THE STUDY REPORT
ON
THE REHABILITATION AND MODERNIZATION OF
THE CEMENT PLANT OF ISLAND CEMENT CORPORATION
IN
THE REPUBLIC OF THE PHILIPPINES

(SUMMARY)

SEPTEMBER, 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

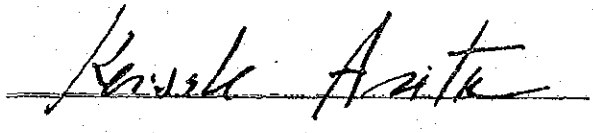
In response to the request of the Government of the Republic of the Philippines, the Government of Japan decided to conduct a study on the Rehabilitation and Modernization of the Cement Plant of Island Cement Corporation and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Philippines a survey team headed by Mr. Ryo Toyabe, ONODA ENGINEERING AND CONSULTING CO., LTD., from January 20 to February 8, 1986.

The team exchanged views with the officials concerned of the Government of the Philippines and conducted a field survey in the Project-related areas including Metro Manila and Antipolo. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

September, 1986



Keisuke Arita
President
Japan International Cooperation Agency

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FOREWORD

- Purpose and Development of This Study -

The Republic of the Philippines started its industrialization in the 1950's and the ratio of manufacturing industries in GNP reached 23.2% in the 1970's.
However due to narrow market and excess capacity, the ratio found it hard to grow and remains at 24.7% as of 1984.
While the ratio of all the mining and manufacturing industries including mining, construction, utilities and manufacturing in GNP is 34.1% exceeding 26.2% of agricultural industries.

On the other hand, a number of plants have been constructed through the economical cooperation of Japan in ASEAN countries including the Philippines.

But those plants are mostly suffering from low operation rate and high production costs due to timeworn facilities and lack of spare parts.
Under such circumstances, the Government of the Republic of the Philippines requested the Government of Japan to conduct the study on the Rehabilitation and Modernization (hereinafter referred to as "the Study") of the cement plant of Island Cement Corporation (hereinafter referred to as "ICC") in April, 1985.

In the response to the request of the Philippines, the Japan International Cooperation Agency (hereinafter referred to as "JICA") despatched a preliminary survey team in September, 1985 to discuss and sign with the Board of Investments (hereinafter referred to as "BOI") on the Implementation Arrangement for conducting the survey.

Based on the Arrangement, JICA has carried out the survey during a period of 20 days starting from the end of January, 1986.

That is, after grasping the overall background of the project to carry out:

(1) diagnosis of Antipolo plant of ICC

(2) formulation of rehabilitation and modernization program assuming that wet long kiln system is converted to dry system

(3) present situations and future prospects of supply and demand of cement in the Philippines

(4) financial analysis and economic evaluation of the project

and then based on the overall consideration on the results obtained to judge the feasibility of the project as well as to give recommendation for implementation of the project.

The field investigation was started on 20th January, 1986 and progressed favourably throughout the whole period thanks to the positive cooperation extended by BOI, ICC and other Departments concerned and completed on 8th February. After returning home of the team, arrangement and analysis of the results of field investigation, laboratory test of samples collected at field, diagnosis of the plant, formulation of rehabilitation and modernization program and financial analysis and economic evaluation were conducted, and finally this report was completed in May 1986.

The field investigation is outlined as follows:

(1) Investigation at ICC's cement plant

Investigation of raw material quarry
Investigation of plant equipment and facilities
Investigation of plant control

(2) Investigation of cement market

Marketing method of ICC - present situation and future policy
Present situation of cement market in the Philippines
Investigation on future prospect of cement market in the Philippines

(3) Investigation of electricity supply

Investigation at National Power Corporation and Manila Electric Company
Investigation at Doroles substation

(4) Investigation for financial analysis and economic evaluation

Collection of cost information
Collection of information on financing
Investigation of taxation and incentive

(5) Itinerary of the field survey

The survey team carried out the field survey during a period of 20 days from January 20 to February 8, 1986.
The offices visited and places surveyed during the period are described as follows.

Remarks:

Abbreviation of places

MNL: Metro Manila, APL: Antipolo

Abbreviation of Offices of the Government and Private Company

BOI	:	Board of Investments
NEDA	:	National Economic and Development Authority
DBP	:	Development Bank of the Philippines
MOF	:	Ministry of Finance
PCIA	:	Philippine Cement Industry Authority
BOMG	:	Bureau of Mines & Geo-sciences
MPWH	:	Ministry of Public Works and Highways
NCSO	:	National Census and Statistics Office
PHILCEMCOR	:	Philippine Cement Manufacturers Corporation
MERALCO	:	Manila Electric Company
ADB	:	Asian Development Bank
ICC	:	Island Cement Corp.
AICDC	:	A.I. Construction & Development Corporation
JETRO	:	Japan External Trade Organization
NPC	:	National Power Corporation
URPO	:	Urban Roads Project Office

Day's order	Date	Day	Work description	Places
1	Jan.20	(M)	Field survey team left Tokyo and arrived at Manila	MNL
			Meeting at Japanese Embassy and JICA Manila office	
2	Jan.21	(T)	Meeting at BOI on survey schedule with ICC staff	MNL
			Meeting at ICC head office	
3	Jan.22	(W)	Meeting at and inspection of ICC cement plant	APL
4	Jan.23	(Th)	(A) Meeting at DBP, NEDA	MNL
			(B) Study at ICC cement plant	APL
5	Jan.24	(F)	(A) Meeting at ICC head office, BOI, NEDA library, NCSO	MNL
			(B) Study at ICC cement plant	APL
6	Jan.25	(Sat)	(A)(B) Study at ICC cement plant	APL
7	Jan.26	(Sun)	(A)(B) Data arrangement	MNL
8	Jan.27	(M)	(A) Meeting at ICC head office and AICDC	MNL
			(B) Meeting at NPC	
9	Jan.28	(T)	(A) Meeting at PHILCEMCOR, BOI, MOF	MNL
			(B) Meeting at MERALCO, NPC	
10	Jan.29	(W)	(A) Meeting at PCIA, ICC, BOMG, ADB	MNL
			(B) Meeting at ICC cement plant	APL
			(C) Meeting at MERALCO, NPC, NPC substation	APL

Day's order	Date	Day	Work description	Places
11	Jan.30	(Th)	(A)(B) Meeting at JETRO, MPWH. Preparation of progress report Mr. Okada left Manila for Japan	MNL
12	Jan.31	(F)	(A)(B) Submission of progress report to BOI. Meeting at ICC, Japanese Embassy and JICA Manila office	MNL
13	Feb.1	(Sat)	Data arrangement	MNL
14	Feb.2	(Sun)	Messrs. Toyabe, Kamata, Kojima, Fukui left Manila for Japan	MNL
15	Feb.3	(M)	Meeting at Tariff Commission, URPO	MNL
16	Feb.4	(T)	Meeting at JETRO, ADB, MPWH	MNL
17	Feb.5	(W)	Meeting at ICC, Japan Ex-im Bank, PHILCEMCOR	MNL
18	Feb.6	(Th)	Meeting at JICA, Data arrangement	MNL
19	Feb.7	(F)	Data arrangement	MNL
20	Feb.8	(Sat)	Mr.Kawasugi left Manila for Japan	MNL

SECTION I PREMISE

I-1 Premise for the Study

This report has been prepared under the following premises.

I-1-1 Raw Materials of Cement

The main raw materials which are being used by ICC, i.e. limestone, high silica clay, low silica clay occur with the following reserves, and so they are sufficient for the operation after the renovation.

(1)	Limestone	56,035,000 ton
(2)	High silica clay	7,640,000 ton
(3)	Low silica clay	1,100,000 ton

I-1-2 Basic Data for Financial Analysis and Economic Evaluation

(1) Price and unit price

The price and unit price as of January 1986 have been used as the basis of calculation and no escalation has been taken into consideration.

(2) Financing

Loan	100% (foreign and local loan)

(3) Loan condition (long term)

	foreign	local
Interest rate	11%/y	12%/y
Repayment	10 years	5 years
Grace period	2 years	2 years
Construction interest	to be included in capital	

(4) Loan condition (short term)

Interest rate	12%/y

(5) Project life

Construction period	:	2 years
Effective operation period	:	20 years

(6) Operation ratio of the plant

To be determined according to the transition of the demand (Refer to Section III)

(7) Annual working day 300 day/y

(8) Taxes and duties

(i)	Income tax	35% to the profit before tax
(ii)	Sales tax	10% of sales revenue

(9) Exchange rate (Official rate as of January 1986)

US$ 1 = Pesos 19.103
US$ 1 = Yen 192.05

(10) Depreciation

	Durable year	Residual value
Machinery and equipment	15 year	1%
Civil and buildings	20 year	1%
Vehicle	5 year	1%
Preoperation expenses & construction interest	10 year	0%

(11) Ex factory price of cement

	40 kg bag
Ordinary portland cement	42.5 Peso/bag
Pozzolan cement	41.5 Peso/bag

(12) Production proportion of cement by kinds

As a results of consultation with ICC, the following cases were adopted.

	Ordinary portland cement		Pozzolan cement
Case I	50 %	:	50 %
Case II	80 %	:	20 %

(13) Clinker production (100% capacity)

		kiln to be operated
Before renovation	780,000 ton/year	No.1 and 2 kiln
After renovation	780,000 ton/year	No.1 kiln

(14) Others

Export promotion fund	0.5 Peso/bag

SECTION II POLICY OF THE GOVERNMENT ON THE CEMENT INDUSTRIES AS WELL AS THE REHABILITATION AND MODERNIZATION OF ICC

The Governmental authority that is in charge of implementing the policy on the cement industry is PCIA which is one department of BOI.

II-1 Price Policy

The Government is now setting up the ceiling price against ex-plant price, and based on the ex-plant price, the regional retail ceiling prices are established.

Ordinary portland cement

Ex-factory price	42.50 Pesos/bag (40 kg)
Retail price (Metro Manila)	48.50 Pesos/bag (40 kg)

II-2 Market Policy

The Philippines is divided into three areas, i.e. Luzon area, Visayas area, and Mindanao area.

The Philippine cement industry has an agreement stipulating that each cement plant, as a rule, can sell its cement only in the area where that plant is located.

II-3 Export Policy

The Government is promoting the exportation of cement by subsidizing US$20.25 per ton of cement to be exported.
This subsidy is made by accumulating the funds of 0.5 Peso per bag to be imposed on the domestic sales.
The export is conducted in integrated system in accordance with a guidelines.

II-4 Improvement of Cement Production Technology and Quality

PCIA is endeavouring to improve the technology of each cement companies through the Technical committee of PHILCEMCOR.

II-5 Policy for the Renovation of ICC

In case the demand for cement is recovered and this renovation project is judged by the owners (DBP and PNB) to be profitable, the Government is ready to cooperate the renovation.

SECTION III PRESENT SITUATION AND FUTURE PROSPECTS OF SUPPLY AND DEMAND

III-1 Outline of Present Situation of the Philippine Cement Industry

In the Philippines, at present, there are 18 cement plants.
(Refer to Fig. 3-1-1)
The total production capacity is about 6,000,000 tons/year and average annual production for last 11 years (1974∿1984) was 4,133,000 tons.

Since the economic situation in the Philippines is dull and the domestic demand fell down to 3,662,000 tons/year in 1984, the management of cement manufacturers is suppressed.

III-2 Production, Domestic Sales and Export

(1) Production

Average annual production for last 11 years is shown in Table 3-2-1.

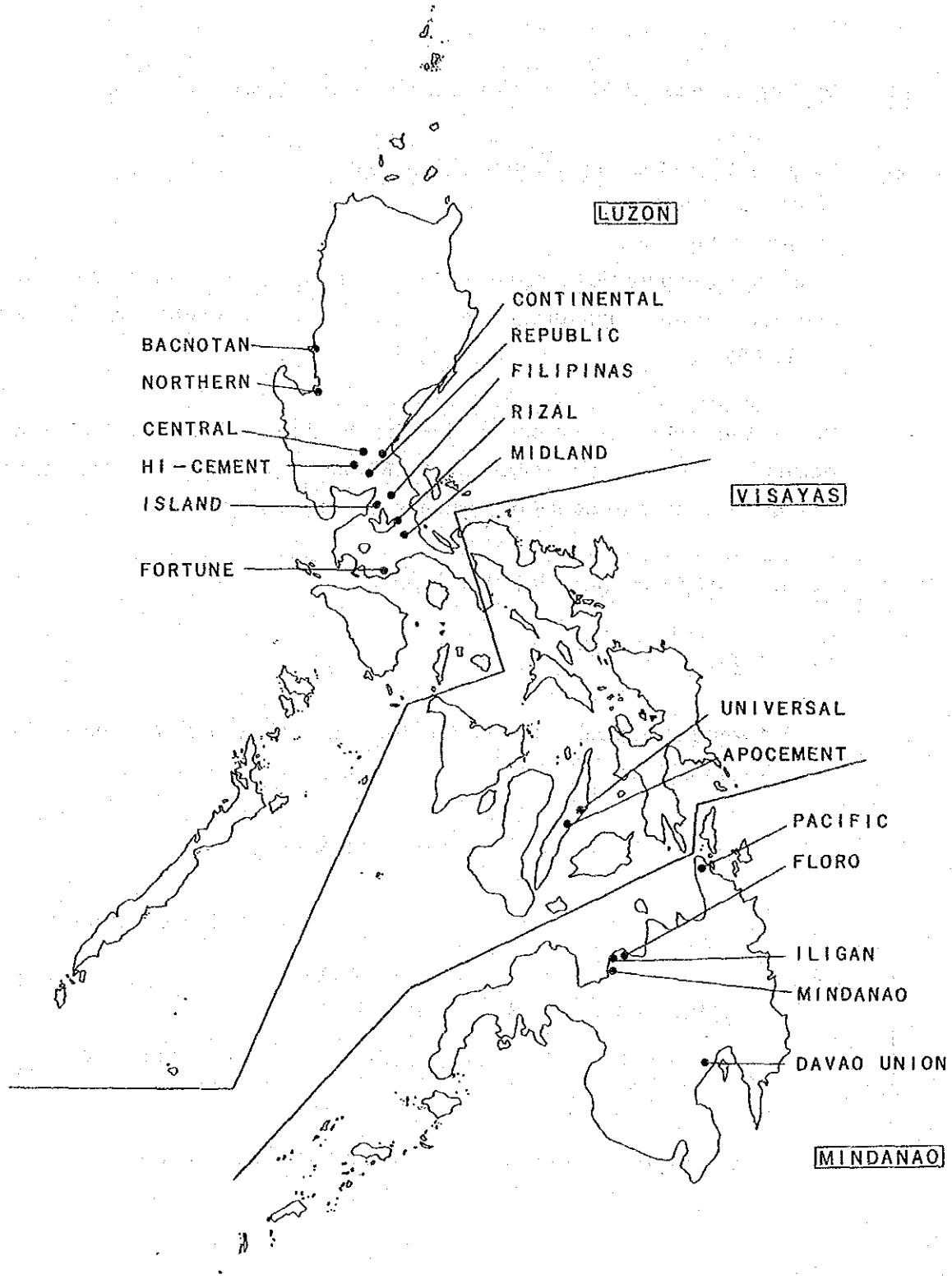
Table 3-2-1 Cement Production

1,000 ton/year

Year	Luzon area		Vis Min area		Total	ICC
	Production	%	Production	%		
1974∿84	2,857	69	1,276	31	4,133	440

ICC's production occupied 10.6% of the total production.

Fig3-1-1 DISTRIBUTION OF PHILIPPINE CEMENT PLANTS



(2) Domestic sales

Average annual domestic sales for last 11 years is shown in Table 3-2-2.

Table 3-2-2 Domestic Sales of Cement

1,000 ton/year

Year	Luzon area		Vis Min area		Total	ICC
	Domestic sales	%	Domestic sales	%		
1974∿84	2,559	73	946	27	3,505	426

ICC's share to the total domestic sales was 12%.
ICC consigns cement for sales to A.I. Construction and Development Corporation (AICDC).

ICC's Antipolo plant is located in the very vicinity (40 km) of a big cement consuming city, Metro Manila.

(3) Export

The Philippines is endevouring to export the surplus of production. (Refer to SECTION II)
At present they established the export subsidy system to compensate low export price.

As ICC's plant is not located in seaside, it has not exported cement but very little.

III-3 Demand Forecast

(1) Demand forecast of cement in the Philippines

Demand forecast of cement in the Philippines were made by the trend analysis, correlation analysis, estimation based on similar cases and the forecast prepared in the Philippines.

As basic data the 5 year moving average of domestic demand covering past 16 years was used.
(Refer to Table 3-3-1)

The results of estimation are shown in Table 3-3-2 and Fig. 3-3-2.
In the table, (1), (2), (3) and (4) show linear equation, linear exponential equation, population correlation line, and GNP correlation line respectively.

Equation (3) was adopted as the base of this study.

(2) Export potentiality

The Philippines has been exporting cement corresponding to 20 ∿ 30% of the domestic consumption.
Main destinations are ranging from South East Asia to Middle East.

It can be said that there will be a possibility to continue exporting cement from now on to such extent as elapsed in 1970's, if the export will be promoted utilizing the vantage ground of this country.

Table 3-3-1 Production, Import, Export and Domestic Sales in the Philippines

(1,000 tons)

	A Production	B Import	C Export	Domestic Consumption (Demand)		
				A+B-C	5-Year Moving Average	Consumption Per Capita (kg)
1969	2,649	249	-	2,898		70
1970	2,448	7	56	2,399		66
1971	2,808	9	288	2,529	2,701	67
1972	3,160	-	328	2,832	2,665	73
1973	4,059	-	1,213	2,846	2,895	71
1974	3,485	-	764	2,721	3,094	66
1975	4,350	-	802	3,548	3,185	83
1976	4,229	-	707	3,522	3,292	81
1977	4,112	-	822	3,290	3,480	73
1978	4,201	-	823	3,378	3,515	73
1979	3,940	-	278	3,662	3,518	77
1980	4,516	-	794	3,722	3,620	80
1981	4,008	-	470	3,538	3,831	72
1982	4,393	-	591	3,802	3,802	75
1983	4,559	-	130	4,429		85
1984	3,662	-	141	3,521		64

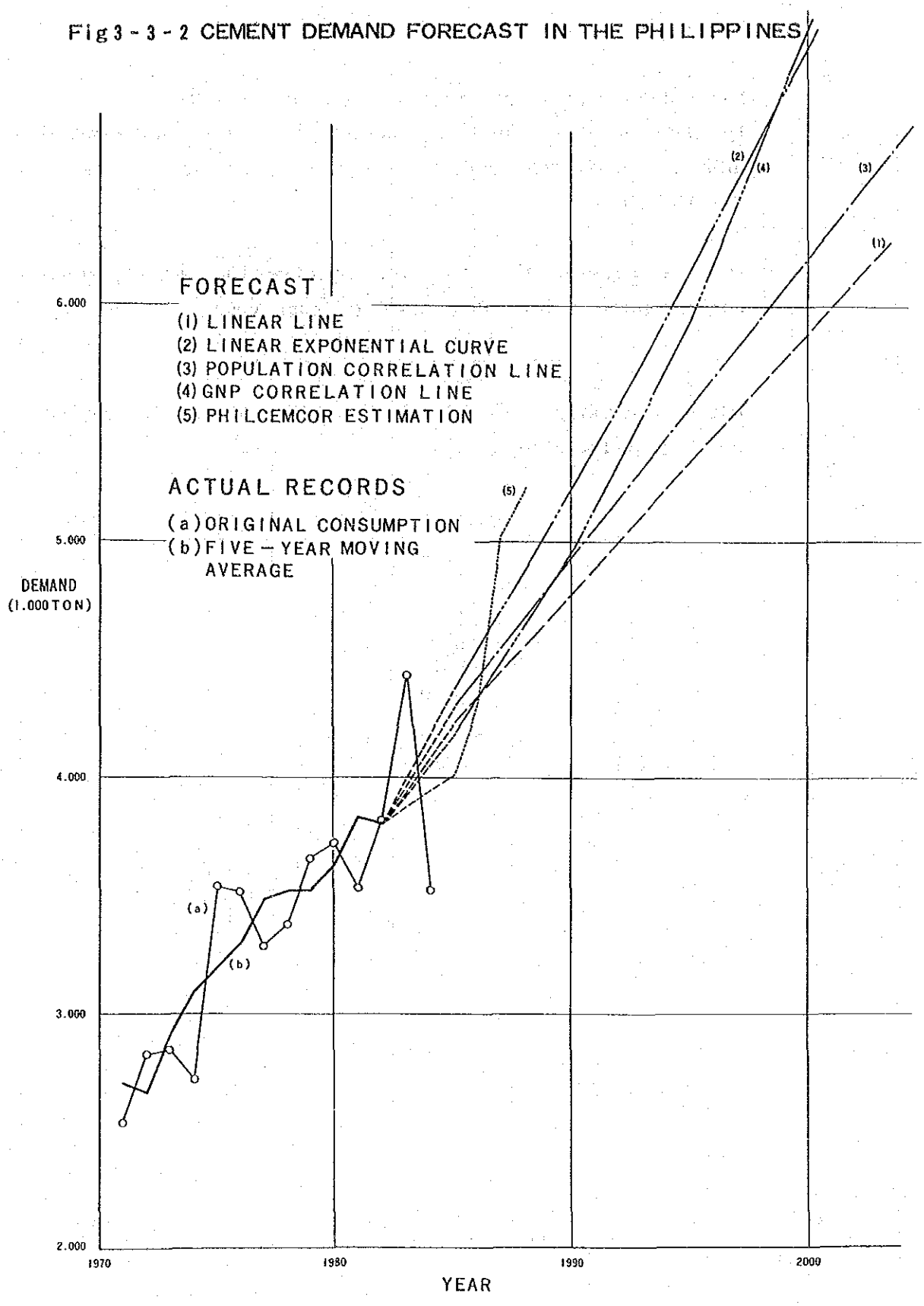
Source: PHILCEMCOR
CEMBUREAU

Table 3-3-2 Cement Demand Forecast

(Unit: ton)

Equation / Year	(1)	(2)	(3)	(4)	(5) Per Capita (kg)
1985	4,220,508	4,357,137	4,282,443	4,186,014	78
1986	4,328,823	4,505,638	4,404,820	4,322,075	79
1987	4,437,138	4,659,201	4,528,664	4,464,939	79
1988	4,545,452	4,817,997	4,653,698	4,614,946	79
1989	4,653,767	4,982,206	4,779,739	4,772,454	80
1990	4,762,082	5,152,011	4,906,422	4,937,836	80
1991	4,870,396	5,327,603	5,028,379	5,111,489	80
1992	4,978,711	5,509,180	5,152,824	5,293,823	80
1993	5,087,026	5,696,946	5,279,962	5,485,274	81
1994	5,195,340	5,891,111	5,409,849	5,686,298	81
1995	5,303,655	6,091,894	5,542,638	5,897,373	81
1996	5,411,970	6,299,520	5,662,538	6,119,002	81
1997	5,520,284	6,514,222	5,784,732	6,355,058	81
1998	5,628,599	6,736,242	5,909,263	6,596,058	82
1999	5,736,914	6,965,829	6,636,177	6,852,621	82
2000	5,845,228	7,203,240	6,165,518	7,122,012	82
2005	6,386,813	8,517,266	6,850,300	8,684,990	82
2010	6,928,388	10,071,066	7,603,135	10,679,784	84

Fig 3 - 3 - 2 CEMENT DEMAND FORECAST IN THE PHILIPPINES



(3) Future market trend

Demand forecast in the future is shown in Table 3-3-3.
In the table, ICC's share is calculated as 11% of total demand and its operation ratio corresponding to the share is described too.

It is considered that ICC will produce the cement which corresponds to its sales share of past years and capacity share.

ICC's renovation, therefore, has little effect on cement industry in the Philippines.

Table 3-3-3 Demand Forecast

(1,000 tons)

Year	A Domestic Demand	B Export (18% of A)	C Total (A + B)	ICC's Sales Share (11% of C)	ICC's Operation Rate after the Renovation	
					Ord./Poz. 80/20 *	Ord./Poz. 50/50 *
					(%)	(%)
1987	4,528.7	815.2	5,343.9	587.8	-	-
1988	4,653.7	837.7	5,491.4	604.1	(70)	(64)
1989	4,779.7	860.3	5,640.0	620.4	(72)	(66)
1990	4,906.4	883.2	5,789.6	636.9	74	68
1991	5,028.4	905.1	5,933.5	652.7	76	69
1992	5,152.8	927.5	6,080.3	668.8	78	71
1993	5,280.0	950.4	6,230.4	685.3	80	73
1994	5,409.8	973.8	6,383.6	702.2	81	75
1995	5,542.6	997.6	6,540.2	719.4	83	77
1996	5,662.5	1,001.3	6,663.8	733.0	85	78
1997	5,784.7	1,041.2	6,825.9	750.8	87	80
1998	5,909.3	1,063.7	6,973.0	767.0	89	82
1999	6,036.2	1,086.5	7,122.7	783.5	91	83
2000	6,165.5	1,109.8	7,275.3	800.3	93	85
2001	6,297.3	1,133.5	7,430.8	817.4	95	87
2002	6,431.7	1,157.7	7,589.4	834.8	97	89
2003	6,568.6	1,182.3	7,750.9	852.6	99	91
2004	6,708,1	1,207.5	7,915.6	870.7	100	93
2005	6,850.3	1,233.1	8,083.4	889.2	100	95
2006	6,995.2	1,259.1	8,254.4	908.0	100	97
2007	7,142.9	1,285.7	8,428.6	927.1	100	99
2008	7,293.4	1,312.8	8,606.2	946.7	100	100
2009	7,446.8	1,340.4	8,787.2	966.6	100	100
2010	7,603.1	1,368.6	8,971.7	986.9	100	100

* Ord./Poz. = Ordinary Cement/Pozzolan Cement

SECTION IV OUTLINE OF ICC AND ENVIRONMENT OF ANTIPOLO

IV-1 Outline of ICC

Formal name:

Island Cement Corporation

Circumstances of establishment:

Antipolo plant of ICC was originally constructed in 1966 by Marinduque Mining Industrial Corporation (MMIC) and the extension was implemented in 1969.

However due to the dullness of MMIC, the ownership of ICC was transferred to Development Bank of Philippines (DBP) and Philippine National Bank (PNB).

Capital:

Authorized capital	:	Pesos 20,000,000.-
Paid-up capital	:	Pesos 15,000,000.-

The seat of plant:

Barrio Tagbac, Antipolo, Rizal

Outline of plant:

Production process	:	Wet process long kiln system 2 lines
Rated capacity	:	Clinker 780,000 ton/year

IV-2 Environment of Antipolo

ICC's cement plant is situated in Tagbac Barrio in the vicinity of Antipolo.

The place is located about 40km to the east of Metro Manila and easy of access.

There occur main cement raw materials in surrounding hills and so the place is favourably located.

The weather is separated into rainy season and dry season.

Not so much change exists in temperature through the year.

SECTION V DIAGNOSIS OF MANAGEMENT OF ICC

V-1 Operation of the Cement Plant and Associated Facilities

Due to the quiet market, the plant is operating on low rate and so generally they are conducting easy operation.

(1) Raw materials

The plant has much stocks of raw materials and so the control is quite easy.

(2) Burning

Due to dull market, short period operation are repeated.
Heat consumption is as high as 1,450 kcal/kg-cl.
This is due to fluctuation of slurry moisture content, low secondary air temperature, and improper burning method.
There are problems in the dust desposition and slurry control.

(3) Cement grinding

Present production is lower than the rated capacity.
The process control method requires to be checked.

(4) Packing

The maintenance of packing machines are not good.
The actual packing quantity is around a half of the rated capacity.

(5) *Water supply*

The industrial water is taken from River Tagbac.
No problem exists both in quantity and in quality but circulating use is necessary during dry season.

(6) Electricity

The electrical unit consumption is high in the mill department. The frequency and period of interruption of power supply are great.

V-2 Maintenance of the Cement Plant and Associated Facilities

The number of employees of Maintenance division is 110 and they think much of maintenance works.

Their works consist of steel processing, change of parts except for big scale parts, cutting of parts (less than 200mmϕ) and repairing of general electrical equipment.

The maintenance of equipment is carried out by the Maintenance division jointly with the Production division.
One of two production lines is almost always suspended and so the maintenance works is conducted easily and the soundness of equipment is good.

Insufficient repair works are found in raw material receiving department, raw material grinding department, and packhouse.
The maintenance of electrical equipment is good but that of local control panels are not good.

V-3 Various Controls

(1) Process control

Each process is controlled with the control standard value.
The important items for process control are raw material storage, raw material mixing weighers, slurry tanks and basins, transportation of pulverized coal, heat consumption, desposition of dust, finish mills and packing machines.

In order to promote the process control favourably, it is necessary to conduct efficient and steady operation of each equipment with sufficient performance.

(2) Quality control

The quality control of raw materials, materials in process, and final products are conducted by controlling the process concerned comparing the test results of sample obtained through standard sampling and testing method with the standard figure.

The cement quality produced in this plant is good and acceptable, being ranked higher in cement produced in the Philippines.

(3) Environmental control

The rules and regulations of National Pollution Control Commission was established in 1978.
No specific control has been done in this plant.
The environmental control especially that for dust is necessary from now on.

(4) Safety control

The person in charge of safety control is appointed in this plant. However safety rules are not established and require to be established. The plant is provided with a clinic.

(5) Cost control

Routine cost control except control of unit consumption is not conducted.
As big items electricity and fuel cost are mentioned, but their remarkable reduction can not be expected through routine control.
For this the renovation is required.

V-4 Training and Research Activity

(1) Training

Various kinds of training were conducted both in- and out-plant. At present, ICC is not conducting any specific training probably due to the reason that there was not sufficient time after the resumption of operation by new company.

(2) Research activity

The Quality and process control department is in charge of the research activity.
The research on new raw materials and new kind of cement are being carried out.

V-5 Purchasing Practice and Inventory Control of Spare Parts

(1) Proper stock of spare parts

Proper stocks of spare parts is determined considering their consumption, frequency and delivery period.

(2) ICC's control method

At present, the stocks are controlled in accordance with "standard amount of use" but this method is not always to be satisfied. Further improvement is required.

V-6 Financial Condition of the Cement Plant

(1) Establishment

ICC was just established on October 8, 1984 separating from MMIC.

(2) Condition of profit and loss

According to monthly profit and loss condition by November 1985, in spite of monthly sales revenue is Pesos 23,000,000 the monthly ordinary loss reaches as much as Pesos 6,300,000.
It is because the proportion of electrical cost and fuel cost in the production cost are quite high (52%) and together with depreciation deteriorate the profit and loss.

(3) Current cement production cost

The production cost which is 46.19 Pesos per bag is exceeding by 3.7 Pesos per bag over the exfactory ceiling price of 42.5 Pesos per bag.

In the production cost the sum of fuel cost and electricity cost is Pesos 24.3 and depreciation is about Pesos 9.2.
The cost of above three items occupies about 72% of the production cost.

(4) Assets of ICC

Beside its capital of Pesos 15,000,000, ICC owes DBP and PNB about Pesos 1,209 million with no interest in compensation for the transfer of plant.

(5) Financial control of ICC

The financial control is conducted both by the plant and head office systematically and effectively.

V-7 Marketing Capacity

ICC consign cement for sales to AICDC.
AICDC is presently planning the establishment of bulk cement centers and the company is dealing with various kinds of building materials. So AICDC has sufficient marketing capacity.

Cement shipment at Antipolo plant is performed in good order upon the instruction of the head office.

V-8 Administration of the Plant (Manning plan)

Antipolo plant of ICC is organized of three divisions such as Maintenance, Production, Administration and staff groups such as Assistant Vice President, Secretariat, Technical staff for Engineering/Mining and Quality and process control.
Number of employee is 348 at present.

	No. of personnel
Assistant Vice President (Resident Manager)	1
Secretariat	4
Technical Control Staff	33
Administration Division	83
Production Division	117
Maintenance Division	110
Total	348

SECTION VI TECHNICAL DIAGNOSIS OF THE EXISTING FACILITIES OF ICC

VI-1 Conditions of Raw Material Quarries

(1) Raw material quarries

ICC owns the raw material quarries of limestone, high silica clay, and low silica clay in the surrounding area of the plant.

(a) Limestone

The limestone is quarried by bench cut system.
The reserves reach 56,000,000 ton.

(b) High silica clay

The high silica clay is quarried by ripping or blasting.
The reserves reach 7,600,000 ton.

(c) Low silica clay

The low silica clay is quarried by ripping or blasting.
The reserves reach 1,100,000 ton and some amount not yet determined.

Other raw materials such as pyrite cinder, pozzolana, gypsum are procured from suppliers.

(2) Quality of raw materials

(i) Characteristics of raw material being used

(a) Raw materials

Limestone, high silica clay, low silica clay and pyrite cinder are suitable as the raw materials for cement manufacturing and gypsum and pozzolana as the additives.

(b) Industrial water

It is suitable as industrial water.

(c) Coal

Both imported coal and local coal are of suitable quality as fuel of burning process for clinker production.

(d) Others

Raw materials mentioned above are suitable for dry process with NSP kiln system.

(ii) Test results of raw materials and products

The samples of limestone, high silica clay, low silica clay, pyrite cinder, pozzolana, gypsum, cement and industrial water collected by the survey team were tested.

All the raw materials were of good quality and cement is of favourable quality too.

The chemical composition of main raw materials are shown in Table 6-2-1.

Table 6-2-1 Chemical Composition of Raw Materials

	LOI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Total
Limestone	41.8	4.0	0.9	0.3	51.7	0.6	0.1	99.4
Dacite	7.0	66.3	13.8	4.9	2.8	2.0	0.2	97.0
Diorite	3.2	54.9	17.7	8.8	7.0	3.2	1.1	95.7
Pyrite cinder	2.9	12.6	1.4	77.6	1.4	0.6	1.9	98.4

Further, burnability test and grindability test of raw mix were carried out. It is confirmed from the results of tests that ICC's raw mix has almost the same burnability and grindability as that of raw mix used in cement plants in Japan.

VI-2 Conditions of the Processing, Offsite and Auxiliary Facilities

(1) Raw materials receiving

This section covers all the equipment from raw material receiving hopper to raw material storage through crushers.

The section is separated into limestone line and clay line and the main equipment is a crusher in each section.

These equipment seems to operate with the rated capacity.

(2) Storage

This is the storage for limestone, clays, gypsum, pozzolana, clinker. The building is a common storage in one house.

The dimensions of storage is:

234 mℓ x 24.5 mw x 11.5 mh

Two units of overhead cranes with a capacity of 10 ton each are provided to the storage.

(3) Raw material grinding

This section covers all the equipment from raw material storage to slurry basin.
The main equipment of this section are grinding mills.
Among the equipment, those for raw mix preparation and water addition are not satisfactorily operated.

(4) Clinker burning

This section covers all the equipment from slurry feeder to clinker storage.
The main equipment of this section are, of course, kilns and coolers. Among the equipment, that for desposition of kiln dust and No.1 cooler (with regards to its cooling capacity) come into question.

(5) Cement grinding

This section covers all the equipment from receiving hoppers of clinker, gypsum and pozzolana to Kinyon pump.
The main equipment of this section are grinding mills.
Although actual operation results of grinding mill is somewhat low, it has a capacity of 70 t/h if maintained well.

VI-3 Conditions of the Facilities for Storage and Shipping of Cement

This section covers all the equipment from cement silo to packing machine. The main equipment of this section are packing machines.

As the supply of cement to packing machine is carried out by manual control, the supply is apt to be unsteady and seems to reduce the capacity of packing machine.

SECTION VII STUDY ON THE PROCESS OF ICC

VII-1 Present Process Scheme

(1) Supply of raw material

Main raw materials such as limestone, high silica clay, low silica clay are exploited at ICC's own quarries and transported to the plant by contractors.

(2) Raw material grinding

Raw material is ground by wet grinding process.
Problems exist at raw mix preparation and moisture control.
The maintenance costs much labour.

(3) Burning

The process is wet process long kiln but its heat consumption is 1,400-1,500 kcal/kg-cl which is higher than normal figures and dust treatment is a problem.
There is much to be desired in transportation of pulverized coal, structure of kiln burner and cooling method of cooler.

(4) Cement grinding

Pozzolan cement is produced in addition to ordinary portland cement. No exclusive hopper for pozzolana is available and it is under construction.

(5) Packing and shipping

The actual capacity of packing machine is only a half of specification. The examination of the equipment is required.

VII-2 Possibility of Conversion of the Present Process Scheme into Dry Process Utilizing the New Suspension Preheater System

No technical problem is foreseen in converting the plant from a wet process to a dry process.

(1) The renovation scheme

No.1 kiln is converted to dry process with NSP system with a capacity of 2,600 t-cl/day.
After the renovation, the operation of No.2 kiln is assumed to be suspended.

(2) The renovation of each department

(i) Raw material receiving

Existing equipment are to be checked and repaired, if necessary.

(ii) Raw material grinding

A shaft type raw mill is newly installed.
Raw material weighing and preparing equipment and a blending silo are newly installed too.

(iii) Burning

No.1 kiln is shortened to 71m long and NSP tower is newly constructed.
A cooler and a EP are newly installed.
Transportation method of pulverized coal is changed to indirect system and the kiln burner is changed too.

(iv) Cement grinding

All the equipment are left as they are but the maintenance is to be thoroughly conducted.

(v) Packing and shipping

The capacity of discharging cement from cement silo is increased and automatic control system is adopted for the extraction of cement.

SECTION VIII STUDY ON ELECTRIC POWER SOURCE OF ICC

VIII-1 Electric Power Supply System in the Philippines

Electric power resources is developed by NPC, but the power supply to the consumers is conducted by MERALCO in the neighbourhood of Metro Manila and by NPC and Electric Cooperative in rural area.

VIII-2 Electrical Installation in the Philippines

(1) Power generating plant

Installation capacity of power generation reaches as much as 5,196MW in which capacity of oil-based thermal power plant is 2,298MW, hydro 1,654MW, geothermal 894MW, and coal 350MW.

The capacity by region is:

Luzon	:	4,101MW
Visaya	:	510MW
Mindanao	:	585MW
Total	:	5,196MW

(2) Transmission lines

The total length of transmission lines and the installation capacity of substations reaches 10,979 circuit km and 11,418MVA respectively.

VIII-3 Power Demand and Supply in the Philippines

(1) Energy generation

The energy generation set a new record of 18,666 x 10^6 kWh in 1984.

(2) Conditions of energy consumption

The energy consumption reached 17,006 x 10^6 kWh in 1984. The energy consumption by region, by consumer, and by month are described in the main report.

VIII-4 Development of Power Resources in the Philippines

The energy generation capacity in 1984 reached about 2.4 times of that in 1977.

The projects under construction as of 1984 are 8 places with a total capacity of about 900MW.

VIII-5 Forecast of Power Demand in the Philippines

According to NPC the growth rate of demand during the period from 1985 to 1990 and from 1990 to 1995 are estimated to be 6.0%/year and 6.2%/year respectively.

VIII-6 Electricity Charges in the Philippines

(1) Electricity charge of NPC

The electricity charge of NPC is determined so that the cost of energy generation will directly reflect on the charge which is composed of basic unit price, fuel cost adjustment, steam cost adjustment, and foreign currency exchange rate adjustment.

The breakdown of sales charge as of December 1985 is shown in Table 8-6-1.

Table 8-6-1 Breakdown of Sales Charge

Pesos/kWh

	BUP	FCA	SCA	FEA	Total
Sales charge	1.0586	0.0055	0.0059	0.1796	1.2496

(2) Price system of MERALCO

The price system of MERALCO is basically the same as NPC. The sales charge for industrial users are remarkably higher than that of NPC due to the subsidizing policy for general consumers.

Sales charge for industry of MERALCO is 2.5817 Pesos/kWh which is more than two times the NPC's charge mentioned above.

VIII-7 Power Conditions Surrounding the Plant

Number of consumers in Antipolo area was 9,634 as of 1985 and among them the industrial consumers were 31 and in Teresa area the number was 1,908 and 9 respectively.
In these area power interruption is quite frequent.
The frequency of power interruption in 1985 were 30 to 50 which is very large.

VIII-8 Present Condition of Power Consumption in Antipolo Plant

The power demand of Antipolo plant averages 13,000-15,000kW monthly which decreases to 9,000kW when cement demand decreases. Electric unit consumption is 140kWh per ton cement which is rather high.

VIII-9 Study on Conversion of Electricity Source to Antipolo Plant

The plan to directly supply electrical power in 230kV from Dolores substation of NPC was studied.

As construction cost the amount of Pesos 87,600 x 10^3 is required. Since the sales price of power decreases less than half, cost reduction is quite high.

Before implementation, the consent of authorities/parties concerned is necessary.

SECTION IX STUDY ON THE MANAGEMENT AFTER REHABILITATION AND MODERNIZATION OF ICC

IX-1 Improvement of Process Operation Control

(1) Control system

As control system, manual control system was adopted instead of sophisticated computer control system.

For effective control, the control of raw material and burning department are to be made from a central control system.

(2) Central control system

Following processes are controlled collectively at a central control room in the burning department.

Extraction from raw material storage, Raw material preparation, Drying and grinding, Blending and storing of raw meal, NSP, Clinker burning, Clinker cooling, Clinker storage and Coal grinding.

Other processes are controlled separately at each control room as before.

IX-2 Improvement of Quality Control

(1) Homogeneity of raw meal

As the process is converted from wet to dry, special care is necessary for maintaining the homogeneity of raw meal.

(2) Mixing proportion of raw material

Mixing proportion is changed somewhat due to lower fuel consumption by conversion to dry process.

Raw material unit consumption is reduced to a certain extent because kiln dust, which was desposed before, is used by circulation.

(3) Control of kiln system

Since the kiln is converted from wet process long kiln to dry process NSP kiln, the operation becomes more steady.

IX-3 Improvement of Environmental Protection

Regardless whether existing or new, all equipment should be controlled in accordance with the rules and regulations of NPCC (National Polution Control Commission)

Especially the care must be taken in preventing dust generation.

IX-4 Improvement of Energy Efficiency and Plant Running Efficiency

(1) Improvement of thermal efficiency

NSP system is adopted through the renovation, which will reduce the heat consumption of kiln to below 800 kcal/kg-cl.

(2) Improvement of operation efficiency of the plant

Long consecutive operation must be executed instead of short term operation by strengthening the control organization.

IX-5 Improvement of Maintenance Practice

(1) Object

The maintenance is to be conducted so that the operation ratio is raised even with low maintenance cost.

(2) New equipment

For new equipment, it is necessary to train workers, prepare maintenance manuals, and organize a suitable maintenance program.

(3) Existing equipment

By strengthening maintenance organization, maintenance works must be conducted sufficiently to keep the rated capacity of the equipment.

IX-6 Improvement of Education and Training

After the renovation, the most modern operation technology is required for raw mill and NSP system.

For this purpose preparation of operation manuals and technical training of operating staff are necessary.

While for improvement of operation ratio of existing equipment daily training of operators is important too.

IX-7 Improvement of Safety Control

(1) Aim

- To do away with all disasters i.e. not only big disasters but very minute ones, and to keep the health of employees.

(2) Countermeasures

- To organize a safety and health committee.
- To establish regulations for safety and health
- To establish standards for safety works
- To examine and improve all the plant facilities
- To hold safety conference periodically

IX-8 Improvement of Organization and Manning Plan

(1) Organization after the renovation

After renovation, the equipment connecting raw mill, raw meal silos, kiln and coal mill are operated together, and so a total systematic control is necessary.

(2) Main points of change

- The raw mill group and silo group of the mill department are to be transferred to the kiln department.

- The employees of the packhouse are to be increased.

According to this plan the number of employee of the Production division is increased by 12.
Total employee of the plant changes from the present 348 to 360.

Table 9-8-1 Manning Plan After Renovation

	No. of personnel
Assistant Vice President (Resident Manager)	1
Secretariat	4
Technical Control Staff	33
Administration Division	83
Production Division	129
Maintenance Division	110
Total	360

SECTION X REHABILITATION AND MODERNIZATION PROGRAM

X-1 Rehabilitation and Modernization (Renovation) Plan

The contents of the renovation are at first to convert existing wet process to the most advanced dry process NSP system, thereby reducing heat consumption, reducing running cost, and increasing the efficiency of employee and then to convert the electric power source for reducing the electrical cost.

The basis of renovation plan in the cement plant is:

(i) to adopt a raw material grinding equipment with man power saving system,

(ii) to convert to the most advanced NSP system, and

(iii) to adopt a central control system by integrating raw material grinding, burning, and coal supplying department.

The specification of electrical and mechanical equipment are described in the main report.

X-2 Capital Requirement

(1) Total capital requirement

The total capital requirement for the renovation is shown in Table 10-2-1.

Table 10-2-1 Total Capital Requirement

(1,000 Pesos)

	Foreign Portion	Local Portion	Total
Fixed capital	415,818	304,210	720,028
Working capital	0	5,154	5,154
Total	415,818	309,364	725,182

The detail of fixed capital is shown in Table 10-2-2.

Table 10-2-2 Fixed Capital

(1,000 Pesos)

	Foreign Portion	Local Portion	Total
Construction cost			
1) Machinery & Equipment	253,600	67,000	320,600
2) Ocean freight	25,000	0	25,000
3) Inland transportation	0	12,000	12,000
4) Erection work	0	81,150	81,150
5) Civil & construction work	41,000	89,000	130,000
6) Engineering fee	42,650	5,000	47,650
7) Contingency	12,000	19,200	31,200
(Sub-total)	(374,250)	(273,350)	(647,600)
Interest during construction	41,568	30,860	72,428
Total	415,818	304,210	720,028

(2) Financing plan

(a) Long term loan : 100% of the total capital requirement

(b) Short term loan

X-3 Implementation Schedule

Before concluding the contract on the renovation works, a preparation period of 10 months, i.e. 2 months for selection of consultant and 8 months for selection of contractor, is necessary.

The renovation works are divided into works in the Philippines and works outside the Philippines.

Work schedule requires 24 months for execution. Therefore total period for works is 34 months including preparation period.

SECTION XI EVALUATION

XI-1 Financial Analysis

(1) Basic concept

The profitability of capital requirement is judged by comparing financial situation after implementing the renovation with that before implementing the renovation.

(2) Basic premises

Refer to I-1.

(3) Disbursement schedule of total capital requirement

The disbursement schedule of total capital requirement is shown in Table 11-1-1.

Table 11-1-1 Disbursement Schedule

(1,000 Pesos)

Year	-2	-1	Total
Amount	157,583	567,599	725,182

(4) Sales plan

(i) Operation ratio

The operation ratio is determined according to the prospects of demand. (Refer to Table 3-3-2)

(ii) Sales volume at full operation

Case I (OPC/PC : 50/50)
939,760 tons/year

Case II (OPC/PC : 80/20)
861,880 tons/year

(5) Production cost

The production cost is shown in Table 11-1-2.

Table 11-1-2 Production Cost

(1,000 Pesos)

Item \ Case	Case I		Case II	
	Before Renovation	After Renovation	Before Renovation	After Renovation
Direct cost				
Raw materials	74,955	70,094	72,899	67,714
Fuel	194,359	107,189	209,908	115,764
Grinding media	9,691	2,616	10,297	2,591
Fire brick	17,550	8,775	18,954	9,425
Lubricant	7,048	7,048	6,981	6,981
Paper bag	73,465	73,465	72,766	72,766
Electric power	236,865	103,875	246,777	107,807
Repair expenses	13,391	13,391	13,264	13,264
Others	8,810	8,810	8,727	8,727
(Total of direct cost)	(636,134)	(395,263)	(660,573)	(405,039)
Fixed cost				
Labour cost	9,492	9,761	9,492	9,761
Administration	8,280	8,280	8,280	8,280
Depreciation	68,305	115,525	68,273	115,499
Interest	602	23,240	5,964	23,221
(Total of fixed cost)	(86,679)	(156,806)	(92,009)	(156,761)
Total	722,813	552,069	752,582	561,800
Unit cost (Peso/ton-cement)	1,026	783	1,078	805

Table 11-1-2 shows the production cost in the 5th year after commencement of commercial operation.

(6) Evaluation

(i) Profitability

The following method was applied for profitability analysis.

FIRROI was calculated based on the difference of cash flow between the case when renovation is implemented and the case when not implemented.

Table 11-1-3 FIRROI of Base Case

(%)

	Case I	Case II
FIRROI (before tax)	33.3	35.5
FIRROI (after tax)	28.8	31.6

Judging from the above table, the profitability of the renovation is high.

(ii) Break-even point

The break-even point in case the renovation is implemented is shown in Table 11-1-4.

Table 11-1-4 Break-even Point

	Case I		Case II	
	Year*	%	Year	%
Break-even point	19	36.0	19	40.5

* This means the year after completion of the renovation.

Judging from the above table, the break-even point drops and this shows that the renovation is quite effective.

(iii) Pay out year

Pay out year of Case I and Case II are 3 year 3 months and 3 year 0 month respectively which shows that the recovery of capital can be made in early time.

(7) Sensitivity analysis

Sensitivity analysis was conducted on the base case on the following factors by varying the figures.

Sales price, Cost for renovation works, Direct cost, Operation rate, Interest, Equity.

(8) Case study

Case study was conducted on the following two cases.

Case A : Case in which only the conversion of electrical power source is implemented.

Case B : Case in which only the conversion to dry process is implemented.

Table 11-1-5 Results of Financial Analysis
(Case Study)

(%)

	Base Case (I)	Case A	Case B
FIRROI (before tax)	33.3	100.0	17.5
FIRROI (after tax)	28.8	92 5	16.9

Since Case A requires less capital requirement its FIRROI is high. FIRROI for Case B is favourable and shows high profitability. To sum up the Base Case which incorporates merits of both Case A and B is most desirable.

(9) Others

(i) FIRROI on cash flow after the renovation

FIRROI was calculated on cash flow in case the renovation is implemented.

Table 11-1-6 Financial Internal Rate of Return

(%)

	Case I	Case II
FIRROI (before tax)	35.6	34.5
FIRROI (after tax)	31.3	30.6

In this case the profitability is calculated to be quite high too.

(ii) Case in which the capital and debt of ICC is considered

The case in which following items were assumed to be total capital requirement was studied.

(a) Capital

Present capital	Pesos	15,000,000
Debt from DBP/PNB	Pesos	1,209,000,000
Total	Pesos	1,224,000,000

(b) Capital requirement for the renovation — Pesos 725,182,000

(c) Grand total — Pesos 1,949,182,000

The results are shown in Table 11-1-7.

Table 11-1-7 Financial Internal Rate of Return

(%)

	Case I	Case II
FIRROI (before tax)	12.2	11.6
FIRROI (after tax)	9.4	8.9
FIRROE	12.2	11.5

It is quite severe condition where the profitability is calculated on the assumed total capital requirement mentioned above (Pesos 1,949,182,000) which corresponds to 2.7 times of the capital requirement for the renovation (Pesos 725,182,000).

However, FIRROI (after tax) of Case I and Case II are 9.4 and 8.9% respectively.
This result shows that the profitability of the renovation is quite high.

XI-2 Economic Evaluation

The economic evaluation of the renovation is described below.

(1) Improvement of international payments

By implementing the renovation, the cement manufacturing process is converted from wet to dry thus reducing fuel consumption as well as foreign currency payments, even though foreign loan for the renovation and its interest must be paid in foreign currency.
By deducting the latter from the former the total foreign currency savings for 20 years is calculated as follows:

Pesos 658 ∿ 747 x 10^6

(2) Ensurance of local employment

Through implementing the renovation, the employment of Antipolo area in regards to the personnel related to ICC is assured for a long period.

(3) Economic internal rate of return (EIRR)

Economic benefit and economic cost of the renovation project were quantitatively calculated in cases when the renovation is implemented and when not implemented and EIRR was calculated on these results.

(i) *Premise for EIRR calculation*

(a) Conversion factor

Standard conversion factor	0.86
Factor for skilled labour	1.00
Factor for unskilled labour	0.80

(b) Other premise

The same premise was applied as for EIRR.

(ii) EIRR

EIRR is shown in Table 11-2-1.

Table 11-2-1 EIRR

(%)

	Case I	Case II
EIRR	28.9	31.8

Judging from the figures in the above table, the renovation project is economically favourable.

SECTION XII CONCLUSION AND RECOMMENDATION

XII-1 Conclusion

Since Antipolo plant of ICC is consuming much fuel due to its wet process and paying higher unit electricity cost because the electricity is supplied by MERALCO.

As these two items are greatly suppressing its financial situation, the renovation plan mainly consisting of the conversion from wet process kiln to dry process NSP kiln and the conversion of electricity source is considered as a countermeasure.

After examination of the plant, this renovation project is judged to be feasible both in technically and economically under the premise stated in I-1.

(1) Policy of the Government of the Republic of Philippines with respect to the cement industries in the Philippines as well as the rehabilitation and modernization of ICC.

The Government of the Philippines is adopting price policy, market price, and export policy towards the cement industries and assisting the improvement of production technology and quality.

The Government intends to cooperate the renovation of ICC in case the cement demand is recovered and the investment to this project is judged to be effective.

Remark: Policy of the Government described above is what was expressed during the field survey in January 1986.

(2) Present situation and future prospects of supply and demand

Average production of past 11 years is 4,100,000 ton/year which corresponds to about 70% of the total production capacity of the country; 6,000,000 ton/year.

Demand forecasts of cement were made by the trend analysis, correlation analysis, estimation based on similar cases and the forecast prepared in the Philippines.

Among the estimations mentioned above, the forecast calculated by correlation analysis with population has been adopted as the basis of this study due to the reasons described as follows.

- The population is highest in correlativity with cement consumption.

- The above forecast is on the conservative side when making an estimation.

(3) The environment of Antipolo

Antipolo area is situated in the vicinity of Metro Manila which is a big cement consuming city and surrounded by deposits of main cement raw materials.

It is quite favourably located as a cement plant site.

(4) Management of ICC

Although controls of plant such as plant operation and maintenance are to be improved in various points, the management of plant as a whole is conducted normally. However fuel cost and electricity cost are so high that they suppress the financial situation greatly.

(5) Facilities of ICC

According to ICC's data, the main raw materials seems to be satisfied both in quality and quantity.

The plant facilities are considered to operate at their rated capacity if maintained well, although some problems are pointed out.

(6) Process of ICC

ICC's present process is wet long kiln system which consumes more fuel than other processes.
No technical problem exists in converting the process from wet long kiln system to dry NSP kiln system.

(7) Study on electric power source to the Antipolo plant of ICC

The unit electricity sales charge for industry of MERALCO from which ICC is supplied the electricity is largely higher than that of NPC.

Therefore by converting the electric power source from MERALCO to NPC, remarkable decrease in production cost can be achieved with a small investment.

(8) Management after rehabilitation and modernization of ICC

The control for raw machinery and equipment to be installed through the renovation should be conducted steadily.

While some parts of various controls which have been imperfect or inadequate should be improved.

(9) Formulation of rehabilitation and modernization program of ICC

The renovation plan was made centering around the process conversion to dry process NSP system and the conversion of electricity power source.

The total capital requirement of the renovation is Pesos 725,182,000. The finance is mainly made by long term loan.

The period necessary for the renovation is:

- 10 months of preparation period for selecting a consultant and a contractor and
- 24 months of construction works, and so
- total 34 months.

(10) Evaluation

(i) Financial analysis

The profitability of the renovation is shown in Table 1-2-1.

Table 1-2-1 FIRROI of Basic Cases

(%)

	Case I	Case II
FIRROI (before tax)	33.3%	35.5%
FIRROI (after tax)	28.8%	31.6%

Note: These figures were calculated based on cash flow difference between before and after of the implementation of renovation.

(ii) Economic evaluation

EIRR of this renovation of Case I and Case II are 28.9% and 31.8% respectively which show high economic viability.

XII-2 Recommendation

This renovation project is to be implemented at the existing cement plant. Therefore in order to implement this renovation satisfactorily, it is necessary to make a detailed plan and sufficient preparation.

It is recommended that immediate attention should be paid to the following items.

(1) Capital requirement

This renovation requires considerable amount of capital requirement. In this report this amount is to be mainly supplied by long term loan.

It is, therefore, desirable that the loan is prepared in early stage on as favourable conditions as possible.

(2) Construction cost of the renovation

(i) Plant facilities

Since the renovation is fairly big works including the conversion to dry process NSP kiln system, it is necessary to take the firm estimate of the renovation cost from a reliable supplier in early stage to consolidate the financing plan of the renovation.

(ii) Conversion of electric power source

For this conversion the installation of a power transmission line is required.

The construction cost of the transmission line largely depends on the condition of installation route.

It is recommended that the site survey is conducted beforehand to estimate firm budget.

(3) Conversion of electric power source

In case of the conversion of electric power source, the conference among the Governmental offices concerned, MERALCO, and NPC is required.

It is recommended to hold such conference in early stage.

(4) Appointment of technical consultant

In order to execute the renovation project favourably, it is necessary to get the advice of the foreign technical consultant who is well experienced in the consulting services of the construction and renovation of cement plant.

(5) Training of operation staff

As stated in IX-6 through the renovation, the process is converted to dry process with NSP system.

It is necessary to prepare the operation manual and conduct the training of operation staff beforehand.

G-02 LOCATION MAP