

THE FEASIBILITY STUDY REPORT
ON
ESTABLISHING A CEMENT PLANT
IN
MUARA, BRUNEI
(SUMMARY)

FEB., 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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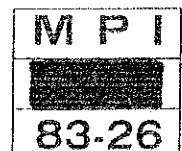
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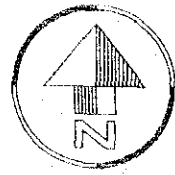


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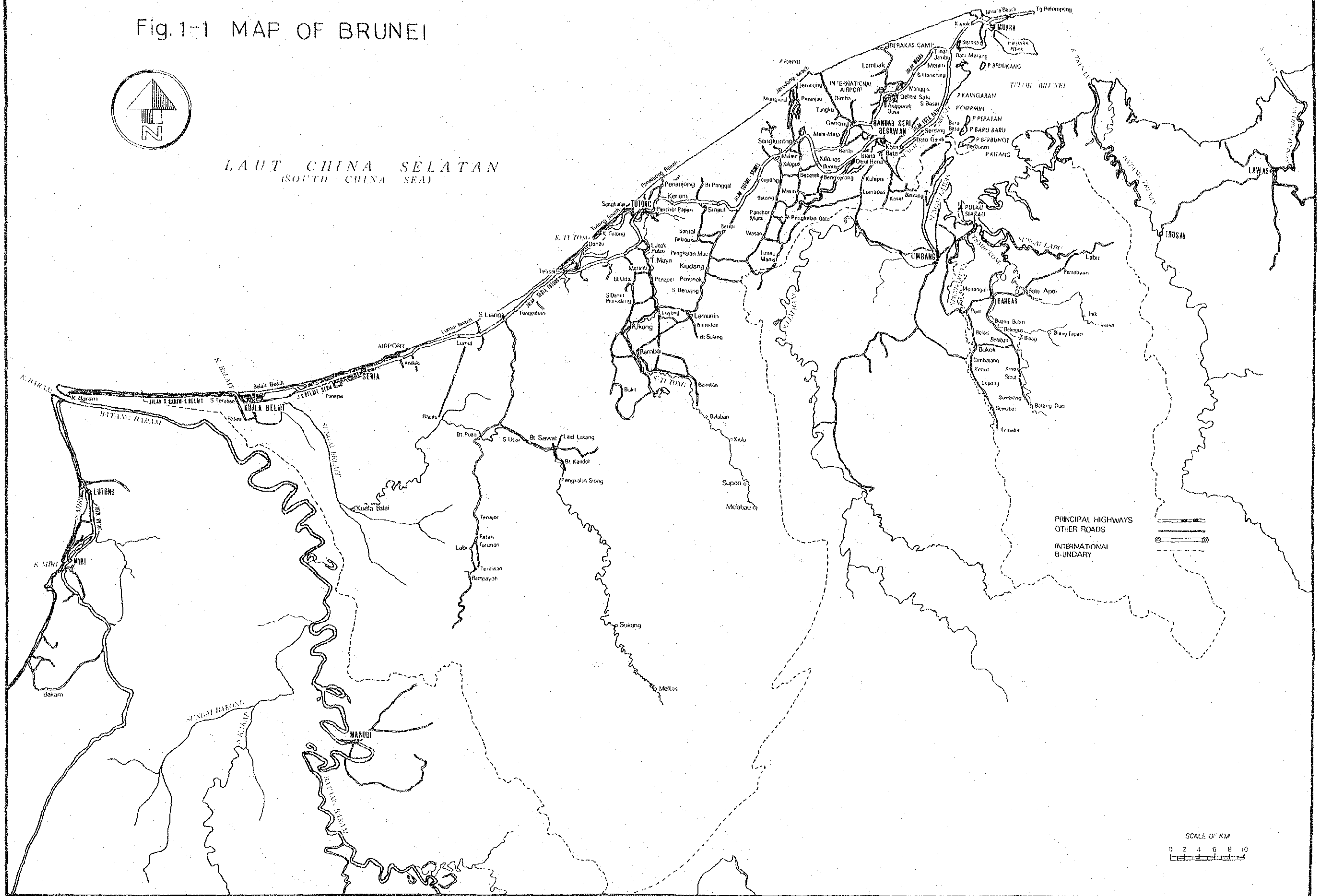
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Fig.1-1 MAP OF BRUNEI



LAUT CHINA SELATAN
(SOUTH CHINA SEA)



PRINCIPAL HIGHWAYS
OTHER ROADS
INTERNATIONAL
B-UNDARY



SCALE OF KM
0 2 4 6 8 10

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1 Outline of Brunei

1.1 General

Brunei is a nation with a total area of 2,226 sq.miles (5,765 km²), located on the northwestern coast of Borneo. The country, bordering on Sarawak, consists of two detached territories, the Western (where the principal cities are located including the capital, Bandar Seri Begawan) and Eastern (Temburong District) sections. It has a tropical pluvial climate with high temperatures and humidity but having a clear distinction between the rainy and dry season.

Its population is estimated at 192,832, as of 1981, consisting of Malays (over 72%), Chinese (20%) and others.

2 Marketing

2.1 Economic condition of Brunei

Brunei has a rich economy, supported by a large income from petroleum. Gross Domestic Products (GDP) amounted to B\$4162.7 million in 1980, or over B\$20 thousand per capita, ranking high in the world. Trade balance has continuously shown a large surplus, reaching B\$8,600 million in 1980. At present Brunei is taking a great interest in developing industries other than petroleum-related ones with a specialized bureau (Economic Development Bureau, EDB), established in 1976, endeavoring to promote and strengthen domestic industries.

2.2 Cement industry of Brunei

(1) Demand

The demand for cement shows a constantly increasing tendency. The total demand of 116 thousand tons consists of about 90,000 tons for Ordinary Portland Cement (OPC) and the balance for Oil Well Cement (OWC). This OWC sale is a marked characteristic in oil producing Brunei.

(2) Supply

The supply of cement to Brunei is entirely in the form of imported cement packed in bags. Principal suppliers include Japan, Philippines and Taiwan whose share has been increasing recently.

(3) Price

CIFF price of imported cement in bags is currently B\$114/ton for OPC and B\$295/ton for OWC.

Adding to it port charges and handling cost, the landed cost is B\$122.8 for OPC and B\$303.8 for OWC.

Current sales prices of cement delivered to the site through the hands of importers and distributors, are estimated to be as follows:

OPC: B\$148.2/T at the capital
B\$157.2/T at local spots
OWC: B\$320.8/T at Seria

(4) Future demand forecast

The demand for OPC, estimated from the recorded figures after 1972, are as follows:

Year	1985	1990	1995	2000
Demand (1000 ton)	102	121	139	158

Although the demand for OWC varies from year to year, it is assumed in this report to be constant at 17,000 tons, on the basis of the recent actual figures, taking into consideration the fact that Brunei is an oil producing nation.

3 Plant and equipment

3.1 Bases for the plan

- (1) There are two plans, one for a plant grinding imported clinker (Case 1) and another for a plant packing imported bulk cement (Case 2).

- (2) The plant site is to be located within the industrial area, south of Muara, the largest port in Brunei. The site is close to the metropolitan area, the largest consuming area, accessible via good roads and is equipped with an adequate infrastructure.
- (3) While all the cement imported in bag is unloaded at the existing port of Muara, in case 1, a new berth, 120 m long and 8 m deep, is to be constructed in front of the site, in view of the inadequate capacity of the existing port, the fact that Brunei has to import most of the materials and also the recent tendency toward unloading bulky/dirty cargo. This berth will contribute not only to the cement plant but also to the future industrial development of Brunei to a great extent. However, in case 2, a convenient dolphin type was employed because of unloading methods of exclusive bulk cement carrier.

3.2 Capacity of the plant equipment

Capacities of the plant and main machinery and equipment are as follows:

- (1) Capacity of the plant: 156,000 tons/year (max.)
- (2) Capacity of main machinery and equipment are shown below:

Item	Case 1	Case 2
a. Raw material unloading berth	120mL x 8mD	Dolphin type
b. Belt conveyor for incoming clinker and gypsum	300t/h x 1	-
c. OPC clinker silo	10,000ton x 1	-
d. OWC clinker silo	4,000ton x 1	-
e. Gypsum yard	1,500ton x 1	-
f. Cement mill	23t/h x 1	-
g. OPC cement silo	2,000ton x 2	14,000ton x 1

Item	Case 1	Case 2
h. OWC cement silo	2,000ton x 1	4,000ton x 1
i. Cement packer	45t/h x 2	45t/h x 2
j. Bulk cement loader	80t/h x 1	80t/h x 2
k. Transformer substation	2,000KVA	350KVA
l. Laboratory equipment	Physical/ chemical test x 1 set	-

3.3 Design policy for the plant

Special attention has been paid to the following points in designing the plant.

- (1) Equipment has to be easy to handle, that is to say, mostly trouble-free, easy to maintain and well laid out.
- (2) Man-power saving has to be achieved by automation.
- (3) Consideration should be given to environmental protection with effective countermeasures against sources of dust and noise.
- (4) Attention must be paid to the safety and health of employees.

3.4 Organization and personnel

(1) Organization

Plant organization calls for a plant with 2 sections in the administration department and 1 section in the production department under the plant general manager.

(2) Personnel

Plant personnel consists of the following, plus two directions.

	Case 1	Case 2
Plant general manager	1	1
Administration department	16	16
Production department	28	16
Total	45	33

3.5 Construction period

Construction period may be estimated as 18 months in Case 1 and 15 months in Case 2.

4 Financial Analysis

4.1 Capital requirement and financing scheme

Total capital requirements for this plant and its financing scheme may be assumed to be as follows:

Item	Amount (1,000 B\$)	
	Case 1	Case 2
<u>Capital Requirement</u>		
(1) Machinery and equipment	11,354	2,231
(2) Construction and buildings	7,185	3,038
(3) New berth (or Dolphin)	4,538	3,576
(Sub Total)	(23,077)	(8,845)
(4) Land premium	60	60
(5) Pre-operation expenses	1,254	542
(6) Pre-operation interest	1,189	396
(7) Wages and others	650	560
(8) Initial working capital	2,609	2,896
Grand Total	28,839	13,299
<u>Financing Scheme</u>		
(1) Equity	11,400	4,400
(2) Long-term debt (Interest 9.2%)	9,651	1,896
(3) Short-term debt (Interest 10.5%)	7,788	7,003
Grand Total	28,839	13,299

(All costs are in 1982 constant price.)

4.2 Production and sales

- (1) The plant will have an economic life of 15 years from the operation commencement in 1985. Sales quantity will cover 80% of the total demand in Brunei in the first year, 90% in the second year and 100% in the third and subsequent years. Production will cover the above sales quantity plus an inventory at the end of the year. Production, sales and inventory volume for 15 operation years are shown in the following table.

Table: Production, Sales and Inventories

(Unit: 1000 ton)

Year	Production		Sales		Inventory	
	OPC	OWC	OPC	OWC	OPC	OWC
1	85.1	18.0	81.6	17.0	3.5	1.0
2	95.2	17.0	95.2	17.0	3.5	1.0
3	109.4	17.0	109.4	17.0	3.5	1.0
4	113.2	17.0	113.2	17.0	3.5	1.0
5	116.9	17.0	116.9	17.0	3.5	1.0
6	120.6	17.0	120.6	17.0	3.5	1.0
7	124.3	17.0	124.3	17.0	3.5	1.0
8	128.0	17.0	128.0	17.0	3.5	1.0
9	131.8	17.0	131.8	17.0	3.5	1.0
10	135.5	17.0	135.5	17.0	3.5	1.0
11	139.0	17.0	139.0	17.0	3.5	1.0
12	139.0	17.0	139.0	17.0	3.5	1.0
13	139.0	17.0	139.0	17.0	3.5	1.0
14	139.0	17.0	139.0	17.0	3.5	1.0
15	139.0	17.0	139.0	17.0	3.5	1.0
Total	1,855.0	256.0	1,851.5	255.0	-	-

(2) Production cost

Production cost at 100% capacity utilization is shown below:

(B\$/ton of cement)

Item	Case 1		Case 2	
	OPC	OWC	OPC	OWC
Variable cost:				
Bulk cement			103.2	175.2
Clinker	73.7	125.8		
Gypsum	2.1	2.1		
Paper bag	9.9	9.9	9.9	9.9
Power	1.9	1.9	0.1	0.1
(Total)	(87.6)	(139.7)	(113.2)	(185.2)
Fixed costs:				
Labor		4.0		3.2
Repair and maintenance		1.1		0.3
Land		0.2		0.1
Water		-		-
Overheads		2.9		2.5
Depreciation		6.5		2.1
(Total)		(14.7)		(8.2)
Sub-Total	102.3	154.4	121.4	193.4
Interest (first year basis)		9.9		4.8
Amortization (first year basis)		3.1 (13.0)		1.2 (6.0)
Total	115.3	167.4	127.2	199.2

- (3) Sales price (FOB Plant) is assumed to be equal to the landed cost of cement currently imported in bags as mentioned earlier, say \$122.8 B\$/T for OPC and B\$ 303.8 B\$/T for OWC.

4.3 Profitability

(1) Profit

Profit over a period of 15 years will be as follows.

Case 1

(Unit: 1,000 ton, Million B\$)

	OPC		OWC		Total	
	Total amount	Amount per year	Total amount	Amount per year	Total amount	Amount per year
Sales volume	1,851.5	123.4	255.0	17.0	2,106.5	140.4
Sales revenue	227.3	15.1	77.5	5.2	304.8	20.3
Production cost	199.3	13.3	40.8	2.7	240.1	16.0
Profit before tax	28.1	1.9	36.7	2.4	64.8	4.3
Corporate tax	6.7	0.4	8.8	0.6	15.5	1.0
Profit after tax	21.3	1.4	27.9	1.9	49.2	3.3

Case 2

(Unit: 1,000 ton, Million B\$)

	OPC		OWC		Total	
	Total amount	Amount per year	Total amount	Amount per year	Total amount	Amount per year
Sales volume	1,851.5	123.4	255.0	17.0	2,106.5	140.4
Sales revenue	227.3	15.1	77.5	5.2	304.8	20.3
Production cost	229.9	15.3	50.0	3.3	279.9	18.7
Profit before tax	-2.5	-0.2	27.4	1.8	24.9	1.7
Corporate Tax	-	-	6.2	0.4	6.2	0.4
Profit after tax	-2.5	-0.2	21.2	1.4	18.7	1.2

(2) Financial rate of return

Rate of return on investment was calculated by the Internal Rate of Return (IRR) method with the following results.

	ROI		ROE		Pay-out time
	B.T.	A.T.	B.T.	A.T.	
Case 1	18.26%	16.33%	19.95%	17.51%	(5.05 years)
Case 2	15.83%	13.92%	17.45%	14.83%	(6.05 years)

(B.T.: Before Tax, A.T.: After Tax)

From this results, the financial rate of return of Case 1 is higher be approximately 3% than that of Case 2 in both ROI and ROE.

(3) Sensitivity analysis

Sensitivity analysis was carried out for both Cases regarding changes in the interest rate of long term loan (from 9.2% to 10.5%) and in the sales price (+10%, -10%, OWC -20%).

Furthermore, for Case 1, sensitivity for elimination of OWC sales, changes in depreciation method and exclusion of the cost of new jetty was analyzed. The results are;

- a. Both Case 1 and 2 are not much affected by a change in the interest rate of long term loan.
- b. Sales price influences considerably. Case 2, especially, is much more affected than Case 1, namely when 10% increase, it shows higher figures than Case 1 but on the contrary when 10% decrease, it shows minus (-) figures although Case 1 still gives a return of 11.07%(B.T.) and 9.54%(A.T.).
- c. Elimination of OWC sales gives a great impact on ROI, driving it down to approx. 10% lower than those of the base cases in Case 1.
- d. When the cost of new jetty is excluded from the Case 1, ROI and ROE shows approx. 4 - 5% higher than that of base case.

5 Economic analysis

The economic analysis was analyzed from two points which are the economic benefits and the economic financial rate of return.

5.1 Economic benefits

This project will bring about the following economic benefits to Brunei.

- (1) Stable supply of high quality cement
- (2) Simplification and rationalization of cement distribution segment
- (3) Promotion of industrialization of Brunei
- (4) Improvement of technical level
- (5) Development of related industries

However, 1, 3, 4, and 5 items of above them are mainly brought by Case 1, but cannot be expected in Case 2. This has been already pointed out in the EDB(Brunei)'s Preliminary Report dated 30th Jan., 1982.

5.2 Economic financial rate of return

The economic financial rate of return is calculated as follows.

Case 1: 19.13% Case 2: 18.16%

Though Case 1 shows marginal 1% higher figures than Case 2, in terms of other economical benefits in 1.5.1, Case 1 is preferable.

6 Conclusion and recommendation

6.1 Conclusion

- (1) There is no problem concerning the plant site, surrounding infrastructure, etc.
- (2) A cement plant of 150 thousand tons/year can be operated, from the viewpoint of marketing in Brunei.
- (3) Case 1 which is a plant for grinding imported clinker shows a little higher profitability than that for Case 2 a plant

for packing cement imported in bulk. Case 2 fluctuate in very wide range depending upon the sales price, which is not recommendable from the view point of stable management.

- (4) If this plant is to produce and market both OWC and OPC, the plan is feasible economically and also technically, of course. But when OWC is excluded, the profitability of Case 1 is much lowered and the IRR of Case 2 becomes minus (-1) figures.
- (5) There is no difficulty in securing a supply of raw materials.
Sources will be; Clinker: South Korea, Taiwan, Philippines, Japan
Gypsum : Thailand, Australia

6.2 Recommendation

Brunei, which will celebrate the anniversary of its independence, is in a position to proceed with its own national development for the future. It is noteworthy that it has directed its attention to the cement, one of the most important basic materials for the national development among other things.

Furthermore, the project is important not only as a produce of cement, an industrial material, but also as a forerunner of an technological industry, expected to bring about technological advancement, which will contribute to the future industrial development of Brunei.

It is, therefore, especially recommended to proceed with the followings.

- (1) One of the feature of this project is that it is desirable from economic viewpoint to produce and market not only OPC but also OWC.

While no technical problem is anticipated in the production of OWC, success of this project should depend largely on whether OWC can satisfactorily be sold to Brunei Shell Ltd., the only user of OWC in Brunei.

Consequently, it is particularly recommended to find out the future trend of the drilling program which will affect the future demand and to commence negotiation soon with Shell about the sale of a product of this plant.

(2) The problem for OPC is that the advent of this plant may eventually result in a partial loss of business and interests for the leading Chinese companies, who, in effect, monopolize import and sale of cement in bags, and who may probably struggle to compete desperately with this plant after the commencement of its operation by lowering the price of imported cement. As it may be difficult to expect an embargo or imposition of protection duty on cement import in view of nature of Brunei's import and its policy on international trade, the followings, among other things, may be the countermeasures for the competition.

- a. To secure the market (especially that of public construction, which accounts for a large position of the entire demand).
- b. To create an efficient distribution network of its own.

However, it should concurrently be studied to guide the Chinese companies toward maintenance of reasonable price market with a view to avoiding futile internecine competition and enabling the coexistence.

(3) As there is almost no accumulation of technology in cement production in Brunei, it is desirable to arrange a tie-up with or assistance from the government or firm of a country advanced in cement production technology, in respect of training of engineers, plant management, etc., in proceeding with this project. Also in this connection, it is recommended to send people to the plants now in operation for inspection, training, etc. with a view to acquiring required knowledge.

In addition to the foregoing, it will also be necessary for the implementation of this project to make a preliminary inquiry with regard to the supply of raw materials, and to start sounding the ideas of the authorities concerned in respect of dredging and construction of a berth and dolphin, specifications of, for example, the plant, equipment which must be stated in the tender(s) for the

project, among other things.

While realization of this project is, in any case, to be decided by the government of Brunei, it is desirable that the government will play a leading role in consideration of the importance of this project stated in beginning of this section.

(4) Although it is not directly related to this project, there was an opportunity to visit the site at Temburong of mining sand and gravel, used for concrete in Brunei, during our stay for the survey of cement project. By sight there appears to be a considerable reserve in Brunei of sand and gravel, which constitute valuable resources, because they are required six times as much as cement in making concrete. While they look to be mined now at random, it would be better if they are mined systematically. This has some reference on the cement project, as one of the reasons for construction of a new berth contemplated in the Case 1, for a crushing plant was the future unloading of the sand and gravel from Temburong at this berth.

It was because there is a considerable merit in unloading a large quantity of sand and gravel, using the new berth and the belt conveyor for intake of raw materials for the clinker grinding. Furthermore, it gives rise to a possibility for additional construction of a plant of ready mixed concrete, using cement and sand and gravel or a plant of products of cement and concrete.

As ready mixed concrete is expected to save labor at the civil and construction site, it is obviously expected to increase in future judging from the tendency in other countries including Japan.

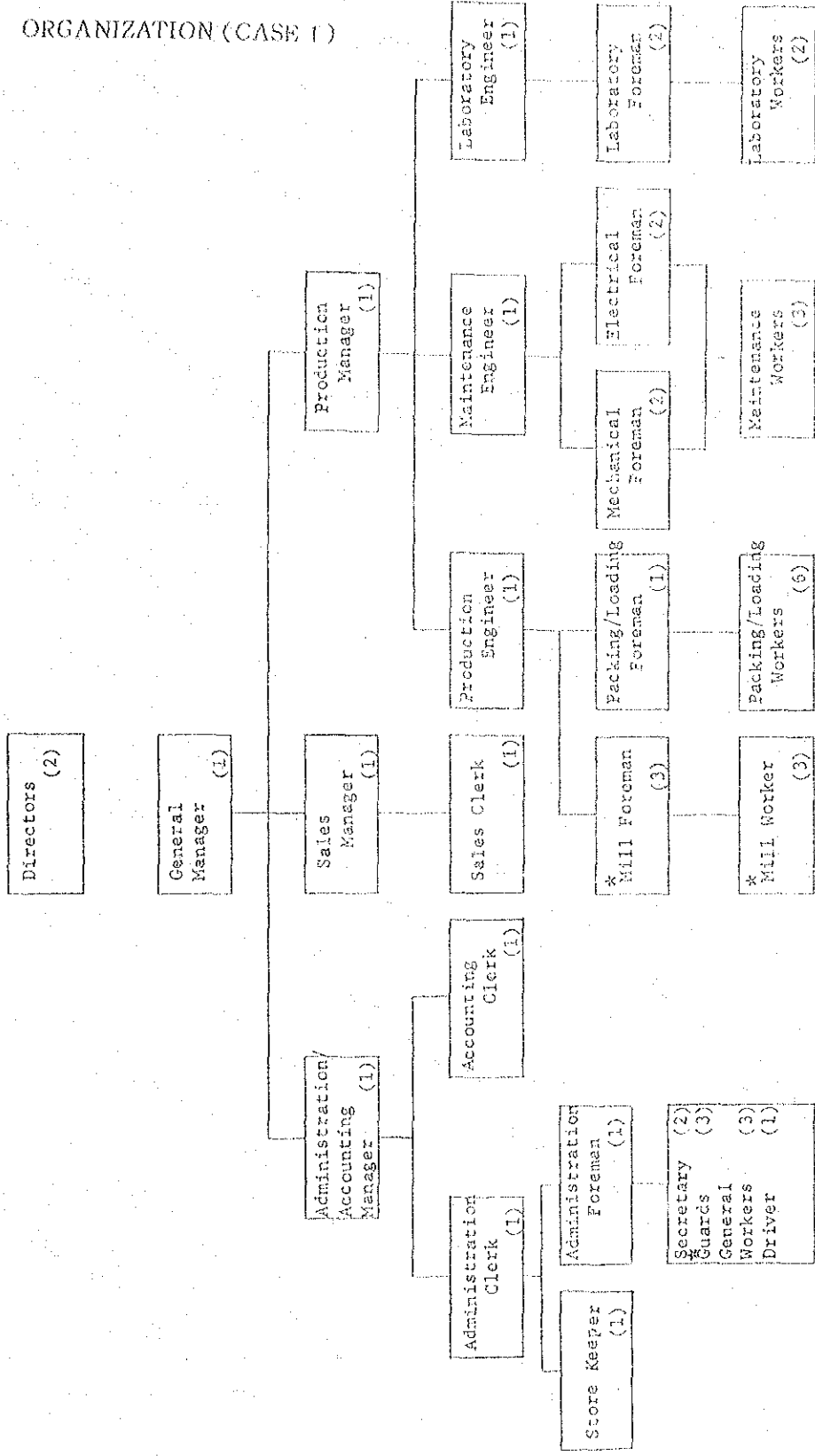
And the increase of ready mixed concrete will also consequently entails an increase in demand for cement, a detailed study will be required.

7 Evaluation of Other Report made by Ube Industries Ltd., Japan
(* As submitted to EDB(Brunei) by the Chairman of Sarawak Economic
Development Corporation on 20th May, 1982)

Evaluation and comments are made on the report relating to the
cement plant construction, already submitted to Brunei. The main
points are as follows of which details are mentioned in Attachment
1 hereof:

- (1) As the said report views Brunei as one of the market for a
clinker crushing plant planned to be built in Sabah by
another company, the objective of the survey is not properly
set.
- (2) While the report dose not refer to OWC, it is better for a
survey to cover all the products marketable in the same
country. The reason given for not referring to it is also
ambigious.
- (3) Some of its technical judgements including the adoption of an
open circuit mill are not adequate.
- (4) The price of bagged cement quoted in the report (CIF 72 US\$)
seems to be higher from current point of view.

Fig. 1 ORGANIZATION (CASE 1)



(Directors 2)

General Manager 1

Manager 3

Clerk/Engineer 6

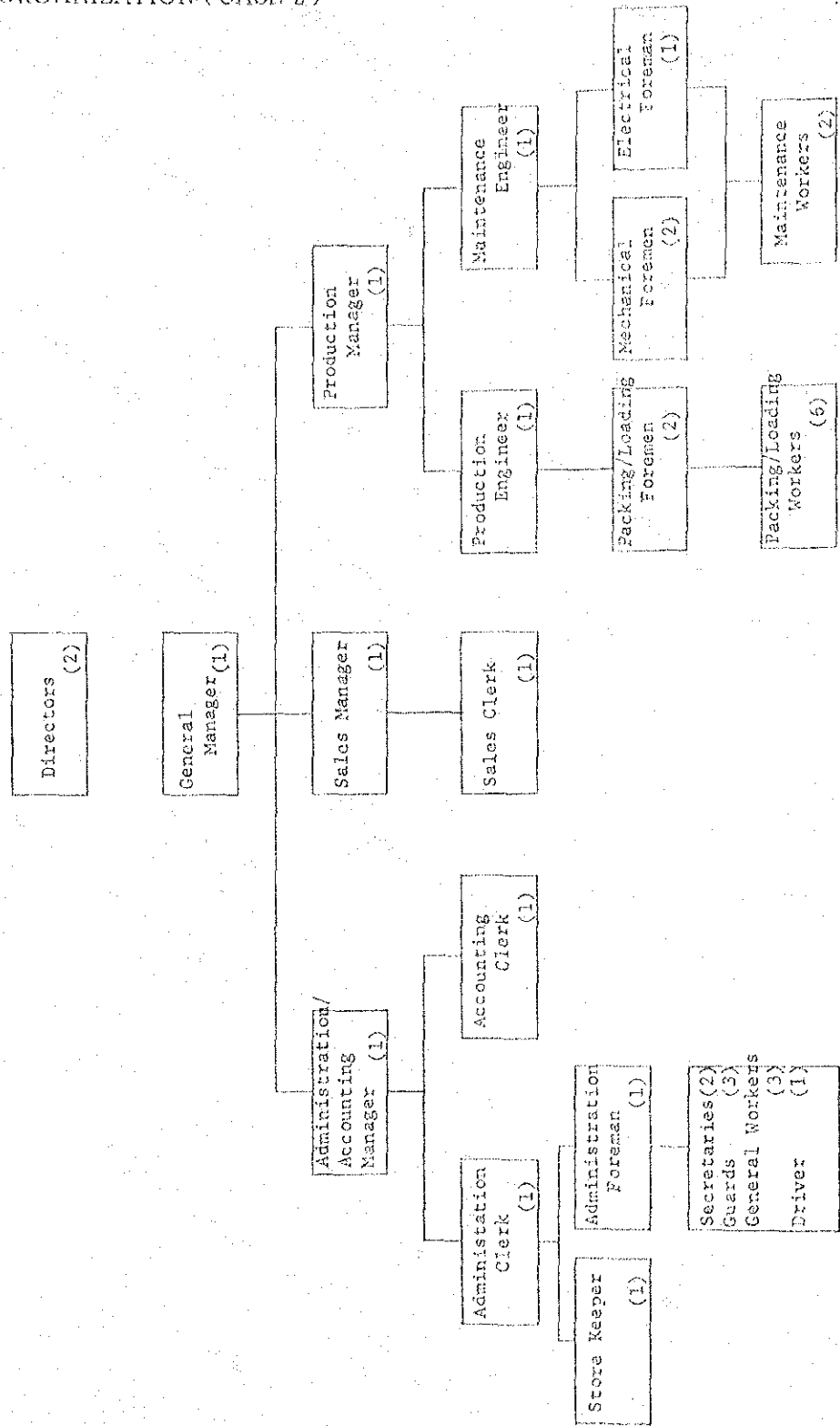
Foreman 12

Worker 23

Total 45 (+2)

* means shift workers; 3 shift x 1 man

Fig. 2 ORGANIZATION (CASE 2)



(Directors 2)

General Manager 1

Manager 3

Chief Clerk/
Engineer 5

Foreman 7

Workers 17

Total 33 (+2)

Fig. 4 CONSTRUCTION SCHEDULE (CASE 2)

NO		Time																								
		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1	Design				Basic	Detailed																				
2	Manufacture																									
3	Shipping																									
4	Civil Works	Dolphin																								
		Receiving Dep't																								
		Packing/Loading Dep't																								
5	Mechanical Works	Receiving Dep't																								
		Packing/Loading Dep't																								
6	Electrical Works	Sub-Station																								
		Motor, Lighting																								
7	Commissioning																									
8	Commercial Operation																									
9	Office and Others																									
10																										

Dolphin, Jetty

Cement Silo
Packing Room
Loading Room

Piping
Cement Extractor,
Packer Bulk Loader
Sub-Station
Electrical Works

Office, Repair Shop, Water,
Road, etc.

Mech. Elec. Equipment

Piling Construction

Construction

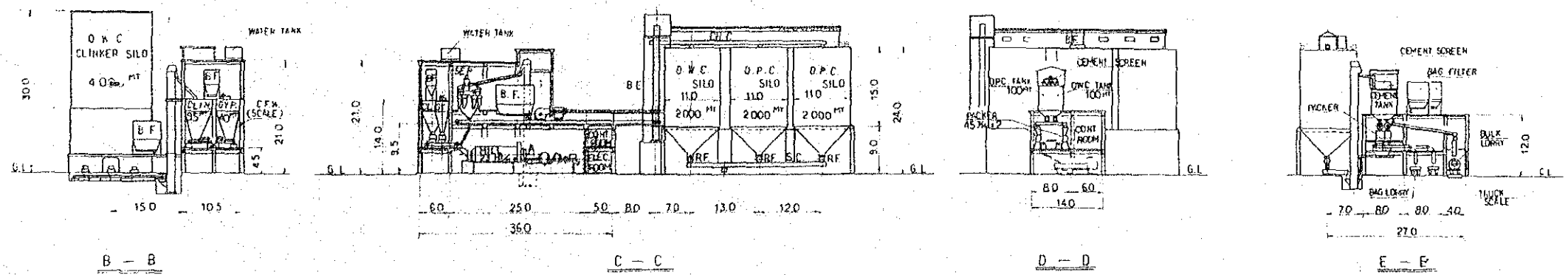
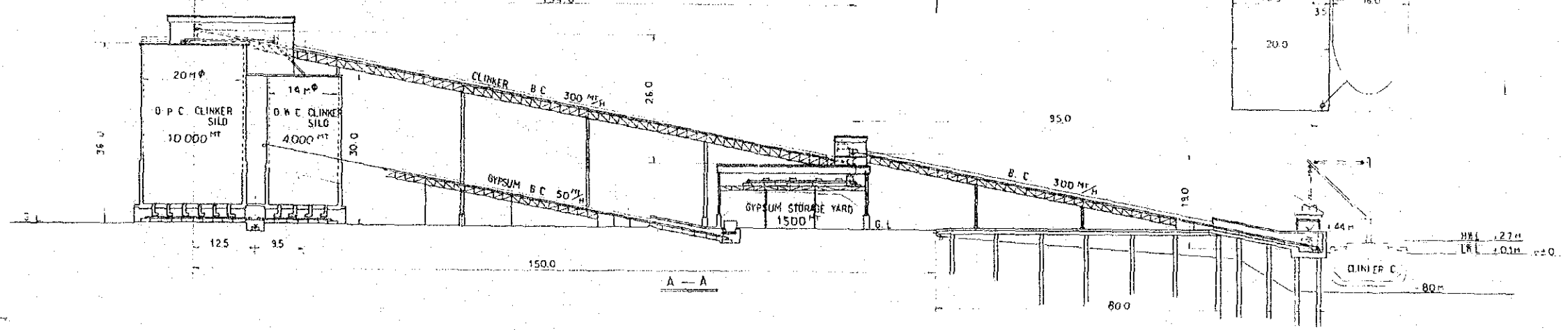
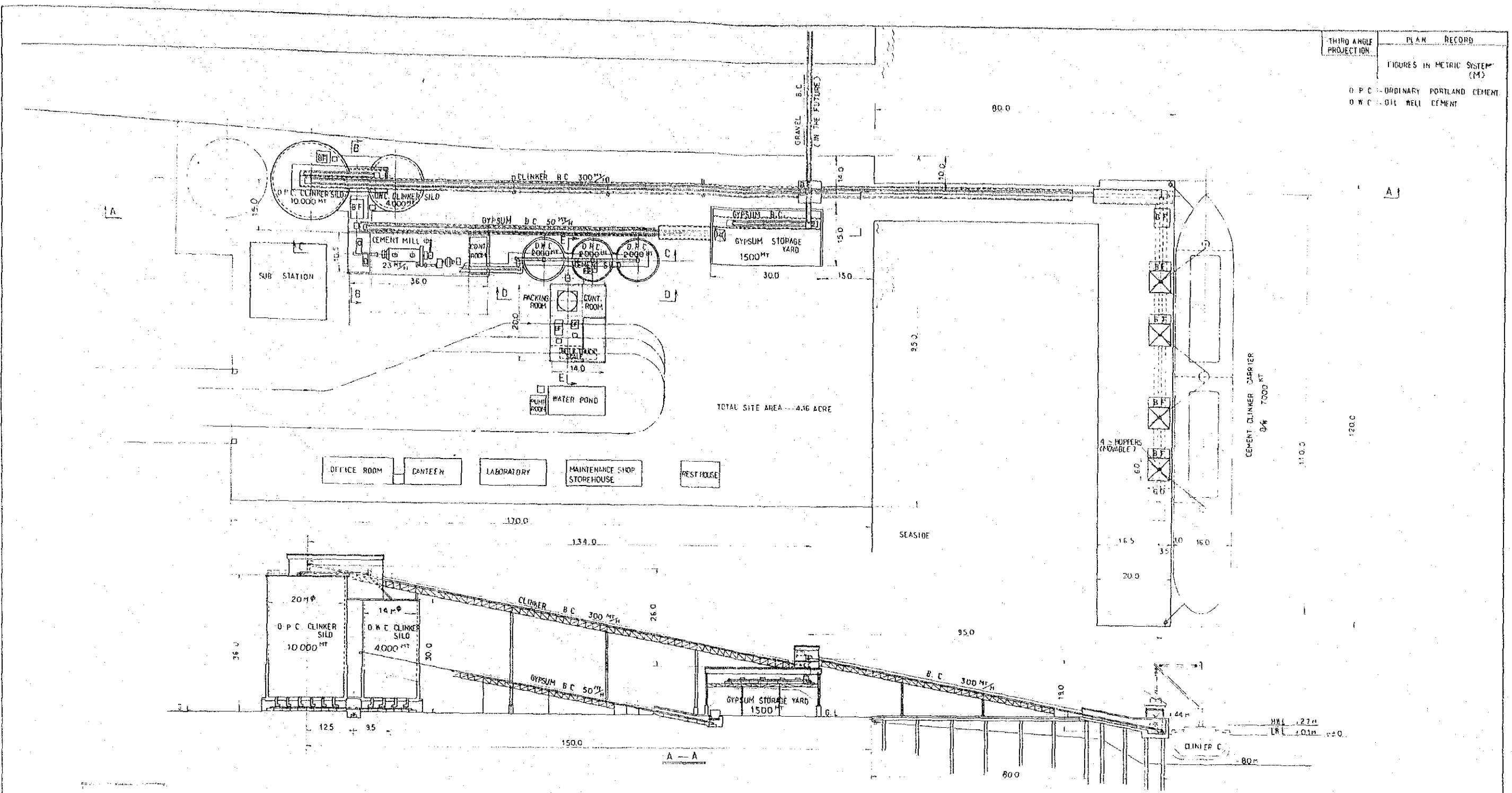
Construction Building

Finishing

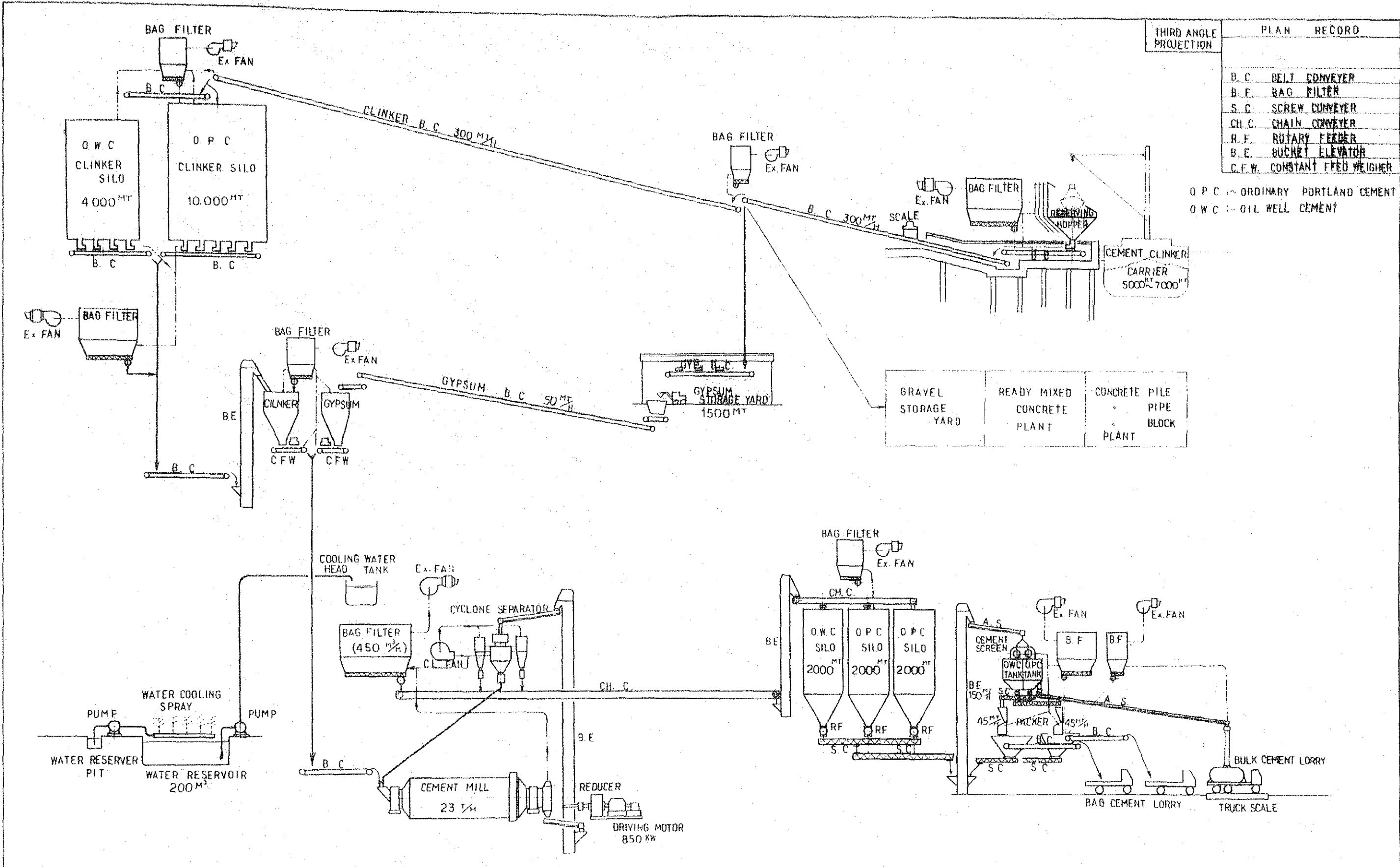
Piling

Finishing Construction Building

THIRD ANGLE PROJECTION
 PLAN RECORD
 FIGURES IN METRIC SYSTEM (M)
 O.P.C. - ORDINARY PORTLAND CEMENT
 O.W.C. - OIL WELL CEMENT



BRUNEI CEMENT (GRINDING) PLANT	
CASE 1	
PLANT LAYOUT	
(GENERAL ARRANGEMENT)	
SCALE 1/500	DATE FEB 10, 1962
A-1-1	
JAPAN INTERNATIONAL COOPERATION AGENCY	



THIRD ANGLE PROJECTION	PLAN RECORD
	B.C. BELT CONVEYER
	B.F. BAG FILTER
	S.C. SCREW CONVEYER
	CH.C. CHAIN CONVEYER
	R.F. ROTARY FEEDER
	B.E. BUCKET ELEVATOR
	C.F.W. CONSTANT FEED WEIGHER

O.P.C. - ORDINARY PORTLAND CEMENT
 O.W.C. - OIL WELL CEMENT



BRUNEI CEMENT (GRINDING) PLANT		
CASE 1		
FLOW SHEET		
SCALE	DATE FEB. 10 1983	DWG NO A-1-2
JAPAN INTERNATIONAL COOPERATION AGENCY		

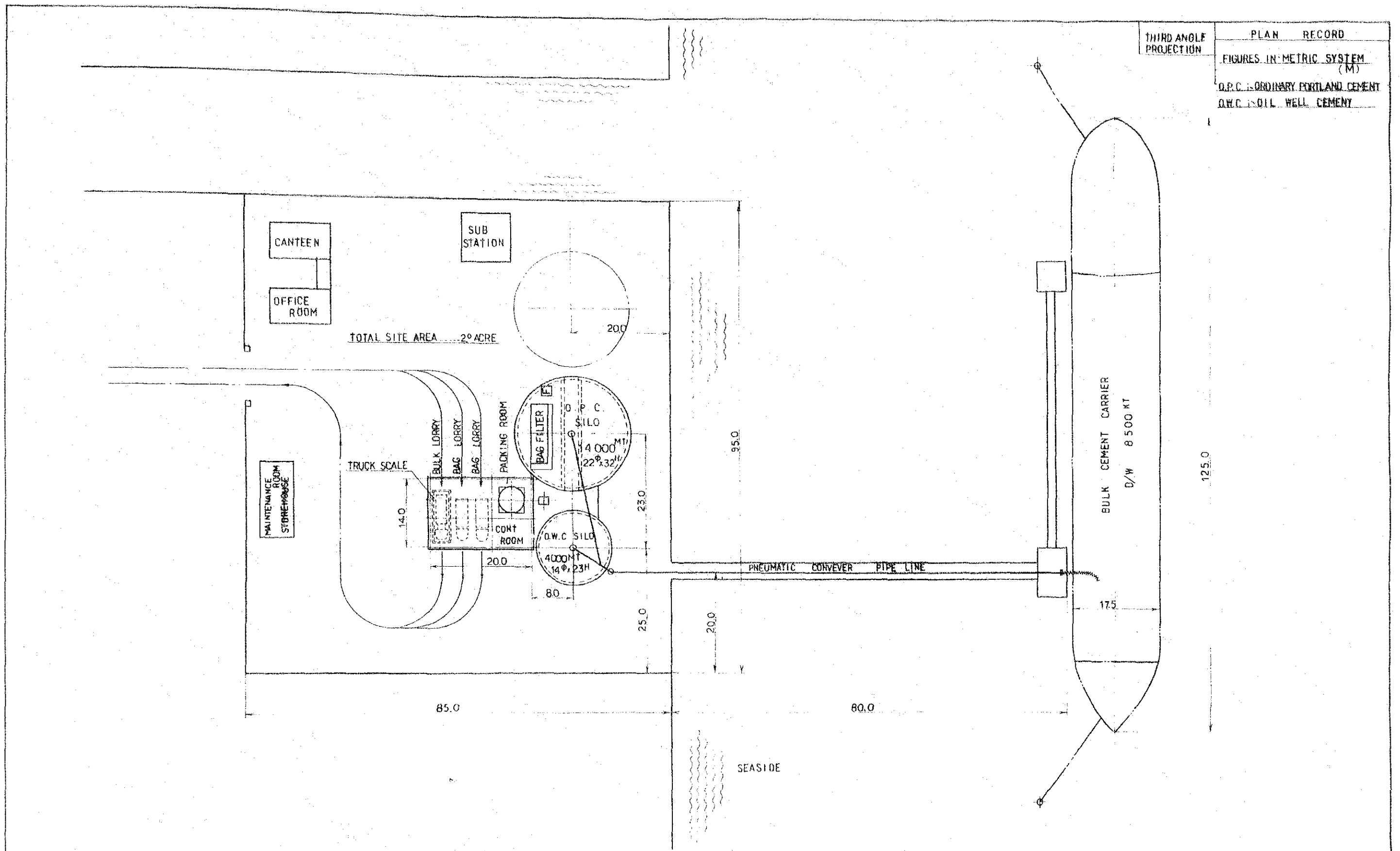
THIRD ANGLE PROJECTION

PLAN RECORD

FIGURES IN METRIC SYSTEM (M)

O.P.C. : ORDINARY PORTLAND CEMENT

O.W.C. : OIL WELL CEMENT



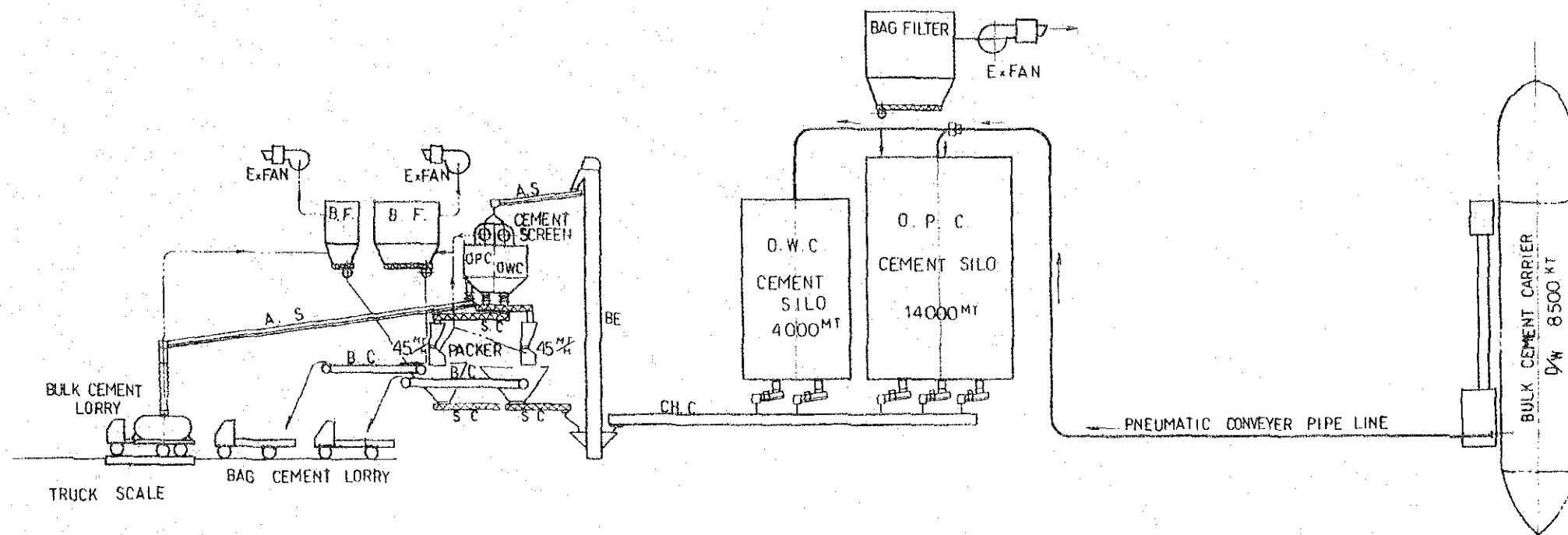
BRUNEI CEMENT (PACKING) PLANT		
CASE 2		
PLANT LAYOUT		
SCALE 1/500	DATE FEB 10 1983	DWG NO. A-1-3
JAPAN INTERNATIONAL COOPERATION AGENCY		

THIRD ANGLE
PROJECTION

PLAN RECORD

O.P.C. - ORDINARY PORTLAND CEMENT

O.W.C. - OIL WELL CEMENT



BRUNEI CEMENT (PACKING) PLANT

CASE 2

FLOW SHEET

SCALE — DATE FEB. 10. 1983 DWG NO. A-1-4

JAPAN INTERNATIONAL COOPERATION AGENCY

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