5.2 Port Finance

5.2.1 Philippine Ports Authority (PPA)

5.2.1.1 General

PPA is under the control of MOTC as mentioned before. The budget of PPA is therefore determined by the Office of Budget Management under the Ministry of Budget. The Board of Directors of PPA prepare and adopt annual estimates of income and expenditures and estimates of capital expenditure for each fiscal year. Appendix 5.2.1 is a flow chart of the budgetary procedure.

PPA has the authority to levy rates and charges and to collect other dues. The Authority utilizes the income for the daily operations of the ports and to finance its capital expenditure activities. If PPA needs to change the level of rates, charges and dues, it can implement a changed tarriff with the prior approval of the President of the Philippines.

Dues includes harbor fees, tonnage and wharfage dues, berthing charges, and port dues. Rates refer to all rates and charges including any toll or rent for facilities used or services rendered. (Appendix 5.2.2 shows the present rates, charges and dues.)

5.2.1.2 Past Financial Perfomance

PPA's financial perfomance during fiscal years 1981 to 1985 is summarized in Table 5.2.1 and detailed in Appendix 5.2.3. The summary income statements demonstrate that PPA has operated profitably over recent years and has earned rates of return ranging from 6.6% in 1981 to 18.2% in 1985.

Restructuring and simplication of the Port Tariff System for easier administration was implemented effective August 1, 1983. Approval was obtained for a 135% across-the-board increase in rates spreading over a 3-year period.

Table 5.2.1 Summary of Past Financial Performance of PPA

(million pesos)

Year ending 31 December	1981	1982	1983	1984	1985
Operating Revenue	279.6	341.7	391.2	444.5	612.1
Working Expenses	150.6	160.7	149.7	203.7	199.9
Depreciation	47.4	71.4	78.5	88.9	88.0
Total Operating Expenses	198.0	232.1	228.2	292.6	287.7
Operating Income	81.6	109.6	163.0	151.9	324.4
Non-Operating Income	51.9	33.5	36.9	58.8	102.0
Interest on Long Term Debt	21.8	36.1	80.4	128.2	187.6
Other Non-Operating Expenses	12.8	27.1	10.9	13.7	14.8
Net Income	98.9	79.9	108.6	68.8	224.0
Working Ratio (%)	54	47	38	46	33
Operating Ratio (%)	71	68	58	64	47
Rate of Return on Net Fixed Assets (%)	6.6	7.1	8.9	8.8	18.2

Due to the restructuring of the Port Tariff, revenue from operations in 1985 amounted to 612.1 million, more than doubling in 4 years. However, based on the summary balance sheet, net fixed assets increased by only about 50 percent over the past 4 years.

Table 5.2.2 Summary Balance Sheet

(million pesos)

	1981	1982	1983	1984	1985
Assets					
Net Fixed Assets	2,533.3	2,830.3	3,167.6	3,333.8	3,768.4
Current Assets	580.7	571.0	690.3	774.6	1,177.2
Other Assets	183.2	149.0	141.8	14.3	13.6
	3,225.2	3,550.3	3,999.7	4,122.7	4,959.2
Equity and Liabilities					
Capital and Retained Earnings	2,653.2	2,799.7	2,890.8	2,841.4	3,083.8
Long Term Debt	486.7	645.9	854.9	1,066.0	1,512.4
Current Liabilities	85.3	104.5	253.7	215.3	362.4
Other Liabilities	-	0.2	0.3	-	0.6
	3,225.2	3,550.3	3,999.7	4,122.7	4,959.2

PPA has also implemented measures to reduce operating costs. These include improvements in the financial planning and control system, maximum utilization of existing manpower to avoid the need for additional hiring, and suspension of non-critical activities like advertising, promotion and sports.

Due to the above measures, Working Expenses and Total Operating Expenses increased by only 30 and 40 percent over the past four years compared to the over 100 percent increase in Operating Revenue during the same period. Thus, the Working Ratio and the Operating Ratio both decreased from 1981 to 1985, though both ratios increased slightly in 1984.

As of 1985, PPA's debt service ratio was about 3.4 times and average debt service ratio from 1982 to 1985 was about 3.2 times indicating a good creditworthiness of PPA.

5.2.2 PMU Manila

5.2.2.1 General

Though the individual PMUs make financial reports such as Balance Sheets, Income Statements and Cash Flow Statements by themselves, the PMUs are not fiscally independent from PPA. Port tariffs, the main sources of revenue at the PMUs, are uniform throughout the Philippines except for storage charges and cargo handling charges which vary accounting to facilities and equipment provided at each particlular port. The revenues are absorbed into the PPA general account,and the expenses are controlled by the PPA budget.

However, it is still necessary to look over the financial position of PMU Manila when considering the development project. This is because PMU Manila is by far the largest and the most important of the 19 PMU's. The operating revenue of PMU Manila represents about 50% of total PPA revenue as of 1985. The operating Income of PMU Manila thus makes a great contribution to total PPA income, and the financial position of PMU Manila greatly affects the financial position of PPA (See Tables 5.2.3 and 5.2.4).

Table 5.2.3 Revenue from Operations by PMU's

(Unit: million pesos)

	1980		1981		1982		1983		1984		1985		GROWTH RATE '85/'80
		SHARE		SHARE		SHARE		SHARE		SHARE		SHARE	
Manila	120.2	53.9	150.6	54.8	187.0	54.7	219.5	56.1	213.3	48.0	297.4	48.6	147.4
Batangas	24.2	10.9	30.9	11.3	35.6	10.4	41.6	10.6	52.7	11.9	77.4	12.6	217.2
Cebu	15.2	6.8	16.7	6.1	20.6	6.0	24.8	6.3	35.6	8.0	48.7	8.0	220.4
Davao	11.4	5.1	12.3	4.5	16.0	4.7	18.5	4.7	26.8	6.0	44.7	7.3	292.1
Iloilo	12.3	5.5	12.9	4.7	16.5	4.8	15.8	4.0	24.1	5.4	24.1	4.0	95.9
Cagayn de Oro	7.9	3.6	9.3	3.4	10.6	3.1	10.8	2.8	16.4	3.7	20.4	3.3	158.2
Iligan	7.1	3.2	8.3	3.0	11.0	3.2	11.3	2.9	13.5	3.0	19.1	3.1	169.0
Other 12 PMUs	24.6	11.0	33.8	12.2	44.4	13.1	48.9	12.6	62.1	14.0	80.3	13.1	226.4
TOTAL	223.1	100.0	274.8	100.0	341.7	100.0	391.0	100.0	445.5	100.0	612.1	100.0	174.4

Table 5.2.4 Net Income from Operations by PMU's

(Unit: million pesos)

	1980	1981	1982	1983	1984	1985
Manila	55.2	69.8	92.8	127.2	107.9	184.9
Batangas	17.4	25.9	29.6	37.2	45.7	70.3
Cebu	1.3	0.5	5.5	12.9	(2.6)	0.2
Davao	3.4	4.1	7.5	11.7	15.9	32.4
Iloilo	4.6	4.5	5.8	7.0	(1.4)	(9.5)
Cagayan de Oro	3.7	1.8	4.9	6.1	(1.1)	(9.5)
Iligan	4.0	4.9	6.5	8.0	9.0	15.0
San Fernando	1.6	1.4	2.4	3.9	1.8	5.8
Other 11 PMUs	(16.1)	(12.6)	(7.1)	3.8	(5.6)	(7.5)
TOTAL	75.1	100.3	149.7	217.7	169.6	282.1

5.2.2.2 Past Financial Performance

The financial performance of PMU Manila from 1981 to 1985 is summarized in Table 5.2.5 and detailed in Appendix 5.2.4.

Table 5.2.5 Summary of the Past Financial Performance of PMU Manila

(million pesos)

Year ending 31 December	1981	1982	1983	1984	1985
Operating Revenue	154.1	187.0	219.5	213.3	297.4
Working Expenses	47.8	52.5	54.2	61.1	63.6
Depreciation	20.1	27.2	31.6	30.6	30.2
Total Operating Expenses	67.9	79.7	85.8	91.7	93.8
Operating Income	86.3	107.3	133.7	121.6	203.6
Interest on Long Term Debt	1.6	1.7	2.6	7.0	8.2
Other Non-Operating Expenses	11.4	12.0	6.4	6.4	6.4
Net Income	73.3	93.6	124.7	108.2	189.0
Working Ratio (%)	31.0	28.1	24.7	28.6	21.4
Operating Ratio (%)	44.1	42.6	39.1	43.0	31.5
Rate of Return on Net Fixed Assets (%)	15.2	17.7	17.8	15.6	27.3

The summary income statement demonstrates that PMU Manila has operated profitably over recent years and has earned rates of return ranging from 15.2% in 1981 to 27.3% in 1985. The Working Ratio and Operating Ratio both decreased from 1981 to 1985, though both ratios increased slightly in 1984.

As of 1985, PMU Manila's liquidity ratio was about 3.34%.

Table 5.2.6 Summary Balance Sheet of PMU Manila

(million pesos)

	1981	1982	1983	1984	1985
Assets					
Net Fixed Assets	979.4	1,087.0	1,264.5	1,229.1	1,195.6
Current Assents	21.0	19.3	32.6	32.9	70.9
Other Assents	97.4	69.6	47.8	1.6	1.7
Total	1,097.8	1,175.9	1,344.9	1,263.6	1,268.2
Equity and Liabilities					
Capital and Retained Earnings	1,085.8	1,165.9	1,334.1	1,253.8	1,247.0
Current Liabilities	12.0	10.0	8.9	8.2	21.2
Other Liabilities	-	-	1.9	1.6	-
T o t a l	1,097.8	1,175.9	1,344.9	1,263.6	1,268.2

CHAPTER 6
DEMAND FORECAST

CHAPTER 6 DEMAND FORECAST

6.1 General

6.1.1 General Port Development Policy and Basic Assumptions

1) Since the roles and functions of ports vary with the socio-economic structure of their hinterlands which are largely influenced by national and regional socio-economic development policy, the future functions or roles of the Port of Manila and thus the basic direction of the port development should be determined in coordination with the socio-economic policy.

However, in the Philippines, the national economic development policy is presently being revised by NEDA due to the change of government, and the fundamental future direction of the national economic policy is not yet clear. Therefore, final decisions must await the announcement of the new policy.

In this Study, it is assumed that the basic direction of national and regional development will not greatly change from the recent past, and the future growth of the Philippine economy is forecast considering the historical growth and the forecast growth of the world economy.

2) Therefore, basic assumptions concerning the roles and functions of the Port of Manila are set as follows:

① Metro Manila is already confronting major urban problems including a housing shortage, traffic congestion, insufficient water supply, etc. Batangas Port and the Urban Corridor will be developed to promote decentralization of population and economic activities away from the central area of Metro Manila.

② To reduce the burden of excessive concentration of traffic in MMA and to achieve more effective and economic transportation, certain cargoes such as iron and steel products and fertilizer will be imported via the Port of Batangas considering the spatial distribution of related industries.

③ The basic functions and roles of the Port of Manila are the same as those specified in the Master Plan Study conducted by the

Salzgittar Consult GMBH except for the above-mentioned relationship with the Port of Batangas.

④ Reflecting the status of MMA as the center of the Philippine economy, the Port of Manila will continue to play a central role as the main gateway for imported goods.

⑤ The export commodities handled at the Port of Manila will not change remarkably during the planning period. As for the domestic trade, the status of the Port of Manila will also remain essentially the same as at present.

6.1.2 Cargo traffic forecast

(1) Methodology

Two methods are used to forecast the cargo volume to be handled at the Port of Manila. One is a macro forecast which is a method to estimate the total cargo volume as a whole including many commodities, regardless of the volume of each commodity. The other is a micro forecast, which is a method to estimate th cargo volume of each commodity group individually.

Based on an analysis of the historical trend of cargo movement at the port, the cargo volume for foreign trade should be estimated by major commodity groups individually. The cargo forecast by commodity group is conducted based on correlations with related indices, and is also forecast based on the forecast supply and demand. On the other hand, domestic cargo, in principal, can be forecast based on correlations with socio-economic activities and by analyzing historical trends.

(2) Selection of Major Commodity Groups

The cargo handled at the Port of Manila is classified as shown in Table 6.1.1. The future volume of each commodity group is then forecast based on the historical volume and growth rate also considering the social, industrial and traffic situation in the future. The selected major commodity groups are as follows:

Import : dairy products, wheat and wheat products, other cereals, feed, paper and pulp, fertilizer, chemicals, metals and metal products, and machinery & transport equipment.

Export : fish & fish products, feed, other food, wood & wood products, and coconut products.

(3) Forecast by Cargo Mode

Based on the analysis of port statistics in 1985 by packing type, that is loose (break bulk) cargo, containerized cargo, dry bulk, and liquid cargo, the forecast volume by cargo mode is determined considering the prevailing packaging methods. Especially, the volume of containerized cargo is forecast considering the future containerizable rate by commodity. The cargo volume by ship type is estimated based on the present transportation practices and the projected lot volume.

TABLE 6.1.1 COMMODITY CLASSIFICATION

NAME OF COMMODITY	CODE NO. OF PSCC
Dairy Products	Division 02
Fish & Fish Products	Division 03
Wheat & Wheat Products	041, 046
Other Cereals	Division 04 excluding 041, 046
Feed	Division 08
Other Food	Section 0 excluding above and 05771, 05772
Tobacco	Division 12
Wood & Wood Products (excluding furniture)	Division 24, 63
Paper and Pulp	Division 25, 64
Textile Fibers	Division 26
Crude Fertilizers & Crude Minerals	Division 27
Metalliferous Ores & Metal Scrap	Division 28
Mineral Fuels	Section 3
Coconut Oil	423.31, 424.32
Other Coconut Products	05771, 05772, 22310
Other Animal & Vegetable Oils	Section 4 excluding Coconut Products
Fertilizer	Division 56
Chemicals	Section 5 excluding Fertilizer
Textiles & Garments	Division 65
Iron & Steel	Division 67
Non-Ferrous Metals	Division 68
Manufactures of Metal, n.e.s.	Division 69
Machinery & Transport Equipment	Section 7
Miscellaneous Manufactured Articles	Section 8
Others	

6.2 Future Socio-Economic Framework

Since the collapse of the Marcos Government, the new Government of the Philippines has been in the process of formulating and adopting major new policies. Under this situation three alternatives, that is high, medium and low projections, are prepared based upon different assumption (See Appendix 6.2.1).

Table 6.2.1 shows the projected GDP and sectoral GDP from 1990 to 2005.

Table 6.2.1 Future Socio-Economic Framework

	In Million Pesos at Constant 1972 Prices					Annual Growth Rate(%)				Share (%)				
	1985	1990	1995	2000	2005	90/85	95/90	00/95	05/00	'85	'90	'95	'00	'05
Medium Case														
GDP	90,469	110,643	141,212	180,226	230,019	4.1	5.0	5.0	5.0	100.0	100.0	100.0	100.0	100.0
(Indicator)	(161.3)	(197.3)	(251.8)	(321.4)	(410.2)									
Agriculture	26,010	31,754	39,524	49,336	61,568	4.1	4.5	4.5	4.5	28.8	28.7	27.9	27.3	26.8
(Indicator)	(162.2)	(198.0)	(246.6)	(307.6)	(383.8)									
Industry	28,880	36,623	47,808	62,012	80,418	4.9	5.5	5.3	5.3	31.9	33.1	33.9	34.4	35.0
(Indicator)	(165.6)	(210.0)	(274.1)	(355.5)	(461.1)									
Services	35,579	42,266	53,880	68,878	88,032	3.5	5.0	5.0	5.0	39.3	38.2	38.2	38.2	38.2
(Indicator)	(157.5)	(187.1)	(238.5)	(304.9)	(389.6)									
High Case														
GDP	90,469	118,700	158,820	212,500	284,325	5.5	6.0	6.0	6.0	100.0	100.0	100.0	100.0	100.0
(Indicator)	(161.3)	(211.7)	(283.2)	(379.0)	(507.0)									
Agriculture	26,010	32,246	43,199	57,800	77,337	4.4	6.0	6.0	6.0	28.9	27.2	27.2	27.2	27.2
(Indicator)	(162.2)	(201.0)	(269.3)	(360.3)	(482.2)									
Industry	28,880	39,547	52,887	70,763	94,680	6.5	6.0	6.0	6.0	31.9	33.3	33.3	33.3	33.3
(Indicator)	(165.6)	(226.7)	(303.2)	(405.7)	(542.8)									
Services	35,579	46,907	62,734	83,937	112,308	5.7	6.0	6.0	6.0	39.3	39.5	39.5	39.5	39.5
(Indicator)	(157.5)	(207.6)	(277.7)	(371.5)	(497.1)									
Low Case														
GDP	90,469	110,101	133,933	163,069	198,455	4.0	4.0	4.0	4.0	100.0	100.0	100.0	100.0	100.0
(Indicator)	(161.3)	(196.3)	(239.0)	(290.8)	(353.9)									
Agriculture	26,010	31,929	38,858	47,290	57,552	4.2	4.0	4.0	4.0	28.9	29.0	29.0	29.0	29.0
(Indicator)	(162.2)	(199.1)	(242.3)	(294.8)	(358.8)									
Industry	28,880	35,232	42,878	52,182	63,506	4.1	4.0	4.0	4.0	31.9	32.0	32.0	32.0	32.0
(Indicator)	(165.6)	(202.0)	(245.8)	(299.2)	(364.1)									
Services	35,579	42,940	52,257	63,597	77,397	3.8	4.0	4.0	4.0	39.3	39.0	39.0	39.0	39.0
(Indicator)	(157.5)	(190.1)	(231.3)	(281.5)	(342.6)									

Indicator : 1972 = 100

6.3 Cargo traffic Forecast

6.3.1 Foreign Trade

6.3.1.1 Macroscopic Forecast

The historical level of foreign trade cargo volume handled at the Port of Manila is erratic as shown below.

Annual Foreign Trade Volume

	Export	Import	Total
1978-79	- 7.5%	15.5%	10.8%
79-80	14.7	-14.6	- 9.5
80-81	-10.8	2.5	0
81-82	-11.1	9.1	5.2
82-83	25.6	5.8	9.1
83-84	- 9.0	-31.9	-27.6
84-85	1.1	0.4	0.6
Average 1978-85	- 0.6	- 3.2	- 2.6
Average 1978-83	1.1	3.2	2.8

However, over the long term, the cargo handling volume of a port generally has a close relation with the social and economic indices of the country. Using the historical correlation between the Gross Domestic Product (GDP) of the Philippines and the volume of foreign trade cargo handled at Manila, the total future cargo traffic through Manila is first forecast without considering the volume of individual commodities. This is the so-called macroscopic forecast.

The average annual growth rates of GDP and of the total foreign trade cargo volume through Manila from 1978 through 1983 are as follows:

Average annual growth rates (1978-1983)

GDP	3.83 %
Total foreign trade cargo volume at Manila	2.75

So the elasticity of cargo volume to GDP is approximately 0.72. Based on the estimated future economic growth (GDP), the average growth rate of the foreign trade volume at Manila is thus estimated using the above elasticity.

Estimated average annual growth rate of
foreign trade cargo through Manila

(%)

	1985-1990	1990-1995	1995-2000	2000-2005
Medium Case	3.0	3.6	3.6	3.6
High Case	3.0	4.3	4.3	4.3
Low Case	2.9	2.9	2.9	2.9

Since 1984, the foreign trade cargo volume has been limited by regulations restricting imports due to the lack of foreign currency in the Philippines. The level of GDP may recover to the 1983 level by 1988. Therefore, assuming the cargo volume in 1988 will be equal to the 1983 volume, 6.047 million tons, the future cargo volume is estimated based on the estimated growth rates as follows:

Table 6.3.1 Estimated Foreign Cargo Volume of Manila
by Macroscopic forecast

(thousand tons)

	1990	1995	2000	2005
Medium Case	6,415	7,656	9,137	10,905
High Case	6,415	7,918	9,773	12,063
Low Case	6,403	7,387	8,522	9,831

6.3.1.2 Forecast by Major Commodity Group

(Import)

1) Dairy Products

The Philippines is dependent on imports for a major portion of its dairy requirements. Almost all dairy imports are unloaded at the Port of Manila. The majority of these imports are condensed and evaporated milk and cream from Australia and New Zealand. The import volume varies year by year. But, based on the moving average every 3 years, the trend of import volume had been upward until 1982. The import volume in 1984 dropped sharply. This was mainly due to the Philippine economic crisis in that year.

① Consumption

Total consumption is calculated by multiplying per capita consumption

by total population. Appendix 6.3.1 lists the data of per capita consumption calculating the moving average every 3 years. The future per capita consumption is estimated based on a correlation between its historical levels and per capita GDP. Using the data from 1974 to 1982 and ignoring the data from 1983 as atypical due to the economic crisis, the per capita consumption volume is forecast as follows.

$Y=0.0241X - 0.92$ (R=0.88947)

where Y: Per capita consumption of dairy products
X: Per capita GDP indicator (1972=100)
R: Correlation coefficient

Per capita consumption of dairy products (kg/capita)

	1990	1995	2000	2005
Medium assumption	2.09	2.53	3.09	3.80
High assumption	2.12	2.72	3.51	4.55
Low assumption	2.07	2.36	2.72	3.15

Total future consumption can then be calculated from the projected per capita consumption and the future population.

Total consumption (thousand tons)

(Year)	1990	1995	2000	2005
Medium	128	173	232	310
High	130	186	264	371
Low	127	161	205	257

② Local production

Local production of dairy products has remained below 3 thousand metric tons per annum over the years. However, the Philippine government is implementing a National Dairy Development Plan in an effort to upgrade native cattle by distributing crossbreed dairy animals to small farmers, and to support small dairy farmers with technology and financing in strategic areas. Feed resources for milk production are generally available in steady supply throughout the nation.

The target of the National Dairy Development Plan (1981-1990) is to produce 10-20 percent of the domestic milk requirements in 10 years and

to thereby reduce the heavy dependence on imports. Based on the development plan and the historical production, we assume the following levels:

1990	local share	5%
1995	local share	10%
2005	local share	20%

In order to achieve the above percentages, local production will have to increase to the following levels:

1990	6 thousand tons
1995	17 thousand tons
2000	35 thousand tons
2005	46 thousand tons

③ Import

Based on the projected total consumption and local production, the future import volume through Manila is estimated as follows:

(thousand tons)

	1990	1995	2000	2005
Medium	122	156	197	264
High	124	169	229	325
Low	121	144	170	211

2) Wheat

Since there is virtually no wheat production in the Philippines, all the raw materials for bread and other flour products have to be imported. The Philippines' flour milling industry is presently composed of eight (8) flour mills: four in Metro Manila, two in Southern Tagalog and one each in the Visayas and in Mindanao. These mills are mostly situated in areas near water transport facilities for bulk handling of the imported wheat and in areas where the population concentration is high.

In mid-1974, the NFA took over wheat importation from the private sector upon the request of flour millers and bakers in view of the then prevailing fluctuation of world prices of wheat which resulted in unstable prices of flour and bakery products. The NFA takeover resulted in lowering the purchase prices of wheat imports through government to government transactions with the U.S and consequently in more stable prices of flour

and bakery products.

In December 1983, in the face of the economic crisis that brought about foreign exchange problems which resulted in reduced wheat imports, a scarcity of flour and fluctuating flour prices, discussions were held among government (NFA) representatives, flour millers and bakers. Mainly based on the request of the bakers, the NFA took over the distribution of flour to the bakers and to retail outlets at government controlled prices. Prior to this, it was reported that flour millers controlled their own marketing chains which tended to raise flour prices to unreasonable levels, to the detriment of the bakers and the consumers.

From 1983 to 1985, wheat imports continued to decline due to the scarcity of foreign exchange as well as to the decline in consumer demand suffered by the baking industry due to the still weak economy.

By 1985, world wheat prices had decreased and the millers requested the transfer of wheat importation and flour distribution from NFA to the private sector inasmuch as flour prices had gone down. This was granted in July 1985 by virtue of Executive Order No. 1028 and in line with the government policy of deregulation and privatization of industries.

① Consumption

Per capita consumption of wheat is closely related with per capita GDP. Based on the historical situation of the flour and baking industry, the per capita consumption is forecast based on the historical correlation between these two indices over 10 years, from 1974 to 1983. Then multiplying the projected per capita consumption by the projected population, the estimated future consumption of wheat is obtained as shown in Table-6.3.2.

Table 6.3.2. Projected Total Consumption of Wheat

Year	Per capita consumption (kg/capita)				Total consumption (000 T.)			
	1990	1995	2000	2005	1990	1995	2000	2005
Medium Assumption	15.5	18.4	22.2	26.9	953	1,259	1,670	2,195
High Assumption	15.5	19.8	25.5	33.0	953	1,355	1,918	2,693
Low Assumption	15.2	17.2	19.8	22.9	934	1,177	1,489	1,868

② Buffer Stock

According to interviews with MAF Staff, a sixty day stock for grain consumption is required. The required future stock volume is estimated as follows:

(thousand tons)

(Year)	Medium	High	Low
1990	159	159	156
1995	210	226	196
2000	278	320	248
2005	366	449	311

The stock as of the end of 1984 was 64 thousand tons according to MFA statistics. The required additional stock by year is estimated as follows:

(1000T./year)

	Medium	High	Low
1985 to 1990	16	16	15
1991 to 1995	10	13	8
1996 to 2000	14	18	10
2001 to 2005	18	26	13

③ Imports through the Port of Manila

The share of wheat import volume though Manila in the national total has fluctuated at around 53-58% over the last six years, and has been decreasing at a rate of 0.8% per annum comparing the three year averages of 1981 and 1984. The wheat imported through Manila is alloted to the four flour mills located in the Manila area. The share of the sales volume of these mills in the national total has been decreasing. Considering the above, the future wheat import share of Manila is estimated as follows:

1990	53 %
1995	51 %
2000	49 %
2005	47 %

The wheat import volume at Manila is forecast using the estimated total national import volume and the wheat import share of Manila Port. The forecast is shown in Table-6.3.3.

Table-6.3.3 Forecast Wheat Imports through Manila

(thousand Tons)

	1990	1995	2000	2005
Medium	514	647	825	1,040
High	514	698	949	1,278
Low	503	604	735	884

3) Other cereals

Then handling volume of other cereals through the Port of Manila from 1980 through 1985 is shown in Table 6.3.4. After a lapse of several years, rice imports began again in 1984. However, the Philippines has been essentially self-sufficient in rice since the middle of the 1970s. Furthermore, the production of rice in 1986 reached 9.1 million tons with a growth rate of 11% from the previous year. This production volume is sufficient to cover the entire domestic consumption according to MAF data. The government is also making various efforts to improve the yield of rice production through the Masagana Program, and expects the Philippines to remain self-sufficient in rice. As it seems likely that the Philippines will remain self-sufficient in rice, this section mainly considers the future imports of corn and malt.

Table 6.3.4 Import of Other Cereals Through Manila

(thousand tons)

	1980	1981	1982	1983	1984	1985
Rice	-	-	-	-	128	280
Maize (Corn)	238	245	341	509	182	241
Malt	57	66	81	100	108	64
Other Cereals	7	8	11	8	4	8

Source: NCSO

a) Corn

Corn is roughly classified into two categories: yellow corn for animal feed and white corn for direct human consumption. The domestic supply of yellow corn in the Philippines is both insufficient and erratic. Present production barely meets the demand of feed millers and livestock/poultry raisers despite recent production increases. Filling the gap are substantial imports, mainly from Thailand and the U.S.

Production

The local production has been increasing at an average annual growth rate of 4.1% over the last ten years, and reached 3.4 million tons in 1985. Future production is estimated by multiplying the future harvest area by the future yield, as forecast below.

ⓐ Harvest area

Appendix 6.3.2 shows the trend of corn harvest area from 1975 to 1985. Since 1980, the total harvest area has remained almost steady. However, the harvest area for yellow corn has been increasing year by year. The Government encourages yellow corn production based on the Maisagana Program, and is promoting the shift of traditional white corn areas towards yellow corn. The harvest area of yellow corn seems to be increasing with the increase of animal feed demand. Assuming that the total corn harvest area will remain at the present level, the future harvest area of each kind of corn is predicted based on the current trends.

Projected Harvest Area of Corn

(000 ha)

	Yellow corn	White and Other corn	Total
1990	1190	2125	3,315
1995	1424	1891	3,315
2000	1657	1658	3,315
2005	1812	1503	3,315

ⓑ Mean Yield

The mean yield of corn production in the Philippines is relatively low compared with other ASEAN countries as shown in Appendix 6.3.4. To improve the mean yield, the Maisagana program is providing full credit supports to introduce hybrids and to increase fertilizer use.

Appendix 6.3.3 shows the mean yield of each type of corn. Due to the Maisagana program, the mean yield for yellow corn has been increasing in recent years. Considering the historical trends and the mean yields in other Asian countries, the estimated future yield rates for each type of corn are as follows:

(t/ha)

(Year)	Yellow corn	White and Other corn	Total
1990	2.08	0.94	1.35
1995	2.43	1.00	1.61
2000	2.78	1.07	1.92
2005	3.12	1.14	2.22

ⓒ Estimated production

From the future harvest areas and yield rates estimated above, future corn production in Philippines can be forecast as follows:

(Year)	1990	1995	2000	2005
Production (thousand tons)	4,473	5,351	6,380	7,366

Consumption

The details of the use of corn in the Philippines are shown in Appendix 6.3.6. Mainly, the corn is used as animal feed and for human food. The future use of corn is estimated below.

ⓐ Food use

The per capita consumption of corn for food use changed from an increasing tendency to a decreasing one in 1976 (crop year 1975/76). Since then, the per capita consumption has been decreasing continuously at an average annual rate of 4.2% based on three year averages. Fig 6.3.1 shows the yearly variation of the per capita consumption of corn. Three year moving averages are plotted in order to eliminate short-term variations. Assuming that the per capita consumption is approximated by the line in the figure, the estimated per capita consumption of corn in the target year is:

(Year)	1990	1995	2000	2005
Per capita consumption(kg/capita)	25.0	24.0	23.2	22.5

Using this estimated per capita consumption, the total future consumption of corn for food use is forecast by multiplying the estimate by the projected population.

Projected Corn Consumption for Food Use

(thousand tons)

(Year)	
1990	1537
1995	1628
2000	1745
2005	1836

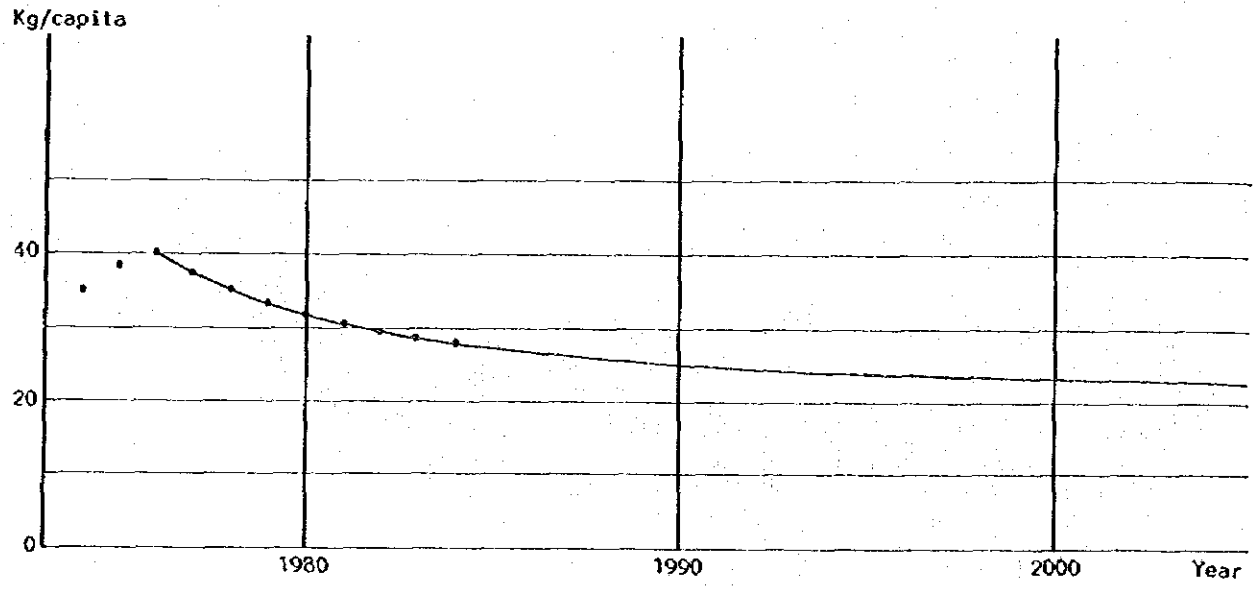


Fig. 6.3.1 Per Capita Consumption of Corn for Food Use

ⓑ Feed use

The use of corn for feed is basically correlated with the population of livestock, especially hogs and poultry. The historical trend of hog and poultry population is erratic as shown as Appendix 6.3.7. So, five year moving averages are used for the projection in order to eliminate short-term variations. The population of poultry and hogs varies along with meat demand.

Therefore, the future population of poultry and hogs is estimated based on the correlation with GDP, which is closely related to the demand for meat.

The estimated future population of poultry and hogs are:

(Year)	1990	1995	2000	2005
Medium Case				
Poultry	62,276	74,033	89,049	108,215
Hogs	8,342	9,762	11,577	13,893
High Case				
Poultry	62,841	77,420	96,937	123,058
Hogs	8,410	10,172	12,531	15,687
Low case				
Poultry	62,341	71,621	82,877	96,590
Hogs	8,350	9,471	10,832	12,489

The annual feed requirements for poultry and hogs are 0.03 tons per chicken and 0.81 tons per hog based on efficient feed-to-live weight conversion as derived from production training manuals published by SEARCA, College Laguna. The feed requirements for poultry and hogs are computed as follows:

(thousand tons)

(Year)	1990	1995	2000	2005
Medium Case	8,625	10,128	12,048	14,499
High Case	8,680	10,562	13,058	16,398
Low Case	8,634	9,821	11,260	13,014

The ratio of corn use for feed to the feed requirements of poultry and hogs is illustrated in Fig.6.3.2 The historical data are shown in Appendix 6.3.8. Assuming the inclination extrapolated from the figure, the estimated future elasticy is obtained. Then, considering this elasticity and the estimated feed requirements for poultry and hogs presented above, the required volume of corn for feed use in the future is estimated as follows:

Estimated Corn Use for Feed

(thousand tons)

(Year)	1990	1995	2000	2005
Medium Case	2,501	3,241	4,096	5,075
High Case	2,517	3,380	4,440	5,739
Low Case	2,504	3,143	3,828	4,555

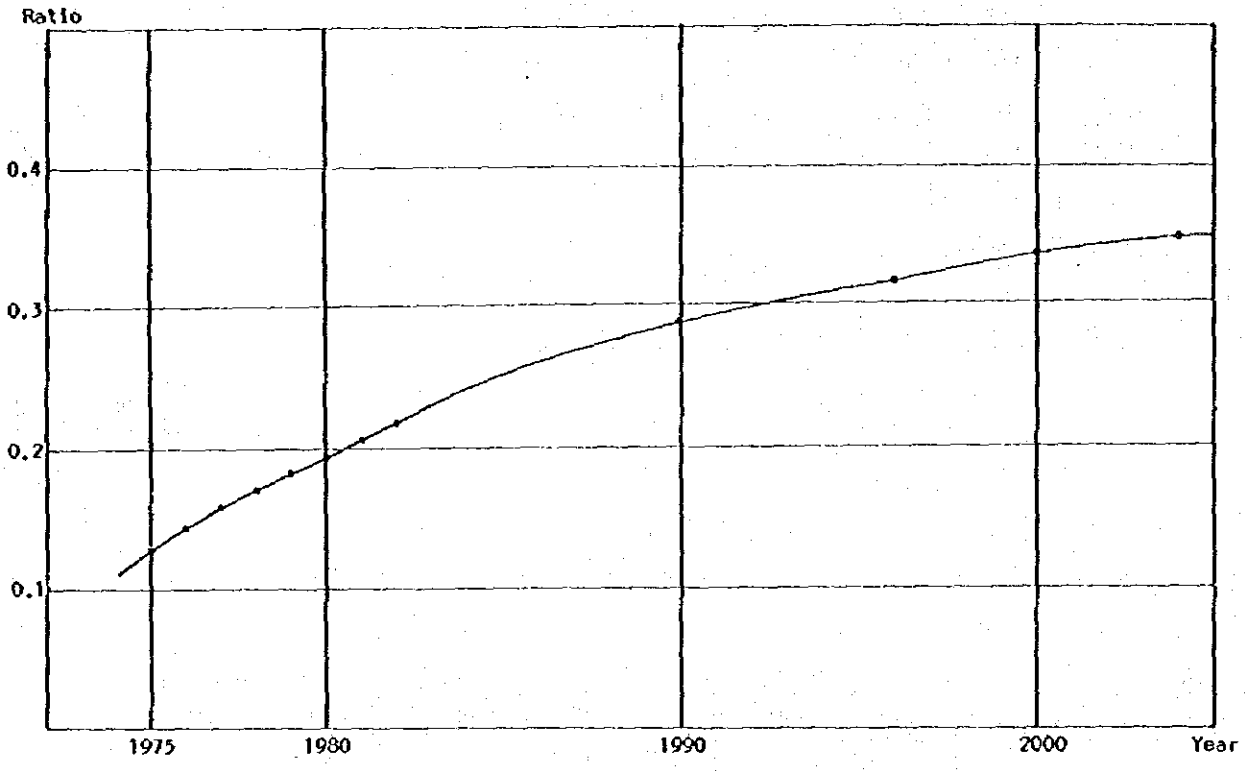


Fig. 6.3.2 Ratio of Feed Corn Use to the Feed Requirements of Poultry and Hogs

ⓒ Other uses

Seed use of corn is estimated at the rate of 20 kg/ha. Corn consumption for other non-food use, mainly as a raw material for manufacturing products, is estimated based on historical trends. The estimated consumption is as follows:

(thousand tons)

	Seed use	Other non-food use	Total
1990	66	222	288
1995	66	265	331
2000	66	308	374
2005	66	351	417

ⓓ Total demand and required stock

The projected total corn demand is estimated by adding up the projected demands estimated above. The result is summarized below:

(thousand tons)

(Year)	1990	1995	2000	2005
Medium Case	4,326	5,200	6,215	7,328
High Case	4,342	5,339	6,559	7,992
Low Case	4,329	5,102	5,947	6,808

The stock of corn at the end of 1984 was 181 thousand tons based on MFA statistics. The required stock of corn is estimated at a sixty day volume. Then, the required additional annual stocks are estimated as follows:

(1000 tons/year)

	Medium	High	Low
1985-'90	90	109	108
'90-'95	29	33	26
'95-2000	34	41	28
2000-2005	37	48	29

Balance of production and consumption of corn

The estimated production and consumption balance of corn in the Philippines is shown in Table 6.3.5.

Table 6.3.5 Production and Consumption Balance of Corn in Philippines

(thousand tons)

Year(case)	Production	Consumption	Balance
1990			
Medium	4473	4416	57
High	4473	4451	22
Low	4473	4437	36
1995			
Medium	5351	5229	122
High	5351	5372	- 21
Low	5351	5128	223
2000			
Medium	6380	6249	131
High	6380	6600	- 220
Low	6380	5975	405
2005			
Medium	7366	7365	1
High	7366	8040	- 674
Low	7366	6837	529

Based on the above estimated balance, it seems that the Philippines will become self-sufficient in corn around 1990.

After achieving self-sufficiency, the possibility of corn exports will depend on the local production cost and the supply-damand balance in the world market. However, it seems unlikely that the Philippines will produce a substantial corn surplus in the foreseeable future.

b) Malt and others

As barley is not produced locally, all the malt used in the country is imported. Manila's share of malt imports has fluctuated at around 75-80 % of the national total in recent years, because the main breweries are located in Manila.

The future import volume of malt is estimated using the historical correlation between GDP and malt imports, because the per capita consumption of beer, the main product using malt, is closely related with per capita income. The import volume of malt through Manila is forecast assuming that Manila's share of 80% will not change in the future. The import volume of the other minor cereals handled at Manila is around 8-10 thousand tons per year.

The estimated volume of malt and other cereal imports is:

(thousand tons)

(Year)	1990	1995	2000	2005
Medium Case	112	151	202	267
High Case	120	170	230	310
Low Case	110	145	185	225

4) Feed

The following is a list of the principal raw materials used as animal feed in the Philippines and their sources.

Yellow corn - local and imports from Thailand and U.S.
Sorghum - local
Rice by-products (bran millings, etc) - local
Corn by-products - local
Copra meal/cake - local
Wheat bran/pollard - local from imported grain
Soybean meal - local and imports from Brazil, U.S.

Fish meal - local and imports

Meat and bone meal - local and imports from Australia and New Zealand

Most of the soybean meal, yellow corn, fish meal, meat and bone meal are imported. This section analyzes the future import demand of these commodities except for yellow corn which is estimated in the previous section. The historical imports of feed into the Philippines and passing through the Port of Manila are listed in Table 6.3.6.

The import share of Manila has been around 90-95 % for last six years. Therefore, the future import volume of the whole country is estimated in order to project the future import volume of feed through the Port of Manila.

The NFA is the sole importer of soybean meal which is sold to feed millers and end-users. Importation of fish meal and meat meal are under taken by some of the feed millers for sale and for their own consumption.

Table 6.3.6 Import of Feed into the Philippines and through Manila Port

(Unit: thousand tons)

		1980	1981	1982	1983	1984	1985
Bean meal	Manila	201	200	348	250	339	226
	Philippines	215	218	387	275	375	226
Fish meal	Manila	24	16	41	14	5	17
	Philippines	24	16	41	14	5	23
Meat meal	Manila	54	33	58	42	13	24
	Philippines	55	33	59	42	13	25
Others	Manila	10	7	7	11	4	5
	Philippines	11	7	8	11	4	5
Total	Manila	289	256	454	317	361	272
	Philippines	305	274	495	342	397	279
Manila Share (Total) (%)		95	93	92	93	91	97
Manila Share (Bean meal) (%)		93	92	90	91	90	100
Manila Share (except bean meal) (%)		98	100	98	100	100	81

Source: Foreign Trade Statistics, NCSO

a) Soybean Meal

From 1976 to 1984, soybean meal imports into the Philippines increased at an average rate of 19 % per year using three year running averages in spite of governmental efforts to encourage farmers to plant this protein-rich feed ingredient. The imports rose to their highest level of 387 thousand tons in 1982. The supply and use of soybeans in the Philippines is shown in Appendix 6.3.9.

Consumption

The commercial mixed feed millers are the major users of imported soybean meal. Poultry feeds and hog feeds comprise a major portion of the commercial mixed feed sold in the Philippines. Demand for feeds is essentially dependent on the animal population. In this case, the number of commercial hogs and poultry has a close relation with the demand for soybean meal.

Therefore, the future volume of soybean meal consumption is estimated based on the feed requirements of commercial hogs and poultry and the estimated animal population.

At first, the future populations of commercial hogs and poultry are estimated using the correlation with GDP, because the per capita consumption of commercial meat is closely related with per capita income. The following is the correlation formula based on the historical data from 1974 to 1982 using 5 year running averages as shown in Appendix 6.3.10.

For hogs Y=18.856X - 1704.06 (R=0.9946)
For poultry Y=169.058X - 11562.56 (R=0.9863)
where Y : Number of commercial hogs or poultry
X : GDP Index (1972 = 100)
R : Correlation coefficient

The estimated number of commercial hogs and poultry are as follows:

Table 6.3.7 Estimated Number of Commercial Hogs and Poultry

(thousand heads)

(Year)	1990	1995	2000	2005
Hogs				
Medium case	1,992	3,012	4,315	5,978
High case	2,041	3,306	4,999	7,266
Low case	1,997	2,803	3,779	4,969
Poultry				
Medium case	21,573	30,719	42,401	57,312
High case	22,012	33,356	48,538	68,858
Low case	21,624	28,842	37,600	48,267

Multiplying the per head annual feed requirements for efficient feed-to-live weight conversion, 0.81 tons/hog and 0.03 tons/poultry, the future feed requirments for commercial hogs and poultry are estimated as follows:

Estimated future total feed requirements
for commercial hogs and poultry

(thousand tons)

	1990	1995	2000	2005
Medium Case	2,260	3,362	4,767	6,561
High Case	2,313	3,679	5,505	7,951
Low Case	2,267	3,135	4,189	5,473

Based on the historical data, using 5 year running averages, the future consumption of soybean meal is then forecast based on its correlation with the total feed requirements.

$$Y = 0.0224X - 131.14 \qquad (R=0.9534)$$

where Y : Soybean meal consumption (thousand tons)

X : Estimated feed requirements for commercial hogs and poultry (thousand tons)

R : Correlation coefficient

As a result, the future consumption of soybean meal is estimated as follows:

Table 6.3.8 Future Consumption of Soybean Meal in the Philippines

(thousand tons)

(Year)	1990	1995	2000	2005
Medium Case	377	625	940	1,344
High Case	389	696	1,106	1,656
Low Case	378	574	811	1,099

Local production

Soybean production for the past 5 years (1980-1984) recorded an average level of 9 thousand tons. The average yield of soybeans when crushed is around 20 % oil and 80 % meal. The soybean meal is marketed primarily as animal feed.

The Philippines also imports soybeans to be processed by local processors like Phil-Asia Food Industries in Batangas, which has a plant capable of processing 350 thousand tons of soybeans annually.

The plant formerly processed enough soybeans to produce soybean oil on a commercial basis. However, the plant is now temporarily closed. When the plant is reopened, raw materials will be imported directly through Batangas port. Analyzing the future crush volume of soybeans, the estimated local production of soybean meal is as follows:

(thousand tons)

(Year)	1990	1995	2000	2005
Estimated local Production of soybean meal	66	123	204	285

The estimation of local production of soybean meal is shown in Appendix 6.3.11.

Imports of soybean meal

The future import volume of soybean meal is estimated as the difference between the local production and the total consumption. The share of soybean meal imports through Manila has been around 90-93 % for the last 6 years except 1985; 100 % was imported through Manila in that year. However, the percentage of the mixed-feed production of Luzon and Metro Manila to that of the entire country has been decreasing in recent years as shown in Appendix 6.3.12. Based on this trend,

the future import share of soybean meal through Manila is estimated to gradually decrease. The future imports through Manila are estimated as follows:

Table 6.3.9 Estimated Volume of Soybean Meal Imports through Manila

(thousand tons)

Year	Share of Manila	Medium Case	High Case	Low Case
1990	90 (%)	280	291	281
1995	85	427	487	383
2000	80	589	722	486
2005	75	794	1,028	611

b) Fish Meal, Meat Meal and Other Feed Ingredients

Fish meal and meat and bone meal importation fluctuated considerably during the last 7 years (See Appendix 6.3.13).

Based on Philippine Association of Feed Millers, Incorporated (PAFMI) data, local fish meal processors supplied only 7 % of the total fish meal consumption before 1977, but by 1981, 64 % of the total requirement was supplied locally. However, due to the erratic protein content of local fish meal, some millers still prefer imported fish meal.

As for meat and bone meal, almost all of the meals are imported. The future import volume of these feed ingredients handled at the Port of Manila is estimated using the growth rate of soybean meal imports. Soybean meal is usually used together with these other meals to produce animal feeds. The estimated import volume is as follows:

Estimated import volume at Manila (1000 tons)

(Year)	Medium case	High case	Low case
1985	46 *	46	46
1990	57	59	57
1995	87	99	78
2000	120	147	99
2005	162	209	124

* actual volume in 1985

c) Summary of Feed Imports

The estimated import volume of feed materials is shown in Table 6.3.10.

Table 6.3.10 Summary of Feed Imports through Manila

(thousand tons)

(Year)	Bean meal	Others	Total
Medium case			
1990	280	57	327
1995	427	87	514
2000	589	120	709
2005	794	162	956
High case			
1990	291	59	350
1995	487	99	586
2000	722	147	869
2005	1,028	209	1,237
Low case			
1990	281	57	338
1995	383	78	461
2000	486	99	585
2005	611	124	735

5) Paper and Pulp

There are 26 pulp and paper mills in the Philippines at present. Nearly 100 % of the raw materials used by the industry are imported. Production and sales of the paper manufacturing industry over the past five years have been declining. The poor performance of the industry is mainly due to the following reasons:

① The economic crisis resulting in depressed consumer demand;

② High production costs (including power and fuel, import costs of raw materials, etc);

③ Increasing competition from foreign products due to import liberalization; and

④ Outdated mills and plant equipment.

It is very difficult to project the future performance of the industry because of the uncertainty of the direct and indirect effects of the

current import liberalization scheme. So, the import volume of paper and pulp of the Philippines is projected analyzing the trend of the total import volume of pulp, waste paper, and paper products. Table 6.3.11 shows the historical import volume of paper and pulp in the Philippines.

Table 6.3.11. Import of Paper and Pulp in the Philippines

(thousand tons)

	Pulp and waste paper	Paper and paper products	Total
1978	94 (47%)	105 (53%)	199
79	113 (49%)	118 (51%)	231
80	103 (45%)	124 (55%)	227
81	93 (44%)	117 (56%)	210
82	96 (41%)	137 (59%)	232
83	114 (46%)	132 (54%)	246
84	113 (43%)	150 (57%)	263
85	100 (40%)	152 (60%)	252

Source: NCSO

Note : Figures in parentheses show the percentage of the total

Due to the import liberalization and the increasing local production costs, the import of pulp and waste paper, the raw material of paper products, has been decreasing over the last three years. On the other hand, the import of paper products has been increasing. The average annual growth rate of imports of paper products is 4.6 % from 1979 through 1984 using three year running averages. The Philippine government is considering the further liberalization of imports. Below, the future import volume of paper products is estimated based on the historical average growth rate. Then, the total import volume of paper and pulp is forecast considering the change of the import share of paper products.

The estimated future import volume of paper and pulp in the Philippines is as follows:

(thousand tons)

(Year)	Pulp and waste paper	Paper and paper products	Total
1990	116	190	306
1995	123	238	361
2000	128	298	426
2005	131	373	504

The import share of the Port of Manila in the national total was around 60-80 % during the last five years. Using the average, 70 %, the future import volume of paper and pulp through Manila is estimated as follows:

Estimated volume of paper and pulp at Manila

(Year)	1990	1995	2000	2005
Paper and pulp (thousand tons)	214	253	298	353

6) Fertilizer

a) Production

A relatively steady growth in local fertilizer production was experienced from 1965 to 1976. Local manufacturing companies supplied more than 50 percent of the national fertilizer demand. However, from 1977, local production volumes became erratic, mainly due to the unpredictable world price fluctuations of fertilizers and the increasing costs of imported raw materials.

Some of the local manufacturing companies shut down their plants in 1976 as their increased production costs made it impossible to compete with imported finished fertilizers.

At present, only two fertilizer manufacturers, namely Atlas Fertilizer (at Cebu) and PHILPHOS (at Leyte) are producing fertilizer in the Philippines. The latter is responsible for 80-85 % of the national production. The historical fertilizer supply and demand including local production in the Philippines is shown in Appendix 6.3.14.

Philippine Phosphate Fertilizer Corporation (PHILPHOS) is a government corporation engaged in the manufacture and marketing of fertilizer products.

At present, PHILPHOS is owned 50 % by the Philippine government and 50 % by the Republic of Nauru based on a joint venture agreement signed in 1981. Under the agreement, around 50 % of the raw material (phosphate rock) used by PHILPHOS comes from Nauru through the company's private facilities in Leyte. PHILPHOS only started commercial operations in late 1985. Plant capacity is placed at around 1 million MT per year (See table 6.3.12).

According to an interview with a representative of the company in

Aug. 1986, around 80% of the total production is exported while 20% is consumed in the domestic market.

The capacity utilization rate of PHILPHOS is presently around 90%. However, the company does not foresee any expansion of facilities in the near future due to the uncertain economic situation of the country.

The production for the local market is estimated at 250 thousand tons 1986. And this volume seems likely to remain stable in the near future, up to 1995. Thereafter we assume that the local production will increase at a rate of 5% per annum. The estimated fertilizer production for the domestic market is shown in Table 6.3.13.

Table 6.3.12 PHILPHOS annual production capacity

	Capacity (metric tons)	Operating days (days/year)
Phosphoric acid	384,000	317
Sulphuric acid	495,000	330
Ammosul	169,000	325
Various fertilizer grades (DAP,MAP, 16-2-0,15-15-14, 14-14-14/12-12-12)	930,000	-

Source: PHILPHOS

Table 6.3.13 Estimated Fertilizer Production for the Domestic Market

(Year)	1990	1995	2000	2005
Fertilizer Production (thousand tons)	250	250	320	410

b) Consumption

The consumption of fertilizers in the Philippines is shown in Appendix 6.3.15. The decade 1973-1983 saw an upward trend in fertilizer demand with average annual increases of 6.28 %. From 1973 the Masagana 99 rice production development program, including a fertilizer subsidy

scheme, raised fertilizer demand.

The consumption of fertilizer in the Philippines thus depends on the existence and viability of government food production programmes, domestic fertilizer prices, credit availability, crop support prices, prospects for irrigation, and agricultural extension. The fertilizer use per harvest area has fluctuated, but in general it has increased over time (See Appendix 6.3.16). For estimation of future fertilizer consumption in the Philippines, a correlation analysis with the gross domestic product (GDP) of the agricultural sector is used in this study.

The correlation equation is :

$$Y=4.842X + 89.63 \qquad (R=0.9377)$$

where Y: volume of fertilizer consumption (thousand tons)
X: GDP index of the agricultural sector (1972=100)
R: correlation coefficient

The equation is based on historical data from 1971-1983 using three-year moving averages. The estimated future fertilizer consumption is as follows:

Table 6.3.14 Estimated Fertilizer Consumption in the Philippines

(thousand tons)

(Year)	1990	1995	2000	2005
Medium case	1,048	1,283	1,579	1,948
High case	1,047	1,371	1,805	2,384
Low case	1,054	1,263	1,517	1,827

c) Imports through Manila

The share of imported fertilizer through Manila Port has fluctuated between 32-50 % with an average of 40 % over the last 6 years except for 1981 as shown in Appendix 6.3.17. Manila's fertilizer import share of 40 % is almostly equal to the share of fertilizer consumption in Luzon (See Appendix 6.3.18). The future share of fertilizer imports through Manila is assumed to remain the same as the present level up to 1995.

After the year 2000, Manila's share is assumed to decrease to 30 %

considering the plan to develop fertilizer import facilities at Batangas port. The estimated future import volume of fertilizer through Manila is shown in Table 6.3.15.

Table 6.3.15 Estimated Fertilizer Imports through Manila

(thousand tons)

(Year)	1990	1995	2000	2005
Medium case	320	410	380	460
High case	320	450	450	590
Low case	320	410	360	430

7) Chemicals

As the Philippines does not produce petroleum, almost all of the raw materials for the chemical industry and many chemical products are imported. The import volume of chemicals is closely related to the industrial activities of the country. Therefore, the future volume of chemical imports is forecast based on the historical correlation between the volume of chemical imports and the industrial sector GDP. The correlation equation is calculated based on data from 1970-1976 and 1980-1984. Data from 1977-1979 is not available. The import volume of chemicals in the Philipines is shown in Appendix 6.3.19.

The correlation equation is as follows:

$$Y=5.588X - 347.6 \qquad (R=0.99)$$

where Y: Import volume of chemicals

X: GDP index of the industrial sector (1972 value=100)

R: Correlation coefficient

The future import volume of chemicals is then estimated by substituting the projected GDP of the industrial sector into the correlation equation.

The estimated volume of chemical imports in the Philippines and the average annual growth rates are calculated as follows:

	Medium case	High case	Low case
1984			
Actual volume	722	722	722
1995			
Estimated volume	1,186	1,156	1,026
Growth rate	4.6	4.4	3.2
2005			
Estimated volume	2,224	2,344	1,687
Growth rate	6.5	7.3	5.1

According to PPA statistics, the import volume of chemicals at the Port of Manila is estimated as 611 thousand tons in 1985. Considering the policy promoting decentralization of industries away from the Metropolitan Manila Area, the future chemical imports at Manila are forecast using the following assumed growth rates:

(thousand tons)

(Year)	1985-1995	1995-2005
Medium Case	4.6%	5.0%
High Case	4.4%	5.5%
Low Case	3.2%	4.0%

The estimated import volume of chemicals through Manila is as follows:

Estimated import of chemicals through Manila

(thousand tons)

(Year)	1990	1995	2000	2005
Medium Case	765	958	1,223	1,561
High Case	758	940	1,229	1,606
Low Case	715	837	1,018	1,239

8. Iron & Steel

a) General

The steel materials consumed in MMA are all either imported from foreign countries or produced in Iligan in the southern Philippines. The steel materials including billets (used for bars and wire rods), hot and

cold rolled products, galvanized sheets, and plates are used by local processing industries. Imported materials are principally handled at South Harbor, Port of Manila.

b) Forecast of National Steel Demand

Table 6.3.16 shows the demand for steel products in the Philippines from 1970 to 1980. In the Philippines, more than half of the steel products are consumed by the construction industry. The following is the correlation equation between steel demand and the GDP of the construction sector from 1970 to 1980:

$$Y=0.112X + 555.22 \qquad (R=0.958)$$

where Y: Demand for Steel Products (thousand metric tons)
X: Construction sector GDP (at 1972 prices, in million pesos)
R: Correlation coefficient

The GDP of the construction sector in 1990, 1995, 2000, and 2005 is estimated based on the elasticity of the construction sector GDP to total GDP. Talbe 6.3.17 shows the estimated GDP and construction sector GDP (See Appendix 6.3.20).

For base year 1985, a 600 thousand metric ton demand is estimated based on various data and interviews with NASCO. The demand for steel products in 1990, 1995, 2000 and 2005 is then estimated based on the correlation equation as shown in Table 6.3.18.

Table 6.3.16 Demand for Steel Products in the Philippines

(Unit: Thousand Metric Tons)

(Year)	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Demand for Steel Products	864	782	726	853	831	972	1,045	1,109	1,311	1,374	1,394

Source: Metal Industry Research and Development Center (MIRDC)

Table 6.3.17 Estimated GDP and Construction Sector GDP

(Unit: Million pesos at constant 1972 prices)

(Year)	Actual	Estimated			
	1985	1990	1995	2000	2005
Construction Sector GDP	4,248	7,248	10,899	15,647	21,438
G D P	90,469	110,643	141,212	180,226	230,019

Table 6.3.18 Estimated Steel Demand in the Philippines

(Unit: Thousand Metric Tons)

(Year)	1985	1990	1995	2000	2005
Estimated Steel Demand	600	1,365	1,780	2,310	2,960

c) Demand for Steel Products in MMA

The demand for steel products in MMA is estimated based on the ratio of the production capacity of steel users in MMA to the national total. 80 % of the total national demand is located in MMA (See Table 6.3.19 and Table 6.3.20).

Table 6.3.19 Estimated Steel Demand in the Entire Metropolitan Area

(Unit: Thousand Metric Tons)

	1985	1990	1995	2000	2005
Estimated Steel Demand	480	1,090	1,425	1,850	2,370

Table 6.3.20 Production Capacity for End Users

(Unit: Thousand Metric Tons)

		the entire Metropolitan Area	Other Areas	National
NASCO	Bars		60	60
	Hot rolled product		55	55[1]
	Cold rolled product		95	95[2]
	Plates		90	90
	Galvanized sheets	120		120
Other Producers	Bars & Wire rods	996		996
	Galvanized sheets	364	132	496
	Pipes	220		220
TOTAL		1,700	432	2,132

Source: National Steel Corporation 1985 Annual Report

SEAISI Directory 1986 (South East Asia Iron and Steel Institute)

Note:

1) 7.8% of the production capacity (700 thousand metric tons) of hot rolled products of NASCO is for end users and the remaining 92.2% is for the processed materials of NASCO and for local production.

2) 11.9% of the production capacity (800 thousand metric tons) of cold rolled products of NASCO is for end users and the remaining 88.1% is for the processed materials of NASCO and for local production.

d) Steel Cargo Volume Handled at the Port of Manila and at Batangas Port

The method used for estimation of the steel cargo volume to be handled at the Port of Manila and at Batangas Port is basically the same method used in the Study on the Development Project of the Port of Batangas.

The main points are as follows:

① MMA will maintain its present central industrial status, but industries will spread into the neighboring regions of Central Luzon and Southern Tagalog.

② The future demand for steel products around MMA is estimated based on this decentralization policy.

③ It is assumed that the increase in demand for steel goods between 1990 and 2000 will be fulfilled by new manufacturers, and that these new establishments will locate in outer MMA (between 50 km and 100 km from Manila).

④ In the future, some of the already established manufacturers will invest in new plants and equipment either to expand production capacity or to replace existing facilities as they become outdated. As it will become increasingly difficult to obtain suitable sites for expansion in the central urban area as the inner city becomes increasingly congested, location in Outer MMA will become increasingly attractive. It seems that when industries relocate they tend to move to Outer MMA. We assume that 30 % of the existing companies will relocate to Outer MMA by the Year 2000.

⑤ In order to make the best possible use of the new development of infrastructures in Southern Outer MMA including the superhighway construction and the new development at Batangas Port, the new establishments will be encouraged to locate in the Batangas area, and existing establishments will be encouraged to relocate there. Thus, we assume that most of the steel demand of Outer MMA (70%) will concentrate in the southern region.

⑥ Philippine steel production currently fulfills 60 % to 69 % of local demand, and this ratio is generally increasing due to the operation of the NASCO works at Illigan. Some types of steel products are difficult to produce domestically, and will continue to be imported for some time. Thus we estimate that in the future, about 20 % of the steel demand in the entire metropolitan area will be imported.

⑦ The estimate of the steel demand in 2005 is calculated by the same method used to calculate demand in the year (See Table 6.3.21).

Table 6.3.21 Forecast Steel Cargo Volume at the Port of Manila and at Batangas Port

(Unit: Thousnad Metric Tons)

	Demand of the entire metro-politan area	Demand of Outer MMA			Southern Outer MMA			MMA(except Southern Outer MMA)		
		New establishments	Relocated establishments	Sub-total	Demand	Cargo Volume at Batangas Ports		Demand	Cargo Volume at Manila Port	
						Imports	Domestic		Imports	Domestic
1990	1,090	-	-	-	-	-	-	1,090	200	890
1995	1,425	-	-	-	-	-	-	1,425	290	1,135
2000	1,850	760	300	1,060	750	150	600	1,100	220	880
2005	2,370	520	560	1,080	760	155	605	1,610	320	1,290

9) Machinery and Transport Equipment

This group of commodities can be divided into three categories: non-electric machinery, electric machinery and transport equipment. Based on the statistics of NCSO, road vehicles including their parts, electric machinery and specialized industrial machinery are the major commodities of this group imported through the Port of Manila. Appendix 6.3.21 shows the details of imported machinery and transport equipment through Manila in six recent years.

The volume of machinery imports dropped sharply in 1984 when the country faced a serious economic crisis. The machinery and transport equipment import share of Manila Port also dropped in 1984, from 60 % to 40 %. The main reason for this was the sharp drop in the imports of road vehicles, most of which are imported through Manila. There is no data available concerning the import volume of machinery and transport equipment for the entire country. So, a historical analysis is carried out on the correlation between the import value of machinery and transport equipment and the gross domestic product (GDP) using three year moving averages.

The correlation equation is obtained as follows:

$$Y=13.94X - 903.17 \qquad (R=0.9351)$$

where Y: Import value of machinery and transport equipment (million $)

X: GDP index (1972 value = 100)

R: Correlation coefficient

Fig. 6.3.3 shows the correlation between the import value of machinery and GDP. Using the statistics of import machinery and transport equipment at Manila, the elasticy of import volume to import value is estimated as 0.913 based on a three year average.

The estimated future import value of machinery and transport equipment of the whole country is shown as Table 6.3.22.

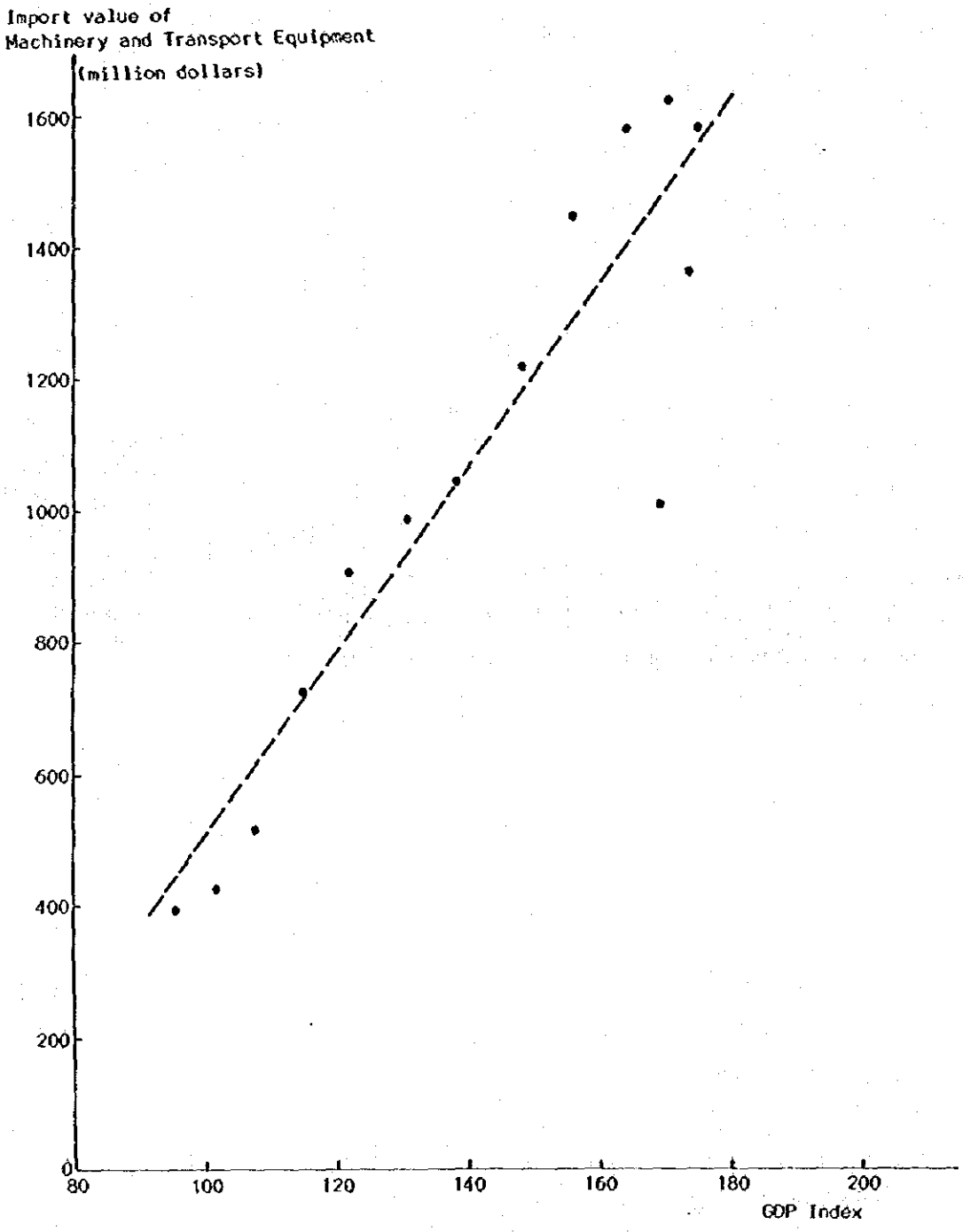


Fig. 6.3.3 Correlation Between Import Value of Machinery and GDP

Table 6.3.22 Estimated Import Value of Machinery and Transport Equipment and Average Annual Growth Rate

Year	Case	Estimated import value (million dollars)	Avg. growth rate of import value (%)	Avg. growth rate of volume (%)
1984		1,055*		
1990	Medium	1,829	9.6	8.7
	High	1,865	10.0	9.1
	Low	1,833	9.6	8.7
1995	Medium	2,583	7.1	6.5
	High	2,801	8.5	7.8
	Low	2,428	5.8	5.3
2000	Medium	3,546	6.5	5.9
	High	4,053	7.7	7.0
	Low	3,151	5.4	4.9
2005	Medium	4,776	6.1	5.6
	High	5,728	7.2	6.6
	Low	4,030	5.0	4.6

Note: * three year average (1983-1985)

The import volume of the whole country is estimated using the average growth rate of the volume as indicated in Table 6.3.22. Based on PPA statistics, the import volume of machinery and transport equipment through Manila is estimated as 139 thousand tons in 1985. There is some difference between the NCSO statistics and the PPA statistics. The reason seems to be the different conversion factors used to convert number of units weight. Using PPA statistics, the import volume of the whole country in 1985 is estimated at 350 thousand tons based on the share of Manila Port in that year, around 40 %. For estimation of the future import volume passing through Manila, the share of Manila is assumed to be 60 % based on the recorded share before the economic crisis. Thus, the future import volume of machinery and transport equipment through Manila is estimated as follows:

Estimated import volume of Machinery and Transport Equipment through the Port of Manila

(Year)	1990	1995	2000	2005
Import Volume (thousand tons)				
Medium case	319	437	582	764
High case	345	473	663	913
Low case	319	413	525	657

10) Other Import Commodities

Other commodities imported through Manila include minerals such as coal, salt and gypsum, textiles, metals and food products. Based on UN statistics, the quantity indicator of foreign trade, that is the indicator which shows the change of foreign trade on a quantity base, of the Philippines increased at an average annual rate of 4.5 % from 1972 to 1982. Historically, the quantity indicator correlates fairly well with the gross domestic product. Fig.6.3.4 shows this relation. The historical trend of the indicator is shown in Appendix 6.3.22. The following correlation equation between the indicator and GDP is estimated based on historical data from 1973-1981 using 3-year moving averages.

$$Y = 0.7414X + 7.87 \qquad (R=0.9854)$$

where Y: Quantity Indicator
X: GDP index (1972=100)
R: Correlation coefficient

The estimated future quantity indicators and average annual growth rates every 5 years are as follows:

(Year)	1985	1990	1995	2000	2005
Medium case	127	154	195	246	312
(growth rate)		(3.9%)	(4.8%)	(4.8%)	(4.9%)
High case	127	155	205	271	361
		(4.1%)	(5.8%)	(5.7%)	(5.9%)
Low case	127	153	185	223	270
		(3.8%)	(3.9%)	(3.8%)	(3.9%)

The future volume of the other commodities to be handled at the Port of Manila is estimated using the average annual growth rates projected above. According to PPA, the volume of other commodities imported through Manila in 1985 is estimated at 779 thousand tons. The future import volume of other commodities is estimated as shown in Table 6.3.23.

Table 6.3.23 Estimated Import Volume of Other Commodities

(thousand tons)

(Year)	1990	1995	2000	2005
Medium case	943	1,192	1,507	1,914
High case	952	1,262	1,665	2,218
Low case	939	1,137	1,370	1,659

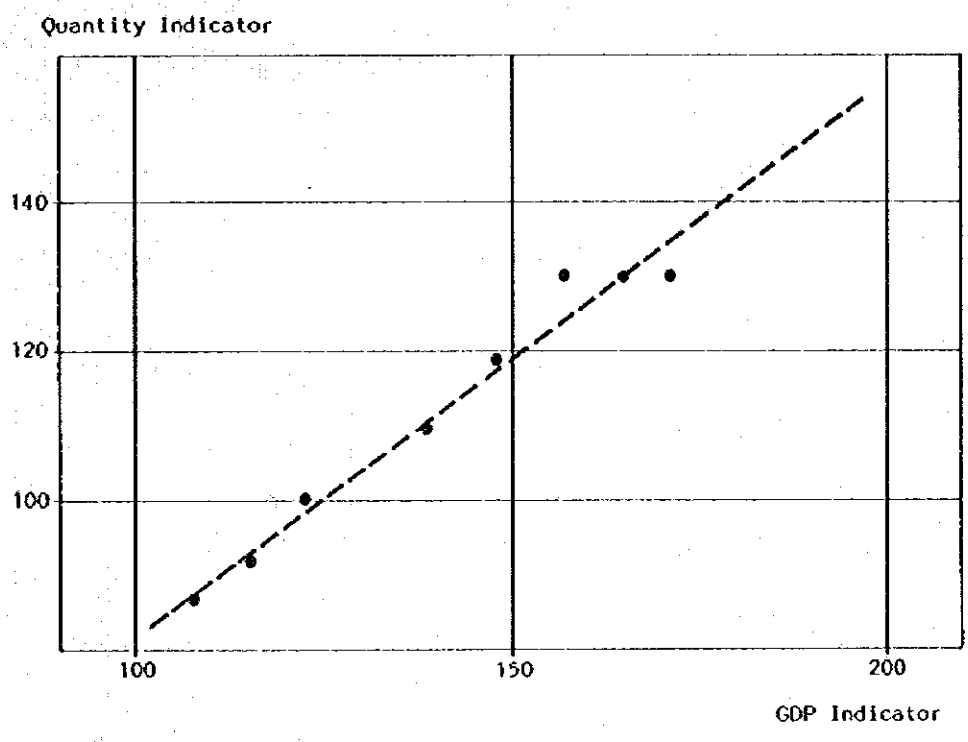


Fig. 6.4.3 Relation Between the Quantity Indicator and GDP

(Export)

11) Fish and Fish Products

Exports of marine products in the Philippines are classfied into two categories: (1) fish and (2) crustaceans and mollusks. The items in each category are exported in either unprocessed or processed form. Since 1982, the export volume of unprocessed fish has remained under 20 thousand tons. On the other hand, the volume of unprocessed crustaceans and mollusks and the volume of processed marine products have increased over the last six years. The overall average annual growth rate of exported marine products was around 9 % from 1982 to 1985. Table 6.3.24 shows the export volume of fish and fish products in the Philippines during the last 7 years.

The Philippines is an island country and its largely untapped marine waters and undeveloped inland resources could yield a potentially large volume of marine products which would not only meet domestic requirements, but also serve as a primary source of foreign exchange.

It is assumed that the export of fish and fish products from the Philippines will continue to grow at the same growth rate experienced in recent years.

Manila's share is assumed as around 50 % of the national total based on the present share, the export volume at Manila is 27 thousand tons in 1985. The results are presented in Table 6.3.25.

Table 6.3.24 Exports of Fish and Fish Products in the Philippines

(thousand tons)

(Year)	1979	1980	1981	1982	1983	1984	1985
Fish, fresh chilled or frozen	39	39	39	18	19	17	17
Crustaceans and mollusks	7	5	5	7	9	10	15
Prepared or preserved fish, crustaceans and mollusks	5	12	19	20	25	24	27
O t h e r s	1	1	1	1	1	1	1
T o t a l	52	70	64	46	54	52	60

Source: NCSO

Table 6.3.25 Estimated Future Exports of Fish and Fish Products at Manila

(thousand tons)

(Year)	National Exports	Exports at Manila
1990	86	43
1995	122	61
2000	177	89
2005	262	131

12) Feed (Copra meal/cake)

Feed exports at Manila are copra meal/cake exported to Europe. Based on NCSO statistics as shown in Table 6.3.26, the exports of copra meal/cake increased sharply in 1976 and then increased at an annual rate of 3.7 % until 1981. The export volume in 1984 dropped largely because the coconut production in the Philippines dropped due to the effects of a typhoon which struck the main production area. However, the export volume in 1985 recovered with a 20 % growth from the previous year.

Feed mills in European countries such as Germany reportedly prefer copra meal over competing products because it gives a sweet aroma to cow's milk. Therefore, the export of copra meal/cake is expected to continue to increase steadily.

The future export volume of copra meal/cake in the Philippines is estimated as follows:

Estimated export of copra meal/cake in the Philippines

	Estimated growth rate (%)	Estimated volume (thousand tons)
1990	3.5	527
1995	3.0	611
2000	3.0	708
2005	2.5	801

Manila's share of copra meal/cake exports has been around 10 % as shown in Appendix 6.3.23. The estimated exports of copra meal/cake from Manila are forecast based on this average share. Exports of other feed products at Manila are estimated at around 5 thousand tons per year.

Thus, the estimated future exports of feed at Manila are as follows:

Estimated Exports of Feed at Manila

(Year)	Estimated volume (thousand tons)
1990	58
1995	66
2000	76
2005	85

Table 6.3.26 Export of Copra Meal/Cake in the Philippines

(thousand tons)

(Year)	Actual	3 year Average
1970	231	
71	288	290
72	352	301
73	263	295
74	271	279
75	303	357
76	498	412
77	436	490
78	535	506
79	548	543
80	545	571
81	620	585
82	589	587
83	551	501
84	364	453
85	444	

Source: Foreign Statistics, NCSO

growth rate

72-77	10.2 %
77-82	3.7 %

13) Other Food

The main export commodities of other food through Manila are sugar products, coffee, vegetables and fruit.

a) Sugar Products

Sugar products are mainly exported near sugar production areas. Only molasses and refined sugar are exported through Manila. The U.S.A. is the main destination for the sugar exports of the Philippines. However, the export volume of sugar products from the Philippines has been decreasing along with the decrease of sugar consumption.

Although the Phlippine government makes various efforts to promote sugar exportation, the export volume has not been increasing. The future exports of sugar products through Manila are thus estimated at 25 thousand tons per year, the same volume as at present.

b) Coffee, Fruits and Vegetables

The Philippines exports a large quantity of bananas. However, they are loaded at particular loading facilities near production areas. The commodities exported through Manila are mostly coffee, processed fruit products and a small quantity of fresh fruits, mostly mangoes. Therefore, the forecast for this commodity group is based on the average annual growth rate of exported coffee, processed fruit products and mangoes in the Philippines. Based on correlation analysis with the GDP of the agricultural sector, the average annual growth rate is estimated using the following correlation equation:

$$Y=1.675X-12.3 \qquad (R=0.9171)$$

where Y: Exports of coffee, mangoes and processed fruit products (thousand tons)

X: Agricultural sector GDP Index (1972 = 100)

R: Correlation coefficient

The future growth rate of the national exports of coffee, mangoes and processed fruit products is estimated as follows.

Table 6.3.27 Estimated Average Annual Growth Rate of Exports of Coffee, Fruits and Vegetables

	Medium case	High case	Low case
1984-1990	4.6 %	4.6 %	4.7 %
1990-1995	4.7	6.2	4.1
1995-2000	4.6	6.1	4.1
2000-2005	4.6	6.1	4.1

The export volume of fruits and vegetables at Manila is around 185 thousand tons in 1985, based on PPA statistics. Using the estimated average annual growth rate, the estimated export volume of coffee, fruits and vegetables through Manila is presented in Table 6.3.28.

Table 6.3.28 Estimated Exports of Coffee, Fruits and Vegetables at Manila

(thousand tons)

(Year)	1990	1995	2000	2005
Medium case	232	292	366	458
High case	232	313	421	566
Low case	233	285	348	425

d) Overall other food exports

Based on the individual commodity group estimates above, the future volume of other food exports at Manila is estimated as follows:

Table 6.3.29 Estimated Other Food Exports at Manila

(thousand tons)

(Year)	1990	1995	2000	2005
Medium case	257	317	391	483
High case	257	338	446	591
Low case	258	310	373	450

14) Forest Products

The exports of forest products in the Philippines have been decreasing. Especially, log exports have been decreasing markedly. However, exports of processed wood products such as lumber, plywood and veneer were increasing until 1979. From 1980, however, with the increased cost of wood production and intensified competition from other wood-producing and exporting countries, the processed wood products exports also declined considerably. Table 6.3.30 shows the average annual growth rate of the export volume of selected forest products. In August 1986, log exports were banned in the Philippines. One of the main reasons for this policy is the log shortage due to deforestation. The log production decreased at an annual rate of 6.1 % from 1970 to 1984.

The Port of Manila ships 35 % of the forest product exports of the Philippines, 144 thousand tons in 1985 based on PPA statistics. The major forest product shipped through Manila is lumber. The exports of lumber in the Philippines decreased at an average annual rate of 5.6 % over the last 7 years (1979-1985). In the same period, the production of lumber declined at an average annual rate of 5.7 %.

The Bureau of Forest Development (BFD) has estimated the future production of processed wood products. Table 6.3.31 shows the projected production. From the table, it seems that lumber products production will decrease at an annual rate of 3.6 %

For the estimation of forest products exports through Manila, a 3.0 % annual decrease rate is used considering the composition of forest product exports at Manila. The future forest products exports at Manila are thus estimated as follows:

(Year)	1990	1995	2000	2005
Exports of forest products (thousand tons)	124	106	91	78

Table 6.3.30 Average Annual Growth Rate of Forest Products Export Volume

(%)

(Period)	1970-75	75-80	80-85	70-85	75-85
Logs	- 15.2	- 25.5	- 6.1	- 16.0	- 16.4
Lumber	12.8	16.4	- 6.5	7.1	4.3
Plywood	- 4.0	11.9	- 8.1	- 0.4	1.4
Veneer Sheet & Corestocks	0.3	2.5	- 15.6	- 4.6	- 7.0
Forest Products Except logs.	3.6	13.0	- 7.6	2.6	2.2

Note: These figures are computed using moving averages.

Table 6.3.31 Projected Production of Processed Wood Products

(in thousand cu.m.)

(Year)	Logs	Lumber	Veneer	Plywood
1987	2878	1322	71	533
1988	2607	1281	65	531
1989	2361	1242	60	529
1990	2140	1187	55	528
1991	1937	1143	51	529
1992	1755	1102	46	530
1993	1590	1063	43	531
1994	1440	1026	40	532
Avg. growth rate	-9.4%	-3.6%	-7.9%	0%

Source: BFD, MNR

15) Coconut Oil and Other Coconut Products

The Philippines is the world's premier producer and supplier of coconut products and by-products. This section estimates the future export volume of coconut oil and other coconut products except copra meal/cake which is estimated separately above.

a) Coconut oil

The Philippines exported around 1.0 million tons of coconut oil to the world market in 1983. The Philippines' share in the world market remained over 70 % during 10 recent years except for 1984. The production and exports of coconut products in the Philippines fell significant-

ly in 1984 when a typhoon destroyed much of the coconut crop. The exports of coconut oil depend upon the supply-demand situation and on the prices of substitute products. Soybean oil and palm oil are the main substitutes for coconut oil. In the world market, consuption of soybean oil and palm oil have been increasing in recent years, but the consumption of coconut oil has remained almost constant.

The world prices of coconut oil fluctuated greatly over the last five years and rose to a relatively high level compared with the substitute oils, 1.6-1.7 times as high, in 1984.

If the price difference between coconut oil and the substitute oils such as soybean oil remains very high for a long period, coconut oil consumers may switch over to the substitutes. The annual export volume of coconut oil through Manila is estimated at 80 thousand tons, using the average of the last five years. The future export volume is assumed to remain at the present level.

b) Other coconut products

Almost all of the volume of other coconut products exported through Manila is desiccated coconut. Desiccated coconut is shredded coconut meat which is used mainly for confectionaries and bakery products. The Philippines supplies about 70 % of the world's desiccated coconut requirements. World demand for desiccated coconut has remained relatively constant over the past ten years. Over 90 % of the desiccated coconut exported from the Philippines is loaded at Manila.

The export volume of coconut products except for copra and by-products is shown in Table 6.3.32. Around 85 thousnad tons of desiccated coconut and other coconut products are exported through Manila each year. Due to the serious typhoon damage, the export volume dropped in 1984, but it seems to be recovering. The future annual export volume of other coconut products from Manila, mainly desiccated coconut, is estimated at a constant 85 thousand tons.

Table 6.3.32 Export of Coconut Products except Copra and By-products

(Unit: 1000 MT)

Year		1980	1981	1982	1983	1984	1985
Coconut Oil	Manila	103	54	57	137	75	77
	Philippines	918	1040	921	998	587	650
Desicated Coconut	Manila	79	78	84	86	72	60
	Philippines	87	86	90	89	77	65
Other Coconut Prod.	Manila	1	1	1	1	3	2
	Philippines	1	1	1	1	4	3

Source: NCSO

16) Other Export Commodities

Other export commodities through Manila include miscellaneous manufactured products, textiles and textile products, minerals, tobacco, chemicals and a small volume of other commodities.

Using the same method used to estimate the volume of other import commodities, the following correlation equation is obtained:

$$Y=1.703X - 93.70 \qquad (R=0.9920)$$

where Y: Quantity indicator of import trade
X: GDP index (1972 = 100)
R: Correlation coefficient

The estimated quantity indicators and average annual growth rates every 5 years are as follows:

(Year)	1985	1990	1995	2000	2005
Medium case	181	242	335	454	605
(growth rate)		(6.0%)	(6.7%)	(6.3%)	(5.9%)
High case	181	245	359	512	716
(growth rate)		(6.2%)	(7.9%)	(7.4%)	(6.9%)
Low case	181	241	313	402	509
(growth rate)		(5.9%)	(5.4%)	(5.1%)	(4.8%)

The export volume of other commodities handled at the Port of Manila is estimated at 478 thousand tons in 1985 based on PPA statistics. Using

the growth rates forecast above, the future export volume of other commodities is estimated as shown in Table 3.6.33.

Table 3.6.33 Estimated Export Volume of Other Commodities

(thousand tons)

(Year)	1990	1995	2000	2005
Medium case	640	885	1,201	1,600
High case	646	945	1,350	1,885
Low case	637	829	1,063	1,344

6.3.1.3 Summary

As a conclusion, Table 6.3.34 shows a summary of the cargo forecast. Table 6.3.35 is a comparison of the total cargo volumes obtained by the macro and micro forecast methods described in Sections 6.3.1.1 and 6.3.1.2.

Herein, the future cargo volumes to be handled at the Port of Manila for the target years are assumed equal to those forecast in the medium case of the forecast by commodity group, that is the micro forecast.

Table 6.3.34 Summary of Foreign Trade Cargo Forecast

(thousand tons)

(Year) / Commodity		1995	2005
Imports	Dairy Products	156	264
	Wheat	647	1,040
	Other Cereals	151	267
	Feed	514	956
	Paper and Pulp	253	353
	Fertilizer	410	460
	Chemicals	958	1,561
	Iron & Steel	290	320
	Machinery & Transport Equip.	437	764
	Others	1,192	1,914
Sub total		5,008	7,899
Exports	Fish & Fish Products	61	131
	Feed	66	85
	Other Food	317	483
	Forest Products	106	78
	Coconut Oil	80	80
	Other Coconut Products	85	85
	Others	885	1,600
Sub total		1,600	2,542
Grand total		6,608	10,441

Table 6.3.35 Comparison of Cargo Forecasts

(thousand tons)

	Import		Export		Total	
	1995	2005	1995	2005	1995	2005
Macro Forecast						
Medium case					7,656	10,905
High case					7,918	12,063
Low case					7,387	9,831
Forecast by Major Commodity						
Medium case	5,008	7,889	1,600	2,542	6,608	10,441
High case	5,291	9,150	1,681	2,935	6,972	12,085
Low case	4,694	6,713	1,537	2,253	6,231	8,966

6.3.2 Domestic Trade

The volume of domestic trade cargo handled at the Port of Manila since 1978 is shown in Table 6.3.36, based on the statistics prepared by PPA.

Table 6.3.36 Domestic Trade at Manila

(thousand tons, %)

Year	Outward		Inward		Total	
	Volume	growth rate	Volume	growth rate	Volume	growth rate
1978	2,895		2,560		5,455	
1979	2,939	1.5	2,755	7.6	5,694	4.4
1980	2,876	-2.1	3,012	9.3	5,888	3.4
1981	2,874	0.0	2,857	-5.1	5,731	-2.7
1982	3,037	5.7	3,254	13.9	6,291	9.8
1983	3,286	8.2	3,920	20.5	7,206	14.5
1984	2,129	-35.2	3,673	-6.3	5,802	-19.5
1985	2,872	34.9	4,116	12.1	6,988	20.4

The volume of domestic cargo movement fluctuated from year to year, especially after 1983 when the national economy went into a serious recession. Generally speaking, the cargo handling volume of a port is

closely related with the social and economic indices of the hinterland of the port. The volume of outward cargo is also influenced by the social and economic indices of the destination areas of the cargo.

As for domestic trade, the hinterland of Manila port is mainly Metro Manila, and the destinations of outward cargo are the ports in Regions IV-XII. The average growth rated for the period which shows normal growth are as follows:

Outward	2.6%	average 1978-1983
Inward	6.2%	average 1978-1983

Based on NEDA's statistics, Metro Manila and Regions IV-XII show the following average annual growth rates of GRDP during the same period:

Regions IV-XII	:	3.3%	(1978-1983)
Metro Manila	:	5.2%	(1978-1982)

The elasticities of the cargo growth to the GRDP growth are computed as follows:

Outward cargo	0.78
Inward cargo	1.2

The elasticity of inward cargo is relatively high compared with that of outward cargo. The reason seems to be that the majority of the inward cargo is raw materials which are processed in Metro Manila. The rapid population increase in Metro Manila also contributed to this high elasticity. Considering the future decentralization of industries and population from Metro Manila and also considering the development of local ports, the future elasticity of the domestic cargo growth both inward and outward is estimated as 0.8. The future volume of domestic cargo to be handled at the Port of Manila is forecast as shown in Table 6.3.37 on the basis of the projected future elasticity and the projected economic growth rate. The future economic growth rates of Metro Manila and Regions IV-XII are assumed equal to the future national average growth rate.

Table 6.3.37 Estimated Domestic Cargo to be Handled at Manila

(thousand tons)

Year	1990		1995		2000		2005	
	In	Out	In	Out	In	Out	In	Out
Medium case	4,840	3,380	5,890	4,110	7,170	5,000	8,720	6,080
High case	4,860	3,630	6,140	4,590	7,760	5,800	9,810	7,330
Low case	4,820	3,360	5,640	3,930	6,600	4,600	7,730	5,380

6.3.3 Forecast by Cargo Mode

In order to estimate the allotment of foreign cargo handled at each harbor district (South Harbor, Anchorage and MICT), estimation of cargo volume by packing type is carried out in this section.

6.3.3.1. Commodity by packing type

The sea-born cargoes are roughly classified into the following four packing types: loose (break bulk), containerized, bulk and liquid. The present situation of commodity throughput by packing type is shown in Table 6.3.38 based on port statistics processed by micro computer.

Table 6.3.38 Commodity Throughput by Packing Type at the Port of Manila (1985)

	Loose cargo	Containerized	Bulk	Liquid
Imports	(%)	(%)	(%)	(%)
Dairy products	3	97	0	0
Wheat and Wheat Products	16	2	82	0
Other cereals	53	2	45	0
Feed	32	9	59	0
Paper and pulp	20	80	0	0
Fertilizer	49	-	51	-
Chemicals	11	54	22	14
Iron & Steel	78	22	0	0
Machinery and transport equipment	39	61	0	0
Exports				
Fish & Fish products	-	100	0	0
Feed	0	100	0	0
Other food	-	97	1	2
Forest products	84	16	0	0
Coconut oil	0	4	0	96
Other Coconut prod.	1	56	43	-

Note: - means less than 1%

Before estimating the future containerized rate, the percentage of general cargo which includes loose and containerized cargo is estimated based on the present throughput by packing type and the future cargo volume estimated in section 6.3.2. The estimated percentages of each packing type by major commodity in the future are shown in Table 6.3.39. Table 6.3.39 also shows the estimated percentage of cargoes which can be containerized for different types of general cargo.

Using the above estimated percentages of each packing type by major commodity and the containerizable ratio, the containerizable percentage of the total general cargo in the target year 2005 is estimated as follows:

Import	83%
Export	85%

Table 6.3.39 Estimated Percentage of Packing Type and Containerizable Ratio by Major Commodity

	General Cargo	Bulk	Liquid	Containerizable ratio
Imports	(%)	(%)	(%)	(%)
Dairy products	100			100
Wheat and Wheat Products	20	80		100
Other cereals	50	50		100
Feed	20	80		100
Paper and pulp	100			100
Fertilizer	50	50		0
Chemicals	65	20	15	90
Iron & Steel	100			25
Machinery and transport equipment	100			75
Others	65	25	10	100
Exports				
Fish & Fish products	100			100
Feed	100			100
Other food	100			100
Forest products	100			50
Coconut oil			100	
Other Coconut prod.	60	40		100
Others	100			80

Note: Containerizable ratio means the percentage of containerizable volume to the general cargo volume.

Table 6.3.40 shows the progress rate of containerization, that is the percentage of containerized cargo to total general cargo at the Port of Manila for the last six years.

Table 6.3.40 Containerization rate at the Port of Manila

Year	Import			Export		
	General C. ('000t)	Container C. ('000t)	Percentage (%)	General C. ('000t)	Container C. ('000t)	Percentage (%)
1980	2,728	1,266	46.4	1,027	523	50.9
1981	2,734	1,373	50.2	940	555	59.0
1982	2,966	1,570	52.9	820	561	68.4
1983	3,200	1,707	53.3	962	574	59.7
1984	1,868	1,229	65.8	924	646	69.9
1985	2,137	1,196	56.0	912	771	84.5

Note:Container cargo volume is based on PPA statistics.
General cargo volume is estimated using the percentage of packing type in 1985 based on port statistics.

Considering the growth of containerization, the containerized rates in the target years are forecast as follows:

(Year)	1990	1995	2000	2005
Import(%)	70	75	80	83
Export(%)	85	85	85	85

As a result, the estimated cargo volume by packing type is shown in Table 6.3.41.

Table 6.3.41 Estimated Cargo Volume by Packing Type

(thousand tons)

Year	Loose Cargo		Containerized		Bulk		Liquid		Total	
	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.
1990	705	176	1644	997	1278	34	209	80	3836	1287
1995	761	223	2285	1263	1700	34	262	80	5008	1600
2000	734	285	2936	1614	2140	34	333	80	6143	2013
2005	803	364	3920	2064	2751	34	425	80	7899	2542

CHAPTER 7
REVISED MASTER PLAN

CHAPTER 7 REVISED MASTER PLAN

7.1 Fundamentals of the Master Plan

7.1.1 The Role of South Harbor

Manila Port is currently operated in three separate sections as follows:

(i)	Domestic cargo	North Harbor
(ii)	Foreign trade cargo	South Harbor (Anchorage and pier)
(iii)	Container cargo	South Harbor M.I.C.T.

In order to secure efficient port operations, this policy should be continued.

Therefore, South Harbor will continue to be used for the exclusive handling of foreign trade cargo except for some containerized cargoes which will be handled at M.I.C.T.

Regarding the allocation of functions between South Harbor and M.I.C.T., M.I.C.T. will mainly accommodate non self-sustaining full container vessels and some self-sustaining full container vellels.

Although the containerization has progressed to a great extent at Manila Port, the development of container handling facilities has lagged behind the containerization itself. As a result there are usually a large number of containers stacked and waiting for shipment not only in the container yard but also on the roads behind the piers.

The Phase II development at M.I.C.T. is now under construction and will be completed is 1989 (See Appendix 7.1.1). As the continued worldwide progress of containerization is inevitable, the successful execution of the Phase II construction at M.I.C.T. is essential.

7.1.2 Overall Evaluation of Existing Facilities at South Harbor

Tables 7.1.1 - 7.1.3 show the dimensions of piers, sheds, container yards, warehouses and buildings in the port zone, as well as the fender type and condition and utilization ratio of piers and a technical evaluation of structures, along with comments concerning operations.

The overall evaluation of each of these facilities is presented below.

(1) The repair of the slabs at the end of pier 3 and at the back up area of berth No.4 are necessary.

(2) Pier 5 is in the best condition structurally of all the piers but the open storage area at the pier is insufficient. Sheds K and L are in very poor condition.

(3) As far as pier 9 is concerned, it is not necessary to make any urgent repairs, but some portions of the slab will have to be repaired eventually. The narrowness of the quay apron also lowers cargo handling productivity to some extent.

(4) It may not be possible to continue to handle container cargoes at pier 13 because the structure is seriously damaged.
However, minimum urgent repairs of part of the slab may be necessary to continue handling containers for the time being.

(5) Pier 15 has suffered the most damage next to pier 13.
However, it will be relatively easy to repair this pier because the damage is concentrated at the base of the pier and in the central pier area.

(6) Container yard CY-01 should be paved.
The warehouse of Block 141 needs repairs. The other facilities located in the back-up area are described in the land use plan.

7.1.3 Identification of the major problems

Almost all of the facilities of South Harbor were constructed after World War II. These facilities are quite old, and the deterioration of slabs and beams has progressed. There are also some problems with cargo

handling on the pier - for example, the aprons are too narrow. Furthermore it takes a long time to handle the grain in the anchorage area.

The cargo handling efficiency is poor.

The major problems are summarized below.

1) Inefficient cargo handling and slow cargo throughput.

There is a large volume of long staying cargo in South Harbor Moreover it takes long time to handle the grain in the anchorage area.

2) Shortage of open storage areas.

Due to the increase of containers and specially shaped cargoes which require open sorting and storage areas, the existing facilities are not always useful.

However, some of the existing transit sheds are underutilized.

3) Narrow aprons and the superannuation of sheds and warehouses.

The width of quay aprons at South Harbor seems to have been designed assuming that all the cargoes enter the transit sheds behind the quays. The aprons are not designed to accommodate the handling of containers and specially shaped cargoes such as timber, steel, etc. or the direct transport of cargoes by truck at quayside.

4) Difference in level of pier surface

The lower central passages restricts to some extent smooth cargo handling and efficient space utilization on the piers. Due to the difference in the level of the pier surface, the traffic can not pass onto the central passage directly from the quaywall side, and it is impossible to reserve an available buffer transferring/sorting space around the sheds.

5) The deterioration of piers and related facilities like fenders.

From the technical evaluation of the existing facilities, the deterioration of piers and related facilities has advanced and some of the existing facilities should be repaired urgently.

The timber cluster type fenders are not convenient for loading/discharging work along quay side, because they create excessive distance, 2-3m, between ship side and quaywall.

6) Poor utilization of berths and other facilities.

7) Narrow basins at the Anchorage.

8) Insufficient berths for small craft.

9) Traffic congestion

The roads in the port zone are congested due to the improper use of road areas.

There are not enough parking spaces. So, many vehicles including container chassis are being parked on the road, increasing traffic congestion.

7.1.4 Basic Concepts for the Formulation of the Master Plan

Based on the role of South Harbor and the countermeasures to solve the major problems, the basic strategies for the Master Plan with a target year of 2005 are as follows.

1) Effective cargo handling

Currently, the cargo handling productivity of Manila Port is low, especially in the case of handling bulk cargo at Anchorage. Besides, due to the outdated arrangement of facilities at piers, productivity is restricted to some extent.

In order to solve these problems, the study team proposes (1) to introduce a mechanical handling system for grain cargo, (2) to transfer part of the loose cargoes at Anchorage to pier, and (3) to widen aprons and to modify the use of the facilities at the port.

2) Rehabilitation of old port facilities

Most of the facilities at South Harbor were constructed after World War II and are very old.

Based on technical observations in the field and research on pier utilization, the facilities are classified into three categories as follows:

(i) facilities which must be improved urgently
(ii) facilities which must be improved by 1995
(iii) facilities which must be improved by the target year of the Master Plan, 2005.

Based on the above categorization, a step plan for the improvement of port facilities is designed.

3) Container cargo handling at South Harbor

At present MICT is expanding and the Phase II construction will be completed in 1988 (See Appendix 7.1.1).

Based on our study, the team recommends that all full container cargo and some portion of the self-sustained container cargo be transferred to M.I.C.T. for efficient cargo handling, effectively using the port facilities at Manila port.

4) Preferential berthing

Cargo with a sizable amount of volume like containers, iron and steel products and timber which are often carried by specialized ships should be given berthing priority at specific piers to raise the cargo handling efficiency of these cargoes.

5) Safety

Port safety must be guaranteed. Laborers, vessels and cargoes must all be kept safe. It is natural to also consider the port facilities themselves. The safety factor must be consider during port facility development. Fortunately, there have been no major marine accidents at the port. However, as some of the port facilities are significantly deteriorated, the safety of these facilities must be checked carefully.

Table 7.1.1 Piers and Berths

Pier No.	Berth No.	Main kind of cargo	# of Mooring hours	Physical conditions: Length (m)	Depth (m)	Width of Apron(m)	Fenders: Type (1)	Fenders: Condition (2)	Structural Safety Level: Grade (2)	Structural Safety Level: Comments	Comments on operational points
3	1		0	161.6	2.5		①	A	B	Slabs of No.4 berth are severly damaged	Shallow depth Lack of sorting space, shortage of quay length
	2		22	158.5	7.3		①	C			
	3	Full container	45	163.1	9.8		②	C			No container marshalling space at the pier
	4		33	163.1	7.5		②	B			
5	1	Conventional, semi-con	6	163.1	6.5	10.2	②	C	A	Piles and Beams of No.3 berth are damaged in some areas	Shallow depth at berth No.1 Narrow apron width No open storage area Shortage of quay length Low berth occupancy Low utility rate of sheds The lower central passage restricts a smooth cargo handling
	2	Conventional, semi-con	21	163.1	9.6	10.2	②	C			
	3	Conventional, semi-con	9	103.7	6.7		①	C			
	4	Bulk	3	163.1	9.0	10.2	①	B			
	5	Conventional	6	163.1	8.2	10.2	①	B			
9	1	Conven. semi-con. bulk	31	167.7	6.3	10.7	①	C	B	Piles of No.3 berth and slabs of No.4 berth are slightly damaged	Shallow depth Narrow apron width The lower central passage restricts a smooth cargo handling
	2	Conven. semi-con. bulk	36	167.7	8.6	10.7	①	C			
	3	Conven. bulk	6	100.6	7.9		①	C			
	4	Conven. semi-con.	23	167.7	9.3	10.7	①	C			
	5	Conven. bulk	25	167.7	5.9	10.7	①	B			
13	1	Semi-con.bulk-con.Ro-Ro	27	127.0	6.4		②	C	C	All slabs and beams are damaged except those within about 10 m behind No.1, 2 and 3 berths	Wide open space Shortage of quay length Narrow pier width Shortage of quay length Lack of back-up area Very narrow apron width
	2	Semi-con. full-con.	11	127.0	9.2		②	C			
	3	Full-con.	36	127.0	9.7		②	C			
	4	Navy	0	87.7	7.2		①	C			
	5	Conven.semi-con.full-con	12	127.7	8.9		①	B			
	6	Conven. semi-con.	3	127.7	9.0	5.3	①	B			
	7	Coast guard, conven, passenger	7	127.0	8.9	5.3	①	B			
15	1	Conven. bulk, passenger, container	22	163.1	8.6	10.3	①	C	B	Passageway and approach are severely damaged	The lower central passage restricts a smooth cargo handling Berth No. 5 is not available for use
	2	Conven. bulk. passenger, container	40	163.1	10.2		①	C			
	3	Conven. bulk	20	100.6	9.0	10.3	①	C			
	4	Conven. bulk	24	157.4	9.7		①	C		Slabs of No.1 berth are damaged	
	5	Yacht	-	173.8	9.5		①	B			

(1):1 - Cluster-type, 2 - Resilient-type (2):A - Sound, B - Slightly-damaged, C - Seriously damaged

Table 7.1.2 Open Storage Areas and Sheds on the Piers

Name of Pier	o/s or Shed	Stocking Capacity(t)	Area m^2	1	2	3	4	5 (%)	6	7	8
Pier 3	o/s	10,000	9,484			63	1,000	10.0	North side is for containers (APL)		
Pier 5	o/s	3,400	5,810			50	2	0.06			
	Shed I	3,000	3,400	2 day	4 days	2,800	1,711	57.00	Wood, pulp	B	
	Shed J	3,000	3,400			2,431	1,200	40.00	Sodium, pulp, textile machinery sulphate	B	
	Shed K	3,000	2,932			0	0	0	closed	C	demolish
	Shed L	3,000	2,932			0	0	0	closed	C	demolish
	Baggage	1,500				1,450	1,082	72.13			
Pier 9	o/s	5,000	5,945			2,777	2,047	40.94			
	Shed A	3,500	4,056			838	1,239	35.40	machines, chemicals, medicine	B	
	Shed B	3,500	4,056			1,862	1,885	53.86	general cargo,	B	
	Shed C	3,500	3,350				88	2.51	Timber (exports)	B	
	Shed D	3,500	3,350			2,852	2,089	59.69	Bags, paper, machines	B	
Pier 13	o/s	10,000	19,398	4-6days	4-6days	33,960	8,700	87.00	containers(1800TEU/month)		
	Shed E	3,000	3,102				2,600	86.67	general cargo, pulp	B	
Pier 15	o/s	10,000	7,040			6,416	3,275	32.75	containers (ESL)		
	Shed M	3,000	2,875			1,339	478	15.93	chemicals, general cargo machines	B	
	Shed N	3,000	2,875			2,143	986	32.86	general cargo	B	

Table 7.1.3 (1) Container Yards, Warehouses and Buildings behind the Piers

Facility	Capacity (t)	Area (m2)	1	2	3	4	5			
CY-01		67,007					-	container yard no pavement no drainage		
CY-02		19,197						container yard. paved.		
Whse 1 (Block 170)	6,000	5,600				2,258	37.00	user MPSI Imported cars	A	
Whse 2 (Block 141)	5,000 (CFS)							non-operational	C	
Whse 3 (Block 142)	5,000 (CFS)	3,528	3 days	5 days	2,143	3,300	30.00	CFS. user MPSI	A	
Whse 6	10,000	4,420	leased to private co.						A	
Whse 7	10,000	4,420	seized cargo						A	
Whse 8	10,000	4,420							A	
Whse 9	10,000	4,420							A	
Whse 10	10,000	4,420							A	
Whse 11 (Block 171)	6,000	5,600				2,200	36.67	MPSI, long staying cargo	A	
Stalag Area (Block 165)	6,000				68	4,052	67.00	Metro port storage Area for imports		
Pier 15 CY										
Block 183	1,932	1,181						Customs office, PPA, national police	A	usable
Block 182	3,901	11,875						Marzman Bldg. Travel Agency. Also PPA will relocate into this building		
Block 177	5,479	3,804						MPSI motor pool	A	usable
Block 176	5,479	6,412						PMU office, multipurpose auditorium motor pool at OTSI		
Block 165	5,479	2,012						storage area. MPSI, capacity 12,000 t (Storage)	A	usable
Block 164	5,479	1,279						Quarantine services. MPSI	A	usable
Block 156 157 149	28,476	15,776						owner BOC user BOC	A	usable
Block 187	2,278	2,832						Bureau of Quarantine owned by MOA	A	usable
Block 184	4,251	3,570						leased to a private company (merchandise) and warehouse (cement)	A	usable

Table 7.1.3 (2)

Facility	Land area	Bldg area	6	7	8	
Block-181	4,251	3,570	CFS operator is Rr. Marzan Co.	A	rehabilitate	
Block-166	5,002	500	Red cross warehouse, land areas owned by B.O.C	C	usable	
Block-163,158	10,005	29,232	Bureau of Printing	B	usable	
Block-155	5,002		MPWH. Equipment service	C	usable	
Block-150	3,904	9,560	Myers building, not usable	B	demolish	Three story R.C. framed building costly for demolition.
Block-147	4,410	4,012	Port personnel Training Center	A	usable	
Other facilities						
Along mulle de Tocoma	-	-	Office and Motor Pool	C	not need	
- do -	-	-	Custom police	B	usable	easy to demolish
- do -	-	-	Storage	C	not used	- do -
- do -	-	-	Bureau of custom, office	B	usable	

Legend

1. CFS Avg. Dwell time last discharge to shipping.
2. CFS Avg. Dwell time shipping to Delivery.
3. Tonnage Delivered monthly.
4. Avg. Tonnage stored daily.
5. Avg. % of occupancy.
6. Main handling commodity or application of buildings.
7. Technical judgement by observation.
8. Possibility of demolition, rehabilitation.

A: The structure is sound.
B: The structure is usable but damaged.
C: The structure is old and has some structural problems

7.2 Planning Premises

7.2.1 Estimated Cargo Volume by Area

Based on the fundamentals of the Master Plan, the future foreign trade cargo volume by each harbor district is forecast as shown in Table 7.2.1.

Table 7.2.1 Estimated Foreign Trade Cargo Volume by Packing Type by Area

(1,000 ton)

Year / Area	Loose		Container		Bulk		Liquid		Total	
	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp
1985										
S.H. Pier	530	138	669	447	214	7	22	5	1435	597
Anchorage	408	1	1	3	891	45	86	87	1386	136
MICT	3	2	526	321	-	-	-	-	529	323
Total	941	141	1196	771	1105	52	108	92	3350	1056
1990										
S.H. Pier	451	176	329	199	235	34	-	-	1015	409
Anch.	254	-	-	-	1043	-	209	80	1506	80
MICT	-	-	1315	798	-	-	-	-	1315	798
Total	705	176	1644	997	1278	34	209	80	3836	1287
1995										
S.H. Pier	541	223	343	189	296	34	-	-	1180	446
Anch.	220	-	-	-	1404	-	262	80	1886	80
MICT	-	-	1942	1074	-	-	-	-	1942	1074
Total	761	223	2285	1263	1700	34	262	80	5008	1600
2000										
S.H. Pier	580	285	382	210	375	34	-	-	1337	529
Anch.	154	-	-	-	1765	-	333	80	2252	80
MICT	-	-	2554	1404	-	-	-	-	2554	1404
Total	734	285	2936	1614	2140	34	333	80	6143	2013
2005										
S.H. Pier	701	364	510	268	477	34	-	-	1688	666
Anch.	102	-	-	-	677	-	425	80	1204	80
Grain Terminal	-	-	-	-	1597	-	-	-	1597	-
MICT	-	-	3410	1796	-	-	-	-	3410	1796
Total	803	364	3920	2064	2751	34	425	80	7899	2542

The basic idea on the allotment of cargo volume handled at each harbor district is described below.

7.2.1.1 Container handling share of South Harbor

1) Based on PPA statistics, the container handling volume by mooring facility in 1983 and 1985 is estimated as shown in the following table.

(Year)	1983		1985		Remarks
		share %		share %	
South Harbor					
Pier 3	691,241	30.3	559,491	28.4	( ) shows conventional and semi-con. handling
			(3,041)		
5	139,820	6.1	55,190	3.4	
9	22,165	1.0	31,258	1.6	
13	400,487	17.6	433,577	22.0	( ) shows Ro-Ro handling
			(15.405)		
15	56,636	2.5	29,458	1.5	
MICT	970,295	42.6	847,418	43.1	
Total	2,281,144	100%	1,967,392	100%	

Note: 1983 figures are PPA statistics.
1985 figures are estimated from PPA worksheets

Based on the table, the percentage of containerized cargo which is handled by non-self-sustaining container ships including Ro-Ro ships is estimated as follows:

(Year)	
1983	72.9%
1985	71.5%

Non-self-sustaining container ships mostly moor at M.I.C.T. and at Pier 3 of South Harbor.

2) The container handling share of full-cellular container ships at major ports in Japan was around 87% in 1985.
The statistics for the Port of Kobe, the principal container port in

Japan, are shown in the following table. The average share has been around 86% over the last 5 years.

Container Handling Share of Full-cellular Container Ships at the Port of Kobe

(%)

Year	1981	1982	1983	1984	1985
All routes	86.5	85.6	85.9	85.6	86.2
Philippine routes	72.5	64.2	70.0	75.7	N.A.
ASEAN Routes except Singapore	73.3	70.5	73.4	80.2	N.A.

3) Semi-container ships and conventional ships will continue to carry some portion of container transportation in the future. Based on the statistics from Kobe, the container handling share of Full-cellular container ships of ASEAN countries except on Singapore and Philippine routes has been increasing.
However the percentages on these routes are still lower than the average due to the imbalance of inward/outward container flow and the scale of containerizable cargo volume.

4) Considering the above tendency, the percentage of the containerized cargoes which will be transported by full-cellular container ships in the Philippines is assumed to reach about 85% in the future.

5) Based on the present characteristics of non-self-sustaining container ships calling at the Port of Manila, the future ship size and other data relevant to the planning are estimated as follows:
Estimated characteristics of Non-self-sustaining Container Ships

Ship Class	Avg. DWT	Avg. Handling Volume	Transport Share
10,000 DWT or less	8,500 tons	4,600 tons	30%
More than 10,000	22,000	4,000	70%

6) Based on the above assumptions, the number of non-self-sustaining container ships which will call at Manila in 2005 is estimated as follows:

Estimated Number of Non-self-sustaining Container Ships in 2005

10,000 DWT or less	332
More than 10,000 DWT	890

7) The Phase II construction project at MICT will be completed in 1989. In order to improve container handling efficiency, most of the containers at the Port of Manila will be handled at MICT in the future.
However, conventional ships and semi-container ships including some self-sustaining container ships handle both containers and other types of cargoes. Therefore, it is assumed that the containers which are handled by these ships will continue to be handled at South Harbor in order to avoid confusion at the container terminal.

8) The future container handling productivity at MICT in the case of using two gantry cranes per ship is estimated at 32 units/ship.gross hour.
The average mooring time is computed as follows:

Average Mooring Time per ship in 2005	
10,000 DWT or less	15 hours
More than 10,000 DWT	13 hours

9) The required number of berths for non-self-sustaining container ship is estimated using a simplified queuing theory equation as follows:

$$S = \alpha \frac{\lambda}{\mu} = 2.5 \times \left(\frac{332}{350} \times \frac{15}{24} + \frac{890}{350} \times \frac{13}{24}\right) = 4.9$$

where s: number of berths required
α: coefficient, 2.5, for the exclusive use berths
λ: number of vessel arrivals per unit time
$\frac{1}{\mu}$: mooring time of vessels

As a result, five exclusive use berths for non-self-sustaining container ships are required at the Port of Manila in 2005.

10) However, some of the self-sustaining container ships which are operated by particular shipping companies which mainly use MICT will be accommodated at MICT.

11) It is assumed that about 20% of the self-sustaining container ships which will call at the Port of Manila in 2005 will be berthed at MICT. The estimated number of self-sustaining container ships which will be berthed at MICT is as follows:

10,000 DWT or less	30
More than 10,000 DWT	22

12) Based on the above assumptions, an analysis of the berthing capacity of MICT in 2005 is conducted by means of a simulation test.
The terminal conditions are as follows:

Number of berths	5 (considering Phase III project)
Number of gantry cranes	10 (2 per ship)

The results are as follows:

Average berth occupancy ratio	40%
Waiting ships to ship entry	5.5%
Waiting time to mooring time	1.4%
Per ship waiting time	0.2 hour

The average berth occupancy ratio of 40% is appropriate for exclusive use facilities.
The volume of containers which will be handled at MICT is estimated at about 430 thousand TEUs in 2005. Judging from the planned capacity of MICT under the Phase III project, MICT should have a sufficient capacity to handle the containers in the target year.

13) In 1985, around 57% of containers are handled at South Harbor. Before transferring container handling to MICT, the shipping companies which, at present, mainly use South Harbor should make the necessary prepartions. So, the transfer of container handling will be advanced step by step.

14) Based on the above assumptions, the future share of container handling at South Harbor is estimated as follows:

(Year)	Share of South Harbor (%)
1985	28
1990	20
1995	15
2000	13
2005	13

Note: The 1985 figure shows the share of containerized cargoes which are handled by conventional ships, semi-container and self-sustaining container ships.

7.2.1.2 Breakbulk cargo handling share of South Harbor

The majority of breakbulk handled at Anchorage is import cargo. The major commodities are bagged fertilizer (159,000 tons), other cereals (98,000 tons, mainly bagged corn), wheat (49,000 tons) and Feed (43,000 tons) in 1985.

The breakbulk volume of the avove major commodities except fertilizer is expected to decrease with the progress of containerization and an improved domestic supply-demand balance.

Based on the survey of factories along the Pasig river, the bagged fertilizer volume to be directly transported from Anchorage to factory by barge is estimated at 50,000 tons in future. The remaining bagged fertilizer is expected to be transferred to pier side handling.

However, considering the difficulty of the changing commercial transactions and customs procedures, the transfer of cargo to pier side handling will be gradual.

Accordingly, the percentage of breakbulk handling at Anchorage to the total at South Harbor is estimated as follows:

1985 (actual)	43 %
1995	29 %
2005	13 %

7.2.2 Future Shipping

7.2.2.1 Historical Trend

In planning to determine the size and number of berths required, the first thing is to determine the size and number of ships which will utilize the port in the future. The future size of ships is usually

predicted by considering the present ship size, future cargo forecasts and trends in the world maritime industry.

Based on PPA's worksheets, the main indicators concerning shipping activity in South Harbor are estimated as shown in Table 7.2.2. Based on the table, the following trends are apparent.

① The number of conventional ships has been decreasing in inverse proportion to the increasing number of container ships.

② The average size of bulk carriers has been increasing year by year.

③ The average handling volume per vessel of each of the ship types fluctuate.

7.2.2.2 Forecast of Future Shipping

1) Conventional general cargo ships

Based on the PPA data, among the conventional general cargo ships calling at Manila in 1985 the average ship size was around 10,000 DWT, as indicated in Chapter 4. Under 25,000 DWT class ships account for around 90% of the total. Over 25,000 DWT class ships are almost all tramper service ships, and their cargoes are particular items such as wheat, feed, coconut products handled at Anchorage and forest products at pier side. Appendix 7.2.1 is a list of the large conventional ships which called at Manila. Other general cargoes are mainly transported by regular service ships, and are almost all transported by vessels under 25,000 DWT. The characteristics of conventional ships other than particular commodity carriers are shown in Appendix 7.2.2.

The majority of ships transporting general cargo in the world are of the 8,000 to 15,000 DWT class, based on Lloyd's Register of Shipping. The nature of transport cargo being what it is, the maximum and the average size of vessels cannot change rapidly at Manila and throughout the world.

Considering the above circumstances, the future ship size for conventional general cargo except for particular commodities is estimated as follows:

Table 7.2.2 Shipping Activity in South Harbor

(Average Oct.- Dec.)

(Year)	1983			1984			1985		
Ship type	No. of Calls per month	Avg.DWT	Avg. Handling Volume	No. of Calls per month	Avg.DWT	Avg. Handling volume	No. of Calls per month	Avg.DWT	Avg. Handling volume
Conventional	74 (25)	10,036	2,967	49 (15)	10,916	3,442	31 (13)	8,279	2,021
Semi-container	8	12,160	1,444	6	11,600	2,226	10	9,982	1,821
Container	39 (2)	10,901	2,121	39 (3)	12,431	2,095	47 (4)	10,191	2,186
Ro-Ro	2	11,205	1,942	1	15,010	1,189	1 (0)	15,737	1,434
Bulk carrier	24 (4)	17,317	1,658	19 (4)	18,275	8,723	16 (3)	19,994	5,390
Tanker	16 (3)	20,074	1,561	13 (3)	12,409	1,305	19 (1)	10,324	1,582
Passenger	4 (4)	7,053	0	7 (7)	5,777	0	4 (4)	5,348	0
Others	13 (6)	7,909	1,250	7 (6)	1,431	281	14 (12)	1,081	170

Source: "Worksheet per vessel activity" PPA, computed by consultant

Note : o Figures in parentheses show the No. of non-cargo handling ships

o Figures in the Table show the estimated average for 3 months (Oct.-Dec.)

Estimated maximum and average size of conventional general cargo ships

Maximum size 25,000 DWT

Ship class DWT	Avg. DWT	Loaded rate %	Lot size tons
~ 10,000	6,000	20	1,100
10,001 ~	17,000	30	4,600

The loaded rate Lr is computed using the following fomula:

Lr = Lot size / DWT X Efficient storageable rate

The efficient storageable rate is assumed to be 0.9

2) Particular cargo ships (Timber, Iron & Steel and Bagged Fertilizer)

① Timber ships

The vessels transporting forestry products are over 10,000 DWT in 1985 as shown in Appendix 7.2.3. The future timber ships calling at Manila are estimated to remain the same size as at present considering the estimated forest products export volume in the future.

The future ship characteristics are as follows:

Average ship size	Average loaded volume
28,000 DWT	3,000 tons

② Iron & Steel ships

The average size of the ships which transport mainly iron and steel products calling at Manila (these vessels carry more than 1,000 tons of iron and steel) is around 10,000 DWT with 2,500 tons of discharged volume as shown in Appendix 7.2.4.

Considering the future characteristics of conventional ships, the characteristics of the iron and steel ships calling at Manila in the future are estimated as follows:

Average ship size	Average discharge volume
10,000 - 15,000 DWT	3,650 tons

The average characteristics by ship class are as follows:

Ship class	Ship size	discharge volume	loaded rate
~ 10,000 DWT	7,000 DWT	1,800 tons	30 %
10,001 ~	20,000	5,500	30

③ Bagged fertilizer

The origins of imported fertilizer carried into Manila are mainly ASEAN and East Asian countries. These trade routes will probably not change in the future. Therefore, the transport situation of fertilizer will not change remarkablly. Bagged fertilizer is imported 50% by conventional general cargo ships and 50% by bulk carriers. The average ship size and the average handling volume are 8,100 DWT and 4,400 tons respectively in 1985. The import volume of fertilizer will increase in the future according to the demand forecast. The future ship size and loaded rate, therefore, will increase a little. The estimated future ship characteristics are as follows:

Ship class	Average DWT	loaded rate (%)	Avg. handling volume (tons)
~ 10,000 DWT	7,500	65	4,400
10,001 ~	15,000	65	8,800

3) Semi-container and Self-sustaining container ships

Based on PPA's statistics, the ship size and the handling volume per ship are as follows:

(Year)	Average DWT	Handling volume per ship	Loaded rate
1983	11,115	2,001 (tons)	20 (%)
1984	12,320	2,114	19
1985	10,154	2,117	23

The container ships which presently call at Manila are mostly feeder ships (except for some direct service ships to/from Japan and Australia/NZ) which connect with main trade routes at Hong Kong, Kaohsiung and Singapore.

The size of main-haul container ships has been increasing. Therefore, the shipping companies generally operate large size container ships limiting their ports of call in an effort to minimize costs. The feeder network around Southeast Asia is already fixed at present.

So, feeder ships will continue to serve the Port of Manila, and main-haul ships will not call at the Port. When the volume of container cargoes increases the transport share of non-self-sustaining container ships will also increase. However, the size of the semi-container and self-sustaining container ships which serve Manila and other similar feeder routes will not change, and therefore, the characteristics of the container ships calling at Manila in the future will not change remarkably. Based on the present characteristics of these ships as shown in Appendix 7.2.5, the future characteristics are forecast as follows:

Ship type	class	Avg. DWT	loaded rate (%)	Avg.handling volume (tons)
Semi-container ships	~ 10,000 DWT	8,000	25	1,800
	10,001 ~	22,000	12	2,400
Self-sustaining Container ships	~ 10,000 DWT	6,000	45	2,400
	10,001 ~	16,000	15	2,200

4) Bulk carriers

① Wheat and soybean meal carriers

These commodities are mainly imported from the United States and Brazil. The ships come through the Panama Canal.

Appendix 7.2.6 shows the ship size of bulk carriers throughout the world. The main size of bulk carriers in the world is around 16,000-48,000 DWT. However, the percentage of 33,000-67,000 DWT class ships has been increasing. According to the demand forecast, the import volume of wheat and soybean meal at Manila will increase, and will reach a sufficient volume to warrant the use of larger vessels.

Thus it is preferable to use larger size ships. In fact, the size of the grain carriers calling at Manila has been increasing as shown in Appendix 7.2.7.

The average wheat and soybean meal carriers calling at Manila in 1985 are of the 20,000-35,000 DWT class. The loaded rate is around 75-85%. The future ship size is estimated as follows:

	Average DWT	Average lot size (tons)
Before completion of the grain terminal	30,000	22,500
After completion of the grain terminal	60,000	50,000

② Other bulk carriers

The major commodities carried by other bulk carriers at Manila are fertilizer, chemicals, minerals including coal and other cereals. These cargoes are mainly imported from Asian countries. This situation will continue in the future, and the ship size will not increase repidly. Based on the present size and loaded rate as indicated in Appendix 7.2.8, the future characteristics of other bulk carriers are forecast as follows:

Ship class	Average DWT	Loaded rate (%)	Average Lot size (tons)
~ 10,000 DWT	7,000	70	4,400
10,001 ~	20,000	70	12,600

7.2.3 Estimated Future Cargo Volume by Ship Type

Assuming that the present maritime transportation system does not change remarkably in the near future, the future cargo volume by ship type is estimated based on the relevant statistics of Manila Port and the forecast cargo volume by packing type by area.

1) At piers

Appendix 7.2.9 shows the estimated cargo volume by ship type by packing type handled at the piers of South Harbor in 1985.

The loose cargoes which are handled by bulk carriers are mostly timber and bagged yellow corn.

The import of yellow corn will be reduced in the future according to the demand forecast.

Timber is generaly exported by tramper ships, and in the Master Plan, it is mostly handled at preferential berths.

So, the loose cargoes excluding special cargoes which will be handled at preferential berths in the future including timber, iron & steel and bagged fertilizer will mainly be carried by conventional general cargo ships and semi-container ships. The estimated share is as follows:

Loose cargo handling share by ship type

Conventional ships	90%
Semi-container and Self-sustaining container ships	10%

After completion of the Phase II M.I.C.T. construction, some portion of the containerized cargoes will be moved from South Harborto M.I.C.T.
The existing cargo handling shares of containerized cargo in South Harbor by conventional ships, semi-container ships and self-sustaining container ships are estimated as 7%, 16% and 77% respectively.
As container cargoes increase, some of the cargo currently handled by self-sustaining container ships will be carried by non-self-sustaining container ships.
Therefore, the future shares of each ship type are estimated as follows:

Containerized cargo handling share by ship type

Conventional ships	10%
Semi-container ships	20%
Self-sustaining container ships	70%

Based on PPA statistics, the majority of bulk cargoes are handled by both bulk carriers and conventional ships. However, the majority of these ships are chartered ships which transport mainly or only these cargoes. Therefore, all ships which transport bulk cargo are classified together into the category of bulk cargo ships.

At South Harbor, there is no storage tank for liquid cargo and there are no pumping facilities at the piers. Liquid cargoes are normally handled at Anchorage by tankers.
This situation will continue in the future, so liquid cargo will not be handled at the piers of South Harbor.
Around 50% of iron & steel, timber and bagged fertilizer are presently transported by chartered ships based on PPA statistics.
Based on the current situation and the future projections, the estimated cargo volume by ship type by packing type in the target year is shown in Table 7.2.3.

Table 7.2.3 Estimated future cargo volume by ship type by packing type at the Piers of South Harbor

(thousand tons)

	1990	1995	2000	2005
Conventional	443	489	595	692
Loose cargo	390	436	536	614
Container	53	53	59	78
Semi container	146	151	172	216
Loose cargo	40	44	53	60
Container	106	107	119	156
Contaner Ships (Self-sustaining)	372	376	420	552
Loose cargo	3	4	6	8
Container	369	372	414	544
Bulk cargo ships (except grain)	269	330	409	511
Iron & steel cargo ships	100	145	110	160
Timber cargo ships	62	53	46	39
Fertilizer (bagged) cargo ships	32	82	114	184
Grain cargo ships				(1,597)
Total	1,424	1,626	1,866	2,354
Loose	627	764	865	1,065
Container	528	532	592	778
Bulk	269	330	409	511

Note: Figures in parentheses show the volume if the grain terminal is located at Pier 3 (alternative case 2).

2) At Anchorage

About 30% of the bulk cargoes which are handled at Anchorage are transported by conventional ships in 1985 as shown in Appendix 7.2.10. The major commodities are feed, wheat, other cereals, crude minerals, fertilizer, chemicals and coconut products. Excluding bulk grain, around 50% of other bulk cargoes are handled by conventional ships at Anchorage.

The future cargo volumes to be handled at Anchorage by ship type by packing type in the target year, 2005, are estimated as follows:

(thousand tons)

	Loose cargo	Bulk	Liquid	Total
Conventional ships	102	338	0	440
Bulk carriers	0	339	0	339
Tankers	0	0	505	505

In the future, bulk grain will be handled at the grain terminal which will be constructed under the Master Plan.

7.2.4 Estimated Number of Calling Ships

Based on the processed data from PPA statistics, the current percentages of cargo volume which are handled at South Harbor by ship type by ship class are estimated as follows:

(Ship class)	Less than 10,000 DWT	Over 10,000 DWT
Conventional ships	43%	57%
Semi-container ships	75	25
Self-sustaining container ships	69	31
Bulk cargo (except grain) ships	20	80
Iron and steel ships	54	46
Timber ships	2	98
Fertilizer (bagged)	53	47
Tankers	69	31

The future transport cargo share is estimated considering the worldwide trend whereby certain types of ships have been increasing their size.

The number of calling ships at South Harbor by ship class can be computed by the estimated cargo volume (as shown in Table 7.2.4) based on the above share and the average handling volume by ship class.

The results are shown in Table 7.2.5.

Table 7.2.4 Estimated cargo volume at South Harbor by ship type by class

Ship Type / Ship Class	Estimated Transport share (%)	Estimated cargo volume('000 tons) Year 1990	1995	2000	2005
(At Piers)					
Conventional ships					
- 10,000	40	177	196	237	277
10,001 -	60	266	293	356	415
Semi-containers					
- 10,000	70	102	106	120	151
10,001 -	30	44	45	52	65
Containers (Self-sus.)					
- 10,000	60	223	226	252	331
10,001 -	40	149	150	168	221
Bulk cargo ships					
- 10,000	20	54	66	82	102
10,001 -	80	215	264	327	409
Iron & Steel ships					
- 10,000	50	50	73	55	80
10,001 -	50	50	72	55	80
Timber ships					
10,001 -	100	62	53	46	39
Fertilizer (bagged)					
- 10,000	50	16	41	57	92
10,001 -	50	16	41	57	92
Grain ships					
10,001 -		-	-	-	1,597
(At Anchorage)					
Conventional ships					
-10,000	20	88	91	85	88
- 10,001 -	80	351	366	338	352
Bulk carriers					
-10,000	20	37	48	54	68
10,000 -	80	148	190	215	271
Tankers					
- 10,000	70	202	239	289	354
10,001 -	30	87	103	124	151
Grain carriers					
Wheat 10,001 -		411	518	660	-
Soya meal 10,001 -		262	411	567	-

Table 7.2.5 Estimated Number of Calling Ships at South Harbor

Ship Type Ship Class	Average DWT	Average Handling Volume (tons)	Year 1990	1995	2000	2005
(At Piers)						
Conventional ships						
- 10,000	6,000	1,100	161	178	215	252
10,001 -	17,000	4,600	58	64	77	90
Semi Containers						
- 10,000	8,000	1,800	57	59	67	84
10,001 -	22,000	2,400	18	19	22	27
Containers (Self-sus.)						
-10,000	6,000	2,400	93	94	105	138
10,001 -	16,000	2,200	68	68	76	100
Bulk cargo ships						
- 10,000	7,000	4,400	12	15	19	23
10,001 -	20,000	12,600	17	21	26	32
Iron & Steel ships						
- 10,000	7,000	1,800	28	41	31	44
10,001 -	20,000	5,500	9	13	10	15
Timber ships						
10,001 -	28,000	3,000	21	18	15	13
Fertilizer (bagged)						
- 10,000	7,500	4,400	4	9	13	21
10,001 -	15,000	8,800	2	5	6	10
Grain carriers						
Grain terminal	60,000	50,000	-	-	-	32
(Pier 3)	(25,000)	(20,000)	-	-	-	(80)
(At Anchorage)						
Conventional ships						
- 10,000	5,000	2,000	44	46	43	44
10,001 -	24,000	10,800	33	34	31	33
Bulk carriers						
- 10,000	7,000	4,400	8	11	12	15
10,001 -	20,000	12,600	12	15	17	22
Tankers						
- 10,000	5,500	1,300	155	184	222	272
10,001 -	23,000	2,000	44	52	62	76
Grain carrier						
Wheat	30,000	25,000	16	21	26	-
Soya meal	30,000	22,500	12	18	25	-

Note: Average DWT and average handling volume per ship at Anchorage are estimated based on the characteristics of the vessels which presently moor at Anchorage.

7.3 Analysis of Existing Port Capacity

In order to determine the required scale of the facilities for future cargo traffic, it is first necessary to analyze the present capacity of the port.

In general port capacity varies according to the type of cargo, size of lot, size of berth, method of loading and unloading, working conditions and other factors.

This section analyzes whether or not the present capacity of the Port will be sufficient to accommodate the estimated future cargo demand by means of simulation tests.

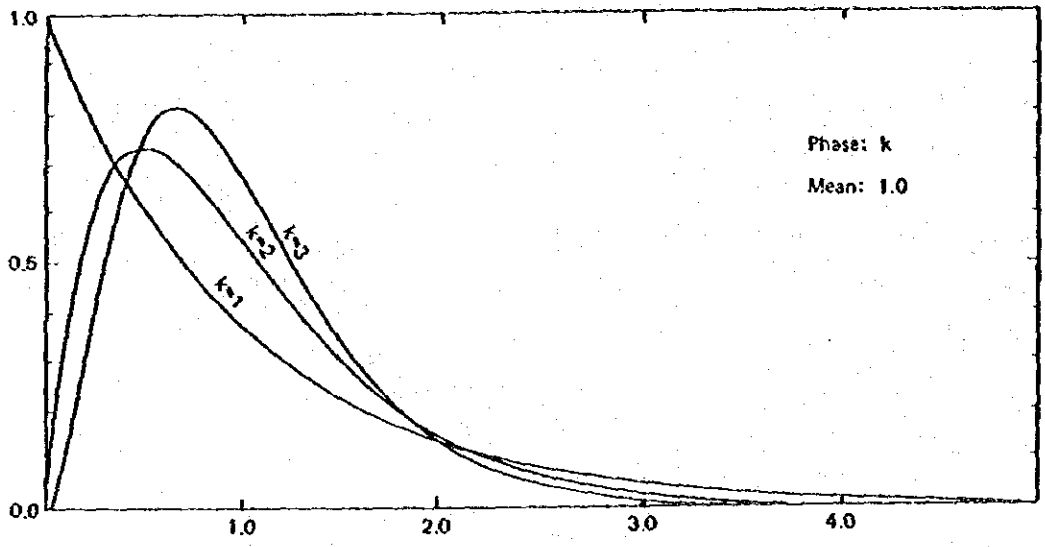
7.3.1. Method of Simulation by Queuing Theory

7.3.1.1 Application of queuing theory to port planning

Ships calling at a port expect to be moored at a designated berth immediately, in the order of arrival, and carry out cargo handling. If a ship is already berthed at the quay and there is no room, the latter ship has to wait until after the first ship completes its cargo handling and leaves. (The ship expects to be berthed as soon as it enters a port. However, the port management body wants to minimize the number of quays in order to increase efficiency, that is to minimize investment. How to balance these conflicting desires, namely, what service level should be set, is important in port planning.)

This phenomenon of ships arriving and leaving a port can be analyzed by queuing theory, as in the analysis of the situation at a bank, where variables include the number of windows and the time each customer takes at the windows. For a port, the variables include the arrival of ships, the number of berths and the berthing time. Great efforts are being exerted to clarify the pattern of ship entries and the berthing time at ports. As to the pattern of ship entries, normally it is a random Poisson curve, namely, entry time intervals are of exponential distribution.

In the pattern of the berthing time of ships as expressed by a histogram, normally there is one peak that is rather on the left side and it often conforms to the Erlung distribution in Phase 2 or Phase 3.



Erlung Distribution

The following four factors are indispensable to the determination of the queuing phenomenon:

① Distribution of arrivals of ships to be berthed
② Distribution of berthing time
③ Number of berths
④ Methods of service

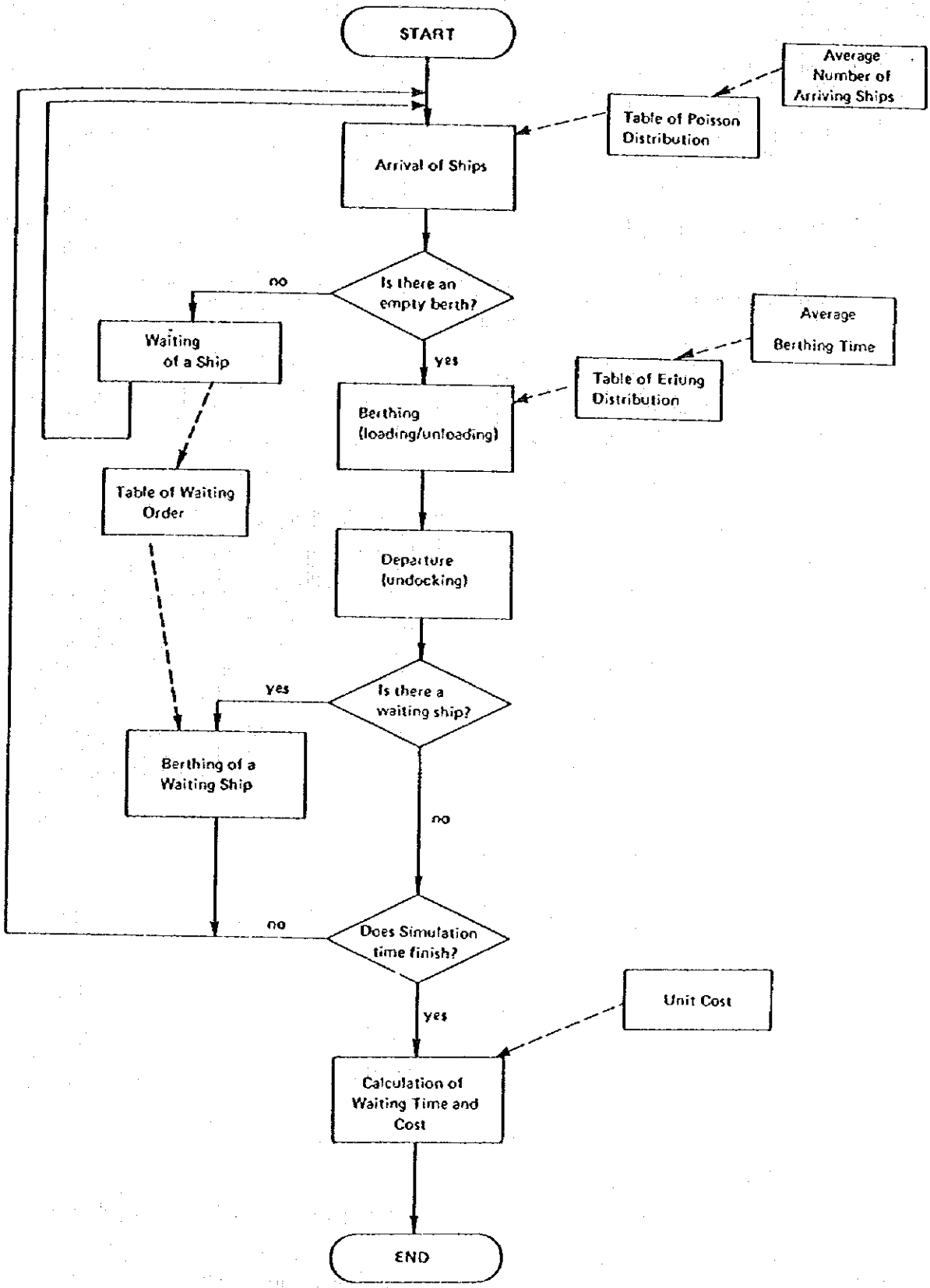
Factor ④ concerns such matters as service in the order of arrival or preferential service. Normally, service in the order of arrival predominates but, in the case of a container port, preferential service is sometimes given to full-container ships.

7.3.1.2 Methodology of simulation test

Queuing theory has been used to make a projection concerning the situation of ships calling at or leaving a port. However, theoretical analysis alone cannot cope with the complicated reality of port activities. For this reason, a computer is used to follow the movement of ships, i.e. entering/berthing, loading/unloading and leaving.

The flow of the simulation model used in this study is shown in the following figure.

In general, input data are comprised of ship types, number of berths, frequency distribution of calling ships, and frequency distribution of mooring time. Output data are comprised of the number of waiting ships, their waiting time and berth occupancy.



Flow Chart of the Simulation Model

7.3.2 Basic Conditions of the Simulation Tests

The basic conditions of the simulation tests are follows:

1) The available berthing facilities for cargo handling in South Harbor are Pier 3, Pier 5 and Pier 9.
Based on the engineering study, Piers 13 and 15 are too deteriorated, and will not be available for cargo handling if rehabilitation works are not executed.

2) As indicated in Appendix 7.3.1, a Phase 3 Erlung distribution applies well to the berthing time of conventional ships. This distribution is used for iron & steel, timber and fertilizer ships, well. A phase 2 Erlung distribution is used for semi-container, self-sustaining container, bulk carrier and grain ships.

3) Simulation tests are performed for the cargo demand in 1995 and in 2005.

7.3.2.1 Premises for the simulation

The simulation tests for these cases are carried out under the following assumptions:

① Ships can enter and leave at any time.

② The number of ships is estimated based on the volume of cargoes by ship type and the per-ship cargo volume as shown in Table 7.2.5.

③ The average mooring time is estimated based on the per-ship cargo volume divided by the actual cargo handling productivity.

④ Semi-container and self-sustaining container ships use berths 3 and 4 at Pier 3 on a preferential basis in principal. However, these ships can also use any other berth, if the preferential berths are occupied.

⑤ The other calling ships use berths other than the preferential berths in principal. However, if all the other berths are

occupied, then the other vessels may also berth at the preferential container berths.

⑥ Considering ship length, the number of berths is assumed as follows:

10,000 DWT and less: 11
Over 10,000 DWT : 5

7.3.2.2 Input data

Table 7.3.1 shows the simulation test input data.

Table 7.3.1 Simulation Input Data (Existing capacity test)

Ship Type commodity	Ship Size (DWT)	Number of Ships 1995	Number of Ships 2005	Average Mooring Time (hours)
Conventional G.C. ship	10,000 and less	178	252	37
	over 10,000	64	90	134
Semi-container Ship	10,000 and less	59	84	26
	over 10,000	19	27	34
Self-sustaining Container ship	10,000 and less	94	138	17
	over 10,000	68	100	16
Bulk cargo	10,000 and less	15	23	85
	over 10,000	21	32	232
Iron & steel	10,000 and less	41	44	48
	over 10,000	13	15	134
Timber	over 10,000	18	13	89
Bagged Fertilizer	10,000 and less	9	21	85
	over 10,000	5	10	163

7.3.3 Simulation Test Results

The results of the simulation tests are shown in Table 7.3.2.

The output data of the simulation tests include the berth occupancy ratio, the ratio of the number of waiting ships to ship entry, the ratio of waiting time to mooring time and the waiting time per ship.

Table 7.3.2 Results of Simulation Tests (Existing capacity)

Facility	1995				2005			
	Average Berth Occupancy Ratio (%)	Ship Waiting Ratio (%)		Per Ship Waiting Time (hours)	Average Berth Occupancy Ratio (%)	Ship Waiting Ratio (%)		Per Ship Waiting Time (hours)
		*Waiting Ships to Ship Entry	Waiting Time to Mooring Time			*Waiting Ships to Ship Entry	Waiting Time to Mooring Time	
Pier 3 -Berths 3 and 4	50.3	19.4	29.6	9.1	79.2	64.5	230	74.3
Others	63.7	18.3	10.1	6.6	85.0	56.6	80.3	53.8
Total		18.6	13.5	7.3		58.6	112	60.3

Note: * The ratio of "Waiting ships to ship entry" is equal to the number of vessels that are waiting for berths over the total number of vessels at the port, including those vessels which are waiting for berths and those vessels that are presently at berth.

In order to evaluate the capacity of the mooring facilities, the following criteria are considered.

① The berth occupancy ratio should be 0.6 - 0.7.

② The desirable ratio of waiting time to mooring time is 10% or less.

③ The desirable waiting time per ship is less than half a day, with a maximum of one day.

Judging from these criteria, the existing mooring capacity of South Harbor will no longer be able to accommodate the projected demand after the year 1995. Especially, the estimated average waiting time of large size container ships including semi-container ships will become unacceptably long, more than 15 hours per ship.