APPENDIX E TERMINAL PLANNING

APPENDIX E TERMINAL PLANNING

E.1 Transport Forecast

E.1.1 Economic Environment

(1) Recent Economic Situation

1) General

In the period from 1996-2000, the salvadorean economy showed steady growth with an average annual rate of 3.5% in Gross Domestic Product (GDP) as a total. As to GDPs by sector, the Industrial sector indicated the largest growth with 5.0% per annum in the same period, followed by services (3.3%) and Agriculture (1.7%). Among the Industrial sectors, the Manufacturing sector showed a high growth of 5.2% in the same period. By the year 2000, El Salvador showed a slowdown in economic activities with a growth rate of 2.0% to the preceding year of 1999. Despite the economic slowdown as a whole, the manufacturing sector showed a comparatively high growth rate of 4.5% to the preceding year. (See Table E.1.1).

Table E.1.1 Historical Trend of Sectorial Gross Domestic Products (GDP) between 1991-2000

	Sector	Billion of US$ at 1995 constant price (growth rate (%) to the preceding year)										Average growth rate	
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1991-2000	1995-2000
Gross Domestic Product	Agriculture	1.12	1.21	1.18	1.15	1.20	1.22	1.22	1.20	1.28	1.27	1.3%	1.7%
		-	8.1%	-2.6%	-2.3%	4.5%	1.2%	0.4%	-1.8%	6.5%	-0.8%	-	-
	Industry	1.97	2.15	2.14	2.31	2.46	2.52	2.71	2.89	2.99	3.09	5.3%	5.0%
		-	9.2%	-0.5%	8.0%	6.7%	2.2%	7.6%	6.7%	3.4%	3.5%	-	-
	Manufacturing	1.54	1.70	1.67	1.79	1.92	1.95	2.11	2.25	2.33	2.44	5.5%	5.2%
		-	9.9%	-1.5%	7.4%	6.9%	1.7%	8.0%	6.6%	3.7%	4.5%	-	-
	Services	3.81	4.06	4.65	4.99	5.33	5.41	5.60	5.78	5.94	6.05	5.1%	3.3%
		-	6.5%	14.5%	7.3%	6.7%	1.6%	3.6%	3.1%	2.8%	1.8%	-	-
	Total	6.90	7.42	7.97	8.45	8.99	9.14	9.53	9.87	10.20	10.41	4.6%	3.5%
		-	7.6%	7.4%	6.1%	6.4%	1.7%	4.3%	3.5%	3.4%	2.0%	-	-

[Source: BCR (Banco Central de Reserva: de El Salvador Central Bank of El Salvador).WB (World Bank)
Note: The manufacturing sector is a part of the industrial sector]

2) Development of Industrial Free Zones

The development of Industrial Free Zones (referred to as "Maquila") brought such considerable growth of the manufacturing sector. The growth rate of the goods

exported from the "Maquila" in terms of FOB in 2000 was 18.0% to the preceding year, whereas the traditional agricultural export goods of the sum of coffee and sugar showed a considerable straight decline in the last two years (-30.3% in 1999, -14.9% in 2000). The exports from "Maquila" accounted for 54.5% of the total exports, by far exceeding those of the traditional exports such as coffee, sugar and shrimp, and accounted approximately to one third of the total value of imports in the same year. The extension of the CBI (Caribbean Basin Initiative) quota scheme implement in 2000 by USA triggered such rapid growth in "Maquila" over the 2000, which is said to be "boom". This initiative triggered the establishment of new factories such that 19 factories in total were in operation by September 2000.

3) Traditional Agricultural Exports

In the recent years, the world market prices of the traditional agricultural produc ts, viz. coffee and sugar, has continuously declined, and to compensate it, the exporters increased the volumes of coffee and sugar in 2000, up to 150,000 MT and 256,000 MT respectively indicating 32.1% and 45.1% increases compared with the preceding year.

4) Current Account Balance

The balances of trade (FOB) and services of El Salvador in 2000 showed a deficit of 1.7 billion and 0.3 billion US$, respectively, totaling 2.0 billion US$ in current price. In the same year, in foreign trade, the total exports (FOB) and imports (CIF) were 3.0 and 4.9 billion US$, respectively. The deficit of 2.0 billion US$ on trade and services mentioned above was mostly covered (around 90%) by family remittances of 1.8 billion US$.

5) Inflation

The annual inflation as of December 2000, measured by the annual variation of the Consumer Price Index (CPI), recorded a rate of 4.3%. On the other hand, the Industrial Price Index (IPI) as of December 2000 recorded an annual increase of 4.5%. The steady oil's international price increases, the elimination of exemptions of Value Added Tax, as well as the gradual reduction of the subsidy on electricity, are said to be factors that determined inflation in 2000.

6) Population

In the last five years in 1996-2000, the annual population growth rates remained in the narrow range of 1.97% - 2.10% with an average of 2.06%. Compared with the last ten years data, the trend is a slight decline in population growth rates. (See Table E.1.2)

Table E.1.2 Historical Trend of Population between 1991-2000

	'000 (growth rate (%) to the preceding year)										Average growth rate	
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1991-2000	1995-2000
Population	5,206	5,310	5,421	5,541	5,669	5,788	5,911	6,035	6,154	6,277	2.10 %	2.06 %
	-	2.00%	2.09%	2.21%	2.31%	2.10%	2.13%	2.10%	1.97%	2.00%	-	-

[Source: BCR (Banco Central de Reserva: de El Salvador Central Bank of El Salvador).WB (World Bank)]

(2) Growth Prospects

1) Prospects by the Salvadorean Organization

As to the future growth of the Salvadorean economy, which is generally forecasted by applying the representative economic index of GDP, two non-government Salvadorean organizations gave the following figures; 3.5% of GDP growth in 2004 given by "Promoviendo El Salvador (PRO-ESA: Promotion of El Salvador). The other is 5% of GDP growth in 2004 given by " Fundación Salvadoreña para el Desarrollo Económico y Social" (FUSADES: Salvadorean Foundation for Economic and Social Development). On the other hand the Government of El Salvador no longer indicated target economic indices in the National Development Plan (Acciones Iniciales del Plan de Nación: Initial Actions of the National Plan), where the direction of the nation and required actions are only shown in qualitatively manner.

2) Prospects by the International Organization

The "Organization for Economic Co-operation and Development (OECD) as an international organization gave long-term GDP growth of 4.6% as a figure in 2001 – 2010 and 4.1% in 2011 – 2020, respectively. On the other hand, United Nations gave population growth of 1.53% in 2001 – 2010 and 1.27% in 2011 – 2020, respectively in Latin America.

3) Future Economic Indices Adopted in this Study

The GDP growth in the future forecast by different organizations is in the range of 3.5% - 5%. This range happens to coincide with the forecast of the former JICA's study; the lowest figure of 3.5% of the above range is the same as JICA's "Low Case" and the highest figure of 5%, JICA's "High Case". The lowest figure of 3.5% also coincides with an average annual growth rate of GDP in the last five years (See Table E.1.1). Referring to those figures in GDP growth, and taking account of conservative estimation to steer the project on a safe side, 3.5% is adopted in GDP growth towards the target years in this study.

On the other hand, the population growth forecast by UN seems too small compared with the recent historical trend. (See Table E.1.2) The forecast figures of the former JICA study are in the middle of the gap between UN's forecast and the recent trend. There is no reason why the former JICA's forecast figures should be modified. Thus, in this study, the population growth rates of 1.84% in 2001 – 2005 and 1.50% in 2005 – 2015 are adopted, the same as those in the former JICA's study.

E.1.2 Forecast of Cargo Volume by Item

(1) Iron and Steel Products: Import

In the forecast, the sectorial GDP of the industry and the volume of imported iron and steel products in the last ten years were correlated, the future volume via the Salvadorean ports was then estimated by applying the forecast sectorial GDP in the future. The resulting volumes of imported iron and steel products in MT are 372,000, 555,000 and 789,000 in years 2005, 2010 and 2015 respectively. (See Table E.1.3).

Table E.1.3 Correlation between Sectoral GDP of Industry and the Volume of Imported Iron and Steel Products in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Sectoral GDP of Industry (Billion US$)	1.97	2.15	2.14	2.31	2.46	2.52	2.71	2.89	2.99	3.09	4.07	5.24	6.74
Y	Imported Iron and Steel Products ('000 MT)	55	74	92	84	110	106	132	235	201	221	372	555	789

Note (1): Sectoral GDP at 1995 constant price (2): Linear regression equation: $Y = a X + b$, $a = 156186$, $b = -262966$, $r = 0.94$]

(2) Fertilizer: Import

In the forecast, the statistical past record of the volume of fertilizer imported via the ports of Acajutla and Cutuco fluctuated in the last ten years without showing any clear trend either upward or downward. Presumably affected by meteorological conditions including draught and also international market conditions in plantation of products. In addition, there might be the aftereffect of the past civil war that ended in 1991. The forecast volume of imported fertilizer was estimated considering the maximum figures at the ports of Acajutla and Cutuco in the past, without applying the correlation analysis. The estimated volume of imported fertilizer is 392,000 MT through the year 2015. (See Table E.1.4)

Table E.1.4 Historical Trends of Sectoral GDP of Agriculture and the Volume of Imported Fertilizer in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Sectoral GDP of Agri-culture (Billion US$)	1.12	1.21	1.18	1.15	1.20	1.22	1.22	1.20	1.28	1.27	1.45	1.60	1.77
Y	Imported Fertilizer ('000 MT)	306	297	305	329	275	269	358	251	286	295	390	390	390

[Note (1): Sectoral GDP at 1995 constant price]

(3) Cereals: Import

Although the extent of correlation between population and the volume of imported cereals in the last ten years is high, the forecast volumes of imported cereals in the future by the correlation analysis is considered to be considerably high. Hence, the volumes in the future were constrained by the level proportional to the estimated population growth in the future. The resulting volumes of imported cereals in MT are 965,000, 1,190,000 and 1,432,000 in 2005, 2010 and 2015 respectively. (See Table E.1.5)

Table E.1.5 Correlation between Population and the Volume of Imported Cereals in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Population ('000)	5,206	5,310	5,421	5,541	5,669	5,788	5,911	6,035	6,154	6,277	6,875	7,406	7,977
Y	Imported Cereals ('000 MT)	382	232	298	431	397	444	600	628	635	754	965	1,190	1,432

[Note (1): Sectoral GDP at 1995 constant price
(2): Linear regression equation: Y = a x X + b, a = 424, b = -1950468, r = 0.93]

(4) Soybean Meal: Import

In the forecast of soybean meal, the forecast method is the same as that applied for cereals. The resulting volumes of imported soybean meal in MT are 194,000, 209,000 and 225,000 in 2005, 2010 and 2015 respectively. (See Table E.1.6)

Table E.1.6 Correlation between Population and the Volume of Imported Soybean Meal in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Population ('000)	5,206	5,310	5,421	5,541	5,669	5,788	5,911	6,035	6,154	6,277	6,875	7,406	7,977
Y	Imported Soybean Meal ('000 MT)	58	88	58	81	109	111	122	170	162	159	194	209	225

[Note (1): Sectoral GDP at 1995 constant price
(2): Linear regression equation: Y = a x X + b, a = 107, b = -500391, r = 0.93]

(5) Vehicles: Import

Though the extent of correlation between the volume of imported vehicles and GDP in the last ten years is not high due to the fluctuation presumably partly incurred by the nature of vehicles as durable consumer goods, the volume is assumed to increase for the

future proportional to GDP growth with growth elasticity (hereinafter referred to as "the method of growth elasticity"). In the last ten years (1991 – 2000), GDP achieved annual growth of 4.7% on an average, while the volumes of vehicles, 7.3%, resulting in the growth elasticity of 1.59 (7.3%/4.7%) in the case of the volume of imported vehicles. The resulting volumes of imported vehicles in MT are 15,000, 22,000 and 33,000 in 2005, 2010 and 2015 respectively. (See Table E.1.7)

Table E.1.7 Historical Trends of the total GDP and the Volume of Imported Vehicles in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Total GDP (Billion of US$)	6.90	7.42	7.97	8.45	8.99	9.14	9.53	9.87	10.20	10.41	12.81		18.69
Y	Imported Vehicles ('000 MT)	5	11	10	14	18	6	11	12	12	10	15	22	33

[Note (1): GDP at 1995 constant price
(2): Growth elasticity for GDP = 7.4%/4.7% = 1.59 (1991 - 2000)]

(6) Chemical Products (Non-containerizable Portion): Import

Chemical products containing various goods are statistically divided in to the two categories, viz. containerizable (suitable for containerization) and non-containerizable (unsuitable for containerization). Such statistically mixed nature has not shown any change in the trend of the percentage of containerization, where almost a constant level of 20% has been kept since 1997.

There is another factor that affected the imported chemical products in volume and the percentage of containerization, but not limited to the chemical products. In the mid 90s, most of the major shipping lines shifted their services from Acajutla Port to Quetzal Port in Guatemala to avoid swell wave problem at Acajutla Port, leaving only one shipping line for container regular services.

Thus, to avoid the past statistical discontinuity the last five years data were adopted and non-containerizable portion was statistically extracted in the forecast. The sectorial GDP of manufacturing was selected as the economic index for the correlation analysis. The resulting volumes of imported chemical products in MT are 32,000, 52,000 and 78,000 in 2005, 2010 and 2015 respectively. (See Table E.1.8)

Table E.1.8 Correlation between Sectoral GDP of Manufacturing and the Volume of Imported Chemical Products (Non-containerizable Portion) in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Sectoral GDP of Manu-facturing (Billion US$)	1.54	1.70	1.67	1.79	1.92	1.95	2.11	2.25	2.33	2.44	3.18	4.11	5.30
Y	Imported Chemical Products (Non-containerizable) ('000 MT)	5	7	6	7	5	2	9	12	12	15	32	52	78

[Note (1): Sectoral GDP at 1995 constant price
(2): Linear regression equation: Y = a x X + b, a = 21933, b = -38156, r = 0.96 (1996 - 2000)]

(7) General Cargo (Containerizable Portion): Import

General cargoes comprising break-bulk cargoes and container cargoes are statistically divided into three categories, viz. containerizable, non-containerizable and statistically mixed as previously mentioned. Non-containerizable cargoes are long, heavy and/or bulky cargoes such as iron and steel products excluding fine steel, bagged fertilizer and bagged cement, generally indicating negligibly small percentages of containerization. Thus, containerizable cargoes that are composed of already containerized cargoes and cargoes remaining in break-bulk, that are extracted out of the entire general cargoes, generally show a statistical steady increase in the percentage of containerization year by year.

The statistics of Acajutla Port unexceptionally shows this trend, reaching 81.5% in the percentage of containerization in containerizable general cargo in 2000. Compared with the previous year, the percentage jumped from 43.9% to 81.5%, mainly owing to full containerization of dairy products from New Zealand in 2000. The past statistical record of Imported containerizable general cargoes was also affected by the shift of the major shipping lines in the mid 90s to Quetzal Port as mentioned before.

Thus, to avoid the statistical discontinuily over the mid 90s, the last five years data were adopted and containerizable portion was statistically extracted from the entire general cargoes in the forecast. Though the extent of correlation between the volume of imported containerizable general cargo and GDP in the last five years is not high presumably due to the aftereffect of the shipping lines' shifts to Quetzal Port, the volume is assumed to increase for the future proportional to GDP growth with growth elasticity. In the forecast, the method of growth elasticity was applied and the total GDP was selected as the economic index. The resulting volumes of imported containerizable general cargo in MT are 119,000, 181,000 and 276,000 in 2005, 2010 and 2015 respectively. (See Table E.1.9)

Table E.1.9 Historical Trends of the Total GDP and the Volume of Imported General Cargo (Containerizable) in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Total GDP (Billion of US$)	6.90	7.42	7.97	8.45	8.99	9.14	9.53	9.87	10.20	10.41	12.81	15.47	18.69
Y	Imported General Cargo (Containerizable) ('000 MT)	91	85	81	99	101	57	68	115	108	78	119	181	276

[Note (1): GDP at 1995 constant price (2): Growth elasticity for GDP = 8.2%/3.3% = 2.50 (1996-2000) (3): Excluding chemical products]

(8) Non-ferrous Metal: Import

In the forecast, the sectorial GDP of manufacturing and the volume of imported non-ferrous metal in the last five years were correlated. The resulting volumes of imported non-ferrous metal in MT are 17,000, 29,000 and 45,000 in 2005, 2010 and 2015 respectively. (See Table E.1.10)

Table E.1.10 Correlation between Sectoral GDP of Manufacturing and the Volume of Imported Non-ferrous Metal in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Sectorial GDP of Manu-facturing (Billion US$)	1.54	1.70	1.67	1.79	1.92	1.95	2.11	2.25	2.33	2.44	3.18	4.11	5.30
Y	Imported Non-ferrous Metal ('000 MT)	1	1	2	5	6	1	2	5	5	7	17	29	45

[Note (1): Sectoral GDP at 1995 constant price (2): Linear regresion equation: Y = a x X + b, a = 13443, b = -25846, r = 0.99 (1996-2000)]

(9) Diesel Oil: Import

In the forecast, the total GDP and the volume of imported diesel oil in the last five years were correlated. The resulting volumes of imported diesel oil in MT are 276,000, 375,000 and 494,000 in 2005, 2010 and 2015 respectively. (See Table E.1.11)

Table E.1.11 Correlation between the Total GDP and the Volume of Imported Diesel Oil in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Total GDP (Billion of US$)	6.90	7.42	7.97	8.45	8.99	9.14	9.53	9.87	10.20	10.41	12.81	15.47	18.69
Y	Imported Diesel Oil ('000 MT)	43	92	173	365	401	156	138	162	171	203	276	375	494

[Note (1): GDP at 1995 constant price (2): Linear regression equation: Y = a x X + b, a = 36996, b= -197515, r = 0.79 (1996 –2000)]

(10) Gasoline: Import

Acajutla Port started to import gasoline in 1997. In the forecast, the statistical rate of imported gasoline to imported diesel oil in volume which has had an approximately constant level of 0.6 in 1998 –2000 was adopted instead of the past statistics itself insufficient to grasp its historical trend. The estimated volumes of imported gasoline in MT are 166,000, 225,000 and 296,000 in 2005, 2010 and 2015 respectively. (See Table E.1.12)

Table E.1.12 Historical Trends of the Total GDP and the Volume of Imported Gasoline in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Total GDP (Billion of US$)	6.90	7.42	7.97	8.45	8.99	9.14	9.53	9.87	10.20	10.41	12.81	15.47	18.69
Y	Imported Gasoline ('000 MT)	0	0	0	0	0	0	12	105	119	128	166	225	296

[Note (1): Sectoral GDP at 1995 constant price (2): The rate of Gasoline for Diesel oil is approximately 0.6 in 1998 – 2000]

(11) Vegetable and Animal Fats: Import

In the forecast, the method of growth elasticity was applied and the population growth was selected as the economic index. The resulting volumes of imported vegetable and animal fats in MT are 77,000, 90,000 and 107,000 in 2005, 2010 and 2015 respectively. (See Table E.1.13)

Table E.1.13 Historical Trends of the Total GDP and the Volume of Imported Animal and Vegetable Fats in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Population ('000)	5,206	5,310	5,421	5,541	5,669	5,788	5,911	6,035	6,154	6,277	6,875	7,406	7,977
Y	Imported Animal and Vegetable Fats ('000 MT)	49	41	46	29	36	19	60	57	71	65	77	90	107

[Note (1): GDP at 1995 constant price (2): Growth elasticity for GDP = 3.3%/2.1% = 1.59 (1991-2000)]

(12) Caustic Soda: Import

In the forecast, the sectorial GDP of manufacturing and the volume of imported caustic soda in the last five years were correlated. The resulting volumes of imported caustic soda in MT are 28,000, 43,000 and 63,000 in 2005, 2010 and 2015 respectively. (See Table E.1.14)

Table E.1.14 Correlation between Sectoral GDP of Manufacturing and the Volume of Imported Caustic Soda in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Sectoral GDP of Manufacturing (Billion of US$)	1.54	1.70	1.67	1.79	1.92	1.95	2.11	2.25	2.33	2.44	3.18	4.11	5.30
Y	Imported Caustic Soda ('000 MT)	0	0	0	12	8	7	8	13	15	15	28	43	63

[Note (1): Sectoral GDP at 1995 constant price (2): Linear regression equation: Y = a x X + b, a = 16457, b = -24566, r = 0.95 (1995-2000)]

(13) Cement: Import

Cement started to be imported via Acajutla Port in1998 and shifted to Punta Gorda wharf in 1999, while until then, local factories had solely provided cement in the Salvadorean market. The volumes of imported cement are assumed to increase proportional to growth of construction sector for the future. The estimated volumes in MT are 58,000, 68,000 and 80,000 in 2005, 2010 and 2015 respectively.

(14) Sugar and Molasses: Export

In 2000, the volume of exported sugar set a record of 256,000 MT to compensate the downturn of the price in the international sugar market with volume. The volume of exported molasses as by-products of sugar also reported a high in the same year. According to the Sugar Association of El Salvador, the exported volume for year 2000 reached the maximum level from the standpoint of supply side. Increase in production will only be accomplished by further increasing unit yield rather than expansion of sugar farms so as to keep the current exported volume and meet an increase in local consumption due to population increase. Thus, in the forecast, the current exported volume level of sugar and molasses; 250,000 MT and 160,000 MT respectively will be kept constant through the target years. (See Table E.1.15)

Table E.1.15 Historical Trends of the Volumes of Exported Sugar and Molasses in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Exported Sugar ('000 MT)	60	100	78	91	71	80	119	224	177	256	250	250	250
Y	Exported Molasses ('000 MT)	61	66	51	58	57	72	110	159	166	150	160	160	160

(15) General Cargo (Containerizable Portion): Export

After the shift of some major shipping lines to Quetzal Port in the mid 90s, the volume of exported container cargo has been shrinking year by year. Current container services via Acajutla Port are connecting with the countries of East Asia, which are major exporters but not importers for El Salvador. In the forecast, the volume of exported

containerizable general cargo in the future is assumed to be keep to the current level of 32,000 MT for the target year. (See Table E.1.16)

Table E.1.16 Historical Trends of the Volume of Exported General Cargo (Containerizable) in 1991-2000

		Actual Record in Statistics										Forecast		
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2005	2010	2015
X	Exported General Cargo (Containerizable) ('000 MT)	98	119	151	99	108	99	85	47	38	11	32	32	32

[Note: An average volume in the last three years (1998 - 2000) is 32,000 MT.]

E.1.3 Transportation Cost Analysis

The operation costs of vessel and onland transportation used for analyzing share of Acajutla and La Union ports for each cargo commodity including container are shown in Table E.1.17 to E.1.21.

Table E.1.17 Distance Between Ports in Container

(Unit: Nautical Miles)

Port	Los Angeles	Hong Kong
Quetzal	2,063	8,543
Acajutla	2,168	8,648
La Unión	2,267	8,747
Corinto	2,294	8,774
Caldera	2,536	9,016

Table E.1.18 Distances Between Ports in Conventional Cargo Transport

(Unit: Nautical Miles)

Port of Origin	La Unión	Acajutla	Quetzal	Main Cargo
Westwego, Luisiana	2,194	2,295	2,400	Cereals
Antewerp	5,618	5,719	5,824	Fertilizer
Murmansk, Russia	6,898	6,999	7,104	Cold rolled Iron
Croix	1,887	1,988	2,093	Molasses

Table E.1.19 Land Transport Costs for Containers

From (Port)	To (City)	Distance (km)	US$/TEU
La Unión	San José	740	358
	Guatemala City	422	216
	Managua	340	179
	San Salvador	184	110
	Tegucigalpa	150	95
	San Miguel	46	49
Acajutla	San Miguel	256	142
	San Salvador	95	70
Quetzal	San Miguel	388	201
	San Salvador	250	139
	Guatemala City	90	68
Santo Tomás	San Salvador	518	259
San Lorenzo	Tegucigalpa	120	82
Corinto	Managua	150	95
Caldera	San José	70	59

Table E.1.20 Land Transport Costs for Loose Cargo

From (Port)	To (City)	Distance (km)	US$/MT
La Unión	San Salvador	184	7.0
	San Miguel	46	3.1
Acajutla	San Miguel	256	9.1
	San Salvador	95	4.5
Quetzal	San Miguel	388	12.4

Table E.1.21 Daily Ship Operational Costs in Hire Base (H/B)

Vessel Type	DWT	TEUs Capacity	At Navigation US$/day/vessel	At Anchorage US$/day/vessel
Container	18,300	1,270	20,926	14,877
	54,760	4,800	66,495	39,451
Bulker	26,000	-	9,994	7,941
	32,200	-	10,553	8,453
	34,000	-	10,680	8,580
	50,000	-	12,756	10,031

According to the cost analysis shown in Table E.1.22, in most of the cases by cargo item except for iron and steel products, the total costs via La Unión Port are less than or equal to those via Acajutla Port owing partly to a deeper berth that will enable to receive larger bulkers up to Panamax ones and partly to higher cargo-handling productivities that could be accomplished at the new marginal type wharf at La Unión Port. Thus, La

Unión Port could attract conventional cargoes from all over the country, and more likely from the eastern region.

Table E.1.22 Cost Comparison of Inter-modal Local Cargo Transport By Cargo Item and the Respective Route between via La Unión Port and via Acajutla

Cargo item	Route	Transport Mode	Distance (km/ Nautical	Vessel size in	Cost Index
Cereals	Westwego, Luisiana - La Unión - San Salvador	Truck transport	184	-	52
		Ship transport	2,194	50,000	48
		Total			**100**
	Westwego, Luisiana - Acajutla - San Salvador	Truck transport	95	-	34
		Ship transport	2,295	34,000	75
		Total			**108**
	Difference				**8**
Fertilizer	Antewer- - La Unión - San Salvador	Truck transport	184	-	31
		Ship transport	5,618	43,000	69
		Total			**100**
	Antewerp - Acajutla - San Salvador	Truck transport	95	-	20
		Ship transport	5,719	26,000	101
		Total			**121**
	Difference				**21**
Iron/steel products	Murmansk, Russia - La Unión - San Salvador	Truck transport	184	-	23
		Ship transport	6,898	30,000	77
		Total			**100**
	Murmansk, Russia - Acajutla - San Salvador	Truck transport	95	-	15
		Ship transport	6,999	30,000	70
		Total			**85**
	Difference				**-15**
Raw sugar	Leningrad, Russia - La Unión - San Salvador	Truck transport	184	-	21
		Ship transport	6,898	26,000	79
		Total			**100**
	Leningrad, Russia - Acajutla - San Salvador	Truck transport	0	-	13
		Ship transport	6,999	26,000	87
		Total			**100**
	Difference				**0**
Containers	Los Angeles-La Unión - San Salvador	Truck transport	184	-	12
		Ship transport	2,268	4800 TEUs	88
		Total			**100**
	Los Angeles-Acajutla- San Salvador	Truck transport	95	-	8
		Ship transport	2,168	1270 TEUs	97
		Total			**104**
	Difference				**4**

[Source: Estimated by the study team]

[Note (1): In each comparison by cargo item between via La Unión Port and via Acajutla Port, the total cost via La Unión Port is expressed to be an index of 10(

(2):In each comparison by cargo item between via La Unión Port and via Acajutla Port, the representative destination in import or origin in export is set within San Salvador.]

E.2 Major Port Facilities Requirement

E.2.1 Berth Occupancy Rate

(1) Multi-Purpose Berth

The berth occupancy rate was estimated at 33%, 34%, and 35% in 2005, 2010, and 2015 respectively as computed below. It was assumed one hour per shipcall for the time of berthing/ unberthing operation.

Table E.2.1 Berth Occupancy Rate of Multi-Purpose Berth

	2005	2010	2015
1) Iron and Steel Cargo Volume (MT)	37,200	55,500	78,900
Number of Shipcall	7	11	16
Assumed Cargo Handling Rate	190 t/hr	190 t/hr	190 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Iron and Steel	12 days	17 days	22 days
2) Cement Cargo Volume (MT)	60,000	70,000	80,000
Number of Shipcall	15	18	20
Assumed Cargo Handling Rate	360 t/hr	360 t/hr	360 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Cement	11 days	12 days	12 days
3) Cereal Cargo Volume (MT)	247,500	266,700	287,400
Number of Shipcall	6	7	7
Assumed Cargo Handling Rate	400 t/hr	400 t/hr	400 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Cereal	37 days	37 days	38 days
4) Fertilizer Cargo Volume (MT)	105,300	105,300	105,300
Number of Shipcall	3	3	3
Assumed Cargo Handling Rate	200 t/hr	200 t/hr	200 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Fertilizer	31 days	29 days	28 days
5) Soybean Flour Cargo Volume (MT)	58,200	62,700	67,500
Number of Shipcall	2	2	2
Assumed Cargo Handling Rate	400 t/hr	400 t/hr	400 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Soybean Flour	9 days	9 days	9 days
6) Sugar Cargo Volume (MT)	60,000	60,000	60,000
Number of Shipcall	3	3	3
Assumed Cargo Handling Rate	210 t/hr	210 t/hr	210 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Sugar	17 days	16 days	15 days

7) Molasses Cargo Volume (MT)	10,000	10,000	10,000
Number of Shipcall	2	2	2
Assumed Cargo Handling Rate	300 t/hr	300 t/hr	300 t/hr
Efficiency of Cargo Handling	0.70	0.75	0.80
Total Berth Time for Molasses	2 days	2 days	2 days
Total for Multi-Purpose Berth			
Number of Shipcall	38	46	53
Total Berth Time 1) to 7)	119 days	122 days	126 days
Berth Occupancy Rate	33 %	34 %	35 %

(2) Passenger Berth

The passenger berth will not only serve passenger ships but also car carriers. The service boats such as tug boat and pilot boat are moored in the same area. The berth time for the passenger ship is assumed to be two days per call judging from the past pattern of passenger ship at the port. The berth occupancy rate of this berth is assumed at 18.4 % in 2015 as shown in Table E.2.2.

Table E.2.2 Berth Occupancy Rate of Passengers and Berth

	2005	2010	2015
1) Passenger Ship			
Number of Shipcall	1	1	1
Assumed Berth Time for Passenger Ship	2 days	2 days	2 days
2) Car Carrier			
Number of Shipcall	15	22	33
Assumed Cargo Handling Rate	60 t/hr	60 t/hr	60 t/hr
Efficiency of Cargo Handling	0.75	0.75	0.75
Total Berth Time for Car Carrier	5 days	7 days	11 days
Total Berth Time for Passenger Ship and Car Carrier	7 days	9 days	12 days
Berth Occupancy Rate	2 %	2 %	3 %

E.2.2 Floor Area Requirement for Administration building

In order to obtain appropriate floor area of the Administration Building, the number of staff to be accommodated and allocation of special room requirements were assumed as shown in Table E. 2.3.

Table E.2.3 List of Required Offices, Areas in Administration Building Based on Number of Persons

No.	OFFICES	No. Psns. required	Calculation (m2)		Area (m2)	Notes
			Ordinary off.	Specific rm.		
A	**ADMINISTRATION OFFICE (CEPA)**					
1	Manager (managing director) and secretary	1+1		72	72.00	L1
2	Harbor Master	1		33	33.00	L2
2.1	Navigation Controller	4		89.52	89.52	L3
2.2	Meeting Rooom			68.52	68.52	L4
3	Administration and Follow up Department	2	2x10=20		20.00	
3.1	General Affair Section	2	2x10=20		20.00	
3.2	Finance Section	3	3x10=30		30.00	
3.3	Concession/License Monitoring	2	2x10=20		20.00	
3.4	Legal Adviser	1	1x10=10		10.00	
3.5	Security Division	6	6x10=60		60.00	
3.6	Information	1	1x10=10		10.00	
4	Maintenance Department	2	2x10=20		20.00	
4.1	Civil Work Section	2	2x10=20		20.00	
4.2	Mechanical Section	2	2x10=20		20.00	
4.3	Electrical Section	2	2x10=20		20.00	
5	Environmental Unit Section	2	2x10=20		20.00	
6	Auditorium (25 persons)			137.5	137.50	L5
7	Cafeteria			93.5	93.50	L6
8	First Aid	2		60	60.00	L7
9	Conference Room (10 persons)			60	60.00	L8
10	Store/Janitor Room	2	2x10=20		20.00	
	TOTAL	**38**	290.00	614.04	**904.04**	
B	**GOVERNMENT OFFICES**					
1	Quarantine and OIRSA office	5		59	59.00	L9
2	Meteorology Office	1	1x10=10		10.00	
3	Customs	5		117.5	117.50	L10
4	Waiting Area			113	113.00	L11
5	Police	3	3x10=30		30.00	
6	Banks	6	6x10=60		60.00	
7	Immigration	5		75	75.00	L12
	TOTAL	**25**	100.00	364.5	**464.50**	
C	**CONCESSIONARIES**					
1	Administration Personnel	3	3x10=30		30.00	
2	Stevedoring Division	6	6x10=60		60.00	
3	Shipping Lines	6	6x10=60		60.00	
4	Yard Control Division	4	4x10=40		40.00	
5	Gate Operation Division	6	6x10=60		60.00	
6	Maintenance Division	1	1x10=10		10.00	
7	Security Division	3	3x10=30		30.00	
	TOTAL	**29**	290.00		**290.00**	
	TOTAL	**92**	680.00	978.54	**1658.54**	

[Notes:]

∠1: The managers room needs wider space since the room accommodate the following items

- Large Scale desks than others
- Reception furniture
- Secretary room
- Private toilet

∠2: The harbor master room will also needs wider room for the same reason as above without provision of secretary room. The room area is approximately (7 x 6) – 3 x 3 = 33 m² as shown on the attached drawing.

∠3: Navigation controller room will accommodate 4 persons or more, however the room needs to provide a complete set of operation desks with chairs and an appropriate space for provision of furniture and people gathering in the time arises. Small office room with 3 x 7 = 21 m² will also be provided for taking a short sleep in an overnight work and storing necessary documents and lockers. The room area is therefore (3.14 x 6.² x ½) + 1.0 x 12 + 3 x 7 = 89.5 m², as shown on the drawing.

∠4: The meeting room will accommodate approximately 15 persons of which room area is (3.14 x 6² x ½) + 1.0 x 12 = 68.5 m², as shown on the drawing.

∠5: The auditorium will accommodate approximately 25 persons with some space for stages, of which floor area is 25 x 5.5 m²/ psn. = 137.5 m².

∠6: The floor area of cafeteria was calculated as follows:

- Number of persons using the rooms

assumed number of persons: 100 psn / 2 shift = 50 persons

- Floor area: 50 psns x 1.25 m²/psn = 62.5 m²

- Kitchen with food storage: (62.5 x 0.4) + 6 = 31 m²

Total: 94 m²

Visitors could be served intermittently.

∠7: First Aid room will accommodate a doctor and a nurse and consists of a reception room, medical treatment room and doctor's room, of which floor area is approximately 6 x 10 = 60 m², as shown on the drawing.

∠8: Conference room will accommodate approximately 10 persons, of which floor area is 10 x 5.5 + 5 (for stage) = 60 m^2

∠9: Quarantine and OIRSA (Regional International Organism of Agricultural and Cattle Health) will accommodate 5 persons, of which floor area is 5 x 10 m^2/psn. + 9 (for testing corner) = 59 m^2.

∠10: Custom room accommodate 5 officers and a reception area, of which floor area is 5 x (10 m^2/ psn. + 8.4) + 25 m^2 = 117.6 m^2 as shown on the drawing. The floor area 25 m^2 is for documents stock area, while the area 8.4 m^2 x 5 = 42 m^2 is a reception area for visitors.

∠11: Waiting area is provided for the people who visit to formalize documentation for import and export procedure. The floor area is 5 officers x 3 seat / officer x 7.5 m^2 / seat = 113.0 m^2.

∠12: Immigration office will accommodate 5 officers, of which floor area is 5 x 10 m^2/psn + 25 m^2 = 75 m^2. The floor area 25 m^2 is for documents stock area.

E.3 Characteristics of Vessels to Call at La Unión Port

E.3.1 Bulkers

Possible characteristics of Vessels type and sizes to call at La Unión Port were estimated for major conventional cargo item containing cereals, fertilizer, iron and steel products and raw sugar. In all of the cases, vessel type is normally bulker and main shipping routes are via Panamá Canal despite the difference of overseas origins/destinations among the cases. Thus, the maximum size of bulkers is the Panamax size. Since, there are no short-sea routes in any of the cases, then having sufficient cargo volumes and been served by a deep-sea port translates into the most economical transport being brought by the largest vessel, namely Panamax bulker. In the case of cereals, it is considered that cargo lot is sufficient to use a Panamax bulker, and so that type is assumed to be used. There are two representative bulkers sizes commonly used for cereals transport; one is Panamax bulker, and the other is handysize bulker. Hence, the assumption of Panamax size is considered to be adequate. In other cases, however, the respective cargo lots are considered to be insufficient to allocate a Panamax bulker. In addition, the assignment of a Panamax bulker in the said cargoes seems to be not commonly used in actual sea-borne transport. In the case of fertilizer, the vessel of the maximum size currently calling at Acajutla Port under partly loaded conditions is assumed to call at La Unión Port under fully loaded conditions in the future. On the other hand, in the cases of iron and steel products and raw sugar, where cargo lots are estimated to be comparatively small, the vessels of an average size currently calling at Acajutla Port are assumed to call at La Unión Port even in the future.

Based on the registered statistic data of ships in the World, the Panamax type ships are sorted by the Panamá Canal requirements.

The registered worldwide bulker is ranged from less 30,000 to more than 300,000 DWT as illustrated in Figure E.3.1.

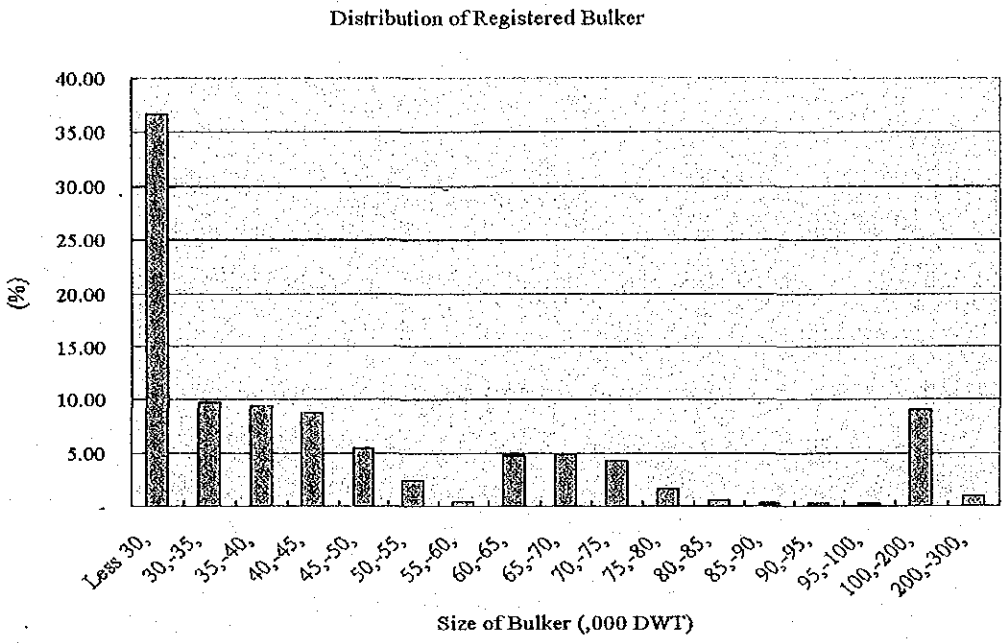

Figure E.3.1 Distribution of Registered Bulker

The Panamá Canal limitation is taken into account. The distribution of ship size hits a ceiling at about 50,000 DWT class as shown in Figure E.3.2 due to the draught limitation.

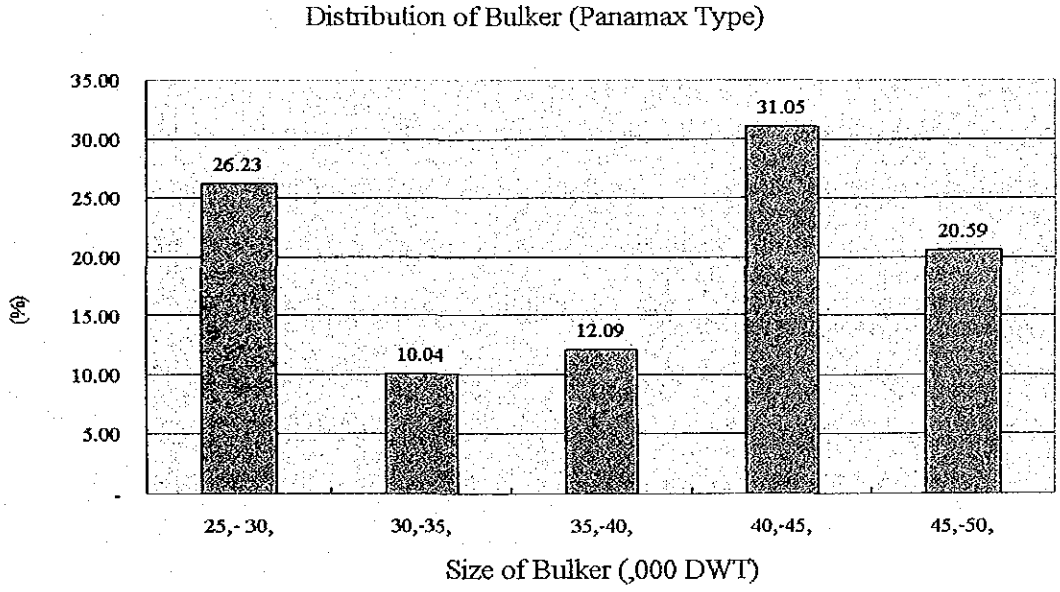

Figure E.3.2 Distribution of Panamax Type Bulker

In Figure E.3.3, the changes of ship characteristic for the last ten years are illustrated. The ship size increase slightly, but there is no significant changes.

The representative ship length is determined based on the correlation between the ship capacity and the ship length. The LOA for the bulkers of 43,000 ~50,000DWT is about 185m according to the graph.

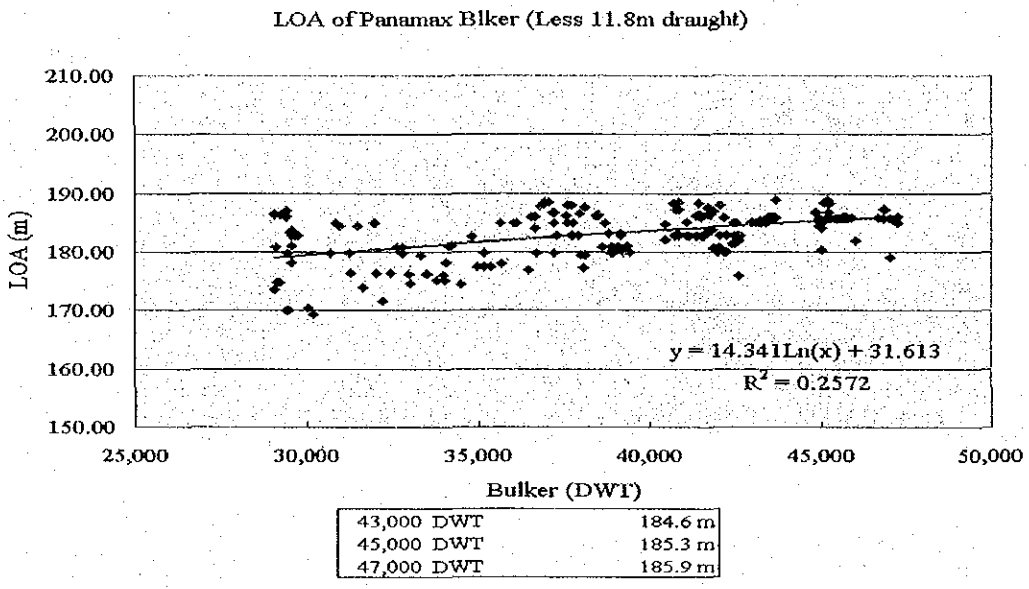

Figure E.3.3 Representative Ship Length of Panamax Type Bulker

In Figure E.3.4, the draught is shown in correlation with the ship capacity.

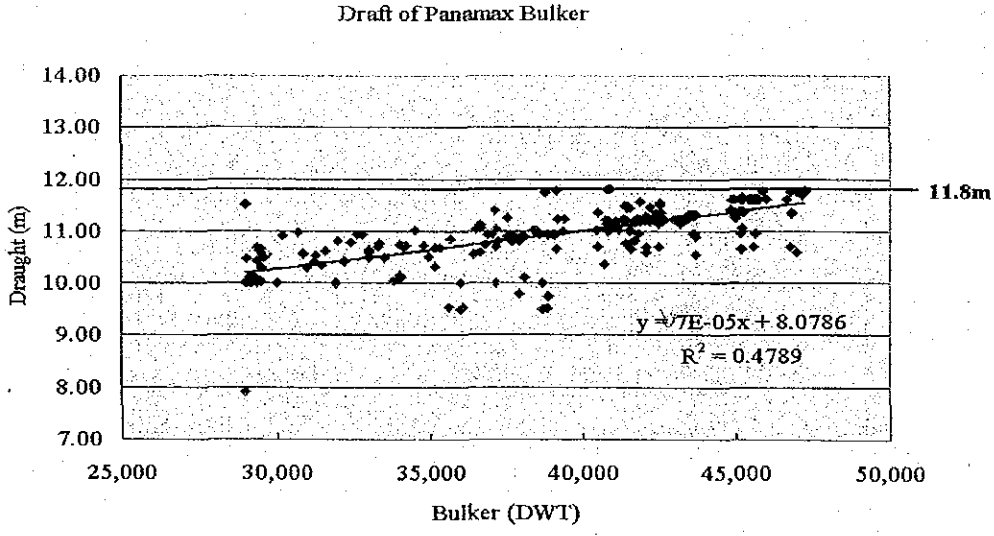

Figure E.3.4 Draught of Panamax Type Bulker

From this graph, it can be said the sailing draft of Panamax Type Bulker is 11.8 m.

This Panamax bulker size is applied for the commodities of Cereal and Soybean Flour. The bulker size for other commodities were determined as shown below considering volume of one shipment lot, frequency of trade, origin-destination of commodity, etc.

Table E.3.1 Present and Future Ship Sizes for Bulk Carrier

Commodity	Present Average Ship Size	Assumed Future Ship Size	Remarks
Iron and Steel	30,000 DWT	30,000 DWT	Handysize Bulker
Cement	4,000 DWT	4,000 DWT	
Cereal	34,000 DWT	43~50,000 DWT	Panamax Bulker
Fertilizer	26,000 DWT	43,000 DWT	Panamax Bulker
Soybean Flour	23,000 DWT	43~50,000 DWT	Panamax Bulker
Suger	26,000 DWT	26,000 DWT	Handysize Bulker
Molasses	24,000 DWT	24,000 DWT	Handysize Bulker

At present, the following shipping lines or consortium of lines are operating container vessels through the Panamá Canal. The characteristics of their container vessels are shown in Table E.3.2.

- Maersk – Sealand
- Evergreen
- COSCO/Yang Ming/K Line
- Mitsui OSK/Hanjin/APL
- ZIM
- NYK/OOCL/P&O

Table E.3.2 Panamax Type Ships Passing Through the Panamá Canal

Shipping Line	LOA	Breadth	Draft (full)
Maersk	294.1	32.2	13.5
Sealand	289.5	32.2	12.6
Evergreen	294.1	32.2	12.6
Cosco	275.1	32.2	12.5
Yang Ming	275.0	32.2	12.0
K Line	276.5	32.2	12.0
Mitsui OSK	289.5	32.2	13.0
Hanjin	289.5	32.2	13.0
APL	260.00	32.2	12.5
NYK	292.2	32.2	13.0
OOCL	289.5	32.2	12.7
P&O	292.1	32.2	13.0
NEDDLLOYD	287.0	32.2	12.7

E.3.2 Container Ships

According to the interviews with major shipping lines/agents providing their services in El Salvador, they intend to assign Panamax container ships to La Unión Port that will take an advantage of closeness to the International trunk shipping route along the coast of El Salvador. Hence, Panamax size is considered to be the representative container ships to call at the new container terminal at La Unión Port.

In Figure E.3.5, the correlation with the length of container ship is illustrated covering 1,500 to 4,800 TEU class. The maximum length is ranked at 294 m of the Panamá Canal limitation. The representative container ship is set out as the Panamax Type, 4,800 TEU class.

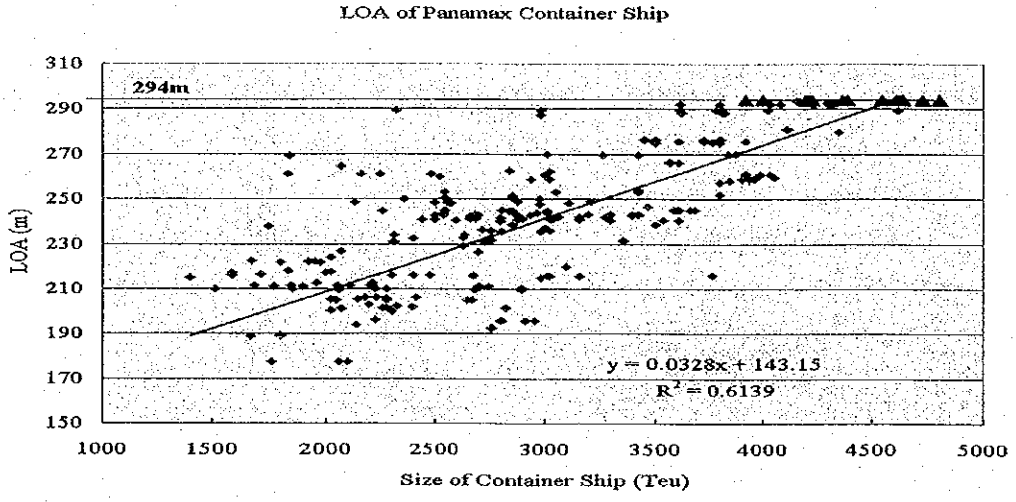

Figure E.3.5 Length of Container Ships

In the case of container ships, the cargo moving is mainly in the west coast. The ships will operate without the draught limitation. The full draught of Panamax container ships (4,800 TEU class) is adapted as 13.1 m as shown in Figure E.3.6.

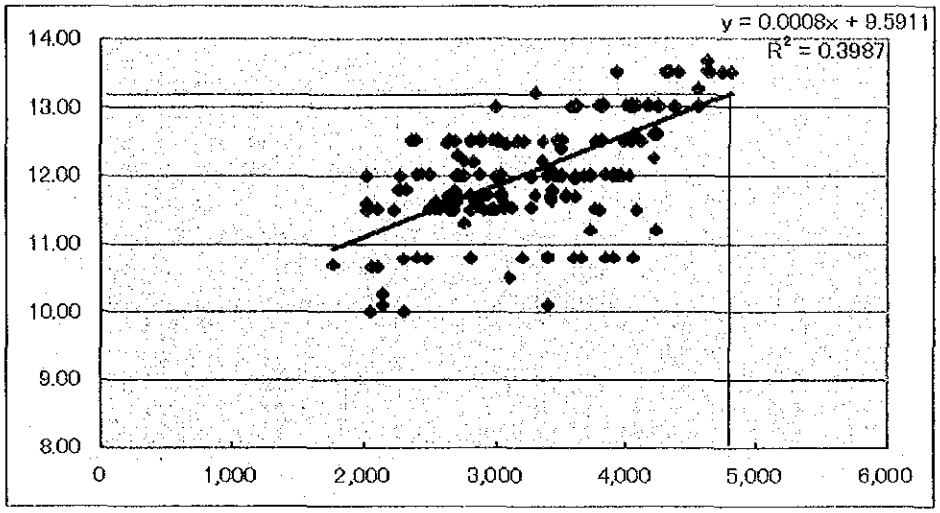

Figure E.3.6 Panamax Container Ships Draught

Also the changes in the characteristic of container ships are examined in Figure E.3.7. In the last ten years, the characteristic of container ships is drastically changes and its ship size reaches the maximum limitation of the Panamá Canal.

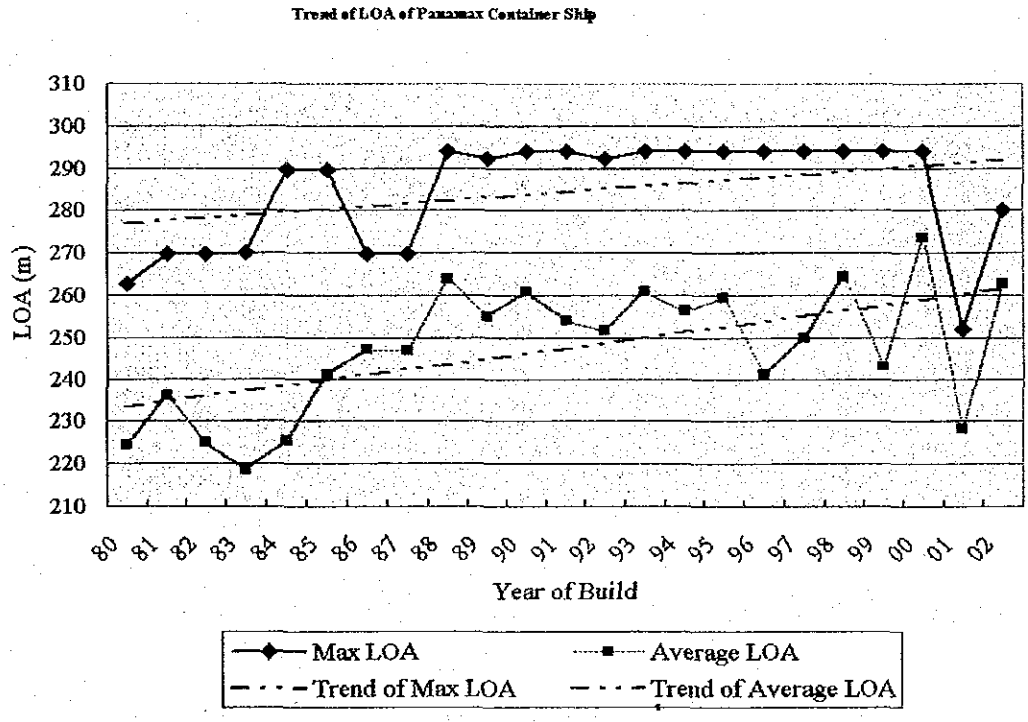

Figure E.3.7 Changes in Characteristic of Container Ships

Therefore, the representative container ship is summarized together with bulker as shown in Table E.3.3.

Table E.3.3 Characteristics of the Representative Vessels to Call Cutuco Port

(Unit: m)

	Cargo Item	Type	DWT	LOA	Breadth	Sailing Draft
Bulker	Cereals/ Soybean Flour	Panamax Bulker	43,000/ 50,000	185	32.2	11.8
	Fertilizer	Handysize Bulker	43,000	183	30.5	12.0
	Iron/Steel Products	Handysize Bulker	30,000	177	27.0	11.0
	Raw Sugar	Handysize Bulker	26,000	173	25.2	10.0
Containers		Panamax Container Ship, Capacity of 4,800 TEUs	55,000	294	32.2	13.1