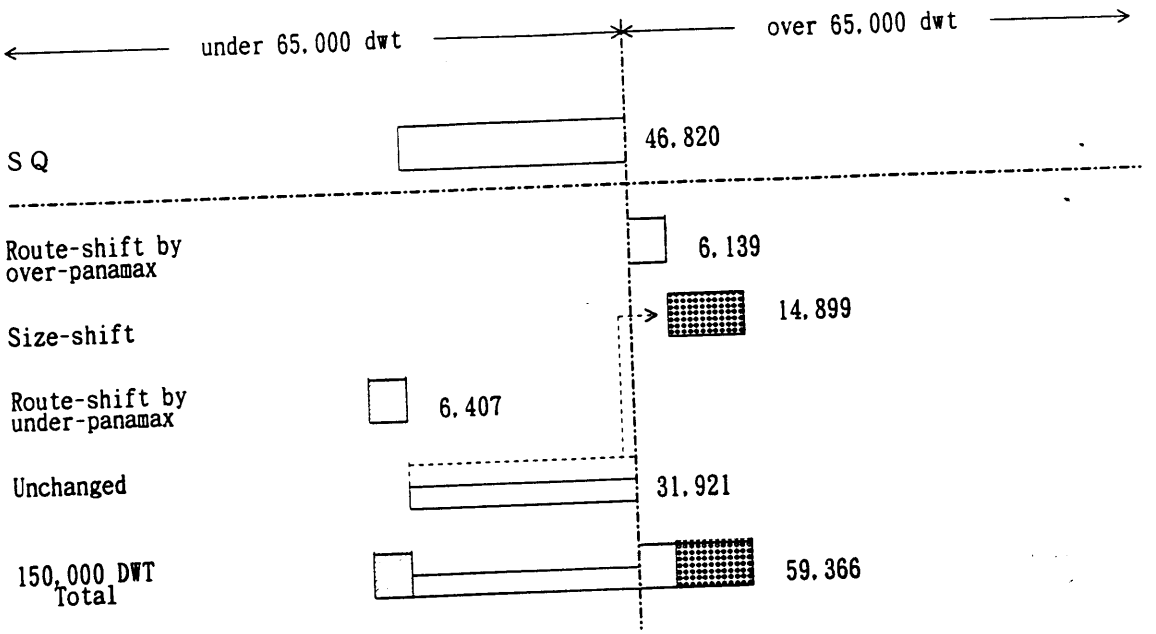


Fig.II-3-3 Cargo Shift Between SQ and 150,000 DWT in the Year 2060 (ship type : FC)
(1,000 tons)

Cargo shift between SQ and 200,000 DWT canal and between SQ and 250,000 DWT canal were also calculated. Then, the benefits were calculated for each route and each cargo type (route-shifting by over-panamax, route-shifting by under-panamax, size-shifting). The calculation method was based on algorythum shown in Annex II. The results of benefit calculation by route are listed in Annex III. Table II-3-5 summarizes the benefits. 91 percent of total benefits will come from size-shifting, while size-shifting cargo volume is nearly equal to the sum of route-shifting cargo volume.

Table II-3-5 Benefits of the New Canals in the Year 2060 (ship type: FC)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	23,053 (000US$) (6,139 (000tons))	270,497 (14,899)	3,622 (6,407)	297,172 (27,445)
200,000DWT	23,053 (6,139)	270,497 (14,899)	3,622 (6,407)	297,172 (27,445)
250,000DWT	23,053 (6,139)	270,497 (14,899)	3,622 (6,406)	297,172 (27,445)

Note 1 : The unit cost on the canal route from Asia to the U.S. East Coast is more expensive than the least expensive alternative for all ship size categories (see page 5-45 of Vol. 1 of CTP(II)). This cost structure was found in the analysis for the year 2020. According to the commodity projection, cargos will shift to the canal in spite of higher costs. The reason for this shift will not be the cost savings. The benefit for these route-shift cargos was estimated as zero in the EAIU Study. This idea was also applied to cargos from Asia to the U.S. East Coast.

(4) Benefits for Oil Tankers (OT) in the Year 2060

Table II-3-6 shows the differences in transit cargo for Oil Tankers by ship size and canal size.

Total net increases are the same for all canal sizes, but the vessel size distribution is different. Similar difference can be seen in the year 2020. This change will occur due to over-panamax vessels shifting to the new canal.

Table II-3-6 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type: OT)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	244	2,719	2,325	728	0	0	0	6,016
150	372	5,081	5,973	3,044	14,000	0	0	28,470
150-SQ	128	2,362	3,648	2,316	14,000	0	0	22,454
200	372	5,081	5,973	3,044	0	14,000	0	28,470
200-SQ	128	2,362	3,648	2,316	0	14,000	0	22,454
250	372	5,081	5,973	3,044	0	0	14,000	28,470
250-SQ	128	2,362	3,648	2,316	0	0	14,000	22,454

(calculated from Table II-1-3)

The cargo volumes shifted to the canal and size-shifting volumes were evaluated in the same way as for CD and FC cargos.

Table II-3-7 summarizes the benefits for OT vessels. Cargo shifting to larger vessels for reasons of economies of scale will be as much as 59 thousand tons, and consists of cargo being transported from the East to the West Coast of Central America. This cargo will shift from 40,000-64,999 dwt to 65,000-99,999 dwt vessels. The cost difference between these two vessel categories by canal route is small. Hence benefits for this cargo will be less than a thousand US dollars. This is shown as zero in Table II-3-7.

Almost all benefits for OT will come from route-shifting. Detailed benefit distribution by route is listed in Annex III.

Table II-3-7 Benefits of the New Canals in the Year 2060 (ship type: OT)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	9,854 (000US$) (16,257 (000tons))	0 (59)	26,203 (6,197)	36,057 (22,513)
200,000DWT	18,675 (16,257)	0 (59)	26,203 (6,197)	44,878 (22,513)
250,000DWT	32,394 (16,257)	0 (59)	26,203 (6,197)	58,597 (22,513)

Note : As mentioned under the year 2020, over-panamax vessels will shift from alternative route to the canal as well as undergo size-shifting if a larger canal is constructed. In this sense, the route-shift benefit includes economies of scale.

(5) Benefits for Container Breakbulk Ships in the Year 2060

Table II-3-8 shows the differences in transit cargo volume for Container Breakbulk ships.

Table II-1-3 showed that no over-panamax vessels will be used in the year 2060 as CB. Therefore shifting will be limited to under-panamax vessels. This means that benefits will be produced only in under-panamax vessels.

As mentioned in a previous section, no benefit will be produced by CB and no size-shifting will occur in the year 2020. It follows that there will be no size-shifting in the year 2060 either. Hence all changes seen in Table II-3-8 are caused by route-shifting vessels.

As the result of this discussion, all benefits are assumed to come from route-shifting of under-panamax vessels.

Table II-3-8 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : CB)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	0	23,019	11,636	0	0	0	0	34,655
150	0	28,944	15,162	0	0	0	0	44,106
150-SQ	0	5,925	3,526	0	0	0	0	9,451
200	0	28,944	15,162	0	0	0	0	44,106
200-SQ	0	5,925	3,526	0	0	0	0	9,451
250	0	28,944	15,162	0	0	0	0	44,106
250-SQ	0	5,925	3,526	0	0	0	0	9,451

(calculated from Table II-1-3)

Table II-3-9 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-9 Benefits of the New Canals in the Year 2060 (ship type : CB)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	14,254 (9,451)	14,254 (9,451)
200,000DWT	0 (0)	0 (0)	14,254 (9,451)	14,254 (9,451)
250,000DWT	0 (0)	0 (0)	14,254 (9,451)	14,254 (9,451)

(6) Benefits for Chemical Tankers (CT) in the Year 2060

Table II-3-10 shows the differences in transit cargo volume for vessel for Chemical Tankers.

Benefits for CT are the same as those for CB. All benefits will come from under-panamax vessels which shift from alternative routes to the canal.

Table II-3-10 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : CT)

(1,000tons)

Case \ Ship size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	1,455	24,079	7,381	0	0	0	0	32,915
150	1,648	25,624	7,738	0	0	0	0	35,010
150-SQ	193	1,545	357	0	0	0	0	2,095
200	1,648	25,624	7,738	0	0	0	0	35,010
200-SQ	193	1,545	357	0	0	0	0	2,095
250	1,648	25,624	7,738	0	0	0	0	35,010
250-SQ	193	1.545	357	0	0	0	0	2.095

(calculated from Table II-1-3)

Table II-3-11 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-11 Benefits of the New Canals in the Year 2060 (ship type : CT)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	3,566 (2,095)	3,566 (2,095)
200,000DWT	0 (0)	0 (0)	3,566 (2,095)	3,566 (2,095)
250,000DWT	0 (0)	0 (0)	3,566 (2,095)	3,566 (2,095)

(7) Benefits for Conventional General Cargo Ships (CG) in the Year 2060

Table II-3-12 shows the differences in transit cargo volume for vessel for Conventional General Cargo ships.

Benefits for CG are the same as those for CB. All benefits will come from under-panamax vessels which shift from alternative routes to the canal.

Table II-3-12 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : CG)

(1,000tons)

Case \ Ship size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	1,326	12,182	0	0	0	0	0	13,508
150	1,705	14,281	0	0	0	0	0	15,986
150-SQ	379	2,099	0	0	0	0	0	2,478
200	1,705	14,281	0	0	0	0	0	15,986
200-SQ	379	2,099	0	0	0	0	0	2,478
250	1,705	14,281	0	0	0	0	0	15,986
250-SQ	379	2,099	0	0	0	0	0	2,478

(calculated from Table II-1-3)

Table II-3-13 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-13 Benefits of the New Canals in the Year 2060 (ship type : CG)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	5,552 (2,478)	5,552 (2,478)
200,000DWT	0 (0)	0 (0)	5,552 (2,478)	5,552 (2,478)
250,000DWT	0 (0)	0 (0)	5,552 (2,478)	5,552 (2,478)

(8) Benefits for Liquid Petroleum Gas Carriers (LP) in the Year 2060

Table II-3-14 shows the differences in transit cargo volume for Liquified Petroleum Gas carriers.

Benefits for LP are the same as those for CB. All benefits will come from under-panamax vessels which shift from alternative routes to the canal.

Table II-3-14 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : LP)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	150	656	264	0	0	0	0	1,070
150	150	1,087	264	0	0	0	0	1,501
150-SQ	0	431	0	0	0	0	0	431
200	150	1,087	264	0	0	0	0	1,501
200-SQ	0	431	0	0	0	0	0	431
250	150	1,087	264	0	0	0	0	1,501
250-SQ	0	431	0	0	0	0	0	431

(calculate from Table II-1-3)

Table II-3-15 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-15 Benefits of the New Canals in the Year 2060 (ship type : LP)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	0 (431)	0 (431)
200,000DWT	0 (0)	0 (0)	0 (431)	0 (431)
250,000DWT	0 (0)	0 (0)	0 (431)	0 (431)

Note : LP has the potential to carry as much as 431 thousand tons of cargo from the East to the West Coast of South America if a new canal is built. However, the benefit is assumed to be zero, since the cost of the alternative route is less than that for the canal route according to CTP(II)FR.

(9) Benefits for Refrigerated Cargo Ships (RE) in the Year 2060

Table II-3-16 shows the differences in transit cargo volume for Refrigerated Cargo ships.

Benefits for RE are the same as those for CB. All benefits will come from under-panamax vessels which shift from alternative routes to the canal.

Table II-3-16 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : RE)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	2,385	13,721	0	0	0	0	0	16,106
150	2,894	14,919	0	0	0	0	0	17,813
150-SQ	509	1,198	0	0	0	0	0	1,707
200	2,894	14,919	0	0	0	0	0	17,813
200-SQ	509	1,198	0	0	0	0	0	1,707
250	2,894	14,919	0	0	0	0	0	17,813
250-SQ	509	1,198	0	0	0	0	0	1,707

(calculated from Table II-1-3)

Table II-3-17 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-17 Benefits of the New Canals in the Year 2060 (ship type : RE)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	10,565 (1,701)	10,565 (1,701)
200,000DWT	0 (0)	0 (0)	10,565 (1,701)	10,565 (1,701)
250,000DWT	0 (0)	0 (0)	10,565 (1,701)	10,565 (1,701)

(10) Benefits for Roll-on Roll-off Ships (RR) in the Year 2060

Table II-3-18 shows the differences in transit cargo volume for Roll-on Roll-off vessels.

Benefits for RR are the same as those for CB. All benefits will come from under-panamax vessels which shift from alternative routes to the canal.

Table II-3-18 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : RR)

(1,000tons)

Case \ Ship size	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	407	1,666	926	0	0	0	0	2,999
150	414	2,516	1,280	0	0	0	0	4,210
150-SQ	7	850	354	0	0	0	0	1,211
200	414	2,516	1,280	0	0	0	0	4,210
200-SQ	7	850	354	0	0	0	0	1,211
250	414	2,516	1,280	0	0	0	0	4,210
250-SQ	7	850	354	0	0	0	0	1,211

(calculated from Table II-3-19)

Table II-3-19 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-19 Benefits of New Canals in the Year 2060 (ship type : RR)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	379 (1,212)	379 (1,212)
200,000DWT	0 (0)	0 (0)	379 (1,212)	379 (1,212)
250,000DWT	0 (0)	0 (0)	379 (1,212)	379 (1,212)

(11) Benefits for Vehicle Carriers (VC) in the Year 2060

Table II-3-20 shows the differences in transit cargo volume for Vehicle Carriers.

Benefit for VC are the same as those for CB. All benefits will come from under-panamax vessels which shift from alternative routes to the canal.

Table II-3-20 Transit Cargo by Ship and Canal Size in the Year 2060 (ship type : VC)

(1,000tons)

Ship size / Case	0 ~ 9,999	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	150,000 ~ 199,999	200,000 ~ 250,000	Total
SQ	104	2,816	0	0	0	0	0	2,920
150	104	2,828	0	0	0	0	0	2,932
150-SQ	0	12	0	0	0	0	0	12
200	104	2,828	0	0	0	0	0	2,932
200-SQ	0	12	0	0	0	0	0	12
250	104	2,828	0	0	0	0	0	2,932
250-SQ	0	12	0	0	0	0	0	12

(calculated from Table II-1-3)

Table II-3-21 gives a summary of benefits. Detailed benefits by route are listed in Annex III.

Table II-3-21 Benefits of New Canals in the Year 2060 (ship type : VC)

	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total
150,000DWT	0 (000US$) (0 (000tons))	0 (0)	37 (12)	37 (12)
200,000DWT	0 (0)	0 (0)	37 (12)	37 (12)
250,000DWT	0 (0)	0 (0)	37 (12)	37 (12)

(12) Summary of Benefits in the Year 2060

Table II-3-22 gives a summary of benefits produced by new canals in the year 2060.

60 percent of the total benefits comes from CD vessels (Combined and Dry Bulk ships), followed by benefits from the following for FC vessels (Full Container ships):

Table II-3-22 Summary of Benefits in the Year 2060

(1,000 US $)

Type	Benefit / Alternatives	Route-shift by Over-panamax	Size-shift	Route-shift by Under-panamax	Total	(%)
CB	150,000DWT	0	0	14,254	14,254	1.3%
	200,000DWT	0	0	14,254	14,254	1.3%
	250,000DWT	0	0	14,254	14,254	1.3%
CD	150,000DWT	412,499	20,898	260,128	693,525	65.4%
	200,000DWT	429,536	22,050	260,128	711,714	65.4%
	250,000DWT	443,523	22,050	260,128	725,701	65.0%
CT	150,000DWT	0	0	3,566	3,566	0.3%
	200,000DWT	0	0	3,566	3,566	0.3%
	250,000DWT	0	0	3,566	3,566	0.3%
FC	150,000DWT	23,053	270,497	3,622	297,172	28.0%
	200,000DWT	23,053	270,497	3,622	297,172	27.3%
	250,000DWT	23,053	270,497	3,622	297,172	26.6%
CG	150,000DWT	0	0	5,552	5,552	0.5%
	200,000DWT	0	0	5,552	5,552	0.5%
	250,000DWT	0	0	5,552	5,552	0.5%
LP	150,000DWT	0	0	0	0	0.0%
	200,000DWT	0	0	0	0	0.0%
	250,000DWT	0	0	0	0	0.0%
RE	150,000DWT	0	0	10,565	10,565	1.0%
	200,000DWT	0	0	10,565	10,565	1.0%
	250,000DWT	0	0	10,565	10,565	0.9%
RR	150,000DWT	0	0	379	379	0.0%
	200,000DWT	0	0	379	379	0.0%
	250,000DWT	0	0	379	379	0.0%
OT	150,000DWT	9,854	0	26,203	36,057	3.4%
	200,000DWT	18,675	0	26,203	44,878	4.1%
	250,000DWT	32,394	0	26,203	58,597	5.3%
VC	150,000DWT	0	0	37	37	0.0%
	200,000DWT	0	0	37	37	0.0%
	250,000DWT	0	0	37	37	0.0%
Total	150,000DWT	445,406	291,395	324,306	1,061,107	100.0%
	200,000DWT	471,264	292,547	324,306	1,088,117	100.0%
	250,000DWT	498,970	292,547	324,306	1,115,823	100.0%

Fig.II-3-4(a)-(c) illustrates the total benefit by type of beneficiary cargo.

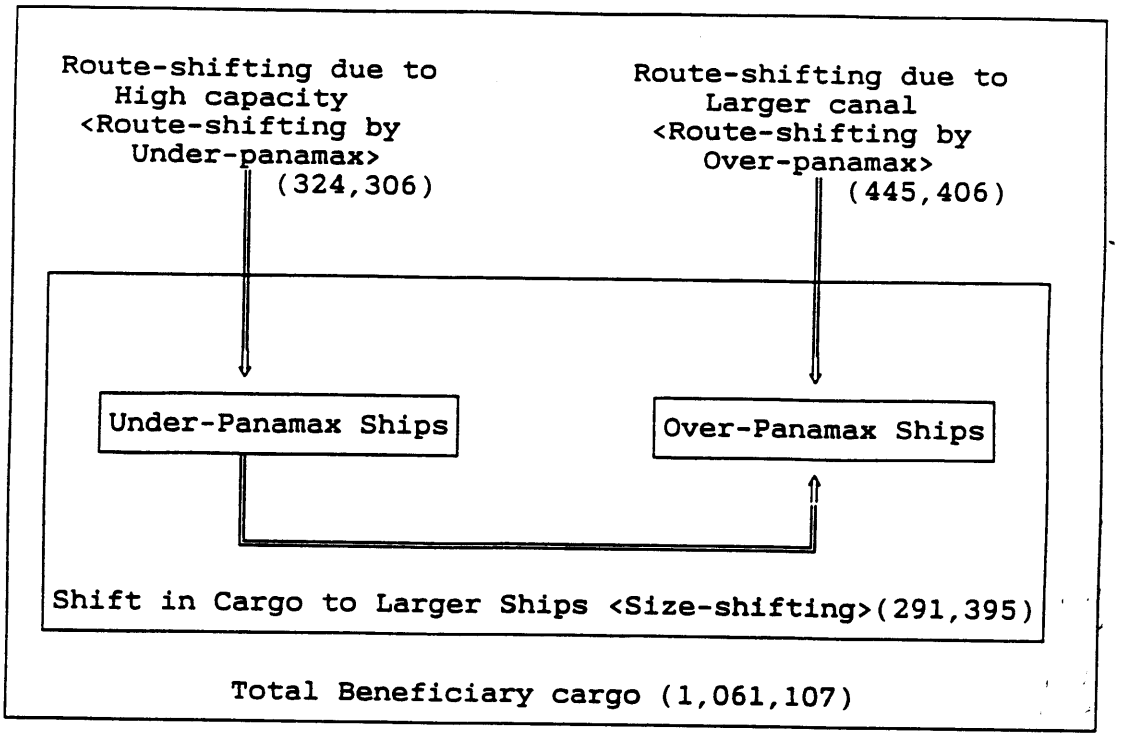


Fig.II-3-4(a) Benefits in the Year 2060 for a 150,000 DWT Canal (1,000 US$)

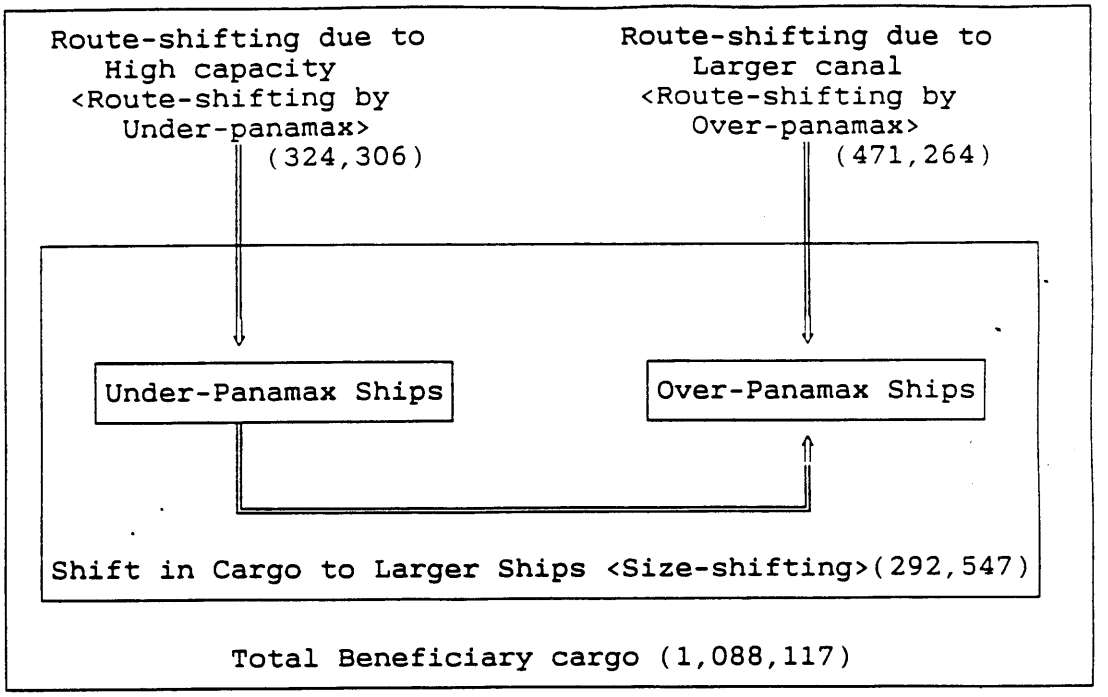


Fig.II-3-4(b) Benefits in the Year 2060 for a 200,000 DWT Canal (1,000 US$)

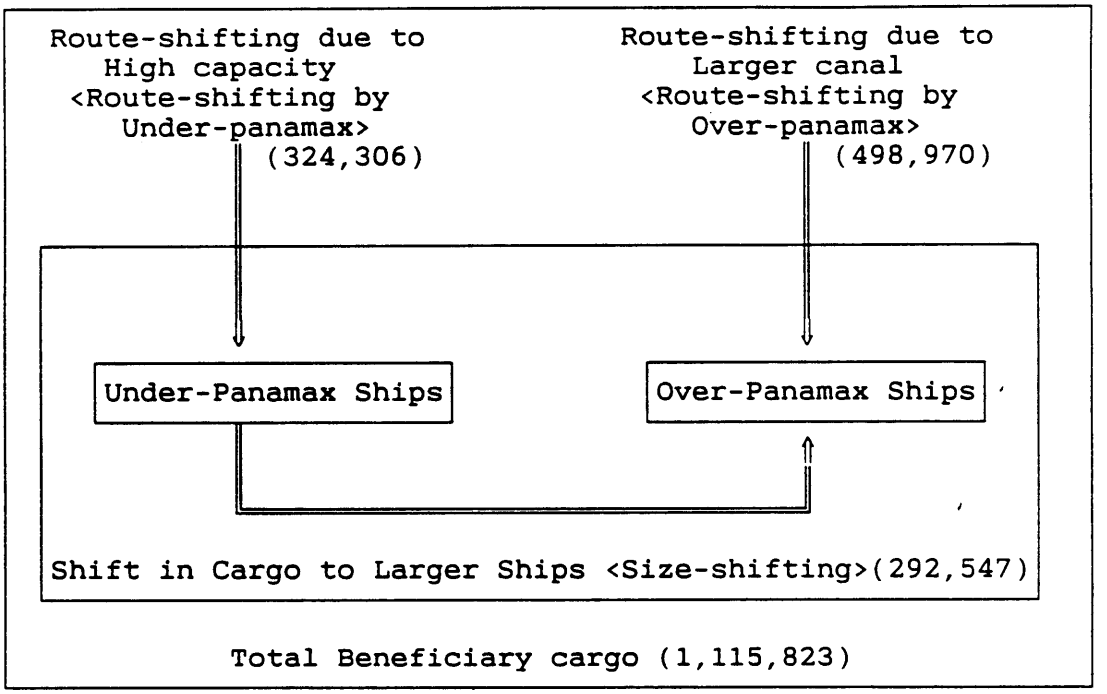


Fig.II-3-4(c) Benefits in the Year 2060 for a 250,000 DWT Canal (1,000 US$)

II.4 Annual Distribution of Benefits

Table II-4-1 gives a summary of benefits produced by new canals in the year 2020 and in 2060. As mentioned in previous sections, all of the benefits in 2020 and most of the benefits in the year 2060 will come from CD, FC and OT.

Compared to benefits in the year 2020, benefits in the year 2060 will be larger, especially due to route-shifting of over-panamax vessels. The increase in transit demand will be reflected in this benefit.

Benefits due to size-shifting vessels which gain economies of scale will be almost the same for all canal sizes both in the yaer 2020 and 2060.

Benefits from route-shifting of under-panamax will be independent of canal size as long as there is no constraint on passage through the canal.

Table II-4-1 Summary of Benefits

(1,000 US$)

Benefits case/year	Route-shift by over-panamax	Size-shift	Route-shift by under-panamax	Total
150,000DWT 2020	217,094	255,711	0	472,805
2060	445,406	291,395	324,306	1,061,107
200,000DWT 2020	240,284	255,971	0	496,255
2060	471,264	292,547	324,306	1,088,117
250,000DWT 2020	259,590	255,971	0	515,561
2060	498,970	292,547	324,306	1,115,823

The benefits during the year 2020 and 2060 were estimated by referring to the benefits for the year 2020 and 2060. Since it is assumed that cargo transit volume will reach the SQ canal's capacity soon after 2020, benefits will increase as the beneficiary cargo grows. The curve between the two years is assumed to be increasing positively at a constant rate. The results are shown in Table II-4-2 and Fig.II-4-1. Fig.II-4-2~Fig.II-4-4 shows the benefits categorized by their source.

Table II-4-2 Benefit Distribution Year

(1,000 US$)

YEAR	150,000 DWT	200,000 DWT	250,000 DWT
2020	472,805	496,255	515,561
2021	482,457	506,092	525,609
2022	492,307	516,123	535,853
2023	502,357	526,354	546,297
2024	512,613	536,787	556,944
2025	523,078	547,427	567,799
2026	533,757	558,278	578,865
2027	544,654	569,344	590,147
2028	555,773	580,629	601,649
2029	567,119	592,139	613,375
2030	578,697	603,876	625,329
2031	590,511	615,846	637,517
2032	602,567	628,053	649,942
2033	614,868	640,502	662,609
2034	627,421	653,198	675,523
2035	640,230	666,145	688,689
2036	653,300	679,349	702,112
2037	666,638	692,815	715,796
2038	680,247	706,548	729,746
2039	694,135	720,553	743,969
2040	708,306	734,836	758,469
2041	722,766	749,401	773,251
2042	737,521	764,256	788,322
2043	752,578	779,405	803,686
2044	767,942	794,854	819,350
2045	783,620	810,609	835,318
2046	799,617	826,677	851,599
2047	815,942	843,063	868,196
2048	832,599	859,774	885,117
2049	849,597	876,816	902,368
2050	866,942	894,196	919,955
2051	884,641	911,921	937,885
2052	902,701	929,997	956,164
2053	921,129	948,431	974,799
2054	939,935	967,231	993,798
2055	959,124	986,403	1,013,167
2056	978,704	1,005,955	1,032,913
2057	998,685	1,025,895	1,053,044
2058	1,019,073	1,046,230	1,073,568
2059	1,039,878	1,066,968	1,094,492
2060	1,061,107	1,088,117	1,115,823

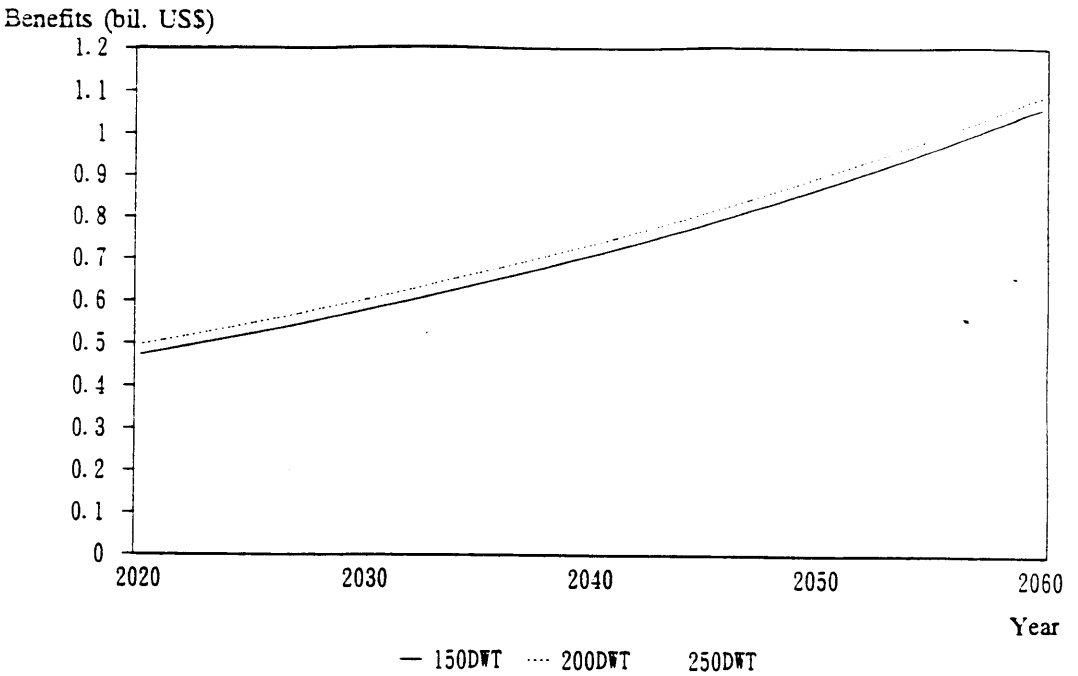


Fig.II-4-1 Benefits Produced by Alternative Canals

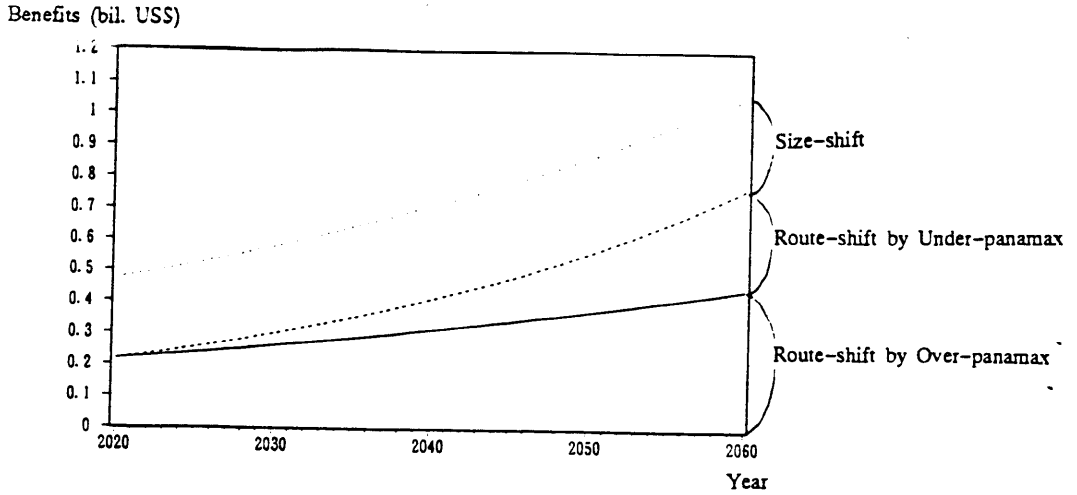


Fig.II-4-2 Benefits for the 150,000 DWT Canal

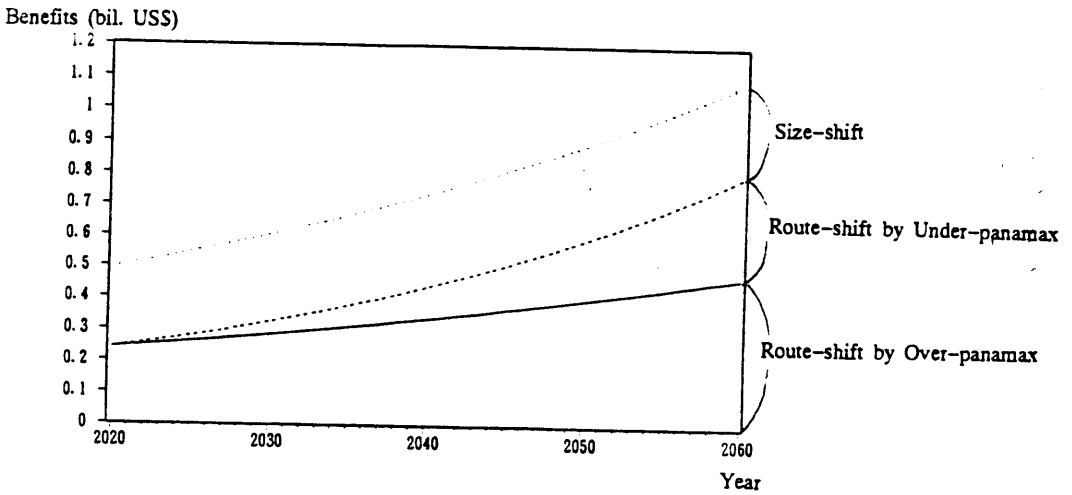


Fig.II-4-3 Benefits for the 200,000 DWT Canal

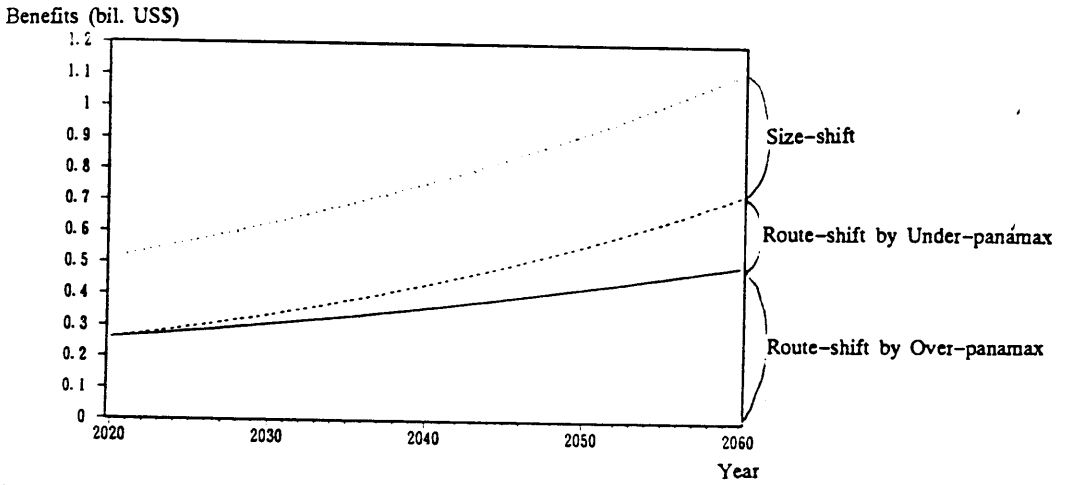


Fig.II-4-4 Benefits for the 250,000 DWT Canal

III. Costs of Alternatives

III. Costs of Alternatives

Economic costs of a project which are used in calculating Cost-Benefit Ratio (B/C ratio) of the project are estimated based on financial costs of the project which are expressed in market prices and provide basic information to tender of the project and other factors. Accordingly, in this Chapter, firstly, concept of costs of the Panama Canal Alternative Project is clarified, secondly, economic costs of the project are estimated ultimately based on the financial costs by converting the latter into the former, and lastly, the economic costs by year are estimated which are required for calculating the B/C ratio and Internal Rate of Return (IRR).

III.1 Costs of the Project

(1) Basis of Estimating Costs of the Project

Economic appraisal of a project is carried out from standpoint of whole society and economy where the project is planned. This result in such a consequence that not only tangible costs consumed for the project but also intangible costs which are incurred by the project but born ultimately by the society or the economy have to be counted as the costs of the project. The latter costs are called "External Diseconomy" of the project.

If the external diseconomy is mitigated by any countermeasures, costs for the mitigation should be included in the Cost-Benefit evaluation. Other component studies "Environment Analysis" and "Impact on Panama" have identified various environmental damages due to the alternative canals project. These studies, however, have not provided quantitative mitigation costs for the damages. Accordingly, the mitigation costs considered in economic evaluation in the EAIU study have been limited to those, such as a part of tidal gate costs in the case of Sea Level Canal, included in the financial project costs.

(2) Financial Costs of the Project

Data on the financial costs of the project, i.e. the tangible costs consumed for the project, are provided in the Final Report of the component study of Engineering Cost Estimates (ECE).*1 The costs comprise project costs i.e. costs of facilities planned in the project, and operation, maintenance and management costs of the project. The project costs are subclassified into construction costs and indirect costs. Tax, custom duties and interest during construction are not included in the project costs, and operation, maintenance and management costs. This implies that these costs are measured at the Resource Cost basis. The project costs by Alternative Canals are presented in Table III-1-1 and III-1-2, and the operation, maintenance and management costs in the year 2020 and 2060 by the alternative in Table III-1-3.

Note *1 In the Final Report of the component study of financing Scheme, Financial Analysis, and Management Arrangements, project costs and operation, maintenance and management costs of the project are also presented. They are modified from viewpoint of disbursement timing of fund for construction from those presented by the ECE Study Team. Therefore, basic concept of costs of the project is common in the reports.

Table III-1-1 Financial Project Costs of High-Rise Lock Alternatives

(Currency in US dollars) (File : SUMHRLC)

	Description	200,000 DWT Rise 85' Phase I ($)	200,000 DWT Rise 85' Phase II ($)	200,000 DWT Rise 85' Total ($)	150,000 DWT Rise 85' Phase I ($)	150,000 DWT Rise 85' Phase II ($)	150,000 DWT Rise 85' Total ($)
I	CONSTRUCTION COSTS						
(A)	CIVIL WORKS						
1	Canal Excavation	3.477.383.640	-	3.477.383.640	3.011.946.860	-	3.011.946.860
2	Placing Area	87.794.350	-	87.794.350	87.794.350	-	87.794.350
3	Lock Construction	1.127.257.294	-	1.127.257.294	991.170.516	-	991.170.516
5	New Dams	236.998.948	92.605.538	329.604.486	-	201.134.249	201.134.249
6	Pump Station	-	149.374.284	149.374.284	-	149.374.284	149.374.284
7	New Permanent Roads	8.752.280	-	8.752.280	8.752.280	-	8.752.280
8	New Canal Crossing	501.187.820	839.491.140	1.340.678.960	450.199.285	776.534.190	1.226.733.475
10	Barrier Dams	-	-	-	-	-	-
11	Breakwater	-	-	-	-	-	-
12	Diversion Scheme	-	-	-	-	-	-
13	Supporting Construction	425.434.300	84.586.000	510.020.300	425.434.300	88.150.000	513.584.300
	Subtotal	5.864.808.632	1.166.056.962	7.030.865.594	4.975.297.591	1.215.192.723	6.190.490.314
(B)	PLANT FORMING A PART OF PERMANENT WORKS						
4	Gate Leaves and Related Facilities	1.011.237.350	-	1.011.237.350	888.887.500	-	888.887.500
9	Navigation Support System	414.209.530	-	414.209.530	414.209.530	-	414.209.530
	Subtotal	1.425.446.880	-	1.425.446.880	1.303.097.030	-	1.303.097.030
	CONSTRUCTION COSTS, TOTAL(I)	7.290.255.512	1.166.056.962	8.456.312.474	6.278.394.621	1.215.192.723	7.493.587.344
II	INDIRECT COSTS						
1	Administrative Costs	89.542.200	14.322.000	103.864.200	77.114.100	14.925.500	92.039.600
2	Headquarter's Costs	152.853.000	24.448.400	177.301.400	131.637.600	25.478.600	157.116.200
3	Construction Supervision	179.283.000	28.675.800	207.958.800	154.399.200	29.884.200	184.283.400
4	Land Aquisition & Rights	-	-	-	-	-	-
5	Compensation Costs	105.000.000	-	105.000.000	105.000.000	-	105.000.000
6	Contingency	729.026.000	116.606.000	845.632.000	627.839.000	121,519.000	749.358.000
	INDIRECT COSTS, TOTAL(II)	1.255.704.200	184.052.200	1.439.756.400	1.095.989.900	191.807.300	1.287.797.200
	PROJECT COSTS, GRAND TOTAL(I+II)	8.545.959.712	1.350.109.162	9.896.068.874	7.374.384.521	1.407.000.023	8.781.384.544

Table III-1-2 Financial Project Costs of Sea Level Canal Alternatives

(Currency in US Dollars) (File: SUMSLC)

	Description	250.000 DWT								
		Case a			Case b			Case c		
		Phase I ($)	Phase II ($)	Total ($)	Phase I ($)	Phase II ($)	Total ($)	Phase I ($)	Phase II ($)	Total ($)
I	CONSTRUCTION COSTS									
(A)	CIVIL WORKS									
1	Canal Excavation	6.244.222.840	-	6.244.222.840	7.373.056.330	-	7.373.056.330	6.244.222.840	-	6.244.222.840
2	Placing Area	188.682.691	-	188.682.691	188.682.691	-	188.682.691	188.682.691	-	188.682.691
3	Lock Construction (Tidal Lock/Gate)	2.037.412.827	477.348.130	2.514.760.957	428.936.820	-	428.936.820	2.292.871.454	477.348.130	2.770.219.584
5	New Dams	-	89.963.144	89.963.144	-	89.963.144	89.963.144	-	89.963.144	89.963.144
6	Pump Station	-	-	-	-	-	-	-	-	-
7	New Permanent Roads	19.419.590	-	19.419.590	19.419.590	-	19.419.590	19.419.590	-	19.419.590
8	New Canal Crossings	221.936.760	547.713.010	769.649.770	309.088.760	547.713.010	856.801.770	221.936.760	547.713.010	769.649.770
10	Barrier Dams	493.502.306	-	493.502.306	493.502.306	-	493.502.306	493.502.306	-	493.502.306
11	Breakwater	402.015.840	-	402.015.840	402.015.840	-	402.015.840	402.015.840	-	402.015.840
12	Diversion Scheme	75.285.156	-	75.285.156	75.285.156	-	75.285.156	75.285.156	-	75.285.156
13	Supporting Construction	574.412.520	66.149.000	640.561.520	574.412.520	37.830.000	612.242.520	574.412.520	66.149.000	640.561.520
	Subtotal	10.256.890.530	1.181.173.284	11.438.063.814	9.864.400.013	675.506.154	10.539.906.167	10.512.349.157	1.181.173.284	11.693.522.441
(B)	PLANT FORMING A PART OF PERMANENT WORKS									
4	Gate Leaves and Related Facilities	949.550.400	316.008.430	1.265.558.830	737.960.800	-	737.960.800	1.252.234.600	316.008.430	1.568.243.030
9	Navigation Support System	546.295.047	-	546.295.047	477.046.333	-	477.046.333	546.295.047	-	546.295.047
	Subtotal	1.495.845.447	316.008.430	1.811.853.877	1.215.007.133	-	1.215.007.133	1.798.529.647	316.008.430	2.114.538.077
	CONSTRUCTION COSTS, TOTAL(I)	11.752.735.977	1.497.181.714	13.249.917.691	11.079.407.146	675.506.154	11.754.913.300	12.310.878.804	1.497.181.714	13.808.060.518
II	INDIRECT COSTS									
1	Administrative Costs	120.063.000	15.271.300	135.334.300	113.010.000	6.890.200	119.900.200	125.571.000	15.271.300	140.842.300
2	Headquarter's Costs	203.059.130	25.867.700	228.926.830	191.425.600	11.671.100	203.096.700	212.702.500	25.867.700	238.570.200
3	Construction Supervision	227.322.500	28.958.600	256.281.100	214.298.900	13.065.700	227.364.600	238.118.100	28.958.600	267.076.700
4	Land Aquisition & Rights	27.337.175	-	27.337.175	27.337.175	-	27.337.175	27.337.175	-	27.337.175
5	Compensation Costs	13.557.600	-	13.557.600	13.557.600	-	13.557.600	13.557.600	-	13.557.600
6	Contingency	1.175.274.000	149.718.000	1.324.992.000	1.107.941.000	67.551.000	1.175.492.000	1.231.088.000	149.718.000	1.380.806.000
	INDIRECT COSTS, TOTAL(II)	1.766.613.405	219.815.600	1.986.429.005	1.667.570.275	99.178.000	1.766.748.275	1.848.374.375	219.815.600	2.068.189.975
	PROJECT COSTS, GRAND TOTAL(I+II)	13.519.349.382	1.716.997.314	15.236.346.696	12.746.977.421	774.684.154	13.521.661.575	14.159.253.179	1.716.997.314	15.876.250.493

Source : ECE Study Final Report

Table III-1-3 Financial Operation, Maintenance and Management Costs

Items	Unit	High-Rise Lock Alternatives				Sea Level Canal Alternatives					
		150,000 DWT		200,000DWT		Case (a)		Case (b)		Case (c)	
		2020	2060	2020	2060	2020	2060	2020	2060	2020	2060
Electrical Power	mill US$	10.4	11.3	10.8	12.2	7.8	10.4	0.6	0.6	8.2	10.8
Man power and Other O & M Cost	mill US$	103.9	163.8	112.2	172.1	154.6	205.8	144.3	195.5	159.7	210.9
Total O & M Cost	mill US$	114.3	175.1	123	184.3	162.4	216.2	144.9	196.1	167.9	221.7

Source : ECE Study Final Report

III.2 Economic Costs of the Project

(1) Method of Calculating Economic Costs

(i) Economic Costs, not financial costs, of the project are used in the appraisal of the project, which requires to convert the financial costs into the economic costs. Taking into account logical consistency with the Social Discount Rate(SDR) discussed in Section I.3, the figure of the financial costs is examined from conceptual viewpoint of Resource Cost and Opportunity Costs, and then is converted to be expressed at international border prices from at the Resource Cost and Opportunity Cost bases. The international border price basis is adopted as the numeraire for appraisal of the project. The numeraire is the same as the one adopted by the OECD (Organization for Economic Cooperation and Development) and the World Bank. As a result, the values of the local portion of this project's cost have to be converted into the same units as the numeraire's.

(ii) The economic cost of the local portion especially in the field of construction costs cannot be directly estimated based on the data presented in the Final Report of the ECE Study Team. This is because the cost estimation procedure adopted in the Report is different from that for the estimating the economic cost. However, individual data and information for estimating the economic cost are scattered about in the Report itself. Capital equipments and construction materials are assumed to be mostly purchased from foreign countries with international market prices reflecting border prices of those resources. By referring to such data and information, the following four local cost items are ultimately selected for the conversion:

(a) Unskilled labor costs,
(b) Land costs,
(c) Compensation costs, and
(d) Electrical power costs.

(iii) As appeared later in the formulae for converting values of the above cost items, Accounting Ratios, Conversion Factors (CF) and Shadow Prices*2 of Panama are used. They are cited from the document "Estimación de Precios de Cuenta para Panamá" MIPPE, BID, 1990. In the document, 130 types of Accounting Ratios, four types of CF and twelve types of Shadow Prices are estimated. The Accounting Ratios are

systematically estimated using an input coefficient matrix (130 X 130) of commodities and services which are consumed in Panama and vector of Shadow Prices (12 X 1) of primary factor input for production of the commodities and services.

The Accounting Ratios of the commodities and services tabulated in the document are ratios of values of the commodities and services in question expressed at international currency border prices (usually in US dollar) to the values expressed in Panamanian domestic market prices. The SCF (Standard Conversion Factor) is used to convert values of miscellaneous intermediate input, commodities and services expressed at local market prices into values at international currency prices. Theoretically, the reciprocal number of the SCF is equivalent to the Shadow Exchange Rate which is one of the primary factors for estimating the Accounting Rate. The SWR (Shadow Wage Rate for unskilled labor) is a ratio of the opportunity cost of the unskilled labor expressed in the local currency to the value expressed in the local market price.

Note *2 Concept of these terminologies are the same as those in the document. In general, the Accounting Ratios correspond to conversion ratios by individual commodity and/or industry, while the CFs mean conversion ratios which are applied to more aggregated groups of commodity and/or industry. The Shadow Rates are applied to estimate values at Opportunity Cost basis.

(2) Conversion of Cost Items to be Converted at Economic Cost Basis

Values of the four local cost items numerated above are converted into the these at the numeraire in the following ways.

1) Unskilled labor costs

According to the ECE Report, the project is to make maximum usage of gigantic construction machines is each phase of construction, which characterizes the project as a capital intensive project. Accordingly labor, especially unskilled labor will not be required in large number.

Unskilled labor costs are estimated by work item data shown in Table III-2-1, and sum of the estimated costs is converted to that at the numeraire by applying the following formula:

Unskilled labor costs : $UC^i = UC^o \times SWR \times CFa$

- UC^i : Unskilled labor costs expressed in international currency border prices (US$) for the year 1990
- UC^o : Unskilled labor costs expressed at Panamanian market prices (Panamanian currency) for the year 1990
- SWR : Shadow Wage Rate for unskilled labor : 0.6
- CFa : Conversion Factor for agricultural product : 0.912

The costs at the Opportunity Cost basis is represented by the product of the UC^i and SWR, and are still expressed at local currency basis. The CFa is adopted to convert the costs into these at the numeraire.

Table III-2-1 Basis Data for Estimating Unskilled Labor Costs

TYPE OF CONSTRUCTION	LABOUR RATE OF TOTAL	UNSKILLED RATE OF LABOUR	UNSKILLED RATE OF TOTAL	CONVERTION FACTOR	CONVERTION RATE
Dry Excavation	0.03	0.4	0.012	0.6*0.912	0.9945664
Dredging	0.10	0.1	0.010	0.6*0.912	0.9954720
Slope Treatment	0.03	0.4	0.012	0.6*0.912	0.9945664
Placing Area	0.03	0.3	0.009	0.6*0.912	0.9959248
Lock & T. Gate Structure	0.10	0.4	0.040	0.6*0.912	0.9818880
Lock & T. Gate Mechanical	0.02	0.3	0.006	0.6*0.912	0.9972832
New Dams	0.03	0.3	0.009	0.6*0.912	0.9959248
Pumping Station	0.02	0.4	0.008	0.6*0.912	0.9963776
New Permanent Roads	0.03	0.4	0.012	0.6*0.912	0.9945664
Canal Crossing	0.02	0.3	0.006	0.6*0.912	0.9972832
Barrier Dam	0.03	0.4	0.012	0.6*0.912	0.9945664
Diversion Scheme	0.03	0.4	0.012	0.6*0.912	0.9945664
Navigation Support Sysytem	0.10	0.1	0.010	0.6*0.912	0.9954720
Breakwater	0.10	0.1	0.010	0.6*0.912	0.9954720
Supporting Construction	0.10	0.4	0.040	0.6*0.912	0.9818880
	0		0		1
Indirect Cost					
1 Administrative			0.049	0.6*0.912	0.9778128
2 Headquater			0.034	0.6*0.912	0.9846048
3 Supervision					1
4 Land Aquisition				0.894	0.894
5 Conpensation				0.894	0.894
6 Contongency					
Electric Power				2.747	2.747

Note : Labor Rate of Total = Labor Cost / Construction Cost by work item
Unskilled Rate of Labor = Unskilled Labor Cost / Labor Cost by work item
Unskilled Rate of Total = Product of the above two

Source : ECE Study Team

2) Land Costs

As shown in Table III-2-2 and III-2-3, land costs of area along the planned canal and placing area for materials from the dry excavation are counted as costs of this project.

Since the land in the canal area is public land, the land acquisition costs for the High-Rise Lock Canal Alternatives are not counted in the ECE Report, while those for the Sea Level Canal Alternatives are considered due to the private land. However, the value of land occupied by the High-Rise Lock Canal should be taken into consideration as the costs of the project, even if there does not exist market price of the land.

Land costs in the canal area are estimated by the Study Team principally is consideration of distance from the city center, topographical features and existing land use. The same method of estimation is adopted to estimate the market prices of land for the Sea Level Canal Alternatives in the ECE Report. In the Tables, average market prices in 1990 by land use are presented, which are calculated based on the corresponding surveyed/ estimated price of more than ten subareas of the land divided for the estimation.

The summed up land costs are converted to that at the numeraire by applying the following formula:

Land costs : $LC^i = LC^o \times SCF$

LC^i : Land costs expressed in international currency border prices (US$) for the year 1990

LC^o : Land costs expressed on an opportunity cost basis (Panamanian currency) for the year 1990

SCF : Standard Conversion Factor : 0.894

Behind the above formula, the following assumption is introduced: Market Prices of the land represent the Opportunity Cost of the land.

Table III-2-2 Land Acquisition Cost for High-Rise Lock Alternative

Land Classification	Quantity (1,000m2)	Unit Cost ($)	Amount (1,000$)	Economic Cost Amount (1,000$)
Area along the Canal				
Plane Areas close to Panama City Center	1,487.00	50.00	74,350.00	Amount
Plane Areas close to Colon City	1,208.00	20.00	24,160.00	x
Hilly Areas close to Panama City	1,944.00	1.00	1,944.00	Conversion
Forest Areas	6,025.00	0.11	662.75	Factor
Subtotal	10,664.00		101,116.75	(0.894)
Placing Area				
Plane Areas	1,500.00	10.00	15,000.00	
Hilly Areas	6,900.00	0.50	3,450.00	
Forest Areas	11,800.00	0.11	1,298.00	
Subtotal	20,200.00		19,748.00	
TOTAL	30,864.00		120,864.75	108,053.09

Source : Quantity : The ECE Report
Unit Cost : The Study Team's estimate

Table III-2-3 Land Acquisition Cost for Sea Level Canal Alternative

Land Classification	Quantity (1,000m2)	Unit Cost ($)	Amount (1,000$)	Economic Cost Amount (1,000$)
Area along the Canal				
Town Residencial Area	2,220.70	3.40	7,550.38	Amount
Agricultural Areas	12,440.00	0.11	1,368.40	x
Forest Areas	8,065.00	0.11	887.15	Conversion
Swamp Areas	670.30	0.80	536.24	Factor
Industrial Areas	121.90	12.00	1,462.80	
Subtotal	23,518.30		11,804.97	(0.894)
Placing Area				
Town Residencial Area	3,129.50	0.91	2,847.85	
Land Aquisition for Agricultural Area	32,437.20	0.37	12,001.76	
Land Aquisition for Forest Areas	15,408.20	0.11	1,694.90	
Subtotal	50,974.90		16,544.51	
TOTAL	74,493.20		28,349.48	25,344.44

Source : The ECE Report with partial modefication by the Study Team

3) Compensation Costs

Compensation costs are for removing or relocating the existing facilities such as private houses and public facilities in the project area to another areas or places. The costs expressed at market prices are converted to those at the numeraire by applying the following formula:

Compensation costs : $CC^i = CC^o \times SCF$

CC^i : Compensation cost expressed in international currency border prices (US$) for the year 1990

CC^o : Compensation costs expressed at Panamanian market prices (Panamanian currency) for the year 1990

SCF : Standard Conversion Factor : 0.894

There is no Accounting Ratio which corresponds to the compensation costs and the costs account for a small portion of the project cost, which results in adoption of the SCF for the conversion.

4) Electrical Power Costs

The cost item is one of major component cost items of the operation, maintenance and management costs. The costs expressed at market prices are converted to these at the numeraire by applying the following formulae:

Electrical power costs : $EC^i = EC^m \times ARe$

Ec^i : Electrical power costs expressed in international currency border prices (US$) for the year 1990

EC^m : Electrical power costs expressed at Panamanian market prices (Panamanian currency) for the year 1990 (estimated by the ECE Study Team)

ARe : Accounting Ratio for electricity in Panama :2.747 (case; Potentia electrical, media tension)

The ARe is one of the Accounting Ratios. As being apparent in the definition of the

Accounting Ratios stated before, Accounting Ratio ARe is sufficient to convert the costs expressed at market prices to those at the numeraire.

(3) Comparison of Financial Costs with Economic Costs

(i) Table III-2-5 and III-2-6 present the economic project costs of the High-Rise Lock Canal alternatives, and Table III-2-7 shows those of the Sea Level Canal Alternatives. From Table III-1-1 and III-1-2 shown before in addition to the above Table, the financial and economic project costs of all alternatives are summarized as follows:

Table III-2-4 (Summary) Financial and Economic Project Costs by Alternatives

(unit : bil. US$)

Cost Items		High-Rise Lock Canal Alternatives		Sea Level Canal Alternatives 250,000 DWT		
		150,000 DWT	200,000 DWT	(a)	(b)	(c)
Construction Costs	F	7.49	8.46	13.25	11.74	13.81
	E	7.39	8.45	13.15	12.22	13.70
Indirect Costs	F	1.29	1.44	1.99	1.77	2.07
	E	1.37	1.53	1.97	1.84	2.05
Project Costs	F	8.78	9.90	15.24	13.52	15.88
	E	8.76	9.98	15.11	14.07	15.75

Note F : Financial project costs
E : Economic project costs

The economic construction costs are lower than the financial costs by less than 1

percent of the latter due to the effect of the Accounting Ratios and Conversion Factors, while in the economic indirect costs of the High-Rise Lock Alternatives the economic costs of land are newly counted, resulting sometimes in a higher economic than financial costs.

(ii) Table III-2-8 shows the economic operation, maintenance and management costs. Comparing the Table III-1-3, it can be pointed out that the economic costs exceed the financial costs in the case of all alternatives due to the high economic cost of electricity.

Table III-2-5 Economic Project Cost Summary of the High-Rise Lock Canal Alternatives
(150,000 DWT) (Average)

Description	CASE 1 (150,000 DWT) Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)
I CONSTRUCTION COSTS			
(A) CIVIL WORKS			
1 Canal Excavation			
Dry	820,235	0	820,235
Dredging	2,106,406	0	2,106,406
Slope	70,857	0	70,857
Canal Excavation Total	2,997,497	0	2,997,497
2 Placing Area	87,437	0	87,437
3 Lock Construction	973,218	0	973,218
5 New Dams	0	200,315	200,315
6 Pump Station	0	148,833	148,833
7 New Permanent Roads	8,705	0	8,705
8 New Canal Crossing	448,976	837,210	1,286,187
10 Barrier Dams	0	0	0
11 Breakwater	0	0	0
12 Diversion Scheme	0	0	0
13 Supporting Construction	417,729	83,054	500,783
Subtotal	4,933,562	1,269,412	6,202,974
(B) PLANT FORMING A PART OF PERMANENT WORKS			
4 Gates Leaves and Related Facilities	886,473	0	886,473
9 Navigation Support System	412,334	0	412,334
Subtotal	1,298,807	0	1,298,807
CONSTRUCTION COSTS TOTAL (I)	6,232,369	1,269,412	7,501,781
II INDIRECT COSTS			
1 Administrative Costs	75,403	14,004	89,407
2 Headquarter's Costs	129,611	24,072	153,683
3 Construction Supervision	154,399	28,676	183,075
4 Land Aquisition & Rights	108,053	0	108,053
5 Compensation Costs	93,870	0	93,870
6 Contingency	623,237	116,133	739,369
INDIRECT COSTS TOTAL (II)	1,184,573	182,885	1,367,458
PROJECT COSTS, GRAND TOTAL (I-II)	7,416,942	1,452,297	8,869,239

Table III-2-6 Economic Project Cost Summary of the High-Rise Lock Canal Alternatives (200,000 DWT) (Average)

Description	CASE 2 (200,000 DWT) Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)
I CONSTRUCTION COSTS			
(A) CIVIL WORKS			
1 Canal Excavation			
Dry	914,378	0	914,378
Dredging	2,470,366	0	2,470,366
Slope	75,992	0	75,992
Canal Excavation Total	3,460,737	0	3,460,737
2 Placing Area	87,437	0	87,437
3 Lock Construction	1,106,840	0	1,106,840
5 New Dams	236,033	92,228	328,261
6 Pump Station	0	148,833	148,833
7 New Permanent Roads	8,705	0	8,705
8 New Canal Crossing	499,826	774,425	1,274,251
10 Barrier Dams	0	0	0
11 Breakwater	0	0	0
12 Diversion Scheme	0	0	0
13 Supporting Construction	417,729	86,553	504,282
Subtotal	5,817,306	1,102,039	6,919,345
(B) PLANT FORMING A PART OF PERMANENT WORKS			
4 Gates Leaves and Related Facilities	1,008,490	0	1,008,490
9 Navigation Support System	412,334	0	412,334
Subtotal	1,420,824	0	1,420,824
CONSTRUCTION COSTS TOTAL (I)	7,238,130	1,102,039	8,340,169
II INDIRECT COSTS			
1 Administrative Costs	87,556	14,594	102,150
2 Headquarter's Costs	150,500	25,086	175,586
3 Construction Supervision	179,283	29,884	209,167
4 Land Aquisition & Rights	108,053	0	108,053
5 Compensation Costs	93,870	0	93,870
6 Contingency	723,813	121,013	844,826
INDIRECT COSTS TOTAL (II)	1,343,075	190,577	1,533,652
PROJECT COSTS, GRAND TOTAL (I+II)	8,581,205	1,292,616	9,873,821

Table III-2-7 Economic Project Cost Summary of the Sea Level Canal Alternatives

Description	CASE A (250,000 DWT)			CASE B (250,000 DWT)			CASE C (250,000 DWT)		
	Phase I	Phase II	Total	Phase I	Phase II	Total	Phase I	Phase II	Total
	(1,000$)	(1,000$)	(1,000$)	(1,000$)	(1,000$)	(1,000$)	(1,000$)	(1,000$)	(1,000$)
I CONSTRUCTION COSTS									
(A) CIVIL WORKS									
1 Canal Excavation									
Dry	3,640,495	0	3,640,495	3,983,123	0	3,983,123	3,640,495	0	3,640,495
Dredging	2,333,284	0	2,333,284	3,096,566	0	3,096,566	2,333,284	0	2,333,284
Slope	238,638	0	238,638	256,120	0	256,120	238,698	0	238,698
Canal Excavation Total	6,212,417	0	6,212,417	7,335,812	0	7,335,812	6,212,417	0	6,212,417
2 Placing Area	187,914	0	187,914	187,914	0	187,914	187,914	0	187,914
3 Lock Construction	2,000,511	468,702	2,469,213	421,168	0	421,168	2,251,343	468,702	2,720,045
5 New Dams	0	89,597	89,597	0	200,315	200,315	0	89,597	89,597
6 Pump Station	0	0	0	0	148,833	148,833	0	0	[illegible]
7 New Permanent Roads	19,314	0	19,314	19,314	0	19,314	19,314	0	19,314
8 New Canal Crossing	221,334	546,225	767,559	308,249	774,425	1,082,674	221,334	546,225	767,559
10 Barrier Dams	490,821	0	490,821	490,821	0	490,821	490,821	0	490,821
11 Breakwater	400,196	0	400,196	400,196	0	400,196	400,196	0	400,196
12 Diversion Scheme	74,876	0	74,876	74,876	0	74,876	74,876	0	74,876
13 Supporting Construction	564,009	64,951	628,960	564,008	86,553	650,562	564,009	64,951	628,960
Subtotal	10,171,391	1,169,475	11,340,865	9,802,357	1,210,126	11,012,483	10,422,222	1,169,475	11,591,697
(B) PLANT FORMING A PART OF PERMANENT WORKS									
4 Gates Leaves and Related Facilities	946,971	315,150	1,262,121	735,956	0	735,956	1,248,833	315,150	1,563,983
9 Navigation Support System	543,821	0	543,821	474,886	0	474,886	543,821	0	543,821
Subtotal	1,490,792	315,150	1,805,942	1,210,842	0	1,210,842	1,792,654	315,150	2,107,804
CONSTRUCTION COSTS TOTAL	11,662,183	1,484,625	13,146,807	11,013,199	1,210,126	12,223,325	12,214,876	1,484,625	13,699,501
II INDIRECT COSTS									
1 Administrative Costs	117,399	14,932	132,332	110,503	14,594	125,097	122,785	14,932	137,717
2 Headquarter's Costs	199,933	25,470	225,403	188,479	25,086	213,565	209,428	25,469	234,897
3 Construction Supervision	227,323	28,959	256,282	214,299	29,884	244,183	238,118	28,959	267,077
4 Land Aquisition & Rights	25,344	0	25,344	25,344	0	25,344	25,344	0	25,344
5 Compensation Costs	12,120	0	12,120	12,120	0	12,120	12,120	0	12,120
6 Contingency	1,166,218	148,462	1,314,680	1,101,320	121,013	1,222,333	1,221,488	148,462	1,369,950
INDIRECT COSTS TOTAL	1,748,337	217,824	1,966,161	1,652,065	190,577	1,842,642	1,829,283	217,823	2,047,106
PROJECT COSTS	13,410,520	1,702,448	15,112,968	12,665,264	1,400,703	14,065,967	14,044,159	1,702,448	15,746,607

Table III-2-8 Economic Operation, Maintenance and Management Costs

Items	Unit	High-Rise Lock Alternatives				Sea Level Canal Alternatives					
		150,000 DWT		200,000DWT		Case (a)		Case (b)		Case (c)	
		2020	2060	2020	2060	2020	2060	2020	2060	2020	2060
Electrical Power	mill US$	29	31	30	34	21	28	2	2	23	30
Man power and Other O & M Cost	mill US$	98	154	106	162	145	193	136	184	150	198
Total O & M Cost	mill US$	127	185	136	196	166	221	138	186	173	228

Source : The Study Team's Estimate

III.3 Annual Distribution of Costs

In order to calculate the B/C ratio and IRR, annual costs of the project during the project life have to be estimated based on the costs presented in the previous several Tables and other information.

(1) Project Costs of Phase I of Construction

In the Final Report of the ECE Study, annual project costs of Phase I construction of all alternatives are presented. However, no definition is given of the calendar year schedules for the construction work. Therefore the Study Team fixes the schedule on supposition that the Phase I of construction with the canal opening for traffic in the year 2020 be completed in the year 2019.

(2) Project Costs of Phase II of Construction

In the case of the high-Rise Lock Alternatives, two cases of calendar year schedules for work in Phase II of construction are presented depending on supposition on rainfall: Average year rainfall case and Dry year rainfall case. The former case is supposed in the ECE Report, while the latter case is added to assure the water supply for the lockage operation needed to accommodate the traffic volume in any Dry year between 2020 through 2060. Water management facilities such as dams and pump stations have to be constructed enough earlier in the Dry year rainfall case than the Average year rainfall case. The annual project costs of the two cases are introduced based on the following preconditions of the opening years of those water mamagement facilities:

Opening year of operation	CASE (I) 150,000 DWT		CASE (II) 200,000 DWT	
	Average Year	Dry Year	Average Year	Dry Year
2020		Indio Dam (173) Ciri Dam (28)	Indio Dam (237)	Indio Dam (237) Trinidad Dam(93)
2029				Pump St.I (117)
2034		Pump St.I (117)		
2049				Pump St. II (32)
2052		Pump St. II (32)	Trinidad Dam(93)	
2057	Indio Dam (173) Ciri Dam (28)			
2058			Pump St.I (117)	

( ) : Construction cost (mil. US$)

Source : ECE Study Final Report (S-39, Summary Table)

In the Dry year rainfall case, pump station I and pump station II for the 150,000 DWT case and pump station II for the 200,000 DWT case are additionally needed to be constructed compared with the Average year rainfall case. Phase II of construction for the Sea Level Canal is assumed to take five years and to be completed in the year 2059.

(3) Operation, Maintenance and Management Costs

The costs are assumed to begin in the year 2020 and remain constant until 2059, and additional costs are assumed to begin in the year 2060 and remain constant until the end of the project life. These costs were estimated based on the assumption that the cost items are the same as these of the present canal of PCC.

(4) Annual Distribution

Annual economic costs of the project (project costs and operation, maintenance and management costs) by the alternatives are shown in Table III-3-1 through III-3-7.

Table III-3-1

Economic Project Cost Distribution by Year

150,000 DWT Case Average Year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL						0.00	0.00	208.86	1,092.34	825.09	1,003.41	945.79	1,165.07	712.61	279.21	0.00	0.00	0.00	0.00	0.00
II INDIRECT COSTS TOTAL						115.96	115.96	109.58	142.08	115.36	133.19	127.43	149.35	104.11	60.77	0.00	0.00	0.00	0.00	0.00
III O&M COST																				
(A) Electrical power																29.00	29.00	29.00	29.00	29.00
(B) Man power and Other O&M Costs																98.00	98.00	98.00	98.00	98.00
Total O&M Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00	127.00	127.00	127.00	127.00
ANNUAL DISTRIBUTION	0.00	0.00	0.00	0.00	0.00	115.96	115.96	318.44	1,234.42	940.45	1,136.60	1,073.22	1,314.42	816.72	339.98	127.00	127.00	127.00	127.00	127.00

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS TOTAL																						
II INDIRECT COSTS TOTAL																						
III O&M COST																						
(A) Electrical power	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
(B) Man power and Other O&M Costs	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00
Total O&M Costs	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00
ANNUAL DISTRIBUTION	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS TOTAL						86.55	236.63	236.63	236.63	236.63				
II INDIRECT COSTS TOTAL						15.61	39.32	39.32	39.32	39.32				
III O&M COST														
(A) Electrical power	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	31.00
(B) Man power and Other O&M Costs	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	154.00
Total O&M Costs	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	185.00
ANNUAL DISTRIBUTION	127.00	127.00	127.00	127.00	127.00	229.16	402.95	402.95	402.95	402.95	127.00	127.00	127.00	185.00

Table III-3-2

Economic Project Cost Distribution by Year

150,000 DWT Case **Dry Year**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL						0.00	0.00	208.86	1,092.34	825.09	1,018.84	995.87	1,215.15	762.69	329.29					
II INDIRECT COSTS TOTAL						115.96	115.96	109.58	142.08	115.36	135.62	135.32	157.24	112.00	68.66					
III O&M COST																				
(A) Electrical power																29.00	29.00	29.00	29.00	29.00
(B) Man power and Other O&M Costs																98.00	98.00	98.00	98.00	98.00
Total O&M Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00	127.00	127.00	127.00	127.00
ANNUAL DISTRIBUTION	0.00	0.00	0.00	0.00	0.00	115.96	115.96	318.44	1,234.42	940.45	1,154.46	1,131.19	1,372.39	874.69	397.95	127.00	127.00	127.00	127.00	127.00

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS TOTAL					11.47	28.72	28.72	28.72	28.72													
II INDIRECT COSTS TOTAL					1.81	4.52	4.52	4.52	4.52													
III O&M COST																						
(A) Electrical power	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
(B) Man power and Other O&M Costs	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00
Total O&M Costs	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00
ANNUAL DISTRIBUTION	127.00	127.00	127.00	127.00	140.28	160.24	160.24	160.24	160.24	127.00	127.00	127.00	127.00	127.00	131.52	127.00	127.00	127.00	127.00	127.00	127.00	127.00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS TOTAL				16.98	16.98	59.66	193.61	193.61	193.61	193.61				
II INDIRECT COSTS TOTAL				2.67	2.67	9.40	30.41	30.41	30.41	30.41				
III O&M COST														
(A) Electrical power	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	31.00
(B) Man power and Other O&M Costs	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00	154.00
Total O&M Costs	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	127.00	185.00
ANNUAL DISTRIBUTION	127.00	127.00	127.00	146.65	146.55	196.06	351.02	351.02	351.02	351.02	127.00	127.00	127.00	185.00

Table III-3-3

Economic Project Cost Distribution by Year

200,000 DWT Case Average Year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL							167 09	1,598 36	769 02	1,028 34	962 79	1,066 31	984 82	596 94	64 46					
II INDIRECT COSTS TOTAL					122 19	122 19	114 03	195 35	112 42	138 35	131 80	142 15	134 00	95 21	24 59					
III O&M COST																				
(A) Electrical power																30 00	30 00	30 00	30 00	30 00
(B) Man power and Other O&M Costs																106 00	106 00	106 00	106 00	106 00
Total O&M Costs	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	136 00	136 00	136 00	136 00	136 00
ANNUAL DISTRIBUTION	0 00	0 00	0 00	0 00	122 19	122 19	281 12	1,793 71	881 44	1,166 69	1,094 59	1,208 46	1,118 82	692 15	89 05	136 00	136 00	136 00	136 00	136 00

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS TOTAL																						
II INDIRECT COSTS TOTAL																						
III O&M COST																						
(A) Electrical power	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00
(B) Man power and Other O&M Costs	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00
Total O&M Costs	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00
ANNUAL DISTRIBUTION	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS TOTAL	83 05	23 06	23 06	23 06	23 06		209 30	238 02	238 02	238 02	28 72			
II INDIRECT COSTS TOTAL	13 22	3 67	3 67	3 67	3 67		33 32	37 90	37 90	37 90	4 57			
III O&M COST														
(A) Electrical power	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	30 00	34 00
(B) Man power and Other O&M Costs	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	106 00	162 00
Total O&M Costs	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	136 00	196 00
ANNUAL DISTRIBUTION	232 27	162 73	162 73	162 73	162 73	136 00	378 62	411 92	411 92	411 92	169 29	136 00	136 00	196 00

Table III-3-4

Economic Project Cost Distribution by Year

200,000 DWT Case Dry Year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL							167.09	1,598.36	769.02	1,028.34	969.89	1,089.37	1,007.88	620.00	87.52					11.46
II INDIRECT COSTS TOTAL					122.19	122.19	114.03	195.35	112.42	138.35	132.92	145.78	137.63	98.84	28.22					1.81
III O&M COST																				
(A) Electrical power																30.00	30.00	30.00	30.00	30.00
(B) Man power and Other O&M Costs																106.00	106.00	106.00	106.00	106.00
Total O&M Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	136.00	136.00	136.00	136.00	136.00
ANNUAL DISTRIBUTION	0.00	0.00	0.00	0.00	122.19	122.19	281.12	1,793.71	881.44	1,166.69	1,102.81	1,235.15	1,145.51	718.84	115.74	136.00	136.00	136.00	136.00	149.27

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS TOTAL	28.72	28.72	28.72	28.72																		
II INDIRECT COSTS TOTAL	4.52	4.52	4.52	4.52																		
III O&M COST																						
(A) Electrical power	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
(B) Man power and Other O&M Costs	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00
Total O&M Costs	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00
ANNUAL DISTRIBUTION	169.24	169.24	169.24	169.24	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS TOTAL	16.98	16.98	0.00	0.00	0.00	64.49	209.30	209.30	209.30	209.30	0.00			
II INDIRECT COSTS TOTAL	2.67	2.67	0.00	0.00	0.00	10.16	32.96	33.32	33.32	33.32	0.00			
III O&M COST														
(A) Electrical power	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	34.00
(B) Man power and Other O&M Costs	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	106.00	162.00
Total O&M Costs	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	196.00
ANNUAL DISTRIBUTION	155.65	155.65	136.00	136.00	136.00	210.65	378.26	378.62	378.62	378.62	136.00	136.00	136.00	196.00

Table III-3-5

Economic Project Cost Distribution by Year

250,000 DWT Case (a)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL	0.00	0.00	0.00	225.60	2,749.27	789.42	763.35	780.21	780.21	980.14	836.53	824.36	951.86	1,021.98	959.22	0.00				
II INDIRECT COSTS TOTAL	72.14	72.14	69.48	69.15	304.11	108.13	105.53	107.21	107.21	127.20	112.84	111.62	124.36	131.37	125.09	0.00				
III O&M COST																				
(A) Electrical power																21.00	21.00	21.00	21.00	21.00
(B) Man power and Other O&M Costs																145.00	145.00	145.00	145.00	145.00
Total O&M Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	166.00	166.00	166.00	166.00	166.00
ANNUAL DISTRIBUTION	72.14	72.14	69.48	294.75	3,053.38	897.55	868.88	887.42	887.42	1,107.34	949.37	935.98	1,076.22	1,153.35	1,084.31	166.00	166.00	166.00	166.00	166.00

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS TOTAL																						
II INDIRECT COSTS TOTAL																						
III O&M COST																						
(A) Electrical power	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
(B) Man power and Other O&M Costs	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00
Total O&M Costs	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00
ANNUAL DISTRIBUTION	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS TOTAL									66.00	355.21	355.21	355.21	355.21	
II INDIRECT COSTS TOTAL									17.12	50.49	50.49	50.49	50.49	
III O&M COST														
(A) Electrical power	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	28.00
(B) Man power and Other O&M Costs	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	193.00
Total O&M Costs	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	221.00
ANNUAL DISTRIBUTION	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	249.12	571.70	571.70	571.70	571.70	221.00

Table III-3-6

Economic Project Cost Distribution by Year

250,000 DWT Case (b)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL	0.00	0.00	0.00	225.60	3,657.02	796.47	954.39	965.81	927.90	873.67	623.43	606.47	711.63	803.00	867.53	0.00				
II INDIRECT COSTS TOTAL	68.85	68.85	65.91	66.46	293.21	107.67	122.94	124.09	120.30	114.87	89.85	88.15	98.66	107.84	114.26	0.00				
III O&M COST																				
(A) Electrical power																2.00	2.00	2.00	2.00	2.00
(B) Man power and Other O&M Costs																136.00	136.00	136.00	136.00	136.00
Total O&M Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	138.00	138.00	138.00	138.00	138.00
ANNUAL DISTRIBUTION	68.85	68.85	65.91	292.06	3,950.23	904.14	1,077.33	1,089.90	1,048.20	988.54	713.28	694.62	810.29	910.84	981.79	138.00	138.00	138.00	138.00	138.00

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS TOTAL																						
II INDIRECT COSTS TOTAL																						
III O&M COST																						
(A) Electrical power	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
(B) Man power and Other O&M Costs	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00
Total O&M Costs	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00
ANNUAL DISTRIBUTION	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS TOTAL									38.00	150.26	169.35	169.35	169.35	
II INDIRECT COSTS TOTAL									7.73	22.78	22.78	22.78	22.78	
III O&M COST														
(A) Electrical power	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
(B) Man power and Other O&M Costs	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	184.00
Total O&M Costs	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	186.00
ANNUAL DISTRIBUTION	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	183.73	311.04	330.13	330.13	330.13	186.00

Table III-3-7

Economic Project Cost Distribution by Year

250,000 DWT Case (c)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS																				
TOTAL	0.00	0.00	0.00	229.77	2,811.98	810.76	784.69	1,170.34	920.49	920.49	845.66	827.37	955.45	1,072.35	918.14	0.00				
II INDIRECT COSTS																				
TOTAL	74.86	74.86	72.42	71.76	314.38	112.30	109.68	148.56	123.52	119.81	115.13	113.91	126.72	138.35	122.67	0.00				
III O&M COST																				
(A) Electrical power																23.00	23.00	23.00	23.00	23.00
(B) Man power and Other O&M Costs																150.00	150.00	150.00	150.00	150.00
Total O&M Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	173.00	173.00	173.00	173.00	173.00
ANNUAL DISTRIBUTION	74.86	74.86	72.42	301.53	3,126.36	923.06	894.37	1,318.90	1,044.01	1,040.30	960.79	941.28	1,082.17	1,210.70	1,040.81	173.00	173.00	173.00	173.00	173.00

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00
	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
									65.00	355.21	355.21	355.21	355.21	
									17.12	50.49	50.49	50.49	50.49	
	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	30.00
	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	198.00
	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	228.00
	173.00	173.00	173.00	173.00	173.00	173.00	173.00	173.00	255.12	578.70	578.70	578.70	578.70	228.00

IV. Comparison of Costs and Benefits

IV. Comparison of Costs and Benefits

In this chapter, the economic benefits estimated in Chapter II and the economic costs estimated in Chapter III are evaluated by using a Cost–Benefit Ratio that is often used as an efficiency index in project evaluation.

IV.1 Time Series of Cost–Benefits

Both costs and benefits occur in the long run when a big infrastructure project is executed. In the alternative canal projects, the 110 years from circa the year 2010 to 2120 is taken as the evaluation period.

Construction will be started about 10 years before the year 2020 for Phase I. Facilities constructed in Phase II will consist of dams, pump stations and crossing bridges mainly for developing available water resource. Each component will be completed in about 5 years in principle so as not to be late at the time when it is necessary. Operation, maintenance and management costs will be incurred during the 100 years of canal operation from the year 2020 to 2120. Direct benefits will be produced in the same period, growing in these years at the increasing rate of the WEFA's traffic projection until demand reaches the capacity of the new alternatives. The OCCE report provides the capacity of the 150,000 DWT canal as 34,600 vessels. Direct benefits in this case grow up to the year 2110 and are assumed to be constant at the level in 2110 for years to the year 2120. Time series of direct benefits are specified in the same way for other alternatives.

IV.2 Total Economic Costs and Total Economic Benefits

The total value and yearly value of economic benefits and economic costs for alternative canals are shown in Tables IV-2-1 and IV-2-2.

The benefits in the initial year 2020 are estimated to be around 500 million US dollars, increasing gradually to a little over 1,000 million dollars in the year 2060. The difference in benefits between the 150,000 DWT canal and 250,000 DWT canal is relatively small. The benefits of the 250,000 DWT canal are only 1.08 times those of the 150,000 DWT canal in the year 2020, and 1.05 times in 2060. On the other hand, the economic costs of the alternative canals vary more greatly than the benefits, from 24,977 million dollars for the High-Rise Lock Canal (150,000 DWT, Average Years case) to 36,639 million dollars for the Sea Level Canal (Case (c)).

Yearly construction costs for Phase I are incurred over 10-15 years before 2020, varying from 1,234 to 3,950 million dollars at the peak. Phase II construction scheduling is affected by the availability of water resources. If as an extreme case Dry year is assumed to continue, Phase II construction has to be completed earlier than the schedule required in case that Average year is assumed to continue. Total cost estimations based on the Dry year assumption are made in the case of High-Rise Lock Canals (150,000 DWT, 200,000 DWT), as well as all other cases based on the Average year assumption. Accordingly, about 1,400 million US dollars of Phase II costs are concentrated around the year 2060 in Average year cases, since a rich availability of water makes possible late scheduling to save an interest cost of investment. On the other hand, they are partly completed in earlier years in Dry year cases to deal with a lack of water resources.

A very rough sketch of the distribution of costs and benefits over the project life is shown in Fig.IV-2-1, Fig.IV-2-2, and Fig.IV-2-3.

Table IV-2-1 Benefit Distribution by Year (mil. US$)

YEAR	150.000 DWT	200.000 DWT	250.000 DWT
2020	473	496	516
2021	482	506	526
2022	492	516	536
2023	502	526	546
2024	513	537	557
2025	523	547	568
2026	534	558	579
2027	545	569	590
2028	556	581	602
2029	567	592	613
2030	579	604	625
2031	591	616	638
2032	603	628	650
2033	615	641	663
2034	627	653	676
2035	640	666	689
2036	653	679	702
2037	667	693	716
2038	680	707	730
2039	694	721	744
2040	708	735	758
2041	723	749	773
2042	738	764	788
2043	753	779	804
2044	768	795	819
2045	784	811	835
2046	800	827	852
2047	816	843	868
2048	833	860	885
2049	850	877	902
2050	867	894	920
2051	885	912	938
2052	903	930	956
2053	921	948	975
2054	940	967	994
2055	959	986	1.013
2056	979	1.006	1.033
2057	999	1.026	1.053
2058	1.019	1.046	1.074
2059	1.040	1.067	1.094
2060	1.061	1.088	1.116
2061 TO 2120	122.050	125.324	131.742
TOTAL	151.928	156.271	163.656

Table IV-2-2 Economic Cost Distribution by Year (mil. US$)

Year	Case 150.000DWT (Ave. Year)	150.000DWT (Dry Year)	200.000DWT (Ave. Year)	200.000DWT (Dry Year)	250.000DWT (a)	250.000DWT (b)	250.000DWT (c)
2005	0	0	0	0	72	69	75
2006	0	0	0	0	72	69	75
2007	0	0	0	0	69	66	72
2008	0	0	0	0	295	292	302
2009	0	0	122	122	3053	3950	3126
2010	116	116	122	122	898	904	923
2011	116	116	281	281	869	1077	894
2012	318	318	1794	1794	887	1090	1319
2013	1234	1234	881	881	887	1048	1044
2014	940	940	1167	1167	1107	989	1040
2015	1137	1154	1095	1103	949	713	961
2016	1073	1131	1208	1235	936	695	941
2017	1314	1372	1119	1146	1076	810	1082
2018	817	875	692	719	1153	911	1211
2019	340	398	89	116	1084	982	1041
2020	127	127	136	136	166	138	173
2021	127	127	136	136	166	138	173
2022	127	127	136	136	166	138	173
2023	127	127	136	136	166	138	173
2024	127	127	136	149	166	138	173
2025	127	127	136	169	166	138	173
2026	127	127	136	169	166	138	173
2027	127	127	136	169	166	138	173
2028	127	127	136	169	166	138	173
2029	127	140	136	136	166	138	173
2030	127	160	136	136	166	138	173
2031	127	160	136	136	166	138	173
2032	127	160	136	136	166	138	173
2033	127	160	136	136	166	138	173
2034	127	127	136	136	166	138	173
2035	127	127	136	136	166	138	173
2036	127	127	136	136	166	138	173
2037	127	127	136	136	166	138	173
2038	127	127	136	136	166	138	173
2039	127	127	136	136	166	138	173
2040	127	127	136	136	166	138	173
2041	127	127	136	136	166	138	173
2042	127	127	136	136	166	138	173
2043	127	127	136	136	166	138	173
2044	127	127	136	136	166	138	173
2045	127	127	136	136	166	138	173
2046	127	127	136	136	166	138	173
2047	127	127	232	156	166	138	173
2048	127	127	163	156	166	138	173
2049	127	127	163	136	166	138	173
2050	127	147	163	136	166	138	173
2051	127	147	163	136	166	138	173
2052	229	196	136	211	166	138	173
2053	403	351	379	378	166	138	173
2054	403	351	412	379	166	138	173
2055	403	351	412	379	249	184	255
2056	403	351	412	379	572	311	579
2057	127	127	169	136	572	330	579
2058	127	127	136	136	572	330	579
2059	127	127	136	136	572	330	579
2060	185	185	196	196	221	186	228
2061 TO 2120	11.100	11.100	11.760	11.760	13.260	11.160	13.680
TOTAL	24.977	25.172	27.273	27.312	35.237	31.326	36.639

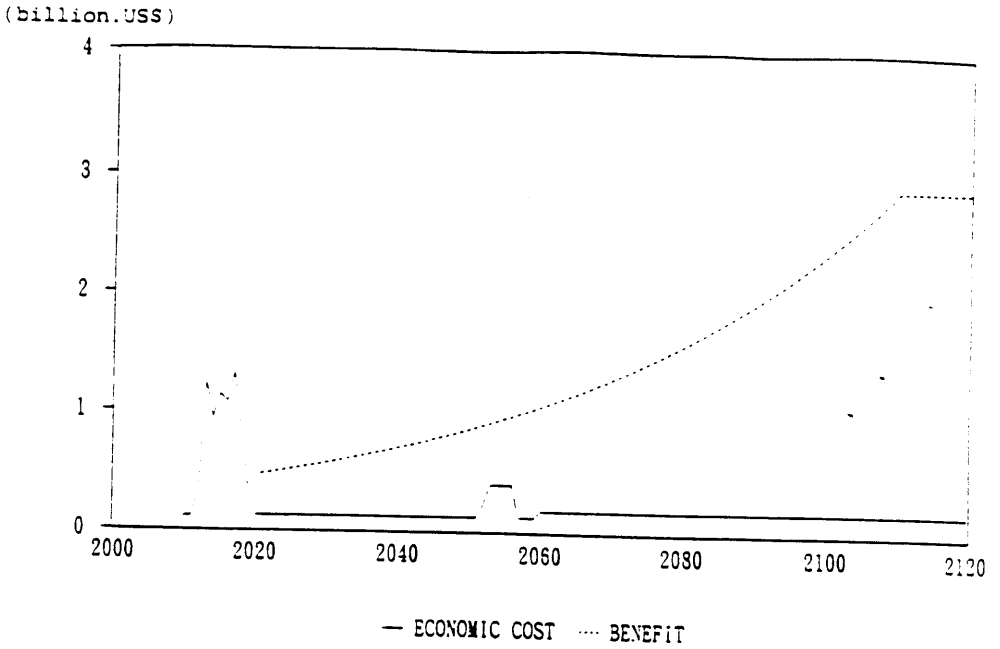


Fig.IV-2-1(a) Time Series of Cost-Benefit
(150,000 DWT canal, Average year case)

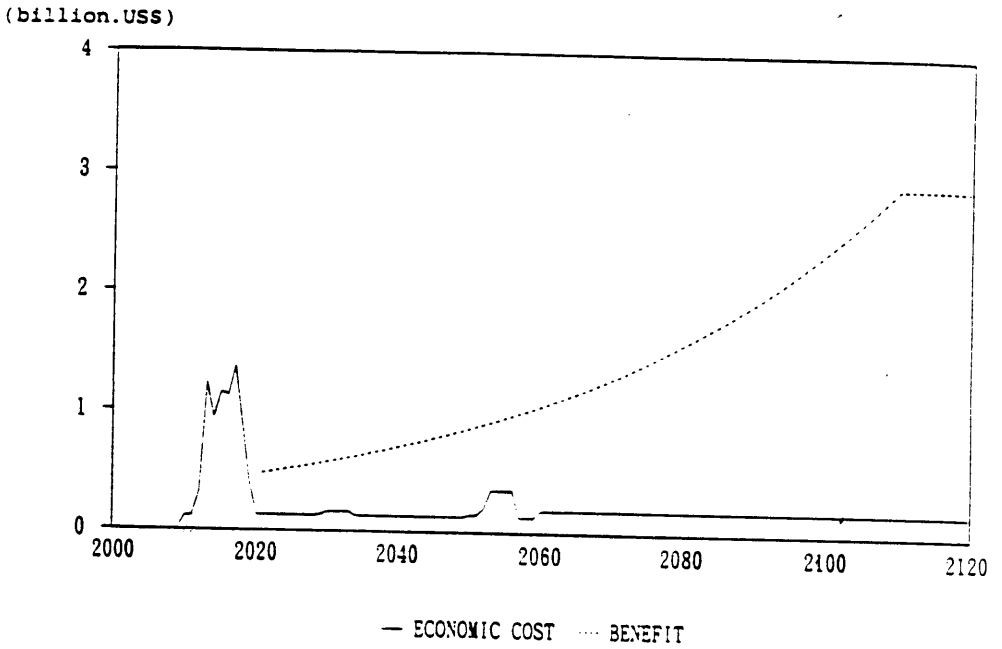


Fig.IV-2-1(b) Time Series of Cost-Benefit
(150,000 DWT canal, Dry year case)

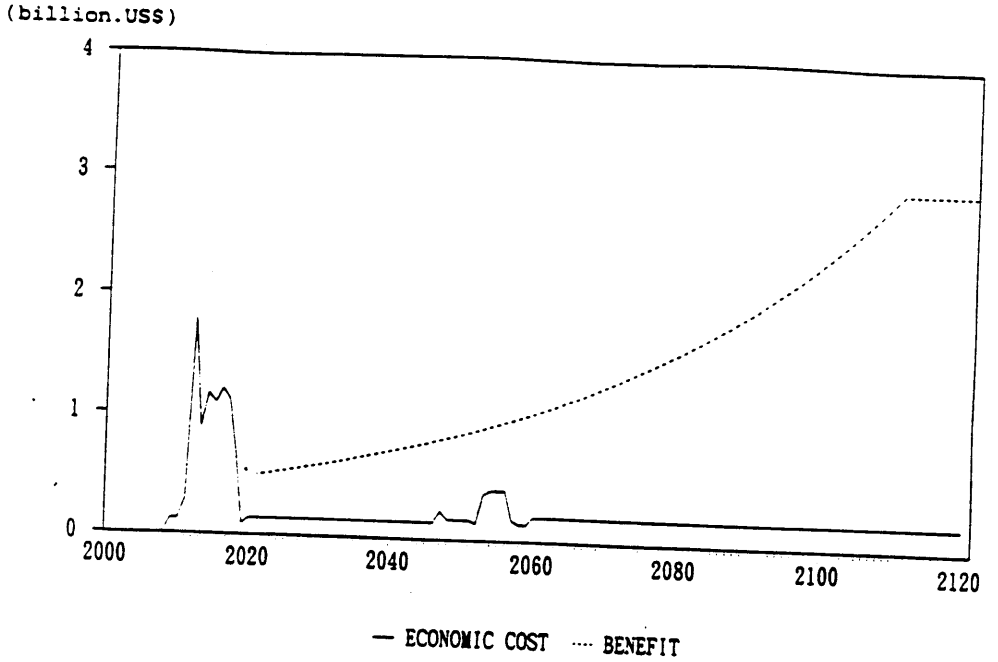


Fig.IV-2-2(a) Time Series of Cost-Benefit
(200,000 DWT canal, Average year case)

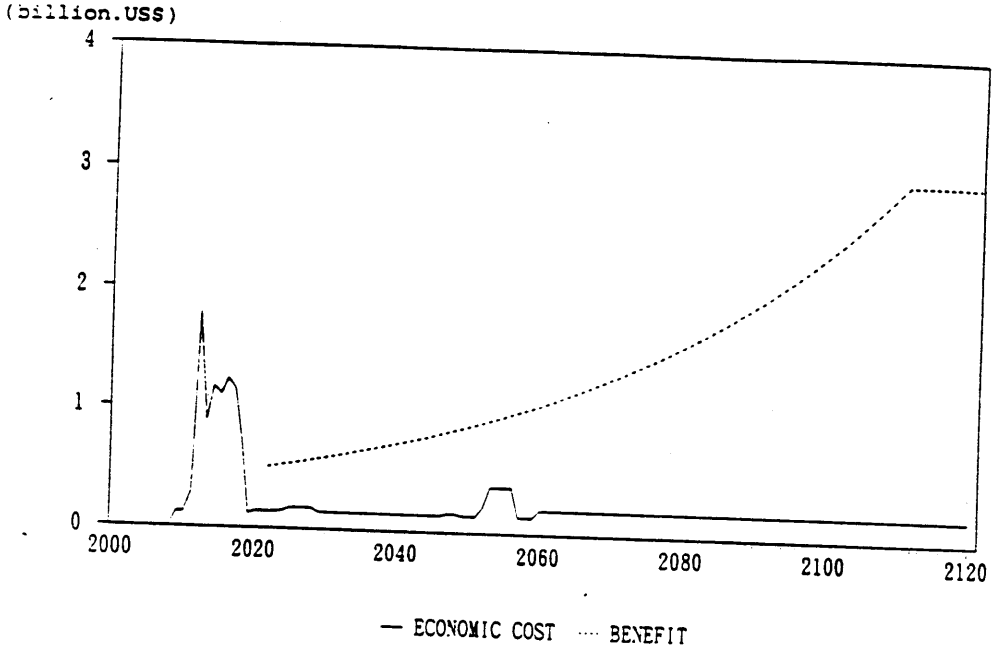


Fig.IV-2-2(b) Time Series of Cost-Benefit
(200,000 DWT canal, Dry year case)

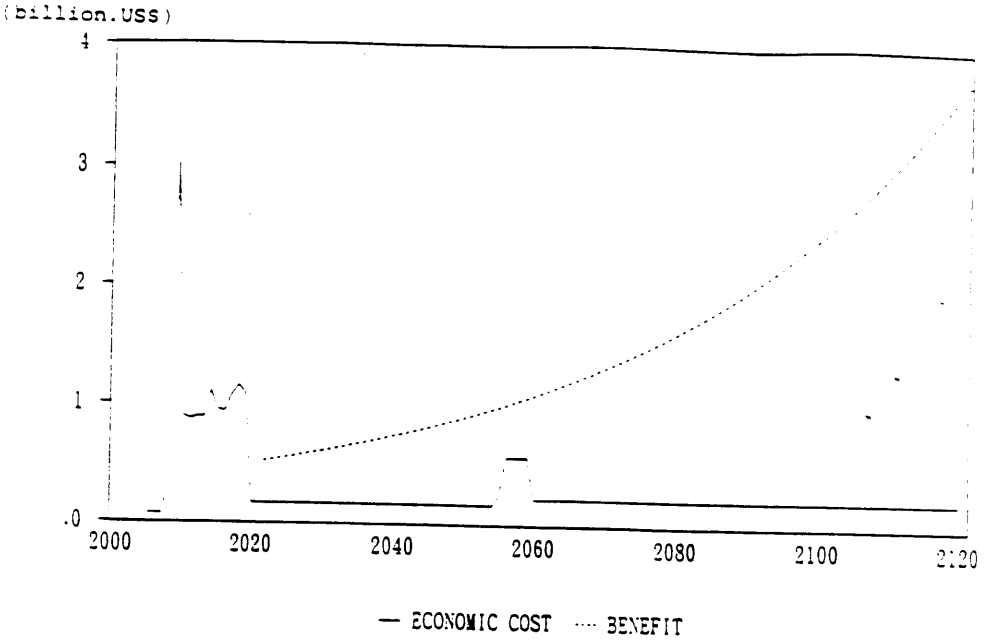


Fig.IV-2-3(a) Time Series of Cost-Benefit
(250,000 DWT (a) canal)

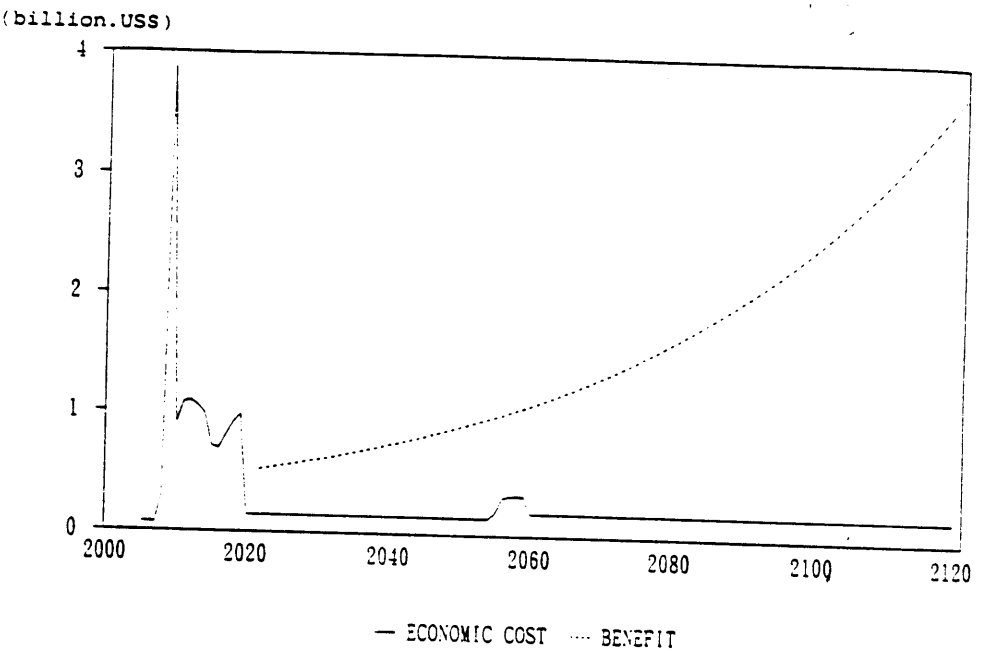


Fig.IV-2-3(b) Time Series of Cost-Benefit
(250,000 DWT (b) canal)

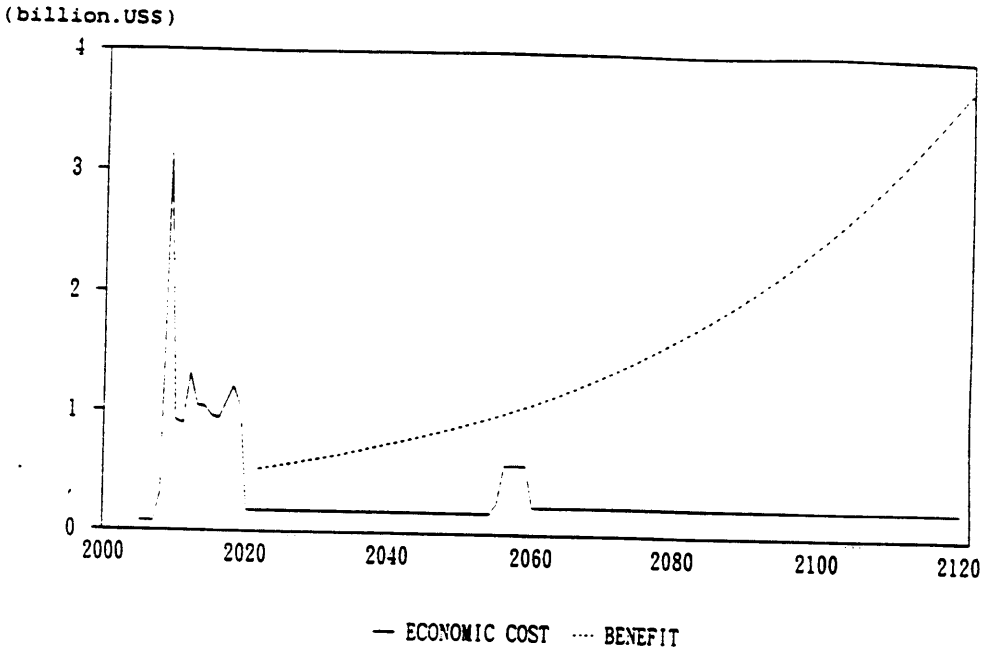


Fig.IV-2-3(c) Time Series of Cost-Benefit
(250,000 DWT (c) canal)

IV.3 Present Value of Alternative Canals

Economic costs and benefits distributed over a period of years have to be converted to values for a base year (present value) before being summed up. We use the year 2010 as the base year at which the economic values of other years are evaluated. Present goods have to be indifferently repaid by future goods increased at a Social Discount Rate per year. This shows that present goods have more value than goods in the next year by the Social Discount Rate. Accordingly, benefits and costs after the year 2010 have to be discounted to convert them to present values. The conversion is made by using the following equation.

$$Ep = Et / (1.0 + r)^t$$

"Ep" is the present value of benefits or costs at the "t th" year (Et). In the year 2010 "t" is set at 0. "r" is the Social Discount Rate, which was discussed in Chapter I and was set at 5 percent as the most reasonable value.

The comparison of costs and benefits is made based on the total present value of economic costs and economic benefits. The Cost-Benefit Ratio (CBR), which is defined in the equation below, determines the economic efficiency of the project.

$$CBR = [\sum_{t=M}^{N} bt/(1.0+r)^t] / [\sum_{t=M}^{N} ct/(1.0+r)^t]$$

"bt" and "ct" are benefits and costs at "t", and "M" and "N" are the first year and last year of the evaluation. In this study, "N" is 110 (2120) for all alternatives, but "M" varies from -5 (2005) to 0 (2010). When construction begins before the base year (2010), M and in some cases t become negative numbers. This shows that costs before the year 2010 are amplified reflecting interest on investment costs.

Table IV-3-1 shows the present value of benefits, and Table IV-3-2 shows the present value of costs. These are calculated for different social discount rates (3%, 4%, 5%, 6%, 7%) to consider sensitivity of the rates against the present values and to estimate the internal rate of return of the alternative canals.

Table IV-3-1(1) Present Value of Benefits (mil. US$)

base year : 2010

social discount rate : 3%

Year	Case 150.000DWT	200.000DWT	250.000DWT
2020	352	369	384
2021	349	366	380
2022	345	362	376
2023	342	358	372
2024	339	355	368
2025	336	351	364
2026	333	348	361
2027	330	344	357
2028	326	341	353
2029	323	338	350
2030	320	334	346
2031	317	331	343
2032	314	328	339
2033	312	325	336
2034	309	321	332
2035	306	318	329
2036	303	315	326
2037	300	312	322
2038	297	309	319
2039	295	306	316
2040	292	303	312
2041	289	300	309
2042	286	297	306
2043	284	294	303
2044	281	291	300
2045	278	288	297
2046	276	285	294
2047	273	282	291
2048	271	280	288
2049	268	277	285
2050	266	274	282
2051	263	271	279
2052	261	269	276
2053	258	266	273
2054	256	263	271
2055	254	261	268
2056	251	258	265
2057	249	256	262
2058	247	253	260
2059	244	251	257
2060	242	248	255
2061 TO 2120	10.927	11.213	11.634
TOTAL	22.965	23.711	24.540

Table IV-3-1(2) Present Value of Benefits (mil. US$)

base year : 2010

social discount rate : 4%

Year	Case 150.000DWT	200.000DWT	250.000DWT
2020	319	335	348
2021	313	329	341
2022	307	322	335
2023	302	316	328
2024	296	310	322
2025	290	304	315
2026	285	298	309
2027	280	292	303
2028	274	287	297
2029	269	281	291
2030	264	276	285
2031	259	270	280
2032	254	265	274
2033	249	260	269
2034	245	255	264
2035	240	250	258
2036	236	245	253
2037	231	240	248
2038	227	236	243
2039	223	231	239
2040	218	227	234
2041	214	222	229
2042	210	218	225
2043	206	214	220
2044	202	209	216
2045	199	205	212
2046	195	201	208
2047	191	198	203
2048	188	194	199
2049	184	190	195
2050	181	186	192
2051	177	183	188
2052	174	179	184
2053	171	176	181
2054	167	172	177
2055	164	169	173
2056	161	166	170
2057	158	162	167
2058	155	159	163
2059	152	156	160
2060	149	153	157
2061 TO 2120	5.245	5.381	5.566
TOTAL	14.427	14.922	15.422

Table IV-3-1(3) Present Value of Benefits (mil. US$)

base year : 2010

social discount rate : 5%

Year	Case 150.000DWT	200.000DWT	250.000DWT
2020	290	305	317
2021	282	296	307
2022	274	287	298
2023	266	279	290
2024	259	271	281
2025	252	263	273
2026	245	256	265
2027	238	248	257
2028	231	241	250
2029	224	234	243
2030	218	228	236
2031	212	221	229
2032	206	215	222
2033	200	209	216
2034	195	203	209
2035	189	197	203
2036	184	191	197
2037	179	186	192
2038	174	180	186
2039	169	175	181
2040	164	170	175
2041	159	165	170
2042	155	160	165
2043	150	156	161
2044	146	151	156
2045	142	147	151
2046	138	143	147
2047	134	139	143
2048	130	135	139
2049	127	131	135
2050	123	127	131
2051	120	123	127
2052	116	120	123
2053	113	116	120
2054	110	113	116
2055	107	110	113
2056	104	107	109
2057	101	104	106
2058	98	101	103
2059	95	98	100
2060	93	95	97
2061 TO 2120	2.600	2.667	2.752
TOTAL	9.710	10.060	10.393

Table IV-3-1(4) Present Value of Benefits (mil. US$)

base year : 2010

social discount rate : 6%

Year	Case 150.000DWT	200.000DWT	250.000DWT
2020	264	277	288
2021	254	267	277
2022	245	256	266
2023	236	247	256
2024	227	237	246
2025	218	228	237
2026	210	220	228
2027	202	211	219
2028	195	203	211
2029	187	196	203
2030	180	188	195
2031	174	181	188
2032	167	174	180
2033	161	168	173
2034	155	161	167
2035	149	155	160
2036	144	149	154
2037	138	144	148
2038	133	138	143
2039	128	133	137
2040	123	128	132
2041	119	123	127
2042	114	118	122
2043	110	114	117
2044	106	110	113
2045	102	105	109
2046	98	101	105
2047	94	98	101
2048	91	94	97
2049	88	90	93
2050	84	87	89
2051	81	84	86
2052	78	80	83
2053	75	77	80
2054	72	74	77
2055	70	72	74
2056	67	69	71
2057	65	66	68
2058	62	64	65
2059	60	61	63
2060	58	59	61
2061 TO 2120	1.327	1.361	1.402
TOTAL	6.912	7.173	7.411

Table IV-3-1(5) Present Value of Benefits (mil. US$)

base year : 2010

social discount rate : 7%

Year	Case 150.000DWT	200.000DWT	250.000DWT
2020	240	252	262
2021	229	240	250
2022	219	229	238
2023	208	218	227
2024	199	208	216
2025	190	198	206
2026	181	189	196
2027	172	180	187
2028	164	172	178
2029	157	164	170
2030	150	156	162
2031	143	149	154
2032	136	142	147
2033	130	135	140
2034	124	129	133
2035	118	123	127
2036	112	117	121
2037	107	111	115
2038	102	106	110
2039	98	101	105
2040	93	97	100
2041	89	92	95
2042	85	88	90
2043	81	84	86
2044	77	80	82
2045	73	76	78
2046	70	72	75
2047	67	69	71
2048	64	66	68
2049	61	63	64
2050	58	60	61
2051	55	57	59
2052	53	54	56
2053	50	52	53
2054	48	49	51
2055	46	47	48
2056	44	45	46
2057	42	43	44
2058	40	41	42
2059	38	39	40
2060	36	37	38
2061 TO 2120	696	714	734
TOTAL	5.141	5.342	5.522

Table IV-3-2(1) Present Value of Costs (mil. US$)

base year : 2010

social discount rate : 3%

Year \ Case	150,000DWT (Ave. Year)	150,000DWT (Dry Year)	200,000DWT (Ave. Year)	200,000DWT (Dry Year)	250,000DWT (a)	250,000DWT (b)	250,000DWT (c)
2005	0	0	0	0	84	80	87
2006	0	0	0	0	81	77	84
2007	0	0	0	0	76	72	79
2008	0	0	0	0	313	310	320
2009	0	0	126	126	3,145	4,069	3,220
2010	116	116	122	122	898	904	923
2011	113	113	273	273	844	1,046	868
2012	300	300	1,691	1,691	836	1,027	1,243
2013	1,130	1,130	807	807	812	959	955
2014	836	836	1,037	1,037	984	878	924
2015	980	996	944	951	819	615	829
2016	899	947	1,012	1,034	784	582	788
2017	1,069	1,116	910	931	875	659	880
2018	645	690	546	567	910	719	956
2019	261	305	68	89	831	752	798
2020	94	94	101	101	124	103	129
2021	92	92	98	98	120	100	125
2022	89	89	95	95	116	97	121
2023	86	86	93	93	113	94	118
2024	84	84	90	99	110	91	114
2025	82	82	87	109	107	89	111
2026	79	79	85	105	103	86	108
2027	77	77	82	102	100	83	105
2028	75	75	80	99	98	81	102
2029	72	80	78	78	95	79	99
2030	70	89	75	75	92	76	96
2031	68	86	73	73	89	74	93
2032	66	84	71	71	87	72	90
2033	64	81	69	69	84	70	88
2034	62	62	67	67	82	68	85
2035	61	61	65	65	79	66	83
2036	59	59	63	63	77	64	80
2037	57	57	61	61	75	62	78
2038	56	56	59	59	73	60	76
2039	54	54	58	58	70	59	73
2040	52	52	56	56	68	57	71
2041	51	51	54	54	66	55	69
2042	49	49	53	53	64	54	67
2043	48	48	51	51	63	52	65
2044	46	46	50	50	61	51	63
2045	45	45	48	48	59	49	61
2046	44	44	47	47	57	48	60
2047	43	43	78	52	56	46	58
2048	41	41	53	51	54	45	56
2049	40	40	51	43	52	44	55
2050	39	45	50	42	51	42	53
2051	38	44	48	40	49	41	51
2052	66	57	39	61	48	40	50
2053	113	98	106	106	47	39	49
2054	110	96	112	103	45	38	47
2055	107	93	109	100	66	49	67
2056	103	90	106	97	147	80	149
2057	32	32	42	34	143	82	144
2058	31	31	33	33	138	80	140
2059	30	30	32	32	134	78	136
2060	42	42	45	45	50	42	52
2061 TO 2120	1,168	1,168	1,237	1,237	1,395	1,174	1,439
TOTAL	10,133	10,359	11,588	11,705	17,098	16,608	17,932

Table IV-3-2(2) Present Value of Costs (mil. US$)

base year : 2010

social discount rate : 4%

Year \ Case	150.000DWT (Ave. Year)	150.000DWT (Dry Year)	200.000DWT (Ave. Year)	200.000DWT (Dry Year)	250.000DWT (a)	250.000DWT (b)	250.000DWT (c)
2005	0	0	0	0	88	84	91
2006	0	0	0	0	84	81	88
2007	0	0	0	0	78	74	81
2008	0	0	0	0	319	316	326
2009	0	0	127	127	3.176	4.108	3.251
2010	116	116	122	122	898	904	923
2011	112	112	270	270	835	1.036	860
2012	294	294	1.658	1.658	820	1.008	1.219
2013	1.097	1.097	784	784	789	932	928
2014	804	804	997	997	947	845	889
2015	934	949	900	906	780	586	790
2016	848	894	955	976	740	549	744
2017	999	1.043	850	870	818	616	822
2018	597	639	506	525	843	666	885
2019	239	280	63	81	762	690	731
2020	86	86	92	92	112	93	117
2021	82	82	88	88	108	90	112
2022	79	79	85	85	104	86	108
2023	76	76	82	82	100	83	104
2024	73	73	79	86	96	80	100
2025	71	71	76	94	92	77	96
2026	68	68	73	90	89	74	92
2027	65	65	70	87	85	71	89
2028	63	63	67	84	82	68	85
2029	60	67	65	65	79	66	82
2030	58	73	62	62	76	63	79
2031	56	70	60	60	73	61	76
2032	54	68	57	57	70	58	73
2033	52	65	55	55	67	56	70
2034	50	50	53	53	65	54	67
2035	48	48	51	51	62	52	65
2036	46	46	49	49	60	50	62
2037	44	44	47	47	58	48	60
2038	42	42	45	45	55	46	58
2039	41	41	44	44	53	44	55
2040	39	39	42	42	51	43	53
2041	38	38	40	40	49	41	51
2042	36	36	39	39	47	39	49
2043	35	35	37	37	45	38	47
2044	33	33	36	36	44	36	46
2045	32	32	34	34	42	35	44
2046	31	31	33	33	40	34	42
2047	30	30	54	36	39	32	41
2048	29	29	37	35	37	31	39
2049	28	28	35	29	36	30	37
2050	26	31	34	28	35	29	36
2051	25	29	33	27	33	28	35
2052	44	38	26	41	32	27	33
2053	75	65	70	70	31	26	32
2054	72	62	73	67	30	25	31
2055	69	60	71	65	43	31	44
2056	66	58	68	62	94	51	95
2057	20	20	27	22	90	52	92
2058	19	19	21	21	87	50	88
2059	19	19	20	20	84	48	85
2060	26	26	28	28	31	26	32
2061 TO 2120	589	589	624	624	704	592	726
TOTAL	8.634	8.850	10.012	10.132	15.285	15.155	16.059

Table IV-3-2(3) Present Value of Costs (mil. US$)

base year : 2010

social discount rate : 5%

Year	Case 150.000DWT (Ave. Year)	150.000DWT (Dry Year)	200.000DWT (Ave. Year)	200.000DWT (Dry Year)	250.000DWT (a)	250.000DWT (b)	250.000DWT (c)
2005	0	0	0	0	92	88	96
2006	0	0	0	0	88	84	91
2007	0	0	0	0	80	76	84
2008	0	0	0	0	325	322	332
2009	0	0	128	128	3.206	4.148	3.283
2010	116	116	122	122	898	904	923
2011	110	110	268	268	828	1.026	852
2012	289	289	1.627	1.627	805	989	1.196
2013	1.066	1.066	761	761	767	905	902
2014	774	774	960	960	911	813	856
2015	891	905	858	864	744	559	753
2016	801	844	902	922	698	518	702
2017	934	975	795	814	765	576	769
2018	553	592	468	487	781	616	819
2019	219	257	57	75	699	633	671
2020	78	78	83	83	102	85	106
2021	74	74	80	80	97	81	101
2022	71	71	76	76	92	77	96
2023	67	67	72	72	88	73	92
2024	64	64	69	75	84	70	87
2025	61	61	65	81	80	66	83
2026	58	58	62	78	76	63	79
2027	55	55	59	74	72	60	75
2028	53	53	57	70	69	57	72
2029	50	56	54	54	66	55	68
2030	48	60	51	51	63	52	65
2031	46	58	49	49	60	50	62
2032	43	55	46	46	57	47	59
2033	41	52	44	44	54	45	56
2034	39	39	42	42	51	43	54
2035	38	38	40	40	49	41	51
2036	36	36	38	38	47	39	49
2037	34	34	36	36	44	37	46
2038	32	32	35	35	42	35	44
2039	31	31	33	33	40	34	42
2040	29	29	31	31	38	32	40
2041	28	28	30	30	37	30	38
2042	27	27	29	29	35	29	36
2043	25	25	27	27	33	28	35
2044	24	24	26	26	32	26	33
2045	23	23	25	25	30	25	31
2046	22	22	23	23	29	24	30
2047	21	21	38	26	27	23	28
2048	20	20	25	24	26	22	27
2049	19	19	24	20	25	21	26
2050	18	21	23	19	24	20	25
2051	17	20	22	18	22	19	23
2052	30	25	18	27	21	18	22
2053	49	43	46	46	20	17	21
2054	47	41	48	44	19	16	20
2055	45	39	46	42	28	20	28
2056	43	37	44	40	61	33	61
2057	13	13	17	14	58	33	58
2058	12	12	13	13	55	32	56
2059	12	12	12	12	52	30	53
2060	16	16	17	17	19	16	20
2061 TO 2120	305	305	324	324	365	307	376
TOTAL	7.618	7.823	8.949	9.065	14.075	14.186	14.808

Table IV-3-2(4) Present Value of Costs (mil. US$)

base year : 2010

social discount rate : 6%

Year \ Case	150.000DWT (Ave. Year)	150.000DWT (Dry Year)	200.000DWT (Ave. Year)	200.000DWT (Dry Year)	250.000DWT (a)	250.000DWT (b)	250.000DWT (c)
2005	0	0	0	0	97	92	100
2006	0	0	0	0	91	87	95
2007	0	0	0	0	83	78	86
2008	0	0	0	0	331	328	339
2009	0	0	130	130	3.237	4.187	3.314
2010	116	116	122	122	898	904	923
2011	109	109	265	265	820	1.016	844
2012	283	283	1.596	1.596	790	970	1.174
2013	1.036	1.036	740	740	745	880	877
2014	745	745	924	924	877	783	824
2015	849	863	818	824	709	533	718
2016	757	797	852	871	660	490	664
2017	874	913	744	762	716	539	720
2018	512	549	434	451	724	571	760
2019	201	236	53	69	642	581	616
2020	71	71	76	76	93	77	97
2021	67	67	72	72	87	73	91
2022	63	63	68	68	82	69	86
2023	60	60	64	64	78	65	81
2024	56	56	60	66	73	61	77
2025	53	53	57	71	69	58	72
2026	50	50	54	67	65	54	68
2027	47	47	51	63	62	51	64
2028	44	44	48	59	58	48	61
2029	42	46	45	45	55	46	57
2030	40	50	42	42	52	43	54
2031	37	47	40	40	49	41	51
2032	35	44	38	38	46	38	48
2033	33	42	36	36	43	36	45
2034	31	31	34	34	41	34	43
2035	30	30	32	32	39	32	40
2036	28	28	30	30	36	30	38
2037	26	26	28	28	34	29	36
2038	25	25	27	27	32	27	34
2039	23	23	25	25	31	25	32
2040	22	22	24	24	29	24	30
2041	21	21	22	22	27	23	28
2042	20	20	21	21	26	21	27
2043	19	19	20	20	24	20	25
2044	18	18	19	19	23	19	24
2045	17	17	18	18	22	18	23
2046	16	16	17	17	20	17	21
2047	15	15	27	18	19	16	20
2048	14	14	18	17	18	15	19
2049	13	13	17	14	17	14	18
2050	12	14	16	13	16	13	17
2051	12	13	15	12	15	13	16
2052	20	17	12	18	14	12	15
2053	33	29	31	31	14	11	14
2054	31	27	32	29	13	11	13
2055	29	26	30	28	18	13	19
2056	28	24	28	26	39	21	40
2057	8	8	11	9	37	21	37
2058	8	8	8	8	35	20	35
2059	7	7	8	8	33	19	33
2060	10	10	11	11	12	10	12
2061 TO 2120	162	162	172	172	194	163	200
TOTAL	6.879	7.070	8.176	8.288	13.210	13.493	13.913

Table IV-3-2(5) Present Value of Costs (mil. US$)

base year : 2010

social discount rate : 7%

Year \ Case	150,000DWT (Ave. Year)	150,000DWT (Dry Year)	200,000DWT (Ave. Year)	200,000DWT (Dry Year)	250,000DWT (a)	250,000DWT (b)	250,000DWT (c)
2005	0	0	0	0	101	97	1.5
2006	0	0	0	0	95	90	98
2007	0	0	0	0	85	81	89
2008	0	0	0	0	337	334	345
2009	0	0	131	131	3,267	4,227	3,345
2010	116	116	122	122	898	904	923
2011	108	108	263	263	812	1,007	836
2012	278	278	1,567	1,567	775	952	1,152
2013	1,008	1,008	720	720	724	856	852
2014	717	717	890	890	845	754	794
2015	810	823	780	786	677	509	685
2016	715	754	805	823	624	463	627
2017	819	855	697	713	670	505	674
2018	475	509	403	418	671	530	705
2019	185	216	48	63	590	534	566
2020	65	65	69	69	84	70	88
2021	60	60	65	65	79	66	82
2022	56	56	60	60	74	61	77
2023	53	53	56	56	69	57	72
2024	49	49	53	58	64	54	67
2025	46	46	49	61	60	50	63
2026	43	43	46	57	56	47	59
2027	40	40	43	54	53	44	55
2028	38	38	40	50	49	41	51
2029	35	39	38	38	46	38	48
2030	33	41	35	35	43	36	45
2031	31	39	33	33	40	33	42
2032	29	36	31	31	37	31	39
2033	27	34	29	29	35	29	36
2034	25	25	27	27	33	27	34
2035	23	23	25	25	31	25	32
2036	22	22	23	23	29	24	30
2037	20	20	22	22	27	22	28
2038	19	19	20	20	25	21	26
2039	18	18	19	19	23	19	24
2040	17	17	18	18	22	18	23
2041	16	16	17	17	20	17	21
2042	15	15	16	16	19	16	20
2043	14	14	15	15	18	15	19
2044	13	13	14	14	17	14	17
2045	12	12	13	13	16	13	16
2046	11	11	12	12	15	12	15
2047	10	10	19	13	14	11	14
2048	10	10	12	12	13	11	13
2049	9	9	12	10	12	10	12
2050	8	10	11	9	11	9	12
2051	8	9	10	8	10	9	11
2052	13	11	8	12	10	8	10
2053	22	19	21	21	9	8	9
2054	21	18	21	19	8	7	9
2055	19	17	20	18	12	9	12
2056	18	16	18	17	25	14	26
2057	5	5	7	6	24	14	24
2058	5	5	5	5	22	13	22
2059	5	5	5	5	21	12	21
2060	6	6	7	7	8	6	8
2061 TO 2120	88	88	93	93	105	89	109
TOTAL	6,308	6,486	7,581	7,686	12,557	12,970	13,236

IV.4 Cost-Benefit Ratio and Internal Rate of Return

(1) Results of Calculations

The Cost-Benefit Ratio (CBR) and a rough estimate of the Internal Rate of Return (IRR) for the alternative canals are summarized in Table IV-4-1.

Table IV-4-1 Economic Efficiency of Alternative Canals

(million US$)

Alternatives	C B R						Estimated IRR
	undiscounted	3%	4%	5%	6%	7%	
High-Rise- Lock 150.000DWT (Average)	151,928	22,965	14,427	9,710	6,912	5,141	6.0%
	24,977	10,133	8,634	7,618	6,879	6,308	
	6.08	2.27	1.67	1.27	1.00	0.81	
High-Rise- Lock 150.000DWT (Dry Year)	151,928	22,965	14,427	9,710	6,912	5,141	5.9%
	25,172	10,359	8,850	7,823	7,070	6,486	
	6.04	2.22	1.63	1.24	0.98	0.79	
High-Rise- Lock 200.000DWT (Average)	156,271	23,711	14,922	10,060	7,173	5,342	5.5%
	27,273	11,588	10,012	8,949	8,176	7,581	
	5.73	2.05	1.49	1.12	0.88	0.70	
High-Rise- Lock 200.000DWT (Dry Year)	156,271	23,711	14,922	10,060	7,173	5,342	5.5%
	27,312	11,705	10,132	9,065	8,288	7,686	
	5.72	2.03	1.47	1.11	0.87	0.70	
Sea Level Case(a) (Average)	163,656	24,540	15,422	10,393	7,411	5,522	4.0%
	35,237	17,098	15,285	14,075	13,210	12,557	
	4.64	1.44	1.01	0.74	0.56	0.44	
Sea Level Case(b) (Average)	163,656	24,540	15,422	10,393	7,411	5,522	4.1%
	31,326	16,608	15,155	14,186	13,493	12,970	
	5.22	1.48	1.02	0.73	0.55	0.43	
Sea Level Case(c) (Average)	163,656	24,540	15,422	10,393	7,411	5,522	3.9%
	36,639	17,932	16,059	14,808	13,913	13,236	
	4.47	1.37	0.96	0.70	0.53	0.42	

Upper : Total Present Benefits
Middle : Total Present Costs
Lower : Cost-Benefit Ratio

High-Rise Lock Alternatives all have CBRs over 1.0 (1.11-1.27) at a 5 percent Social Discount Rate. Dry year cases decrease CBR compared with Average year cases because of the increased expense of Phase II construction, although the differences are marginal. The difference in CBR between a 150,000 DWT canal and a 200,000 DWT canal is larger than that between Dry case and Average case. CBRs for the 200,000 DWT canal approach 1.0, reflecting the fact that additional enlargement of maximum draft size does not add many benefits compared to the additional cost. This is because a 150,000 DWT canal would attract almost all route-shifting cargo carried by over-panamax and a 200,000 DWT canal would attract very little more. Sea Level alternatives show relatively low CBRs for the same reason. Their CBRs are 0.68-0.77, where present benefits remain considerably below present economic costs.

Very rough estimates of IRRs are also shown in Table IV-4-1. IRRs for a High-Rise Lock 150,000 DWT canal are 6.0 percent (Average year case) and 5.9 percent (Dry year case). Both figures are 5.5 percent for a 200,000 DWT canal. In th case o a Sea Level canal, the highest IRR is 4.1 percent. The IRR for other Sea Level canal is below 4.0 percent.

(2) Economic Feasibility

Economic evaluation of alternatives depend to a great extent upon the level of Social Discount Rate. Judging from a CBR evaluated at a 5 percent social discount rate, both High-Rise Lock Alternatives are found to be economically feasible, while Sea Level Alternatives are not.

V. Impact of Alternatives

V. Impact of Alternatives

V.1 Impact during Construction, Operation and Maintenance

(1) Scope of Analysis

Short term impact of canal alternatives upon the Panamanian economy is expected during construction. Such economic impacts can be divided into the direct economic impact of construction expenditure and indirect economic impact accrued from induced income from the direct economic impact. In this chapter the magnitude and direction of the economic impact on the Panamanian economy are analyzed and estimated, and the earliest construction stage, which is scheduled for completion before the year 2020, is selected as the subject period for analysis. Although further major construction will take place in the later years of the project (by the year 2060), analysis of the earliest period of construction is sufficient for understanding the nature, magnitude and direction of the economic impact.

(2) Direct Economic Impact

1) Expenditure in Panama

In order to estimate the direct impact of construction, it is necessary to define local expenditure on construction in Panama. Based on information from the ECE report the following steps have been taking in compiling the estimate :

a. Classification the construction cost of canal alternatives into the three categories of equipment, materials and labor;
b. Calculation of each category's share of local expenditure;
c. Summation of local expenditures for all categories.

The share of local expenditure for the canal alternatives shown in Table V-1-1 and V-1-2 is estimated through analyzing the nature of each aspect of construction work and the detailed bills of quantities.

The calculation of the total local expenditure for each canal alternative is shown in Table V-1-3 and 4.

Local expenditure on canal construction for the canal alternatives is summarized in Table V-1-5. The 150,000 DWT alternative (High-Rise Lock Canal: HRLC) expends 845 million dollars in the local economy out of a total expenditure of 7.4 billion US dollars, while another HRLC alternative (200,000 DWT) expends 946 million dollars locally out of a total of 8.5 billion dollars. The 250,000 DWT alternative matches Sea Level Canal case b studied in ECE,*1 and requires the largest local expenditure, 1,087 million dollars, out of the total expenditure of 12.7 billion dollars. Of local expenditure, the major portion is used for labor payments in Panama.

Although annual disbursements on construction depend upon execution planning, an amount of about 100 million dollars is expended evenly during the peak years of construction. For the 250,000 DWT alternative, an exceptionally large outlay occurs in the fifth year of construction, because major excavation work starts in that particular year. For the same reason there are large expenditures in the fourth year in the case of the 150,000 DWT and 200,000 DWT alternatives.

2) Direct Impact upon Local Production

Two types of economies exists in the Panamanian productive sectors. One is the service economy which has a high international competitiveness based on the geographical position and institutional development initiated and founded on the monetary system established in 1904, based on the free circulation of the US dollars as legal tender. In comparison with other regional economies which obtain earnings by exporting agricultural goods, mining or manufacturing products through great effort, for the Panamanian economy it is comparatively much easier to obtain earnings through export of services, which represent nearly a third of the GNP. On the other extreme are Panamanian manufacturing and agricultural activities principally aimed at the domestic market. These sectors depend on tariff protections or quantity barriers and tax incentives and are subject to extensive regulations, tutelage patents and government discretion. Most of these activities are not

Table V-1-1 Local Share of Project Cost in Panama for the High-Rise Lock Canal

Construction Work	Const. Cost Ditribution			of which Local Share in Panama			Local Share
	Equip.	Materials	Labor	Equip.	Materials	Labor	in total
I. Const. Cost							
(A) Civil Works							
Canal Excavation	76%	15%	9%	100%	0%	2%	7%	9%
Placing Area	84%	13%	3%	100%	0%	1%	3%	4%
Lock Construction	39%	51%	10%	100%	0%	10%	8%	18%
New Dams	84%	13%	3%	100%	0%	1%	2%	4%
Pump Station	78%	20%	2%	100%	0%	2%	2%	4%
New Permanert Rd.	86%	11%	3%	100%	0%	1%	3%	4%
New Canal Crossing	86%	12%	2%	100%	0%	1%	1%	3%
Barrier Dams	81%	16%	3%	100%	0%	2%	2%	4%
Breakwater	50%	40%	10%	100%	0%	16%	7%	23%
Diversion Scheme	81%	16%	3%	100%	0%	2%	2%	4%
Supporting Const.	40%	50%	10%	100%	0%	20%	9%	29%
(B) Plant Forming								
Gate Leaves and Facilities	93%	5%	2%	100%	0%	1%	1%	2%
Navigation Support	85%	5%	10%	100%	0%	1%	7%	8%
II. Indirect Costs								
Administrative Costs	48%	17%	35%	100%	0%	7%	32%	38%
Headquarter's Costs	70%	10%	20%	100%	0%	4%	8%	12%
Const. Supervision	55%	20%	25%	100%	0%	8%	23%	31%
Land Aquisition								
Compensation		80%	20%	100%	0%	32%	20%	52%
Contingency	67%	25%	8%	100%	0%	5%	7%	12%

Source: MRI and YEC Consortium, based on "Preliminary Engineering and Cost Estimates, Phase II," Final Draft Report, April 1993.

Table V-1-2 Local Share of Project Cost in Panama for the Sea Level Canal

Construction Work	Const. Cost Ditribution			of which Local Share in Panama			Local Share
	Equip.	Materials	Labor	Equip.	Materials	Labor	in total
I. Const. Cost							
(A) Civil Works							
Canal Excavation	51%	13%	6%	100%	0%	1%	5%	6%
Placing Area	84%	13%	3%	100%	0%	1%	3%	4%
Lock Construction	57%	35%	8%	100%	0%	7%	6%	13%
New Dams	84%	13%	3%	100%	0%	1%	2%	4%
Pump Station	78%	20%	2%	100%	0%	2%	2%	4%
New Permanert Rd.	86%	11%	3%	100%	0%	1%	3%	4%
New Canal Crossing	86%	12%	2%	100%	0%	1%	1%	3%
Barrier Dams	81%	16%	3%	100%	0%	2%	2%	4%
Breakwater	50%	40%	10%	100%	0%	16%	7%	23%
Diversion Scheme	81%	16%	3%	100%	0%	2%	2%	4%
Supporting Const.	40%	50%	10%	100%	0%	20%	9%	29%
(B) Plant Forming							
Gate Leaves and Facilities	93%	5%	2%	100%	0%	1%	1%	2%
Navigation Support	85%	5%	10%	100%	0%	1%	7%	8%
II. Indirect Costs							
Administrative Costs	48%	17%	35%	100%	0%	7%	32%	38%
Headquarter's Costs	70%	10%	20%	100%	0%	4%	8%	12%
Const. Supervision	55%	20%	25%	100%	0%	8%	23%	31%
Land Aquisition							
Compensation		80%	20%	100%	0%	32%	20%	52%
Contingency	77%	17%	6%	100%	0%	3%	5%	8%

Source: MRI and YEC Consortium, based on "Preliminary Engineering and Cost Estimates, Phase II," Final Draft Report, April 1993.

Table V-1-3 Local Expenditure on High-Rise Lock Canal Projects in Panama

(Phase I Construction)

Construction Work	150,000 DWT ('000 US$)	200,000 DWT ('000 US$)
I. Const. Cost		
(A) Civil Works		
Canal Excavation	262,039	302,532
Placing Area	3,512	3,512
Lock Construction	180,393	205,161
New Dams	0	8,769
Pump Station	0	0
New Permanert Rd.	333	333
New Canal Crossing	11,705	13,031
Barrier Dams	0	0
Breakwater	0	0
Diversion Scheme	0	0
Supporting Const.	123,376	123,376
sub-total	581,358	656,714
(B) Plant Forming		
Gate Leaves and Facilities	16,889	19,214
Navigation Support	31,066	31,066
sub-total	47,955	50,280
Const. Cost Total	629,313	706,994
II. Indirect Costs		
Administrative Costs	29,535	34,295
Headquarter's Costs	15,797	18,342
Const. Supervision	52,341	60,777
Land Aquisition	0	0
Compensation	54,600	54,600
Contingency	62,931	70,699
Indirect Cost Total	215,204	238,713
Grand Total (I + II)	844,517	945,707

Source: MRI and YEC Consortium.

Table V-1-4 Local Expenditure on Sea Level Canal Projects in Panama

(Phase I Construction)

Construction Work	250,000DWT Case a ('000 US$)	Case b ('000 US$)	Case c ('000 US$)
I. Const. Cost			
(A) Civil Works			
Canal Excavation	380,898	449,756	380,898
Placing Area	7,547	7,547	7,547
Lock Construction	273,013	57,478	307,245
New Dams	0	0	0
Pump Station	0	0	0
New Permanert Rd.	738	738	738
New Canal Crossing	5,770	8,036	5,770
Barrier Dams	19,740	19,740	19,740
Breakwater	92,464	92,464	92,464
Diversion Scheme	3,011	3,011	3,011
Supporting Const.	166,580	166,580	166,580
sub-total	949,761	805,350	983,993
(B) Plant Forming			
Gate Leaves and Facilities	18,041	14,021	23,792
Navigation Support	40,972	35,778	40,972
sub-total	59,013	49,799	64,764
Const. Cost Total	1,008,774	855,149	1,048,757
II. Indirect Costs			
Administrative Costs	45,984	43,283	48,094
Headquarter's Costs	24,367	22,971	25,524
Const. Supervision	77,062	72,647	80,722
Land Aquisition	0	0	0
Compensation	7,050	7,050	7,050
Contingency	100,877	85,515	104,876
Indirect Cost Total	255,340	231,466	266,266
Grand Total (I + II)	1,264,114	1,086,615	1,315,023

Source: MRI and YEC Consortium.

Table V-1-5 Distribution of Project Costs and Local Expenditures

Year	150,000DWT Total (mil.US$)	Local ('000US$)	200,000DWT Total (mil.US$)	Local ('000US$)	250,000DWT Total (mil.US$)	Local ('000US$)
1	82	9,400	88	9,784	71	6,075
2	82	9,400	88	9,784	71	6,075
3	285	32,619	251	27,778	68	5,763
4	1,196	136,979	1,703	188,502	324	27,630
5	928	106,289	866	95,777	2,754	234,748
6	1,106	126,695	1,126	124,554	879	74,947
7	1,049	120,078	1,060	117,280	1,038	88,442
8	1,332	152,494	1,255	138,872	1,049	89,421
9	876	100,304	1,172	129,693	1,010	86,131
10	439	50,258	781	86,425	955	81,418
11			156	17,258	704	60,018
12					814	69,430
13					920	78,430
14					1,012	86,294
15					1,077	91,791
Total	7,374	844,516	8,546	945,706	12,747	1,086,616

Source: MRI and YEC Consortium, based upon "Preliminary Engineering and Cost Estimates, Phase II," Final Draft Report, April 1993.

internationally competitive, which in a large measure is due to the high cost of public services, the limited domestic market and state regulations and intervention.

During construction, local expenditures for the project are expected to stimulate production by Panamanian industries by strengthening the interlinkage of industrial sectors. The construction sector will purchase goods and services from the commercial and service sectors. The commercial and service sectors will purchase goods from other industrial sectors which will require services provided by the construction sector at the next stage. This reciprocal transaction of goods and services will result in an increase in the level national production grater than the initial injection of money into the Panamanian economy. This impact on the economy is estimated as a direct impact of canal construction upon local production by citing the national accounting matrix of Panama. The Panamanian Input-output model is described by the national accounting matrix quoted from the Compatible Economic Model for Central American Isthmus (MOCECA: Modelo de Coherencia Economia del Istmo Centroamericano).*[2]

The amount of local expenditure during construction, which is limited by the annual production of the construction sector in Panama, ranges from 6 million dollars to 235 million dollars. This fact supports us in using this model for the analysis. The coefficient of repercussion, the share of wage expenditure in national accounting and the average wage of each industrial sector are calculated based on information from the model and are applied to analysis of the estimate.

Results are shown in Table V-1-6, V-1-7, and V-1-8, which indicate an increase in industrial production and employment opportunities due to the implementation of the canal alternatives. Each table shows the coefficient of induced production of ten industrial sectors in Panama, annual outlays from the demand effect in those sectors and their totals, and induced employment opportunities.

For the 150,000 DWT alternative, the demand effect is estimated to be 1.5 billion dollars for the period of ten year Phase I construction. A remarkable amount of induced production can be expected in the manufacturing industry and commercial, service and financial sectors within the Panamanian economy. The estimated figures are 261, 112, 143 and 151 million dollars respectively that potentially make up 6%, 3%, 3% and 4% of the GNP of Panama respectively.

New employment opportunities are also created by the demand effect of canal

construction. For the 150,000 DWT alternative, the total number of new jobs which can be created in all sectors of the Panamanian economy is estimated about to be 68 thousand during the whole period of construction. The number of construction jobs is estimated to be 38 thousand, which is consistent with labor planning in the ECE Study.*3 The induced production sector mentioned above can create 11, 9, 4 and 5 thousand jobs respectively throughout the construction period.

As is easily understood, the larger amount of local expenditure on other canal alternatives inflate the demand effect, and the same industrial sectors as in the case of the 150,000 DWT alternative are the most affected. As a matter of fact, the 250,000 DWT alternative that requires the largest local expenditures induces the largest amount of production, and creates the largest volume of employment.

Note *1 ECE studies three sea level canal alternatives. For this study case b is selected because it is the least expensive construction plan.

*2 MOCECA is a social accounting matrix of which the same accounting framework is applied to the other Central American countries. This research program was undertaken in 1992 by CADESCA (El Cómite de Acción de Apoyo al Desarrollo Económico y Social de Centroamerica) with financial and technical support from the European Community and Swedish Government through the International Development Agency.

*3 The ECE Study states that 50 thousand foreign and local labors would be needed for the construction of the 150,000 DWT alternative.

Table V-1-6 Repercussion Effect on the Local Economy of Panama During Construction of the 150,000 DWT Canal

Year	Local Expend. of Project ('000US$)	Agri.Exp.	Agr. Grain	Livestock	Other Agr.	Agro-ind.	Other Ind.	Construct.	Commerc.	Service	Finance	Total
Coefficient		0.0006	0.0003	0.0012	0.0029	0.0034	0.3087	1	0.1326	0.1689	0.1785	
1	9,400	6	3	11	27	32	2,902	9,400	1,246	1,588	1,678	16,893
2	9,400	6	3	11	27	32	2,902	9,400	1,246	1,588	1,678	16,893
3	32,619	20	10	39	95	111	10,069	32,619	4,325	5,509	5,822	58,620
4	136,979	82	41	164	397	466	42,285	136,979	18,163	23,136	24,451	246,165
5	106,289	64	32	128	308	361	32,811	106,289	14,094	17,952	18,973	191,012
6	126,695	76	38	152	367	431	39,111	126,695	16,800	21,399	22,615	227,684
7	120,078	72	36	144	348	408	37,068	120,078	15,922	20,281	21,434	215,792
8	152,494	91	46	183	442	518	47,075	152,494	20,221	25,756	27,220	274,047
9	100,304	60	30	120	291	341	30,964	100,304	13,300	16,941	17,904	180,256
10	50,258	30	15	60	146	171	15,515	50,258	6,664	8,489	8,971	90,319
11												
12												
13												
14												
15												
Total	844,516	507	253	1,013	2,449	2,871	260,702	844,516	111,983	142,639	150,746	1,517,680
Employment ('000)		0	0	0	0	0	11	38 *(50)	9	4	5	68

Note *: The number refers to the estimated number of laborers in the Engineering Study (ECE), inclusive foreign and local laborers.
Source: MRI and YEC Consortium. Repercussion coefficients are obtained from the MOCECA Input -output table.

Table V-1-7 Repercussion Effect on the Local Economy of Panama During Construction of the 200,000 DWT Canal

Year	Local Expend. of Project ('000US$)	Agri.Exp.	Agr. Grain	Livestock	Other Agr.	Agro-ind.	Other Ind.	Construct.	Commerc.	Service	Finance	Total
Coefficient		0.0006	0.0003	0.0012	0.0029	0.0034	0.3087	1	0.1326	0.1689	0.1785	
1	9,784	6	3	12	28	33	3,020	9,784	1,297	1,653	1,746	17,583
2	9,784	6	3	12	28	33	3,020	9,784	1,297	1,653	1,746	17,583
3	27,778	17	8	33	81	94	8,575	27,778	3,683	4,692	4,958	49,920
4	188,502	113	57	226	547	641	58,191	188,502	24,995	31,838	33,648	338,757
5	95,777	57	29	115	278	326	29,566	95,777	12,700	16,177	17,096	172,121
6	124,554	75	37	149	361	423	38,450	124,554	16,516	21,037	22,233	223,836
7	117,280	70	35	141	340	399	36,204	117,280	15,551	19,809	20,934	210,764
8	138,872	83	42	167	403	472	42,870	138,872	18,414	23,455	24,789	249,567
9	129,693	78	39	156	376	441	40,036	129,693	17,197	21,905	23,150	233,071
10	86,425	52	26	104	251	294	26,679	86,425	11,460	14,597	15,427	155,314
11	17,258	10	5	21	50	59	5,328	17,258	2,288	2,915	3,081	31,014
12												
13												
14												
15												
Total	945,707	567	284	1,135	2,743	3,215	291,940	945,707	125,401	159,730	168,809	1,699,530
Employment ('000)		0	0	0	0	0	13	42 *(59)	10	4	6	76

Note *, Source: See Table V-1-6.

Table V-1-8 Repercussion Effect on the Local Economy of Panama During Construction of the 250,000 DWT Canal

Year	Local Expend. of Project ('000US$)	Agri.Exp.	Agr. Grain	Livestock	Other Agr.	Agro-ind.	Other Ind.	Construct.	Commerc.	Service	Finance	Total
Coefficient		0.0006	0.0003	0.0012	0.0029	0.0034	0.3087	1	0.1326	0.1689	0.1785	
1	6,075	4	2	7	18	21	1,875	6,075	806	1,026	1,084	10,917
2	6,075	4	2	7	18	21	1,875	6,075	806	1,026	1,084	10,917
3	5,763	3	2	7	17	20	1,779	5,763	764	973	1,029	10,357
4	27,630	17	8	33	80	94	8,529	27,630	3,664	4,667	4,932	49,654
5	234,748	141	70	282	681	798	72,467	234,748	31,128	39,649	41,903	421,866
6	74,947	45	22	90	217	255	23,136	74,947	9,938	12,659	13,378	134,687
7	88,442	53	27	106	256	301	27,302	88,442	11,727	14,938	15,787	158,939
8	89,421	54	27	107	259	304	27,604	89,421	11,857	15,103	15,962	160,698
9	86,131	52	26	103	250	293	26,589	86,131	11,421	14,548	15,374	154,786
10	81,418	49	24	98	236	277	25,134	81,418	10,796	13,752	14,533	146,316
11	60,018	36	18	72	174	204	18,528	60,018	7,958	10,137	10,713	107,858
12	69,430	42	21	83	201	236	21,433	69,430	9,206	11,727	12,393	124,773
13	78,430	47	24	94	227	267	24,211	78,430	10,400	13,247	14,000	140,947
14	86,294	52	26	104	250	293	26,639	86,294	11,443	14,575	15,403	155,079
15	91,791	55	28	110	266	312	28,336	91,791	12,171	15,503	16,385	164,958
Total	1,086,613	652	326	1,304	3,151	3,694	335,437	1,086,613	144,085	183,529	193,960	1,952,752
Employment ('000)		0	0	0	0	0	14	49 *(81)	12	5	7	87

Note *, Source: See Table V-1-6.

(3) Indirect Economic Impact

Induced production calculated as direct economic impact will bring an additional income which is the cited value added in MOCECA. These added values are shown in Table V-1-9 by alternative canal.

Some portion of this income is expended, again creating new demand for production in the Panamanian economy. This kind of repetitive repercussion is called a "multiplier effect", and it can be qualified as an indirect impact with the following formula using the marginal propensity to consume and import ratio. ΔY includes the initial income ΔI.

$$\Delta Y = 1 / (1-a+m) \times \Delta I$$

- ΔY : increment of income due to the multiplier effect
- ΔI : initial income increment
- a : marginal propensity to consume (0.712 from Table V-2-2)
- m : import ratio (0.131 from Table V-2-2)

The results of calculation of indirect impact due to construction are summarized in Table V-1-10.

Table V-1-9 Induced Value Added Due to Construction

('000 US$)

Item	Case \ Industry	Agri. Exp.	Agr. Grain	Livestock	Other Agr.	Agro-ind.	Other Ind.	Construct.	Commerc.	Service	Finance	Total
Induced Production	150,000DWT	507	253	1,013	2,449	2,871	260,702	844,516	111,983	142,639	150,746	1,517,680
	200,000DWT	567	284	1,135	2,743	3,215	291,940	945,707	125,401	159,730	168,809	1,699,530
	250,000DWT	652	326	1,304	3,151	3,694	335,437	1,086,613	144,085	183,529	193,960	1,952,752
Value Added Ratio		**0.6**	**0.62**	**0.66**	**0.82**	**0.27**	**0.27**	**0.46**	**0.68**	**0.64**	**0.5**	
Value Added	150,000DWT	304	157	669	2,008	775	70,390	388,477	76,148	91,289	75,373	705,590
	200,000DWT	340	176	749	2,249	868	78,824	435,025	85,273	102,227	84,405	790,136
	250,000DWT	391	202	861	2,584	997	90,568	499,842	97,978	117,459	96,980	907,861

Table V-1-10 Impact Due to Construction

(mil. US$)

	Direct Impact		Indirect Impact
	Production	Income	(Multiplier Effects)
150,000DWT	1,518	706	979
200,000DWT	1,700	790	1,096
250,000DWT	1,953	908	1,259

Note 1 : 0.712 (Marginal propensity to consume) and 0.131 (Import ratio) are assumed, from Table V-2-2

Note 2 : Initial income of the direct impact is excluded from the indirect impact.

(4) Regional Development

The increase in production and employment would effect the geographical concentration or localization of economic activities in Panama, and the process of regional development would be changed significantly.

In general, Panama is a developing country whose income level is still low and whose level of urbanization should be raised (see Table V-1-11). If Panama makes an effort to develop its economy, the current level of urbanization (53.4%) is expected to rise remarkably. As a matter of fact, local expenditure on construction and its repercussion effect are expected to promote the concentration of population. The construction of canal alternatives would employ more than 3,000 workers every year. The number of unemployed in the adjacent labor centers, Panama City and Colon, currently exceeds 64 thousand;[*4] thus, new employment opportunities from canal construction would be sufficiently absorbed by those centers.

Jobs created by the repercussion effect in the manufacturing, commercial, services and financial sectors would also promote the concentration of population in Panama City and Colon. Table V-1-12 shows the geographical concentration of selected industries in Panama. All sectors show more than 70 percent concentration in Panama City and Colon. This fact indicates that most job opportunities generated by construction work would be absorbed in Panama City and Colon, and may result in the further movement of population from rural areas and other states to these two cities.

Note *4 Dirección de Estadística y Censos Nacionales de Población y Vivienda, 13 de mayo de 1990.

Table V-1-11 Principal User Countries of the Panama Canal and Their Economic Indicators

Country	per capita GNP ($)	Population ('000)	GNP (b.US$)	Urban Population (%)
Japan	20,960	123,000	2,578.08	76.9%
United States	19,820	246,000	4,875.72	74.8%
Norway	19,550	4,196	82.03	74.1%
Sweden	19,300	8,436	162.81	83.8%
Germany	18,460	61,268	1,131.01	83.8%
Canada	16,940	25,950	439.59	76.8%
United Arab Emirates	16,420	1,496	24.56	77.8%
France	16,200	55,874	905.16	74.2%
Kuwait	14,630	1,958	28.65	94.8%
Belgium	14,520	9,878	143.43	96.7%
Netherlands	14,510	14,758	214.14	88.5%
Italy	13,350	57,441	766.84	68.4%
United Kingdom	12,850	57,100	733.74	89.0%
Australia	12,330	16,532	203.84	85.5%
New Zealand	10,190	3,292	33.55	84.0%
Hong Kong	9,250	5,681	52.55	93.6%
Singapore	9,090	2,647	24.06	100.0%
Israel	8,940	4,444	39.73	91.1%
Spain	7,750	38,996	302.22	77.4%
Saudi Arabia	6,060	14,016	84.94	75.6%
Portugal	3,650	10,291	37.56	32.7%
Korea, Rep.	3,600	41,975	151.11	69.1%
Iran	3,590	48,569	174.36	55.3%
Trinidad and Tobago	3,410	1,241	4.23	67.0%
Venezuela	3,130	18,751	58.69	83.2%
South Africa	2,280	33,996	77.51	58.4%
Brazil	2,120	144,000	305.28	73.3%
Panama	**1,810**	**2,311**	**4.18**	**52.6%**
Mexico	1,750	83,656	146.40	71.4%
Costa Rica	1,680	2,670	4.49	46.2%
Chile	1,510	12,760	19.27	85.1%
Colombia	1,180	31,707	37.41	68.8%
Ecuador	1,090	10,073	10.98	54.2%
Jamaica	1,080	2,379	2.57	51.1%
Peru	1,040	20,681	21.51	69.1%
Thailand	1,030	54,469	56.10	21.5%
El Salvador	960	5,032	4.83	43.7%
Guatemala	900	8,686	7.82	38.9%
Honduras	860	4,837	4.16	42.1%
Nicaragua	800	3,623	2.90	58.5%
Egypt	660	50,161	33.11	45.6%
Philippines	630	59,851	37.71	41.6%
Indonesia	480	175,000	84.00	28.8%
China	330	1,088,000	359.04	79.6%

Source: The World Bank, " The World Table, 1992."

Table V-1-12 Geographical Distribution of Panamanian Employment

Industrial Sector	Bocas del Toro	Cocle	Colon	Chiriqui	Darien	Herrera	Los Santos	Panama	Veraguas	Comarca de San Blas	Total
Manufacturing	1%	9%	8%	9%	0%	4%	2%	61%	5%	0%	100%
Commercial	2%	3%	12%	11%	0%	3%	2%	64%	3%	0%	100%
Services	1%	3%	11%	9%	0%	2%	2%	69%	3%	0%	100%
Finance	1%	2%	4%	7%	0%	3%	2%	78%	2%	0%	100%
Total	3%	5%	7%	14%	1%	3%	3%	59%	5%	0%	100%

Source: Dirección de Estadística y Censo, Censos Nacionales de Población y Vivienda, 13 de mayo de 1990

V.2 Induced Trade

(1) Definition of Induced Trade

Estimating of induced trade assumes that shippers would benefit from using canal alternatives, and their monetary benefits contribute to the reduction of commodity price in the international market. If a particular commodity is prices elastic, an increase in trade will result.

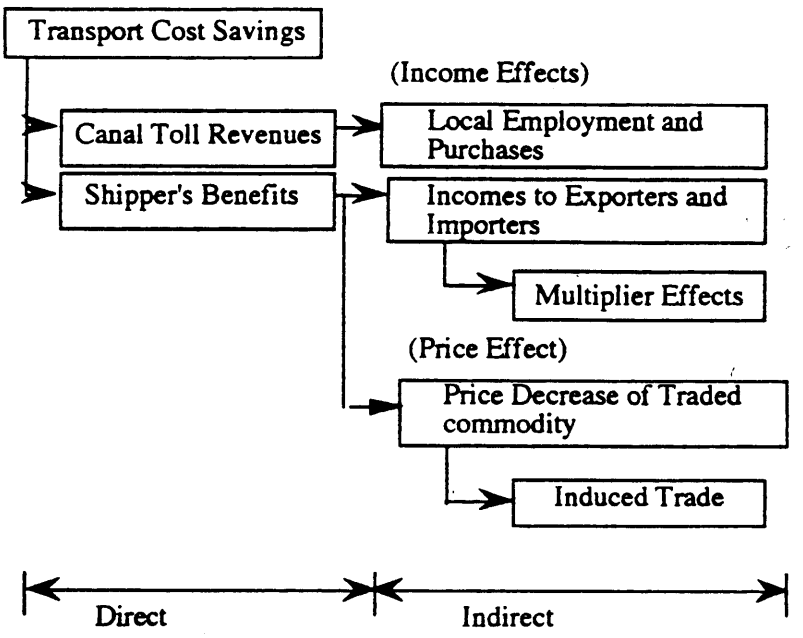


Fig.V-2-1 Impact Induced by Transport Cost Savings from Canal Alternative

This section estimates the induced trade numerically using several economic parameters available in economic publications. Although the results are conditional upon several critical assumptions, they help us to form a picture of the direction and magnitude of induced trade.

Fig.V-2-2 schematically illustrates how transport cost savings from canal alternatives would increase international trade in commodities. It shows the demand and supply curves of traded commodities along a particular canal route. Definitions are given as follows: Demand in importing country, D; supply in exporting country with transport costs for the status quo canals, S(SQ); supply of exporting country with transport cost of alternative canal, S(Alt.); and Supply of exporting country without transport cost, S(O). As for the status quo canal, the import price of commodity P1 and the amount X1 are maintained at the market equilibrium (A), the current transport cost is T=P1-P1', and the total transport cost for delivering the quantity X1 of the commodity is described by the area P1AA'P2'.

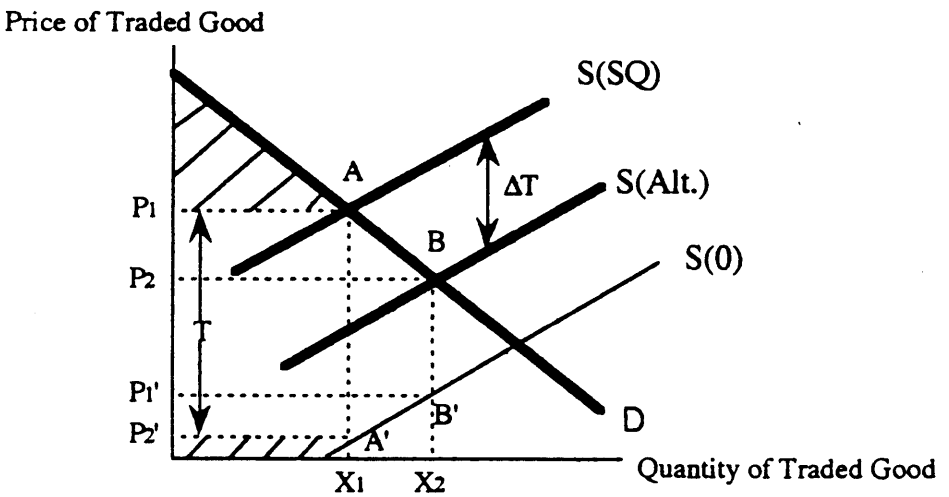


Fig.V-2-2 Income and Price Effects of Transport Cost Savings

ΔT in the diagram indicates transport cost savings accrued to a shipper. If a shipper keeps the savings as a profit, the commodity price is not affected at all. However, when a shipper competes with other shippers in shipping prices, profit margins will be undermined resulting in a reduction in commodity price. A new market equilibrium could be achieved at B in the diagram: the price declines from P1 to P2, and the quantity of commodity traded increases from X1 to X2. The increment in trade due to this price effect, ΔX, is defined as the induced trade to be estimated.

(2) Assumptions of the Estimation

(i) The FSFA/MA component study has proposed optimal toll schedules and rates (US$) to maximize revenues subject to minimum traffic diversion. While traffic volume and transport costs under the above-mentioned optimal toll schedules and rates are described in the FSFA/MA interim report, the economic benefits accruing to shippers are calculated on the basis of the cost difference between the status quo canal and the alternatives.

(ii) The commodity price is determined by the interaction between suppliers and consumers; as a result, a reduction in commodity price cannot cover the whole transferred benefit of shippers but only a certain percentage thereof. Although the percentage varies with the price sensitivities of supply and demand, the following figures are assumed to apply uniformly: 75 percent when the commodity is shipped from developed countries to developing countries, 25 percent when the commodity is shipped from developing countries to developed countries, and 50 percent in other cases.

The above numbers are based on Gibbs'[*5] statement describing how developing countries generally export in markets in which the elasticity of shipping is low relative to the elasticity of demand, while conversely they import in markets where the elasticity of demand is low relative to the elasticity of supply. He uses the above numbers when he allocates transport costs between exporters and importers in his canal closure analysis. Fig.V-2-3 schematically illustrates the grounds for his statement. It shows four diagrams of demand and supply for different combinations of developed and developing countries. When a developed country exports to a developed country, price-sensitive demand and supply curves are assumed. Diagram (a) shows moderate slopes of demand and supply. If the transport cost decreases by ΔT, the resultant decline in price will be approximately $\Delta P=0.5\Delta T$. When a developing country imports a commodity from a developed country (diagram (b)), the steeper demand curve which represents a demand relatively sensitive to price of the imported commodity will make the price decline of the commodity greater. In diagram (c), the opposite combination of countries for demand and supply is assumed. This combination of countries makes the price decline relatively small. In diagram (d), which assumes developing countries as the source of both supply and demand (or consumption), the steep curves for demand and supply make the price decline as great as in diagram (a). As a result, Gibbs' statement holds true, in the general circumstance of trade of developed and developing countries.

Note *5 Stephen Roger Gibbs, Multiobjective Analysis of the Panama Canal: The Value of a Marine Transportation System. Ph.D. Diss. MIT: Cambridge, May 1976, pp. 204–206.

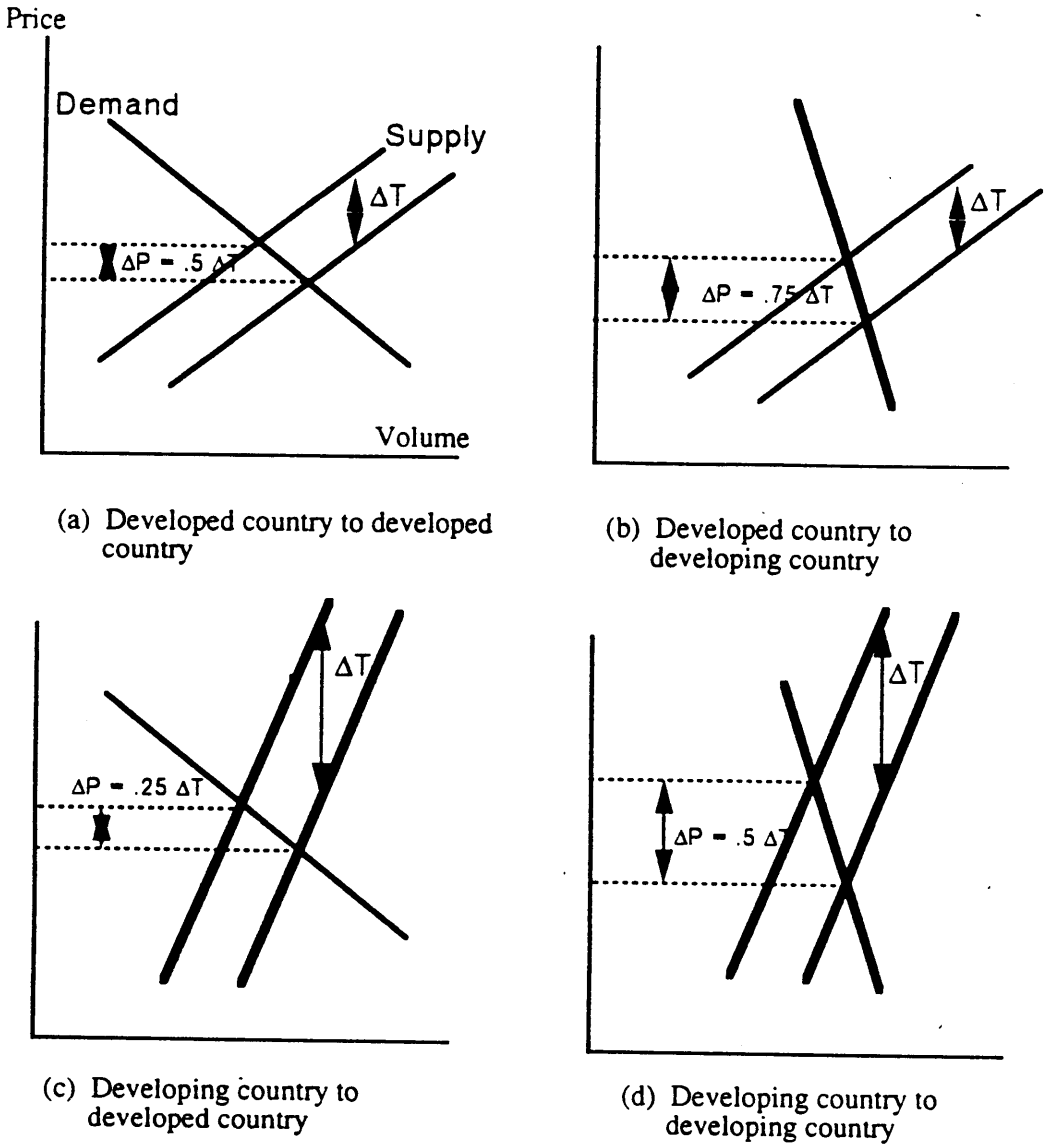


Fig.V-2-3 Reduction in Commodity Price Due to Transport Cost Savings in Different Combinations of Developed and Developing Countries

(3) Estimate Equations

Induced trade from canal alternatives is calculated as the increment in trade over the status quo canal by multiplying the price elasticity of demand, the expected price change, and the canal cargo volume that benefits from usage of the canal alternative.

Volume of induced trade

$$\Delta Mij = \mu j \ (a \ \Delta Tij)/P \ \ Xij$$

Volume of induced trade

$$\Delta M\$ij = \Delta Mij \ (P - a \ \Delta Tij)$$

- ΔMij : Induced trade in volume (metric tons) from region i to region j
- i, j : Regions of origin and destination for commodity, see Table V-2-2.
- μj : Price elasticity of demand in the region. Cross country comparisons are available in Henri Their and Kenneth W. Clements, Applied Demand Analysis, "Results from System-wide Approaches," NY; Ballinger Publishing, Dec. 1986.
- a : Percentage assumption given in (2)(ii)
- ΔTij : Transport cost savings between regions i and j (US$/ton)
- P : Commodity price (US$/ton)
- Xij : Canal cargo volume that benefits from transport cost savings.
- $\Delta M\$ij$: Induced trade in value (US$) from region i to region j

Transit volume and tolls for the SQ canal and the alternative canals are provided in the FSFA/MA report. Dry Bulk Carriers transport 483,000 ton from Africa to the West Coast of Central America. The costs with toll par ton for the transportation are 14.76 US dollars for SQ canal and 14.55 US dollars for the 150,000 DWT canal. Parameters are defined in this case as $\mu j = 0.8$, $a = 0.5$, $P = 120.3$ assuming that commodity is fertilizer. The induced volume is obtained by the following equation.

$$0.8 \times (0.5 \times 0.21) \times 483 / 120.3 = 337 \text{ ton}$$

(4) Results (See Table V-2-2 and 3)

Induced volume were estimated for all commodities.

1) Induced world trade for the 150,000 DWT canal alternative is estimated to be 68 million US dollars or 563 thousand metric tons. Larger capacity canal alternatives increase this number; 80 million US dollars or 668 thousand metric tons for the 200,000 DWT alternative and 90 million US dollars or 749 thousand metric tons for the 250,000 DWT alternatives.

2) The most prominent increases in trade are expected in exports from the U.S. East Coast and import to Asia. The reason is that the largest amount of canal cargo is observed on the route from the U.S. East Coast to Asia, and this cargo will benefit from the using a new canal. In the case of the 150,000 DWT alternative, the increases in value are 60 million US dollars the export from the U.S. East Coast and 62 million dollars for imports to Asia. As canal capacity increases from 150,000 DWT to 250,000 DWT, imports to Asia increase significantly. This is because Brazil, Colombia and Venezuela are expected to export to the Asian markets. In general, the increase in canal capacity will result in the concentration of canal cargo along a specific route, primarily from the U.S. East Coast to Asia.

3) Dry bulk cargo is a major cargo type that accounts for nearly 90 percent of the induced trade. Fertilizer, food and petro-chemicals are induced in this type of cargo.

4) If the canal toll increases, induced trade will consequently diminish. The amount of diminution will be exactly proportional to the shippers' share of transport cost savings.

Table V-2-1 Economic Indicators of Panama Canal User Regions

	Country		Gross Regional Product (bil.US$)	Per Capita GRP (US$)	Marginal Propensity to Consume	Import ratio
Pacific Region						
1. Asia	China	Korea, Rep.	3,342.65	12,485	0.861	11.70%
	Hong Kong	Philippines				
	Indonesia	Singapore				
	Japan	Thailand				
2. C. America WC	Mexico	Guatemala	174.78	1,451	0.719	15.30%
	Panama	Honduras				
	Costa Rica	Nicaragua				
	El Salvador					
3. Canada WC	Canada		439.59	16,940	0.902	24.30%
4. Oceania	Australia	New Zealand	237.39	11,890	0.623	17.10%
5. S. America WC	Colombia	Ecuador	89.17	1,217	0.656	15.40%
	Chile	Peru				
6. U.S. WC	United States		4,875.72	19,820	0.867	9.20%
Atlantic Region						
1. Africa	Egypt	South Africa	110.62	2,280	0.661	25.30%
2. C. America EC	Mexico	Panama	150.58	1,754	0.712	13.10%
3. Canada EC	Canada		439.59	16,940	0.902	24.30%
4. Europe	Belgium	Norway	4,478.94	15,242	0.796	17.20%
	France	Portugal				
	Germany	Spain				
	Italy	Sweden				
	Netherlands	United Kingdom				
5. Middle East	Iran	Saudi Arabia	352.24	8,940	0.571	16.40%
	Israel	United Arab Emirates				
	Kuwait					
6. S. America EC	Brazil	Venezuela	401.38	2,538	0.634	7.80%
	Colombia					
7. U.S. EC	United States		4,875.72	19,820	0.867	9.20%
8. West Indies	Jamaica		6.80	3,077	0.610	33.70%
	Trinidad and Tobago					

Source: The World Bank, "World Table 1991," The Johns Hopkins University Press: Washington, D.C., July 1991.

Table V-2-2 Induced Trade (Volume) Due to Transport Cost Savings from Canal Alternatives in the Year 2020

Regions	∠Export('000 MT)			∠Import('000 MT)		
	150,000DWT	200,000DWT	250,000DWT	150,000DWT	200,000DWT	250,000DWT
(Pacific)						
1. Asia	14	14	14	519	607	694
2. C. America WC	2	2	2	2	2	2
3. Canada WC	-8	8	2	3	3	3
4. Oceania	1	1	1	1	1	1
5. S. America WC	3	3	3	1	1	1
6. U. S. WC	19	19	19	7	7	7
(Atlantic)						
1. Africa	3	3	3	6	7	7
2. C. America EC	2	2	2	3	3	3
3. Canada EC	-2	9	8	1	1	1
4. Europe	7	7	7	3	20	14
5. Middle East	0	0	0	0	0	0
6. S. America EC	27	105	193	0	0	0
7. U. S. EC	495	495	495	17	17	17
TOTAL	563	668	749	563	668	749

Source: MRI and YEC Consortium.

Table V-2-3 Induced Trade (Value) Due to Transport Cost Savings from Canal Alternatives in the Year 2020

Regions	∠Export('000 US$)			∠Import('000 US$)		
	150,000DWT	200,000DWT	250,000DWT	150,000DWT	200,000DWT	250,000DWT
(Pacific)						
1. Asia	1,669	1,669	1,669	62,431	73,081	83,538
2. C. America WC	288	288	288	287	287	287
3. Canada WC	-1,015	1,004	293	347	347	347
4. Oceania	64	64	64	71	71	71
5. S. America WC	375	397	397	84	84	84
6. U. S. WC	2,266	2,266	2,266	818	818	818
(Atlantic)						
1. Africa	358	358	358	774	796	796
2. C. America EC	230	230	230	327	327	327
3. Canada EC	-185	1,121	983	119	120	120
4. Europe	851	851	851	397	2,416	1,705
5. Middle East	0	0	0	0	0	0
6. S. America EC	3,260	12,603	23,198	0	0	0
7. U. S. EC	59,525	59,525	59,525	2,029	2,029	2,029
TOTAL	67,684	80,376	90,122	67,684	80,376	90,122

Source: MRI and YEC Consortium.

Note : Minus figures imply reduced trade caused by higher tolls and other transportation costs for the alternative canal than for the SQ canal.

V.3 Impact of Tolls

Canal toll may have an impact on the Panamanian economy through the canal operator's revenue and on canal users. Users' behavior regarding selection of the canal has been analyzed in the process of compiling traffic projections. However, canal users for whom the Panama route is the only alternative would be directly affected economically by a change in the toll level.

(1) Revenue Impact on the Panamanian Economy

The revenues of the canal operator will be spent partly on maintenance and operation or dividends to the government of Panama. These expenses will induce new demand for economic projections in Panama.

The alternative canals will result in increased payment for maintenance and operation and for royalties to the government of Panama as compared to the SQ canal. In addition, the government will receive dividends from the canal operator in the case of any of the High-Rise Lock Canals. These increases are shown in Table V-3-1 for the year 2040 as a typical example. The economic impact is also analyzed before for this year.

Table V-3-1 Increase Expenses in Panama Due to Operation of Alternative Canals in 2040

(mil. US$)

Component / Alternative Canal	Increase in Maintenance and Operation Costs	Increase in Royalty Payment to the Government of Panama	Dividends to the Government of Panama	Total
High-Rise Lock Canal 150,000DWT	57.9	50.5	795.9	904.3
High-Rise Lock Canal 200,000DWT	55.7	46.7	752.5	854.9
Sea Level Canal 250,000DWT	63.7	51.1	0	114.8

These expenses will induce new demand for economic production in Panama. The significance of the impact on each industry is determined by the kind of goods for which initial demand exists and inter-industrial relations. In this analysis MOCECA was used for quantitative data for these values.

Table V-3-2 shows the increase in production in each industry to satisfy the new demand due to increased expenses. In the calculation, it is assumed that all the revenue of the government of Panama is expended on goods in the same proportion as that of the composition of total demand in Panama. After deciding the composition of final demand, induced industrial production was obtained by using the inverse matrix coefficients of MOCECA.

Table V-3-2 Induced Production Due to the Operation of Alternative Canals in 2040

Demand Increase (million US$)	Industry	AGROEXPORTS	GRAINS PRODUCTION	CATTLE	OTHER AGRIC. PRODUCTS	AGROINDUSTRY	INDUSTRY	CONSTRUCTION	COMMERCE	COMMERCIAL SERVICES	NON COMMERCIAL SERVICES	EXPORTATION SERVICES	FINANCE	TOTAL
	150,000DWT	29.55	1.80	8.98	13.95	91.56	39.91	78.44	75.13	174.56	174.00	191.03	25.41	904.30
	200,000DWT	27.90	1.70	8.48	13.17	86.45	37.68	74.07	70.94	164.82	164.30	181.40	23.99	854.90
	250,000DWT	1.78	0.11	0.54	0.84	5.53	2.41	4.74	4.54	10.54	10.51	66.54	1.53	109.60
Inverse Matrix Coefficients	AGROEXPORTS	1.0013	0.0008	0.0242	0.0004	0.1064	0.0011	0.0006	0.0008	0.0040	0.0018	0.0005	0.0013	
	GRAINS PRODUCTION	0.0009	1.0390	0.0260	0.0003	0.0868	0.0007	0.0003	0.0004	0.0020	0.0037	0.0003	0.0007	
	CATTLE	0.0023	0.0139	1.0317	0.0083	0.1747	0.0031	0.0012	0.0011	0.0050	0.0059	0.0007	0.0018	
	OTHER AGRIC. PRODUCTS	0.0159	0.0009	0.0067	1.0160	0.0076	0.0097	0.0029	0.0011	0.0050	0.0052	0.0019	0.0018	
	AGROINDUSTRY	0.0102	0.0047	0.1943	0.0025	1.0810	0.0078	0.0034	0.0037	0.0170	0.0136	0.0029	0.0061	
	INDUSTRY	0.2033	0.0380	0.0247	0.0226	0.0766	1.1604	0.3087	0.0299	0.0520	0.0363	0.0513	0.0394	
	CONSTRUCTION	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	COMMERCE	0.0562	0.0354	0.0720	0.0674	0.1029	0.1390	0.1326	1.0148	0.0370	0.0321	0.0234	0.0254	
	COMMERCIAL SERVICES	0.1629	0.1637	0.0737	0.0741	0.1397	0.2275	0.1689	0.2857	1.3240	0.2711	0.1283	0.4812	
	NON COMMERCIAL SERVICES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	
	EXPORTATION SERVICES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	
	FINANCE	0.0533	0.0880	0.0799	0.0416	0.0585	0.0937	0.1785	0.1696	0.0474	0.0519	0.1070	1.1851	
Induced Production (million US$)	150,000DWT	44.52	2.49	13.76	17.20	167.94	65.57	140.96	113.22	260.68	247.36	251.45	44.28	1,369.43
	200,000DWT	42.03	2.35	13.00	16.24	158.57	61.92	133.10	106.91	246.14	233.57	238.78	41.81	1,294.42
	250,000DWT	2.69	0.15	0.83	1.04	10.14	3.96	8.51	6.84	15.74	14.93	87.58	2.67	155.08

Note : 44.52 = 29.55 * (1.0013+0.0009+.....+0.0533)

(2) Impact of Toll Rate Changes upon Users

1) General

In the component study report on the Financing Scheme, Financial Analysis, and Management Arrangements (FSFA/MA), an optimal toll rate is proposed. The new toll rate is based on the following policies:

- The optimal rate for maximizing canal revenue with
  - a) Minimum total traffic diversions,
  - b) No toll rate increases of 100 percent over the current rates, and
  - c) Maintenance of a diversity of ship types to avoid traffic specialization.

The new rating policy is a significant change from the current toll level. When such a significant change in toll rate is instituted in 2020, the new toll policy will also need to be assessed regarding the impact on the world shipping community or on the world economy through it.

2) World Benefit and Toll Rate

The Panama Canal as well as the Suez Canal is located at a globally important geographical point. By utilizing the canal as a seaborne route, world shippers benefit by the savings in shipping costs. The world benefit of the canal can be divided into two categories:

i) The canal's contribution to the shipping community
- cost saving to shippers after toll payment to the canal operator
- time saved by shippers

ii) The canal's contribution to the canal operator
- toll revenue for the canal operator

[World Benefit] = [Benefit to the Shipping Community] + [Toll Revenue]

From the macro-economic viewpoint, it is necessary to find a reasonable balance between the canal's contribution to the world shipping community and its contribution to the canal operator. The FSFA/MA report proposes a new toll rate to cover the cost of new canal

alternatives and to keep a healthy balance in canal management. However, it is important to assess the impact of a new toll on canal users, since a toll policy maximizing canal revenue would mean minimizing benefits to shippers, if they are captive users who do not have any other alternative route.

3) Differences in Impact by Type of Cargo and Vessel

The impact of the toll on users would differ depending on the three factors listed below and can summarized by vessel type as follows:

a) Seaborne route
   - millage and/or shipping cost savings
b) Price of commodity
   - high or low inventory costs
c) Size of vessel
   - cheap or expensive shipping costs per cargo ton-mile

i) Combined and Dry Bulk Carriers (CD)

Large-size vessels will be used in the future and the major commodities will be coal, iron ore, etc. The export price per ton is comparatively cheap and shipping cost per ton cheap for these commodities. It is expected that the higher toll rate will rise the export price due to the higher share of shipping costs, making the exporting countries less competitive in world markets.

ii) Oil Tankers (OT)

Large-size vessels are used at present and will be used in the year 2020. Oil will be a comparatively low-price cargo and also enjoy low shipping costs of large tankers. These vessels will be sensitive to the toll rate in terms of choice of route between the Panama route and others.

iii) Full Container Ships (FC)

Full Container Ships carry commodities with high inventory costs. Major routes using

the canal are to and from the U.S.A., Asia, and West Europe. The most competitive route is the land-bridge across the U.S.A., because it provides shorter transportation time with less inventory costs. Since the inventory cost savings by the land-bridge will get larger as time value increase in future, the toll rate will have to be decided based on careful consideration of the advantages of the land bridge.

iv) Other Ships

General cargo, minor bulk cargo etc. are among the important cargos which pass through the Panama Canal. These varied cargos are mainly transported by small-size vessels. It is characteristic of these cargos that they have relatively high shipping costs (per ton) and enjoy considerable benefits from route cost savings derived from using the canal. The impact of the toll rate on these ships is thus generally smaller than that for the above ships. However, for users from countries adjacent to Panama who do not have any other alternative route, the higher toll rate may have negative impact in the world trade market.

V.4 Saved Cost-induced Income

(1) Definition of Saved Cost-induced Income

The canal alternatives are expected to reduce the transport costs of world trade, and will contribute to the world economy. Savings will first be realized by the shippers as transport cost savings and a part of them are transferred to the canal operator as toll revenues. The shippers' savings will be transferred also to user regions of the Panama Canal when price competition among the shippers takes place. The transferred savings can be utilized as income for individuals or corporations. This income will induce investment or consumptions in countries in user regions, resulting in the increase in their economic production. The saved cost-induced income to the world is thus defined as the income to canal user countries induced by the transport cost savings from canal alternatives and the associated increase of economic production in those countries (multiplier effect).

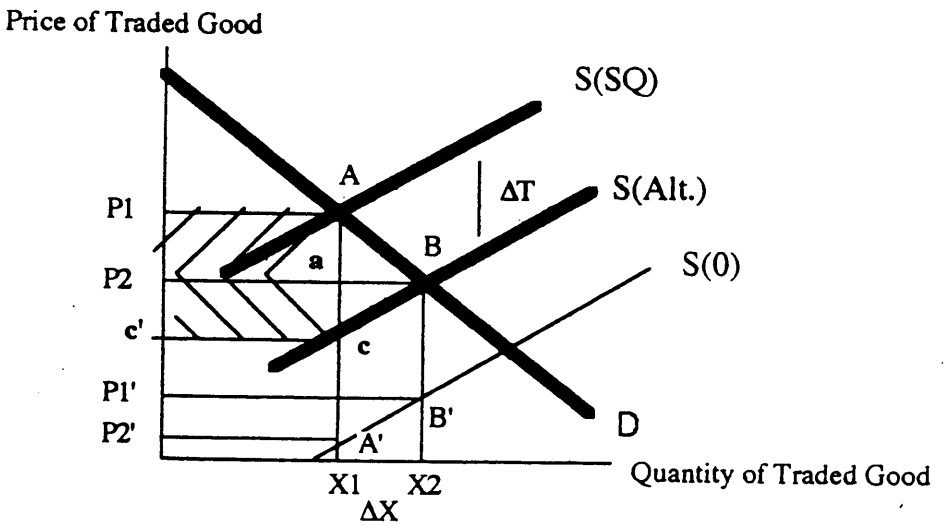


Fig.V-4-1 Increased Income to Exporters and Importers Accrued from Transport Cost Savings

(2) Method of Estimation

1) Schematic Understanding

Fig.V-4-1 is the same diagram as seen in Fig.V-2-2. It shows the transport cost savings and the accrued income to exporters and importers. At point A, an equilibrium of bilateral trade is maintained with price P1 and quantity X1. As long as the price reduction is not realized, no income increase accrues to any country. However, if the price of traded goods decreases due to the transport cost saving ΔT, a new equilibrium is realized at point B where price P2 and quantity X2 are achieved. Consequently, the exporting country increases its income (profit) by the amount P2Bcc', and the importing country reduces spending by P1ABP2. For the sake of simplicity, the income of the exporting country is defined as rectangle P2acc', and the income of the importing country is defined by the rectangle of P1AaP2. The combined area of these incomes, P1Acc', is the total of transport cost savings accruing to canal user countries.

2) Assumptions

Estimation of exporters' and importers' incomes involves the following assumptions:

i) Optimal toll schedules and rates, on which information is provided by the FSFA/MA component study interim report, are assumed in this analysis.

ii) The shipper's benefit will be transferred to the country (or region) of origin and the country (or region) of destination. Perfect competition among shippers bidding for shipments until they gain zero benefit is assumed.

iii) Allocation of benefits among countries of origin and destination is determined by the price responses (elasticity) of demand and supply for the traded commodity. The characteristics of those responses depend upon the type of commodity, the income levels of the exporting and importing countries, and the combination of trading countries. DeVanney et al[*6] have shown that the allocation of transportation costs between sellers of a transported commodity and buyers of the commodity is determined by the elasticity of the supply curve for the commodity in the country of origin (Es) and the elasticity of the demand curve in the

country of destination (Ed). The ratio of the importer's share of transport cargoes to the exporter's share is equal to the ratio of supply elasticity to demand elasticity or Es/Ed. The developing countries generally export to markets in which the elasticity of supply is low relative to the elasticity of demand; conversely, they import from markets where the elasticity of demand is low relative to the elasticity of supply. As a result, developing countries tend to bear the transportation charges both for import and export, and any decreases in charges would be to their benefit. This analysis assumes that a developing country receives 75 percent of the benefit when it trades with a developed country, but 50 percent when it trades with an other developing country. A developed country, on the other hand, receives 50 percent of the benefit when it trades with another developed country, while it receives only 25 percent when it trades with a developing country.

3) Estimate Equations

i) First, transport cost savings under the optimal toll schedule and rates (Assumption i) are calculated. Those savings accrue from the reduction in commodity price due to competition among shippers in the international shipping market (Assumption ii), and are assumed to be allocated to regions of export and import.

ΔIij = (transport cost savings of the canal alternative under the optimal toll) ij

ΔIij : Total income accrued from transport cost savings along the canal route from region i to region j.

ii) Then the total income is allocated to those trading regions of trade (Assumption iii).

$\Delta Ii = bij \times \Delta Iij$, $\Delta Ij = (1- bij) \times \Delta Iij$

ΔIi : income for exporting region,
ΔIj : income for importing region,
bij : percentage share of income by exporting region.

iii) Lastly, the multiplier effect is estimated by the following formula using the marginal propensities to consume and import ratios of regions listed in Table V-2-1, where those data are quoted from the "World Table 1991".

$$\Delta Yi = 1/(1- ai+mi) \times \Delta Ii$$

ΔYi : increment of economic production in region i due to the multiplier effect,

ΔI : incremental income of region i previously calculated,

ai : marginal propensity to consume of region i,

mi : import ratio of region i.

Note *6 Devanney III, John W., V.M. Livanos, and R.J. Stewart, Conference Ratemaking and the West Coast of South America, Commodity Transportation and Economic Development Laboratory. Massachusetts Institute of Technology, January 1972, pp. 32-34.

(3) Results

1) Annual incremental income to the world economy from a new canal ranges from 301 million US dollars for the 150,000 DWT alternative to 330 million dollars for the 200,000 DWT alternative and 349 million dollars for the 250,000 DWT alternative. The major beneficiaries are Asia, the U.S. East Coast and the U.S. West Coast, receiving 134 million dollars, 133 million dollars, and 13 million dollars respectively from using the 150,000 DWT Canal.

i) Income to Asia accrues mostly from imports (62 million dollars). Their imports are shipped from the U.S. East Coast as container deck cargo.

ii) The income to the U.S. East Coast accrues mostly from exports (60 million dollars) shipped to Asia as container deck cargo.

iii) The East Coast of South America benefits from exports of tanker cargo, most of which is destined for Asia (2 million dollars).

iv) Increases in income for the different size canal alternatives is marginal and estimated to be within a difference of 50 million dollars.

2) The multiplier effect on the world economy due to incremental income increases world production by 921 million dollars with the 150,000 DWT canal, 973 million dollars with the 200,000 DWT canal, and 1,004 million dollars with the 250,000 DWT canal. Regions with large multiplier coefficients such as the U.S. West Coast and Europe achieve a large increment of production, while regions with large incomes also display a large increment of production.

3) The sum of income effect and multiplier effect will contribute to the growth of world GNP every year. However, this contribution is minimal, so that the GNPs of the largest beneficiary regions, the U.S.A., Asia, and the East Coast of South America grow a mere 0.01 percent.

Table V-4-1 Induced Income and Multiplier Effect Due to Transport Cost Savings from Canal Alternatives in the Year 2020

Regions	⊿Income('000 US$) 150,000DWT		200,000DWT		250,000DWT		Multiplier Effect('000 us$) (% to GNP) 150,000DWT	200,000DWT	250,000DWT
(Pacific)									
1. Asia	133, 980		140, 779		146, 002		389, 378	409, 139	424, 317
(Ex.)(Im.)	(21, 133)	(112, 846)	(21, 133)	(119, 646)	(21, 133)	(124, 868)	(0. 01%)	(0. 01%)	(0. 01%)
2. C. America WC	1, 152		1, 152		1, 152		1, 502	1, 502	1, 502
(Ex.)(Im.)	(435)	(717)	(435)	(717)	(435)	(717)	(0. 00%)	(0. 00%)	(0. 00%)
3. Canada WC	-1, 016		2, 113		996		-1, 963	4, 084	1, 924
(Ex.)(Im.)	(-1, 612)	(596)	(1, 517)	(596)	(399)	(596)	(0. 00%)	(0. 00%)	(0. 00%)
4. Oceania	207		207		207		170	170	170
(Ex.)(Im.)	(97)	(110)	(97)	(110)	(97)	(110)	(0. 00%)	(0. 00%)	(0. 00%)
5. S. America WC	758		789		789		764	795	795
(Ex.)(Im.)	(522)	(236)	(553)	(236)	(553)	(236)	(0. 00%)	(0. 00%)	(0. 00%)
6. U. S. WC	13, 140		13, 140		13, 140		45, 259	45, 259	45, 259
(Ex.)(Im.)	(7, 090)	(6, 050)	(7, 090)	(6, 050)	(7, 090)	(6, 050)	(0. 00%)	(0. 00%)	(0. 00%)
(Atrantic)									
1. Africa	3, 357		3, 387		3, 387		2, 314	2, 334	2, 334
(Ex.)(Im.)	(223)	(3, 134)	(223)	(3, 163)	(223)	(3, 163)	(0. 00%)	(0. 00%)	(0. 00%)
2. C. America EC	846		846		846		1, 173	1, 173	1, 173
(Ex.)(Im.)	(328)	(519)	(328)	(519)	(328)	(519)	(0. 00%)	(0. 00%)	(0. 00%)
3. Canada EC	-101		1, 907		1, 696		-195	3, 686	3, 278
(Ex.)(Im.)	(-285)	(184)	(1, 722)	(185)	(1, 512)	(185)	(0. 00%)	(0. 00%)	(0. 00%)
4. Europe	10, 363		13, 492		12, 374		17, 198	22, 390	20, 536
(Ex.)(Im.)	(6, 131)	(4, 232)	(6, 131)	(7, 361)	(6, 131)	(6, 244)	(0. 00%)	(0. 00%)	(0. 00%)
5. Middle East	0		0		0		0	0	0
(Ex.)(Im.)	(0)	(0)	(0)	(0)	(0)	(0)	(0. 00%)	(0. 00%)	(0. 00%)
6. S. America EC	5, 014		19, 389		35, 690		6, 279	24, 280	44, 693
(Ex.)(Im.)	(5, 014)	(0)	(19, 389)	(0)	(35, 690)	(0)	(0. 00%)	(0. 01%)	(0. 01%)
7. U. S. EC	133, 155		133, 155		133, 155		458, 646	458, 646	458, 646
(Ex.)(Im.)	(111, 762)	(21, 393)	(111, 762)	(21, 393)	(111, 762)	(21, 393)	(0. 01%)	(0. 01%)	(0. 01%)
TOTAL	300, 854		330, 355		349, 433		920, 525	973, 459	1, 004, 629

Source: MRI and YEC Consortium.

Note : Minus figures imply reduced trade caused by higher tolls and other transportation costs for the alternative canal than for the SQ canal.

V.5 Impact Upon Adjacent Countries

(1) Impact Upon Adjacent Countries

Movement of Labor

The employment increase due to construction in the case of 250,000 DWT canal is estimated to be 87 thousand presented in Section V.1. This number will be absorbed in the local labor market in Panama, and there will be little need to import labor from abroad. Consequently, movement of labor from abroad will not be significant during the construction period.

Movement of Commodities

Since major equipment for construction will be bought from developed countries, probably the U.S.A. and Japan, a significant amount of imports from the adjacent Central and South American countries is not expected. Only indirectly will the industries of Panama stimulated by local expenditure on construction increase the amount of imports from the adjacent countries.

For instance, local expenditure on the 150,000 DWT canal is 845 million US dollars in total (see Table V-1-5). This expenditure will induce 17 to 274 million dollars of inter-sectorial purchases by Panamanian industries on an annual basis. Since Panama's dependency on import is calculated to be about 26 percents,[*7] 5 to 71 million dollars will be expended on imported goods and non-financial services. Table V-5-1 shows that Panamanian imports from the western hemisphere are 40 percent, which gives a rough estimate of 2 to 28 million dollars for additional imports from the adjacent Central and South American countries. However, this accounts for only 1 percent of total Panamanian imports.

Note *7 Import ratio to GNP in 1988. (The World Bank, World Tables 1992)

Table V-5-1 Panamanian International Trade Statistics

from PANAMA	Export				Import			
	1985		1991		1985		1991	
	(mil.$)	(%)		(%)		(%)		(%)
to								
Argentina	...	...	0.5	0.1	3.5	0.3	7.2	0.4
Bahamas	6.6	2.0	0.9	0.3	...	...	...	...
Bolivia	...	...	0.6	0.2	...	...	...	...
Brazil	...	...	0.1	0.0	28.7	2.1	24	1.4
Chile	0.1	0.0	0.1	0.0	4.7	0.3	13.6	0.8
Colombia	1.1	0.3	4.2	1.2	12.6	0.9	34	2.0
Costa Rica	17.6	5.3	26.7	7.8	34.6	2.5	46.7	2.8
Dominican Republic	0.9	0.3	0.1	0.0	0.2	0.0	0.7	0.0
Ecuador	2.1	0.6	2.7	0.8	81.4	5.8	104.3	6.2
El Salvador	2.9	0.9	5.6	1.6	5.7	0.4	8.3	0.5
Guatemala	3.3	1.0	6.4	1.9	17	1.2	21.2	1.3
Guyana	...	...	...	...	...	...	...	...
Haiti	...	...	0.1	0.0	...	...	...	...
Honduras	2.1	0.6	3.7	1.1	2.1	0.2	2.2	0.1
Jamaica	0.3	0.1	0.2	0.1	0.1	0.0	0.1	0.0
Leeward Islands	...	...	1.1	0.3	...	...	...	...
Mexico	0.1	0.0	12.9	3.8	110.2	7.9	30.8	1.8
Netherlands Antilles	2.6	0.8	3.1	0.9	10.2	0.7	41.4	2.4
Nicaragua	1.2	0.4	3	0.9	1	0.1	0.7	0.0
Paraguay	...	...	...	...	0.1	0.0	0.1	0.0
Peru	1.2	0.4	1.4	0.4	7	0.5	7.7	0.5
St. Pierre-Miquelon	...	...	0.1	0.0	0.2	0.0	0.2	0.0
Suriname	0.2	0.1	0.2	0.1	...	...	...	...
Trinidad and Tobago	...	...	0.1	0.0	6.4	0.5	4.1	0.2
Uruguay	...	...	...	...	...	...	0.3	0.0
Venezuela	2.5	0.7	2.8	0.8	88.3	6.3	46.5	2.7
Windward Islands	...	...	...	...	...	...	...	...
West Hem.not spec.	1.8	0.5	13.2	3.9	165.7	11.9	283.5	16.7
Western Hemisphere	46.5	14.0	90.5	26.3	579.9	41.7	677.1	40.0
World Total	333.5	100.0	341.8	100.0	1,391.8	100.0	1,695.0	100.0

Source: IMF Direction of Trade Statistics Yearbook 1992.

(2) Colon Free Trade Zone (Colon FTZ)

The Colon FTZ is a transitional trade area that gives merchants duty-free privileges for their transactions. This area houses great numbers of retail shops for commodity exhibitions and warehouses for commodity storage. As long as commodity traders retain 60 percent of their imports for re-export, they retain their duty-free privileges.

Table V-5-2 shows the origin of imports and the destination of re-exports to and from the Colon FTZ. It tells us that the Colon FTZ imports from Asia and re-exports to Central and South America. The source of supply from Asian regions is concentrated on a few industrial countries such as Hong Kong, Japan, South Korea and Taiwan, and total imports to the Central and South American countries have been growing since 1985 although each market still remains fragmented.

Transit trade will be saturated around the year 2020 when traffic on the existing canal reaches capacity. The capacity increase of the canal will make it possible to bring larger volumes of cargo to the Colon FTZ from large Asian suppliers as compared to the SQ canal.

(3) Impact Upon Adjacent Countries during Operation

Table V-5-3 shows the ocean-borne trade of fifteen selected countries and their usage of the Panama Canal in 1988. These countries are major users of the Panama Canal as well as major would maritime traders.[8] The table first lists the three countries that have both Pacific and Atlantic coasts, then seven Pacific countries, and finally five Atlantic countries. The third column contains the volume of ocean cargo loaded at their ports, and the fourth column shows their shares in world ocean cargo. The fifth column shows their exports through the Panama Canal, and the sixth column shows their canal cargo shares. The seventh column indicates their canal dependency, expressed by canal usage over total export tonnage. The eighth to twelfth columns show correspond to the same data for cargo imports.

The table shows two interesting features of Panama Canal traffic: 1) countries with large economies such as the U.S.A., Canada, and Japan are more important for the Canal than those with small economies, while 2) the Canal is more important for adjacent countries with

Table V-5-2 Colon Free Trade Zone Trade Data

	1985 (mil. $)	(%)	1991 (mil. $)	(%)
Import from				
Japan	372.4	23.5	559.9	15.2
United States	175.6	11.1	317.8	8.6
China-Taiwan	245.6	15.5	390.0	10.6
Hong Kong	141.5	8.9	854.7	23.2
Singapore	10.8	0.7	120.8	3.3
Thailand	5.1	0.3	155.9	4.2
South Korea	103.6	6.5	418.4	11.4
United Kingdom	29.7	1.9	37.6	1.0
Sweeden	98.8	6.2	51.9	1.4
Germany	30.4	1.9	29.4	0.8
France	39.4	2.5	66.8	1.8
Italy	122.3	7.7	141.9	3.9
Colombia	21.6	1.4	112.6	3.1
Others	188.6	11.9	423.5	11.5
Total Import	1,585.4	100.0	3,681.2	100.0
Re-export to				
Brazil	39.3	2.2	94.0	2.4
Panama	154.1	8.6	283.4	7.2
Venezuela	140.4	7.9	332.9	8.4
Aruba Island	207.3	11.6	485.9	12.3
Ecuador	204.3	11.4	302.4	7.6
Colombia	205.8	11.5	394.8	10.0
St. Andrew Island	40.7	2.3	54.3	1.4
Mexico	48.8	2.7	166.6	4.2
United States	119.4	6.7	154.6	3.9
Bolivia	63.9	3.6	98.2	2.5
Chile	36.1	2.0	284.5	7.2
Guatemala	41.7	2.3	107.9	2.7
Costa Rica	47.2	2.6	98.2	2.5
Peru	20.3	1.1	103.4	2.6
Salvador	44.6	2.5	67.9	1.7
Argentina	21.0	1.2	113.7	2.9
Paraguay	34.8	1.9	157.9	4.0
Honduras	40.5	2.3	80.5	2.0
Nicaragua	33.8	1.9	142.0	3.6
Cuba	48.5	2.7	90.0	2.3
Others	195.4	10.9	346.6	8.8
Total Re-export	1,787.9	100.0	3,959.7	100.0

Source: MRI and YEC Consortium, based on the Colon FTZ internal information.

Table V-5-3 Ocean-borne Trade of Selected Countries in the Year 1988

no.	Country	Export					Import				
		Goods Loaded ('000MT)	(%)	thr. Panama ('000LT)	(%)	Canal Utilization (%)	Goods Unloaded ('000MT)	(%)	thr. Panama ('000LT)	(%)	Canal Utilization (%)
1	United States	353,590	9.5%	76,048	48.6%	21.5%	461,605	11.9%	35,793	22.9%	7.8%
2	Canada	155,220	4.2%	14,054	9.0%	9.1%	66,150	1.7%	3,114	2.0%	4.7%
3	Mexico	96,750	2.6%	4,559	2.9%	4.7%	11,470	0.3%	4,038	2.6%	35.2%
4	Japan	80,718	2.2%	8,273	5.3%	10.2%	650,127	16.8%	29,884	19.1%	4.6%
5	Australia	245,434	6.6%	3,584	2.3%	1.5%	24,706	0.6%	1,919	1.2%	7.8%
6	South Korea	54,300	1.5%	1,267	0.8%	2.3%	132,189	3.4%	7,479	4.8%	5.7%
7	Chile	14,313	0.4%	4,641	3.0%	32.4%	4,862	0.1%	3,175	2.0%	65.3%
8	Peru	8,851	0.2%	3,872	2.5%	43.7%	5,020	0.1%	2,905	1.9%	57.9%
9	Ecuador	8,402	0.2%	7,280	4.7%	86.6%	2,518	0.1%	1,826	1.2%	72.5%
10	China	76,194	2.0%	1,673	1.1%	2.2%	73,945	1.9%	10,083	6.4%	13.6%
11	West Germany	44,078	1.2%	863	0.6%	2.0%	100,152	2.6%	1,786	1.1%	1.8%
12	Netherlands	87,900	2.4%	1,224	0.8%	1.4%	266,500	6.9%	3,773	2.4%	1.4%
13	United Kingdom	142,219	3.8%	470	0.3%	0.3%	169,701	4.4%	2,667	1.7%	1.6%
14	Venezuela	82,082	2.2%	3,173	2.0%	3.9%	17,561	0.5%	1,067	0.7%	6.1%
15	Brazil	160,640	4.3%	1,551	1.0%	1.0%	53,280	1.4%	457	0.3%	0.9%
16	Others	2,125,810	56.9%	23,951	15.3%	1.1%	1,826,134	47.2%	46,517	29.7%	2.5%
	World	3,736,501	100%	156,483	100%	4.2%	3,865,920	100%	156,483	100%	4%

Source: Masakazu Iwabuchi, "A Generalized Gravity Equation with Pooled Trade Data and its Application to the Analysis of Maritime Trade: Panama Canal Pricing Issues," Ph.D. Diss., Cornell Univ., May 1992.

relatively small economies such as Chile, Peru, Ecuador, and Mexico than for those with large economies. The first point is reflected in each country's share of Canal traffic. Among exporters who use the canal, the U.S.A. is the single largest exporter, accounting for nearly half of total Canal traffic,[*9] followed by Canada and Japan which account for another fourteen percent of the traffic. Among importers, the U.S.A. and Japan are again large users of the Canal, and their share accounts for 40 percent of total cargo. If these three countries were to stop using the Canal for their trade (both export and import), the Canal would lose more than 80 percent of its revenues. Thus Canal traffic as well as revenue, are greatly affected by a small number of countries.

On the other hand, a quite different set of countries have a high dependency on the Canal. While the U.S.A. has a relatively high dependency, 21 percent for exports and 7 percent for imports, Chile, Peru, Ecuador and Mexico have a much higher dependency on the Canal for their trade. Since these countries are the most affected by the pricing of the Panama Canal, the real issue is that if the Canal price is freed from a fixed rate, the countries with large economies will affect the Canal price a great deal, while the Canal price most affects smaller countries adjacent to Panama.

Note *8 Fifteen countries amount for nearly half of world trade in volume and value; the share of world trade of those countries in 1988 was:

	Export	Import
Value	55%	52%
Volume	43%	53%

(Source: IMF Direction of Trade Statistics Yearbook 1990, and UN Statistical Yearbook 1990.)

*9 Heavy usage of the canal by the U.S.A. is observed in its exports of grain and coal from its Gulf and Atlantic coasts to Asia.

V.6 Influences on Shipping Industry

(1) General

The Panama Canal Project is expected to exert significant influence on the world's ship-building industry. If the Panama Canal is made so that it will allow larger ships to pass through it, then steamship companies can likely become more competitive, increasing their profits through the use of larger ships to reduce marine transportation costs. This very probably will lead to demand for construction of larger ships, stimulating the ship-building industry. The projected level of influence on the ship-building industry depends on the alternative adopted for the canal project and the type of ship or sea route to be used. The analysis of anticipated impact on the world's shipping industry is based on the results of the Commodity and Traffic Projection (CTP (II)).

(2) Project Impact on Cargo and Transit Demand

Projections (for the year 2020) on transit cargo for each canal alternative plan have revealed the following:

1) The ships shown below will not be influenced in terms of ship size and distribution by any increase in the size of canal:

(a) Container Breakbulk Ships
(b) Chemical Tankers
(c) Conventional General Cargo Ships
(d) Liquid Gas Carriers
(e) Refrigerated Cargo Ships
(f) Roll-on Roll-off Ships
(g) Vehicle Carriers

Such ships will be less influenced by the canal project because each is characterized by one of the following:

i) Cargos are transported by existing small ships of 40,000 dwt or less, canceling out the advantages of using larger ships.

ii) Few advantages can be expected from using ships larger than panamax size and navigating the improved or new canal because they are presently using the Panama canal as less expensive cargo routes than the other routes (e.g., Land-Bridge, Cape Horn). This means that no change in saving on cargo shipping costs is expected.

2) The cargos carried by the following three types of ships will benefit from an increase in the maximum capable ship size of the canal:

(a) Combined and Dry Bulk Carriers (CD)
(b) Full Container Ships (FC)
(c) Oil Tankers (OT)

Because savings in shipping cost are significant with larger ships, these types of ships have been made larger. As a result, more large Oil Tankers and Dry Bulk Carriers are taking routes other than the Panama route. Unlike ships carrying oil or cereals, Container Ships carry cargos with higher time value. For this reason, the largest possible ships that can navigate the Panama Canal, i.e., panamax size ships, are being built and used.

As for oil and bulk cargo, though the major portion of these cargos is carried by larger ships than panamax size on other possible routes (e.g., Cape Horn), they could enjoy the cost savings due to a shorter sailing milage of the canal routes than non-Panama routes.

3) Two Expected Effects on the Shipping Industry

The canal project alternatives will exert the following types of impact upon the shipping industry:

(a) Route shift effect: Relative reduction in shipping demand for the world fleet

Large ships of 65,000 dwt or more are expected to shift from non-Panama routes back to the Panama Canal. This shift-back will cause reduced ship transportation ton/mile throughout the world, as well as reduction of sailing time of vessels shifted back to the canal. The latter implies an increase in carring capacity of cargo of the vessels without increase in number and ship size. Accordingly, in the case that the increase in the carrying capacity is higher than in volume of the cargo carried by the vessels, the larger canal would result in over-supply of carrying-capacity tonnage. CD and OT type ships are most likely to incur the route-shift effect.

(b) Size-shift effect : Increase in demand for construction of large ships

Larger ships will be able to navigate the Panama Canal, and more large ships (65,000 dwt or more) will be built, leading to lower transportation costs. In the case of cargo with high time value, the lowering transportation costs would give vessels passing through the canal routes strong comperative advantage, which would change the existing cargo routes to the canal routes. Typically, Full Container Ships will benefit from this up-sizing effect.

Table V-6-1 Size-shift Benefit in the Year 2020

(mil. US$)

Ship Type	FC	CD	OT
Benefit	216	35	5

(derived from Table II-2-8)

4) Size-shift Effect for Full Container Ships

According to projections of results, Full Container Ships, which are projected to be the most affected by size-shifting, will take the two sea routes listed below:

(a) Asia - East Coast of North America
(b) West Europe - West Coast of North America

The new canal project will bring about changes in transit cargos carried via these two sea routes as shown in Table V-6-2.

Table V-6-2 Change in Transit Cargo: Full Container Ships in the Year 2020

(unit: 1,000 tons)

Alternative (DWT)	0 to 9,999	10,000 to 39,999	40,000 to 64,999	65,000 to 99,999	Total
SQ - 150,000	0	- 1,413	- 8,553	+ 13,786	+ 3,820
SQ - 200,000	0	- 1,413	- 8,553	+ 13,786	+ 3,820
SQ - 250,000	0	- 1,413	- 8,553	+ 13,786	+ 3,820

Route : Asia - East Coast of North America
West Europe - West Coast of North America

(3) Impact on the Shipping Industry

Improvement to the Panama Canal or a new canal may lead to increased demand for new Full Container Ships. In terms of cargo demand, the number of larger ships is projected to increase in the two sea routes shown in Table V-6-3.

Table V-6-3 Sea Routes and Navigating Conditions of Container Ships

Route	Distance (miles)	Round Voyage (days)	Annual Number of Voyages
Asia - E. coast of N. America	9,672	48	7.3
Europe - W. coast of N. America	7,985	40	8.75

Note: Speed = 18 knots

The container ships currently navigating the Panama Canal can carry containers of about 2,000 TEU. Steamship companies have a choice of two possible measures for coping with future increases in cargo demand. One is to build new ships and increase transit frequency, thus minimizing the transportation of empty containers by regular liners. The other is to build larger ships, thus enhancing competitiveness through reduced transportation costs. Present projections of demand forecast the latter possibility, i.e., more large ships will be used for the two sea routes.

Assuming, therefore, that there will be demand for construction of new large ships capable of carrying 4,000 TEU, an estimate has been made of the number of orders for new ships. According to Lloyd's Shipping Economist (April 1993), the contract price for building a new 2,500-TEU container ship is 50 million US dollars. Assuming that the price of a 4,000-TEU ship is 80 million, the canal project is expected to lead to the demand for new ships shown in Table V-6-4.

Table V-6-4 Demand for New Ship Construction for Full Container Ships

New construction	After completion of the canal	Year 2020 ~ 2060
Number of ships	19 ~ 23	38 ~ 46
Contract amount	$1,520 ~ 1,840 mil.	$3,040 ~ 3,680 mil.

Note : 13,786,000 ton / (4,000 TEU × 20 ton/TEU × 7.3 ~ 8.75) = 23 ~ 19 ships

The Panama Canal Project is expected to produce demand for construction of about 20 Full Container Ships after the completion of the new canal; this will amount to approximately 1,600 million US dollars. This amount corresponds to slightly less than 5 percent of current world annual ship construction.

V.7 Improvement of Navigation Safety

(1) Present Situation

Serious ship accidents seldom happen since navigation is strictly regulated and monitored by the Panama Canal Commission (PCC). Actually, according to Annual Reports published by the Panama Canal Commission, only five major accidents occurred after the year 1970.

If small accidents are taken into consideration, lock striking is the most frequent type of accident. The present locks were designed in accordance with the ship design current in the early part of this century. Developments in ship design and the appearance of new ship types such as full containers or car carriers have increased the possibility of lock striking. Regarding collisions or grounding, the Panama Canal is said to be relatively safe. This is because the Panama Canal has a rather wide channel with two lanes. First, ships easily avoid grounding accidents by using a wide navigation berth. Second, there is not a single lane or junction where ships going in opposite directions meet with each other, resulting in less probability of collision.

(2) Improvement of Safety

If new locks are used for under-panamax ships near the capacity of the present locks as well as over-panamax ships, maneuvering in the locks will be easier due to the increase in room as well as a lock design more in keeping with recent ship types.

Regarding grounding accidents, the situation does not differ between the SQ canal and the alternatives except for the Gaillard (Culebra) Cut, where large ships can pass each other in both directions. Widening of the narrow cut decreases the chance of ships running out of the channel and grounding on the banks.

As for collisions, the High-Rise Lock alternative canals have the channel through the third lock connected to the existing channel, where there may be more chance of collision between large ships coming through the new locks and small ships coming through the present channel. However, such an accident would result only if there were a complete breakdown in the monitoring system. The elimination of the present junction at the widened Gaillard Cut and more spaced-out convoys due to the enlarged capacity of the alternative canals would have positive effects on navigation safety with less chance of collision.

The alternative canals would generally provide users with safer channel due to design standards more in keeping with recent ship types and increased room for vessel navigation.

V.8 Socio-Cultural and Environmental Impact

The social-cultural and environmental impact of construction and operation of an alternative canal in Panama was analyzed in the component study "Impact Upon Panama". The followings are mainly extracts from the study results with some modification by theEAIU Study Team.

(1) Socio-Cultural and Environmental Impact During the Construction Period

1) Socio-Cultural Impact

(i) Demographic Impact

Anticipation and actualization of large investments in the case of either alternative will create an accelerated flow of migrants from local and foreign regions. The growth of the Metropolitan Region will exceed present forecasts. The magnitude of the impact caused by the High Rise Lock Alternative will be smaller. The increase of spontaneous settlements and/or population is an expected impact both during mobilization for and construction of either alternative. Encroachment upon government-owned or private lands by internal or external migrant coming to the Metropolitan Region and Project Area in search of better opportunities and employment and as a result of speculation due to the anticipated increase in value of the land will be an indirect socio-cultural impact. These side-effects will occur in the case of either of the alternatives chosen, but can be expected to be greater in the case of the Sea Level Canal. In both cases the supply of labor will be higher than the estimated demand. The need for selective qualified labor will not necessarily coincide with the usual over-supply created by migratory flows, or collateral formal activities, generated by construction work.

(ii) Provision of Security by Population Relocation

The opening up of a predominately rural/remote area to significant job opportunities and the relocation of large numbers of people associated with the construction of the Sea Level Canal will result in new requirements for the provision of security. Although much in the way of the security and services associated with the canal alternatives will be furnished

by the canal authorities, the ultimate responsibility for both rests with the government of Panama. There are concerns that the maintenance of full control over the area may offer a significant challenge to the Panamanian government. The inability to provide adequate security to the area is significant in its own right; however the inability to provide such security has significant implications for government legitimacy.

(iii) Excess Migration and Sudden Loss of Jobs after Completion

Given existing levels of poverty and existing employment conditions throughout Central America, it is highly likely that migration to the project areas will greatly exceed project requirements and become a burden to society. Although this is likely to be significant to either alternative, the remote areas surrounding the Sea Level Alternative provide greater challenges. In addition to excess migration, there is the related problem of the relatively sudden loss of those jobs once either project is complete.

(iv) Evolving Discontent Following Relocation

Although the canal engineering studies address the requirement to relocate significant portions of the population, they do not detail plans for such relocation. Study of relocations associated with other development projects show that, even with detailed planning, there are numerous unanticipated consequences to relocation that raise levels of dissatisfaction. Even with relatively successful relocations, favorable attitudes often wane with time. Although relocations are associated with both alternatives, the Sea Level Alternative requires greater numbers be relocated and will probably require a greater change in environment.

2) Environmental Impact

(i) Disposal of Excavated Earth and Rocks

A Sea Level Canal alternative would generate large volumes of earth and rocks, which would be hard to dispose of and whose relocation would cause significant hydrological and geomorphical problems, not to mention the negative effect on lands used for dumping and the availability of natural resources.

(ii) Agro-Chemical Contamination

The increased demand for food and agricultural raw materials generated by the digging of a new canal will lead to intensified agriculture and more chemical input. The agro-industrial sectors currently a primary caused of contamination in the Central Provinces and in the West. Such impact will be marginally greater in the case of the Sea Level Canal.

(2) Socio-Cultural and Environmental Impact During Operation

1) Socio-Cultural Impact

(i) Population Increase in the Metropolitan Area

The population increase in the Metropolitan Region will increase poverty levels, informal markets, and social pathologies, and put pressure on and thus impact the public security system and administration of justice. This impact may become more severe as the pressures to expand urban areas increase with the opening up of significantly larger areas of the country. Social infrastructure and public services in the Metropolitan Region absorb a large part of the state's resources. Both alternatives will require additional resources, which, if given priority, will be detrimental to the rest of the country. This impact is more significant in the case of the Sea Level Canal.

(ii) Post-Construction Utilization

The permanence of the villages to accommodate construction workers after the construction period, unless they are constructed on the assumption of post construction utilization by the Canal Authority as maintenance or industrial areas, will remind the Panamanians of the Canal Zone days, which in turn will have a negative impact on the national conscience. This is much more significant with the Sea Level Canal, since existing accommodation in the Metropolitan Region can be used during construction of the High-Rise Lock Canal.

(iii) Canal Security

The construction of a Sea Level Canal will require a doubling of the security force required to protect the canal itself - a requirement that would impose a significant political risk on the government of Panama. While the High-Rise Lock Alternative will require a slight expansion of security forces, the associated political risk is relatively small.

2) Environmental Impact

(i) Lowered Water Table and Contamination

The digging of a Sea Level Canal may lower the water table in the area of the Continental Divide from its present level of approximately 30 feet to as low as 150 feet. Likewise there are concerns that, because the canal trench will go below the current level of

the water table, seepage of polluted water from the Sea Level Canal may enter the underground water supply. Underground water is a source of potable water for most individual homes and communities in that region. The Government of Panama must deal with the short-term problem of replacing wells for area residents. Because much of the surface water in this region is to be used to support the sea-level fresh water barrier, there may not be viable alternatives to underground water. The shortage of water may lead to significant discontent in the region.

(ii) Adequacy of Fresh Water

Existing fresh water supplies are barely adequate to meet current needs (including water requirements for the operation of the existing canal). Likewise, while operation of the present canal results in some contamination of water, such contamination is generally understood and under control. While both alternatives will require additional water supplies, there is concern as to whether there has been sufficient study to determine the adequacy of the new supply to meet the greater requirements of either of the two alternatives. Likewise, because there are so many unknowns associated with the Sea Level Canal, there is significant concern about the possibility of contaminating the fresh water supply.

(iii) Migration of Species Between Oceans

The problems of movement of species between the Pacific Ocean and the Caribbean Sea caused by the Sea Level Canal Alternative and hence changes in sea and coastal marine life will be of great consequence for Panama and the world. These consequences are considered significant, and since magnitude is not known they are considered a significant negative impact.

(iv) Changes to the Ocean in Panama Bay

The fauna and flora of the Gulf of Panama are more adaptable to changes in salinity and temperature, and therefore the impact from dumping of sediment could be less than in the Atlantic. However, there have been changes to coral formation subject to adverse factors south of Taboga and in the Pearl Archipelago, the first areas which would be affected by coastal transformation (along with the continental platform sea bed) if Sea Level Canal construction got underway in the Pacific.

(v) Alteration of Watercourses

An important impact of the Sea Level Canal Alternative would be the alteration of various watercourses in the area, activating erosion processes caused by deforestation and changes in river bed levels. This would increase the transportation of sediment to Gatun Lake

and the current canal. This excavated material would also be unstable, since with the heavy tropical rains it would slide and create blockages in the stream valleys, especially during high run-off periods after rainfall.

VI. Overall Evaluation

VI. Overall Evaluation

The High-Rise Lock Alternatives have been found to be economically feasible in the cost-benefit analysis, while the Sea Level Alternatives have not. The Cost-Benefit Ratio ranges 1.11-1.27 for High-Rise Lock Alternatives at 5 percent of Social Discount Rate and 0.70-0.74 for Sea Level Alternatives.

Other benefits and costs, which are studied but not included in the C/B analysis, include socio-cultural impact, environmental costs and intangible safety impact on canal users. Consideration of these other benefits and costs generally supports alternative canals.

Interruption of shipping traffic due to construction work can be minimized. The alternative canals provide users with safer channel due to design standards more in keeping with recent ship types, and due to more allowance for vessels navigation in the channel. Urban development promoted by construction work of alternative canals is significant in Panama City and Colon through newly created employment opportunities. However, the magnitude of this effect, 3,000 newly-hired workers annually, is not so large, when compared with the number of total existing workers. Mitigation costs seem to be limited since possible consideration was given to them in the estimates of engineering costs, although another ongoing component study will provide quantified data on those costs.

Socio-cultural impact is caused principally by the migration to the Metropolitan Region and the relocation of people from the project area. Social infrastructures and public services will be necessary for accommodating the increasing people in Metropolitan Region and for providing the social security in the project area. The necessity will impose a rather heavy burden on the Government, resulting in decrease in allocating the resource to other use.

Environmental impact is caused by the geographic alteration due to the construction work. Various damage, such as water pollution due to the lowered water table of the Sea Level Canal, hydrogical and geomorphical issues at the place for disposal of excavated earth and rocks, inter-ocean migration of species, are identified qualitatively.

Both socio-cultural and environmental impacts are much more significant in the Sea Level Canal than in the High-Rise Lock Canal since the relocation of people and geographic alteration are more required in the Sea Level Canal than the other.

Impact analysis has identified some positive economic effects on the Panamanian economy, the economy of adjacent countries, and the world economy. These effects are generally positive except for the toll effect on captive users of the Panama route.

The effect on the world economy in terms of induced trade and induced income due to reduced shipping costs, is marginal as compared with size of the economy of each country where such repercussions occur. The induced trade cargo in the world ranges 1,126–1,498 thousand ton in the year 2020 by alternatives and the induced income through the multiplier effect in the world ranges 921–1,004 million US dollars in the same year. The cargo volume is only 0.4–0.6 percent of the forecasted Panama Canal (SQ) traffic forecast in the year 2020. The induced income is also only 0.01 percent of the GDP even in the largest beneficiary regions such as the U.S.A., Asia and the East Coast of South America. An increased demand for larger ship construction is one of the influences on world economy. However, only 20 Full Container Ships will be demanded additionally up to the year 2020. The effect on adjacent countries, induced by the construction demand, is also not expected to reach significant levels, because newly increased labor needs will be absorbed by the local labor market in Panama and because major equipment for construction will be bought from the developed countries.

On the other hand, the effect on the Panamanian economy, due to local expenditure during construction and canal revenue, is more noticeable as compared with the GDP level of Panama. The induced income in Panama, due to direct demand effect of the construction and the repercussion through the multiplier effect, ranges 1,685–2,167 million US dollars around in 10 years of construction. The payments from canal revenue, for maintenance and operation, royalty to the Government of Panama, and dividends to the Government, will contribute to the Panamanian economy. The induced production, due to the direct demand effect and through the repercussion, ranges 155 million US dollars in the case of Sea Level Canal to 1,369 million Us dollars in the case of 150,000 DWT canal in the year 2040 after 20 years from the opening of operation. In addition, these economic impacts will continue for a long time so as to foster stable growth in Panama's economy.

The new toll rate established by the operator of the alternative canals will make some countries for which the Panama route is the only route less competitive in the world trade market.

Impacts other than those considered in Cost–Benefit analysis have been favorable to the High–Rise Lock Canals, because they bring the positive economic effects while not so

much negative socio-cultural and environmental effects as those in the case of the Sea Level Canals. On the other hand, negative socio-cultural effects are significant in the Sea Level Canal.

Consequently, High-Rise Lock Alternatives increase in viability. The Sea Level Alternatives, however, are difficult to recover the economic infeasibility.

Annex

Annex I Social Discount Rate

Chapter 1 The Concept of Social Discount Rate (SDR)

1) Definition and Function of SDR

a. In general, SDR is defined as a rate for discounting values of future goods and services produced/required in a project (i.e. benefits and costs of the project) into present values in order to measure the investment efficiency or social effect of the project.

b. Along with the above-mentioned function, the SDR provides a basis for evaluating indices (e.g. Internal Rate of Return (IRR)) representing the investment efficiency of the project. This is because the SDR represents the average opportunity cost of capital expected in the economy concerned, i.e. the average marginal profitability of the capital.

c. The SDR is adopted in an economic appraisal of the project, while in a financial analysis of the business entity of the project interest rates (real) play the same function as the SDR.

2) Characteristics of SDR

a. There exists the following constraint on the SDR : The countries/areas whose SDRs are estimated should be the same as those which not only enjoy benefits but also bear the costs of the project concerned. In other words, only one type of SDR is applied to discount the values of both the benefits and the costs. Therefore, if the countries/areas which enjoy the benefits are different from those which have to bear the costs of the project, the domain on which the SDR is estimated has to be decided from only one standpoint either that of the beneficiaries or that of the cost bearers, taking into consideration the relative importance of the two aspects.

This is so in the case of the project appraisal of the Panama Canal

Alternatives.

b. In the fields of project appraisal and general economic theory, the values of future goods and services are customarily expressed/measured in constant prices of the base year of the evaluation. Accordingly, The SDR estimated or discussed should be a real rate, not a nominal rate.

Chapter 2 Basis for Adopting the Formula for Estimating/ Projecting the SDR Proposed by the Study Team

1. Summary

a. The EAIU Study Team proposes the following formula for estimating/ projecting the SDR to be applied in the economic appraisal of this Project:

SDR = EG + RP

where EG : Average annual economic growth rate in the economy concerned in the year prior or subsequent to the year for which the SDR is estimated

RP : Factor of risk premium, which is determined mainly from the viewpoint of the degree of market soundness in the economy.

b. The background to the above formula is as follows:

In the economic appraisal of this project, the year 2010 is adopted as the base year, and two countries (the U.S.A. and Japan) are selected as the main beneficiaries in estimating and forecasting the SDR to be applied (for details, see Chapter 4 of this Annex). These factors make it necessary to forecast the SDRs in the two countries, which has not been tried in any published literature relating to the discount rate.

As described in Chapter 2 of this Annex, only estimation and forecast methods are presented in the literature. At the same time, the literature reveals that the SDR of the economy concerned should be estimated based on the results of two or three different approaches relating to the SDR, and forecasting an optimum path of economic development is essential for projecting the SDR. This implies that vast amounts of data on economic activities in the past, present and future are required for estimating and forecasting the SDR. In addition to the above, time constraints and other resources in this analysis results in the above simple formula for estimating and projecting the SDR applied to appraise this project.

The proposed formula is deduced from a different viewpoint on the SDR from those discussed in the literature as clarified below.

Below the basis on which the independent variables "EG" and "RP" were adopted to explain the SDR will be discussed (for details, see subsequent section of this chapter).
The relationship between the "RP" and the degree of market soundness in the economy concerned will be presented later Chapter 3 of this Annex.

c. Theoretical SDR, which is theoretically discussed by applying Welfare Economics, can be interpreted as the point which corresponds to the maximum potential economic growth rate of the economy concerned, based on the following consequences:

(1) Meanings of the equilibrium point which can be fixed by the Production Possibility Curve and Social Indifference Curve. The theoretical SDR can be estimated/determined as a gradient of the tangent line, which passes through the equilibrium point, to both curves (see Fig.ANI-1), and

(2) Consequences of "Complete Competitive Markets", which are assumed in the theory on consideration of "Business Risks" and the possibility of realizing "Maximum Marginal Rate of Return".

This is the basis for adopting the independent variable "EG" in the above-mentioned formula.

d. Unfortunately, the Production Possibility and Social Indifference Curves supposed in the theory are very difficult to measure, using the basic data/information relating to the two curves that exist or can be supplied. Accordingly, the theoretical SDR cannot be estimated either. To estimate practical SDRs based on actual/existing data is virtually paramount to assuming an economy with "Incomplete Competitive Markets" as a background to making the estimate. The economy can be characterized as one "With High Risk and Return", as opposed to one with "Complete Competitive Markets". Accordingly, in the estimated practical SDRs, a portion is understood to be included to take account of risk as well as a portion expected from economic growth of the economy concerned.
This is the basis for introducing the independent variable "RP".

2. Outline of SDR as Discussed in the Literature

This outline provides the main background for devising the proposed formula for estimating and forecasting the SDR which is applied to appraise this project.

1) Outline

a. In published literature and papers on project appraisal*[1], not only discount rate relating to appraisal of efficiency of a project but also those relating to appraisal of efficiency and social impact of projects are discussed. The former rate corresponds to the concept of the Opportunity Cost of Capital (OCC, defined later) and is used in traditional appraisals of projects. The latter rate reflects public policy on the relative importance of present and future consumption (i.e. saving and investment) in addition to on element for appraising the efficiency of the project. As a result, the latter rate is a little different from the former rate.
The latter rate is expressed as an Accounting Rate of Interest (ARI), or sometimes Social Accounting Rate of Interest (SARI), in order to distinguish it from the former rate (Economic Accounting Rate of Interest (EARI)) in the literature.

b. In this study, only the efficiency of this project (Alternatives to the Panama Canal) is appraised. Accordingly, the EARI in the literature used in this report, the concept of which is the same as that of the "Social Discount Rate (SDR)" is estimated and forecasted to appraise this project. As discussed in detail in Chapter 4 of this Annex, this project can be characterized as a worldwide project in terms of the main beneficiaries and cost bearers. The nature of this project makes estimation of the SARI which is applied to this project difficult or meaningless. This is reason for the adoption of the SDR based on the same concept as the EARI and the OCC.

2) Point at Issue

a. In this study, the year 2010 is adopted as the base year for the economic appraisal, and two countries (the U.S.A. and Japan) are selected as the main

beneficiaries of this project for estimating and forecasting the SDR. This results in the SDRs for the two countries having to be forecasted for the year 2010, for which there is no concrete numerical reference mainly because the two countries are developed countries which are beyond the scope of analysis of the literature.

b. The literature discusses estimation and forecast methodologies of the ARI. Even in the case of estimating recent ARIs based on actual economic data, the literature recommends the following approaches instead of direct estimation of the Opportunity Cost of Capital (OCC) in the economies concerned:

- Two-step approach :	Estimation of ARIs based on economic appraisal of past and planned projects in the economies as the first step, and modification of the estimated ARIs as the second step, taking account of economic policy and recent conditions, or
- Integration of different approaches :	Estimation of ARIs based on the respective results of the marginal output-capital ratio approach modified to reflect labor's contribution, the aggregated production function approach, and the micro-level approach, or
- Adoption of proxies of the OCC :	Market interest rate, or highest rate of yield on long-term National Bonds, etc.

The second approach is adopted in World Bank Staff Working Papers No. 521 (Egypt) and 609 (Thailand), and the results of the last approach are presented in Table ANI-1.
The above-mentioned recommendation and the applied results suggest that:

- Even direct estimation of ARIs based on economic data in developing countries is very difficult, and
- One-point estimation of ARIs is impossible and the ARI of the economy concerned ought to be presented with some width.

ARI forecasting methodologies are also discussed in the literature. However, it is pointed out that an optimum path of economic development for

the economy concerned must be forecasted as a basis for forecasting the ARI. In order to forecast the optimum path, the following preparation is required:

– Econometric model :	Main components of the model consist of the projected input–output coefficient matrix and capital stock matrix of the economy concerned.
– Forecast of exogenous variables of the model :	For example, foreign trade (export and import by industrial sector) which can be forecasted based on analysis and forecasting of international relation.

c. From the above it can be concluded that the point at issue in the published literature on ARI or SDR is measurability based on actual economic data. To measure the ARI or SDR in accordance with the estimation and forecasting methodologies discussed in the literature, vast amounts of data and analysis on past, present and future economic conditions in the economies concerned are indispensable as the above discussion shows.
Unfortunately, time constraints and other reasons relating to this study do not allow adoption of the estimation and forecasting procedures presented in the literature.

Note *1 –I.M.D. Little and J.A. Mirrless, Project appraisal and planning for developing countries. Heinemann Educational Books, Ltd., 1974.

–Lyn Squire and Herman G. van der Tak, Economic Analysis of Projects. World Bank Research Publication, the Johns Hopkins University Press, 1975.

3. Interpretation of the Theoretical SDR and Method of Estimation

In this section, the basis for adopting the factor "EG" as one of the independent variables in the proposed formula for estimating and forecasting the SDR is explained. The basis is derived from an analysis of the theoretical SDR developed by applying Welfare Economies.

1) Method of Estimating of the Theoretical SDR

a. As shown in Fig.ANI-1, the theoretical SDR can be estimated/determined as a gradient of the tangent line to the Production Possibility Curve PP' and the Social Indifference Curve II', which intersects the Equilibrium Point Z. Theoretical SDR has the same magnitude as one of the following terminologies used in the field of the theory of project appraisal:

from the consumer's viewpoint:
- Social Time Preference Rate, and
- Social Marginal Substitution Ratio between consumable goods and services which consumers can manage,

from the production side:
- Marginal Substitution Ratio between finished products, and

from both sides:
- Relative Price between finished products.

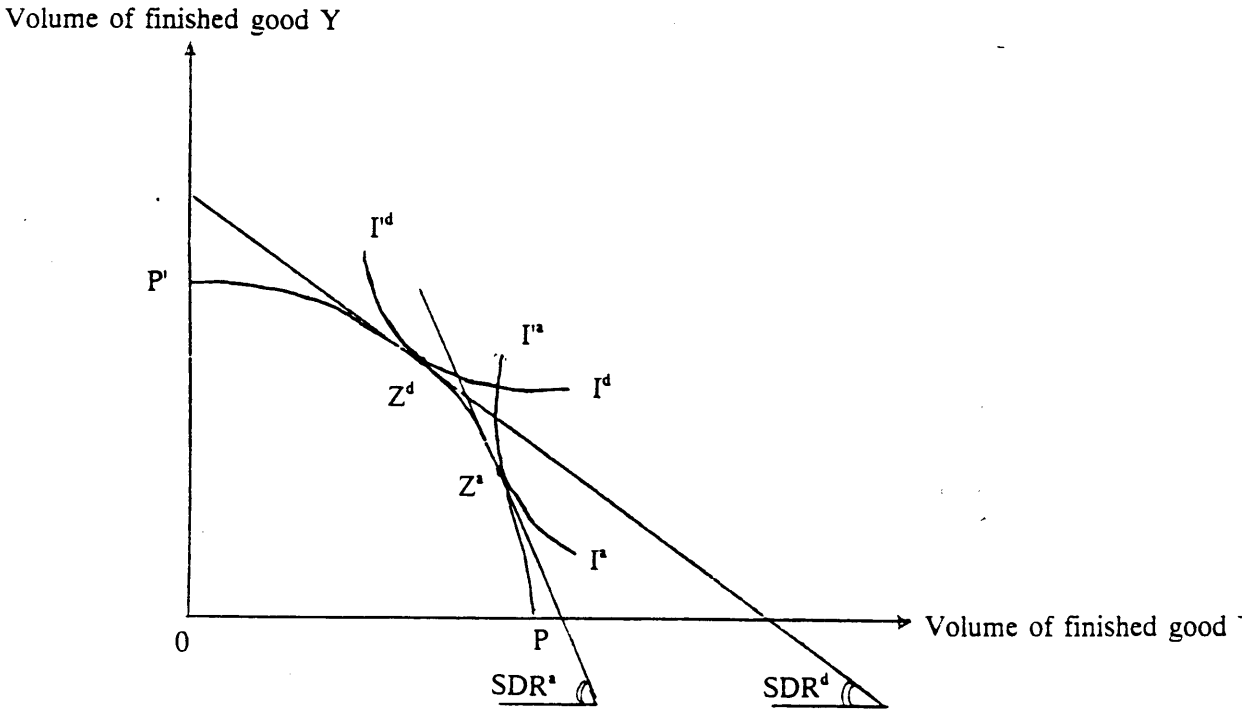
b. The Production Possibility Curve PP' and Social Indifference Curve II' can be defined as follows on the assumption of "Complete Competitive Markets":

Production Possibility Curve or Social Production Transformation Curve:

A curve which is formed by a set of points where the combination of the production of goods X and Y is maximized on the condition of a given amount of factors of production (raw materials and labor etc for the production of X and Y).

Social Indifference Curve:

A curve which is formed by a set of points where a combination of the minimum amount of X and Y gives the consumer (representing consumers in the consuming economy) an equivalent level of utility.



Legend:

Curve P'P : Production Possibility Curve or Social Production Transformation Curve

Curve I'I : Social Indifference Curve

d : Desirable in the economy concerned

a : Actual in the economy concerned

Point Z : Equilibrium point attained from efficient production and maximized consumer utility approaches

Fig.ANI-1 Mechanism for Determining Theoretical SDR

2) Significance of the Equilibrium Point Z

a. At Equilibrium Point Z, Parato's value premise*2 is satisfied along with Lerner's*3. This implies that at Point Z, both optimal production formation (distribution of production resources by usage) and optimal consumption formation (distribution of consumable products among consumers) are theoretically realized at the same time.

Another observation to be made is that at Point Z, prices of the finished goods X and Y are guaranteed in the sense of being endorsed by the consumer's willingness to pay, and a Maximum Marginal Rate of Return is attained, which results in maximum profit to the production units.

Note *2 Parato's value premise is as follows: It is socially beneficial to increase the utility of at least one person without decreasing the utility of all other persons.

Note *3 Lerner's (A.P. Lerner) value premise is as follows: It is socially beneficial to increase the net output volume of at least one finished product without decreasing the net output volumes of other finished products.

b. In Fig.ANI-1, two Equilibrium Points Z^d (Desirable) and Z^a (Actual) are shown. In general, Z^a is below Z^d on the Curve PP' in many developing countries, resulting in a higher SDR than the one brought about by Z^d. Reasons which may be cited for the above situation are as follows:

i. High risk on the supply side, i.e. high uncertainty in the supply of finished goods in terms of prices, quantity and quality, and

ii. A Social Indifference Curve based on the short-sightedness of consumers. This short-sightedness is mainly caused by their low level of income and the high risk involved.

3) Consequence of Assuming "Complete Competitive Markets"

a. A standard complete competitive market (factors of production markets and finished product markets, terminology used in economics) can be defined as follows:

A market where

i. The goods or services to be transacted are completely homogeneous,
ii. There exist numerous consumers and suppliers of the goods and services concerned, and transactions between the consumers and suppliers do not affect the market price due to the relatively small volume transacted by the each subject vis-a-vis the total volume of goods and services transacted in the market,
iii. Information on the characteristics and market prices of the goods and services is disseminated to a reasonable degree among all participants in the market, and
iv. There are no obligations with regard to entering or withdrawing from the market and associated movement of resources (mainly capital).

Strictly speaking, the Complete Competitive Market defined above does not exist even in the world's most developed countries.

However, it can be pointed out that the higher the level of the economy of the country concerned, the greater the possibility of forming Semi-Complete Competitive Markets in kinds and numbers.

b. The above definition leads to the following two consequences;
First the variation in the business "Risk" for the suppliers and the behavior "Risk" for the consumers of the goods and services becomes very small in a Complete Competitive Market compared with in an Incomplete Competitive Market. However, the "Risk" cannot be wiped out even in a Complete Competitive Market, because the concept of "Risk" is related by its very nature to the future. Therefore, it can be concluded that the factor of "Risk" is almost totally neglected or not reflected in the Production Possibility Curve and the Social Indifference Curve illustrated in Fig.ANI-1, and ultimately in the theoretical SDR. This point is a major difference from the one discussed

based on an actual economy.

The second consequence is that the assumption of a Complete Competitive Market is a sufficient condition for the Maximum Marginal Rate of Return being attained at the Equilibrium Point Z. In other words, the Maximum Marginal Rate of Return is assured on the supply side of the goods and services when the market is a Complete Competitive Market. Therefore, the theoretical SDR can be interpreted as the value at which the Maximum Marginal Rate of Return is almost certain to be realized on the supply side.

4) Interpretation of the Theoretical SDR

a. Based on the two consequences of assuming a Complete Competitive Market at Equilibrium Point Z, the level of the theoretical SDR can be interpreted as corresponding to an economy which grows at Maximum Potential Growth Rate.

This is the basis for introducing the independent variable "EG" into the proposed formula for estimating and forecasting the practical SDR.

b. Attention needs to be paid to the difference between the two concepts of Maximum Potential Growth Rate and "EG". The former is theoretically conceptualized based on, so to speak, a static equilibrium analysis on the assumption of a "Complete Competitive Market" and "Unchangeableness of the total volume of resources to be consumed" (the equilibrium analysis illustrated in Fig.ANI-1 is classified as this type of analysis). On the other hand, as the definition of factor "EG" suggests, "EG" is estimated based on a dynamic economy with Incomplete Competitive Markets.

4. Implications of the Practical SDR and Method of Estimation

In this section, the basis for adopting the factor "RP" as a second independent variable in the proposed formula for estimating and forecasting the SDR is explained. The basis is derived from consideration of the difficulty of measuring the theoretical SDR and the SDR recommended in the above literature and by international financial organizations, which has already been pointed out briefly in the previous section, and analysis of differences in characteristics between economies with Complete and Incomplete Competitive Markets.

1) Discussions of Methods of Estimating the Practical SDR

a. Measurement of the Production Possibility Curve and Social Indifference Curve, which are fundamental factors for discussing the theoretical SDR, is impossible because:

- Complete Competitive Markets in themselves do not exist anywhere in the world, and
- Even if they did, the cost–performance ratio of a survey for providing basic data for estimating the theoretical SDR would be very low.

Accordingly, literature relating to the practical SDR recommends that the Social Marginal Product (SMP) or Opportunity Cost of Capital (OCC) of the actual economy concerned be estimated rather than the theoretical SDR.
The discussion in Section 2 starts at the SMP or OCC phase.

b. The OCC can be defined as:
The maximum value among those of other types of finished products produced when the finished product actually selected is not produced, using the same factor of production in kind and volume.

c. However, as World Bank Staff Working Papers No. 521 and 609 have revealed, measuring the OCC or SMP is also difficult using basic data on the economies of developing countries. They tried the following approaches and ultimately recommended SDRs with a variant of 3–4% of the economies concerned, which were estimated by referring to the estimated results through

the approaches:

i. Marginal output-capital ratio approach modified to reflect labor's contribution,
ii. Aggregated production function approach, and
iii. Micro-level approach.

The papers exhibit a difference of around 10% in the estimated ARI basis among estimations through the above three approaches. This implies that one-point estimation of the ARI or SDR is very difficult.

d. In the light of these individual attempts to estimate SDRs, international financial organizations and major western donor countries finally recommended that project appraisers adopt the following indicators as a proxy of the OCC or SMP, i.e. a proxy of the SDR of the economy concerned:

i. Market interest rate, or
ii. Highest rate of yield of either long-term National Bonds or Private Securities, or
iii. Lowest Internal Rate of Return of recently completed projects.

The SDRs recommended by the organizations for application to project appraisals in developing countries are tabulated in Table ANI-1.

2) Implications of Estimating the Practical SDR Using Actual Basic Data

a. Estimating the practical SDR using actual basic data is the same as assuming Incomplete Competitive Markets as the basis for estimating the SDR. This is because the behavior of the supply and demand sides of the Markets is reflected in the basic data.

b. An economy with Incomplete Competitive Markets can be characterized as one with high risk and high return, compared with an economy with Complete Competitive Markets. In other words, such an economy can be characterized as a more dynamic economy than one with Complete Competitive Markets as well as a transient economy to the same. Therefore, in the practical SDRs

estimated based on actual economic data, a portion which corresponds to high risk and high return should be included in addition to the portion which corresponds to average profit rate at the supply side. The latter portion is formed based on the average economic growth rate and functions as the lowest level of investment incentive to suppliers.

This is the basis for introducing the independent variable "RP" into the proposed formula for estimating the practical SDR.

Chapter 3 Relationship Between the "Degree of Market Soundness" and Factor "RP", and Estimation of the Factor

1) Degree of Market Soundness

a. The definition of a Complete Competitive Market has been given in Chapter 2 of Annex. Complete markets for capital, labor, materials and finished products in an economy with Complete Competitive Markets are regarded as having a 100% degree of market soundness in this analysis. Accordingly, the degrees of market soundness of actual markets or markets to be analyzed becomes lower, the further removed they are from a Complete Competitive Market. It is also supposed in this analysis that the degree of market soundness rises constantly throughout all economic development stages: take-off, growing/expansion, and the mature stage. As a result, degree of market soundness in the developing countries is generally supposed to be lower than in the developed countries in types and numbers.

b. The process whereby degree of market soundness increases is as follows: In a free/open economy, not an economy controlled by the government, economic development is usually encouraged by development of information and service industries and increases in investment funds. These industries provide more information in kinds, volume and quality to existing and potential market participants (consumers, entrepreneurs, production units), and the increase in investment funds with the propagation of market information leads to an increase in participants in existing and potential industries and to industrial diversification in the economy concerned. This is the process whereby the degree of market soundness increases.

2) Relationship between Degree of Market Soundness and Factor "RP"

a. Complementing the discussion on "Risks", "Complete and Incomplete Competitive Markets" and the factor "RP" in Chapter 2, the significances of the factor "RP" can be clarified as follows:

-The factor "RP" represents the magnitude of the business "Risks" for the suppliers of goods and services and the behavior "Risk" for the consumers in the economy concerned.

-The "Risk" always exists even though markets in the economy are completely competitive. This is because the concept of "Risk" relates by its very nature to the future, while the concept of a "Complete Competitive Market" tells little about the future. However, the magnitude of the "Risk" becomes smaller proportionally to the rise in degree of market soundness. In other words, it becomes smaller the more prevalent Complete Competitive Markets become in economic society in terms of number, type and depth.

-Assuming that business activities take advantage of the economic situation with "Risks", i.e., suppliers of goods and services do not reduce their activities due to existence of "Risks", the magnitude of the "Risks", i.e. the factor "RP", can be interpreted as a variable which represents the magnitude of business chances in the economy concerned. This assumption can be verified by such fact as that a powerful intention to invest can always be observed, especially in developing countries.

b. As mentioned above, not only more information on the characteristics and market price of goods and services in the industries concerned, but also more information on new business chances in potential/undeveloped industries can be expect to be disseminated to all existing and potential participants in the markets as market soundness increases. The former factor clearly implies that new investors in existing industries can reduce but not avoid "Risk" to a greater extent than prior investors. This is because "Risk" comes generally from a lack of information on present and future conditions relating to the matter concerned.

The latter factor results in the following consequence, in combination with the above assumption that business activities take advantage of the economic

situation with "Risks": Existing and potential investors develop new industries. As a result, in the long term,

-Business activities are observed in all industrial sectors which the economy wishes to have, and

-The tendency for profit rates to converge appears in all sectors, i.e. the number of industrial sectors with high return but high risk is expected to decrease.

This is the relationship between the degree of market soundness and the factor "RP".

3) Estimation of the Factor "RP" Included in the SDRs Recommended by International Organizations

a. As stated above, the factor "RP" corresponds to the degree of business risk in the economy concerned and the magnitude of "RP" is inversely proportional to the degree of market soundness in the economy.

b. By applying the proposed formula and using the data shown in Table ANI-1 and ANI-2, the factor "RP" included in the SDRs recommended for application in developing countries by international organizations can be estimated as follows :
The range of the factor "RP" can be estimated by subtracting the "Average Annual GDP Growth Rate" in Table ANI-2 from the "Recommended SDR" in Table ANI-1.

Case (premises for calculating "RP")	Estimated Range of "RP"
- 1965-73 Growth GDP rate*	5-6% per annum
- 1973-80 Growth GDP rate*	6-7

* Low and middle income economies, Table ANI-2

Accordingly, the factor "RP" is estimated to drop within a range of 5–7% per annum.

c. In the case of low and middle income economies, almost the same magnitude of factor "RP" as that of factor "EG" (4.8–6.6%/annum, 1965–1980) is included in the SDR.

It is not expected that the low and middle income economies will grow at 5–6% per annum, the growth rate realized in the latter half of 1960s and the first half of 1970s, for the long-term future, while business "Risks" will not decrease so smoothly. Accordingly, the portion which corresponds to the factor "RP" may account for a larger part than that corresponding to the factor "EG" in the newly estimated SDRs for these economies.

Table ANI-1 Social Discount Rates Recommended by International Organizations, England and the United States of America

Organization	Recommended SDR*	SDR interpreted as	Basic data or method for fixing the SDR
ODM	8% (basically) 8~12% (actually applied)	Opportunity Cost of Capital (OCC)	-Real interest rate on first-class securities -Highest rate of interest on foreign loans to country concerned
UNIDO		Consumption Rate of Interest (CRI)	CRI = e.GR + PTP e : Elasticity of marginal utility to consumption (0.5~2.0) GR : Increasing rate of consumption PTP: Pure time preference (2~8%)
USAID	10%	OCC	-Lowest International Rate of Return (IRR) of recently completed projects
ADB	8~12% -8% is adopted in case of economic growth rate of less than 6% -12% more than 6%	OCC	-Average rate of yield on Bonds issued by IBRD (World Bank) and International Regional Development Banks

Note * Cited from manuals issued by the organizations. It is not clear whether or not the figures are recently revised.

Source : "Appraisal of Transportation Projects in Foreign Countries" (originally in Japanese) edited by Japan Society of Civil Engineers, December 1986

Table ANI-2 Average Annual GDP Growth Rates by Economy Level of Income

(unit: % per annum)

	1965-73	1973-80	1980-86
Low-and middle income economies	6.6	4.8	3.8
Low-income economies	6.0	4.6	6.1
Middle-income economies	6.9	4.9	2.5
High-income economies	4.6	3.0	2.5
OECD members	4.5	2.9	2.6
Total reporting economies	4.9	3.4	2.8
Oil exporters	7.3	4.9	0.8

Source : World Development Report 1990, the World Bank

4) Estimation of "RP" for the Year 1990 and 2010
(Arithmetic Mean of These of the U.S.A. and Japan)

a. In this analysis, the factor "RP", which is an arithmetic mean*4 of those of the U.S.A.*4 and Japan,*4 is estimated to be 3.0% per annum for the year 1990 and 2.5% per annum for 2010. The "RP" for the year 1990 is almost half of that of the developing countries (5-7% per annum, estimated), and the "RP" for the year 2010 is estimated based on those for 1990 and on the supposition that the markets in the two countries become more sound as their economies develop.

b. Due to time constraints and other reasons relating this survey, quantitative analysis on the relationship between the degree of market soundness and the factor "RP" has not been attempted. However, the above estimation is made based on:

-Estimation of the factor "RP" in the case of the developing countries,
-Supposition of a difference in the maturity of the economies of these two countries and the developing countries, and

–Analysis of the relationship between degree of market soundness and the factor "RP".

Note *4 Reasons for adopting this will be presented in Chapter 4 of this Annex.

Chapter 4 Relationship between the Practical SDR and Beneficiaries and Cost Bearers of the Project

1) Main Beneficiaries of the Panama Canal Alternative Project

a. In this analysis, the U.S.A. and Japan are selected as the main beneficiaries of this project, based on the benefits by OD (Origin–Destination) pair for Combined and Dry Bulk Carriers (CD), which account for 47 percent of total benefits in the year 2020 and 60 percent in 2060.

Table ANI–3 Five Largest Benefits for CD by OD Pair
– 150,000 DWT case –

Order	OD		2020		2060	
			Benefit (1,000US$)	Share (%)	Benefit (1,000US$)	Share (%)
1.	US EC	– Asia	167,566	72.8		
	US EC	– Asia			237,932	38.2
2.	S.America EC	Asia	18,005	7.8		
	Asia	– US EC			86,616	13.9
3.	Canada WC	– Europe	14,285	6.2		
	US WC	– Europe			48,278	7.8
4.	Canada EC	– Asia	3,769	1.6		
	Canada WC	– Africa			45,360	7.3
5.	Oceania	– US EC	3,534	1.5		
	US WC	– Africa			37,634	6.0
	Others		23,062	10.0	167,107	26.8
	Total		230,221	100.0	622,927	100.0

Note: The benefits are estimated based on the projected transit cargo volumes presented in the WEFA Draft Final Report

As shown in the above Table, the route between the U.S.A. and Asia remains the major beneficiary of this project in spite of a decrease in its share of total CD benefits from 72.8 percent in 2020 to 52.1 percent in the year 2060.

b. As long as the OD area classification made by the WEFA is adopted, "Asia" cannot be subclassified into countries in Asia. However, the fact that Japan enjoys the biggest international trade among those countries is the basis for selecting Japan as one of the main beneficiaries of this project. When a country other than Japan in the Asian area is recognized as one of the main beneficiaries, this can be easily reflected in estimating the practical SDR applied to appraisal of the project.

In this analysis, arithmetic means of the economic growth rates and the factor "RP" for the two countries are adopted, in calculating the SDR. However, it is possible in calculating to give various weight to economic growth rates and the factor "RP" for the two countries in order to reflect the more precise distribution of benefits between the two country in the SDR. Unfortunately, there is no basic data for estimating what weight to give each factor, which is the reason for adopting the arithmetic means.

2) Relationship between the SDR Applied and the Cost Bearers of the Project

a. In general, from the standpoint of project appraisal, the following can be pointed out the SDR applied to discount cost of the project concerned has to be that representing the country/area where the business entity of the project responsible for recovering the cost is located; at the same time, only an SDR needs to be applied to discount both the benefits and costs of the project. The above has been stated in Chapter 1 of this Annex.

b. In the appraisal of this project, transportation cost savings, most of which would be enjoyed by foreign beneficiaries, are adopted as direct benefits from this project. This implies that the SDR for discounting the benefits into present values in the year 2010 has to be that of the main beneficiaries. On the other hand, in the Draft Final Report on the Financing Scheme, Financial Analysis, and Management Arrangement Component Study submitted by Nathan Associates, a Panama Canal Authority is recommended as the preferred management organization (business entity) qualified to meet the political,

financial management, and operating efficiency requirements of the canal alternative. This would be set up as an independent authority by national Panamanian legislation (Authority Act) and would have responsibility for recovering project and other costs. In this case, the SDR applied to discount the costs of this project would have to be that of Panama. The SDR is independent of the financing scheme of the project. This is inconsistent with the case of discounting the benefits.

c. In this analysis, the SDR to be applied to the project appraisal is selected from the standpoint of discounting only the direct benefits of the project. The SDR represents those of two countries, the U.S.A. and Japan. As a result, the SDR neglects the type of project business entity. In other words, the SDR adopted is independent of the type of business entity proposed by other Component Study Team.

Panama would enjoy large indirect benefits through e.g. construction of the Alternative Canal as discussed in Chapter V of this Final Report, while a very small portion of the direct benefits would be enjoyed by Panama. Therefore, to take account of Panama in the estimation and projection of the SDR is irrelevant in light of the above-mentioned function and limitation of the SDR.

Chapter 5 Forecast of the Factor "EG" for the Year 2010

a. The EAIU Study Team forecasts an arithmetic mean of economic growth rates for the U.S.A. and Japan (the factor "EG") for the period of the year 2005–2010 of 2.5% per annum, while the same figure was 3.8% per annum in the latter half of 1980s (see Table I–3–1). Behind the forecast of 2.5% per annum lies a rough estimate of 2.0% annual economic growth in the U.S.A. and 3.0% in Japan.

b. The Study Team did not obtain a long term projection on the U.S. economy which would be available from public agencies in the U.S.A. or international organizations. However, the Study Team supposes around 2.0% per annum economic growth in the U.S.A. for the period of the year 2005–2010, taking into account the following factors:

   i. Past long–term U.S. economic growth trends, and
   ii. The negative impact on economic growth of worldwide constraints on resources and environmental concerns.

   On the other hand, the following long term projection on the Japanese economy has been published by the Economic Planning Agency, Japan, in the document "Simulation, Industry in the Year 2010" (originally in Japanese):

Actual	1980 – 1988	4.0% per annum
Forecast	1990 – 2000	3.8%
	2000 – 2010	2.7%

c. From the above discussion, it can be pointed out that the Study Team's projection, 2.5% per annum, an arithmetic mean of the economic growth rates of the U.S.A. and Japan for the period of the year 2005–2010, is a little higher or almost equal to estimated based on the published projection.

Annex II Formulae for Calculating Benefit

1. Route-shifting Benefit by Over-panamax Vessels

The benefit for a ton of route-shifting cargo is equal to the cost savings from using the canal route.

The benefit for a ton of cargo is :

$$b_{kmi} = Ca_{kmi} - Cp_{kmi}$$

b_{kmi} : unit benefit for a cargo in ship size category i, OD route m, ship type k ($/ton)

Ca_{kmi} : unit transportation cost for the least expensive alternative route in ship size category i, OD route m, ship type k ($/ton)

Cp_{kmi} : unit transportation cost for the Panama Canal route in ship size category i, OD route m, ship type k ($/ton)

i : ship size category index (over-panamax)

m : OD route index

k : ship type index

The total benefit for cargos in each ship size, OD route, and ship type is :

$$B_{kmi} = Q_{kmi} \times b_{kmi}$$

B_{kmi} : total benefit for cargos in ship size category i, OD route m, ship type k($)

Q_{kmi} : cargo volume in ship size category i, OD route m, ship type k (tons)

The sum of benefits for over-panamax vessels of ship type k is :

$$B_k = \sum_i \sum_m B_{kmi} \quad \text{(i : ship size category index for over-panamax)}$$

2. Size-shifting Benefit

The total benefit for size-shifting cargo is equal to the sum of cost savings on each transportation of cargo. Here, the cargo in question is SQ transit cargo. In other words, route-shifting cargos should be excluded. The total transportation cost by OD route and ship type in the SQ canal is :

$$CB_{km} = \sum_{i}(QB_{kmi} \times Cp_{kmi})$$

CB_{km} : total transportation cost for the SQ canal in OD route m, ship type k ($)

QB_{kmi} : SQ transit cargo volume, OD route m, ship type k, ship size i

The total transportation cost for SQ transit cargo by OD route and ship type in a new canal would be :

$$CA_{km} = \sum_{i}(QA_{kmi} \times Cp_{kmi})$$

CA_{km} : total transportation cost for SQ transit cargo passing through the new canal, OD route m, ship type k

QA_{kmi}: SQ transit cargo distribution in the new canal, OD route m, ship type k, ship size i

The total benefit is :

$$B_{km} = CB_{km} - CA_{km}$$

$$= \sum_{i}(QB_{kmi} \times Cp_{kmi}) - \sum_{i}(QA_{kmi} \times Cp_{kmi})$$

$$= \sum_{i}(QB_{kmi} - QA_{kmi}) \times Cp_{kmi}$$

B_{km} : size-shifting benefit, OD route m, ship type k

3. Route-shifting Benefit by Under-panamax Vessels

The benefit of a ton for route-shifting cargo is equal to the cost savings from using the canal route.

The formula is the same as that for over-panamax vessels because the cost savings are gained by changing routes to the canal. The difference is in the ship size category used in the calculations.

The benefit for a ton of cargo is :

$$b_{kmi} = Ca_{kmi} - Cp_{kmi}$$

- b_{kmi} : unit benefit for a cargo in ship size category i, OD route m, ship type k ($/ton)
- Ca_{kmi} : unit transportation cost for the least expensive alternative route in ship size category i, OD route m, ship type k ($/ton)
- Cp_{kmi} : unit transportation cost for the Panama Canal route in ship size category i, OD route m, ship type k ($/ton)
- i : ship size category index (under-panamax)
- m : OD route index
- k : ship type index

The total benefit for cargos in each ship size, OD route, and ship type is :

$$B_{kmi} = Q_{kmi} \times b_{kmi}$$

- B_{kmi} : total benefit for cargos in ship size category i, OD route m, ship type k($)
- Q_{kmi} : cargo volume in ship size category i, OD route m, ship type k (tons)

The sum of benefit for under-panamax vessels of ship type k is :

$$B_k = \sum_i \sum_m B_{kmi} \quad \text{(i : ship size category index for under-panamax)}$$

4. Examples

a) One example is the route from Oceania to the U.S. East Coast through a 150,000 DWT canal.

As shown in Table ANII-1, 6,406,467 tons of CD cargo would pass through the SQ canal and 6,406,468 tons through the 150,000 DWT canal. The difference between these figures, i.e. 1 ton, is negligible compared to total cargo volume. Hence it is assumed that this difference is a calculation error, and that total cargo would be the same.

While there is no increase in total cargo, ship size distribution changes. That is, 1,282,557 additional tons would be carried by over-panamax ships in the case of a 150,000 DWT canal. This cargo would be transferred from 10,000–39,999 dwt ships and 40,000–64,999 dwt ships. The volume transferred would be 323,126 tons and 959,430 tons, respectively.

The benefit is calculated by the following equation. All benefits in this case are from size-shifting.

Total benefits = Total cost savings
= Costs by using the SQ canal – Cost by using the 150,000 DWT canal
= 695,978 × 18 + 3,083,052 × 15 + 2,627,437 × 13
– (372,852 × 18 + 2,123,622 × 15 + 3,909,994 × 13)
= 3,534,477 US$

Table ANII-1 Transit Cargo in the Year 2020 and Costs of Using the Panama Canal Route
(Oceania to the U.S. East Coast)

cargo : tons
cost : US$/ton

Case \ Ship Size	0 ~ 9,000	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	Total
S Q	0	695,978	3,083,052	2,627,437	0	6,406,467
150	0	372,852	2,123,622	3,909,994	0	6,406,468
150−SQ	0	-323,126	-959,430	1,282,557	0	1
PC COST		18	15	13		

b) Another example is the route from the West Coast of Canada to Europe.

Table ANII-2 shows the transit cargos using the SQ canal and the 150,000 DWT canal. When the 150,000 DWT canal is opened, 1,358,967 tons would be added to the 9,815,288 tons which pass through the SQ canal and the total cargo volume would be 11,174,255 tons.
The additional 1,358,967 tons is cargo shifted from alternative routes.

Table ANII-2 Transit Cargo Volume in the Year 2020
(the West Coast of Canada to Europe)

cargo : tons
cost : US$/ton

Case \ Ship Size	0 ~ 9.000	10.000 ~ 39.999	40.000 ~ 64.999	65.000 ~ 99.999	100.000 ~ 149.999	Total
S Q	0	2.984.815	5.650.102	1.180.371	0	9.815.288
150	0	2.512.535	4.196.443	1.871.424	2.593.853	11.174.255
150-SQ	0	-472.280	-1.453.659	691.053	2.593.853	1.358.967

It is necessary to identify the kind of benefits, i.e. shifting to larger vessels or shifting from alternative routes. The unit cost savings (benefits) are not the same. Table ANII-2 shows the classified cargo volume in the 150,000 DWT canal together with the costs of using the Panama Canal and the least expensive alternative route. These cost data were provided by CTP(II). In this example 2,593,853 tons are carried by 100,000-149,999 dwt vessels in the case of a 150,000 DWT canal. 1,234,886 tons of this is SQ transit cargo shifted to larger ships. The rest, 1,358,967 tons, is new cargo, i.e. route-shifting cargo.

Table ANII-3 Cargo Classification in the Year 2020 and Costs of Using the Panama Canal Route and the Least Expensive Alternative Route (the West Coast of Canada to Europe)

cargo : tons
cost : US$/ton

Case \ Ship Size	0 ~ 9,000	10,000 ~ 39,999	40,000 ~ 64,999	65,000 ~ 99,999	100,000 ~ 149,999	Total
S Q	0	2,984,815	5,650,102	1,180,371	0	9,815,288
150	0	2,512,535	4,196,443	1,871,424	2,593,853	11,174,255
Larger Ships	0	2,512,535	4,196,443	1,871,424	1,234,886	9,815,288
Route Shift	0	0	0	0	1,358,967	1,358,967
PC Cost		17	14	12	8	
Alternative Cost		24	20	17	11	

The benefits of size-shifting is calculated by comparing total costs for the SQ and 150,000 DWT canals. The equation is as follows:

Size-shifting benefit
= Cost by ship-mix distribution on the SQ canal
- Cost by ship-mix distribution of SQ transit cargo using the 150,000 DWT canal
= (2,984,815 × 17 + 5,650,102 × 14 + 1,180,371 × 12)
- (2,512,535 × 17 + 4,196,443 × 14 + 1,871,424 × 12 + 1,234,886 × 8)
= 10,208,262 US$

The benefits of route shifting are calculated by the following equation:

Benefits of route shifting
= Cost of shifted cargo using the least expensive alternative route
- Cost of shifted cargo using Panama canal route
= 1,358,967 tons × 11 US$ - 1,358,967 tons × 8 US$/ton
= 4,076,901 US$

The total benefit is the sum of two figures, i.e. 14,285,163 US$.

Annex III Benefits for Each OD Route

The following tables show benefits by canal size, ship type, and OD route.

Note 1 : Beneficiary cargos are :

CD, FC, and OT in 2020

All types in 2060

Note 2 : "0" means that a cargo exists but no benefit is produced on the OD route.

"–" means that no cargo exists, and no benefit is produced on the OD route.

Table ANIII-1 Benefits in 2020 (Ship Type : CD)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	39,037	121,432	16,603	-	45,570	3,160,146
	0	39,024	121,432	16,586	-	45,570	3,160,146
	0	39,024	121,432	16,586	-	45,570	3,160,146
C America West Coast	7,235	103,860	-	146,612	-	20,451	286,668
	7,235	103,860	-	146,612	-	20,451	286,668
	7,235	103,860	-	146,612	-	20,451	286,668
Canada West Coast	1,402,573	21,075	-	14,285,163	572,792	1,103,319	235,410
	1,402,573	21,084	-	14,741,893	572,792	1,505,754	235,410
	1,402,573	21,084	-	14,741,893	572,792	1,505,754	235,410
Oceania	0	41,450	165,155	78,360	-	182,546	3,534,477
	0	41,450	165,155	78,360	-	182,546	3,534,505
	0	41,450	165,155	78,360	-	182,546	3,534,505
S America West Coast	54,086	21,609	1,548	3,333,000	0	29,895	266,417
	54,086	21,609	1,548	4,993,432	0	29,895	266,417
	54,086	21,609	1,548	4,993,432	0	29,895	266,417
U S West Coast Hawaii	2,512,696	9,516	113,520	3,447,311	-	69,670	15,484
	2,512,722	9,516	113,520	3,447,322	-	69,670	15,484
	2,512,722	9,516	113,520	3,447,322	-	69,670	15,484

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	96,688	541,469	76,204	32,025	40,663
	-	96,688	541,469	76,204	32,025	40,663
	-	96,688	541,469	76,204	32,025	40,663
C America East Coast	159,765	68,160	0	0	46,885	47,108
	159,765	68,160	0	0	46,885	47,108
	159,765	68,160	0	0	46,885	47,108
Canada East Coast	3,768,906	-	-	13,118	23,386	-
	5,162,883	-	-	13,118	23,386	-
	5,627,543	-	-	13,118	23,386	-
Europe	87,919	199,160	176,958	44,088	59,568	1,822,542
	87,919	199,160	176,958	44,088	59,568	1,822,542
	87,919	199,160	176,958	44,088	59,568	1,822,542
Middle East	-	-	-	-	0	-
	-	-	-	-	0	-
	-	-	-	-	0	-
S America East Coast	18,005,126	37,050	16,555	-	217,387	602,169
	30,541,625	37,050	16,555	-	217,387	602,169
	37,062,999	37,050	16,555	-	217,387	602,169
U S East Coast	167,565,969	561,618	8,961	237,789	219,155	57
	167,565,969	561,618	8,961	237,789	219,155	57
	167,565,969	561,618	8,961	237,789	219,155	57

Table ANIII-2 Benefits in 2020 (Ship Type : FC)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	0	0	0	0	0	69,141,085
	0	0	0	0	0	0	69,141,085
	0	0	0	0	0	0	69,141,085
C America West Coast	-	0	-	0	0	0	0
	-	0	-	0	0	0	0
	-	0	-	0	0	0	0
Canada West Coast	-	-	-	0	-	-	-
	-	-	-	0	-	-	-
	-	-	-	0	-	-	-
Oceania	-	0	0	-	-	0	0
	-	0	0	-	-	0	0
	-	0	0	-	-	0	0
S America West Coast	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
U S West Coast Hawaii	0	0	0	17,293,106	0	-	0
	0	0	0	17,293,106	0	-	0
	0	0	0	17,293,106	0	-	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	-	0
	-	-	-	-	-	0
	-	-	-	-	-	0
C America East Coast	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0
Canada East Coast	0	-	-	0	-	0
	0	-	-	0	-	0
	0	-	-	0	-	0
Europe	0	0	0	0	0	14,806,970
	0	0	0	0	0	14,806,970
	0	0	0	0	0	14,896,970
Middle East	0	-	-	-	0	0
	0	-	-	-	0	0
	0	-	-	-	0	0
S America East Coast	0	0	-	-	0	0
	0	0	-	-	0	0
	0	0	-	-	0	0
U S East Coast	110,173,513	0	-	0	0	0
	110,173,513	0	-	0	0	0
	110,173,513	0	-	0	0	0

Table ANIII-3 Benefits in 2020 (Ship Type : OT)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound (US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	-	-	0	-	-	0
	0	-	-	0	-	-	0
	0	-	-	0	-	-	0
C America West Coast	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
Canada West Coast	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
Oceania	-	-	-	0	-	-	0
	-	-	-	0	-	-	0
	-	-	-	0	-	-	0
S America West Coast	-	456,258	0	0	-	0	0
	-	456,258	0	0	-	0	0
	-	456,258	0	0	-	0	0
U S West Coast Hawaii	0	0	0	-	-	0	0
	0	0	0	-	-	0	0
	0	0	0	-	-	0	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	-	0
	-	-	-	-	-	0
	-	-	-	-	-	0
C America East Coast	0	0	-	-	0	0
	0	0	-	-	0	0
	0	0	-	-	0	0
Canada East Coast	0	-	-	-	-	-
	0	-	-	-	-	-
	0	-	-	-	-	-
Europe	-	0	-	0	0	0
	-	0	-	0	0	0
	-	0	-	0	0	0
Middle East	-	-	-	-	-	0
	-	-	-	-	-	0
	-	-	-	-	-	0
S America East Coast	4,900,000	3,335,196	-	-	400,443	658,705
	11,900,000	3,335,196	-	-	400,443	658,705
	24,220,000	3,335,196	-	-	400,443	658,705
U S East Coast	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0

Table ANIII-4 Benefits in 2060 (Ship Type : CB)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
C America West Coast	0	0	-	0	-	0	0
	0	0	-	0	-	0	0
	0	0	-	0	-	0	0
Canada West Coast	0	-	-	0	-	0	0
	0	-	-	0	-	0	0
	0	-	-	0	-	0	0
Oceania	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
S America West Coast	1,969,783	0	0	0	-	0	0
	1,969,783	0	0	0	-	0	0
	1,969,783	0	0	0	-	0	0
U S West Coast Hawaii	0	0	0	0	44,016	416,720	0
	0	0	0	0	44,016	416,720	0
	0	0	0	0	44,016	416,720	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	0	0	-	-	0
	-	0	0	-	-	0
	-	0	0	-	-	0
C America East Coast	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Canada East Coast	4,077,230	0	-	72,037	0	0
	4,077,230	0	-	72,037	0	0
	4,077,230	0	-	72,037	0	0
Europe	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Middle East	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
S America East Coast	0	0	2,635,893	0	0	5,038,020
	0	0	2,635,893	0	0	5,038,020
	0	0	2,635,893	0	0	5,038,020
U S East Coast	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0

Table ANIII-5 Benefits in 2060 (Ship Type : CD)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound (US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	3,129,055	1,793,778	0	-	171,724	86,615,812
	0	3,129,055	1,793,778	0	-	171,724	86,615,812
	0	3,129,055	1,793,778	0	-	171,724	86,615,812
C America West Coast	1,889	0	-	4,607,327	-	267,837	99,497
	1,889	0	-	4,607,327	-	267,837	99,497
	1,889	0	-	4,607,327	-	267,837	99,497
Canada West Coast	45,359,858	16,197	-	13,894,981	338,908	3,046,891	190,987
	45,359,858	16,197	-	15,445,846	338,908	3,895,932	190,987
	45,359,858	16,197	-	15,445,846	338,908	3,895,932	190,987
Oceania	0	2,128,075	2,216,165	0	-	0	4,435,232
	0	2,128,075	2,216,165	0	-	0	4,435,232
	0	2,128,075	2,216,165	0	-	0	4,435,232
S America West Coast	2,368,378	1,388,589	91,223	9,166,808	0	0	19,736,096
	2,368,378	1,388,589	91,223	10,918,570	0	0	19,736,096
	2,368,378	1,388,589	91,223	10,918,570	0	0	19,736,096
U S West Coast Hawaii	37,633,734	1,817	26,385	48,277,580	-	436,418	3,614
	37,633,734	1,817	26,385	48,277,580	-	436,418	3,614
	37,633,734	1,817	26,385	48,277,580	-	436,418	3,614

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	192,108	28,516,531	0	62,662	1,273,776
	-	192,108	28,516,531	0	62,662	1,273,776
	-	192,108	28,516,531	0	62,662	1,273,776
C America East Coast	161,600	131,996	16,856	83,031	2,759,874	45,832
	161,600	131,996	16,856	83,031	2,759,874	45,832
	161,600	131,996	16,856	83,031	2,759,874	45,832
Canada East Coast	14,792,843	-	-	356,817	1,527,877	-
	20,860,155	-	-	356,817	1,527,877	-
	22,377,303	-	-	356,817	1,527,877	-
Europe	0	260,360	2,486,690	0	513,514	1,546,280
	0	260,360	2,486,690	0	513,514	1,546,280
	0	260,360	2,486,690	0	513,514	1,546,280
Middle East	-	-	-	-	312,843	-
	-	-	-	-	312,843	-
	-	-	-	-	312,843	-
S America East Coast	19,535,528	441,378	190,938	-	0	1,721,918
	27,805,219	441,378	190,938	-	0	1,721,918
	40,275,008	441,378	190,938	-	0	1,721,918
U S East Coast	237,932,009	1,758,366	0	2,803,684	16,056,818	45
	237,932,009	1,758,366	0	2,803,684	16,056,818	45
	237,932,009	1,758,366	0	2,803,684	16,056,818	45

Table ANIII-6 Benefits in 2060 (Ship Type : CT)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	-	0	-	0	-	69.516	0
	-	0	-	0	-	69.516	0
	-	0	-	0	-	69.516	0
C America West Coast	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
Canada, West Coast	-	-	-	0	-	-	0
	-	-	-	0	-	-	0
	-	-	-	0	-	-	0
Oceania	-	0	-	0	-	-	2,938,179
	-	0	-	0	-	-	2,938,179
	-	0	-	0	-	-	2,938,179
S America West Coast	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
U S West Coast Hawaii	-	0	-	0	0	11,230	0
	-	0	-	0	0	11,230	0
	-	0	-	0	0	11,230	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	0	-
	-	-	-	-	0	-
	-	-	-	-	0	-
C America East Coast	0	0	-	-	0	0
	0	0	-	-	0	0
	0	0	-	-	0	0
Canada East Coast	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
Europe	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0
Middle East	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
S America East Coast	-	462,218	-	-	0	85,230
	-	462,218	-	-	0	85,230
	-	462,218	-	-	0	85,230
U S East Coast	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0

Table ANIII-7 Benefits in 2060 (Ship Type : FC)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	0	0	0	0	0	0	96,859,997
	0	0	0	0	0	0	96,859,997
	0	0	0	0	0	0	96,859,997
C America West Coast	-	0	-	0	0	0	0
	-	0	-	0	0	0	0
	-	0	-	0	0	0	0
Canada West Coast	-	-	-	0	-	-	-
	-	-	-	0	-	-	-
	-	-	-	0	-	-	-
Oceania	-	0	190,865	-	-	2,303	0
	-	0	190,865	-	-	2,303	0
	-	0	190,865	-	-	2,303	0
S America West Coast	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
U S West Coast Hawaii	0	0	0	23,868,883	0	-	0
	0	0	0	23,868,883	0	-	0
	0	0	0	23,868,883	0	-	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	-	0
	-	-	-	-	-	0
	-	-	-	-	-	0
C America East Coast	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0
Canada East Coast	0	-	-	2,287,648	-	0
	0	-	-	2,287,648	-	0
	0	-	-	2,287,648	-	0
Europe	0	0	0	0	0	16,538,433
	0	0	0	0	0	16,538,433
	0	0	0	0	0	16,538,433
Middle East	0	-	-	-	0	0
	0	-	-	-	0	0
	0	-	-	-	0	0
S America East Coast	0	0	-	-	0	0
	0	0	-	-	0	0
	0	0	-	-	0	0
U S East Coast	163,765,049	0	-	0	0	0
	163,765,049	0	-	0	0	0
	163,765,049	0	-	0	0	0

Table ANIII-8 Benefits in 2060 (Ship Type : CG)

150,000 DWT
200,000 DWT
250,000 DWT

Northound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	-	0	25,968	0	-	0	0
	-	0	25,968	0	-	0	0
	-	0	25,968	0	-	0	0
C America West Coast	0	0	-	0	-	0	0
	0	0	-	0	-	0	0
	0	0	-	0	-	0	0
Canada West Coast	-	0	-	0	0	0	-
	-	0	-	0	0	0	-
	-	0	-	0	0	0	-
Oceania	0	0	-	0	-	0	41,351
	0	0	-	0	-	0	41,351
	0	0	-	0	-	0	41,351
S America West Coast	2,680,722	0	112,440	0	175,056	0	0
	2,680,722	0	112,440	0	175,056	0	0
	2,680,722	0	112,440	0	175,056	0	0
U S West Coast Hawaii	0	0	-	0	-	142,428	-
	0	0	-	0	-	142,428	-
	0	0	-	0	-	142,428	-

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	0	-	-	0	-
	-	0	-	-	0	-
	-	0	-	-	0	-
C America East Coast	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0
Canada East Coast	125,770	0	-	7,019	1,182,544	-
	125,770	0	-	7,019	1,182,544	-
	125,770	0	-	7,019	1,182,544	-
Europe	0	0	0	0	121,778	0
	0	0	0	0	121,778	0
	0	0	0	0	121,778	0
Middle East	-	-	-	-	0	134,498
	-	-	-	-	0	134,498
	-	-	-	-	0	134,498
S America East Coast	0	0	6,616	-	0	257,965
	0	0	6,616	-	0	257,965
	0	0	6,616	-	0	257,965
U S East Coast	0	0	-	533,262	-	0
	0	0	-	533,262	-	0
	0	0	-	533,262	-	0

Table ANIII-9 Benefits in 2060 (Ship Type : LP)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
C America West Coast	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
Canada West Coast	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
Oceania	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
S America West Coast	-	0	-	-	-	-	0
	-	0	-	-	-	-	0
	-	0	-	-	-	-	0
U S West Coast Hawaii	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
C America East Coast	0	0	-	-	0	0
	0	0	-	-	0	0
	0	0	-	-	0	0
Canada East Coast	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
Europe	-	0	-	-	0	-
	-	0	-	-	0	-
	-	0	-	-	0	-
Middle East	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
S America East Coast	0	0	-	-	0	0
	0	0	-	-	0	0
	0	0	-	-	0	0
U S East Coast	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0

Table ANIII-10 Benefits in 2060 (Ship Type : RE)

150,000 DWT
200,000 DWT
250,000 D T

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	17.172	0	-	-	-	41.861	0
	17.172	0	-	-	-	41.861	0
	17.172	0	-	-	-	41.861	0
C America West Coast	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
Canada West Coast	0	-	-	0	-	-	-
	0	-	-	0	-	-	-
	0	-	-	0	-	-	-
Oceania	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
S America West Coast	8.825.565	0	-	0	580.429	0	0
	8.825.565	0	-	0	580.429	0	0
	8.825.565	0	-	0	580.429	0	0
U S West Coast Hawaii	-	-	-	0	-	48.094	-
	-	-	-	0	-	48.094	-
	-	-	-	0	-	48.094	-

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	1.051.682	0	-	-	0	-
	1.051.682	0	-	-	0	-
	1.051.682	0	-	-	0	-
C America East Coast	0	0	-	-	0	-
	0	0	-	-	0	-
	0	0	-	-	0	-
Canada East Coast	0	0	-	-	-	-
	0	0	-	-	-	-
	0	0	-	-	-	-
Europe	0	0	0	-	0	0
	0	0	0	-	0	0
	0	0	0	-	0	0
Middle East	-	-	-	-	0	-
	-	-	-	-	0	-
	-	-	-	-	0	-
S America East Coast	0	-	-	-	0	-
	0	-	-	-	0	-
	0	-	-	-	0	-
U S East Coast	0	0	-	-	0	-
	0	0	-	-	0	-
	0	0	-	-	0	-

Table ANIII-11 Benefits in 2060 (Ship Type : RR)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	-	0	0	0	-	-	0
	-	0	0	0	-	-	0
	-	0	0	0	-	-	0
C America West Coast	-	-	-	0	-	0	0
	-	-	-	0	-	0	0
	-	-	-	0	-	0	0
Canada West Coast	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
Oceania	-	0	-	0	-	-	0
	-	0	-	0	-	-	0
	-	0	-	0	-	-	0
S America West Coast	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
	-	0	-	0	-	0	0
U S West Coast Hawaii	-	0	0	0	-	-	0
	-	0	0	0	-	-	0
	-	0	0	0	-	-	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	0	-	-	0	-	-
	0	-	-	0	-	-
	0	-	-	0	-	-
C America East Coast	-	0	-	0	0	-
	-	0	-	0	0	-
	-	0	-	0	0	-
Canada East Coast	0	-	-	379.154	-	-
	0	-	-	379.154	-	-
	0	-	-	379.154	-	-
Europe	0	0	-	0	0	0
	0	0	-	0	0	0
	0	0	-	0	0	0
Middle East	-	-	-	0	-	-
	-	-	-	0	-	-
	-	-	-	0	-	-
S America East Coast	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
U S East Coast	0	0	-	0	0	-
	0	0	-	0	0	-
	0	0	-	0	0	-

Table ANIII-12 Benefits in 2060 (Ship Type : OT)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	243	-	-	0	-	-	1,071,802
	243	-	-	0	-	-	1,071,802
	243	-	-	0	-	-	1,071,802
C America West Coast	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
	0	0	0	0	-	0	0
Canada West Coast	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
	-	-	-	-	-	-	0
Oceania	-	-	-	0	-	-	945,402
	-	-	-	0	-	-	945,402
	-	-	-	0	-	-	945,402
S America West Coast	-	3,181,435	112,965	0	-	0	4,904,878
	-	3,181,435	112,965	0	-	0	4,904,878
	-	3,181,435	112,965	0	-	0	4,904,878
U S West Coast Hawaii	1,688,515	0	0	-	-	40,487	0
	1,688,515	0	0	-	-	40,487	0
	1,688,515	0	0	-	-	40,487	0

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	-	1,414
	-	-	-	-	-	1,414
	-	-	-	-	-	1,414
C America East Coast	1,454,159	0	-	-	7,064,909	0
	1,454,159	0	-	-	7,064,909	0
	1,454,159	0	-	-	7,064,909	0
Canada East Coast	2,419,188	-	-	-	-	-
	2,419,188	-	-	-	-	-
	2,419,188	-	-	-	-	-
Europe	-	0	-	0	254,720	0
	-	0	-	0	254,720	0
	-	0	-	0	254,720	0
Middle East	-	-	-	-	-	682
	-	-	-	-	-	682
	-	-	-	-	-	682
S America East Coast	4,637,461	6,424,101	-	-	0	1,382,505
	13,457,361	6,424,101	-	-	0	1,382,505
	27,177,361	6,424,101	-	-	0	1,382,505
U S East Coast	0	0	0	0	472,195	0
	0	0	0	0	472,195	0
	0	0	0	0	472,195	0

Table ANIII-13 Benefits in 2060 (Ship Type : VC)

150,000 DWT
200,000 DWT
250,000 DWT

Northbound

(US$)

O \ D	AFRICA	C America East Coast	Canada East Coast	Europe	Middle East	S America East Coast	U S East Coast
Asia	37,056	0	-	0	-	0	0
	37,056	0	-	0	-	0	0
	37,056	0	-	0	-	0	0
C America West Coast	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
Canada West Coast	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
Oceania	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
S America West Coast	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
	-	0	-	-	-	-	-
U S West Coast Hawaii	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

Southbound

O \ D	Asia	C America West Coast	Canada West Coast	Oceania	S America West Coast	U S West Coast
Africa	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
C America East Coast	-	0	-	0	-	-
	-	0	-	0	-	-
	-	0	-	0	-	-
Canada East Coast	0	-	-	-	-	-
	0	-	-	-	-	-
	0	-	-	-	-	-
Europe	0	-	0	0	-	0
	0	-	0	0	-	0
	0	-	0	0	-	0
Middle East	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
S America East Coast	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
U S East Coast	0	-	-	0	-	-
	0	-	-	0	-	-
	0	-	-	0	-	-

Annex IV Cargo Shifting Due to a New Canal

The following Tables show the cargo volume differences between the SQ canal and a new canal. The figure in each cell is the difference in cargo volume between the SQ canal and the new canal by route and ship type.
e.g. (cargo volume in a 150,000 DWT canal) – (cargo volume in the SQ canal)

Tables for some canal–type and ship–type combinations are omitted because there is no difference.

1) 2020

FC : The figure for the 200,000 DWT and 250,000 DWT canals are equal to those for the 150,000 DWT canal.

CB, CT, CG, LP, RE, RR, VC : The figures for all alternatives are the same as those for the SQ canal.

2) 2060

FC,CB, CT, CG, LP, RE, RR, VC : The figures for the 200,000 DWT and 250,000 DWT cases are equal to those for the 150,000 DWT canal.

2020 CARGO TON 150000-SQ

			0	10,000	40,000	65,000	100,000	150,000	200,000	TOTAL
			9,999	39,999	64,999	99,999	149,999	199,999	250,000	
ASIA	U.S.EC	CD	0	-261,082	-927,362	1,188,443	0	0	0	-1
ASIA	CANADA EC		0	-15,353	-44,667	60,020	0	0	0	0
ASIA	C AMERICA EC		0	-5,259	-12,730	17,988	0	0	0	-1
ASIA	S AMERICA EC		0	-7,595	0	7,595	0	0	0	0
ASIA	EUROPE		0	0	-8,293	8,292	0	0	0	-1
ASIA	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	-78,470	0	78,470	0	0	0	0
CANADA WC	C AMERICA EC		0	-5,270	-3	5,274	0	0	0	1
CANADA WC	S AMERICA EC		0	-24,807	-87,203	112,009	804,868	0	0	804,867
CANADA WC	EUROPE		0	-472,280	-1,453,659	691,053	2,593,853	0	0	1,358,967
CANADA WC	AFRICA		0	-172,536	-539,893	712,429	0	0	0	0
CANADA WC	MIDDLE EAST		0	-48,766	-140,105	188,872	0	0	0	1
C AMERICA WC	U.S.EC		0	-60,049	-166,565	226,613	0	0	0	-1
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	-51,930	-161,540	213,470	0	0	0	0
C AMERICA WC	S AMERICA EC		0	-6,817	0	6,817	0	0	0	0
C AMERICA WC	EUROPE		0	-21,745	-59,632	81,377	0	0	0	0
C AMERICA WC	AFRICA		0	-1,118	-2,763	3,881	0	0	0	0
OCEANIA	U.S.EC		0	-323,126	-959,430	1,282,557	0	0	0	1
OCEANIA	CANADA EC		0	-33,031	0	33,031	0	0	0	0
OCEANIA	C AMERICA EC		0	-8,290	0	8,290	0	0	0	0
OCEANIA	S AMERICA EC		0	0	-91,273	91,273	0	0	0	0
OCEANIA	EUROPE		0	-13,060	0	13,060	0	0	0	0
OCEANIA	AFRICA		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	-88,592	-641	89,233	0	0	0	0
S AMERICA WC	CANADA EC		0	-516	0	516	0	0	0	0
S AMERICA WC	C AMERICA EC		0	-7,203	0	7,203	0	0	0	0
S AMERICA WC	S AMERICA EC		0	-9,965	0	9,965	0	0	0	0
S AMERICA WC	EUROPE		0	-310,195	801	308,723	1,045,505	0	0	1,044,834
S AMERICA WC	AFRICA		0	-7,166	-25,422	32,588	0	0	0	0
S AMERICA WC	MIDDLE EAAST		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	-3,294	-5,610	8,905	0	0	0	1
U.S WC	CANADA EC		0	-11,223	-34,314	45,537	0	0	0	0
U.S WC	C AMERICA EC		0	-2,379	0	2,379	0	0	0	0
U.S WC	S AMERICA EC		0	-13,934	0	13,934	0	0	0	0
U.S WC	EUROPE		0	-309,305	-950,393	1,259,698	0	0	0	0
U.S WC	AFRICA		0	-228,232	-685,774	914,007	0	0	0	1
SUB TOTAL			0	-2,602,588	-6,356,471	7,723,502	4,444,226	0	0	3,208,669
AFRICA	U.S. WC	CD	0	-7,561	-1,435	8,997	0	0	0	1
AFRICA	CANADA WC		0	-67,699	-202,974	270,673	0	0	0	0
AFRICA	C AMERICA WC		0	-24,172	0	24,172	0	0	0	0
AFRICA	S AMERICA WC		0	-6,405	0	6,405	0	0	0	0
AFRICA	OCEANIA		0	-12,708	22	12,686	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	-7,858	197	7,660	0	0	0	-1
CANADA EC	OCEANIA		0	-1,756	-4,338	6,094	0	0	0	0
CANADA EC	ASIA		0	0	0	0	1,256,302	0	0	1,256,302
C AMERICA EC	U.S. WC		0	-11,777	0	11,777	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	-34,080	0	34,080	0	0	0	0
C AMERICA EC	S AMERICA WC		0	-15,626	0	15,625	0	0	0	-1
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	-31,953	0	31,953	0	0	0	0
EUROPE	U.S. WC		0	-157,715	-516,989	674,705	0	0	0	1
EUROPE	CANADA WC		0	-14,686	-51,764	66,450	0	0	0	0
EUROPE	C AMERICA WC		0	-39,832	-39,832	79,664	0	0	0	0
EUROPE	S AMERICA WC		0	-14,892	0	14,892	0	0	0	0
EUROPE	OCEANIA		0	-7,348	0	7,348	0	0	0	0
EUROPE	ASIA		0	-12,537	-80	12,617	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
MIDDLE EAST	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	-50,123	-175,777	225,900	0	0	0	0
S AMERICA EC	CANADA WC		0	-3,311	0	3,311	0	0	0	0
S AMERICA EC	C AMERICA WC		0	-12,350	0	12,350	0	0	0	0
S AMERICA EC	S AMERICA WC		0	-37,211	-105,754	142,965	0	0	0	0
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	-119,515	-239,223	358,737	16,929,093	0	0	16,929,092
U.S.EC	U.S. WC		0	-19	0	19	0	0	0	0
U.S.EC	CANADA WC		0	1,814	-2,854	5,963	0	0	0	4,923
U.S.EC	C AMERICA WC		0	-278,352	6,501	271,851	0	0	0	0
U.S.EC	S AMERICA WC		0	-70,429	549	69,882	0	0	0	2
U.S.EC	OCEANIA		0	-30,163	-28,184	58,347	0	0	0	0
U.S.EC	ASIA		0	0	0	0	55,855,323	0	0	55,855,323
SUB TOTAL			0	-1,068,264	-1,361,935	2,435,123	74,040,718	0	0	74,045,642
TOTAL			0	-3,670,852	-7,718,406	10,155,625	78,484,944	0	0	77,254,3[illegible]

Calculated from CTP Final Report

2020 CARGO TON 200000-SQ

			0	10,000	40,000	65,000	100,000	150,000	200,000	TOTAL
			9,999	39,999	64,999	99,999	149,999	199,999	250,000	
ASIA	U.S.EC	CD	0	-261,082	-927,362	1,188,443	0	0	0	-1
ASIA	CANADA EC		0	-15,253	-44,667	60,020	0	0	0	0
ASIA	C AMERICA EC		0	-5,259	-12,729	17,988	0	0	0	0
ASIA	S AMERICA EC		0	-7,595	0	7,595	0	0	0	0
ASIA	EUROPE		0	0	-8,293	8,293	0	0	0	0
ASIA	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	-78,470	0	78,470	0	0	0	0
CANADA WC	C AMERICA EC		0	-5,270	-4	5,274	0	0	0	0
CANADA WC	S AMERICA EC		0	-24,807	-87,203	112,009	402,434	402,434	0	804,867
CANADA WC	EUROPE		0	-472,280	-1,453,659	691,053	778,156	1,815,697	0	1,358,967
CANADA WC	AFRICA		0	-172,536	-539,893	712,429	0	0	0	0
CANADA WC	MIDDLE EAST		0	-48,766	-140,105	188,872	0	0	0	1
C AMERICA WC	U.S.EC		0	-60,049	-166,565	226,613	0	0	0	-1
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	-51,930	-161,540	213,470	0	0	0	0
C AMERICA WC	S AMERICA EC		0	-6,817	0	6,817	0	0	0	0
C AMERICA WC	EUROPE		0	-21,745	-59,632	81,377	0	0	0	0
C AMERICA WC	AFRICA		0	-1,118	-2,763	3,881	0	0	0	0
OCEANIA	U.S.EC		0	-323,126	-959,431	1,282,556	0	0	0	-1
OCEANIA	CANADA EC		0	-33,031	0	33,031	0	0	0	0
OCEANIA	C AMERICA EC		0	-8,290	0	8,290	0	0	0	0
OCEANIA	S AMERICA EC		0	0	-91,273	91,273	0	0	0	0
OCEANIA	EUROPE		0	-13,060	0	13,060	0	0	0	0
OCEANIA	AFRICA		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	-88,592	-641	89,233	0	0	0	0
S AMERICA WC	CANADA EC		0	-516	0	516	0	0	0	0
S AMERICA WC	C AMERICA EC		0	-7,203	0	7,203	0	0	0	0
S AMERICA WC	S AMERICA EC		0	-9,965	0	9,965	0	0	0	0
S AMERICA WC	EUROPE		0	-259,259	801	256,448	1,044,833	1,857,481	0	2,900,304
S AMERICA WC	AFRICA		0	-7,166	-25,422	32,588	0	0	0	0
S AMERICA WC	MIDDLE EAAST		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	-3,294	-5,610	8,905	0	0	0	1
U.S WC	CANADA EC		0	-11,223	-34,314	45,537	0	0	0	0
U.S WC	C AMERICA EC		0	-2,379	0	2,379	0	0	0	0
U.S WC	S AMERICA EC		0	-13,934	0	13,934	0	0	0	0
U.S WC	EUROPE		0	-309,305	-950,393	1,259,697	0	0	0	-1
U.S WC	AFRICA		0	-228,232	-685,775	914,006	0	0	0	-1
SUB TOTAL			0	-2,551,652	-6,356,473	7,671,225	2,225,423	4,075,612	0	5,064,135
AFRICA	U.S. WC	CD	0	-7,561	-1,435	8,997	0	0	0	1
AFRICA	CANADA WC		0	-67,699	-202,974	270,673	0	0	0	0
AFRICA	C AMERICA WC		0	-24,172	0	24,172	0	0	0	0
AFRICA	S AMERICA WC		0	-6,405	0	6,405	0	0	0	0
AFRICA	OCEANIA		0	-12,708	22	12,686	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	-7,858	197	7,660	0	0	0	-1
CANADA EC	OCEANIA		0	-1,756	-4,338	6,094	0	0	0	0
CANADA EC	ASIA		0	0	0	0	464,659	1,256,302	0	1,720,961
C AMERICA EC	U.S. WC		0	-11,777	0	11,777	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	-34,080	0	34,080	0	0	0	0
C AMERICA EC	S AMERICA WC		0	-15,626	0	15,625	0	0	0	-1
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	-31,953	0	31,953	0	0	0	0
EUROPE	U.S. WC		0	-157,715	-516,989	674,705	0	0	0	1
EUROPE	CANADA WC		0	-14,686	-51,764	66,450	0	0	0	0
EUROPE	C AMERICA WC		0	-39,832	-39,832	79,664	0	0	0	0
EUROPE	S AMERICA WC		0	-14,892	0	14,892	0	0	0	0
EUROPE	OCEANIA		0	-7,348	0	7,348	0	0	0	0
EUROPE	ASIA		0	-12,537	-80	12,617	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
MIDDLE EAST	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	-50,123	-175,777	225,900	0	0	0	0
S AMERICA EC	CANADA WC		0	-3,311	0	3,311	0	0	0	0
S AMERICA EC	C AMERICA WC		0	-12,350	0	12,350	0	0	0	0
S AMERICA EC	S AMERICA WC		0	-37,211	-105,754	142,965	0	0	0	0
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	-119,515	-239,223	358,737	4,392,594	12,536,499	0	16,929,092
U.S.EC	U.S. WC		0	-19	0	19	0	0	0	0
U.S.EC	CANADA WC		0	1,814	-2,854	5,963	0	0	0	4,923
U.S.EC	C AMERICA WC		0	-278,352	6,501	271,851	0	0	0	0
U.S.EC	S AMERICA WC		0	-70,429	549	69,882	0	0	0	2
U.S.EC	OCEANIA		0	-30,163	-28,184	58,347	0	0	0	0
U.S.EC	ASIA		0	0	0	0	55,855,323	0	0	55,855,323
SUB TOTAL			0	-1,068,264	-1,361,935	2,435,123	60,712,576	13,792,801	0	74,510,301
TOTAL			0	-3,619,916	-7,718,408	10,106,348	62,937,999	17,868,413	0	79,574,436

2020CARGO TON 250000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
ASIA	U.S.EC	CD	0	-261,082	-927,362	1,188,443	0	0	0	-1
ASIA	CANADA EC		0	-15,353	-44,667	60,020	0	0	0	0
ASIA	C AMERICA EC		0	-5,259	-12,729	17,988	0	0	0	0
ASIA	S AMERICA EC		0	-7,595	0	7,595	0	0	0	0
ASIA	EUROPE		0	0	-8,293	8,293	0	0	0	0
ASIA	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	-78,470	0	78,470	0	0	0	0
CANADA WC	C AMERICA EC		0	-5,270	-4	5,274	0	0	0	0
CANADA WC	S AMERICA EC		0	-24,807	-87,203	112,009	402,434	402,434	0	804,867
CANADA WC	EUROPE		0	-472,280	-1,453,659	691,053	778,156	1,815,697	0	1,358,967
CANADA WC	AFRICA		0	-172,536	-539,893	712,429	0	0	0	0
CANADA WC	MIDDLE EAST		0	-48,766	-140,105	188,872	0	0	0	1
C AMERICA WC	U.S.EC		0	-60,049	-166,565	226,613	0	0	0	-1
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	-51,930	-161,540	213,470	0	0	0	0
C AMERICA WC	S AMERICA EC		0	-6,817	0	6,817	0	0	0	0
C AMERICA WC	EUROPE		0	-21,745	-59,632	81,377	0	0	0	0
C AMERICA WC	AFRICA		0	-1,118	-2,763	3,881	0	0	0	0
OCEANIA	U.S.EC		0	-323,126	-959,431	1,282,556	0	0	0	-1
OCEANIA	CANADA EC		0	-33,031	0	33,031	0	0	0	0
OCEANIA	C AMERICA EC		0	-8,290	0	8,290	0	0	0	0
OCEANIA	S AMERICA EC		0	0	-91,273	91,273	0	0	0	0
OCEANIA	EUROPE		0	-13,060	0	13,060	0	0	0	0
OCEANIA	AFRICA		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	-88,592	-641	89,233	0	0	0	0
S AMERICA WC	CANADA EC		0	-516	0	516	0	0	0	0
S AMERICA WC	C AMERICA EC		0	-7,203	0	7,203	0	0	0	0
S AMERICA WC	S AMERICA EC		0	-9,965	0	9,965	0	0	0	0
S AMERICA WC	EUROPE		0	-259,259	801	256,448	1,044,833	1,857,481	0	2,900,304
S AMERICA WC	AFRICA		0	-7,166	-25,422	32,588	0	0	0	0
S AMERICA WC	MIDDLE EAAST		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	-3,294	-5,610	8,905	0	0	0	1
U.S WC	CANADA EC		0	-11,223	-34,314	45,537	0	0	0	0
U.S WC	C AMERICA EC		0	-2,379	0	2,379	0	0	0	0
U.S WC	S AMERICA EC		0	-13,934	0	13,934	0	0	0	0
U.S WC	EUROPE		0	-309,305	-950,393	1,259,697	0	0	0	-1
U.S WC	AFRICA		0	-228,232	-685,775	914,006	0	0	0	-1
SUB TOTAL			0	-2,551,652	-6,356,473	7,671,225	2,225,423	4,075,612	0	5,064,135
AFRICA	U.S. WC	CD	0	-7,561	-1,435	8,997	0	0	0	1
AFRICA	CANADA WC		0	-67,699	-202,974	270,673	0	0	0	0
AFRICA	C AMERICA WC		0	-24,172	0	24,172	0	0	0	0
AFRICA	S AMERICA WC		0	-6,405	0	6,405	0	0	0	0
AFRICA	OCEANIA		0	-12,708	22	12,686	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	-7,858	197	7,660	0	0	0	-1
CANADA EC	OCEANIA		0	-1,756	-4,338	6,094	0	0	0	0
CANADA EC	ASIA		0	0	0	0	464,659	791,642	464,660	1,720,961
C AMERICA EC	U.S. WC		0	-11,777	0	11,777	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	-34,080	0	34,080	0	0	0	0
C AMERICA EC	S AMERICA WC		0	-15,626	0	15,625	0	0	0	-1
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	-31,953	0	31,953	0	0	0	0
EUROPE	U.S. WC		0	-157,715	-516,989	674,705	0	0	0	1
EUROPE	CANADA WC		0	-14,686	-51,764	66,450	0	0	0	0
EUROPE	C AMERICA WC		0	-39,832	-39,832	79,664	0	0	0	0
EUROPE	S AMERICA WC		0	-14,892	0	14,892	0	0	0	0
EUROPE	OCEANIA		0	-7,348	0	7,348	0	0	0	0
EUROPE	ASIA		0	-12,537	-80	12,617	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
MIDDLE EAST	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	-50,123	-175,777	225,900	0	0	0	0
S AMERICA EC	CANADA WC		0	-3,311	0	3,311	0	0	0	0
S AMERICA EC	C AMERICA WC		0	-12,350	0	12,350	0	0	0	0
S AMERICA EC	S AMERICA WC		0	-37,211	-105,754	142,965	0	0	0	0
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	-119,515	-239,223	358,737	4,392,594	12,536,499	6,521,378	23,450,470
U.S.EC	U.S. WC		0	-19	0	19	0	0	0	0
U.S.EC	CANADA WC		0	1,814	-2,854	5,963	0	0	0	4,923
U.S.EC	C AMERICA WC		0	-278,352	6,501	271,851	0	0	0	0
U.S.EC	S AMERICA WC		0	-70,429	549	69,882	0	0	0	2
U.S.EC	OCEANIA		0	-30,163	-28,184	58,347	0	0	0	0
U.S.EC	ASIA		0	0	0	0	55,855,323	0	0	55,855,323
SUB TOTAL			0	-1,068,264	-1,361,935	2,435,123	60,712,576	13,328,141	6,986,038	81,031,679
TOTAL			0	-3,619,916	-7,718,408	10,106,348	62,937,999	17,403,753	6,986,038	86,095,814

2020CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
ASIA	U.S.EC	FC	0	-441,444	-3,081,391	5,022,836	0	0	0	1,500,001
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	0	0	0	0	0	0	0
ASIA	AFRICA		0	0	0	0	0	0	0	0
ASIA	ASIA		0	0	0	0	0	0	0	0
ASIA	MIDDLE EAST		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	MIDDLE EAST		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	0	0	0	0	0	0	0
OCEANIA	CANADA EC		0	-1	0	0	0	0	0	-1
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	0	0	0	0	0	0
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	EUROPE		0	87,276	-172,075	884,798	0	0	0	799,999
U.S WC	AFRICA		0	0	0	0	0	0	0	0
U.S WC	MIDDLE EAST		0	0	0	0	0	0	0	0
SUB TOTAL			0	-354,169	-3,253,466	5,907,634	0	0	0	2,299,999
AFRICA	U.S. WC	FC	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	-281,825	-483,033	884,858	0	0	0	120,000
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	1	0	0	0	0	1
EUROPE	S AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	OCEANIA		0	0	0	0	0	0	0	0
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
MIDDLE EAST	S AMERICA WC		0	0	0	0	0	0	0	0
MIDDLE EAST	ASIA		0	-1	0	0	0	0	0	-1
S AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
S AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	0	0	0	0	0	0	0
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	-777,647	-4,816,315	6,993,962	0	0	0	1,400,000
SUB TOTAL			0	-1,059,473	-5,299,347	7,878,820	0	0	0	1,520,000
TOTAL			0	-1,413,642	-8,552,813	13,786,454	0	0	0	3,819,999

2020CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
ASIA	U.S.EC	OT	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	0	0	0	0	0	0	0
ASIA	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	0	0	0	0	0	0	0
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		233	13,040	-469,531	456,258	0	0	0	0
S AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	-1	0	0	0	0	-1
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	1	0	0	0	0	0	1
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	AFRICA		0	0	0	1	0	0	0	1
SUB TOTAL			233	13,041	-469,532	456,259	0	0	0	1
AFRICA	U.S. WC	OT	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	-297,464	297,464	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	OCEANIA		0	0	0	0	0	0	0	0
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	22,319	-681,025	658,705	0	0	0	0
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	-1
S AMERICA EC	C AMERICA WC		0	0	-3,335,196	3,335,196	0	0	0	0
S AMERICA EC	S AMERICA WC		0	0	-400,443	400,442	0	0	0	0
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	-1
S AMERICA EC	ASIA		0	0	0	0	14,000,000	0	0	14,000,000
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			0	22,319	-4,714,128	4,691,807	14,000,000	0	0	13,999,998
TOTAL			233	35,360	-5,183,660	5,148,066	14,000,000	0	0	13,999,999

2020CARGO TON 200000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
ASIA	U.S.EC	OT	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	0	0	0	0	0	0	0
ASIA	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	0	0	0	0	0	0	0
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		233	13,040	-469,531	456,258	0	0	0	0
S AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	-1	0	0	0	0	-1
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	1	0	0	0	0	0	1
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	AFRICA		0	0	0	1	0	0	0	1
SUB TOTAL			233	13,041	-469,532	456,259	0	0	0	1
AFRICA	U.S. WC	OT	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	-297,464	297,464	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	OCEANIA		0	0	0	0	0	0	0	0
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	22,319	-681,025	658,705	0	0	0	-1
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
S AMERICA EC	C AMERICA WC		0	0	-3,335,196	3,335,196	0	0	0	0
S AMERICA EC	S AMERICA WC		0	0	-400,443	400,442	0	0	0	-1
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	0	0	0	0	14,000,000	0	14,000,000
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			0	22,319	-4,714,128	4,691,807	0	14,000,000	0	13,999,998
TOTAL			233	35,360	-5,183,660	5,148,066	0	14,000,000	0	13,999,999

2020 CARGO TON 250000-SQ

			0 9.999	10,000 39.999	40,000 64.999	65,000 99.999	100,000 149.999	150,000 199.999	200,000 250,000	TOTAL
ASIA	U.S.EC	OT	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	0	0	0	0	0	0	0
ASIA	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	0	0	0	0	0	0	0
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		233	13,040	-469,531	456,258	0	0	0	0
S AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	-1	0	0	0	0	-1
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	1	0	0	0	0	0	1
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	AFRICA		0	0	0	1	0	0	0	1
SUB TOTAL			233	13,041	-469,532	456,259	0	0	0	1
AFRICA	U.S. WC	OT	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	-297,464	297,464	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	OCEANIA		0	0	0	0	0	0	0	0
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	22,319	-681,025	658,705	0	0	0	-1
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
S AMERICA EC	C AMERICA WC		0	0	-3,335,196	3,335,196	0	0	0	0
S AMERICA EC	S AMERICA WC		0	0	-400,443	400,442	0	0	0	-1
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	0	0	0	0	0	14,000,000	14,000,000
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			0	22,319	-4,714,128	4,691,807	0	0	14,000,000	13,999,998
TOTAL			233	35,360	-5,183,660	5,148,066	0	0	14,000,000	13,999,999

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	CB	0	0	0	0	0	0	0	0
Asia	CANADA.E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	0	0	0	0	0	0	0
Asia	AFRICA		0	93	8	0	0	0	0	101
CANADA W.C	USEC		0	0	0	0	0	0	0	0
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
C.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
C.AMERICA W.C	AFRICA		0	0	0	0	0	0	0	0
Oceania	USEC		0	51,125	788,739	0	0	0	0	839,864
Oceania	CANADA.E.C		0	0	87,930	0	0	0	0	87,930
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	220,577	24,991	0	0	0	0	245,568
Oceania	EUROPE		0	89,893	609,335	0	0	0	0	699,228
Oceania	AFRICA		0	8,600	748	0	0	0	0	9,348
Oceania	MIDDLE EAST		0	0	11,003	0	0	0	0	11,003
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		0	167,297	0	0	0	0	0	167,297
S.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
S.AMERICA W.C	AFRICA		0	47,991	4,175	0	0	0	0	52,166
USWC/HAWAii	USEC		0	0	0	0	0	0	0	0
USWC/HAWAii	CANADA.E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	95,846	8,334	0	0	0	0	104,180
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
USWC/HAWAii	MIDDLE EAST		0	2,751	0	0	0	0	0	2,751
SUB TOTAL			0	684,173	1,535,263	0	0	0	0	2,219,436
Africa	USWC/HAWAii	CB	0	0	0	0	0	0	0	0
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		0	0	0	0	0	0	0	0
Asia	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	21,485	3,791	0	0	0	0	25,276
CANADA E.C	Asia		0	372,851	442,595	0	0	0	0	815,446
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	Oceania		0	1,032,849	196,456	0	0	0	0	1,229,305
EUROPE	Asia		0	0	0	0	0	0	0	0
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	1,017,603	241,902	0	0	0	0	1,259,505
S.AMERICA E.C	CANADA W.C		0	287,414	48,083	0	0	0	0	335,497
S.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	S.AMERICA W.C		0	506,793	161,358	0	0	0	0	668,151
S.AMERICA E.C	Oceania		0	80,641	14,231	0	0	0	0	94,872
S.AMERICA E.C	Asia		0	1,475,186	606,561	0	0	0	0	2,081,747
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	Oceania		0	445,806	275,664	0	0	0	0	721,470
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			0	5,240,628	1,990,641	0	0	0	0	7,231,269
TOTAL			0	5,924,801	3,525,904	0	0	0	0	9,450,705

2060CARGO TON 150000-SQ

			0 9.999	10.000 39.999	40.000 64.999	65.000 99.999	100.000 149.999	150.000 199.999	200.000 250.000	TOTAL
Asia	USEC	CD	0	4,901,951	4,007,076	3,225,112	0	0	0	12,134,139
Asia	CANADA.E.C		0	88,984	460,500	145,326	0	0	0	694,810
Asia	C.AMERICA E.C		0	476,011	18,864	31,961	0	0	0	526,836
Asia	S.AMERICA E.C		0	128,793	6,869	36,062	0	0	0	171,724
Asia	EUROPE		0	0	140,942	30,792	0	0	0	171,734
Asia	AFRICA		0	384	51	77	0	0	0	512
CANADA W.C	USEC		0	0	-190,978	190,977	0	0	0	-1
CANADA W.C	C.AMERICA E.C		0	0	-16,197	16,197	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	292,277	337,989	340,489	849,041	0	0	1,819,796
CANADA W.C	EUROPE		0	4,406	-889,597	13,677	1,838,862	0	0	967,348
CANADA W.C	AFRICA		0	2,736,275	3,330,597	1,622,490	0	0	0	7,689,362
CANADA W.C	MIDDLE EAST		0	0	-169,454	169,454	0	0	0	0
C.AMERICA W.C	USEC		0	0	-99,497	99,497	0	0	0	0
C.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	-142,323	142,323	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	200,878	10,713	56,246	0	0	0	267,837
C.AMERICA W.C	EUROPE		0	345,103	162,609	118,040	0	0	0	625,752
C.AMERICA W.C	AFRICA		0	0	-1,889	1,889	0	0	0	0
Oceania	USEC		0	0	936,975	1,280,641	0	0	0	2,217,616
Oceania	CANADA.E.C		0	644,234	34,359	180,386	0	0	0	858,979
Oceania	C.AMERICA E.C		0	351,554	18,750	98,435	0	0	0	468,739
Oceania	S.AMERICA E.C		0	0	23,297	62,943	0	0	0	86,240
Oceania	EUROPE		0	324,729	17,319	90,924	0	0	0	432,972
Oceania	AFRICA		0	7,844	1,046	1,569	0	0	0	10,459
S.AMERICA W.C	USEC		0	2,362,555	670,530	552,029	0	0	0	3,585,114
S.AMERICA W.C	CANADA.E.C		0	18,245	973	5,108	0	0	0	24,326
S.AMERICA W.C	C.AMERICA E.C		0	207,873	11,087	58,204	0	0	0	277,164
S.AMERICA W.C	S.AMERICA E.C		0	271,621	14,486	76,054	0	0	0	362,161
S.AMERICA W.C	EUROPE		0	5,595,389	1,660,630	1,910,789	0	0	0	9,166,808
S.AMERICA W.C	AFRICA		0	30,303	202,662	63,436	0	0	0	296,401
S.AMERICA W.C	MIDDLE EAST		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	-3,614	3,613	0	0	0	-1
USWC/HAWAii	CANADA.E.C		0	0	-13,188	13,187	0	0	0	-1
USWC/HAWAii	C.AMERICA E.C		0	0	-1,817	1,817	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	327,313	17,457	91,648	0	0	0	436,418
USWC/HAWAii	EUROPE		0	377,075	5,503,520	3,624,091	0	0	0	9,504,686
USWC/HAWAii	AFRICA		0	1,562,414	5,218,561	2,236,855	0	0	0	9,017,830
SUB TOTAL			0	21,256,211	21,279,308	16,592,338	2,687,903	0	0	61,815,760
Africa	USWC/HAWAii	CD	0	85,800	136,027	75,167	0	0	0	296,994
Africa	CANADA W.C		0	3,460,490	2,121,341	2,063,069	0	0	0	7,644,900
Africa	C.AMERICA W.C		0	-48,028	0	48,027	0	0	0	-1
Africa	S.AMERICA W.C		0	-12,530	0	12,529	0	0	0	-1
Africa	Oceania		0	603,897	420,318	271,566	0	0	0	1,295,781
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	249,973	91,013	84,982	0	0	0	425,968
CANADA E.C	Oceania		0	104,407	7,880	19,956	0	0	0	132,243
CANADA E.C	Asia		0	1,749,717	1,424,400	1,326,739	1,516,828	0	0	6,017,684
C.AMERICA E.C	USWC/HAWAii		0	-11,458	0	11,458	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	-4,214	0	4,214	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	-65,998	0	65,998	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	557,847	22,020	154,142	0	0	0	734,009
C.AMERICA E.C	Oceania		0	16,650	657	4,601	0	0	0	21,908
C.AMERICA E.C	Asia		0	-32,320	0	32,320	0	0	0	0
EUROPE	USWC/HAWAii		0	-184,628	-311,570	496,198	0	0	0	0
EUROPE	CANADA W.C		0	161,624	121,902	124,782	0	0	0	408,308
EUROPE	C.AMERICA W.C		0	-65,090	0	65,090	0	0	0	0
EUROPE	S.AMERICA W.C		0	390,271	15,405	107,838	0	0	0	513,514
EUROPE	Oceania		0	183,249	7,234	50,635	0	0	0	241,118
EUROPE	Asia		0	136,488	188,513	86,833	0	0	0	411,834
S.AMERICA E.C	USWC/HAWAii		0	306,655	300,828	1,114,435	0	0	0	1,721,918
S.AMERICA E.C	CANADA W.C		0	73,661	2,908	20,354	0	0	0	96,923
S.AMERICA E.C	C.AMERICA W.C		0	335,499	13,235	92,644	0	0	0	441,378
S.AMERICA E.C	S.AMERICA W.C		0	903,130	88,666	303,846	0	0	0	1,295,642
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	1,130,378	739,394	693,249	7,654,348	0	0	10,217,369
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	S.AMERICA W.C		0	0	86,553	17,728	0	0	0	104,281
USEC	USWC/HAWAii		0	-15	0	15	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	-515,807	-737,210	1,253,016	0	0	0	-1
USEC	S.AMERICA W.C		0	2,105,364	71,846	766,351	0	0	0	2,943,561
USEC	Oceania		0	585,613	99,125	224,714	0	0	0	909,452
USEC	Asia		0	0	-6,398,795	6,398,795	75,167,305	0	0	75,167,305
SUB TOTAL			0	12,200,625	-1,488,310	15,991,291	84,338,481	0	0	111,042,087
TOTAL			0	33,456,836	19,790,998	32,583,629	87,026,384	0	0	172,857,847

2060 CARGO TON 200000-SQ

			0 9.999	10.000 39.999	40.000 64.999	65.000 99.999	100.000 149.999	150.000 199.999	200.000 250.000	TOTAL
Asia	USEC	CD	0	4,901,951	4,007,076	3,225,112	0	0	0	12,134,139
Asia	CANADA E.C		0	88,984	460,500	145,326	0	0	0	694,810
Asia	C.AMERICA E.C		0	476,011	18,864	31,961	0	0	0	526,836
Asia	S.AMERICA E.C		0	128,793	6,869	36,062	0	0	0	171,724
Asia	EUROPE		0	0	140,942	30,792	0	0	0	171,734
Asia	AFRICA		0	384	51	[illegible]	0	0	0	512
CANADA W.C	USEC		0	0	-190,978	190,977	0	0	0	-1
CANADA W.C	C.AMERICA E.C		0	0	-16,197	16,197	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	292,277	337,989	340,489	0	849,041	0	1,819,796
CANADA W.C	EUROPE		0	4,406	-889,597	13,677	0	1,838,862	0	967,348
CANADA W.C	AFRICA		0	2,736,275	3,330,597	1,622,490	0	0	0	7,689,362
CANADA W.C	MIDDLE EAST		0	0	-169,454	169,454	0	0	0	0
C.AMERICA W.C	USEC		0	0	-99,497	99,497	0	0	0	0
C.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	-142,323	142,323	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	200,878	10,713	56,246	0	0	0	267,837
C.AMERICA W.C	EUROPE		0	345,103	162,609	118,040	0	0	0	625,752
C.AMERICA W.C	AFRICA		0	0	-1,889	1,889	0	0	0	0
Oceania	USEC		0	0	936,975	1,280,641	0	0	0	2,217,616
Oceania	CANADA.E.C		0	644,234	34,359	180,386	0	0	0	858,979
Oceania	C.AMERICA E.C		0	351,554	18,750	98,435	0	0	0	468,739
Oceania	S.AMERICA E.C		0	0	23,297	62,943	0	0	0	86,240
Oceania	EUROPE		0	324,729	17,319	90,924	0	0	0	432,972
Oceania	AFRICA		0	7,844	1,046	1,569	0	0	0	10,459
S.AMERICA W.C	USEC		0	2,362,555	670,530	552,029	0	0	0	3,585,114
S.AMERICA W.C	CANADA.E.C		0	18,245	973	5,108	0	0	0	24,326
S.AMERICA W.C	C.AMERICA E.C		0	207,873	11,087	58,204	0	0	0	277,164
S.AMERICA W.C	S.AMERICA E.C		0	271,621	14,486	76,054	0	0	0	362,161
S.AMERICA W.C	EUROPE		0	5,595,389	1,660,630	1,910,789	0	1,946,402	0	11,113,210
S.AMERICA W.C	AFRICA		0	30,303	202,662	63,436	0	0	0	296,401
S.AMERICA W.C	MIDDLE EAST		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	-3,614	3,613	0	0	0	-1
USWC/HAWAii	CANADA.E.C		0	0	-13,188	13,187	0	0	0	-1
USWC/HAWAii	C.AMERICA E.C		0	0	-1,817	1,817	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	327,313	17,457	91,648	0	0	0	436,418
USWC/HAWAii	EUROPE		0	377,075	5,503,520	3,624,091	0	0	0	9,504,686
USWC/HAWAii	AFRICA		0	1,562,414	5,218,561	2,236,855	0	0	0	9,017,830
SUB TOTAL			0	21,256,211	21,279,308	16,592,338	0	4,634,305	0	63,762,162
Africa	USWC/HAWAii	CD	0	85,800	136,027	75,167	0	0	0	296,994
Africa	CANADA W.C		0	3,460,490	2,121,341	2,063,069	0	0	0	7,644,900
Africa	C.AMERICA W.C		0	-48,028	0	48,027	0	0	0	-1
Africa	S.AMERICA W.C		0	-12,530	0	12,529	0	0	0	-1
Africa	Oceania		0	603,897	420,318	271,566	0	0	0	1,295,781
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	249,973	91,013	84,982	0	0	0	425,968
CANADA E.C	Oceania		0	104,407	7,880	19,956	0	0	0	132,243
CANADA E.C	Asia		0	1,749,717	1,424,400	1,326,739	0	3,033,656	0	7,534,512
C.AMERICA E.C	USWC/HAWAii		0	-11,458	0	11,458	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	-4,214	0	4,214	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	-65,998	0	65,998	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	557,847	22,020	154,142	0	0	0	734,009
C.AMERICA E.C	Oceania		0	16,650	657	4,601	0	0	0	21,908
C.AMERICA E.C	Asia		0	-32,320	0	32,320	0	0	0	0
EUROPE	USWC/HAWAii		0	-184,628	-311,570	496,198	0	0	0	0
EUROPE	CANADA W.C		0	161,624	121,902	124,782	0	0	0	408,308
EUROPE	C.AMERICA W.C		0	-65,090	0	65,090	0	0	0	0
EUROPE	S.AMERICA W.C		0	390,271	15,405	107,838	0	0	0	513,514
EUROPE	Oceania		0	183,249	7,234	50,635	0	0	0	241,118
EUROPE	Asia		0	136,488	188,513	86,833	0	0	0	411,834
S.AMERICA E.C	USWC/HAWAii		0	306,655	300,828	1,114,435	0	0	0	1,721,918
S.AMERICA E.C	CANADA W.C		0	73,661	2,908	20,354	0	0	0	96,923
S.AMERICA E.C	C.AMERICA W.C		0	335,499	13,235	92,644	0	0	0	441,378
S.AMERICA E.C	S.AMERICA W.C		0	903,130	88,666	303,846	0	0	0	1,295,642
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	1,130,378	739,394	693,249	0	8,269,691	0	10,832,712
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	S.AMERICA W.C		0	0	86,553	17,728	0	0	0	104,281
USEC	USWC/HAWAii		0	-15	0	15	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	-515,807	-737,210	1,253,016	0	0	0	-1
USEC	S.AMERICA W.C		0	2,105,364	71,846	766,351	0	0	0	2,943,561
USEC	Oceania		0	585,613	99,125	224,714	0	0	0	909,452
USEC	Asia		0	0	-6,398,795	6,398,795	0	75,167,305	0	75,167,305
SUB TOTAL			0	12,200,625	-1,488,310	15,991,291	0	86,470,652	0	113,174,258
TOTAL			0	33,456,836	19,790,998	32,583,629	0	91,104,957	0	176,936,420

2060 CARGO TON 250000-SQ

			0 9.999	10.000 39.999	40.000 64.999	65.000 99.999	100.000 149.999	150.000 199.999	200.000 250.000	TOTAL
Asia	USEC	CD	0	4,901,951	4,007,076	3,225,112	0	0	0	12,134,139
Asia	CANADA.E.C		0	88,984	460,500	145,326	0	0	0	694,810
Asia	C.AMERICA E.C		0	476,011	18,864	31,961	0	0	0	526,836
Asia	S.AMERICA E.C		0	128,793	6,869	36,062	0	0	0	171,724
Asia	EUROPE		0	0	140,942	30,792	0	0	0	171,734
Asia	AFRICA		0	384	51	77	0	0	0	512
CANADA W.C	USEC		0	0	-190,978	190,977	0	0	0	-1
CANADA W.C	C.AMERICA E.C		0	0	-16,197	16,197	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	292,277	337,989	340,489	0	849,041	0	1,819,796
CANADA W.C	EUROPE		0	4,406	-889,597	13,677	0	1,838,862	0	967,348
CANADA W.C	AFRICA		0	2,736,275	3,330,597	1,622,490	0	0	0	7,689,362
CANADA W.C	MIDDLE EAST		0	0	-169,454	169,454	0	0	0	0
C.AMERICA W.C	USEC		0	0	-99,497	99,497	0	0	0	0
C.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	-142,323	142,323	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	200,878	10,713	56,246	0	0	0	267,837
C.AMERICA W.C	EUROPE		0	345,103	162,609	118,040	0	0	0	625,752
C.AMERICA W.C	AFRICA		0	0	-1,889	1,889	0	0	0	0
Oceania	USEC		0	0	936,975	1,280,641	0	0	0	2,217,616
Oceania	CANADA.E.C		0	644,234	34,359	180,386	0	0	0	858,979
Oceania	C.AMERICA E.C		0	351,554	18,750	98,435	0	0	0	468,739
Oceania	S.AMERICA E.C		0	0	23,297	62,943	0	0	0	86,240
Oceania	EUROPE		0	324,729	17,319	90,924	0	0	0	432,972
Oceania	AFRICA		0	7,844	1,046	1,569	0	0	0	10,459
S.AMERICA W.C	USEC		0	2,362,555	670,530	552,029	0	0	0	3,585,114
S.AMERICA W.C	CANADA.E.C		0	18,245	[illegible]	5,108	0	0	0	24,326
S.AMERICA W.C	C.AMERICA E.C		0	207,873	11,[illegible]	58,204	0	0	0	277,164
S.AMERICA W.C	S.AMERICA E.C		0	271,621	14,486	76,054	0	0	0	362,161
S.AMERICA W.C	EUROPE		0	5,595,389	1,660,630	1,910,789	0	1,946,402	1,946,402	13,059,612
S.AMERICA W.C	AFRICA		0	30,303	202,662	63,436	0	0	0	296,401
S.AMERICA W.C	MIDDLE EAST		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	-3,614	3,613	0	0	0	-1
USWC/HAWAii	CANADA.E.C		0	0	-13,188	13,187	0	0	0	-1
USWC/HAWAii	C.AMERICA E.C		0	0	-1,817	1,817	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	327,313	17,457	91,648	0	0	0	436,418
USWC/HAWAii	EUROPE		0	377,075	5,503,520	3,624,091	0	0	0	9,504,686
USWC/HAWAii	AFRICA		0	1,562,414	5,218,561	2,236,855	0	0	0	9,017,830
SUB TOTAL			0	21,256,211	21,279,308	16,592,338	0	4,634,305	1,946,402	65,708,564
Africa	USWC/HAWAii	CD	0	85,800	136,027	75,167	0	0	0	296,994
Africa	CANADA W.C		0	3,460,490	2,121,341	2,063,069	0	0	0	7,644,900
Africa	C.AMERICA W.C		0	-48,028	0	48,027	0	0	0	-1
Africa	S.AMERICA W.C		0	-12,530	0	12,529	0	0	0	-1
Africa	Oceania		0	603,897	420,318	271,566	0	0	0	1,295,781
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	249,973	91,013	84,982	0	0	0	425,968
CANADA E.C	Oceania		0	104,407	7,880	19,956	0	0	0	132,243
CANADA E.C	Asia		0	1,749,717	1,424,400	1,326,739	0	1,516,828	1,516,828	7,534,512
C.AMERICA E.C	USWC/HAWAii		0	-11,458	0	11,458	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	-4,214	0	4,214	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	-65,998	0	65,998	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	557,847	22,020	154,142	0	0	0	734,009
C.AMERICA E.C	Oceania		0	16,650	657	4,601	0	0	0	21,908
C.AMERICA E.C	Asia		0	-32,320	0	32,320	0	0	0	0
EUROPE	USWC/HAWAii		0	-184,628	-311,570	496,198	0	0	0	0
EUROPE	CANADA W.C		0	161,624	121,902	124,782	0	0	0	408,308
EUROPE	C.AMERICA W.C		0	-65,090	0	65,090	0	0	0	0
EUROPE	S.AMERICA W.C		0	390,271	15,405	107,838	0	0	0	513,514
EUROPE	Oceania		0	183,249	7,234	50,635	0	0	0	241,118
EUROPE	Asia		0	136,488	188,513	86,833	0	0	0	411,834
S.AMERICA E.C	USWC/HAWAii		0	306,655	300,828	1,114,435	0	0	0	1,721,918
S.AMERICA E.C	CANADA W.C		0	73,661	2,908	20,354	0	0	0	96,923
S.AMERICA E.C	C.AMERICA W.C		0	335,499	13,235	92,644	0	0	0	441,378
S.AMERICA E.C	S.AMERICA W.C		0	903,130	88,666	303,846	0	0	0	1,295,642
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	1,130,378	739,394	693,249	0	7,654,348	12,469,789	22,687,158
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	S.AMERICA W.C		0	0	86,553	17,728	0	0	0	104,281
USEC	USWC/HAWAii		0	-15	0	15	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	-515,807	-737,210	1,253,016	0	0	0	-1
USEC	S.AMERICA W.C		0	2,105,364	71,846	766,351	0	0	0	2,943,561
USEC	Oceania		0	585,613	99,125	224,714	0	0	0	909,452
USEC	Asia		0	0	-6,398,795	6,398,795	0	75,167,305	0	75,167,305
SUB TOTAL			0	12,200,625	-1,488,310	15,991,291	0	84,338,481	13,986,617	125,028,704
TOTAL			0	33,456,836	19,790,998	32,583,629	0	88,972,786	15,933,019	190,737,268

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 249,999	TOTAL
ASIA	U.S.EC	CG	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	3,246	0	0	0	0	0	3,246
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	51,815	0	0	0	0	0	51,815
CANADA WC	U.S EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	ASIA		0	0	0	0	0	0	0	0
CANADA WC	MIDDLE EAST		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		961	2,247	0	0	0	0	0	3,208
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		35,350	3,074	0	0	0	0	0	38,424
OCEANIA	EUROPE		0	590	0	0	0	0	0	590
OCEANIA	AFRICA		0	9,113	0	0	0	0	0	9,113
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	14,055	0	0	0	0	0	14,055
S AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	S AMERICA EC		192,905	113,708	0	0	0	0	0	306,613
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	AFRICA		0	148,929	0	0	0	0	0	148,929
S AMERICA WC	MIDDLE EAST		0	25,008	0	0	0	0	0	25,008
U.S WC	U.S.EC		0	0	0	0	0	0	0	0
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		11,500	7,964	0	0	0	0	0	19,464
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	ASIA		0	347	0	0	0	0	0	347
U.S WC	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			240,716	380,096	0	0	0	0	0	620,812
AFRICA	U.S. WC	CG	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
ASIA	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	147,818	0	0	0	0	0	147,818
CANADA EC	OCEANIA		0	7,019	0	0	0	0	0	7,019
CANADA EC	ASIA		0	25,154	0	0	0	0	0	25,154
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		1,222	52,335	0	0	0	0	0	53,557
EUROPE	OCEANIA		1,118	301,095	0	0	0	0	0	302,213
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	19,214	0	0	0	0	0	19,214
MIDDLE EAST	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		11,613	65,111	0	0	0	0	0	76,724
S AMERICA EC	CANADA WC		0	1,654	0	0	0	0	0	1,654
S AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	S AMERICA WC		123,961	530,749	0	0	0	0	0	654,710
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	479,536	0	0	0	0	0	479,536
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S.AMERICA WC		0	0	0	0	0	0	0	0
U.S EC	OCEANIA		0	88,877	0	0	0	0	0	88,877
U.S EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			137,914	1,718,562	0	0	0	0	0	1,856,476
TOTAL			378,630	2,098,658	0	0	0	0	0	2,477,288

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 249,999	TOTAL
ASIA	U.S.EC	CT	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	23,172	0	0	0	0	0	23,172
ASIA	EUROPE		49,663	439,398	0	0	0	0	0	489,061
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		33,613	1,769	0	0	0	0	0	35,382
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	235,102	258,493	0	0	0	0	493,595
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	225,482	56,370	0	0	0	0	281,852
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	S AMERICA EC		5	99,216	0	0	0	0	0	99,221
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	0	0	0	0	0	0
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	5,615	0	0	0	0	0	5,615
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	AFRICA		0	0	0	0	0	0	0	0
U.S WC	MIDDLE EAST		0	0	0	0	0	0	0	0
SUB TOTAL			83,281	1,029,754	314,863	0	0	0	0	1,427,898
AFRICA	U.S. WC	CT	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		53,637	44,086	0	0	0	0	0	97,723
EUROPE	OCEANIA		0	267,554	0	0	0	0	0	267,554
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	0	42,615	0	0	0	0	42,615
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
S AMERICA EC	C AMERICA WC		56,369	22,545	0	0	0	0	0	78,914
S AMERICA EC	S AMERICA WC		0	181,056	0	0	0	0	0	181,056
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	0	0	0	0	0	0	0
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			110,006	515,241	42,615	0	0	0	0	667,862
TOTAL			193,287	1,544,995	357,478	0	0	0	0	2,095,760

2060 CARGO TON 200000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	CD	0	4,901,951	4,007,076	3,225,112	0	0	0	12,134,139
Asia	CANADA E.C		0	88,984	460,500	145,326	0	0	0	694,810
Asia	C.AMERICA E.C		0	476,011	18,864	31,961	0	0	0	526,836
Asia	S.AMERICA E.C		0	128,793	6,869	36,062	0	0	0	171,724
Asia	EUROPE		0	0	140,942	30,792	0	0	0	171,734
Asia	AFRICA		0	384	51	--	0	0	0	512
CANADA W.C	USEC		0	0	-190,978	190,977	0	0	0	-1
CANADA W.C	C.AMERICA E.C		0	0	-16,197	16,197	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	292,277	337,989	340,489	0	849,041	0	1,819,796
CANADA W.C	EUROPE		0	4,406	-889,597	13,677	0	1,838,862	0	967,348
CANADA W.C	AFRICA		0	2,736,275	3,330,597	1,622,490	0	0	0	7,689,362
CANADA W.C	MIDDLE EAST		0	0	-169,454	169,454	0	0	0	0
C.AMERICA W.C	USEC		0	0	-99,497	99,497	0	0	0	0
C.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	-142,323	142,323	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	200,878	10,713	56,246	0	0	0	267,837
C.AMERICA W.C	EUROPE		0	345,103	162,609	118,040	0	0	0	625,752
C.AMERICA W.C	AFRICA		0	0	-1,889	1,889	0	0	0	0
Oceania	USEC		0	0	936,975	1,280,641	0	0	0	2,217,616
Oceania	CANADA E.C		0	644,234	34,359	180,386	0	0	0	858,979
Oceania	C.AMERICA E.C		0	351,554	18,750	98,435	0	0	0	468,739
Oceania	S.AMERICA E.C		0	0	23,297	62,943	0	0	0	86,240
Oceania	EUROPE		0	324,729	17,319	90,924	0	0	0	432,972
Oceania	AFRICA		0	7,844	1,046	1,569	0	0	0	10,459
S.AMERICA W.C	USEC		0	2,362,555	670,530	552,029	0	0	0	3,585,114
S.AMERICA W.C	CANADA E.C		0	18,245	973	5,108	0	0	0	24,326
S.AMERICA W.C	C.AMERICA E.C		0	207,873	11,087	58,204	0	0	0	277,164
S.AMERICA W.C	S.AMERICA E.C		0	271,621	14,486	76,054	0	0	0	362,161
S.AMERICA W.C	EUROPE		0	5,595,389	1,660,630	1,910,789	0	1,946,402	0	11,113,210
S.AMERICA W.C	AFRICA		0	30,303	202,662	63,436	0	0	0	296,401
S.AMERICA W.C	MIDDLE EAST		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	-3,614	3,613	0	0	0	-1
USWC/HAWAii	CANADA E.C		0	0	-13,188	13,187	0	0	0	-1
USWC/HAWAii	C.AMERICA E.C		0	0	-1,817	1,817	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	327,313	17,457	91,648	0	0	0	436,418
USWC/HAWAii	EUROPE		0	377,075	5,503,520	3,624,091	0	0	0	9,504,686
USWC/HAWAii	AFRICA		0	1,562,414	5,218,561	2,236,855	0	0	0	9,017,830
SUB TOTAL			0	21,256,211	21,279,308	16,592,338	0	4,634,305	0	63,762,162
Africa	USWC/HAWAii	CD	0	85,800	136,027	75,167	0	0	0	296,994
Africa	CANADA W.C		0	3,460,490	2,121,341	2,063,069	0	0	0	7,644,900
Africa	C.AMERICA W.C		0	-48,028	0	48,027	0	0	0	-1
Africa	S.AMERICA W.C		0	-12,530	0	12,529	0	0	0	-1
Africa	Oceania		0	603,897	420,318	271,566	0	0	0	1,295,781
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	249,973	91,013	84,982	0	0	0	425,968
CANADA E.C	Oceania		0	104,407	7,880	19,956	0	0	0	132,243
CANADA E.C	Asia		0	1,749,717	1,424,400	1,326,739	0	3,033,656	0	7,534,512
C.AMERICA E.C	USWC/HAWAii		0	-11,458	0	11,458	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	-4,214	0	4,214	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	-65,998	0	65,998	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	557,847	22,020	154,142	0	0	0	734,009
C.AMERICA E.C	Oceania		0	16,650	657	4,601	0	0	0	21,908
C.AMERICA E.C	Asia		0	-32,320	0	32,320	0	0	0	0
EUROPE	USWC/HAWAii		0	-184,628	-311,570	496,198	0	0	0	0
EUROPE	CANADA W.C		0	161,624	121,902	124,782	0	0	0	408,308
EUROPE	C.AMERICA W.C		0	-65,090	0	65,090	0	0	0	0
EUROPE	S.AMERICA W.C		0	390,271	15,405	107,838	0	0	0	513,514
EUROPE	Oceania		0	183,249	7,234	50,635	0	0	0	241,118
EUROPE	Asia		0	136,488	188,513	86,833	0	0	0	411,834
S.AMERICA E.C	USWC/HAWAii		0	306,655	300,828	1,114,435	0	0	0	1,721,918
S.AMERICA E.C	CANADA W.C		0	73,661	2,908	20,354	0	0	0	96,923
S.AMERICA E.C	C.AMERICA W.C		0	335,499	13,235	92,644	0	0	0	441,378
S.AMERICA E.C	S.AMERICA W.C		0	903,130	88,666	303,846	0	0	0	1,295,642
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	1,130,378	739,394	693,249	0	8,269,691	0	10,832,712
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	S.AMERICA W.C		0	0	86,553	17,728	0	0	0	104,281
USEC	USWC/HAWAii		0	-15	0	15	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	-515,807	-737,210	1,253,016	0	0	0	-1
USEC	S.AMERICA W.C		0	2,105,364	71,846	766,351	0	0	0	2,943,561
USEC	Oceania		0	585,613	99,125	224,714	0	0	0	909,452
USEC	Asia		0	0	-6,398,795	6,398,795	0	75,167,305	0	75,167,305
SUB TOTAL			0	12,200,625	-1,488,310	15,991,291	0	86,470,652	0	113,174,258
TOTAL			0	33,456,836	19,790,998	32,583,629	0	91,104,957	0	176,936,420

2060 CARGO TON 250000-SQ

			0 9.999	10,000 39.999	40,000 64.999	65,000 99.999	100,000 149.999	150,000 199.999	200,000 250,000	TOTAL
Asia	USEC	CD	0	4,901,951	4,007,076	3,225,112	0	0	0	12,134,139
Asia	CANADA.E.C		0	88,984	460,500	145,326	0	0	0	694,810
Asia	C.AMERICA E.C		0	476,011	18,864	31,961	0	0	0	526,836
Asia	S.AMERICA E.C		0	128,793	6,869	36,062	0	0	0	171,724
Asia	EUROPE		0	0	140,942	30,792	0	0	0	171,734
Asia	AFRICA		0	384	51	77	0	0	0	512
CANADA W.C	USEC		0	0	-190,978	190,977	0	0	0	-1
CANADA W.C	C.AMERICA E.C		0	0	-16,197	16,197	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	292,277	337,989	340,489	0	849,041	0	1,819,796
CANADA W.C	EUROPE		0	4,406	-889,597	13,677	0	1,838,862	0	967,348
CANADA W.C	AFRICA		0	2,736,275	3,330,597	1,622,490	0	0	0	7,689,362
CANADA W.C	MIDDLE EAST		0	0	-169,454	169,454	0	0	0	0
C.AMERICA W.C	USEC		0	0	-99,497	99,497	0	0	0	0
C.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	-142,323	142,323	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	200,878	10,713	56,246	0	0	0	267,837
C.AMERICA W.C	EUROPE		0	345,103	162,609	118,040	0	0	0	625,752
C.AMERICA W.C	AFRICA		0	0	-1,889	1,889	0	0	0	0
Oceania	USEC		0	0	936,975	1,280,641	0	0	0	2,217,616
Oceania	CANADA.E.C		0	644,234	34,359	180,386	0	0	0	858,979
Oceania	C.AMERICA E.C		0	351,554	18,750	98,435	0	0	0	468,739
Oceania	S.AMERICA E.C		0	0	23,297	62,943	0	0	0	86,240
Oceania	EUROPE		0	324,729	17,319	90,924	0	0	0	432,972
Oceania	AFRICA		0	7,844	1,046	1,569	0	0	0	10,459
S.AMERICA W.C	USEC		0	2,362,555	670,530	552,029	0	0	0	3,585,114
S.AMERICA W.C	CANADA.E.C		0	18,245	973	5,108	0	0	0	24,326
S.AMERICA W.C	C.AMERICA E.C		0	207,873	11,087	58,204	0	0	0	277,164
S.AMERICA W.C	S.AMERICA E.C		0	271,621	14,486	76,054	0	0	0	362,161
S.AMERICA W.C	EUROPE		0	5,595,389	1,660,630	1,910,789	0	1,946,402	1,946,402	13,059,612
S.AMERICA W.C	AFRICA		0	30,303	202,662	63,436	0	0	0	296,401
S.AMERICA W.C	MIDDLE EAST		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	-3,614	3,613	0	0	0	-1
USWC/HAWAii	CANADA.E.C		0	0	-13,188	13,187	0	0	0	-1
USWC/HAWAii	C.AMERICA E.C		0	0	-1,817	1,817	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	327,313	17,457	91,648	0	0	0	436,418
USWC/HAWAii	EUROPE		0	377,075	5,503,520	3,624,091	0	0	0	9,504,686
USWC/HAWAii	AFRICA		0	1,562,414	5,218,561	2,236,855	0	0	0	9,017,830
SUB TOTAL			0	21,256,211	21,279,308	16,592,338	0	4,634,305	1,946,402	65,708,564
Africa	USWC/HAWAii	CD	0	85,800	136,027	75,167	0	0	0	296,994
Africa	CANADA W.C		0	3,460,490	2,121,341	2,063,069	0	0	0	7,644,900
Africa	C.AMERICA W.C		0	-48,028	0	48,027	0	0	0	-1
Africa	S.AMERICA W.C		0	-12,530	0	12,529	0	0	0	-1
Africa	Oceania		0	603,897	420,318	271,566	0	0	0	1,295,781
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	249,973	91,013	84,982	0	0	0	425,968
CANADA E.C	Oceania		0	104,407	7,880	19,956	0	0	0	132,243
CANADA E.C	Asia		0	1,749,717	1,424,400	1,326,739	0	1,516,828	1,516,828	7,534,512
C.AMERICA E.C	USWC/HAWAii		0	-11,458	0	11,458	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	-4,214	0	4,214	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	-65,998	0	65,998	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	557,847	22,020	154,142	0	0	0	734,009
C.AMERICA E.C	Oceania		0	16,650	657	4,601	0	0	0	21,908
C.AMERICA E.C	Asia		0	-32,320	0	32,320	0	0	0	0
EUROPE	USWC/HAWAii		0	-184,628	-311,570	496,198	0	0	0	0
EUROPE	CANADA W.C		0	161,624	121,902	124,782	0	0	0	408,308
EUROPE	C.AMERICA W.C		0	-65,090	0	65,090	0	0	0	0
EUROPE	S.AMERICA W.C		0	390,271	15,405	107,838	0	0	0	513,514
EUROPE	Oceania		0	183,249	7,234	50,635	0	0	0	241,118
EUROPE	Asia		0	136,488	188,513	86,833	0	0	0	411,834
S.AMERICA E.C	USWC/HAWAii		0	306,655	300,828	1,114,435	0	0	0	1,721,918
S.AMERICA E.C	CANADA W.C		0	73,661	2,908	20,354	0	0	0	96,923
S.AMERICA E.C	C.AMERICA W.C		0	335,499	13,235	92,644	0	0	0	441,378
S.AMERICA E.C	S.AMERICA W.C		0	903,130	88,666	303,846	0	0	0	1,295,642
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	1,130,378	739,394	693,249	0	7,654,348	12,469,789	22,687,158
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	S.AMERICA W.C		0	0	86,553	17,728	0	0	0	104,281
USEC	USWC/HAWAii		0	-15	0	15	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	-515,807	-737,210	1,253,016	0	0	0	-1
USEC	S.AMERICA W.C		0	2,105,364	71,846	766,351	0	0	0	2,943,561
USEC	Oceania		0	585,613	99,125	224,714	0	0	0	909,452
USEC	Asia		0	0	-6,398,795	6,398,795	0	75,167,305	0	75,167,305
SUB TOTAL			0	12,200,625	-1,488,310	15,991,291	0	84,338,481	13,986,617	125,028,704
TOTAL			0	33,456,836	19,790,998	32,583,629	0	88,972,786	15,933,019	190,737,268

2060 CARGO TON 150000-SQ

			0 9.999	10.000 39.999	40.000 64.999	65.000 99.999	100.000 149.999	150.000 199.999	200.000 249.999	TOTAL
ASIA	U.S.EC	CG	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	3,246	0	0	0	0	0	3,246
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	51,815	0	0	0	0	0	51,815
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
CANADA WC	ASIA		0	0	0	0	0	0	0	0
CANADA WC	MIDDLE EAST		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		961	2,247	0	0	0	0	0	3,208
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		35,350	3,074	0	0	0	0	0	38,424
OCEANIA	EUROPE		0	590	0	0	0	0	0	590
OCEANIA	AFRICA		0	9,113	0	0	0	0	0	9,113
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	14,055	0	0	0	0	0	14,055
S AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	S AMERICA EC		192,905	113,708	0	0	0	0	0	306,613
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	AFRICA		0	148,929	0	0	0	0	0	148,929
S AMERICA WC	MIDDLE EAST		0	25,008	0	0	0	0	0	25,008
U.S WC	U.S.EC		0	0	0	0	0	0	0	0
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		11,500	7,964	0	0	0	0	0	19,464
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	ASIA		0	347	0	0	0	0	0	347
U.S WC	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			240,716	380,096	0	0	0	0	0	620,812
AFRICA	U.S. WC	CG	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
ASIA	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	147,818	0	0	0	0	0	147,818
CANADA EC	OCEANIA		0	7,019	0	0	0	0	0	7,019
CANADA EC	ASIA		0	25,154	0	0	0	0	0	25,154
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		1,222	52,335	0	0	0	0	0	53,557
EUROPE	OCEANIA		1,118	301,095	0	0	0	0	0	302,213
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	19,214	0	0	0	0	0	19,214
MIDDLE EAST	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		11,613	65,111	0	0	0	0	0	76,724
S AMERICA EC	CANADA WC		0	1,654	0	0	0	0	0	1,654
S AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	S AMERICA WC		123,961	530,749	0	0	0	0	0	654,710
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	479,536	0	0	0	0	0	479,536
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	88,877	0	0	0	0	0	88,877
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			137,914	1,718,562	0	0	0	0	0	1,856,476
TOTAL			378,630	2,098,658	0	0	0	0	0	2,477,288

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 249,999	TOTAL
ASIA	U.S.EC	CT	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	23,172	0	0	0	0	0	23,172
ASIA	EUROPE		49,663	439,398	0	0	0	0	0	489,061
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		33,613	1,769	0	0	0	0	0	35,382
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	235,102	258,493	0	0	0	0	493,595
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	225,482	56,370	0	0	0	0	281,852
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	S AMERICA EC		5	99,216	0	0	0	0	0	99,221
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	0	0	0	0	0	0
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	5,615	0	0	0	0	0	5,615
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	AFRICA		0	0	0	0	0	0	0	0
U.S WC	MIDDLE EAST		0	0	0	0	0	0	0	0
SUB TOTAL			83,281	1,029,754	314,863	0	0	0	0	1,427,898
AFRICA	U.S. WC	CT	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		53,637	44,086	0	0	0	0	0	97,723
EUROPE	OCEANIA		0	267,554	0	0	0	0	0	267,554
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	0	42,615	0	0	0	0	42,615
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
S AMERICA EC	C AMERICA WC		56,369	22,545	0	0	0	0	0	78,914
S AMERICA EC	S AMERICA WC		0	181,056	0	0	0	0	0	181,056
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	0	0	0	0	0	0	0
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			110,006	515,241	42,615	0	0	0	0	667,862
TOTAL			193,287	1,544,995	357,478	0	0	0	0	2,095,760

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	FC	0	-444,292	-4,525,670	4,222,152	3,247,809	0	0	2,499,999
Asia	CANADA E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	1,373,201	207,927	0	0	0	0	1,581,128
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	0	0	0	0	0	0	0
Asia	Asia		0	1,790	94	0	0	0	0	1,884
Asia	AFRICA		0	0	467	0	0	0	0	467
Asia	MIDDLE EAST		0	0	0	0	0	0	0	0
CANADA W.C	USEC		0	0	0	0	0	0	0	0
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
C.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
C.AMERICA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	MIDDLE EAST		0	0	0	0	0	0	0	0
Oceania	USEC		0	1,097,211	93,502	0	0	0	0	1,190,713
Oceania	CANADA E.C		0	162,959	13,953	0	0	0	0	176,912
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	2,234	69	0	0	0	0	2,303
Oceania	EUROPE		0	0	0	0	0	0	0	0
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		0	79	2	0	0	0	0	81
S.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	0	0	0	0	0	0
USWC/HAWAii	CANADA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	EUROPE		0	121,027	-196,365	1,175,338	0	0	0	1,100,000
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
USWC/HAWAii	MIDDLE EAST		0	0	0	0	0	0	0	0
SUB TOTAL			0	2,314,209	-4,406,021	5,397,490	3,247,809	0	0	6,553,487
Africa	USWC/HAWAii	FC	0	0	0	0	0	0	0	0
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	263,732	22,224	0	0	0	0	285,956
CANADA E.C	Asia		0	0	0	0	0	0	0	0
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
EUROPE	USWC/HAWAii		0	-332,316	-633,629	1,125,944	0	0	0	159,999
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	Oceania		0	150,790	12,054	0	0	0	0	162,844
EUROPE	Asia		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	S.AMERICA W.C		0	61,783	1,911	0	0	0	0	63,694
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	72,322	2,237	0	0	0	0	74,559
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	Asia		0	4,244	359	0	0	0	0	4,603
MIDDLE EAST	S.AMERICA W.C		0	1,671	34	0	0	0	0	1,705
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	Oceania		0	2,534,204	204,703	0	0	0	0	2,738,907
USEC	Asia		0	-784,111	-7,982,745	6,438,204	4,828,653	0	0	2,500,001
SUB TOTAL			0	1,972,319	-8,372,852	7,564,148	4,828,653	0	0	5,992,268
TOTAL			0	4,286,528	-12,778,873	12,961,638	8,076,462	0	0	12,545,755

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	LP	0	0	0	0	0	0	0	0
Asia	CANADA E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	USEC		0	0	0	0	0	0	0	0
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
C.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
C.AMERICA W.C	AFRICA		0	0	0	0	0	0	0	0
Oceania	USEC		0	0	0	0	0	0	0	0
Oceania	CANADA E.C		0	0	0	0	0	0	0	0
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	EUROPE		0	0	0	0	0	0	0	0
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	0	0	0	0	0	0
USWC/HAWAii	CANADA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			0	0	0	0	0	0	0	0
Africa	USWC/HAWAii	LP	0	0	0	0	0	0	0	0
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	0	0	0	0	0	0	0
CANADA E.C	Asia		0	0	0	0	0	0	0	0
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	Oceania		0	0	0	0	0	0	0	0
EUROPE	Asia		0	0	0	0	0	0	0	0
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	S.AMERICA W.C		0	431,167	0	0	0	0	0	431,167
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	Oceania		0	0	0	0	0	0	0	0
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			0	431,167	0	0	0	0	0	431,167
TOTAL			0	431,167	0	0	0	0	0	431,167

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	RE	0	0	0	0	0	0	0	0
Asia	CANADA E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		3,063	2,042	0	0	0	0	0	5,105
Asia	EUROPE		0	0	0	0	0	0	0	0
Asia	AFRICA		2,862	1,908	0	0	0	0	0	4,770
CANADA W.C	USEC		0	0	0	0	0	0	0	0
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
C.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
C.AMERICA W.C	AFRICA		0	0	0	0	0	0	0	0
Oceania	USEC		0	0	0	0	0	0	0	0
Oceania	CANADA E.C		0	0	0	0	0	0	0	0
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		2,540	1,694	0	0	0	0	0	4,234
Oceania	EUROPE		220,900	979,019	0	0	0	0	0	1,199,919
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		33,131	19,550	0	0	0	0	0	52,681
S.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
S.AMERICA W.C	AFRICA		47,415	63,305	0	0	0	0	0	110,720
S.AMERICA W.C	MIDDLE EAST		11,091	7,394	0	0	0	0	0	18,485
USWC/HAWAii	USEC		0	0	0	0	0	0	0	0
USWC/HAWAii	CANADA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		4,433	1,171	0	0	0	0	0	5,604
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			325,435	1,076,083	0	0	0	0	0	1,401,518
Africa	USWC/HAWAii	RE	0	0	0	0	0	0	0	0
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		175,280	116,854	0	0	0	0	0	292,134
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	0	0	0	0	0	0	0
CANADA E.C	Asia		0	0	0	0	0	0	0	0
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	Oceania		0	0	0	0	0	0	0	0
EUROPE	Asia		0	0	0	0	0	0	0	0
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	S.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	S.AMERICA W.C		8,279	5,519	0	0	0	0	0	13,798
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	Oceania		0	0	0	0	0	0	0	0
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			183,559	122,373	0	0	0	0	0	305,932
TOTAL			508,994	1,198,456	0	0	0	0	0	1,707,450

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	RR	0	0	0	0	0	0	0	0
Asia	CANADA E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	USEC		0	0	0	0	0	0	0	0
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
C.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
C.AMERICA W.C	AFRICA		0	0	0	0	0	0	0	0
Oceania	USEC		0	6,102	3,145	0	0	0	0	9,247
Oceania	CANADA E.C		0	0	0	0	0	0	0	0
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	EUROPE		0	17	93	0	0	0	0	110
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		6,687	207	0	0	0	0	0	6,894
S.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	0	0	0	0	0	0
USWC/HAWAii	CANADA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			6,687	6,326	3,238	0	0	0	0	16,251
Africa	USWC/HAWAii	RR	0	0	0	0	0	0	0	0
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	1,159	61	0	0	0	0	1,220
Africa	Asia		0	387	20	0	0	0	0	407
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	18,611	42,331	0	0	0	0	60,942
CANADA E.C	Asia		0	0	0	0	0	0	0	0
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	Oceania		0	569,622	146,918	0	0	0	0	716,540
EUROPE	Asia		0	0	0	0	0	0	0	0
MIDDLE EAST	USWC/HAWAii		0	0	0	0	0	0	0	0
MIDDLE EAST	Oceania		0	5,758	303	0	0	0	0	6,061
S.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	0	0	0	0	0	0	0
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	Oceania		0	248,939	162,029	0	0	0	0	410,968
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			0	844,476	351,662	0	0	0	0	1,196,138
TOTAL			6,687	850,802	354,900	0	0	0	0	1,212,389

2060 CARGO TON 150000-SQ

			0	10,000	40,000	65,000	100,000	150,000	200,000	
			9,999	39,999	64,999	99,999	149,999	199,999	250,000	TOTAL
Asia	USEC	OT	0	75,566	1,542	0	0	0	0	77,108
Asia	CANADA E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	22,486	459	0	0	0	0	22,945
Asia	AFRICA		81	0	0	0	0	0	0	81
CANADA W.C	USEC		0	0	0	0	0	0	0	0
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
C.AMERICA W.C	CANADA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	S.AMERICA E.C		13,029	0	0	0	0	0	0	13,029
C.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
C.AMERICA W.C	AFRICA		0	0	0	0	0	0	0	0
Oceania	USEC		15,547	70,354	76,465	0	0	0	0	162,366
Oceania	CANADA E.C		0	0	0	0	0	0	0	0
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	EUROPE		0	63,620	1,298	0	0	0	0	64,918
S.AMERICA W.C	USEC		0	218,136	389,074	0	0	0	0	607,210
S.AMERICA W.C	CANADA E.C		1,534	12,216	275	0	0	0	0	14,025
S.AMERICA W.C	C.AMERICA E.C		1,981	121,655	433,715	0	0	0	0	557,351
S.AMERICA W.C	S.AMERICA E.C		25,254	10,273	489	0	0	0	0	36,016
S.AMERICA W.C	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	USEC		0	0	0	0	0	0	0	0
USWC/HAWAii	CANADA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	S.AMERICA E.C		72	11,500	17,127	0	0	0	0	28,699
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		1,030	0	0	332,965	0	0	0	333,995
SUB TOTAL			58,528	605,806	920,444	332,965	0	0	0	1,917,743
Africa	USWC/HAWAii	OT	0	0	202	0	0	0	0	202
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	0	0	0	0	0	0	0
CANADA E.C	Asia		0	297,807	409,320	0	0	0	0	707,127
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	-59,319	59,319	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		47,992	636,708	202,281	0	0	0	0	886,981
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		3,942	68,396	38,630	30,007	0	0	0	140,975
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		3,498	76,814	1,645	0	0	0	0	81,957
EUROPE	Oceania		0	33,572	685	0	0	0	0	34,257
EUROPE	Asia		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	404,948	532,221	40,388	0	0	0	977,557
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		7,157	120,245	1,203,717	1,799,338	0	0	0	3,130,457
S.AMERICA E.C	S.AMERICA W.C		4,823	39,983	378,739	53,965	0	0	0	477,510
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	48,731	995	0	14,000,000	0	0	14,049,726
MIDDLE EAST	USWC/HAWAii		0	112	2	0	0	0	0	114
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		2,474	28,390	18,417	0	0	0	0	49,281
USEC	Oceania		0	0	0	0	0	0	0	0
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			69,886	1,755,706	2,727,535	1,983,017	14,000,000	0	0	20,536,144
TOTAL			128,414	2,361,512	3,647,979	2,315,982	14,000,000	0	0	22,453,887

2060 CARGO TON 200000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	OT	0	0	0	0	0	0	0	0
Asia	CANADA.E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	0	0	0	0	0	0	0
Asia	AFRICA		0	0	0	0	0	0	0	0
CANADA W.C	USEC		0	-36,584	-188,959	-29,617	0	0	0	-255,160
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		-19,543	-59,314	-1,383	0	0	0	0	-80,240
C.AMERICA W.C	CANADA.E.C		0	-7,735	-158	0	0	0	0	-7,893
C.AMERICA W.C	C.AMERICA E.C		-27,407	-66,050	-1,513	0	0	0	0	-94,970
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	-92,415	-1,886	0	0	0	0	-94,301
C.AMERICA W.C	AFRICA		-72	0	0	0	0	0	0	-72
Oceania	USEC		0	0	0	0	0	0	0	0
Oceania	CANADA.E.C		0	0	0	0	0	0	0	0
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	EUROPE		0	0	0	0	0	0	0	0
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	EUROPE		-36,333	-132,935	-3,900	0	0	0	0	-173,168
USWC/HAWAii	USEC		0	-59,941	-14,437	-27,168	0	0	0	-101,546
USWC/HAWAii	CANADA.E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	-25,123	-31,641	-39,291	0	0	0	-96,055
USWC/HAWAii	S.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			-83,355	-480,097	-243,877	-96,076	0	0	0	-903,405
Africa	USWC/HAWAii	OT	0	0	202	0	0	0	0	202
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	0	0	0	0	0	0	0
CANADA E.C	Asia		0	297,807	409,320	0	0	0	0	707,127
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	-59,319	59,319	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		47,992	636,708	202,281	0	0	0	0	886,981
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		3,942	68,396	38,630	30,007	0	0	0	140,975
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		3,498	76,814	1,645	0	0	0	0	81,957
EUROPE	Oceania		0	33,572	685	0	0	0	0	34,257
EUROPE	Asia		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	404,948	532,221	40,388	0	0	0	977,557
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		7,157	120,245	1,203,717	1,799,338	0	0	0	3,130,457
S.AMERICA E.C	S.AMERICA W.C		4,823	39,983	378,739	53,965	0	0	0	477,510
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	48,731	995	0	0	14,000,000	0	14,049,726
MIDDLE EAST	USWC/HAWAii		0	112	2	0	0	0	0	114
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		2,474	28,390	18,417	0	0	0	0	49,281
USEC	Oceania		0	0	0	0	0	0	0	0
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			69,886	1,755,706	2,727,535	1,983,017	0	14,000,000	0	20,536,144
TOTAL			-13,469	1,275,609	2,483,658	1,886,941	0	14,000,000	0	19,632,739

2060 CARGO TON 250000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 250,000	TOTAL
Asia	USEC	OT	0	0	0	0	0	0	0	0
Asia	CANADA.E.C		0	0	0	0	0	0	0	0
Asia	C.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	S.AMERICA E.C		0	0	0	0	0	0	0	0
Asia	EUROPE		0	0	0	0	0	0	0	0
Asia	AFRICA		0	0	0	0	0	0	0	0
CANADA W.C	USEC		0	-36,584	-188,959	-29,617	0	0	0	-255,160
CANADA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
CANADA W.C	EUROPE		0	0	0	0	0	0	0	0
CANADA W.C	AFRICA		0	0	0	0	0	0	0	0
C.AMERICA W.C	USEC		-19,543	-59,314	-1,383	0	0	0	0	-80,240
C.AMERICA W.C	CANADA.E.C		0	-7,735	-158	0	0	0	0	-7,893
C.AMERICA W.C	C.AMERICA E.C		-27,407	-66,050	-1,513	0	0	0	0	-94,970
C.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
C.AMERICA W.C	EUROPE		0	-92,415	-1,886	0	0	0	0	-94,301
C.AMERICA W.C	AFRICA		-72	0	0	0	0	0	0	-72
Oceania	USEC		0	0	0	0	0	0	0	0
Oceania	CANADA.E.C		0	0	0	0	0	0	0	0
Oceania	C.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	S.AMERICA E.C		0	0	0	0	0	0	0	0
Oceania	EUROPE		0	0	0	0	0	0	0	0
S.AMERICA W.C	USEC		0	0	0	0	0	0	0	0
S.AMERICA W.C	CANADA.E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	C.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	S.AMERICA E.C		0	0	0	0	0	0	0	0
S.AMERICA W.C	EUROPE		-36,333	-132,935	-3,900	0	0	0	0	-173,168
USWC/HAWAii	USEC		0	-59,941	-14,437	-27,168	0	0	0	-101,546
USWC/HAWAii	CANADA.E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	C.AMERICA E.C		0	-25,123	-31,641	-39,291	0	0	0	-96,055
USWC/HAWAii	S.AMERICA E.C		0	0	0	0	0	0	0	0
USWC/HAWAii	EUROPE		0	0	0	0	0	0	0	0
USWC/HAWAii	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			-83,355	-480,097	-243,877	-96,076	0	0	0	-903,405
Africa	USWC/HAWAii	OT	0	0	202	0	0	0	0	202
Africa	CANADA W.C		0	0	0	0	0	0	0	0
Africa	C.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	S.AMERICA W.C		0	0	0	0	0	0	0	0
Africa	Oceania		0	0	0	0	0	0	0	0
Africa	Asia		0	0	0	0	0	0	0	0
CANADA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
CANADA E.C	C.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	S.AMERICA W.C		0	0	0	0	0	0	0	0
CANADA E.C	Oceania		0	0	0	0	0	0	0	0
CANADA E.C	Asia		0	297,807	409,320	0	0	0	0	707,127
C.AMERICA E.C	USWC/HAWAii		0	0	0	0	0	0	0	0
C.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
C.AMERICA E.C	C.AMERICA W.C		0	0	-59,319	59,319	0	0	0	0
C.AMERICA E.C	S.AMERICA W.C		47,992	636,708	202,281	0	0	0	0	886,981
C.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
C.AMERICA E.C	Asia		3,942	68,396	38,630	30,007	0	0	0	140,975
EUROPE	USWC/HAWAii		0	0	0	0	0	0	0	0
EUROPE	CANADA W.C		0	0	0	0	0	0	0	0
EUROPE	C.AMERICA W.C		0	0	0	0	0	0	0	0
EUROPE	S.AMERICA W.C		3,498	76,814	1,645	0	0	0	0	81,957
EUROPE	Oceania		0	33,572	685	0	0	0	0	34,257
EUROPE	Asia		0	0	0	0	0	0	0	0
S.AMERICA E.C	USWC/HAWAii		0	404,948	532,221	40,388	0	0	0	977,557
S.AMERICA E.C	CANADA W.C		0	0	0	0	0	0	0	0
S.AMERICA E.C	C.AMERICA W.C		7,157	120,245	1,203,717	1,799,338	0	0	0	3,130,457
S.AMERICA E.C	S.AMERICA W.C		4,823	39,983	378,739	53,965	0	0	0	477,510
S.AMERICA E.C	Oceania		0	0	0	0	0	0	0	0
S.AMERICA E.C	Asia		0	48,731	995	0	0	0	14,000,000	14,049,726
MIDDLE EAST	USWC/HAWAii		0	112	2	0	0	0	0	114
USEC	USWC/HAWAii		0	0	0	0	0	0	0	0
USEC	CANADA W.C		0	0	0	0	0	0	0	0
USEC	C.AMERICA W.C		0	0	0	0	0	0	0	0
USEC	S.AMERICA W.C		2,474	28,390	18,417	0	0	0	0	49,281
USEC	Oceania		0	0	0	0	0	0	0	0
USEC	Asia		0	0	0	0	0	0	0	0
SUB TOTAL			69,886	1,755,706	2,727,535	1,983,017	0	0	14,000,000	20,536,144
TOTAL			-13,469	1,275,609	2,483,658	1,886,941	0	0	14,000,000	19,632,739

2060 CARGO TON 150000-SQ

			0 9,999	10,000 39,999	40,000 64,999	65,000 99,999	100,000 149,999	150,000 199,999	200,000 249,999	TOTAL
ASIA	U.S.EC	VC	0	0	0	0	0	0	0	0
ASIA	CANADA EC		0	0	0	0	0	0	0	0
ASIA	C AMERICA EC		0	0	0	0	0	0	0	0
ASIA	S AMERICA EC		0	0	0	0	0	0	0	0
ASIA	EUROPE		0	0	0	0	0	0	0	0
ASIA	AFRICA		0	9,264	0	0	0	0	0	9,264
CANADA WC	U.S.EC		0	0	0	0	0	0	0	0
CANADA WC	C AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	S AMERICA EC		0	0	0	0	0	0	0	0
CANADA WC	EUROPE		0	0	0	0	0	0	0	0
CANADA WC	AFRICA		0	0	0	0	0	0	0	0
C AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
C AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
C AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
C AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
C AMERICA WC	AFRICA		0	0	0	0	0	0	0	0
OCEANIA	U.S.EC		0	0	0	0	0	0	0	0
OCEANIA	CANADA EC		0	0	0	0	0	0	0	0
OCEANIA	C AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	S AMERICA EC		0	0	0	0	0	0	0	0
OCEANIA	EUROPE		0	0	0	0	0	0	0	0
S AMERICA WC	U.S.EC		0	0	0	0	0	0	0	0
S AMERICA WC	CANADA EC		0	0	0	0	0	0	0	0
S AMERICA WC	C AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	S AMERICA EC		0	0	0	0	0	0	0	0
S AMERICA WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	U.S.EC		0	0	0	0	0	0	0	0
U.S WC	CANADA EC		0	0	0	0	0	0	0	0
U.S WC	C AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	S AMERICA EC		0	0	0	0	0	0	0	0
U.S WC	EUROPE		0	0	0	0	0	0	0	0
U.S WC	AFRICA		0	0	0	0	0	0	0	0
SUB TOTAL			0	9,264	0	0	0	0	0	9,264
AFRICA	U.S. WC	VC	0	0	0	0	0	0	0	0
AFRICA	CANADA WC		0	0	0	0	0	0	0	0
AFRICA	C AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	S AMERICA WC		0	0	0	0	0	0	0	0
AFRICA	OCEANIA		0	0	0	0	0	0	0	0
AFRICA	ASIA		0	0	0	0	0	0	0	0
CANADA EC	U.S. WC		0	0	0	0	0	0	0	0
CANADA EC	C AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	S AMERICA WC		0	0	0	0	0	0	0	0
CANADA EC	OCEANIA		0	0	0	0	0	0	0	0
CANADA EC	ASIA		0	0	0	0	0	0	0	0
C AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
C AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
C AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
C AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
C AMERICA EC	ASIA		0	0	0	0	0	0	0	0
EUROPE	U.S. WC		0	0	0	0	0	0	0	0
EUROPE	CANADA WC		0	0	0	0	0	0	0	0
EUROPE	C AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	S AMERICA WC		0	0	0	0	0	0	0	0
EUROPE	OCEANIA		0	2,545	0	0	0	0	0	2,545
EUROPE	ASIA		0	0	0	0	0	0	0	0
MIDDLE EAST	U.S.WC		0	0	0	0	0	0	0	0
S AMERICA EC	U.S. WC		0	0	0	0	0	0	0	0
S AMERICA EC	CANADA WC		0	0	0	0	0	0	0	0
S AMERICA EC	C AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	S AMERICA WC		0	0	0	0	0	0	0	0
S AMERICA EC	OCEANIA		0	0	0	0	0	0	0	0
S AMERICA EC	ASIA		0	0	0	0	0	0	0	0
U.S.EC	U.S. WC		0	0	0	0	0	0	0	0
U.S.EC	CANADA WC		0	0	0	0	0	0	0	0
U.S.EC	C AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	S AMERICA WC		0	0	0	0	0	0	0	0
U.S.EC	OCEANIA		0	0	0	0	0	0	0	0
U.S.EC	ASIA		0	0	0	0	0	0	0	0
SUB TOTAL			0	2,545	0	0	0	0	0	2,545
TOTAL			0	11,809	0	0	0	0	0	11,809

Annex V Glossary of Terminology

1. Benefits / Costs

[Marginal increase/decrease or marginal save/loss of economic welfare which are caused by a project as compared to the without project situation]

2. Direct Benefits / Costs

[Economic tangible and instantly perceived benefits/costs] Generally, benefits provided as the main purpose of the project and costs necessary for preparing the function of the project. In this study, transportation cost savings are taken as the direct benefit, while constitution costs, operation, maintenance and management costs, and mitigation costs are taken as direct costs. Cost-Benefit analysis is based on direct benefits/costs.

3. Other (Indirect) Benefits / Costs

[All benefits/costs except for direct benefits/costs] Socio-cultural benefits/costs such as regional development impact or increased social risk are classified in this category. Environmental damages, which is not quantified as a migration costs, is also costs of this type.

4. Intangible Benefits / Costs

[Benefits/costs which can not be quantified] Environmental damages or psychological effects are classified into this category.

5. Demand Effect

[Increased production or induced income due to the production which is caused by the new demand for industry created by a project.]

6. Repercussion Effect

All changes related directly and indirectly with a project are referred to repercussion effects. However, it is defined in a specified sense as the indirect impact on industries through a multiplier effect.

7. Multiplier Effect

Income once induced to households or business entities creates additional demand for industrial productions through their expenditures. Such additional productions are followed by another income. Once a project create a new demand due to the construction ignites this kind of repetition. Accumulated income or production through the repetition is defined as a multiplier effect.

8. Social Discount Rate (SDR)

The SDR is used in field of an economic or social appraisal of project. It is defined as a rate for discounting future benefits and costs of the project into the present values at base year of the appraisal in order to measure investment efficiency or and social effect of the project. SDR is decided reflecting the time preference ratio or the opportunity cost capital.

9. International Rate of Return (IRR)

The IRR is one of indices which represent investment efficiency. It is defined as a rate which makes present value of benefits of the project equal to that of costs of the project. The economic or social viability is checked by comparing the IRR with a Social Discount Rate in the economy.

10. Border Price

For economic or social appraisal of a project, not for financial analysis of the project, benefits and costs of the project are converted from the ones expressed at Market Price into the ones expressed at Resource Cost basis (values of goods and services free of tax and with

adjustment caused by subsidy on them) or Opportunity Cost basis. These values are often expressed as a border price in such appraisal. The Border Price of good or service is a value of the good or service measured at the national Border, resulting in the value being expressed at International Currency basis in most cases.

11. Project Life

[Duration for the appraisal of the project] Project life consists of construction period and operation period. The operation period ends in the year when physical function of the project terminates or other competitor comes to take down the market position of the project function.

12. Over-panamax and Under-panamax

Panamax is the vessel with the largest size which the present Panama Canal can accommodate (65,000 dwt). Over-panamax/under-panamax is defined as vessel with the size larger/smaller than the panamax size. Accordingly, over-panamax cannot use the present canal, while under-panamax can.

13. Status Quo Canal (SQ)

[Existing Panama Canal] Benefits and costs are calculated based on the status quo canal. The SQ canal includes future improvement in the case where alternative canal project were not executed.

14. Origin and Destination (OD)

A pair of regions on countries from and to where cargos are transported or vessel sails on.

15. dwt

[Vessel size measured by the dead weight tonnage of the vessel] The panamax has a size of 65,000 dwt.

16. DWT

[Capacity of alternative canal measured by a maximum size of vessel which the canal can accommodate] 150,000 DWT canal can accommodate vessels with the size up to 150,000 dwt.

Comisión de Estudio
de las Alternativas
al Canal de Panamá
CENTRO DE INFORMACION

02.06.09
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Correcciones incluidas
(Julio)

COMMISSION FOR THE STUDY OF ALTERNATIVES TO THE PANAMA CANAL

THE STUDY OF ALTERNATIVES TO THE PANAMA CANAL
COMPONENT STUDY
ECONOMIC ANALYSIS AND IMPACT ON USERS

ADDITIONAL STUDY

COMISION DE ESTUDIO
DE LAS ALTERNATIVAS
AL CANAL DE PANAMA
22 JUL. 1993
Recibido

JULY 1993

Comisión de Estudio
de las Alternativas
al Canal de Panamá
CENTRO DE INFORMACION

MITSUBISHI RESEARCH INSTITUTE, INC.

YACHIYO ENGINEERING CO., LTD.

Under Contract with the

JAPAN INTERNATIONAL COOPERATION AGENCY

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I. Basic Idea of This Study

I-1 Conditions

(1) General

This is an additional work of EAIU (Economic Analysis and Impacts on Users) study of Alternatives to Panama Canal.

The original work which was separately documented had the following study :

1) Benefit of alternatives
2) Economic cost of alternatives
3) Cost-Benefit comparison of alternatives
4) Impact of alternatives
5) Overall evaluation

The subjects of this report are 1), 2) and 3) of the original work,

i.e. ;
1) Benefit of alternatives under new capacity restrictions
2) Economic cost of alternatives under a single lane option
3) Cost-Benefit comparison of above benefit and cost

The basic difference from the original study comes from the following points.

1) The smaller capacity of the status-quo (SQ) canal should be used.
2) The single lane canals should be estimated.

(2) The SQ Canal Capacity

The maximum number of vessels which can pass through the SQ canal has been estimated 17,000. CTP study projected that the number of the canal transits would be 17,320 vessels in 2020 and be 18,083 vessels in 2060 (Table I-1-1).

According to CTP report, the demand to the SQ canal would be less than its capacity in 2020, but would exceed its capacity in 2060. The number of vessels (18,083) in 2060 was the constrained transit due to the limit of the capacity.

Table I-1-1 Panama Canal Transits Calculated in CTP Study

Canal size	Year	Number of vessels		
		Laden	Ballast	Total
SQ	2020	14,855	2,465	17,320
	2060	15,694	2,389	18,030

(Calculated from CTP report, Volume IV, pages 1-5 to 1-12)

Note : The values of Table I-1-1 were calculated by summing up the total transits of each ship type listed in the CTP report.

The original EAIU study totally depended on vessels calculated in CTP study. If the capacity of SQ canal is small, the number of vessels would be changed, and as the result, the benefit would be different from the original EAIU study then, the interest that how the benefit is sensitive to the capacity was arisen. In this additional work of EAIU study, the benefit was re-estimated with the capacity of 17,000 vessels.

(3) A Single Lane Option

The sizes of alternative canals are 150,000DWT, 200,000DWT and 250,000DWT. They were also estimated in the original EAIU Study. However, the number of lanes in the alternative was one for this additional work.

The construction costs will be less expensive than those of the cases in the original EAIU study. The construction costs and maintenance costs were estimated in another component study. Economic cost was estimated in this additional work.

In addition to the economic cost estimation, the capacity constraints should be considered. The capacities of canals was estimated as listed in Table I-1-2. This value was calculated in another component study. The canal transits will increase year by year until they reach the capacity. No more vessels cannot pass through the canal after the year when the transits reach the capacity. The level of benefit will be unchanged after that year.

Table I-1-2 Capacity of the Alternatives

Case	maximum number of vessels per year
High-Rise Lock (150,000DWT) (Culebra single cut)	34,400
High-Rise Lock (200,000DWT) (Culebra single cut)	34,600
Sea Level (a) (Tidal Lock) (Atlantic approach single channel)	24,000
Sea Level (b) (Tidal Gate) (Atlantic approach single channel)	35,800

Derived from the Final Report of "Operating Characteristics and Capacity Evaluation Study Phase 2".

(4) Alternatives in this study

The alternatives studies in this study are summarized as follows.

1) High–Rise Lock with Culebla single cut for Average Year case (150,000 DWT)
2) High–Rise Lock with Culebla single cut for Dry Year case (150,000 DWT)
3) High–Rise Lock with Culebla single cut for Average Year case (200,000 DWT)
4) High–Rise Lock with Culebla single cut for Dry Year case (200,000 DWT)
5) Sea Level Canal with Tidal Lock (250,000 DWT (a))
6) Sea Level Canal with Tidal Gate (250,000 DWT (b))

I–2 Methodology

(1) Benefit Estimation

Benefits of alternative canals are transportation cost savings of transit cargos. There were three types of benefits based on the source of them.

1) benefit from size–shift cargo
2) benefit from route–shift cargo by under–panamax vessels
3) benefit from route–shift cargo by over–panamax vessels.

The benefit belongs to cargos. The amount of benefit is calculated with cost savings and the volume of cargos. Hence the type or route of cargo should be taken into account for the estimation of benefit . The type of benefits should be identified for each cargo. This concept was the same as the original EAIU study.

Type 2) benefit will be derived from cargos which use the alternative route for the SQ canal and will shift to the canal if a new canal is operated. In the original EAIU study, it was assumed that there would be no capacity constraint in the year 2020. Type 2) benefit would be zero.

In this additional study, however, capacity of SQ canal was assumed to be less than the transit demand. The type 2 benefit would be produced in the additional study.

Assume a ton of cargo is carried through a new canal. Three cases were considered to re–estimate benefit.

a. If this cargo would use the SQ canal even if a new one is not constructed and the SQ capacity is 17,000 vessels, the benefit produced by this cargo has already estimated in the original EAIU study. The benefit of the additional study is equal to that of the original one. (Fig I–2–1(a))

If this cargo would not use the SQ canal with 17,000 capacity but would use the SQ canal with the original capacity, there would be two cases.

b. vessel size becomes larger if a new canal is operated.
This cargo was estimated as a size–shift cargo and the benefit was calculated in the original study.

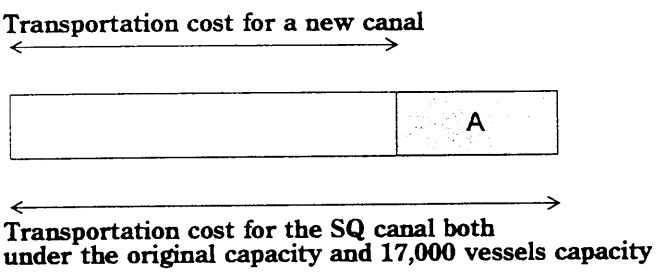
The benefit which should be estimated is the sum of this size-shift benefit and the route-shift benefit to the SQ canal. (Fig I-2-1(b))

c. Vessel size does not change even if a new canal is operated.
This cargo was assumed not to produce benefit in the original study because the transportation cost through a new canal would be equal to that through the SQ canal. However, route-shift benefit should be calculated in the additional study because this cargo would use an alternative route under lower capacity. (Fig I-2-1(c))

As a result, the additional benefit (B in Figures I-2-1 (a)-(b)) should be estimated and be added to the original benefit for any case.

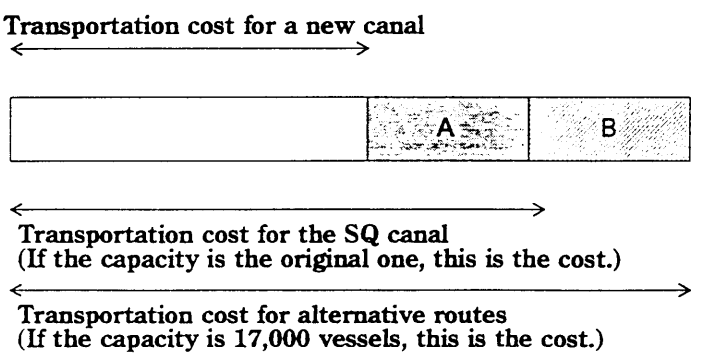
Fig I-2-1 Benefit calculation

(a)



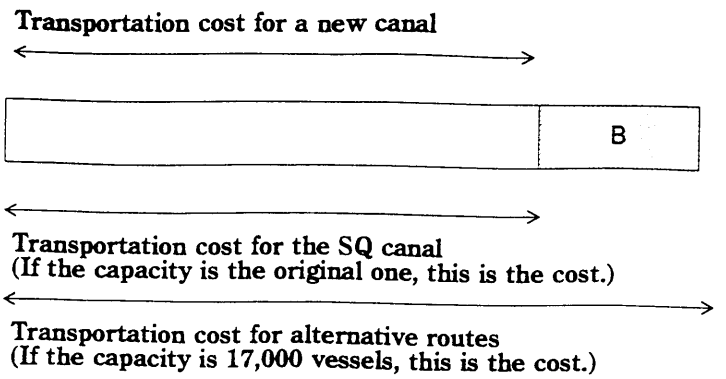
A: benefit which was estimated in the original study
No added benefit for the additional study

(b)



A: benefit which was estimated in the original study
B: added benefit which was calculated in the additional study
A + B: benefit of cargo under a new condition

(c)



B: added benefit which was calculated in the additional study
No benefit in the original study

This idea could be applied to the case in 2060. The transit demand to the SQ canal was assumed to exceed in the original study. The route-shift benefit by under panamax vessels was calculated and was not zero. Under the condition of the additional work, other cargos would also have to use alternative routes and would shift routes to the canal, if a new canal was constructed. The new benefit should be added to the original one because these new route-shift cargos would exist.

There is no difference in the idea to derive the additional benefit in 2020 and 2060. The calculation flow is as follows.

1) Find a new route-shift cargo
(cargo which would use the SQ canal under the original capacity but not use it under 17,000 canal capacity)
2) Calculate the cost savings of these cargos
(cost difference between the canal route and an alternative route)
3) Add the new benefits to the original ones
(benefits are the sum of the cost savings)

The detail calculation is explained in the next chapter.

(2) Economic Cost Estimation

Construction cost and O&M cost under new conditions was calculated in the other component study. These cost were translated into the economic cost by using conversion factors. The method was the same as the original EAIU study.

(3) Cost-benefit comparison

Benefit and economic cost which were calculated with the above methods were compared to check the economic feasibility of alternative canals. The method was the same as the original EAIU study.

II. Benefit of alternatives

II-1 Beneficiary Cargo

(1) Transits of SQ Canal in 2020

Table II-1-1 shows the number of canal transits in 2020 calculated from CTP study report. These values were based on the idea that the transits would not be constrained by the canal capacity. 17,320 vessels was estimated to pass the SQ canal.

The additional study assumed that the SQ canal capacity should be 17,000 vessels. Hence, 320 vessels is to be removed from the canal transits. Some of them will be ballast vessels which are not beneficiary. Number of laden vessels should be estimated because the beneficiary cargos are carried only by them. The following idea were used to get the number of laden vessels.

Table II-1-1 Transit in 2020

Ship type *1	Laden	Ballast	Total
CB	1,620	41	1,661
CD	3,606	376	3,982
CT	1,061	81	1,142
FC	2,380	9	2,389
CG	893	140	1,033
LP	221	128	349
RE	3,082	933	4,015
RR	263	31	294
OT	753	331	1,084
VC	640	383	1,023
PS	337	11	348
Total	14,856	2,464	17,320

*1) Abbreviation is listed in the last of this section.

1) Passenger ships will not use the alternative routes.
Capacity constraint causes the delay of voyage hours of vessels. Cargo carriers will be very sensitive to the time because the inventory cost of cargo will increase. Voyage hours will be important for passenger ships, too. But they will also have some importance to use the canal even if the transit hours becomes larger.

2) The ratio between laden and ballast will remain. There is no reason that only ballast vessels or only laden vessels will switch to alternative routes. Hence, it was assumed that the ratio of them would be equal to that of the original case.

Under the above condition, the number of laden vessels was calculated.

Cargo Carriers = (# Capacity) − (# Passenger Ship in CTP)
= 17,000 − 348
= 16,652 vessels

Ratio of Ladens = (# Laden Cargo Carriers in CTP) / (# Total Cargo Carriers in CTP)
= 14,519 / 16,972

Laden Cargo Carrier = (# Cargo Carries) × (Ratio of Ladens)
= 14,245 vessels

The number of laden cargo vessels will be 14,245 under the capacity of 17,000 vessels. These vessels will carry the beneficiary cargos.

(2) Transits of SQ Canal in 2060

The same idea was applied to the case in 2060. Table II−1−2 shows the transits in 2060 calculated from CTP study report. Total number was 18,083, which was already constrained by the capacity. 1,083 vessels has to be removed in order to fit to the capacity of 17,000 vessels.

Table II-1-2 Transit in 2060

Ship type *1	Laden	Ballast	Total
CB	2,328	58	2,386
CD	2,605	318	2,923
CT	1,204	94	1,298
FC	2,272	5	2,277
CG	1,394	223	1,617
LP	105	65	170
RE	3,938	953	4,891
RR	405	55	460
OT	267	125	392
VC	743	440	1,183
PS	435	51	486
Total	15,696	2,387	18,083

1) Abbreviation is listed in the last part of section.

The number of laden cargo vessels were estimated as followings.

Cargo Carriers = (# Capacity) − (# Passenger Ship in CTP)
= 17,000 − 486
= 16,514 vessels

Ratio of Ladens = (# Laden Cargo Carriers in CTP) / (# Total Cargo Carriers in CTP)
= 15,216 / 17,597

Laden Cargo Carrier = (# Cargo Carries) × (Ratio of Ladens)
= 14,322 vessels

*1 Abbreviation List

CB :	Container Breakbulk Ships
CD :	Combined and Dry Bulk Carriers
CT :	Chemical Tankers
FC :	Full Container Ships
CG :	Conventional General Cargo Ships
LP :	Liquid Petroleum Gas Carriers
RE :	Refrigerated Cargo Ships
RR :	Roll-on Roll-off Ships
OT :	Oil Tankers
VC :	Vehicle Carriers
PS :	Passenger Ships

II–2 Benefits in 2020

As described in II–1, the maximum number of beneficiary vessels which pass through the SQ canal will be 14,245 in year 2020. The original EAIU study assumed that more vessels would use the SQ canal. Hence, some vessels should be removed from the SQ canal to adjust 17,000 vessels capacity. There were three ideas.

1) remove vessels whose cost savings by the canal route are the smallest
2) remove vessels whose cost savings by the canal route are not negative and are the smallest
3) remove vessels randomly up to 14,245 vessels

The concept of 1) is :

If the cost saving of a cargo is small, i.e. the merit of the canal is small, this cargo will switch from the canal when the canal becomes congested. This idea is reasonable if all cargos are carried with the least transportation cost strategy. However, some cargos are carried through the canal even if the transportation cost of the canal route is more expensive. Some other factors will exist.

Then, the concept of 2) is derived :

If the cost saving is negative, i.e., the canal route is used in spite of the higher cost, this cargo will use the canal even after the canal becomes congested. Therefore, these cargos are assumed not to be removable from the canal. This idea leads that the route choice strategy depending on the cost saving will be applicable only to the cargo with the cost savings equal to or greater than zero. However, some cargos which have positive cost saving may use the canal even after the congestion happens. Seen from the transportation costs of the canal and an alternative route, this cargo looks to choose the canal because of cost–savings. However, the real behavior may not depend on the cost savings. If this is true, these cargos also should not to be removed from the canal. As the result there is no reason to remove a cargo from the canal.

Then, it leads the concept of 3) :

The vessels should be selected randomly from the SQ canal transit up to 14,245 vessels.

The benefits based on these three methods were calculated in this study. The result is listed in Table II-2-1.

Table II-2-1 Benefit Increment in 2020

(unit : 1,000 US$)

	Calculation method		
	1)	2)	3)
Total transportation cost saving of SQ cargo in the original EAIU study	4,311,623	4,311,623	4,311,623
Total transportation cost saving of SQ cargo in this additional EAIU study	4,311,623	4,311,325	4,233,754
Cost saving difference (= Benefit increment)	0	298	77,869

Negative cost saving by using the canal is treated as zero in this calculation because the cargo with negative cost savings has some other reasons. The negative cost savings were not be summed up for benefit estimation.

262 (=14,507-14,245, see Note) vessels should be removed from the vessels in original study to adjust the capacity constraints. 1,192 vessels out of the total SQ vessels in the original EAIU study have negative cost savings. Hence, case 1) leads to no additional benefit.

Case 2) neglects these 1,192 vessels. However, 126 vessels have zero-cost-savings, and 271 vessels have 1$/ton-cost-savings. The removed vessels (262 vessels) from the canal gain small cost savings. It means the additional benefit of case 2) is small.

Case 3) use the random selection to remove vessels from the canal. The cargos with positive cost savings as well as cargos with negative cost savings are removed from the original SQ vessels.

The total benefit is the sum of the original benefit and the additional benefit. The

result is shown in Table II-2-2 (a)-(c).

Table II-2-2 (a) Benefit of 150,000DWT Canal in 2020

(unit : 1,000 US$)

	Calculation case		
	1)	2)	3)
Original benefit	458,118	458,118	458,118
Benefit increment	0	298	77,869
Benefit in this report	458,118	458,416	535,987

Table II-2-2 (b) Benefit of 200,000DWT Canal in 2020

(unit : 1,000 US$)

	Calculation case		
	1)	2)	3)
Original benefit	482,789	482,789	482,789
Benefit increment	0	298	77,869
Benefit in this report	482,789	483,087	560,658

Table II-2-2 (c) Benefit of 250,000DWT Canal in 2020

(unit : 1,000 US$)

	Calculation case		
	1)	2)	3)
Original benefit	502,095	502,095	502,095
Benefit increment	0	298	77,869
Benefit in this report	502,095	502,393	579,964

Note : From Table II-1-1, the number of laden cargo vessels was calculated as 14,519 vessels. However, this value is 14,507 from Volume IV of CTP report "Transit Projections". Detail analysis was necessary to calculate benefits, It meant that volume IV of the report was used. Hence, the latter value was adopted in this additional work. The beneficiary vessels had to coincide with the amount of beneficiary cargos. The difference between these two numbers is only 12, which would be caused by under-decimal values.

II-3 Benefits in 2060

As described in II-1, the maximum number of vessels which pass through the SQ canal will be 14,322 in year 2060. Some vessels should be removed from the SQ canal to adjust 17,000-capacity.

The method used in 2020 was applied to calculate benefits in 2060.

The benefit based on three methods is listed in Table II-3-1.

Table II-3-1 Benefit Increment in 2060

(unit : 1,000 US$)

	Calculation method		
	1)	2)	3)
Total transportation cost saving of SQ cargo in the original EAIU study	5,924,163	5,924,163	5,924,163
Total transportation cost saving of SQ cargo in this additional EAIU study	5,788,956	5,741,325	5,566,583
Cost saving difference (= Benefit increment)	135,207	182,838	357,580

Negative cost saving is treated as zero in this calculation because the cargo with negative cost savings has some other reasons. The negative cost savings were not be summed up for benefit estimation.

920 (=15,242-14,322, see Note) vessels should be removed from the vessels in original study to adjust the capacity constraints. 147 vessels out of the total SQ vessels have negative cost savings, and 81 vessels have zero-cost-savings. These vessels don't contribute of benefit increment.

The total benefit is the sum of the original benefit and the additional benefit. The

result is shown in Table II-3-2 (a)~(c).

Table II-3-2 (a) Benefit of 150,000DWT Canal in 2060

(unit : 1,000 US$)

	Calculation case		
	1)	2)	3)
Original benefit	1,061,107	1,061,107	1,061,107
Benefit increment	135,207	182,838	357,580
Benefit in this report	1,196,314	1,243,945	1,418,687

Table II-3-2 (b) Benefit of 200,000DWT Canal in 2060

(unit : 1,000 US$)

	Calculation case		
	1)	2)	3)
Original benefit	1,088,116	1,088,116	1,088,116
Benefit increment	135,207	182,838	357,580
Benefit in this report	1,223,323	1,270,954	1,445,696

Table II-3-2 (c) Benefit of 250,000DWT Canal in 2060

(unit : 1,000 US$)

	Calculation case		
	1)	2)	3)
Original benefit	1,115,823	1,115,823	1,115,823
Benefit increment	135,207	182,838	357,580
Benefit in this report	1,251,030	1,298,661	1,473,403

Note : From Table II-1-1, the number of laden cargo vessels was calculated as 15,261 vessels. However, this value is 15,242 from Volume IV of CTP report "Transit Projections". Detail analysis was necessary to calculate benefits. Hence, volume IV of the report was used and the latter value was adopted in this additional work. The beneficiary vessels had to coincide with the amount of beneficiary cargos. The difference between these two numbers is only 19.

II-4 Benefit Distribution by Year

Three types of idea to calculate the benefit were considered in II-2 and II-3. Case 1) and Case 2) benefits assumed that the cargos which would have small cost differences between a canal route and an alternative route would use a alternative. Case 3) benefit assumed that any vessel had the possibility to use an alternative route. Each concept was reasonable under each assumption. In this study, Case 3) benefits were adopted to estimate the economic feasibility because Case 3) benefits were larger than others. As for the feasibility study, the potential benefit should be used if it is reasonable.

Benefit of alternative canal will increase from 2020 to 2060. This increase is assumed to continue after 2060. This assumption is same as the original study. The distribution is listed in Table II-4-1.

This benefit increase is caused by the cargo increase which is carried by increasing number of vessels.

After the number of vessels reaches the capacity described in Table I-1-2, the benefit will not increase any more. The benefit will have to remain at a constant level.

The vessel increment is assumed to be a constant rate, and the year when the number reaches the capacity is estimated. Table II-4-2 and Fig.II-4-1 show the benefit distribution by year including years 2061 to 2120 for each alternative canal.

Table II-4-1 Benefit Distribution by Year (2020 to 2060)

(unit : 1,000 US$)

YEAR	150,000 DWT	200,000 DWT	250,000 DWT(a)	250,000 DWT(b)
2020	550,674	574,124	593,430	593,430
2021	563,858	587,533	607,076	607,076
2022	577,357	601,256	621,036	621,036
2023	591,179	615,299	635,318	635,318
2024	605,332	629,670	649,927	649,927
2025	619,824	644,376	664,873	664,873
2026	634,663	659,426	680,162	680,162
2027	649,858	674,828	695,803	695,803
2028	665,416	690,589	711,803	711,803
2029	681,346	706,719	728,172	728,172
2030	697,658	723,225	744,916	744,916
2031	714,360	740,117	762,046	762,046
2032	731,463	757,403	779,570	779,570
2033	748,974	775,093	797,497	797,497
2034	766,905	793,196	815,836	815,836
2035	785,266	811,722	834,596	834,596
2036	804,065	830,681	853,789	853,789
2037	823,315	850,082	873,422	873,422
2038	843,026	869,937	893,507	893,507
2039	863,209	890,255	914,054	914,054
2040	883,874	911,048	935,073	935,073
2041	905,035	932,327	956,576	956,576
2042	926,702	954,102	978,573	978,573
2043	948,888	976,386	1,001,076	1,001,076
2044	971,605	999,191	1,024,096	1,024,096
2045	994,866	1,022,528	1,047,646	1,047,646
2046	1,018,684	1,046,410	1,071,737	1,071,737
2047	1,043,072	1,070,850	1,096,383	1,096,383
2048	1,068,044	1,095,861	1,121,595	1,121,595
2049	1,093,613	1,121,456	1,147,386	1,147,386
2050	1,119,795	1,147,649	1,173,771	1,173,771
2051	1,146,604	1,174,454	1,200,763	1,200,763
2052	1,174,054	1,201,884	1,228,375	1,228,375
2053	1,202,162	1,229,956	1,256,623	1,256,623
2054	1,230,943	1,258,683	1,285,520	1,285,520
2055	1,260,412	1,288,081	1,315,081	1,315,081
2056	1,290,587	1,318,165	1,345,322	1,345,322
2057	1,321,485	1,348,952	1,376,259	1,376,259
2058	1,353,122	1,380,459	1,407,907	1,407,907
2059	1,385,517	1,412,701	1,440,283	1,440,283
2060	1,418,687	1,445,696	1,463,283	1,473,403

Table II-4-2 Benefit Distribution by Year (2020 to 2120)

(mil. US$)

YEAR	150.000 DWT	200.000 DWT	250.000 DWT(a)	250.000 DWT(b)
2020	551	574	593	593
2021	564	588	607	607
2022	577	601	621	621
2023	591	615	635	635
2024	605	630	650	650
2025	620	644	665	665
2026	635	659	680	680
2027	650	675	696	696
2028	665	691	712	712
2029	681	707	728	728
2030	698	723	745	745
2031	714	740	762	762
2032	731	757	780	780
2033	749	775	797	797
2034	767	793	816	816
2035	785	812	835	835
2036	804	831	854	854
2037	823	850	873	873
2038	843	870	894	894
2039	863	890	914	914
2040	884	911	935	935
2041	905	932	957	957
2042	927	954	979	979
2043	949	976	1.001	1.001
2044	972	999	1.024	1.024
2045	995	1.023	1.048	1.048
2046	1.019	1.046	1.072	1.072
2047	1.043	1.071	1.096	1.096
2048	1.068	1.096	1.122	1.122
2049	1.094	1.121	1.147	1.147
2050	1.120	1.148	1.174	1.174
2051	1.147	1.174	1.201	1.201
2052	1.174	1.202	1.228	1.228
2053	1.202	1.230	1.257	1.257
2054	1.231	1.259	1.286	1.286
2055	1.260	1.288	1.315	1.315
2056	1.291	1.318	1.345	1.345
2057	1.321	1.349	1.376	1.376
2058	1.353	1.380	1.408	1.408
2059	1.386	1.413	1.440	1.440
2060	1.419	1.446	1.463	1.473
2061 TO 2120	183.189	181.116	87.797	187.563
TOTAL	220.865	219.879	127.527	227.304

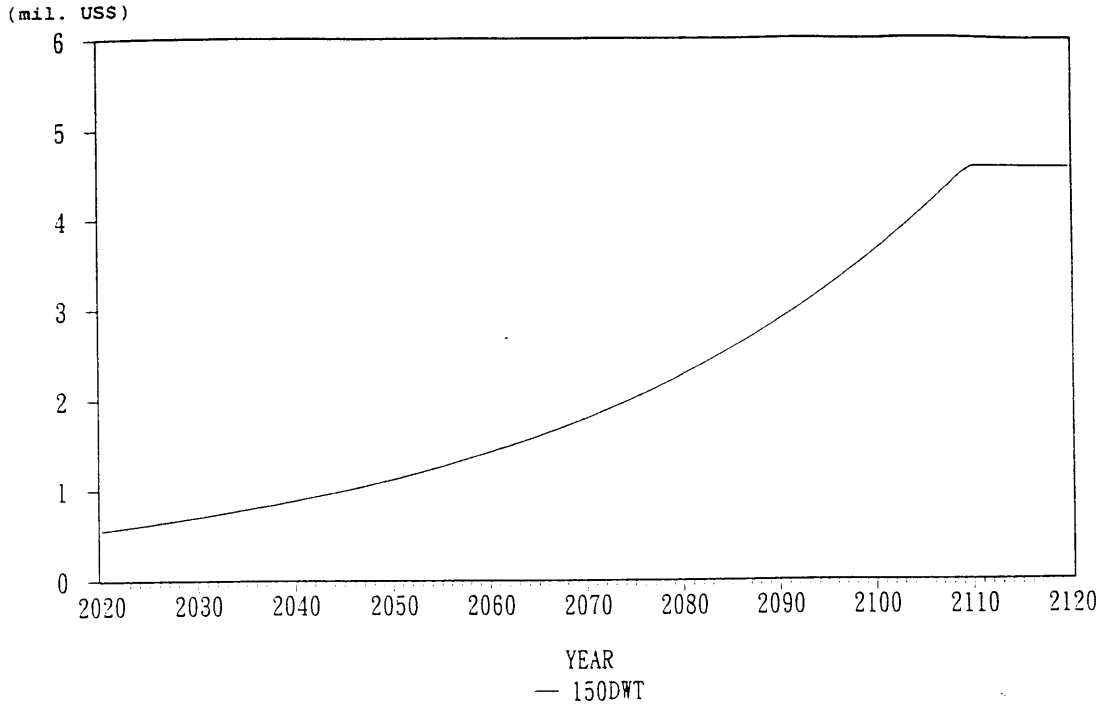


Fig. II-4-1(a) Benefit Distribution by Year (2020 to 2120) - 150,000DWT -

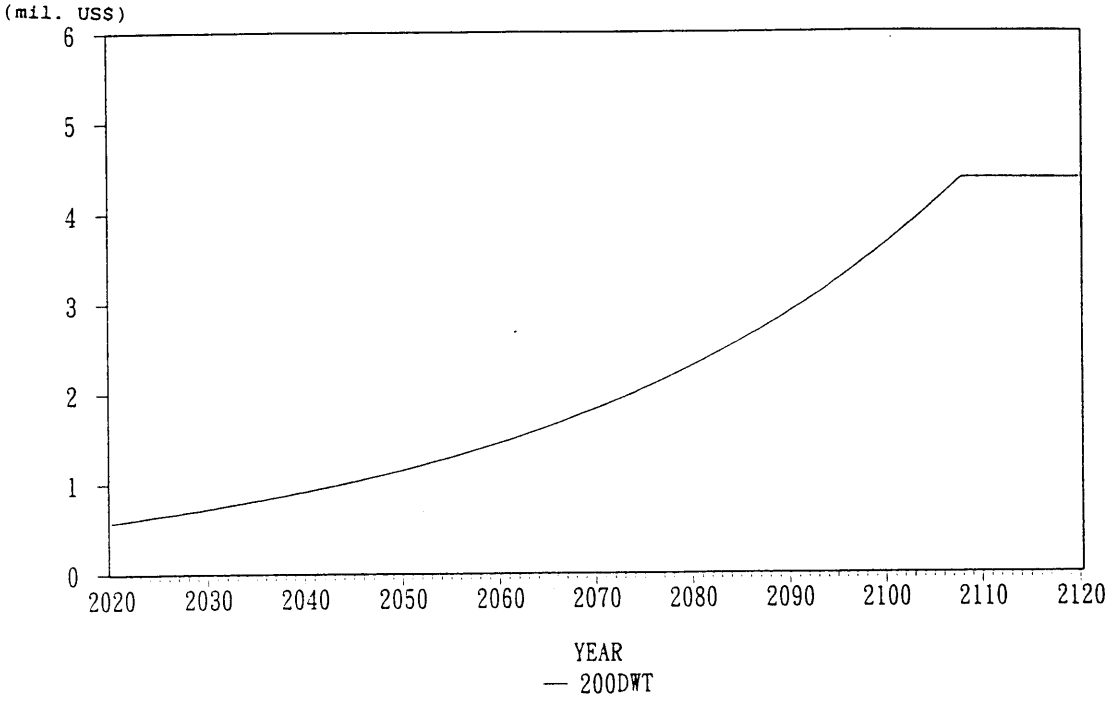


Fig. II-4-1(b) Benefit Distribution by Year (2020 to 2120) - 200,000DWT -

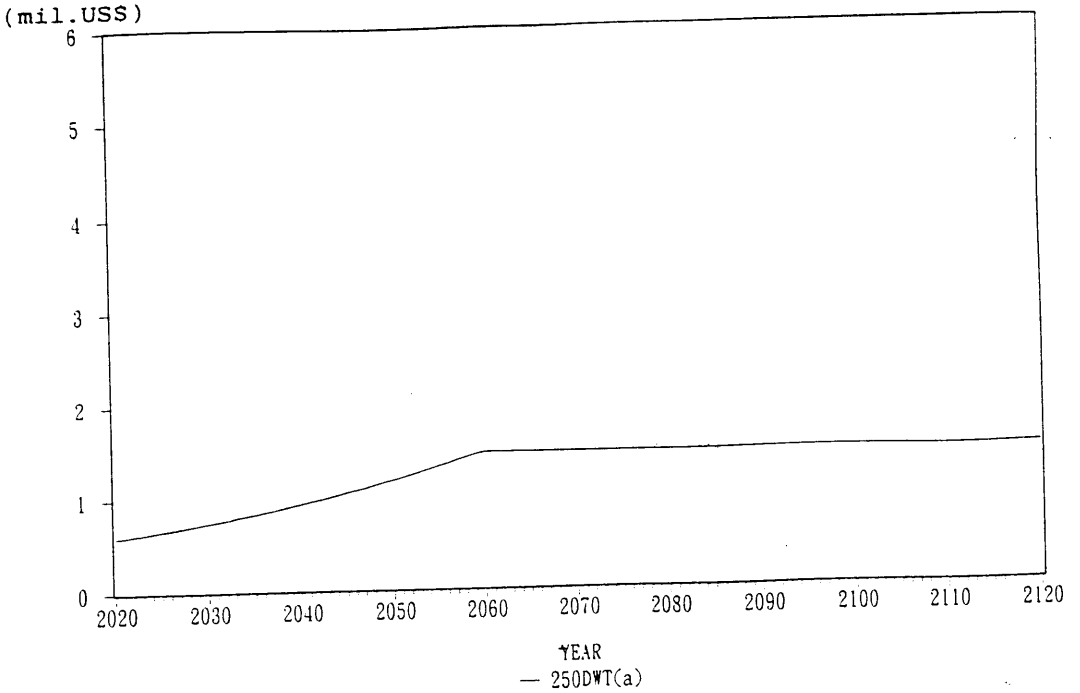


Fig. II-4-1(c) Benefit Distribution by Year (2020 to 2120) - 250,000DWT(a)-

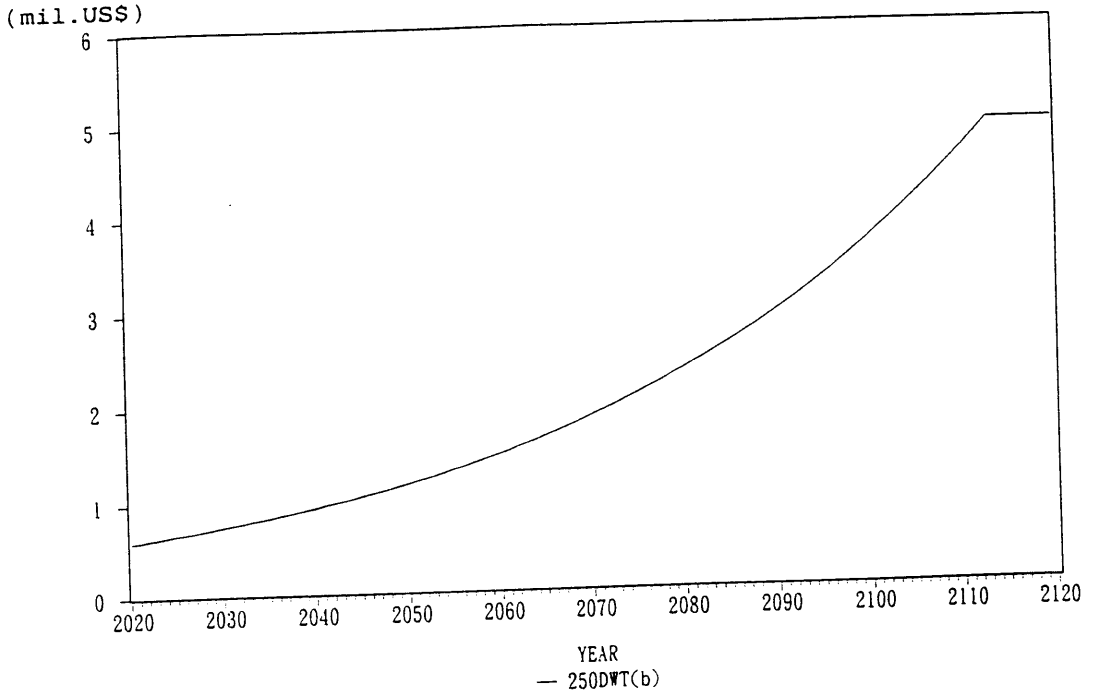


Fig. II-4-1(d) Benefit Distribution by Year (2020 to 2120) - 250,000DWT(b)-

III. Costs of Alternatives

III-1 Economic Cost

(1) Method of Calculating Economic Cost

The basis for the economic costs of the canal alternatives were the costs which are shown in the final report of the component study of Engineering and Cost Estimates (ECE). Hereinafter the ECE cost will be called the project cost.

In this study the economic costs were defined in terms of international prices (so-called border prices); therefore the project cost should be converted to economic costs using the conversion factors.

The method and conversion factors used to calculate the economic costs in the additional EAIU Study followed those of the original EAIU Study.

Operation and maintenance costs for the canal alternatives were also derived from the final report of the ECE Study (Single lane option version).

Since depreciation costs are included in the ECE Study's operation and maintenance costs, depreciation costa are eliminated in calculating the economic operation and maintenance costs. The method follows that of the original EAIU Study. The details are described in Chapter II of the final report of the original EAIU Study.

(2) Economic Project Costs

Economic costs of the alternatives are listed in Table III-1-1 ~ III-1-3. High-Rise Lock Canal 150,000 DWT case (Table III-1-1) has Average year case, and 200,000 DWT case (Table III-1-2) has Average year case and Dry year case. The costs of Dry year case is more expensive than that of Average year case. The Dry year case requests larger dams for 150,000 DWT canal and larger pump station for both cases.

Sea Level Canal case (Table III-1-3) has two options, i.e. Tidal Lock case (a) and

Table III-1-1

Economic Project Cost Summary of High Rise Lock Canal Alternatives

150,000 DWT (Single lane option)

Description	Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)	Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)
	Average year			Dry year		
I CONSTRUCTION COSTS						
(A) CIVIL WORKS						
1 Canal Excavation						
-Dry Excavation	344,853	--	344,853	344,853	--	344,853
-Dreding	1,199,903	--	1,199,903	1,199,903	--	1,199,903
-Slope Treatment etc.	40,581	--	40,581	40,581	--	40,581
Canal Excavation Total	1,585,336	--	1,585,336	1,585,336	--	1,585,336
2 Placing Area	87,437	--	87,437	87,437	--	87,437
3 Lock Construction	839,671	--	839,671	839,671	--	839,671
5 New Dams	--	172,090	172,090	--	200,315	200,315
6 Pump Station	8,705	0	8,705	8,705	148,833	157,538
7 New Permanent Roads	448,976	--	448,976	448,976	--	448,976
8 New Canal Crossing	--	774,425	774,425	--	774,425	774,425
10 Barrier Dams	--	--	0	--	--	0
11 Breakwater	--	--	0	--	--	0
12 Diversion Scheme	--	--	0	--		0
13 Supporting Construction	285,968	86,553	372,521	285,968	86,553	372,521
Subtotal	3,256,093	1,033,068	4,289,161	3,256,093	1,210,126	4,466,219
(B) PLANT FORMING A PART OF PERMANENT WORKS						
4 Gates Leaves and Related Facilities	886,473		886,473	886,473	--	886,473
9 Navigation Support System	412,334		412,334	412,334	--	412,334
Subtotal	1,298,807	0	1,298,807	1,298,807	0	1,298,807
CONSTRUCTION COSTS, TOTAL(I)	4,554,899	1,033,068	5,587,967	4,554,899	1,210,126	5,765,025
II INDIRECT COSTS						
1 Administrative Costs	55,115	14,594	69,709	55,115	14,594	69,709
2 Headquarter's Costs	94,738	25,086	119,824	94,738	25,086	119,824
3 Construction Supervision	112,857	29,884	142,741	112,857	29,884	142,741
4 Land Aquisition & Rights	97,249	--	97,249	97,249	--	97,249
5 Compensation Costs	93,870	--	93,870	93,870	--	93,870
6 Contingency	455,490	103,307	558,797	455,490	121,013	576,503
INDIRECT COSTS, TOTAL(II)	909,319	172,872	1,082,191	909,319	190,577	1,099,896
PROJECT COSTS,GRAND TOTAL(I+II)	5,464,218	1,205,940	6,670,158	5,464,218	1,400,703	6,864,921

Table III-1-2

Economic Project Cost Summary of High Rise Lock Canal Alternatives

200,000 DWT (Single lane option)

Description	Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)	Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)
	Average year			Dry year		
I CONSTRUCTION COSTS						
(A) CIVIL WORKS						
1 Canal Excavation						
-Dry Excavation	379,717	--	379,717	379,717	--	379,717
-Dreding	1,462,243	--	1,462,243	1,462,243	--	1,462,243
-Slope Treatment etc.	42,110	--	42,110	42,110	--	42,110
Canal Excavation Total	1,884,071	--	1,884,071	1,884,071	--	1,884,071
2 Placing Area	87,437	--	87,437	87,437	--	87,437
3 Lock Construction	953,042	--	953,042	953,042	--	953,042
5 New Dams	236,033	92,228	328,261	236,033	92,228	328,261
6 Pump Station	--	114,869	114,869	--	148,833	148,833
7 New Permanent Roads	8,705	--	8,705	8,705	--	8,705
8 New Canal Crossing	499,826	837,210	1,337,036	499,826	837,210	1,337,036
10 Barrier Dams	--	--	0	--	--	0
11 Breakwater	--	--	0	--	--	0
12 Diversion Scheme	--	--	0	--	--	0
13 Supporting Construction	285,968	83,054	369,022	285,968	83,054	369,022
						0
Subtotal	3,955,080	1,127,362	5,082,442	3,955,080	1,161,326	5,116,406
						0
						0
						0
(B) PLANT FORMING A PART OF PERMANENT WORKS						
4 Gates Leaves and Related Facilities	1,008,490	--	1,008,490	1,008,490	--	1,008,490
9 Navigation Support System	412,334	--	412,334	412,334	--	412,334
						0
Subtotal	1,420,824	0	1,420,824	1,420,824	0	1,420,824
						0
CONSTRUCTION COSTS, TOTAL(I)	5,375,904	1,127,362	6,503,266	5,375,904	1,161,326	6,537,230
						0
						0
						0
II INDIRECT COSTS						
1 Administrative Costs	65,035	14,004	79,039	65,035	14,004	79,039
2 Headquarter's Costs	111,789	24,072	135,861	111,789	24,072	135,861
3 Construction Supervision	133,168	28,676	161,844	133,168	28,676	161,844
4 Land Aquisition & Richts	97,249	--	97,249	97,249	--	97,249
5 Compensation Costs	93,870	--	93,870	93,870	--	93,870
6 Contingency	537,590	112,736	650,326	537,590	116,133	653,723
						0
INDIRECT COSTS, TOTAL(II)	1,037,746	179,488	1,217,234	1,038,701	182,885	1,221,586
						0
PROJECT COSTS,GRAND TOTAL(I+II)	6,413,650	1,306,850	7,720,500	6,414,605	1,344,210	7,758,815

Table III-1-3

Economic Project Cost Summary of Sea Level Canal Alternatives

Description	250,000DWT (a) (Tidal Lock)			250,000DWT (b) (Tidal Gate)		
	Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)	Phase I (1,000$)	Phase II (1,000$)	Total (1,000$)
I CONSTRUCTION COSTS						
(A) CIVIL WORKS						
1 Canal Excavation						
-Dry Excavation	3,640,495	--	3,640,495	3,639,737	--	3,639,737
-Dreding	2,333,284	--	2,333,284	1,973,589	--	1,973,589
-Slope Treatment etc.	238,638	--	238,638	256,120	--	256,120
Canal Excavation Total	6,212,417	--	6,212,417	5,869,446	--	5,869,446
2 Placing Area	187,914	--	187,914	187,914	--	187,914
3 Lock Construction	495,359	468,702	964,061	421,168	--	421,168
5 New Dams	--	89,597	89,597	--	89,597	89,597
6 Pump Station		--	0	--	--	0
7 New Permanent Roads	19,314	--	19,314	19,314	--	19,314
8 New Canal Crossing	187,163	546,225	733,388	221,334	546,225	767,559
10 Barrier Dams	490,821	--	490,821	490,821	--	490,821
11 Breakwater	400,198	--	400,198	400,198	--	400,198
12 Diversion Scheme	74,876	--	74,876	74,876	--	74,876
13 Supporting Construction	472,720	64,951	537,671	472,720	37,145	509,865
Subtotal	8,540,782	1,169,475	9,710,257	8,157,791	672,967	8,830,758
(B) PLANT FORMING A PART OF PERMANENT WORKS						
4 Gates Leaves and Related Facilities	315,150	315,150	630,300	735,956	--	735,956
9 Navigation Support System	543,821	--	543,821	474,886	--	474,886
Subtotal	858,971	315,150	1,174,121	1,210,842	0	1,210,842
CONSTRUCTION COSTS, TOTAL(I)	9,399,753	1,484,625	10,884,378	9,368,633	672,967	10,041,600
II INDIRECT COSTS						
1 Administrative Costs	94,342	14,932	109,274	94,011	6,737	100,748
2 Headquarter's Costs	160,914	25,469	186,383	160,350	11,491	171,841
3 Construction Supervision	182,958	28,959	211,917	182,317	13,066	195,383
4 Land Aquisition & Rights	24,656	--	24,656	24,656	--	24,656
5 Compensation Costs	12,120	--	12,120	12,120	--	12,120
6 Contingency	939,975	148,462	575,502	936,863	67,297	1,004,160
INDIRECT COSTS, TOTAL(II)	1,414,965	217,822	1,119,852	1,410,317	98,591	1,508,908
PROJECT COSTS,GRAND TOTAL(I+II)	10,814,718	1,702,447	12,004,230	10,778,950	771,558	11,550,508

III-2 Economic Costs Distribution by Year

Economic Project Costs were distributed to years as shown in Table III-2-1 ~ III-2-8. Table III-2-1 and 2 are Phase I and Phase II of 150,000 DWT canal, respectively. Here, Phase II distribution are listed for Average year case. The cost will start at year 2010 and finish at 2019 for Phase I. Phase II cost for Dry year case will start at year 2052 and finish at 2056.

Table III-2-3 and 4 are 200,000 DWT canal. The construction term will be larger than 150,000 DWT case for both Phase I and II. Table III-2-5 and 6 are cost distribution of Sea Level Canal (a) and III-2-7 and 8 are Sea Level Canal (b).

Table III-2-1 Economic Cost Distribution by Year
High Rise Lock Canal, Single Lane Culebra Cut Option
Case : 150,000DWT, Rise 85' (the Year of 2020) Phase I

	Major Cost Component	Economic Amount	Year of Expenditure (unit:millions of dollars)									
			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
I	CONSTRUCTION COSTS											
(A)	CIVIL WORKS											
1	Canal Excavation	1,585.34				396.33	297.25	297.25	297.25	297.25		
2	Placing Area	87.44				21.86	16.39	16.39	16.39	16.39		
3	Lock Construction	839.67					209.92	176.33	176.33	176.33	100.76	
5	New Dams	-										
6	Pump Station	-										
7	New Permanent Roads	8.70									5.44	3.26
8	New Canal Crossing	448.98				112.24	74.08	74.08	74.08	74.08	40.41	
10	Barrier Dams	-										
11	Breakwater	-										
12	Diversion Scheme	-										
13	Supporting Construction	285.97			142.98	142.98						
	Subtotal	3,256.09	0.00	0.00	142.98	673.42	597.64	564.06	564.06	564.06	146.61	3.26
(B)	PLANT FORMING A PART OF PERMANENT WORKS											
4	Gate Leaves and and Related Facilities	886.47						221.62	164.00	164.00	164.00	172.88
9	Navigation Support System	412.33								206.17	103.08	103.08
	Subtotal	1,298.81						221.62	164.00	370.17	267.08	275.95
	CONSTRUCTION COSTS TOTAL	4,554.90			142.98	673.42	597.64	785.68	728.05	934.22	413.69	279.21
II	INDIRECT COSTS											
1	Administrative Costs	55.12	2.76	2.76	5.24	6.34	6.34	6.34	6.34	6.34	6.34	6.34
2	Headquarter's Costs	94.74	22.74	22.74	22.74	3.79	3.79	3.79	3.79	3.79	3.79	3.79
3	Construction Supervision	112.86	3.39	3.39	8.92	13.88	13.88	13.88	13.88	13.88	13.88	13.88
4	Land Aquisition & Rights	97.25	38.90	38.90	19.45							
5	Compensation Costs	93.87	37.55	37.55	18.77							
6	Contingency	455.49				45.55	45.55	45.55	45.55	91.10	91.10	91.10
	INDIRECT COSTS TOTAL	909.32	105.33	105.33	75.11	69.56	69.56	69.56	69.56	115.11	115.11	115.11
	ANNUAL DISTRIBUTION	5,464.22	105.33	105.33	218.10	742.98	667.20	855.23	797.61	1,049.33	528.80	394.32

Table III-2-2 Economic Cost Distribution by Year
High Rise Lock Canal, Single Lane Culebra Cut Option
CASE : 150,000DWT, Rise85' Average Year Phase II

(million US$)

Description	Economic Amount	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
I CONSTRUCTION COSTS														
(A) CIVIL WORKS														
1 Canal Excavation														
-Dry Excavation	--													
-Dreding	--													
-Slope Treatment etc.	--													
Canal Excavation Total	--													
2 Placing Area	--													
3 Lock Construction	--													
5 New Dams	172							43	43	43	43			
6 Pump Station	0							0	0	0	0			
7 New Permanent Roads	--													
8 New Canal Crossing	774							194	194	194	194			
10 Barrier Dams	--													
11 Breakwater	--													
12 Diversion Scheme	--													
13 Supporting Construction	87						87	0	0	0	0			
Subtotal	1,033						87	237	237	237	237			
(B) PLANT FORMING A PART OF PERMANENT WORKS														
4 Gates Leaves and Related Facilities														
9 Navigation Support System														
Subtotal	0													
CONSTRUCTION COSTS, TOTAL(I)	1						87	237	237	237	237			
II INDIRECT COSTS														
1 Administrative Costs	15						1	3	3	3	3			
2 Headquarter's Costs	25						3	6	6	6	6			
3 Construction Supervision	30						3	7	7	7	7			
4 Land Aquisition & Richts	--													
5 Compensation Costs	--													
6 Contingency	103						9	24	24	24	24			
INDIRECT COSTS, TOTAL(II)	173						16	40	40	40	40			
PROJECT COSTS,GRAND TOTAL(I+II)	174						103	277	277	277	277			

Table III-2-3 Economic Cost Distribution by Year
High Rise Lock Canal, Single Lane Culebra Cut Option
Case : 200,000DWT, Rise 85' (the Year of 2020) Phase I

	Major Cost Component	Economic Amount	Year of Expenditure (unit:millions of dollars)										
			2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
I	CONSTRUCTION COSTS												
(A)	CIVIL WORKS												
1	Canal Excavation	1,884.07				471.02	282.61	282.61	282.61	282.61	282.61		
2	Placing Area	87.44				21.86	13.12	13.12	13.12	13.12	13.12		
3	Lock Construction	953.04				238.26	157.25	157.25	157.25	157.25	85.77		
5	New Dams	236.03				59.01	23.60	38.24	38.24	38.24	38.71		
6	Pump Station	-											
7	New Permanent Roads	8.70									2.18	3.92	2.61
8	New Canal Crossing	499.83				124.96	93.72	93.72	93.72	93.72			
10	Barrier Dams	-											
11	Breakwater	-											
12	Diversion Scheme	-											
13	Supporting Construction	285.97			114.39	171.58							
	Subtotal	3,955.08			114.39	1,086.68	570.30	584.93	584.93	584.93	422.39	3.92	2.61
(B)	PLANT FORMING A PART OF PERMANENT WORKS												
4	Gate Leaves and and Related Facilities	1,008.49						252.12	186.57	186.57	186.57	196.66	
9	Navigation Support System	412.33								164.93	123.70	123.70	
	Subtotal	1,420.82						252.12	186.57	351.50	310.27	320.36	
	CONSTRUCTION COSTS TOTAL	5,375.90		0.00	114.39	1,086.69	570.30	837.06	771.51	936.44	732.66	324.28	2.61
II	INDIRECT COSTS												
1	Administrative Costs	65.03	2.93	2.93	5.85	7.15	7.15	7.15	7.15	7.15	7.15	7.15	3.25
2	Headquarter's Costs	111.79	27.39	27.39	27.39	3.91	3.91	3.91	3.91	3.91	3.91	3.91	2.24
3	Construction Supervision	133.17	3.66	3.66	10.65	15.31	15.31	15.31	15.31	15.31	15.31	15.31	7.00
4	Land Aquisition & Rights	97.25	38.90	38.90	19.45								
5	Compensation Costs	93.87	37.55	37.55	18.77								
6	Contingency	537.59				40.32	40.32	40.32	40.32	107.52	107.52	107.52	53.76
	INDIRECT COSTS TOTAL	1,038.70	110.42	110.42	82.12	66.70	66.70	66.70	66.70	133.90	133.90	133.90	67.24
	ANNUAL DISTRIBUTION	6,414.61	110.42	110.42	196.51	1,153.38	637.00	903.76	838.20	1,070.34	866.56	458.17	69.86

Table III-2-4 Economic Cost Distribution by Year
High Rise Lock Canal, Single Lane Culebra Cut Option
CASE : 200,000DWT, Rise 85' Average Year Phase II

(million US$)

Description	Economic Amount	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
I CONSTRUCTION COSTS														
(A) CIVIL WORKS														
1 Canal Excavation														
-Dry Excavation	--													
-Dreding	--													
-Slope Treatment etc.	--													
Canal Excavation Total	--													
2 Placing Area	--													
3 Lock Construction	--													
5 New Dams	92		23	23	23	23								
6 Pump Station	115								29	29	29	29		
7 New Permanent Roads	--													
8 New Canal Crossing	837							209	209	209	209			
10 Barrier Dams	--													
11 Breakwater	--													
12 Diversion Scheme	--													
13 Supporting Construction	83	83												
Subtotal	1,127	83	23	23	23	23	0	209	238	238	238	29		
(B) PLANT FORMING A PART OF PERMANENT WORKS														
4 Gates Leaves and Related Facilities	--													
9 Navigation Support System	--													
Subtotal	0													
CONSTRUCTION COSTS, TOTAL(I)	1,127	83	23	23	23	23	0	209	238	238	238	29		
II INDIRECT COSTS														
1 Administrative Costs	13	1	0	0	0	0	0	3	3	3	3	0		
2 Headquarter's Costs	24,072	2	0	0	0	0	0	4	5	5	5	1		
3 Construction Supervision	28,676	2	1	1	1	1	0	5	6	6	6	1		
4 Land Aquisition & Richts	--													
5 Compensation Costs	--													
6 Contingency	112,736	8	2	2	2	2	0	21	24	24	24	3		
INDIRECT COSTS, TOTAL(II)	165,497	13	4	4	4	4	0	33	38	38	38	5		
PROJECT COSTS,GRAND TOTAL(I+II)	166,624	96	27	27	27	27	0	242	276	276	276	34		

Table III-2-5 Economic Cost Distribution by Year
Sea Level Canal. Route 10
Case : 250,000DWT (a) (the Year of 2020) Phase I

	Major Cost Component	Economic Amount	Year of Expenditure (unit:millions of dollars)														
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
I	CONSTRUCTION COSTS																
(A)	CIVIL WORKS																
1	Canal Excavation	6,212.42					1,553.10	434.87	434.87	465.93	465.93	465.93	465.93	465.93	465.93	465.93	528.06
2	Placing Area	187.91					46.98	18.79	6.58	6.58	6.58	6.58	6.58	6.58	6.58	37.58	38.52
3	Lock Construction	495.36							247.68	82.56	82.56	82.56					
5	New Dams	--															
6	Pump Station	--															
7	New Permanent Roads	19.31													4.83	8.69	5.79
8	New Canal Crossing	187.16					46.79	21.52	21.52	21.52	21.52	21.52	21.52	11.23			
10	Barrier Dams	490.82					122.71	80.99	80.99	80.99	80.99	44.17					
11	Breakwater	400.20					100.05	31.22	31.22	31.22	31.22	31.22	31.22	31.22	31.22	31.22	19.21
12	Diversion Scheme	74.88					32.57	28.08	14.23								
13	Supporting Construction	472.72				189.09	283.63										
	Subtotal	8,540.78				189.09	2,185.83	645.46	837.08	688.79	688.79	651.98	525.25	514.95	508.55	543.42	591.58
(B)	PLANT FORMING A PART OF PERMANENT WORKS																
4	Gate Leaves and and Related Facilities	315.15								78.79	59.09	59.09	59.09	59.09			
9	Navigation Support System	543.82													135.96	201.21	206.65
	Subtotal	858.97								78.79	59.09	59.09	59.09	59.09	135.96	201.21	206.65
	CONSTRUCTION COSTS TOTAL	9,399.75				189.09	2,185.83	615.46	837.08	767.58	747.88	711.07	584.34	574.04	644.51	744.63	798.23
II	INDIRECT COSTS																
1	Administrative Costs	94.40	1.42	1.42	5.19	8.49	7.08	7.08	7.08	7.08	7.08	7.08	7.08	7.08	7.08	7.08	7.08
2	Headquarter's Costs	160.91	40.23	40.23	40.23	20.75	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
3	Construction Supervision	182.96	4.57	4.57	4.57	8.23	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64	14.64
4	Land Aquisition & Rights	24.66	9.86	9.86	4.93												
5	Compensation Costs	12.12	4.85	4.85	2.42												
6	Contingency	939.98				42.30	42.30	42.30	42.30	42.30	42.30	42.30	42.30	150.40	150.40	150.40	150.40
	INDIRECT COSTS TOTAL	1,414.96	60.93	60.93	57.35	79.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	173.88	173.88	173.88	173.88
	ANNUAL DISTRIBUTION	10,814.71	60.93	60.93	57.35	268.87	2,251.61	681.24	902.86	833.36	813.66	776.85	650.12	747.92	818.39	918.51	972.11

Table III-2-6
Economic Cost Distribution by Year
Sea Level (250,000 DWT (a)) (Phase II)

Description	Economic Amount	2055	2056	2057	2058	2059
I CONSTRUCTION COSTS						
(A) CIVIL WORKS						
1 Canal Excavation						
-Dry Excavation	--					
-Dreding	--					
-Slope Treatment etc.	--					
Canal Excavation Total	--					
2 Placing Area	--					
3 Lock Construction	469		117	117	117	117
5 New Dams	90		22	22	22	22
6 Pump Station	--					
7 New Permanent Roads	--					
8 New Canal Crossing	546		137	137	137	137
10 Barrier Dams	--					
11 Breakwater	--					
12 Diversion Scheme	--					
13 Supporting Construction	65	65				
Subtotal	1,170	65	276	276	276	276
(B) PLANT FORMING A PART OF PERMANENT WORKS						
4 Gates Leaves and Related Facilities	315		79	79	79	79
9 Navigation Support System	--					
Subtotal	315		79	79	79	79
CONSTRUCTION COSTS, TOTAL(I)	1,485	65	355	355	355	355
II INDIRECT COSTS						
1 Administrative Costs	15	1	3	3	3	3
2 Headquarter's Costs	25	13	3	3	3	3
3 Construction Supervision	29	3	7	7	7	7
4 Land Aquisition & Richts	--					
5 Compensation Costs	--					
6 Contingency	148		37	37	37	37
INDIRECT COSTS, TOTAL(II)	218	17	50	50	50	50
PROJECT COSTS,GRAND TOTAL(I+II)	1,702	82	405	405	405	405

Table III-2-7 Economic Cost Distribution by Year
Sea Level Canal. Route 10
Case : 250,000DWT (b) (the Year of 2020) Phase I

	Major Cost Component	Economic Amount	Year of Expenditure (unit:millions of dollars)														
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
I	CONSTRUCTION COSTS																
(A)	CIVIL WORKS																
1	Canal Excavation	5,869.45					1,467.36	410.86	410.86	440.21	440.21	440.21	440.21	440.21	440.21	440.21	498.90
2	Placing Area	187.91					46.98	18.79	6.58	6.58	6.58	6.58	6.58	6.58	6.58	37.58	38.52
3	Lock Construction	421.17					105.29	88.45	88.45	88.45	50.54						
5	New Dams																
6	Pump Station																
7	New Permanent Roads	19.31													4.83	8.69	5.79
8	New Canal Crossing	221.33					55.33	25.45	25.45	25.45	25.45	25.45	25.45	13.28			
10	Barrier Dams	490.82					122.71	80.99	80.99	80.99	80.99	44.17					
11	Breakwater	400.20					100.05	31.22	31.22	31.22	31.22	31.22	31.22	31.22	31.22	31.22	19.21
12	Diversion Scheme	74.88					32.57	28.08	14.23								
13	Supporting Construction	472.72				189.09	283.63										
	Subtotal	8,157.79				189.09	2,213.92	683.83	657.76	672.88	634.98	547.63	503.45	491.28	482.83	517.70	562.43
(B)	PLANT FORMING A PART OF PERMANENT WORKS																
4	Gate Leaves and and Related Facilities	735.96							183.99	183.99	183.99	183.99					
9	Navigation Support System	474.89													118.72	175.71	180.46
	Subtotal	1,210.84							183.99	183.99	183.99	183.99	0.00	0.00	118.72	175.71	180.46
	CONSTRUCTION COSTS TOTAL	9,368.63				189.09	2,213.92	683.83	841.75	856.87	818.97	731.62	503.45	491.28	601.55	693.41	742.89
II	INDIRECT COSTS																
1	Administrative Costs	94.01	1.41	1.41	5.17	8.45	7.05	7.05	7.05	7.05	7.05	7.05	7.05	7.05	7.05	7.05	7.05
2	Headquarter's Costs	160.35	40.09	40.09	40.09	20.69	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76
3	Construction Supervision	182.32	4.56	4.56	4.56	8.20	14.59	14.59	14.59	14.59	14.59	14.59	14.59	14.59	14.59	14.59	14.59
4	Land Aquisition & Rights	24.66	9.86	9.86	4.93												
5	Compensation Costs	12.12	4.85	4.85	2.42												
6	Contingency	936.86				42.16	42.16	42.16	42.16	42.16	42.16	42.16	42.16	149.90	149.90	149.90	149.90
	INDIRECT COSTS TOTAL	1,410.32	60.77	60.77	57.17	79.51	65.56	65.56	65.56	65.56	65.56	65.56	65.56	173.30	173.30	173.30	173.30
	ANNUAL DISTRIBUTION	10,778.95	60.77	60.77	57.17	268.60	2,279.48	749.39	907.31	922.43	884.53	797.18	569.01	664.58	774.85	866.70	916.18

Table III-2-8
Economic Cost Distribution by Year
Sea Level (250,000 DWT (b)) (Phase II)

Description	Economic Amount	2055	2056	2057	2058	2059
I CONSTRUCTION COSTS						
(A) CIVIL WORKS						
1 Canal Excavation						
-Dry Excavation	--					
-Dreding	--					
-Slope Treatment etc.	--					
Canal Excavation Total	--					
2 Placing Area	--					
3 Lock Construction	--					
5 New Dams	90		22	22	22	22
6 Pump Station	--					
7 New Permanent Roads	--					
8 New Canal Crossing	546		137	137	137	137
10 Barrier Dams	--					
11 Breakwater	--					
12 Diversion Scheme	--					
13 Supporting Construction	37	37				
Subtotal	673	37	159	159	159	159
(B) PLANT FORMING A PART OF PERMANENT WORKS						
4 Gates Leaves and Related Facilities	--		0	0	0	0
9 Navigation Support System	--					
Subtotal	0		0	0	0	0
CONSTRUCTION COSTS, TOTAL(I)	673	37	159	159	159	159
II INDIRECT COSTS						
1 Administrative Costs	7	1	2	2	2	2
2 Headquarter's Costs	11	6	1	1	1	1
3 Construction Supervision	13	1	3	3	3	3
4 Land Aquisition & Richts	--					
5 Compensation Costs	--					
6 Contingency	67		17	17	17	17
INDIRECT COSTS, TOTAL(II)	99	8	23	23	23	23
PROJECT COSTS,GRAND TOTAL(I+II)	772	45	182	182	182	182

III-3 Total Cost Distribution by Year

(1) Cost Distribution Including O & M Cost

Table III-3-1 ~ III-3-6 are cost distribution of project costs and O & E cost during years 2005 through 2060.

(2) Cost Distribution Through 2120

O & M cost will be necessary after year 2060 as well as 2020 through 2060. The summary of cost distribution is listed in Table III-3-7. Fig. III-3-1 ~ 6 are economic cost distribution in Figures.

Table III-3-1 Economic Cost Distribution
High Rise Lock 150,000 DWT (Average Year)

Major Cost Component	Amount	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS TOTAL	5,588								143	673	598	786	728	934	414	279					
II INDIRECT COSTS TOTAL	1,082						105	105	75	70	70	70	70	115	115	115					
III O&M COST																					
(A)Electrical power	1,191																29	29	29	29	29
(B)Man power and Other O&M Costs	4,074																98	98	98	98	98
Total O&M Costs	5,265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	127	127	127	127
ANUAL DISTRIBUTION	11,936	0	0	0	0	0	105	105	218	743	667	855	798	1,049	529	394	127	127	127	127	127

2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127
127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127

2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
					86	237	237	237	237				
					15	40	40	40	40				
29	29	29	29	29	29	29	29	29	29	29	29	29	31
98	98	98	98	98	98	98	98	98	98	98	98	98	154
127	127	127	127	127	127	127	127	127	127	127	127	127	185
127	127	127	127	127	228	403	403	403	403	127	127	127	185

Table III-3-2 Economic Cost Distribution
High Rise Lock 150,000 DWT (Dry Year)

Major Cost Component	Amount	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS																					
TOTAL	5,765								143	673	598	801	778	984	464	329					
II INDIRECT COSTS																					
TOTAL	1,100						105	105	75	70	70	72	77	123	123	123					
III O&M COST																					
(A)Electrical power	1,191																29	29	29	29	29
(B)Man power and Other O&M Costs	4,074																98	98	98	98	98
Total O&M Costs	5,265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	127	127	127	127
ANUAL DISTRIBUTION	12,130	0	0	0	0	0	105	105	218	743	667	873	856	1,107	587	452	127	127	127	127	127

2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
				11	29	29	29	29													
				2	5	5	5	5													
29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127
127	127	127	127	140	160	160	160	160	127	127	127	127	127	127	127	127	127	127	127	127	127

2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
			17	17	60	194	194	194	194				
			3	3	9	30	30	30	30				
29	29	29	29	29	29	29	29	29	29	29	29	29	31
98	98	98	98	98	98	98	98	98	98	98	98	98	154
127	127	127	127	127	127	127	127	127	127	127	127	127	185
127	127	127	147	147	196	351	351	351	351	127	127	127	185

Table III-3-3 Economic Cost Distribution
High Rise Lock 200,000 DWT (Average Year)

Major Cost Component	Amount	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS																					
TOTAL	6,504							114	1,087	570	837	772	936	733	324	3					
II INDIRECT COSTS																					
TOTAL	1,218					110	110	82	67	67	67	67	134	134	134	67					
III O&M COST																					
(A)Electrical power	1,234																30	30	30	30	30
(B)Man power and Other O&M Costs	4,402																106	106	106	106	106
Total O&M Costs	5,636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	136	136	136	136	136
ANUAL DISTRIBUTION	13,358	0	0	0	0	110	110	197	1,153	637	904	838	1,070	867	458	70	136	136	136	136	136

Major Cost Component	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS																						
TOTAL																						
II INDIRECT COSTS																						
TOTAL																						
III O&M COST																						
(A)Electrical power	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
(B)Man power and Other O&M Costs	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
Total O&M Costs	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136
ANUAL DISTRIBUTION	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136

Major Cost Component	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS														
TOTAL	84	23	23	23	23		209	238	238	238	29			
II INDIRECT COSTS														
TOTAL	13	4	4	4	4		33	38	38	38	5			
III O&M COST														
(A)Electrical power	30	30	30	30	30	30	30	30	30	30	30	30	30	34
(B)Man power and Other O&M Costs	106	106	106	106	106	106	106	106	106	106	106	106	106	162
Total O&M Costs	136	136	136	136	136	136	136	136	136	136	136	136	136	196
ANUAL DISTRIBUTION	233	163	163	163	163	136	379	412	412	412	169	136	136	196

Table III-3-5 Economic Cost Distribution
Sea Level 250,000 DWT (a)

Major Cost Component	Amount	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS																					
TOTAL	10,887				189	2,186	615	837	768	748	711	584	574	645	745	798					
II INDIRECT COSTS																					
TOTAL	1,634	61	61	57	80	66	66	66	66	66	66	66	174	174	174	174					
III O&M COST																					
(A)Electrical power	868																21	21	21	21	21
(B)Man power and Other O&M Costs	5,993																145	145	145	145	145
Total O&M Costs	6,861	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166	166	166	166	166
ANUAL DISTRIBUTION	19,382	61	61	57	269	2,252	681	903	833	814	777	650	748	818	919	972	166	166	166	166	166

2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145
166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166
166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166

2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
								66	355	355	355	355	
								17	50	50	50	50	
21	21	21	21	21	21	21	21	21	21	21	21	21	28
145	145	145	145	145	145	145	145	145	145	145	145	145	193
166	166	166	166	166	166	166	166	166	166	166	166	166	221
166	166	166	166	166	166	166	166	249	572	572	572	572	221

Table III-3-6 Economic Cost Distribution
Sea Level 250,000 DWT (b)

Major Cost Component	Amount	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
I CONSTRUCTION COSTS																					
TOTAL	10,044				189	2,214	684	842	857	819	732	503	491	602	693	743					
II INDIRECT COSTS																					
TOTAL	1,509	61	61	57	80	66	66	66	66	66	66	66	173	173	173	173					
III O&M COST																					
(A)Electrical power	82																2	2	2	2	2
(B)Man power and Other O&M Costs	5,624																136	136	136	136	136
Total O&M Costs	5,706	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	138	138	138	138	138
ANUAL DISTRIBUTION	17,259	61	61	57	269	2,279	749	907	922	885	797	569	665	775	867	916	138	138	138	138	138

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
I CONSTRUCTION COSTS																						
TOTAL																						
II INDIRECT COSTS																						
TOTAL																						
III O&M COST																						
(A)Electrical power	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
(B)Man power and Other O&M Costs	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136
Total O&M Costs	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
ANUAL DISTRIBUTION	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138

	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
I CONSTRUCTION COSTS														
TOTAL									38	159	159	159	159	
II INDIRECT COSTS														
TOTAL									8	23	23	23	23	
III O&M COST														
(A)Electrical power	2	2	2	2	2	2	2	2	2	2	2	2	2	2
(B)Man power and Other O&M Costs	136	136	136	136	136	136	136	136	136	136	136	136	136	184
Total O&M Costs	138	138	138	138	138	138	138	138	138	138	138	138	138	186
ANUAL DISTRIBUTION	138	138	138	138	138	138	138	138	184	320	320	320	320	186

Table III-3-7 Economic Cost Distribution by Year

(mil. US$)

Year	Case 150.000DWT (Ave. Year)	150.000DWT (Dry Year)	200.000DWT (Ave. Year)	200.000DWT (Dry Year)	250.000DWT (d)	250.000DWT (e)
2005	0	0	0	0	61	61
2006	0	0	0	0	61	61
2007	0	0	0	0	57	57
2008	0	0	0	0	269	269
2009	0	0	110	110	2252	2279
2010	105	105	110	110	681	749
2011	105	105	197	197	903	907
2012	218	218	1153	1153	833	922
2013	743	743	637	637	814	885
2014	667	667	904	904	777	797
2015	855	873	838	846	650	569
2016	798	856	1070	1097	748	665
2017	1049	1107	867	893	818	775
2018	528	587	458	485	919	867
2019	394	452	70	97	972	916
2020	127	127	136	136	166	138
2021	127	127	136	136	166	138
2022	127	127	136	136	166	138
2023	127	127	136	136	166	138
2024	127	127	136	147	166	138
2025	127	127	136	169	166	138
2026	127	127	136	169	166	138
2027	127	127	136	169	166	138
2028	127	127	136	169	166	138
2029	127	140	136	136	166	138
2030	127	160	136	136	166	138
2031	127	160	136	136	166	138
2032	127	160	136	136	166	138
2033	127	160	136	136	166	138
2034	127	127	136	136	166	138
2035	127	127	136	136	166	138
2036	127	127	136	136	166	138
2037	127	127	136	136	166	138
2038	127	127	136	136	166	138
2039	127	127	136	136	166	138
2040	127	127	136	136	166	138
2041	127	127	136	136	166	138
2042	127	127	136	136	166	138
2043	127	127	136	136	166	138
2044	127	127	136	136	166	138
2045	127	127	136	136	166	138
2046	127	127	136	136	166	138
2047	127	127	232	156	166	138
2048	127	127	163	156	166	138
2049	127	127	163	136	166	138
2050	127	147	163	136	166	138
2051	127	147	163	136	166	138
2052	228	196	136	211	166	138
2053	403	351	379	378	166	138
2054	403	351	412	378	166	138
2055	403	351	412	378	249	184
2056	403	351	412	378	572	320
2057	127	127	169	136	572	320
2058	127	127	136	136	572	320
2059	127	127	136	136	572	320
2060	185	185	196	196	221	186
2061 TO 2120	11.100	11.100	11.760	11.760	13.260	11.160
TOTAL	23.035	23.230	25.117	25.153	32.642	28.419

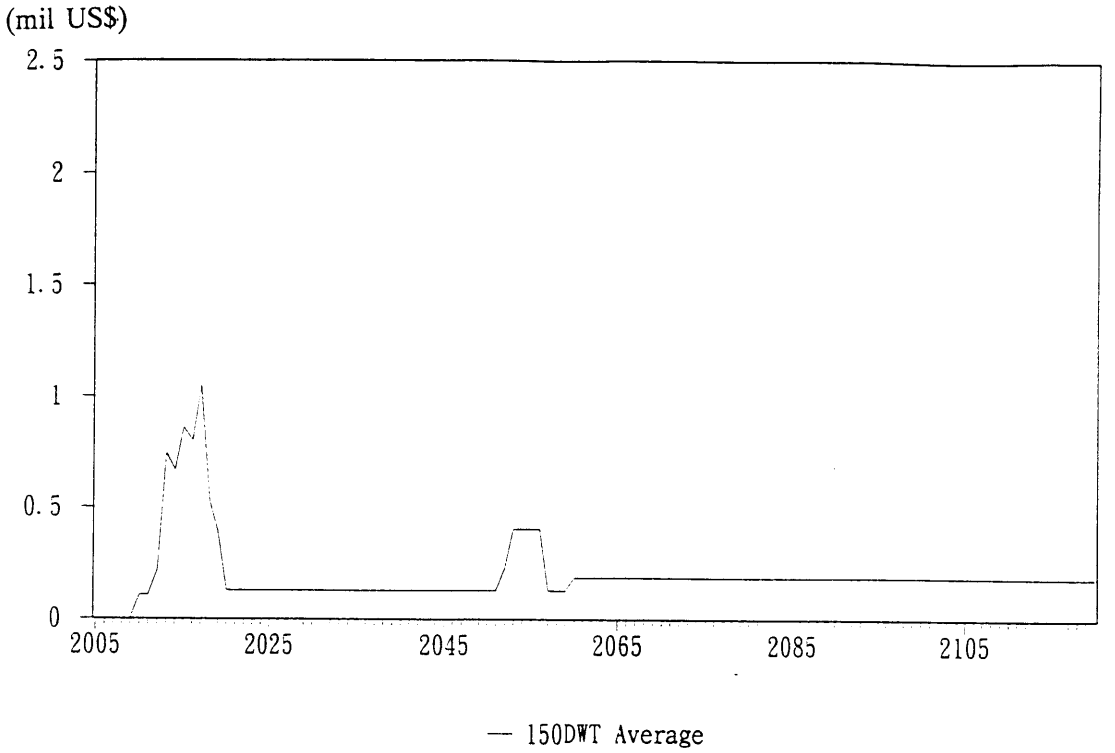


Fig. III-3-1 Economic Cost Distribution 150,000 DWT Average Year

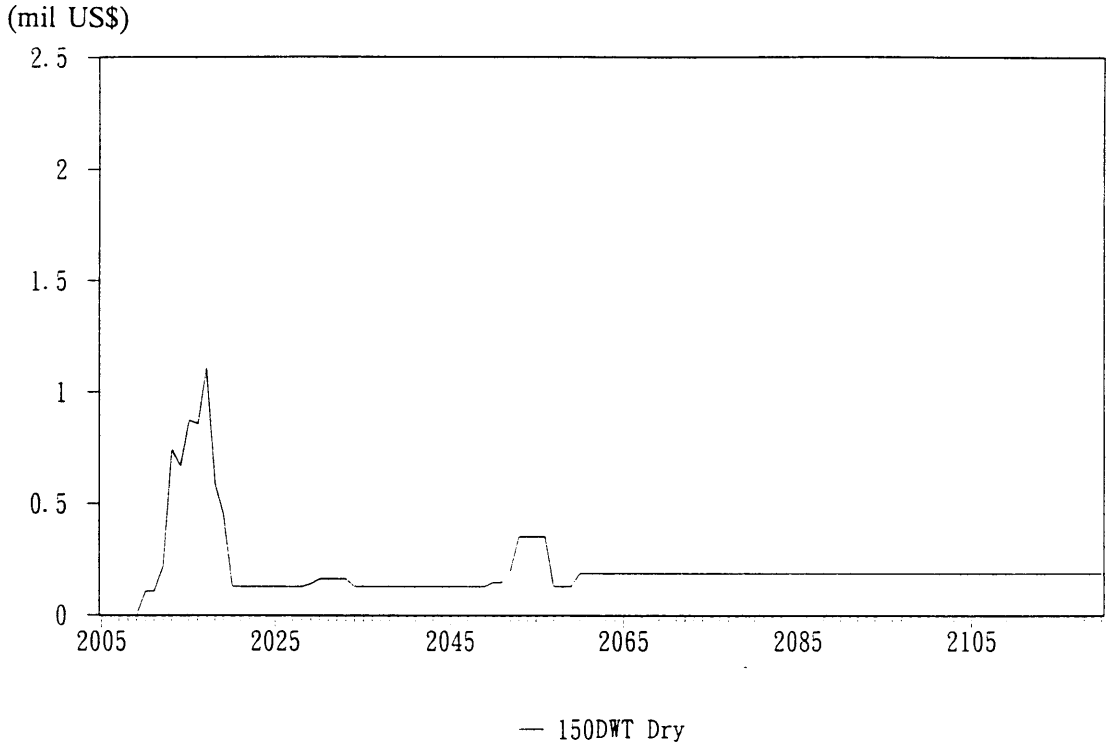


Fig. III-3-2 Economic Cost Distribution 150,000 DWT Dry Year

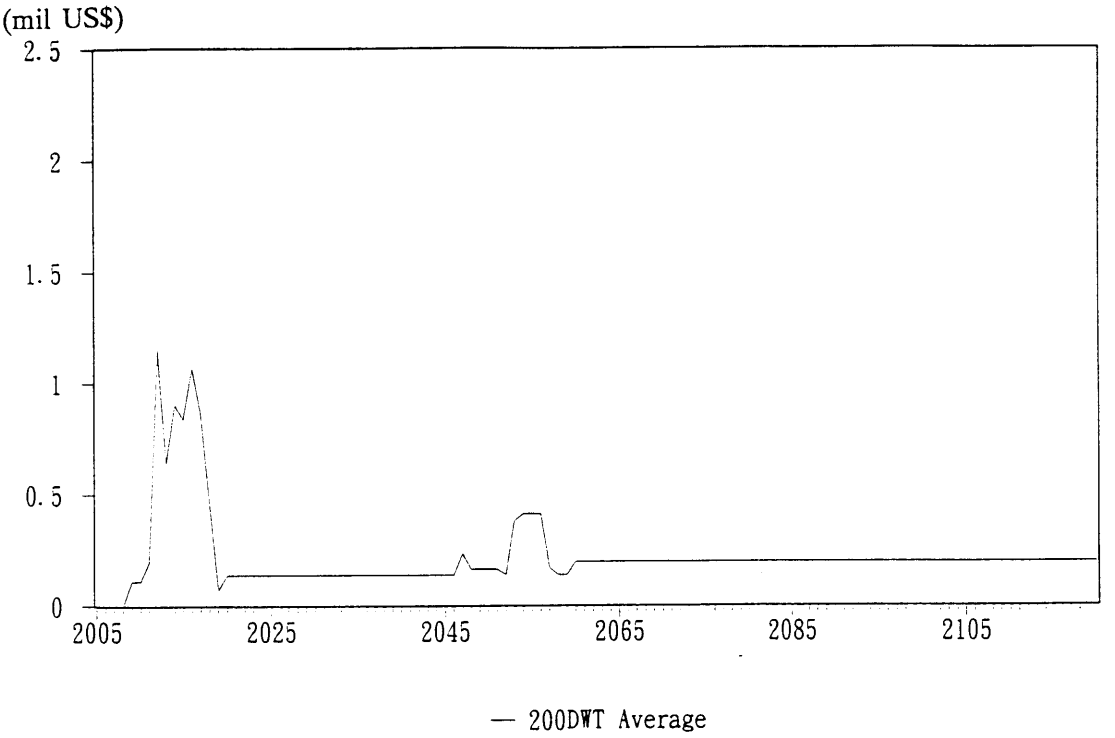


Fig. III-3-3 Economic Cost Distribution 200,000 DWT Average Year

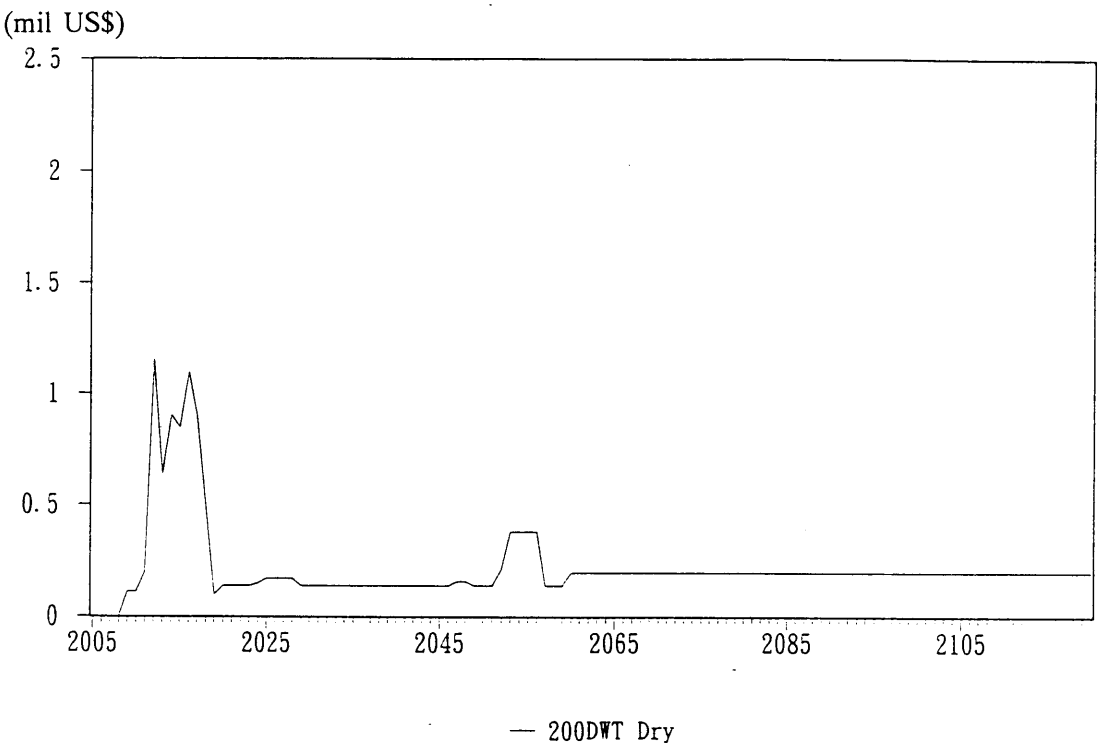


Fig. III-3-4 Economic Cost Distribution 200,000 DWT Dry Year

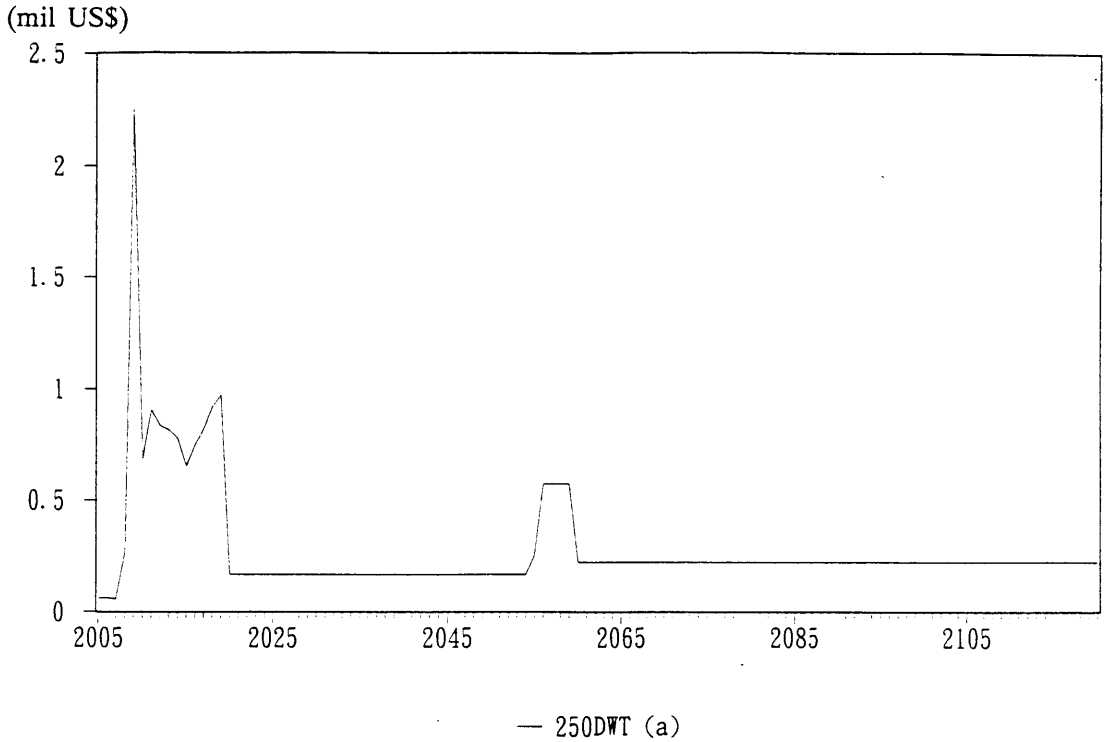


Fig. III-3-5 Economic Cost Distribution 250,000 DWT (a)

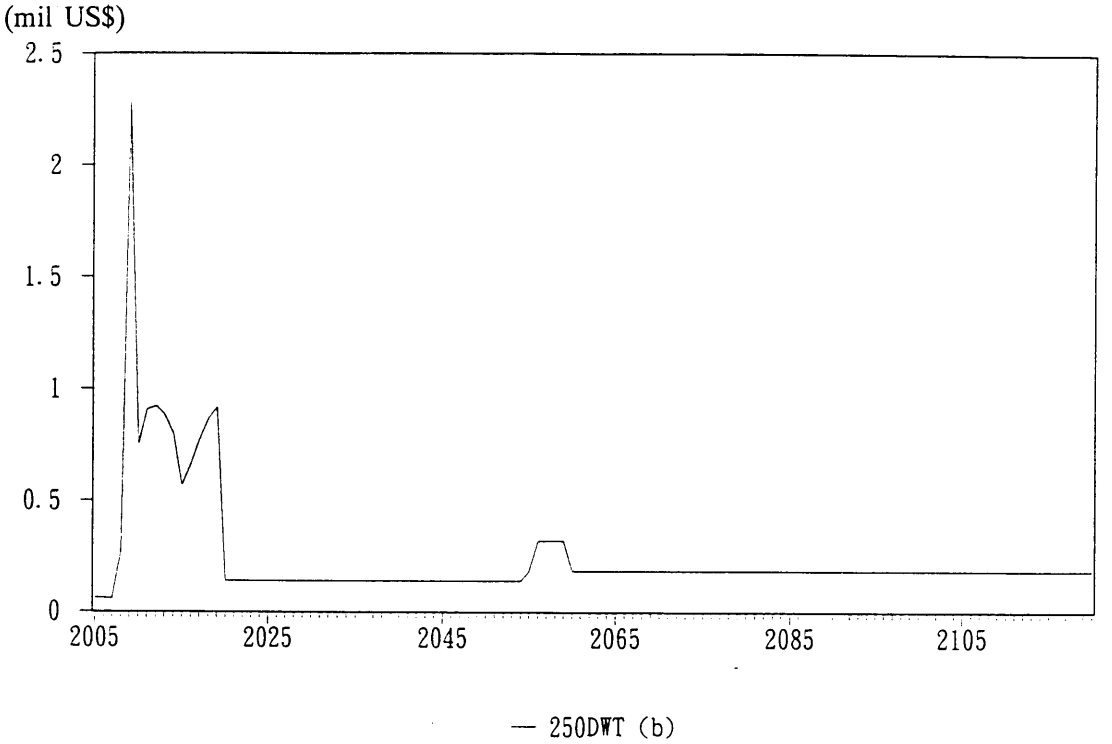


Fig. III-3-6 Economic Cost Distribution 250,000 DWT (b)

IV. Cost and Benefit Comparison

IV-1 Present Value of Benefits and Economic Costs

Benefits of alternatives in this study is large compared to the original study because of the capacity constraint of the SQ canal. As for the economic cost, the value is smaller because the construction cost and O & M costs are smaller.

It is necessary to convert these benefits and costs to the present value. The method is same as the original EAIU Study (see section IV.3) in EAIU Final Report. The range of social discount rate is 3 % to 9%.

Table IV-1-1 shows the present value of benefits, and Table IV-1-2 shows the present value of economic costs.

Table IV-1-1 (1) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 3%

Year	Case 150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	410	427	442	442
2021	407	424	439	439
2022	405	422	436	436
2023	403	419	433	433
2024	400	416	430	430
2025	398	414	427	427
2026	396	411	424	424
2027	393	408	421	421
2028	391	406	418	418
2029	389	403	415	415
2030	386	400	412	412
2031	384	398	410	410
2032	382	395	407	407
2033	379	393	404	404
2034	377	390	401	401
2035	375	388	399	399
2036	373	385	396	396
2037	371	383	393	393
2038	368	380	391	391
2039	366	378	388	388
2040	364	375	385	385
2041	362	373	383	383
2042	360	371	380	380
2043	358	368	377	377
2044	356	366	375	375
2045	354	363	372	372
2046	351	361	370	370
2047	349	359	367	367
2048	347	356	365	365
2049	345	354	362	362
2050	343	352	360	360
2051	341	350	357	357
2052	339	347	355	355
2053	337	345	353	353
2054	335	343	350	350
2055	333	341	348	348
2056	331	338	345	345
2057	329	336	343	343
2058	327	334	341	341
2059	326	332	338	338
2060	324	330	334	336
2061 TO 2120	16.004	15.971	9.238	16.355
TOTAL	30.971	31.405	25.082	32.201

Table IV-1-1 (2) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 4%

Year \ Case	150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	372	388	401	401
2021	366	382	394	394
2022	361	376	388	388
2023	355	370	382	382
2024	350	364	375	375
2025	344	358	369	369
2026	339	352	363	363
2027	334	346	357	357
2028	328	341	351	351
2029	323	335	346	346
2030	318	330	340	340
2031	313	325	334	334
2032	309	320	329	329
2033	304	314	324	324
2034	299	309	318	318
2035	295	304	313	313
2036	290	300	308	308
2037	286	295	303	303
2038	281	290	298	298
2039	277	285	293	293
2040	273	281	288	288
2041	268	276	284	284
2042	264	272	279	279
2043	260	268	274	274
2044	256	263	270	270
2045	252	259	265	265
2046	248	255	261	261
2047	244	251	257	257
2048	241	247	253	253
2049	237	243	249	249
2050	233	239	244	244
2051	230	235	240	240
2052	226	231	237	237
2053	223	228	233	233
2054	219	224	229	229
2055	216	221	225	225
2056	212	217	221	221
2057	209	214	218	218
2058	206	210	214	214
2059	203	207	211	211
2060	200	203	206	207
2061 TO 2120	7.618	7.623	4.658	7.786
TOTAL	18.982	19.350	16.703	19.833

Table IV-1-1 (3) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 5%

Year	Case 150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	338	352	364	364
2021	330	344	355	355
2022	321	335	346	346
2023	314	326	337	337
2024	306	318	328	328
2025	298	310	320	320
2026	291	302	312	312
2027	284	294	304	304
2028	276	287	296	296
2029	270	280	288	288
2030	263	273	281	281
2031	256	266	274	274
2032	250	259	266	266
2033	244	252	260	260
2034	238	246	253	253
2035	232	240	246	246
2036	226	234	240	240
2037	221	228	234	234
2038	215	222	228	228
2039	210	216	222	222
2040	205	211	216	216
2041	199	205	211	211
2042	194	200	205	205
2043	190	195	200	200
2044	185	190	195	195
2045	180	185	190	190
2046	176	181	185	185
2047	172	176	180	180
2048	167	172	176	176
2049	163	167	171	171
2050	159	163	167	167
2051	155	159	162	162
2052	151	155	158	158
2053	148	151	154	154
2054	144	147	150	150
2055	140	143	146	146
2056	137	140	143	143
2057	133	136	139	139
2058	130	133	135	135
2059	127	129	132	132
2060	124	126	128	128
2061 TO 2120	3.746	3.758	2.415	3.831
TOTAL	12.507	12.806	11.713	13.129

Table IV-1-1 (4) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 6%

Year \ Case	150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	307	321	331	331
2021	297	310	320	320
2022	287	299	309	309
2023	277	288	298	298
2024	268	279	287	287
2025	259	269	277	277
2026	250	260	268	268
2027	241	251	258	258
2028	233	242	249	249
2029	225	234	241	241
2030	218	226	232	232
2031	210	218	224	224
2032	203	210	216	216
2033	196	203	209	209
2034	189	196	201	201
2035	183	189	194	194
2036	177	183	188	188
2037	171	176	181	181
2038	165	170	175	175
2039	159	164	169	169
2040	154	159	163	163
2041	149	153	157	157
2042	144	148	152	152
2043	139	143	146	146
2044	134	138	141	141
2045	129	133	136	136
2046	125	128	132	132
2047	121	124	127	127
2048	117	120	123	123
2049	113	116	118	118
2050	109	112	114	114
2051	105	108	110	110
2052	102	104	106	106
2053	98	100	103	103
2054	95	97	99	99
2055	92	94	96	96
2056	88	90	92	92
2057	85	87	89	89
2058	83	84	86	86
2059	80	81	83	83
2060	77	78	79	80
2061 TO 2120	1.899	1.909	1.284	1.943
TOTAL	8.751	8.990	8.564	9.224

Table IV-1-1 (5) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 7%

Year	Case 150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	280	292	302	302
2021	268	279	288	288
2022	256	267	276	276
2023	245	255	264	264
2024	235	244	252	252
2025	225	234	241	241
2026	215	223	230	230
2027	206	214	220	220
2028	197	204	211	211
2029	188	195	201	201
2030	180	187	193	193
2031	173	179	184	184
2032	165	171	176	176
2033	158	164	168	168
2034	151	156	161	161
2035	145	150	154	154
2036	138	143	147	147
2037	132	137	141	141
2038	127	131	134	134
2039	121	125	128	128
2040	116	120	123	123
2041	111	114	117	117
2042	106	109	112	112
2043	102	105	107	107
2044	97	100	103	103
2045	93	96	98	98
2046	89	92	94	94
2047	85	88	90	90
2048	82	84	86	86
2049	78	80	82	82
2050	75	77	78	78
2051	72	73	75	75
2052	68	70	72	72
2053	66	67	69	69
2054	63	64	65	65
2055	60	61	63	63
2056	57	59	60	60
2057	55	56	57	57
2058	53	54	55	55
2059	50	51	52	52
2060	48	49	50	50
2061 TO 2120	989	996	697	1.013
TOTAL	6.422	6.614	6.476	6.791

Table IV-1-1 (6) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 8%

Year \ Case	150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	255	266	275	275
2021	242	252	260	260
2022	229	239	247	247
2023	217	226	234	234
2024	206	214	221	221
2025	195	203	210	210
2026	185	192	199	199
2027	176	182	188	188
2028	167	173	178	178
2029	158	164	169	169
2030	150	155	160	160
2031	142	147	151	151
2032	135	139	143	143
2033	128	132	136	136
2034	121	125	129	129
2035	115	119	122	122
2036	109	112	115	115
2037	103	106	109	109
2038	98	101	104	104
2039	93	96	98	98
2040	88	91	93	93
2041	83	86	88	88
2042	79	81	83	83
2043	75	77	79	79
2044	71	73	75	75
2045	67	69	71	71
2046	64	66	67	67
2047	60	62	64	64
2048	57	59	60	60
2049	54	56	57	57
2050	52	53	54	54
2051	49	50	51	51
2052	46	47	48	48
2053	44	45	46	46
2054	42	43	43	43
2055	39	40	41	41
2056	37	38	39	39
2057	35	36	37	37
2058	34	34	35	35
2059	32	33	33	33
2060	30	31	31	31
2061 TO 2120	528	532	386	541
TOTAL	4.889	5.046	5.030	5.185

Table IV-1-1 (7) Present Value of Benefits

(mil. US$)

base year : 2010

social discount rate : 9%

Year	Case 150.000DWT	200.000DWT	250.000DWT(a)	250.000DWT(b)
2020	233	243	251	251
2021	219	228	235	235
2022	205	214	221	221
2023	193	201	207	207
2024	181	188	194	194
2025	170	177	183	183
2026	160	166	171	171
2027	150	156	161	161
2028	141	146	151	151
2029	133	137	142	142
2030	124	129	133	133
2031	117	121	125	125
2032	110	114	117	117
2033	103	107	110	110
2034	97	100	103	103
2035	91	94	97	97
2036	86	88	91	91
2037	80	83	85	85
2038	75	78	80	80
2039	71	73	75	75
2040	67	69	70	70
2041	63	64	66	66
2042	59	61	62	62
2043	55	57	58	58
2044	52	53	55	55
2045	49	50	51	51
2046	46	47	48	48
2047	43	44	45	45
2048	40	41	42	42
2049	38	39	40	40
2050	36	37	37	37
2051	33	34	35	35
2052	31	32	33	33
2053	30	30	31	31
2054	28	28	29	29
2055	26	27	27	27
2056	25	25	26	26
2057	23	23	24	24
2058	22	22	22	22
2059	20	21	21	21
2060	19	19	20	20
2061 TO 2120	288	291	217	296
TOTAL	3.830	3.959	3.993	4.071

Table IV-1-2 (1) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 3%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	71	70
2006	0	0	0	0	69	68
2007	0	0	0	0	63	62
2008	0	0	0	0	285	285
2009	0	0	114	114	2.319	2.348
2010	105	105	110	110	681	749
2011	102	102	191	191	877	881
2012	206	206	1.087	1.087	786	869
2013	680	680	583	583	745	809
2014	593	593	803	803	690	708
2015	738	753	723	730	561	491
2016	668	717	896	919	626	557
2017	853	900	705	726	665	630
2018	417	463	362	383	725	684
2019	302	347	54	74	745	702
2020	94	94	101	101	124	103
2021	92	92	98	98	120	100
2022	89	89	95	95	116	97
2023	86	86	93	93	113	94
2024	84	84	90	98	110	91
2025	82	82	87	109	107	89
2026	79	79	85	105	103	86
2027	77	77	82	102	100	83
2028	75	75	80	99	98	81
2029	72	80	78	78	95	79
2030	70	89	75	75	92	76
2031	68	86	73	73	89	74
2032	66	84	71	71	87	72
2033	64	81	69	69	84	70
2034	62	62	67	67	82	68
2035	61	61	65	65	79	66
2036	59	59	63	63	77	64
2037	57	57	61	61	75	62
2038	56	56	59	59	73	60
2039	54	54	58	58	70	59
2040	52	52	56	56	68	57
2041	51	51	54	54	66	55
2042	49	49	53	53	64	54
2043	48	48	51	51	63	52
2044	46	46	50	50	61	51
2045	45	45	48	48	59	49
2046	44	44	47	47	57	48
2047	43	43	78	52	56	46
2048	41	41	53	51	54	45
2049	40	40	51	43	52	44
2050	39	45	50	42	51	42
2051	38	44	48	40	49	41
2052	66	57	39	61	48	40
2053	113	98	106	106	47	39
2054	110	96	112	103	45	38
2055	107	93	109	100	66	49
2056	104	90	106	97	147	82
2057	32	32	42	34	143	80
2058	31	31	33	33	138	77
2059	30	30	32	32	134	75
2060	42	42	45	45	50	42
2061 TO 2120	1.168	1.168	1.237	1.237	1.395	1.174
TOTAL	8.450	8.676	9.679	9.795	14.714	13.768

Table IV-1-2 (2) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 4%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	74	74
2006	0	0	0	0	71	71
2007	0	0	0	0	65	64
2008	0	0	0	0	291	291
2009	0	0	115	115	2.342	2.371
2010	105	105	110	110	681	749
2011	101	101	189	189	868	872
2012	202	202	1.066	1.066	770	853
2013	661	661	566	566	723	786
2014	570	570	773	773	664	681
2015	703	718	689	696	534	468
2016	630	676	846	867	591	525
2017	797	841	659	679	622	589
2018	386	429	335	354	671	633
2019	277	318	49	68	683	644
2020	86	86	92	92	112	93
2021	82	82	88	88	108	90
2022	79	79	85	85	104	86
2023	76	76	82	82	100	83
2024	73	73	79	85	96	80
2025	71	71	76	94	92	77
2026	68	68	73	90	89	74
2027	65	65	70	87	85	71
2028	63	63	67	84	82	68
2029	60	67	65	65	79	66
2030	58	73	62	62	76	63
2031	56	70	60	60	73	61
2032	54	68	57	57	70	58
2033	52	65	55	55	67	56
2034	50	50	53	53	65	54
2035	48	48	51	51	62	52
2036	46	46	49	49	60	50
2037	44	44	47	47	58	48
2038	42	42	45	45	55	46
2039	41	41	44	44	53	44
2040	39	39	42	42	51	43
2041	38	38	40	40	49	41
2042	36	36	39	39	47	39
2043	35	35	37	37	45	38
2044	33	33	36	36	44	36
2045	32	32	34	34	42	35
2046	31	31	33	33	40	34
2047	30	30	54	36	39	32
2048	29	29	37	35	37	31
2049	28	28	35	29	36	30
2050	26	31	34	28	35	29
2051	25	29	33	27	33	28
2052	44	38	26	41	32	27
2053	75	65	70	70	31	26
2054	72	63	73	67	30	25
2055	69	60	71	65	43	31
2056	66	58	68	62	94	53
2057	20	20	27	22	90	51
2058	19	19	21	21	87	49
2059	19	19	20	20	84	47
2060	26	26	28	28	31	26
2061 TO 2120	589	589	624	624	704	592
TOTAL	7.026	7.243	8.177	8.295	12.960	12.330

Table IV-1-2 (3) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 5%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	78	78
2006	0	0	0	0	74	74
2007	0	0	0	0	66	66
2008	0	0	0	0	296	296
2009	0	0	116	116	2.364	2.393
2010	105	105	110	110	681	749
2011	100	100	187	187	860	864
2012	198	198	1.046	1.046	756	837
2013	642	642	550	550	703	764
2014	549	549	744	744	639	656
2015	670	684	657	663	509	446
2016	595	638	799	819	558	496
2017	746	787	616	635	582	551
2018	357	397	310	328	622	587
2019	254	292	45	62	627	591
2020	78	78	83	83	102	85
2021	74	74	80	80	97	81
2022	71	71	76	76	92	77
2023	67	67	72	72	88	73
2024	64	64	69	74	84	70
2025	61	61	65	81	80	66
2026	58	58	62	78	76	63
2027	55	55	59	74	72	60
2028	53	53	57	70	69	57
2029	50	56	54	54	66	55
2030	48	60	51	51	63	52
2031	46	58	49	49	60	50
2032	43	55	46	46	57	47
2033	41	52	44	44	54	45
2034	39	39	42	42	51	43
2035	38	38	40	40	49	41
2036	36	36	38	38	47	39
2037	34	34	36	36	44	37
2038	32	32	35	35	42	35
2039	31	31	33	33	40	34
2040	29	29	31	31	38	32
2041	28	28	30	30	37	30
2042	27	27	29	29	35	29
2043	25	25	27	27	33	28
2044	24	24	26	26	32	26
2045	23	23	25	25	30	25
2046	22	22	23	23	29	24
2047	21	21	38	26	27	23
2048	20	20	25	24	26	22
2049	19	19	24	20	25	21
2050	18	21	23	19	24	20
2051	17	20	22	18	22	19
2052	29	25	18	27	21	18
2053	49	43	46	46	20	17
2054	47	41	48	44	19	16
2055	45	39	46	42	28	20
2056	43	37	44	40	61	34
2057	13	13	17	14	58	32
2058	12	12	13	13	55	31
2059	12	12	12	12	52	29
2060	16	16	17	17	19	16
2061 TO 2120	305	305	324	324	365	307
TOTAL	6.082	6.287	7.182	7.297	11.805	11.374

Table IV-1-2 (4) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 6%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	82	81
2006	0	0	0	0	77	77
2007	0	0	0	0	68	68
2008	0	0	0	0	302	302
2009	0	0	117	117	2.387	2.416
2010	105	105	110	110	681	749
2011	99	99	185	185	852	856
2012	194	194	1.027	1.027	742	821
2013	624	624	535	535	683	743
2014	528	528	716	716	615	631
2015	639	652	626	632	486	425
2016	562	603	755	773	527	469
2017	698	736	576	594	544	515
2018	331	368	287	304	576	544
2019	233	268	41	57	575	542
2020	71	71	76	76	93	77
2021	67	67	72	72	87	73
2022	63	63	68	68	82	69
2023	60	60	64	64	78	65
2024	56	56	60	65	73	61
2025	53	53	57	71	69	58
2026	50	50	54	67	65	54
2027	47	47	51	63	62	51
2028	44	44	48	59	58	48
2029	42	46	45	45	55	46
2030	40	50	42	42	52	43
2031	37	47	40	40	49	41
2032	35	44	38	38	46	38
2033	33	42	36	36	43	36
2034	31	31	34	34	41	34
2035	30	30	32	32	39	32
2036	28	28	30	30	36	30
2037	26	26	28	28	34	29
2038	25	25	27	27	32	27
2039	23	23	25	25	31	25
2040	22	22	24	24	29	24
2041	21	21	22	22	27	23
2042	20	20	21	21	26	21
2043	19	19	20	20	24	20
2044	18	18	19	19	23	19
2045	17	17	18	18	22	18
2046	16	16	17	17	20	17
2047	15	15	27	18	19	16
2048	14	14	18	17	18	15
2049	13	13	17	14	17	14
2050	12	14	16	13	16	13
2051	12	13	15	12	15	13
2052	20	17	12	18	14	12
2053	33	29	31	31	14	11
2054	31	27	32	29	13	11
2055	29	26	30	27	18	13
2056	28	24	28	26	39	22
2057	8	8	11	9	37	21
2058	8	8	8	8	35	20
2059	7	7	8	8	33	18
2060	10	10	11	11	12	10
2061 TO 2120	162	162	172	172	194	163
TOTAL	5.410	5.602	6.474	6.585	10.990	10.691

Table IV-1-2 (5) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 7%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	85	85
2006	0	0	0	0	80	80
2007	0	0	0	0	70	70
2008	0	0	0	0	308	308
2009	0	0	118	118	2.409	2.439
2010	105	105	110	110	681	749
2011	98	98	184	184	844	848
2012	190	190	1.007	1.007	728	806
2013	606	606	520	520	664	722
2014	509	509	689	689	593	608
2015	610	623	598	603	464	406
2016	531	570	713	731	498	443
2017	653	690	540	556	510	483
2018	307	342	267	282	535	504
2019	214	246	38	53	529	498
2020	65	65	69	69	84	70
2021	60	60	65	65	79	66
2022	56	56	60	60	74	61
2023	53	53	56	56	69	57
2024	49	49	53	57	64	54
2025	46	46	49	61	60	50
2026	43	43	46	57	56	47
2027	40	40	43	54	53	44
2028	38	38	40	50	49	41
2029	35	39	38	38	46	38
2030	33	41	35	35	43	36
2031	31	39	33	33	40	33
2032	29	36	31	31	37	31
2033	27	34	29	29	35	29
2034	25	25	27	27	33	27
2035	23	23	25	25	31	25
2036	22	22	23	23	29	24
2037	20	20	22	22	27	22
2038	19	19	20	20	25	21
2039	18	18	19	19	23	19
2040	17	17	18	18	22	18
2041	16	16	17	17	20	17
2042	15	15	16	16	19	16
2043	14	14	15	15	18	15
2044	13	13	14	14	17	14
2045	12	12	13	13	16	13
2046	11	11	12	12	15	12
2047	10	10	19	13	14	11
2048	10	10	12	12	13	11
2049	9	9	12	10	12	10
2050	8	10	11	9	11	9
2051	8	9	10	8	10	9
2052	13	11	8	12	10	8
2053	22	19	21	21	9	8
2054	21	18	21	19	8	7
2055	19	17	20	18	12	9
2056	18	16	18	17	25	14
2057	5	5	7	6	24	13
2058	5	5	5	5	22	12
2059	5	5	5	5	21	12
2060	6	6	7	7	8	6
2061 TO 2120	88	88	93	93	105	89
TOTAL	4.902	5.081	5.940	6.044	10.383	10.176

Table IV-1-2 (6) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 8%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	90	89
2006	0	0	0	0	83	83
2007	0	0	0	0	72	72
2008	0	0	0	0	314	313
2009	0	0	119	119	2,432	2,462
2010	105	105	110	110	681	749
2011	98	98	182	182	836	840
2012	187	187	989	989	714	791
2013	590	590	506	506	646	702
2014	490	490	664	664	571	586
2015	582	594	570	576	442	387
2016	503	539	674	691	471	419
2017	612	646	506	521	478	452
2018	285	317	248	262	496	468
2019	197	226	35	48	486	458
2020	59	59	63	63	77	64
2021	54	54	58	58	71	59
2022	50	50	54	54	66	55
2023	47	47	50	50	61	51
2024	43	43	46	50	57	47
2025	40	40	43	53	52	44
2026	37	37	40	49	48	40
2027	34	34	37	46	45	37
2028	32	32	34	42	42	35
2029	29	33	32	32	38	32
2030	27	34	29	29	36	30
2031	25	32	27	27	33	27
2032	23	29	25	25	31	25
2033	22	27	23	23	28	24
2034	20	20	21	21	26	22
2035	19	19	20	20	24	20
2036	17	17	18	18	22	19
2037	16	16	17	17	21	17
2038	15	15	16	16	19	16
2039	14	14	15	15	18	15
2040	13	13	14	14	16	14
2041	12	12	13	13	15	13
2042	11	11	12	12	14	12
2043	10	10	11	11	13	11
2044	9	9	10	10	12	10
2045	9	9	9	9	11	9
2046	8	8	9	9	10	9
2047	7	7	13	9	10	8
2048	7	7	9	8	9	7
2049	6	6	8	7	8	7
2050	6	7	7	6	8	6
2051	5	6	7	6	7	6
2052	9	8	5	8	7	5
2053	15	13	14	14	6	5
2054	14	12	14	13	6	5
2055	13	11	13	12	8	6
2056	12	10	12	11	17	9
2057	3	3	5	4	15	9
2058	3	3	3	3	14	8
2059	3	3	3	3	13	7
2060	4	4	4	4	5	4
2061 TO 2120	49	49	52	52	58	49
TOTAL	4,500	4,665	5,517	5,615	9,910	9,769

Table IV-1-2 (7) Present Value of Costs

(mil. US$)

base year : 2010

social discount rate : 9%

Year	150.000DWT		200.000DWT		250.000DWT	
	(Ave. Year)	(Dry Year)	(Ave. Year)	(Dry Year)	(d)	(e)
2005	0	0	0	0	94	94
2006	0	0	0	0	86	86
2007	0	0	0	0	74	74
2008	0	0	0	0	319	319
2009	0	0	120	120	2.454	2.485
2010	105	105	110	110	681	749
2011	97	97	180	180	828	832
2012	184	184	971	971	701	776
2013	574	574	492	492	628	683
2014	473	473	640	640	550	565
2015	556	567	545	550	423	370
2016	476	510	638	654	446	396
2017	574	606	474	489	448	424
2018	265	294	230	243	461	435
2019	182	208	32	44	448	422
2020	54	54	57	57	70	58
2021	49	49	53	53	64	53
2022	45	45	48	48	59	49
2023	41	41	44	44	54	45
2024	38	38	41	44	50	41
2025	35	35	37	46	46	38
2026	32	32	34	43	42	35
2027	29	29	31	39	38	32
2028	27	27	29	36	35	29
2029	25	27	26	26	32	27
2030	23	29	24	24	30	25
2031	21	26	22	22	27	23
2032	19	24	20	20	25	21
2033	17	22	19	19	23	19
2034	16	16	17	17	21	17
2035	15	15	16	16	19	16
2036	14	14	14	14	18	15
2037	12	12	13	13	16	13
2038	11	11	12	12	15	12
2039	10	10	11	11	14	11
2040	10	10	10	10	13	10
2041	9	9	9	9	11	10
2042	8	8	9	9	11	9
2043	7	7	8	8	10	8
2044	7	7	7	7	9	7
2045	6	6	7	7	8	7
2046	6	6	6	6	7	6
2047	5	5	10	6	7	6
2048	5	5	6	6	6	5
2049	4	4	6	5	6	5
2050	4	5	5	4	5	4
2051	4	4	5	4	5	4
2052	6	5	4	6	4	4
2053	10	9	9	9	4	3
2054	9	8	9	9	4	3
2055	8	7	9	8	5	4
2056	8	7	8	7	11	6
2057	2	2	3	2	10	6
2058	2	2	2	2	9	5
2059	2	2	2	2	8	5
2060	2	2	3	3	3	3
2061 TO 2120	27	27	29	29	33	28
TOTAL	4.170	4.323	5.170	5.260	9.529	9.437

IV-2 Cost-Benefit Ratio and Internal Rate of Return

(1) Calculation Result

The cost-benefit ratio (CBR) and a rough estimation of the internal rate of return (IRR) for the alternative canals are summarized in Table IV-2-1.

Table IV-2-1 Economic Efficiency of Alternative Canals

(million US$)

Alternatives	C B R								Estimated IRR
	undiscounted	3%	4%	5%	6%	7%	8%	9%	
High-Rise- Lock	220,865	30,971	18,982	12,507	8,751	6,422	4,889	3,830	
150,000DWT	23,035	8,450	7,026	6,082	5,410	4,902	4,500	4,170	8.5%
(Average)	9.59	3.67	2.70	2.06	1.62	1.31	1.09	0.92	
High-Rise- Lock	220,865	30,971	18,982	12,507	8,751	6,422	4,889	3,830	
150,000DWT	23,230	8,676	7,243	6,287	5,602	5,081	4,665	4,323	8.3%
(Dry Year)	9.51	3.57	2.62	1.99	1.56	1.26	1.05	0.89	
High-Rise- Lock	219,879	31,405	19,350	12,806	8,990	6,614	5,046	3,959	
200,000DWT	25,117	9,679	8,177	7,182	6,474	5,940	5,517	5,170	7.6%
(Average)	8.75	3.24	2.37	1.78	1.39	1.11	0.91	0.77	
High-Rise- Lock	219,879	31,405	19,350	12,806	8,990	6,614	5,046	3,959	
200,000DWT	25,153	9,795	8,295	7,297	6,585	6,044	5,615	5,260	7.5%
(Dry Year)	8.74	3.21	2.33	1.75	1.37	1.09	0.90	0.75	
Sea Level	127,527	25,082	16,703	11,713	8,564	6,476	5,030	3,993	
Case(a)	32,642	14,714	12,960	11,805	10,990	10,383	9,910	9,529	5.0%
(Average)	3.91	1.70	1.29	0.99	0.78	0.62	0.51	0.42	
Sea Level	227,304	32,201	19,833	13,129	9,224	6,791	5,185	4,071	
Case(b)	28,419	13,768	12,330	11,374	10,691	10,176	9,769	9,437	5.5%
(Average)	8.00	2.34	1.61	1.15	0.86	0.67	0.53	0.43	

Upper : Total Present Benefits
Middle : Total Present Costs
Lower : Cost-Benefit Ratio

Alternatives except Sea Level Case(a) have CBRs over 1.0 (1.15-2.06) at 5% of social discount rate. If 6% of social discount rate is adopted, CBRs of Sea Level Case(b) will also become under 1.0.

Estimated IRR in Table IV-2-1 shows that 150,000DWT canal has IRRs over 8% and 200,000DWT has IRRs around 7.5%, while Sea Level Canal has IRRs 5 to 5.5%.

Table IV-2-2 Cost-Benefit Ratio for 2 lanes option

(For information)

(million US$)

Alternatives	C B R							Estimated IRR
	3%	4%	5%	6%	7%	8%	9%	
High-Rise- Lock	30,971	18,982	12,507	8,751	6,422	4,889	3,830	
150.000DWT	10,118	8,614	7,595	6,852	6,278	5,813	5,425	7.1%
(Average)	3.06	2.20	1.65	1.28	1.02	0.84	0.71	
High-Rise- Lock	30,971	18,982	12,507	8,751	6,422	4,889	3,830	
150.000DWT	10,344	8,830	7,799	7,043	6,455	5,978	5,578	7.0%
(Dry Year)	2.99	2.15	1.60	1.24	0.99	0.82	0.69	
High-Rise- Lock	31,405	19,350	12,806	8,990	6,614	5,046	3,959	
200.000DWT	11,562	9,979	8,908	8,130	7,530	7,045	6,639	6.5%
(Average)	2.72	1.94	1.44	1.11	0.88	0.72	0.60	
High-Rise- Lock	31,405	19,350	12,806	8,990	6,614	5,046	3,959	
200.000DWT	11,680	10,099	9,026	8,243	7,636	7,144	6,731	6.4%
(Dry Year)	2.69	1.92	1.42	1.09	0.87	0.71	0.59	
Sea Level	32,338	19,881	13,146	9,230	6,794	5,186	4,071	
Case(a)	17,035	15,203	13,975	13,095	12,427	11,898	11,465	4.8%
(Average)	1.90	1.31	0.94	0.70	0.55	0.44	0.36	
Sea Level	32,338	19,881	13,146	9,230	6,794	5,186	4,071	
Case(b)	15,500	14,018	13,022	12,303	11,753	11,315	10,954	5.0%
(Average)	2.09	1.42	1.01	0.75	0.58	0.46	0.37	
Sea Level	32,338	19,881	13,146	9,230	6,794	5,186	4,071	
Case(c)	17,806	15,915	14,648	13,737	13,046	12,499	12,050	4.7%
(Average)	1.82	1.25	0.90	0.67	0.52	0.41	0.34	

Upper : Total Present Benefits

Middle : Total Present Costs

Lower : Cost-Benefit Ratio

Table IV-2-2 shows the cost-benefit ratio for 2 lane options. The SQ canal capacity was assumed to be 17,000 vessels. The cost was derived from the original EAIU study.

As for High-Rise-Lock Canal, benefits of 2 lane option are almost equal to those of 1 lane option because the year when the demand will reach the capacity is almost equal to 2 lane option case. As for Sea Level Canal, however, benefits of 2 lane case is larger than those of 1 lane case because the capacity of 1 lane option is much smaller than that of 2 lane option.

High-Rise-Lock Canal will still be feasible even in these cases with SDR 5%.

IV-3 Economic Feasibility

Judged from CBRs at 5% of social discount rate, all alternatives are feasible.

Table IV-3-1 shows the CBRs in the original EAIU study and this additional EAIU study. It can be found that Sea Level Canal becomes economically feasible in the condition of this additional study.

Table IV-3-1 Comparison of CBR between the Original EAIU Study and This Additional Study

Alternatives	3%	4%	5%	6%	7%
High-Rise Lock 150,000DWT	2.27	1.67	1.27	1.00	0.81
(Average)	3.67	2.70	2.06	1.62	1.31
High-Rise Lock 150,000DWT	2.22	1.63	1.24	0.98	0.79
(Dry Year)	3.57	2.62	1.99	1.56	1.26
High-Rise Lock 200,000DWT	2.05	1.49	1.12	0.88	0.70
(Average)	3.24	2.37	1.78	1.39	1.11
High-Rise Lock 200,000DWT	2.03	1.47	1.11	0.87	0.70
(Dry Year)	3.21	2.33	1.75	1.37	1.09
Sea Level Case (a)	1.44	1.01	0.74	0.56	0.44
(Average)	1.70	1.29	0.99	0.78	0.62
Sea Level Case (b)	1.48	1.02	0.73	0.55	0.43
(Average)	2.34	1.61	1.15	0.86	0.67

Upper : the original EAIU Study
Lower : the additional EAIU Study

Comisión de Estudio
de las Alternativas
al Canal de Panamá
CENTRO DE INFORMACION

INFORME FINAL

COMPONENTE DEL ESTUDIO

ANALISIS DE IMPACTOS SOBRE PANAMA

APENDICE C. FE DE ERRATA Y CUADROS ADICIONALES

APENDICE C. FE DE ERRATAS Y CUADROS ADICIONALES

I. INTRODUCCION

Página I-5, último párrafo, penúltima línea, "119 distritos" deberá leerse 16 distritos.

II. IMPACTO ECONOMICO

Página II-1 2.0.2.3. En vez de ... Yachiyo Engineering Co. (YEC) ... deberá leerse Mitsubishi Research Institute ...

Página II-3 (y otros) Substituir PIB con PNB. El PNB no aparece en la contabilidad nacional de Panamá, siendo la razón principal para ello la dificultad de obtener ingresos de factores panameños en el exterior, ya que no existe una obligación legal ni fiscal de declarar ingresos provenientes de fuentes extranjeras.

Página II-6 Los antecedentes utilizados para estimar la producción real por trabajador (en precios de 1992) se resumen en las dos tablas siguientes. Una de las tablas indica la producción por trabajador en precios de 1970 en algunos sectores de actividades, de acuerdo con cifras oficiales. La otra tabla indica el cambio en porcentaje de la producción real por trabajador para los mismos sectores.

La producción por trabajador en precios de 1992 se calculó al multiplicar las cifras de la primera tabla por 2.75, lo cual representa el aumento en el deflactor implícito del PIB entre 1970 y 1992.

Se calculó el promedio de los valores de 1992, ponderado por los valores de las demandas sectoriales, y éste se utilizó para estimar la creación de empleos. Este promedio es de US$7,400.

El supuesto de una producción constante por trabajador puede ser optimista. Tal como lo indica la tabla, las cifras recientes indican una disminución en la producción real por trabajador en los últimos cinco años.

PRODUCCION POR TRABAJADOR
(1987 - 1989, 1991 - 1992)

Sector	1987	1988	1989	1991	1992(p)
Sector Primario	1,177	1,007	1,021	1,167	1,132
Minería	4,770	5,466	5,396	4,365	2,036
Industria Manufacturera	2,600	2,352	2,224	2,719	2,686
Comercio y Servicios	-	-	-	-	3,331
Servicios Públicos	9,048	8,221	7,680	9,223	8,780
Construcción	2,676	1,707	1,130	2,802	2,735

Fuente: INDESA, Basado en la Contraloría General de la República, "Encuestas de Hogares".

TASA DE CRECIMIENTO DE LA PRODUCCION POR TRABAJADOR
(1987 - 1989, 1991 - 1992)

Sector	88/87	89/88	91/89	92/91
Sector Primario	-14.4	1.4	14.3	-3.0
Minería	14.6	-1.3	-19.1	-53.4
Industria Manufacturera	-9.5	-5.4	22.3	-1.2
Servicios Públicos	-9.1	-6.6	20.1	-4.8
Construcción	-36.2	-33.8	148.0	-2.4

Fuente: INDESA, Basado en la Contraloría General de la República, "Encuestas de Hogares".

Página II-24 2.3.7.3. Los cálculos son los siguientes: US$74 millones son el resultado obtenido al dividir US$1,086 millones (impacto directo del Canal a Nivel - Opción A, de acuerdo con el resumen de la página II-26) entre 14.5 años de construcción. US$82 millones son el resultado obtenido al dividir US$844.5 millones del impacto monetario directo para el Canal de Esclusas de Nivel Alto - 150,000 (véase la misma referencia) entre aproximadamente 10.5 años de construcción.

Página II-27 0.95% es el aumento promedio en el PIB anual durante el período de construcción. El valor agregado es un valor total durante la construcción (10 años, en el caso del Canal de Esclusas de Nivel Alto - 150,000), que se deberá convertir a cifras anuales promedio, y que deberá dividirse entre el PIB real promedio durante el período (no el año base). El resultado aproximado es (70.8)/(7,446.8) = 0.95%.

Página II-27 (CUADRO II-3) Valor agregado + Compras Intermedias = Valor Bruto de Producción. Cambio en el valor agregado = Cambio en el PIB. Cambio en el valor agregado real / número de años es aproximadamente igual al aumento anual en el PIB real. Dicho valor se divide entre el PIB real promedio, suponiendo un crecimiento de 3.5%. Es un cálculo sencillo.

El valor agregado y las compras intermedias no deben sumarse para obtener el PIB.
Los porcentajes diez veces más altos que los que se calcularon en la tabla son errores tipográficos.

Los resultados pueden parecer "mínimos" en función del porcentaje de crecimiento inducido por la construcción. Se deben considerar dos elementos: (1) la parte mayor de las compras extranjeras en cualquiera de las dos alternativas; y (2) la alta tendencia de importar en la demanda inducida por la construcción.

Página II-28 En realidad no hay razón alguna para descontar los impactos. El ejercicio se efectuó únicamente para obtener una sola cifra para las diferentes alternativas. En vista de que los impactos se calcularon para un período de 40 años, una alternativa factible para comparar las cifras de flujo sería convertirlas en cifras "de valores" al descontarlas a una tasa determinada.

¿Por qué se tiene una tasa de descuento de 6%? La aplicación de una tasa es más o menos arbitraria. Sin embargo, se deben tener en cuenta algunos principios:

(a) Si la economía local proporciona el financiamiento del proyecto, la tasa de descuento deberá ser igual a la media ponderada del total bruto de los impuestos de la productividad marginal del capital y la preferencia de

tiempo personal del importe neto de los impuestos. Los "pesos" deben ser iguales a la proporción de los fondos provenientes de la "desviación de la inversión" y de la "desviación de ahorros" en la economía local, respectivamente. (Ver Harberger, "On the Social Opportunity Cost of Capital).

(b) Si las fuentes externas proporcionan el financiamiento del proyecto a la economía local, la tasa de descuento deberá ser igual al costo financiero promedio del capital del proyecto específico.

En el caso (a), utilizamos estas tasas de 1990: 8% como la productividad marginal del capital y 4% como la preferencia de tiempo de los consumidores (igual a la tasa de la libreta de ahorros). Luego, con un peso de 50-50, la tasa de descuento es de 6%.

En el caso (b), utilizamos los datos del Informe de Nathan and Associates (Tabla 6-1), página 6-12. La tasa promedio es de aproximadamente 6%.

A propósito, el empleo de una tasa diferente (menor o mayor) hubiera cambiado el valor actual indicado en la tabla, pero no hubiera alterado el hecho de que las opciones del Canal a Nivel tienen un impacto mayor durante la operación que las opciones del Canal de Esclusas de Nivel Alto.

Las opciones "con" dividendos se obtienen de un esquema de financiamiento propuesto (ver Nathan and Associates, Tablas 6-10 y 6-22 para ejemplo) y no de una fuente de operaciones pura. Los dividendos son tan altos en las opciones del Canal de Esclusas de Nivel Alto - comparados con "sin dividendos" en las opciones del Canal a Nivel -- que el valor actual de los impactos calculados con dividendos distorsionaría los resultados. Recalqué el hecho de que las cifras de dividendos son el resultado de una estrategia financiera determinada, pero si dicha estrategia cambiara en el día de mañana, también cambiarían los resultados de la evaluación. Traté de usar datos de impactos "sólidos" para calcular este valor actual.

Página II-29 2.4.6. El punto que se comenta aquí requiere una corrección metodológica: por supuesto, la productividad de la mano de obra es de suma importancia al proyectar la creación de empleos inducida por la producción directa e indirecta.

La metodología utilizada en el trabajo y acordada por MRI (la aplicación de una matriz de coeficientes de insumo y producción fija) permite la estimación del nivel de producción inducido por un aumento inicial en la demanda (en este caso la construcción del ensanche del Canal).

La pregunta es: ¿Cómo se calcula el total de empleos generados por el proyecto (directa más indirecta)?

El cálculo es el siguiente: Si Y es el aumento en la producción causado por efectos indirectos, y LP = la producción real por trabajador (productividad de la mano de obra), luego la creación de empleos,

E es:

$E = Y . (E/ Y)$

ó $E = Y . 1/LP = Y/LP$

Se calculó E al estimar Y a partir de los efectos totales, utilizando la matriz de insumo y producción y tomando LP de los datos históricos mostrados arriba.

Cuadro II-A-24 El cuadro correcto aparece como el cuadro Núm. 17. El Canal a Nivel (Caso A) no incluye los pagos de dividendo.

Cuadro No.17
Resumen de Ingresos a Panamá Durante la Operación del Canal a Nivel - Caso A
Autoridad del Canal de Panamá y Sistema Optimo de Tarifas
(En millones de dólares de 1990)

Años	Costos de Operación y Mantenimiento Correspondiente a Panamá (1)	Pagos al Gobierno por Concepto de Regalías (2)	Total de Ingresos a la Economía (3)	Distribución de Ingresos % al Gobierno (4)
2020	58.7	27.4	86.1	31.8%
2021	58.9	28.7	87.6	32.7%
2022	59.4	29.8	89.1	33.4%
2023	59.8	30.9	90.6	34.1%
2024	60.2	32.0	92.2	34.7%
2025	60.6	33.1	93.7	35.3%
2026	61.0	34.2	95.2	35.9%
2027	61.4	35.3	96.8	36.5%
2028	61.8	36.5	98.3	37.1%
2029	62.2	37.6	99.9	37.7%
2030	62.7	38.8	101.5	38.3%
2031	63.1	40.0	103.1	38.8%
2032	63.5	41.2	104.7	39.3%
2033	63.9	42.4	106.3	39.9%
2034	64.3	43.6	107.9	40.4%
2035	64.7	44.8	109.5	40.9%
2036	65.1	46.1	111.2	41.4%
2037	65.5	47.3	112.8	41.9%
2038	65.9	48.6	114.5	42.4%
2039	66.3	49.8	116.2	42.9%
2040	66.8	51.1	117.9	43.4%

Cuadro No.17 (CONT.)
Resumen de Ingresos a Panamá Durante la Operación del Canal a Nivel - Caso A
Autoridad del Canal de Panamá y Sistema Optimo de Tarifas
(En millones de dólares de 1990)

Años	Costos de Operación y Mantenimiento Correspondiente a Panamá (1)	Pagos al Gobierno por Concepto de Regalías (2)	Total de Ingresos a la Economía (3)	Distribución de Ingresos % al Gobierno (4)
2041	67.2	52.4	119.6	43.8%
2042	67.6	53.7	121.3	44.3%
2043	68.0	55.0	123.0	44.7%
2044	68.4	56.4	124.7	45.2%
2045	68.8	57.7	126.5	45.6%
2046	69.2	59.1	128.3	46.0%
2047	69.6	60.4	130.0	46.5%
2048	70.0	61.8	131.8	46.9%
2049	70.4	63.2	133.6	47.3%
2050	70.8	64.6	135.4	47.7%
2051	71.2	66.0	137.3	48.1%
2052	71.6	67.5	139.1	48.5%
2053	72.0	68.9	140.9	48.9%
2054	72.5	70.4	142.8	49.3%
2055	72.8	71.8	144.7	49.7%
2056	73.3	73.3	146.6	50.0%
2057	73.7	74.8	148.5	50.4%
2058	74.0	76.4	150.4	50.8%
2059	74.5	77.9	152.4	51.1%
2060	65.4	81.9	147.3	55.6%

(1)Elaborada con base en los datos de los Cuadros No. 1 y 2
(2) Cuadro No.3, Columna (5)
(3) Suma de Columnas (1) y (2)

III. IMPACTO SOCIOCULTURAL E IMPACTO SOBRE LA POBLACION

Generalidades: Los términos de referencia en los objetivos del estudio establecen que se deben "calificar y cuantificar" los probables efectos e impactos en la medida que sea posible. Los términos de referencia requirieron los análisis de estudio desarrollados de la información disponible. El Informe Final incluye las proyecciones demográficas elaboradas especialmente para este estudio por Booz•Allen & Hamilton, Inc. Dichas proyecciones se incluyen en los Cuadros III-A-7 y III-A-8 del apéndice.

Las proyecciones se desarrollaron a partir de datos censales y al emplear las siguientes hipótesis:

a) Tasa de crecimiento baja. Se calculó una tasa de crecimiento de 10% en las tendencias calculadas sin tener en cuenta las alternativas al Canal para los distritos afectados directamente por la construcción del Canal a Nivel.

b) Tasa de crecimiento alta. Se calculó una tasa de crecimiento de 25% en las tendencias sin tener en cuenta las alternativas al Canal para los distritos directamente afectados por la construcción del Canal a Nivel.

- En el cálculo de estas tasas de crecimiento, se tomaron en consideración los efectos de las obras principales realizadas en el país. Por ejemplo:

  - El distrito de Portobelo. La construcción de carreteras aumentó la población cuatro veces.

  - El distrito de Chepo. La construcción de la carretera del Darién y la construcción de la Represa de Bayano duplicó la población.

  - El distrito de Santa Isabel. La carretera a Nombre de Dios duplicó la población.

Para las alternativas del Canal de Esclusas de Nivel Alto, las tendencias relevantes son las actuales, ya que su efecto sobre los distritos será mínimo.

Página I-7 De hecho, la Región Interoceánica es mayor en tamaño que la Región Metropolitana, ya que la Región Interoceánica incluye la Cuenca, que a su vez incluye los lechos fluviales que están situados en otras provincias.

Página III-1 3.0.1 Cualesquier criterios, supuestos o análisis de los impactos de población y socioculturales tienen un componente político.

Página III-4 Además del párrafo 3.0.3.1.2: El Cuadro III-A-7 presenta una proyección demográfica para la Región Metropolitana, incluyendo una tasa de crecimiento de 10% por encima de la tendencia media. Algunos distritos con mayor crecimiento durante los períodos censales de 1970-1980 y 1980-1990 se ajustaron para reflejar el crecimiento mayor a partir de las tendencias anticipadas durante dicho período. Estos distritos son: Arraiján, La Chorrera, Panamá y San Miguelito. Aun cuando estos distritos no tendrán la misma tasa de crecimiento en el futuro, ya que el espacio físico disponible es muy limitado.

Por otra parte, 10 distritos adicionales se verán afectados por un nuevo crecimiento. Donoso se prevé como un distrito que recibe una población que se traslada de algunos corregimientos de Chagres. Portobelo mantendrá la tendencia de crecimiento estimada originalmente, ya que no quedará afectada por las alternativas al Canal.

El Cuadro III-A-8 presenta la estimación de la población de la Región Metropolitana con un crecimiento de 25% por encima de la tendencia estimada (Canal a Nivel) y con un crecimiento de 10% para los distritos antes mencionados.

Los Cuadros III-A-9 a III-A-12 presentan las estimaciones de las tendencias de crecimiento de la población para los distritos de Donoso, Chagres, Arraiján y La Chorrera desde 1960 hasta 2030, desglosadas por corregimiento. Estos distritos serán los más afectados por el Canal a Nivel.

Página III-4 El Párrafo 3.0.3.1.4 deberá leer "Identificación de sitios arqueológicos e históricos". Se debe eliminar la frase, "A fin de facilitar y reubicar a aquellos que quedarán afectados por la construcción".

Página III-5 Existe una diferencia entre la Región Metropolitana (Provincias de Panamá y Colón) y el Area Metropolitana (Arraiján, Colón, La Chorrera, San Miguelito y Panamá). Estos cinco distritos se refieren al Area. Los datos recalcan el área de mayor población en la Región.

Página III-6 Las cifras de Población de la Figura III-1 no se incluyen debido al hecho de que la discusión se refiere a las localidades. Las cifras y tendencias de la población se indican en el Cuadro III-A-1 hasta III-A-9 del Apéndice al Capítulo III.

Página III-7 La definición del Area Metropolitana se encuentra en el tercer párrafo de la Página III-5

Página III-7 El Párrafo Núm. 1 (véanse los mapas a colores ... proyecciones de 1980 a 2020)" el primer mapa muestra las proyecciones para los años 1980-2000 y el segundo mapa muestra las proyecciones para los años 2000 a 2020.

Página III-9 Párrafo 1, "2030" deberá leer "2020".

Página III-8 Se debe añadir un párrafo que lea: A partir de las cifras para las tendencias de crecimiento de la población por corregimiento y distrito calculadas para la Región Metropolitana, se calcularon diversos escenarios: 10% adicional por encima de la tasa de crecimiento de la tendencia (hipótesis de bajo crecimiento) y un 25% adicional por encima de la tasa de crecimiento de la tendencia (hipótesis de alto crecimiento).

Estos escenarios se escogieron para los corregimientos que quedarán más afectados por el Canal a Nivel. Dentro de estos escenarios no se efectuó un cálculo de aquellos distritos que no quedan afectados directamente por el Canal a Nivel. Con el escenario de un 10%, la población de la Región Metropolitana llegó a 3,245,857 personas, es decir, un incremento de 287,297 habitantes. Con el escenario del 25%, el aumento por encima de la tendencia sería de 712,987 habitantes (véanse los Cuadros III-A-6 a III-A-8).

Página III-10 "de una y de ambas alternativas." deberá leer "cada una de las alternativas". Para el Canal a Nivel, véanse los Cuadros III-A-9 a III-A-12 y para el Canal de Esclusas de Nivel Alto, véanse el III-A-13 y III-A-14.

Página III-12 El Cuadro III-6 debe reemplazarse con el siguiente Cuadro III-6:

TABLA-III-6

ESTIMACIONES DE POBLACION DE LA REGION METROPOLITANA POR PROVINCIA Y DISTRITO SIN CONSTRUCCION DEL CANAL: AÑOS 2000, 2010 AND 2020.

Provincia y Distrito	2000	2010	2020
Región Metropolitana	1,607,298	2,037,293	2,958,560
Provincia de Colón	212,675	270,443	346,605
Distrito de Colón	175,471	218,512	272,110
Distrito de Chagres	10,954	13,036	15,514
Distrito de Portobelo	6,858	7,946	9,205
Distrito de Sta. Isabel	3,471	4,496	5,824
Distrito de Donoso	15,921	26,453	43,952
Provincia de Panamá	1,394,623	1,766,850	2,117,405
Distrito de Arraiján	102,869	155,226	218,961
Distrito de Capira	12,744	48,680	63,843
Distrito de Chame	8,063	23,012	28,359
Distrito de Chepo	41,438	51,010	62,793
Distrito de La Chorrera	120,352	154,061	187,799
Distrito de Panamá	716,809	848,424	955,912
Distrito de San Carlos	14,830	17,676	21,067
Distrito de San Miguelito	333,003	456,294	561,697
Distrito de Taboga	2,191	2,653	3,212
Distrito de Chimán	4,764	7,404	11,506
Distrito de Balboa	2,575	2,410	2,256

Fuente: Preparado por Booz•Allen & Hamilton Inc., 1993

Página III-14 Figura III-7, el número de localidades para la provincia de Panamá indica "321" y debe leer "342".

Página III-16, Ultima línea, 62.6% deberá leer 62.5%.

Página III-17, Primer párrafo, segunda línea, 42.5% deberá leer 45.5%.

Página III-17, Segundo párrafo, última oración. "87.3%" deberá leer 68%.

Página III-19 Esta página fue borrada accidentalmente. A continuación agregamos el contenido de dicha página:

6.7; mientras que en la provincia de Colón es 7.1 y en la provincia de Panamá es de 8.0. Como puede verse en el cuadro III-12, la educación en la Región Metropolitana es también superior a la del resto del país.

CUADRO III-12

ESCUELAS, AULAS, MATRICULA Y DOCENTES
TOTAL DEL PAIS Y LA REGION METROPOLITANA. AÑO 1992

NIVEL Y PROVINCIA	ESCUELAS	AULAS	MATRICULA	DOCENTES
TOTAL	**3,923**	**19,414**	**589,772**	**25,435**
INICIAL	854	1,783	37,464	1,581
PRIMARIA	2,718	12,659	352,595	13,751
MEDIA	351	4,972	199,713	10,103
COLON	**272**	**1,390**	**47,849**	**1,823**
INICIAL	73	91	3,115	113
PRIMARIA	174	875	28,402	967
MEDIA	25	424	16,332	743
PANAMA	**1,122**	**7,912**	**271,839**	**11,425**
INICIAL	397	1,068	21,987	909
PRIMARIA	569	4,325	142,384	5,212
MEDIA	156	2,519	107,468	5,304

Fuente: Ministerio de Educación, Depto de Estadística.

Página III-23 Los asteriscos que se encuentra en el Cuadro III-13 son un error mecanográfico

Página III-A-43-45 La información se refiere a los distritos y no a los corregimientos.

Página III-A-43-44 Debido al hecho de que se han redondeado los decimales en las sumatorias, algunas cifras no representan sumas exactas.

Los siguientes cuadros proporcionan una lista de áreas afectadas por distrito y corregimiento para la construcción del Canal de Esclusas de Nivel Alto y el Canal a Nivel.

AREAS POBLADAS AFECTADAS POR LA CONSTRUCCION DEL CANAL DE ESCLUSAS DE NIVEL ALTO

PROVINCIA DE COLON	PROVINCIA DE PANAMA
DISTRITO DE COLON	DISTRITO DE PANAMA
Corregimiento de Cristóbal Gamboa Gatún	Corregimiento de Ancón Altos de Balboa Balboa La Boca Los Ríos Paraíso Pedro Miguel

AREAS POBLADAS AFECTADAS POR LA CONSTRUCCION DEL CANAL A NIVEL

PROVINCIA DE COLON

DISTRITO DE COLON

Corregimiento de Escobal
La Escoba
La Ullama
Las Cruces
Los Negros

DISTRITO DE CHAGRES

Corregimiento de Chagres
Nuevo Chagres
Santa Fe
Corregimiento de Achiote
Caño Quebrado
Llano Bonito

Corregimiento de Palmas Bellas
La Margarita
Mateo
Palmas Bellas
Pueblo Nuevo
Corregimiento de Piña
Punta Grande
Tarascón

DISTRITO DE DONOSO

Corregimiento de San José del Gral

Corregimiento de Río Indio

Corregimiento de Gobes

Corregimiento de El Guásimo

Corregimiento de Coclé del Norte

Corregimiento de Donoso

PROVINCIA DE PANAMA

DISTRITO DE LA CHORRERA

Corregimiento de Barrio Colón
Limón
Corregimiento de Amador
Caño del Gigante
Gigante
Lagarterita
Tinajones Arriba
Tinajones Abajo
Los Hules Abajo

Corregimiento de El Arado
Cabecera de Bernardino
El Cuipal
El Limón
El Lirio
La Celestina
Loma Alta
Moscú
Naranjal
Río Congo
Río Congo Abajo
Río Viejo
Santa Cruz
Corregimiento de La Represa
Alto del Jobo
Calabacito
Cañito
Caño Quebrado Abajo
Cerro Cañito
El Cuipal
La Laguna
Pueblo Nuevo
Quebrada Lagarto
Río Pescado

AREAS POBLADAS AFECTADAS POR LA CONSTRUCCION DEL CANAL A NIVEL

PROVINCIA DE COLON	PROVINCIA DE PANAMA
DISTRITO DE CHAGRES	Corregimiento de Mendoza Mendoza
Corregimiento de Salud	Corregimiento de Puerto Caimito La Playita Nuevo Puerto Caimito Puerto Caimito Quebrada Rodeo
Corregimiento de Piña	DISTRITO DE ARRAIJAN
Corregimiento de Palmas Bellas	Corregimiento de Vista Alegre
Corregimiento de La Encantada	Corregimiento de Veracruz
Corregimiento de El Guabo	Corregimiento de Santa Clara
Corregimiento de Achiote	Corregimiento de Nuevo Emperador
Corregimiento de Chagres	Corregimiento de Juan D. Arosemena
	Corregimiento de Arraiján

IV. IMPACTO POLITICO

Página IV-2 4.1 ¿Se trata de cuatro supuestos?

Respuesta: Sólo hay cuatro supuestos. La palabra cinco debe cambiarse a cuatro.

Página IV-3. 4.1.4 "Se debe especificar si se trata del Canal a Nivel o el Canal de Esclusas de Nivel Alto".

Respuesta: Si bien la reubicación puede ser una pequeña consideración en cuanto al Canal de Esclusas de Nivel Alto, la suposición es válida para ambas alternativas. Al aceptar esta suposición, la inferencia es que el Gobierno de Panamá tomará las decisiones respecto a la indemnización, independientemente de la alternativa seleccionada.

Página IV-3 4.2.1 "En el alcance se deben incluir las asociaciones cívicas, los gremios y los medios de comunicación".

Respuesta: Mediante los términos empleados en el estudio -- "asociaciones, sindicatos movimientos populares y otros canales" -- se quiso incluir a las asociaciones cívicas, los gremios y los medios de comunicación.

Página IV-4, se deben eliminar las tres líneas superiores.

Página IV-4 4.2.1.2 "Se debe revisar este párrafo porque la legitimidad política se confunde con el sustento político".

Respuesta: Esta definición se emplea adecuadamente y no se debe a una confusión. Los términos "legitimidad política" y "legitimidad moral" suelen confundirse o mal interpretarse tanto en la literatura como en las conversaciones. Por definición, la legitimidad política existe cuando las instituciones sociales y la población de un país aceptan el proceso político y el régimen que está en el poder. Esta aceptación puede ser activa o tácita. Basado en normas internacionales, siempre que las instituciones sociales y la población de un país toleren la situación, el proceso o el régimen se consideran como políticamente legítimos. Un ejemplo extremo de ello es el régimen del Proceso Nacional de Reorganización en Argentina. Durante muchos años, a pesar de la naturaleza moralmente depravada del régimen militar, el Proceso Nacional de Reorganización se consideró como políticamente legítimo; la mayoría de las instituciones sociales y el pueblo de Argentina le dieron un apoyo real o tácito. En muchas formas, la sustentación política, el apoyo a un régimen, sea real o tácito, implica una legitimidad política. En el caso de Panamá, con el carácter frágil de una democracia que se desarrolla nuevamente, la legitimidad política requiere que las instituciones políticas continúen fomentando el apoyo y la aceptación mediante la atención a las necesidades sociales y económicas.

Página IV-7 4.3.2.1
Necesitamos explicaciones adicionales sobre la supervisión nacional o extranjera de las instalaciones, especialmente con relación a la inestabilidad nacional e internacional.

Antes del Tratado de 1903, los medios de transporte transcontinental (por Riel y Vía Acuática) y las actividades/operaciones subsiguientes estuvieron bajo la supervisión de Colombia. Comenzando con el Tratado de 1903, las actividades y operaciones se llevaron a cabo bajo la supervisión extranjera de los EE.UU. Estos hechos fundamentales fueron una base para las negociaciones de los tratados. Además, los tratados que tuvieron éxito parecen basarse en la estabilidad política nacional e internacional al momento de llevarse a cabo las negociaciones de los tratados. No se tuvo la intención de establecer una relación de causa y efecto entre la supervisión extranjera y la estabilidad internacional. Un análisis de las diversas variables/factores sí plantea la idea de que Panamá se ve afectada por los acontecimientos/ circunstancias internacionales de carácter económico y político a un mayor grado de lo que normalmente se esperaría para un país de su tamaño, y este factor podría considerarse en las futuras negociaciones sobre las alternativas al Canal.

Observaciones Generales (en español)

Se ha tratado de racionalizar y mejorar los supuestos. Nuestra inquietud principal al redactar la evaluación del impacto político fue proporcionar las áreas de impacto definitivo y no especular sobre la estructura política actual o futura ni la forma de participación. Este intento nos llevó a desarrollar el análisis en torno a las inquietudes de carácter legal y social que se pueden conocer o predecir en base a las tendencias. Obviamente, tal como se desarrolló en el Capítulo sobre el Impacto Político, los principales impactos ocurrirán durante la movilización y construcción de la alternativa al Canal. Los impactos políticos después de la construcción, o durante las operaciones, sólo se pueden suponer como los que ocurrirían en Panamá si no se construye una alternativa. Estos impactos están relacionados con la capacidad decreciente de Panamá, con el tiempo, como una ruta central para el comercio internacional en el Hemisferio Occidental. Dichos impactos no están relacionados directamente con ninguna de las dos alternativas, sino más bien se refieren a una decisión de no emprender ninguna de las dos alternativas y, por ende, se considera que no deben formar parte de estudio.

Los expertos del Contratista en la materia son de la opinión y confían que la democracia que se desarrolla en Panamá se verá fortalecida por los acontecimientos que tendrán lugar durante los próximos 30 años. Esto ocurrirá con o sin la construcción de una nueva alternativa al Canal.

Resulta importante considerar el hecho de que esto ocurrirá, con o sin la construcción de una nueva alternativa al Canal al responder a la solicitud de la Comisión de que se incluyan comentarios sobre "las nuevas expectativas en ideas políticas", "la participación política de todos los panameños en asuntos del gobierno", "las nuevas fuerzas políticas" y "los programas de los partidos políticos en el futuro". Hoy día y durante los próximos 20 años, Panamá

formulará nuevos programas, políticas y expectativas. Antes del diseño final, la movilización para la construcción y la construcción de una alternativa al Canal en sí, Panamá habrá establecido la base para el futuro político y las nuevas fuerzas políticas para décadas de operaciones.

Todas las indicaciones son que el sistema político panameño madurará democráticamente, evolucionando durante los próximos 20 a 30 años. Sin embargo, dado el reciente retorno al gobierno democrático y el actual fortalecimiento de los procesos democráticos, el estudio no analizó la naturaleza especulativa de la base política futura de Panamá en función de los cambios políticos (nuevos procesos de toma de decisiones, partidos, participación y fuerzas políticas) que evolucionarán sin importar el desarrollo de una alternativa al Canal.

El estudio sí trató de enfocar aquellos aspectos sobre la política panameña que quedarían afectados directa o indirectamente por una decisión de construir una alternativa al Canal. Este enfoque se desarrolló mediante el análisis de acciones pasadas y tendencias actuales o predecibles y nos conduce específicamente a los impactos relacionados con inquietudes de tipo legal y social que afectarán la estructura política y los procesos de toma de decisiones, independientemente de los cambios que puedan o no ocurrir. Al adoptar este enfoque, el estudio se diseñó para ayudar a resaltar aquellas áreas que impedirán u obstaculizarán las opciones políticas, los cambios o la toma de decisiones. Asimismo, el enfoque del estudio proporciona un medio para poner de relieve las diferencias entre las dos alternativas y, por tanto, ofrece a la Comisión algunos mecanismos para evaluar las opciones.

Página IV-6 "El primer párrafo de la página indica "dando lugar a una <u>profunda diferencia</u> entre las dos áreas del territorio nacional". Esta aseveración debe revisarse, ya que no parece existir la necesidad de calificarlo de esa manera.

Respuesta: Estamos de acuerdo con la observación, la palabra "profunda" es técnicamente correcta; no obstante, el significado de la oración puede entenderse mejor mediante el uso de la frase "diferencia específica e identificable ...

Página IV-6. Explicación sobre la supervisión nacional o extranjera de las instalaciones. En los diez (10) casos de los tratados sobre transporte continental y actividades/operaciones subsiguientes, tres (3) casos indican actividades que estuvieron bajo la supervisión nacional de Colombia. Comenzando con el Tratado de 1903, las actividades u operaciones se llevaron a cabo bajo una supervisión extranjera. No existe ninguna implicación específica al eliminar la palabra "nacional" de la versión en español; esto es sólo cuestión de estilo.

Página IV-7 4.4 Substituir la palabra "menguada" por "limitada" y "delicadas" por "importantes".

Página IV-8 4.4.1 Primer párrafo "Se entiende que se harán cambios en la legislación actual" se cambiará por "Se entiende que se requerirán cambios en la legislación actual".

4.4.1.1 Segundo párrafo de la misma página "la fuerza laboral panameña lo percibirá como una amenaza" se cambiará por " la fuerza laboral panameña podría percibirlo como una amenaza"

Página IV-12, el Canal de Esclusas de Nivel Alto *sí* afectará las selvas húmedas. Al colocar las áreas D-4, D-5, D-6, D-7, D-8, D-9 y W-1 en el Mapa V-3 de la página V-38, se indica cómo las selvas húmedas quedarán afectadas por el Canal de Esclusas de Nivel Alto.

V. IMPACTO AMBIENTAL E IMPACTO SOBRE LA GEOGRAFIA

Página V-2, primer párrafo, debe eliminarse" y se consideran como más realistas en cuanto a las proyecciones del tránsito".

Página V-9, punto 5.3.2.1.1. donde dice "canales de acceso subterráneo" debe decir "canales de acceso submarino"

Página V-10, en el último párrafo 717.58 Km debe leer 728.58 Km^2

Página V-18, Sección 5.4.11.2 Sobre 525 millones de Kw, éstas son cifras de PCC para 1990. Para 1992, el consumo fue de 538 millones de Kw.

Se debe eliminar la Página V-41.

VI. IMPACTO SOBRE LAS INFRAESTRUCTURAS

Página VI-9. Bajo Tratamiento y Distribución de Aguas Negras, primer párrafo, última oración, en vez de Matías Hernández, léase Martín Sánchez.

Página VI-28. Primer párrafo, "El Canal a Nivel afectará el sistema de drenaje" deberá leer "El Canal a Nivel no afectará el sistema de drenaje".

Página VI-31. Sección 6.5.8 Represas. Costo de reubicar cada familia de B/50,000 parece exagerado. Revisar.

Respuesta: Tal como se indicó en la Página VI-5, párrafo 6.2.2, el estudio de los impactos incluyó a aquéllos obtenidos del Informe ECE de Yachiyo. La Página IV 3.3-10 del Informe ECE indica lo siguiente:

Costo de Compensación al Reubicar la Vivienda	$10,329,600
Compensación	$ 3,228,000

Al utilizar estas dos cifras, el Costo Estimado Total es de $13,557,600

La Página IV 1.11-3 del Informe ECE indica lo siguiente:

Unidades de vivienda que deben trasladarse	135
Unidades industriales que deben trasladarse	2
Unidades de restaurantes que deben trasladarse	1

Al utilizar estas cifras, existe un total de 138 unidades que se deben reubicar.

Suponiendo que todas las unidades son iguales, se calcularía un costo en línea recta para cada unidad al dividir $13,557,600 entre 138 unidades. Ello indicaría que el costo de reubicar cada unidad sería de: $98,243

Ya que el Informe de Ingeniería no detalló los costos de compensación por tipo de unidad que se trasladará, equiparamos 10 unidades de vivienda con una unidad de restaurantes, y 50 unidades de vivienda a una unidad industrial. Esto proporcionó un número total de unidades que deben reubicarse bajo el Canal a Nivel de:

Unidades de vivienda que deben trasladarse	135
Unidades industriales (50X2) que deben trasladarse	100
Unidades de restaurantes (10X1) que deben trasladarse	10

Al utilizar estas cifras, existe un total de 245 unidades que deben reubicarse.

Suponiendo que las unidades se equiparan aproximadamente en las relaciones correctas, el costo de trasladar cada unidad se calcula al dividir $13,557,600 entre 245 unidades. Esto indica que el costo de reubicación de las unidades originales de ECE sería de: $ 55,337

A fin de reducir la ampliación del error, utilizamos una cifra más moderada de $50,000. Con esta cifra por unidad de vivienda, teniendo en cuenta la precisión del Informe ECE, quedaría $6,807,600 para reubicar las dos unidades industriales y una unidad de restaurantes.

Al utilizar los cálculos anteriores, puede observarse que en vez de resultar exagerado, el costo de reubicar cada unidad de vivienda (cada familia) se calculó al utilizar una cifra mucho más moderada que la que se utilizó en el Informe ECE.

VII. IMPACTO FINANCIERO Y CONSECUENCIAS QUE EL IMPACTO EN LOS USUARIOS HA DE TENER PARA PANAMA

Este apéndice trata sobre las interrogantes y solicitudes de aclaraciones que se han presentado respecto a los impactos financieros sobre Panamá y las consecuencias que el impacto en los usuarios ha de tener para Panamá. Las interrogantes y temas específicos que se han planteado, y a los que se responderá en este capítulo, son los siguientes:

- ¿Cuál es la definición de las importaciones utilizadas y cómo se obtuvieron dichas importaciones?

- En la Figura VII-3, ¿por qué no se diferencian los impactos para el Canal de Esclusas de Nivel Alto entre las alternativas de 150,000 y 200,000 TPM?

- ¿Cuál es la definición de "Compras en Panamá", tal como se emplea en este capítulo?

- ¿Por qué no se incluyeron en la Figura VII-3 los ingresos del Gobierno devengados de los derechos de importación e impuestos sobre la renta?

- ¿Es plausible la exención de los derechos de importación con relación al Proyecto de las Alternativas al Canal de Panamá? Es ésta la razón por la cual se omitieron en la Figura VII-3?

- ¿De dónde provienen los ingresos gubernamentales directos del Canal, tal como se indica en la Figura VII-3 y se trata en el capítulo? ¿Qué incluyen estos ingresos?

Cada una de estas preguntas se contestan, a su vez, en el resto de este capítulo.

1. ¿CUAL ES LA DEFINICION DE LAS IMPORTACIONES UTILIZADAS Y COMO SE OBTUVIERON DICHAS IMPORTACIONES?

Para el Estudio de los Impactos sobre Panamá, las importaciones se estimaron a partir de la información presentada en el Componente de Estudio: Análisis Económico e Impacto sobre los Usuarios, por el Informe Interino de Mitsubishi Research Institute (MRI). Las importaciones se definieron como los costos económicos del proyecto para equipo y materiales menos los gastos locales de equipo y materiales. Es decir, se da por sentado que las importaciones son iguales a los gastos no locales de equipo y materiales, siendo la razón fundamental que si el equipo y materiales utilizados en el proyectos provenían de fuentes no locales, dicho equipo y material debía importarse a Panamá. El componente del costo laboral del costo económico de las alternativas del proyecto no se consideró en las importaciones.

Las importaciones a Panamá se estimaron al tomar el resumen del costo económico del proyecto para las dos alternativas por categoría (se utilizó el costo total para las Fases I y II), tal como se indica en las Tablas II-2-1 y II-2-2 del Informe Interino de MRI, y al calcular qué parte del costo se utilizó para equipo y materiales basado en las distribuciones mostradas en las Tablas V-1-1 y V-1-2. "Luego los gastos locales de equipo y materiales se estimaron y restaron en base a la participación en la producción en Panamá", mostrados también en las Tablas V-1-1 y V-1-2.

2. EN LA FIGURA VII-3, ¿POR QUE NO SE DIFERENCIAN LOS IMPACTOS PARA EL CANAL DE ESCLUSAS DE NIVEL ALTO ENTRE LAS ALTERNATIVAS DE 150,000 TPM Y 200,000 TPM?

En la sección de Metodología y Supuestos Claves del informe (Sección 7.1), y específicamente en el punto 7.1.5, se afirma que el capítulo sólo tratará la opción de 150,000 TPM para el Canal de Esclusas de Nivel Alto y el Caso C para el Canal a Nivel. Hubo dos razones para ello, tal como se explica en el punto 7.1.5 y se resume en los siguientes dos párrafos.

La primera razón fue que las dos alternativas finales de los cinco finalistas (dos variaciones sobre el Canal de Esclusas de Nivel Alto y tres variaciones del Canal a Nivel de una sola vía) serán las dos que muestren los mejores

resultados en los análisis tanto en los componentes de estudio económico como financiero. Las dos mejores alternativas finales de los Informes Interinos de los dos estudios fueron la de 150,000 TPM para el Canal de Esclusas de Nivel Alto y el Caso C para el Canal a Nivel.

La segunda razón simplemente se debió a la facilidad de presentación y comprensión. Al tratar, comprender y comparar los impactos cuantificados, resulta mucho más fácil enfocar un solo punto, v.g., una escala de dos a tres cifras en dólares, que se requerirían si las variaciones sobre las dos alternativas principales se mantuvieran durante toda la discusión. Al tratar las dos alternativas solamente, se presenta el mejor caso para el Canal de Esclusas de Nivel Alto y el Canal a Nivel.

3. ¿CUAL ES LA DEFINICION DE "COMPRAS EN PANAMA", TAL COMO SE EMPLEA EN ESTE CAPITULO?

Las compras en Panamá se definieron de la misma manera que los Gastos Locales en Panamá, que aparece en el Informe Interino de MRI. Estimamos el desglose de los gastos locales en materiales y mano de obra al utilizar la información presentada en las Tablas V-1-1 y V-1-2 en el Informe de MRI, y obtuvimos cifras un poco diferentes.

4. ¿POR QUE NO SE INCLUYERON EN LA FIGURA VII-3 LOS INGRESOS DEL GOBIERNO DEVENGADOS DE LOS DERECHOS DE IMPORTACION E IMPUESTOS SOBRE LA RENTA?

Los derechos de importación del gobierno y los impuestos sobre la renta que se estimaron no se incluyeron en la Figura VII-3 debido a un simple error. La versión completa de la Figura VII-3 se excluyó inadvertidamente del informe.

La versión de la Figura VII-3 que debió incluirse en el informe aparece a continuación.

RESUMEN DE LOS IMPACTOS FINANCIEROS MAS IMPORTANTES DE LAS DOS ALTERNATIVAS DEL CANAL

	Canal de Esclusas de Nivel Alto (150,000 DWT)*	Canal a Nivel (Case C)*	Diferencia
Durante la Construcción			
Importaciones a Panamá** (millones de dólares)	$7,818	$10,180	30%
Compras en Panamá** (millones de dólares)			
– Bienes y Materiales	$349	$352	< 1%
– Mano de Obra	$569	$696	22%
Ingresos del Gobierno (Estimado) de:			
- Impuestos a la Importación	$782	$1,018	30%
- Impuestos sobre la Renta	$20	$25	25%
Durante Operaciones —En el 2000			
Ingresos Directos del Gobierno por el Canal** (millones de dólares)	$123.7	$127.5	3%
Garantía Parcial del Gobierno ***	a Ser Determinado		ínfima

* Variación más favorable de cada alternativa se seleccionó para se discutida y para ser cuantificada para estimar los impactos sobre Panamá

* *Fuente: Componente del Estudio:Análisis Económico e Impacto Sobre los Usuarios por Mistubishi Research Institute

* **Fuente: Componente del Estudio: Esquema Financiero, Análisis Financiero y Arreglos Gerenciales de Nathan Associates

Las estimaciones de los ingresos gubernamentales provenientes de derechos de importación e impuestos sobre la renta son de carácter general y deben considerarse como estimaciones del orden de magnitud solamente. Los ingresos de derechos de importación se estimaron en base a la información de que, en 1990, el valor de las importaciones a Panamá fue de $1,489.1 millón (valor C.S.F.), mientras que los ingresos del Gobierno de Panamá provenientes de derechos de importación fue de $148.5 millones. Esto indicó que se genera $1 en derechos de importación para cada $10 en importaciones.[1]

Las estimaciones del aumento en el impuesto personal se basaron en el salario mínimo promedio para los trabajadores de la construcción en las ciudades de Panamá y Colón, suponiendo 40 horas por semana y 52 meses por año, más una bonificación obligatoria del décimotercer mes. La tabla del impuesto personal sobre la renta se utilizó para identificar el impuesto anual por trabajo. Se utilizaron las estimaciones de 68,000 empleos para el Canal de Esclusas de Nivel Alto y 87,000 empleos para el Canal a Nivel.[2]

5. ¿ES PLAUSIBLE LA EXENCION DE LOS DERECHOS DE IMPORTACION CON RELACION AL PROYECTO DE LAS ALTERNATIVAS AL CANAL DE PANAMA? ¿ES ESTA LA RAZON POR LA CUAL SE OMITIERON LOS DERECHOS DE IMPORTACION EN LA FIGURA VII-3?

Booz•Allen dio por sentado que los derechos de importación se cargarían sobre el equipo y materiales importados a Panamá para uso en la construcción del nuevo Canal. Esta suposición se basó en el hecho de que durante la fase y discusión del Informe Inicial, la Comisión solicitó específicamente que estimásemos los derechos de importación, sin dar ninguna indicación de que no se cobrarían, o que tal vez no se cobrarían, los derechos de importación.

La posibilidad de que los derechos de importación relacionados con el proyecto de las alternativas al Canal de Panamá queden exentos no fue la razón por la cual se omitieron las estimaciones de derechos de importación en la Figura VII-3. Tal como se indicó anteriormente, la omisión se debió simplemente a un error.

Es plausible que los derechos de importación relacionados con el nuevo proyecto del Canal de Panamá queden exentos. Esta sería una decisión de política que le corresponde al Gobierno de Panamá.

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[1]Esto se explica en la nota de pie número 1 que aparece en la página VII-8 del informe.
[2]Esto se explica en la nota de pie número 2 que aparece en la página VII-9 del informe.

6. ¿DE DONDE PROVIENEN LOS INGRESOS GUBERNAMENTALES DIRECTOS DEL CANAL, TAL COMO SE INDICA EN LA FIGURA VII-3 Y SE TRATA EN EL CAPITULO? ¿QUE INCLUYEN ESTOS INGRESOS?

Los datos sobre ingresos gubernamentales directos del Canal, tal como aparecen en el Apéndice VII-3 y se tratan en el Capítulo 7, se obtuvieron directamente del Informe Interino de Nathan Associates sobre el Componente de Estudio denominado "Esquema de Financiamiento, Análisis Financiero y Arreglos Administrativos". Estos ingresos gubernamentales directos se describen como "Pagos a Panamá" en el informe de Nathan Associates. Dichos ingresos son pagos que el Gobierno de Panamá recibe directamente del Canal. Históricamente, el Gobierno de Panamá ha recibido ingresos directos del Canal. En el Año Fiscal 1991, el Gobierno recibió $87.6 millones de la Comisión del Canal de Panamá, que comprendían $10 millones por servicios públicos prestados por el Gobierno, $10 millones en una anualidad fija, y $67.7 millones en base al tonelaje total.

Dichos ingresos varían de acuerdo con el esquema de administración que se utiliza y el sistema de peajes seleccionado. Nathan Associates identificó una Autoridad del Canal de Panamá y el sistema de peajes óptimo como los preferidos. El estudio de los Impactos sobre Panamá dio por sentado que se establecería una Autoridad del Canal de Panamá y el sistema de peajes óptimo.

Las estimaciones en el Estudio de los Impactos sobre Panamá se tomaron de la Tabla 6-10 del Informe Interino de Nathan Associates para la alternativa del Canal de Esclusas de Nivel Alto, que aparecen en la columna titulada "Pagos a Panamá" en ambas tablas.

Booz•Allen se da cuenta de que el informe final de Mitsubishi Research Institute sobre el Análisis Económico y el Impacto sobre los Usuarios contiene estimaciones del aumento en el pago de "regalías" al Gobierno de Panamá y sobre "Dividendos al Gobierno de Panamá". Ninguno de estos términos se explica o define claramente, y las cifras proporcionadas para ambos son para el año 2040. Los pagos de regalías parecen ser iguales a los pagos a Panamá que se indican en el Informe de Nathan Associates, pero debido a que MRI presenta el aumento solamente (en vez de la cantidad absoluta) y que no se proporcionó el punto de partida, esto no se pudo verificar. No se definieron los dividendos al Gobierno de Panamá y Booz•Allen no los tiene muy claros; por ende, éstos no se incluyeron en esta revisión del Estudio de los Impactos sobre Panamá.